The Village of Kiryas Joel

Amended Final Environmental Impact Statement for the Proposed Connection to the New York City Catskill Aqueduct

February 2009

Amended Final Environmental Impact Statement

Village of Kiryas Joel

Proposed Connection to the New York City Catskill Aqueduct

Project Location:	Between Vails Gate and Kiryas Joel (Orange County, New York)
Lead Agency:	Board of Trustees of the Village of Kiryas Joel Municipal Building 51 Forest Road, P.O. Box 566 Monroe, NY 10950
Environmental Consultant:	Camp Dresser & McKee Raritan Plaza I Raritan Center Edison, NJ 08818
Legal Counsel:	Whiteman Osterman & Hanna LLP One Commerce Plaza Albany, NY 12260 Tel: 518-487-7620

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Date of Acceptance by Lead Agency: ____________________

Prepared for:
Village of Kiryas Joel

Prepared by:
Camp Dresser & McKee
Whiteman Osterman & Hanna LLP

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AMENDED FEIS PREFACE

On October 9, 2007, the Supreme Court of the State of New York, Appellate Division, Second Judicial Department, issued a Decision and Order "remitting the matter to the Board of Trustees of the Village of Kiryas Joel for the preparation and circulation of an amended final environmental impact statement … which analyzes the impact of the project on wetlands, sewage facilities, and the discharge of wastewater and treated effluent into surface and ground waters, includes a phase 1-B archaeological study and review, analyzes the growth-inducing effects of the project, and analyzes those alternative to the project which were identified in the final environmental impact statement with respect to these impacts."

Specifically, the Court found that the Village needed to more fully identify the "nature and extent of all of the wetlands that would be disturbed or affected by the construction of the proposed water pipeline, how those wetlands would be disturbed, and how each disturbance, if any, would affect the salutary flood control, pollution absorption, groundwater recharge, and habitat functions of those wetlands."

Additionally, the Court directed the Village to identify "the location, nature, or extent of the bodies of surface water in which wastewater from the proposed treatment plant would discharged, and which State classes and standards of quality and purity apply to those water bodies" and "how much effluent would be discharged into those bodies of water over what periods of time, what the nature of the effluent might be, and what the effect upon those bodies of water are likely to be."

With respect to historical and archaeological resources, the Court directed the Village to prepare "a site-specific and design-specific phase 1-B archaeological study." Finally, the Court directed the Village to conduct a "demographic analysis or projections with respect to the effect of the availability of a steady and stable supply of potable water on population movement into or out of the Village" to support the prior conclusions that "the Village birth rate would continue to grow at a steady rate of 6% per year."

This AFEIS is prepared in direct response to the Court's Decision and Order. In the intervening time since the Order, the Village has engaged its consultants to conduct additional studies of wetlands, archaeology, sewage treatment, and population growth. A detailed description of the additional studies and analyses is set forth in Section 3.

To avoid confusion, this document incorporates the previously accepted Final Environmental Impact Statement ("FEIS") as the base for the Amended FEIS, and separately denotes by italicized and bolded text the Amended FEIS updated information and any resulting modifications to the original analysis of potential adverse environmental impacts. Specifically, a new Section 3 has been added here to set forth all of the additional analysis ordered by the Court. In addition, the individual responses to comments in Section 2 have also been updated, where relevant. This updated information is also identified in bolded italics. In certain circumstances, updated studies have been conducted and appended hereto and, in others, the modifications are reflected in an updated or modified analysis based on the Court's direction.

This Amended FEIS has been distributed to all involved and interested agencies and anyone else who had previously requested copies of the DEIS and FEIS. As a direct corollary to the Amended FEIS, the Village Board of Trustees, as SEQRA lead agency will consider the Amended FEIS and issue an updated Amended Findings Statement no sooner than ten days from the date of its acceptance of this Amended FEIS.

Section 1
Introduction

The residents of the Village of Kiryas Joel currently depend on groundwater wells for their entire supply of potable water. The existing water supply system in the Village of Kiryas Joel includes nine active groundwater production wells and two water treatment plants.

The current average daily water demand in the Village of Kiryas Joel is approximately 0.98 million gallons per day (mgd), and peak daily water demand exceeds 1.3 mgd. NYSDEC has authorized Kiryas Joel to withdraw 1.0 mgd from nine wells in Kiryas Joel and 0.31 mgd from five wells in an unincorporated area of the Town of Monroe near Mountain Lakes, for a total of 1.31 mgd. Due to internal growth and the corresponding increase in water demand, wells in the Village have been heavily used, causing a net decrease in their output. Since the Village wells are no longer capable of producing the maximum permitted yield, Kiryas Joel's water system is unable to supply enough water on days of high demand. To overcome the supply deficit, the Village is occasionally forced to truck in additional water in preparation for religious holidays, when peaks of water demand often occur. The yield of the Village's water supply system is only marginally capable of meeting the current demand of approximately 0.98 mgd. Under the frequent peak water demands, the water supply is inadequate.

The 2008 average daily water demand in the Village of Kiryas Joel is approximately 1.41 mgd, and peak daily water demand is approximately 1.65 mgd. Peak demand occurs only on a few occasions per year. Subsequent to the completion of the FEIS and Findings Statement, the New York State Department of Environmental Conservation ("DEC") approved a new groundwater well on March 9, 2005 (Well #27), that increased the Village's water supply by 135,000 gpd. In addition, on August 17, 2005, DEC approved another new groundwater well for the Village (Well #28) with an output of 486,000 gallons per day. In total, both approvals by DEC represent an addition of 621,000 gpd of new water supply to the Village. As a result, the Village now has DEC approval to draw in excess of 1.9 mgd from its existing wells, though as noted in the DEIS, the total actual yield of the Village's wells is dependent on environmental conditions.

The purpose of the proposed action is to provide a reliable and adequate supply of high-quality potable water for the Village of Kiryas Joel. The Village of Kiryas Joel's existing water supply system is minimally adequate for its present population, and the Village will need increasing amounts of potable water as it continues to grow. As the rate of groundwater withdrawal in the vicinity of Kiryas Joel grows larger in comparison to the groundwater recharge rate, it will become increasingly difficult for a groundwater–dependent system to maintain an adequate water supply for a growing community. To increase the reliability of its potable water supply, Kiryas Joel needs to gain access to a substantial source of surface water. The Catskill Aqueduct is the best available source of surface water.

The Village of Kiryas Joel proposes to connect to the Catskill Aqueduct near Riley Road in the Vails Gate section of the Town of New Windsor. The Vails Gate location is proposed because it is just upstream of the point where the aqueduct descends more than 1,000 feet to cross under the Hudson River.

Water would be withdrawn from the Catskill Aqueduct using a vacuum priming system, and the water would be conveyed to a pump station. The water would be pumped through a 13-mile pipeline that would follow State Route 94, County Route 27, State Route 208, and State Route 17. The pipeline would end at a new water treatment facility adjacent to the site of the existing water treatment facility on Berdichev Road in the Village of Kiryas Joel. After treatment, the aqueduct water would be fed into the Village's water distribution system.

Pursuant to the Appellate Division order, the alternative pipeline route along New York State Routes 94 and 32 and County Route 44 (Alternative Route A) was also further assessed as part of this Amended FEIS. This is a 12.5 mile route also beginning at the New Windsor Water Treatment Plant Catskill Aqueduct connection on Riley Road and continuing east on NYS Route 94 to Vails Gate; then south along NYS Route 32 and West on County Route 44, terminating at a new water treatment facility on an undeveloped lot in the Village of Kiryas Joel south of Seven Springs Road (CR 44) and west of Bakertown Road.

In September 2000, the Village of Kiryas Joel filed an official request with NYCDEP for conceptual approval to establish a connection to the Catskill Aqueduct designed to withdraw up to 2.0 mgd of water. In a letter dated November 27, 2000, NYCDEP conceptually approved the proposed connection and withdrawal of water. The letter acknowledged the Village's estimate that Kiryas Joel would be entitled, pursuant to the NYC Administrative Code §24-360(e), to withdraw 1.1 mgd based on its population as measured by the 1990 Census. Based on the 2000 Census, Kiryas Joel would be entitled to withdraw approximately 1.9 mgd. NYCDEP must still grant final approval of the proposed connection to the Catskill Aqueduct.

Project development began with the examination of different potential technologies, various pipeline routes, various water treatment plant and pump station locations, various pipeline size alternatives and the preparation of a series of environmental documents in compliance with the State Environmental Quality Review Act (SEQRA) procedures. On July 2, 2002, the Board of Trustees of the Village of Kiryas Joel circulated a Notice of Establishment as Lead Agency to potentially involved agencies associated with the proposed action. Also included in that correspondence was the full SEQRA Environmental Assessment Form (EAF) and the Board's intention, if determined to be Lead Agency, to prepare a Positive Declaration for this Type 1 action, thereby requiring the preparation of an Environmental Impact Statement (EIS). On August 6, 2002, the Board officially assumed the role of Lead Agency for the Catskill Aqueduct Connection project and issued a Positive Declaration. On April 2, 2003 the Village of Kiryas Joel issued the Draft Scoping Document for the Environmental Impact Statement for the Proposed Connection to the New York City Catskill Aqueduct, notice of which was published in ENB. A 23-day comment period was established where public and agency comments were requested to be received by April 25, 2003 for consideration by the lead agency. The Final Scoping Document was adopted by the lead agency on June 3, 2003. On October 7, 2003, the Draft Environmental Impact Statement (DEIS) was deemed complete and made available for public review, with an established 49-day public and agency comment period. For the purpose of receiving comments on the DEIS, a public hearing was held at the Ezras Choilim Health Center in the Village of Kiryas Joel on November 14, 2003. Comments were received until November 24, 2003 marking the end of the DEIS comment period.

This Final Environmental Impact Statement (FEIS) document contains the substantive public and agency comments on the DEIS and responses to them. Appendix A contains a transcript of the public hearing. Written public hearing statements and written comments received by the Village of Kiryas Joel are reproduced in their entirety in Appendix B.

Specific comments were received on elements of the DEIS. Each specific comment is identified by a two-part number (example: 2-5). The first number (2 in the example) refers to the person making the comment and the second number identifies successive comments by the same person (comment 5 in the example). The first commenters listed are those who spoke at the public hearing, in the order they spoke, followed by those who submitted written comments in chronological order. The list of commenters with his/her assigned number is provided on Table 1-1.

The comment summaries were further categorized into subject matter groupings that correspond for the most part to the sections of the DEIS. The response categories are listed on Table 1-2 and are self-explanatory. Also included is Table 1-3 which identifies each commenter and the corresponding response categories under which their comments are addressed.

In order to eliminate the potential for confusion, each comment has been restated, the comment identification number has been given and the appropriate response follows the comment. In those cases where the same concern was expressed by several commenters the comments are listed individually and a single response is given following those comments summarized. This was done to avoid redundancy.

Those comments that do not pertain to the proposed water supply pipeline project are considered to be beyond the scope of this Final Environmental Impact Statement (FEIS) and are summarized and placed in the category "Beyond the Scope." No response to these comments is offered.

The FEIS has been distributed to all involved agencies and is available for public review at the Village Hall, 51 Forest Road, Monroe, NY.

The FEIS, which incorporates the DEIS (October 2003) by reference, is intended to provide the Village of Kiryas Joel Board of Trustees with the environmental information it needs to issue findings which will form the basis for future decision making on the project. The lead agency will issue findings after a minimum of ten days from the notice of completion of the FEIS.

TABLE 1-1

LIST OF COMMENTERS

Public Hearing Speakers
November 14, 2003

Commenter No.	**Name**
1	Charles Bohan Supervisor of the Town of Blooming Grove
2	Nancy Calhoun New York State Assembly
3	Paul Aggarwal New York City Department of Environmental Protection
4	Geoff Welsh Ramapo River Committee
5	Jennie Kiesling
6	Philip Chase Representative, Deerpark to Upper Delaware Council
7	Manny Mangual
8	Ann Krawet
9	Dr. Steven Benardo

Note: Mr. Bill Douglass attended the Public Hearing as a Representative of the Upper Delaware Council. At the hearing Mr. Douglass read the Upper Delaware Council's written comments into the record. The comments are responded to in Section 2 and are identified as Commenter No. 11, Upper Delaware Council.

Written Comments

Commenter No.	Name
10	New York State Thruway Authority
11	Upper Delaware Council
12	Village of Washingtonville
13	Town of Blooming Grove
14	Town of Woodbury (Lorraine McNeill, Council Member)
15	Town of Woodbury (Sheila A. Conroy, Supervisor)
16	Orange County
17	New York State Department of Environmental Conservation
18	Arnold M. Frogel

TABLE 1-2
RESPONSE CATEGORIES
FOR SECTION 2

Table 1-3
Commenter/ Response Category
Summary Table

#1	#2	#3	#4	#5	#6	#7	#8	#9
Charles Bohan	**Nancy Calhoun**	**Paul Aggarwal**	**Geoff Welsh**	**Jennie Kiesling**	**Philip Chase**	**Manny Mangual**	**Ann Krawet**	**Dr. Steven Bernardo**
TRAFFIC	WATER DEMAND AND SUPPLY PROJECTIONS	PAUL AGGARWAL/ NYCDEP	GROWTH INDUCEMENT	WATER DEMAND AND SUPPLY PROJECTIONS	DELAWARE RIVER WATERSHED	WATER ACCESS	GROWTH INDUCEMENT	COMMUNITY FACILITIES
TOWN OF BLOOMING GROVE/ SUPERVISOR CHARLES BOHAN	BACKUP WATER SUPPLY		RAMAPO RIVER WATERSHED	GROWTH INDUCEMENT	BEYOND THE SCOPE		REGIONAL WATER PLAN	
	THREATENED AND ENDANGERED SPECIES			REGIONAL WATER PLAN			BEYOND THE SCOPE	
	BLASTING							
	HISTORIC, ARCHITECTURAL AND ARCHEOLOGICAL RESOURCES							
	TRAFFIC							

Table 1-3
Commenter/ Response Category
Summary Table

#10	#11	#12	#13	#14	#15	#16	#17	#18
New York State Thruway Authority	**Upper Delaware Council**	**Village of Washingtonville**	**Town of Blooming Grove**	**Town of Woodbury (Lorraine McNeil)**	**Town of Woodbury (Sheila Conroy)**	**Orange County**	**NYSDEC**	**Arnold Frogel**
PIPELINE ROUTE	DELAWARE RIVER WATERSHED	VILLAGE OF WASHINGTONVILLE	TRAFFIC	BACKUP WATER SUPPLY	WATER DEMAND AND SUPPLY PROJECTIONS	WATER DEMAND AND SUPPLY PROJECTIONS	WATER DEMAND AND SUPPLY PROJECTIONS	WATER DEMAND AND SUPPLY PROJECTIONS
	HUDSON RIVER ALTERNATIVES		TOWN OF BLOOMING GROVE/ SUPERVISOR CHARLES BOHAN	GROWTH INDUCEMENT	WASTEWATER TREATMENT CAPACITY	WASTEWATER TREATMENT CAPACITY	WASTEWATER TREATMENT CAPACITY	GROWTH INDUCEMENT
				STREAMS	BACKUP WATER SUPPLY	REGULATORY REQUIREMENTS AND INVOLVED/ INTERESTED AGENCIES	STREAMS	
				RAMAPO RIVER WATERSHED	REGULATORY REQUIREMENTS AND INVOLVED/ INTERESTED AGENCIES	GROWTH INDUCEMENT	STORMWATER	
				WETLANDS	GROWTH INDUCEMENT	FLOODING	VEGETATION	
				THREATENED AND ENDANGERED SPECIES	THREATENED AND ENDANGERED SPECIES	LAND	LAND	
				HISTORIC, ARCHITECTURAL AND ARCHEOLOGICAL RESOURCES	LAND	POPULATION/ DEMOGRAPHICS	BLASTING	
					BLASTING	TRAFFIC	HISTORIC, ARCHITECTURAL AND ARCHEOLOGICAL RESOURCES	
					POPULATION/ DEMOGRAPHICS	ENERGY	POPULATION/ DEMOGRAPHICS	
					LAND USE/ ZONING	SOLID WASTE/ SLUDGE DISCHARGE	FISCAL IMPACTS	
					TRAFFIC	REGIONAL WATER PLAN	LAND USE/ ZONING	
					NOISE		NOISE	
					ENERGY		VISUAL	
					HAZARDOUS WASTE		CONSTRUCTION	
					PIPELINE ROUTE		VILLAGE WATER TREATMENT PLANT	
					ALTERNATE PIPE SIZE		TOWN OF NEW WINDSOR ALTERNATIVES	
					WATER CONSERVATION		REGIONAL WATER PLAN	
					REGIONAL WATER PLAN			

Section 2
Responses to Specific Comments

All substantive comments, both written and oral, are summarized and reproduced in the text that follows.

As previously noted, each specific comment is identified by a two part number (example: 2-5). The first number (2 in the example) refers to the person or agency making the comment (or the second commenter) and the second part identifies successive comments by the same person (or the fifth comment by that same commenter). The comment summaries were further categorized into subject matter groupings that correspond for the most part to the section of the DEIS.

In order to eliminate the potential for confusion, each comment has been restated, the comment identification number has been given and the appropriate response follows the comment. In those cases where the same concern was expressed by several commenters, the comments are listed individually and a single response is given following those comments summarized. This was done to avoid redundancy.

Those comments that do not pertain to the proposed water supply pipeline project are considered to be beyond the scope of this FEIS and are summarized in the category "Beyond the Scope." No response to these comments is offered.

AMENDED FEIS

As noted in Section 1, the lead agency has revisited the FEIS responses to comments and provides updated information, as relevant to the particular responses set forth below, based on the amended environmental impact assessments summarized in Section 3 and included in appendices attached hereto. The updated information is set forth in bolded italics.

PAUL AGGARWAL/
NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION

3-1 *The Aqueduct connection has been designed for 2 million gallons per day water consumption. What we find is that, according to the Village population and probably in the coming couple of years, that amount will probably not be enough to meet the water supply needs of the Village. So the question is how the Village plans to meet their water demand by the year 2020 or even beyond to supply their consumers?*

The proposed Aqueduct connection will meet the current water needs of Kiryas Joel. The amount of water the Village is legally entitled to withdraw from the Aqueduct will grow in proportion to the population of the Village. The proposed pumping and water treatment facilities would have a capacity of approximately 2 million gallons per day (mgd), but the major element of the proposed project, the pipeline, would have a capacity substantially greater than 2 mgd. Water use in Kiryas Joel is projected to reach 2 mgd in approximately 2017 (see table in the response to comments 16-16 and 17-2 below). If necessary in the future, the Village could increase the capacity of the pumping and water treatment facilities and, based on future aqueduct entitlements, request approval from NYCDEP to withdraw more than 2 mgd from the Aqueduct.

Note: This comment-response is also included in the Water Demand and Supply Projections response category on page 2-5.

3-2 *...if the water supply is only for 2 million gallons we kind of do not see the point as to why the line should be 24 inches...Some reasons are given were given in the DEIS, but we believe more reasons need to be done to justify that.*

The project as proposed includes the use of a 24-inch diameter pipeline to transmit up to 2.0 mgd to the Village of Kiryas Joel. This pipeline diameter was initially presented to the NYCDEP in the conceptual plans for this project. Given that the pipeline will have a service life of 50 years or more, the choice of pipeline diameter was based not only on the Village's current aqueduct entitlement request of 2 mgd but also on potential future entitlements due to future growth. Also considered was the fact that reducing the pipeline diameter would not reduce environmental impacts. Trench size, construction duration and potential environmental impacts would be the same for a 24-inch diameter pipeline as for any other size pipeline. Nevertheless, due to concerns that the pipe is oversized, a reduction in pipeline diameter to 18 inches would be acceptable.

Note: This comment-response is also included in the Alternative Pipe Size response category on page 2-53.

3-3 *It is not mandatory by us, but the question of backup water supply is an important one. From time to time we do take down our aqueducts for repairs, maintenance, and any unforeseen problems. So, therefore, it is rather essential for the Village to have some sort of backup water supply. The existing water supply they have would have to be maintained, or there has to be some understanding between the different communities that do take water from the village that when needed the Village can get that water back for their own consumers. The potential likely degree of reliance in the backup water supply must be addressed.*

3-4 What is the storage capacity of the Village's four water storage tanks?

As proposed, the Aqueduct connection would provide water to the Village, and the existing Village water supply system, which will be regularly maintained, would provide backup to the Aqueduct connection. The Village of Kiryas Joel currently has four water storage tanks with a total capacity of approximately 2.5 million gallons. The tank storage capacities are: 1 million gallons, 0.85 million gallons, 0.37 million gallons and 0.30 million gallons. In addition to the four tanks presently utilized, the Village is in the process of designing a fifth tank with a storage capacity of 2 million gallons. Together, the 4 current storage tanks and the 14 permitted wells can provide approximately 2 mgd of water for 3 days, 1.8 mgd for 4 days, or 1.6 mgd for 5 days. In such circumstances, water management procedures also may be implemented, as needed.

Note: Comment-response 3-3 is also included in the Backup Water Supply response category on page 2-13.

Subsequent to the completion of the FEIS and Findings Statement, the New York State Department of Environmental Conservation ("DEC") approved a new groundwater well on March 9, 2005 (Well #27), that increased the Village's water supply (and corresponding wastewater production) by 135,000 gpd (125 gpm @ 18 hrs/day). In addition, on August 17, 2005, DEC approved another new groundwater well for the Village (Well #28) with an output of 486,000 gallons per day. In total, both approvals by DEC represent an addition of 621,000 gpd of new water supply to the Village. As a result, the Village now has approval to draw in excess of 1.9 mgd from its existing wells. As noted in the DEIS, this current capacity will serve and be maintained as the Village's backup water supply in the event of shutdown of the Aqueduct for repairs or otherwise. Copies of the DEC issued well permits are attached to the Amended FEIS as Appendix I.

3-5 Once you have the aqueduct water, what happens to the demographic make-up of the town, the Village, or the community?

The proposed Aqueduct connection is not expected to have any impact on the demographic makeup of the Town of Monroe, the Village of Kiryas Joel, or the larger community.

Note: This comment-response is also included in the Population/ Demographics response category on page 2-35.

As noted above, since the Village presently has available water supply in volumes nearly identical to what it will be entitled to from the Aqueduct, no change in the demographic of the Village is expected to occur as a result of the change in source to the Aqueduct.

3-6 The Village of Kiryas Joel's wastewater treatment plant has a 0.9 million gallons capacity and leases 0.35 million gallons of that capacity to Water (sic) District #1. The question is, will that arrangement, which finishes in probably November 2004, continue beyond that, or if the Village would like to get that capacity for their own use?

The County has requested a 2 year extension of the lease agreement between the Village of Kiryas Joel and Orange County Sewer District #1. The Village will continue to lease 0.35 million gallons of the Village's 0.9 million gallon capacity wastewater treatment plant to Sewer District #1.

Note: This comment-response is also included in the Wastewater Treatment Capacity response category on page 2-10.

3-7 *We would like to know the time frame for development of additional wells by the Village. More information should be given on the parcel outside the Village where additional wells might be developed.*

Due to the nature of water exploration, no set timetable for the development of additional wells can be developed. Water must be located and tested for quality and quantity and impact on neighboring public and private wells before application for taking authority can be undertaken. Currently, the Village is in the process of permitting two wells with an estimated capacity of 0.8 mgd. One of these wells is a deep rock well located on the Brenner Property. The second is a sand and gravel well located on a Village owned parcel. Parcels on which additional wells may be developed are disclosed in the approval process for such wells.

Note: This comment-response is also included in the Backup Water Supply response category on page 2-13.

Subsequent to the completion of the FEIS and Findings Statement, the New York State Department of Environmental Conservation ("DEC") approved a new groundwater well on March 9, 2005 (Well #27), that increased the Village's water supply (and corresponding wastewater production) by 135,000 gpd (125 gpm @ 18 hrs/day). In addition, on August 17, 2005, DEC approved another new groundwater well for the Village (Well #28) with an output of 486,000 gallons per day. In total, both approvals by DEC represent an addition of 621,000 gpd of new water supply to the Village. As a result, the Village now has approval to draw in excess of 1.9 mgd from its existing wells. As noted in the DEIS, this current capacity will serve and be maintained as the Village's backup water supply in the event of shutdown of the Aqueduct for repairs or otherwise. Copies of the DEC issued well permits are attached to the Amended FEIS as Appendix I.

3-8 *Please discuss why the Village would not want to get their water from the New Windsor water tap on the aqueduct?*

Based on your comment, discussions have recently taken place between the Village of Kiryas Joel and the Town of New Windsor regarding the use of the New Windsor aqueduct connection and filtration plant. The Village is exploring this alternative with the Town. Such a change will require prior approval by NYCDEP. Likewise, should these discussions result in changes to the proposed project, the Village, as lead agency, remains obligated under SEQRA to analyze such changes for potentially significant adverse environmental impacts.

Note: This comment-response is also included in the Town of New Windsor Alternative response category on page 2-57

WATER DEMAND AND SUPPLY PROJECTIONS

2-1 I think you also note that your existing groundwater wells in Brenner do supply enough water for your Village.

As stated in the DEIS, the total allotted or permitted yield of Kiryas Joel's groundwater wells is 1.31 mgd, the sum of 0.308 mgd for the Brenner property wells and 1.0 mgd for wells in the Village. This would be sufficient to meet the current maximum daily water demand of 1.3 mgd. However, as noted in the DEIS, heavy use of the Village wells has reduced production from the wells over time and/or low groundwater levels. Calcification and other mineral actions have built up on the casing walls blocking the flow of water into the wells causing increased drawdown water levels and a decrease in pump flow (Several of these wells have been successfully redeveloped). With such damage, the water system becomes less efficient requiring longer pumping cycles and higher pump-energy to deliver the required volume of water to support the community. Therefore, the Village is not able to produce the permitted amount of water and has proposed the connection to the Catskill Aqueduct as a more reliable water source. The connection to the aqueduct will reduce the dependence of the Village on groundwater, minimizing stress and damage to the aquifer and Village wells. The connection will establish a reliable water supply for the Village that avoids conflict and reduces impacts on surrounding communities. Through the connection to the Catskill Aqueduct, vulnerability to drought will also be minimized by broadening the area from which water can be drawn.

Subsequent to the completion of the FEIS and Findings Statement, the New York State Department of Environmental Conservation ("DEC") approved a new groundwater well on March 9, 2005 (Well #27), that increased the Village's water supply (and corresponding wastewater production) by 135,000 gpd (125 gpm @ 18 hrs/day). In addition, on August 17, 2005, DEC approved another new groundwater well for the Village (Well #28) with an output of 486,000 gallons per day. In total, both approvals by DEC represent an addition of 621,000 gpd of new water supply to the Village. As a result, the Village now has approval to draw in excess of 1.9 mgd from its existing wells. As noted in the DEIS, this current capacity will serve and be maintained as the Village's backup water supply in the event of shutdown of the Aqueduct for repairs or otherwise. Copies of the DEC issued well permits are attached to the Amended FEIS as Appendix I.

3-1 The Aqueduct connection has been designed for 2 million gallons per day water consumption. What we find is that, according to the Village population and probably in the coming couple of years, that amount will probably not be enough to meet the water supply needs of the Village. So the question is how the Village plans to meet their water demand by the year 2020 or even beyond to supply their consumers?

5-2 The Environmental Impact Statement says the population growth at Kiryas Joel is 5.9 percent and that this project won't increase growth, nor does it say that growth will decrease. 5.9 percent is not sustainable growth....I want to know whether the water supply that you are predicting from this plan will deal with that population?

15-1 The DEIS claims the proposed Aqueduct connection is needed to support the Village for the next 20 years, but does not provide projections of the population for the next 20 years. Therefore, one cannot determine how long it would take for the Village to exceed the supply of water from the Aqueduct--is it 10 years, 15 years, or 20 years?

Using the approximate 6-percent annual population growth factor referenced throughout the document, it is estimated that Village wells would be deactivated for only 4 years following the projected completion of the project in 2008. Using the same growth rate, by 2010, the Village would need to start pumping its wells again in order to supply the peak generation on religious holidays (using a figure of 88 gallons per capita per day calculated from 2002 peak water use as shown in Table 2-1 of the DEIS, divided by the 2002 projected population of 14,762), which would occur 50 to 75 days per year. By 2011, only 5 years after connection to the aqueduct, it is likely that the Village will have to activate its groundwater wells full time in order to meet an average daily demand (based on 82.83 gallons per capita per day as reported in Connection to New York City Aqueduct Preliminary Report for Conceptual Approval of 2.07 million gallons per day (MGD).

Again, using the projected annual growth rate, by 2020, only 14 years after completion of the connection to the aqueduct, the Village's population will reach 42,132 residents, needing an average of 3.49 MGD. Totaling these figures, it appears that in just 14 years the Village's average daily demand will exceed both the supply of its existing groundwater wells as well as the proposed 2.0 MGD from the aqueduct connection.

All of the above is predicated on a 6-percent growth rate. However, it should be noted that on page 1-3 of the DEIS it states that the marriage rate is increasing, which may make this rate too conservative, in which case the average daily demand will exceed both groundwater well and aqueduct connections even sooner than 14 years.

We believe that the EIS should present a detailed projection of population, using numbers from its own history, over the 20 years from the completion of the project. This should include an estimate of the amount of water needed each year, again based on historical records for the Village. Lastly, the EIS should identify when the Village's population will exceed the capacity of its well fields, then the capacity of the aqueduct and finally the capacity of the well fields and the aqueduct working together.

Unless shown to the contrary, tapping into the Aqueduct will only temporarily satisfy these growth rates and water needs. In only a few years, much less than 20 years, the Village will find itself right back where it is now. This has significant implications for surrounding aquifers and private wells. While the aqueduct connection may provide temporary relief, in a few years the demand will again be there to draw water from the already inadequate local wells. The EIS needs to address this.

For the above reasons, the project sponsor's preferred alternative does not serve the purpose of the proposed action for the full planning period and additional alternatives should be explored.

15-14 Will the Village keep its permits to withdraw 1.31 mgd for its water supply wells? At the current growth rates, how long will it be before the Village will be required to use its wells in providing the average daily demand for water? How long will it be before the Village needs to use its wells to provide for increased water demand on holidays or days of special observances? How often will the latter occur?

15-15 How does the aqueduct reduce stress on neighboring communities and property owners if such entities will not have access to the 1.31 mgd currently permitted to Kiryas Joel, and if Kiryas Joel must resume pumping the aquifer to supply its average daily need again in the future?

The proposed Aqueduct connection will meet the current water needs of Kiryas Joel. The amount of water the Village is legally entitled to withdraw from the Aqueduct will grow in proportion to the population of the Village. The proposed pumping and water treatment facilities would have a capacity of approximately 2 million gallons per day (mgd), but the major element of the proposed project, the pipeline, would have a capacity substantially greater than 2 mgd. Water use in Kiryas Joel is projected to reach 2 mgd in approximately 2017 (see table in the response to comments 16-16 and 17-2 below). If necessary in the future, the Village could increase the capacity of the pumping and water treatment facilities and, based on future aqueduct entitlements, request approval from NYCDEP to withdraw more than 2 mgd from the Aqueduct.

As soon as the connection to the Catskill Aqueduct is complete and the aqueduct water is available the Village of Kiryas Joel will reduce dependence on their wells and depend on the surface water supply from the Aqueduct as their main water source. However, because Kiryas Joel needs a backup water supply, the Village will retain access to its allocated quantity of groundwater. Regardless of how much water the Village obtains from the Aqueduct in comparison to the amount it obtains from groundwater wells, the Village will pump less groundwater with the proposed Aqueduct connection than without it. The proposed Aqueduct connection will therefore reduce pressure on groundwater supplies by relieving the aquifer of stresses experienced from water demand from the Village and surrounding communities. Additionally, Kiryas Joel's transition from groundwater to surface water dependence will minimize impacts surrounding communities may have experienced in the past while competing for groundwater.

Subsequent to the completion of the FEIS and Findings Statement, the New York State Department of Environmental Conservation ("DEC") approved a new groundwater well on March 9, 2005 (Well #27), that increased the Village's water supply (and corresponding wastewater production) by 135,000 gpd (125 gpm @ 18 hrs/day). In addition, on August 17, 2005, DEC approved another new groundwater well for the Village (Well #28) with an output of 486,000 gallons per day. In total, both approvals by DEC represent an addition of 621,000 gpd of new water supply to the Village. As a result, the Village now has approval to draw in excess of 1.9 mgd from its existing wells. As noted in the DEIS, this current capacity will serve and be maintained as the Village's backup water supply in the event of shutdown of the Aqueduct for repairs or otherwise. Copies of the DEC issued well permits are attached to the Amended FEIS as Appendix I.

15-3 The DEIS does not give quantities for the current shortfall during holidays. For example, how much water is trucked in when the shortfalls occur? Are there other occasions, besides religious holidays, when there are water shortages? On page 1-2 and 1-3, the DEIS states: "As a result of the community's religious practices, peak flows are generally caused by preparation for holiday periods and the Sabbath. High demands have occurred during the temporary influx of population for holidays, and also on the anniversary of the death of Grand Rabbi Joel Teitelbaum, founder of Kiryas Joel. Peak daily demands typically occur 50 to 75 days per year." What are these peaks--how much additional water is needed? What is the actual consumption on those 50 to 75 days?

The need for trucking in supplemental water during the holidays varies. As an example, the Village trucked in 51 loads of water (approximately 250,000 gallons to 300,000 gallons) during the month of December 2003.

16-11 On page 2-53 of the DEIS, Table 2-7 lists projected population growth out to the year 2025. Using daily water demand of 60 gallons per capita per day for water consumption, we get the following water needs for Kiryas Joel and surrounding municipalities:

Year	*Daily Water Demand*
2000	*1.9 MGD*
2010	*2.6 MGD*
2015	*3.1 MGD*
2020	*3.6 MGD*
2025	*4.2 MGD*

Even with the Aqueduct connection, the Village may not have enough water much past the year 2015.

Table 2-7 in the DEIS projects population for the entire Town of Monroe (including but not limited to the Village of Kiryas Joel). The water demand table above, which is based on the population figures of Table 2-7, also applies to the entire Town of Monroe, inclusive of the Village of Kiryas Joel and surrounding municipalities. Projections for the Village alone are set forth below in response to comments 16-16 and 17-2.

15-4 On page 1-1 of the DEIS it states that the average per capita water consumption in the Village is substantially lower than in both Orange County and New York State. Please provide numbers and documentation, such as from meter readings, to substantiate this claim. These per-capita figures should also include water usage for communal facilities.

16-15 What is the water use per capita value CDM is using for the Village of Kiryas Joel?

Average per-capita water consumption in the Village of Kiryas Joel is approximately 66 gallons per day, based on average water use of 0.98 MGD in 2002 and an estimated population of 14,904 in 2002.

16-16 The EIS should include a tabulated projection of population and water consumption for the next 25 years to complement the assessment of impacts that are associated with construction of the proposed water transmission line.

17-2 The DEIS does a good job of presenting the current water supply needs of the Village, and the fact that the Village's needs will grow in the future. However, the DEIS fails to provide any *population projections and fails to quantify the number of gallons per day that might be needed by the Village in the next 5, 10, or 20 years. Although Section 3.5 briefly mentions a minimum 20-year planning period, it does not explain how "2.0 MGD would meet the Village's needs for approximately 10 years." Without establishing a specific, verifiable water supply need, it is not possible to compare these needs with the potential adverse environmental impacts caused by the construction and operation of this new water supply system.*

The table below shows projections of population and water supply need for Kiryas Joel based on the 2002 average water use of 66 gallons per capita per day and on continuation of the internal population growth rate of 5 percent per year indicated by population and age distribution data from the U.S. Census.

Year	Projected Population	Water Supply Need (mgd)
2005	16,800	1.1
2010	21,400	1.4
2015	27,300	1.8
2020	34,900	2.3
2025	44,500	2.9

The growth study analysis and report prepared by AKRF Environmental and Planning Consultants ("AKRF") for the Amended FEIS projected population in the Village of Kiryas Joel through the year 2030 as set forth in the following table (see Appendix N):

Population Projections, 2000-2030

Year	Population	Year	Population
2000	13,138	**2016**	27,334
2001	13,923	**2017**	28,510
2002	14,605	**2018**	29,731
2003	15,296	**2019**	30,994
2004	16,051	**2020**	32,302
2005	16,814	**2021**	33,714
2006	17,661	**2022**	35,203
2007	18,516	**2023**	36,759
2008	19,388	**2024**	38,424
2009	20,270	**2025**	40,161
2010	21,169	**2026**	42,048
2011	22,120	**2027**	44,011
2012	23,088	**2028**	46,088
2013	24,099	**2029**	48,246
2014	25,128	**2030**	50,527
2015	26,200		

Sources: U.S. Census Bureau, 2000 Census; National Center for Health Statistics, Table 308, Deaths by State of Residence Distributed According to State or Country of Birth, By Age, 2000; Village of Kiryas Joel; AKRF, Inc.

Based on the foregoing population projections and a per capita consumption of 66 gpd, revised projected water demand is as follows:

Year	Projected Population	Water Supply Need (mgd)
2010	**21,169**	**1.4**
2015	**26,200**	**1.7**
2020	**32,302**	**2.1**
2025	**40,161**	**2.6**
2030	**50,527**	**3.3**

17-5 What would be the average and maximum daily water demand for the full buildout of the Village under the Master Land Use Plan?

The Village projects that 1,447 to 1,781 new housing units could be built in the Village. Based on the average household size of 5.74 reported by the 2000 Census, these new housing units could accommodate 8,300 to 10,200 additional residents. Based on the estimated 2002 population of 14,904, this would bring the Village population to between 23,200 and 25,100. Based on the 2002 average per capita water consumption of 66 gallons per day, this population would use approximately 1.53 to 1.66 million gallons of water per day. The maximum daily water demand would be approximately 2.3 mgd. Such development, if it occurs, will likely take place over an extended period of time and be commensurate with the projected population growth as identified in the previous response.

18-1 As a New York City resident and City water supply customer, I have a right to object to the excessive volume of water that would be siphoned off our source of supply if the Village of Kiryas Joel connects to the Catskill Aqueduct.

New York State law provides that communities in the counties through which the aqueduct passes are entitled to draw water from the Catskill Aqueduct. Therefore, the Village of Kiryas Joel, as an aqueduct host community and with the approval of the New York City Department of Environmental Protection to tap into the Aqueduct, can withdraw from the Aqueduct in accordance with this entitlement and approval.

WASTEWATER TREATMENT CAPACITY

3-6 *The Village of Kiryas Joel's wastewater treatment plant has a 0.9 million gallons capacity and leases 0.35 million gallons of that capacity to Water (sic) District #1. The question is, will that arrangement, which finishes in probably November 2004, continue beyond that, or if the Village would like to get that capacity for their own use?*

The County has requested a 2 year extension of the lease agreement between the Village of Kiryas Joel and Orange County Sewer District #1. The Village will continue to lease 0.35 million gallons of the Village's 0.9 million gallon capacity wastewater treatment plant to Sewer District #1.

15-13 *The discussion of wastewater treatment included in the DEIS is not adequate to conclude that there will not be an impact to wastewater treatment in connection with the proposed action. The existing Harriman Sewer Plant is being expanded but is now operating at full permitted capacity. What level of growth for the Village of Kiryas Joel was included in planning the expansion of the plant and is the combination of the plant and the Village adequate to serve the additional population supported by the proposed action?*

As described in the DEIS, the expansion of the Harriman Sewer Plant is planned in order to accommodate 1.5 MGD of the effluent anticipated from already approved projects. The DEIS states the 0.35MGD of capacity of the Village Wastewater Treatment Plant is currently leased to neighboring communities. If the Village terminates this lease, the neighboring communities will increase their usage of the Harriman Sewer Plant. Therefore, it would seem that there is currently no excess of sewer treatment at the Harriman Plant as expanded and the Kiryas Joel Wastewater Treatment Plant. Details on the current capacities and current demands for sewerage treatment at the Harriman and the Kiryas Joel plant need to be provided. Also projections should be made as to the future capacity demands for sewerage treatment at the time of completion of the aqueduct connection and a five, ten, fifteen and twenty years after the aqueduct connection....The environmental document should detail how impacts to wastewater treatment from the additional population to be supported by the aqueduct will be mitigated and funded.

16-6 *The DEIS fails to provide alternatives to discharge into the County sewer in the event a permit is not issued. It does not address the details of the discharge in terms of content, quantity, effect on hydraulic capacity of the carrying lines, whether the discharge would occur during peak or off-peak hours, and where, within the County sewer system, the discharge will occur.*

16-7 *Section 2.13.1.2 (Wastewater) fails to adequately address, quantitatively and qualitatively, how wastewater generated from the increased water consumption, will be treated in the event that there is insufficient treatment capacity at the Harriman and Village plants. This section states that "[t]he current expansion of both the Harriman WWTP and Kiryas Joel's own wastewater treatment facility would accommodate a large increase in wastewater discharges from Kiryas Joel." The DEIS should provide quantifiable information about these facility capacities and this "large increase."...This section fails to project increased wastewater treatment needs of the rest of the District and how any such increased demand will impact the proposal. Nor does this section take into account the participation in the expansion by municipal contract users of the Harriman plant that are not part of the OCSD#1. The Towns of Woodbury and Blooming*

Grove have already committed to purchasing a share of the additional capacity. In addition, while the current lease between the County and the Village expires in 2004, the lease contains an option clause for two additional one-year extensions of the lease.

16-12 *The relationship of increased water use to demands and capacity at Sewer District 1 as well as alternative options for necessary sewage treatment should be further discussed.*

16-24 *Section 2, Environmental Setting, Direct Impacts and Mitigation fails to adequately address the relationship of current, expanded, or new sewage treatment facilities to the proposal. This is of particular interest to Orange County in relationship to Orange County Sewer District 1 (see prior comments). While Section 2.13.1.2 does summarize current conditions as related to wastewater treatment, the DEIS is silent on impacts for future sewage treatment associated with the facilitation of Village growth via improved water capacity.*

17-3 *The DEIS does not provide sufficient information in order to evaluate the potential for the impact on sewerage facilities and the discharge of treated effluent into area streams. The DEIS should indicate the Village's current total used and unused sewer capacity either within the Village or reserved for the Village in the Harriman Sewerage Treatment Plant (Orange County Sewer District #1). Will the 2.0 MGD of water from this pipeline exceed the total sewage capacity available to the Village? If so, how will the Village guarantee that water from the pipeline will not result in exceedance of this capacity?*

As noted in the DEIS, the Village of Kiryas Joel is within Orange County Sewer District No.1 and is entitled to discharge their wastewater to the Harriman WWTP. In this regard, expansion of the Harriman WWTP from 4.5 mgd to 6.0 mgd is about to begin in 2004. The timing of the proposed water supply project is such that the aqueduct water would not become available before the Harriman plant expansion has been completed. Moreover, additional wastewater flow from Kiryas Joel (or any other community in the Orange County Sewer District No. 1) would not happen immediately. Growth in Kiryas Joel and other communities of OCSD No.1 will utilize the additional wastewater treatment capacity over time. It should be noted that expansion of the Harriman WWTP beyond 6.0 mgd to serve all of OCSD No.1 has been recognized as a future need to plan for. Thus, as Kiryas Joel and the other communities grow, expansion of the wastewater infrastructure can be reasonably anticipated.

Additional treatment capacity is also available from the Village's own wastewater treatment facility. The capacity of this facility has recently been expanded to 0.97 mgd. Currently, Orange County has leased 0.35 mgd of this capacity for other communities. That lease expires in November 2004.

In summary, between the approved 6.0 mgd capacity at the Harriman WWTP and the Village's own 0.97 mgd treatment plant, plus ongoing planning for future expansion of the Harriman Wastewater Treatment Plant and the Kiryas Joel Wastewater Treatment Plant, sufficient wastewater treatment capacity should be available for the gradual growth in wastewater generation in Kiryas Joel resulting from increased water use up to 2 mgd, as proposed with the subject project. The availability of wastewater treatment capacity serves as a growth limiting factor for the Village and all surrounding communities.

Subsequent to the completion of the FEIS and Findings Statement, the New York State Department of Environmental Conservation ("DEC") approved a new groundwater well on March 9, 2005 (Well

#27), that increased the Village's water supply (and corresponding wastewater production) by 135,000 gpd (125 gpm @ 18 hrs/day). In addition, on August 17, 2005, DEC approved another new groundwater well for the Village (Well #28) with an output of 486,000 gallons per day. In total, both approvals by DEC represent an addition of 621,000 gpd of new water supply to the Village. Copies of the DEC issued well permits are attached in Appendix H. As a result, the Village now has approval to draw in excess of 1.9 mgd from its existing wells. Despite such a significant increase in the Village's water supply and corresponding waste water generation, DEC expressly determined that this new water supply would have no adverse impact on the Harriman Wastewater Treatment Plant ("WWTP") or the Ramapo River.

In 2006, the Harriman WWTP capacity extension project was completed and the new 2.0 mgd capacity became available. Year 2008 monthly reports recently produced by the Orange County Department of Public Works – Division of Environmental Facilities and Services("DEF"), indicate that there currently remains approximately 1.5 mgd of available capacity at the Harriman WWTP. Copies of these DEF reports are attached in Appendix F.

In August 2008, the Orange County Supreme Court, Environmental Claims Part, issued a Decision and Order enjoining Orange County from selling any of the newly created capacity to communities outside of Orange County Sewer District ("OCSD") No. 1 until such time as it is determined that there is adequate capacity first to accommodate the District, including the Village. A copy of the decision is attached in Appendix J. It is, therefore, evident that there is now an adequate, secure and dedicated capacity available to accommodate the potential increase in wastewater to be generated by the Project now and into the foreseeable future.

Also since the time the DEIS and FEIS were completed, in 2006, Orange County engaged CDM to complete the "Harriman Wastewater Treatment Facility Membrane Bioreactor Pilot Study" pursuant to a grant from the New York State Energy Research and Development Authority ("NYSERDA"). The study assessed the feasibility, effectiveness, and cost of implementing a membrane bioreactor ("MBR") treatment system at the Harriman WWTP. The study concluded that facility capacity could be cost effectively increased an additional 3.0 mgd, from 6.0 mgd to 9.0 mgd. County officials have expressed an intent to implement the results of the study and therefore further expand the Harriman WWTP's available treatment capacity. A copy of the NYSERDA Study is attached in Appendix K.

BACKUP WATER SUPPLY

2-2 *I would also note that the wells that you currently have--I don't know if you would have to pay back the monies that were given to you as grants because of the fact that they were largely provided by both state and federal grants. I'm sure they don't give you grants for interim use. They assume it's going to be for permanent usage and not as a backup system.*

All wells in the Kiryas Joel water system have been used and continue to be used as the primary source of potable water for the Village. The Village has decided it needs a more reliable primary source of potable water. After implementation of the proposed Aqueduct connection, the existing water supply wells, which will still be regularly maintained as part of the Village water system, would become the Village's primary water source at times when the Aqueduct is shut down for maintenance or repair. The majority of the monies previously received by the Village for water system development have been in the form of loans and bonds. The Village remains obligated to meeting its loan and bond requirements.

3-3 *It is not mandatory by us, but the question of backup water supply is an important one. From time to time we do take down our aqueducts for repairs, maintenance, and any unforeseen problems. So, therefore, it is rather essential for the Village to have some sort of backup water supply. The existing water supply they have would have to be maintained, or there has to be some understanding between the different communities that do take water from the village that when needed the Village can get that water back for their own consumers. The potential likely degree of reliance in the backup water supply must be addressed.*

14-5 *The 14 wells currently used by the Village are being considered a backup supply. Will this backup supply be adequate when the NYCDEP shuts down the Aqueduct as they do on a regular basis (for approximately 3 days) and cuts off that water for use?*

15-5 *We estimate that within 5 years after completion of the aqueduct connection, Kiryas Joel would once more be increasingly dependent upon groundwater and would generate potential impacts (from traffic from water tank trucks and/or damage to the aquifer and neighboring wells from over-pumping) on its neighbors whenever the aqueduct needs to be shut down, either for maintenance or for unforeseen circumstances.*

15-16 *NYC requires municipalities connected to their aqueduct must have a second source of water. The DEIS does not address back-up water supplies when the aqueducts are periodically shut down nor what provisions will be made to supply alternate water for a community that will become dependent upon the aqueduct for its primary water source...Information about what type of back-up supply need to be addressed in the DEIS.*

As proposed, the Aqueduct connection would provide water to the Village, and the existing Village water supply system would provide backup to the Aqueduct connection. The Village has four water storage tanks with a total capacity of approximately 2.5 million gallons. In addition to the four tanks presently utilized, the Village is in the process of designing a fifth tank with a storage capacity of 2 million gallons. Together, the 4 current storage tanks and the 14 permitted wells can provide approximately 2 mgd of water for 3 days, 1.8 mgd for 4 days, or 1.6 mgd for 5 days. In such circumstances, water management procedures also may be implemented, as needed.

Subsequent to the completion of the FEIS and Findings Statement, the New York State Department of Environmental Conservation ("DEC") approved a new groundwater well on March 9, 2005 (Well #27), that increased the Village's water supply (and corresponding wastewater production) by 135,000 gpd (125 gpm @ 18 hrs/day). In addition, on August 17, 2005, DEC approved another new groundwater well for the Village (Well #28) with an output of 486,000 gallons per day. In total, both approvals by DEC represent an addition of 621,000 gpd of new water supply to the Village. As a result, the Village now has approval to draw in excess of 1.9 mgd from its existing wells. As noted in the DEIS, this current capacity will serve and be maintained as the Village's backup water supply in the event of shutdown of the Aqueduct for repairs or otherwise. Copies of the DEC issued well permits are attached to the Amended FEIS as Appendix I.

3-7 We would like to know the time frame for development of additional wells by the Village. More information should be given on the parcel outside the Village where additional wells might be developed.

Due to the nature of water exploration, no set timetable for the development of additional wells can be developed. Water must be located and tested for quality and quantity and impact on neighboring public and private wells before application for taking authority can be undertaken. Currently, the Village is in the process of permitting two wells with an estimated capacity of 0.8 mgd. One of these wells is a deep rock well located on the Brenner Property. The second is a sand and gravel well located on a Village owned parcel. Parcels on which additional wells may be developed are disclosed in the approval process for such wells.

Subsequent to the completion of the FEIS and Findings Statement, the New York State Department of Environmental Conservation ("DEC") approved a new groundwater well on March 9, 2005 (Well #27), that increased the Village's water supply (and corresponding wastewater production) by 135,000 gpd (125 gpm @ 18 hrs/day). In addition, on August 17, 2005, DEC approved another new groundwater well for the Village (Well #28) with an output of 486,000 gallons per day. In total, both approvals by DEC represent an addition of 621,000 gpd of new water supply to the Village. Copies of the DEC water supply well permits are attached to the Amended FEIS as Appendix I.

WATER ACCESS

7-1 *There are many people in the community that are not necessarily in agreement with the leadership. Would the water be accessible to those people as well?*

The water from the proposed Catskill Aqueduct connection would be available to all residents of the Village of Kiryas Joel.

7-2 *There are many wells in the community, some private and some not so private. There is a grid of water pipes in the Village, so could there be a tradeoff of water from one side to be used on another side of the Village?*

The water supply pipes in the Village of Kiryas Joel are interconnected so that any building in the Village can receive water from any well in the Village water system.

REGULATORY REQUIREMENTS AND INVOLVED/INTERESTED AGENCIES

15-26 We believe that taking a hard look at the potential impacts from the additional population commensurate with increased availability of drinking water is a SEQRA requirement. This requirement is not addressed by stating, contrary to fact that population growth can occur without a simple drink of water. Despite the Village's religious practices, SEQRA and Municipal Zoning require acceptance of responsible land management practices.

16-1 We request that the Orange County Sewer District No.1, the Orange County Department of Environmental Facilities, Public Works, and Planning listed as involved agencies under SEQR in relation to this proposal.

16-4 On page S-5 the Orange County Department of Environmental Services and Orange County Sewer District No.1 should be, but are not, included on the list of agencies from which permits and approvals may be required.

16-5 In addition, the Orange County Department of Public Works should be included on the list. Required approvals include, but are not necessarily limited to, a permit for the proposed discharge of the backwash from the proposed water filtration plant into Orange County Sewer District No. 1 sewers.

16-8 On page S-5 is a list of the approvals that are needed. They should add the Orange County DPW to the list for any work that is done within the right-of-way of any County road. We also request that the Orange County Sewer District No.1, the Orange County Department of Environmental Facilities, and Planning be added as agencies having permitting and review authority.

16-10 On page 1-10 the County DPW should be listed as an involved agency. County Environmental Facilities and Planning should also be listed as "interested parties."

16-18 On page S5, and throughout other relevant areas of the DEIS, the Orange County Department of Environmental Facilities and Services is not included and it should be. This is especially true with respect to a potential proposal to discharge backwash water into OCSD1 sewers from the new Water Filtration Plant proposed for construction on Berdichev Road in the Village.

The purpose of SEQRA is to identify adverse environmental effects and to mitigate such adverse effects to the maximum extent practicable. Human health and existing patterns of population growth and community character are major components of the "environment" as defined by SEQRA. Existing population growth, as opposed to population migration, is dependent on the birth of children and on the availability of water for supporting the existing population and their families. The unavailability of sufficient wholesome, potable water may have severe adverse impacts. The lack of such water results in unwholesome conditions, disease and even death. Conversely, provision of a more reliable, safe water supply – the action being analyzed under SEQRA – reduces the adverse impacts and preserves the human health, population patterns and community character of the Village. The existing religious practices of the residents of the Village are the major components of existing community character and, therefore, do not conflict with the responsible application of SEQRA, municipal zoning or land use practices. The Aqueduct connection is in compliance with the Village's municipal zoning as required by the Village's comprehensive plan. Therefore, the provision of water supply actually furthers the goal of protecting the environment, supporting zoning and furthering land use planning.

SEQRA notices and copies of the SEQRA documents have been filed with Orange County with the offices of the County Executive. Comments have been received from County agencies and have been reviewed. All County agency comments will be given due consideration in the appropriate context. SEQRA defines an "involved agency" as an agency that has jurisdiction by law to make discretionary decisions to fund, approve or directly undertake an action. 6NYCRR 617.1(s). The Village, as lead agency, has exercised due diligence in determining a list of involved agencies as included in the EAF, Final Scope, and DEIS at Section 1.6. With respect to a county highway permit, for example, the NYS Village Law provides independent authority for construction of the aqueduct connection, stating that "water pipes may be laid, re-laid, or repaired under any public highway in the county in which any part of the Village is located." The only requirement set forth in this state law is that the Village "cause the surface of such highway to be restored to its usual condition. Since the Village has express statutory authority to lay the water pipes in the County highway and the Village is conducting one of its essential governmental operations (which, by nature, may not be subject to the permitting authority of other municipalities pursuant to the public interest test applied by the courts), The County highway work permit is ministerial in nature. Therefore, the Village will cooperate with the County in its permitting processes in all those matters which the Village finds reasonable and proper concerning the County's interests with respect to the Village's project at such time as any County permit applications are submitted. The County agencies, having appropriate areas of interest and expertise, will be added to the list of interested agencies.

GROWTH INDUCEMENT

4-2 *We are not happy with the general growth in Orange County and with the Village of Kiryas Joel at the headwaters of the Ramapo River watershed we are concerned with the level of development that this project may induce.*

5-3 *...But more realistically, given water is a finite resource shared by all communities, whether we could justify any plan that allows one community to have that growth rate.*

8-2 *The DEIS says that growth in the Village of Kiryas Joel is primarily internal. However, with this abundant water I'm concerned as a next-door neighbor that such growth would not be internal, that it would attract a lot of people from New York....Would there be a transparent mechanism to prevent the influx of outsiders, non-KJ generated people from migrating to the area if the proposed Catskill Aqueduct Tap project comes into effect? A transparent system so that only people who live in this community and their children, rather than outsiders, would be using this water?*

14-7 *Section 2.8.2, the increase in the population due to large family size is discussed. "The lack of essential services, such as drinking water has not slowed population growth in Kiryas Joel." While the intention of the project may not be to encourage "significant additional growth" due to an influx of residents from outside the village, it is very likely that such growth will occur. The provision of an additional service (water supply) would supplement the already occurring growth (due to family size). This would have an immediate effect on the infrastructure on the surrounding areas and in the region, including but not limited to roads and wastewater treatment facilities. What plans are in place to address these issues?*

15-25 *Why hasn't growth management been investigated as part of the DEIS? It is important to the community to plan for a safe and healthful environment for itself and its neighbors. At some point it will become physically impossible to accommodate additional population within Kiryas Joel. Shouldn't the DEIS ask difficult questions such as how many people can be supported by the existing infrastructure and how will improvements to infrastructure increases the carrying load of the land? At the minimum the growth inducing aspects section should assess how the existing infrastructure (including sewage treatment and roadways) of the Village and surrounding communities would be able to support the additional population.*

15-27 *Although the letter from the NYC Water Board acknowledges that Kiryas Joel is entitled to withdraw 1.1 MGD based on its population (1990 census), the DEIS repeatedly states that the Village is now entitled to withdraw approximately 1.0 MGD based on the 2000 census. Which is correct? Can one assume that the Village will modify its entitlement requests after each census and increase it's taking of water from the aqueduct?*

15-29 *There is a possibility that this action may support migration into the community from elsewhere as well as the natural growth of the community due to marriages and births. While young women must remain in the Village to raise their families, do husbands come from outside Kiryas Joel? The possibility of outside migration should be seriously explored unless the Village has a plan to prevent such migration from occurring.*

16-22 *With the increased availability of water supply and wastewater treatment and a large demand for housing in areas outside the Village, how will the influx of outside community housing development be curbed, controlled and/or prevented within the Village?*

16-25 *We concur that the inherent nature of the specific proposal applies only to meeting water demands within the Village of Kiryas Joel and that growth-inducement outside of the Village as a result of access to the NYS Catskill Aqueduct is not intended with this project. However, there is both a trend of regional growth and a clear record of interest by the neighboring municipalities along the proposed waterline regarding future access to this pipeline and/or shared use of the aqueduct tap. Those neighbors have expressed a range of interests from access as community backup supplies, access to address certain, existing neighborhood shortages, as well as the influences of improved water capacities on development expansion from the Village into neighboring Towns. The DEIS should provide some further discussion on these issues. At a minimum, the DEIS should, in Section 6, provide a record of growth trends and water needs in the immediate region of the Village and along the pipeline routes, and the DEIS should review any record or discussion with Town and Village leaders in this region and along these routes relevant to water needs and prospective access to Catskill aqueduct water.*

18-2 *I can only view this additional water supply as a sign of encouragement to further residential and business development in what is now open green space where people from our urban areas can come to enjoy the natural beauty and wildlife, and the solitude that have been vanishing at a more rapid pace these days as urban sprawl brings with it more traffic, more pollution, and a generally worsening quality of life.*

The provision of adequate potable water supply is part of the Village's growth management plan. Proper growth management seeks to provide adequate infrastructure for the people's needs. The Village has ongoing programs to provide for such needs and this project is a next step in a multi-year, multi-million dollar program to provide potable water supply for the people of the Village. The Village's growth management plan seeks to sustain growth by meeting the people's needs. To date, the internal growth from the Village has been sustained and the Village's growth management policy seeks to sustain it in the future. While neighboring Villages have an abundance of water supply, the Village has been working hard to maintain sufficient supplies to meet peak demands. Comments made infer that "growth management" is a code word for artificially withholding needed infrastructure to inhibit growth. Such artificial limitations may be effective in limiting population migration, but not in limiting natural internal growth.

The Village's projection of internal growth of its population is based on observation of the population dynamic in the Village. Unlike the surrounding environment, virtually all maturing young persons get married and raise children in marital family units which remain stable throughout the lifetimes of the husbands and wives. The children are nurtured, raised and supported in an environment which treasures them as divine gifts. The census data show that the overall population of the Village is young and maturing. Young women remain in the community, while young men move to where their wives reside. Some migration of young men to the Village is expected, but is offset by young men moving to other communities. Thus no significant growth from outside sources coming to the Village is observed.

The suggestions of some commentators are that mechanisms for preventing population migration or outside growth should be implemented. While such measures are deemed by the Village to be unnecessary based on the lack of significant growth from outside sources, such measures would be prohibited by constitutional principles which uphold the right of people in the United States to move and live where they choose.

Since the Village project does not propose to supply water in areas outside the Village, growth inducement in such areas is not being analyzed. Growth inducement in those areas related to water supply will be analyzed by those who undertake to supply water to those areas.

In response to the Appellate Division Decision and Order, the Village engaged another consultant, AKRF Environmental and Planning Consultants (AKRF), with expertise in economic impact analysis, modeling and forecasting, demographic analysis, market studies, public policy analysis, and long-range planning to expand upon the population projections for the Village and assess the potential for significant increased growth induced by the Project. A summary of the growth study is included in Section 3 and the full report is attached in Appendix N. Population projections are now provided through 2030, with corresponding estimated water supply demand. The study concluded that current population figures, and thus future projections, are slightly less than projected in the DEIS. The study also assessed the level of in-migration into the Village over the Village's history and concluded that the amount of such in-migration has been steadily decreasing and is forecasted to continue to decline. Finally, the study concluded, based on the history of the Village, that the ready availability or lack of certain utilities, such as sewer and water, has had no cognizable influence on the internal or external growth of the Village population. This is expected to remain the case once the Project is completed, since the Village is merely replacing its existing water supply with a new source.

In the original EIS, the Village considered its historic growth, future growth projections and remaining build-out potential. (DEIS §§ 1.2.1 and 6; FEIS pp. 2-18 – 2-20). The Village considered that: (i) the Project was not intended to provide water to areas outside the Village; (ii) the Project involves only a new water source tying directly into the existing distribution system; not creation or expansion of the distribution system; and (iii) the Project will not bring water to an undeveloped or unserviced area. The original EIS also recognized that the Project will create few, if any, permanent employment opportunities and job creation will not induce people to move into the Village. Based on these considerations, the Village concluded the Project will not significantly induce new growth inside or outside of the Village.

STREAMS

14-1 Along the proposed route, there are major stream crossings at Moodna Creek and Perry Creek...More detailed plans for mitigation, especially in the instances of burying the pipeline for the stream crossing, should be addressed. Also more detailed plans and preparation are needed in regard to the proximity of the many surface water areas adjacent to the proposed route.

The project design has not been completed; therefore, detailed plans for mitigation at stream crossings have not been finalized. Stream crossings will be completed in accordance with applicable State or Federal permit regulations (e.g., NYSDEC Protection of Waters permit and/or US Army Corps of Engineers Section 10/404 permits). Any impacts to the flow or water quality of the streams at these locations would be temporary and construction-related, and proper construction mitigation measures would be employed to minimize such impacts. Pipeline stream crossings would be designed to allow the regulatory flood flow of water under a bridge or through a culvert to prevent new flooding impacts. If practical, attaching the pipeline to existing bridges or "boring or jacking" the pipe below the streambed (preferred method of the Army Corps of Engineers), will be implemented to avoid stream disturbance. However, should in-stream work be unavoidable, accepted methods of utility stream crossing that may be put into practice include stream diversion, flume pipe crossing, or cofferdam utility crossing. Stream work will be continuous and in compliance with State and/or Federal requirements until the work is complete and the stream can either be re-diverted or returned to previous conditions

During design, careful consideration will be given to the control methods used during the utility stream crossings to protect sediment from entering into the stream during construction and to minimize the amount of disturbance the stream experiences. A Soil Erosion and Sediment Control (SESC) plan will be devised to assist in achieving minimal water and natural resource disturbance. In accordance with the NYSDEC's Soil Erosion and Sediment Control Guidelines, surface runoff that is relatively clean and sediment free will be diverted from flowing through areas of construction activity on the project site. Run off from land disturbing activities will not be discharged off-site or into storm drains or watercourses unless directed through a properly designed, installed and maintained structure, such as a sediment trap, to retain sediment on-site. Additionally, the SESC plan will require the installation of a silt fence around the perimeter of the pump station and water treatment plant locations and along the preferred pipeline route to prevent off site movement of sediment produced by construction activities. Erosion control blankets, straw mulch or other control measures will be utilized in drainage swales and ditches, as well as on slopes exceeding 3:1 as a means of stabilization and control. The extent of land alteration, including removal of existing vegetation and land cover will be minimized to the greatest extent possible. Erosion control blankets, straw mulch or other control measures will be utilized in drainage swales and ditches, as well as on slopes exceeding 3:1 as a means of stabilization and control. Gabion baskets, rip-rap, log cribbing or vegetative measures will be used to minimize impacts to stream beds and banks on-site and off-site that may be affected by land clearing, grading, and construction activities. The SESC plan for the proposed project will be completed and approved prior to construction and will remain in place until project completion.

As part of the expanded wetlands delineation conducted in response to the Appellate Division Order and Decision, eight wetland areas were noted as stream crossings along Alternative Route C (County

Routes 94/27/208). The Moodna Creek and Woodbury Creek are Class C water bodies under DEC regulations. Crossings of these two water bodies will not require a Protection of Waters permit from DEC. Nevertheless, as described above, best management practices, including erosion and sediment control measures, will be utilized as noted above to ensure no impacts to stream flow or from sediment runoff occur at any of the stream crossings.

17-22 The DEIS does not indicate how many acres of temporary or permanent stormwater detention ponds will be needed. It does not indicate where those detention ponds will be located and the impacts of their construction. A similar analysis is also needed for any pump stations or temporary staging areas along the pipeline route.

A construction plan has not yet been prepared; therefore, the number and location of detention ponds is not known at this time. These items will be provided for under the SPDES construction permit for this project. Similarly, staging areas have not yet been determined for the project. No pump stations are proposed along the pipeline route.

17-23 Please discuss whether the proposed Water Treatment Plant will result in any discharge to nearby streams from such things as filter backwash, alum, or any other discharge of process water or effluent from the plant. Please discuss whether area streams around the proposed Water Treatment Plant site (or any alternate site for it) can adequately assimilate such discharges during normal and drought periods.

Any liquid discharge from the new water treatment processes would be to the sanitary sewer system where it is treated pursuant to permit. Backwash water from the Village's current water treatment plant is discharged to a wastewater treatment plant via the sanitary sewer system... Sludge would be disposed of as a solid waste. Therefore, no area streams would be directly affected by process water or effluent from the plant.

DELAWARE RIVER WATERSHED

11-1 The EIS must address potential impacts on the Delaware River watershed, including the area below the New York City reservoirs.

The reservoirs that are the source for Catskill Aqueduct water, the Schoharie Reservoir and the Ashokan Reservoir, were created by diverting water from the Delaware River watershed. However, the proposed 2 mgd water withdrawal from the aqueduct represents only 0.3% of the capacity of the Catskill Aqueduct (580 mgd). As a result, the proposed water withdrawal will have a negligible impact on the Delaware River.

6-1 We hope there will be no taps on either the Catskill Aqueduct or Delaware Aqueduct until the Hudson River is taken for water at 325 mgd.

The development of the Hudson River as a source for New York City water would be a large-scale initiative that is beyond the scope of the Kiryas Joel connection project. It is not economically feasible for the Village of Kiryas Joel to withdraw and treat Hudson River water for the proposed project.

RAMAPO RIVER WATERSHED

4-1 *We request a Supplemental Environmental Impact Study to address the impact on the Ramapo River watershed mostly through the increase of treated sewage effluent that would result from this connection. We would hope that the supplemental would include the level of treatment the sewage will get.*

14-6 *What studies have been conducted to determine the impact to the Ramapo River watershed?*

The quantity and quality of wastewater treatment effluent discharged to New York watersheds is regulated by the State through State Pollutant Discharge Elimination System permitting. Any additional wastewater generated from the Village of Kiryas Joel will be treated at its own plant or at the Harriman treatment plant and would be subject to each plant's respective existing permit limits. These limits serve to reduce the impact on water quality based on the regulated uses of a receiving water body. The impact of wastewater effluent on area streams has been studied in the permit applications for the wastewater treatment plants to which Kiryas Joel wastewater will be discharged. No modifications to these permits are anticipated to directly result from this project. Therefore, there are no additional significant adverse impacts anticipated from treated wastewater effluent and no supplemental studies warranted.

In response to the Appellate Division Decision and Order, the Village expanded its analysis of the potential impact of the Project on the Ramapo River. This analysis is included in Section 3 below. The analysis concluded that there will be no adverse impacts to the Ramapo River as a result of the Project but rather there will likely be a positive impact resulting from the inter-basin transfer of water into the Ramapo River watershed.

Subsequent to the completion of the FEIS and Findings Statement, on March 9, 2005, the New York State Department of Environmental Conservation ("DEC") approved a new groundwater well (Well #27) that increased the Village's water supply (and corresponding wastewater production) by 135,000 gpd (125 gpm @ 18 hrs/day). In addition, on August 17, 2005, DEC approved another new groundwater well for the Village (Well #28) with an output of 486,000 gallons per day. In total, both approvals by DEC represented an addition of 621,000 gpd of new water supply to the Village. As a result, the Village now has approval to draw in excess of 1.9 mgd from its existing wells, with a corresponding potential volume of wastewater generated. Despite such a significant increase in the Village's water supply and corresponding waste water generation potential, DEC expressly determined in its approvals that this new water supply would have no adverse impact on the Harriman WWTP or the Ramapo River. In response to public comments regarding the potential impact of this additional water supply on growth, wastewater and the Ramapo River, DEC stated:

> ***In regards to the concern about growth impacts, particularly upon the sewage treatment capacity in the Ramapo River Basin, this Department carefully reviewed its files in regards to the capacity of both the Village' Sewage Treatment Plant and Orange County's Harriman Sewage Treatment Plant to treat this additional wastewater. We determined that there is sufficient excess capacity to treat this additional water, without adverse impacts on the Ramapo River.***

Moreover, Orange County engaged CDM in 2006 to complete the "Harriman Wastewater Treatment Facility Membrane Bioreactor Pilot Study" pursuant to a grant from the New York State Energy Research and Development Authority ("NYSERDA Study"). The NYSERDA Study assessed the feasibility, effectiveness, and cost of implementing a membrane bioreactor ("MBR") treatment system at the Harriman WWTP. The study concluded that facility capacity could be cost effectively increased an additional 3.0 mgd, from 6.0 mgd to 9.0 mgd. Additionally, the study's results demonstrated that the anticipated discharge permit standards for such an increase are readily achievable and technologically feasible for the Harriman WWTP and will also actually increase the quality of the effluent discharged to the Ramapo River. This study is summarized in the analysis of potential wastewater impacts on the Ramapo River in Section 3 and attached in full in Appendix K.

FLOODING

16-21 The DEIS states that there will be no problem with the maximum flow of Moodna Creek due to the proposed pipeline being suspended from the bridge. What year flood mark was used to support this statement?

The DEIS concludes that there would be no flood impact from the pipeline because the invert of the pipeline would not be below the existing Route 27 bridge structure. The bridge structure beneath the roadway consists of four steel beams that appear to extend approximately 4 to 5 feet below the base of the roadway. Therefore, an 18-inch or 24-inch pipe affixed to the bridge would be placed up between these beams and not below the existing bridge profile. The FEMA map of the bridge location shows that the surface of the bridge roadway is not within the 100-year flood plain. Pipeline crossings of all streams would be designed to allow the regulatory flood flow of water under a bridge or through a culvert to prevent new flooding impacts.

STORMWATER

17-14 Please include a detailed discussion of stormwater management during construction on steep slopes.

A stormwater management plan pursuant to state stormwater permitting regulations would be developed during the design phase of the project. All stormwater management during construction of the pipeline would be executed in compliance with applicable regulations. Any potential stormwater impacts would be monitored in the field, and steps would be taken to prevent such temporary impacts to the extent possible. The appropriate erosion and sediment control approvals would be obtained prior to construction of the pipeline.

During design, careful consideration will be given to the control methods used during the utility stream crossings to protect sediment from entering into the stream during construction and to minimize the amount of disturbance the stream experiences. A Soil Erosion and Sediment Control (SESC) plan will be devised to assist in achieving minimal water and natural resource disturbance. In accordance with the NYSDEC's Soil Erosion and Sediment Control Guidelines, surface runoff that is relatively clean and sediment free will be diverted from flowing through areas of construction activity on the project site. Run off from land disturbing activities will not be discharged off-site or into storm drains or watercourses unless directed through a properly designed, installed and maintained structure, such as a sediment trap, to retain sediment on-site. Additionally, the SESC plan will require the installation of a silt fence around the perimeter of the pump station and water treatment plant locations and along the preferred pipeline route to prevent off site movement of sediment produced by construction activities. The extent of land alteration, including removal of existing vegetation and land cover will be minimized to the greatest extent possible. Erosion control blankets, straw mulch or other control measures will be utilized in drainage swales and ditches, as well as on slopes exceeding 3:1 as a means of stabilization and control. Gabion baskets, rip-rap, log cribbing or vegetative measures will be used to minimize impacts to stream beds and banks on-site and off-site that may be affected by land clearing, grading, and construction activities. The SESC plan for the proposed project will be completed and approved prior to construction and will remain in place until project completion.

Since the completion of the FEIS and Findings Statement, DEC has implemented a new stormwater general SPDES permit for construction activities, GP-0-08-001. The stormwater pollution protection plan for the Project which is required prior to beginning construction will be updated appropriately to account for the changes in the general permit.

WETLANDS

14-2 More inclusive planning is also required in regard to the wetlands (e.g. those at Route 27 near Mountain Lodge Road) as well.

As stated in the DEIS (page 2-16), a field survey of the mapped (NWI and NYSDEC) wetland areas was conducted to generally confirm the presence of mapped wetlands along the proposed pipeline route. The focus of the analysis was to identify potential areas of impact so that the design could be focused to avoid the potential for such impacts. During design the DEIS recommends delineation of several areas (including Route 27 at Mountain Lodge Road) in order to identify the full extent of wetlands and to avoid impacts to these wetlands during construction. The delineation would be conducted in accordance with the appropriate Federal/State requirements as part of the final design of this section of the pipeline route.

As noted in the DEIS, no permanent wetland impacts (permanent fill) requiring a permit are anticipated.

In response to the Appellate Division Decision and Order, the Village expanded upon its wetland analysis and delineated those areas along alternative routes A and C that could potentially be impacted by the Project. The expanded analysis is set forth in Section 3 below and in Appendix E.

THREATENED AND ENDANGERED SPECIES

2-3 ...Route 27, also known as Clove Road, there is a large infestation of the timber rattlesnake.

14-4 In Section 2.3.3 The DEIS discusses Endangered and Threatened Species and although " no Federal or State listed or proposed endangered or threatened species are known to exist within the project study area", what plans for mitigation does the proposed project have in the event that such species are discovered in the project area?

As described in section 2.3.1 of the DEIS, no Federal or State listed or proposed endangered or threatened species are known to exist along the proposed area of disturbance. Therefore, development of mitigation measures is not required. If during final project design and/or project construction endangered or threatened species are discovered, the appropriate agencies (i.e., NYSDEC) will be notified and specific measures will be implemented as directed by that agency.

15-23 The DEIS has not explored the potential for endangered or threatened species at the alternative water treatment site. The DEIS should contact DEC's Natural Heritage program to determine the presence of endangered or threatened species. The alternative water treatment site should be field checked for endangered and threatened flora and fauna; timber rattlesnakes are known to inhabit the Schunnemunk Mountains.

The NYSDEC was contacted to determine if sitings of threatened or endangered species were recorded for any of the three pipeline routes, the connection to the aqueduct site, and pump station and treatment plant locations. No sitings were identified. As the alternative water treatment plant located on Seven Springs Road just west of Bakertown Road is not the preferred location for the water treatment plant, there is no need to field check the site for the presence of such species.

VEGETATION

17-20 If any construction is outside of the road pavement, how many acres of trees and shrubs will be removed in order to install the pipeline? How many acres will be replanted?

As described in the DEIS, the pipeline would be placed in the roadway shoulder, easement or the roadway itself. Therefore, it is unlikely that the installation of the pipeline would require the removal of trees and large shrubs. To the extent any vegetation will be removed, it will be minimized to the greatest extent possible. The contractor's staging areas may require the removal of existing vegetation. These areas will be re-vegetated at the conclusion of their use by the contractor.

17-24 The DEIS does not indicate whether the pipeline trench will be constructed within 50 ft. of any mature trees, and if so, what analysis would be done on whether such construction could damage or destroy the root system of these trees. Please provide a methodology for such analysis and an indication of how impacts to mature trees will be avoided or prevented.

As stated in the DEIS, the pipeline would be placed either within the shoulder, easement or the roadway itself. The placement will be determined by many factors including, but not limited to, the existence of utilities within a roadway, the width of a roadway shoulder or its easement, and the presence of wetlands or potential historic/archaeological resources. During final design the location of trees required to be protected under local tree preservation regulations within 50 feet of the pipeline trench will be identified. Efforts will be made to place the trench outside the area of the tree's root system. Temporary fencing will be placed to prevent accidental disturbance of these trees.

15-6 *The DEIS states that the aqueduct pipeline will cross the Moodna Creek and potentially other streams, via attachments to existing bridges. How does this assure that the pipeline is not susceptible to damage during extremely cold weather, damage during bridge and roadway repairs/improvements, and to damage from intentional mischief or sabotage?*

16-2 *The DEIS should explain maintenance responsibilities for this pipeline as well as protocols for maintenance during bridge work or reconstruction.*

Standard pipeline maintenance and protection measures will be developed during the design phase of the project. The constant flow of water through the pipeline would help reduce the risk of freezing during unusually cold weather. During a bridge repair, it would be the responsibility of the Village to work with the entity repairing the bridge to temporarily or permanently relocate or otherwise protect the pipeline. The risk of sabotage is present for any water supply; indeed, greater attention is being focused on this threat across the nation. Appropriate security measures would be investigated to protect the pipeline at any point where it is exposed.

17-13 *Although the DEIS discusses the potential for encountering steep slopes or shallow bedrock in generic terms, it did not identify the specific areas where theses problems might be encountered. It did not provide a map or quantify how many hundreds of thousands of linear feet of this proposed pipeline might encounter these types of difficult construction areas. Please quantify in detail where these areas might be located, their length, and how steep are the slopes or how shallow is the bedrock in these areas. Please discuss site-specific construction techniques to reduce impacts on land, traffic, streams, and nearby businesses for each of these areas.*

The project route has not yet been surveyed. This would be completed during the design phase of the project. At that time, detailed information and construction planning regarding steep slopes or bedrock would be presented as part of the State permitting process.

A Soil Erosion and Sediment Control (SESC) plan will be devised to assist in achieving minimal water and natural resource disturbance. In accordance with the NYSDEC's Soil Erosion and Sediment Control Guidelines surface runoff that is relatively clean and sediment free will be diverted from flowing through areas of construction activity on the project site. Run off from land disturbing activities will not be discharged off-site or into storm drains or watercourses unless directed through a properly designed, installed and maintained structure, such as a sediment trap, to retain sediment on-site. Additionally, the SESC plan will require the installation of a silt fence around the perimeter of the pump station and water treatment plant locations and along the preferred pipeline route to prevent off site movement of sediment produced by construction activities. Erosion control blankets, straw mulch or other control measures will be utilized in drainage swales and ditches, as well as on slopes exceeding 3:1 as a means of stabilization. Gabion baskets, rip-rap, log cribbing or vegetative measures will be used to minimize impacts to stream beds and banks on-site and off-site that may be affected by land clearing, grading, and construction activities... The SESC plan for the proposed project will be completed and approved prior to construction and will remain in place until project completion.

16-3 *The Village may have to install the pipe in the shoulder or roadway due to adjacent wetlands. This could pose a safety threat to the traveling public if the pipe should ever fail. A flow of*

1,400 GPM could easily wash out the roadway. Given that this is not a well-lit road and that it has a great deal of both vertical and horizontal curvature, a wash out at night could be life threatening to anybody driving on it.

Any pipe theoretically can fail and if undetected such a failure could cause washouts. However, with modern design and construction techniques combined with today's materials, the likelihood of pipe failure is low. Should a failure occur, corrective action would be implemented as soon as possible to minimize impacts.

16-9 The trench is described as being 4' wide and 4.5' deep. The depth of the trench has to be greater than that to allow for future drainage installations. The depth to the top of the water main should be 4.5', minimum.

The pipeline would be installed under Orange County roads in compliance with County and NYSDOT standards such as the *New York State Department of Transportation Requirements for the Design and Construction of Underground Utility Installations Within the State Highway Right-of-Way*. The depth of cover over the pipe would be increased to 4.5 feet if required.

BLASTING

2-4 *Additionally, there is discussion about blasting and blasting is a real concern in Blooming Grove. When you go along Clove Road there are areas known as Glenwood Hills and Mountain Lodge Park and many years ago in the 1980's there was a proposal to bring sewer lines up to that area, and this was turned down vehemently by the people there and by engineering studies that led to the conclusion that blasting in that area could impact the wells people had and also their foundations of their homes. This can be documented from the 1980's, so I think that would be something that on Route 27 would bring major concern.*

15-7 *Page 2-40 lists the first two mitigations for blasting and discusses adherence to laws and permitting procedures. The DEIS states that the requirement of inspection of off-site properties previous to blasting would only be conducted when requested or authorized by the owner. Some property owners may not understand their rights to request inspection as the mitigation is presently written. We recommend that the project sponsor be required to send notice of blasting by certified mail to all property owners within 500 feet of blasting. This notice should include information in clear language regarding how the property owner can make an appointment for pre- and post-blasting inspections. We also recommend monitoring of any public and private water supply wells within 500 feet of blasting. A plan for this monitoring should be made part of the DEIS so that it can be commented upon by the public, especially those directly affected.*

17-15 *...These (construction techniques) should include a detailed discussion of ...blasting impacts in areas of shallow bedrock. DEC recommends a pre-blast survey of the foundations and wells of all homes, institutions and businesses within 500 ft. of blasting.*

Because the pipeline is proposed to be installed in existing paved roads or road shoulders, blasting is not expected to be required. Blasting would be used as a last resort if bedrock or large boulders were encountered and alternative means such as ripping were not feasible. Blasting would be limited to the smallest area possible. If blasting is necessary, it would be done in conformance with state and local rules and regulations. This includes notices to surrounding property owners as required by any applicable regulations.

Precise pre- and post-blast survey plans will be developed during design, based on geologic investigations for design, locations of proposed blasting (if any), and state and local requirements.

HISTORIC, ARCHITECTURAL AND ARCHEOLOGICAL RESOURCES

2-7 *...a very highly regarded, but he is deceased, the late Roger King, is a historian. And he brought to my attention that on Route 208 proceeding up toward the Peddler Hill area, there is a roadway that was changed – Route 208, was changed in the 1920s and it goes through a 1700s cemetery. And by using infrared Mr. King himself had gone and seen that there are numerous bodies of historical significance buried in the shoulder of Route 208. ...which is right along the area where you are looking to go.*

In response to this comment, local repositories were researched by HPI, cultural resources specialists for the EIS. The information found suggests past re-routing of the road (now Route 208) did occur in the vicinity of a small cemetery and buried remains may have been moved. (See the response to the comments below for a description of the protocol to be followed to avoid sensitive cultural resources or mitigate potential impacts should resources be encountered.) Additionally, the Town of Blooming Grove installed a sewer force main in the easterly shoulder of Route 208 in this area without any adverse effects (i.e., no human remains were unearthed).

14-3 *In regard to Archeological Sites and areas of Historic significance, reliance on anecdotal evidence or general trends (e.g. "Native American settlements or villages tended to be located near critical resources, such as water, flat or gently sloped fertile lands, or vantage points on the landscape") are not satisfactory for mitigation efforts. It is highly likely that currently unknown locations of historical and archeological importance will be encountered. "As road locations have changed, it is possible that some early historic sites are located under current roadbeds." Again, more specific planning is required and should be delineated in the Environmental Impact Statement. Also, more specific plans are required for the known archeological and historic sites such as those on the west side of Riley Road. (USN #07115.0000706 and USN07115.0000707 and the historic sites along Rt. 94).*

The following protocol will be incorporated as special conditions in the SEQRA Findings to be issued for this project to avoid adverse effects on cultural resources.

1. The Stage 1-A investigation will be used to assess and identify general areas of potential archeological or historic sensitivity in the project corridor including alignment, staging areas, temporary access roads, etc. Maps of the preferred pipeline route shall also be assessed to confirm that construction will occur in areas of prior disturbance.

2. For the known archeological site locations and the areas of potential sensitivity identified in step 1, an evaluation based on construction drawings, USGS topographic maps, and observations made during a site visit will be completed to verify those areas that have been disturbed and can be eliminated from further consideration.

3. Stage 1B archeological testing, per Office of Parks, Recreation and Historic Preservation (OPRHP) guidelines, will be conducted at sites or areas of sensitivity within the preferred route that cannot be documented to have been disturbed. The archeological field-testing will be done sufficiently in advance of construction to allow appropriate consultation regarding potential impacts to archeological sites.

4. When Stage 1B evaluation results in the discovery of archeological materials, additional investigation will be carried out to determine the extent of archeological site integrity and significance. OPRHP shall be consulted and given the opportunity to review and approve avoidance or mitigation plans prior to the start of construction in the area

5. The implementation of the work identified in steps 1-4 will be administered by a 35CFR61-qualified archeologist.

The New York State Office of Parks, Recreation and Historic Preservation has concurred in the foregoing protocol to address any potential adverse impacts on cultural resources. The letter received from the New York State Office or Parks, Recreation and Historic Preservation is included in this document as Appendix C.

17-6 Although Appendix "B" of the DEIS contains a Stage 1-A Culture Resources Report by a professional archaeologist, that Report recommends a Stage 1-B study in selected areas along the pipeline where there is a potential for the remnants of abandoned mill sites. However, it is unclear whether this study should consider areas used for staging construction equipment, as well as pump stations that may be necessary along the pipeline route. Please address this question and provide a revised Report if the current did not consider these areas. Additionally, the Stage 1-B study must be completed as part of preparation of any revised DEIS or an FEIS.

The Stage 1-A Cultural Resources Report contained in Appendix B to the DEIS includes procedures to be implemented in areas such as the contractor's staging area. This discussion is contained on page 31 of that report. In summary, where the contractor's staging area would be located in an area that may be sensitive for historic/archeological resources, the report recommends the use of either a geo-filter on the existing grade or depositing a few inches of topsoil so that a distinct horizon is formed and the potential for impact to these resources is avoided. These areas would be restored and not reused for other purposes once this project is implemented.

As clarification, the 'potential abandoned mill sites' are located at the major stream crossings only, as these are water-dependent structures. The Stage 1-A report recommends that these areas have limited monitoring of excavation conducted only within the zones specifically sensitive for historic mills (as noted on Figure 3-19 of the EIS).

The protocol described in response to comment 14-3 will be incorporated as special conditions in the SEQRA Findings to be issued for this project to avoid adverse effects on cultural resources.

As noted above, the New York State Office of Parks, Recreation and Historic Preservation has concurred in the foregoing protocol to address any potential adverse impacts on cultural resources. The letter received from the New York State Office or Parks, Recreation and Historic Preservation is included in this document as Appendix C.

In response to the Appellate Division order, the archaeological assessment was expanded to follow the protocol through step 3, the completion of a Phase 1-B study in undisturbed areas along the pipeline routes identified as potentially sensitive sites for archaeological resources. On behalf of the Village, HPI completed a "refinement study" for sensitive sites along alternative Routes A (NYS Route 32 and County Route 44) and C (NYS Routes 94,208 and 17 and County Route 27). One

undisturbed sensitive site was identified along each route. The site on Route C was the site of a former cemetery that had reportedly been relocated when the road had been built. Due to the inherent difficulty and cost involved in conducting a Phase 1-B study in an area of potential human remains, it was determined to defer completion of that study pending completion of the study of Route A and further determination of whether Route C was a viable route for the Project. A Phase 1-B was completed for Route A. The findings of the study are set forth in Section 3. The refinement study and the Phase 1-B report are attached here in Appendix M.

POPULATION/DEMOGRAPHICS

15-2 The DEIS claims the proposed Aqueduct connection is needed to support the Village for the next 20 years, but does not provide projections of the population for the next 20 years.

16-23 The DEIS lacks adequate documentation quantifying current against future growth. Our recommendation is that Section 1.2, "Need," include some elaboration on future growth, ideally using a quantifiable methodology and projected out in time for a reasonable period related to the limitations of the proposal.

17-1 The DEIS fails to provide any population projections.

Population growth in Kiryas Joel is now almost entirely internal, meaning it results from births occurring within the Village rather than from people moving into the Village. Analysis of age distribution data from the 1990 Census and the 2000 Census indicates that the internal component of population growth in Kiryas Joel between 1990 and 2000 was approximately 5 percent per year.

The table below shows population projections for Kiryas Joel based on continuation of the internal growth rate of 5 percent per year indicated by U.S. Census data.

Year	Projected Population
2005	16,800
2010	21,400
2015	27,300
2020	34,900
2025	44,500

The proposed Aqueduct connection is needed to meet the water needs of the projected internal growth of the Village population.

SEQRA requires a statement of need for the proposed action solely in order to provide the lead agency something to balance against the action's unmitigated impacts in its SEQRA Findings Statement. The Village has identified a need for an additional reliable water supply given its current demand and the limitations on its current groundwater supply. SEQRA does not require the EIS to make any further determination of need, or future forecast, than that. To project water supply needs over 25 years, as one commenter suggests, is the type of speculation not required by SEQRA.

The only unmitigated impacts to balance, if any, will be the short-term construction impacts. These short-term impacts will be the same regardless of whether the Village need exceeds its capacity in the future 5, 10, or 20.

In response to the Appellate Division Decision and Order, the Village engaged another consultant , AKRF Environmental and Planning Consultants (AKRF), with expertise in economic impact analysis, modeling and forecasting, demographic analysis, market studies, public policy analysis, and long-range planning to expand upon the population projections for the Village and assess the potential for significant increased growth induced by the Project. A summary of the growth study is included in Section 3 and the full report is attached in Appendix N. Population projections are now provided through 2030, with corresponding estimated water supply demand. The study concluded that current population figures, and thus future projections, are slightly less than projected in the DEIS. The study also assessed the level of in-migration into the Village over the Village's history and concluded that the amount of such in-migration has been steadily decreasing and is forecasted to continue to decline. Finally, the study concluded, based on the history of the Village, that the ready availability or lack of certain utilities, such as sewer and water, has had no cognizable influence on the internal or external growth of the Village population. This is expected to remain the case once the Project is completed, since the Village is merely replacing its existing water supply with a new source.

The growth study analysis and report prepared by AKRF for the Amended FEIS projected population in the Village of Kiryas Joel through the year 2030 as set forth in the following table:

Population Projections, 2000-2030

Year	Population	Year	Population
2000	13,138	**2016**	27,334
2001	13,923	**2017**	28,510
2002	14,605	**2018**	29,731
2003	15,296	**2019**	30,994
2004	16,051	**2020**	32,302
2005	16,814	**2021**	33,714
2006	17,661	**2022**	35,203
2007	18,516	**2023**	36,759
2008	19,388	**2024**	38,424
2009	20,270	**2025**	40,161
2010	21,169	**2026**	42,048
2011	22,120	**2027**	44,011
2012	23,088	**2028**	46,088
2013	24,099	**2029**	48,246
2014	25,128	**2030**	50,527
2015	26,200		

Sources: U.S. Census Bureau, 2000 Census; National Center for Health Statistics, Table 308, Deaths by State of Residence Distributed According to State or Country of Birth, By Age, 2000; Village of Kiryas Joel; AKRF, Inc.

Based on the foregoing population projections and a per capita consumption of 66 gpd, revised projected water demand is as follows:

Year	Projected Population	Water Supply Need (mgd)
2010	21,169	1.4
2015	26,200	1.7
2020	32,302	2.1
2025	40,161	2.6
2030	50,527	3.3

3-5 *Once you have the aqueduct water, what happens to the demographic make-up of the town, the Village, or the community?*

The proposed Aqueduct connection is not expected to have any impact on the demographic makeup of the Town of Monroe, the Village of Kiryas Joel, or the larger community.

In response to the Appellate Division Decision and Order, the Village engaged another consultant , AKRF Environmental and Planning Consultants (AKRF), with expertise in economic impact analysis, modeling and forecasting, demographic analysis, market studies, public policy analysis, and long-range planning to expand upon the population projections for the Village and assess the potential for significant increased growth induced by the Project. A summary of the growth study is included in Section 3 and the full report is attached in Appendix N. Population projections are now provided through 2030, with corresponding estimated water supply demand. The study concluded that current population figures, and thus future projections, are slightly less than projected in the DEIS. The study also assessed the level of in-migration into the Village over the Village's history and concluded that the amount of such in-migration has been steadily decreasing and is forecasted to continue to decline. Finally, the study concluded, based on the history of the Village, that the ready availability or lack of certain utilities, such as sewer and water, has had no cognizable influence on the internal or external growth of the Village population. This is expected to remain the case once the Project is completed, since the Village is merely replacing its existing water supply with a new source.

FISCAL IMPACTS

17-9 Please provide and compare the projected costs for the design, construction and the yearly operations of this water supply project and the alternatives discussed.

As stated in the DEIS, the total estimated cost of the proposed Aqueduct connection project is $25 million. This estimate consists of approximately $3.9 million in the design, permitting and financing phase and approximately $21.9 million in construction phase costs. The estimated annual operation and maintenance cost is $570,000 per year.

As stated in the DEIS, reducing the pipeline diameter from the proposed 24 inches to 18 inches would reduce the construction cost by approximately $1 million, or 4 percent of the estimated project cost. Use of a smaller pipeline would increase the projected electrical cost of pumping water through the pipeline, approximately $140,000 per year, by approximately 10 percent.

As stated in the DEIS, selecting either of the alternative pipeline routes would not significantly affect the cost of the project. Similarly, siting the pumping station on New York City property near the New Windsor water treatment facility instead of at the New Windsor facility would not significantly affect project cost.

17-10 Please describe the impacts of the proposed project on the Village's municipal budget. Please also include the yearly operating costs and debt payments of maintaining the existing well fields on standby.

As stated in the DEIS, implementation of the proposed Aqueduct connection would increase the cost of the Kiryas Joel water supply system, because the existing groundwater pumping system would be maintained as backup to the Aqueduct connection. Approximately one quarter of the existing water cost of $2.75 per thousand gallons is the cost of electricity to operate the existing groundwater pumps. Implementation of the proposed Aqueduct connection would largely eliminate this component of current water costs. Overall, it is estimated that the proposed Aqueduct connection would increase the cost of water in Kiryas Joel by 10 to 15 percent.

COMMUNITY FACILITIES

9-1 *Ensuring that children have a home that is complete with bedrooms and access to water and all of the other issues are the most important environment to me. Environment of the home. Environment of the community.*

The purpose of the proposed project is to provide a reliable and adequate supply of high-quality potable water for the residents of the Village of Kiryas Joel. The water supply will reduce vulnerability to drought, reduce the dependence on groundwater and minimize conflict and competition for water among surrounding communities. The proposed Catskill Aqueduct Connection will provide a vital facility for a livable environment in Kiryas Joel.

LAND USE/ZONING

17-4 *The DEIS does not provide a copy of the Village's Master Land Use Plan or Zoning Map showing the remaining undeveloped or underdeveloped parcels in the Village that could be developed with water from this pipeline. The DEIS also does not indicate whether this proposed water line, and the future development that would result from it, are in keeping with that Master Plan. The DEIS should identify all undeveloped or underdeveloped parcels in the Village, their allowable land use under the local zoning plan, and the number of new residents that could be allowed if all this land were developed.*

An analysis by the Village of Kiryas Joel has determined the approximate number of new residents for whom housing could be provided within the existing borders of Kiryas Joel. The analysis indicates a total of 185.4 acres of developable land, which could accommodate 1,447 to 1,781 dwelling units. This would provide for 8,306 to 10,223 new residents. Future options the Village may consider include changes in zoning to allow greater housing density, and adding more land to the Village.

15-8 *Under land use analysis, Figure 2-12 used USGS satellite imagery to denote the uses along the proposed aqueduct routes. More detailed and accurate data is available from Orange County Water Authority. We believe that if the DEIS considered the land use data available from OCWA, they would find that a greater density of residential and nonresidential uses exist along some of the State and County corridors. We request that the land use analysis be repeated with the OCWA data.*

Data available from OCWA were used as much as possible in the DEIS. More accurate land use mapping does not appear to be available from OCWA. The mapping prepared by USGS based on satellite imagery, which appears in Figure 2-12 in the DEIS, is the best regional land use mapping available.

TRAFFIC

1-3 *My people in Blooming Grove are very concerned that no matter which way it (the pipeline) goes . . .it's going to have a tremendous impact on our traffic situation over there. We have one-way in and one-way out of Blooming Grove and that's Route 208 and Clove Road, which is 27.*

Pages 2-60 to 2-69 of the DEIS contain a complete discussion of existing traffic conditions, potential project impacts on traffic and recommended mitigation measures. The conclusions of the analysis are that with implementation of the recommended mitigation measures (i.e., alternating one-way traffic; work hour restrictions; public notifications; signage), traffic impacts will be minor and temporary and significant adverse impacts will not occur.

Note: This comment-response is also included in the Town of Blooming Grove/ Supervisor Charles Bohan response category on page 2-51.

2-5 *...your references in the DEIS say that Route 27 terminates at Mill Road and that leaves a small section of land, the rope of Clove Road that continues to connect with Route 94. I think you want to check and see if that is or is not a town road, because if Route 27 terminates, what is left is obviously going to be a town road.*

The commenter is correct. Route 27 terminates at Orrs Mill Road (County Route 20). The section of Clove Road between State Route 94 and County Routes 27 and 20 is a town road.

2-6 *...I live on Route 208. It's a growing community. Your notation is of 16,500 in traffic and I think that is probably underestimated. The traffic on that road in the morning and evenings is very substantial.*

The Average Annual Daily Traffic (AADT) for 2001 reported by the New York State Department of Transportation is 16,500 between the intersection with U.S. Route 6/State Route 17 and the intersection with County Route 27. Because AADT is based on actual traffic counts it is not an underestimate. Morning and afternoon commute hours are the peak hours for traffic. Up to 10% of daily traffic typically occurs during the morning or afternoon peak hour. It is because of this increase in traffic during commute hours that construction restrictions are anticipated to be specified for the morning and afternoon commute hours.

13-3 *The proposed routing will significantly increase the traffic congestion in the Town during construction, especially along Route 208, Clove Road and through Salisbury Mills. Please address how these safety and traffic congestion concerns will be mitigated.*

Based on the analysis in the DEIS, the increase in traffic congestion during construction, while unavoidable, will not be significantly adverse with the implementation of the traffic control measures described in the DEIS.

Traffic safety and congestion mitigation recommendations are addressed in detail on pages 2-68 and 2-69 of the DEIS. Site-specific measures along particular sections of the pipeline routing such as through Salisbury Mills and along Clove Road (CR 27) and NYS Route 208 in Blooming Grove will be developed in consultation with the Town of Blooming Grove officials during detailed design to reduce traffic impacts on the community.

Note: This comment-response is also included in the Town of Blooming Grove/ Supervisor Charles Bohan response category on page 2-51.

15-10 The DEIS discusses possible restrictions prohibiting construction during commuter hours. This should definitely be identified as a required mitigation on all State and County roads. Careful planning needs to go into work schedules, notifying the public of work schedules and detours so as to be less disruptive to the general public.

Agreed. Careful planning and necessary restrictions during construction will be developed during detailed design and included in the construction contract requirements. Specific construction restrictions during morning and afternoon commute hours (such as maintaining two lanes of traffic) are anticipated for the proposed project.

15-24 In reviewing the alternative analyses, it was not made clear what impacts to traffic flow could be anticipated for each alternative construction route. This is extremely important for Rt. 32 alternatives because the Rt. 32 corridor is already over its design capacity and experiences low levels of service. We strongly believe that the environmental impacts from pursuing the alternate routes has not been examined at an adequate level of detail. If the project sponsor intends to pursue either alternate routes, much more analysis must be provided with the opportunity to respond to this prior to the FEIS. For example, the environmental review should include a "hard look" at impacts to traffic flow, including traffic flow at intersections both south and north of areas of construction. If the preferred route is via Blooming Grove then there is no need to pursue further impact analysis on the other alternate routes.

The preferred route for the pipeline is via Routes 94, 27, and 208 through the Town of Blooming Grove.

As noted in section 2.10 of the DEIS, in each of the alternative routes, the location of the pipeline would be either in the highway right-of-way outside of the limits of the roadway; in the shoulder of the roadway; in one or two of the travel lanes; or a combination of all three. Section 2.10.2.1 sets forth the projected temporary impacts during construction in each of these areas. Specifically the area along the Rt. 32 corridor contains the most consistent shoulder and right-of-way enabling less disturbance of existing roadway. As noted in the DEIS, this route would also create a temporary impact to the 5-point intersection (Rts. 94/32) in Vails Gate. (See Table 3-1 of the DEIS). This intersection includes NYS routes 94, 300, and 32. The New York State Department of Transportation ("NYSDOT") has jurisdiction for permitting any construction activity along its roadways. This would include the construction/installation of the water main connecting the Catskill Aqueduct to the Village of Kiryas Joel along State routes. In order to mitigate potential impacts to traffic safety at this intersection a number of mitigation measures, including those identified for the Rt. 32 alternative in the DEIS at section 2.10.3, will be employed, including among others, proper signage alert motorist that construction activities are ahead, use of reflective barrels, flag persons to direct traffic as required, reduction of speed through the construction zone. Utility projects are often done in the overnight period to avoid a major disruption in traffic. These projects are also typically conducted so that the work for the day/night includes, setting up the maintenance and

protection of traffic devices, excavation, pipe installation, backfill excavated area, install temporary pavement or plates to enable continued traffic movement during non-construction periods of the day. A NYSDOT Highway Work Permit will be required that will include the traffic safety measures mentioned above, a detailed work schedule and plans and profile of the water main to be installed. The construction contractor is required to conduct its work in accordance with the permit issued by NYSDOT.

16-14 Page 2-64 states that the intersection of NYS Route 208 and CR 27 is controlled with a traffic signal. That is in error as the intersection is controlled with a stop sign.

The commenter is correct. The intersection of NYS Route 208 and CR 27 is controlled with a stop sign at the CR 27 approach.

16-13 On page 2-64 is a list of the AADT for roads along the construction path. However, the DEIS fails to show the AADT for the first 2 miles of CR 27 starting at the intersection of CR 27 and NYS Route 208. The AADT for that stretch of CR 27 is 5060. The AADT for the balance of CR 27 is shown and is approximately 3300.

The comment, from the County Department of Public Works, is acknowledged. The AADT for the stretch of CR 27 starting at NYS Route 208 of 5060 does not change the traffic impact analysis for this section of the proposed project pipeline construction.

NOISE

15-11 *There seems to be an inconsistency in the document concerning noise and hours of construction. The DEIS states that as a mitigation that "...nighttime and weekend construction would be avoided to the maximum extend (sic) possible." However, as a mitigation to traffic the DEIS states that "...consideration would be given to utilizing nighttime construction to help minimize traffic." We recommend that the DEIS provide criteria for determining areas of the pipeline route where nighttime construction may be preferable. Nighttime and weekend construction schedules should balance the needs to commuters with the needs for limited noise in residential areas that could interfere with people's sleep and work activities.*

As stated on p. 2-69 of the DEIS, nighttime construction does not appear to be necessary. No areas along the pipeline route have been identified at this time where nighttime construction would be preferable. Weekend construction is not anticipated either. This is consistent with the recommendation in Section 2-11, Noise, to avoid nighttime and weekend construction to the maximum extent possible.

Nighttime construction would be considered only if daytime traffic conditions require it. This will be evaluated further during design; however, based on current traffic conditions, placing restrictions on construction during normal commute hours is expected to sufficiently address daytime traffic control such that nighttime construction can be avoided.

15-12 *We further request that construction on weekends or during commuter hours be expressly prohibited if either of the other alternate pipeline routes are considered.*

Comment noted. The alternative pipeline routes, which partially pass through the Town of Woodbury, are not being considered as the preferred alternative at this time.

17-25 *The evaluation of Local Noise regulations in Section 2.11.2.1 does not include any noise regulations for the Village of Kiryas Joel. Please provide them and analyze how potential sources of noise can meet these regulations or would have to be mitigated to meet them.*

The Village of Kiryas Joel noise law (Local Law No. 4 of 1993, as amended) contains provisions relating to prohibited noises, permitted noises, sound device prohibitions, violations and remedies and enforcement. Pertinent to the proposed project is the prohibition of: 1) construction, including excavation, demolition, alteration or repair, of any structure other than between 8:00 a.m. and 8:00 p.m., except in case of urgent necessity in the interest of public safety, 2) the creation of a loud and excessive noise in connection with the loading and unloading of any vehicle, and 3) the discharge into the open air of engine exhaust except through a muffler or similar noise-attenuating device. Sounds created by public utilities in carrying out operation of permitted franchises are permitted. There are no numerical sound level limits prescribed in the law.

Based on the foregoing, construction and operation of the project is anticipated to comply with the Village noise law.

17-26 *The evaluation of Long-Term Noise impacts in Section 2.11.4.2 of the DEIS does not provide background noise sampling data for the proposed Water Treatment Plant site within the Village. It also does not identify the nearest residential receptors of noise or their distance from the property line of the proposed plant site. Please provide this information and revise your evaluation appropriately.*

Background noise in the vicinity of the proposed water treatment plant site is expected to be similar to monitoring location 1, near the New Windsor treatment plant site. At that location, the measured Leq sound levels ranged from 57 to 59 dBA.

The nearest residential receptors to the proposed site are the boarding students at the UTA Mastiva rabbinical college about 100 feet across Berdichev Road from the proposed plant site property line (see DEIS, p.2-54). The nearest houses are on top of a hill overlooking the site, about 300 feet from the property line of the proposed plant site. At these distances, a minor to moderate increase in noise (3 to 6 dBA) is projected. No significant noise impact is anticipated.

17-27 *As discussed earlier, there is no detailed location map or site plan for the proposed plant and no way to understand whether the new plant is closer to residential receptors. Without this information, it is very difficult to independently evaluate the conclusion in this section of the DEIS that there will not be a noise impact. It also does not explain how the estimated maximum operating sound level of 60 dBA at the property line was determined.*

The new treatment plant is proposed to be located on the existing Village water treatment plant site. Although a site plan has not been designed for the project yet, the new plant is expected to be adjacent to the existing plant building and would be the same distance from the rabbinical college and residential receptors as the existing plant.

The estimated maximum operating sound level of 60 dBA at the property line actually pertains to the proposed pumping station in New Windsor and is a proposed specification to be met in the project design to achieve compliance with the Town of New Windsor noise ordinance.

VISUAL

17-11 The DEIS does not provide a Visual Impact Analysis (VIA) for the proposed Water Treatment Plant, Pump Station or along the pipeline route....

17-12 DEIS does not identify any areas along the proposed pipeline route where trees and shrubs will be removed and whether they currently act as a visual buffer for residential or other land uses. Please identify and discuss the benefits & impacts of restoring all significant strands of trees and shrubs, shortly after construction is completed.

NYSDEC's Guidance on "Assessing and Mitigating Visual Impacts" (DEP-00-2) states under heading III, Policy; "When a facility is potentially within the viewshed of a designated aesthetic resource, the Department will require a visual assessment, and in the case where significant impacts are identified, require the applicant to employ reasonable and necessary measures to either eliminate, mitigate, or compensate for adverse aesthetic effects."

The proposed Catskill Aqueduct Connection project does not require a VIA because the proposed facilities to be constructed are not within the viewshed of any designated aesthetic resource. The pipeline route is to be constructed in existing roads and road shoulders, in existing rights of way; therefore, few or no trees or shrubs will be removed before, during or after construction. Should it be necessary to remove any foliage that act as visual buffers for residential or other land uses, the disturbed areas will be re-vegetated promptly to restore the buffer. Furthermore, the pipeline will typically be underground and have no long-term impact on visual aesthetics. In instances where the terrain requires the pipeline to run along side of bridges it will be painted to harmonize with its surroundings.

In choosing the preferred locations of the pump station and water treatment plant, visual aesthetics played a role. As stated in the DEIS, construction of a connection to the Catskill Aqueduct and a pump station near the New Windsor water treatment facility would be consistent with existing land use. Construction of a new water treatment facility at the site of the existing Kiryas Joel water treatment facility on Berdichev Road would also be consistent with existing land use. Both preferred locations are in areas that already house similar structures and project development would require limited disturbance to natural lands and visual aesthetics.

The proposed action includes a pumping station in the vicinity of the New Windsor treatment plant and pump station. As the New Windsor treatment plant site is dedicated to water treatment and pumping activities, the proposed action would be a continuation of its current use. The site and adjacent area (a tower line easement) is generally free of trees and shrubs, which will limit visual impacts mainly to construction only. This location is not in the direct line of sight of any residences and is only visible to individuals traveling along Riley Road in the Vails Gate section of New Windsor.

The proposed action also includes a Water Treatment Plant adjacent to the current water treatment plant used by the Village of Kiryas Joel. Located across Berdichev Road from the UTA Masivta rabbinical college, the proposed site is a fenced parcel and currently supports the Village of Kiryas Joel's operating water treatment plant and former treatment plant. A limited number of individuals will have a clear view to the proposed site; these are the boarding students at the UTA Mastiva rabbinical college about 100 feet across Berdichev Road from the proposed plant site property line (see DEIS p.2-54).

The nearest houses are on top of a hill overlooking the site, about 300 feet from the property line. Trees between the treatment plant parcel and the residential units provide a visual buffer. One alternative is to demolish the former plant building and replace the structure with the proposed water treatment plant. This would reduce visual impacts to an even greater extent because it would simply replace a former structure rather than add a third. Development on the treatment plant site would require minimal or no tree removal, minimizing long-term visual impacts to the residences. The treatment plant location is not in the direct line of sight of major roads.

ENERGY

15-17 What is the electricity currently consumed to run all of the Village's wells?

Electricity usage to operate the Village wells incurs an energy cost of approximately $0.70 per thousand gallons. At $0.10 per kilowatt-hour, this translates into 7 kilowatt-hours per thousand gallons. The Village of Kiryas Joel currently yields 1.31mgd of groundwater, the sum of the 0.308mgd from the Brenner property wells and 1.0mgd from wells within the Village. Therefore, with a consumption rate of 7 kilowatt-hours per thousand gallons, approximately 9170 kilowatt-hours per day is used when all the wells that support the Village are in operation.

15-18 Based on our [the Town of Woodbury] calculations in less than 15 years the Village will need to run existing wells in addition to the aqueduct to support the future population. How much electricity would be needed to run the wells, the well water treatment facilities, the aqueduct pump station, and the aqueduct water treatment facilities?

Because the facilities have not yet been designed and an energy system has not yet been developed there is not enough information to determine the total amount of energy required to run the wells, the well water treatment facilities, the aqueduct pump station and the aqueduct water treatment facility simultaneously.

15-19 On consideration of the recent electrical problems that were experienced across the east coast and the occasional outages that occur yearly, what methods could be explored to mitigate some of this significant electrical consumption? Could solar energy be integrated into the system? Would additional water storage tank capacity help to mitigate spikes of higher electrical consumption associated with peak water demand?

At this stage in the project, the energy design has not yet been completed. A main objective during design will be energy efficiency and alternative sources will be considered including solar energy; however, it is unlikely that solar power will be used as an energy source in the operation of the pump station or water treatment plant.

In addition to the nine active groundwater wells in the Village and the five wells located on the Brenner property, the Village's current water supply infrastructure includes four storage tanks, approximately 11 miles of transmission mains, and two treatment plants. The proposed project does not include additional storage tanks. Furthermore, the Village is currently in the process of designing a 2 million gallon capacity storage tank to provide additional water storage. Future water projects may involve tank expansion or tank construction; however, for the purpose of this project, additional tank capacity is beyond the project's scope.

15-20 How would the additional population supported by the increased water supply contribute to an increase in electrical consumption?

As stated in section 6 of the DEIS says, the proposed connection to the Catskill Aqueduct is not anticipated to be the direct cause for growth in Kiryas Joel and its surrounding communities.

Therefore, increased residential energy consumption is not anticipated to result from the proposed aqueduct connection project.

15-21 In the case of an extended blackout, such as the one recently experienced, will there be a back-up generator to maintain water service to the community and to reduce the potential water-hammer as described in the DEIS? Should electricity fail, how long would storage water last and should expanding the Villages volumes be explored?

Should an energy failure occur, both facilities, the pump station and water treatment plant, will have back up generators to continue operation. Should electricity fail for an extended period of time, the stored water should last for several days with a water management plan in place.

16-20 On page 1-6, a 24" diameter pipeline is justified due to energy cost savings. For the proposed route has a system head curve for the 13-miles of 24" diameter pipeline been generated and can it be provided for further review? What is the cost effective, maximum carrying capacity of the proposed 24" diameter x 13-mile long pipeline?

A system head curve has not been generated for the proposed route. It will be generated during the design phase after the locations of the pump station and water treatment plant have been confirmed. Pumping costs were estimated for the 2 mgd flow based on an estimated daily energy requirement for three different pipe diameters, 12", 18" 24", along the proposed route. At a flow rate of 2 mgd a pipe diameter of 12" would consume 7272 KWh/day. The cost per day would be $691 or $252,140 annually. An 18" diameter pipe is more efficient with a requirement of 4391 KWh/day and costs of $417 per day and $152,253 per year. The 24" diameter pipe is the most energy and cost efficient with a daily energy requirement of 4040 KWh/day. This energy cost is $384 per day or $140,076 per year.

SOLID WASTE/ SLUDGE DISCHARGE

16-17 ...The type of treatment required at the new water filtration plant will generate raw sludge that will require handling and disposal. How will the raw sludge be handled and ultimately be disposed of? What daily volume of raw sludge will be produced? What percent solids will the raw sludge consist of and what elements will the raw sludge consist of?

Sludge produced by the new water filtration plant will be treated in the same manner as sludge from the existing plant is currently treated. That sludge is thickened and transported to a wastewater treatment plant for treatment and disposal. The plant will most likely produce alum sludge, a coagulation sludge that is common for plants using alum (polyaluminum hypochlorite) as a coagulant. On average 48kg of alum sludge/1000m^3 of water is produced. Therefore, the new water filtration plant will produce approximately 801 lbs/day or 292,365 lbs/year. The composition will most likely consist of 15-40% Al_2O_3 x 5.5 H_2O (aluminum hydroxide and bound water), 35-70% silicates and inert materials, and 15-25% organics.

HAZARDOUS WASTE

15-22 The DEIS states that "Because of small quantities of {polyaluminum chloride and sodium hypochlorite} involved {in water treatment}, even a sudden and complete tank failure would be unlikely to cause significant health problems in the time it would take to evacuate the affected area." The affected area should be described. Will the affected area include any lands located adjacent to or within the boundaries of Woodbury?

The nearest boundary of the Town of Woodbury is approximately 2 miles east of the proposed site of the Water Treatment Plant. Therefore, in the unlikely event that the facility experiences tank or operations failure the Town of Woodbury and lands located adjacent to or within the boundaries of Woodbury will not be affected. The affected area would not extend beyond the treatment plant grounds. Should a hazardous situation arise, immediate response personnel will be notified immediately to assess and control the situation. Prior to start up of the water treatment plant, an emergency response plan will be filed in compliance with applicable laws.

Both treatment materials, polyaluminum chloride and sodium hypochlorite, will be stored in liquid form and in storage tanks at the Water Treatment Plant minimizing the likelihood that a tank failure will affect areas offsite. Sodium hypochlorite used in liquid form produces minimal chlorine air emissions precluding potential effects on sensitive receptors in the study area. Sodium hypochlorite is the coagulant used at the Harriman Wastewater Treatment Site. Polyaluminum hypochlorite is a stable chemical that will be used in small quantities as a coagulant in the water treatment process. Under normal conditions the chemical is stable and has minimal health hazards (eye, skin, mouth, throat, stomach irritation); under extremely high temperatures (e.g., fire conditions) the chemical may release hydrochloric acid vapors; at such time immediate response personnel would be notified.

CONSTRUCTION

17-17 Please discuss construction impacts on the aqueduct itself. What is the age of the aqueduct at the location of the tap? What is a potential for short-term or long-term damage to the aqueduct during construction of a connection to it? What alternatives are available that would reduce or completely avoid disturbance of the aqueduct itself in order to obtain the water?

The Catskill Aqueduct was constructed between 1907 and 1917. While there is potential for damage to the aqueduct during the construction of the connection, standard construction methods would be used in order to minimize this potential. Prior to construction, detailed reviews of the project's construction plans and specifications will be conducted by the City of New York DEP and other regulatory agencies. Numerous standard practices will be built into the construction documents to minimize disturbance of the aqueduct and environment. Frequent construction inspections will be conducted to assure that proper procedures and protocol are carried out during the project's construction. With the above in place, minimal disturbance to the Catskill Aqueduct will occur.

17-18 Please indicate how much area would be needed to temporarily store construction materials along the pipeline. Please discuss where excess excavated materials be disposed of and how will the Village verify that materials will not be disposed of in any state or federally regulated wetland area?

17-21 Please discuss how many cubic yards of excess soil, rock, asphalt, concrete, etc. will be removed from the work corridor and where will it be disposed of?

Construction planning would be completed during the design and permitting phase of the project. At that time, staging and disposal areas would be determined. Materials excavated during pipeline installation will be backfilled to the greatest extent possible limiting the amount of materials that require stockpiling or transport. Removal and disposal of excess materials and fill are the responsibility of the contractor and will be conducted in accordance with state and local waste disposal protocols. No disposal will take place within a wetland unless the proper wetland fill permit were obtained; it is not anticipated that disposal of fill material in a wetland area would be necessary.

17-19 The DEIS did not discuss whether any pump stations would be needed along the 13-mile route, the locations of pump stations, the dimensions such pump stations and construction or operating impacts of these pump stations.

Other than the single pump station located at the aqueduct connection site, no other pump stations would be required along the pipeline route.

PIPELINE ROUTE

10-1 *We have no objections to the document [DEIS], and concur with the preferred alternative route.*

15-31 *Should the desired route change from the preferred route presented in the DEIS to one of the alternative routes we ask that the communities involved in the newly preferred route be given the opportunity to respond to a revised plan.*

Comments acknowledged.

VILLAGE WATER TREATMENT PLANT SITE

17-16 Please provide a site plan for each alternative location considered. Please provide a discussion of the minimum square footage (or acreage) needed to construct a water treatment plant of the size assumed necessary for this project. Please include a thorough search of all vacant lands near the terminus of the pipeline in the Village that meet this minimum size criteria.

As noted on page 3-5 of the DEIS, the new water treatment plant would require approximately 1 acre of land. The Village's current water treatment plant site on Berdichev Road was identified as a logical candidate because it is located near the alternative pipeline routes and it is land currently owned by the Village of Kiryas Joel that has already been identified for water supply use.

Use of the Village's current water treatment plant site for the construction of the new plant to treat Catskill Aqueduct water would represent a continued use of this site. Currently, treated water enters the Village's distribution system at this location making this a logical location for the construction of the new plant. The location on the filter plant site for the new plant is currently a parking area and storage area for trailers. Limited clearing of natural vegetation, if any, would be needed to construct the new facility. The most feasible candidate 'alternate' treatment plant site, based on a search of suitable available vacant lands in or near the Village, is located on the eastern side of the Village. New construction east of the Village's boundary would require additional pipeline construction to allow the treated water to enter the existing distribution system. This would represent an added capital cost and disturbance to the natural environment over that as described under the 'proposed action'.

ALTERNATE PIPE SIZE

3-2 *...if the water supply is only for 2 million gallons we kind of do not see the point as to why the line should be 24 inches...Some reasons are given were given in the DEIS, but we believe more reasons need to be done to justify that*

15-28 *In support of a 24 inch diameter water main, the DEIS indicates that it is needed to satisfy the 20 year design period (and to save energy). It also notes that infrastructure of this type is usually in service for a minimum of 50 years, often closer to 100 years... Although an 18 inch diameter pipe could provide 2 MGD, the head-loss at 4.2 MGD would be great and most likely would require a second booster pump station. However, 4.2 MGD could be transmitted easily through a 24 inch diameter pipe.*

The project as proposed includes the use of a 24-inch diameter pipeline to transmit up to 2.0 mgd to the Village of Kiryas Joel. This pipeline diameter was initially presented to the NYCDEP in the conceptual plans for this project. Given that the pipeline will have a service life of 50 years or more, the choice of pipeline diameter was based not only on the Village's current aqueduct entitlement request of 2 mgd but also on potential future entitlements due to future growth. Also considered was the fact that reducing the pipeline diameter would not reduce environmental impacts. Trench size, construction duration and potential environmental impacts would be the same for a 24-inch diameter pipeline as for any other size pipeline. Nevertheless, due to concerns that the pipe is oversized, a reduction in pipeline diameter to 18 inches would be feasible.

TOWN OF BLOOMING GROVE/ SUPERVISOR CHARLES BOHAN

1-1 *I want to determine whether or not my town will have access to the water that is going to be coming from the aqueduct through my town to get to Kiryas Joel.*

1-2 *...if you are going to have a treatment plant at the Village that it's basically raw water, so-called, that is coming through my town, which means that if I had to access it in anyway I'd also have to build a treatment plant. That doesn't make very much sense; it would further impact my problem.*

13-1 *We request that the DEIS address allowing the Town of Blooming Grove to tap the proposed transmission main and utilize the water as an auxiliary/supplemental/emergency supply during extended periods of drought, or catastrophic mechanical failure.*

13-2 *That the Village of Kiryas Joel consider an alternative treatment plant site to allow for treated water to be conveyed through the transmission main.*

The project as proposed does not contemplate any interconnections. Providing emergency access to the aqueduct water through a connection from the proposed Village pipeline would require preparation of an application to NYCDEP accompanied by an environmental assessment of the potential effects of such an action. This type of arrangement would work best if the water were treated at the existing aqueduct tap rather than at a new plant in Kiryas Joel. Formal consideration of such an action by the Village and other potentially involved agencies must await preparation of plans by Blooming Grove and Washingtonville and is subject to environmental review and requisite governmental approvals, including NYCDEP.

The Village, as lead agency under SEQRA, will analyze any changes to the current proposed project in accordance with the law and regulations.

1-3 *My people in Blooming Grove are very concerned that no matter which way it (the pipeline) goes . . .it's going to have a tremendous impact on our traffic situation over there. We have one-way in and one-way out of Blooming Grove and that's Route 208 and Clove Road, which is 27.*

Transportation and traffic impacts are important issues with this project. Pages 2-60 to 2-69 of the DEIS contain a complete discussion of existing traffic conditions, potential project impacts on traffic and recommended mitigation measures. The conclusions of the analysis are that with implementation of the recommended mitigation measures, traffic impacts will be minor and temporary and significant adverse impacts will not occur.

13-3 *The proposed routing will significantly increase the traffic congestion in the Town during construction, especially along Route 208, Clove Road and through Salisbury Mills. Please address how these safety and traffic congestion concerns will be mitigated.*

Based on the analysis in the DEIS, the increase in traffic congestion during construction, while unavoidable, will not be significantly adverse with the implementation of the traffic control measures described in the DEIS.

Traffic safety and congestion mitigation recommendations are addressed in detail on pages 2-68 and 2-69 of the DEIS. Site-specific measures along particular sections of the pipeline routing such as through Salisbury Mills and along Clove Road (CR 27) and NYS Route 208 in Blooming Grove will be developed during detailed design to minimize traffic impacts on the community.

VILLAGE OF WASHINGTONVILLE

12-1 *We request that the DEIS address allowing the Village of Washingtonville to tap the proposed transmission main and utilize the water as an auxiliary/supplemental/emergency supply during extended periods of drought, or catastrophic mechanical failure.*

12-2 *That the Village of Kiryas Joel consider an alternative treatment plant site to allow for treated water to be conveyed through the transmission main.*

12-3 *We request that the DEIS allow the Village of Washingtonville to supplement the aqueduct water when the excess water is available from our wells and during periods of aqueduct shutdown, since the Village of Kiryas Joel wells will not be able to satisfy the future projected demand, as a back-up source.*

The project as proposed does not contemplate any interconnections. Providing emergency access to the aqueduct water through a connection from the proposed Village pipeline would require preparation of an application to NYCDEP accompanied by an environmental assessment of the potential effects of such an action. This type of arrangement would work best if the water were treated at the existing aqueduct tap rather than at a new plant in Kiryas Joel. Formal consideration of such an action by the Village and other potentially involved agencies must await preparation of plans by Blooming Grove and Washingtonville and is subject to environmental review and requisite governmental approvals, including NYCDEP.

With regard to allowing the Village of Washingtonville to provide backup water to the Village of Kiryas Joel when the aqueduct is shut down and Washingtonville has excess water available, this is a worthwhile suggestion with positive environmental implications.

The Village, as lead agency under SEQRA, will analyze any changes to the current proposed project in accordance with the law and regulations.

TOWN OF NEW WINDSOR ALTERNATIVES

3-8 *Please discuss why the Village would not want to get their water from the New Windsor water tap on the aqueduct?*

17-7 *In accordance with an earlier letter from the Town of New Windsor's Town Engineer, please address the environmental impacts and benefits of not constructing a separate connection to the aqueduct near the Riley Road Filtration Plant. As the Town has suggested, please consider the benefits and impacts on the Aqueduct itself of sharing the Town's existing tap on the aqueduct.*

Please also consider their other suggestions of construction of a new horizontal tap into the aqueduct that could be used jointly by the two municipalities, to prevent problems during low flow periods in the aqueduct. The Village should also evaluate the benefits and impacts of joint use of an expanded Riley Road Filtration Plant by the two municipalities as compared to a separate standalone Water Filtration Plant for the Village.

Discussions have recently taken place between the Village of Kiryas Joel and the Town of New Windsor regarding the use of the New Windsor aqueduct connection and filtration plant. The Village is exploring this option with the Town. Likewise, such a change will require approval by NYCDEP. Should these discussions result in changes to the proposed project, the Village, as lead agency, remains obligated under SEQRA to analyze such changes for potentially significant adverse environmental impacts.

HUDSON RIVER ALTERNATIVE

11-2 Since a water treatment plant is apparently part of the proposal anyway, we suggest that the previously evaluated Hudson River water alternative be used instead of tapping into the Catskill Aqueduct.

Although it is true that both the proposed action and the Hudson River alternative would require the construction of a water treatment plant, the type of treatment facility required is not the same. Because the water quality of the Hudson River is low, specifically, the water is brackish; a multi-stage treatment process would be required. Desalination would be required, a process which generates a large quantity of waste (solid and liquid) that would require additional treatment and disposal. Pumping water from the Hudson River to the Village could require crossing Storm King Mountain or other lands with significant elevations. Treatment costs and pumping requirements make this option very costly, while the treatment process itself would generate large quantities of wastes that would require additional treatment and disposal. Use of Hudson River water as a potable water supply for the Village is, therefore, not a feasible alternative at this time.

WATER CONSERVATION

15-30 Under mitigation there should be a discussion of water conservation planning………Page 1-3, under "Previous Work to Expand the Water Supply" references implementation of water conservation measures but does not elaborate as to what these methods are, how long they have been in effect and how successful they have been.

Conservation measures have been in-place and were upgraded in early 2000. Measures include: community education, installation and replacement of water meters, a leak detection program, and the distribution of water conservation kits. The resident per capita water consumption rate in the Village is relatively low due to their social practices, which include the absence of traditional high demand uses such as outdoor swimming pools, outdoor bathing and car washes.

REGIONAL WATER PLAN

5-1 *...What I would like to know is given that I live in a community in which the wells are not adequate, why there is no comprehensive plan for the water supply of all of the communities and why we are talking about any Village?*

8-1 *...if there is some kind of a water connection that will supply water to one particular area in this county that the entire group of people in the county should be able to avail themselves at the same price and the same cost to that water, since in fact, the federal and state funds are what is going to create this system.*

15-9 *A priority addressed in the Environmental Infrastructure Strategy section of the Orange County Comprehensive Plan is to ... "give priority to regionalizing water resources by interconnecting systems." While the DEIS repeatedly states that neighboring communities have been unwilling to help Kiryas Joel meet its drinking water needs, it also states that these communities have been experiencing growth of their own.... This has left communities unable to help each other with drinking water shortages, and has resulted in an environment where communities are constantly monitoring each other's consumption.... We request that another alternative be included in the DEIS that considers a regional approach to providing drinking water including assessing the possibility of partnering with neighboring communities to share the benefits and the costs of tapping into the aqueduct and withdrawing larger amounts of water to benefit the region, perhaps only on an emergency basis, such as during the 2002 summer's drought.*

16-19 *However, there is both a trend of regional growth and a s clear record of interest by the neighboring municipalities along the proposed waterline regarding future access to this pipeline and/or share use of the aqueduct tap.*

17-8 *Please discuss in detail the suggested alternative of sharing pipeline water and sharing costs with other municipalities along the pipeline route so that they too can take their own entitlement water from the New York City Aqueduct system. Please also discuss the environmental benefits and impacts of a possible regional approach to providing the New York City entitlement water through the offices of the Orange County Government or possibly the Orange County Water Authority.*

SEQRA requires that an EIS evaluate only reasonable alternatives that are feasible, considering the objective and capabilities of the project sponsor. The objective of the project sponsor is to provide a reliable water source to the Village. It is unreasonable to demand that the Village assess and provide for the entire region's needs. Consideration of a regional water supply alternative or additional taps for other communities is not required and as such would not be reasonable or feasible for the Village to undertake and such alternatives would not be under the Village's control (i.e., the Village itself does not have the authority to provide such alternatives).

The Village of Kiryas Joel originally proposed this action for its needs. The Village is willing to cooperate with the County and the surrounding communities; however it is not its responsibility or within its power to develop a comprehensive regional water supply plan for the neighboring communities. The Village needs a more reliable water supply now to assure that the community of Kiryas Joel has a viable and safe environment for living.

Comprehensive water plans to address the water needs of the Village and the surrounding communities along with the necessary systems would best be prepared by the Orange County Water Authority and/or the County of Orange in coordination with the NYCDEP. Such planning is beyond the scope of this project as well as beyond the Village's means. It should be noted that only emergency, backup water supply has been requested by neighboring communities.

Regarding the Orange County Comprehensive Plan (OCCP), the Village's proposed project is an attempt to provide the water resources needed for its community members while incurring minimal impacts on the surrounding communities. The OCCP focuses development on Priority Growth Areas, historic cities, villages, and hamlets and their immediate surroundings, where public infrastructure such as central water, sewer, and higher capacity roads exist, or could be efficiently extended to accommodate future growth. The Village of Kiryas Joel is identified as a Priority Growth Area in the County Plan. The central idea of the OCCP is to encourage growth that can be supported efficiently and minimizes disturbance to the rural countryside. The proposed action does just that. As a Priority Growth Area, the Village of Kiryas Joel is attempting through the proposed project to ensure it is able to maintain its community and provide a livable environment with adequate water, housing, schools, etc., focusing on already built up areas and developing areas that will have minimal adverse impacts.

BEYOND THE SCOPE

The following comments have been determined to be beyond the scope of this environmental review process. Although the comments raise interesting points or questions, they are not within the scope of this EIS.

6-2 *[We hope] that NYC builds the recommended EPA filtration plant for all its water supply systems, and prevents the wastage of leakage of between 30 and 100 million gallons of water a day, and considers the health and the ecology of the rivers of our watershed so we can have our maximum ecotourism.*

8-3 *...as the population will grow in this village because of the availability of water, should it come into effect, would this village government anticipate at a particular point of population withdrawing from the Town of Monroe.*

Section 3
Response to Appellate Division Order

On October 9, 2007, the Supreme Court of the State of New York, Appellate Division, Second Judicial Department, issued a Decision and Order "remitting the matter to the Board of Trustees of the Village of Kiryas Joel for the preparation and circulation of an amended final environmental impact statement ... which analyzes the impact of the project on wetlands, sewage facilities, and the discharge of wastewater and treated effluent into surface and ground waters, includes a phase 1-B archaeological study and review, analyzes the growth-inducing effects of the project, and analyzes those alternative to the project which were identified in the final environmental impact statement with respect to these impacts."

Specifically, the Court found that the Village needed to more fully identify the "nature and extent of all of the wetlands that would be disturbed or affected by the construction of the proposed water pipeline, how those wetlands would be disturbed, and how each disturbance, if any, would affect the salutary flood control, pollution absorption, groundwater recharge, and habitat functions of those wetlands."

Additionally, the Court directed the Village to identify "the location, nature, or extent of the bodies of surface water in which wastewater from the proposed treatment plant would discharged, and which State classes and standards of quality and purity apply to those water bodies" and "how much effluent would be discharged into those bodies of water over what periods of time, what the nature of the effluent might be, and what the effect upon those bodies of water are likely to be."

With respect to historical and archaeological resources, the Court directed the Village to prepare "a site-specific and design-specific phase 1-B archaeological study." Finally, the Court directed the Village to conduct a "demographic analysis or projections with respect to the effect of the availability of a steady and stable supply of potable water on population movement into or out of the Village" to support the prior conclusions that "the Village birth rate would continue to grow at a steady rate of 6% per year."

This AFEIS is prepared in direct response to the Court's Decision and Order. A copy of the Decision and Order is attached here as Appendix D. In the intervening time since the Order, the Village has engaged its consultants to conduct additional studies of wetlands, archaeology, sewage treatment, and population growth. The results of the additional studies and analyses are set forth below and in the attached appendices.

A. <u>Wetlands</u>

In its Decision and Order, the Appellate Division concluded that the DEIS and FEIS did not fully identify the "nature and extent of all of the wetlands that would be disturbed or affected by the construction of the proposed water pipeline, how those wetlands would be disturbed, and how such disturbance, if any, would affect the salutary flood control, pollution absorption, groundwater recharge, and habitat functions of those wetlands." The Court also directed that this analysis be conducted with respect to the project alternatives. To address the Court's directive, the Village engaged its wetlands consultant, Camp Dresser & McKee ("CDM"), to expand upon its DEIS wetlands impact assessment along the project's alternative routes. The findings of its expanded assessment are incorporated below and in Appendix E, attached hereto.

Due to the time of year of the Court's decision (November 2007), CDM was compelled to wait until after the following spring thaw to conduct its field work. CDM wetland scientists (Dwight Dunk, *PWS, Laura Burbage, Kelly Simmons and Danielle Lemoi) conducted field reconnaissance on April 3 and April 4, 2008 and again on April 30 and May 1, 2008 to provide greater detail on the nature and extent of wetlands that could potentially be disturbed by the construction of a water main connection to the Village of Kiryas Joel from the Catskill Aqueduct. As the pipeline will be constructed entirely within the rights of way along State and local roads, or within the road bed itself, the field delineation considered only those wetlands located within these areas. Information obtained during field reconnaissance and delineation will be used to ensure that the design and installation of a water main for the Village of Kiryas Joel will avoid and minimize wetland impacts to the greatest extent practicable.*

CDM wetlands experts walked the entire length of two alternative water main routes generally described as follows:

Alternative Route A: NYS Route 32/County Route 44.

This is a 12.5 mile route beginning at the New Windsor Water Treatment Plant Catskill Aqueduct connection on Riley Road and continuing east on NYS Route 94 to Vails Gate; then south along NYS Route 32 and west on County Route 44, terminating at a new water treatment facility on an undeveloped lot in the Village of Kiryas Joel south of Seven Springs Road and west of Bakertown Road. The land use along this route is a mix of residential, rural and commercial development, with the majority of the alternative supporting residential land use.

Alternative Route C: County Routes 94/27/208.

This 13 mile route also begins at the New Windsor Water Treatment Plant Catskill Aqueduct connection on Riley Road and continues on NYS Route 94 to County Route 27 to NYS Route 208 to County Route 17 to Shunnemunk Road in the Village of Kiryas Joel, terminating at the site of the existing water treatment plant on Berdichev Road. Land use along this route is a mixture of residential and rural with discrete pockets of commercial development.

Alternative Route B: NYS Routes 87/County Route 44

A third alternative was identified in the DEIS that followed NYS Routes 87 (NYS Thruway) and 32 and County Route 44. Due to the impracticability of obtaining approval for locating the pipeline along the NYS Thruway, this alternative is no longer considered reasonable or feasible, considering the objectives and capabilities of the Village.

1. Study Methodology

Two person teams of wetlands scientists were assigned to each route. CDM wetland scientists delineated the upland/wetland boundary of identified wetlands in accordance with the U.S. Army Corps of Engineers ("ACOE") standards described in the ACOE Wetlands Delineation Manual (TR Y-87-1), using vegetation, soils and indicators of wetland hydrology. Wetlands within the roadway rights-of-way (50 feet on either side) were delineated where the plant community is comprised of wetland indicator species (50% or more by visual inspection) and where the wetland plant community includes hydric soils and indicators of wetland hydrology are observable. The limit of the wetland was delineated where one or more of these three parameters ceased to exist. Definitions of each of these parameters and their corresponding indicators are listed below. Wetland boundary points were recorded at the limits of the of each wetland area. These boundaries are also identified on the wetlands maps attached here as Appendix E.

Wetland plants are species adapted for life in anaerobic soil conditions. The United States Fish and Wildlife Service ("USFWS") rates plants as OBL, FACW, FAC, FACU or UPL per the National List *of Plant Species that Occur in Wetlands: Northeast (Region1) U.S. Fish and Wildlife Service, May 1988. The limit of a wetland plant community extends to the limit of dominant plant coverage (50% of more by areal cover) rated as OBL, FACW, or FAC.*

Hydric soils can be mineral or organic soils that formed in saturated conditions, or where flooding or ponding occurs long enough during the growing season to develop anaerobic conditions in the upper part of the soil horizon, generally within the root zone; hydric (mineral) soil indicators include the presence of a gray color and/or mottles immediately below the surface or thick, dark surface layers overlaying a gray or mottled subsurface, and hydric (organic) soils indicators include more than 50 percent (by volume) of the upper 32 inches of soil is composed of organic soil material.

Characteristics of wetland hydrology show the movement, distribution or quantity of water in areas that are periodically inundated or have soils saturated to the surface at some time during the growing season; indicators include, but are not limited to, drainage patterns, drift lines, watermarks, sediment deposition and visual observation of inundated and/or saturated soils.

CDM wetlands scientists recorded field observations of the wetland and surrounding environment in field notebooks and preserved the coordinates of each wetland boundary point within the roadway rights-of way using hand-held Global Position System ("GPS") units (Trimble Geo XT, 2005 Series Pocket PC).

Figures 1 through 10 in Appendix E depict maps of the alternative pipeline alignments based on the Orange County Geographic Information System ("GIS") data, recent aerial photography of the area and the field collected GPS points. The figures also depict the delineated wetland boundaries. The mapped DEC freshwater wetlands are shown in a blue hatch pattern. For the purposes of this study, those wetland areas not under the jurisdiction of DEC are assumed to be federal jurisdiction (ACOE) wetland areas. This is somewhat conservative as it possible that some of the smaller isolated units are not regulated by either agency.

2. Field Results

There were three types of wetlands identified along both alternative routes: palustrine forested (PFO), palustrine emergent (PEM), and palustrine scrub / shrub (PSS). Palustrine forested wetlands are predominantly red maple (Acer rubrum) swamps that support species such as elms (Ulmus spp.), dogwoods (Cornus spp.), and ash (Fraxinus spp.) in the tree layer; with multiflora rose (Rosa multiflora), pussy willow (Salix discolor), honeysuckle (Lonicera spp.), and arrowwood (Viburnum recognitum) in the shrub layer with skunk cabbage (Symplocarpus foetidus) and sensitive fern (Onoclea sensibilis) in the herbaceous layer. Palustrine emergent wetlands are predominantly cattail (Typha latifolia) marshes or common reed (Phragmites australis) dominated marshes, and with species such as purple loostrife (Lythrum salicaria), reed canary grass (Phalaris arundinacea), and tussock sedge (Carex stricta) also found in emergent wetlands. Palustrine scrub / shrub wetlands are populated by trees saplings and shrubs including such species as dogwood (Cornus stolonifera and C. ammomum) , pussy willow (Salix discolor), and multiflora rose.

Alternative Route A (NYS Route 32/County Route 44)

Thirty-eight wetland units or areas meeting the foregoing federal definition of a wetland were identified along Alternative Route A. These consist entirely of ACOE wetlands, since no DEC wetlands or associated regulated buffers were identified within these units. Wetlands are present on both sides of the roadway and most commonly are associated with stream channels or drainage ditches. Of the 38 wetland units noted along Route A, 14 are associated with stream crossings. Moodna Creek, a DEC Class C stream, is located immediately to the west of Route 32, for an approximately 1.8 mile stretch between Route 20 and Juenger Road. The river's floodplain is wide and in places extends nearly up to the road. Although floodplains often exhibit some wetland characteristics, only those areas which exhibit all three wetland parameters were identified as wetlands. Only those wetland resources located within or immediately adjacent to the rights-of-way were delineated and recorded by GPS survey methods. Table 1 summarizes the wetland types identified along Alternative Route A. Table 2-2 of the DEIS contains definitions of the referenced wetland types. Appendix E depicts the wetland units delineated along Route A (figures 6-10).

Drainage ditches and stream channels are also prevalent along the route but were not always associated with wetland resources. Many of the culverts not associated with wetlands but which convey flow under the roadway were also located using GPS during the wetland delineation and are identified by blue points on the attached wetland maps.

Table 1. Wetland Summary along Alternative A Alignment

Wetland ID	Wetland Classification	Notes
1-1	PFO	
1-2	PFO	
1-3	PFO	
1-4	PFO	
1-5	PFO	
1-6	PFO	
1-7	PFO	
1-8		Stream Channel
1-9		Stream Channel
1-10		Stream Channel
1-11	PFO	
1-12		Stream Channel
1-13		Stream Channel
1-14	PFO	
1-15		Stream Channel
1-16		Stream Channel
1-17	PEM	Private Property
1-18	PEM	Private Property
1-19	PFO	
1-20		Stream Channel
1-100	PEM, PFO	
1-101	PSS	
1-102	PFO, PSS	
1-103	PFO	
1-104	PEM	
1-105	PEM	
1-106		Stream Channel
1-107		Stream Channel
1-108	PFO	
1-109	PFO, PEM	
1-110	PFO, PSS, PEM	
1-111	PEM, PFO	
1-112		Stream Channel
1-113		Stream Channel
1-114		Stream Channel
1-115	PFO	
1-116	PFO	
1-117	PFO	
1-118	PEM, PSS	
1-119	PFO	
1-120	PSS	
1-121	PSS	
1-122		Stream Channel
1-123	PFO	
1-124	PFO	
1-125	PFO	
1-126	PFO	Small pond in wetland

Alternative Route C (County Routes 94/27/208)

There were 51 wetland units identified along Alternative Route C. Three of these units appear to contain DEC regulated buffer areas, while the remainder consists of ACOE wetlands. These units were identified on both sides of the roadway and were located within or adjacent to the roadway rights-of-way. Eight wetland areas were noted as stream crossings. The Moodna Creek and Woodbury Creek are Class C streams. Table 2 summarizes the types of wetlands located along Alternative Route C. Appendix E depicts the wetland units delineated along Route B (figures 1-5). The DEC buffers are located on Map/Figure 1: wetland unit # 2-5 [along NYS Route 94] and on Map/Figure 4: wetland unit # 2-17 & # 2-18 [along County Route 27].

Drainage ditches and stream channels are also prevalent along the route but were not always associated with wetland resources. Many of the culverts not associated with wetlands but which convey flow under the roadway were also located using GPS during the wetland delineation and are identified by blue points on the attached wetland maps.

Table 2. Wetland Summary along Alternative C Alignment

Wetland ID:	Wetland Classification:	Notes:
2-1	PSS, PEM	Bordering stream
2-2	PSS	
2-3	PEM	
2-4	PEM	
2-5	PFO	
2-6	PSS	
2-7	PFO	
2-8	PFO	
2-9		Stream channel
2-10		Stream channel
2-11		Stream channel
2-12	PFO	
2-13	PSS	
2-14		Pond
2-15	PFO	

2-16		*Stream channel*
2-17	*PFO, PEM*	*Large complex with stream flow into unit*
2-18	*PFO, PSS*	
2-19	*PFO*	
2-20	*PFO, PSS*	
2-21	*PEM, PSS*	
2-22	*PFO*	*Private Property*
2-23	*PEM*	*Private Property*
2-24	*PEM*	*Private Property*
2-25	*PFO*	
2-26		*Outside ROW*
2-27		*Private Property*
2-28		*Private Property*
2-29		*Stream channel*
2-30	*PFO*	
2-31	*PEM*	
2-32	*PFO, PSS, PEM*	
2-33	*PFO*	
2-34	*PSS, PEM*	
2-35		*Stream channel*
2-36		*Stream channel*
2-37	*PEM, PFO*	
2-38	*PEM, PFO*	
2-39	*PEM*	
2-40	*PEM, PSS*	
2-41	*PSS*	
2-42	*PEM*	
2-43	*PEM, PSS, PFO*	
2-44	*PFO*	
2-45	*PEM*	
2-46		*Pond*
2-47		*Stream channel*
2-48		*Stream channel*
2-49	*PFO*	
2-50	*PFO*	
2-51	*PFO*	

3. Conclusions

State and federal wetlands were identified and delineated in the field along both sides of the roadways of both alternative routes. The wetlands delineated on the figures attached in Appendix E are those located within or immediately adjacent to the roadway rights-of-way (50 feet on either side). Pipeline construction and any equipment staging will be limited to within the rights-of-way; therefore, potential impacts to wetlands beyond the rights-of-way will be avoided. There is sufficient room within the rights-of-way to complete construction of the proposed water main without direct impact or alteration of any of the identified wetlands. Nevertheless, protective measures will be implemented to avoid any indirect impacts to wetlands in these areas where the wetlands are located near to the rights-of -way.

The wetland field delineation conducted in April/May 2008 identified a total of 38 wetland units along the proposed eastern water transmission main (Route A). A total of 51 wetland units were identified along the proposed western water transmission main (Route C). Of the 38 wetland units noted along Route A, 14 are associated with stream crossings. As described in the DEIS, mitigation measures will be employed to avoid potential adverse impacts to streams at these crossings. Where practical, the water main will be attached to the underside of a bridge crossing a stream. Where attaching the water main to the bridge is not practical, the water main will be jacked beneath the stream. The sending and receiving pits would need to be a minimum of 50 feet from the stream bank and the top of the water main at least 5 feet beneath the stream bottom. Eight wetland areas were noted as stream crossings along Route B. The Moodna Creek and Woodbury Creek are Class C water bodies under DEC regulations. Crossings of these two water bodies will not require a permit from DEC. Nevertheless, best management practices, including erosion and sediment control measures, will be utilized to ensure sediment runoff is controlled at the stream crossings.

DEC regulated freshwater wetlands and adjacent or buffer areas occur sporadically only along Route C. No construction activity will occur directly within any of these DEC regulated wetlands. However, there is the potential for temporary disturbance of the adjacent area or buffer of these wetlands. DEC regulations at 6 NYCRR Part 663 identify permitted uses in both the wetland proper and its associated adjacent area. An 'adjacent area' is defined as the land or water that is outside of a wetland and within 100 feet of its boundary. The regulations expressly authorize construction activity associated with a utility installation within a freshwater wetland adjacent (buffer) area by letter of permission, rather than by individual permit. General requirements under the letter of permission are that any construction related impacts in a wetland adjacent area be temporary and that the contractors replace soils excavated and replant vegetation restoring any disturbed adjacent areas to its pre-construction condition.

The remaining wetland units are presumed to be ACOE regulated wetlands, though some may fall outside of such regulation where isolated. All were located at or adjacent to the limits of the visible roadway right-of-way, meaning that no wetlands were identified to actually exist within any of the rights-of-way. Because the water transmission main will be installed either within the roadway right-of-way or the roadway bed itself where the right-of-way is not accessible, no direct impacts to wetlands or wetland loss as a result of this project are anticipated. In those limited areas where wetlands were located on both sides of the road and locating the water main in the travel lanes is not a viable option, a Preconstruction Notification (PCN) will be filed with the US Army Corps of Engineers under Nationwide Permit number 12, Utility Line Activity. Pursuant to the PCN, the applicant obtains coverage under an existing permit and must adhere to the general terms and conditions of that permit. Accordingly, there will be no need to obtain any individual DEC or ACOE *wetlands permits for the project construction although coordination with one or both of these agencies will take place as needed.*

Finally, because no direct or permanent impact to wetlands along the water transmission main route is anticipated, no affect on flood control, pollution absorption, groundwater recharge and habitat function of the wetland units will result from the construction of the water transmission main.

B. Wastewater Treatment Impacts

1. Background

In its Decision and Order, the Appellate Division concluded that the DEIS and FEIS did not fully identify the "location, nature, or extent of the bodies of surface water into which wastewater from the proposed treatment plant would be discharged, and which State classes and standards of quality and purity apply to those water bodies... [n]or did the DEIS or FEIS adequately identify how much effluent would be discharged into those bodies of water over what periods of time, what nature of the effluent might be, and what the effect upon those bodies of water are likely to be."

In response to the Court's decision, CDM revisited the issues of the source and volume of wastewater anticipated to be generated as a result of the Project, as well as the ability of available treatment systems to accommodate it without impact on the receiving water bodies.

As described in the DEIS and FEIS, the Project includes a new drinking water treatment plant. The water treatment plant will not generate a significant wastewater stream. Wastewater would be limited to staff and possible lab waste. The minimal wastewater stream (< 50 gpd) from the water treatment plant will easily be accommodated by either the Village's existing wastewater treatment plant or by the Harriman Wastewater Treatment Plant ("WWTP") operated by the Orange County Department of Public Works – Division of Environmental Facilities and Services ("DEF"). All wastewater within the Village is currently being accommodated by either of these two wastewater treatment plants and, as noted below, adequate available capacity exists at these facilities to accommodate any new wastewater generated by the Project.

The wastewater treatment plant within the Village is located at Bakerstown Road in Monroe, NY. This plant is permitted at 0.97 mgd under SPDES number NY-0250520. Using existing infrastructure, wastewater within the Village can also be accepted at the Harriman WWTP operated by the Orange County DEF. The Harriman WWTP is located at River Road in Harriman, NY. The Harriman WWTP has a permitted flow of 6.0 mgd under SPDES number NY-0027901. Year 2008 monthly reports recently produced by the DEF indicate that there currently remains approximately 1.5 mgd of available capacity at the Harriman WWTP. Copies of these DEF reports are attached in Appendix F.

The Village of Kiryas Joel WWTP and the Harriman WWTP are located within the Ramapo River watershed. The Ramapo River begins near the Village of Kiryas Joel, flows southeast to Harriman, then south into western Rockland County, then into northern Bergen County, New Jersey. The Village WWTP has one permitted outfall to a tributary of the Ramapo River with a NYSDEC water classification of D, while the Harriman WWTP has a total of two permitted outfalls to the Ramapo River. Outfall 001 discharges to a tributary of the Ramapo River with a water classification of C. Outfall 002 discharges to the Ramapo River which has a water classification of A(T).

The Ramapo watershed is a federally-designated, sole source aquifer. Thirty percent of Rockland County and two million residents in New Jersey receive their drinking water from the Ramapo Valley aquifer (source: DEIS – Western Ramapo Wastewater Treatment Plant, 2002). As such, the residents and users of the watershed place high importance on preserving their water resources, including preserving both the quality and quantity of water in the River. Toward this end, Rockland County through the auspices of Rockland County Sewer District No. 1 is in the process of constructing a new advanced wastewater treatment plant to return high quality effluent to the Ramapo River basin in lieu of utilizing existing infrastructure that would result in an out of basin discharge to the Hudson River. Moreover, Rockland County has expressed encouragement for the Aqueduct Project as it will result in a positive inter-basin transfer of water into the Ramapo watershed. Correspondence from the Rockland County Legislature is attached here in Appendix G.

2. WWTP Capacity and Potential Water Quality Impacts

The Village of Kiryas Joel WWTP has a capacity of 0. 97 mgd. This plant operates under SPDES permit number NY-0250520. The flow and effluent limits are provided in the table below. The Village's WWTP has a permitted discharge to a Class D tributary of the Ramapo River. As a member of Orange County Sewer District ("OCSD") No. 1, the Village's wastewater is also treated at the Harriman WWTP. The Harriman WWTP has a treatment capacity of 6.0 mgd. In addition to the waste from the Village, it also treats wastewater generated by other OCSD members, including the Village of Harriman, the Village of Monroe, and a portion of the Town of Monroe. In addition to maintaining their individual sanitary sewer systems, the towns of Blooming Grove, Monroe, Woodbury and Chester, as well as the Village of Chester, have formed the Moodna Basin Southern Region (MBSR) Joint Sewerage Board. The sanitary sewer systems within the MBSR are also authorized to contribute up to 2 mgd of flow to the Harriman WWTP.

The Village of Kiryas Joel is entitled to discharge all of its wastewater to the Harriman WWTP, provided the capacity is available. The Kiryas Joel treatment facility was built during a period when the Harriman plant was operating above its rated capacity and DEC had imposed a moratorium on new discharges to the Harriman facility, such as discharges from newly constructed buildings. The sanitary sewer system in Kiryas Joel is designed such that all wastewater from the Village flows to the Harriman plant unless part or all of it is diverted to the Village WWTP.

The Harriman WWTP was built in 1974 as a 2.0 mgd conventional, suspended growth, activated sludge facility. In 1987 the average design flow of the plant was expanded from 2.0 mgd to 4.0 mgd with the addition of an oxidation ditch treatment system designed for an average flow of 2.0 mgd. In 2002, Orange County petitioned the State Comptroller for permission to issue bonds or notes to finance the expansion of the Harriman WWTP for the primary benefit of OCSD No. 1, including the Village of Kiryas Joel. The Orange County petition and supporting documents are attached in Appendix H. Upgrades completed in 2007 increased the capacity from 4.0 to 6.0 mgd through the construction of a new 2.0 conventional activated sludge ("CAS") system. Flow from all systems is directed to final polishing filters and a chlorine contact tank where chlorine gas and sulfur dioxide gas are added for disinfection and dechlorination. Plant effluent is discharged to the Ramapo River. Sludge from the facility is dewatered using belt filter presses and composted. The Harriman WWTP operates under SPDES permit number NY-0027901. The table below outlines the current allowable parameters. The current design flow is 6.0 mgd. Year 2008 monthly reports recently produced by the DEF indicate that there currently remains approximately 1.5 mgd of available capacity at the Harriman WWTP. Copies of these DEF reports are attached in Appendix F.

Current SPDES Permit No. NY-0250520

Effluent Characteristic	*Effluent Limits*
Flow Monthly Average, mgd	*0.97*
Carbonaceous Biological Oxygen Demand ($CBOD_5$)- Daily Maximum, mg/L	*5.0*
Total Suspended Solids Daily Maximum, mg/L	*10*
Solids, Settleable Daily Maximum, mL/L	*0.1*
Ammonia Nitrogen - Monthly Average June – October, mg/L	*1.5*
Ammonia Nitrogen - Monthly Average November – May, mg/L	*2.2*
Phosphorus Monthly Average, mg/L	*0.5 as P*
Temperature - Daily Maximum, °C	*Monitor*
pH (Average Month, Range)	*6.0 – 9.0*
Fecal Coliform - 30-day Average, No/100 mL	*200*
Fecal Coliform - 7-day Average, No/100 mL	*400*
Chlorine, Total Residual, Daily Maximum, mg/L	*0.1*

Even before the most recent Harriman WWTP 2.0 mgd expansion, it was evident that there was adequate capacity between the Village WWTP and the Harriman WWTP to accommodate the potential increase in wastewater generated by the Project. Subsequent to the completion of the FEIS and Findings Statement, on March 9, 2005, the New York State Department of Environmental Conservation ("DEC") approved a new groundwater well (Well #27) that increased the Village's water supply (and corresponding wastewater production) by 135,000 gpd (125 gpm @ 18 hrs/day). In addition, on August 17, 2005, DEC approved another new groundwater well for the Village (Well #28) with an output of 486,000 gallons per day. In total, both approvals by DEC represented an addition of 621,000 gpd of new water supply to the Village. As a result, the Village now has approval to draw in excess of 1.9 mgd from its existing wells, with a corresponding potential volume of wastewater generated. Despite such a significant increase in the Village's water supply and corresponding waste water generation potential, DEC expressly determined in its approvals that this new water supply would have no adverse impact on the Harriman WWTP or the Ramapo River. In response to public comments regarding the potential impact of this additional water supply on growth, wastewater and the Ramapo River, DEC stated:

> ***In regards to the concern about growth impacts, particularly upon the sewage treatment capacity in the Ramapo River Basin, this Department carefully reviewed its***

> *files in regards to the capacity of both the Village' Sewage Treatment Plant and Orange County's Harriman Sewage Treatment Plant to treat this additional wastewater. We determined that there is sufficient excess capacity to treat this additional water, without adverse impacts on the Ramapo River.*

Copies of the DEC water supply well permits and DEC correspondence are attached here as Appendix I. As a result of these approvals, the Village's existing available water supply equals that anticipated by the new pipeline and Aqueduct source. As noted, the existing groundwater wells will serve as the necessary backup supply for the Village in the event of shutdown of the Aqueduct and, accordingly, there will be no immediate increase in water use and wastewater production as a result of the project. In addition, as a result of the connection to the aqueduct and the conversion from a groundwater-based water supply, the Village project will result in a significant positive environmental benefit by reducing the daily pressure on the local aquifer by over 1.4 mgd

In August 2008, the Orange County Supreme Court, Environmental Claims Part, issued a Decision and Order enjoining the County from selling over 1.0 mgd of the newly created capacity to communities outside of OCSD No.1, including those in the MBSR, until such time as it was determined that there was adequate capacity first to accommodate the District, including the Village. It is, therefore, further evident that there is now an adequate, secure and dedicated capacity available to accommodate the potential increase in wastewater to be generated by the Project now and into the foreseeable future. See, Village of Kiryas Joel v. County of Orange, Index Nos. 1892/07; 3958/07 (Sup. Ct. Orange Co., August 7, 2008) (a copy of the Decision and Order is included in Appendix J).

Also since the time the DEIS and FEIS were completed, in 2006, Orange County engaged CDM to complete the "Harriman Wastewater Treatment Facility Membrane Bioreactor Pilot Study" pursuant to a grant from the New York State Energy Research and Development Authority (NYSERDA Study). The NYSERDA Study assessed the feasibility, effectiveness, and cost of implementing a membrane bioreactor (MBR) treatment system at the Harriman WWTP. The study concluded that facility capacity could be cost effectively increased an additional 3.0 mgd, from 6.0 mgd to 9.0 mgd. Additionally, the study's results demonstrated that the anticipated discharge permit standards for such an increase are readily achievable and technologically feasible for the Harriman WWTP and will also actually increase the quality of the effluent discharged to the Ramapo River. A copy of the NYSERDA Study is attached in Appendix K.

A key consideration for the NYSERDA Study was the ability of the MBR pilot unit to meet effluent quality standards with the proposed facility upgrades. The NYSDEC was consulted to assist in determining the potential future State Pollutant Discharge Elimination System (SPDES) permit effluent limits. The memo entitled, "Harriman STP "Preliminary" 9 mgd SPDES Limits for 001 and 002 Outfalls" dated February 16, 2006 details the proposed limits. A copy of the memo is attached in Appendix L. These limits, which are shown in the table below, are anticipated based on permits being issued in New Jersey watersheds that are downstream of the facility, permits being issued in other New York watersheds, and classification of the Ramapo River which is designated as a Class A water body as set by the DEC, which is a drinking water standard.

Current SPDES Permit No. NY-0027901 and Proposed SPDES Permit Effluent Limits*

Effluent Characteristic	Current Effluent Limits		Proposed Effluent Limits	
	Outfall 001	Outfall 002	Outfall 001	Outfall 002
Flow Monthly Average, mgd	6.0	2.0	9.0	2.0
Biological Oxygen Demand - Monthly Average, mg/L	Monitor	5.0	Monitor	5.0
Biological Oxygen Demand - Daily Maximum, mg/L	5.0	Monitor	5.0	Monitor
Ultimate Oxygen Demand - Monthly Average, mg/L	Monitor	Monitor	Monitor	Monitor
Ultimate Oxygen Demand - Daily Maximum, mg/L	50	55	45	55
Total Suspended Solids Monthly Average, Jun – Oct, mg/L	Monitor	Monitor	Monitor	Monitor
Total Suspended Solids Monthly Average, Nov – May, mg/L	30	30	20	30
Total Suspended Solids 7-day Average, Nov – May, mg/L	45	45	30	45
Total Suspended Solids Daily Maximum, Jun – Oct, mg/L	10	10	10	10
Dissolved Oxygen – Maximum Day, mg/L	7.0	7.0	7.0	7.0
Ammonia Nitrogen - Monthly Average June – October, mg/L	1.3	1.1	1.2	1.1
Ammonia Nitrogen - Monthly Average November – May, mg/L	2.2	6.8	2.2	6.8
Total Kjeldahl Nitrogen Monthly Average, mg/L	Monitor	Monitor	Monitor	Monitor
Nitrate Monthly Average, mg/L	N/A	N/A	10	10
Total Phosphorus Monthly Average, mg/L	N/A	N/A	0.5	0.5
Temperature - Daily Maximum, °C	Monitor	21.1	Monitor	21.1
pH (Average Month, Range)	6.5 – 8.5	6.5 – 8.5	6.5 – 8.5	6.5 – 8.5
Fecal Coliform - 30-day Average, No/100 ml	200	200	200	200
Fecal Coliform - 7-day Average, No/100 ml	400	400	400	400
Total Copper - Daily Maximum, lb/d	1.0	1.0	1.4	1.4
Total Zinc - Daily Maximum, lb/d	8.4	8.4	12.0	12.0

** Proposed based on the MBR pilot study with an increase of capacity to 9.0 mgd*

Data collected during the NYSERDA Study was used to estimate the maximum treatment capacity that can be provided by the Harriman WWTP. A computer program simulated the alternatives, estimating the potential to increase the facility's capacity and predicting the effluent quality based on existing and predicted permit limits. Based on the study results, the Harriman WWTP is capable of treating a capacity of 9.0 mgd while meeting the preliminary future permit limits.

Any wastewater discharged into the Ramapo River watershed must be of very high quality in order to meet the water quality standards set by DEC. The pilot study has shown that capacity of the Harriman WWTP can be increased while maintaining the high quality effluent required. A copy of the NYSERDA Study is attached here in Appendix J. Officials from Orange County have publicly expressed an intention to implement the recommendations of the Study. The NYSERDA Study lends still further support for the conclusion that there is adequate treatment capacity to accommodate the Project and that there will be no adverse environmental impacts from the Project with regard to wastewater treatment capacity and no adverse environmental impact with regard to the receiving water body, the Ramapo River.

It is important to recognize as part of this impact assessment that water withdrawn from the Ramapo River must be returned to the Ramapo watershed as it is a sole source aquifer providing drinking water to downstream residence of New York and New Jersey. By virtue of the inter-basin transfer of water from the Aqueduct, the water resource of the Ramapo watershed will be further improved due to the increase in quantity without a corresponding withdrawal from the River.

3. Water Quality Permitting

Pursuant to the SPDES permitting program under 6 NYCRR Part 750, DEC determines the permit effluent limits for WWTPs. These limits are based on the classification of the receiving water body and its assimilative capacity. DEC issues the project/site specific SPDES permit. Therefore, if the permit holder is in compliance with discharge limits mandated by the SPDES permit, there is no significant impact to the receiving water body.

Accordingly, the quality of the wastewater treatment plant effluent is not affected by the source of the Village's potable water source (i.e., potable water from groundwater wells versus surface water from the Catskill Aqueduct). Rather, it is more dependent upon the ability of the owner/operator of the facility to maintain the facility in a proper manner. Therefore, there are no significant impacts to the receiving water body (Ramapo River) as a result of the Village's proposed connection the NYC Catskill Aqueduct.

C. Cultural Resource Management

In its Decision and Order, the Appellate Division concluded that, with respect to historical and archaeological resources, the DEIS and FEIS were inadequate by the absence of "a site-specific and design-specific phase 1-B archaeological study." In response to the Court's decision, the Village retained Historical Perspectives, Inc. (HPI) to expand on its prior studies by completing a sensitive site refinement study and phase 1-B study. Reports for both studies are attached here in Appendix M.

In its initial assessment for the DEIS and FEIS, HPI conducted an archaeological study of the sensitivity areas along the alternative routes in a standard phased approach, correlating the extent of documentary research with the route-selection process (HPI 2003, 2004). Such a phased approach eliminated the possibility of unnecessary in-depth documentation and/or field testing on non-selected *routes, as well as the impracticality of invasive field-testing along the entire 11-13 mile length of the pipeline, most of which will be placed along or under existing roadways. To ensure that no adverse impacts to archaeological resources would result from construction of the Project, the New York State Office of Parks, Recreation, and Historic Preservation (OPRHP) approved an archaeological protocol that provided for a sequence of identification, testing, analysis, recovery, and avoidance. The protocol was incorporated as a special mitigation measure in the SEQRA Findings. Future State permits, including those by NYSDEC, will incorporate the protocol as a special condition.*

HPI's initial Phase IA technical report and a subsequent amendment identified sensitivity zones for three pipeline routes (HPI 2003, 2004) (See DEIS App. B). Subsequent to the Court's ruling, HPI was tasked to implement the OPRHP-approved protocol through phase 3, the Phase 1-B study, as appropriate. To carry out these tasks, a more exhaustive pedestrian survey, additional documentary research, and detailed mapping of potentially sensitive areas were undertaken for two of the proposed alternative routes, Routes A and C (the "refinement study") (HPI 2008). The refinement study would then serve as the basis for identifying candidate sites for the phase 1-B field study. The refinement study is included here in Appendix M.

Route A is the easternmost corridor running along NYS Route 32 and County Route 44. Route C is the westernmost corridor running along NYS Routes 94, 208 and 17 and County Route 27. Alternative Route B -- NYS Routes 87 (NYS Thruway) and 32 and County Route 44 -- has been eliminated from consideration due to the difficulty in siting the pipeline along the New York State Thruway.

The goal of the refinement study was to expertly narrow the sensitivity zones to reflect archival data, the current design plans, and existing field conditions within the sensitivity zone of alignments A and C. For purposes of this study, an Area of Potential Effect (APE) for both alignments was defined to include the road right-of-ways (ROW) extending 15.25m (50ft) on either side of the paved road, as well as the area directly within the roadway itself. A detailed map delineating the APE is attached with the refinement study in Appendix M.

Mapped or identified historical resources more than 300' (roughly 90 meters) outside of the project site were excluded from the APE. This included houses, barns, outbuildings, and other features that fronted onto old roads that paralleled the existing ROW, so that all portions of their yard were far removed from the APE. Exceptions to this were historical complexes that had their backyard areas abutting the APE, which were included as potentially sensitive areas.

In addition, areas within the APE that bear extensive evidence of disturbance from cutting and filling to create the existing roadbed were also excluded. Likewise, areas within the APE that are above or below the existing street bed corridor by more than 3m (roughly 10 ft) were excluded due to the impracticability of placing the pipeline in these areas. Nevertheless, areas containing previously recorded finds are noted on the maps. The refinement study resulted in a delineation of the undisturbed areas within the APE identified as potentially sensitive for pre-contact and/or historical resources.

The refinement study found that Route C has more archaeologically sensitive areas than Route A. The most significant difference between the two routes is that much of Route A travels along a 20th century road that has far fewer areas of historical sensitivity since it was laid out through what appears to have been undeveloped farmland. Route A has a total of 41 areas of historical sensitivity, and most of these are individual lots or structures, while Route C has 54 identified areas of historical sensitivity, with many of these actually representing multiple structures or lots. Route C also passes through a 19th century cemetery that was disturbed by the early 20th century rerouting of Route 208 directly across it. Although records indicate that graves were removed from the roadbed and *reinterred when Route 208 was constructed, it is possible that human remains that were not recovered at that time still exist within the ROW (HPI 2004).*

Pursuant to the approved testing protocol, sites or areas of sensitivity that have no documented or field verified disturbance were identified for standard Phase I-B archaeological testing. For Route C, the area in the vicinity of the cemetery was identified. Due to the inherent difficulty and cost of conducting a Phase I-B study of an area that may disturb human remains, as well as the difficulty of completing construction in such an area, the decision was made to defer study of this area pending results from other areas and final determination that this route would continue to be the preferred route for the pipeline. In the event that this route remains as the preferred route, further 1-B study will need to be conducted unless the Project can be rerouted and redesigned to completely avoid this area.

For Route A, one area was selected for a Phase 1-B study based on the refinement study. The Phase I-B archaeological study of this sensitive area was undertaken in August 2008 over the course of two days by a team of three archaeologists. Thirty 40x40cm (15.8x15.8in) hand excavated shovel tests (STs) were completed within the ROW along both sides of Route 32 in Cornwall, New York immediately north of the Cornwall-Woodbury border. This area was identified as potentially undisturbed and sensitive for both precontact and historical resources during the prior refinement study, and was identified as location Area A-21.

The Phase I-B study found no precontact material in any of the 30 STs. Historical and modern material was limited to a small assortment of 19th and 20th century artifacts, most post-dating the construction of Route 32 in the 1930s. Three STs on the east side of Route 32 contained 19th century material: STs 7, 11, and 12. A stone foundation was noted about 7.25m (24.6ft) east of the ROW boundary near ST3. While it is possible that these historic artifacts relate to this former structure, the positive STs are located 60, 129, and 135m (98.5, 425, and 443ft) north of ST3, so their relationship is not certain. A review of historical maps and atlases show that in 1851 a Toll Gate stood to the east of Route 32 in the approximate vicinity of the three positive STs, and that to the south of this was the F. Smith farmhouse. However, the exact locations of these former structures are uncertain given the age of the historic maps and changes to the landscape. By 1903 there were no structures in this area, although the "Houghton Farm" house may have stood near the north end of the APE on the east side of Route 32. Artifacts from the three positive STs are more likely related to one of these structures, and are hereafter referred to as the Toll Gate site.

In the event that the final pipeline route is located on the east side of Route 32 in the vicinity of the positive STs and stone wall, then additional archaeological investigations and documentary research, pursuant to the approved protocol and in consultation with OPRHP, would be conducted to determine the significance of the site and to more firmly associate artifacts with a specific source. However, the preferred option would be to preserve the potential resource in place. This can be accomplished by locating the pipeline on the west side of Route 32 or under the roadway itself in this area, which would appear to be far enough removed and separated by significant amount of disturbed area to avoid potential impacts to these resources.

The Village has implemented the OPRHP-approved protocol for selected sites along Alternative Route A. Route B has been eliminated from consideration because it is not feasible due to difficulties in gaining approvals to utilize the NYS Thruway. With respect to Alternative Route C, the Village has reserved completing the protocol due to the difficulty and sensitivity of risk for disturbing a site potentially containing human remains. In the event the Village plans to utilize Route C, a Phase 1B will be completed to confirm the absence or presence of archaeological resources under the strict guidance and oversight of OPRHP or, in the alternative, the Project will need to be rerouted *to completely avoid this area. Likewise, in the event that the proposed route of the Project deviates from the identified ROWs, the OPRHP-approved protocol will continue to be enforced.*

D. Growth

In its Decision and Order, the Appellate Division concluded that the DEIS and FEIS "provided no demographic analysis or projections with respect to the effect of the availability of a steady and stable supply of potable water on population movement into or out of the Village, other than a conclusory assumption that the Village birth rate would continue to grow at a steady rate of 6% per year, and thus failed to take a 'hard look' at the secondary impacts of the project." Accordingly, the Court directed the Village to further analyze the growth-inducing effects of the project. In response to the Court's decision, the Village retained a new expert consultant, AKRF Environmental and Planning Consultants ("AKRF") to undertake an expanded review and analysis of available demographic data and population projections to determine whether there could be expected to be an identifiable change in the growth patterns of the Village as a result of the project. The AKRF report is summarized below and attached in full at Appendix N hereto.

The AKRF growth study report is organized into three sections. Section A presents demographic data for the Village of Kiryas Joel and compares the demographic characteristics of the Village to other communities with high concentrations of Hasidic population and to the counties in which these communities are located. Section B presents population projections for the Village from 2000 through 2030, and outlines the methodology and assumptions used to develop these projections. Section C analyzes whether it could be anticipated that the Project will have a significant effect on the growth trends for the Village.

As in the Draft EIS, the AKRF growth study indicates that the rate of population growth in the Village of Kiryas Joel has been high over the past several decades, compared not only to Orange County but to other communities with substantial Hasidic populations. The study also concludes that the Village will continue to experience internal grow at a substantial rate due primarily to the religious and social norms of Hasidic Judaism.

As highlighted in Section A of the report, compared to the counties in which they are located, communities with a high concentration of Yiddish speakers (a proxy for Hasidic population) have a higher proportion of married-couple families, larger family sizes, and higher population growth rates. Many of these characteristics are magnified in Kiryas Joel where approximately 89 percent of the population is Hasidic.

The population projections for Kiryas Joel in Section B were based on three key factors: births, deaths, and migration. Custom tabulations using 2000 Census Public Use Microdata Sample ("PUMS") data were used to estimate an average number of children born to Kiryas Joel households (6 children per household). Births were spread across the female population based on information from the Village and other sources on typical marrying age for Hasidic women (age 18 to 19), and extrapolated to 2030. Annual deaths were projected based on New York State data from the National Center for Health Statistics. Net in-migration was estimated based on data obtained through the Census and from household count and marriage records obtained directly from the Village. These data indicate that in-migration is a small contributor to overall population growth in Kiryas Joel and that the percent of total population that is in-migrant will decrease further in the future. Overall, due primarily to the large family sizes encouraged through the social and religious norms of Hasidic Judaism, the Village population is expected to grow from 13,138 in 2000 to an estimated 50,530 in 2030.

Section C of the AKRF study concludes that potential constraints based on the availability of utilities such as sewer and water are unlikely to have a substantial effect on the population movement into or out of the Village as identified in population trends for the Village. This conclusion was based on a review of historical events related to the availability of sewer and water and their effect on Village population trends.

An EIS must contain an "evaluation of the potential significant environmental impacts at a level of detail that reflects the severity of the impacts and the reasonable likelihood of their occurrence." 6 NYCRR 617.9(b)(5)(iii). Identification and discussion of growth-inducing aspects are required only where applicable and significant. 6 NYCRR 617.9(b)(5)(iii)(d). Induced growth is a relevant subject of EIS scrutiny where a proposed action will actually encourage or cause an increase in population or business. DEC SEQR Handbook at 43-44. Accepted examples of growth inducing actions include the extension of public utilities into previously unserviced areas and highway extensions or new interchanges in an otherwise undeveloped area. In Section C, the AKRF study considered growth inducement and came to the reasoned conclusion that an in-kind replacement of the Village's existing water source with another would not significantly induce new growth not already projected to occur.

In the prior Draft EIS, the Village considered its historic growth, future growth projections and remaining build-out potential. (DEIS §§ 1.2.1 and 6; FEIS pp. 2-18 – 2-20). The Village considered that: (i) the Project was not intended to provide water to areas outside the Village; (ii) the Project involves only a new water source tying directly into the existing distribution system; not creation or expansion of the distribution system; and (iii) the Project will not bring water to an undeveloped or unserviced area. The Draft EIS also recognized that the Project will create few, if any, permanent employment opportunities and job creation will not induce people to move into the Village. Based on these considerations, the Village concluded the Project will not significantly induce new growth inside or outside of the Village.

This conclusion is now further supported by the AKRF study. The Amended FEIS continues to project natural internal growth based on historic trends and the community's religious culture. Events over the Village's short history support the conclusion that the Village's population is not significantly affected by outside forces such as availability or lack of new utilities. For example, from the mid-1980's through mid-1990's, DEC had imposed a moratorium on new sewer connections to the Harriman Wastewater Treatment Plant. Notwithstanding the fact that the Village was subject to the moratorium, there was no significant or noticeable leveling off or decline in Village population during this time period. Likewise, once the moratorium was lifted, there was also no significant or noticeable spike in internal population growth or in-migration. Similarly, with respect to water supply, at the time of the original DEIS, the Village was experiencing difficulty satisfying demand for water supply with its existing inventory of ground water wells. During this time, Village population continued to grow at consistent rates as shown in the AKRF report. More recently, since the completion of the FEIS, the Village increased its available water supply through the expansion of its Brenner well-field. As noted in the wastewater discussion, since the time of the original FEIS, the Village expanded its well-water supply capacity by an additional 621,000 gpd to a total in excess of 1.9 mgd. When compared to existing water demand in the Village, the new well capacity has created an actual surplus of over .3 mgd above peak demand and approximately .5 mgd above average daily demand. Notwithstanding this significant increase in available water capacity, the Village population has not experienced a corresponding surge in growth.

AKRF's current estimate for a Village population of 21,169 in year 2010 is remarkably consistent with estimates by Orange County dating back more than twenty years which forecast a population of 18,000 in 2010. (Hazen and Sawyer: Orange County Comprehensive Sewerage Study (September 1991), Table 5-1 (adapted from CDM:Facilities Expansion Engineering Report and Feasibility Study *for Orange County Sewer District No.1 and Moodna Southern Joint Sewerage Board (April 1988), Table 3-1, attached hereto as Appendix O.) The consistency between Orange County's projections and the actual growth of the Village over two decades marked by sewer moratoria, water shortages, and now new well capacity supports the conclusion that, traditionally, the rate of population growth in the Village has not been significantly influenced by water supply or infrastructure constraints and the inference that infrastructure, or the lack thereof, is not the determinative factor in projecting the future growth rate for the Village's population.*

Again, the Village's internal population growth has remained constant both before and after this increase in water supply and the level of in-migration has still continued its downward trend. Internal growth will likely continue and may potentially increase somewhat once the Project comes on-line, but it is not anticipated to be to any significant extent that can be quantified. Rather than leading to a significant increase in growth, the Project is a carefully considered and measured response to meet the internal needs forecasted by a responsible municipality.

E. Conclusion

The foregoing analyses of potential significant adverse impacts to wetlands, wastewater treatment and the Ramapo River, archaeological resources, and growth inducement are directly responsive to the Appellate Division Decision and Order, dated October 9, 2007. A copy of the decision is appended hereto in Appendix D. Based on the expanded and amended analysis summarized above, amendments were also made to responses to related comments in Section 2. Once the Amended FEIS is accepted as complete by the Village Board of Trustees as lead agency, it will be distributed to the other involved and interested agencies and individuals who had previously requested copies.

Appendix A

APPENDIX A

TRANSCRIPT

Public Hearing on the Draft Environmental Impact Statement

November 14, 2003

COPY

STATE OF NEW YORK : COUNTY OF ORANGE

VILLAGE OF KIRYAS JOEL : VILLAGE BOARD

---X

IN THE MATTER

OF

PUBLIC HEARING ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT ON THE PROPOSED CATSKILL AQUEDUCT CONNECTION

---X

Ezras Choilim Health Center
Village of Kiryas Joel
November 14, 2003

B E F O R E :

ARI FELBERMAN, MODERATOR

VILLAGE BOARD

ABRAHAM WIEDER, MAYOR

SAMUEL LANDAU, TRUSTEE

YUDEL KAHAN, TRUSTEE

MENDEL SCHWIMMER, TRUSTEE

JACOB MITTLEMAN, TRUSTEE

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THOMAS SCHOETTLE, P.E., P.P.

WHITEMAN OSTERMAN & HANNA, ESQS.
Village of Kiryas Joel SEQR Counsel
One Commerce Plaza
Albany, New York 12260
BY: MICHAEL G. STERTHOUS, ESQ.

ALSO PRESENT:

GEDALYE SZEGEDIN, Village Clerk

THE MODERATOR: Good morning and welcome to the Village of Kiryas Joel. Before we begin I ask that you please rise and join Mr. Don Nichol in the citing of the pledge of allegiance.

(Whereupon the pledge of allegiance was recited.)

THE MODERATOR: Thank you.

Allow me to introduce myself, my name is Ari Felberman. I'm Kiryas Joel's Governmental Relations Coordinator. The mayor requested that I serve as the moderator of this public hearing.

On behalf of Kiryas Joel's Mayor, the Honorable Mayor Abraham Wieder, and on behalf of the Village Trustees; Mr. Jacob Mittleman, Mr. Samuel Landau, Mr. Mendel Schwimmer and Mr. Yudel Kahan, I thank you for joining us today for this public hearing.

Seated on my right are the Village's elected officials that I just mentioned.

And seated to my left are the Village's professional staff, allow me a quick moment to introduce them. Immediately to my left is

Village Clerk, Gedalye Szegedin; Mr. Mike Sterthous, from the law firm of Whiteman, Osterman & Hanna, in Albany, New York, at the other end of the table; Village Attorney, Don Nichol of Jacobowitz & Gubits Law Firm; and Mr. Tom Schoettle and Hank Boucher of the Camp Dresser & McKee Engineering Firm.

Ladies and gentlemen, this is a public hearing on the Draft Environmental Impact Statement of the Village of Kiryas Joel's proposed water supply project.

This project calls for tapping into the New York City Catskill Aqueduct in Vails Gate in Orange County and for the water to be transported via a transmission pipeline to the Village of Kiryas Joel. This plan also calls for a pumping station and a water treatment plant.

The Draft Environmental Statement was accepted by the Village of Kiryas Joel Board of Trustees as the lead agency on October 7, 2003.

This public hearing is being held in accordance with Part 617 of the New York

State Regulations implementing the State Environmental Quality Review Act known also as SEQRA -- SEQRA, not secret. It's public.

The purpose of this public hearing is to receive your comments on the environmental issues associated with this project. Those wishing to be heard, as I mentioned before, should please complete the speaker's cards and bring it up to me. I'll then call upon you to address the lead agency.

I ask that the duration of your comments be no longer than three minutes, this way we will have a chance to hear all opinions and all comments. If what you are about to say was already said by a previous speaker I would request that you yield to the next speaker. Again, for the purpose that every opinion be heard.

A stop watch will be reset before every speaker and at the sound of the stop watch you know that your time is up and please try to cut it short or get to the point if you haven't already done so.

For the sake of time management, before

each speaker begins his or her statement I'll announce the name of the following speaker so they will be ready to follow right after.

When your name is called please approach the speaker's podium to my left, state your name clearly for the record. The Stenographer seated right before the speaker's podium will record your comment.

Now, just not to tire her out too much please speak slowly so she doesn't have to overdo it. Thank you.

I want to stress from the get-go that this is a public hearing, not a question and answer session. The lead agency will not respond to your comments or questions at this time. They will incorporate their response in the Final Environmental Impact Statement, also known as the EIS.

I further want to point out that the lead agency will respond in writing only to the substantive comments received today at this public hearing. The comments and the lead agency's responses will become part of the official record of the Final EIS, Environmental Impact Statement.

And when I say substantive comments I mean those comments that will be addressing environmental issues.

The Final EIS will be reviewed by the lead agency and will be accepted in the same manner as the Draft EIS. It too will be subject to a 10 day comment period.

Before opening the hearings to your comments I'll call upon a representative of the Village's engineering firm of Camp Dresser & McKee, Mr. Henry Boucher, known as Hank, to provide an overview of the project along with a summary of the Draft EIS.

Thank you.

Let me just remind you again, Mr. Boucher will not respond to any questions either, it will all be in the Final EIS. Thanks.

MR. BOUCHER: Thank you. Good morning.

I'll use these boards in order to provide a brief summary description of the project.

As the Moderator indicated, this is a

project to connect the Village of Kiryas Joel water system to the New York City Catskill Aqueduct. On this board shows a depiction of the proposed project.

The New York City Catskill Aqueduct is coming through the Vails Gate area and the project would connect to the aqueduct along Riley Road. Where the aqueduct passes through there would be a pumping station at that connection. This would be in the vicinity of the -- there is an existing New Windsor water treatment plant in that vicinity that taps the aqueduct. The tap would occur there, there would be an approximately 13 mile pipeline to be located in existing roads, not cross-country, and would come down Route 94, down Route 27 through Blooming Grove, connect up with Route 208, come down to the south, and then head again towards the Village along Route 6 and 17; on the north side of Route 6 and 17 along the exit ramp and into the Village.

The current proposed location for the treatment facilities would be at the

Village's existing water treatment plant.

Those are the basic components of the project; the connection to the aqueduct, the pumping station in that vicinity, the pipeline in existing roads, and a treatment facility at the water treatment plant.

Essentially the goals of the project are to provide a consistent and reliable source of high quality drinking water to the Village to meet its current water demands. Other goals of the project are to reduce the dependance on groundwater wells for supplying drinking water to meet its current water demands.

Another goal of the project is to reduce the vulnerability or the susceptibility to drought and to provide greater options in terms of sources of water in terms of drought or other circumstances like that. And also, to do this in such a way as to minimize adverse environmental impacts in the Village, in the neighboring communities, and to the environment.

Before settling -- before deciding on

the proposed project as the preferable alternative a number of other alternatives were evaluated -- and this is all documented in the Draft Environmental Impact Statement.

Among the alternatives that were evaluated was the alternative of taking no action; an alternative to drill additional groundwater wells to provide the needed drinking water. We also looked at alternative routes for the transmission pipeline. And we also looked at alternative sizes for the transmission pipe and alternative locations for the pumping station. And also considered any other alternatives that have been -- that were previously eliminated in prior -- prior efforts.

The two main alternative routes that were evaluated for the pipeline were what I refer to on this diagram as the New York State Thruway alternative and the Route 32 alternative.

In the case of the Route 32 alternative the connection would be at the same location, but the pipeline, instead of going west on 94 would go east on 94, go through the five-way intersection at Vails Gate, and then go south on Route 32 all the way down to the Highland Mills area, and then come ahead towards the Village on Route 44, and terminate -- the pipeline would terminate on the north side of the Village where a new water treatment plant would have to be built.

The other alternative for the pipeline that was evaluated in the Environmental Impact Statement was the alternative of -- because the Thruway is near the connection -- near the connection point, that alternative that was considered was to go over to the Thruway and come down the Thruway right-of-way to the point where the Thruway and 32 cross. And at that point the Thruway alternative would become the same as the Route 32 alternative and continue down 32 for a short distance and then towards the Village on Route 44.

Essentially the conclusion of the alternatives evaluation in the Draft

Environmental Impact Statement was that the proposed project before you today was determined to be the preferred alternative among the alternatives because it was the alternative that best met the goals and objectives of the project minimizing adverse environmental impacts.

Let me now give you a summary of some of the findings of the environmental impact evaluation of the preferred alternative, which as I mentioned is the alternative that routes the pipeline down 94, 27, and 208.

After selecting that as the preferred alternative the EIS takes a detailed examination of that particular proposed action in terms of potential environmental impacts and the need to mitigate, or take measures, or design measures to minimize any potential impacts.

The overall findings of our evaluation are that there would be no significant short or long-term adverse impacts to the environment. There are some unavoidable impacts, some unavoidable consequences, mainly in the short-term, mainly during construction, that are described and detailed in the Draft Environmental Impact Statement. And there are some environmental resources, some sensitive environmental resources, along the pipeline route that will have to be avoided during construction and the design of the pipeline will have to take into account those resources so as to minimize any disturbance to them.

And what I'm referring to -- this is a map showing the proposed project overlaying the New York State DEC wetlands in the study area. And what we found was generally -- generally the route avoids DEC wetlands. There is one area along Route 27 where there is a DEC wetland that comes right up to the edge of the road, or near to the road.

This area.

(Indicating.)

MR. BOUCHER: The Environmental Impact Statement describes as a sensitive area where during design some more precise field delineation will be necessary to delineate exactly where that wetland is in relation to the proposed pipeline.

As I mentioned, the pipeline is designed to be constructed in the road or along the shoulder of the road in order to avoid undisturbed areas and to minimize impacts. But in this area careful attention in the design will have to be taken so that the wetland disturbance will be reduced to an absolute minimum. And if there is any disturbance it would be a short-term construction related disturbance that can be mitigated during construction and any disturbance can be restored. Otherwise most of the DEC wetlands in the study area are away from the proposed project and as a consequence we concluded that the project would not have any adverse wetland impacts.

Similarly, when we looked at areas of potential historic or archeological resources for all of the proposed routes -- and this map depicts the areas that are considered sensitive for either historic or prehistoric archeological and historic resources. There are some areas along Route 94 and along Route 27 that are considered sensitive for historic resources. The recommendations in the Environmental Impact Statement are to avoid -- during construction to avoid disturbing those areas as much as possible and to provide monitoring during construction in case historic resources are encountered. This does not indicate there are historic resources there, it simply means that the archeologist determined that there is a potential based on historic records in encountering resources. So the design, the EIS recommends that special measures be implemented during construction in these sensitive areas so that if there are any resources there they can -- they will not be adversely affected.

Most of the other unavoidable impacts that we found in the draft were of the construction related variety and have to do with the unavoidable traffic disruption during construction, since the project will be constructed in roads it will be like one commonly encounters when driving along. Where the project pipeline is being installed there will be alternating one-way traffic setup. The traffic analysts concluded there would be no need at this point in the design for detours, it could be handled with flaggers and one-way traffic. So there will be some short-term inconvenience to motorists, but there will be no long-term -- long-term effect. Similarly with construction noise and dust, these are all short-term impacts.

So to sum up, the proposed project has been found in the Draft EIS to -- there would be no significant adverse environmental impacts and the few short-term and unavoidable impacts can be mitigated to minimize the environmental impact.

Thank you. I'd like to turn it back now to our Moderator.

THE MODERATOR: Thank you, Mr. Boucher, for your presentation and overview.

Before we open the hearing for public comment I would like to, again, for the folks that came in after I first announced it, we have speaker's cards. Anybody interested to speak who has not filled one out yet can get one right here by the Village Clerk. Please fill it out and we will call upon you.

We will now open for public hearing. I call upon first, as a professional courtesy, we will call upon elected officials that are with us today.

So I call upon Mr. Charles Bohan, he is the Supervisor of the Town of Blooming Grove, to address this public hearing.

SUPERVISOR BOHAN: Good morning.

Basically, I'm here this morning to try and determine whether or not what you are attempting to do is favorable to my municipality or unfavorable, or whether or not my town will have access to the water that is going to be coming from the aqueduct through my town to get to Kiryas Joel.

I'm under the impression, just looking at it, if you are going to have a treatment plant at the Village that it's basically raw water, so-called, that is coming through my town, which would mean that if I had to access it in anyway I'd also have to build a treatment plant. That doesn't make very much sense, it would further impact my problem. Just like everybody else in every other municipality we suffer for water and sewage and everything that goes with it.

I'm basically trying to determine what this will mean to my municipality. And based on the fact that I haven't seen the Draft Environmental Impact Statement it's sort of hard to comment on just how thoroughly it may impact.

I'll be looking forward to hearing from you to let me know basically where I'm at.

My people in Blooming Grove are very concerned over the fact that no matter which way it goes, or whether or not we can use it, it's going to have a tremendous impact on our traffic situation over there. We have one-way in and one-way out of Blooming Grove and that's Route 208 and Clove Road, which is 27.

To a point where we are in the middle of a building moratorium now to try and slow things down to put some sort of order into development so we don't all end up at the same intersection at the same time one of these days. We are really getting there.

I don't know what your project is going to mean to us in that respect. And, basically, I'm here to get information to bring back to the people that put me in office. Thank you.

THE MODERATOR: Thank you, Supervisor Bohan. I almost regret saying I wasn't going to respond because we can give you many responses to your issue, but I have to stick to the program. We will respond after the 10 day public hearing period and hopefully it will solve everyone's problems.

I now call upon the Honorable Assemblywoman Nancy Calhoun to address this public hearing.

ASSEMBLYWOMAN CALHOUN: Good morning, Honorable Village Board Members, Honorable Professionals, Mr. Felberman.

My name is Nancy Calhoun and up until

December 31st of this past year for 10 years I was the representative in this area. And I have a 20 year history in government in the Town of Blooming Grove, having served since 1982 first as a Town Board Member, Supervisor and now Assembly Member. And I do currently represent Blooming Grove and the Town of Woodbury, which is neighbors to the Village.

I had the opportunity to briefly review your DEIS and I would like to certainly bring a number of concerns that I have to your attention.

I'm rather puzzled because many many -- and I believe your gentleman, Mr. Boucher, also mentioned that this is intended to meet current yields or current needs. In fact, the comments are, KJ's water system is unable to supply enough water on days of high demand. And the DEIS went forward to talk about 50 to 75 days a year. And at the same time I notice in any other community in the county if this were true you would not be able to continue to build, there are restrictions if you cannot supply water.

I see at this point, construction, just coming into your meeting here today, has substantial development at a time when your own DEIS by a an extremely reputable engineering firm says that 20 percent of the time there is not sufficient water in the town.

I think also that you also note that your existing groundwater in your wells in Brenner do supply enough water for this project or for your Village. I would also note that the wells that you currently have -- I don't know if you would have to payback the monies that were given to you as grants because of the fact that they were largely provided by both state and federal grants. I'm sure they don't give you grants for interim use. They assume it's going to be for permanent usage and not as a backup system. I've never heard of another municipality that was able to apply and get a grant that ultimately would be used as a backup, it's supposed to be for your primary current usage.

It's obvious that your DEIS notes that your needs will grow as time passes. But I think this is something that is kind of like a Catch-22. You need more water, you maintain you have enough at times, and now you are looking to increase, but you can only take the amount that you need for today. So as I understood it it would be up to 1.9 -- 1.9 million gallons per day under the current 2000 year amounts.

Letting myself go onto another issue, and I'm absolutely certain and was very pleased to hear that you're environmentally concerned. And I have a tremendous knowledge of Blooming Grove over those 20 years with the help of engineer Jim Farr and others. A of the couple items that have not been mentioned at all and I saw there were five items that were listed as potential environmental -- I guess you call them bog turtles, and other sensitive environmental impacts.

And the one you left out, which is probably the most important is coming along

Route 27, also known as Clove Road, is there is a large infestation of the timber rattlesnake. And while I don't always agree with it it is a highly protected species and is not even mentioned in the DEIS as having impact in this area.

Additionally, there is discussion about blasting and blasting is a real concern in Blooming Grove. When you go along Clove Road there are areas known as Glenwood Hills and Mountain Lodge Park and many years ago in the 1980's there was a proposal to bring sewer lines up to that area, and this was turned down vehemently by the people there and by engineering studies that led to the conclusion that blasting in that area could impact the wells people had and also their foundations of their homes. This can be documented from the 1980's, so I think that would be something that on Route 27 would bring major concern.

Just as a point, you have the intersection with State Route 208 to 27 as a three-way, which is correct, and you have it controlled by a traffic signal. We'd love to have a traffic signal there, but there is none at the present time.

And I make another comment, it's my understanding you are trying to stay within right-of-ways of county roads and state roads, but your references in the DEIS say that Route 27 terminates at Orrs Mills Road and that leaves a small section of land, the rope of Clove Road that continues up to connect with Route 94. I think you want to check and see if that is or is not a town road, because if Route 27 terminates what is left is obviously going to be a town road.

You mentioned that in the DEIS that you did not want to use Route 32 because of the fact there would be traffic congestion. Well, I can tell you --

(Whereupon the stopwatch sounded.)

ASSEMBLYWOMAN CALHOUN: I would indulge you for another couple minutes. I'll be very quick.

THE MODERATOR: Elected officials are exempt.

ASSEMBLYWOMAN CALHOUN: I'll make it quick.

Route 208, I live on Route 208. It's a growing community. Your notation is of 16,500 in traffic and I think that is probably underestimated. The traffic on that road in the mornings and evenings is very substantial.

One other thing which came to our attention recently, a very highly regarded, but he is deceased, the late Roger King, is a historian. And he brought to my attention that on Route 208 proceeding up toward the Peddler Hill area, there is a roadway that was changed -- Route 208, was changed in the 1920's and it goes through a 1700's cemetery. And by using infrared Mr. King himself had gone and seen that there are numerous bodies of historical significance buried in the shoulder of Route 208. So I think that this is something that has to be fully addressed. The fact is these are people who -- I believe it was called Blaggsville -- it was a very early colonial settlement. And if you look there is a cemetery presently very visible on either side of the road. And, again, Mr. King, who cannot be here today to testify, did make the statement that there are significant burials of 1700's on both sides in the shoulders of that roadway, which is right along the area where you are looking to go.

I think that pretty much covers my concerns, but I think the most important concern is the divergence with whether this is for current demand, which seemed to be the statement, or for future demand.

And I also note, and I have to say I read it in the newspaper, that there was an application placed for EFC funding. It's my understanding that funding normally must be for current usage. So I would say that if you are looking to do it for future demand you can't be going and saying it's for current. And if you are saying you have current demand covered then you don't need it for current. If you don't have the current demand covered then the County of Orange should be looking very seriously at the current trend of building here, which is bringing automatically more people in while your own papers are maintaining you don't have sufficient water to cover your current water demands. I thank you for your time and I will be pleased to sit down and let others speak.

THE MODERATOR: Thank you very much, Assemblywoman Calhoun.

I now call upon Paul Aggarwal from the New York City Department of Environmental Protection.

You too, sir, are exempt from the three minute.

MR. AGGARWAL: First of all, a very good morning to the Village Board and all of you. My name is Paul Aggarwal from New York City DEP.

Basically, the aqueduct belongs to our department and the application has been made to make a connect to that aqueduct. So as a result we have a lot of investment in this project. We had been already corresponding with CDM, especially Mr. Hank Boucher. He is handling the most of the comments.

But still, there are two issues I think are very important to us and I would like to bring them up here as quickly as I can.

As the Assemblywoman pointed out, I think that was a very good comment, that right now this connection has been made for two million gallons a day water consumption. What we find is that, according to the Village population and probably in the coming couple of years, that that amount will be probably not enough to meet the water supply for the Village, the two million gallons a day.

So the question is how the Village perceives to meet their water demand by the year 2020 or even beyond to supply their consumers?

Second question would be that if the water supply is only for two million gallons we kind of do not see the point as to why the line should be 24 inches -- the project is proposing the 24 inch wide pipe, 13 mile long. Since we do quite a few projects for the different communities anyone taking that nine to ten to twelve million gallons goes to about 18 to 24 inch line. And here just for two million gallons a 24 inch line, somehow it does not appear to me -- what I'm saying is we would like to see some rationale behind this 24 inch line for the two million gallon water supply. Some reasons were given in the DEIS, but we belive more reasons need to be done to justify that.

Also, not that it's mandatory by us, however, the question of backup water supply is an important one. The reason for that being that from time to time we do take down our aqueducts for repairs, maintenance, and any unforeseen problems. And at that time the Village would not have any water supply from the aqueduct. So, therefore, it is rather essential for the Village to have a backup water supply.

As I was mentioning, that if we have to take the aqueduct down for repairs, maintenance, or any unforeseen circumstances

I think it behooves the Village to have some sort of backup water supply. So the existing water supply they have, which is approximately 1.3 million gallons, including 14 wells, 9 of their own and 5 on the Brenner property, would have to be maintained by the Village, or there has to be some understanding between the different communities that do take water from the Village that when needed the Village can get that water back for their own consumers. So that has to be addressed in the DEIS as well.

At one point the report mentioned that the Village has four storage tanks. We would like to know what the storage capacity of those four tanks?

Also, some of the questions that we had written to CDM on the SEQR that document need to be addressed. Mainly, that the capacity of the proposed project should provide the requirements of the Village and the potential likely degree of reliance in the backup supply must be addressed. That has not been mentioned anywhere in the document.

The other thing is that once you have the aqueduct water -- I think this is definitely a question that -- what happens to the demographic makeup of the town, the Village, or the community? And that has not been addressed. Basically it could provide a few more businesses, commercial in nature, or it could provide any other entity. And I think that should be addressed as to what sort of makeup we can expect in the future.

I think last, but not the least, there is also a concern about the wastewater. Actually, what happens, as the operation increases so does the wastewater. And the wastewater, if not treated properly, is definitely a threat to groundwater sources. We believe the Village has .9 million gallons capacity today and --

(The speaker cannot be understood.)

MR. AGGARWAL: Some of the water, probably all of the water can be transferred to the Harriman wastewater treatment plant.

However, at this time I think the Village has at least about .35 million gallons to Water District Number 1.

The question is, will that arrangement, which finishes in probably November 2004, will continue beyond that, or if the Village would like to get the -- that capacity with them for their own use.

I believe I have covered most of the issues in my notes. Yes.

Also, some more wells have to be installed, we would like to know what is the time frame?

And the parcel that the report talks about outside the Village's boundaries that they might have some more wells, that I think should be also addressed in the report.

And lastly, I think we had asked the question that, why the Village would not want to get their water from the New Windsor water tap on the aqueduct? There has been no reasonable explanation to that question.

We definitely would want the Village to take a second look to the connection of New Windsor. They have a filtration plant at the site. And as far as two million gallon supply is concerned, New Windsor --

(The speaker cannot be understood.)

MR. AGGARWAL: They can definitely supply the Village if they desire. We'd like to have an answer to that question.

Thank you very much.

THE MODERATOR: Thank you very much, Mr. Aggarwal.

Before we continue I would request that everybody please shut off their cell phones, it's just very disruptive.

I hope I'm reading this correctly.

Geoff Welch from the Ramapo River Committee?

MR. WELCH: Yes. Thank you.

I looked over the Draft Environmental Impact Study, you know, just as I came in. But I really didn't know about the project so I'd like to get a copy of the complete Environmental Impact Study. I don't know if it's available on CD-ROM, but that would be a handy format to get it in. And --

THE MODERATOR: Just a moment, that question -- is there an exception? Can we answer this now? Can he receive it?

MR. SCHOETTLE: Not here today.

MR. WELCH: Very good.

THE MODERATOR: Okay, we will get in touch with you then.

MR. BOUCHER: Very good.

I -- it's not your fault, but I wish that all projects that have significance for the watershed of the Ramapo River that we would have down river notification of interested parties. We tried to set this up one time with the New York State DEC.

But the Ramapo River is an interstate water supply that contributes water to over two million people in New York and New Jersey. And the water supply down in Rockland County is derived from 10 wells along the Ramapo River from United Water, there is four for the Village of Suffern.

I'll show you the watershed quickly.

And down through New Jersey there is aquifer water wells into the glacier and sand and water aquifer that is recharged at a rate of about 60 percent from surface water in the

Ramapo River.

So at Pompton Lakes, I should mention New Jersey, down at the bottom here, water is piped through a large interconnections to the Wanaque Reservoir, which is 29.5 billion gallon reservoir that supplies Northern New Jersey, many communities in Northern New Jersey.

But Kiryas Joel is here at the very headwaters of the Ramapo River watershed, so it's always good to think in terms of these great natural systems that we all depend on.

And everything is in line is also a federal sole source aquifer area as result of a petition in 1992 from the Village of -- Township of Mahwah, New Jersey from the EPA.

So I don't know if there is any federal dollars involved then you have to address the impacts on the watershed, but we would hope the environmental impact study would do that anyway, so we would request a Supplemental Environmental Impact Study to address the impact on the Ramapo River watershed mostly through the increase of treated sewage effluent which would result from this connection.

And, obviously, this is a close inducing project, which doesn't seem to be adequately addressed. Any increase of over 10 percent of impervious material surfaced in a watershed effects surface water quality.

And you have a tributary coming down into the Ramapo River, we are not happy in general with the growth in Orange County at the headwaters of the watershed. And there is -- there's malls that have been put in, there's been horrific runoff of siltation loading into the Ramapo River from Orange County.

We have had a major problem with just a small development along Sterling Road in Tuxedo and Tuxedo has a lot of development.

The problem with the Ramapo watershed is there is no management plan for it. It's an interstate water supply. New York City is doing marvelous things protecting their water supply in the Catskill and we are making a strategic planning mistake by not having an interstate water supply plan for the Ramapo River.

So here at the headwaters --

(Whereupon the stopwatch sounded.)

MR. WELCH: Having this level of development, you know, is a concern and we -- just a couple other points.

See we would hope the supplemental could address those questions and the level of treatment that the sewage will get. Even with modern sewage treatment plants the U.S. Geological Survey through recent studies has shown --

MR. FELBERMAN: Okay, he is going to make it short, it's very disruptive, another minute or so, please.

MR. WELCH: Yes, I'll wrap up in a minute.

There are impacts from even treated sewage because many of the substances we use in daily life actually still emerge from sewage treatment plants, these are organic wastewater contaminants, and they have measured certain levels in the Ramapo River.

So we would ask for the supplemental and maybe that this project is a good project, but we should address all of these issues based on the fact that the Ramapo River is an interstate water supply and the sole source aquifer designation. Thank you.

THE MODERATOR: Thank you, Mr. Welch.

I call upon Jenny Keesling.

MS. KEESLING: Thank you. I want to make three comments very briefly.

One of which I think is germane to this gathering, although it's probably the least interesting.

I do represent an endangered species. I'm a cyclist. And Route 27 is a very unusual road in the low traffic density. There are not very many places where you can ride in this county. I've been hit by two trucks and a car. I know what I talk about, so I would like you to think about that.

The other two comments are perhaps addressed to the wrong audience, but I need to say these somewhere.

The first is, I live in Monroe. I have

a well. My husband and I do not take baths, we take very short showers. We do not flush toilets without thinking about it. We live under very severe water rationing.

What I would like to know is given that I live in a community in which the wells are not adequate, why there is no comprehensive plan for the water supply of all of the communities and why we are talking about any Village?

I think that may not be part of your jurisdiction, but I think the issue ought to raised.

The other is that your Environmental Impact Statement says the population growth at Kiryas Joel is 5.9 percent and that this project won't increase that growth, nor does it say that that growth will decrease. Five point nine percent is not sustainable growth. I don't have a calculator with me, but my rough estimate, the population of Kiryas Joel will be over 40,000 in the year 2020. And what I want to know is whether the water supply that you are predicting from this plan will deal with that population? But more realistically, given water is a finite resource shared by all communities, whether we could justify any plan that allows one community to have that rate of growth.

Thank you.

THE MODERATOR: Thank you, Ms. Keesling.

Mr. Philip Chase, the rep for the Deerpark to Upper Delaware Council.

MR. CHASE: Thank you for the opportunity to speak today.

I'm from Port Jervis, New York. We are on the other side of the Kittatinny Ridge and the Shawangunks, which means our watershed is the Delaware, not the Hudson. You people live in the Hudson watershed. We are in the Delaware watershed, which means that every drop of water that doesn't evaporate will end up in the Delaware River.

However, the City of New York constructed three reservoirs in the Delaware watershed area; the Neversink, Pepacton, and Cannonsville. And from those we have an aqueduct such as you are talking about tapping into. And ours is the Delaware aqueduct, which is also influenced by the Catskill Aqueduct. Whoever is taking out of those, they love to go to the Delaware aqueduct. And approximately 50 percent of the water that the city gets comes from our aqueduct.

Our rivers are not managed properly by the New York City DEP, they do absolutely zero for management of our rivers. And this is a very important thing for our ecotourism. A study was done in 1996 in Hancock, New York, a small town on the west branch of the Delaware, showing for that year, and we have had mostly poor years other than that, 17.9 million dollars just from trout fishing. The spin off was 30 million dollars.

However, within a few years they had drawn Cannonsville down to three percent, killed the reservoir. As I mentioned before we get no management for our rivers.

Way back in 1951 New York City was trying to determine if they would go to the west branch of the Delaware and flood it and make it into the Cannonsville Reservoir, so they hired a panel of experts. These experts were engineers and environmentalists and they came up to the conclusion that the Hudson River was the appropriate place to get 325 million gallons of water a day. A filtered Hudson River water supply was a better source than non-filtered Catskill water, which is what we have at the present time. The city has done everything it can not to build the recommended -- the EPA recommended filtration plant, which would be in the billions of dollars, and that would filter all of the water for the city.

There is also presently a pumping station at Chelsea where the city can take 100 million gallons of water from the Hudson, which is not being used.

Our rivers are the life blood of the Delaware watershed. As New York City takes more water from us our rivers are more and more jeopardized, it's been shown year after year as they are downgraded and we get no cooperation.

I've gone to the Delaware River Basin Commission meetings for the last eight years and I'm on the Upper Delaware Council. We are in charge of the wild scenic portion of the Delaware River from Port Jervis up to Hancock, 75 miles.

In conclusion, I would just like to state that we hope there will be no taps on either the aqueduct of the Catskill or the Delaware aqueduct until the Hudson is taken for water at 325 million gallons a day, that New York City builds the recommended EPA filtration plant for all its water supply systems, and prevents the wasteage of leakage of between 30 and 100 million gallons of water a day, and considers the health and the ecology of the rivers of our watershed so we can have our maximum ecotourism. Thank you.

MR. BOUCHER: Thank you, Mr. Chase.

Mr. Aggarwal, you got more than you counted for.

I call upon Mr. Manny Mangual.

MR. MANGUAL: Good morning, gentlemen.

First, I just wanted to commend you. I

think it was, you know, there is a problem and as the stewards of the Village I believe that you went and sought -- or sought some resolve to the problems here.

And it's interesting that many complaints were about the wells and about, you know, the growth and the water you are taking from the surrounding community. And I would -- I am just surprised you wouldn't get more support from the area politicians.

I also think that in some areas I think that when there is a problem that involves many communities you would expect your legislators to help resolve these issues. They have not come to offer any kind of a -- any kind of resolution, or offer any kind of mediation, or anything, and instead they've come to attack, so that's a shame.

But I have two questions and it's regarding the community itself. One is, as you know, that there are many people in the community that are not necessarily in agreement with the leadership. And so the question is would the water be accessible to those people as well?

And my second question is -- is that there are many wells in the community and some private and some not so private, and can -- you know, kind of like electricity if somebody opens up a little power plant, you know, everybody gets to use it. You have this grid of water pipes in the Village so could there be a trade off of water from one side to be used on another side of the Village?

So those are two questions that I have. I think specifically you know what I'm talking about. And so those are my two concerns, but, again, I just want to applaud you for coming to finding a solution to the needs of this community.

THE MODERATOR: Thank you, Mr. Mangual.

Mr. Bill Douglas from the Upper Delaware Council.

Before Mr. Douglas begins his remarks are there any others that would like to make any comments today? Could you please -- anybody that hasn't yet, please bring your cards up. Thank you.

Mr. Douglas, go ahead.

MR. DOUGLAS: Thank you very much. Welcome.

The Upper Delaware Council is aware from a notice in the October 22, 2003 issue of the Environmental Notice Bulletin that the Board of Trustees of the Village of Kiryas Joel, as lead agency, has accepted a Draft Environmental Impact Statement on a proposed Catskill Aqueduct connection.

The action involves construction of a tap of the Catskill aqueduct and a transmission main to transport water supplies to the Village of Kiryas Joel. The project will include a water treatment plant and pumping station. The water supply line will extend from the New York City Catskill Aqueduct connection in New Windsor, New York along Riley Road, State Route 94, Clove Road, County Route 27, State Route 208, and State Route 17 to its termination in the Village of Kiryas Joel, Orange County, New York. We understand that a public hearing will be held on November 14, 2003 at the Village Hall and that comments will be accepted until November 24, 2003.

The UDC's comments are about impacts to the environment, economy, water quality, and flows in the Delaware River Basin, primarily down stream of the Cannonsville, Pepacton, and Neversink Reservoirs which are owned and operated by New York City. The UDC is concerned that the cumulative effect of new connections into the New York City water supply system, including the Catskill Aqueduct, will ultimately mean more demand making less water available for the Delaware River as it flows downstream through the states of New York, Pennsylvania, New Jersey and Delaware.

Fully half of the 1.3 billion gallons of water that the City of New York uses on a daily basis comes from the Delaware River watershed. Because of this exportation of Delaware River water out of the Delaware basin into the Hudson basin there is less available to satisfy all of the needs of the

Delaware River.

The proposed pipeline will only encourage additional growth and an even greater demand for Delaware River watershed water. We believe that the EIS is deficient and must address potential impacts on the Delaware River watershed, including the area below the New York City reservoirs.

Since a water treatment plant is apparently part of the proposal anyway, we suggest that the previously evaluated Hudson River water alternative be used instead of tapping into the Catskill Aqueduct.

The Upper Delaware Council is the oversight body responsible for the coordinated implementation of the River Management Plan for the Upper Delaware Scenic and Recreational River, a component of the National Wild and Scenic Rivers System. Our voting members are the two states, New York and Pennsylvania, and eleven local governments, New York towns and townships, which border on the Upper Delaware River. The Delaware River Basin Commission is a non-voting member of the Council. We operate under a direct contractual relationship with the National Park Service for the oversight, coordination, and implementation of many elements of the River Management Plan.

Please add the Upper Delaware Council to your list of interested parties for this proposal.

Thank you for the opportunity to comment on this Draft EIS.

THE MODERATOR: Thank you, Mr. Douglas.

The address we have on the card is the address you want the information sent?

MR. DOUGLAS: Yes.

THE MODERATOR: Thank you.

I call upon Ms. Ann Krautin (phonetic).

MR. KRAUTIN: Good morning, gentlemen, good morning, everybody. I'm glad that you are here with all of you looking at this problem and perhaps solution.

First I would like to say, just very briefly, that the area politicians as well as everyone that made all the statements are responding to all of the people in the community and not just one particular segment.

And in particular in the Town of Monroe there was a very strong turn out in the recent election and one prior to that for people, including myself, who want to retain the quality of life that has been here for many years.

We are not against growth. We are for controlled growth. And this is what a lot of people have been speaking with our local representatives about. So that to criticize our representatives on that basis I think is erroneous.

Secondly, a point was previously made I would like to reiterate, that if there is some kind of a water connection that will supply water to one particular area in this county that the entire group of people in the county should be able to avail themselves at the same price and same cost to that water, since, in fact, the federal and state funds are what is going to create this system.

Third, there was mentioned about KJ's

growth, it says that your growth is primarily internal. However, with this abundant water I'm concerned as a next-door neighbor that such growth would not be internal, that it would attract a lot of people from New York that -- as already is happening in this area, in this Village.

Would there be a transparent mechanism to prevent the influx of outsiders, non-KJ generated people, in the -- in the -- if we do have this aqueduct tapping come into effect? A transparent system so that only people who live in this community and their children, rather than outsiders, would be using this water?

Finally, my last point is that as population will grow in this Village because of the availability of water, should it come into effect, would this Village government anticipate at a particular point of population withdrawing from the Town of Monroe? Since, in effect, you would have your own water supply, you would have -- as I read in the paper -- your own library, your own sewer plant, and would be in the majority or close to the majority at that time. Many people in the Town of Monroe have different perspectives and would prefer to have control of their own political system, and that would be impossible in the event that this water situation does go forward the way you want it to go forward. Thank you.

THE MODERATOR: Thank you very much, Ms. Krautin.

I call on Dr. Steven Benardo from the Kiryas Joel School District, the Superintendent.

MR. BENARDO: Good morning, quite frankly, I hadn't intended to speak, but hearing so many people speak about environmental issues I feel an obligation to speak.

I have an environmental background myself. I am on the Henry Hudson Scenic Byway Task Force. I am on the Parks and Recreation Subcommittee of the Community Planning Board in the Northwest Bronx. In addition, I'm on the Riverdale Nature

Preservancy Council and I've spent a long time working on environmental issues in my own community.

In addition, as Superintendent of the school district here I've had an opportunity over the course of the 14 years I have been in the school district to address each member of the Board of Trustees on various occasions concerning an issue of concern to me, which is, that adequate housing is an environmental issue in education.

Ensuring that children have a home that is complete with bedrooms and access to water and all of the other issues are the most important environment to me. Environment of the home. Environment of the community.

Secondly, I've heard a number of concerns about other communities, not responding to their issues. In the 14 years here I've seen that the Board of Trustees or other organizations within the community have worked tirelessly to ensure a fire department, or ambulance service, or a school district for that matter. And I think this is just one more area that they've proven they care about their community and other communities certainly can learn from that level of concern.

I wish you the best of luck with your project.

THE MODERATOR: Thank you very much, Dr. Benardo.

Being that there are no others that would like to address the lead agency I guess this public hearing comes to a close.

And I thank you all, ladies and gentlemen, for participating in this public hearing. Your comments have been duly noted and will be responded to and will become part of the Final EIS.

Again, thank you very much, have a good day.

THE FOREGOING IS CERTIFIED to be a true and correct transcription of the original stenographic minutes to the best of my ability.

Yvette Arnold

/Yvette Arnold

LAWYER'S NOTES/ERRATA SHEET

Page	Line	

Appendix B

APPENDIX B

WRITTEN COMMENTS

On the Draft Environmental Impact Statement

John L. Buono
Chairman

Nancy E. Carey
Board Member

John R. Riedman
Board Member

Michael R. Fleischer
Executive Director

New York State Thruway Authority

New York Division
4 Executive Boulevard
Suffern, NY 10901
www.thruway.state.ny.us

John T. Brizzell, P.E.
Deputy Executive
Director/Chief Engineer

Ramesh Mehta, PE
Division Director
Phone (845) 918-2500
Fax (845) 918-2594

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CAMP, DRESSER & McKEE
EDISON, NEW JERSEY

October 31, 2003

Mr. Gedalye Szegedin, Village Clerk
Village of Kiryas Joel
PO Box 566
Monroe, NY 10950

RE: Draft Environmental Impact Statement
V/ Kiryas Joel Water Supply Project
MP 50 to 56; Orange County

Dear Mr. Szegedin:

The Thruway Authority, as an involved agency, has received a copy of the October 2003 Draft Environmental Impact Statement (DEIS) for the proposed subject project. We have no objections to the document, and concur with the preferred alternative route.

Thank you for the opportunity to provide comments. Should you have any questions, please call me at 845-918-2510.

Very truly yours,

J. D. Hohman, P.E.
Division Highway Management

JDH:an

cc: Mr. R. Mehta
Mr. A. Shareef, NYSDOT Region 8 Planning
Mr. H. Boucher, PE, CDM

Upper Delaware Council

P.O. Box 192; 211 Bridge Street, Narrowsburg, New York 12764-0192 (Tel.) 845-252-3022 • (Fax) 845-252-3359

William E. Douglass, Executive Director • David B. Soete, Senior Resource Specialist
Laurie Ramie, Public Relations/Fund Raising Specialist • Carol Coney, Office Manager

November 6, 2003

GEDALYE SZEGEDIN, VILLAGE CLERK
VILLAGE OF KIRYAS JOEL
PO BOX 566
MONROE NY 10950

RE: DRAFT EIS on the proposed Catskill Aqueduct Connection
Village of Kiryas Joel

Dear Clerk Szegedin:

The Upper Delaware Council (UDC) is aware from a notice in the October 22, 2003 issue of the *Environmental Notice Bulletin* that the Board of Trustees of the Village of Kiryas Joel, as lead agency, has accepted a Draft Environmental Impact Statement (EIS) on the proposed Catskill Aqueduct Connection. The action involves construction of a tap of the Catskill Aqueduct and a transmission main to transport water supplies to the Village of Kiryas Joel. The project will include a water treatment plant and pumping station. The water supply pipeline will extend from the NYC Catskill Aqueduct connection in New Windsor, NY along Riley Rd., State Rt. 94, Clove Rd., County Rt. 27, State Rt. 208, and State Rt. 17 to its termination in the Village of Kiryas Joel, Orange County, NY. We understand that a public hearing on the Draft EIS will be held November 14, 2003 at the Village Hall and that comments will be accepted until November 24, 2003.

The UDC's comments are about impacts to the environment, economy, water quality, and flows in the Delaware River Basin primarily down stream of the Cannonsville, Pepacton, and, Neversink Reservoirs which are owned and operated by New York City. The UDC is concerned that the cumulative effect of new connections into the New York City water supply system, including the Catskill Aqueduct, will ultimately mean more demand for Delaware River watershed water, making less water available for the Delaware River as it flows downstream through the states of New York, Pennsylvania, New Jersey, and Delaware.

Fully half of the 1.3 billion gallons of water that the City of New York uses on a daily basis comes from the Delaware River watershed. Because of this exportation of Delaware River water out of the Delaware Basin into the Hudson Basin, there is less water available to satisfy all the needs of the Delaware River.

The proposed water pipeline will only encourage additional growth and an even greater demand for Delaware River watershed water. We believe that the EIS is deficient and must address potential impacts on the Delaware River watershed, including the area below the New York City reservoirs.

Since a water treatment plant is apparently part of the proposal anyway, we would suggest that the previously evaluated Hudson River water alternative be used instead of tapping into the Catskill Aqueduct.

The Upper Delaware Council is the oversight body responsible for the coordinated implementation of the River Management Plan for the Upper Delaware Scenic and Recreational River, a component of the National Wild and Scenic Rivers System. Our voting members are the two states (NY and PA) and eleven local governments (NY Towns and PA Townships) which border on the Upper Delaware River. The Delaware River Basin Commission (DRBC) is a non-voting member of the Council. We operate under a direct contractual relationship with the National Park Service for the oversight, coordination, and implementation of many elements of the River Management Plan.

Please add the Upper Delaware Council to your list of interested parties for this proposal.

Thank you for the opportunity to comment on this Draft EIS.

Sincerely,

Bruce Selneck

Bruce Selneck,
Chairman

cc: Hon. Charles Schumer, US Senator NY
Hon. Hillary Clinton, US Senator NY
Hon. Arlen Specter, US Senator PA
Hon. Rick Santorum, US Senator PA
Hon. Sue W. Kelly, US Congresswoman NY 19th District
Hon. Maurice D. Hinchey, Jr., US Congressman NY 22nd District
Hon. James T. Walsh, US Congressman NY 25th District
Hon. Donald Sherwood, US Congressman PA 10th District
Delaware River Basin Congressional Task Force members
Hon. George E. Pataki, Governor, New York
Hon. Edward G. Rendell, Governor, Pennsylvania
Hon. Michael R. Bloomberg, Mayor, New York City
Hon. John Bonacic, NY State Senator 42nd District
Hon. Charles D. Lemmond, Jr., PA State Senator 20th District
Hon. Aileen Gunther, NY State Assemblywoman 98th District
Hon. Clifford Crouch, NY State Assemblyman 107th District
Hon. Jerry Birmelin, PA State Representative 139th District
Hon. Sandra J. Major, PA State Representative 111th District
Jane M. Kenny, Regional Administrator, US EPA - Region 2
Donald S. Welsh, Regional Administrator, US EPA - Region 3
Christopher Ward, Commissioner, NYC DEP
Carol Collier, Executive Director, DRBC
Gary Paulachok, Deputy Delaware River Master
William Rudge, NYS DEC and UDC Rep.
Wayne Elliot, Fisheries Manager, NYS DEC
Marian Hrubovcak, PA DCNR and UDC Rep.
David Lamereaux, PA DEP and UDC Alt.
Ross B. Decker, Mayor, Port Jervis
James Chandler, Supervisor, Town of Deerpark
Richard V. Gassmann, Mayor, Matamoras
Kenneth L. Thiele, Chairman, Westfall Township Supervisors
David Forney, Superintendent, National Park Service - UDSRR
file

Village of Washingtonville

29 West Main Street
Washingtonville, New York 10992-1412
Fax (845) 496-1990
E-mail: washingtonvillevilla@hvc.rr.com
Website: washingtonville-ny.org
Settled 1723 — Incorporated 1895

17 November 2003

Hon. Gedalye Szegedin
Village Clerk
PO Box 566
Monroe, New York 10950

REFERENCE: COMMENTS - DEIS FOR VILLAGE OF KIRYAS JOEL PROPOSED CONNECTION TO NEW YORK CITY CATSKILL AQUEDUCT

Dear Hon. Szegedin:

On behalf of Mayor Leonard Curcio, the Village of Washingtonville Board of Trustees and our residents, we have reviewed the above referenced document. Our Village also currently relies on a groundwater aquifer for our water supply. During periods of extended drought, we have difficulty satisfying our water demands. We respectfully request that the DEIS address the following issues:

1. Allowing the Village of Washingtonville to tap the purposed transmission main and utilize the water as an auxiliary/supplemental/emergency supply during extended periods of drought, or catastrophic mechanical failure.

2. That the Village of Kiryas Joel consider an alternative treatment plant site to allow for treated water to be conveyed through the transmission main.

3. Allowing the Village of Washingtonville to supplement the aqueduct water when excess water is available from our wells and during periods of aqueduct shut-down, since the Village of Kiryas Joel wells will not be able to satisfy the future projected demand, as a back-up source.

On behalf of the residents of the Village of Washingtonville, we sincerely appreciate your consideration of our requests.

If you or your engineers would like to discuss our technical comments, please feel free to contact me at (888) 296-2765.

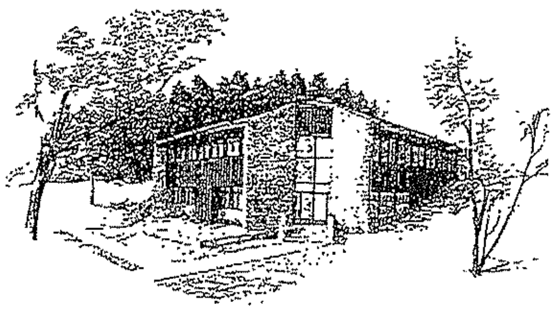
Very truly yours,

James M. Farr/bn

James M. Farr, P.E.
Village Engineer

cc: Mayor Curcio and Village Board
Mr. Kevin Kropchak, DPW Superintendent
Mr. Art Jefferies, Water Works

Town of Blooming Grove



James M. Farr, P.E.
Engineer for the Town
(845) 496-4177
(Fax) 496-1945

Eugene T. Jaques
Building Inspector
(845) 496-7011
(Fax) 496-1945

P.O. BOX 358
HORTON ROAD and ROUTE 94
BLOOMING GROVE, N.Y. 10914

20 November 2003
Revised 21 November 2003

Hon. Gedalye Szegedin
Village Clerk
PO Box 566
Monroe, New York 10950

REFERENCE: COMMENTS - DEIS FOR VILLAGE OF KIRYAS JOEL PROPOSED CONNECTION TO NEW YORK CITY CATSKILL AQUEDUCT

Dear Hon. Szegedin:

On behalf of Town of Blooming Grove Supervisor Charles Bohan, the Town Board and our residents, we have reviewed the above referenced document. The proposed transmission main routing will either adjoin or be in close proximity to three (3) Town administered water districts along Route 208. These Districts rely on a bedrock groundwater aquifer for their water supply. Each of these water districts is completely built-out. Similar to the Village of Kiryas Joel situation, there are periods when the groundwater wells can not satisfy the water demand, requiring water to be tankered into the district. We respectfully request that the DEIS address the following issues:

1. Allow the Town of Blooming Grove to tap the purposed transmission main and utilize the water as an auxiliary/supplemental/emergency supply during extended periods of droughts, catastrophic mechanical failure, or inadequate supply.

2. That the Village of Kiryas Joel consider an alternative treatment plant site to allow for treated water to be conveyed through the transmission main.

3. The proposed routing will significantly increase the traffic congestion in the Town during construction, especially along Route 208, Clove Road and through Salisbury Mills. Please address how these safety and traffic congestion concerns will be mitigated.

On behalf of the residents of the Town of Blooming Grove, we sincerely appreciate your consideration of our requests.

If you or your engineers would like to discuss our technical comments, please feel free to contact me at (845) 496-4177.

Very truly yours,

James M. Farr /bn

James M. Farr, P.E.
Town Engineer

cc: Supervisor Bohan and Town Board
Ms. Barbara Decker, Town Clerk
ECO

Office Phone
845-928-7578
845-928-6829

Fax
845-928-8214

e-mail
tow@magiccarpet.com

TOWN BOARD
TOWN OF WOODBURY
511 ROUTE 32 • P.O. BOX 1004
HIGHLAND MILLS, NEW YORK 10930

Sheila A. Conroy, Supervisor

Accessibility for the disabled will be provided to all town facilities.

TOWN OF WOODBURY ORANGE 1889 COUNTY STATE OF NEW YORK

Please call 845-928-7578 for further information

November 21st 2003

Mr. Gedalye Szegedin, Village Clerk,
Village of Kiryas Joel
PO Box 566
Monroe NY 10950

Dear Mr. Szegedin:

I am writing in response to the Draft Environmental Impact Statement for the "Proposed Connection to the New York City Catskill Aqueduct". I would like to address issues relative to the impacts on the wetlands and surface water, historical and archeological sites, endangered and threatened species and growth with it's subsequent impacts (e.g. Infrastructure demands; wastewater).

Along the proposed route, there are major stream crossings at Moodna Creek and Perry Creek. Section 2.2.3.2 page 2-10 indicates "would require the pipeline to be affixed to bridges or culverts or buried under streams as conditions dictate". More detailed plans for mitigation, especially in the instances of burying the pipeline for the stream crossing, should be addressed. Also more detailed plans and preparation, not just reactions to those impacts "monitored in the field" are needed in regard to the proximity of the many surface water areas adjacent to the proposed route. More inclusive planning is also required in regard to the wetlands (e.g. Those at RT. 27 near Mountain Lodge Road) as well.

In regard to Archeological Sites and areas of Historic significance, reliance on anecdotal evidence or general trends (e.g. "Native American settlements or villages tended to be located neat critical resources, such as water, flat or gently sloped fertile lands, or vantage points on the landscape") are not satisfactory for mitigation efforts. It is highly likely that currently unknown locations of historical and archeological importance will be encountered. "As road locations have changed, it is possible that some early historic sites are located under current roadbeds". Again, more specific planning is required and should be delineated in the Environmental Impact Statement. Also more specific plans are required for the known archeological and historic sites such as those on the west side of Riley Road. (USN #07115.0000706 and USN07115.0000707 and the historic sites along Rt. 94.

In Section 2.3.3 The DEIS discusses Endangered and Threatened Species and although "no Federal or State listed or proposed endangered or threatened species are know to exist within the project study area". What plans for mitigation does the proposed project have in the event that such species are discovered in the project area?

The 14 wells currently used by the village are being considered as a backup supply. Will this back up supply be adequate when the NYCDEP shuts down the Aqueduct as they do on a regular basis (for approximately 3 days) and cuts off that water for use?

Have the impacts to the region been considered in any detail? Does the project consider impacts to the watershed areas in the region? What studies have been conducted to determine the impact to the Ramapo River watershed?

Section 2.8.2, the increase in the population due to large family size is discussed. "The lack of essential services, such as drinking water has not slowed population growth in Kiryas Joel". While the intention of the project may not be to encourage "significant additional growth" due to an influx of residents from outside the village, it is very likely that such growth will occur. The provision of an additional essential service (water supply) would supplement the already occurring growth (due to family size). This would have an immediate effect on the infrastructure on the surrounding areas and in the region, including, but not limited to roads and wastewater treatment facilities. What plans are in place to address these issues?

Based on the information that I have presented here, I find the plans discussed in the DEIS inadequate. I ask that better preparations be made to address these issues.

Sound regional planning will benefit those in the Village of Kiryas Joel and their neighbors in the surrounding area.

Thank you for your time and attention in this matter

Sincerely,

Lorraine McNeill

Lorraine McNeill
Council Member, Town of Woodbury
511 Rt. 32
Highland Mills NY 10930

Cc: Honorable Sheila Conroy
Honorable Nancy Calhoun
Honorable Bill Larkin
Town Clerk
file

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Sheila A. Conroy, Supervisor

Accessibility for the disabled will be provided to all town facilities.

TOWN OF WOODBURY ORANGE 1889 COUNTY STATE OF NEW YORK

Please call 845-928-7578, for further information

November 23, 2003

Mr. Gedalye Szegedin, Village Clerk
Municipal Building
51 Forest Road, P. O. Box 566
Monroe, New York 10950

RE: Comments on D.E.I.S.
Village of Kiryas Joel Connection to N.Y.C. Aqueducrt

Dear Mr. Szegedin:

Thank you for including the Town of Woodbury as an interested party and for a copy of the complete D.E.I.S. Since the preferred pipeline route in this document is indicated as going via Blooming Grove, some of our earlier comments about impacts to Woodbury, in the scope document, (relating to noise, dust, traffic and other construction issues) have been reduced. We do have, however, some comments on the current document, which are as follow:

<u>1) DEIS, Section 1.2 and Throughout the Document: Need for the Proposed Action</u>

A) This section of the DEIS states that there is need for additional sources of drinking water for the Village. Page 3-11 further states that the planning time frame for the aqueduct connection is 20 years. However, here and throughout the document there is no concrete analysis that projects the population of Kiryas Joel 20 years into the future in order to determine how much water is needed to support the needs identified above. In other words, the DEIS claims the project is needed to support the Village for the next 20 years, but does not provide projections of the population for the next 20 years. Therefore, one cannot determine how long it would take for the Village to exceed the supply from the aqueduct---- is it 10 years, 15 years, or 20 years? There is no way to verify or determine this from the information in the DEIS.

Using the approximate 6% annual population growth factor referenced throughout the document, it is estimated that Village wells would be deactivated for only 4 (four) years following the projected completion of the project in 2008. Using the same growth rate, by 2010, the Village would need to start pumping its wells again in order to supply the peak generation on religious holidays (using a figure of 88 gallons per capita per day calculated from 2002 peak water use as shown in Table 2-1 of this document, divided by the 2002 projected population of 14,762), which would occur 50 to 75 days per year. By 2011, only 5 years after connection to the aqueduct, it is likely that the Village will have to activate its groundwater wells full time in order to meet an average daily demand (based on 82.83 gallons per capita per day as reported in *Connection to New York City Aqueduct Preliminary Report for Conceptual Approval* of 2.07 mg/day.

Again, using the projected annual growth rate, by 2020, only 14 years after completion of the connection to the aqueduct, the Village's population will reach 42,132 residents, needing an average of 3.49 mg/day. Totaling these figures, it appears that in just 14 years, the Village's average daily demand will exceed both the supply of its existing groundwater wells as well as the proposed 2.0 MGD from the aqueduct connection.

All of the above is predicated on a 6% growth rate. However, it should be noted that on pages 1-3 of the DEIS it states that the marriage rate is increasing which may make this rate too conservative in which case the average daily demand will exceed both groundwater well and aqueduct connections even sooner than 14 years.

We believe that the DEIS should present a detailed projection of population, using numbers from its own history, over the twenty years from the completion of the project. This should include an estimate of the amount of water needed each year, again based on historical records for the Village. Lastly, the DEIS should identify when the Village's population will exceed the capacity of its well fields, then the capacity of the aqueduct and finally the capacity of the well fields and the aqueduct working together. The DEIS does not give quantities for the current shortfall during holidays. For example, how much water is trucked in when the shortfalls occur? Are there other occasions, besides religious holidays, when there are water shortages? On Page 1-2 and 1-3, the DEIS states: "As a result of the community's religious practices, peak flows are generally caused by preparation for holiday periods and the Sabbath. High demands have occurred during the temporary influx of population for holidays, and also on the anniversary of the death of Grand Rabbi Joel Teitelbaum, founder of Kiryas Joel. Peak daily demands typcially occur 50 to 75 days per year." What are these peaks---how much additional water is needed? What is the actual consumption on those 50 to 75 days?

Unless shown to the contrary, tapping into the Aqueduct will only temporarily satisfy these growth rates and water needs. In only a few years, much less than 20 years, the Village will find itself right back where is it now. **This has significant implications for surrounding aquifers and private wells.** While the aqueduct connection may provide temporary relief, in a few years the demand will again be there to draw water from the already inadequate local wells. The DEIS needs to address this.

B. On Page 1-1 of the DEIS, it states that the average per capita water consumption in the Village is substantially lower than in both Orange County and New York State. Please provide numbers and documentation, such as from meter readings, to substantiate this claim. These per capita figures should also include water usage for communal facilities.

2. DEIS, Section 1.3: Purpose of Project

The DEIS states that the purposes of the project are:

- Establish a long-term consistent high-quality water supply for a growing community,
- Reduce the dependence of the Village on groundwater as its source of drinking water.
- Establish a drinking water supply that avoids conflict with surrounding communities,
- Reduce vulnerability to drought by broadening the area from which water can be drawn,
- Avoid or minimize adverse impacts to the environment, the Village, and surrounding communities.

Using the calculations shown above, connection to the aqueduct will serve the stated purposes of the project for only 5 to 14 years after its completion. We estimate that within 5 years after completion of the aqueduct connection, Kiryas Joel would once more be increasingly dependent upon groundwater and would generate potential impacts (from traffic from water tank trucks and/or damage to aquifer and neighboring wells from over pumping —see B Groundwater Resources) on its neighbors whenever the aqueduct needs to be shutdown, either for maintenance or for unforeseen circumstances. This would potentially raise conflicts between the communities with which it shares the aquifer. After 14 years, the Village would be dependent again on its full permitted groundwater capacity and would be susceptible to local droughts. Therefore, the project sponsor's preferred alternative does not serve the purpose of the proposed action for the full planning period and additional alternatives should be explored.

3. DEIS, Section 2.2: Surface Water Resources

The DEIS states that the aqueduct pipeline will cross the Moodna Creek and potentially other streams, via attachments to existing bridges. It is agreed that this would be less disruptive to the environment, but how does this assure that the pipeline is not susceptible to damage during extremely cold weather, damage during bridge and roadway repairs/improvements, and to damage from intentional mischief or sabotage. Damage to the pipeline or any interruption of service could drastically decrease the water supply in the Village, especially as it continues to grow and becomes dependent upon this supply (which has been demonstrated above).

4. DEIS, Section 2.4: Geology

A. Page2-40 lists the first two mitigations for blasting and discusses adherence to laws and permitting procedures. The DEIS states that the requirement of inspection of off-site properties previous to blasting would only be conducted when requested or authorized by the owner. Some property owners may not understand their rights to request inspection as the mitigation is presently written. We recommend that the project sponsor be required to send notice of blasting by certified mail to all property owners within 500 feet of blasting. This notice should include information in clear language regarding how the property owner can make an appointment for pre- and post-blasting inspections. We also recommend monitoring of any public and private water supply wells within 500 feet of blasting. A plan for this monitoring should be made part of the DEIS so that it can be commented upon by the public, especially those directly affected.

5. DEIS. Section 2.9. Land Use

A. Under land use analysis, Figure 2-12 used USGS satellite imagery to denote the uses along the proposed aqueduct routes. More detailed and accurate data is available from Orange County Water Authority. We believe that if the DEIS considered the land use data available from OCWA, they would find that a greater density of residential and nonresidential uses exist along some of the State and County corridors. We request that the land use analysis be repeated with the OCWA data.

B. The DEIS addresses the recently adopted Orange County Comprehensive Plan by correctly describing Kiryas Joel's status as a priority growth area. However, the Plan goes beyond just describing where growth should occur. A priority addressed in the Environmental Infrastructure Strategy section of the Plan is to "...give priority to regionalizing water resourses by interconnecting systems." While the DEIS repeatedly states that neighboring communities have been unwilling to help Kiryas Joel meet its drinking water needs, it also states that these communities have been experiencing growth of their own. In fact, all of southeast Orange County has been dealing with water shortage problems recently and communities in the area have all been required to issue water use restrictions over the last five years. This has left communities unable to help each other with drinking water shortages, and has resulted in an environment where communities are constantly monitoring each other's consumption. Neighboring communities have been looking to deal with water needs in a variety of ways including summer water restrictions, increasing water usage rates in the summer, modifying zoning by looking at both potable water and wastewater needs. We request that another alternative be included in the DEIS that considers a regional approach to providing drinking water including assessing the possibility of partnering with neighboring communities to share the benefits and the costs of tapping into the aqueduct and withdrawing larger amounts of water to benefit the region, perhaps only on an emergency basis, such as during the 2002 summer's drought.

6. DEIS. Section 2.10: Traffic

The DEIS discusses possible restrictions prohibiting construction during commuter hours. This should definitely be identified as a required mitigation on all State and County roads. Careful planning needs to go into work schedules, notifying the public of work schedules and detours so as to be less disruptive to the general public.

7. DEIS, Section 2.11: Noise

There seems to an inconsistency in the document concerning noise and hours of construction. The DEIS states that as a mitigation that "…nighttime and weekend construction would be avoided to the maximum extend possible." However, as a mitigation to traffic the DEIS states that "…consideration would be given to utilizing nighttime construction to help minimize traffic." We recommend that the DEIS provide criteria for determining areas of the pipeline route where nighttime construction may be preferable. Nighttime and weekend construction schedules should balance the needs to commuters with the needs for limited noise in residential areas that could interfere with people's sleep and work activities.

We further request that construction on weekends or during commuter hours be expressly prohibited if either of the other alternate pipeline routes are considered.

8. DEIS, Section 2.13: Utilities

A. The discussion of wastewater treatment included in the DEIS is not adequate to conclude that there will not be an impact to wastewater treatment in connection with the proposed action. The existing Harriman Sewer Plant is being expanded but is now operating at full permitted capacity. What level of growth for the Village of Kiryas Joel was included in planning the expansion of the plant and is the combination of the plant and the Village adequate to serve the additional population supported by the proposed action?

As described in the DEIS, the expansion of the Harriman Sewer Plant is planned in order to accommodate 1.5 MGD of effluent anticipated from already approved projects. The DEIS states that .35 MGD of capacity of the Village Wastewater Treatment Plant is currently leased to neighboring communities. If the Village terminates this lease, the neighboring communities will increase their usage of the Harriman Sewer Plant. Therefore, it would seem that there is currently no excess of sewer treatment at the Harriman Plant as expanded and the Kiryas Joel Wastewater Treatment Plant. Details on the current capacities, and current demands for sewage treatment at the Harriman and the Kiryas Joel plant need to be provided. Also projections should be made as to the future capacity and demands for sewage treatment at the time of completion of the aqueduct connection and at five, ten, fifteen and twenty years after the aqueduct connection.

We do not believe that there is an existing way to dispose of the additional 0.7 MGD of wastewater that would be generated by the population that would be supported when groundwater wells are down and the aqueduct is brought on line. Unless growth mitigation is suggested, at some time in the future, it is likely that the Village will be using both its groundwater wells and the aqueduct. At that time, up to 2MGD of additional wastewater treatment capacity will be required beyond what is available to the region today. The environmental document should detail how impacts to wastewater treatment from the additional population is to be supported by the aqueduct will be mitigated and funded.

Increased water availability and usage must be evaluated at both ends of the equation--- drinking water and wastewater. The DEIS does not adequately address the wastewater end of the equation.

B. Throughout the DEIS, the document states that the proposed action would reduce stress on the aquifer from which water is currently drawn. On page 2-84 the DEIS states, "This would reduce the potential for Kiryas Joel's wells to compete with private wells for the same groundwater."

We note that when the aqueduct connection is completed in 2006, the Village will have a projected population of 18,636. At this point, the population of the Village would demand an average of 1.54 MGD. This demands exceeds the permitted yield of the Village's wells. If the aqueduct is de-activated for any reason, (the DEIS discusses regular deactivation by NYC for maintenance),the Village will not have adequate back up to supply its needs and it may be forced to over pump the aquifer or bring in water via trucks to compensate. In either case, Woodbury would be impacted from potential damage and draw down of its water supply aquifer with potential negative impacts on surrounding wells and increased traffic for trucking in needed water.

Will the Village keep its permits to withdraw 1.31 MGD for its water supply wells? At the current growth rates, how long will it be before the Village will be required to use its wells in providing the average daily demand for water? How long will it be before the Village need to use its wells to provide for increased water demands on holidays or days of special observances? How often will the latter occur? How does the aqueduct reduce stress on neighboring communities and property owners if such entities will not have access to the 1.31 MGD currently permitted to Kiryas Joel, and if Kiryas Joel must resume pumping the aquifer to supply its average daily need again in the future, which seems very likely and sooner rather than later.

Backup Well Supply Impacts to Area Wells:: NYC requires municipalities connected to their aqueducts must have a second source of water. This is required in case the city must shut down aqueducts for inspection and/or maintenance/repairs. Inspections are frequent, but usually of short duration. However, maintenance can require removal from service for extended periods of time. The DEIS does not address this at all nor what provisions will be made to supply alternate water for a community that will become dependent upon the aqueduct for its primary water source. If the aqueduct is shut down for a major repair requiring use of an alternate water supply for say six months or longer and the Village has increased water demand to 3 MGD or 4 MGD, the existing well supplies will not be sufficient. Additionally, if growth continues without regard to land management techniques, adequate auxiliary water supply will not be available to make up the gap. The DEIS alludes to the need for back up when it states on Page 3-3: " Although groundwater supply wells do not meet the objectives as stated in Section 1.3 of this document, under the proposed action, existing and future groundwater wells would be required to provide a back-up water source if the Aqueduct flow were interrupted (e.g., for maintenance)." While the DEIS confirms the need for a back-up source, it does not elaborate on how this will be accomplished. Information about what type of back-up, how much supply need to be addressed DEIS. This could have significant impact to the Village and/or New York City's ability to properly operate and maintain its aqueduct system.

9. DEIS, Section 2.14: Energy

The document states that 4,900 kWh would be required to pump the maximum permitted flow throughout the aqueduct. It further states that this would be offset by the decrease in electricity needed to operate the Village's groundwater wells. What is the electricity that is currently consumed to run all of the Village's wells? The Village will eventually need to run existing wells in addition to the aqueduct to support the future population. By our calculations, this will be in less than 15 years. How much electricity would be needed to run the wells, the well water treatment faculties, the aqueduct pump station, and the aqueduct-water treatment facilities? In consideration of the recent electrical problems that were experienced across the east coast and the occasional outages that occur yearly, what methods could be explored to mitigate some of this significant electrical consumption? Could solar energy be integrated into the system? Would additional water storage tank capacity help to mitigate spikes of higher electrical consumption associated with peak water demand, such as in the summer or during religious holidays? How would the additional population supported by the increased water supply contribute to an increase in electrical consumption? In the case of an extended blackout, such as the one recently experienced, will there be a back- up generator to maintain water service to the community and to reduce the potential water-hammer as described in the DEIS (page 1-8) as "the most significant design issue?" Should electricity fail, how long would stored water last and should expanding the Village's volumes be explored?

10. DEIS, Section 2.16: Haxardous Waste

The DEIS states that "Because of the small quantities of {polyaluminum chloride and sodium hypochlorite} involved {in water treatment}, even a sudden and complete tank failure would be unlikely to cause significant health problems in the time it would take to evacuate the effected area." The effected area should be described. Will the effected area include any lands located adjacent to or within the boundaries of Woodbury? Please describe fully.

11. DEIS, Section 3.3: Alternate Pipeline Routes

A. The DEIS has not explored the potential for endangered or threatened species at the alternate water Treatment site. The DEIS should contact DEC's Natural Heritage program to determine the presence of endangered or threatened species. The alternative water treatment site should be field checked for endangered and threatened flora and fauna ; timber rattlesnakes are known to inhabit the Schunnemunk Mountains.

B. We agree that the project sponsor's preferred route of Rt. 208/27/94 would cause less disruption to traffic than using Rt. 32 and County Rt. 44. In reviewing the alternative analyses, it was not made clear what impacts to traffic flow could be anticipated for each alternative construction route. This is extremely important for Rt. 32 alternatives because the Rt. 32 corridor is already over its design capacity and experiences low levels of service. We strongly believe that the environmental impacts from pursuing the alternate routes has not been examined at an adequate level of detail. If the project sponsor intends to pursue either alternate routes, much more analysis must be provided with the opportunity to respond to this prior to the FEIS. For example, the environmental review should include a "hard look" at impacts to traffic flow, including traffic flow at intersections both south and north of areas of construction. If the preferred route is via Blooming Grove then there is no need to pursue further impact analysis on the other alternate routes.

12. DEIS, Section 6: Induced Growth

A. The DEIS states that this project will not induce growth because water will not be made available to neighboring communities and because the Village must grow due to its religious requirements. More specifically, the DEIS states that large families are a response to religious obligations and that women must stay in the community to raise their own families. The DEIS states that, "whether or not the proposed aqueduct connection is implemented, Kiryas Joel will continue to grow."

All life on the planet is bound by natural limitations to population. In New York State, water and sewage treatment are two factors that determine the population that a given tract of land can support. The statement in the DEIS belies the facts: a population cannot be supported without an adequate drinking water supply and a safe means to treat resulting sewage.

Kiryas Joel is already the densest community in Orange County (according to the 2000 census) and may already have reached double the population density of the next densest community, the City of Newburgh. Questions arise as to why growth management has not been investigated as part of this DEIS. It is important to the community to plan for a safe and healthful environment for itself and its neighbors. The DEIS should address this. At some point it will become physically impossible to accommodate additional population within Kiryas Joel. Rather than wait until the next time the Village runs out of water, sewer, vacant land, road capacity, or any other natural constraint to growth, shouldn't this DEIS ask difficult questions such as how many people can be supported by existing infrastructure and how will improvements to infrastructure increase the carrying load of the land. At the minimum, the Growth Inducing Aspects section should assess how many Village residents currently are able to acquire adequate amounts of water to maintain a healthful standard of living; and how many additional persons would be accommodated with the additional water to be supplied by the aqueduct. The Growth Inducing Aspects section should also assess how the existing infrastructure (including sewage treatment and roadways) of the Village and surrounding communities would able to support the additional population. We believe that taking a hard look at the potential impacts from the additional population commensurate with increased availability of drinking water is a SEQRA requirement. This requirement is not addressed by stating, contrary to fact, that population growth can occur without a supply of drinking water. Despite the obligations of the Village's religious practices, SEQRA and Municipal Zoning require acceptance of responsible land management practices.

In terms of growth, it is important to note certain themes repeated in the DEIS regarding growth and water supply:

- Although the letter from the NYC Water Board acknowledges that Kiryas Joel is entitled to withdraw 1.1 MGD based on its population (1990 census), the DEIS repeatedly states that the Village is now entitled to withdraw approximately 1.0MGD based on the 2000 census. Which is correct? From this, can one assume that the Village will modify its entitlement requests after each census and increase it taking of water from the aqueduct?
- In support of a 24 inch diameter water main, the DEIS indicates that is needed to satisfy the 20 year design period (and to save energy). It also notes that infrastructure of this type is usually in service for a minimum of 50 years, often closer to 100 years. Although pipe selection is reported to have been based on a 2MGD design, the DEIS acknowledges that the Village is already entitled to 1.9 MGD (using the 2000 census). In reality, if the Village continues to grow at 6% per year as the DEIS states, they will increase 320% from their current size within the 20 year design period of this project. Since water demand during recent peak periods is over 1.3 MGD (DEIS, page 1-3), a 320% increase would require approximately 4.2 MGD. Although an 18 inch diameter pipe could provide 2 MGD, the head-loss at 4.2 MGD would be great and most likely would require a second booster pump station. However, 4.2 MGD could be transmitted easily through a 24 inch diameter pipe.

There is a possibility that this action may support migration into the community from elsewhere as well as the natural growth of the community due to marriages and births. For example, while young women must remain in the Village to raise their families, do husbands come from outside Kiryas Joel? The possibility of outside migration should be seriously explored unless the Village has a plan to prevent such migration from occurring.

Under mitigations, there should be discussion of water conservation planning, such as educating the community on ways to reduce water usage, testing for and implementing a program to reduce leaks in the system so as to not lose water in this manner, requiring water saving plumbing in all business and residential construction, testing of both residential and commercial water meters to insure that they are accurate so that the Village knows how much water is really being used, tracking water bills to find ones that show an abnormally high reading in a cycle which might indicate a leak. Such a plan could also reduce sewage outflow. Page 1-3, under "Previous Work to Expand the Water Supply" references implementation of water conservation measures but does not elaborate as to what these methods are, how long they have been in effect and how successful they have been. Considering the growing population and water needs, an aggressive water conservation program is crucial and should be detailed more fully in the DEIS.

Lastly, these comments have focused on the Blooming Grove route since that is the one that seems to be preferred and was examined the most fully in this DEIS. The other two alternatives were addressed minimally, which is understandable since they appear to not be the one chosen. However, should this change, it is hoped that the communities involved in the other alternatives will be given the opportunity to respond to a revised plan. It seems time consuming to go into detailed responses on these two alternate routes unless there is reconsideration of either one as the actual route to be selected.

Thank you for the opportunity to review the document and to attend the public hearing. We attended the hearing but decided to put our comments into written form.

Sincerely yours,

Sheila A. Conroy

Sheila A. Conroy

Cc: Town Clerk
Town Board

COUNTY OF ORANGE

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DAVID E. CHURCH, AICP
COMMISSIONER

November 24, 2003

Gedalye Szegedin
Village Clerk, Village of Kiryas Joel
PO Box 566
Monroe, New York 10950

re: Preliminary Comments
DEIS Proposed Connection to the New York City Catskill Aqueduct

The Orange County Departments of Environmental Facilities, Public Works, and Planning have cooperatively reviewed the Draft Environmental Impact Statement (DEIS) for the Proposed Connection to the New York City Catskill Aqueduct, dated October 2003, and together forward to you the following comments. We also appreciate your willingness to extend, by two days, our opportunity to comment as per your telephone conversation with David Church, Commissioner of Planning.

Initially, these Departments need to make three (3) lead comments. First, we request that Orange County, Orange County Sewer District No. 1, and all three Departments noted above be listed as involved agencies under SEQR in relation to this proposal. Second, we ask for your patience in receiving our comments as there remains a question as to whether each or any of these County agencies have received complete prior, public notice. This has aggravated our ability to promptly review this important DEIS within your schedule. Therefore, we are asking for an additional ten (10) day extension to allow the County to be sure that we have completed our review in light of this tight timing.

Third, we together raise the important question, under NYS SEQR, as to whether the DEIS as presented has met the test of taking a "hard look" at some issues that are particularly important to the County. These issues are elaborated below and include: village growth projections and their relationship to water usage, associated sewage treatment requirements with growth in population and water usage, and alternatives to manage population growth, water usage and subsequent sewage treatment.

A. The Department of Public Works' comments are focused on the proposed 24" pipeline running along County Route (CR) 27 to supply water to the Village of Kiryas Joel.

1. Page S-2 of the DEIS discusses the need to attach the pipe to the County bridge across the Moodna Creek. The document also states that intention to attach the pipe to other bridges along the way. At 2MGD the pipe will transmit almost 1,400 GPM. The DEIS should explain maintenance responsibilities for this pipeline as well as protocols for maintenance during

bridge work or reconstruction.

2. On page S-2 it says that the Village may have to install the pipe in the shoulder or roadway due to adjacent wetlands. This could pose a safety threat to the traveling public if the pipe should ever fail. A flow of 1,400 GPM could easily wash out the roadway. Given that this is not a well-lit road and that it has a great deal of both vertical and horizontal curvature, a wash out at night could be life threatening to anybody driving on it.

3. On page S-5 the Orange County Department of Environmental Services and Orange County Sewer District No. 1 should be, but are not, included on the list of agencies from which permits and approvals may be required. In addition, the Orange County Department of Public Works should be included on the list. Required approvals include, but are not necessarily limited to, a permit for the proposed discharge of the backwash from the proposed water filtration plant into Orange County Sewer District No. 1 sewers. The DEIS fails to provide alternatives to discharge into the County sewer in the event a permit is not issued. It does not address the details of the discharge in terms of content, quantity, effect on hydraulic capacity of the carrying lines, whether the discharge would occur during peak or off-peak hours, and where, within the County sewer system, the discharge will occur.

Section 2.13.1.2 (Wastewater) fails to adequately address, quantitatively and qualitatively, how wastewater generated from the increased water consumption, will be treated in the event that there is insufficient treatment capacity at the Harriman and Village plants. This section states that "[t]he current expansion of both the Harriman WWTP and Kiryas Joel's own wastewater treatment facility would accommodate a large increase in wastewater discharges from Kiryas Joel." The DEIS should provide quantifiable information about these facilitity capacities and this "large increase".
The proposed 2.0 MGD additional water capacity apparently exceeds the combined, available treatment capacity of the expanded Harriman and Village treatment plants, even if there was no additional capacity from other properties within the sewer district. This section fails to project increased wastewater treatment needs of the rest of the District and how any such increased demand will impact the proposal. Nor does the section take into account the participation in the expansion by municipal contract users of the Harriman plant that are not part of OCSD # 1 which would reduce the available, expanded treatment capacity within OCSD #1. The Towns of Woodbury and Blooming Grove have already committed to purchasing a share of the additional capacity. In addition, while the current lease between the County and the Village expires in 2004, the lease contains an option clause for two additional one-year extensions of the lease.

4. On page S-5 is a list of the approvals that are needed. They should add the Orange County DPW to the list for any work that is done within the right-of-way of any County road. The full list of County agencies provided on page 1, paragraph 2 should also be added as each may have permitting or review authority.

5. On page 1-8 the trench is described as being 4' wide and 4.5' deep. The depth of the trench has to be greater than that to allow for future drainage installations. The depth to the top of the water main should be 4.5', minimum.

6. On page 1-10 the County DPW should be listed as an involved agency. County Environmental Facilities and Planning should also be listed as "interested parties".

7. Page 2-53, Table 2-7 lists projected population growth out to the year 2025. Using a daily water demand of 60 gallons per capita for water consumption, we get the following water needs for Kiryas Joel and surrounding municipalities:

Year	Daily Water Demand
2000	1.9 MGD
2010	2.6 MGD
2015	3.1 MGD
2020	3.6 MGD
2025	4.2 MGD

Even with the Aqueduct connection, the Village may not have enough water much past the year 2015. This amount of population growth and water use will also require further expansions of the Orange County Sewer District 1 treatment plant in Harriman. The relationship of increased water use to demands and capacity at Sewer District 1 as well as alternative options for necessary sewage treatment should be further discussed.

7. On page 2-64 is a list of the AADT for roads along the construction path. However, the DEIS fails to show the AADT for the first 2 miles of CR 27 starting at the intersection of CR 27 and NYS Route 208. The AADT for that stretch of CR 27 is 5060. The AADT for the balance of CR 27 is shown and is approximately 3300.

8. Page 2-64 states that the intersection of NYS Route 208 and CR 27 is controlled with a traffic signal. That is in error as the intersection is controlled with a stop sign.

B. The Department of Environmental Facilities and Services offers the following additional comments.

On Page S1, 1-1, and throughout other relevant areas of the report, the Census population from 1990 and 2000 is used to project annual growth rate @ 5.9%. The report also discusses a less than average water usage per capita rate for Village residents without reporting the value used in the report. What is the water use per capita value CDM is using for the Village of Kiryas Joel? The report should include a tabulated projection of population and water consumption for the next 25 years to complement the assessment of impacts that are associated with construction of the proposed water transmission line.

On page S2, and throughout other relevant areas of the report, the construction of a new water filtration plant off Berdichev Road in the Village will need to be constructed. The type of treatment required is discussed in the report and suggests the generation of raw sludge that will require handling and disposal. How will the raw sludge be handled and ultimately disposed of?

What daily volume of raw sludge will be produced? What percent solids will the raw sludge consist of and what elements and compounds will the raw sludge consist of?

On Page S5, and throughout other relevant areas of the DEIS, the Orange County Department of Environmental Facilities and Services is not included and it should be. This is especially true with respect to a potential proposal to discharge backwash water into OCSD1 Sewers from the new Water Filtration Plant proposed for construction on Berdichev Road in the Village.

On Page 1-6, a 24" diameter pipeline is justified due to energy cost savings. For the proposed route, has a System Head Curve for the 13 miles of 24" diameter pipeline been generated and can it be provided for further review? What is the cost effective, maximum carrying capacity of the proposed 24" diameter X 13-mile long pipeline.

On Page 2-10, the DEIS states that there will be no problem with the maximum flow of the Moodna Creek due to the proposed pipeline being suspended from the bridge. What year flood mark was used to support this statement and what is the differential between the invert of the pipe for the flood mark used as well as for the 100-Year Flood Mark if different?

The Planning Department's primary authority in reviewing the DEIS is via NYS General Municipal Law with a focus on "intercommunity" or county-wide concerns. As guidance in our review, we reference the 2003 Orange County Comprehensive Plan. That Plan supports the vitality of the Village of Kiryas Joel, and identifies the Village as an element of the Priority Growth Areas of the County. The 2003 County Plan also identifies the importance of defining the "carry capacities" of communities, notably in the context of public water and sewage treatment; the Plan also emphasizes the necessity of municipal partnerships in addressing these and other key issues.

Therefore, we appreciate your proactive efforts towards overcoming water carrying capacity limitations given the rate of growth and development the Village has shown during your first 25 years of incorporation. The County appreciates your proposal's objective in "establishing a potable water supply that avoids conflict with surrounding communities." However we have a certain comments in that context.

(1) Section 1.2.4, page 1-4 of the DEIS sets the two key conditions motivating the Village of Kiryas Joel to advance this proposal as outlined in the DEIS, (1) "The Village of Kiryas Joel's existing water supply system is minimally adequate for its present population...." and (2) "....the Village will need increasing amounts of potable water as it continues to grow." Section 1.3 goes on in establishing five (5) objectives for the proposal consistent with these key conditions. Unfortunately, the DEIS lacks adequate documentation quantifying current against future growth nor does it translate such quantifiable analysis into future water demands. With the increased availability of water supply and wastewater treatment and a large demand for housing in areas outside of the Village, how will the influx of outside community housing development be curbed, controlled and/or prevented within the Village? Our recommendation is that Section 1.2 "Need" includes some elaboration on future growth and demands for water infrastructure, ideally using a quantifiable methodology and projected out in time for a reasonable period related to the

limitations of the proposal.

(2) Section 2, Environmental Setting, Direct Impacts and Mitigation fails to adequately address the relationship of current, expanded, or new sewage treatment facilities to the proposal. This is of particularly interest to Orange County in relationship to Orange County Sewer District 1 (see prior comments). While Section 2.13.1.2 does summarize current conditions as related to wastewaster treatment, the DEIS is silent on impacts for future sewage treatment associated with the facilitation of Village growth via improved water capacity.

(3) Section 6, Growth-Inducing Aspects, as well as elsewhere in the DEIS. We concur that the inherent nature of the specific proposal applies only to meeting water demands within the Village of Kiryas Joel and that growth-inducement outside of the Village as a result of access to the NYS Catskill Aqueduct is not intended with this project. However, there is both a trend of regional growth and a clear record of interest by the neighboring municipalities along the proposed waterline regarding future access to this pipeline and/or share use of the aqueduct tap. Those neighbors have expressed a range of interests from access as community backup supplies, access to address certain, existing neighborhood shortages, as well as the influences of improved water capacities on development expansion from the Village into neighboring Towns. The DEIS should provide some further discussion on these issues. At a minimum, the DEIS should, in Section 6, provide a record of growth trends and water needs in the immediate region of the Village and along the pipeline routes, and the DEIS should review any record or discussion with Town and Village leaders in this region and along these routes relevant to water needs and prospective access to Catskill aqueduct water.

Should you have any questions please contact Edmund Fares, Commissioner of Public Works, David Church, Commissioner of Planning.

Submitted on behalf of the Orange County departments of Public Works, Environmental Facilities and Services, and Planning,

David Church
Commissioner of Planning

cc: Edmund Fares, Commissioner of Public Works
William Gunther, Commissioner of Environmental Facilities

New York State Department of Environmental Conservation
Division of Environmental Permits, Region 3
21 South Putt Corners Road, New Paltz, New York 12561-1696
Phone: (845) 256-3054 • FAX: (845) 255-3042
Website: www.dec.state.ny.us

Erin M. Crotty
Commissioner

November 24, 2003

ATTN: GEDALYE SZEGEDIN, VILLAGE CLERK
VILLAGE OF KIRYAS JOEL
MUNICIPAL BUILDING, P.O. BOX 566
50 FOREST ROAD
MONROE, NY 10950

RE: Proposed Catskill Aqueduct Connection
PROG#: DEC ID #3-3399-00028/00001
LOCATION: V-Kiryas Joel, Various Towns, Orange County

Response to Draft EIS

Dear Mr. Szegedin:

Thank you for the opportunity to comment on the October 2003 Draft Environmental Impact Statement (DEIS) for the Village's proposed connection to the New York City Catskill Aqueduct. In the DEIS the Village proposes to connect its water supply system to the Catskill Aqueduct in the vicinity of Vails Gate in the Town of New Windsor. The project also involves construction of a pump station at the aqueduct, construction of a 13-mile water transmission pipeline to the Village's existing Berdichev Road water treatment facility and construction of a new water treatment plant within the Village. The purpose of connecting to the Catskill Aqueduct is to provide the Village with a new primary, long-term, consistent, high-quality source of drinking water. The Village proposes to take up to 2,000,000 gallons of water per day (MGD) through a pipeline that would follow State Route 94, County Route 27, State Route 208, and State Route 17. The Village would retain its existing wells on standby status.

Based our review, the Department has the following questions, comments and concerns.

Water Demand Estimates:
The DEIS does a good job of presenting the current water supply needs of the Village, and the fact that the Village's needs will grow in the future. However, the DEIS fails to provide any population projections and fails to quantify the number of gallons per day that might be needed by the Village in the next 5, 10 or 20 years. Although Section 3.5 briefly mentions a minimum 20-year planning period, it does not explain how "2.0 MGD would meet the Village's needs for approximately 10 years." Without establishing a specific, verifiable water supply need, it is not possible to compare these needs with the potential adverse environmental impacts caused by the construction and operation of this new water supply system.

Sewer Facilities:
The primary concern of this Deparment is a potential impact on sewage facilities and the discharge of treated effluent into area streams. The DEIS does not provide sufficient information in order to evaluate the potential for this impact. The DEIS should indicate the Village's current total used and unused sewer capacity either within the Village or reserved for the Village in the Harriman Sewage Treatment Plant (Orange County Sewer District #1). Will the 2.0 MGD of water from this pipeline exceed the total sewage capacity available to the Village? If so, how will the Village guarantee that water from the pipeline will not result in exceedance of this capacity?

Master Land Use Plan or Zoning Plan:
In conjunction with these sewage capacity concerns identified above, the DEIS does not provide a copy of the Village's Master Land Use Plan or Zoning Map showing the remaining un-developed or under-developed parcels in the Village that could be developed with water from this pipeline. The DEIS also does not indicate whether this proposed water line, and the future development that would result from it, are in keeping with that Master Plan. The DEIS should identify all un-developed or under-developed parcels in the Village, their allowable land-use under the local zoning plan and number of new residents that could be allowed if all this land were developed. What would be the average and maximum daily water demand for the full build-out of the Village under the Master Land Use Plan?

Please note that the above requested population and water demand estimate must exclude vacant land within the Village that is currently identified as wetlands regulated by this Department. Please also subtract from that estimate all acreage that may be needed for future school facilities, hospital facilities and other necessary service facilities before determining the net total buildout of the Village.

State Historic Preservation Act (SHPA):
Although Appendix "B" of the DEIS contains a Stage I-A Culture Resources Report by a professional archaeologist, that Report recommends a Stage 1-B study in selected areas along the pipeline where there is a potential for the remnants of abandoned mill sites. However, it is unclear whether this study should considered areas used for staging construction equipment, as well as pump stations that may be necessary along the pipeline route. Please address this question and provide a revised Report if the current did not consider these areas. Additionally, the Stage 1-B study must be completed as part of preparation of any revised DEIS or an FEIS.

Alternatives:
In accordance with an earlier letter from the Town of New Windsor's Town Engineer, please address the environmental impacts and benefits of not constructing a separate connection to the aqueduct near the Riley Road Filtration Plant. As the Town has suggested, please consider the benefits and impacts on the Aqueduct itself of sharing the Town's existing tap on the aqueduct. Please also consider their other suggestions of construction of a new horizontal tap into the aqueduct, that could be used jointly by the two municipalities, to prevent problems during low flow periods in the aqueduct. The Village should also evaluate the benefits and impacts of joint use of an expanded

Riley Road Filtration Plant by the two municipalities as compared to a separate standalone Water Filtration Plant for the Village.

Please discuss in detail the suggested alternative of sharing pipeline water and sharing costs with other municipalities along the pipeline route so that they too can take their own entitlement water from the New York City Aqueduct system. Please also discuss the environment benefits and impacts of a possible regional approach to providing this New York City entitlement water through the offices of the Orange County Government or possibly the Orange County Water Authority.

In accordance with Question #19 of the Full Environmental Assessment Form (Full EAF) and as a follow up to the above discussion of the financial impacts of various alternatives, please describe the impacts of the proposed project on the Village's municipal budget. Please provide and compare the projected costs for the design, construction and the yearly operation of this water supply project and the alternatives discussed elsewhere in these comments. Please also include the yearly operating costs and debt payments of maintaining the existing well fields on standby.

Visual Impacts:

The DEIS did not provide a Visual Impact Analysis (VIA) for the proposed Water Treatment Plant, the pump stations along a pipeline route, or the pumpstation at the aqueduct itself. Please use the Department's "Guidance in Assessing Visual Impacts" which is available at the web address (see our letterhead on page 1), or at our New Paltz office. The VIA should identify the existing visual content around each the proposed structure. It should go on to identify how the design and dimension of each proposed structure would visually impact the surrounding area and how those impacts would be avoided, minimized or mitigated by the siting, design, construction, materials to be used, etc., for each of these proposed structures.

The DEIS does not identify any areas along the proposed pipeline route where trees and shrubs will be removed and whether they currently act as a visual buffer for residential or other land uses. Please identify and discuss the benefits & impacts of restoring all significance stands of trees and shrubs, shortly after construction is completed, in any area where such stands of trees or shrubs act as a visual buffer. This is particularly relevant within the densely populated Village boundaries and in residential neighborhoods or around schools or public institutions.

Impacts on Land:

Although Section 2.4.1.4 discusses the potential for encountering steep slopes or shallow bedrock in generic terms, the DEIS did not identify the specific areas where these problems might be encountered. It did not provide a map or quantify how many hundreds or thousands of linear feet of the proposed pipeline might encounter these types of difficult construction areas. Please quantify in detail where these areas might be located, their length, and how steep are the slopes or how shallow is the bedrock in these areas. Please discuss site specific construction techniques to reduce impacts on land, traffic, streams, and a nearby homes and businesses for each of these areas. These should include a detailed discussion of stormwater management during construction on steep slopes and blasting impacts in areas of shallow bedrock. DEC recommends a pre-blast survey of the foundations and wells of all homes, institutions and businesses within 500 ft. of blasting.

Construction of a proposed new Water Treatment Plant is mentioned but its location is only casual noted is as being adjacent to the Village's existing Water Treatment Plant and a detailed site plan was not provided. Please provide a site plan of the primary location chosen for the proposed new water treatment plant and one for each alternative locations that was considered. Please provide a discussion of the minimum square footage (or acreage) needed to construct a water treatment plant of the size assumed necessary for this project. Please include a thorough search of all vacant lands near the terminus of the pipeline in the Village that meet this minimum size criteria.

Please discuss construction impacts on the aqueduct itself. What is the age of the aqueduct at the location of the tap? What is a potential for short-term or long-term damage to the aqueduct during construction of a connection to it? What alternatives are available that would reduce or completely avoid disturbance of the aqueduct itself in order to obtain the water, such as the alternates identified in these comments?

Please indicate how much area would be needed to temporarily store construction materials along the pipeline. Please discuss where excess excavated material will be disposed of and indicate how the Village would verify that the material will not be disposed of in any state or federally regulated wetland area.
The DEIS did not discuss whether any pump stations would be needed along the 13-mile route, the location of pumpstations, the dimensions such pump stations and construction or operating impacts of these pump stations.

If any construction is outside of the road pavement, how many acres of trees and shrubs will be removed in order to install the pipe line? How many acres will be replanted?

Please discuss how many cubic yards of excess soil, rock, asphalt, concrete, etc., will be removed from the work corridor and where will be disposed of?

<u>Impacts on Surface Waters:</u>
The DEIS does not indicate how many acres of temporary or permanent stormwater detention ponds will be needed. It does not indicate where those detention ponds will be located and the impacts of their construction. A similar analysis is also needed for any pump stations or temporary staging areas along the pipeline route.

Please discuss whether the proposed Water Treatment Plant will result in any discharge to nearby streams from such things as filter backwash, alum, or any other discharge of process water or effluent from the plant. Please discuss whether area streams around the proposed Water Treatment Plant site (or any alternate site for it) can adequately assimilate such discharges during normal and drought periods.

Impacts on Vegetation:
The DEIS does not indicate whether the pipeline trench will be constructed within 50 ft. of any mature trees, and if so, what analysis would be done on whether such construction could damage or destroy the root system of these trees. Please provide a methodology for such analysis and an indication of how impacts to mature trees will be avoided or prevented.

Noise Impacts:
The evaluation of Local Noise regulations in Section 2.11.2.1 does not include any noise regulations for the Village of Kiryas Joel. Please provide them and analyze how potential sources of noise can meet these regulations or would have to be mitigated to meet them.

The evaluation of Long-Term Noise impacts in Section 2.11.4.2 of the DEIS does not provide background noise sampling data for the proposed Water Treatment Plant site within the Village. It also does not identify the nearest residential receptors of noise or their distance from the property line of the proposed plant site. Please provide this information and revise your evaluation appropriately.

As discussed earlier, there is no detailed location map or site plan for the proposed plant and no way to understand whether the new plant is closer to residential receptors. Without this information, it is very difficult to independently evaluate the conclusion in this section of the DEIS that there will not be a noise impact. It also does not explain how the estimated maximum operating sound level of 60 dBA at the property line was determined.

The Department has no comments on the review in the DEIS of impacts on Air Quality, Traffic, Energy, Endangered Species and Solid & Hazardous Waste.

Thank you again for the opportunity to comment on the DEIS for this project. If you have any questions about the above requested information, please contact me in New Paltz at 845-256-3165.

Sincerely,

Michael D. Merriman

Michael D. Merriman
Deputy Regional Permit Administrator

File Name: KiryasJoel,Response to DEIS for NYS Aqueduct.wpd

cc: H. Boucher, PE at Camp Dresser in McKee (CDM)
Supervisor, Town of New Windsor
Supervisor, Town of Cornwall
Supervisor, Town of Woodbury
Supervisor, Town of Monroe
Supervisor, Town of Blooming Grove
R. Pierpont, NYS OPRHP, Waterford
M. Montysko, NYS DOH, Troy

gwcc: M. Moran; M. Duke; W. Rosenbach;
L. Meyerson; M. George; P. Ferracane; M. Holt; J. Garry;

340 West 28th Street #14A
New York, NY 10001
Nov. 30, 2003

Att: Gedalye Szegedin,
Village Clerk
P.O. Box 566
Monroe, NY 10950

In reference to the planned connection of the Village of Kiryas Joel to the Catskill Aqueduct, since this project is meant to increase the current supply of water to your community, I, as a New York City resident and City water supply consumer, have a right to object to the excessive volume of water that would be siphoned off our source of supply. I can only view it as an sign of encouragement to further residential and business development in what is now open green space where people from our urban areas can come to enjoy the natural beauty and wildlife, and the solitude that have been vanishing at a more rapid pace these days as urban sprawl brings with it more traffic, more pollution, and a generally worsening quality of life.

If there is a plentiful local water supply from the Brenner farm, then certainly that should fulfill the current needs of your community, so I say—by all means use that.

Sincerely,

Arnold M. Frogel

Arnold M. Frogel

Appendix C

New York State Office of Parks, Recreation and Historic Preservation
Historic Preservation Field Services Bureau
Peebles Island, PO Box 189, Waterford, New York 12188-0189 518-237-8643

Bernadette Castro
Commissioner

March 16, 2004

Michael Sterthous
Whiteman, Osterman & Hanna, LLP
One Commerce Plaza
Albany, NY 12260

Dear Mr. Sterthous:

Re: DEC 3-3399-0028/0001
Proposed Catskill Aqueduct Connection
Village of Kiryas Joel, Orange County, NY
02PR04346

Thank you for requesting the comments of the Office of Parks, Recreation and Historic Preservation (OPRHP) with regard to the potential for this project to affect significant historical/cultural resources. OPRHP has reviewed your letter of February 25, 2004, which outlines a proposed protocol for conducting archaeological investigations. While we typically recommend that the Phase 1B archaeological work be completed prior to our review, we understand that in this case, it will be necessary to continue further into the SEQRA process to allow a more complete design of the project to be prepared. We also understand that the reviewing agency has indicated that they would not provide clearance to continue this process, without receiving our comments. Therefore, OPRHP will comment on the proposed protocol.

It is the opinion of the OPRHP that the proposed protocol will act to help identify, protect and/or mitigate any adverse impacts to archaeological resources that may be identified. OPRHP recommends that any reviewing agencies include this protocol as a condition of any process under their review and that no construction be allowed to proceed until these conditions have been met. With these conditions in place, OPRHP has no objections to the project applicant being allowed to proceed in the design process.

Please contact me at extension 3291 if you have any questions regarding these comments.

Sincerely

Douglas P. Mackey
Historic Preservation Program Analyst
Archaeology

Appendix D

Matter of County of Orange v Village of Kiryas Joel
2007 NY Slip Op 07699
Decided on October 9, 2007
Appellate Division, Second Department
Published by New York State Law Reporting Bureau pursuant to Judiciary Law § 431.
This opinion is uncorrected and subject to revision before publication in the Official Reports.

Decided on October 9, 2007

SUPREME COURT OF THE STATE OF NEW YORK
APPELLATE DIVISION : SECOND JUDICIAL DEPARTMENT

ROBERT A. SPOLZINO, J.P.
DAVID S. RITTER
MARK C. DILLON
THOMAS A. DICKERSON, JJ.

2005-11560
2006-02997
(Index No. 04-7547)

[*1]In the Matter of County of Orange, respondent,

v

Village of Kiryas Joel, et al., appellants.

Whiteman Osterman & Hanna LLP, Albany, N.Y. (Howard A. Levine and Daniel A. Ruzow of counsel) and Thacher Proffitt & Wood LLP, White Plains, N.Y. (Kevin J. Plunkett of counsel), for appellants (one brief filed).
Menter, Rudin & Trivelpiece, P.C., Syracuse, N.Y. (Thomas J. Fucillo, Mitchell J. Katz, and Julian B. Modesti of counsel), for respondent.

DECISION & ORDER

In a proceeding pursuant to CPLR article 78 to review (a) a determination of the Board of Trustees of the Village of Kiryas Joel dated July 8, 2004, authorizing, inter alia, the construction of a public water supply facility and a pipeline connecting the public water supply facility with the Catskill Aqueduct, (b) a determination of the Board of Trustees of the Village of Kiryas Joel dated July 9, 2004, adopting a findings statement pursuant to the State Environmental Quality Review Act in connection with the project, and (c) a determination of the Board of Trustees of the Village of Kiryas Joel dated October 29, 2004, in effect, declining to conduct any further environmental review in connection with the project, the Village of Kiryas Joel and the Board of Trustees of the Village of Kiryas Joel appeal from (1) a judgment of the Supreme Court, Orange County (Rosenwasser, J.), dated October 20, 2005, which granted the petition, annulled the determinations, and remitted the matter to the Board of Trustees of the Village of Kiryas Joel for the preparation and circulation of a supplemental environmental impact statement addressing certain environmental issues, and (2) so much of an order of the same court dated February 27, 2006, as denied that branch of their motion which was for leave to renew their opposition to the petition.

ORDERED that the judgment is modified, on the law, by deleting the provision thereof remitting the matter to the Board of Trustees of the Village of Kiryas Joel for the preparation [*2]and circulation of a supplemental environmental impact statement addressing certain environmental issues, and substituting therefor a provision remitting the matter to the Board of Trustees of the Village of Kiryas Joel for the preparation and circulation of an amended final environmental impact statement, in accordance herewith, which analyzes the impact of the project on wetlands, sewage facilities, and the discharge of wastewater and treated effluent into surface and ground waters, includes a phase 1-B archaeological study and review, analyzes the growth-inducing effects of the project, and analyzes those alternatives to the project which were identified in the final environmental impact statement with respect to these impacts; as so modified, the judgment is affirmed; and it is further,

ORDERED that the order dated February 27, 2006, is affirmed insofar as appealed from; and it is further,

ORDERED that one bill of costs is awarded to the petitioner.

After the Board of Trustees of the Village of Kiryas Joel (hereinafter the Board of Trustees) prepared and circulated a draft environmental impact statement (hereinafter the DEIS) and a final environmental impact statement (hereinafter the FEIS) in connection with a proposal to construct water pumping and wastewater treatment facilities within the Village, together with a 13-mile-long water pipeline connecting those facilities to an aqueduct, located in the Town of New Windsor, that is owned and operated by the City of New York (hereinafter the project), the Board of Trustees authorized the issuance of bonds to finance the project and approved a findings statement pursuant to the State Environmental Quality Review Act (ECL art 8 [hereinafter SEQRA]). In response to a resolution of the County Legislature of the County of Orange requesting further environmental review, the Board of Trustees later resolved, in effect, to refuse to undertake any additional environmental review.

The County, in which the Village is located, commenced the instant CPLR article 78 proceeding challenging the FEIS and the SEQRA findings statement, on the grounds that those documents failed to contain adequate analysis of several areas of environmental concern, and failed to identify and analyze a reasonable number of feasible alternatives to the project. The Supreme Court granted the petition, annulled the Board of Trustees' determinations, and remitted the matter to the Board of Trustees, directing it to prepare a supplemental environmental impact statement that properly analyzed the areas of environmental concern that were in controversy, and addressed certain alternatives to the project proposed by the County. We modify in order to clarify that the environmental document required to be prepared by the Board of Trustees upon remittitur should be characterized as an amended FEIS, but we decline the County's request to compel the Board of Trustees to identify and consider alternatives in addition to those already identified in the DEIS and the FEIS.

Initially, the County has established "a demonstrated interest in the potential environmental impact of the project" (*Matter of Town of Babylon v New York State Dept. of Transp.* 33 AD3d 617, 618-619), and thus, had standing to prosecute this CPLR article 78 proceeding, predicated upon both its status as an involved agency (*see Village of Chestnut Ridge v Town of Ramapo*, __ AD3d __ [2d Dept, Aug. 14, 2007]; *Matter of Town of Pleasant Val. v Town of Poughkeepsie Planning Bd.*, 289 AD2d 583; *see also* 6 NYCRR 617.2[s]), and as an interested property owner facing injury in fact (*see Society of Plastics Indus. v County of Suffolk*, 77 NY2d 761, 774; *Village of Chestnut Ridge v Town of Ramapo*, ___ AD3d ___ [2d Dept, Aug. 14, 2007]; *Town [*3]of Riverhead v New York State Dept. of Envtl. Conservation*, 193 AD2d 667, 669). Moreover, this proceeding was commenced within the four-month statute of limitations that is applicable (*see* CPLR 217), measured from when the lead agency committed itself to a definite course of future action (*see Eadie v Town Bd. of N. Greenbush*, 7 NY3d 306, 316; *Matter of Village of Pelham v City of Mount Vernon Indus. Dev. Agency*, 302 AD2d 399, 400; *Matter of Mule v Hawthorne Cedar Knolls Union Free School Dist.*, 290 AD2d 698, 699-700; *see also* 6 NYCRR 617.2[b][2], [3]).

"The law is well settled that judicial review of a SEQRA determination is limited to determining whether the challenged determination was affected by an error of law or was arbitrary and capricious, an abuse of discretion, or was the product of a violation of lawful procedure" (*Matter of Village of Tarrytown v Planning Bd. of Vil. of Sleepy Hollow*, 292 AD2d 617, 619; *see Akpan v Koch*, 75 NY2d 561; *Matter of Jackson v New York State Urban Dev. Corp.*, 67 NY2d 400, 416; *Matter of City of Rye v Korff*, 249 AD2d 470). In reviewing the lead agency's determination, the court must determine whether the lead agency "identified the relevant areas of environmental concern, took a hard look' at them, and made a reasoned elaboration' of the basis for its determination" (*Matter of Jackson v New York State*

Urban Dev. Corp., 67 NY2d at 417; *see Chinese Staff & Workers Assn. v City of New York*, 68 NY2d 359; *Matter of Doremus v Town of Oyster Bay*, 274 AD2d 390). In this regard, "it is not the role of the courts to weigh the desirability of any action or choose among alternatives, but to assure that the agency itself has satisfied SEQRA, procedurally and substantively" (*Matter of Jackson v New York State Urban Dev. Corp.*, 67 NY2d at 416; *Matter of Village of Tarrytown v Planning Bd. of Vil. of Sleepy Hollow*, 292 AD2d at 619).

Where, as here, a lead agency determines that a proposed action may have a significant impact upon the environment, and thus requires the preparation of an EIS, that document must set forth "a description of the proposed action, including its environmental impact and any unavoidable adverse environmental effects" (ECL 8-0109[2][a]-[c]; 6 NYCRR 617.14 [f][1]-[4]); alternatives to the proposed action (ECL 8-0109 [2][d]); and mitigation measures to minimize the environmental impact (ECL 8-0109[2][f]; 6 NYCRR 617.14 [f][7]). Where an agency fails or refuses to undertake necessary analyses, improperly defers or delays a full and complete consideration of relevant areas of environmental concern, or does not support its conclusions with rationally-based assumptions and studies, the SEQRA findings statement approving the FEIS must be vacated as arbitrary and irrational (*see Matter of Riverkeeper, Inc. v. Planning Bd. of Town of Southeast*, 32 AD3d 431, 436, *lv granted* 8 NY3d 807; *see generally Matter of Penfield Panorama Area Community v Town of Penfield Planning Bd.*, 253 AD2d 342).

Here, the Supreme Court correctly determined that neither the DEIS nor the FEIS fully identified the nature and extent of all of the wetlands that would be disturbed or affected by the construction of the proposed water pipeline, how those wetlands would be disturbed, and how such disturbance, if any, would affect the salutary flood control, pollution absorption, groundwater recharge, and habitat functions of those wetlands. Moreover, neither the DEIS nor the FEIS fully identified the location, nature, or extent of the bodies of surface water into which wastewater from the proposed treatment plant would be discharged, and which State classes and standards of quality and purity apply to those water bodies (*see* 6 NYCRR ch X, art 4, 10). Nor did the DEIS or the FEIS adequately identify how much effluent would be discharged into those bodies of water over what periods of time, what the nature of the effluent might be, and what the effect upon those bodies of water are likely to be. With respect to historical and archaeological resources, the Supreme Court properly determined that the DEIS and the FEIS were rendered inadequate by the absence of a site-specific and design-specific phase 1-B archaeological study. [*4]

The Supreme Court also properly found that the DEIS and the FEIS provided no demographic analysis or projections with respect to the effect of the availability of a steady and stable supply of potable water on population movement into or out of the Village, other than a conclusory assumption that the

Village birth rate would continue to grow at a steady rate of 6% per year, and thus failed to take a "hard look" at the secondary impacts of the project.

Hence, the determinations of the Board of Trustees were properly annulled. However, the matter should have been remitted to the Board of Trustees for the preparation of an amended FEIS which considers and analyzes these issues as they apply to the proposal and the alternatives identified in the DEIS and the FEIS. A supplemental environmental impact statement (hereinafter SEIS), as directed by the Supreme Court, is not the proper vehicle in which to consider these issues. An agency may require an SEIS where inadequacies in the FEIS "arise from ...(a) changes proposed for the project; (b) newly discovered information; or (c) a change in circumstances related to the project" (6 NYCRR § 617.9[a][7][I]; *see Matter of Jackson v New York State Urban Development Corp.*, 67 NY2d at 429-430; *Matter of Riverkeeper, Inc. v Planning Board of Town of Southeast*, 32 AD3d at 438 (Spolzino, J., concurring in part and dissenting in part); *see also* 6 NYCRR 617.9[a][7][i]). Since the inadequacies here did not "arise from" those factors, but rather from deficiencies in the initial FEIS, the FEIS must be amended to address the additional issues of environmental concern. Contrary to the County's contention, however, the DEIS and the FEIS were not inadequate for failing to consider a reasonable number of feasible alternatives. Where an EIS identifies feasible alternatives to a proposed project, analyzes the impacts associated with those alternatives in comparison to the initial proposal, and incorporates aspects of the alternatives in mitigation of the impacts associated with the initial proposal, the lead agency has satisfied its obligations under SEQRA (*see* ECL 8-0109[2][d]; 6 NYCRR 617.14[f][5]). The FEIS, in this instance, considered three alternative pipeline routes, "no action," alternative pipe dimensions, an alternate site for a filtration and pump station, and the potential drilling of additional wells. The alternatives section of an FEIS need not identify or discuss every conceivable alternative, including the particular alternatives propounded by the County, and need not be exhaustive, particularly where the various options lie along a continuum of possibilities (*see Matter of Halperin v City of New Rochelle*, 24 AD3d 768, 777). A rule of reason is applicable to the discussion of alternatives in an FEIS (*see Akpan v Koch*, 75 NY2d at 570). Where there has been such a reasonable consideration of alternatives, the judicial inquiry is at an end (*see Matter of Town of Dryden v Tompkins County Bd. of Representatives*, 78 NY2d 331, 333-334; *Matter of Halperin v City of New Rochelle*, 24 AD3d at 777.

The parties' remaining contentions either are without merit or have been rendered academic. SPOLZINO, J.P., RITTER, DILLON and DICKERSON, JJ., concur.

ENTER:

James Edward Pelzer

Clerk of the Court

Appendix E

CDM

Field Completion Memorandum

To: *File*

From: *Dwight Dunk, PWS*

Date: *May 30, 2008*

Subject: *Field Reconnaissance for the Village of Kiryas Joel Connection to the Catskill Aqueduct*

CDM wetland scientists (Dwight Dunk, PWS, Laura Burbage, Kelly Simmons and Danielle Lemoi) conducted field reconnaissance on April 3 and April 4, 2008 and again on April 30 and May 1, 2008 (D. Dunk and D. Lemoi only during second reconnaissance trip) to provide greater detail on the nature and extent of wetlands, within the rights-of-way, that could potentially be disturbed by the construction of a water main connection to the Village of Kiryas Joel from the Catskill Aqueduct. Information obtained during field reconnaissance will be used to ensure that the design and installation of a water main for the Village of Kiryas Joel will avoid and minimize wetland impacts in accordance with the federal "no net loss" policy.

CDM staff walked the entire length of two alternative water main routes generally described as follows:

<u>Route 32 or Eastern Route (Alternative 1on the wetland maps)</u> – This is a 12.5 mile route beginning at the New Windsor Water Treatment Plant Catskill Aqueduct connection on Riley Road and continuing to County Route (CR) 94 to CR 32 to CR 44, terminating at an undeveloped lot in the Village of Kiryas Joel south of Seven Springs Road (CR 44) and west of Bakertown Road. The land use along this route is a mix of residential, rural and commercial development, with the majority of the alternative supporting residential land use.

<u>Route 94/27 or Western Route (Alternative 2 on the wetland maps)</u> – This 13 mile route begins at the New Windsor Water Treatment Plant Catskill Aqueduct connection on Riley Road and continues to CR 94 to CR 27 to CR208 to CR 17 to Shunnemunk Road in the Village of Kiryas Joel, terminating at the site of the existing water treatment plant on Berdichev Road. Land use along this route is a mixture of residential and rural with discrete pockets of commercial development.

Methodology

Two person teams were assigned to each route. CDM wetland scientists determined the upland/wetland boundary in accordance with the U.S. Army Corps of Engineers (the Corps), as described in the Corps Wetlands Delineation Manual (TR Y-87-1), using vegetation, soils and indicators of wetland hydrology. Wetlands within the roadway rights-of-way were demarcated where the plant community is comprised of wetland indicator species (50% or more by visual inspection) and where the wetland plant community includes hydric soils and indicators of wetland hydrology are observable. The limit of the wetland was demarcated where one or more of these three parameters ceased to exist. Definitions of each of these parameters and their corresponding indicators are listed below. Wetland boundary points were recorded at the limits of the of each wetland area.

Wetland vegetation: Wetland plants are species adapted for life in anaerobic soil conditions. The USFWS rates plants as OBL, FACW, FAC, FACU or UPL per the National List of Plant Species that Occur in Wetlands: Northeast (Region1) U.S. Fish and Wildlife Service, May 1988. The limit of a wetland plant community extends to the limit of dominant plant coverage (50% of more by areal cover) rated as OBL, FACW, or FAC.

Hydric or Wetland soils: Hydric soils can be mineral or organic soils that formed in saturated conditions, or where flooding or ponding occurs long enough during the growing season to develop anaerobic conditions in the upper part of the soil horizon, generally within the root zone; hydric (mineral) soil indicators include the presence of a gray color and/or mottles immediately below the surface or thick, dark surface layers overlaying a gray or mottled subsurface, and hydric (organic) soils indicators include more than 50 percent (by volume) of the upper 32 inches of soil is composed of organic soil material.

Wetland hydrology: These characteristics show the movement, distribution or quantity of water in areas that are periodically inundated or have soils saturated to the surface at some time during the growing season; indicators include, but are not limited to, drainage patterns, drift lines, watermarks, sediment deposition and visual observation of inundated and/or saturated soils.

CDM staff recorded observations of the wetland and surrounding environment in field notebook(s) and recorded the coordinates of each wetland boundary point using hand-held Global Position System (GPS) units (Trimble Geo XT, 2005 Series Pocket PC). Only the boundaries abutting the roadway were documented and recorded.

The attached figures depict maps of the alignments based on the Orange County Geographic Information System (GIS) data, recent aerial photography of the area and the field collected GPS points. The approximate wetland resource boundaries are depicted on figures 1 through 10, attached.

Results

<u>Route 32 or Eastern Route (Alternative 1 on the wetlands maps)</u>

Thirty-eight wetland units were identified along this water main route. Wetlands are present on both sides of the roadway and most commonly are associated with stream channels or drainage ditches. Moodna Creek is located immediately to the west of Route 32, for an approximately 1.8 mile stretch between Route 20 and Juenger Road. The river's floodplain is wide and in places extends nearly up to the road. Although floodplains often exhibit some wetland characteristics, only those areas which exhibit all three wetland parameters were identified as wetlands. Only those wetland resources located within or immediately adjacent to the assumed rights-of-way were recorded by GPS survey methods. Table 1 summarizes the wetland types identified along this water main route.

Table 1. Wetland Summary Along Route 32 (Eastern Route) Water Main Alignment

Wetland ID	Wetland Classification	Notes
1-1	PFO	-
1-2	PFO	-
1-3	PFO	-
1-4	PFO	-
1-5	PFO	-
1-6	PFO	
1-7	PFO	
1-8		Stream Channel
1-9		Stream Channel
1-10		Stream Channel
1-11	PFO	
1-12		Stream Channel
1-13		Stream Channel
1-14	PFO	
1-15		Stream Channel
1-16		Stream Channel
1-17	PEM	Private Property
1-18	PEM	Private Property
1-19	PFO	
1-20		Stream Channel
1-100	PEM, PFO	
1-101	PSS	
1-102	PFO, PSS	
1-103	PFO	
1-104	PEM	
1-105	PEM	
1-106		Stream Channel
1-107		Stream Channel
1-108	PFO	

1-109	PFO, PEM	
1-110	PFO, PSS, PEM	
1-111	PEM, PFO	
1-112		Stream Channel
1-113		Stream Channel
1-114		Stream Channel
1-115	PFO	
1-116	PFO	
1-117	PFO	
1-118	PEM, PSS	
1-119	PFO	
1-120	PSS	
1-121	PSS	
1-122		Stream Channel
1-123	PFO	
1-124	PFO	
1-125	PFO	
1-126	PFO	Small pond in wetland

Route 94/27 or Western Route (Alternative 2 on the Wetland maps)

There were 51 wetland units identified along the Route 94/27 water main alignment. These units were identified on both sides of the roadway and were located within or adjacent to the assumed rights-of-way. Table 2 summarizes the types of wetlands located this water main route.

Table 2. Wetland Summary Along Route 94/27 (Western Route) Water Main Alignment

Wetland ID:	**Wetland Classification:**	**Notes:**
2-1	PSS, PEM	Bordering stream
2-2	PSS	
2-3	PEM	
2-4	PEM	
2-5	PFO	
2-6	PSS	
2-7	PFO	
2-8	PFO	
2-9		Stream channel
2-10		Stream channel
2-11		Stream channel
2-12	PFO	
2-13	PSS	
2-14		Pond
2-15	PFO	

2-16		Stream channel
2-17	PFO, PEM	Large complex with stream flow into unit
2-18	PFO, PSS	
2-19	PFO	
2-20	PFO, PSS	
2-21	PEM, PSS	
2-22	PFO	Private Property
2-23	PEM	Private Property
2-24	PEM	Private Property
2-25	PFO	
2-26		Outside ROW
2-27		Private Property
2-28		Private Property
2-29		Stream channel
2-30	PFO	
2-31	PEM	
2-32	PFO, PSS, PEM	
2-33	PFO	
2-34	PSS, PEM	
2-35		Stream channel
2-36		Stream channel
2-37	PEM, PFO	
2-38	PEM, PFO	
2-39	PEM	
2-40	PEM, PSS	
2-41	PSS	
2-42	PEM	
2-43	PEM, PSS, PFO	
2-44	PFO	
2-45	PEM	
2-46		Pond
2-47		Stream channel
2-48		Stream channel
2-49	PFO	
2-50	PFO	
2-51	PFO	

Please note that drainage ditches and stream channels are prevalent along both alternative water main routes but were not always associated with wetland resources. Many of the culverts not associated with wetland but which convey flow under the roadway were also located using GPS during the wetland reconnaissance.

There were three types of wetlands identified along both alternative routes, palustrine forested (PFO), palustrine emergent (PEM), and palustrine scrub / shrub (PSS). Palustrine forested wetlands are predominantly red maple (*Acer rubrum*) swamps that support species such as elms (*Ulmus* spp.), dogwoods (*Cornus* spp.), and ash (*Fraxinus* spp.) in the tree layer; with multiflora rose (*Rosa multiflora*), pussy willow (*Salix discolor*), honeysuckle (*Lonicera* spp.), and arrowwood (*Viburnum recognitum*) in the shrub layer with skunk cabbage (*Symplocarpus foetidus*) and sensitive fern (*Onoclea sensibilis*) in the herbaceous layer. Palustrine emergent wetlands are predominantly cattail (*Typha latifolia*) marshes or common reed (*Phragmites australis*) dominated marshes , and with species such as purple loostrife (*Lythrum salicaria*), reed canary grass (*Phalaris arundinacea*), and tussock sedge (*Carex stricta*) also found in emergent wetlands. Palustrine scrub / shrub wetlands are populated by trees saplings and shrubs including such species as dogwood (*Cornus stolonifera* and *C. ammomum*) , pussy willow (*Salix discolor*), and multiflora rose.

Conclusions

Wetlands were observed along both sides of the roadways, many along the toe-of-slope while others were located beyond the limits of the assumed rights-of-way. All wetlands located on the figures are within or immediately adjacent to the assumed rights-of-way. Note there are wetland areas beyond the limits of the rights-of-way, however, water main construction will occur within the rights-of-way and therefore direct impacts of those wetlands will be avoided. It appears as though there is sufficient room within the rights-of-way to complete construction of the proposed water main without direct alteration of the vegetated wetlands.

CDM

Figure 1
Village of Kiryas Joel Catskill Aqueduct Connection Amended EIS - Refined Wetland Location
Orange County, NY

Legend

- Alternative 1 —— Wetlands Lines 1 ▨ Wetlands *
- Alternative 2 —— Wetlands Lines 2
- Culvert —+— Railroads
- —— Roads

* Source:
New York State Department of Environmental Conservation

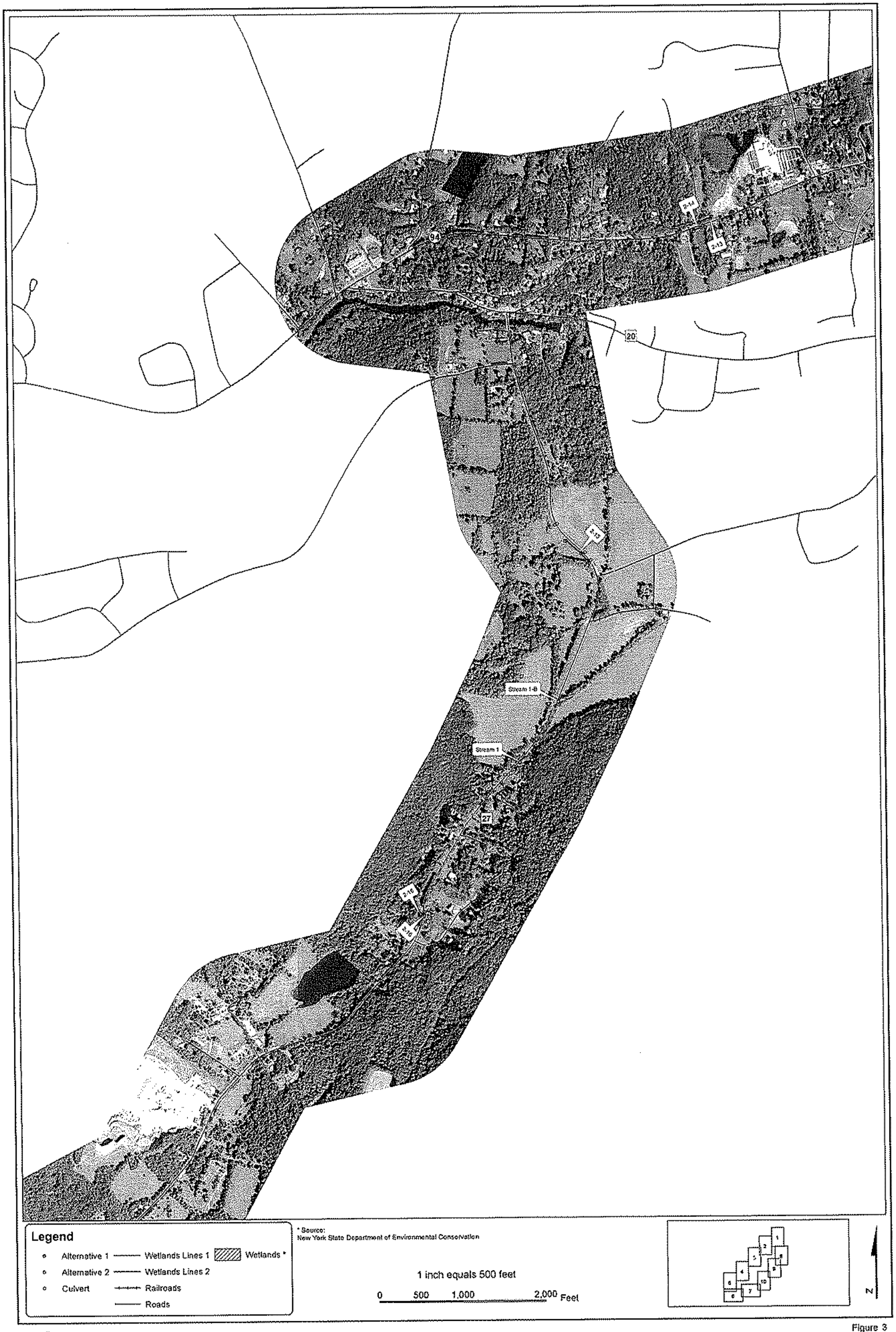
1 inch equals 500 feet

0 500 1,000 2,000 Feet

N

CDM

Figure 2
Village of Kiryas Joel Catskill Aqueduct Connection Amended EIS - Refined Wetland Location
Orange County, NY

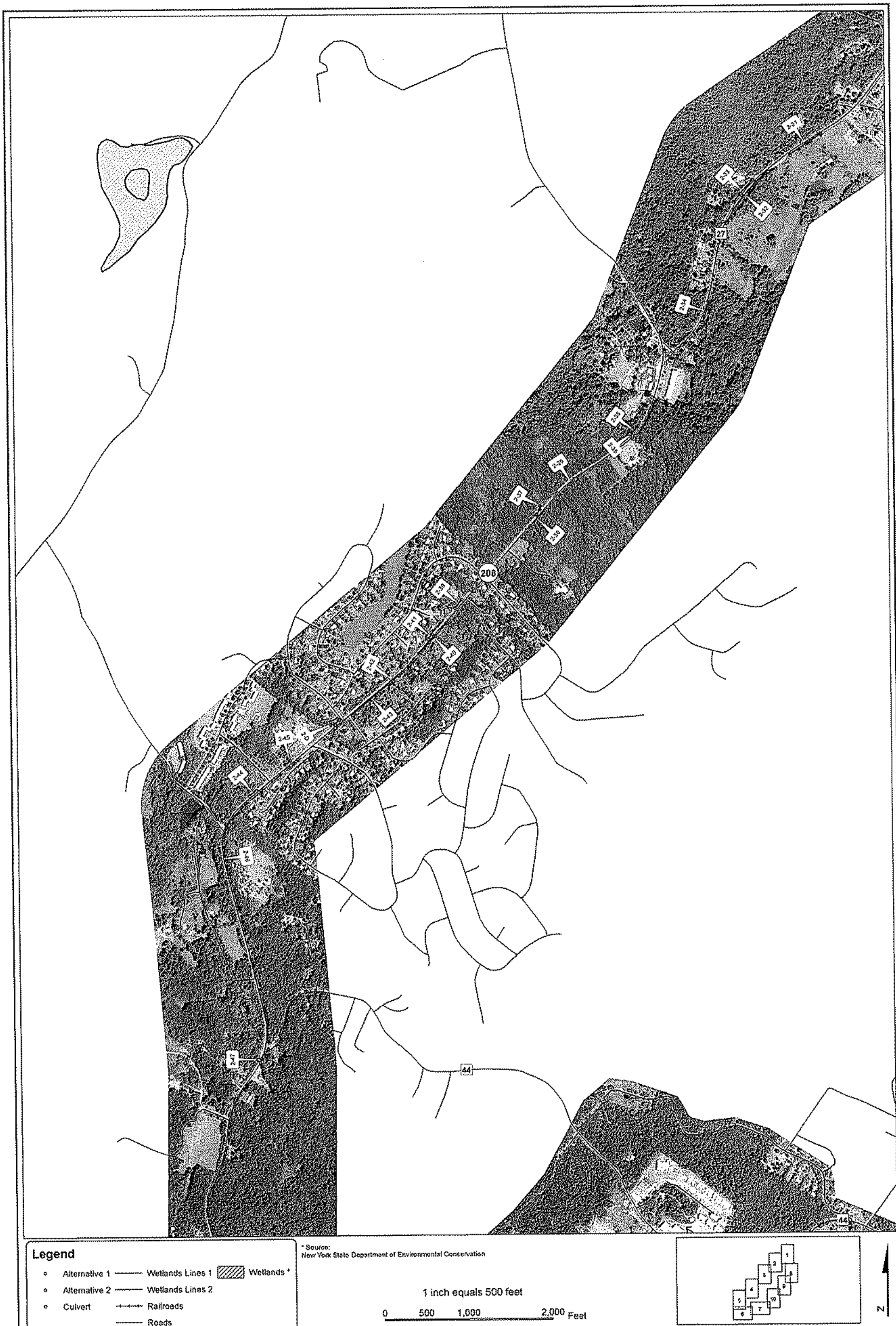


CDM

Figure 3
Village of Kiryas Joel Catskill Aqueduct Connection Amended EIS - Refined Wetland Location
Orange County, NY

CDM

Figure 4
Village of Kiryas Joel Catskill Aqueduct Connection Amended EIS - Refined Wetland Location
Orange County, NY



CDM

Figure 5
Village of Kiryas Joel Catskill Aqueduct Connection Amended EIS - Refined Wetland Location
Orange County, NY

CDM

Figure 6
Village of Kiryas Joel Catskill Aqueduct Connection Amended EIS - Refined Wetland Location
Orange County, NY

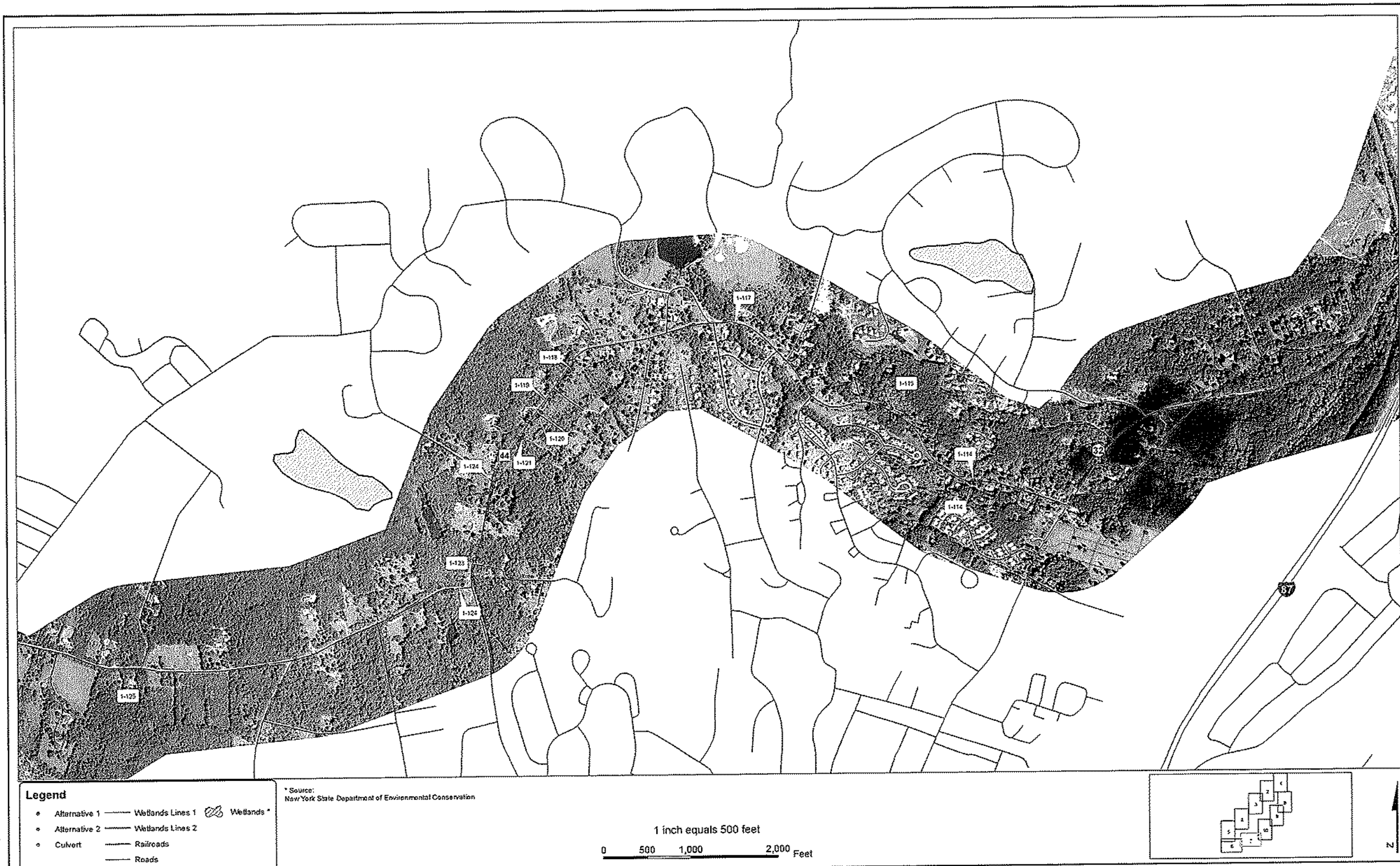
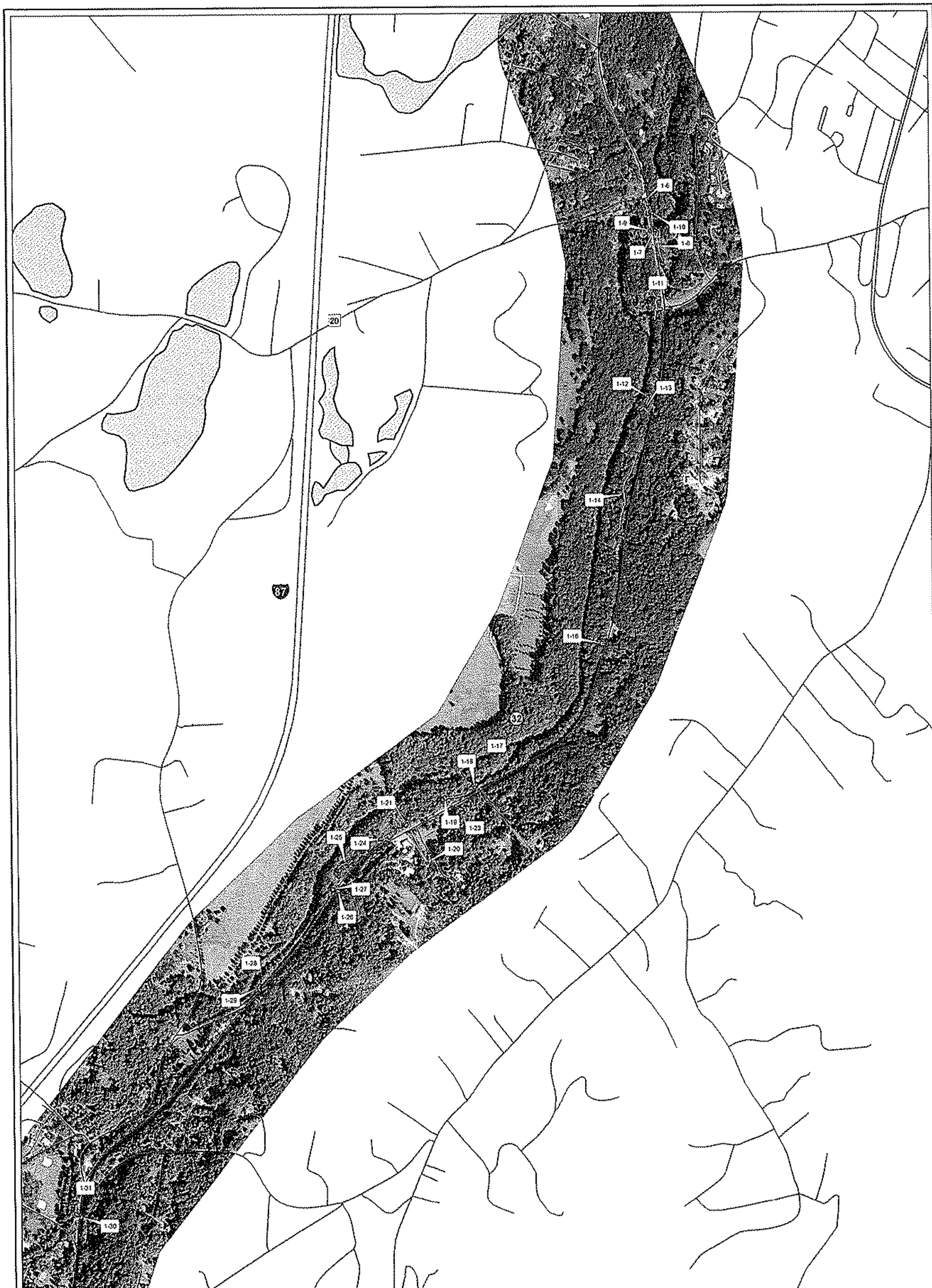


Figure 7
Village of Kiryas Joel Catskill Aqueduct Connection Amended EIS - Refined Wetland Location
Orange County, NY

CDM



Legend

- Alternative 1 — Wetlands Lines 1 — Wetlands *
- Alternative 2 — Wetlands Lines 2
- Culvert — Railroads
- Roads

* Source:
New York State Department of Environmental Conservation

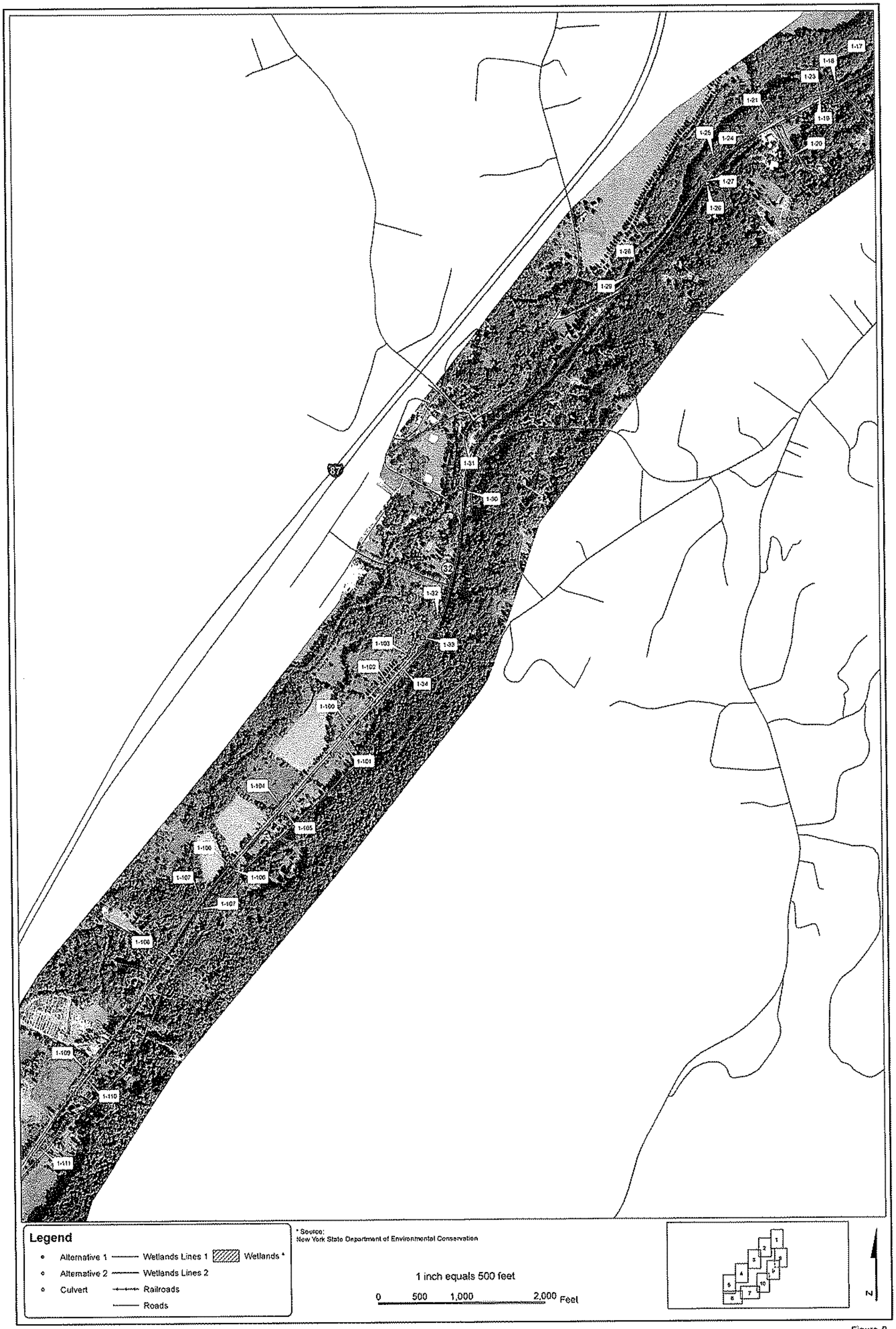
1 inch equals 500 feet

0 500 1,000 2,000 Feet

N

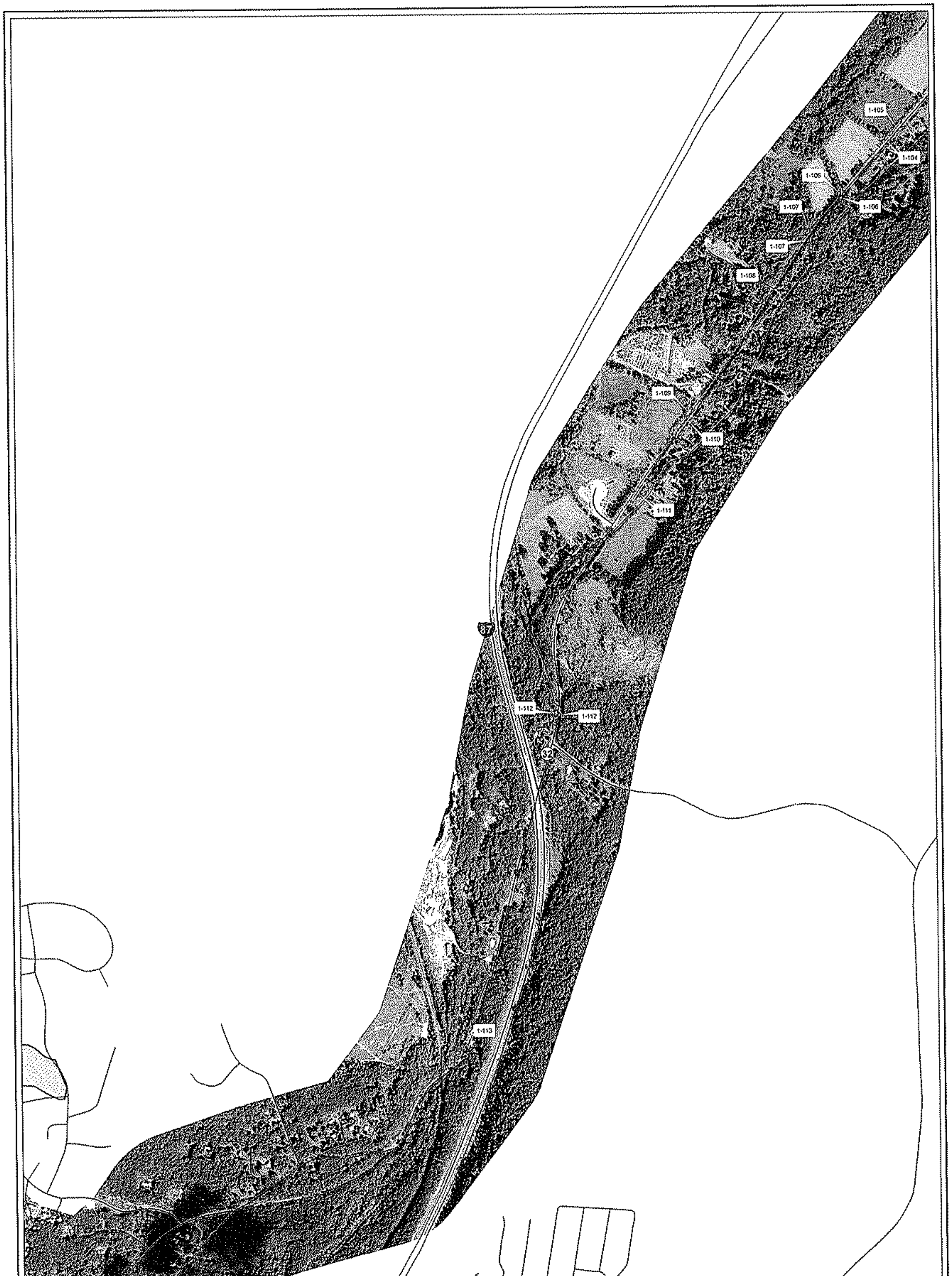
CDM

Figure 8
Village of Kiryas Joel Catskill Aqueduct Connection Amended EIS - Refined Wetland Location
Orange County, NY



CDM

Figure 9
Village of Kiryas Joel Catskill Aqueduct Connection Amended EIS - Refined Wetland Location
Orange County, NY



CDM

Figure 10
Village of Kiryas Joel Catskill Aqueduct Connection Amended EIS - Refined Wetland Location
Orange County, NY

Appendix F

GS

INTER-OFFICE MEMORANDUM

ORANGE COUNTY DEPARTMENT OF PUBLIC WORKS –

DIVISION OF ENVIRONMENTAL FACILITIES AND SERVICES

TO: Peter S. Hammond, Deputy Commissioner

FROM: Anthony R. Griffin, P.E., Principal Sanitary Engineer

DATE: October 24, 2008

SUBJECT: Harriman Sewage Treatment Plant Monthly Flow Reports for May 2008 through September 2008.

Dear Mr. Hammond:

The following is attached for your information and use:

1. "Existing Flow into the Harriman Sewage Treatment Plant", for the Months of May 2008 through September 2008.

If you have any questions or comments, please do not hesitate to contact me.

Attach.
cc:Edward A. Diana, County Executive
M. William Lahey, Chairman of O.C. Legislators
Michael D. Paduch, Chair. Physical Services Committee
Edmund A. Fares, P.E., Commissioner
Jim Jusvig, Harriman STP Chief Plant Operator, CAMO
David Darwin, County Attorney
Gregory W. Townsend, O.C. Legislator, District 7
Michael Amo, O.C. Legislator, District 1
Sandy Leonard, Supervisor, Town of Monroe
John M. Karl III, Mayor, Village of Monroe
Philip Salerno, P.E., MBJOMC Administrator
Stephen H. Welle, Mayor, Village of Harriman
Abraham Weider, Mayor, Village of Kiryas Joel
[redacted]
Robert Jeroloman, Mayor, Village of S. Blooming Grove
Stephanie Berean-Weeks, Mayor, Village of Woodbury
G. Bruce Chichester, Trustee, Village of Harriman
Stephen M. Neuhaus, Town of Chester
Philip Valastro, Mayor, Village of Chester
Henry Christensen, Esq., Moodna Attorney
File

ORANGE COUNTY DEPARTMENT OF PUBLIC WORKS -
DIVISION OF ENVIRONMENTAL FACILITIES AND SERVICES
EXISTING FLOW INTO THE 6.0 MGD
HARRIMAN SEWAGE TREATMENT PLANT
REPORT DATE OF May 31, 2008

	2007 JUN	JUL	AUG	SEP	OCT	NOV	DEC	2008 JAN	FEB	MAR	APR	MAY	Total	12 MONTH AVG. ENDING 31-May-08	PRESENT LIMIT	REMAINING AVAILABLE BALANCE
RAIN IN INCHES	2.68	4.46	4.73	0.82	5.60	2.82	5.88	1.55	8.05	5.90	2.64	3.57	48.70			
VILLAGE OF CHESTER	298,273	289,163	256,836	256,500	284,393	279,066	357,072	325,774	401,775	412,909	266,279	430,557		321,550	347,000	25,450
TOWN OF CHESTER	225,148	253,809	305,299	262,752	266,880	275,297	292,743	262,738	272,333	299,549	265,697	278,676		271,743	410,000	138,257
TOWN OF MONROE	129,741	104,844	58,706	85,280	87,628	86,297	88,930	100,699	108,033	90,085	118,561	101,235		96,670	133,000	36,330
TOWN OF BLOOMING GROVE	221,060	214,248	215,897	198,163	219,061	260,817	359,913	321,232	363,966	387,421	294,403	286,484		278,555	490,000	211,445
TOWN OF WOODBURY	622,003	603,213	652,413	580,417	598,542	681,773	854,723	862,197	1,163,128	1,185,887	751,923	706,845		771,922	635,000	(136,922)
MOODNA TOTAL	1,496,225	1,465,277	1,489,151	1,383,112	1,456,504	1,583,250	1,953,381	1,872,640	2,309,235	2,375,851	1,696,863	1,803,797		1,740,441	2,015,000	274,560
OCSD#1	1,995,775	1,993,723	2,436,849	2,160,888	2,359,496	2,739,750	3,561,619	3,205,360	4,033,765	3,663,149	2,402,137	2,300,203		2,737,726	3,985,000	1,247,274
HSTP TOTAL	3,492,000	3,459,000	3,926,000	3,544,000	3,816,000	4,323,000	5,515,000	5,078,000	6,343,000	6,039,000	4,099,000	4,104,000		4,478,167	6,000,000	1,521,833

ORANGE COUNTY DEPARTMENT OF PUBLIC WORKS -
DIVISION OF ENVIRONMENTAL FACILITIES AND SERVICES
EXISTING FLOW INTO THE 6.0 MGD
HARRIMAN SEWAGE TREATMENT PLANT
REPORT DATE OF June 30, 2008

	2007 JUL	AUG	SEP	OCT	NOV	DEC	2008 JAN	FEB	MAR	APR	MAY	JUN	Total	12 MONTH AVG. ENDING 30-Jun-08	PRESENT LIMIT	REMAINING AVAILABLE BALANCE
RAIN IN INCHES	4.46	4.73	0.82	5.60	2.82	5.88	1.55	8.05	5.90	2.64	3.57	2.54	48.56			
VILLAGE OF CHESTER	289,163	256,836	256,500	284,393	279,066	357,072	325,774	401,775	412,909	266,279	430,557	380,057		328,365	347,000	18,635
TOWN OF CHESTER	253,809	305,299	262,752	266,880	275,297	292,743	262,738	272,333	299,549	265,697	278,676	233,131		272,409	410,000	137,591
TOWN OF MONROE	104,844	58,706	85,280	87,628	86,297	88,930	100,699	108,033	90,085	118,561	101,235	136,212		97,209	133,000	35,791
TOWN OF BLOOMING GROVE	214,248	215,897	198,163	219,061	260,817	359,913	321,232	363,966	387,421	294,403	286,484	223,607		278,768	490,000	211,232
TOWN OF WOODBURY	603,213	652,413	580,417	598,542	681,773	854,723	862,197	1,163,128	1,185,887	751,923	706,845	585,090		768,846	635,000	(133,846)
MOODNA TOTAL	1,465,277	1,489,151	1,383,112	1,456,504	1,583,250	1,953,381	1,872,640	2,309,235	2,375,851	1,696,863	1,803,797	1,558,097		1,745,597	2,015,000	269,404
OCSD#1	1,993,723	2,436,849	2,160,888	2,359,496	2,739,750	3,561,619	3,205,360	4,033,765	3,663,149	2,402,137	2,300,203	2,006,903		2,738,654	3,985,000	1,246,347
HSTP TOTAL	3,459,000	3,926,000	3,544,000	3,816,000	4,323,000	5,515,000	5,078,000	6,343,000	6,039,000	4,099,000	4,104,000	3,565,000		4,484,250	6,000,000	1,515,750

ORANGE COUNTY DEPARTMENT OF PUBLIC WORKS -
DIVISION OF ENVIRONMENTAL FACILITIES AND SERVICES
EXISTING FLOW INTO THE 6.0 MGD
HARRIMAN SEWAGE TREATMENT PLANT
REPORT DATE OF July 31, 2008

	2007 AUG	SEP	OCT	NOV	DEC	2008 JAN	FEB	MAR	APR	MAY	JUN	JUL	Total	12 MONTH AVG. ENDING 31-Jul-08	PRESENT LIMIT	REMAINING AVAILABLE BALANCE
RAIN IN INCHES	4.73	0.82	5.60	2.82	5.88	1.55	8.05	5.90	2.64	3.57	2.54	2.54	46.64			
VILLAGE OF CHESTER	256,836	256,500	284,393	279,066	357,072	325,774	401,775	412,909	266,279	430,557	380,057	378,332		335,796	347,000	11,204
TOWN OF CHESTER	305,299	262,752	266,880	275,297	292,743	262,738	272,333	299,549	265,697	278,676	233,131	222,800		269,825	410,000	140,175
TOWN OF MONROE	58,706	85,280	87,628	86,297	88,930	100,699	108,033	90,085	118,561	101,235	136,212	144,238		100,492	133,000	32,508
TOWN OF BLOOMING GROVE	215,897	198,163	219,061	260,817	359,913	321,232	363,966	387,421	294,403	286,484	223,607	216,674		278,970	490,000	211,030
TOWN OF WOODBURY	652,413	580,417	598,542	681,773	854,723	862,197	1,163,128	1,185,887	751,923	706,845	585,090	542,065		763,750	635,000	(128,750)
MOODNA TOTAL	1,489,151	1,383,112	1,456,504	1,583,250	1,953,381	1,872,640	2,309,235	2,375,851	1,696,863	1,803,797	1,558,097	1,504,109		1,748.833	2,015,000	266,168
OCSD#1	2,436,849	2,160,888	2,359,496	2,739,750	3,561,619	3,205,360	4,033,765	3,663,149	2,402,137	2,300,203	2,006,903	2,042,891		2,742,751	3,985,000	1,242,249
HSTP TOTAL	3,926,000	3,544,000	3,816,000	4,323,000	5,515,000	5,078,000	6,343,000	6,039,000	4,099,000	4,104,000	3,565,000	3,547,000		4,491,583	6,000,000	1,508,417

ORANGE COUNTY DEPARTMENT OF PUBLIC WORKS -
DIVISION OF ENVIRONMENTAL FACILITIES AND SERVICES
EXISTING FLOW INTO THE 6.0 MGD
HARRIMAN SEWAGE TREATMENT PLANT
REPORT DATE OF August 31, 2008

	2007 SEP	OCT	NOV	DEC	2008 JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	Total	12 MONTH AVG. ENDING 31-Aug-08	PRESENT LIMIT	REMAINING AVAILABLE BALANCE
RAIN IN INCHES	0.82	5.60	2.82	5.88	1.55	8.05	5.90	2.64	3.57	2.54	2.54	3.15	45.06			
VILLAGE OF CHESTER	256,500	284,393	279,066	357,072	325,774	401,775	412,909	266,279	430,557	380,057	378,332	422,406		349,593	347,000	(2,593)
TOWN OF CHESTER	262,752	266,880	275,297	292,743	262,738	272,333	299,549	265,697	278,676	233,131	222,800	218,254		262,571	410,000	147,429
TOWN OF MONROE	85,280	87,628	86,297	88,930	100,699	108,033	90,085	118,561	101,235	136,212	144,238	149,112		108,026	133,000	24,974
V. OF S. BLOOMING GROVE	198,163	219,061	260,817	359,913	321,232	363,966	387,421	294,403	286,484	223,607	216,674	206,935		278,223	490,000	211,777
VILLAGE OF WOODBURY	580,417	598,542	681,773	854,723	862,197	1,163,128	1,185,887	751,923	706,845	585,090	542,065	527,074		753,305	635,000	(118,305)
MOODNA TOTAL	1,383,112	1,456,504	1,583,250	1,953,381	1,872,640	2,309,235	2,375,851	1,696,863	1,803,797	1,558,097	1,504,109	1,523,781		1,751,718	2,015,000	263,282
OCSD#1	2,160,888	2,359,496	2,739,750	3,561,619	3,205,360	4,033,765	3,663,149	2,402,137	2,300,203	2,006,903	2,042,891	2,141,219		2,718,115	3,985,000	1,266,885
HSTP TOTAL	3,544,000	3,816,000	4,323,000	5,515,000	5,078,000	6,343,000	6,039,000	4,099,000	4,104,000	3,565,000	3,547,000	3,665,000		4,469,833	6,000,000	1,530,167

ORANGE COUNTY DEPARTMENT OF PUBLIC WORKS -
DIVISION OF ENVIRONMENTAL FACILITIES AND SERVICES
EXISTING FLOW INTO THE 6.0 MGD
HARRIMAN SEWAGE TREATMENT PLANT
REPORT DATE OF September 30, 2008

	2007 OCT	NOV	DEC	2008 JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	Total	12 MONTH AVG. ENDING 30-Sep-08	PRESENT LIMIT	REMAINING AVAILABLE BALANCE
RAIN IN INCHES	5.60	2.82	5.88	1.55	8.05	5.90	2.64	3.57	2.54	2.54	3.15	6.49	50.73			
VILLAGE OF CHESTER	284,393	279,066	357,072	325,774	401,775	412,909	266,279	430,557	380,057	378,332	422,406	424,432		363,588	347,000	(16,588)
TOWN OF CHESTER	266,880	275,297	292,743	262,738	272,333	299,549	265,697	278,676	233,131	222,800	218,254	257,734		262,153	410,000	147,847
TOWN OF MONROE	87,628	86,297	88,930	100,699	108,033	90,085	118,561	101,235	136,212	144,238	149,112	121,800		111,069	133,000	21,931
V. OF S. BLOOMING GROVE	219,061	260,817	359,913	321,232	363,966	387,421	294,403	286,484	223,607	216,674	206,935	231,437		280,996	490,000	209,004
VILLAGE OF WOODBURY	598,542	681,773	854,723	862,197	1,163,128	1,185,887	751,923	706,845	585,090	542,065	527,074	621,497		756,729	635,000	(121,729)
MOODNA TOTAL	1,456,504	1,583,250	1,953,381	1,872,640	2,309,235	2,375,851	1,696,863	1,803,797	1,558,097	1,504,109	1,523,781	1,656,900		1,774,534	2,015,000	240,466
OCSD#1	2,359,496	2,739,750	3,561,619	3,205,360	4,033,765	3,663,149	2,402,137	2,300,203	2,006,903	2,042,891	2,141,219	2,474,100		2,744,216	3,985,000	1,240,784
HSTP TOTAL	3,816,000	4,323,000	5,515,000	5,078,000	6,343,000	6,039,000	4,099,000	4,104,000	3,565,000	3,547,000	3,665,000	4,131,000		4,518,750	6,000,000	1,481,250

Appendix G

The Legislature of Rockland County

Ilan S. Schoenberger
County Legislator
Chair – Budget and Finance Committee

March 3, 2005

Hon. Abraham Wieder
Mayor, Village of Kiryas Joel
Municipal Building
51 Forest Road
P.O. Box 566
Monroe, NY 10950

RE: Proposed Village of Kiryas Joel Water Supply Pipeline

Dear Mayor Wieder:

As a Legislator from Rockland County, as well as a member of the Rockland County Solid Waste Management Authority, I welcome the opportunity to comment upon the Village of Kiryas Joel's proposed aqueduct project and the beneficial affects it will have on the Ramapo River, the County of Rockland and the Town of Ramapo.

I read the September 5, 2004 edition of the *Journal News* article entitled *Lifeline to Millions,* which discussed the impact of the Ramapo River to the many communities where it traverses Rockland and Orange counties and Northern New Jersey.

As you are no doubt aware, much of the potable water in Rockland County, and particularly in the Town of Ramapo, part of which I represent and where I reside, is the Ramapo River. I am also aware of the need to replenish the watershed and for responsible watershed management. I have been advised that the proposed pipeline project by the Village of Kiryas Joel from the New York City Aqueduct, will result in additional water resources being introduced into the Ramapo River watershed. This will result in a positive benefit to those of us who rely upon the Ramapo River as our source of water supply.

In addition, Rockland County has experienced periods of drought, during which water from Rockland County was diverted to the State of New Jersey by United Water. I have been advised, that increased flow to the Ramapo River from the Kiryas Joel water supply pipeline project will help alleviate water shortage in Rockland County, particularly during times of drought.

I look forward to working with the Village of Kiryas Joel, and you as Mayor, to ensure that the interests of all communities affected will be enhanced and benefited by the Village of Kiryas Joel's water supply pipeline project to benefit the entire area and preserve the natural resources that we all share.

Very truly yours,

Ilan S. Schoenberger

ILAN S. SCHOENBERGER
County Legislator

ISS/cs

RA4050

The Legislature of Rockland County

PHILIP SOSKIN
Legislator - District 7

Multi-Services Committee
Government Operations Committee
Vice-Chair, Special Committee on Transportation

Tax Delinquency Subcommittee
Rockland County Solid Waste
Management Authority

March 14, 2005

Mayor Abraham Wieder
Village of Kiryas Joel
P.O. Box 5666
Monroe, NY 10949

Dear Mayor Wieder:

I am writing in support of the Village of Kiryas Joel's proposed tap into the New York City Aqueduct system that is now being evaluated by the New York City Department of Environmental Protection (DEP).

I understand that Kiryas Joel is applying for this tap by right, under an agreement signed in 1905, by New York City that allows host-counties to tap into the aqueduct. Over the past century this agreement provided a steady water supply for seventy-four communities along the pipeline route.

As a Rockland County Legislator I want to lend my full-fledged support to your proposed project. As my fellow Legislators and I see it the implementation of this project will go a long way to augment Rockland County's water supply. You may be aware that Rockland County's main water source is the Ramapo River, which flows from Orange to Rockland County and into the State of New Jersey.

Communities along its banks draw their water supply from it and return it. Your Village, however, is proposing an innovative step. It proposes to bring 2 million gallons of water per day from the New York City Aqueduct, treat it in the Village's state-of-the-art water filtration plant and deposit it in the Ramapo River.. Your Village's proposed project will thus be a boon to the water supply of Rockland County and beyond.

Sincerely,

Philip Soskin

PHILIP SOSKIN
Legislator District 7

RA4051

The Legislature of Rockland County

WILLIAM L. DARDEN
Legislator - District 8

Majority Leader

Vice-Chair, Planning & Public Works Committee
Budget & Finance Committee

Special Committee on Rules
Chair, Subcommittee on Naming
County Owned Buildings

March 16, 2005

Hon. Abraham Wieder, Mayor
Village of Kiryas Joel
Municipal Building
51 Forest Road
P.O. Box 566
Kiryas Joel, New York 10950

Dear Mayor Wieder:

I am writing to express my support of the Village of Kiryas Joel's proposed tap into the New York City Aqueduct system, which is currently being evaluated by the New York City Department of Environmental Protection (DEP).

It is my understanding that Kiryas Joel is applying for this by the right, under an agreement signed in 1905 by New York City that allows host counties to tap into the aqueduct. Seventy-four communities along the pipeline route have been provided with a steady water supply over the past century due to this agreement.

As the Majority Leader of the Rockland County Legislature, I offer my support to the Village of Kiryas Joel in its endeavor to implement this project. Along with my fellow Legislators, I view this project to go a long way to supplement Rockland County's water supply. You may be aware that Rockland County's main water source is the Ramapo River, which flows from Orange and Rockland County and into the State of New Jersey.

Communities along its banks draw their water supply from it and return it. The innovative approach that your village is proposing, to bring two million gallons of water per day from the New York City Aqueduct, treat it in the village's state of the art water filtration plant and deposit it in the Ramapo River. The Village of Kiryas Joel's proposed project will undoubtedly be a catalyst to the water supply of Rockland County and surrounding areas.

Sincerely yours,

William L. Darden
Majority Leader

WLD:ba

RA4052

The Legislature of Rockland County

ROBERT M. BERLINER
Legislator - District 6

Vice-Chairman of the Legislature

Chair, Special Committee on Rules
Budget & Finance Committee
Environmental Committee

Member, Rockland County Solid Waste
Management Authority
Liaison, Volunteer Counseling Services

March 15, 2005

Hon. Abraham Wieder
Mayor, Village of Kiryas Joel
Municipal Building
51 Forest Road
P. O. Box 566
Kiryas Joel, New York 10950

Dear Mayor Wieder:

I am writing in support of the Village of Kiryas Joel's proposed tap into the New York City Aqueduct system that is now being evaluated by the New York City Department of Environmental Protection (DEP).

I understand that Kiryas Joel is applying for this by the right, under an agreement signed in 1905, by New York City that allows host-counties to tap into the aqueduct. Over the past century this agreement provided a steady water supply for the seventy-four communities along the pipeline route.

As a Rockland County Legislator I want to lend my full support to your proposed project. As my fellow Legislators and I see it the implementation of this project will go a long way to augment Rockland County's water supply. You may be aware that Rockland County's main water source is the Ramapo River, which flows from Orange and Rockland County and into the State of New Jersey.

Communities along its banks draw their water supply from it and return it. Your Village, however, is proposing an innovative step. It proposes to bring 2 million gallons of water per day from the New York City Aqueduct, treat it in the Village's state-of-the-art water filtration plant and deposit it in the Ramapo River. Your Village's proposed project will thus be a boon to the water supply of Rockland County and beyond.

Sincerely,

Robert M. Berliner

ROBERT M. BERLINER
County Legislator

RMB/lm

RA4053

The Legislature of Rockland County

DAVID FRIED
County Legislator

March 15, 2005

Hon. Abraham Wieder, Mayor
Village of Kiryas Joel
Municipal Building
51 Forest Road
P. O. Box 566
Kiryas Joel, New York 10950

Dear Mayor Wieder:

I am writing in support of the Village of Kiryas Joel's proposed tap into the New York City aqueduct system that is now being evaluated by the New York City Department of Environmental Protection (DEP).

I have been informed that Kiryas Joel's application is based on a 1905 agreement with New York City that allows host-counties to tap into the aqueduct. Over the past century, this agreement has provided a steady water supply for the seventy-four communities along the aqueduct route.

As you are aware, Rockland County has a limited water supply. Our only supply is the rain which falls on Rockland. As such, the people and families of Rockland County have been forced by County government to endure significant drought restrictions, sometimes for several months at a time. It is critical that Rockland leaders support efforts which will augment our residents' access to expanded water resources. I have been advised that the application referenced above will be an affirmative step toward achieving such a goal. One of Rockland County's main water sources is the Ramapo River, which flows from Orange and Rockland Counties into the State of New Jersey.

Communities along the banks of the Ramapo River draw significant water from this source. It is my understanding that Kiryas Joel's proposal will bring an additional 2 million gallons of water per day from the New York City aqueduct, treat it in the Village's state-of-the-art water filtration plant, and then deposit it in the Ramapo River. Hence, the proposed project will thus expand the water supply available to the residents of Rockland County. Based on the information before me, I believe this plan to provide a significant benefit to Rockland County.

Sincerely,

DAVID FRIED
Deputy Majority Leader

DF/lm

Appendix H

2002-49

COUNTY OF ORANGE / Department of Law
GOVERNMENT CENTER, 255 Main Street
GOSHEN, NEW YORK 10924 TEL: (845) 291-3150

EDWARD A. DIANA
County Executive

CATHERINE M. BARTLETT
County Attorney

August 28, 2002

Comptroller of the State of New York
State Department of Audit and Control
State Office Building
Albany, New York

Re: Application of Orange County, New York for Permission for an Increase and Improvement to Orange County Sewer District No. 1.

To Whom It May Concern:

In accordance with Part 85 of Chapter III of 2 NYCRR, enclosed please find Orange County's Application for Permission to the State Comptroller for an increase and improvement to the facilities of Orange County Sewer District No. 1. The application concerns proposed enhancements to the Harriman Wastewater Treatment Plant, which will increase treatment capacity and efficiency, and add odor controls.

A certified copy of the resolution required by § 85.3(b)(1) is attached as Exhibit "O" to the Application, and the legal opinion of counsel required by § 85.3(b)(2) is attached to the Application as Exhibit "Q."

Should you have any questions or require additional information, please feel free to contact me.

Very truly yours,

DAVID L. DARWIN
Chief Assistant County Attorney

DLD:smw
Enc.

COUNTY OF ORANGE / Department of Law
GOVERNMENT CENTER, 255 Main Street
GOSHEN, NEW YORK 10924 TEL: (845) 291-3150

EDWARD A. DIANA
County Executive

CATHERINE M. BARTLETT
County Attorney

August 27, 2002

Orange County Legislature
255-275 Main Street
Goshen, New York 10924

Re: Application for Permission to the State Comptroller for the Increase and Improvement to the Harriman Wastewater Treatment Facility

Ladies and Gentlemen:

As you know, the Legislature at its August meeting approved the Application to the State Comptroller for permission to proceed with the proposed improvements to the Harriman Wastewater Treatment Plant. The applicable State regulations, (Part 85 of Chapter III of 2 NYCRR) require my opinion as to the matters set forth below. The State Comptroller may rely on such opinion as though it were addressed directly to him.

As Chief Assistant County Attorney, I have acted as legal counsel to the County and Orange County Sewer District No. 1 in connection with this application. In my capacity as legal counsel, I have examined the original or true and complete copies of the application and the exhibits and attachments attached and submitted therewith. I have reviewed original or true and complete copies of other documents and records necessary to render my opinion, including, but not limited to: the Constitution of the State of New York and relevant statutes, including Article 5-A of the New York State County Law, the State Environmental Quality Review Act ("SEQRA") and the regulations promulgated thereto; all resolutions of the Orange County Legislature pertaining to the Application; proof of publication of required notices; the Final Environmental Impact Statement and other documents required to be prepared and/or published and/or filed pursuant to SEQRA; maps and plans of the proposed project and the cost estimate and reports of the Orange County Sewer District No. 1 filed with the Orange County Legislature. Based on the foregoing, and the information provided to me by the Orange County Department of Environmental Facilities and Services, I advise you that in my opinion:

1. The Application contains all of the information required by applicable statutes and regulations.

2. The County, in relation to the increase and improvement to Orange County Sewer District No. 1 facilities for which the Comptroller's consent is sought, and the expenditure of funds therefore, has undertaken all actions and proceedings required by applicable provisions of law.

3. Said increase and improvement to the facilities of Orange County Sewer District No. 1 has been duly authorized by the County of Orange as required by statute except for: (i) obtaining the permission or consent of the Comptroller; (ii) the adoption of a resolution or resolutions for appropriations and funding after the Comptroller has granted such consent or permission; and (iii) any publication or notice required to be published after receipt of such consent or permission (e.g., publication of a bond resolution).

4. Neither other County Officials nor I are aware of any material pending or threatened lawsuits or claims relating to such increase and improvement for which the permission of the Comptroller is being sought.

5. Any assessments, charges or taxes to be levied and imposed to finance such expenditure of funds are authorized by statute and all necessary action has been taken by the County to authorize the imposition or levy of such assessments, charges or taxes. The foregoing is subject to the caveat that § 452 of the General Municipal Law requires a resolution after a public hearing on the establishment of sewer rents, and to the extent that such proceedings may be necessary, the are appropriately taken after the permission of the Comptroller is obtained.

Very truly yours,

DAVID L. DARWIN
Chief Assistant County Attorney

DLD:smw

cc - New York State Comptroller
Gail Sicina, Clerk of Legislature
Geoffrey Chanin, Counsel for Legislature
Michael Amo, Legislator
Melissa Bonacic, Legislator
Michael Pillmeier, Legislator
Harvey J. Burger, Legislator
Frank A. Fornario, Jr., Legislator
Patrick J. Berardinelli, Sr., Legislator
Spencer M. McLaughlin, Legislator
Dimitrios Lambros, Legislator
L. Stephen Brescia, Legislator
Bernard Winstanley, Legislator
M. William Lahey, Legislator
A. Alan Seidman, Chair of Legislature
Wayne A. Decker, Legislator
Roxanne L. Donnery, Legislator
George A. Green, Legislator
Leigh J. Benton, Legislator

Anthony R. Marino, Legislator
Bonnie Kraham, Legislator
Michael D. Paduch, Legislator
Jeffrey D. Berkman, Legislator
Thomas Pahucki, Legislator

COUNTY OF ORANGE

IN THE MATTER OF THE APPLICATION OF THE COUNTY OF ORANGE, NEW YORK FOR AN ORDER OF THE STATE COMPTROLLER GRANTING PERMISSION FOR THE INCREASE AND IMPROVEMENT OF FACILITIES OF ORANGE COUNTY SEWER DISTRICT NO. 1

TO: The Comptroller of the State of New York, State Department of Audit and Control, State Office Building, Albany, New York

The petition of Orange County respectfully shows:

First: That Orange County Sewer District No. 1 was established in 1970 by Resolution of the Orange County Legislature to serve the a portion of the southern area of the County; and

Second: That the Harriman Wastewater Treatment Plant ("HWWTP") was completed in 1978 for the purpose of serving Orange County Sewer District No. 1, with a treatment capacity of 2.0 million gallons per day (mgd); and

Third: That in 1978 the County of Orange and OCSD #1 entered into an intermunicipal agreement with the Towns of Monroe, Woodbury, Blooming Grove, Chester, and the Village of Chester, ("Moodna Basin Municipalities" or "Municipalities") (copies of which are annexed as **Exhibit "A"**) pursuant to which the Municipalities constructed a 2.0 mgd expansion to the HWWTP. Pursuant to said agreement the Municipalities were allocated 2.0 mgd of capacity and OCSD #1 was made responsible for the operation and maintenance of the combined treatment plant with a capacity of 4.0 mgd; and

Fourth: That in February, 2000, the County's SPEDES permit was modified to allow treatment of 4.5 mgd (a copy is annexed as **Exhibit "B"**); and

Fifth: The HWWTP has, in the past, consistently exceeded its permitted treatment capacity limits and effluent limits, and as a result, OCSD # 1 and the County of Orange have been the object of moratoria on new connections and sewer main extensions from 1986 to 1996; numerous orders on consent with the New York State Department of Environmental Conservation (DEC); and lawsuits over lack of capacity and permit violations; and

Sixth: OCSD #1 has made great strides in resolving the problems which caused the flow and effluent limitation violations and odor control problems; including extensive inflow and infiltration removal, and upgrading the treatment plant facilities;

Seventh: That the area within OCSD #1 has continued to grow and develop at a rapid rate, so that despite the significant accomplishments and improvements, the treatment capacity of HWWTP is inadequate and unable to serve the needs of OCSD #1, and the HWWTP is in need of enhancements and improvements to meet the needs of the OCSD #1 as well as to ensure continued compliance with flow and effluent limitations and to control odors; and

Eighth: That the DEC and the County have entered into a consent order that authorizes interim flow and effluent limitations pending the anticipated completion of the proposed increase and improvement, a copy of which is annexed hereto as **Exhibit "C"**; and

Ninth: Under the terms of a Stipulation and Order of the United States District Court, Southern District of New York, the County has implemented a schedule for the construction and completion of the aforesaid improvement and enhancements to the HWWTP, a copy of which is annexed hereto as "**Exhibit "D"**; and

Tenth: That the Administrative Head of OCSD #1 did submit to the Legislature a report (that describes the improvements, project costs, typical homeowner costs, etc.) to the Orange County Legislature, which consists of a Benefited Area Cost Estimate, a copy of which report is annexed hereto as **Exhibit "E"**; maps and plans of the proposed increase and improvement submitted as a separate **Exhibit "E-1"**; the "Harriman Wastewater Treatment Plant Upgrade Technical Specifications" submitted herewith as a separate **Exhibit "E-2"**; "Harrimant Wastewater Treatment Plant Preliminary Construction Cost Estimate" submitted herewith as a separate **Exhibit "E-3"**; and the Harriman Wastewater Treatment Plant Design Report" submitted herewith as a separate **Exhibit "E-4"**.

Eleventh: In February, 1999 the Orange County Legislature, with the concurrence of the New York State Department of Environmental Conservation, became lead agency for the project pursuant to the State Environmental Quality Review Act and the Regulations promulgated thereto. The project was determined to be a "Type I" action and in March, 1999 the Legislature gave the project a positive declaration, and approved a draft scoping document. Comments were accepted and a final scoping document was approved in May, 1999. A Draft Environmental Impact Statement was prepared, which was accepted by the Legislature in March, 2001. Following a public hearing and comment period, a Final Environmental Impact Statement was prepared, which was accepted by the Legislature on July 13, 2001 and a Findings Statement was adopted on August 10, 2001 (copies of the resolutions accepting the FEIS and adopting the Findings Statement are annexed hereto as **Exhibit "F"**); and

Twelfth: That the Orange County Legislature, upon receipt and consideration of the aforesaid report of the Administrative Head of OCSD #1, did call for a public hearing on the question, a copy of which resolution is annexed hereto as **Exhibit "G"**); and

Thirteenth: The notice of public hearing was duly published as required by law, copies of which proofs of publication are annexed hereto as **Exhibits "H," "I," "J," "K," "L" and "M"**; and

Fourteenth: That on June 5, 2002 at 7:00 p.m. a public hearing on the question was duly held at the Legislative Chambers located at the Orange County Government Center, 255-275 Main Street, Goshen, New York, a copy of which minutes are annexed hereto as **Exhibit "N"**; and

Fifteenth: That the Orange County Legislature directed that an application be prepared and submitted to the New York State Comptroller under Part 85 of Title 2 of the NYCRR, entitled "Application for Permission of the State Comptroller" and that upon completion of the public hearing, and upon review of the application, the Orange County Legislature has determined that the contents of the application are accurate and that the proposed improvements are in the public interest and will not constitute an undue burden on the properties which will bear the cost, and all real property to be assessed will be benefited by the proposed improvements and no benefited property has been excluded, a copy of which resolutions are annexed hereto as **Exhibit "O"**; and

Sixteenth: That the statements and information required by Part 85 are annexed hereto as **Exhibit "P"**; and

Seventeenth: That upon examination of all enclosed original documents, legal counsel has attached an opinion that conforms with § 85.5 of Part 85 (**Exhibit "Q"**); and

Eighteenth: That this application is made pursuant to § 268 of the County Law;

WHEREFORE, the Orange County Legislature, through its designee, Orange County Executive Edward Diana, pursuant to Article 5-A of the County Law, respectfully prays and requests:

1. Approval of the Increase and Improvement of the Facilities of Orange County Sewer District No. 1 at a cost not to exceed $26,000,000.00; and

2. An order by the Comptroller of the State of New York granting permission to continue and proceed with the project.

Dated:

COUNTY OF ORANGE

BY: ______________________
Edward A. Diana, County Executive

Approved as to Content:

____
Edmund Fares
Commissioner, Orange County Department of Environmental Facilities and Services and Administrative Head, OCSD #1

Approved as to form:

____
David L. Darwin
Chief Assistant County Attorney

STATE OF NEW YORK)

COUNTY OF ORANGE)

EDWARD A. DIANA, being duly sworn, deposes and says that he is the County Executive of Orange County, the corporation named in the within entitled action; that he has read the foregoing application and knows the contents thereof; and that the same is true to his own knowledge, except as to the matters therein stated to be alleged upon information and belief, and as to those matters ~~he believes it to be~~ true.

EDWARD A. DIANA

Sworn to before me this
28th day of August, 2002.

Notary Public

MARY J. HENRICI
Notary Public, State of New York
Qualified in Orange County
My Commission Expires Dec. 31, 2005

STATE OF NEW YORK)

COUNTY OF ORANGE)

DAVID L. DARWIN, being duly sworn, deposes and says that he is the Chief Assistant County Attorney of Orange County, the corporation named in the within entitled action; that he has read the foregoing application and knows the contents thereof; and that the same is true to his own knowledge, except as to the matters therein stated to be alleged upon information and belief, and as to those matters he believes it to be true.

DAVID L. DARWIN

Sworn to before me this
29th day of August, 2002.

Notary Public

SUSAN M. WIERZBICKI
NOTARY PUBLIC, STATE OF NEW YORK
QUALIFIED IN ORANGE COUNTY
NO. 01WI4514353
COMMISSION EXPIRES JUNE 30, 20 03

STATE OF NEW YORK)

COUNTY OF ORANGE)

EDMUND FARES, being duly sworn, deposes and says that he is the Commissioner of the Orange County Department of Environmental Facilities and Services and the Administrative Head of the Orange County Sewer District No. 1, the corporation named in the within entitled action; that he has read the foregoing application and knows the contents thereof; and that the same is true to his own knowledge, except as to the matters therein stated to be alleged upon information and belief, and as to those matters he believes it to be true.

EDMUND FARES

Sworn to before me this
27th day of August 2002.

Notary Public

KIM JOHNSON
NOTARY PUBLIC, STATE OF NEW YORK
No. 01JO5038641
Qualified in Orange County
Commission Expires January 30, 2003

COUNTY OF ORANGE

IN THE MATTER OF THE APPLICATION OF THE COUNTY OF ORANGE, NEW YORK FOR AN ORDER OF THE STATE COMPTROLLER GRANTING PERMISSION FOR THE INCREASE AND IMPROVEMENT OF FACILITIES OF ORANGE COUNTY SEWER DISTRICT NO. 1

EXHIBITS

Exhibit A

Misc 51-#1 / MOODNA BASIN / EM070 — DO NOT REMOVE

Vic Executed Copy

MOODNA INTER-MUNICIPAL AGREEMENT

- Sept. 8, 1978

THIS AGREEMENT made this 8th day of September, 1978 by and between the TOWN OF BLOOMING GROVE, with offices at Main Street, Washingtonville, New York; the TOWN OF CHESTER, with offices at Laroe Road, Chester, New York; the TOWN OF MONROE, with offices at 17 Lake Street, Monroe, New York; the TOWN OF WOODBURY, with offices in Highland Mills, New York; and the VILLAGE OF CHESTER, with offices at Main Street, Chester, New York; hereinafter referred to collectively as the MUNICIPALITIES, and ORANGE COUNTY SEWER DISTRICT #1, hereinafter referred to as the DISTRICT, with offices at Route 17M, P.O. Box 509, Goshen, New York, for the:

1. Administration, Design, Construction and Joint Use of the:

   Village of Chester Trunk Sewer;
   Chester Interceptor;
   Route 17M Interceptor;
   Monroe Interceptor;
   Harriman Wastewater Treatment Plant Expansion and Outfall;

   hereinafter referred to as the JOINT FACILITIES.

2. The Operation and Maintenance of the Harriman Wastewater Treatment Plant.

WITNESSETH:

WHEREAS, the above MUNICIPALITIES, pursuant to the authority vested in them by Article 12C, Section 239-n of the General Municipal Law, joined with the Towns of Cornwall, Goshen, Hamptonburgh, Montgomery, New Windsor, and the Villages of Cornwall, Maybrook and Washingtonville to form a study group known as the MOODNA BASIN JOINT REGIONAL SEWERAGE BOARD so as to participate in the Moodna Basin Wastewater Facilities Planning Program, and

WHEREAS, the MOODNA BASIN JOINT REGIONAL SEWERAGE BOARD caused to be prepared the Moodna Basin Wastewater Facilities Plan dated January 1978, and

WHEREAS, the Towns of Blooming Grove, Chester and Monroe have caused to be prepared individual Collector Sewer Wastewater Facilities Plans, dated January, 1978; March, 1977; and March, 1977, respectively, and

WHEREAS, the Village of Chester and Town of Woodbury have received Step III Collector Sewer Construction Grants from the USEPA in September 1977, and the Towns of Chester and Monroe have held the necessary local referendums, petitions, etc. to create their respective Town Sewer Districts, and

WHEREAS, the Moodna Basin Wastewater Facilities Plan concludes that the most Cost-Effective Solution to providing Interceptor and Treatment Facilities for the South/Southwest portion of the Town of Blooming Grove, and the Towns of Chester, Monroe, Woodbury, and Village of Chester is to construct Interceptor Sewers, singularly and/or jointly, to and connecting to the existing ORANGE COUNTY SEWER DISTRICT #1 Interceptors and Treatment Plant and to further expand the capacity of the DISTRICT'S Treatment Facility (with an Outfall to Woodbury Creek), as shown on Figure 1 and listed in Table 2, as compared to construction of separate individual municipal interceptor and treatment facilities, and

WHEREAS, the economy of scale resulting from the proposed full and/or expanded use of the existing ORANGE COUNTY SEWER DISTRICT #1 Treatment Facility by the above MUNICIPALITIES will result in a significant savings to existing ORANGE COUNTY SEWER DISTRICT #1 users, and

WHEREAS, the projected 1990 flows to the plant is estimated, based on the MOODNA BASIN WASTEWATER FACILITIES PLAN, as follows:

Blooming Grove	0.71 MGD	2.76
Chester (T)	0.60 MGD	
Chester (V)	0.36 MGD	
Monroe	0.20 MGD	
Woodbury	0.89 MGD	
O.C.S.D. #1	1.24 MGD	
TOTAL	4.00 MGD	

NOW, THEREFORE, the parties agree, pursuant to the authority vested in them by Article 6 of the General Municipal Law, as follows:

1. The DISTRICT Shall:

   A. Allow the MUNICIPALITY(s) to connect to and use the DISTRICT'S Interceptor and Treatment Facility(s), shown on Figure 1, provided:

      1) The DISTRICT has reviewed and approved the design of the connections to the DISTRICT'S Interceptors;

      2) The DISTRICT has inspected and approved construction of the connections;

      3) A Step 3 Wastewater Treatment Works Construction Grant has been received by the MUNICIPALITY(s) from the United States Environmental Protection Agency for the expansion of the DISTRICT'S Treatment Plant by the MUNICIPALITY(s), unless the DISTRICT agrees to waive this provision;

4) That the allowable discharges indicated in Table 1 are not exceeded prior to completion of the Treatment Plant Expansion.

The above approvals will not be unreasonably withheld.

B. Lease, to be drawn by the DISTRICT, to the MUNICIPALITIES the site for the Sewage Treatment Plant Expansion, along with the right to connect said expansion to the DISTRICT'S existing facilities, for $1.00/year for a period equivalent to the length of the bonds for the construction of the Sewage Treatment Plant Expansion.

C. Allow the construction of the Sewage Treatment Plant Expansion on DISTRICT property and adjacent and contiguous to the DISTRICT'S Sewage Treatment Plant, along with the right to connect said expansion to the DISTRICT'S existing facilities, provided the DISTRICT reviews and approves the design of the proposed addition for a NOT TO EXCEED TOTAL COST of $30,000 and the expansion is constructed in accordance with approved United States Environmental Protection Agency Plans and Specifications. DISTRICT approval will not be unreasonably withheld. The above review fee will be billed by the DISTRICT to the MUNICIPALITY(s) in a manner and format satisfactory to the USEPA so that the costs will be grant eligible under the Step 2 or 2/3 USEPA Grant, and the review fee will only be paid upon receipt of 75% USEPA Aid related to the review fee.

D. Operate and Maintain the combined (MUNICIPALITIES and DISTRICT) Sewage Treatment Plant, and Woodbury Creek Outfall, if constructed. Permit the MUNICIPALITIES to discharge, at no additional cost, effluent through the DISTRICT'S Outfall at a discharge rate equal to the average daily discharge rate permitted by the NPDES Permit, less the average daily influent from the DISTRICT'S users.

E. Provide all necessary accounting and administration services for sharing of operations and maintenance and debt service costs under this Agreement related to the DISTRICT'S existing facilities and the combined DISTRICT/MUNICIPALITIES treatment plant, and bill the MUNICIPALITIES annually in advance for their respective costs. Payment for capital costs by the MUNICIPALITIES shall be made by February 1 of the following year. Payment by the MUNICIPALITIES for the Operation and Maintenance charges shall be made in four equal installments payable on February 1, May 1, August 1, and November 1. Two (2) years after the JOINT FACILITIES are connected and/or substantially completed, the above billing/payment procedures will be reviewed and if warranted, modified to make uniform billing procedures within both the DISTRICT and the MUNICIPALITIES.

F. Be responsible only for Operation and Maintenance of the combined DISTRICT and MUNICIPALITIES Wastewater Treatment Plant.

E. Accept septage wastes resulting from the use of Septic Tank Effluent Pumps and Small Diameter Gravity Sewers within the Sewer District(s) of the effected MUNICIPALITIES, at no additional cost to the MUNICIPALITIES, provided the schedule, method and manner of disposal receives prior DISTRICT approval.

2. The MUNICIPALITIES will, in connection with the JOINT FACILITIES:

A. Separately finance their respective shares by the sale of Notes and Bonds, as indicated in Table 2, in their own discretion and each shall be liable only for their own financing. If actual project costs are less than the indicated maximum amounts, the respective costs will be reduced accordingly to reflect actual costs.

B. Lease the Sewage Treatment Plant Expansion to the DISTRICT for $1.00 per year for a period equal to the DISTRICT'S lease of the Treatment Plant site to the MUNICIPALITIES and with terms similar to that of the DISTRICT'S lease of the plant site to the MUNICIPALITIES.

C. Not approve any significant changes to the boundaries of their respective Sewer District(s) which would result in a potential significant increase in flow from their district(s) without informing the DISTRICT, in writing, and the other MUNICIPALITIES in advance.

D. Authorize the PRIME MUNICIPALITY, as indicated in Table 2 and below, to be the Grant Applicant for Step II and Step III for the JOINT FACILITIES for available USEPA/NYSDEC Construction Grant(s).

FACILITY	PRIME MUNICIPALITY
Treatment Plant	Town of Woodbury
Chester Village Trunk System	Village of Chester
Chester Interceptor	Town of Chester
Route 17M Interceptor	Town of Chester
Monroe Interceptor	Town of Monroe

E. Be co-signer to the applicable agreement(s) and/or amendments, as indicated in Table 2, for services related to the adminis- tration, design and construction of the JOINT FACILITIES as recommended by the PRIME MUNICIPALITY and approved by the Weighted Vote of the participating MUNICIPALITIES, for a par- ticular JOINT FACILITY. The Weighting of Votes, for a particular JOINT FACILITY, shall be equal to the ratio of capital costs financed by a MUNICIPALITY to the total capital cost to be financed by all participating MUNICIPALITIES, as indicated in Table 2 under "Maximum Capital Authorization" for each facility.

F. Provide sufficient advance funds to the PRIME MUNICIPALITY to enable the prompt payment of approved invoices for the admin- istration, design and construction of the JOINT FACILITIES on a quarterly basis.

G. Assist the PRIME MUNICIPALITY in obtaining easements and agree to exercise their powers of condemnation, upon written request from the PRIME MUNICIPALITY, if easement negotiations cannot be successfully completed, provided the PRIME MUNICIPALITY has afforded the other participating MUNICIPALITY(s) a reasonable opportunity to review and comment on the affected JOINT FACIL- ITY(s). Title for all easements will be retained by the PRIME MUNICIPALITY, and the MUNICIPALITIES agree not to impose levy, assess or otherwise tax the JOINT FACILITIES within their MUNICIPALITY.

H. Agree that the PRIME MUNICIPALITY, as indicated in Table 2, will allow the other participating MUNICIPALITY(s) to connect to and use the JOINT FACILITY, in accordance with the cost sharing pro- visions contained herein, without surcharge or connection fees.

I. Agree that the PRIME MUNICIPALITY will be responsible for Opera- tion and Maintenance of the respective JOINT FACILITY(s) (not including the Treatment Plant and Outfall Addition) and accounting/ administrative services related to cost sharing of Operation and Maintenance costs for the JOINT FACILITY(s). Operation and Main- tenance costs of a JOINT FACILITY will be shared on the same principal as set for the combined DISTRICT/MUNICIPALITIES Treat- ment Plant. The PRIME MUNICIPALITY will not impose a surcharge on the other participating MUNICIPALITIES. In the event of a situation arising which requires emergency Operation and/or Maintenance, and the PRIME MUNICIPALITY is unable or otherwise fails to perform Operation and Maintenance, another participating MUNICIPALITY can perform the necessary emergency Operation and

Maintenance Services and back charge the other MUNICIPALITIES (including itself) through the PRIME MUNICIPALITY.

J. Agree to hold the DISTRICT harmless under this Agreement other than the Treatment Plant Expansion, except as agreed to herein from any action by non-participants to this agreement.

3. The Total Annual Charge by the DISTRICT to a MUNICIPALITY(s) for use of DISTRICT Facilities will be the sum of the categories described below:

A. Debt Service for Interceptors, Preliminary Treatment and/or Advanced Treatment is equal to the thirty (3) day average daily flow from flow measurements at the points shown on Figure 1, divided by 333 gallons and then multiplying the result by the percentages of the year the facilities are actually used, and then multiplying by the sum of the applicable Debt Service Unit Costs shown in Table 1.

Upon retirement of the DISTRICT'S initial bonded indebtedness on the original Interceptor, Preliminary Treatment and Advanced Treatment Facilities, the unit cost for use of those Facilities will be zero and there will be no costs for use of the original DISTRICT'S Interceptor and Preliminary Treatment Facilities.

Upon completion of the MUNICIPALITIES Treatment Plant Expansion, the Advanced Treatment will not be required by the MUNICIPALITIES, and therefore, there will be no charge if they are used (in lieu of the MUNICIPALITIES Facilities as determined by the DISTRICT), until such time as a MUNICIPALITY(s) capacity in the new facility is fully utilized and that same MUNICIPALITY elects to use the DISTRICT'S Advanced Treatment Facilities.

B. After connection of all the MUNICIPALITIES and/or expansion of the Treatment Plant, the Operation and Maintenance cost for use of the combined Treatment Plant will be determined by multiplying the DISTRICT'S approved Operation and Maintenance budget for Treatment Plant Operation (after consideration of any possible State and/or Federal Operation and Maintenance Aid) times the total annual flow from a MUNICIPALITY(s) divided by the total annual cumulative flow from all the MUNICIPALITIES and the DISTRICT.

Prior to connection of all the MUNICIPALITIES and/or expansion of the Treatment Plant from 2 MGD to 4 MGD, the Operation and Maintenance cost for use of the DISTRICT'S Plant will be based upon the DISTRICT'S approved Operation and Maintenance budget for Treatment Plant Operation (after consideration of any possible State and/or Federal Operation and Maintenance Aid) times the lower ratio of either the average daily flow from a MUNICIPALITY(s) divided by the average daily design capacity of the DISTRICT'S Plant, 2 MGD, or the average daily flow divided by total average daily flow from the MUNICIPALITIES and the DISTRICT, then multiplied by the percentage of the year the plant is used. In 1980, the net Operation and Maintenance budget is estimated to be $250,000. If the actual budget increases by more than 15% or beyond $287,500, the DISTRICT will notify the MUNICIPALITIES by September 1979.

4. Three (3) years after full use of the combined system by all the MUNICIPALITIES and the DISTRICT, the gallonage definition (333 gallons equals one unit) will be re-evaluated jointly and a report of the evaluation study made to the MUNICIPALITIES and DISTRICT.

5. If a MUNICIPALITY(s) uses a JOINT FACILITY(s) in excess of its proportionate share, as indicated in Table 2, that MUNICIPALITY(s) will compensate the other MUNICIPALITY(s) who have unused capacity in a JOINT FACILITY(s) in proportion to their respective unused capacity(s). The total compensation, to be allocated between the respective MUNICIPALITY(s) shall be equal to the thirty (30) day average daily flow of the exceeding MUNICIPALITY(s), in excess of its allocated capacity, divided by 333 gallons (or a subsequently re-defined gallonage equivalent, as described in #5 above) multiplied by the cumulative unit debt service rate for the effect JOINT FACILITY(s). The same principal shall apply to use by the DISTRICT of a JOINT FACILITY(s) of the MUNICIPALITIES or use by a MUNICIPALITY(s) of the DISTRICT'S Advance Treatment Facility after completion of the MUNICIPALITIES Treatment Facility. As long as excess capacity

exists in a JOINT FACILITY and/or the Combined Treatment Plant, the Participant(s) with excess capacity agree to make it available to the Participant(s) needing excess capacity until the combined Facilities are further expanded, in proportion to their respective needs, as it is projected that the wastewater flow of the MUNICIPALITIES may initially exceed the capacity of the Treatment Plant Expansion and the flows of the DISTRICT will be less than its available capacity. Use by one Participant of another Participants excess capacity, on an interim basis, will obligate that Participant to participate in a subsequent expansion of the Effected Facility(s) (as discussed in Paragraph #9) so that the original allocated capacity in the Treatment Plant, 2 MGD for the DISTRICT and as indicated in Table 2 for the MUNICIPALITIES, will be protected. Actual allocation of potentially available capacities will be based on actual need, not projections. When a JOINT FACILITY or the Combined Treatment Plant reaches 85% of their design capacity, steps will be initiated to expand the respective facilities, as indicated in Paragraphs #8 and #9.

6. If one MUNICIPALITY desires to purchase another MUNICIPALITY'S capacity in the Treatment Plant Expansion and Outfall, the MUNICIPALITIES agree that the purchase price for the capacity will be equal to the replacement cost of the equivalent additional Treatment Plant capacity, assuming the Existing Treatment Facility is in good repair and still has at least fifteen (15) years of useful life remaining.

7. Ownership of the JOINT FACILITIES will remain with the MUNICIPALITIES who finance the construction of the respective facilities in proportions indicated in Table 2 under "Shares".

8. If the flow in a JOINT FACILITY, other than the Harriman Treatment Plant, reaches 85% of its design capacity, the PRIME MUNICIPALITY will notify the other participating MUNICIPALITIES and convene a meeting of the Boards of the affected MUNICIPALITIES to determine what action, if any, should be taken regarding provisions for increased capacity.

9. If the combined flow of both the DISTRICT'S and MUNICIPALITIES Treatment Facility and the DISTRICT'S Interceptor Facilities, as shown on Figure 1, reaches 85% of its design capacity, the DISTRICT will prepare or will have prepared all necessary maps, plans and reports in accordance with applicable laws and make application for any available State and/or Federal Funds so as to insure that a Facility or Facilities to increase the capacity will be constructed. No MUNICIPALITY will be required to disconnect from the DISTRICT'S Facilities without the MUNICIPALITY'S prior concurrence and without allowing a sufficient amount of time to obtain proper disposal methods. The cost of the above preparation and application will be included in the DISTRICT'S annual Operation and Maintenance budget and chargeable as described in Paragraph #3 B. The Debt Service and the cost of Operation and Maintenance of the increased capacity facility(s) will be borne proportionately by the DISTRICT and the MUNICIPALITIES. The proportionate share will be calculated on the

basis of those signatories to this agreement who require the construction of the additional facility(s) by reason of their increased flow so as to exceed 85% of their allocated capacity as set forth in Table 2 for the MUNICIPALITIES and for 2 MGD for the DISTRICT.

10. Any penalties related to violation of the NPDES Permit for Operation of the combined Sewage Treatment Plant will be apportioned between the DISTRICT and the MUNICIPALITIES (provided that the DISTRICT has taken all reasonable measures to provide proper Operation and Maintenance of the combined plant in accordance with the current NPDES Permit and that the penalties levied by the regulatory agencies are not due to negligence or mismanagement of the DISTRICT; but are, in fact, due to circumstances beyond the reasonable control of the DISTRICT, MUNICIPALITIES, and/or the Orange County Legislature), in relation to the respective number of tributary units from the preceding year.

11. The TOWN OF MONROE agrees to finance 100% of the WALTON LAKE ESTATES INTERCEPTOR shown on Figure 1, within the TOWN OF MONROE and to allow the TOWN OF CHESTER to connect the TOWN OF MONROE'S portion of the WALTON LAKE ESTATES INTERCEPTOR at no cost, in consideration of the increased aid (75% - 87-1/2%) received by the TOWN OF MONROE on the HEATON ROAD "Collection" Sewer (TOWN OF MONROE portion of WALTON LAKE ESTATES INTERCEPTOR) due to connection of the Walton Lake Estates Treatment Plant.

12. Any dispute which may arise out of interpretation of this Agreement will be submitted to an impartial third party acceptable to all the signatories to this Agreement for an advisory opinion.

13. This Agreement is contingent upon NYSDEC/USEPA approval of the Moodna Basin Joint Regional Sewerage Board Wastewater Facility Planning Report, not withstanding possible "technical" amendments to the report which do not increase the costs or decrease the capacities by more than 15%, as set forth in Table 2, for the Proposed JOINT FACILITIES, within six (6) months of its execution.

14. If the TOWN OF BLOOMING GROVE, subsequent to executing this Agreement, is unable to finance their share of the JOINT FACILITIES, due to not having completed the formation of the necessary Town Sewer District(s), as shown on Table 2, the TOWN OF MONROE agrees to finance an additional $500,000 of the TREATMENT PLANT EXPANSION and the MUNICIPALITIES agree to delay construction of the WOODBURY CREEK OUTFALL until the TOWN OF BLOOMING GROVE participates in this Agreement, so as to not increase the respective costs of the Treatment Plant addition beyond those indicated in Table 2. In this event, the proportionate shares of the Treatment Plant, shown in Table 2, will be re-allocated based on the revised cost sharing ratios.

IN WITNESS WHEREOF, the parties hereto have exe ted this Agreement on the day and year first above written, by the signatures of Robert Muller, Supervisor of the TOWN OF BLOOMING GROVE, as authorized by Resolution of the Town Board of the TOWN OF BLOOMING GROVE dated September 5, 1978; Christopher J. Kennedy, Supervisor of the TOWN OF CHESTER or George Hulse, Deputy Supervisor, as authorized by Resolution of the Town Board of the TOWN OF CHESTER dated September 5, 1978; John DeAngelis, Supervisor of the TOWN OF MONROE, as authorized by Resolution of the Town Board of the TOWN OF MONROE dated September 8, 1978; Louis Burgunder, Supervisor of the TOWN OF WOODBURY, as authorized by Resolution of the Town Board of the TOWN OF WOODBURY dated September 7, 1978; Ross P. Vero, Mayor of the VILLAGE OF CHESTER or John H. Lutjens, Deputy Mayor, as authorized by Resolution of the Village Board of the VILLAGE OF CHESTER dated August 29, 1978; and Louis J. Cascino, P.E., Administrative Head of the ORANGE COUNTY SEWER DISTRICT #1, as authorized by the County Legislature of ORANGE COUNTY dated September 8, 1978.

TOWN OF BLOOMING GROVE

By: ______________________
Robert Muller, Supervisor

TOWN OF CHESTER

By: ______________________
Christopher J. Kennedy, Supervisor

TOWN OF MONROE

By: ______________________
John DeAngelis, Supervisor

TOWN OF WOODBURY

By: ______________________
Louis Burgunder, Supervisor

VILLAGE OF CHESTER

By: ______________________
John H. Lutjens, Deputy Mayor

ORANGE COUNTY SEWER DISTRICT #

By: ______________________
Louis J. Cascino, P.E.
Administrative Head

TABLE I

UNIT DEBT SERVICE COSTS FOR USE
OF ORANGE COUNTY SEWER DISTRICT #1 FACILITIES[4]

MUNICIPALITY	INTERCEPTORS[1]	PRELIMINARY TREATMENT AND SOLIDS HANDLING[2]	ADVANCED TREATMENT[3]
Blooming Grove	$2.39	$2.78	$8.33
Chester (T)	$2.39	$2.78	$8.33
Chester (V)	$2.39	$2.78	$8.33
Monroe	$2.39	$2.78	$8.33
Woodbury	---	$2.78	$8.33

1 OCSD net local interceptor Debt Service = $43,000 with average capacity of 6.0[5] MGD or 18,000 units = $2.39/unit.

2 OCSD net local Preliminary Treatment and Solids Handling Debt Service = $50,000 with average capacity of 6.0[5] MGD or 18,000 units = $2.78/unit.

3 OCSD net local Advanced Waste Treatment Debt Service = $50,000 with average capacity of 2.0[5] MGD or 6,000 units = $8.33/unit.

4 Initial Flow Allowances:

CONTRIBUTOR	AVERAGE FLOW (MGD)
Blooming Grove	0.24
Chester (T)	0.22
Chester (V)	0.15
Monroe	0.07
Woodbury	0.32
TOTAL	1.00

5 A unit equals 333 gallons per day.

I.

PROPORTIONATE
(JOINT)

MUNICIPALITY	TREATMENT PLANT & OUTFALL: SHARE %	TREATMENT PLANT & OUTFALL: ALLOWABLE 30 DAY AVERAGE FLOW, BASED ON 1990 CAPACITY (MGD)	TREATMENT PLANT & OUTFALL: MAXIMUM CAPITAL AUTHORIZATION[1]	CHESTER VILLAGE TRUNK SEWER SYSTEM: SHARE %	CHESTER VILLAGE TRUNK SEWER SYSTEM: ALLOWABLE PEAK FLOW,[1] BASED ON 2020 CAPACITY (MGD)	CHESTER VILLAGE TRUNK SEWER SYSTEM: MAXIMUM CAPITAL AUTHORIZATION	CHESTER: SHARE %	CHESTER: ALLOWABLE PEAK FLOW, BASED ON 1993 CAPACITY (MGD)
BLOOMING GROVE	26	.52	$2,700,000[6,7]	------	------	N/A	10	.17
CHESTER (T)	22	.44	$1,630,600[6,7]	20[8]	.48	N/A[5]	43[8]	.74
CHESTER (V)	13	.26	$1,172,000	80	1.92	$1,792,000[5]	47	.80
MONROE	7	.14	$ 631,500	------	------	N/A	------	------
WOODBURY	32[8]	.64	$2,886,700	------	------	N/A	------	------
TOTALS	100	2.00	$9,021,000	100	2.40	$1,792,000	100	1.71
UNIT DEBT SERVICE RATE[2]			$18.17		3.00			3.69

SEE ATTACHED SHEET FOR FOOTNOTES

LE 2

SHARES & COSTS OF
ACILITIES

INTERCEPTOR	ROUTE 17M INTERCEPTOR			MONROE INTERCEPTOR		
MAXIMUM CAPITAL AUTHORIZATION[3]	SHARE %	ALLOWABLE PEAK FLOW, BASED ON 2020 CAPACITY (MGD)	MAXIMUM CAPITAL AUTHORIZATION[3]	SHARE %	ALLOWABLE PEAK FLOW, BASED ON 2020 CAPACITY (MGD)	MAXIMUM CAPITAL AUTHORIZATION[4]
N/A[6]	58	3.35	N/A[7]			N/A
$1,190,000[5,6]	22[8]	1.24	$272,000[7]	57	1.03	$ 650,000
$ 380,000[5]	20	1.16	$ 68,000			N/A
N/A			N/A	43[8]	0.77	$ 490,000
N/A			N/A			N/A
$1,570,000	100	5.75	$340,000	100	1.0	$1,140,000
		0.24			2.56	

FOOTNOTES

[1] Based on Preliminary Design Report for the Harriman Wastewater Treatment Facility dated March 1978, prepared by Moodna Basin Engineers and inflated 25%.

[2] Based upon dividing Maximum Capital Authorization x 12-1/2% x .09637 by total capacity in units (1 MGD = 3,000 units)

[3] Based on Preliminary Design Report for the Chester Village Interceptor dated July 1978, prepared by Moodna Basin Engineers and inflated 25%.

[4] Based on Preliminary Design Report for Monroe Interceptor dated December 1977, prepared by Moodna Basin Engineers and inflated 25%.

[5] To be financed entirely by Village of Chester. Town of Chester share paid by increasing the Town of Chester share of the Chester Interceptor by $358,000 and decreasing Village of Chester share accordingly.

[6] Town of Blooming Grove share of Chester Interceptor of $157,000 to be financed by Town of Chester with corresponding increase in Town of Blooming Grove share of treatment plant.

[7] Town of Blooming Grove share of 17M Interceptor of $197,000 to be financed by Town of Chester with corresponding increase in Town of Blooming Grove share of treatment plant.

[8] Prime Municipality.

Sept 8, 1988

AGREEMENT made among the TOWN OF BLOOMING GROVE, a municipal corporation of the State of New York with principal offices located at Town Hall, Main Street, Washingtonville, New York, hereinafter "Blooming Grove,"

The TOWN OF CHESTER, a municipal corporation of the State of New York with principal offices located at Town Hall, Kings Highway, Chester, New York, hereinafter "Chester,"

The TOWN OF MONROE, a municipal corporation of the State of New York with principal offices located at Town Hall, 11-13 Stage Road, Monroe, New York, hereinafter "Monroe,"

The TOWN OF WOODBURY, a municipal corporation of the State of New York with principal offices located at Town Hall, P.O. Box D, Highland Mills, New York, hereinafter "Woodbury,"

The VILLAGE OF CHESTER, a municipal corporation of the State of New York with principal offices located at Village Hall, 141 Main Street, Chester, New York, hereinafter "Village of Chester,"

Which said Towns and the Village are variously described in this Agreement as the "Local Municipalities" or the "Local Municipality," and

The COUNTY OF ORANGE, with principal offices located in the Orange County Government Center, 255 Main Street, Goshen, New York, acting for itself and for Orange County Sewer District No. 1, hereinafter "the County,"

WHEREAS, the parties to this Agreement have previously entered into an agreement known as the Moodna Basin Inter-Municipal Agreement dated September 8, 1978 which said agreement provided for the development of two million gallons per day (hereinafter "2 mgd") of sewage treatment capacity by the construction of additional facilities at the Harriman Sewage Treatment Plant, hereinafter "the HTP," which said plant is owned and operated by the County; and

WHEREAS, in light of recent rapid development in the area served by the HTP, the New York State Department of Environmental Conservation ("DEC") has requested of the County, and the County has requested of the Local Municipalities, that the Agreement of September 8, 1978 be modified to provide for

(a) monitoring of the demand each Municipality is placing on the HTP;

(b) limitation of the demand each Municipality and, in turn, all the Municipalities together may place upon the HTP; and

(c) centralized control over new hookups to the sewer system, at least to the extent of assuring that no Municipality is placing a demand on the HTP in excess of such Municipality's limit; and

WHEREAS, the Local Municipalities have agreed to a standardized system of projecting the demand from new hookups made by various categories of users; and

WHEREAS, the Local Municipalities have agreed to limit their respective use of HTP among themselves and for the related adjustment of financial obligations;

NOW, THEREFORE, it is agreed:

1. Revised Allocations. The provisions of the Agreement of September 8, 1978, are amended as follows:

a. Except for its last sentence, the entirety of Paragraph 5 of such Agreement is rescinded and replaced with the following:

"From and after September 8, 1988, the total capacity of the HTP shall be allocated as follows, and the parties agree to take any and all measures necessary to assure that their respective average daily demands do not, during the term of this Agreement exceed their respective allocations as set forth below:

	Gallons per Day
Orange County Sewer District No. 1	1,985,000
Blooming Grove	490,000
Chester	410,000
Monroe	133,000
Woodbury	635,000
Village of Chester	347,000
	4,000,000"

b. The allocation listed in Table 2 of the Agreement of September 8, 1978, shall be deemed amended to conform to the foregoing whenever in the future the Agreement may require reference to be made to such Table.

2. <u>Standardized Schedule</u>. The parties agree that the schedule annexed hereto and labelled "Schedule of Gallons Per Day" shall be used by the Local Municipalities and by the County

to determine the sewage demand made by the various types of proposed users.

3. County Permits. The Local Municipalities and the County agree that, except for sewer hookups serving users within Orange County Sewer District No. 1 and sewer hookups into sewer systems with treatment facilities under other than HTP, no new users will be permitted to hook into any local municipal sewer system without a permit issued by the County pursuant to the provisions of this Agreement. The permit shall be known as a monitored sewer service hookup permit, hereinafter "the permit".

a. The Building Inspector of each Local Municipality shall submit a request to the County for a permit for each new user covered by this Agreement. The County shall determine only the demand a proposed new user will make on the sewer system in accordance with the demand schedule set forth above in this agreement and the extent of any sewer capacity available to the Local Municipality. If the County determines there is capacity for the permit sought, the permit will be issued.

b. The Building Inspector shall not file the permit request with the County until the level of Local Municipal approval set forth below has been achieved for the various types of users.

(1) No application for a permit shall be filed for a single-family home or a two-family home until a building permit has been issued, subject only to the issuance of the permit, except as set forth in the following subparagraphs.

(2) No application for a permit for a single-family home or a two-family home shall be filed for lots on a proposed subdivision until the subdivision has received at least preliminary approval from the Local Municipality's Planning Board.

(3) No application for a permit shall be filed for any use requiring a site plan and/or a special permit until the public hearing for such use has been held or in the alternative if no public hearing is required until the municipal board empowered to grant the site plan and/or the special permit has determined the extent of the development in the project and has adopted a resolution setting forth the extent of that development.

(4) No application for a permit shall be filed for any user other than the ones set forth above unless such permit application is accompanied by a resolution from the Town Board or Village Board of the Local Municipality requesting a permit for that project.

4. Monitoring. The County will determine the average daily demand on the sewer system made by each Local Municipality based upon the County monitoring system. This demand will be determined on an annual basis as of January 1 in each year during which this Agreement remains in full force and effect. The parties to this Agreement acknowledge that the Local Municipality's average daily demand may change annually depending upon such factors as increase or decrease in infiltration and the

actual demand placed upon the system by users within each Local Municipality.

5. Review and Appeal. The parties to this Agreement acknowledge that the monitoring program will require continued cooperation among the Local Municipalities and the County. In order to further that cooperation the parties agree to meet at least four (4) times during each calendar year that this Agreement remains in effect. The meetings shall take place at ETP, or such other location as may be agreed upon, on the second Monday in the following months: March, June, September and December. At each of the meetings among other orders of business, the parties will review the total demand placed upon the system in relation to each Municipality's available capacity and such changes as may be necessary in the monitoring and permit system.

In the event that any Municipality disagrees with the number of gallons the County determines that Municipality is using at the plant, the Municipality shall have the right to present its concerns at the meeting to have the usage figure reviewed. In the event the Municipality is dissatisfied with the determination reached at the meeting, then the Municipality shall have the right to appeal from the determination. The County and the Municipality shall jointly select one professional engineer whose decision each party agrees to abide by. In the event the Municipality and the County are unable to agree on such professional engineer within ten (10) days of the date of the

DRAKE, SOMMERS, LOEB, TARSHIS & CATANIA, P.C.
P. O. BOX 1479 • NEWBURGH, N. Y. 12550 • (914) 565-1100

meeting then the Municipality and the County shall each select an independent engineer within twenty (20) days of the meeting and those two (2) professional engineers shall select a third professional engineer within ten (10) days of their selection. Within ten (10) days of the selection of the third professional engineer, an informal hearing will be held and the parties agree to be bound by the determination made by majority vote of the three (3) professional engineers. Each party agrees to pay its own expenses and to share the cost of the jointly selected engineer whether that jointly selected engineer be the individual selected by the County and the Municipality or the engineer selected by the two professional engineers.

6. Financial Adjustments.

a. Sale of capacity to Village of Chester.

In the light of the changes to the Agreement of September 8, 1978, the Village of Chester agrees to make the following payments to the other Local Municipalities:

Payee	Amount
Orange County Sewer District No. 1	$ 56,400.
Blooming Grove	112,800.
Chester	112,800.
Monroe	26,320.
Woodbury	18,800.

Such payments shall be made in three (3) substantially equal annual installments commencing February 1, 1989 and ending February 1, 1991.

b. As an alternative to the sale provision set forth above, any Municipality may elect to rent the gallonage proposed to be sold to the Village of Chester in accordance with the preceding paragraph. The term of the lease shall be until a new sewage treatment facility is constructed and lessor's capacity is restored, or the Harriman Treatment Plant is expanded and lessor's capacity is restored, which said new facility, or expanded facility, provides additional capacity to the Village of Chester at least equal to the number of gallons of treatment capacity rented, or forty (40) years from the date of this agreement which ever shall first occur. The annual rental to be paid by the Village of Chester for each gallon leased to the Village of Chester shall be the sum of 50 cents per gallon per year to be paid annually in advance. Within thirty (30) days after the date this agreement is fully executed by all parties, each Municipality must notify the Village of Chester of its decision whether to sell or to lease the capacity referred to above.

7. From time to time in the past Local Municipalities have agreed bilaterally as to the collection of sewer rents from users in one Municipality connected to the facilities to another Municipality and as to the allocation of flow between the two Municipalities. Any such agreements which exist now and any which may be created in the future shall be, when filed in writing with the County, recognized by the County in determining the availability of capacity within the Municipalities in

question. Addenda A lists certain existing agreements identified as of the effective date of this Agreement.

8. There shall be no further transfer of any additional sewage treatment capacity, either by sale or by lease, without the prior approval of the unit of government from which the sewage treatment capacity is to be transferred.

9. Except as expressly modified hereby, the Agreement of September 8, 1978 remains in full force and effect.

IN WITNESS WHEREOF, the parties hereto have set their hands and seals the day and year indicated next to their respective signatures, the latest date being the date of this Agreement, which shall be effective as of September 8, 1988, notwithstanding the date or dates of execution.

TOWN OF BLOOMING GROVE

By: Nancy Calhoun 9/8/88
Date

TOWN OF CHESTER

By: [signature] 9/8/88
Date

TOWN OF MONROE

By: [signature] 9-6-88
Date

TOWN OF WOODBURY

By: Robert Tell 9/8/88
Date

VILLAGE OF CHESTER

By: Frank Rattuto 9/8/88
Date

COUNTY OF ORANGE

By: Louis J. Caesar 9/8/88
Date

[illegible]LE OF GALLONS PER DAY

	GALLONS PER DAY OF USE
* One family dwelling - 1 kitchen	400
* One family dwelling - 2 kitchens	800
* Each separate apartment in a two family, three family or multiple dwelling	400
Garbage disposal units - each disposal unit	400
Lauderettes in apartment houses: for each two washing machines	400
Mobile home	400
Cobination one family home with a professional or business office other than dentist	800
Combination one family home with a professional or business office dentist	1200
Rooming houses - each four rooms or part	400
Hotel or motels (no meals) - each four rooms or part	400
Hotels - American plan with meals - each 2 rooms	400
Offices - with five occupants or less	400
Stores - with five occupants or less	400
Commercial establishments - with five occupants or less (occupants are defined as owners, managers or employees)	400
for each additional five occupants or part	400
Industrial plants - shall be any enterprise which produces industrial wastes. For each 400 gallons per day of flow plus additional gallons per day based on quantity and quality to be determined and assigned	400
Launderettes: for each two washing machines	400

* See Page "3" of this Schedule

	GALLONS PER DAY OF USE
Laundries: based on capacity and gallons per day to be assigned	
Car laundries: based on capacity and gallons per day assigned	
Bar and grill	1200
Luncheonette (Open less than fourteen hours a day)	1200
Luncheonette (Open more than fourteen hours a day)	2400
Restaurant - small - twenty seats or less	1200
Restaurant - medium - twenty-one to seventy-five seats	1600
Restaurant - large - over seventy-five seats	2000
Restaurant - each 20 seats or part above 100 seats	400
Restaurant with bar - add 1200 gallons per day	
Schools: public-private-parochial Elementary - for each sixty pupils	400
Junior high school - for each fifty-four pupils	400
Senior high school - for each forty-two pupils	400
Colleges:	
For each fifty-four students	400
For each seventy-five evening students	400
For each eight resident students (where dormitories are available)	400
Churches - Synagogues - Temples: (including Sunday School)	
Small congregation - under one hundred families	400
Medium congregation - one hundred to two hundred fifty families	800
Large congregation - over two hundred fifty families	1200
For part time week day schools add 400 gallons per day	

	GALLONS PER DAY OF USE
Drive-In theaters - for each forty car spaces or part	400
Theaters - for each sixty seats or parts	400
Bowling Alleys - for each two lanes	400
Hospitals - for each four beds	1200
Convalescent homes (Group homes or hostels for each 2 beds	400
Service stations - without car wash	400
Service stations - with car wash	800
Beauty Salons and Barber Shops - Minimum	800
Three to five customer service stations	1200
Six or more service stations	1600
(Count each shampoo facility as a customer service station)	
Fire houses	400

* For dwelling units within a condominium/coop/multiple residence, the gallons of use per day will be based on 100 gallons per bedroom per day.

AGREEMENT

AGREEMENT entered into as of this 12 day of April, 1995, by and among the following parties:

The TOWN OF BLOOMING GROVE, a municipal corporation of the State of New York with principal offices located at Town Hall, Main Street, Washingtonville, New York, hereinafter "Blooming Grove,"

The TOWN OF CHESTER, a municipal corporation of the State of New York with principal offices located at Town Hall, Kings Highway, Chester, New York, hereinafter "Chester,"

The TOWN OF MONROE, a municipal corporation of the State of New York with principal offices located at Town Hall, 11-13 Stage Road, Monroe, New York, hereinafter "Monroe,"

The TOWN OF WOODBURY, a municipal corporation of the State of New York with principal offices located at Town Hall, P.O. Box D, Highland Mills, New York, hereinafter "Woodbury,"

The VILLAGE OF CHESTER, a municipal corporation of the State of New York with principal offices located at Village Hall, 47 Main Street, Chester, New York, hereinafter "Village of Chester,"

Said Towns and Villages (collectively referred to as the Moodna Communities), as well as the Villages of Monroe, Harriman and Kiryas Joel and a portion of the Town of Monroe within Orange County Sewer District No 1 are also described in this Agreement as the "Local Municipalities" or the "Local Municipality", and

The COUNTY OF ORANGE (hereinafter the "County"), with principal offices located in the Orange County Government Center, 255 Main Street, Goshen, New York, acting for itself and for Orange County

Sewer District No. 1 ("OCSD#1" or the "District"),

WHEREAS, the parties to this Agreement have previously entered into an agreement known as the Moodna Basin Inter-Municipal Agreement dated September 8, 1978, for the development of two million gallons per day of additional sewage treatment capacity as a result of the construction of additional facilities at the Harriman Sewage Treatment Plant, hereinafter "the HTP"; and

WHEREAS, the parties entered into a further agreement as of September 8, 1988, pertaining to:

(a) monitoring the demand each Moodna Community and the OCSD #1 is placing on the HTP;

(b) limiting the demand which the District, and which each Moodna Community may place upon the HTP;

(c) centralizing control over new hook-ups to the sewer system; and

WHEREAS, the parties desire to redefine the manner in which decisions shall be made concerning the operation and maintenance of the HTP,

NOW, THEREFORE, it is hereby agreed as follows:

1. CONSULTATION. The County agrees (for itself and for the District) that on and after the date of this Agreement, it will act with respect to the operation and maintenance of the HTP only after it has given the Local Municipalities sufficient notice and an opportunity to respond to the proposed action whenever the effect of an action would be to:

(a) adopt a budget,

(b) approve any non-budgeted expenditure in excess of $50,000,

(c) undertake any capital project in excess of $25,000,

(d) retain any consultant,

(e) hire additional personnel,

(f) establish a price for the receipt of septage,

(g) allocate costs among Orange County Sewer District No. 1 and the Moodna Communities,

(h) determine flows,

(i) contract between the County and OCSD #1 for any consultant for services rendered in running the HTP.

2. In addition to its duty to give consultation, the County will not adopt a budget for the operation and maintenance of the HTP or sign a consent order until it has received prior written approval from the Local Municipalities. Approval of the budget by the Local Municipalities is deemed to be approval of all items in the budget, including costs of county employees. Operation and Maintenance budgets shall be signed by the highest elected official of each Local Municipality. The County may adopt a budget and execute a consent order and will be considered to be acting upon the prior approval of each Local Municipalities if the action is approved by:

(a) three of the following Local Municipalities:

(i) Town of Woodbury,

(ii) Town of Blooming Grove,

(iii) Town of Chester,

(iv) Village of Chester, and

(v) Town of Monroe; and

(b) two of the three following Villages

(i) the Village of Harriman,

(ii) the Village of Kiryas Joel, and

(iii) the Village of Monroe.

An action shall be considered approved by a Local Municipality if it has been presented in writing by the County to the Clerk of a Local Municipality as a proposed action with specific reference to this Agreement and no written objection has been received by the County from the Supervisor, Mayor or their written designee or attorney of such Local Municipality within thirty (30) calendar days after such delivery. If such an objection is timely received as to a particular action, it shall be effective until expressly rescinded in a writing and signed by the Chief Executive or attorney for such Local Municipality.

3. Each Local Municipality agrees that it will timely pay its proper allocation of all expenses as set forth in a budget as herein provided, and will pay its proper allocation of fines imposed by reason of approved consent orders, including each and every loss, cost, damage or expense incurred as a result of a joint decision of the County and Local Municipalities.

4. Failure of any Local Municipality to pay its share of operation and maintenance expenses, as set forth in an approved budget, by the 1st day of July and last day of December of each

year will result in the denial of any request by such Local Municipality for hook-ups into the system until full payment is made and a civil penalty in the amount of $1,000 per day for each day payment is delayed. The County agrees to provide a proposed budget for municipal review no later than May 1st of each year.

5. All the parties hereto agree to work together toward the establishment of an Authority to own, operate and maintain the HTP, and each of the parties hereto agrees to transfer all its right, title and interest in and to the HTP to such Authority, once the same is established, provided that

(a) such establishment and such transfer can be accomplished without the loss, forfeiture or refund of federal or state grant moneys heretofore received or currently due or to become due;

Authority

(b) such establishment and such transfer can be accomplished without causing the loss of any tax exemption currently applicable to any of the bonded indebtedness of any party hereto; and

(c) the Authority shall be governed by a Board composed of a representative of each party hereto, with votes weighted by usage, allocation, population, or some other formula incorporating one or more of such factors.

6. The parties agree to the establishment of a committee to implement the establishment of a sewer authority (hereinafter

Legal committee?

"Sewer Authority Committee") with the political heads (or their designees) of each of the following Local Municipalities as members of said committee: Villages of Kiryas Joel, Chester, Harriman, Monroe, and Towns of Blooming Grove, Chester, Monroe, and Woodbury and the County Executive or his designee. The parties met on December 28, 1994 and have established a working group to spearhead planning for the establishment of an authority. At the meeting it was agreed that the working group will meet monthly, act on behalf of the Sewer Authority Committee and will be composed of no more than five individuals, two of whom will represent the interests of the Moodna Communities, two of whom will represent the interests of the District and one who will represent the interests of the County.

7. The parties agree to cooperate with the working group and any other subcommitte to be designated by the Sewer Authority Committee (which Committee shall meet at least 4 times a year) and work towards the establishment of an Orange County Sewer Authority by no later than October of 1996. Once the Sewer Authority is established, the Sewer Authority Committee shall convene for the purpose of revising or eliminating this Agreement as deemed appropriate by majority vote of the Committee.

8. All septage waste collected by a Local Municipality must be disposed of pursuant to the terms of its hauling permit and may not be disposed of anywhere else in the collection systems leading to the plant. All septage volume registered from the Local Municipalities at the HTP will be counted as part of such Local

Municipality's flow for the month deposited. Improper disposal will result in the denial of sewer hook-up permits and the imposition of a civil penalty in the amount of $10,000 for each violation.

9. Each of the Moodna Communities (for purposes of this paragraph only, the Town of Chester and the Village of Chester shall be considered a single municipality) shall have meters installed to gauge the flow into the HTP and shall report all results to the County on a monthly basis. Failure to submit electrically and volumetrically calibrated flow figures in any month, shall result in a flow figure for that month to be computed at a rate ten (10%) percent higher than the last reported figure. All Local Municipalities shall allow the County to inspect its flow meters at any time requested.

10. The County and the Moodna Communities recognize that it is in their best interest to control inflow and infiltration (I & I) into the collection systems leading to the HTP since the volume of water entering into the system results in a decrease in allocated capacity. In recognition of the need to provide service to its consumers, each Moodna Community and District that has exceeded 85% of its allocated flow as set forth in the September 8, 1978 Agreement shall undergo an aggressive I & I preventive program to preserve its allocation and reduce the volume the plant must treat. The District's program shall be in conformance with the findings reached in the 1991 Clinton Bogart study and shall

attempt, at a minimum, to achieve the reductions as outlined in the study. The Village of Chester, and Towns of Monroe and Chester agree to implement an I & I program and have engaged Lanc & Tully, Engineering and Surveying, P.C., to conduct a study to identify I & I remedial work in those communities and agree to the following schedule:

a. Preliminary results, identifying areas for detailed study: December 31, 1994 (Completed).

b. Final report with recommendations for economically feasible remedial work: June 30, 1995.

c. Completion of recommended remedial work: June 30, 1996.

The Town of Woodbury had engaged the firm of New England Pipe Company (Phase I) and has recently engaged the firm of Riddick Associates to conduct an I & I study (Phase II) and commits to the following schedule:

a. Preliminary results, identifying areas for detailed study: Phase I - 1987 (prior study by New England Pipe Co.-Completed.) Phase II - November 1996. (If required.)

b. Final report with recommendations for economically feasible remedial work: Phase I - September 1987. Phase II - December 1996. (If required.)

c. Completion of remedial work: Phase I - July 1995. Phase II - July 1997. (If required.)

11. The allocation of each Moodna Community and District as contained in the 1988 Agreement shall be strictly observed. Any savings achieved through an I & I program will result in less flow

into the plant and consequently this will be registered by each community's flow meter. The reduction of flow shall inure to the benefit of the community which has achieved its reduction through its I & I program.

12. Except as modified hereby, the Agreement of September 8, 1978 and September 8, 1988 remain in full force and effect.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement as of the date set forth above.

TOWN OF BLOOMING GROVE	COUNTY OF ORANGE
By: ______________________	By: ______________________
Dated: ______________________	JOSEPH G. RAMPE
	Dated: 4/13/95
TOWN OF CHESTER	TOWN OF MONROE
By: ______________________	By: ______________________
Dated: 3-21-95	Dated: 3-21-95
TOWN OF WOODBURY	VILLAGE OF CHESTER
By: Robert Till	By: John H. Lunga
Dated: 3-21-95	Dated: ______________________

VILLAGE OF MONROE

By:______________________________

Dated:____________________________

VILLAGE OF HARRIMAN

By:______________________________

Dated:____________________________

VILLAGE OF KIRYAS JOEL

By:______________________________

Dated:____________________________

Exhibit B

New York State Department of Environmental Conservation
Division of Environmental Permits, Region 3
21 South Putt Corners Road, New Paltz, New York 12561-1696
Phone: (914) 256-3054 Fax: (914) 255-3042
Website: www.dec.state.ny.us

Environmental Conservation 30 YEARS
John P. Cahill
Commissioner

ORANGE COUNTY
FEB 7 2000
DEPT OF ENVIRONMENTAL FACILITIES & SERVICES

February 2, 2000

WILLIAM GUNTHER ACTING COMMISSIONER
ORANGE COUNTY DEPT ENVIRONMENTAL FACILITIES & SERVICES
ROUTE 17M PO BOX 637
GOSHEN NY 10924

RE. Draft Permit Modification to 4.5 MGD
Harriman WWTF
DEC No. 3-3358-00038/00001
SPDES No. NY-0027901

Dear Mr. Gunther:

Enclosed is a modified Permit issued by the NYS Department of Environmental Conservation (DEC) for the Harriman Facility. This permit authorizes the increase in flow from that Facility to 4.5 MGD.

Note that the effective date for the Temperature effluent limitation for outfall 002 is January 1, 2003 as agreed to by DEC following discussion with the County.

If you have any questions regarding the above, please contact me at (914) 256-3014.

Sincerely,

Alexander F. Ciesluk, Jr.

Alexander F. Ciesluk, Jr.
Deputy Regional Permit Administrator
Region 3

AFC/dv
w/enclosure
cc: J. Marcogliese, DEC Reg. 3
R. Hannaford, DEC, BWFD
USEPA, Region II
Orange Co. Executive J. Rampe
Orange Co. Health
T. Micelli, Rockland Co. Health Dept.
C. Hjelm, United Water of NY
Orange Environment Inc.
Mayor, V. Suffern
R. Gallione, T. Mahawah
R. Oberthaler, NJDEP

NEW YORK STATE CENSUS 2000
BE PART OF THE COUNT

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

State P utar Discharge Elimination Syst (SPDES)

DISCHARGE PERMIT

Special Conditions (Part 1)

Industrial Code:	4952	SPDES Number:	NY- 002 7901
Discharge Class (CL):	05	DEC Number:	3-3358-00038-00001
Toxic Class (TX):	T	Effective Date (EDP):	06/24/93
Major Drainage Basin:	15	Expiration Date (ExPD):	06/01/03
Sub Drainage Basin:	01	Modification Dates:	(EDM) 02/02/00.
Water Index Number:	NJ-12	Attachment(s):	General Conditions (Part II) Date: 11/90
Compact Area:			

This SPDES permit is issued in compliance with Title 8 of Article 17 of the Environmental Conservation Law of New York State and in compliance with the Clean Water Act, as amended, (33 U.S.C. §1251 et.seq.)(hereinafter referred to as "the Act").

PERMITTEE NAME AND ADDRESS

Name: Orange Co. Dept. of Environmental Facilities & Services   Attention: William C. Gunther, Acting Commissioner
Street: P.O. Box 637
City: Goshen   State: NY   Zip Code: 10924

is authorized to discharge from the facility described below:

FACILITY NAME AND ADDRESS

Name: OCSD #1 Harriman Sewage Treatment Plant
Location (C,T,V): Harriman (V)   County: Orange
Facility Address: River Road
City: Harriman   State: NY   Zip Code: 10926
NYTM -E: NYTM - N:
From Outfall No.: 001   at Latitude: 41 ° 18 ' 38 "   & Longitude: 74 ° 08 ' 37 "
into receiving waters known as: Ramapo River   Class: C

and; (list other Outfalls, Receiving Waters & Water Classifications)

Outfall No: 002 at Latitude 41° 17' 43" & Longitude 74° 08' 23" into receiving water known as: Ramapo River Class: A(T)
Outfall No: 003 at Latitude 41° 21' 15" & Longitude 74° 6' 42" into receiving water known as: Woodbury Creek Class: C(T)

in accordance with the effluent limitations, monitoring requirements and other conditions set forth in Special Conditions (Part I) and General Conditions (Part II) of this permit.

DISCHARGE MONITORING REPORT (DMR) MAILING ADDRESS

Mailing Name: OCSD #1, Harriman Sewage Treatment Plant
Street: P.O. Box 637
City: Goshen   State: NY   Zip Code: 10924
Responsible Official or Agent: William G. Darling   Phone: (914) 291-2033

This permit and the authorization to discharge shall expire on midnight of the expiration date shown above and the permittee shall not discharge after the expiration date unless this permit has been renewed, or extended pursuant to law. To be authorized to discharge beyond the expiration date, the permittee shall apply for permit renewal not less than 180 days prior to the expiration date shown above.

Permit Administrator:	Alexander F. Ciesluk, Jr.
Address:	21 South Putt Corners Road New Paltz, New York 12561-1696
Signature: Alexander F. Ciesluk Jr.	Date: 2/02/00

DISTRIBUTION:

J. Marcogliese
R. Hannaford
USEPA, Region II
Orange Co. Health Dept.

2/4/00

FINAL EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning EDM - February 2, 2000 and lasting until June 1, 2003 the discharges from the permitted facility shall be limited and monitored by the permittee as specified below:

LIMITATIONS APPLY: [ ] All Year [ ] Seasonal Discharge from June 1 to October 31

Outfall Number 001

EFFLUENT LIMITATIONS

[X] Flow	30 day arithmetic mean	2.5 [X] MGD [ ] GPD
[X] CBOD, 5 - Day	Daily Maximum	5.0 mg/l and 104 lbs/day(1)
[ ] BOD, 5 - Day	7 day arithmetic mean	____ mg/l and ____ lbs/day
[ ] UOD(2)	____	____ mg/l and ____ lbs/day
[X] Solids, Suspended	Daily Maximum	10.0 mg/l and 208 lbs/day(1)
[ ] Solids, Suspended	7 day arithmetic mean	____ mg/l and ____ lbs/day

[X] Effluent disinfection required: [X] All Year [ ] Seasonal from ____ to ____

[X] Coliform, Fecal	30 day geometric mean shall not exceed 200/100 ml	
[X] Coliform, Fecal	7 day geometric mean shall not exceed 400/100 ml	
[X] Chlorine, Total Residual	Daily Maximum	0.1 mg/l
[X] pH	Range	6.5 to 8.5 SU
[X] Solids, Settleable	Daily Maximum	0.1 ml/l
[X] Ammonia	30 day arithmetic mean	1.5 mg/l as NH_3
[X] Dissolved Oxygen	Daily Minimum	7.0 mg/l
[X] Copper, Total Recoverable	Daily Maximum	3.6 lbs/day (3)
[X] Zinc, Total Recoverable	Daily Maximum	11.7 lbs/day(3)

MONITORING REQUIREMENTS

Parameter	Frequency	Sample Type	Sample Location Influent	Sample Location Effluent
[X] Flow, [X] MGD [ ] GPD	Continuous	Record	X	____
[X] CBOD, 5 - Day, mg/l	1/week	24 hr. Comp.	X	X
[X] Solids, Suspended, mg/l	1/week	24 hr. Comp.	X	X
[X] Coliform, Fecal, No./100 ml	1/week	Grab	____	X
[X] Nitrogen, TKN (as N), mg/l	1/month	24 hr. Comp.	____	X
[X] Ammonia (as NH_3), mg/l	1/week	24 hr. Comp.	____	X
[X] pH, SU (standard units)	2/day	Grab	X	X
[X] Solids, Settleable, ml/l	2/day	Grab	X	X
[X] Chlorine, Total Residual, mg/l	2/day	Grab	____	X
[ ] Phosphorus, Total (as P), mg/l	____	____	____	____
[X] Temperature, Deg. F	2/day	Grab	____	X
[X] Dissolved Oxygen	1/week	Grab	____	X
[X] Copper, Total Recoverable	1/month	24 hr. Comp.	____	X
[X] Zinc, Total Recoverable	1/month	24 hr. Comp.	____	X

NOTES: (1) and effluent value shall not exceed 15 % and 15 % of influent values for $CBOD_5$ & TSS respectively.

(2) Ultimate Oxygen Demand shall be computed as follows:
UOD = 1 ½ x $CBOD_5$ + 4 ½ x TKN (Total Kjeldahl Nitrogen)

(3) The limit is a Phased Total Maximum Daily Load Limit pursuant to 6NYCRR part 702.16(b)(2). The Department will modify this limit following completion of the compliance action on Page 8 of 10.

FINAL EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning EDM - February 2, 2000 and
lasting until June 1, 2003
the discharges from the permitted facility shall be limited and monitored by the permittee as specified below:

LIMITATIONS APPLY: [ ] All Year [X] Seasonal Discharge from November 1 to May 31

Outfall Number 001

EFFLUENT LIMITATIONS

[X] Flow	30 day arithmetic mean	2.5 [X] MGD [ ] GPD
[ ] BOD, 5 - Day	30 day arithmetic mean	____ mg/l and ____ lbs/day(1)
[ ] BOD, 5 - Day	7 day arithmetic mean	____ mg/l and ____ lbs/day
[X] UOD(2)(4)	Daily Maximum	60.0 mg/l and 1252 lbs/day
[X] Solids, Suspended	30 day arithmetic mean	30 mg/l and 626 lbs/day(1)
[X] Solids, Suspended	7 day arithmetic mean	45 mg/l and 939 lbs/day

[X] Effluent disinfection required: [X] All Year [ ] Seasonal from ____ to ____

[X] Coliform, Fecal	30 day geometric mean shall not exceed 200/100 ml	
[X] Coliform, Fecal	7 day geometric mean shall not exceed 400/100 ml	
[X] Chlorine, Total Residual	Daily Maximum	0.1 mg/l
[X] pH	Range	6.5 to 8.5 SU
[X] Solids, Settleable	Daily Maximum	0.1 ml/l
[X] Ammonia	30 day arithmetic mean	2.2 mg/l as NH_3
[X] Dissolved Oxygen	Daily Minimum	7.0 mg/l
[X] Copper, Total Recoverable	Daily Maximum	3.6 lbs/day(3)
[X] Zinc, Total Recoverable	Daily Maximum	11.7 lbs/day(3)

MONITORING REQUIREMENTS

Parameter	Frequency	Sample Type	Sample Location Influent	Sample Location Effluent
[X] Flow, [X] MGD [ ] GPD	Continuous	Record	X	
[X] CBOD, 5 - Day, mg/l	1/week	24 hr. Comp.	X	X
[X] Solids, Suspended, mg/l	1/week	24 hr. Comp.	X	X
[X] Coliform, Fecal, No./100 ml	1/week	Grab		X
[X] Nitrogen, TKN (as N), mg/l	1/week	24 hr. Comp.		X
[X] Ammonia (as NH_3), mg/l	1/week	24 hr. Comp.		X
[X] pH, SU (standard units)	2/day	Grab	X	X
[X] Solids, Settleable, ml/l	2/day	Grab	X	X
[ ] Chlorine, Total Residual, mg/l	2/day	Grab		X
[ ] Phosphorus, Total (as P), mg/l				
[X] Temperature, Deg. F	2/day	Grab	X	X
[X] Dissolved Oxygen	1/week	Grab		X
[X] Copper, Total Recoverable	1/month	24 hr. Comp.		X
[X] Zinc, Total Recoverable	1/month	24 hr. Comp.		X

NOTES:
(1) and effluent value shall not exceed 15 % and 15 % of influent values for $CBOD_5$ & TSS respectively.
(2) Ultimate Oxygen Demand shall be computed as follows:
$UOD = 1\frac{1}{2} \times CBOD_5 + 4\frac{1}{2} \times TKN$ (Total Kjeldahl Nitrogen)
(3) The limit is a Phased Total Maximum Daily Load Limit pursuant to 6NYCRR part 702.16(b)(2). The Department will modify this limit following completion of the compliance action on Page 8 of 10.
(4) Samples for $CBOD_5$ & TKN used to calculate UOD are to be collected at the same time.

2/2/00

FINAL EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning EDM - February 2, 2000

and lasting until June 1, 2003

the discharges from the permitted facility shall be limited and monitored by the permittee as specified below:

LIMITATIONS APPLY: [ ] All Year [X] Seasonal from June 1 to October 31

Outfall Number 002

EFFLUENT LIMITATIONS

[X] Flow	30 day arithmetic mean	2.0 [X] MGD. [ ] GPD
[X] CBOD, 5 - Day	Daily Maximum	5.0 mg/l and 83 lbs/day(1)
[ ] BOD, 5 - Day	7 day arithmetic mean	___ mg/l and ___ lbs/day
[ ] UOD(2)		___ mg/l and ___ lbs/day
[X] Solids, Suspended	Daily Maximum	10.0 mg/l and 166 lbs/day(1)
[ ] Solids, Suspended	7 day arithmetic mean	___ mg/l and ___ lbs/day
[X] Effluent disinfection required: [X] All Year [ ] Seasonal from ___ to ___		
[X] Coliform, Fecal	30 day geometric mean shall not exceed 200/100 ml	
[X] Coliform, Fecal	7 day geometric mean shall not exceed 400/100 ml	
[X] Chlorine, Total Residual	Daily Maximum	0.1 mg/l
[ ] pH	Range	6.5 to 8.5 SU
[X] Solids, Settleable	Daily Maximum	0.1 ml/l
[X] Ammonia	30 day Arithmetic Mean	1.1 mg/l as NH_3
[X] Dissolved Oxygen	Daily Minimum	7.0 mg/l
[X] Copper, Total Recoverable	Daily Maximum	2.7 lbs/day(3)
[X] Zinc, Total Recoverable	Daily Maximum	9.3 lbs/day(3)
[X] Temperature (4)	Daily Maximum	70°F

MONITORING REQUIREMENTS

Parameter	Frequency	Sample Type	Sample Location Influent	Sample Location Effluent
[X] Flow, [X] MGD [ ] GPD	Continuous	Record	X	
[X] CBOD, 5 - Day, mg/l	1/week	24 hr. Comp.	X	X
[X] Solids, Suspended, mg/l	1/week	24 hr. Comp.	X	X
[X] Coliform, Fecal, No./100 ml	1/week	Grab		X
[X] Nitrogen, TKN (as N), mg/l	1/month	24 hr. Comp.		X
[X] Ammonia (as NH_3), mg/l	1/week	24 hr. Comp.		X
[X] pH, SU (standard units)	2/day	Grab	X	X
[X] Solids, Settleable, ml/l	2/day	Grab	X	X
[X] Chlorine, Total Residual, mg/l	2/day	Grab		X
[ ] Phosphorus, Total (as P), mg/l				
[X] Temperature, Deg. F	2/day	Grab	X	X
[X] Dissolved Oxygen	1/week	Grab		X
[X] Copper, Total Recoverable	1/month	24 hr. Comp.		X
[X] Zinc, Total Recoverable	1/month	24 hr. Comp.		X

NOTES:
(1) and effluent value shall not exceed 15 % and 15 % of influent values for $CBOD_5$ & TSS respectively.
(2) Ultimate Oxygen Demand shall be computed as follows:
UOD = 1 ½ x $CBOD_5$ + 4 ½ x TKN (Total Kjeldahl Nitrogen)
(3) The limit is a Phased Total Maximum Daily Load Limit pursuant to 6NYCRR part 702.16(b)(2). The Department will modify this limit following completion of the compliance action on Page 8 of 10.
(4) Effective Date January 1, 2003.

FINAL EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning EDM - February 2, 2000 and lasting until June 1, 2003

the discharges from the permitted facility shall be limited and monitored by the permittee as specified below:

LIMITATIONS APPLY: [ ] All Year [X] Seasonal from November 1 to May 31

Outfall Number 002

EFFLUENT LIMITATIONS

[X] Flow	30 day arithmetic mean	2.0 [X] MGD [ ] GPD
[ ] BOD, 5 - Day	30 day arithmetic mean	___ mg/l and ___ lbs/day[1]
[ ] BOD, 5 - Day	7 day arithmetic mean	___ mg/l and ___ lbs/day
[X] UOD[2][4]	Daily Maximum	65.0 mg/l and 1085 lbs/day
[X] Solids, Suspended	30 day arithmetic mean	30 mg/l and 501 lbs/day[1]
[X] Solids, Suspended	7 day arithmetic mean	45 mg/l and 751 lbs/day
[X] Effluent disinfection required: [X] All Year [ ] Seasonal from ___ to ___		
[X] Coliform, Fecal	30 day geometric mean shall not exceed 200/100 ml	
[X] Coliform, Fecal	7 day geometric mean shall not exceed 400/100 ml	
[X] Chlorine, Total Residual	Daily Maximum	0.1 mg/l
[X] pH	Range	6.5 to 8.5 SU
[X] Solids, Settleable	Daily Maximum	0.1 ml/l
[X] Ammonia	30 day Arithmetic Mean	6.8 mg/l as NH_3
[X] Dissolved Oxygen	Daily Minimum	7.0 mg/l
[X] Copper, Total Recoverable	Daily Maximum	2.7 lbs/day[3]
[X] Zinc, Total Recoverable	Daily Maximum	9.3 lbs/day[3]
[X] Temperature[5]	Daily Maximum	70°F

MONITORING REQUIREMENTS

Parameter	Frequency	Sample Type	Sample Location Influent	Sample Location Effluent
[X] Flow, [X] MGD [ ] GPD	Continuous	Record	X	
[X] CBOD, 5 - Day, mg/l	1/week	24 hr. Comp.	X	X
[X] Solids, Suspended, mg/l	1/week	24 hr. Comp.	X	X
[X] Coliform, Fecal, No./100 ml	1/week	Grab		X
[X] Nitrogen, TKN (as N), mg/l	1/week	24 hr. Comp.		X
[X] Ammonia (as NH_3), mg/l	1/week	24 hr. Comp.		X
[X] pH, SU (standard units)	2/day	Grab	X	X
[X] Solids, Settleable, ml/l	2/day	Grab	X	X
[X] Chlorine, Total Residual, mg/l	2/day	Grab		X
[ ] Phosphorus, Total (as P), mg/l				
[X] Temperature, Deg. F	2/day	Grab	X	X
[X] Dissolved Oxygen	1/week	Grab		X
[X] Copper, Total Recoverable	1/month	24 hr. Comp.		X
[X] Zinc, Total Recoverable	1/month	24 hr. Comp.		X

NOTES:
(1) and effluent value shall not exceed 15 % and 15 % of influent values for $CBOD_5$ & TSS respectively.
(2) Ultimate Oxygen Demand shall be computed as follows:
$UOD = 1\frac{1}{2} \times CBOD_5 + 4\frac{1}{2} \times TKN$ (Total Kjeldahl Nitrogen)
(3) The limit is a Phased Total Maximum Daily Load Limit pursuant to 6NYCRR part 702.16(b)(2). The Department will modify this limit following completion of the compliance action on Page 8 of 10.
(4) Samples for $CBOD_5$ & TKN used to calculate UOD are to be collected at the same time.
(5) Effective Date January 1, 2003.

FINAL EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning May 10, 1999

and lasting until June 1, 2003

the discharges from the permitted facility shall be limited and monitored by the permittee as specified below:

LIMITATIONS APPLY: [X] All Year [ ] Seasonal from ________ to ________

Outfall Number 003

EFFLUENT LIMITATIONS

[ ] Flow	30 day arithmetic mean	______ [ ] MGD [ ] GPD	
[ ] BOD, 5 - Day	30 day arithmetic mean	______ mg/l and	______ lbs/day(1)
[ ] BOD, 5 - Day	7 day arithmetic mean	______ mg/l and	______ lbs/day
[ ] UOD(2)	______	______ mg/l and	______ lbs/day
[ ] Solids, Suspended	30 day arithmetic mean	______ mg/l and	______ lbs/day(1)
[ ] Solids, Suspended	7 day arithmetic mean	______ mg/l and	______ lbs/day

[ ] Effluent disinfection required: [ ] All Year [ ] Seasonal from ________ to ________

[ ] Coliform, Fecal	30 day geometric mean shall not exceed 200/100 ml	
[ ] Coliform, Fecal	7 day geometric mean shall not exceed 400/100 ml	
[ ] Chlorine, Total Residual	Daily Maximum	______ mg/l
[ ] pH	Range	______ SU
[ ] Solids, Settleable	Daily Maximum	______ ml/l
[ ] ______	______	______ mg/l as ______
[ ] ______	______	______
[ ] ______	______	______
[ ] ______	______	______
[ ] ______	______	______
[ ] ______	______	______

MONITORING REQUIREMENTS

Parameter	Frequency	Sample Type	Sample Location Influent	Sample Location Effluent
[ ] Flow, [ ] MGD [ ] GPD	______	______	______	______
[ ] BOD, 5 - Day, mg/l	______	______	______	______
[ ] Solids, Suspended, mg/l	______	______	______	______
[ ] Coliform, Fecal, No./100 ml(3)	______	______	______	______
[ ] Nitrogen, TKN (as N), mg/l	______	______	______	______
[ ] Ammonia (as NH_3), mg/l	______	______	______	______
[ ] pH, SU (standard units)	______	______	______	______
[ ] Solids, Settleable, ml/l	______	______	______	______
[ ] Chlorine, Total Residual, mg/l(3)	______	______	______	______
[ ] Phosphorus, Total (as P), mg/l	______	______	______	______
[ ] Temperature, Deg.____	______	______	______	______
[ ] ______	______	______	______	______
[ ] ______	______	______	______	______
[ ] ______	______	______	______	______
[ ] ______	______	______	______	______

NOTES: (1) and effluent value shall not exceed __ % and __ % of influent values for BOD_5 & TSS respectively.
(2) Ultimate Oxygen Demand shall be computed as follows:
UOD = 1 1/2 x $CBOD_5$ + 4 1/2 x TKN (Total Kjeldahl Nitrogen)
(3) Monitoring of these parameters is only required during the period when disinfection is required.
Note: Utilization of this outfall is prohibited until SPDES Permit is modified to specifically authorize use.

ACTION LEVEL REQUIREMENTS (TYPE I)

The parameters listed below have been reported present in the discharge but at levels that currently do not require technology or water quality based limits. Action levels have been established which, if routinely or excessively exceeded, will result in reconsideration and/or development of technology or water quality based limits.

Routine action level monitoring results, if not provided for on the Discharge Monitoring Report (DMR) form, shall be appended to the DMR for the period during which the sampling was conducted. If submission of DMR's is not required by this permit, the results shall be maintained in accordance with instructions on the RECORDING, REPORTING AND MONITORING page of this permit.

If any of the action levels is exceeded, the permittee shall undertake a short-term, high-intensity monitoring program for the parameter(s). Samples identical to those required for routine monitoring purposes shall be taken on each of at least three consecutive operating and discharge days and analyzed. Results shall be expressed in terms of both concentration and mass, and shall be submitted no later than the end of the second month following the month when the action level was first exceeded. Results may be appended to the DMR or transmitted under separate cover to the addresses listed on the RECORDING, REPORTING AND MONITORING page of this permit. If levels higher than the actions levels are confirmed the results shall constitute an application for permit modification and the permit may be reopened for consideration of revised action levels or effluent limits.

The permittee is not authorized to discharge any of listed parameters at levels which may cause or contribute to a violation of water quality standards.

Outfall Number & Effluent Parameter	Action Level	Units	Minimum Monitoring Requirements Measurement Frequency	Sample Type
001				
Phenolics, Total*	0.9	lbs/day	4/year	24-hr. comp.
002				
Phenolics, Total*	0.7	lbs/day	4/year	24-hr. comp.

*By the 4AAP Method.

2/2/00

SCHEDULE OF COMPLIANCE

a) The permittee shall comply with the following schedule.

Action Code	Outfall Number(s)	Compliance Action	Due Date
	All	The permittee shall complete and submit the results of the following studies to the Offices listed on the final page of this permit on or before May 10, 2001. 1. <u>QUANTIFICATION OF METALS</u> Identify the sources of copper and zinc within the POTW. This study shall consider both controllable sources (industrial/commercial) and uncontrollable sources (residential). Sufficient samples shall be collected and analyzed so the waste stream characterization is representative of the discharge to the POTW. The following detection levels shall be achieved: Cu-20 ppb; Zn-20 ppb. 2. <u>RAW WATER STUDY</u> Evaluate methods to reduce the levels of copper introduced into the POTW's by residential and commercial sources. This study shall quantify reductions in copper available through modifications to the water chemistry of raw potable water that tend to reduce corrosivity and leaching of copper from residential and commercial water pipes. Where a study is already being performed to address reductions of copper or other priority pollutant metals under the Safe Drinking Water Act, or the Solid Waste Disposal Act, the study already being performed may be considered adequate. 3. <u>REMOVALS STUDY</u> This study must include collection and analysis of 12 monthly influent and effluent 24 hour composite flow proportioned composite samples for copper and zinc. Effluent sample collection must lag influent sample collection by the hydraulic retention time of the treatment plant. The minimum practicable detection levels shall be achieved through EPA method 9.2 extraction of samples and analysis by graphite furnace atomic adsorption spectroscopy. 4. <u>GOAL</u> The goal of these studies is to have the discharge be able to meet the following Calculated Water Quality Based Effluent Limits: <u>Outfall 001</u> <u>Outfall 002</u> Copper, Total Recoverable 0.5 lbs/day 0.4 lbs/day Zinc, Total Recoverable 3.8 lbs/day 3.2 lbs/day	May 10, 2001

2/2/00

DISCHARGE NOTIFICATION REQUIREMENTS

a) The permittee shall, except as set forth in (c) below, maintain the existing identification signs at all outfalls to surface waters, which have not been waived by the Department in accordance with 17-0815-a. The sign(s) shall be conspicuous, legible and in as close proximity to the point of discharge as is reasonably possible while ensuring the maximum visibility from the surface water and shore. The signs shall be installed in such a manner to pose minimal hazard to navigation, bathing or other water related activities. If the public has access to the water from the land in the vicinity of the outfall, an identical sign shall be posted to be visible from the direction approaching the surface water.

The signs shall have minimum dimensions of eighteen inches by twenty four inches (18" x 24") and shall have white letters on a green background and contain the following information:

N.Y.S. PERMITTED DISCHARGE POINT

SPDES PERMIT No.: NY__________

OUTFALL No. :____

For information about this permitted discharge contact:

Permittee Name: ______________________________

Permittee Contact: ______________________________

Permittee Phone: ( ) - ### - ####

OR:

NYSDEC Division of Water Regional Office Address :

NYSDEC Division of Water Regional Phone: ( ) - ### -####

b) For each discharge required to have a sign in accordance with a), the permittee shall provide for public review at a repository accessible to the public, copies of the Discharge Monitoring Reports (DMRs) as required by the RECORDING, REPORTING AND ADDITIONAL MONITORING REQUIREMENTS page of this permit. This repository shall be open to the public, at a minimum, during normal daytime business hours. The repository may be at the business office repository of the permittee or at an off-premises location of its choice (such location shall be the village, town, city or county clerk's office, the local library or other location as approved by the Department). In accordance with the RECORDING, REPORTING AND ADDITIONAL MONITORING REQUIREMENTS page of your permit, each DMR shall be maintained on record for a period of three years.

d) If, upon November 1, 1997, the permittee has installed signs that include the information required by 17-0815-a(2)(a), but do not meet the specifications listed above, the permittee may continue to use the existing signs for a period of up to five years, after which the signs shall comply with the specifications listed above.

d) The permittee shall periodically inspect the outfall identification signs in order to ensure that they are maintained, are still visible and contain information that is current and factually correct.

RECORDING, REPORTING AND ADDITIONAL MONITORING REQUIREMENTS

a) The permittee shall also refer to the General Conditions (Part II) of this permit for additional information concerning monitoring and reporting requirements and conditions.

b) The monitoring information required by this permit shall be summarized, signed and retained for a period of three years from the date of the sampling for subsequent inspection by the Department or its designated agent. Also, monitoring information required by this permit shall be summarized and reported by submitting;

[X] (if box is checked) completed and signed Discharge Monitoring Report (DMR) forms for each 1 month reporting period to the locations specified below. Blank forms are available at the Department's Albany office listed below. The first reporting period begins on the effective date of this permit and the reports will be due no later than the 28th day of the month following the end of each reporting period.

[ ] (if box is checked) an annual report to the Regional Water Engineer at the address specified below. The annual report is due by February 1 and must summarize information for January to December of the previous year in a format acceptable to the Department.

[X] (if box is checked) a monthly "Wastewater Facility Operation Report..." (form 92-15-7) to the Regional Water Engineer and/or County Health Department or Environmental Control Agency specified below.

[ ]

Send the original (top sheet) of each DMR page to:

Department of Environmental Conservation
Division of Water
Bureau of Watershed Compliance Programs
50 Wolf Road
Albany, New York 12233-3506
Phone: (518) 457-8954

Send the first copy (second sheet) of each DMR page to:

Department of Environmental Conservation
Regional Water Engineer
200 White Plains Road
Tarrytown, New York 10591-5805
Phone: (914) 332-1835

Send an additional copy of each DMR page to:

c) Noncompliance with the provisions of this permit shall be reported to the Department as prescribed in the attached General Conditions (Part II)

d) Monitoring must be conducted according to test procedures approved under 40 CFR Part 136, unless other test procedures have been specified in this permit.

e) If the permittee monitors any pollutant more frequently than required by the permit, using test procedures approved under 40 CFR Part 136 or as specified in this permit the results of this monitoring shall be included in the calculations and recording of the data on the Discharge Monitoring Reports.

f) Calculation for all limitations which require averaging of measurements shall utilize an arithmetic mean unless otherwise specified in this permit.

g) Unless otherwise specified, all information recorded on the Discharge Monitoring Report shall be based upon measurements and sampling carried out during the most recently completed reporting period.

h) Any laboratory test or sample analysis required by this permit for which the State Commissioner of Health issues certificates of approval pursuant to section five hundred two of the Public Health Law shall be conducted by a laboratory which has been issued a certificate of approval. Inquiries regarding laboratory certification should be sent to the Environmental Laboratory Accreditation Program, New York State Health Department Center for Laboratories and Research, Division of Environmental Sciences , The Nelson A. Rockerfeller Empire State Plaza, Albany, New York 12201.

Exhibit C

STATE OF NEW YORK
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

In the Matter of the Alleged Violations of Article 17 and 71 of the Environmental Conservation Law and Part 750 et seq., of Title 6 of the Official Compilation of Codes, Rules and Regulations of the State of New York (6 NYCRR)

County of Orange

Respondent.

ORDER ON CONSENT

Case No. R3-20001116-129

WHEREAS:

1. The Department of Environmental Conservation ("DEC") is a Department of the State of New York with jurisdiction to enforce the environmental laws of the State, pursuant to §3-0302 of the Environmental Conservation Law ("ECL"), Title 6 of the Official Compilation of the Codes, Rules and Regulations of the State of New York ("NYCRR") and Orders issued thereunder.

2. DEC has jurisdiction over the abatement and prevention of pollution of state waters pursuant to ECL Section 17-0101, et al. and Title 6 NYCRR Part 750, et al.. This jurisdiction authorizes DEC to regulate the discharge of pollutants from point sources into the waters of the State in conformity with the Federal Clean Water Act, 33 U.S.C. Section 1251, et seq.

3. Pursuant to its authority to protect the waters of the State, DEC administers the State Pollutant Discharge Elimination System Permit ("SPDES") program. In general, the SPDES program prohibits any discharge of pollutants to the waters of the State without a SPDES permit establishing pollutant limitations and treatment requirements.

4. The County of Orange ("Respondent") is a municipal agency owning, operating and having responsibility for a waste water treatment plant located on River Road in the Village of Harriman (the "facility"). The facility discharges treated waste water into the Ramapo River with 2 outfalls. At outfall 001, the classification of the Ramapo River is "C," and at outfall 002 the classification of the Ramapo River is "A(T)."

5. Respondent has violated ECL § 17-0803, 6 NYCRR Part751.1 and the conditions contained in the Respondent's SPDES Permit # NY0027901, as detailed below:

During the period November, 1999 through present, the following violations have occurred:

(a) Exceedance of the effluent limitation for ammonia;

(b) Exceedance of the daily maximum effluent limitation for settleable solids;

(c) Exceedance of the daily maximum effluent limitation for UOD

(d) Exceedance of the daily maximum effluent limitation for BOD; and

(e) Flow.

6. Respondent has undertaken and completed certain corrective measures with respect to the effluent violations as described in Part IIA and is proceeding with an upgrade and enhancement of the facility which will increase the capacity to the facility to 6.0 mgd and which Respondent intends to design to meet all effluent and flow limitations.

7. ECL §71-1929 provides for a civil penalty not to exceed twenty five thousand dollars ($25,000) for each violation of Article 17, or any regulations, permits or Orders issued thereunder. Pursuant to ECL § 71-1929, a person who violates any of the provisions of, or who fails to perform any duty imposed by ECL Article 17 or the rules or regulations of the Department promulgated pursuant thereto, or the terms of any certificate or permit issued thereunder, shall, *inter alia,* be liable for a penalty of not to exceed twenty-five thousand dollars per day for each violation.

8. Respondent affirmatively waives its right to a hearing and judicial review in the manner provided by law, consents to the issuance and entry of this Order pursuant to ECL Articles 17 and 71 and agrees to be bound by the terms, provisions, obligations and conditions contained herein.

NOW, IT IS HEREBY ORDERED THAT:

I. PENALTIES

A. Payable Penalty. With respect to the aforesaid violations, a civil penalty in the amount of **Five Thousand Dollars ($5,000.00)** is hereby assessed against Respondent, which amount shall be paid by Respondent to the Department upon Respondent's return of an executed copy of this Order to the Department. In addition, there is assessed against Respondent an additional penalty of **Five Thousand Dollars ($5,000.00)** which is hereby suspended pending full compliance with the terms of this Order. In the event that Respondents fail to comply with this Order, payment of the suspended penalty or such portion thereof as may be specified by DEC will be made by Respondents within 15 days after service upon Respondent of a notice of noncompliance demanding such payment. Such notice shall be deemed a part of this Order. Service of such notice may be made by ordinary mail.

B. Stipulated Penalties. (1) In the event that Respondent fails to comply with the provisions of Paragraph II herein by the dates set forth therein, the following stipulated penalties shall be due and payable:

Period of Noncompliance	Penalty Per Violation
First violation of a limit under Paragraph II D	$100.00
Second Violation of a limit under Paragraph II D	$200.00
Third Violation of a limit under Paragraph II D and each violation thereafter	$400.00

(2) In the event that the Department determines that Respondent has violated the provisions of Paragraph II herein, the Department may serve upon the Respondent a notice of noncompliance which shall set forth the nature of the violation and the calculation of penalties due. Respondent shall deliver the full penalty amount to the Department within twenty (20) business days after receipt of such notice. Neither the Department's demand for payment of a stipulated penalty, nor Respondent's payment thereof, shall discharge Respondent from the obligation to comply with any obligation established under this Order. The payment of stipulated penalties as set forth above shall not limit the Department's right to seek such other relief as may be authorized by law.

(3) Where emergencies, or repairs to the facility are required that will result in equipment being off-line, the County will provide the DEC with 30 days notice, or such other notice as is practicable under the circumstances, of the emergency or repair. In such cases, the DEC will, in its discretion, suspend the limits established in this consent order and/or establish interim limits for the duration of the emergency or repair, and the stipulated penalties shall not be applicable. The DEC will not unreasonably refuse to suspend the limits contained in this order where it has received the notice provided in this paragraph.

(4) For purposes of this section a violation of an effluent limitation that is measured as monthly average will be deemed to be a single violation for each reported sample that exceeded the average monthly limit; a violation of the monthly average will not result in a penalty for each day of the month that the violation occurred.

C. Failure To Make Penalty Payment. (1) In the event that the Respondent fails to pay any penalty due pursuant to this Order by the date due, this Order together with a notice of noncompliance specifying the amount due may be filed and enforced by DEC as a civil judgment for the total penalty amount set forth in the notice of noncompliance. (2) With regard to any penalty due pursuant to this Order which is not paid by the specified due date, Respondent shall be liable for and shall pay interest from the due date at the rate specified by the New York Civil Practice Law and Rules for interest on a judgment.

II. COMPLIANCE AND CORRECTIVE ACTIONS

A. To address effluent violations:

Respondent has performed the corrective actions set forth below

1. Respondent conducted and completed a complete rehabilitation of all oxidation ditch turbines including impeller, gear box and motors by February 15, 2001.

2. Respondent conducted and completed as of February 2001 a complete rehabilitation of air grid system on one oxidation ditch.

3. Respondent has performed repair and replacement of sand in filter #4 as of January 2001.

Respondent shall perform the actions set forth below in accordance with the terms of this Order.

1. Respondent shall conduct a complete rehabilitation of air grid system on remaining oxidation ditch by November 1, 2001.

B. To address flow violations:

1. Respondent shall repair and replace MH#11 and associated sewer mains and manholes by November 30, 2001.

2. Respondent shall repair remaining manholes in District by October 1, 2001;

3. In December 2000, Respondent implemented an enhanced program in locating trouble spots/areas. This includes high visibility marking of all manholes in remote/easement areas. Checking suspect (low lying, new construction) areas more often, and tracing unusually high or unusual flows;

4. Respondent shall continue to review and evaluate TV line inspection tapes for cataloging remaining leaks. The Respondents shall complete any repairs[1] by July 1, 2004; and

5. Installation of new strategically placed flow meters to identify and quantify flows from contributing communities December 1, 2001.

---

[1]This refers to repairs that have been identified prior to July 1, 2004.

C. To address inflow problem (Unauthorized Storm Water Disconnection Program):

The Respondent will institute a program to eliminate public and private sources of illegal inflow (e.g., sump pumps, roof leaders, cross connections, etc.) as follows:

1. The Respondent shall commence smoke and dye testing of identified priority areas by September 30, 2001.

2. Respondent shall take all steps to ensure all illegal connections[2] are removed by July 1, 2004.

The Respondent will commence disconnection, or initiate administrative or other proceedings authorized by law for the enforcement and disconnection of discovered violations within 30 days after the discovery of each unauthorized or illegal source of flow.

D. **Interim Effluent Limitations:**

The following effluent limitations shall remain in effect until January 1, 2002. After January 1, 2002, and until July 1, 2004, the following limitations will be in effect when daily flow at the facility exceeds 4.5 mgd. The interim limitation for flow shall remain in effect until July 1, 2004.

1. **<u>FLOW – Outfall 001</u>**

6/01 thru 10/31	3.0 MGD (30 Day Average)
11/1 through 5/31	3.3 MGD (30 Day Average)

2. **<u>AMMONIA – Outfalls 001 and 002</u>**

6/01 through 10/31	2.0 mg/l (30 Day Average)
11/01 through 5/31	6.8 ml/l (Daily Maximum)

3. **<u>SETTLEABLE SOLIDS – Outfalls 001 and 002</u>**

11/01 thru 5/31	1.0 ml/l (Daily Maximum)

4. **<u>$CBOD_5$ – Outfall 001</u>**

6/01 thru 10/31	14 mg/l (Daily Maximum)
350 lbs./day (Daily Maximum)	

[2] This refers to illegal connections that have been identified prior to July 1, 2004.

5. CBOD$_5$ – Outfall 002

6/01 thru 10/31 14 mg/l (Daily Maximum)
350 lbs./day (Daily Maximum)

6. UOD – Outfall 001

11/01 thru 5/31 94 mg/l (Daily Maximum)
2,587 lbs./day (Daily Maximum)

7. UOD – Outfall 002

11/01 thru 5/31 94 mg/l (Daily Maximum)
1,568 lbs./day (Daily Maximum)

E. Reporting Requirements:

The Respondent shall submit progress reports on all of the above actions to be sent to Joseph Marcogliese, Regional Water Engineer, New York State Department of Environmental Conservation, Tarrytown Sub-Office, 200 White Plains Road, 5th Floor, Tarrytown, New York 10591, commencing July 2, 2001 and every 4 months thereafter.

III. FULL SETTLEMENT

The Department shall not institute any action or proceeding for penalties or other relief for the violations described above for so long as Respondents remain in compliance with this Order. Any failure by Respondents to comply fully with the terms of this Order may subject the Respondents to further enforcement action for the violations described above. Compliance with this Order shall not excuse nor be a defense to charges of any violations of the ECL or any regulation or permit issued thereunder, which are not specifically identified and described in this Order. This Order shall not be construed as being in settlement of events or violations not specifically set forth herein.

IV. ACCESS

The Respondent hereby consents and agrees that the Department or an authorized representative shall be allowed upon presentation of appropriate credentials to: (1) enter the Facility during all hours of operation, and other hours as appropriate to the situation; (2) have access to and copy, at reasonable times, any records which are required to be maintained at the Facility or which relate to compliance with environmental requirements; (3) inspect at appropriate times any equipment, practices, and operations regulated or required under any permit or order; and (4) sample or monitor at appropriate times substances or parameters for the purpose of assuring compliance with any permit, order or applicable requirements.

V. COMPLIANCE WITH APPLICABLE LAWS, RULES AND REGULATIONS

Respondents shall be obligated to obtain whatever permits, easements, rights of entry, approvals or authorizations as may be necessary in order to carry out their obligations under this Order. This Order shall not relieve the Respondents of the obligation to comply with any other laws, rules or regulations of the State of New York or any other governmental authority which are applicable to Respondents' activities, nor preclude or limit such enforcement action as may be authorized by law for any such violation.

VI. SUMMARY ABATEMENT

The terms of this Order shall not be construed to prohibit the Commissioner or his duly authorized representative from exercising any summary abatement powers granted pursuant to statute or regulations.

VII. OTHER REMEDIES

Nothing contained in this Order shall be construed as barring, diminishing, adjudicating or in any way affecting:

A. Any legal, administrative or equitable rights or claims, actions, suits, causes of action or demands whatsoever that the Department may have against anyone other than Respondents;

B. The right of the Department to enforce, administratively or at law or in equity, the terms, provisions and conditions of this Order against Respondents, their directors, officers, employees, servants, agents, successors and assigns in the event that Respondents shall fail to fulfill any of Respondents' obligations contained herein;

C. The right of the Department to bring any future action, or pursue any pending action, either administrative or judicial, to require remediation, contribution for costs incurred or funds expended, for any violations, past, present or future, known or unknown, of the ECL, or the rules and regulations promulgated thereunder, or conditions contained in licenses or permits issued to Respondents, not addressed in this Order;

D. The right of the Department to pursue any claims for natural resource damages; or

E. The right of the Respondents to challenge any such action by the Department, whether administrative hearing or otherwise, to the extent otherwise permitted by law, and except as provided in this Order.

VIII. FORCE MAJEURE

Respondents shall not be in default of compliance with this Order to the extent that Respondents may be unable to comply with any provision of this Order because of the action of a national or local government body or court, an act of God, war, strike, riot or catastrophe as to any of which the negligence or willful misconduct on the part of Respondents was not a proximate cause, and for which Respondent exercised all due diligence to prevent. Respondents shall provide notice to the Department in writing immediately upon obtaining knowledge of such event, and shall request an appropriate modification to this Order. Relief under this clause shall not be available to Respondents, with regard to a particular event, if Respondents fail to provide timely notice of such event. The Respondents shall have the burden of proving entitlement to relief under this clause, by clear and convincing evidence.

IX. MODIFICATION

A. If, for any reason, Respondents desire that any provision of this Order be changed, Respondents shall make timely written application therefor to the Department setting forth reasonable grounds for the relief sought, together with any supporting documentation tending to establish such grounds. Such request shall be made as soon as reasonably possible after Respondents learn of the grounds for such relief. Where, as may be determined by DEC, a request for a modification is made in timely fashion and is properly supported and justified in light of all the circumstances, including Respondents' compliance history and the potential environmental consequences of such modification, DEC agrees that such relief will not be unreasonably withheld. The granting of a requested modification may be conditioned upon Respondents' acceptance of additional terms, such as payment of penalties and/or suspension, modification or curtailment of operation.

B. This Order may be modified by the Department pursuant to the criteria and procedures set forth at ECL Section 70-0115 and 6 NYCRR Section 621.13.

C. No change or modification to this Order shall be made or be effective except as may be specifically set forth in writing by the Department, pursuant to the procedure set forth in subparagraphs A or B, above.

X. DEFAULT

The failure of Respondents to comply fully and in timely fashion with any provision of this Order shall constitute a default and a failure to perform an obligation under this Order and under the ECL, and shall constitute sufficient grounds for revocation of any permit, license, certification or approval issued to the Respondents by the Department.

XI. ENTIRE AGREEMENT

The provisions hereof shall constitute the complete and entire Order between Respondents and the Department concerning the Facility. No terms, conditions, understandings or agreements purporting to modify or vary the terms hereof shall be binding unless made in writing pursuant to the Modification provision hereof. No informal advice, guidance, suggestions or comments by the Department regarding reports, proposals, plans, specifications, schedules or any other writing submitted by Respondents shall be construed as relieving Respondents of their obligation to obtain such formal approvals as may be required by this Order.

XII. BINDING EFFECT

The provisions of this Order shall be deemed to bind the Respondents, their officers, directors, agents, employees, contractors, successors and assigns, and all persons, firms and corporations acting under or for them, including, without limitation, any subsequent operator of the Facility who may carry on activities now conducted by Respondents at the Facility; and Respondents shall provide a copy of this Order (including any submissions incorporated herein) to any contractor or subcontractor hired to perform work required under this Order, and shall require compliance with this Order as a term of any contract for work under this Order. Respondents shall nonetheless be responsible for ensuring that all work performed under this Order is in compliance with the terms of the Order.

XIII. INDEMNIFICATION

Respondents shall indemnify and hold harmless the State of New York, DEC and any of their representatives, employees or contractors for all claims, actions, damages and [costs] of every name and description arising out of or resulting from DEC's or Respondents' (or their directors, officers, employees, servants, agents, contractors, successors or assigns) acts in fulfillment or attempted fulfillment of the provisions of this order, except any claims, actions, damages and costs resulting from the negligence, or wrongful or culpable conduct of the DEC or its directors, officers, employees, servants, agents, successors or assigns.

XIV. EFFECTIVE DATE

The effective date of this Order shall be the date upon which the Order is executed by the Commissioner or his designee.

XV. AUTHORITY TO EXECUTE ORDER

The individual signatories to this Order represent that they have the authority to bind the respective parties by execution of this Order.

Dated: New Paltz, New York
August 2 , 2001

ERIN M. CROTTY
COMMISSIONER
NEW YORK STATE DEPARTMENT
OF ENVIRONMENTAL
CONSERVATION

BY: ______________________ MMC
MARC MORAN

REGIONAL DIRECTOR
REGION 3

CONSENT BY RESPONDENT

Respondent acknowledge the authority and jurisdiction of the Commissioner of Environmental Conservation of the State of New York to issue the foregoing Order, waive public hearing or other proceedings in this matter, accept the terms and conditions set forth in the Order and consent to the issuance thereof.

County of Orange

By________________________
Joseph G. Rampe

Title: County Executive

Acknowledgment

STATE OF NEW YORK)
) ss.:
COUNTY OF ORANGE)

On the 31st day of July 2001, before me personally came JOSEPH G. RAMPE, to me known, who being duly sworn, deposed and said that he resides in the Town of Warwick; that he is the County Executive of the County of Orange and that he signed his name for and on behalf of said Respondent with full authority to do so.

____
NOTARY PUBLIC

SHERI TORNONE
Notary Public, State of New York
No. 01TO 4943443
Qualified in Orange County
Commission Expires October 24, 2002

Exhibit D

UNITED STATES DISTRICT COURT
SOUTHERN DISTRICT OF NEW YORK

ORIGINAL

ORANGE ENVIRONMENT, INC., Plaintiff, -against- COUNTY OF ORANGE, Defendant.	96 CIV 5742 (BDP)(LMS)

CONSENT DECREE + ORDER

WHEREAS, Plaintiff Orange Environment, Inc. ("OEI") served a notice of its intent to sue the County of Orange ("the County" or "Orange County") on April 1, 1996, pursuant to Section 505 of the Clean Water Act ("CWA" or "the Act"), 33 U.S.C. § 1365, for alleged violations of the SPDES permit issued for the Harriman Sewage Treatment Plant ("Harriman plant") operated by the County which, if proven, are themselves violations of Section 301(a) of the Act;

WHEREAS, on July 30, 1996, more than sixty days after serving such notice, Plaintiff filed a Complaint against Defendant requesting injunctive relief and costs, including attorneys' fees;

WHEREAS, on March 6, 1998, this Court issued a Memorandum Decision and Order: (1) granting Plaintiff partial summary judgment on the issue of liability for 88 violations of Defendant's SPDES permit; (2) granting leave for Plaintiff to amend its Complaint to add a claim for civil penalties; (3) deferring to the time of trial the issue whether plaintiff's actions are precluded by state enforcement of the Act under comparable provisions of state law; and (4) deferring to trial the issue whether plaintiff's claims have become moot;

WHEREAS, on March 26, 1998, Plaintiff filed an Amended Complaint against Defendant requesting the imposition of civil penalties;

WHEREAS, Defendant operates the Harriman plant as an integral component of the Orange County Sewer District No. 1 ("OCSD No. 1") which serves several communities in the southern portion of Orange County and which discharges its treated sewage effluent into the Ramapo River;

WHEREAS, the County has implemented and shall continue to implement a program to reduce inflow and infiltration ("I/I") into the Harriman plant;

WHEREAS, since December, 1996, the compliance rate at the Harriman plant for non-flow parameters has been or exceeded 99%;

WHEREAS, the County intends to request from the New York State Department of Environmental Conservation "DEC") that the flow limitation in its current SPDES permit of 4.0 mgd be increased, on an interim basis, to 4.5 mgd by application for a SPDES permit modification;

WHEREAS, the County shall proceed to implement an upgrade of the Harriman plant to allow a permitted flow limitation of 6.0 mgd as set forth in Article III of this Consent Decree;

WHEREAS, the plaintiff acknowledges that from the date that the moratoria on sewer connections and sewer main extensions were lifted by the DEC in January, 1996, the defendant's policy has been to limit new connections to the Harriman plant; and the County shall continue its policy to limit new connections to the OCSD No. 1 system until such time as the proposed plant upgrade/expansion is complete.

WHEREAS, the County will perform a Biological Survey of the Upper Ramapo River as set forth in Article V of this Consent Decree;

WHEREAS, the County shall contribute the sum of $40,000 to a dedicated environmental improvement fund for the Ramapo River as set forth in Article VI of this Consent Decree;

WHEREAS, all these undertakings set forth in Articles III, V, and VI are satisfactory to

Plaintiff;

WHEREAS, the Plaintiff and Defendant agree that settlement of this matter is in the best interests of the parties and the public and that entry of this Consent Decree without further litigation is the most appropriate means of resolving this matter;

NOW, THEREFORE, without trial of any issue of fact or law and without any admission by the Defendant of the facts or violations alleged in the Complaint, and upon consent of the parties, it is hereby ORDERED, ADJUDGED and DECREED as follows:

I.

This Court has jurisdiction over the subject matter herein pursuant to 33 U.S.C. Section 1365 and has jurisdiction over the parties hereto. Venue is proper in this Court.

II.

The provisions of this Consent Decree shall apply to and be binding upon the parties to this action, their agents, assigns and successors in interest. Neither party shall raise as a defense to any action taken to enforce the provision of this Consent Decree the failure of any of its officers, directors, contractors, agents, servants, or employees to have taken or refrain from taking such actions as shall be required to comply with the provisions of this Decree.

III.

In furtherance of a report prepared by Camp, Dresser & McKee ("CDM"): Final Harriman Wastewater Treatment Plant Facility Plan ("Upgrade Plan"), dated May 1997, the Defendant shall proceed to upgrade the Harriman plant to expand its treatment capacity to 6.0 mgd. The parties acknowledge that the technologies incorporated into the final plant design may differ from those suggested by CDM in its report. Proposals submitted by design consultants in response to a Request for Proposals for design consultation services may include technologies proposed by the plaintiff - Fluidized Biological Reactor Systems, Bio-Filtration Odor Control, and Aerobic Sludge Digestion. To the extent any of these technologies are proposed in any valid bid for design services, they will be given due consideration by the County.

This upgrade/expansion shall proceed in accordance with the following schedule:

EVENT	*DATE*
1. Prepare and submit an application to NYSDEC for a SPDES permit for 6.0 mgd flow and an interim flow limit of 4.5 mgd.	Within 60 days
2. Perform the required SEQRA review for the 6.0 mgd upgrade/expansion proposal, utilizing the data obtained from the Biological Survey of the Upper Ramapo River (see Article V, *infra*).	Within 8 months
3. Apply for funding to the New York State Clean Air/Clean Water Bond Act ("Bond Act") for the upgrade/expansion plan	Completion applications will be submitted annually on or before the deadline established by the State.
4. Complete funding arrangements necessary to prepare a Request for Proposals for the design of the upgrade/expansion plan.	12 months
5. Funding. Funding for the project shall be obtained as provided below.	See below.
6. Issue a Request for Proposals for design consultant services for the design of the Harriman plant upgrade/expansion.	Within 150 days after the necessary funding arrangements are completed. (See below)
7. Review proposals (bid review); acceptance of proposal; notification of acceptance of proposal	Within 60 days after all proposals have been received. If all bids are rejected, target date to be extended by the period of time reasonably necessary to reissue RFP

	and rebid design proposals.
8. Complete design, plans and specifications of the Harriman plant upgrade/expansion	Within 12 months after award of contract for design services.
9. Construction bids, including bid period, bid review and bid awards for general construction, plumbing and gas fitting; heating, hot water heating, ventilation and air conditioning; and electric wiring and illuminating fixtures.	Within 4 months after completion of design phase. If all bids are rejected, the target date will be extended by the time reasonably necessary to rebid the construction contracts.
10. Begin construction of the Harriman plant upgrade/ expansion in accordance with the approved design plans.	Within 4 months after award of construction contracts.

Funding. In addition to applying to the Bond Act for funding of the upgrade/expansion project, the defendant shall seek funding from other sources, such as the issuance of municipal bonds, including bunt not limited to bonding under the State Revolving Fund ("SRF"). The parties acknowledge that such funding arrangements involve a multi-step procedures of indeterminate length and may require review and approval by the State Comptroller. In addition, under Article 5-A of the County Law public hearings and approval by the County Legislature and State Comptroller will be required as part of the expansion/upgrade funding process. The defendant shall act diligently to comply with all applicable requirements and submit all necessary applications within such deadlines as are established by the State in order to acquire funding necessary for this project.

In any event, the Defendant shall make all best efforts to complete the Harriman plant upgrade/expansion within five years after the entry of this Consent Decree. Until final completion of the upgrade plan, the Defendant shall continue its current policy of limiting new connections to the OCSD No. 1 system. The plaintiff acknowledges that the defendant has and may have legal commitments to provide capacity or allow connections to the Harriman plant; satisfaction of such obligations shall not be a violation of this agreement. The plaintiff acknowledges further that as of the date of this Consent Decree the defendant has had the discretion to authorize connections, and has done so, if at all, only on a limited basis, and based upon the consideration of several factors, including plant flow, connection priorities, hardship, health and environmental considerations, and other factors set forth in Articles I and III of the Orange County Sewer Law (Local Law No. 17 of 1974, as amended). Nothing in this Consent Decree shall be construed to limit or modify the defendant's authority to allow connections on a limited basis, consistent with this policy, pending the completion of the proposed upgrade to the Harriman plant.

IV.

Plaintiff shall not oppose, nor object to an interim flow increase at the Harriman plant to 4.5 mgd pending the completion of the upgrade plan at any stage or proceeding related to the expansion/upgrade including the permit application and the SEQRA review process. In addition, Plaintiff agrees that the limited upgrade and expansion of the Harriman plant proposed in Article III will serve both to bring the Defendant into full compliance with all its SPDES permit limitations and address the reasonable near-term treatment needs of the communities served by OCSD No. 1.

In that context, Plaintiff will not oppose, nor object to a flow limitation of 6.0 mgd for the upgraded Harriman plant if such flow increase and the other concurrent SPDES limitations are demonstrated to be non-detrimental to the water quality of the Ramapo River. Plaintiff's determination in this regard shall be based solely upon the findings of section "3" of the Biological Survey of the Upper Ramapo River, and the recommendations and findings of the NYSDEC. If after such due consideration, Plaintiff determines that a permitted flow of 6.0 mgd from the Harriman plant will be detrimental to the water quality of the Ramapo River, it shall transmit that determination, along with a detailed scientific explanation and other comments to the Defendant and NYSDEC for their consideration. Plaintiff shall indicate in the letter that notwithstanding its determination, that it will not formally object to or oppose the flow increase to 6.0 mgd. A copy of the correspondence shall be transmitted to the defendant at the same time it is sent to the NYSDEC.

In any event, Plaintiff shall not commence, nor participate, except as outlined, *supra*, in any litigation or administrative action, in any federal, state or local forum, against Defendant or Orange County Sewer District No. 1, or any municipal user of the Harriman Plant, on any cause of action relating to the Harriman plant or its upgrade/expansion for a period of five years commencing with the entry of this Consent Decree. However, such limitation shall cease upon final completion of the upgrade/expansion if that event occurs within five years after entry of this Decree.

V.

The Defendant shall conduct a Biological Survey of the Upper Ramapo River to assess the overall quality of this portion of the Ramapo River and to provide reasoned recommendations for improvements to its riparian habitat. Within ninety (90) days after entry of this Consent Decree, the Defendant shall commence this, or a comparable study which shall consist of the following elements (and with a total cost not to exceed $37,500):

1. *Site Reconnaissance* - A site reconnaissance from approximately Monroe Park to Hillburn (about 17 miles) will be undertaken. This task will involve walking and/or canoeing this entire river reach. The primary purpose of this task will be to conduct general habitat mapping (recording river and bank characteristics, location of major pools, riffles, and falls, etc.) as well as looking for potential point-source and non-point source pollution sources. Locations will be determined using a hand held-held GPS unit for easy integration with existing GIS maps.

2. *Biotic Survey* - The biotic survey will be conducted through three seasonal periods: spring, summer, and fall. Each survey period will sample two faunal components, benthic

macroinvertebrates and fish. Macroinvertebrates (e.g., insects, annelid worms, crustaceans) would be sampled at ten (10) stations in the river. Seven of these stations will match the locations used in NYSDEC's stream surveys of the Ramapo conducted in 1986, 1991, and 1993. These stations are: (0) Harriman, above River Rd. bridge; (1) Harriman, below Monroe Park pond (just below the Harriman plant outfall); (2) Harriman, at the Nepara plant bridge; (3) Arden, below the bridge at Route 17; (4) Southfields, above Route 210 bridge; (5) Tuxedo Park, below East Village Rd. bridge; and, (6) Hillburn, above 4th Street bridge. An additional site will be added at Sloatsburg, near the mouth of Stony Brook. Two other sites will be selected from tributaries of the upper Ramapo river, including Arden Brook, Indian Kill, Parker Cabin Hollow, Stahae Brook, Stony Brook, or Torne Brook.

All sites will, to the degree possible, have comparable current speed, substrate type, canopy cover, and embeddedness. All macroinvertebrate sampling will be performed in accordance with good and accepted methods of scientific practice.

Fish sampling will be conducted at five of the ten macroinvertebrate stations (2, 3, 4, 5, and 6) using a backpack mounted electrofishing unit. All habitats within a 30 meter section of the river will be sampled. All fish will be identified as to species, measured, and returned to the river. The sampling time will be recorded so that catches may be standardized by sampling duration.

3. *Water Quality* - Water temperature, pH, dissolved oxygen and specific conductance will be measured at all ten sampling stations during each survey. In addition, additional parameters will be measured during each survey at the five fish sampling stations. These additional parameters are alkalinity, total suspended solids, phosphates, orthophosphates, total phosphorous, ammonia, nitrite, nitrate, total Kjeldahl nitrogen, sulfate, chlorine, BOD, CBOD, and fecal coliform.

4. *Sediment Analysis* - There will be a one-time analysis of bottom sediments. A core sample of surficial bottom sediments (top 3 inches of silt and clay) will be collected from stations 1, 3, and 5. These sediments will be tested for heavy metals, pesticides, herbicides, PCBs, total petroleum hydrocarbons, volatile organic compounds (VOC), base neutral/acid extractable compounds and total organic compounds. Sediment grain size will also be determined.

5. *Reporting* - A report summarizing the field findings will be provided within ninety days following completing of the last sampling round. For the macroinvertebrate survey, the following indices will be determined: species richness, EPT value, Hilsenhof Biotic Index, Percent Model Affinity, and species diversity. These indices will be calculated and combined to achieve an overall water quality index following the standardized NYSDEC protocol. All electrofishing sampling results will be expressed as total number of specimens collected and catch per unit effort (number per second). Catch per unit effort (CPUE) will be standardized by sampling duration in order to facilitate comparisons among stations and previously collected data. Station comparisons will be made on the basis of species richness, diversity, and percentage similarity. Additionally, the Fish Index of Biotic Integrity (IBI) and the Anderson Index (AI) will be calculated. A description of the

IBI and AI procedure is described in Stevens, et al. (1994).[1] In addition to the biotic indices of habitat quality, an index of water quality will be computed following Stevens, et al. (1994). The report will also contain recommendations for riparian enhancement, including ways to improve the upper Ramapo River riparian habitat, water quality, and fishery.

Prior to commencing the study, the Defendant shall provide Plaintiff with a work plan for the study. A work plan for a comparable study shall be acceptable to the plaintiff if it consists of the same or similar components of the design study outlined above. Upon completion, the Defendant shall transmit a full copy of the written report to Plaintiff and the NYSDEC. To the extent any findings resulting from the study are completed during the SEQR process and are required by law to be included in the SEQR process, the Defendant shall also incorporate the findings of the study into its SEQRA environmental review for the 6.0 mgd upgrade/expansion of the Harriman plant. In addition, Plaintiff shall not utilize the study as the basis of, or in evidence in, this or any future litigation against Defendant relating to the Harriman plant.

VI.

Within sixty (60) days after the entry of this Consent Decree, the Defendant shall contribute the sum of $40,000 dollars to a dedicated Ramapo River Improvement Fund ("the Fund") under the control of Orange County Land Trust. The Fund shall be used solely for qualified environmental projects aimed at enhancing the environmental, aesthetic and recreational uses of the upper Ramapo River for the citizens of Orange County. A qualified environmental project is one which is consistent with the 501(c)(3) exempt purposes set forth in the Orange County Land Trust's Application for Recognition of Exemption filed with the Internal Revenue Service. The Orange

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1 Stevens, G., R.E. Schmidt, D.R. Roeder, J.S. Tashiro, and E. Kiviat. 1994. *Baseline Assessment of Tributaries to the Hudson (BATH): Water Quality, Fishes, Macroinvertebrates, and Diatoms in Fishkill Creek, Quassic Creek, and Moodna Creek - Report to the Hudson River Improvement Fund of the Hudson River Foundations.*

County Land Trust will use its best effort to so expend said funds within eighteen (18) months of the date that the sum of $40,000.00 is received from the Defendant. Decisions relating to the funding of individual projects deriving from the Fund are under the sole discretion and control of the Orange County Land trust and neither Plaintiff nor Defendant shall have any control or voice in such decisions.

VII.

Within thirty (30) days after the entry of this Consent Decree, the Defendant shall pay to Plaintiff the amount of $35,000. Said sum shall be made payable to Scott Thornton, as attorney. This sum shall in part constitute payment in full of the costs of litigation (including reasonable attorney and expert witness fees) to Orange Environment, Inc., and will be deemed appropriate under Section 505(d) of the Clean Water Act which authorizes the award of such costs or fees. This sum of $35,000 shall in part also constitute full and complete satisfaction (subject to the exception below) of all costs, including attorneys' and expert witness fees, incurred by Plaintiff in the future to monitor compliance with this Consent Decree, for which any claim can be made under Section 505(d) of the Act. However, nothing in this Decree prevents Plaintiff or Defendant from applying to the Court under Section 505(d) for payment of its costs, including reasonable attorneys' and expert witness fees, incurred in enforcing material violations of this Consent Decree, subject to any objections or defenses thereto raised by the other party. Plaintiff represents that no part of the sum provided for herein shall be used for any purpose other than as stated in this paragraph.

VIII.

a. The parties expressly recognize and appreciate that certain factors associated with the proposed Harriman upgrade are beyond the ability of the parties to control. These factors include, but are not limited to certain aspects state permit approvals, SEQR, and bidding processes; construction delays, objections raised by third parties, and litigation which may ensue, funding, and legislative and municipal approvals. For these reasons, the parties have agreed on "target dates" for the completion or attainment of each of the requirements set forth in Article III herein. The County shall be in compliance with this agreement so long as it proceeds in good faith and with due diligence to meet each target date. Reasonable extensions of time necessitated by factors beyond the ability of the parties to control are implied by this agreement. The County's obligations are subject to its acquiring all necessary state, federal and local approvals, which it shall seek in good faith and with due diligence. So long as the Defendant proceeds in good faith and with due diligence with each phase of the expansion upgrade as set forth in Article III herein it shall not be held in default of this Consent Decree.

b. If compliance with a requirement of this Consent Decree is delayed or will be delayed by any reason beyond the target date specified in this Decree, the Defendant shall, within a reasonable time after Defendant knows of the delay, inform Plaintiff in writing, describing the anticipated length of delay, and the reasons for it. The Defendant shall take all reasonable measures to prevent and minimize such delay.

If the delay in compliance with a requirement under this Decree is caused by circumstances entirely beyond the control of the Defendant, including those factors stated in subparagraph "a" of this Article and cannot be cured by the Defendant, the time for compliance with that requirement may be extended for a period appropriate to the delay resulting from the circumstances. In such event, the parties shall stipulate to such extension of time and so inform this Court. If the parties cannot agree, the Defendant may submit the matter to this Court for resolution.

IX.

The Defendant shall submit progress reports twice annually to the Plaintiff on compliance with all requirements of this Decree on the last days of March, and September, beginning on the first such date occurring after the entry of this Consent Decree, and continuing until all the requirements of this Decree are satisfied. Defendant shall submit interim reports where necessary to inform plaintiff of any significant events or occurrences relative to this Decree, including any delays in meeting target dates set forth in Article III.

No party shall be in default of this decree unless it shall first have received fourteen (14) days written notice from the other party setting forth the basis for the alleged default, and the default is not cured within said fourteen day period or such other period as the parties may agree to.

All communications, notices, reports, plans, and schedules required pursuant to this Decree shall be submitted personally or by certified mail, return receipt requested, or by overnight delivery service. Such communications shall be served on plaintiff by delivery to:

Scott A. Thornton, Esq.
1486 Lower Road
New Hampton, New York 10958

or to such other person and address as may be specified by Plaintiff, in writing, to Defendant.

All such written communications from the Plaintiff to Defendant shall be submitted to:

David L. Darwin, Esq.
Senior Ass't County Attorney
Orange County Government Center
Goshen, New York 10924

and: Robert A. Meyer
Orange County Department of Environmental Facilities and Services
Rt. 17 M, P.O. Box 637
Goshen, N.Y. 10924

and: Orange County Executive
Orange County Government Center
Goshen, New York, 10924

or to such other person and address as may be specified by Defendant, in writing, to Plaintiff.

X.

This Court shall retain jurisdiction over this matter and all disputes arising thereunder as may be necessary and appropriate for the construction, execution and enforcement of this Consent Decree. Upon completion of the Harriman plant upgrade within the time established hereunder, the Defendant shall be deemed to be in full compliance with terms and conditions of this order, and the Plaintiff will provide the defendant, upon written request, with an order of dismissal, with prejudice, which shall be transmitted to the Court to be so ordered.

XI

Except as otherwise expressly provided herein, this Consent Decree is in full satisfaction of all liabilities and obligations of the Defendant arising out of this litigation and fully and finally settles this litigation and all claims for damages, penalties, costs, expenses (including expert and attorney' fees), injunctive, declaratory and other relief of any nature whatsoever. Upon the execution of this Consent Decree the Plaintiff shall execute and deliver to the defendant a general release, which may contain a reservation of rights with respect to violations of this agreement. Plaintiff also will deliver to the defendant a copy of a resolution of its Board of Directors authorizing plaintiff to enter into this Consent Decree.

FOR PLAINTIFF
ORANGE ENVIRONMENT, INC.

by: Michael R. Edelstein
Michael R. Edelstein, President

FOR DEFENDANT
COUNTY OF ORANGE

by:
Joseph G. Rampe, County Executive

SO ORDERED:

APPROVED AND ENTERED
as an Order of this Court
this 11th day of January, 1998

Lisa Margaret Smith
Hon. Lisa Margaret Smith, U.S.M.J.

Exhibit E

Benefit Area Assessed Cost Estimate for $26,000,000.00 Harriman Wastewater Treatment Plant Enhancement Project

Prepared by:

Orange County Department of Environmental Facilities and Services
P.O. Box 637
2455-2459 Route 17M
Goshen, New York 10924

I) GENERAL:

a) Assumed Project Financing:

i) Borrowing Amount:	$26,000,000.00
ii) Borrowing Rate:	5.5%
iii) Borrowing Term:	30 Years
iv) Annual Level Debt Service:	$1,773,444.00

b) Benefit Areas:

i) Orange County Sewer District No. 1:

(1) Full Valuation Assessment (05/21/02): $1,475,256,081.00

ii) Out-of District Requested Sewerage Use:

(1) Town of Monroe (@ current allocated capacity limit):	133,000 gpd
(2) Town of Blooming Grove:	26,000 gpd
(3) Town of Woodbury:	30,000 gpd
(4) Total Requested Out-of District Use:	189,000 gpd

iii) Out-of-District Estimated Assessment:

(1) Typical Single Family Home Full Valuation in Town of Woodbury (03/13/01): $183,000.00

(2) Sewerage Unit of Use Conversion @ 400 gpd per Unit of Use: 189,000 gpd/400gpd/unit = 473 Units of Use

(3) Out-of District Full Valuation Assessment @ $183,000 Full Valuation per Typical Single Family Home: 473 Units x $183,000 = $86,559,000.00

iv) OCSD1 plus Out-of District Assessments:

(1) OCSD1 Full Valuation Assessment:	$1,475,256,081.00
(2) Out-of District Full Valuation Assessment:	86,559,000.00
(3) OCSD1 plus Out-of-District Total Full Valuation Assessment:	$1,561,815,081.00

II) BENEFIT AREA INCREASED ANNUAL COST ESTIMATES:

a) Annual Cost per $1,000.00 Full Valuation Assessment (FVA):

i) OCSD1: $1,773,444 ÷ 1,475,256,081 × 1,000 = $1.202 per $1,000.00 FVA

ii) OCSD1 Plus Out-of-District Area: $1,773,444 ÷ 1,561,815,081 × 1,000 = $1.136 per $1,000.00 FVA

b) Annual Cost per Typical Single Family Home (SFH):

i) OCSD1: $183,000.00 × 1.202 ÷ 1,000 = $219.99 per SFH

ii) OCSD1 Plus Out-of-District Area: $183,000 × 1.136 ÷ 1,000 = $207.99 per SFH

iii) Average of i) and ii) above: (219.99 + 207.99)/2 = $213.99 per SFH

III) TREATMENT FACILITY ESTIMATED ANNUAL INCREASE IN OPERATION AND MAINTENANCE USER FEE:

a) Anticipated increase of 33% for chemical, electrical and gas @ $17.00 per Unit of Use, where each Single Family Home is charged One (1) Unit of Use.

IV) TOTAL ANNUAL INCREASE PER TYPICAL SINGLE FAMILY HOME:

a) Estimated Sewer Tax increase for $26,000,000.00: 214.00

b) Estimated Operation and Maintenance User Fee: 17.00

c) Total estimated annual increase: ***$231.00 per Typical SFH.***

——— ***End Cost Estimate*** ———

Exhibit F

J. Green

Agenda No. 18

RESOLUTION NO. 201 OF 2001

RESOLUTION ACCEPTING THE FINAL ENVIRONMENTAL IMPACT STATEMENT ON THE PROPOSED ENHANCEMENTS TO THE HARRIMAN WASTEWATER TREATMENT PLANT

WHEREAS, this Legislature previously accepted a Draft Environmental Impact Statement for the proposed 2.0 million gallon per day ("mgd") enhancement to the Harriman Wastewater Treatment Plant ("HWWTP") and held a public hearing and established a public comment period thereon; and

WHEREAS, the time for receipt of public comments has expired; and

WHEREAS, comments from the public have been received and reviewed, and responses thereto duly made and incorporated into the Final Environmental Impact Statement ("FEIS"); and

WHEREAS, the FEIS has been reviewed by this Legislature as Lead Agency for the project and has been found to be complete in all respects.

NOW, THEREFORE, it is hereby

RESOLVED, that the FEIS is hereby accepted as complete; and it is further

STATE OF NEW YORK
COUNTY OF ORANGE
OFFICE OF THE CLERK OF
THE COUNTY LEGISLATURE

THIS IS TO CERTIFY THAT I, GAIL SICINA Clerk of the County Legislature of said County of Orange, have compared the foregoing copy of resolution with the original resolution now on file in my office and which was passed by the County Legislature of said County of Orange on the 13th day of July, 2001 and that the same is a correct and true transcript of such original resolution and the whole thereof.

In Witness Whereof, I have hereunto set my hand and the official seal of said County Legislature this 26th day of August, 2002

Gail Sicina

CLERK OF THE COUNTY LEGISLATURE OF THE COUNTY OF ORANGE

H. Green

A[illegible]nda No. 18

RESOLUTION NO. 201 OF 2001

RESOLUTION ACCEPTING THE FINAL ENVIRONMENTAL IMPACT STATEMENT ON THE PROPOSED ENHANCEMENTS TO THE HARRIMAN WASTEWATER TREATMENT PLANT

WHEREAS, this Legislature previously accepted a Draft Environmental Impact Statement for the proposed 2.0 million gallon per day ("mgd") enhancement to the Harriman Wastewater Treatment Plant ("HWWTP") and held a public hearing and established a public comment period thereon; and

WHEREAS, the time for receipt of public comments has expired; and

WHEREAS, comments from the public have been received and reviewed, and responses thereto duly made and incorporated into the Final Environmental Impact Statement ("FEIS"); and

WHEREAS, the FEIS has been reviewed by this Legislature as Lead Agency for the project and has been found to be complete in all respects.

NOW, THEREFORE, it is hereby

RESOLVED, that the FEIS is hereby accepted as complete; and it is further

RESOLVED, that the FEIS and a written notice of completion be filed in accordance with 6 NYCRR Part 617.12; and it is further

RESOLVED, that a written findings statement be issued no earlier than ten (10) days from the date of filing of the FEIS, and shall be filed in accordance with 6 NYCRR Part 617.12.

APPROVED: July 13, 2001

JOSEPH G. RAMPE, COUNTY EXECUTIVE

Green 4 gold

Agenda No. 18

RESOLUTION NO. 226 OF 2001

RESOLUTION ADOPTING THE FINDINGS STATEMENT AND APPROVING THE CERTIFICATION OF FINDINGS PERTAINING TO THE FINAL ENVIRONMENTAL IMPACT STATEMENT FOR THE ENHANCEMENTS TO THE HARRIMAN WASTEWATER TREATMENT PLANT

WHEREAS, the Orange County Legislature is considering modifications and enhancements to the Harriman Wastewater Treatment Plant that will increase the treatment capacity of the Treatment Plant to 6.0 million gallons per day; and

WHEREAS, this Legislature has accepted and reviewed a Final Environmental Impact Statement ("FEIS") filed and published a notice of completion of the FEIS; and

WHEREAS, it is now necessary and appropriate to adopt and approve the Findings Statement and Certification of Findings pertaining to the Harriman Wastewater Treatment Plant enhancement FEIS; and

WHEREAS, the FEIS presents the facts and conclusions relied upon to support the Findings Statement,

NOW, THEREFORE, it is hereby

RESOLVED, that this Legislature hereby approves and adopts as described in the State Environmental Quality Review Act, the Statement of Findings and Certification of Findings with respect to the FEIS for the Harriman Wastewater Treatment Plant (attached hereto), and finds that the above-stated action has the potential to have certain minor, adverse environmental impacts, and that these potential impacts can be adequately mitigated and therefore approves the action as set forth in the Statement of Findings and the FEIS, and be it further

RESOLVED, that the Findings Statement for the above-described action shall be filed in accordance with the requirements of the New York State Environmental Quality Review Act.

APPROVED: August 10, 2001

JOSEPH G. RAMPE, COUNTY EXECUTIVE

green & gold

Agenda No. 78

RESOLUTION NO. 226 OF 2001

RESOLUTION ADOPTING THE FINDINGS STATEMENT AND APPROVING THE CERTIFICATION OF FINDINGS PERTAINING TO THE FINAL ENVIRONMENTAL IMPACT STATEMENT FOR THE ENHANCEMENTS TO THE HARRIMAN WASTEWATER TREATMENT PLANT

WHEREAS, the Orange County Legislature is considering modifications and enhancements to the Harriman Wastewater Treatment Plant that will increase the treatment capacity of the Treatment Plant to 6.0 million gallons per day; and

WHEREAS, this Legislature has accepted and reviewed a Final Environmental Impact Statement ("FEIS") filed and published a notice of completion of the FEIS; and

WHEREAS, it is now necessary and appropriate to adopt and approve the Findings Statement and Certification of Findings pertaining to the Harriman Wastewater Treatment Plant enhancement FEIS; and

WHEREAS, the FEIS presents the facts and conclusions relied upon to support the Findings Statement,

NOW, THEREFORE, it is hereby

RESOLVED, that this Legislature hereby approves and adopts as described in the State Environmental Quality Review Act, the Statement of Findings and Certification of Findings with respect to

STATE OF NEW YORK
COUNTY OF ORANGE
OFFICE OF THE CLERK OF
THE COUNTY LEGISLATURE

THIS IS TO CERTIFY THAT I, GAIL SICINA
Clerk of the County Legislature of said County of Orange, have compared the foregoing copy of resolution with the original resolution now on file in my office and which was passed by the County Legislature of said County of Orange on the 10th day of August, 2001 and that the same is a correct and true transcript of such original resolution and the whole thereof.

In Witness Whereof, I have hereunto set my hand and the official seal of said County Legislature this 26th day of August, 2002

Gail Sicina

CLERK OF THE COUNTY LEGISLATURE OF THE COUNTY OF ORANGE

Statement of Findings

Enhancements to the Harriman Wastewater Treatment Plant

The Harriman Wastewater Treatment Plant (WWTP) was originally constructed in 1974 as a 2.0 mgd conventional, suspended growth, activated sludge facility. In 1987, the average design flow of the plant was expanded from 2.0 mgd to 4.0 mgd for the purpose of accommodating additional generated flows. The facility is currently operating at 4.5 mgd under an interim permit. The plant consists of preliminary treatment facilities, including screening and grit removal, activated sludge and oxidation ditch treatment systems, polishing filters and a chlorine contact tank.

The purpose of the proposed enhancements is to meet the wastewater treatment needs of Orange County Sewer District No. 1 (OCSD No. 1) and the Moodna Basin Southern Region (MBSR) Joint Sewerage Board sewer service areas and to provide operational improvements in the areas of odor control and treatment efficiency. The service area of OCSD No. 1 includes the Villages of Harriman, Kiryas Joel and Monroe, and part of the Town of Monroe. The Towns of Blooming Grove and Chester, the Village of Chester, the Town of Woodbury and part of the Town of Monroe are members of the MBSR Joint Sewerage Board. These enhancements are further intended to meet the wastewater treatment needs generated by the approved developments (contribution of 1.5 to 2.0 mgd average flow) within the service area.

Project development began with the examination of different potential technologies, various locations, and size alternatives and the preparation of a series of environmental documents in compliance with the State Environmental Quality Review (SEQR) procedures. The Orange County Legislature assumed responsibility as the Lead Agency (February 1999) for the proposed WWTP enhancements project and later determined the need for a comprehensive Environmental Impact Statement (EIS). On March 9, 2001, the Draft Environmental Impact Statement (DEIS) was deemed complete and made available for public review, with an established 46-day public and agency comment period. For the purpose of receiving comments on the DEIS, a public hearing was held in Goshen, NY on April 9, 2001. The public comment period was closed on April 27, 2001.

A Final Environmental Impact Statement (FEIS) was prepared that contains the substantive public and agency comments on the DEIS and responses to them. The FEIS was deemed complete by the Lead Agency on July 13, 2001. As with the DEIS, the filing of a notice of completion for the FEIS triggered the start of a review period, in this case a minimum of ten calendar days, in which the public and agencies could review and consider the document.

operational system, include; increased capital cost to the project, potential for drawdown of public supply wells, and potential for the introduction of contaminants and suspended solids that may be present in the groundwater making this alternative infeasible.

Use of an onsite mechanical chiller was also evaluated to address the potential summer temperature effluent exceedance. The size of the system required to cool the effluent is cost prohibitive. Significant modifications to the plant's power distribution system would be required. This alternative was found to be technically and economically infeasible.

In summary, the impact of the plant effluent on the water quality and habitat of the Ramapo River has been characterized as 'slight' by both the NYSDEC and Bagdon Environmental. The Harriman plant effluent is a positive factor for the Ramapo River as it provides aquatic habitat and water supply to the downstream communities. The alternatives evaluated in the FEIS would result in either a reduction of flow in the Ramapo or could result in a degradation of its quality, a negative environmental impact.

Therefore, the proposed enhancements as described and evaluated in the DEIS and FEIS are found to minimize adverse environmental impacts to the maximum extent possible, while providing the benefit of much needed additional treatment capacity for the service area.

Conclusions and Findings

In issuing this Statement of Findings, the Orange County Legislature has carefully examined and given due consideration to the Draft Environmental Impact Statement for the Proposed Enhancements to the Harriman Wastewater Treatment Plant (January 2001) and the Final Environmental Impact Statement for the Proposed Enhancements to the Harriman Wastewater Treatment Plant (June 2001) and public and agency comments on those documents.

After thorough consideration, the Legislature finds the proposed enhancements in the above referenced documents to be environmentally sound and the best alternative to provide much needed capacity for the Harriman Wastewater Treatment Plant service area.

Therefore, in consideration of the above, the Legislature, as the Lead Agency in this matter, issues this Statement of Findings, and certifies under Section 8-1019.8 of the Environmental Conservation Law and 6 NYCRR Section 617.11, that

1. The Legislature has carefully examined and given due consideration to the Draft and Final EIS on the Proposed Enhancements to the Harriman Wastewater Treatment Plant (January 2001 and June 2001, respectively) and public and agency comments on those documents.
2. The requirements of Article 8 of the New York State Environmental Conservation Law, and regulations promulgated thereunder at 6 NYCRR Part 617, have been met and fully satisfied; and
3. The facts and conclusions herein before stated with respect to the proposed action are hereby adopted as the factual findings and conclusions relied upon by the Legislature to support its decision; and

4. Consistent with social, economic, and the essential considerations from among the reasonable alternatives, the proposed action as described minimizes or avoids adverse environmental effects to the maximum extent practicable and is hereby endorsed by this Legislature.

Exhibit G

Agenda No. 15

Sen. Kr. Kleinano (?)

RESOLUTION NO. 76 OF 2002

RESOLUTION CALLING FOR A PUBLIC HEARING FOR THE PURPOSE OF CONSIDERING A PROPOSED INCREASE AND IMPROVEMENT OF THE FACILITIES OF ORANGE COUNTY SEWER DISTRICT NO. 1 IN THE COUNTY OF ORANGE, NEW YORK

WHEREAS, pursuant to proceedings heretofore had and taken in accordance with the provisions of Article 5-A of the County Law, Orange County Sewer District No. 1 has been established, and

WHEREAS, the County of Orange and Orange County Sewer District No. 1 propose to improve and increase the facilities of Orange County Sewer District No. 1, consisting of new treatment facilities within existing plant property at the Harriman Wastewater Treatment Plant, new odor controls, upgrades to existing treatment facilities and an increase of treatment capacity to 6.0 million gallons per day, and

WHEREAS, pursuant to County Law Section 5-A a report and estimate of the cost of said increase and improvement is to be filed with the Clerk of the Legislature and

WHEREAS, the maximum estimated cost of the aforesaid increase and improvement of the facilities of said Sewer District is $26,000,000.00 to be assessed against a benefited area which consists of Orange County Sewer District No. 1, the Town of Monroe, and portions of the Towns of Blooming Grove and Woodbury; and

WHEREAS, the consent of the State Comptroller must be obtained prior to the expenditure for said increase and improvement if such expenditure is to be financed by the issuance of bonds or notes of the County therefor, and the maximum cost thereof to the Typical Property (as defined in the County Law), is estimated to be $240.00, which is above the Average Estimated Cost threshold of $17.00 to the Typical Properties for similar Types of expenditures, as computed by the State Comptroller, in accordance with the provisions of Section 268 of the County Law, and

WHEREAS, it is now desired to call a public hearing to consider said increase and improvement in accordance with the provisions of Section 254 of the County Law; Now, therefore, it is hereby

RESOLVED, that a meeting of the Orange County Legislature shall be held at the Legislative Chambers, Room 303, County Government Center, Goshen, New York on June 5, 2002 at 7:00 o'clock in the evening for the purpose of conducting a Public Hearing on the aforesaid matter and for such other action on the part of said County Legislature as may be required by law or proper in the premises, and it is further

RESOLVED, that the Clerk of said Legislature is hereby authorized and directed to cause a Notice of said Public Hearing in the form annexed hereto to be published, not less than ten nor more than twenty days before the date set herein for the public hearing, at least once in each of the official newspapers in the manner provided by law and in one such other newspaper having a general circulation in the area of potential impacts of this action as follows: The Times Herald Record, the Warwick Advertiser-Photo News, the Sentinel, the Wallkill Valley Times, News of the Highlands, Inc. and Hudson Valley Black Press.

APPROVED: April 12, 2002

EDWARD A. DIANA, COUNTY EXECUTIVE
089

WHEREAS, it is now desired to call a public hearing to consider said increase and improvement in accordance with the provisions of Section 254 of the County Law; Now, therefore, it is hereby

RESOLVED, that a meeting of the Orange County Legislature shall be held at the Legislative Chambers, Room 303, County Government Center, Goshen, New York on June 5, 2002 at 7:00 o'clock in the evening for the purpose of conducting a Public Hearing on the aforesaid matter and for such other action on the part of said County Legislature as may be required by law or proper in the premises, and it is further

RESOLVED, that the Clerk of said Legislature is hereby authorized and directed to cause a Notice of said Public Hearing in the form annexed hereto to be published, not less than ten nor more than twenty days before the date set herein for the public hearing, at least once in each of the official newspapers in the manner provided by law and in one such other newspaper having a general circulation in the area of potential impacts of this action as follows: The Times Herald Record, the Warwick Advertiser-Photo News, the Sentinel, the Wallkill Valley Times, News of the Highlands, Inc. and Hudson Valley Black Press.

STATE OF NEW YORK
COUNTY OF ORANGE
OFFICE OF THE CLERK OF
THE COUNTY LEGISLATURE

THIS IS TO CERTIFY THAT I, GAIL SICINA

Clerk of the County Legislature of said County of Orange, have compared the foregoing copy of resolution with the original resolution now on file in my office and which was passed by the County Legislature of said County of Orange on the 12th day of April, 2002, and that the same is a correct and true transcript of such original resolution and the whole thereof.

In Witness Whereof, I have hereunto set my hand and the official seal of said County Legislature this 26th day of August, 2002.

Gail Sicina

CLERK OF THE COUNTY LEGISLATURE OF THE COUNTY OF ORANGE

N[illegible]ICE OF PUBLIC HEARING

NOTICE IS HEREBY GIVEN, that the Legislature of the County of Orange will meet at its Chambers in the Orange County Government Center, 255 Main Street, Goshen, New York, Room 303 on the 5th day of June, 2002 at 7:00 p.m. on that day to hold a Public Hearing to receive public comment on the Harriman Wastewater Treatment Plant Enhancement Project in and for Orange County Sewer District No. 1. The enhancement includes new treatment facilities within existing plant property, new odor controls, upgrades to existing treatment facilities and an increase of treatment capacity to 6.0 million gallons per day, all as more fully described in the report and estimate of cost prepared by the Orange County Department of Environmental Facilities and Services, which has been filed with the Clerk of the County Legislature in the Orange County Government Center, 255 Main Street, Goshen, NY 10924.

The maximum estimated cost of the such increase and improvement is $26,000,000.00 assessed against a benefited area which consists of Orange County Sewer District No. 1, the Town of Monroe, and portions of the Towns of Blooming Grove and Woodbury. The annual maximum cost of such expenditures to the Typical Property (as defined in the County Law) is estimated to be $240.00 , which is above the Average Estimated Cost of $17.00 to the Typical Properties for similar Types of expenditures, as computed by the State Comptroller, in accordance with the provisions of Section 268 of the County Law. The County Legislature has caused to be prepared and filed for public inspection with the Clerk of the Orange County Legislature a detailed explanation of how such costs were computed, as incorporated in said report and estimate of cost prepared by the County Department of Environmental Services and Facilities.

Dated:
Goshen, New York

BY ORDER OF THE COUNTY LEGISLATURE
OF THE COUNTY OF ORANGE, NEW YORK

By: Gail Sicina
Clerk, County Legislature

Exhibit H

Hudson Valley Press

Post Office Box 2160
Newburgh, NY 12550 - Tel. (845) 562-1313

AFFIDAVITS

State of New York:
County of Orange: ss.

C. Stewart, being duly sworn, says that she/he reside in said County and State, and that they now he/she is and at all times hereinafter named, is the Principal Clerk of The Hudson Valley Press, which is the publisher and printer of The Hudson Valley Press, a newspaper published and printed in the City of Newburgh, in the County of Orange, in the State of New York, and that a notice of which the annexed printed notice is a copy, has been published in said newspaper for __1__ insertions commencing on the __22nd__ day of __May__ 2002 and ending on the __22nd__ day of __May__ 2002.

CStewart
____

Sworn to before me this __22nd__ day of __May__ 2002.

____
NOTARY PUBLIC IN AND FOR ORANGE COUNTY

CM Stewart

CHARLES A. STEWART
Notary Public, State of New York
Qualified in Orange County
Commission Expires 2-28-03
4772430

Help Wanted | Legal Notices | Business Opportunities | Real Estate

the Contractor shall provide Faithful Performance and Payment Bonds, each equal to 100% of the Contract amount and all required insurance coverages with the County named as additionally insured and held harmless against any defects in workmanship or materials which appear within one year from the final completion and acceptance by the County of Orange.

In the event that the successful bidder is determined to be in default of the contract, the County of Orange reserves its legal and equitable rights against the defaulting contractor. The County and/or any political subdivision shall have the exclusive right to award a completion contract to the next available lowest responsive and responsible bidder.

County of Orange
By Edmund A Fares, PE
Commissioner of Public Works
Dated: May 7, 2002

Legal Notice

NOTICE OF PUBLIC HEARING ON LOCAL LAW

PUBLIC NOTICE IS HEREBY GIVEN that there has been presented to the County Executive of the County of Orange on May 10, 2002, a Local Law, a summary of which reads as follows:

Local Law Introductory No 1 of 2002 is a Local Law regulating smoking in restaurants in Orange County.

Orange does hereby close all that portion of So. Centerville Road, (County Road No 22) in the Town of Minisink. **BEGINNING** at the point of intersection of So. Centerville Road, (County Road No 22) and State Route 284 and runs **THENCE** in a northerly direction along said So. Centerville Road, (County Road No 22) approximately 5,808 feet (1.1 miles) to a point of intersection with South Plank Road for the purpose of allowing the Orange County Department of Public Works, its agents or contractors, to excavate, repair, pave and do all such work as required in connection with the replacement of a bridge structure on said County road. Said closing being effective by the conspicuous posting of "Road Closed" signs on or about June 10, 2002.

The said County road will be closed to all through traffic for a period of approximately one hundred eighty (180) days in accordance with the provisions of Section 104 of the Highway Law. Appropriate traffic control devices, in accordance with the provisions of the N.Y.S.D.O.T. MUTCD, will be in place and detour routes will be prominently marked. In the case of inclement weather or other unforeseen problems, this period of time may be extended as needed.

Normal through traffic using this portion of So. Centerville Road. (County

pursuant to Section 210 of the General Municipal Law.
Gail Sicina, Clerk
Orange County Legislature
Dated: May 15, 2002

Legal Notice

At a regular meeting of the City Council of the City of Newburgh held May 13, 2002, at 7:30 PM at the Multi-Purpose Activity Building, the City Council adopted the following Ordinances, copies of which are on file in the City Clerk's Office for public inspection:

Ordinance #12-2002 An Ordinance to amend Section 150-11 of the City of Newburgh Code of Ordinances relative to the keeping of cats.
Katrina Cotten
Deputy City Clerk
Dated: May 14, 2002

Legal Notice

RESOLUTION NO 109 2002
BOND RESOLUTION
DATED MAY 10, 2002

BOND RESOLUTION OF THE COUNTY OF ORANGE, NEW YORK, AUTHORIZING THE PARTIAL RECONSTRUCTION OF THE SERVICE ROAD AT THE ORANGE COUNTY AIRPORT, STATING THE ESTIMATED COST THEREOF IS $120,000, AND APPROPRIATING SAID AMOUNT THEREFOR, AUTHORIZING THE ISSUANCE OF $120,000 BONDS OF THE COUNTY

the Orange County Government Center, 255 Main Street, Goshen, NY 10924.

The maximum estimated cost of the such increase and improvement is $26,000,000.00 assessed against a benefited area which consists of Orange County Sewer District No 1, Town of Monroe, and portions of the Towns of Blooming Grove and Woodbury. The annual maximum cost of such expenditures to the Typical Property (as defined in the County Law) is estimated to be $240.00, which is above the Average Estimated Cost of $17.00 to the Typical Properties for similar Types of expenditures, as computed by the State Comptroller, in accordance with the provisions of Section 268 of the County Law. The County Legislature has caused to be prepared and filed for public inspection with the Clerk of the Orange County Legislature a detailed explanation of how such costs were computed, as incorporated in said report and estimate of cost prepared by the County Department of Environmental Services and Facilities.

By order of the County Legislature of the County of Orange, New York
By Gail Sicina
Clerk, County Legislature
Dated: May 22, 2002
Goshen, New York

Legal Notice

ADVERTISEMENT FOR

Broadway, 3rd Floor, Newburgh, New York.

The Information for bidders, Specifications and other Contract Documents may be reviewed and obtained at the City of Newburgh Comptroller's Office becoming available on Wednesday, May 22, 2002 upon payment of a non-refundable deposit of $10.00 per set. Contractors may have Contract Documents mailed to their office by contacting Elizabeth Garrison in the Comptroller's Office at (845) 569-7316 with their Federal Express account number, however, a check or money order must have been received by this office prior to any mailing. Addenda, if any, will be issued to only those persons whose name and address are on record of having obtained the Contract Documents. The non-refundable payment shall be in check form and shall be drawn payable to the City of Newburgh.

Each bid shall be accompanied by an acceptable form of Bid Guarantee in an amount equal to at least five (5) percent of the amount of the Bid payable to the City of Newburgh as a guarantee of performance and/or delivery of proposed Bid.

OWNERS RIGHTS RESERVED:. The City of Newburgh, hereinafter called the Owner, reserves the right to reject any or all Bids and to

Bidders are also required to comply with the provisions of Section 291-299 of the Executive Law of the State of New York.

No bidder may withdraw his bid within forty-five (45) days after the actual date of the opening thereof.

Subject to the provisions of Article 28, Part III of the New York State Tax Law and the provisions of the Contract Documents, the Owner is exempt from payment of sales and compensating use taxes of the State of New York and cities and counties on all materials supplied to the Owner pursuant to this contract.

The City of Newburgh hereby notifies all bidders that it will affirmatively insure that in regard to any contract entered into pursuant to this advertisement, minority business enterprises will be afforded full opportunity to submit bids in response to this invitation and will not be discriminated against on the ground of race, color or national origin in consideration of an award.

BY ORDER OF THE CITY OF NEWBURGH
By Lizette Mandola
City Comptroller
Dated: Friday, May 17, 2002

"AN EQUAL OPPORTUNITY/ AFFIRMATIVE ACTION EMPLOYER"

Legal Notice

NOTICE: Sealed bids will be received in the Office of the rooms separated from the rest of the establishment by full floor-to-ceiling walls. Smoking is also allowed at bar areas in restaurants with bars only if such bar area is equipped with a ventilation system providing negative air pressure such that smoke cannot migrate from the bar area to other areas. By the specific terms of the law these requirements do not go into effect until January 1, 2003.

Therefore, pursuant to Section 20 of the Municipal Home Rule Law, the County Executive of the County of Orange will hold a public hearing on the aforesaid Local Law in the Administrative Conference Room (No 321) in the Orange County Government Center, 255 Main Street, Goshen, New York, on the 29th day of May, 2002, at 11:00 o'clock in the morning of that day, at which time all persons interested therein will be heard.

A true copy of said local law is on file in the Office of the Clerk of the Orange County Legislature, Room 302, Orange County Government Center, 255 Main Street, Goshen, New York, 10924.

Edward A Diana
County Executive
Goshen, New York 10924
Dated: May 14, 2002

Legal Notice

ROAD CLOSING NOTICE
So. Centerville Road
County Road No 22
Town of Minisink
County of Orange

The undersigned Commissioner of Public Works of the County of State Route 284 and Limekiln Road, (County Road No 93).

Edmund A Fares, PE
Commissioner
Dated: May 7, 2002

Legal Notice

REQUEST FOR PROPOSALS FOR PRINTING PROCEEDINGS OF ORANGE COUNTY LEGISLATURE FOR THE YEARS 2001 AND 2002

Sealed proposals will be received by Gail Sicina, Clerk of the Orange County Legislature, at the office of said Clerk, 255 Main Street, Goshen, New York, up to the end of business on June 18, 2002, for the printing and delivery to the County of Orange for the 2001 and 2002 Proceedings of the Orange County Legislature, the specifications for which may be obtained from said Clerk.

The Legislature of Orange County reserves the right to reject any and all proposals and the prices submitted shall be exclusive of federal and state taxes.

All proposals shall be addressed to Gail Sicina, Clerk, Orange County Legislature, 255 Main Street, Goshen, New York 10924, shall be contained in sealed enveloped marked "Proposals for Printing Proceedings" and shall provide for delivery within the time set forth in said specifications.

No contract will be awarded to any corporation not incorporated in the State of New York until such corporation shall have qualified to do business within the State of New York

Consisting of the partial reconstruction of the service road at the Orange County Airport

Period of probable usefulness: Fifteen (15) years

Amount of obligations to be issued: $120,000

A complete copy of the Bond Resolution summarized above shall be available for public inspection during normal business hours at the office of the Clerk of the Orange County Legislature, in Goshen, New York.

Dated: May 22, 2002
Goshen, New York

Legal Notice

NOTICE OF PUBLIC HEARING

NOTICE IS HEREBY GIVEN, that the Legislature of the County of Orange will meet at its Chambers in the Orange County Government Center, 255 Main Street, Goshen, New York, Room 303 on the 5th day of June, 2002 at 7:00 PM on that day to hold a Public Hearing to receive public comment on the Harriman Wastewater Treatment Plant Enhancement Project in and for Orange County Sewer District No 1. The enhancement includes new treatment facilities within existing plant property, new odor controls, upgrades to existing treatment facilities and an increase of treatment capacity to 6.0 million gallons per day, all as more fully described in the report and estimate of cost prepared by the Orange County Department of Environmental Facilities and services, which has been filed with the Clerk of the County Legislature in

City of Newburgh and will be received by the City of Newburgh until 11:00 a.m. (local time) on Thursday, June 6, 2002, for One (1) Marine Patrol Motorboat and Trailer for the Police Department in the City of Newburgh, New York, in accordance with Bid Documents and Specifications prepared by the City of Newburgh.

Bids will be publicly opened and read at 11:00 a.m. (local time) on Thursday, June 6, 2002 in the Comptroller's Office of the City of Newburgh, City Hall, 83

STATEMENT OF NON-COLLUSION: Bidders on Contracts are required to execute a non-collusive bidding affidavit pursuant to Section 103d of the General Municipal Law of the State of New York.

Attention of bidders is particularly called to the requirement as to conditions of employment to be observed and the minimum wage rates to be paid under the Contract, Section 3, Segregated Facilities, Section 109, and Executive Order 11246.

3, 2002 for the following bid(s):

<u>CAFETERIA</u>
DISHWASHING
COMMODITY DELIVERY
BREAD & ROLLS
ICE CREAM
MILK

Complete specifications and bid forms may be obtained at the above address.

The Board of Education reserves the right to reject any or all proposals submitted.

Board of Education, City School District, City of Newburgh, Valinda Velus Allman, Purchasing Agent

Exhibit I

TIMES HERALD-RECORD

40 Mulberry Street, Middletown, NY 10940

State of New York }
County of Orange } ss:

Patricia Foddrill

being duly sworn deposes and says that ORANGE COUNTY PUBLICATIONS Division of Ottaway Newspapers-Radio, Inc. is a corporation organized under the laws of the State of New York and is, at all the times hereinafter mentioned, was the printer and publisher of The Times Herald-Record, a daily newspaper distributed in the Orange, Ulster, Rockland, Dutchess, Pike, Pa., Delaware and Sullivan Counties, published in the English language in the City of Middletown, County of Orange, State of New York, that deponent is the

Principal Clerk

of said The Times Herald-Record acquainted with the facts hereinafter stated, and duly authorized by said Corporation to make this affidavit; that the

Legal Notice

a true printed copy of which is hereunto annexed, has been duly and regularly published in the manner required by law in said The Times Herald-Record in each of its issues published upon each of the following dates, to wit: in its issues of

5/24/02

Principal Clerk P. Foddrill

Sworn in before me this 24

day of May 2002

Christine M. Durkee

Notary Public, Orange County

CHRISTINE M. DURKEE
Notary Public - State of New York
No. 01DU5044794
Qualified in Orange County
My Commission Expires June 5, 2003

OF ORANGE COUNTY LEGISLATURE
FOR THE YEARS 2001 AND 2002

Sealed proposals will be received by Gail Sicina, Clerk of the Orange County Legislature, at the office of said Clerk, 255 Main Street, Goshen, New York, up to the end of business on June 18, 2002, for the printing and delivery to the County of Orange for the 2002 and 2002 Proceedings of the Orange County Legislature, the specifications for which may be obtained from said Clerk.

The Legislature of Orange County reserves the right to reject any and all proposals and the prices submitted shall be exclusive of federal and state taxes.

All proposals shall be addressed to Gail Sicina, Orange County Legislature, 255 Main Street, Goshen, New York 10924, shall be contained in sealed envelopes marked 'Proposals for Printing Proceedings" and shall provide for delivery within the time set forth in said specifications.

No contract will be awarded to any corporation not incorporated in the State of New York until such corporation shall have qualified to do business within the State of New York pursuant to Section 210 of the General Municipal Law.

DATED: MAY 15, 2002

GAIL SICINA, CLERK
ORANGE COUNTY LEGISLATURE

NOTICE OF SALE
SUPREME COURT - COUNTY OF ORANGE
INDYMAC BANK, F.S.B.

Plaintiff

AGAINST

JEFFREY DEBARE, ET AL.

Defendant(s)

Persuant to a judgment of foreclosure and sale duly dates 1/8/2002 I, the undresigned Referee will sell at public auction at the Orange County Government Center, 255 Main Street, Supreme Court Lobby, Village of Goshen, Orange County, NY on 6/7/2002 at 9:30 AM premises known as 33 HOUSTON STREET, MIDDLETOWN, NY 10940. All that certain plot piece or parcel of land, with the buildings and improvements thereon erected, situate, lying and being in the CITY OF MIDDLETOWN, County of Orange and State of New York Section 36 Block 14 Lot 23 Approximate amount of lien $97,511.90 plus interest and costs. Premises will be sold subject to provisions of filed judgment Index # 6351/01

HOWARD DALLOW, Esq., Referee.

MARVIN BAUM, P.C., ATTORNEY FOR PLAINTIFF
P.O. BOX 1291, BUFFALO, NY 14240 (716) 204-2400
DATED: 5/10/2002 AG

PUBLIC NOTICE
TOWN OF MAMAKATING

PLEASE TAKE NOTICE that the Town Board of the Town of Mamakating has scheduled a Public Hearing to consider Local Law #4 entitled "Amending Town Code Section 62-19 (G) - Standard Requirements" for Tuesday, June 11, 2002 in the Town Hall, 2948 Route 209, Wurtsboro, N.Y.

Said hearing will begin at 7:00 p.m. at which time any and all persons will be given an opportunity to be heard.

Dated: May 21, 2002

BY ORDER OF THE TOWN BOARD
TOWN OF MAMAKATING
JEAN M. DOUGHERTY, TOWN CLERK

The Board of Cooperative Educational Services, Sole Supervisory District of Orange & Ulster Counties popularly known as BOCES (in accordance with Section 103 of Article 5-A of the General Municipal Law) hereby invites the submission of sealed bids for:

OC-558-02 VOCATIONAL - TECHNICAL CENTER
DATABASE MAINTENANCE

Sealed bid will be received until 1:00 PM on the 4th day of June 2002, at the Business Office, Gibson Road, Goshen N.Y., Phone 291-0100.

Board of Cooperative Educational Services reserves the right to waive any informalities in the bids, or to reject all bids, or to accept any bid which in the opinion of the Board will be in the best interest of board of Cooperative Educational Services. Any bid submitted will be binding for ninety (90) days subsequent to the date of the bid opening.

BOARD OF COOPERATIVE EDUCATIONAL SERVICES
SUPERVISORY DISTRICT OF
ORANGE & ULSTER COUNTIES
MR. WILLIAM INGLES
PURCHASING AGENT

NOTICE OF PUBLIC HEARING

NOTICE IS HEREBY GIVEN, that the Legislature of the County of Orange will meet at its Chambers in the Orange County Government Center, 255 Main Street, Goshen, New York, Room 303 on the 5th day of June, 2002 at 7:00 p.m. on that day to hold a Public Hearing to receive public comment on the Harriman Wastewater Treatment Plant enhancement Project in and for Orange County Sewer District No. 1. The enhancement includes new treatment facilities within existing plant property, new odor controls, upgrades to existing treatment facilities and an increase of treatment capacity to 6.0 million gallons per day, all as more fully described in the report and estimate of cost prepared by the Orange County Department of Environmental Facilities and Services, which has been filed with the Clerk of the County Legislature in the Orange County Government Center, 255 Main Street, Goshen, NY 10924.

The maximum estimated cost of the such increase and improvement is $26,000,000.00 assessed against a benefited area which consists of Orange County Sewer District No. 1, the Town of Monroe, and portions of the Towns of Blooming Grove and Woodbury. The annual maximum cost of such expenditures to the Typical Property (as defined in the County Law) is estimated to be $240.00, which is above the Average Estimated Cost of $17.00 to the Typical Properties for similar Types of expenditures, as computed by the State Comptroller, in accordance with the provisions of Section 268 of the County Law. The County Legislature has caused to be prepared and filed for public inspection with the Clerk of the Orange County Legislature a detailed explanation of how such costs were computed, as incorporated in said report and estimate of cost prepared by the County Department of Environmental Services and Facilities.

Dated: May 24, 2002
Goshen, New York

BY ORDER OF
THE COUNTY LEGISLATURE
OF THE COUNTY OF ORANGE, NEW YORK

GAIL SICINA
CLERK, COUNTY LEGISLATURE

All that certain plot, piece or parcel of land situate lying and being in the Town of Blooming Grove, County of Orange and State of New York, and being described as follows:

BEGINNING at a point in the easterly right of way line of a 33 foot wide right of way, said point marking the division line of Lot No. 10 on the north and the herein described parcel on the south, all as shown on a certain map entitled "Map of Subdivision Land of E.R. and Victoria H. Dobson Hardscrabble Tract #1" Town of Blooming Grove, Orange County, New York, and filed in the Orange County Clerk's Office on June 6, 1930 as Map No. 1073.

PARCEL I

Being and intended to be Lot No. 12, Lot No. 13, Lot No. 14 and a portion of the parcel labeled as park on the aforesaid filed map no. 1073.

PARCEL II

Containing 2.815 acres of land. Parcel I and Parcel II containing 12.399 acres. All of which the above is shown on the aforesaid field map no. 1073.

Being the same Premises described in deed dated 04/23/1997 and recorded on 05/28/1997 in Book 4574 at P217.

REFER TO FILED JUDGMENT FOR COMPLETE DESCRIPTION.

Premises known as 1 Driftwood Lane, Chester, New York. Sold subject to all of the terms and conditions contained in said judgment. Approximate amount of judgment $129,255.59 plus interest and costs.

INDEX NO. 2001-7266

HELEN ULLRICH, REFEREE

THE ABOVE SALE ORIGINALLY SCHEDULED FOR MAY 7, 2002, IS HEREBY POSTPONED UNTIL MAY 30, 2002, SAME TIME, SAME PLACE. HELEN ULLRICH, REFEREE

NOTICE OF SALE

SUPREME COURT: ORANGE COUNTY.
MANUFACTURERS AND TRADERS TRUST COMPANY, Pltf. vs HENRY CARMINATI, et al., Defts. Index No. 2001-2261. Pursuant to judgment of foreclosure and sale dated February 26, 2002, I will sell at Public Auction at the lobby of the Supreme Court Wing of the Orange County Government Center, 255 Main Street, in the Village of Goshen, County of Orange and State of New York, on June 3rd 2002, at 10:00 AM prem. k/a 168 Seven Springs Mountain Road, Blooming Grove, NY. Said property located on the northeastedrly side of Mountain Road a.k.a. County Highway 44. Being two parcels of land, located primarily in the town of Monroe and also in the town of Blooming Grove, the first being SBL #13-1-74 a plot 75 ft. x 77 ft. approx. and the second being SBL #1-1-6 a plot of 2.20 acres approx. Approx. amt. of judgment is $111,101.41 plus costs and interest. Sold subject to terms and conditions of filed judgement and terms of sale. PATRICK T. BURKE, referee. SCHILLER & KNAPP, LLP, attys. for Pltf., New Loudon Road, Latham, NY 12110.

LEGAL NOTICE

Notice of Lien To be auctioned:
One (1) 1994 Acura Integra
Vin # JA4DB7654RS

Owner - Autotech Leasing Assoc. The auction will be on June 3, 2002 at 8 A.M. by Reynaldo Bacan at Reymar & Sons, 560 Rt. 211E., Middletown, N.Y. 10941.

The Contractor shall furnish promptly upon demand by the Owner proof that said insurance remains in full force and effect.

The Contractor's failure to procure or maintain said insurance shall constitute an act of default and entitle the Owner to terminate the Contract, at the Owner's sole discretion, shall entitle the Owner to procure and maintain such insurance on behalf of the Contractor and at the Contractor's sole expense, and to charge the costs of all premiums against the Contractor's payment requisitions for the period in question.

All bids shall be submitted subject to the following conditions:

1. The Town Board reserves the right to waive any informalities, to reject any or all bids and readvertise for new bids.
2. All bidders shall submit proof of responsibility, as required by the Town Board.
3. Each bid must contain the certificate of non-col bidding required by Section 103-d of the General Mun Law, relating to non-collusion (Schedule 4 hereto).
4. No bids shall be withdrawn for a period of forty- (45) days after the receipt thereof, without the consent o Town Board of the Town of Newburgh.
5. The bidder shall make allowance in his bid for any price increase in labor and materials. Requisitions for work and/or material shall be at the price bid with no additional charges for such increases.
6. Bids shall be submitted in an opaque envelope clearly marked on the front:

BID OPENING - INSTALLATION OF
NEW HVAC SYSTEM
June 4, 2002-10:00 AM

BY ORDER OF THE TOWN BOARD
TOWN OF NEWBURGH
ANDREW J. ZARUTSKIE, TOWN CLERK
TOWN OF NEWBURGH

Dated: May 24, 2002

ARTICLES OF ORGANIZATION
OF
CORBIN HILL, LLC

Under Section 203 of the Limited Liability Company Law

1. The name of the limited liability company is: BIN HILL, LLC
2. The county within this state in which the office of the limited liability company is to be located is: Orange Co
3. The Secretary of State is designated as agent limited liability company upon whom process against it may be served. The post office address within or without the state to which the secretary of state shall mail a copy of any process against the limited liability company served upon him or her is:

c/o Melvin Fischman
X-L Plastics
220 Clifton Boulevard
Clifton, NJ 07011

4. The limited liability company is to be managed by 1 or more members.

IN WITNESS WHEREOF, this certificate has been subscribed this 24th day of April, 2002, by the undersigned who affirms that the statements made herein are true under the penalties of perjury.

Melvin Fischman, Organizer
(Filed with Dept. of State 04/26/02)

Exhibit J

State of New York
County of Orange

Gilda Henderson being duly sworn says that she is the Accounting Clerk of Straus Newspapers, publisher of weekly newspapers in Orange County, NY; and that the advertisement annexed hereto was published in The Warwick Advertiser/Photo News/Chronicle each week for 1 successive weeks, commencing on the 24th day of May, 2002

To wit: 5/24/02

Gilda Henderson, Accounting Clerk

Sworn to before me this 3rd day of June, 2002

OTTILLA M. BERTOLOTTI
Notary Public, State of New York
No. 01BE5070850
Qualified in Orange County
Commission Expires December 23, 2002

NOTICE OF PUBLIC HEARING
NOTICE IS HEREBY GIVEN, that the Legislature of the County of Orange will meet at its Chambers in the Orange County Government Center, 255 Main Street, Goshen, New York, Room 303 on the 5th day of June, 2002 at 7:00 p.m. on that day to hold a Public Hearing to receive public comment on the Harriman Wastewater Treatment Plant Enhancement Project in and for Orange County Sewer District No. 1. The enhancement includes new treatment facilities within existing plant property, new odor controls, upgrades to existing treatment facilities and an increase of treatment capacity to 6.0 million gallons per day, all as more fully described in the report and estimate of cost prepared by the Orange County Department of Environmental Facilities and Services, which has been filed with the Clerk of the County Legislature in the Orange County Government Center, 255 Main Street, Goshen, NY 10924. The maximum estimated cost of the such increase and improvement is $26,000,000.00 assessed against a benefited area which consists of Orange County Sewer District No. 1, the Town of Monroe, and portions of the Towns of Blooming Grove and Woodbury. The annual maximum cost of such expenditures to the Typical Property (as defined in the County Law) is estimated to be $240.00, which is above the Average Estimated Cost of $17.00 to the Typical Properties for similar Types of expenditures, as computed by the State Comptroller, in accordance with the provisions of Section 268 of the County Law. The County Legislature has caused to be prepared and filed for public inspection with the Clerk of the Orange County Legislature a detailed explanation of how such costs were computed, as incorporated in said report and estimate of cost prepared by the County Department of Environmental Services and Facilities. Dated: May 23, 2002 Goshen, New York BY ORDER OF THE COUNTY LEGISLATURE OF THE COUNTY OF ORANGE, NEW YORK By: Gail Sicina Clerk, County Legislature

Exhibit K

Wallkill Valley Times
P.O. Box 434
Walden, NY 12586-0434
845-778-2181

Affidavit of Publication

To: OC Legislature
County Government Center
255 Main St
Goshen, NY 10924-1601

Re: Legal notice #15239

State of New York }
} SS:
County of Orange }

I, Carl Aiello, being duly sworn, depose and say: that I am the Publisher of Wallkill Valley Times, a weekly newspaper of general circulation published in Walden, County of Orange, State of New York; and that a notice, of which the annexed is a printed copy, was duly published in Wallkill Valley Times once on 05/22/02.

Carl J Aiello

Sworn to before me this 22nd day of May, 2002

Diane M Holbert

Notary Public

DIANE M. HOLBERT
Notary Public, State of New York
No. 4961755
Qualified in Orange County
Commission Expires February 5, 20 06

NOTICE OF PUBLIC HEARING

NOTICE IS HEREBY GIVEN that the Legislature of the County of Orange will meet at its Chambers in the Orange County Government Center, 255 Main Street, Goshen, New York, Room 303 on the 5th day of June, 2002 at 7 p.m. on that day to hold a Public Hearing to receive public comment on the Harriman Wastewater Treatment Plant Enhancement Project in and for Orange County Sewer District No. 1. The enhancement includes new treatment facilities within existing plant property, new odor controls, upgrades to existing treatment facilities and an increase of treatment capacity to 6.0 million gallons per day, all as more fully described in the report and estimate of cost prepared by the Orange County Department of Environmental Facilities and Services, which has been filed with the Clerk of the County Legislature in the Orange County Government Center, 255 Main Street, Goshen, NY 10924.

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DATED: May 22, 2002
Goshen, New York

BY ORDER OF THE ORANGE COUNTY LEGISLATURE OF THE COUNTY OF ORANGE, NEW YORK
By: Gail Sicina,
Clerk, County Legislature
#15239

Exhibit L

NOTICE OF PUBLIC HEARING
NOTICE IS HEREBY GIVEN, that the Legislature of the County of Orange will meet at its Chambers in the Orange County Government Center, 255 Main Street, Goshen, New York, Room 303 on the 5th day of June, 2002 at 7:00 p.m. on that day to hold a Public Hearing to receive public comment on the Harriman Wastewater Treatment Plant Enhancement Project in and for Orange County Sewer District No. 1. The enhancement includes new treatment facilities within existing plant property, new odor controls, upgrades to existing treatment facilities and an increase of treatment capacity to 6.0 million gallons per day, all as more fully described in the report and estimate of cost prepared by the Orange County Department of Environmental Facilities and Services, which has been filed with the Clerk of the County Legislature in the Orange County Government Center, 255 Main Street, Goshen, NY 10924. The maximum estimated cost of the such increase and improvement is $26,000,000.00 assessed against a benefited area which consists of Orange County Sewer District No. 1, the Town of Monroe, and portions of the Towns of Blooming Grove and Woodbury. The annual maximum cost of such expenditures to the Typical Property (as defined in the County Law) is estimated to be $240.00, which is above the Average Estimated Cost of $17.00 to the Typical Properties for similar Types of expenditures, as computed by the State Comptroller, in accordance with the provisions of Section 268 of the County Law. The County Legislature has caused to be prepared and filed for public inspection with the Clerk of the Orange County Legislature a detailed explanation of how such costs were computed, as incorporated in said report and estimate of cost prepared by the County Department of Environmental Services and Facilities.
Dated: May 21, 2002
Goshen, New York
BY ORDER OF THE COUNTY LEGISLATURE OF THE COUNTY OF ORANGE, NEW YORK
By: Gail Sicina Clerk,
County Legislature

State of New York
County of Orange, ss:
Michael Smith being duly sworn disposes and says that he is Vice President of the E.W. Smith Publishing Company; Inc. Publisher of The Sentinel, a weekly newspaper published and of general circulation in the Town of New Windsor, Town of Newburgh and City of Newburgh and that the notice of which the annexed is a true copy was published once in said newspaper, commencing on the 21 day of May A.D., 2002 and ending on the 21 day of May A.D. 2002

Michael E Smith

Subscribed and shown to before me this 17 day of June, 2002.

Mary E Fordenbacher

Notary Public of the State of New York
County of Orange.

Mary E. Fordenbacher
Notary Public, State of NY
Residing in Orange County
No. 4718013

My commission expires 2.28.03

Exhibit M

ffavit of Publicatio

STATE OF NEW YORK
COUNTY OF ORANGE } SS:

Joseph V. Gill being duly sworn, deposes and says that he is the General Manager of The News of the Highlands, Inc., publisher of The Cornwall Local and The News of The Highlands, weekly newspapers published at Cornwall, in the Town of Cornwall and at Highland Falls in the Town of Highlands, County of Orange, State of New York, and that a notice, a true copy of which is hereto annexed was published in said newspapers [once in each week for 1 successive week(s)] on the following date(s): May 22, 2002

Joseph V. Gill

Sworn to before me this 23 day of May 2002

Notary Public
Kathleen F. Cockey

KATHLEEN F. COCKEY
Notary Public Reg. No. 4679323
Orange County, New York
Commission Expires Jan. 31, 2003

NOTICE OF PUBLIC HEARING

NOTICE IS HEREBY GIVEN, that the Legislature of the County of Orange will meet at its Chambers in the Orange County Government Center, 255 Main Street, Goshen, New York, Room 303 on the 5th day of June, 2002 at 7:00 p.m. on that day to hold a Public Hearing to receive public comment on the Harriman Wastewater Treatment Plant Enhancement Project in and for Orange County Sewer District No. 1. The enhancement includes new treatment facilities within existing plant property, new odor controls, upgrades to existing treatment facilities and an increase of treatment capacity to 6.0 million gallons per day, all as more fully described in the report and estimate of cost prepared by the Orange County Department of Environmental Facilities and Services, which has been filed with the Clerk of the County Legislature in the Orange County Government Center, 255 Main Street, Goshen, NY 10924.

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Dated: May 22, 2002
Goshen, New York
BY ORDER OF THE COUNTY LEGISLATURE OF THE COUNTY OF ORANGE, NEW YORK
By: Gail Sicina
Clerk, County Legislature

5/22

Exhibit N

PUBLIC HEARING ON THE HARRIMAN WASTEWATER TREATMENT PLANT ENHANCEMENT PROJECT

Public Hearing on the Harriman Wastewater Treatment Plant Enhancement Project was held in the Legislative Chamber, Room 303, Orange County Government Center, 255 Main Street, Goshen, New York on Wednesday, June 5, 2002 at 7:00 p.m.

The Public Hearing was called to order at 7:05 p.m. by Legislator Leigh J. Benton, Chairman of the Environmental Facilities & Services Committee.

The Clerk read the Notice of Public Hearing and stated that the notice had been published in the May 21, 2002 issue of The Sentinal; the May 22, 2002 issues of The Wallkill Valley Times, Hudson Valley Black Press, News of the Highlands; May 23, 2002 issue of the Warwick Advertiser-Photo News; and the May 24, 2002 issue of the Times-Herald Record, proofs of which publications are on file in the Clerk's Office.

Chairman Benton noted that the Notice of Public Hearing was also mailed to approximately 7,800 tax map parcels within the Sewer District.

Chairman Benton introduced Mr. William Gunther, Deputy Commissioner of the Environmental Facilities & Services Department. Mr. Gunther welcomed everyone to the public hearing and gave background on the project. The project was started in 1996 and originally it was planned that the Sewer District would bear the costs alone. There has been quite a bit of interest from outside communities so it is hoped that the costs will come down. The centerpiece of the project is odor control and strengthening the existing treatment plant which is 4.5 mgd and is scheduled to go to 6 mgd. Mr. Gunther introduced Tom Schoettle of the firm of Camp, Dresser & McKee whose primary role is the design engineer for the facility improvements.

Mr. Schoettle stated that the facility upgrade is driven by the need to increase treatment capacity at the facility and also to address more stringent treatment limits that are being imposed by the State of New York. Planned improvements at the facility will address these more stringent effluent limits and provide enhancements to the existing odor control as well as sludge-handling facilities. They will remediate deficiencies that are presently existing with outfall No. 2 at the facility and provide a net increase of 2 mgd; provide a net increase of 2 mgd to the facility and enhance facility aesthetics through some landscaping as well as the odor control.

The project has progressed to this point in a number of phases. The first of those phases began in 1996 at which time CDM conducted a facility evaluation and a needs assessment to determine what exactly specific deficiencies existed at the facility so that we could program those existing problems into the large objective of providing more capacity at the flow. We conducted a needs assessment then and established effluent limits that were likely to be imposed with the State of New York and prepared a conceptual design at that stage. Subsequently, we entered the environmental review phase which involved the preparation of a draft and final environmental impact statement and the SEQR process was completed in August of that year. Detailed design commenced on a parallel track and the detailed design presently stands at 95% complete and bid documents are just about ready to go out for public solicitation.

During that same time period the County negotiated successfully an interim increase in the plant's capacity to 4.5 mgd. It will be rated for 6 mgd with a net increase of 2 mgd. We are working on some project funding issues right now and some final technical details we are trying to work through with the State primarily relating to permit and we are going to shortly embark on the construction phase of the project at which time the new permit will become in effect for the full 6 mgd and completion of the project after approximately a 3-year construction period.

Some more background on the plant, it is located in the Village of Harriman. The design average flow was originally designed for 4 mgd but performance at the facility has allowed us to upgrade those to 4.5 mgd. The facility presently discharges to the Ramapo River. It was last upgraded in the mid-1980s. At that time a 2 mgd treatment train was added bring it from an original 2 mgd to a 4 mgd plant. Facility improvements overall are an increase of 2 mgd and we plan on closing the sludge storage facilities to provide enhanced odor control. Primary settling tanks are going to be added. Two additional aeration tanks as well as two secondary clarifiers will be added. Two effluent sand filters will be added as well as chlorine contact tanks and post-aeration tanks. The new facilities are shown on this plan (drawing). As a side note, the facilities being added will also relieve some of the stress from a treatment standpoint on the existing facility so not only are we providing an additional 2 mgd capacity at the facility but the new facilities have been designed to relieve some of the burden on the existing treatment train to enable that train to provide a higher level of treatment as well.

We will also be providing a new process building housing effluent filters and some miscellaneous equipment at the facilities. We are re-routing a portion of the original outfall No. 3 which formerly went to Woodbury Creek. That outfall is presently planned to be used to expand the capacity of outfall No. 2 to the Ramapo and we are replacing the Harriman Pump Station which is a lift station on the site which serves the Village of Harriman. An architectural rendering of the new process building shows a number of elevations on the building. This houses some equipment as well as provides for indoor storage of the sludge cake which is stored at the site, markedly reducing the odors at the site. We have included comprehensive provisions of odor control in addition to enclosing the sludge storage facilities. We are also providing tank covers and air scrubbers for the odorous components of the treatment facilities. We are providing a new disinfectant system and improving the control and automation capability of the facilities and we are enhancing the landscaping, fencing and on-site roadway features of the plant. Finally, a new standby generator and a new backwash pump station which is provided for the filters.

Overall the benefits to the residents of the Sewer District will be additional treatment capacity. We will be able to reduce the burden on the existing treatment facility so some of the chronic problems that we have had with the existing facility will be alleviated to a great degree with the enhancements. We are going to continue the good neighbor policy through the improved aesthetics and control of odors and noise. Finally, there is a 27-month construction period at this point. There are provisions in the contract documents for sequence of construction to minimize outages of the existing plant and maintain the present level of service throughout the construction period. There are provisions for sediment and odor control to reduce the amount of material that is tracked from the site, truck traffic and so forth into the site during the construction period. We have designed the facility improvements to minimize the impacts that they will have during the construction period on the existing facilities. So, we have a high level of confidence that the existing facilities will continue to meet permits and so forth. What is next on the horizon is to secure project financing, New York State Comptroller approval, resolving some issues with New York State regarding temperature of the discharge, finalize and get that last 5 percent of the design in and get the plans approved by EFC.

Mr. Benton thanked Messrs. Gunther and Schoettle. He noted that written comments were received from Mr. Andrew Barone, 10 Brewster Road, Monroe, New York. Also received was a letter from Mr. Fred Schuepfer of Harriman, New York opposing the enhancement project because of its effect on the Ramapo River and the explosion of growth in southeastern Orange County. A letter was also received from Jacobowitz and Gubits on behalf of clients who own apartment complexes in the Sewer District who feel the proposed charges are excessive and disproportionate.

Mr. Benton called upon members of the public who signed up to speak.

Mr. Andrew Barone, 10 Brewster Road, Monroe read his letter (attached).

Mr. Benton: Members of the public should come to the microphone and state your full name and address so that your question can be responded to properly in writing for the record.

Patricia Brennan, 37 Woodland Road, Monroe: At least 15 years ago sewers went into our area and they stopped for some reason below us. We never have received the sewers and there is a stipend every year on our property tax. I want to know how the increase in capacity of sewerage will affect us who have been there 20, 30, 40 years who have still not received them when new people are moving in all the time and are hooked up almost immediately.

Mr. Benton: Tonight is just for public comment and questions so that we can respond in writing and there can be no confusion as to our answers to you.

Mr. Benton: Tonight is just for public comment and questions so that we can respond in writing and there can be no confusion as to our answers to you. The responses will be specifically to you as well as included in the report to the Comptroller. Everyone who shows up here tonight and asks a question, we will answer. When the document is published, you will be able to come in to the Legislature and read the responses to everyone's questions.

Mr. Seidman: What we can do is after the meeting you can see the Clerk and give her your name and address we will have all the answers mailed to everyone who requests them.

Claude Clayton, 34 Millard Circle, Monroe: When I read the proposal I was not certain, is this expansion being created to handle increased demand or is it to open up capacity for development in the district. If it is the latter, have you considered the impact that it will have to generate new homes, children, school taxes and village taxes. In addition I ask if there will be an increased demand for water sources.

John Ruhle, 39 High Ridge Road, Monroe: I have been here for 36 years and went into the Sewer District in 1979. I understood when we went in to the Sewer District then that it would be good for 30, 40, 50 years. Meantime, as Mr. Barone so ably put it, we keep paying more and now you want to add several million gallons more which is going to cost 26 billion and my question is for who? Are businesses coming in on this? Are they paying their fair share or is it just the one district that is going to pay for everything? Also, there was a sewer plant put in the Kiryas Joel section which according to the papers a few years ago we were going to benefit from but I haven't heard any talk about that but with them pulling out of Harriman's District and having their own sewer district, why all of a sudden we need all this expansion?

John Murray, 41 High Road, Monroe: I agree with Mr. Barone. I see no real value to the cost of the project to the advantages it is going to give us. First of all I don't understand how the assessments come about. People that live in townhouses and condos, how are they assessed in relation to people in private homes? Are they paying the same as we are paying, I really don't know?

Kay Tosi, 128 Orchard Street, Monroe: I want to thank Mr. Barone for really laying out. I went down and checked off a zillion questions I had and you worded them so beautifully. I still want to put them in my own words so that I make sure that I get an answer I can understand. My first question is that the presentation included construction. Is this already a done deal? Is this going ahead? Are we going to have a bond issue vote where every person in the district gets a chance to have their voice individually heard or is it done through our Legislators where we have to make sure they know how we feel about this project? My next question is why is the estimate of this company so far off from the estimate the State Comptroller came up with? Is this $240 increase a pro rated amount based on the number of current and potential users or is it just taking the cost and spreading it out among the current users? I guess just to understand the whole project and the cost impact is how is that cost per household or business calculated? I think some other people had asked that. Does every buildable lot in the Sewer District pay a certain amount or, I guess it's not only if you are hooked up because there are so many people who are not hooked up and they are paying so I would like a clear explanation of how that is calculated. Finally, does this cost include the cost of laying new sewers to places like that one woman had said—we've been here and that treatment capacity is there but we're still not hooked up. I think that is a really major issue that needs to be addressed. I hear that from residents in Monroe all the time.

Robert Purdy, 107 Mercury Court, Monroe: This is a public hearing. I was under the impression that public hearings were taking place before the project began. Monroe has already been offered this capacity. The Town Board has voted to accept it. I am sort of curious as to why it was offered prior to the public hearing to the Town of Monroe? I am also curious as to the explanation Monroe gave us as to why they accepted it was that if they didn't accept, they would be held liable if a developer came in and wanted sewer, the capacity was not there, but you had offered it to Monroe. If Monroe had turned it down according to their advisors, they would be held responsible which puts them and the Town of Monroe and the residents in a catch 22. Developing in this area has gone rampant. Everybody has come up with some sort of a solution to prevent or to curb development. You good people have put developing right in our hip pocket again by giving capacity. The only thing that will stop developing is going to be lack of water or the availability of and the capacity for sewers. By offering this capacity, you have allowed developers to come in and say, hey good people who have lived here for 25 or 30 years, we're not going to worry about it anymore. We have everything we need. We're going to develop. We can cluster, we can do whatever we want, if they don't have the capacity for the sewers, if they don't have the availability to get water, they can't develop. You are not overtaxing us money-wise, you are taking away our way of life up here by doing this. I am dead against it. I am offended by this whole thing I really am. Sorry, probably put a lot of work into it. It's horrible.

Mr. Nash: I'm Mark Nash from the County Attorney's office. There's been some discussion with respect to the amount, the 6 mgd and I would just like to give you a piece of information. The County of Orange is required to comply with a Consent Decree which is a court order based upon litigation from 1999. In Article 3 the County is ordered, adjudged and degreed to upgrade the Harriman Plant and expand its treatment capacity to 6 mgd. So that's where the number comes from.

Keica Healy, 39 Amy Todt Drive, Monroe: I have two questions. I really hoped to have received some answers here. I don't know if you are at liberty to answer any questions but they were really questions that I had as I watched your overview. You mentioned rerouting one of the existing outfalls, outfall No. 3 to the Ramapo, the one that currently goes to Woodbury Creek. Once you reroute this will there be any discharge at all into Woodbury Creek or will you just be rerouting a portion of the new 2 mgd. I'm sure that it has been addressed but I just want to verify that the additional 2 mgd is addressed in the final environmental impact study. I'm going to assume that it was but I've learned not to assume anything. The second question I had is that one of the improvements that you mentioned was effluent filters. My question is what type of filters are you planning to install and in the hopes of filtering out what before it discharges to the Ramapo or Woodbury Creek. The reason I am asking this specifically is, I am not sure whether you are aware of this, but NYS DEC is about to release the results of the mercury in fish tissue study that they did on the Ramapo River last June. They have the results and they are planning to come down and share the results and give a whole presentation on them and one of the things they sampled fish and sediment samples and water samples from 9 or 10 different stations along the Ramapo River. They went upstream of both Nepera's outfall and the sewage treatment plant outfall. They took some samples at the outfall. I don't have the figures yet but I do believe that there is some level of mercury coming from the outfall at the sewage treatment plant. I don't know what the numbers are. The meeting, and I'm inviting everyone who is here, the meeting is Monday, June 24th at 7:15 p.m. at the Education Center in Woodbury on Route 32 and Smith Clove Road. The DEC will be there to explain the results of the study. My concern is having mercury in the Ramapo already. Some of it is from discharge. Some of it is from fallout from Ohio or wherever. But, do we really need to be putting any more in. So I really hope that, I know you are going to sit down and have a conversation with the DEC before all this is finalized, and hopefully they will bring this up as well. We have got to make sure, and I don't know why there is mercury in the outfall and I don't know how much there is, but really every attempt needs to be made at this point to try to filter it out and I'm not a scientist or engineer and I have no idea what sort of filters can be put in or if it is feasible or if it is not feasible but it's definitely something that you are going to have to talk about if you're not already talking about it. So I invite everyone to come to the meeting on the 24th of June if they can make it. Thank you.

Mr. Benton: And I also will make sure that you get a map besides the legal description, exactly showing you where the changes will be.

Greg Kline, 32 Oxford Lane, Harriman Farms, Harriman: I live across from the sewage plant. I moved there in May of 1989 and when I did I contacted the EPA and attended meetings at Harriman Town Hall and the issue of the sewage treatment plant came up on numerous occasions. I heard various plans about things that would be done to enhance and improve the processing because if you live there, if you live near there, you can see it, you can smell it and I haven't noticed any change. Any change that there is is negligible at best over the years. I understood when I moved in that the plant was processing above its design capacity. There was talk of converting the plant into a pumping station and that if that happened we wouldn't be smelling it at all. That didn't happen. There was talk about putting rubber caps over some of the wells that were there and that would get rid of the odor and to the best of my knowledge that didn't happen. Basically it's just similar over the past 13 years. I have also noticed that in the last two or three years that development in our area has been rampant compared to the other years I have lived in Harriman and the questions that I have are what the conditions will be during the 27-month period that this work is being done. I would like to know at what point during the 27 months that the upgrades would be operational. What we can expect to experience during those 27 months. Also I would like qualifications on what the aesthetic improvements would be. I would like to hear specifics. I would like to hear down to the period what those aesthetic improvements would be. Also, I'd like to know that if and when these changes are completed, will the odors be non-existent, will they be better, will they be the same, will they be worse and I would like binding guarantees on just which of those would be the case. Same applies to noise. I haven't noticed the plant to be particularly noisy. That's a lesser concern of mine personally. I would also like to know if the noise level would be better or worse and I would like binding guarantees what that noise level would be and specifically what that noise level would be. I'd like to know specifically in parts per million etc. that kind of information as to what we could expect from the air in odors. I'd also like qualifications, what is an effluent. I'd also like to know if there are prior models to gauge the results of such an increase. Are there any treatment plants that have gone from 4 or 4.5 mgd up to 6 mgd. And, finally, I'd like to know if there will be a printed recap of all this information that we are discussing. Will it be available, how will it be available, I personally would like to receive a copy. And that's it.

Mary Bingham, 17 Carol Drive, Monroe: I was here on April 9, 2001 when the environmental SEQR was done. I still have not gotten a copy of the answers to my questions at that time. I am still waiting. It is more than a year and they have had time to get it to me. There weren't that many people speaking at that time so I don't think it is a big complicated matter. I would really like to get my answers from a year ago. One of the problems I mentioned at that time was antibiotics in the water. Everybody is taking antibiotics now including our pets. Ramapo Rockland County has expressed an interest in gray water. One of the people speaking before had mentioned what kind of filters are going to be in place and what kind of effluent are they going to filter out. A lot of people have very severe reaction and people are allergic to penicillin. Are these filters going to take out penicillin? Is this still going to be in the gray water. I would like to have that question answered. As I said, I came in a little late, so I'm not quite sure. I don't believe it was published as far as notice in the Photo News in the Monroe section. I believe I overheard something about Warwick but I don't believe I heard anything about the Monroe Photo News. I would like to find out why it was not. Go to Town Board meetings in the Town of Monroe. I understand from past meetings that a lot of these undeveloped tracts right now are paying a per acre charge. I'm not sure if it was picked out of a hat or it is set in stone, but I heard $50 an acre. People have spoken before saying they are paying O & M of $360 or so. Now these developers from these large tracts of land are coming in saying I don't want one house on there, I don't want two houses on there. I don't want three houses on there. I want four houses. Maybe the reason why we are short of capacity is nobody thought of what the actual land is going to be developed as. Just took one acre of land and instead of having one unit go on there you have four. You quadruple the amount you need as far as capacity. Why wasn't this addressed? Also people have said they have been waiting ten years, 20 years, 30 years, they have been paying in. Also at the Town Board meetings they say we know we will never ever get sewer. This is not fair. This is not just. People pay for a service. They are entitled to a service. The large developers that are coming in now should not be first come, first served. I'm coming in with a housing proposal for 150 units, I want 150 gallons for the sewage capacity. No, the people who have been paying should have like an escrow account set up. The Town should figure out who is not hooked in yet, who needs to be hooked in, and set aside x million gallons of capacity. It's not fair to them. Those are my questions. Thank you.

Mr. Benton: Anyone else?

Kay Tosi: The County Attorney had mentioned that there was some kind of Court order that said that we had to increase the capacity of the plant. Beyond that, I don't know the history of all of that, what is the legal obligation of the County to provide sewers to tracts of land?

Kathy Valentine, 26 Summit Avenue, Harriman: I have a four-family house and I bought it 5 years ago and the sewer bill there was $800 a year and every year it has gone up and I am now paying over $1,300 a year so I think if I am correct I will probably be charged an additional $240 per unit which is going to be almost $2,300 a year and let's say it starts next year, then the year after that it goes up another $100 or $200 and I just don't see how you can justify—there are only five people who live in the house and two out of the last three years I got my sewer bill I called up and asked if there was any other way my bill could be determined rather than per unit because I just don't think it is fair to pay $1,300 a year for five people who live in a house even though it is an income property. It's crazy. In other towns it is based on the water usage. My water bill is only maybe $400 to $500 a year, I'm not sure off the top of my head. I realize it would probably cost everybody a lot more money to do a change in the system so it could be based on the water usage or monitored. Is there anything that can be done for people.

Mr. Benton: I would like to thank everyone for coming including Legislators on the Environmental Facilities & Services Committee and others with other elected officials and representatives here and would like to declare this hearing closed at 8:03 p.m.

Exhibit O

Benton & Green

Agenda No. 14-A

RESOLUTION NO. 170 OF 2002

RESOLUTION DIRECTING THE PREPARATION OF AN APPLICATION FOR PERMISSION TO THE STATE COMPTROLLER WITH RESPECT TO AN INCREASE AND IMPROVEMENT TO THE FACILITIES OF ORANGE COUNTY SEWER DISTRICT NO. 1

WHEREAS, pursuant to proceedings heretofore had and taken in accordance with the provisions of Article 5-A of the County Law, including approving orders of the State Comptroller, Orange County Sewer District No. 1 was established; and

WHEREAS, the Orange County Legislature has heretofore directed that there be prepared a report and estimate of the cost by the County Engineers (Orange County Department of Environmental Facilities and Services) relating to a proposed increase and improvement to the facilities of said Orange County Sewer District No. 1, which report and cost estimate, together with maps and plans of said increase and improvement were filed with the Clerk of County Legislature pursuant to Section 268 of the County Law; and;

WHEREAS, said report, cost estimate, maps and plans describe an increase and improvement of the facilities of said Orange County Sewer District No. 1, consisting of enhancements and upgrades to the Harriman Wastewater Treatment plant including the addition of a treatment train that will add 2.0 million gallons per day of treatment capacity to the Harriman Treatment Plant, and improved odor controls and related facilities, all as more fully described in the report, plans and maps hereinbefore referred to; and

WHEREAS, the maximum estimated cost of said increase and improvements is $26,000,000.00 to be assessed against a benefited area which consists of the entire Orange County Sewer District No. 1; and

WHEREAS, a Public Hearing to consider the proposed increase and improvement was duly held on June 5, 2002 in accordance with section 254 of the County Law; and

WHEREAS, the consent of the State Comptroller must be obtained prior to the expenditure for said increase and improvement if such expenditure is to be financed by the issuance of bonds or notes of the County therefor, and the cost thereof to the typical property owner is above the Average Estimated Cost of $17.00 to Typical Properties for similar types of expenditures, as computed by the State Comptroller, in accordance with Section 268 of the County Law.

NOW, THEREFORE, it is hereby

RESOLVED, that the Orange County Legislature hereby directs the Orange County Department of Environmental Facilities and Services, together with the County Attorney and the Commissioner of Finance, to prepare an Application for Permission to the State Comptroller for said increase and improvement, and to submit same to the Legislature for its review and approval.

APPROVED: JULY 12, 2002

EDWARD A. DIANA, COUNTY EXECUTIVE
180

WHEREAS, the consent of the State Comptroller must be obtained prior to the expenditure for said increase and improvement if such expenditure is to be financed by the issuance of bonds or notes of the County therefor, and the cost thereof to the typical property owner is above the Average Estimated Cost of $17.00 to Typical Properties for similar types of expenditures, as computed by the State Comptroller, in accordance with Section 268 of the County Law.

NOW, THEREFORE, it is hereby

RESOLVED, that the Orange County Legislature hereby directs the Orange County Department of Environmental Facilities and Services, together with the County Attorney and the Commissioner of Finance, to prepare an Application for Permission to the State Comptroller for said increase and improvement, and to submit same to the Legislature for its review and approval.

STATE OF NEW YORK
COUNTY OF ORANGE
OFFICE OF THE CLERK OF
THE COUNTY LEGISLATURE

THIS IS TO CERTIFY THAT I, GAIL SICINA

Clerk of the County Legislature of said County of Orange, have compared the foregoing copy of resolution with the original resolution now on file in my office and which was passed by the County Legislature of said County of Orange on the 12th day of July, 2002, and that the same is a correct and true transcript of such original resolution and the whole thereof.

In Witness Whereof, I have hereunto set my hand and the official seal of said County Legislature this 26th day of August, 2002

Gail Sicina

CLERK OF THE COUNTY LEGISLATURE OF THE COUNTY OF ORANGE

Green

Agenda No. 10

RESOLUTION NO. 201 OF 2001

RESOLUTION ACCEPTING THE FINAL ENVIRONMENTAL IMPACT STATEMENT ON THE PROPOSED ENHANCEMENTS TO THE HARRIMAN WASTEWATER TREATMENT PLANT

WHEREAS, this Legislature previously accepted a Draft Environmental Impact Statement for the proposed 2.0 million gallon per day ("mgd") enhancement to the Harriman Wastewater Treatment Plant ("HWWTP") and held a public hearing and established a public comment period thereon; and

WHEREAS, the time for receipt of public comments has expired; and

WHEREAS, comments from the public have been received and reviewed, and responses thereto duly made and incorporated into the Final Environmental Impact Statement ("FEIS"); and

WHEREAS, the FEIS has been reviewed by this Legislature as Lead Agency for the project and has been found to be complete in all respects.

NOW, THEREFORE, it is hereby

RESOLVED, that the FEIS is hereby accepted as complete; and it is further

RESOLVED, that the FEIS and a written notice of completion be filed in accordance with 6 NYCRR Part 617.12; and it is further

RESOLVED, that a written findings statement be issued no earlier than ten (10) days from the date of filing of the FEIS, and shall be filed in accordance with 6 NYCRR Part 617.12.

APPROVED: July 13, 2001

SEPH G. RAMPE, COUNTY EXECUTIVE

STATE OF NEW YORK
COUNTY OF ORANGE
OFFICE OF THE CLERK OF
THE COUNTY LEGISLATURE

THIS IS TO CERTIFY THAT I, GAIL SICINA

Clerk of the County Legislature of said County of Orange, have compared the foregoing copy of resolution with the original resolution now on file in my office and which was passed by the County Legislature of said County of Orange on the ....9th.................. day of ....August, 2002.................., and that the same is a correct and true transcript of such original resolution and the whole thereof.

In Witness Whereof, I have hereunto set my hand and the official seal of said County Legislature this ......12th...................... day of ....August, 2002................

Gail Sicina

CLERK OF THE COUNTY LEGISLATURE OF THE COUNTY OF ORANGE

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Ar nda No. 22

RESOLUTION NO. 197 OF 2002

RESOLUTION APPROVING (1) AN INCREASE AND IMPROVEMENT OF THE FACILITIES OF THE ORANGE COUNTY SEWER DISTRICT NO. 1 AND (2) AN APPLICATION FOR PERMISSION TO THE STATE COMPTROLLER FOR THE EXPENDITURE OF FUNDS FOR SAID INCREASE AND IMPROVEMENT OF FACILITIES.

WHEREAS, the Orange County Legislature has heretofore directed that there be prepared a report and estimate of the cost by the County Engineers (Orange County Department of Environmental Facilities and Services) relating to a proposed increase and improvement to the facilities of said Orange County Sewer District No. 1, which report and cost estimate, together with maps and plans of said increase and improvement were filed with the Clerk of the County Legislature pursuant to Section 268 of the County Law; and

WHEREAS, said report and cost estimate, maps and plans describe an increase and improvement of the facilities of said Orange County Sewer District No. 1, consisting of enhancements and upgrades to the Harriman Wastewater Treatment Plant including the addition of a treatment train that will add 2.0 million gallons per day of treatment capacity to the Harriman Treatment Plant, and improved odor controls and related facilities, all as more fully described in the report, plans and maps hereinbefore referred to; and

WHEREAS, the maximum estimated cost of said increase and improvements is $26,000,000.00 to be assessed against a benefited area which consists of the entire Orange County Sewer District No. 1; and

WHEREAS, the consent of the State Comptroller must be obtained prior to the expenditure for said increase and improvement if such expenditure is to be financed by the issuance of bonds or notes of the County therefor, and the cost thereof to the typical property owner is above the average estimated cost of $17.000 to typical properties for similar types of

4. Said County Legislature had determined that the expenditure for which consent is sought is in the public interest and will not constitute an undue burden on the property that will bear the cost thereof;

5. The cost of the proposed increase and improvement is to be assessed against a benefited area which consists of the entire area of the Orange County Sewer District No. 1. Said Legislature has determined that all real property so assessed will be benefited by the proposed improvements and that no benefited property has been excluded;

6. Said application is hereby directed to be executed by the County Executive on behalf of the County of Orange, and upon such execution said application is directed to be forwarded to the State Comptroller to obtain his consent to the total expenditure authorized herein, and such expenditure shall not be made or contract let for the purpose authorized herein until such consent has been obtained.

APPROVED: AUGUST 9, 2002

EDWARD A. DIANA, COUNTY EXECUTIVE
200

Exhibit P

EXHIBIT "P"

A. All documents and information required by the provisions of County Law Article 5-A are attached as Exhibits "A" through "O."

B. A description of the proposed improvements appears as **attachment "1"** to this Exhibit "P" and is more fully described in **Exhibits "E-1", "E-2", "E-3"** and **"E-4."**

C. The estimated maximum amount of the proposed increase and improvement is $26,000,000.00.

D. The factors considered by the Orange County Legislature prior to making its determination that this improvement will be in the public interest include:

1. The Harriman Wastewater treatment plant is about twenty-five years old and is in need of the upgrade and modernization in order to eliminate the continuous repair of old and, in some cases, inadequate equipment.

2. The Sewer District needs to correct existing deficiencies at the facility, and it is necessary to improve the facility to handle existing flow, particularly during wet weather periods.

3. Historically the facility has exceeded its treatment capacity and effluent limitations, resulting in enforcement actions by the State Department of Environmental Conservation ("DEC"). The Sewer District has had to lease capacity from the Village of Kiryas Joel in order meet its current needs without violating the County's SPDES permit. The enhancement is necessary to increase treatment capacity to meet immediate and short-term sewage treatment needs of the Sewer District and comply with flow and effluent limitations, which will become more stringent pursuant to the current consent order with the DEC.

4. The County of Orange and the Sewer District have been sued in numerous lawsuits alleging violations of various rights due to the inability of the Sewer District to provide treatment capacity to properties within OCSD #1. The County and the Sewer District also were defendants in a federal Clean Water Act citizens' suit, resulting in a consent decree requiring the County to proceed with the enhancements to upgrade the treatment capacity to at least 6.0 million gallons per day.

5. The enhancements will include enhanced odor controls to address the concerns and complaints of residential properties in the vicinity of the facility.

6. The legislature has determined that the increase and improvement is in the public interest and are necessary, convenient and desirable, and will not constitute an undue burden on the property which will bear the cost thereof, and that the improvements will be assessed against the entire benefited area (OCSD #1), and all real property so

assessed will be benefited by the proposed improvements and that no benefited property has been excluded.

E. The anticipated amount of the improvements is $26,000,000.00. The improvements will be financed from General Obligation Serial Bonds. The term will be 30 years with an interest rate of 5.0 %. This project is eligible to be financed through New York State's Revolving Loan Fund with interest rates that are 33 1/3 % to 50 % subsidized.

F. The cost of operation and maintenance attributable to the proposed improvements will be limited to an increase in the costs of chemicals, electricity and gas. It is estimated that costs for these items will increase by about 33% due to the proposed enhancements, or by about $122,000.00 or an increase of about $17.00 per unit if usage, where a single family home is charged one unit of use. Currently, the Sewer District bills for 7,875 units. The estimate is based upon current usage for the existing facility.

G (1). Debt Service.

The costs of debt service will be raised applying the existing formula. Debt service is assessed on an ad valorem basis to all properties located within the Sewer District. Debt service for the improvement will be raised on the same basis.

The Town of Blooming Grove and the Town of Woodbury, have committed contractually to acquiring 26,000 gpd and 30,000 gpd of capacity, respectively. The Town of Monroe (that portion not within OCSD No. 1) has committed by resolution to acquire 133,000 gpd. These contractual users have agreed to pay a percentage of the capital cost of the improvement equal to the percentage of the total capacity which it will acquire. Copies of the commitments are annexed as **attachments "2," "3" and "4"** to this Exhibit "P."

Debt service charges are designated as "Type I" and "Type "II". Type I assessments include debt service on the original Harriman Treatment Plant and main interceptor sewers. Type II assessments include debt service on infrastructure and facilities within OCSD No. 1 (i.e. collection sewer mains) other than the Treatment Plant. Properties within OCSD #1 that are connected to the facility or located within 150 feet of a sewer main are assessed "Type I" and "Type II" costs. Properties not connected to the facility and located more than 150 feet from a sewer main are assessed only "Type I" charges. (Note: all properties within OCSD No. 1 pay Type I.)

The formula used to assess debt service is set forth in the cost estimate annexed to the application as Exhibit "E" ("Benefit Area Assessed Cost Estimate for $26,000,000.00 Harriman Wastewater Treatment Plant Enhancement Project").

G (2). Operation and Maintenance.

Properties are assessed based on a formula established in the Orange County Sewer Law, which assigns a number of units to each property according to the type of use. O&M charges are based on units of use, with a single family home assigned one unit of use. A copy of the assigned usage formula is annexed as **Attachment "5"** to this Exhibit "P." The cost of O&M per unit will be calculated by dividing the Sewer District portion of O&M by the number of units within the District.

Pursuant to an intermunicipal agreement, a percentage of operation and maintenance charges associated with the Harriman Plant are paid by the municipal contract users of the Harriman Plant, which corresponds to the percentage of capacity contributed by said users based on average 3 year flow. The contract users own that part of the plant constructed by them pursuant to the intermunicipal agreement and pay the entire debt service for their part of the of the Harriman Plant. Thus, only the remaining percentage of the total O&M costs associated with the Harriman Treatment Plant are paid by properties located within OCSD No. 1. For the 2002 budget year, the OCSD No. 1 share of O&M was 59% of the total O&M budget for the Harriman Plant.

In addition to O&M associated with the Harriman Plant, the Sewer District pays O&M associated with the County's lease for OCSD No. 1 of the Village of Kiryas Joel Treatment Plant. The current lease between the Village of Kiryas Joel and the County of Orange expires on November 1, 2004, and provides for two (2) one-year options to renew. The cost estimate submitted with this application is based on a conservative analysis that assumes, for purposes of this application, that the County will continue to lease the Village Treatment Plant. If and when the lease is terminated, the estimated O&M cost will be reduced accordingly. In the event that the lease terminates at the end of the four-year period or thereafter, the O&M rate will be reduced accordingly.

The O&M rate per unit is, and will continue to be, recalculated at each billing period semi-annually based on the number of additional units coming into service since the previous billing cycle. Therefore, as new units come on line, the cost per unit will decrease.

H. Not applicable.

I. Not applicable.

J. Not applicable.

K and L. The County of Orange's statement of full valuation and a statement of net indebtedness for the County of Orange is annexed hereto as **Attachment "6."**

M. A schedule of debt service appropriation for the current fiscal year is annexed to this Exhibit "N" as **attachment "7."**

N. Not applicable.

O. The current tax rates for the municipalities within OCSD # 1 are provided in **attachment "8"** to this Exhibit "P."

P. The assessed value of a typical property in Orange County Sewer District No. 1 is $48, 357.00. In OCSD #1, a typical property, as defined in the Part 85 regulations, is residential. The $48,357.00 figure was derived by dividing the total assessed value of residential property within OCSD # 1 ($295,799,600) by the number of residential properties (6117).

Q. Since the improvements will not be completed within the first year after the application is approved, the amount charged to the Typical Property owner will be limited to interest on borrowed funds during the first year after the application is approved. For purposes of this analysis an assumption is made that the County will borrow $13,000,000.00 during the first year. The Typical Property owner will pay, in the first year after the application is approved, an estimated $69.91 based on interest on $13,000,000.00 borrowed within the first year. After the improvement is completed, the estimated cost of operation and maintenance to the Typical Property (a single family home or each unit of usage) will be increased by $17.00 per year, based on the calculation set forth above in "F". The cost of debt service from the proposed improvement to the Typical Property within OCSD No. 1 is estimated to be $214.00 per year, the calculation for which is annexed as the Cost Estimate, annexed to the Application as part of **Exhibit "E."**

In 2006 the County of Orange will be retiring an old bond issue that will reduce existing debt to 111,584.71 from the 2002 debt of 248,143.00.

R. The maximum amount to be paid by the highest assessed property owner, Brookside Gardens, Assoc., in the Village of Harriman, Town of Monroe, a 91-unit residential development, which has an assessed value of $2,000,000.00 and currently is charged $31,475.00 including capital charges and O&M, is:

First year after application is approved:

O&M:	$330.28 (current) + $0.00 (new) x 91 =	$30,055.48
Capital:	$1,420.00 (current) + $1522.22 (interest only year 1) =	$ 2,942.22
Total		$32,997.70

First year after project completion:

O&M:	$330.28 (current) + $17.00 (new) x 91 =	$31,602.48
Capital:	$1,420.00 (current) + $2400.00 =	$ 3,820.00
Total		$35,422.48

S. There are no state-owned parcels within Orange County Sewer District No. 1

T. There is no agricultural district within Orange County Sewer District No. 1. The District has only one property with an agricultural exemption with an assessment of $17,600.00.

U. Orange County Sewer District lies within three villages and one town.[1] The populations for these municipalities, based upon the 2000 census, are:

Town of Monroe:	31,407
Village of Harriman	2,252
Village of Kiryas Joel	13, 138
Village of Monroe	7,780

There are 5, 800 single family homes and 239 two-family homes in the OCSD # 1. The average assessed value of a typical one- or two-family home, broken down by municipality, is as follows:

Village of Monroe:	$50,457.00
Village of Harriman (Town of Monroe)	$28,623.06
Village of Harriman (Town of Woodbury)	$93,993.55
Village of Kiryas Joel	$40,070.71
Town of Monroe	$55,649.52

V. a. The primary purposes of the improvement and increase are to benefit developed properties, including properties within the Sewer District which have been unable to connect to the facility due to lack of capacity, and to accommodate existing flows, particularly wet weather flows, and achieve compliance with flow and effluent limits. For example, upon the termination of the County's lease with the Village of Kiryas Joel, 342,000 gpd of the new capacity will immediately be applied to existing development within OCSD #1. Secondarily, the improvement will benefit planned development for which approvals have been granted or are pending. The status of proposals for the development of pending projects is set forth as **Attachment "9"** to this Exhibit "P."

b. The County Legislature's determination that the cost of the improvements will not constitute an undue burden on the area which will bear the cost of the improvements is not dependent on the development of vacant land. The cost estimate for the Typical Property was calculated based on existing development within OCSD #1 already paying sewer assessments including debt service and O&M. As noted in "G" above, development of vacant land will result in a *decrease* in O&M per unit and a *decrease* in debt service charges, since the formula for calculating these charges is based on the number of assessed units, and the total assessed value of the district.

W. The following is a list of outside users that will contribute to the project's costs:

[1] Only two (2) units are located in the Town of Woodbury so population figures for Woodbury are not included.

Town of Woodbury: 1.5% or $390,000.00 (based on purchase of 30,000 gpd/2,000,000 gpd)

Town of Blooming Grove: 1.3% or $260,000.00 (based on purchase of 26,000 gpd/2,000,000 gpd).

Town of Monroe: 6.6% or 1,716,000.00 (based on purchase of 133,000 gpd/2,000,000 gpd)

X. Annexed to the application as **Exhibits "C" and "D"** are copies of a consent order and judgment in the matter of Orange Environment Inc. v. County of Orange, and DEC Order on Consent, Case No. R3-20001116-129. There are no other pending judicial or administrative proceedings which relate to the proposed improvements.

Y. The Legislature published a notice of hearing and filed the cost estimate and maps and plans in accordance with County Law Article 5-A. In addition to the requirements of the County Law, notices of hearing were mailed to every property owner within OCSD No.1 that is currently paying debt service and/or operation and maintenance costs.

Z. Copies of written objections from owners of real property that will bear the cost of improvements are annexed to this Exhibit "P" as **attachment "10."**

disinfection and dechlorination before the effluent is discharged through two outfalls (Outfall No. 1 and 2) to the Ramapo River. Use of a third outfall (Outfall No. 3) to Woodbury Creek has been discontinued. The ultraviolet disinfection system which was installed during the 1987 upgrade has been abandoned. All sludges generated from the WWTP are thickened by gravity, dewatered by belt filter presses and composted with the grit and screenings removed in the preliminary treatment stage. Figure 1-2 shows the existing plant along with the proposed enhancements.

1.4.2 Proposed Plant Enhancements

The proposed enhancements consist of new treatment facilities at the existing treatment plant on a vacant portion of the plant property and new or replacement facilities and equipment at the existing plant. A conventional, suspended growth, activated sludge process, similar to the original 1974 plant, is proposed for the new treatment facilities. The proposed enhancements would increase the total capacity of the plant to 6.0 mgd average design flow (21 mgd peak hourly flow). This would be achieved by constructing a new 2.0 mgd hydraulically independent treatment train. The majority of the new train would be constructed on the vacant land (consisting of shrubs, grasses, and sporadic trees) to the west of the existing treatment plant with the remainder of the new train constructed at the existing plant. The new train would discharge through both outfall No. 2 and the new outfall year-round. These new facilities would complement the existing plant which would treat an average flow of 4.0 mgd and discharge to the Ramapo River through outfall No. 1 year-round.

Specific improvements included in the proposed enhancements are as follows (see Figures 1-2):

- Construction of two new primary settling tanks,
- Construction of two new aeration tanks equipped with fine bubble diffusers,
- Construction of two new secondary clarifiers,
- Modification of the existing influent flow splitter box to accommodate two new adjustable weirs to accommodate the new treatment train described above,
- Installation of new aeration blowers and air piping to supply air to the new treatment system,
- Installation of three new effluent sand filters housed in a new process building,
- Replacement of the traveling bridges, including all pumps, rails, drives and controls on the existing effluent sand filters. Provisions will be made to measure influent flow to individual sand filters to improve flow balancing,

- Construction of a new chlorine contact tank adjacent to the new process building,
- Replacement of the existing chlorine gas disinfection and dechlorination feed systems with new liquid sodium hypochlorite and liquid sodium bisulfite feed systems,
- Construction of a new sludge thickener,
- Replacement of the existing Harriman Pumping Station,
- Miscellaneous piping modifications and relocations to accommodate the construction of new facilities described above,
- Extension of the dewatered sludge loading garage to accommodate one 30-cubic yard sludge roll off container with odor control,
- Modifications to existing outfalls No. 1 and No. 2 to accommodate the additional plant flow, including the construction of a new effluent junction box adjacent to the existing outlet chamber,
- Construction of a new outfall parallel and adjacent to outfall No. 2. This outfall would consist of a new 24-inch pipe connecting to the existing pipe for outfall No. 3 where the pipe for outfall No. 3 turns toward the northeast direction and crosses Arden House Road. The new pipe will be approximately 4,700 feet long and will terminate at or next to outfall No. 2. See Figure 1-1.
- Installation of carbon canister odor control systems to treat off gases. System 1 will treat the influent building and channel, sludge decant tank, and existing primary settling tank effluent channels. System 2 will treat the new and existing sludge thickeners, belt filter press room, grit classifier room and sludge transfer room. System 3 will treat the new primary settling tanks and sludge storage area.
- Construction of supplemental power distribution facilities as required to accommodate the above improvements,
- Addition of a new standby engine generator,
- Provision of a 6-bay storage area for sludge rolloff containers (in process building).

1.4.3 Related Programs

Since 1994, the OCSD No. 1 has been implementing an Infiltration/Inflow (I/I) program in its sewer service area. As of June 1999, all interceptor manholes in the service area and all collection manholes in the southwestern Monroe portion of the

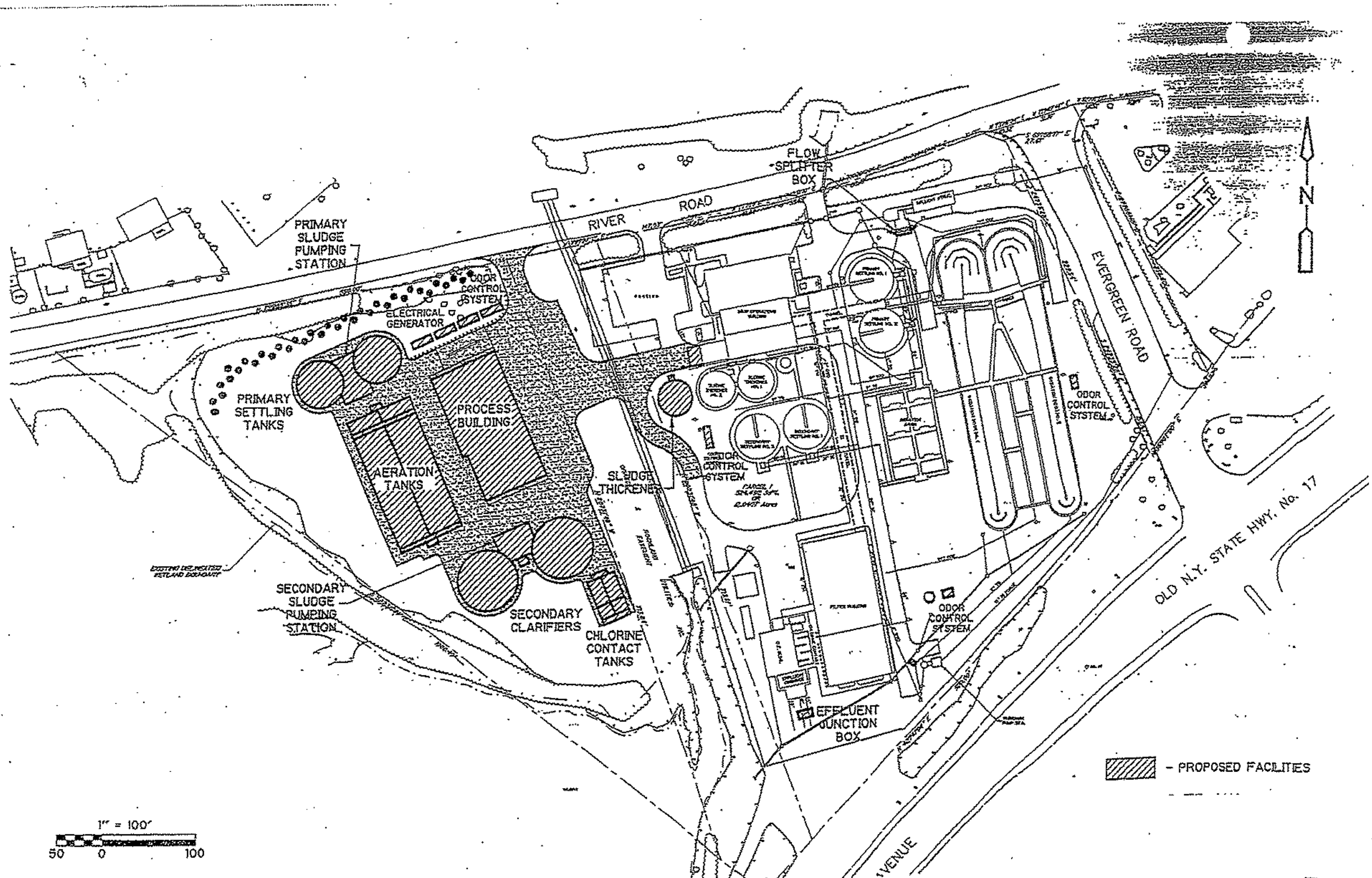

Figure 1-2
Site Plan
Harriman WWTP Enhancements
Orange County Department Of Environmental Services & Facilities

CDM Camp Dresser & McK

SEWAGE TREATMENT AGREEMENT
AMONG
CROMWELL ROAD ASSOCIATES, INC., TOWN OF BLOOMING GROVE
AND COUNTY OF ORANGE

THIS AGREEMENT, dated this 28th day of June, 2001, by and among Cromwell Road Associates, Inc., a duly established New York corporation with principal offices at 620 Coney Island Avenue, P. O. Box 180-451, Brooklyn, NY 11218 ("Cromwell"), the Town of Blooming Grove, a New York municipal corporation with offices at Town Hall, 6 Horton Road, Blooming Grove, New York ("Town"), and the County of Orange, a New York municipal corporation with offices at Orange County Government Center, 255-275 Main Street, Goshen, New York ("County")

WITNESSETH:

WHEREAS, Cromwell owns real property off Quaker Hill Road in the Town of Blooming Grove and Town of Monroe designated as Town of Blooming Grove Tax Map No. 55-1-13.2 and Town of Monroe Tax Map No. 7-1-1 (the "property"), which property is improved with sixty (60) dwelling units; and

WHEREAS, Cromwell's sewer system, including its sewage treatment facilities, has failed and the state supreme court has ordered Cromwell to install a new sewer system and has prohibited Cromwell from occupancy of the property until such system has been installed and approved; and

WHEREAS, Cromwell has requested the County and Town to authorize and provide sewage treatment at the County's Harriman sewage treatment plant, and the County and Town have agreed subject to the terms and conditions herein; and

WHEREAS, the Town has determined that this agreement and Cromwell's installation of a new sewer system as provided herein will not have the significant adverse effect on the environment.

NOW, THEREFORE, based on the mutual promises, obligations, considerations, terms and conditions herein, the parties agree as follows:

1. The County shall lease 30,000 gallons per day (gpd) sewage treatment capacity to Cromwell at the annual rate of $1.65 per gallon per day. A partial year lease shall be charged on pro rata basis. The County's lease of the sewage treatment capacity to Cromwell shall terminate when the County's own leased capacity (from the Village of Kiryas Joel) is diminished to 30,000 gpd or when the County's planned expansion of the Harriman sewage treatment plant is operational, whichever is earlier. Cromwell and the County agree that until installation of the on-site sewer lines is completed and approved as provided in paragraph 8 below, Cromwell shall pay to the County at the annual rate of $1.65 per gallon per day for each additional gallon per day of flow in excess of 30,000 gpd as measured by the flow meter which shall be installed as required in paragraph 5 below.

2. When the capacity leased by the County from the Village of Kiryas Joel has been diminished to 30,000 gpd (i.e., 75 units of 400 gpd) as measured by actual connections, then the County may elect to terminate its lease with Cromwell at that time or at any time thereafter by providing 15 days written notice to Cromwell and the Town. Upon termination of the County's lease, the Town shall lease 26,000 gpd sewage treatment capacity to Cromwell until such time as the County's Harriman treatment plant expansion is operational and treatment capacity from that expansion is made available to the Town. The Town shall lease said 26,000 gallons per day (gpd) sewage treatment capacity to Cromwell at the annual rate of $1.65 per gallon per day. A partial year lease shall be charged on a pro rata basis.

3. The Town agrees that it will purchase from the County no less than 26,000 gpd sewage treatment capacity, which capacity shall be provided to the Town upon completion of the 2.0 mgd enhancement to the Harriman sewage treatment plant. The Town and County agree that the details of this transaction will be memorialized in a separate purchase and sale agreement. A

courtesy copy of a draft of this agreement will be provided to Cromwell, but failure to provide said courtesy copy shall have no effect. This provision shall not be construed to preclude the Town from acquiring more than 26,000 gpd capacity from the County's Harriman treatment plant enhancement. At such time as the 2.0 mgd enhancement to the Harriman sewage treatment plant is completed, operating and on-line and said treatment capacity is made available to the Town, the Town's capacity allocation under existing inter-municipal agreements will be modified to reflect its purchase of the additional 26,000 gpd capacity. When such capacity in the County's expanded Harriman treatment plant is made available to the Town, the Town shall provide that capacity to Cromwell. In consideration of the Town's provision to Cromwell of sewage treatment capacity in the Harriman treatment plant expansion, Cromwell shall pay to the Town (i) a sewer use fee equal to 150% of the fee paid by the Town to the County for such sewage treatment capacity; and (ii) the full amount of all capital and other charges paid by the Town to the County related to such sewage treatment capacity. Any lease of capacity to Cromwell, whether by the County or Town, shall terminate at that time.

4. All payments by Cromwell to the Town and County, whether for leased capacity or for capacity provided by the Harriman treatment plant expansion, shall be due within thirty (30) days of the mailing or other delivery of a bill to Cromwell. A late payment charge of 1 ½% per month shall be assessed. Cromwell agrees that any and all unpaid amounts shall be deemed a charge against and levied as a lien against the Blooming Grove property and shall be assessed as a real property tax against the Blooming Grove property and collected in the same manner as real property taxes.

5A. Cromwell shall be responsible for all design and construction and all costs of the sewer facilities necessary to connect to the Harriman treatment plant. The design and construction of all facilities, including on-site facilities, shall be subject to approval and inspection by the Town and/or County and any other agency with jurisdiction. Cromwell shall pay all of the Town's and County's review and inspection costs and expenses. In addition, Cromwell shall pay all of the Town's attorney's and engineering fees incurred in connection with this agreement. All such costs, expenses and fees must be paid by Cromwell upon execution of this agreement or, for charges incurred after execution of this agreement, within 30 days of mailing or other delivery of a bill to Cromwell. In addition, all such costs, expenses and fees shall be deemed a charge against the Blooming Grove property and may be levied as a lien against the Blooming Grove property and assessed and collected in the same manner as real property taxes.

5B. With respect to that portion of the gravity sewer main to be installed within the boundaries of Orange County Sewer District No. 1 ("OCSD No. 1"), Cromwell shall apply to the County for all required permits and pay all required inspection, permit and any other applicable administrative fees and shall comply with all of the requirements of OCSD No. 1, including the Orange County Sewer Law. Cromwell shall install at its expense a flow meter at the pump station as per the "Technical Specifications for Quaker Hill Cottages Force Main and Pump Station," prepared and submitted to the County by Lanc and Tully Engineering and Surveying. The County and Town shall have access to the pump station at reasonable times and upon reasonable notice for purposes of inspection and verification.

6A. That portion of the gravity sewer main (approximately 1,400 feet) to be installed within the boundaries of OCSD No. 1 shall be offered for dedication to the County by Cromwell. The County shall be granted a deeded right-of-way for access to that portion of the gravity sewer main located within OCSD No. 1. and the County shall be responsible to operate, repair and maintain that portion of the gravity sewer main located within the boundaries of OCSD No. 1. That portion of the sewer mains to be installed within municipal rights-of-way outside of the boundaries of OCSD No. 1 shall be offered for dedication to the Town by Cromwell. The Town shall be granted such rights as necessary to enter upon and open the municipal rights-of-way for the purpose of operation, repair, maintenance and replacement of such sewer mains. All costs and expenses incurred by the Town in connection with the operation, repair, maintenance or replacement of such sewer mains shall be paid by Cromwell and the Town may collect and enforce said payment in the same manner as provided in paragraph 4 above.

6B. Cromwell shall be responsible to promptly and properly restore the Town's highway and right-of-way and any other property not owned by Cromwell which is disturbed by installation of the sewer facilities. Cromwell shall post a bond, in a form and amount satisfactory to the Town, to secure such restoration, which bond shall be posted with the Town prior to commencement of any work. Cromwell shall comply with all applicable laws, regulations and rules of all municipalities with jurisdiction.

7. Cromwell agrees to and shall defend, indemnify and hold harmless the Town and County from any and all injuries, damages, claims and costs which may arise from or as a result of this agreement; from Cromwell's construction; or from any act or omission related to Cromwell's use of the on-site sewer facilities. Cromwell shall maintain liability insurance in the minimum amount of $1,000,000/$2,000,000, naming the Town and County as additional insureds, and shall provide to the Town and County a certificate of insurance and insurance endorsement so providing.

8. The parties agree that on-site sewer lines may be installed by Cromwell after occupancy of the property this Summer. Construction of the on-site sewer lines shall commence no later than September 10, 2001, weather permitting, and shall be completed no later than April 30, 2002. Cromwell agrees that occupancy of the property is prohibited and that there shall be no

occupancy of the property after October 15, 2001, unless the on-site sewer lines and all other sewer facilities are properly installed and approved by the Town.

9. Prior to commencement of construction in the Town's right-of-way, Cromwell shall provide to the Town a certified survey of its property showing property boundary lines and topographic contours and location of all structures, fire lanes, parking areas, utilities and all other structures typically shown on a property survey.

10. Cromwell agrees that all structures or portions thereof on the Blooming Grove property must obtain a certificate of occupancy from the Town Building Department prior to any use or occupancy of the property. The Town agrees to cooperate with Cromwell in the issuance of such certificates of occupancy.

11. Cromwell agrees that no person shall use or occupy the property until all sewer facilities, except the on-site sewer lines, are completed, approved, inspected, connected to the public sewer, and operational and all certificates of occupancy have been issued.

12. Cromwell agrees that the property is a nonconforming use and shall not be used for a greater duration or to a greater extent than in the past.

13. Cromwell agrees that no dwelling unit(s) shall be constructed on the property except with the approval of the Town Board, the Town's Zoning Board of Appeals and the Town's Planning Board. Cromwell agrees that no addition to any existing dwelling unit shall be constructed except with approval of the Town's Zoning Board of Appeals and any other agency with jurisdiction and after issuance of a building permit; and that no addition shall be occupied except after issuance of a certificate of occupancy. Cromwell agrees that no structure shall be constructed, installed or located on the property except after issuance of a building permit and that no structure shall be used or occupied except after issuance of a certificate of occupancy.

14. Cromwell shall clean and properly abandon its current leach fields area, sewer lines and related property and facilities no later than July 30, 2001, completion of which shall be approved by the Town and County and any other agency with jurisdiction. Cromwell agrees that occupancy of the property is prohibited and that there shall be no occupancy of the property after October 15, 2001, unless all such work is properly completed and approved.

15. If the Town and/or County seeks to enforce any provision of this agreement or any payment required hereunder against Cromwell or against any person using or occupying the property and if the Town and/or County prevails in such enforcement, whether by judgment, order or settlement, then Cromwell shall pay to the Town and/or County, as applicable, all of the enforcement fees, costs and expenses so incurred, including but not limited to reasonable attorney's and engineering fees.

16. The requirements and obligations set forth herein shall take effect upon execution of this agreement, notwithstanding that the Town's obligation to provide sewage treatment capacity does not commence until the County's lease of sewage treatment capacity to Cromwell terminates as provided in this agreement.

17. All notices and bills required or provided in connection with this agreement shall be sent to the respective party at the respective address set forth above. A courtesy copy of notices to Cromwell will be provided to Mr. Stanley Rieder, 1426 57th Street, Brooklyn, New York 11219 and David Donovan, Esq., Dickover, Donnelly, Donovan & Biagi, LLP, 28 Bruen Place, P. O. Box 610, Goshen, New York 10924; to the County, to David Darwin, Esq., Orange County Law Department, Orange County Government Center, 255-275 Main Street, Goshen, New York 10924; and to the Town, to Jacobowitz and Gubits, LLP, 158 Orange Avenue, P. O. Box 367, Walden, New York 12586, but failure to provide any courtesy notice shall have no effect.

18. Each signatory hereto represents and warrants that he is fully authorized by the party whom he represents to execute this agreement on behalf of that party and to bind that party. This

agreement shall be binding upon and inure to the benefit of the parties hereto and their respective successors.

19. All parties to this agreement and their counsel have reviewed and revised this agreement and any rule of construction to the effect that ambiguities are to be resolved against the drafting party shall not be employed in the interpretation or enforcement of this agreement.

20. This agreement constitutes the complete and final expression of the terms of the agreement. No amendment to this agreement shall be effective unless it is in writing and signed by the duly authorized representatives of all parties affected by any such amendment.

CROMWELL ROAD ASSOCIATES, INC.

BY: Harry Ired Vice President

TOWN OF BLOOMING GROVE

BY: Katherine E. Bonelli
Katherine E. Bonelli, Supervisor

COUNTY OF ORANGE

BY: ______________________
Joseph G. Rampe, County Executive

STATE OF NEW YORK)
NEW YORK)ss.:
COUNTY OF ~~ORANGE~~)

On the 15th day of June, 2001, before me, the undersigned, a Notary Public in and for said State, personally appeared Harry Fried, personally known to me or provided to me on the basis of satisfactory evidence to be the individual whose name is subscribed to the within instrument and acknowledged to me that he/she executed the same in his/her capacity, and that by his/her signature on the instrument, the individual, or the person upon behalf of which the individual acted, executed the instrument.

Diane J. Pugacz
NOTARY PUBLIC - STATE OF NEW YORK

DIANE J. PUGACZ
Notary Public, State of New York
No. 01PU4770943
Qualified in Queens County
Commission Expires Aug 31, 2002

STATE OF NEW YORK)
)ss.:
COUNTY OF ORANGE)

On the 28th day of June, 2001, before me, the undersigned, a Notary Public in and for said State, personally appeared KATHERINE E. BONELLI, personally known to me or provided to me on the basis of satisfactory evidence to be the individual whose name is subscribed to the within instrument and acknowledged to me that she executed the same in her capacity, and that by her signature on the instrument, the individual, or the person upon behalf of which the individual acted, executed the instrument.

Barbara E. Decker
NOTARY PUBLIC - STATE OF NEW YORK

BARBARA E. DECKER
Notary Public, State of New York
No. 4635474
Qualified in Orange County
Commission Expires 1-31-2003

STATE OF NEW YORK)
)ss.:
COUNTY OF ORANGE)

On the 20th day of June, 2001, before me, the undersigned, a Notary Public in and for said State, personally appeared JOSEPH G. RAMPE, personally known to me or provided to me on the basis of satisfactory evidence to be the individual whose name is subscribed to the within instrument and acknowledged to me that he executed the same in his capacity, and that by his signature on the instrument, the individual, or the person upon behalf of which the individual acted, executed the instrument.

Mary J. Henrici
NOTARY PUBLIC - STATE OF NEW YORK

MARY J. HENRICI
Notary Public, State of New York
Qualified in Orange County
My Commission Expires Dec. 31, 2001

This AGREEMENT is made this 14th day of March, 2001 between Orange County Sewer District No. 1 and the County of Orange (collectively referred to as "the County") and the Town of Woodbury (hereinafter, "Woodbury")

WHEREAS, the County has leased sewage treatment capacity from the Village of Kiryas Joel for a term of four years, commencing November 1, 2000, and

WHEREAS the County operates the Harriman Wastewater Treatment Plant and is proceeding with an enhancement to that plant that will expand the treatment capacity to 6.0 million gallons per day; and

WHEREAS, it is anticipated that the enhancement will be completed within the next two to three years; and

WHEREAS, Woodbury is desirous of leasing from the County a portion of the sewage capacity acquired by the County from the Village of Kiryas Joel in order to satisfy an immediate need to serve properties located within the Town of Woodbury.

Now, therefore, the County and Woodbury agree as follows:

1. The County will lease to Woodbury 30,000 gallons per day (gpd) of capacity. The term of the lease shall be from the date this Agreement is executed by all parties through and including October 31, 2004. In the event that the lease agreement between the County and Village of Kiryas Joel is terminated prior to October 31, 2004 and the enhancement is completed, operational and on line, then this agreement shall terminate on the date that the County' agreement with the Village terminates.

2. Woodbury agrees to pay the County $1.65 per gallon per day annually ("Sewer Rent"), or $49,500.00 per annum for the 30,000 gpd, whether or not any or all of the 30,000 gpd is in use. This annual payment shall be made in two equal installments per year, and shall be billed by OCSD No. 1 concurrently with its semi- annual billing now in effect for Woodbury's use of the Harriman Wastewater Treatment Plant.

3. Woodbury agrees that it will purchase from the County not less than 30,000 GPD of capacity, which will be provided to Woodbury upon completion of the 2.0 mgd. enhancement to the Harriman Wastewater Treatment Plant. The purchase price will be a proportionate share of the total cost of the enhancement, or 30,000/2,000,000 gallons or 1.5% of the total cost of the enhancement. The parties agree that the details of this transaction will be memorialized in a separate purchase and sale agreement. The parties to this Agreement agree that it may become necessary for Woodbury pay to the County the cost of its proportionate share of the enhancement during the term of this Agreement. Woodbury agrees that it will take all necessary steps to comply with such payment obligations. Any resolution adopting this Agreement shall specifically commit Woodbury to its participation in the Harriman WWTP enhancement to the extent indicated herein.

4. The capacity leased to Woodbury by this Agreement is in addition to the 635,000 gpd capacity allocated to Woodbury in the aforementioned intermunicipal agreements, and shall not be encumbered by any capacity used by Woodbury in excess of its allocation under the intermuncipal agreements. However, upon the termination of this Agreement, the 30,000 gpd purchased by Woodbury from the County will be merged with its existing allocation under the intermuncipal agreements, and to the extent that the Woodbury's sewer flows to the Harriman plant exceed the combined capacity of 665,000 gpd, no connections will be permitted as per the requirements of the 1988 intermunicipal agreement.

5. The capacity leased to Woodbury by this Agreement shall be allocated on the basis of 400 gallons per day per living unit, which shall be calculated in accordance with the formula established in the Schedule of Gallons Per Day in the September 8, 1988 intermunicipal agreement and the applicable provisions of the Orange County Sewer Law. Woodbury shall continue to submit to the County all requests for permits as provided in section 3 of the 1988 intermuncipal agreement. In addition, all such requests shall indicate the number of units of capacity requested, the use to be made of the property for which each request is made, and the basis for the number of units requested. Woodbury or the applicant shall furnish to the County upon its request documentation to verify the proper allocation of units of capacity requested. When the entire 30,000 gpd of capacity has been allocated in accordance with the formula set forth herein, no further applications for connections will be approved by Woodbury, and the County will have no obligations with respect to any requests for connections. Woodbury agrees to defend, indemnify and hold harmless the County from any claims asserted against it arising from any failure or refusal by the County or Woodbury to provide capacity after the 30,000 gpd allocation has been exhausted.

6. The parties acknowledge that the County has an option in its lease agreement with the Village of Kiryas Joel to renew its lease for two successive one-year periods upon such fair and reasonable terms and conditions, including the amount to be paid to the Village by the County, and the allocation of plant capacity between the Village and County, as shall be negotiated by the parties at the time the option is exercised by the County. In the event that the option is exercised by the County, this Agreement shall be renewed for same period or periods, and shall continue for so long as the County's lease agreement with the Village remains in effect, except that the Sewer Rent stated in paragraph 2 of this Agreement shall be equal to the sewer rent paid by the County to the Village.

7. The County acknowledges that Woodbury may expand its Sewer District to accommodate a limited number of homes with failing septic systems and consents to a modest expansion of the Woodbury Sewer District for such limited purpose.

8. Except as provided herein, all of the terms of the intermunicipal agreements referred to herein shall continue to apply and remain in full force and effect.

9. This Agreement shall be subject to such municipal approvals as may be required by the terms of the aforesaid intermuncipal agreements.

Town of Woodbury

By: ______________________

County of Orange

By: ______________________

Orange County Sewer District No. 1

By: ______________________

4

SUPERVISOR: 845-783-1900 EXT. 227
SANDY LEONARD

COUNCILPERSONS:
DONALD F. WEEKS
JAMES H. ROGERS, SR.
PETER J. MARTIN
LORI CURRIER WOODS

TOWN JUSTICES: 845-782-8404
JACK ROSENTHAL
MORTON MARSHAK

ATTORNEY:
KEVIN DOWD

TOWN OF MONROE
THE LAKE REGION

11 STAGE ROAD
MONROE, NEW YORK
10950

www.monroeny.org
PHONE MONROE 845-783-1900
FAX 845-782-5597

TOWN CLERK: 845-783-1900 EXT. 221
JUDITH L. DISE

HIGHWAY SUPERINTENDENT: 845-782-8583
ROY MONTANYE

BUILDING INSPECTOR: 845-783-1900 EXT. 226
WILLIAM P. MUENTE

ASSESSOR: 845-783-1900 EXT. 224
DOROTHY S. POST

ENGINEER:
RONALD ROTHENBERG

July 22, 2002

Orange County Legal Department
Main Street
Goshen, N.Y. 10924
Att: David Darwin
By Fax 291-3167

The following Resolution was adopted April 1, 2002

Upon motion of Councilman Rogers seconded by Councilman Weeks it was unanimously agreed that the Town of Monroe would participate in the enhancement of the Harriman Wastewaster Treatment Plant. It is the understanding of the Town Board that the capacity allocation for each participating municipality will be equal to the percentage of the approximnately 4.0 mgd allocated to it under the intermunicipal agreement and that a proportionate share of the total cost of the project will be charged to each municipality, based on the percentage of the additional capacity it acquires. A copy of this Resolution will be sent to the County.

Very truly yours,

Judith L. Dise

Judith L. Dise
Town Clerk

I hereby certify that this is a true copy of a resolution adopted by the Town Board of the Town of Monroe at a meeting of said Board held on the 1st day of April, 2002

Judith L. Dise
JUDITH L. DISE
Town Clerk

5

The basis of the charge for the sewer rents to be paid by the users shall be determined from the following schedule of units of use.

Classification of Property	Units of Use
One family dwelling - 1 kitchen	1 unit
One family dwelling - 2 kitchens	2 units
Each separate apartment in a two family, three family or multiple dwelling	1 unit
Garbage disposal units - each disposal unit	1 unit
Launderettes in apartment houses: for each two washing machines	1 unit
Mobile home.	1 unit
Combination one family home with a professional or business office other than dentist	2 units
Combination one family home with a professional or business office dentist	3 units
Rooming houses - each four rooms or part	1 unit
Hotel or motels (no meals) - each four rooms or part	1 unit
Hotels - American plan with meals - each 2 rooms	1 unit
Offices - with five occupants or less	1 unit
Stores - with five occupants or less	1 unit
Commercial establishments - with five occupants or less (occupants are defined as owners, managers or employees)	1 unit
for each additional five occupants or part	1 unit

Industrial plant - [illegible]ll be any enterprise which produces industrial wastes as defined by Section 2.1. For each 400 gallons per day of flow plus additional units based on quantity and quality to be determined and assigned	1 unit
Launderettes: for each two washing machines	1 unit
Laundries: based on capacity and units to be assigned	
Car laundries: based on capacity and units assigned	
Bar and grill	3 units
Luncheonette (Open less than fourteen hours a day)	3 units
Luncheonette (Open more than fourteen hours a day)	6 units
Restaurant - small - twenty seats or less	3 units
Restaurant - medium - twenty-one to seventy-five seats	4 units
Restaurant - large - over seventy-five seats	5 units
Restaurant - each 20 seats or part above 100 seats	1 unit
Restaurant with bar - add three units	
Schools: public-private-parochial Elementary - for each sixty pupils	1 unit
Junior high school - for each fifty-four pupils	1 unit
Senior high school - for each forty-two pupils	1 unit

Colleges:	
For each fifty-four students	1 unit
For each seventy-five evening students	1 unit
For each eight resident students (where dormitories are available)	1 unit
Churches - Synagogues - Temples: (including Sunday School)	
Small congregation - under one hundred families	1 unit
Medium congregation - one hundred to two hundred fifty families	2 units
Large congregation - over two hundred fifty families	3 units
For part time week day schools add one unit	
Drive-In theaters - for each forty car spaces or part	1 unit
Theaters - for each sixty seats or parts	1 unit
Bowling Alleys - for each two lanes	1 unit
Hospitals - for each four beds	3 units
Convalescent homes (Group homes or hostels for each 2 beds	1 unit
Service stations - without car wash	1 unit
Service stations - with car wash	2 units
Beauty Salons and Barber Shops - Mimimum	2 units
Three to five customer service stations	3 units
Six or more service stations	4 units
(Count each shampoo facility as a customer service station)	
Fire houses	1 unit

Section 11.4. [illegible]

There is hereby e[illegible]ablished and imposed [illegible] a[illegible]ual sewer rent on all users to be determined by multiplying the unit charge times the number of units assigned to each user based upon the schedule of units of use in section 11.3 of this Article. The unit charge shall be established annually by the Orange County Legislature at the time of the adoption of the county budget, except that in the calendar year 1977 the unit charge shall be established on or before December 31, 1977.

Section 11.5. Statements.

The Commissioner of Finance of the County of Orange shall cause statements to be prepared setting forth the amount of sewer rents for each user subject thereto and shall mail the same to such user on or before the dates set forth in Section 11.6 of this law. The failure of any user to receive a statement promptly shall not excuse non-payment thereof and in the event a user fails to receive a statement promptly, he shall, upon request made to the Commissioner of Finance of the County of Orange, be furnished with such statement or a duplicate thereof.

6

SCHEDULE OF NET INDEBTEDNESS JUNE 16, 2002

VS CONSTITUTIONAL DEBT LIMIT

COMPUTATION OF DEBT LIMIT				
	Full Valuation			
Fiscal Year Ending				
1997	15,082,369,345			
1998	14,855,813,070			
1999	15,109,765,384			
2000	16,142,878,467			
2001	17,509,873,307			
TOTAL	$ 78,700,699,573			
Five Year Average	$ 15,740,139,915			
Debt Limit (7% of 5 yr. avg.)		$	1,101,809,794	100%
NET INDEBTEDNESS				
Inclusions:				
Serial Bonds	$ 193,890,000			17.60%
Bond Anticipation Notes	0			0.00%
Capital Notes	0			0.00%
Total Inclusions		$	193,890,000	17.60%
Exclusions:				
Excludable Sewer Debt:				
Serial Bonds	$ 525,000			0.05%
Refunded Bonds	2,270,000			0.21%
Bond Anticipation Notes				
Appropriations:				
Serial Bonds	7,397,749			0.67%
Bond Anticipation Notes	0			0.00%
Capital Notes				
Total Exclusions		$	10,192,749	0.93%
Net Indebtedness @12/31/01		$	183,697,251	16.67%
Net Debt - Contracting Margin				
Debt Limit	$ 1,101,809,794			
less: Net Indebtedness	183,697,251			
Net Debt - Contracting Margin		$	918,112,543	83.33%
Percentage of Debt Contracting Power Used	16.67%			

04/11/2002

7

2002
Orange County Government
Legislative Budget

230 Fund: Debt Service

		2000 Yr. End Actual	2001 Original Budget	2002 Dept. Request	2002 Exec. Total	2002 Legis. Adj.	2002 Legis. Total	$ Increase/ (Decrease)	% Increase/ (Decrease)
Contractual Expenditures		50,068.08	110,905	108,900	108,900	0	108,900	-2,005	-1.8[illegible]
9008	70 Land Acq. - Prin.	0.00	0	0	0	0	0	0	0.00%
9009	72 OCCC 1St Ser. Prin.	50,000.00	50,000	0	0	0	0	-50,000	100.00%
9010	72 OCCC 2nd Ser. Prin.	150,000.00	150,000	0	0	0	0	-150,000	100.00%
9012	74 OCCC 3rd Ser Prin.	125,000.00	125,000	0	0	0	0	-125,000	100.00%
9014	77 PI - Prin.	175,000.00	175,000	175,000	175,000	0	175,000	0	0.00%
9017	86 PI - Prin.	150,000.00	150,000	0	0	0	0	-150,000	100.00%
9019	92 PI - Prin.	485,000.00	380,000	285,000	285,000	0	285,000	-95,000	25.00%
9020	93 PI - Refd -Prin.	195,763.00	195,517	189,643	189,643	0	189,643	-5,874	3.00%
9022	95 PI-Prin.	95,000.00	95,000	95,000	95,000	0	95,000	0	0.00[illegible]
9023	96 PI-Prin.	315,000.00	315,000	140,000	140,000	0	140,000	-175,000	55.[illegible]%
9024	97 PI-Prin.	2,365,000.00	1,220,000	1,200,000	1,200,000	0	1,200,000	-20,000	[illegible]
9025	97 PI-REFD - Prin.	1,716,176.64	2,074,384	2,163,488	2,163,488	0	2,163,488	89,104	4.30%
9026	98 PI-Prin.	1,210,030.00	1,273,716	1,341,950	1,341,950	0	1,341,950	68,234	5.36%
9027	99 PI-Prin.	0.00	737,448	777,311	777,311	0	777,311	39,863	5.41%
9028	2000 PI-Prin.	0.00	1,110,000	1,100,000	1,100,000	0	1,100,000	-10,000	0.90%
9351	95 Spring St. Loan - Prin	215,000.00	215,000	220,000	220,000	0	220,000	5,000	2.33%
9353	96A Winter St. Loan - Pr	80,000.00	85,000	85,000	85,000	0	85,000	0	0.00%
9354	96B Winter St. Loan - Pr	60,000.00	65,000	65,000	65,000	0	65,000	0	0.00%
9355	97 Spring St. Loan - Prin	10,000.00	10,000	10,000	10,000	0	10,000	0	0.00%

230 Fund: Debt Service

		2000 Yr. End Actual	2001 Original Budget	2002 Dept. Request	2002 Exec. Total	2002 Legis. Adj.	2002 Legis. Total	$ Increase/ (Decrease)	% Increase/ (Decrease)
9553	96A Winter St. Loan - Pr	0.00	0	0	0	0	0	0	0.00%
Principal on Debt		7,396,969.64	8,426,065	7,847,392	7,847,392	0	7,847,392	-578,673	-6.87
9508	70 LAN Acq. Int.	0.00	0	0	0	0	0	0	0.[illegible]
9509	72 OCCC 1st Ser. Int.	4,900.00	2,450	0	0	0	0	-2,450	100.00%
9510	72 OCCC 2nd Ser. Int.	14,700.00	7,350	0	0	0	0	-7,350	100.00%
9512	74 OCCC 3rd Ser. Int.	9,843.75	3,282	0	0	0	0	-3,282	100.00%
9514	77 PI - Int.	51,012.50	41,738	32,463	32,463	0	32,463	-9,275	22.22%
9517	86 PI - Int.	14,062.50	4,688	0	0	0	0	-4,688	100.00%
9519	92 PI - Int.	215,875.00	189,200	168,300	168,300	0	168,300	-20,900	11.05%
9520	93 PI - Redf. - Int.	59,058.33	50,206	41,253	41,253	0	41,253	-8,953	17.83%
9522	95 PI - Int.	86,600.00	81,755	76,910	76,910	0	76,910	-4,845	5.93%
9523	96 PI - Int.	121,061.26	104,997	88,932	88,932	0	88,932	-16,065	15.3[illegible]
9524	97 PI - Int.	2,622,778.80	2,516,354	2,455,354	2,455,354	0	2,455,354	-61,000	2.42%
9525	97 PI Refd. - Int.	1,308,915.08	1,231,688	1,127,968	1,127,968	0	1,127,968	-103,720	8[illegible]
9526	98 PI - Int.	2,293,211.44	2,237,248	2,178,339	2,178,339	0	2,178,339	-58,909	2.63%
9527	99 PI - Int.	1,327,928.31	1,381,660	1,344,050	1,344,050	0	1,344,050	-37,610	2.72%
9528	2000 PI - Int.	0.00	397,677	343,563	343,563	0	343,563	-54,114	13.61%
9529	2001 PI - Int.	0.00	0	318,302	318,302	0	318,302	318,302	0.00%
9851	95 Spring St. Loan - Int.	85,668.47	103,257	99,151	99,151	0	99,151	-4,106	3.98%
9853	96A Winter St. Loan - In	-32,068.37	33,840	32,402	32,402	0	32,402	-1,438	4.25%

2002
Orange County Government
Legislative Budget

230 Fund: Debt Service

		2000 Yr. End Actual	2001 Original Budget	2002 Dept. Request	2002 Exec. Total	2002 Legis. Adj.	2002 Legis. Total	$ Increase/ (Decrease)	% Increase/ (Decrease)
9854	96B Winter St. Loan - In	17,806.92	32,403	31,271	31,271	0	31,271	-1,132	[illegible]9%
9855	97 Spring St. Loan - Int.	5,359.80	5,193	5,012	5,012	0	5,012	-181	-3.49%
Interest on Debt		8,206,713.79	8,424,986	8,343,270	8,343,270	0	8,343,270	-81,716	-0.97%
EXPENSE TOTALS -		15,653,751.51	16,961,956	16,299,562	16,299,562	0	16,299,562	-662,394	-3.91%

8

SWIS CODE	TOWN/VILLAGE	ASSESSED VALUE	TAX RATE
334001	VILLAGE OF MONROE		
	COUNTY	166,427,700	11.257500
	TOWN	166,427,700	5.519800
	VILLAGE	166,427,700	18.050000
	SCHOOL	166,427,700	71.357100
	SWO60	166,427,700	0.864900
334089	TOWN OF MONROE		
	COUNTY	117,631,300	11.257500
	TOWN	117,631,300	8.042700
	SCHOOL	117,631,300	71.357100
	SWO60	117,631,300	0.864900
334005	VILLAGE OF KIRYAS JOEL		
	COUNTY	98,947,800	11.257500
	TOWN	98,947,800	5.519800
	VILLAGE	98,947,800	14.137400
	SCHOOL	98,947,800	40.430000
	SWO60	98,947,800	0.864900
334003	VILLAGE OF HARRIMAN - MONROE		
	COUNTY	25,941,665	11.257500
	TOWN	25,941,665	5.519800
	VILLAGE	25,941,665	21.645400
	SCHOOL	25,941,665	71.357100
	SWO60	25,941,665	0.864900
335801	VILLAGE OF HARRIMAN - WOODBURY		
	COUNTY	32,746,521	5.753400
	TOWN	32,746,521	3.311000
	VILLAGE	32,746,521	11.081600
	SCHOOL	32,746,521	36.494900
	SWO60	32,746,521	0.442400
335889	TOWN OF WOODBURY		
	COUNTY	1,654,100	5.753400
	TOWN	1,654,100	10.412900
	SCHOOL	1,654,100	36.494900
	SWO60	1,654,100	0.442400

	SPD-MUNI-CODE	CODE	TOTAL ASSMNT	TALLY
Village of Monroe	334001	RG012	110,803,700	2149
	334001	SW060	166,427,700	2713
	334001	SW061	163,217,500	2653
	334001		440,448,900	7515
Village of Harriman in Monroe	334003	RG012	11,686,900	269
	334003	SW060	25,919,368	673
	334003	SW061	25,058,368	658
	334003		62,664,636	1600
Village of Kiryas Joel	334005	SW060	98,947,800	1781
	334005	SW061	98,366,100	1773
	334005		197,313,900	3554
Town of Monroe	334089	AQ001	5,181,400	145
	334089	AQ002	1,122,800	24
	334089	DD014	3,416,000	44
	334089	FD012	117,631,300	1885
	334089	LT017	100,554,800	1851
	334089	RD011	106,100	2
	334089	RD021	874,900	30
	334089	RG012	82,810,800	1614
	334089	SW060	117,631,300	1885
	334089	SW061	58,202,200	1015
	334089	WD031	853,800	18
	334089	WD045	854,200	19
	334089	WD050	3,746,400	73
	334089	WD054	7,983,700	170
	334089	WD055	6,659,100	138
	334089	WD059	1,247,100	17
	334089	WD060	1,247,100	17
	334089		510,125,000	8947
Village of ~~Wood~~ Harriman in Woodbury	335801	RG013	11,891,900	122
	335801	SW060	32,746,521	167
	335801	SW061	31,717,121	162
	335801		76,355,542	451
Town of Woodbury	335889	FD013	1,654,100	2
	335889	LT009	1,654,100	2
	335889	SW060	1,654,100	2
	335889		4,962,300	6
			1,291,870,278	22073

CODE	DISTRICT	RATE	Rate Basis
AQ001	Monroe Aquatic - 6	0.1852	per thousand
AQ002	Monroe Aquatic - 8	0.2316	per thousand
DD014	Carriage Hill Drainage Ditch	50.0046	per unit
FD012	Monroe Fire	2.7405	per thousand
FD013	Woodbury Fire	1.2729	per thousand
LT009	Woodbury Light	0.155	per thousand
LT017	Monroe Town Light	0.2248	per thousand
RD011	Crossman Ave. Extension	0	
RD021	Lower Hill Road	601.67	per unit
RG012	Monroe Refuse	1.0344	per unit
RG013	Woodbury Refuse	215.0744	per unit
SW060	Sewer District #1 - Bond	0.8649	per thousand
SW061	Sewer District #1 - Bond laterals	0.5247	per thousand
WD031	Oreco Terrace Water O & M	234.2113	per unit
WD045	Oreco Terrace Water	0	
WD050	Monroe Water 1 O & M	358.8229	per unit
WD054	Hofliss Water	10.4524	per unit
WD055	Hofliss Water O & M	345.1605	per unit
WD059	Post Road Water Bond	110.1237	per unit
WD060	Post Road Water O & M	194.9077	per unit

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OCSD#1 Pending Projects

Project Name	Number of Lots/Units
Courtney Young	2
Bald Hill Estates	112
Smith Farm	231
Henry Farm	112
Shea Meadow	50
Leva Subdivision	19
Eagle Ridge Subdivision	42
Mine Road Subdivision	21
Wolland School Road Subdivision	4
Coviello II Hilltop	2
PY Trading Subdivision	66
Cromwell Meadows Subdivision	11
Lobianco Subdivision	1
Hosri Subdivision	1
M&M Developers – 4 Lots Round Lake Park	4
Sorentino Hilltop Subdivision	7
Harriman Glen Site Plan	200
Dutch Hollow Estates	170
Ridge Top	32
Coviello 1 – 5 Lot Subdivision	5
Perales Subdivision	1
Pine Tree V	23
Hidden Creek	156
BMG Acquisitions	432
Concord Manor	72
Woodroe Estates	63
Village Gate	18
Gilbert Estates	21
Alexander Smith III	104
Mansion Ridge	80
Vaad Mnt Phase II	72
Forest Rd	18
Vaad Mnt Phase III	6
Gold Construction	15

OCSD#1 Pending Projects

Project Name	Number of Lots/Units
Issac Lowy; 63 Bakertown	6
7 Meron Drive	12
10 Gitzel Burger Blvd.	6
4 Siget Court	6
Seven Springs Condominiums	60
Meron Realty	36
32 Van Buren	2
Zenta & Schunnemunk	3
29 Van Buren Dr.	4
Vaad Mnt. IV	48
Vaad Mnt. V	24
23 Van buren Dr.	2
Hakiryah Affordable Housing	220
Mountain Rd. (North)	?
Grand Total	2,602 Units

Or

1,040,800 gallons

10

Exhibit Q

COUNTY OF ORANGE / Department of Law
GOVERNMENT CENTER, 255 Main Street
GOSHEN, NEW YORK 10924 TEL: (845) 291-3150

EDWARD A. DIANA
County Executive

CATHERINE M. BARTLETT
County Attorney

August 27, 2002

Orange County Legislature
255-275 Main Street
Goshen, New York 10924

Re: Application for Permission to the State Comptroller for the Increase and Improvement to the Harriman Wastewater Treatment Facility

Ladies and Gentlemen:

As you know, the Legislature at its August meeting approved the Application to the State Comptroller for permission to proceed with the proposed improvements to the Harriman Wastewater Treatment Plant. The applicable State regulations, (Part 85 of Chapter III of 2 NYCRR) require my opinion as to the matters set forth below. The State Comptroller may rely on such opinion as though it were addressed directly to him.

As Chief Assistant County Attorney, I have acted as legal counsel to the County and Orange County Sewer District No. 1 in connection with this application. In my capacity as legal counsel, I have examined the original or true and complete copies of the application and the exhibits and attachments attached and submitted therewith. I have reviewed original or true and complete copies of other documents and records necessary to render my opinion, including, but not limited to: the Constitution of the State of New York and relevant statutes, including Article 5-A of the New York State County Law, the State Environmental Quality Review Act ("SEQRA") and the regulations promulgated thereto; all resolutions of the Orange County Legislature pertaining to the Application; proof of publication of required notices; the Final Environmental Impact Statement and other documents required to be prepared and/or published and/or filed pursuant to SEQRA; maps and plans of the proposed project and the cost estimate and reports of the Orange County Sewer District No. 1 filed with the Orange County Legislature. Based on the foregoing, and the information provided to me by the Orange County Department of Environmental Facilities and Services, I advise you that in my opinion:

1. The Application contains all of the information required by applicable statutes and regulations.

2. The County, in relation to the increase and improvement to Orange County Sewer District No. 1 facilities for which the Comptroller's consent is sought, and the expenditure of funds therefore, has undertaken all actions and proceedings required by applicable provisions of law.

3. Said increase and improvement to the facilities of Orange County Sewer District No. 1 has been duly authorized by the County of Orange as required by statute except for: (i) obtaining the permission or consent of the Comptroller; (ii) the adoption of a resolution or resolutions for appropriations and funding after the Comptroller has granted such consent or permission; and (iii) any publication or notice required to be published after receipt of such consent or permission (e.g., publication of a bond resolution).

4. Neither other County Officials nor I are aware of any material pending or threatened lawsuits or claims relating to such increase and improvement for which the permission of the Comptroller is being sought.

5. Any assessments, charges or taxes to be levied and imposed to finance such expenditure of funds are authorized by statute and all necessary action has been taken by the County to authorize the imposition or levy of such assessments, charges or taxes. The foregoing is subject to the caveat that § 452 of the General Municipal Law requires a resolution after a public hearing on the establishment of sewer rents, and to the extent that such proceedings may be necessary, the are appropriately taken after the permission of the Comptroller is obtained.

Very truly yours,

DAVID L. DARWIN
Chief Assistant County Attorney

DLD:smw

cc - New York State Comptroller
Gail Sicina, Clerk of Legislature
Geoffrey Chanin, Counsel for Legislature
Michael Amo, Legislator
Melissa Bonacic, Legislator
Michael Pillmeier, Legislator
Harvey J. Burger, Legislator
Frank A. Fornario, Jr.
P:atrick J. Berardinelli, Sr., Legislator
Spencer M. McLaughlin, Legislator
Dimitrios Lambros, Legislator
L. Stephen Brescia, Legislator
Bernard Winstanley, Legislator
M. William Lahey, Legislator
A. Alan Seidman, Chair of Legislature
Wayne A. Decker, Legislator
Roxanne L. Donnery, Legislator
George A. Green, Legislator
Leigh J. Benton, Legislator

Anthony R. Marino, Legislator
Bonnie Kraham, Legislator
Michael D. Paduch, Legislator
Jeffrey D. Berkman, Legislator
Thomas Pahucki, Legislator

COUNTY OF ORANGE / Department of Law
GOVERNMENT CENTER, 255 Main Street
GOSHEN, NEW YORK 10924 TEL: (845) 291-3150

EDWARD A. DIANA
County Executive

CATHERINE M. BARTLETT
County Attorney

November 22, 2002

RECEIVED
NOV 25 2002
NYS-OSC
LEGAL SERVICES

Office of New York State Comptroller
Legal Services, 14th Floor
110 State Street
Albany, New York 12236

Att: Ellen MacDonald, Esq,

RE: Application of Orange County, New York for Permission for an Increase and Improvement to Orange County Sewer District No, 1

Dear Ms. MacDonald:

I enclose a copy of my signed, amended opinion of counsel in connection with the County's application. Thank you for your courtesies and cooperation.

Very truly yours,

DAVID L. DARWIN
Chief Assistant County Attorney

DLD:smw
Enc.
Faxed & Mailed

COUNTY OF ORANGE / Department of Law
GOVERNMENT CENTER, 255 Main Street
GOSHEN, NEW YORK 10924 TEL: (845) 291-3150

EDWARD A. DIANA
County Executive

CATHERINE M. BARTLETT
County Attorney

AMENDED

November 22, 2002

Orange County Legislature
255-275 Main Street
Goshen, New York 10924

Re: Application for Permission to the State Comptroller for the Increase and Improvement to the Harriman Wastewater Treatment Facility

Ladies and Gentlemen:

This letter amends my letter dated August 22, 2002. The amendment reflects my review of certain agreements relevant to the above-stated project.

As you know, the Legislature at its August meeting approved the Application to the State Comptroller for permission to proceed with the proposed improvements to the Harriman Wastewater Treatment Plant. The applicable State regulations, (Part 85 of Chapter III of 2 NYCRR) require my opinion as to the matters set forth below. The State Comptroller may rely on such opinion as though it were addressed directly to him.

As Chief Assistant County Attorney, I have acted as legal counsel to the County and Orange County Sewer District No. 1 in connection with this application. In my capacity as legal counsel, I have examined the original or true and complete copies of the application and the exhibits and attachments attached and submitted therewith. I have reviewed original or true and complete copies of other documents and records necessary to render my opinion, including, but not limited to: the Constitution of the State of New York and relevant statutes, including Article 5-A of the New York State County Law, the State Environmental Quality Review Act ("SEQRA") and the regulations promulgated thereto; all resolutions of the Orange County Legislature pertaining to the Application; proof of publication of required notices; the Final Environmental Impact Statement and other documents required to be prepared and/or published and/or filed pursuant to SEQRA; maps and plans of the proposed project and the cost estimate and reports of the Orange County Sewer District No. 1 filed with the Orange County Legislature.

I have reviewed the existing intermunicipal agreements dated September 8, 1978; September 8, 1988; April 12, 1995; and proposed contracts or agreements referred to in the application, including the an agreement dated March 29, 2001 between the County and the Town of Woodbury, in which the Town commits to purchasing 30,000 gpd of capacity from the County at a price equal to its proportionate share of the total cost of the improvement (30,000/2,000,000 or 1.5% of the cost of the improvement) and an agreement between the County, Cromwell Road Associates and the Town of Blooming

Grove, pursuant to which the Town commits to purchasing no less than 26,000 gpd of capacity from the County. I also have reviewed a resolution from the Town of Monroe, in which the Town has committed to purchase a percentage of the new capacity in an amount equal to the percentage of capacity currently allocated to it for which the Town will pay a proportionate share of the total cost of the improvement.

Based on the foregoing, and the information provided to me by the Orange County Department of Environmental Facilities and Services, I advise you that in my opinion:

1. The Application contains all of the information required by applicable statutes and regulations.

2. The County, in relation to the increase and improvement to Orange County Sewer District No. 1 facilities for which the Comptroller's consent is sought, and the expenditure of funds therefore, has undertaken all actions and proceedings required by applicable provisions of law.

3. Said increase and improvement to the facilities of Orange County Sewer District No. 1 has been duly authorized by the County of Orange as required by statute except for: (i) obtaining the permission or consent of the Comptroller; (ii) the adoption of a resolution or resolutions for appropriations and funding after the Comptroller has granted such consent or permission; and (iii) any publication or notice required to be published after receipt of such consent or permission (e.g., publication of a bond resolution).

4. Neither other County Officials nor I are aware of any material pending or threatened lawsuits or claims relating to such increase and improvement for which the permission of the Comptroller is being sought.

5. Any assessments, charges or taxes to be levied and imposed to finance such expenditure of funds are authorized by statute and all necessary action has been taken by the County to authorize the imposition or levy of such assessments, charges or taxes. The foregoing is subject to the caveat that § 452 of the General Municipal Law requires a resolution after a public hearing on the establishment of sewer rents, and to the extent that such proceedings may be necessary, the are appropriately taken after the permission of the Comptroller is obtained.

Very truly yours,

DAVID L. DARWIN
Chief Assistant County Attorney

RE: Application for Permission to the State Comptroller for the Increase and Improvement to the Harriman Wastewater Treatment Facility

DLD:smw

cc - New York State Comptroller
Gail Sicina, Clerk of Legislature
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Michael Amo, Legislator
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Bernard Winstanley, Legislator
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Bonnie Kraham, Legislator
Michael D. Paduch, Legislator
Jeffrey D. Berkman, Legislator
Thomas Pahucki, Legislator

ALAN G. HEVESI
COMPTROLLER

110 STATE STREET
ALBANY, NEW YORK 12236

STATE OF NEW YORK
OFFICE OF THE STATE COMPTROLLER

RECEIVE
MAR 26 2003
NYS...
LEGAL ...

March 21, 2003

Gail Sicina, Clerk
Orange County Legislature
255 Main Street
Goshen, NY 10924

Re: County of Orange;
Increase and Improvement of
Facilities - Orange County
Sewer District No. 1 -
Harriman Wastewater
Treatment Plant
File No. 2002-49

Dear Ms. Sicina:

Enclosed for filing is the order of the State Comptroller in the above matter. Your attention is directed to County Law section 268.

Kindly sign, date and return the copy of this letter as a receipt in the enclosed envelope.

Very truly yours,

Mitchell S. Morris

Mitchell S. Morris
Associate Counsel

MSM:DLY:dly
Enclosure
(518) 474-6007
cc: David L. Darwin, Esq.

Filed this 24th day of

March, 2003

Gail Sicina
Clerk

STATE OF NEW YORK DEPARTMENT OF AUDIT AND CONTROL

In the Matter
of the

Application of the County Legislature of Orange County, New York, for a Certificate of the State Comptroller consenting to an increase and improvement of facilities in Orange County Sewer District No. 1, in said county

WHEREAS, on the 30th day of January, 1970, the Comptroller of the State of New York, upon the application of the Board of Supervisors of Orange County, New York, did grant permission to establish Orange County Sewer District No. 1 in said county; and

WHEREAS, we are informed that a final order establishing Orange County Sewer District No. 1 was adopted by the Board of Supervisors of Orange County on 27th day of February, 1970; and

WHEREAS, application has been duly made to the undersigned by the County Legislature of Orange County for a Certificate of the State Comptroller consenting to an expenditure of $26,000,000, for construction constituting an increase and improvement of facilities pursuant to section 268 of the County Law, in Orange County Sewer District No. 1; and

WHEREAS, the additional facilities include the renovation and improvement of the Harriman Wastewater Treatment Plant; and

WHEREAS, we are informed that Orange County may be eligible for long term financing from the New York State Environmental Facilities Corporation, which administers the New York State Clean Water State Revolving Fund for the construction which is the subject of this proceeding; and

WHEREAS, the undersigned has duly examined such application,

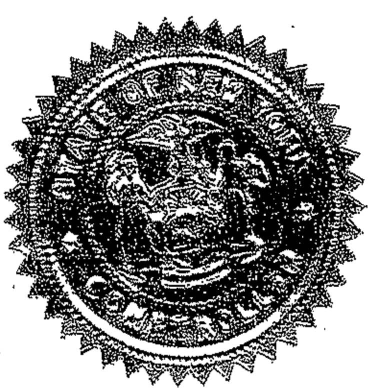
NOW, THEREFORE, pursuant to such examination and upon such application of the County Legislature of Orange County, the undersigned does hereby find and determine, after due deliberation:

(1) That the public interest will be served by the additional facilities to be constructed in Orange County Sewer District No. 1.

(2) That the additional amount to be expended for such purposes will not be an undue burden upon the property of the district.

I, ALAN G. HEVESI, Comptroller of the State of New York, do hereby order that such application of the County Legislature of Orange County for permission to increase the facilities in Orange County Sewer District No. 1 in said county be, and the same hereby is, granted at a maximum cost of $26,000,000, including any applicable State aid.

Executed in duplicate under my hand and the seal of the Comptroller of the State of New York, at the City of Albany, New York this 20 day of March, 2003.



ALAN G. HEVESI
State Comptroller

By

Anthony R. Nanula
Deputy Comptroller

Appendix I

Exhibit 1: Excerpt from Village of Kiryas Joel Well #27 Permit issued by Michael Merriman, Deputy Regional Permit Administrator for Region 3 of the NYS DEC, dated March 9, 2005

95-20-6(10/90)-25c R3

DEC PERMIT NUMBER		EFFECTIVE DATE
3-3340-00141/00008		March 9, 2005
FACILITY/PROGRAM NUMBER(s)	**PERMIT** Under the Environmental Conservation Law (ECL)	EXPIRATION DATE
WSA# 10,611 FWW# MO-14 (Class II)		FW & WQ: 12/31/07 WS: None (*Except see General Condition "D" on page 4*)

TYPE OF PERMIT (Check All Applicable Boxes)
X New ☐ Renewal ☐ Modification

☐	Article 15, Title 5: Protection of Water	☐	Article 17, Titles 7, 8: SPDES	☐	Article 27, Title 9; 6NYCRR 373: Hazardous Waste Management
XX	Article 15, Title 15: Water Supply	☐	Article 19: Air Pollution Control	☐	Article 34: Coastal Erosion Management
☐	Article 15, Title 15: Water Transport	☐	Article 23, Title 27: Mined Land Reclamation	☐	Article 36: Floodplain Management
☐	Article 15, Title 15: Long Island Wells	XX	Article 24: Freshwater Wetlands	☐	Articles 1, 3, 17, 19, 27, 37; 6NYCRR 380: Radiation Control
☐	Article 15, Title 27: Wild, Scenic & Recreational Rivers	☐	Article 25: Tidal Wetlands	☐	Other ______
XX	6NYCRR 608: Water Quality Certification	☐	Article 27, Title 7; 6NYCRR 360: Solid Waste Management		

PERMIT ISSUED TO: The Village of Kiryas Joel - 7th Application — TELEPHONE NUMBER:

ADDRESS OF PERMITTEE: 500 Forest Street, PO Box 566, Monroe, NY 10950

CONTACT PERSON FOR PERMITTED WORK: Mayor Abraham Weider — TELEPHONE NUMBER:

NAME AND ADDRESS OF PROJECT/FACILITY: Well #27 in Brenner Property Wellfield

LOCATION OF PROJECT/FACILITY: (same)

COUNTY	TOWN	WATERCOURSE/WETLAND NO.	NYTM COORDINATES
Orange	Monroe	FWW# MO-14 (Class II)	E: N: 4

DESCRIPTION OF AUTHORIZED ACTIVITY

The permittee is permitted to take an additional supply of water for use in the existing Village water supply system by the use of the Well #27 having a maximum pumping rate of 125 gallons per minute. This well, as with all of the existing Brenner Property wells, shall be pumped for no more than 18 hours per day for a total daily taking of 135,000 gallons per day. The total approved withdrawal from all six wells in the Brenner Property wellfield is now increased to 442, 800 gallons per day, in accordance with all the conditions of this permit, in particular Special Condition # 1.

The permittee is also permitted excavate a trench and install a water line through the adjacent area of Freshwater Wetland #MO-14 (Class II) from Well #27 to the existing pump house, in accordance with the plans and reports referenced in Special Condition #1..

By acceptance of this permit, the permittee agrees that the permit is contingent upon strict compliance with the ECL, all applicable regulations, the General Conditions specified (**See Page 2**) and any Special Conditions included as part of this permit.

DEPUTY PERMIT ADMINISTRATOR	ADDRESS	
Michael D. Merriman	21 South Putt Corners Rd., New Paltz NY 12561	MDM
AUTHORIZED SIGNATURE Michael D. Merriman	Date March 9 2005	Page 1 of 6

DRAI:PERMIT1 8/94 — File Name: Kiryas Joel WSA 10611. add Well 27.wpd

Exhibit 5: Village of Kiryas Joel Well Permit #28 issued on August 17, 2005 by Michael Merriman, Deputy Regional Permit Administrator for Region 3 of NYS DEC

DEC PERMIT NUMBER	3-3340-00141/00009
FACILITY/PROGRAM NUMBER(S)	WSA # 10,612 8th Application
EFFECTIVE DATE	August 17 2005
EXPIRATION DATE	None (*Except see General Condition "D" on page 3*)

PERMIT

Under the Environmental Conservation Law (ECL)

TYPE OF PERMIT (Check All Applicable Boxes)

☒ New ☐ Renewal Modification ☐ Permit to Construct ☐ Permit to Operate

XX	Article 15, Title 5: Protection of Water
XX	Article 15, Title 15: Water Supply
	Article 15, Title 15: Water Transport
	Article 15, Title 15: Long Island Wells
	Article 15, Title 27: Wild, Scenic & Recreational Rivers
XX	6NYCRR 608: Water Quality Certification
	Article 17, Titles 7, 8: SPDES
	Article 19: Air Pollution Control
	Article 23, Title 27: Mined Land Reclamation
XX	Article 24: Freshwater Wetlands
	Article 25: Tidal Wetlands
	Article 27, Title 7; 6NYCRR 360: Solid Waste Management
	Article 27, Title 9; 6NYCRR 373: Hazardous Waste Management
	Article 34: Coastal Erosion Management
	Article 36: Floodplain Management
	Articles 1, 3, 17, 19, 27, 37; 6NYCRR 380: Radiation Control
	Other

PERMIT ISSUED TO	The Village of Kiryas Joel
TELEPHONE NUMBER	(845) 783-8300
ADDRESS OF PERMITTEE	500 Forest Street, PO Box 566, Monroe, NY 10950
CONTACT PERSON FOR PERMITTED WORK	Mayor Abraham Weider
TELEPHONE NUMBER	
NAME AND ADDRESS OF PROJECT/FACILITY	Well #28 adjacent to the Ramapo River
LOCATION OF PROJECT/FACILITY	(same)

COUNTY	TOWN	WATERCOURSE/WETLAND NO.	UTM COORDINATES
Orange	Monroe		E: 569.6 N: 4574.8

DESCRIPTION OF AUTHORIZED ACTIVITY

Take an additional supply of water for use in the Village's existing water supply and distribution system by the installation of Well #28, having a maximum pumping capacity of 450 gallons per minute. This 45-foot deep sand and gravel aquifer well shall be pumped at no more than 75% of capacity, averaged monthly, resulting in an average daily maximum taking of 486,000 gallons per day.

The permittee is also authorized to disturb the adjacent area of state regulated Freshwater Wetland MO-1 (Class II) and to disturb federal wetlands in order to construct a 6-inch diameter water transmission line back to its treatment and distribution system in accordance with Special Condition #1 of this permit.

By acceptance of this permit, the permittee agrees that the permit is contingent upon strict compliance with the ECL, all applicable regulations, the General Conditions specified (See Page 2) and any Special Conditions included as part of this permit.

DEPUTY PERMIT ADMINISTRATOR	ADDRESS	
Michael D. Merriman	21 South Putt Corners Rd., New Paltz NY 12561	MDM
AUTHORIZED SIGNATURE: Michael D. Merriman	Date: August 17, 2005	Page 1 of 4

NOTIFICATION OF OTHER PERMITTEE OBLIGATIONS

Item A: Permittee Accepts Legal Responsibility and Agrees to Indemnification
The permittee has accepted expressly, by the execution of the application, the full legal responsibility for all damages and costs, direct or indirect, of whatever nature and by whomever suffered, for liability it incurs resulting from activity conducted pursuant to this permit or in noncompliance with this permit and has agreed to indemnify and save harmless the State from suits, actions, damages and costs of every name and description resulting from such activity.

Item B: Permittee to Require it's Contractors to Comply with Permit
The permittee shall require its independent contractors, employees, agents and assigns to read, understand and comply with this permit, including all special conditions, and such persons shall be subject to the same sanctions for violations of this permit as those prescribed for the permittee.

Item C: Permittee Responsible for Obtaining Other Required Permits
The permittee is responsible for obtaining any other permits, approvals, lands, easements and rights-of-way that may be required for this project.

Item D: No Right to Trespass or Interfere with Riparian Rights
This permit does not convey to the permittee any right to trespass upon the lands or interfere with the riparian rights of others in order to perform the permitted work nor does it authorize the impairment of any rights, title, or interest in real or personal property held or vested in a person not a party to the permit.

GENERAL CONDITIONS

General Condition 1: Facility Inspection by the Department
--The permitted site or facility, including relevant records, is subject to inspection at reasonable hours and intervals by an authorized representative of the Department of Environmental Conservation (the Department) to determine whether the permittee is complying with this permit and the ECL. Such representative may order the work suspended pursuant to ECL 71-0301 and SAPA 401(3).
--The permittee shall provide a person to accompany the Department's representative during an inspection to the permit area when written or verbal notification is provided by the Department at least 24 hours prior to such inspection.
--A copy of this permit, including all referenced maps, drawings and special conditions, must be available for inspection by the Department at all times at the project site. Failure to produce a copy of the permit upon request by a Department representative is a violation of this permit.

General Condition 2: Relationship of this Permit to Other Department Orders and Determinations
Unless expressly provided for by the Department, issuance of this permit does not modify, supersede or rescind any order or determination previously issued by the Department or any of the terms, conditions or requirements contained in such order or determination.

General Condition 3: Applications for Permit Renewals or Modifications
The permittee must submit a separate written application to the Department for renewal, modification or transfer of this permit. Such application must include any forms or supplemental information the Department requires. Any renewal, modification or transfer granted by the Department must be in writing.
The permittee must submit a renewal application at least:

a) 180 days before expiration of permits for State Pollutant Discharge Elimination System (SPDES), Hazardous Waste Management Facilities (HWMF), major Air Pollution Control (APC) and Solid Waste Management Facilities (SWMF); and
b) 30 days before expiration of all other permit types.

Submission of applications for permit renewal or modification are to be submitted to:
NYSDEC Regional Permit Administrator, Region 3
21 South Putt corners Road, New Paltz, NY 12651, Telephone: 845-256-3054

General Condition 4: Permit Modifications, Suspensions and Revocations by the Department
The Department reserves the right to modify, suspend or revoke this permit when:

a) the scope of the permitted activity is exceeded or a violation of any condition of the permit or provisions of the ECL and pertinent regulations is found;
b) the permit was obtained by misrepresentation or failure to disclose relevant facts;
c) new material information is discovered; or
d) environmental conditions, relevant technology, or applicable law or regulation have materially changed since the permit was issued.

A. The permittee must require that any contractor, project engineer, or other person responsible for the overall supervision of this project has read, understands and agrees to comply with this permit and associated plan(s).

B. Prior to starting work on any construction authorized herein, detailed plans of the structures proposed to be built and specifications for such work shall have been submitted to and approved by the Department. Thereafter, such construction work shall be entirely completed in full accordance with the plans and specifications which have been submitted and approved.
NOTE: Approval by this Department of final plans and specifications, and of completed works, will not be issued until equivalent approvals have been issued by the NYS Department of Health.

C. Section 15-1529 of the Environmental Conservation Law forbids the operation of any of these works until, as constructed, they have been approved by the Department. Such final approval will be given only on written request. In general, such approval will not be given until all provisions affecting quality of the water and safety of the works have been complied with in full.

D. The Department reserves the right to rescind this permit or to take whatever action it may deem suitable and proper if the works authorized to be constructed herein are not initiated by December 31, 2008.

SPECIAL CONDITIONS

For Article 15, Title 15 (Water Supply)

1. The permittee shall construct a water transmission line in accordance with Figure No. 3 "Proposed Conveyance and Treatment Facilities" by Thomas Schoettle, PE, of Camp Dresser & McKee, received May 18, 2004.

2. All land within 200 feet of any well approved herein shall be protected and controlled, in order to prevent pollution of the ground or groundwater, by direct ownership of the land, by the acquisition of protective easements, or by other appropriate measures. This area shall further be protected from surface water pollution by construction of suitable diversion ditches or embankments, and the development of the wells shall so be carried out that there shall be no opportunity for pollution to enter the wells.

3. Before any water from the source(s) approved herein may be used for any purpose, the permittee shall have caused a sample of the water from each to be collected and analyzed and shall have submitted the results of such analyses to the Department and to the New York State Department of Health (DOH). Should DOH find that the water from any source requires treatment to attain satisfactory sanitary quality, it will notify the Department of the specific treatment required for that source. The permittee shall use water from such sources only after certifying to the Department that it has achieved full compliance with DOH's treatment requirements

4. Nothing contained in this permit and approval shall be held to authorize the permittee to supply, sell or distribute, for any purpose, water from any source approved herein unless all such water shall first have been treated in a manner satisfactory to the New York State Department of Health.

5. The Department reserves the right to require the taking of further sanitary precautions or the further treatment of the water from any source approved herein should future conditions cause the New York State Department of Health to specify such action.

6. The permittee shall make provisions to provide an adequate supply of water to those residents whose private well-water systems are diminished or rendered non-productive by the permittee's use of the sources of water supply approved by this permit.

7. During any construction directly or indirectly associated with the activities authorized herein, the permittee shall make provisions to minimize erosion on the construction site and to prevent increased sedimentation in any water body on or adjacent to the site.

8. For the first 12 months of Well No. 28 operation, the permittee shall submit a monthly report of pumping and draw down to Region 3 Regional Water Engineer in the Department's Tarrytown office. Monthly reports will

SPECIAL CONDITIONS

For Article 15 Title 15 (Water Supply)

include water levels in the Ramapo River collected on at least a daily basis, obtained via use of two staff gauges installed in the river. One gauge shall be immediately downstream of Well #28. The other shall be installed at an appropriate, nearby upstream location outside of any possible area of influence of Well #28. If pumping at the well results in a lowering of Ramapo River levels, NYSDEC reserves the right to re-open this permit.

WATER CONSERVATION CONDITIONS:

9. The permittee must maintain meters on all sources of supply used in the system and on all customer service connections supplied by the system.

10. At least once every fifteen years, the permittee must have all of its small service connection meters (less than 1-inch in diameter) calibrated for accuracy according to standards of the American Water Works Association (AWWA). Larger service meters and all source meters must be calibrated more frequently, based upon the AWWA standards for the size of meter used.

11. The permittee must maintain records of annual metered water production and consumption, and, at least once annually, must conduct a system water audit that utilizes metered production and consumption data to determine unaccounted-for water.

12. The permittee must develop and implement a leak detection and repair program that uses sonic detection equipment to inspect its entire distribution system in a systematic fashion. At a minimum, this program must cover the entire system in a three-year cycle by inspecting at least one-third of the system each year. Whenever two consecutive annual water audits shall show that unaccounted-for water is 15% or less of system production, the leak detection and repair program may be modified to cover the entire system in a longer cycle.

13. The permittee must retain records of production & consumption, reports of audit results, and summaries of leaks detected and repaired for at least ten years. The permittee must provide copies of such of these records, as might be requested in writing by the Department within one month of receiving such a request.

STATE ENVIRONMENTAL QUALITY REVIEW

Under the State Environmental Quality Review Act (SEQR), the project associated with this permit is classified as an Unlisted Action with the Village of Kiryas Joel designated as the lead agency. It has been determined that the project will not have a significant effect on the environment.

Distribution:
M. Moran & M. Duke
M. George & L. Meyerson, DOW, Tarrytown
M. Holt, DOW, Albany (3504)
L. Bergus & M. Schliefer, Orange County Health Department
M. Montysko, NYS DOH, Troy
D. Gaugler, NPO
T. Schoettle, PE of Camp Dresser & Mckee
T. Cusack, Leggette Brashears & Graham
R. Raczko, PE, United Water New York
T. Montagnino, Homeowners Assoc. of Old Country Road
R. Fromaget

New York State Department of Environmental Conservation
Division of Environmental Permits, Region 3
21 South Putt Corners Road, New Paltz, New York 12561-1620
Phone: (845) 256-3054 FAX: (845) 255-3042
Website: www.dec.state.ny.us

IMPORTANT NOTICE TO ALL PERMITTEES

The permit you requested is enclosed. Please read it carefully and note the special conditions that are included in it. The permit is valid for only that activity expressly authorized therein; work beyond the scope of the permit may be considered a violation of law and be subject to appropriate enforcement action. Granting of this permit does not relieve the permittee of the responsibility of obtaining any other permission, consent or approval from any other federal, state or local government which may be required.

If a permit notice sign is enclosed, you must post it at the work site with appropriate weather protection, as well as a copy of the permit per General Condition 1. If the permit is associated with a project that will entail construction of new water pollution control facilities or modifications to existing facilities, plan approval for the system design will be required from the appropriate departmental office or delegated local health department, as specified in the State Pollutant Discharge Elimination System (SPDES) permit.

Please note the expiration date of the permit. Applications for permit renewal should be made well in advance of the expiration date (minimum of 30 days) and submitted to the Regional Permit Administrator at the above address. For SPDES, Solid Waste and Hazardous Waste Permits, renewals must be made at least 180 days prior to the expiration date.

NOTE: The DEC permit number & program ID number noted on the top of page 1 of the permit are important and should be retained for your records. These numbers should be referenced on all correspondence related to this permit, and on any future applications for permits associated with this facility/project area.

If you have any questions on the extent of work authorized or your obligations under the permit, please contact the staff person indicated below or the Division of Environmental Permits at the above address.

Michael D. Merriman

Division of Environmental Permits, Region 3
Telephone (845) 256-3165

☐ Applicable Only if Checked
STORMWATER SPDES INFORMATION: We have determined that your project qualifies for coverage under the General Stormwater SPDES Permit. You must now file the enclosed Notice of Intent to obtain coverage under this General Permit.

This form can also be downloaded at: http://www.dec.state.ny.us/website/dcs/spdes/

Send the completed form to: NYS DEC, Stormwater Permitting, Division of Water, 625 Broadway
Albany NY 12233-3505

DEP2:UPA\PERMITCOVERLTR(2/05)

Exhibit 6: Letter from Michael Merriman, Deputy Regional Permit Administrator for Region 3 of NYS DEC, to Robert F. Raczko, et al., regarding Village of Kiryas Joel Well #28 dated August 17, 2005

New York State Department of Environmental Conservation
Division of Environmental Permits, Region 3
21 South Putt Corners Road, New Paltz, New York 12561-1620
Phone: (845) 256-3054 • **FAX:** (845) 255-3042
Website: www.dec.state.ny.us

Denise M. Sheehan
Acting Commissioner

August 17, 2005

ATTN: ROBERT F. RACZKO, PE
UNITED WATER NEW YORK
360 WEST NYACK ROAD
WEST NYACK, NY 10994

ATTN: THOMAS MONTAGNINO
HOMEOWNERS ASSOC. of OLD COUNTRY ROAD
C/O 16 OLD COUNTRY ROAD
MONROE, NY 10950

ATTN: ROBERT A. FROMAGET
S.O.C.A. AT WORK
5 ARLINGTON DRIVE
MONROE, NY 10950

RE: Village of Kiryas Joel; Add Well #28
DEC #: 3-3340-00141-00001 WSA# 10,612
LOC: T-Monroe, Orange County

Dear Sirs:

Thank you for your comment letters in response to our May 2, 2005 Notice of Complete Application for the Village of Kiryas Joel's Well #28. Our engineering staff has reviewed your comments and has the following responses to them:

In regards to the one-page May 31, 2005 letter received from United Water New York, the Department staff has determined that there will be no net loss of water in the Ramapo River downstream of the Harriman Sewage Treatment Plant. This is due to the fact that water from Well #28 will be used within the Village of Kiryas Joel. The Village traditionally uses only a small percentage of its water for outside uses. Thus, almost all water used in the Village is collected in the Village's wastewater collection system. That wastewater is treated either in the Village's Wastewater Treatment Plant and discharged back into a tributary of the Ramapo River or is piped to Orange County's Harriman Sewage Treatment Plant and discharged back into the Ramapo River. Thus, only a small percentage of the water from Well #28 will not be discharged back into the Ramapo River.

In regards to the letter by Thomas Montagnino representing the Homeowners Association of Old Country Road, that letter focused almost exclusively on the pumptesting of a completely different well, known as the Manhattan Beer Distributor's morning well, that apparently was conducted sometime in the last six to 12 months. Well #28 is located over 1500 ft. away from Old Country Road and on the opposite side of the existing Brunner Property Wellfield. Well #28 is located in a completely different aquifer than the deep rock wells used by the homes along Old Country Road. Well #28 is only 45 ft. deep and is located in a shallow gravel aquifer associated with the Ramapo River. Thus, it is too far away and too shallow to have any effect on those private wells along Old Country Road.

Additionally, the residents along Old Country Road are already afforded an additional level of protection by the requirement in the Water Supply permits for the wells in the Brenner Property Wellfield (which, as discussed previously, are closer to Old Country Road than Well #28) that requires monitoring of offsite wells to determine whether the use of the Brenner Property Wellfield has any measurable effect on those offsite wells. If the Village, or any other water supplier, proposes to use the Manhattan Beer Distributor's Well, this Department will require that it be retested to determine a safe pumping rate to prevent adverse impacts on surrounding private wells. However, at this time neither the Village, nor any other water supplier, is seeking this Department's approval to use that well.

In regards to their request for additional time to review the file, since June 3, 2005 the Homeowners Association has not followed up on the opportunity to make an appointment to come to this office, and review our files. If they had, I'm sure that they would have immediately recognized that, based on the above evaluation, Well #28 was not the cause of the recent problems they suffered in their private wells.

Lastly, in regards to the letter from Robert Fromager, it is predominantly focused on a separate project by the Village of Kiryas Joel to attempt to connect to the New York City Aqueduct as a replacement source of water. That project is not related to this Department's Notice of Complete Application for Well #28. In regards to the concern about growth impacts, particularly upon the sewage treatment capacity in the Ramapo River Basin, this Department carefully reviewed its files in regards to the capacity of both the Village's Sewage Treatment Plant and Orange County's Harriman Sewage Treatment Plant to treat this additional wastewater. We determined that there is sufficient excess capacity to treat this additional water, without adverse impacts on the Ramapo River.

Based on our evaluation of these three letters, we have decided to issue the permit. A copy is attached for your use. Please note that we do welcome your comments and concerns, and encourage you to view any and all permit applications you feel might effect your property. If you have any other questions, please don't hesitate to contact me in New Paltz at 845-256-3165.

Sincerely,

Michael D. Merriman

Michael D. Merriman
Deputy Regional Permit Administrator

File Name: V-KJ Well #28 Response to 3 Comment Letters.wpd

enc.: Issued Permit
cc: (Same as Permit)

Appendix J

To commence the statutory time period for appeals as of right [CPLR 5513(a)], you are advised to serve a copy of this order, with notice of entry upon all parties

SUPREME COURT OF THE STATE OF NEW YORK
COUNTY OF ORANGE
ENVIRONMENTAL CLAIMS PART

---x

In the Matter of the Application of

VILLAGE OF KIRYAS JOEL and MAYOR ABRAHAM WIEDER; VILLAGE TRUSTEE JACOB MITTELMAN; VILLAGE TRUSTEE BARUCH MARKOWITZ; VILLAGE TRUSTEE SAMUEL LANDAU; VILLAGE TRUSTEE JACOB FREUND; and VILLAGE ADMINISTRATOR GEDALYE SZEGEDIN, each individually and in his official capacity,

Plaintiffs/Petitioners,

DECISION AND ORDER

Orange County
Index Nos. 1892/07
3958/07
Motion Date: Jan. 21, 2008

For a Judgment Pursuant to Article 78 of the CPLR and a Declaratory Judgment Pursuant to Section 3001 of the CPLR

- against -

COUNTY OF ORANGE, ORANGE COUNTY SEWER DISTRICT # 1, TOWN OF WOODBURY, TOWN OF CHESTER, TOWN OF MONROE, TOWN OF BLOOMING GROVE, VILLAGE OF CHESTER, (Moodna Defendants/Respondents) VILLAGE OF WOODBURY, and VILLAGE OF SOUTH BLOOMING GROVE (Non-Contract Defendants/Respondents),

Defendants/Respondents.

---x

NICOLAI, J.

The following papers numbered 1 to 141 were read on this combined declaratory judgment action and CPLR Article 78 proceeding on plaintiffs'/petitioners' application pursuant to CPLR §6301 and §6311 for an order granting a preliminary injunction and upon the defendants'/respondents' motions, pursuant to CPLR §3211(a) and §7804 for an order dismissing the complaint/petition.

Papers	Numbered
Respondents/Defendants County of Orange and Orange County Sewer District #1 Notice of Motion - Attorney Affirmation - Exhibits (OC Index No. 07/1892)	1-5
Respondents/Defendants County of Orange and Orange County Sewer District #1 Notice of Motion - Attorney Affirmation - Exhibits - Reply Memorandum of Law (OC Index No. 07/3958)	6-11
Respondents/Defendants County of Orange and Orange County Sewer District #1 Reply Memorandum of Law (OC Index Nos. 07/1892 and 07/3958)	12
Respondents/Defendants County of Orange and Orange County Sewer District #1 Notice of Motion - Attorney Affirmation - Exhibits - Affidavit of David Lindsey - Exhibits - Affidavit of Robert Jeroloman - Exhibits - Memorandum of Law - Reply Memorandum of Law (Previously Adjourned by the Court [Owen, J.]) (OC Index No. 07/1892)	13-43
Respondent/Defendant Town of Woodbury Notice of Motion - Attorney Affirmation - Reply Affirmation (OC Index No. 07/1892)	44-46
Respondent/Defendant Town of Woodbury Notice of Motion - Attorney Affirmation - Exhibits - Reply Affirmation (OC Index No. 07/3958)	47-60
Respondents/Defendants Town and Village of Chester Notice of Motion - Attorney Affirmation – Memorandum of Law - Reply Affirmation - Exhibit - Reply Memorandum of Law (OC Index No. 07/1892)	61-66
Respondents/Defendants Town and Village of Chester Notice of Motion - Attorney Affirmation – Memorandum of Law - Reply Affirmation - Exhibit - Reply Memorandum of Law (OC Index No. 07/3958)	67-72
Respondent/Defendant Town of Blooming Grove - Notice of Motion - Attorney Affirmation - Bohan Affidavit Memorandum of Law (OC Index No. 07/1892)	73-76

Upon the foregoing papers, it is ordered that this application is resolved as follows.

Facts and Procedural History

Plaintiff/petitioner, Village of Kiryas Joel (Kiryas Joel) is one among a number of municipalities within the defendant/respondent County of Orange and defendant/respondent County of Orange Sewer District #1 (OCSD) (collectively, the County). The individual plaintiffs/petitioners are Village Trustees and other officials of Kiryas Joel who have brought this action/proceeding individually and in their official capacity. They have brought a combined declaratory judgment action and CPLR Article

78 proceeding seeking to preliminarily or permanently enjoin the County from entering into a contract for sale or otherwise undertaking any further action towards the sale of wastewater treatment capacity from the County's Harriman Wastewater Treatment Plant to communities outside the OCSD. Petitioners contend that the County's efforts to allocate some of the OCSD's newly-acquired wastewater treatment capacity to non-OCSD municipalities violate County Law, General Municipal Law and SEQRA.

The OCSD has one water treatment facility, the Harriman Wastewater Treatment Plant, which serves Kiryas Joel, the Village of Harriman, the Village of Monroe and part of the Town of Monroe, all of which are located within the OCSD. The portion of the Town of Monroe that is outside the OCSD as well as the Town and Village of Woodbury, the Town of Blooming Grove, the Village of South Blooming Grove and the Town and Village of Chester, which have been joined in this action/proceeding as necessary parties, pursuant to the order of the Court dated July 2, 2007 (Owen, J.), are the municipalities outside the OCSD to which the County seeks to allocate some of the OCSD's wastewater treatment capacity. These out-of-OCSD municipalities that have been joined to this action/petition may be grouped into two categories for the purposes of this determination. The first group of these defendant/respondent municipalities are denominated as "the Moodna communities" and are comprised of the Town and Village of Chester, the Town of Monroe, the Town of Woodbury and the Town of Blooming Grove. They are so named because all are members of the Moodna Basin Joint Regional Sewerage Board and, along with the OCSD, were signatories to the 1978 Moodna Basin Inter-municipal Agreement (and its 1988 amendment), by which the OCSD agreed to enhance its wastewater treatment capacity by 2 million gallons per day and to allocate both the expense and the expanded wastewater treatment capacity to these Moodna communities. The Villages of Woodbury and South Blooming Grove are the "non-contracting municipalities" which form the second group of out-of-OCSD municipal defendants/respondents. They are parties to this petition/action but were not signatories to the 1978 Inter-municipal Agreement (nor to the subsequent amendment).[1] Collectively, these two groups of defendants/respondents are referred to in this decision as the out-of-OCSD municipalities.

Pursuant to the terms of a Consent Decree and Order of the United States District Court for the Southern District of New York, the County was given until August 1, 2006 to expand the wastewater treatment capacity at the Harriman Wastewater Treatment Plant from 4.0 million gallons per day (the capacity which resulted from the expansion that followed the 1988 amendment to the 1978 Inter-municipal Agreement) to 6.0 million gallons per day. In 2001, Environmental Impact Statements were prepared as was the Statement of Findings. Notably, the Statement of Findings, as adopted by the Orange County Legislature, expressly states that the "purpose of the proposed enhancements [was] to meet the wastewater treatment needs of [the OCSD] and the Moodna Basin Southern Region Joint Sewerage Board sewer service areas." The Orange County

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[1]It is useful to note that the non-contracting municipality of the Village of South Blooming Grove, which was incorporated on July 14, 2006, is located wholly within the Town of South Blooming Grove which is itself a Moodna Community. Moreover, the Village of South Blooming Grove is part of the Town of Blooming Grove's sewer district which discharges to the Harriman Sewer Treatment Plant pursuant to the inter-municipal agreement of 1978. As for the Village of Woodbury, it is subject to an inter-municipal agreement of its own with the Town of Woodbury. According to this agreement, the Village of Woodbury has undertaken the responsibilities, rights and obligations of the sewer district of the Town of Woodbury (a Moodna community) as of January 1, 2008.

Legislature then petitioned the New York State Comptroller for its consent to make the expenditures necessary to complete the expansion project. During the petition process, it was the County's position that the then-current capacity of the Harriman Wastewater Treatment Plant was inadequate to serve the needs of the communities within the OCSD, that the Moodna Communities were allocated 2.0 million gallons of wastewater treatment per day and that it was the County's intention to provide the non-contracting municipalities a limited (maximum 189,000 gallons per day) portion of the expanded capacity of the Harriman Wastewater Treatment Plant. The County's petition also reflected that more than 1.0 million gallons per day of the yet-to-be-expanded wastewater treatment capacity was already accounted for with various pending in-OCSD development projects and existing in-OCSD properties which had not been able to receive OCSD services because of a lack of capacity. Following the approval of its petition and the adoption of the resolution by the Orange County Legislature, the Harriman Wastewater Treatment Plant was improved and expanded such that it now has a wastewater treatment capacity of 6.0 million gallons per day.

In 2006, after the OCSD completed the expansion project, the County initiated a plan to allocate more than 1.0 million gallons per day of the OCSD's newly-enhanced wastewater treatment capacity, and the associated costs, to the out-of-OCSD municipalities. Petitioners objected on the grounds that the County had not quantified the excess treatment capacity, had not determined that there was adequate capacity within the OCSD and had not conducted a SEQRA review. By letter dated January 8, 2007, the County informed the out-of-OCSD municipalities that the Harriman Wastewater Treatment Plant was on line and fully operational at a 6.0 million gallon per day capacity.

The letter stated that its purpose was to "inquire as to your interest in a) purchasing capacity; and b) consolidation of your sewer district into the [OCSD]." The letter specifically referenced the provision in the 1978 Inter-Municipal Agreement for allocating expanded wastewater treatment capacity and the associated costs among the participating Moodna communities.

Petitioners commenced the first proceeding/action (Orange County Index Number 07/1892) on March 1, 2007 by Order to Show Cause and Verified Petition and Complaint. Thereafter, the County moved to dismiss this petition/action inter alia, on the ground that petitioners had failed to join the Moodna communities as necessary parties pursuant to CPLR 1003 and 3211(a)(10). While that application was pending before the Court, petitioners commenced a second petition/action (Orange County Index Number 07/3958) on May 7, 2007 by Summons and Verified Petition and Complaint. This second proceeding/action is virtually identical to the first save that in addition to the County, it names the Moodna communities and the non-contracting municipalities as defendants/respondents. By Decision and Order of this Court dated July 2, 2007 (Owen, J.), the Moodna communities and the non-contracting municipalities were joined in the first action as necessary parties. The substantive aspects of the motion to dismiss were deferred until joinder was fully affected. On July 17, 2007, petitioners filed a Supplemental Summons and Notice of Petition and Amended Verified Petition and Complaint seeking injunctive relief, a judgment under CPLR Article 78 and a declaratory judgment against the County, the Moodna communities and the non-contracting municipalities. The County's original motion to dismiss has been deemed submitted as to petitioners amended petition/action. In addition to the County's motion to dismiss, similar motions have been filed by the Village of South Blooming Grove, the Town of South Blooming Grove, the Town and Village of Chester, the Town of Woodbury and the Village of Woodbury. The Town of Monroe, which initially made a motion to dismiss, has withdrawn that application and submitted its Verified Answer. This matter has been transferred to the Environmental Claims Part and is resolved as follows.

Analysis

With respect to any Article 78 proceeding, it must be determined, as a preliminary matter, whether petitioners' proceeding is timely. An Article 78 proceeding "must be commenced within four months after the determination to be reviewed becomes final and binding upon the petitioner" (CPLR 217 [1]). *Save the Pine Bush v. City of Albany, 70 NY2d 193, 203 (1987).* Petitioners contend that the County's letter of January 8, 2007 to the out-of-OCSD municipalities offering the sale of wastewater treatment capacity derived from the completed expansion project built and financed by the OCSD property owners was the trigger to their right to commence this action.

Petitioners argue that the January 8, 2007 letter constituted "the County's first formal offer to convey to the Moodna Communities more than 1.0 million gallons per day (mgd) of the new capacity built and financed by the District property owners". Respondents contend that the Statement of Findings, adopted by the Orange County Legislature on August 10, 2001 for the first expansion of the wastewater treatment facility, which states that the "purpose of the proposed enhancements [was] to meet the wastewater treatment needs of [the OCSD] and the Moodna Basin Southern Region Joint Sewerage Board sewer service areas" was the event that should have triggered the injury and therefore the commencement of the Statute of Limitations.

Inasmuch as the apportionment of future wastewater treatment capacity between the County and the Moodna communities was undertaken in the 1978 Inter-municipal Agreement (IMA), a reasonable argument cannot be made that any concrete injury resulting from wastewater capacity allocation would have been incurred some thirty (30) years ago. Respondents cannot claim that the Statute of Limitations commenced in 1978 with the execution of the IMA. The County's contention that the January 8, 2007 letter merely effectuated a long standing provision in the IMA is not plausible.

The terms of the 1978 IMA may have anticipated the necessity of an elastic mechanism for constructing additional wastewater treatment capacity to serve OCSD municipalities as well as the Moodna communities, however, the County cannot act contrary to the applicable laws. The County must comply with the SEQRA process and a determination of excess must be made prior to the sale or offer to sell any excess wastewater treatment capacity. Although the County's January 8, 2007 letter seeks to allocate the additional wastewater treatment capacity in a manner that is consistent with the historical operation of the Harriman Sewer Treatment Facility and with the 1978 IMA, the County has failed to make the required determination for its actions under SEQRA, General Municipal Law §119 and County Law §253-a(1) and §266. The County never made a determination that the existing sewage treatment capacity at the Harriman Plant was adequate to meet the needs of the in-OCSD municipalities.

Extending the use of 1.0 mgd of wastewater treatment to out-of-OCSD municipalities requires a review of the circumstances surrounding the capacity. Circumstances have undoubtably changed for the OCSD members with regard to many instances including population and housing markets. At a bare minimum, the County should have undertaken to prepare a Supplemental Environmental Impact Statement (SEIS) to evaluate relevant environmental concerns to the OCSD members and their proposed increased needs. *See Doremus v. Town of Oyster Bay, 274 AD2d 390, 393 (2d Dep't. 2000).* The County has made a determination to sell capacity at its wastewater treatment facility without consulting the members of the OCSD to see what, if any, projects are proposed that will add to the in-OCSD municipalities wastewater. There has been a history where in-OCSD municipalities have had moratoriums on construction due to a lack of capacity at the Harriman Wastewater Treatment Facility. The petitioners herein were subject to such limits on their development and therefore, the County must take all necessary steps to insure that the in-OCSD municipalities are adequately allocated with regard to their wastewater treatment needs and that is precisely an issue to be studied pursuant to the SEQRA process.

In addition to the environmental concerns that have to be addressed by the County, the sale of wastewater treatment capacity requires a determination from the County that the capacity to be sold is actually beyond the needs of the members of the sewer district. County Law § § 253-a and 266 and General Municipal Law § 119 require a determination be made by the OCSD that the treatment capacity actually be "in excess of its own needs". The County has an obligation to assess the treatment capacity needs of the district members and to make a reasoned determination of excess capacity on the record.

There is no indication in the record that the County undertook such a study or even discussed future needs of in-OCSD municipalities. Members of the OCSD financed and constructed the expanded capacity at the Harriman Plant for its own use and gain.

Without an inquiry into proposed development plans for in-OCSD properties and a determination of that the existing sewage treatment capacity at the Harriman Plant is adequate for the needs of the OCSD members, the County cannot offer 1.0 mgd of wastewater treatment to out-of-OCSD municipalities.

Accordingly, the defendants'/respondents' motions to dismiss are DENIED and the defendants/respondents are hereby enjoined from selling any wastewater treatment capacity to any entity outside the OCSD without first complying with the provisions of SEQRA, the County Law and the General Municipal Law.

Dated: White Plains, New York
August 7, 2008

FRANCIS A. NICOLAI, J.S.C.

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Appendix O

Appendix K

Harriman Wastewater Treatment Facility Membrane Bioreactor Pilot Study

Final Report 06-08
October 2006

New York State
Energy Research and
Development Authority

NYSERDA

NYSERDA

The New York State Energy Research and Development Authority (NYSERDA) is a public benefit corporation created in 1975 by the New York State Legislature. NYSERDA's responsibilities include:

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- Making energy more affordable for residential and low-income households.
- Helping industries, schools, hospitals, municipalities, not-for-profits, and the residential sector, including low-income residents, implement energy-efficiency measures.
- Providing objective, credible, and useful energy analysis and planning to guide decisions made by major energy stakeholders in the private and public sectors.
- Managing the Western New York Nuclear Service Center at West Valley, including: (1) overseeing the State's interests and share of costs at the West Valley Demonstration Project, a federal/State radioactive waste clean-up effort, and (2) managing wastes and maintaining facilities at the shut-down State-Licensed Disposal Area.
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NYSERDA administers the **New York Energy $mart**SM program, which is designed to support certain public benefit programs during the transition to a more competitive electricity market. Some 2,700 projects in 40 programs are funded by a charge on the electricity transmitted and distributed by the State's investor-owned utilities. The **New York Energy $mart**SM program provides energy efficiency services, including those directed at the low-income sector, research and development, and environmental protection activities.

NYSERDA derives its basic research revenues from an assessment on the intrastate sales of New York State's investor-owned electric and gas utilities, and voluntary annual contributions by the New York Power Authority and the Long Island Power Authority. Additional research dollars come from limited corporate funds. Some 400 NYSERDA research projects help the State's businesses and municipalities with their energy and environmental problems. Since 1990, NYSERDA has successfully developed and brought into use more than 170 innovative, energy-efficient, and environmentally beneficial products, processes, and services. These contributions to the State's economic growth and environmental protection are made at a cost of about $.70 per New York resident per year.

Federally funded, the Energy Efficiency Services program is working with more than 540 businesses, schools, and municipalities to identify existing technologies and equipment to reduce their energy costs.

For more information, contact the Communications unit, NYSERDA, 17 Columbia Circle, Albany, New York 12203-6399; toll-free 1-866-NYSERDA, locally (518) 862-1090, ext. 3250; or on the web at www.nyserda.org

Harriman Wastewater Treatment Facility
Membrane Bioreactor Pilot Study
Final Report

Prepared for the

New York State
Energy Research and
Development Authority

Albany, NY
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NYSERDA
Report 06-08

NYSERDA 8135

October 2006

NOTICE

Abstract

The Orange County Department of Environmental Facilities and Services conducted a 6-month pilot study at the Harriman Wastewater Treatment Plant to establish the feasibility of incorporating membrane bioreactor (MBR) technology as a means of upgrading the treatment capacity of the existing oxidation ditches at the facility. The pilot study, which was cost-shared by the New York State Energy Research and Development Authority (NYSERDA), demonstrated the viability of MBR technology for use at the facility. Data collected during this pilot study were used to estimate the average day treatment capacity that can be provided at the existing site through the use of MBRs. These data were also used to compare the use of MBRs for expansion of the facility with a more conventional treatment technology (step-feed aeration). A computer modeling program (BioWin ™) was used to simulate the two alternatives, estimate the potential to increase the facility's capacity, and predict effluent quality based on existing and future anticipated permit limits.

Based on the necessary improvements required to increase the capacity of the existing oxidation treatment system, planning level capital costs, additional annual operating costs and the present value based on a 20-year life cycle were estimated for each of the two expansion alternatives.

Key Words

MBR, membrane bioreactor, pilot study, conceptual design, biological nutrient removal, NYSERDA, Harriman Wastewater Treatment Plant, Biowin ™

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SUMMARY

The Harriman Wastewater Treatment Plant (HWWTP) is a 4.0 million gallon per day (mgd) facility that serves the Orange County Sewer District No.1 and the Moodna Basin Southern Region in Orange County, New York, and is operated by the Orange County Department of Environmental Facilities and Services (OCDEFS). Currently, the HWWTP has two treatment trains, a 2.0 mgd conventional activated sludge (CAS) system constructed in 1974 and a 2.0 mgd oxidation ditch system constructed in 1987. Upgrades (Phase I) completed in 2006 at the HWWTP increased the capacity of the facility to 6.0 mgd through the construction of a new 2.0 mgd CAS system.

Continued residential and commercial growth has prompted the County to plan for additional treatment capacity, above the 6.0 mgd that is now available with the above-mentioned construction (Phase I). Conventional expansion of the facility is constrained by limited land for any new treatment facilities. The existing oxidation ditch system is outdated and nearing the end of its useful life. Since little space is available at the site, future expansion requires acquisition of additional land or the re-use of existing tanks.

Accordingly, the County conducted a pilot study from November 2004 to May 2005, which was cost-shared by the New York State Energy and Research Development Authority (NYSERDA), to establish the feasibility of incorporating membrane bioreactor (MBR) technology as a means of upgrading the existing oxidation ditches and substantially increasing the capacity of the oxidation ditches. The pilot study demonstrated the viability of MBR technology for use at the HWWTP. Data collected during this pilot study was used to estimate the maximum treatment capacity that can be provided within the existing oxidation ditch footprint through the use of MBRs. These data were also used to compare this expansion alternative with a more conventional treatment technology for expansion of the facility. A computer program was used to simulate the two alternatives, estimate the potential to increase the facility's capacity, and predict effluent quality based on existing and anticipated permit limits.

Based on the results of the pilot study, modeling, and conceptual design undertaken as part of the study, it was determined that expansion of the existing facility was feasible by incorporating a MBR treatment system into the existing oxidation ditches. By retrofitting the oxidation ditches with new MBR equipment, upgrading the existing facility headworks and chlorine contact tanks, and performing other ancillary upgrades, the MBR train would have a treatment capacity of 5.0 mgd, an increase of 3.0 mgd compared to the existing oxidation ditch system.

This type of expansion would increase the daily energy use at the facility by 2,200 kwh. (Note: This is a worse case estimate assuming the system will never be gravity operated. The feasibility of this mode of operation must be verified through hydraulic analysis, which was outside the scope of this project. Should gravity operation be feasible, power consumption would decrease by 40 hp.)

As a comparison to incorporating MBR technology, a new conventional activated sludge treatment system (step-feed aeration) was evaluated to replace the oxidation ditches. Under this alternative, the existing oxidation ditches were converted to a suspended growth activated sludge treatment system with diffused aeration and internal recycles necessary to achieve the required effluent limits and a similar 3.0 mgd capacity increase. In addition, this alternative included the construction of new secondary clarifiers and sand filters, as well as upgrades of the existing facility headworks, sand filters, chlorine contact tanks, and other ancillary facilities. This type of expansion would decrease the daily energy use at the facility by 1,029 kwh.

The lower energy requirements of the step-feed system are the result of the inherent inefficiencies of the facility's existing aerators and turbines. These would be replaced by a high-efficiency fine bubble aeration system should the facility be expanded by conventional means. (Note: The ability to increase the capacity of the HWWTP by conventional means is contingent on increasing the depth of the existing oxidation ditches. The feasibility of doing this would have to be verified through structural and geotechnical analyses, which were outside of the scope of this project. Results of such analyses may show that construction of deeper tanks is not feasible or that doing so would be cost prohibitive.)

From an environmental perspective, the MBR system out performed the step-feed system for the majority of effluent parameters modeled. It appears that the MBR system would be capable of producing a high-quality effluent without the use of separate clarifiers or filters, which would be required with the step-feed aeration system. Additionally, based on the results of modeling, the effluent from the MBR system would require less chlorine to disinfect and less coagulant to achieve phosphorus removal than that produced by the step-feed system.

Based on the necessary improvements required to increase the capacity of the existing oxidation treatment system, planning level capital costs, and additional annual operating costs, the present value based on a 20-year life cycle were estimated for each of the two alternatives.

	Planning Level Capital Cost	***Additional Annual Operating Cost***	***Present Value (20-year life cycle)***
Membrane Bioreactor (MBR) Expanded Facility	$24,950,000	$369,100	$29,590,000
Conventional Activated Sludge Expanded Facility	$34,311,000	$167,000	$36,410,000

Both the conceptual MBR and step-feed systems are capable of treating the required average flow while meeting the preliminary future permit limits. However, based on the results of this project, the MBR system expansion option appears to be the most appropriate approach for several reasons including superior effluent quality, reduced chemical requirements, lower capital costs, and fewer constructability issues.

Section 1

PROJECT DESCRIPTION

This report presents the results of the membrane bioreactor (MBR) pilot unit study, modeling and conceptual design of a full-size treatment system at the Harriman Wastewater Treatment Plant (HWWTP) in Harriman, NY, which is operated by the Orange County Department of Environmental Facilities and Services (OCDEFS). Co-funding for the pilot study was provided under a grant from the New York State Energy and Research Development Authority (NYSERDA) under Program Opportunity Notice (PON) #786. OCDEFS provided operational assistance and laboratory analysis during the pilot study.

BACKGROUND

The HWWTP currently consists of two treatment trains – a conventional activated sludge treatment system and an oxidation ditch treatment system. The conventional activated sludge treatment system (Train 2), constructed in 1974, was designed for an average daily flow of 2.0 mgd. The oxidation ditch treatment system (Train 1), constructed in 1987, was also designed for an average daily flow of 2.0 mgd. After demonstrating that the facility could treat flows in excess of 4.0 mgd, the New York State Department of Environmental Conservation (NYSDEC) temporarily increased the facility's permitted capacity to 4.5 mgd. The facility is currently being upgraded (Phase I) with a new, 2.0 mgd conventional activated sludge treatment train (Train 3). Upon construction completion, the design flow rate of the facility will be 6.0 mgd. Continued residential and commercial growth within the sewer district has prompted the County to plan beyond the scope of Phase I for additional wastewater treatment capacity under a second upgrade (Phase II).

The facility serves the Orange County Sewer District No. 1 (OCSD No. 1) and the Moodna Basin Southern Region (MBSR). Member communities in OCSD No. 1 include the Villages of Harriman, Monroe, and Kiryas Joel, and a portion of the Town of Monroe. The Towns of Blooming Grove, Chester, and Woodbury, the Village of Chester, and part of the Town of Monroe are members of the MBSR Joint Sewerage Board. In addition, the facility accepts and processes liquid septage trucked by private haulers.

The existing wastewater treatment facility consists of preliminary, primary, and secondary treatment, followed by disinfection, as well as sludge thickening, and dewatering. Upon entering the facility, raw wastewater is combined with filter backwash water. The flow then passes through a preliminary treatment facility that provides screening and grit removal. The flow is then split between the original 2.0 mgd conventional activated sludge system and the 2.0 mgd oxidation ditch treatment system. In order to achieve a high quality effluent, flow from the conventional activated sludge system and the oxidation ditches is combined and directed to final polishing sand filters. The flow is then conveyed to a chlorine contact tank where chlorine gas and sulfur dioxide gas is added for disinfection and dechlorination. Finally, the flow is discharged through two outfalls (Outfall 001 and 002) to the Ramapo River. The sludge generated from the

HWWTP is thickened by gravity, dewatered by belt filter presses, and composted with the grit. The screenings removed in the preliminary treatment stage are land-filled. The new 2.0 mgd treatment train being constructed at the facility (as part of the Phase I upgrade) will consist of primary settling tanks, aeration tanks, secondary clarifiers, and sand filters. A new chlorine contact tank and chemical storage facility are also being constructed. A new flow distribution box will evenly distribute the influent flow to the three separate treatment trains. The existing treatment trains will continue to operate as described above.

Historical Data Analysis

Operating data from 2002 and 2003 was reviewed to establish design criteria for the project. Table 1-1 presents a summary of the influent wastewater characteristics, based on the available data.

Table 1-1
Influent Wastewater Characteristics

Parameter	Average Month	Maximum Month	Maximum Day
Flow, mgd	4.5	7.1	13.4
Biological Oxygen Demand (BOD), mg/L	135	199	241
Total Suspended Solids (TSS), mg/L	227	509	568
Ammonia (NH_3), mg/L	17.7	21.8	30.0
Temperature, °C	17.0	23.0	25.0
pH	7.4	7.7	8.3

The maximum instantaneous flow recorded during the two years was 20.0 mgd. Large amounts of precipitation are typically correlated with increased influent flow; indicating that the plant is influenced by infiltration and inflow. The average influent BOD/TSS ratio is 0.78.

Table 1-2 presents a summary of the effluent wastewater characteristics, based on the available data.

Table 1-2
Effluent Wastewater Characteristics

Parameter	Average Month	Maximum Month	Maximum Day
BOD, mg/L	6.9	16.3	40.4
TSS, mg/L	8.0	20.2	59.0
NH_3, mg/L	2.7	5.7	10.5
TKN, mg/L	4.3	12.9	42.0
UOD, mg/L	29.9	64.2	117
Temperature, °C	17	23.6	25.6
pH	7.3	7.7	8.3

The UOD concentration is calculated by: UOD (mg/L) = 4.5 * TKN (mg/L) + 1.5 * BOD5 (mg/L). The effluent wastewater temperature was equal to or greater than the maximum permit limit of 21.1 °C (70 °F) for 22.3% of the days in 2002 and 2003.

Solids Inventory. Table 1-3 presents the average mixed liquor suspended solids (MLSS) concentration, solids volume index (SVI), and aerobic solids retention time (SRT) for the three aeration systems. SVI is calculated by dividing the MLSS concentration by the settled sludge volume for each aeration system. SVI values are based on settled sludge volumes after 60 minutes; the standard 30 minute settled sludge volumes were not available.

Table 1-3
Average Solids Summary

Treatment System	*MLSS, mg/L*	*SVI, mL/g*	*SRT, days*
Conventional Aeration Tanks	1,860	95	12.6
Near Oxidation Ditch	1,866	108	27.8
Far Oxidation Ditch	1,490	116	30.4
Average, All Systems	1,729	106	22.4

The SRT for each aeration system was calculated with available MLSS and effluent TSS concentrations and average wasting rates. The SRT is calculated by dividing the mass under air (solids mass in the aeration tank or oxidation ditch) by the sum of the effluent solids load (lb/d) and the aeration solids (MLSS) load (lb/d).

Net Sludge Yield. The average amount of dewatered sludge removed from the facility is 37,000 lb/d (18.5 wet tons/d). The dewatered sludge includes primary sludge and waste activated sludge (WAS) from the three aeration systems. The WAS concentration is approximately twice the concentration of the mixed liquor for each aeration system. With this WAS concentration assumption, the average net sludge yield is 0.52 lb TSS per lb of BOD removed. Table 1-4 presents the average volumes of sludge wasted per day.

Table 1-4
Average Sludge Wasted

Treatment System	*Volume, gpd*
Conventional Aeration Tanks	25,000
Near Oxidation Ditch	20,000
Far Oxidation Ditch	20,000
Total, All Systems	65,000

Power Consumption Summary. Based on the existing equipment at the facility, the load demand of the conventional aeration tanks is 278 kW and it is estimated that they consume 137,500 kWh during maximum month conditions. The monthly power consumption assumes that the aeration blowers and RAS pumps are operating at full power, 24 hours a day. The three blowers (75 hp each), two return activated sludge (RAS) pumps (15 hp each), and three waste activated sludge (WAS) pumps (7.5 hp each) were included in this estimate. Likewise, the load demand of the oxidation ditches is 735 kW and it is estimated that they consume 392,000 kWh during maximum month conditions. The monthly power consumption assumes that the draft tube aerators, aeration blowers, and RAS/WAS pumps are operating at full power, 24 hours a day. The four draft tube aerators (125 hp each), two aeration blowers (100 hp each), and two RAS/WAS pumps (15 hp each) were included in this estimate. Meter readings for individual equipment or processes were not available. The specific power consumption for the facility is 3.56 kWh per thousand gallons (kgal).

EQUIPMENT EVALUATION – MEMBRANE BIOREACTOR

Membrane bioreactors (MBRs) are a variation of the activated sludge process that uses low-pressure size exclusion membranes in place of gravity clarifiers to separate suspended biomass from treated effluent. Two general categories of membranes are used in MBRs – microfiltration (MF) and ultrafiltration (UF). MF membranes are any semi-permeable membrane with pore sizes between 0.1 and 1.0 micrometers (micron, µm) while UF membranes have pore sizes between 0.002 and 0.01 µm. As a result of the small pore sizes, MF membranes act as a nearly complete barrier to the passage of suspended solids, bacteria, and protozoan cysts. Because of their smaller pore sizes, UF membranes are also a barrier to viruses. MF and UF membranes also remove phosphorus and metals in proportion to their content in the solids.

The MBR process is an innovative and rapidly developing technology that offers many potential advantages in comparison to conventional activated sludge treatment processes for wastewater treatment. The major advantages of the MBR system for wastewater treatment are high oxygen utilization, high rate efficiency nutrient removal, small footprint, feed forward control of oxygen demand, modular/retrofit, complete solids removal, and lower sludge production. The major disadvantages of the MBR system for wastewater treatment are membrane fouling, fine screens required, high capital cost, and complex process.

The actual membrane material is the basic building block of the MBR technology and there is a range of commercially available membrane materials and configurations that can be used. The final selection of membrane type and configuration depends on the treatment objective: surface water disposal, irrigation water, plant water, or reuse.

There are two major MBR configurations: external (recirculated) and submerged (integrated). External MBRs use pumps to re-circulate mixed liquor from the aeration tanks through the membranes and back to the aeration tank. The driving force in an external MBR is the pressure differential created by the pumps across the membrane surface. In a submerged membrane, pressure differential is created by gravity or by using pumps to create a vacuum on the permeate (effluent) side of the membrane. First generation submerged MBR designs placed the membranes directly in the aeration tanks. Experience shows that placing the membranes in separate tanks after the aeration tanks can facilitate maintenance. All MBR processes require the use of coarse-bubble aeration under the membranes to scour the membrane surface to reduce fouling. Submerged MBR systems are more economical for large municipal wastewater treatment plants that have limited developable land. The MBR process provides the smallest footprint of any commonly used biological process.

The following submerged MBR manufacturers were evaluated: Aqua-Aerobics Systems/Pall, Enviroquip/Kubota, Ionics/Mitsubishi, USFilter, and Zenon Environmental Systems. A brief description of each system is provided, and Appendix A presents a tabular comparison of the major design features.

Aqua-Aerobics Systems/Pall. The Pall Corporation and Aqua-Aerobics system consists of a bioreactor and a series of phases that promote biological treatment. Separate mixing and aeration devices allow the contents of the reactor to go through alternating aerobic and anoxic periods. Following settling, supernatant from the reactor is transferred from the first barrier to the cloth media filter. Inlet water passes through the 10-μm cloth media. Filtered water is collected in the center tube where it is directed to a supply channel that feeds the external microfiltration membrane system. Flow enters the membrane module where low positive pressure enables the fluid to permeate the membrane, excluding fine particulates down to 0.1 μm in size. Permeate from the membranes is taken directly from the top of the module. The maximum pretreatment fine screen size recommended is 2 mm.

Enviroquip/Kubota. Enviroquip/Kubota's MBR system incorporates flat-plate microfiltration membranes into the process treatment zones to obtain high design flux rates, typically 15 gallons/ft^2/day (gfd). The peak design flux rate can be as high as 35 gfd. The diffuser case houses a coarse-bubble diffuser manifold that distributes air for membrane cleaning. The permeate port at the top of each cartridge is connected to a manifold with a transparent tube. The system can be gravity operated or can use low-suction head permeate pumps to drive the filtration process. The flat-plate membranes can tolerate larger wastewater solids and therefore the maximum pretreatment fine screen size is 3 mm. In addition to the constant coarse-bubbled diffused air to prevent membrane fouling, maintenance cleaning of the membranes is accomplished by relaxing the membranes for one minute during every 10 minutes of operation.

Ionics/Mitsubishi Rayon Corporation. The Ionics/Mitsubishi MBR system uses a biological reaction process with a microfiltration membrane as the final filtration barrier. The system uses hollow fiber membranes in a horizontal configuration and the membranes can be stacked three-high in certain applications. The typical design flux rate is less than 7 gfd and peak flows are accommodated with an equalization tank. Coarse-bubbled diffused air is used to scour the membranes and drive the biological treatment process. A vacuum on the membranes is used to extract the effluent. The maximum pretreatment fine screen size recommended is 2 mm. In lieu of a backwash step, the membranes are allowed to relax for two minutes during every 12 minutes of operation, helping to decrease membrane fouling.

USFilter. The USFilter Immersed MBR system is a single-sludge activated treatment process. The mixing system transports dissolved air and mixed liquor uniformly around and across the microfiltration modules. The membrane modules have been adapted to withstand the rigors of continuous immersion in activated sludge. The typical design flux rate is less than 15 gfd and the peak flux rate can be as high as 30 gfd. The membrane system is placed in an independent tank that draws from aeration tanks. Fluid transfer management is accomplished with a unique "Fluid Renewal System" that provides both fluid transfer, in the form of mixed liquor, and air scour energy, through a two-phase jet. The jet introduces fluid consistently to all membranes in the system by dividing the membrane module into narrow fiber bundles that allow air and fluid to move up and between the individual membrane fibers. This prevents liquid viscosity from increasing and fouling the membrane surface. The maximum pretreatment fine screen size recommended is 2 mm. Membrane maintenance is performed for one minute during every 15 minutes of operation by either backpulsing or relaxing the membranes.

Zenon. Zenon's MBR system (ZeeWeed® 500) draws water through the membrane fibers in an "outside-in" flow path under a slight vacuum. The ZeeWeed® membrane has been approved by the National Sanitation Foundation (NSF) as an ultrafilter and the outside surface is a highly water-permeable polymeric membrane that can remove biological contaminants, particulates, and colloidal species from water. The typical design flux rate is less than 15 gfd and the peak flux rate can be as high as 25 gfd. The ZeeWeed® 500 membrane module consists of hundreds of membrane fibers oriented vertically between two headers. The shell-less hollow fibers are slightly longer than the distance between the top and bottom headers to allow movement when aerated. The air from coarse bubble diffusers moves through the fibers; scouring and removing solids from the membrane surface. Maintenance cleaning is accomplished by backpulsing and relaxing the membranes every hour. Even with air scouring and backpulsing, the system requires the use of a 2 mm fine screen to avoid stringy material from being caught up on the membrane fibers.

EQUIPMENT EVALUATION – FINE SCREEN

Fine screens used in wastewater applications are typically rotary drum screens, static wedge-wire screens, perforated plate screens, step screens, and band screens. The opening widths range in size from 0.2 to 6 mm and cleaning often occurs with brushes or a water spray system. Rotary drum screens are typically made of stainless steel or nonferrous wire mesh screens with 0.25 to 6.35 mm openings. These screens are appropriate for small plants or where headloss is not an issue. Static wedge-wire screens contain small stainless steel wedge-shaped bars, with openings typically 0.25 to 1.5 mm wide. The static screens can have headlosses up to 7 feet and are typically cleaned 1 to 2 times per day with high pressure hot water, steam, or degreaser. Perforated plate screens are typically attached to a drive chain and the screens are rotated so they can be cleaned. The screens are kept clean by rake bars that extend over the full width of the screen in combination with the screen's installation angle. At the upper turning point, the perforated plates are continuously cleaned by a fast rotating brush. Cleaning is supported by an integrated spray bar and the screenings are discharged into a subsequent wash press. Step screens consist of a separation screen made up of movable and fixed step-like lamellae (thin, flat layers). The moveable lamellae execute a self-cleaning rotary motion over the screening surface according to the countercurrent principle. This eliminates the need for cleaning brushes, scrapers or additional flushing mechanisms. The solid matter is retained by the step-like separation screen. Intermittent operation builds up a screenings mat which performs the principal filtration so that smaller solids are held back. A band screen has openings as small as 2 mm and has an endless band of screening panels through which the water passes, from the outside inwards. Debris collected on the mesh panels is raised to deck level and removed by back washing. Main chains, supported by two sprockets above deck, carry the screening band.

HARRIMAN MBR PILOT UNIT

The operating conditions, system characteristics, and experience in New York State were compared for each of the five manufacturers. Of the systems evaluated, Enviroquip/Kubota was the only manufacturer that had a flat-plate membrane system; instead of a hollow fiber system. The flat plate membranes have the largest pore size of the systems evaluated and the system can treat wastewater effectively to meet effluent permits. The larger pore size allows the system to operate by gravity and reduces the fouling frequency. When specifically compared to hollow fiber membranes, flat plates have a reduced cleaning frequency, do not require back flushing, and can operate by gravity; therefore conceivably requiring less energy to operate.

USFilter already has several large MBRs in operation, has established their system in the marketplace, and data is widely available. Zenon has recently been pilot tested in the State and this current project does not aim to reproduce existing research or data. Although the Ionics/Mitsubishi Rayon MBR system has a unique membrane orientation (horizontal) and has not been pilot tested in New York State; it uses hollow fiber membranes. The Ionics/Mitsubishi Rayon, Aqua-Aerobics/Pall, USFilter, and Zenon MBR systems all require pumps to extract the effluent (permeate) from the system; while the Enviroquip/Kubota MBR system can be operated by gravity. There have been no pilot tests of the Enviroquip/Kubota MBR at municipal wastewater treatment plants in New York State. There is currently a pilot test for a treatment plant that is heavily influenced by industrial activity. Due to the limited extent of that study, it does not appear that there will be a significant data set established or an evaluation report that would include an energy analysis. Additionally, the Enviroquip/Kubota MBR system reports a peak flux that translates into a maximum day flow peaking factor of 2.33; highest of the systems evaluated.

Section 2

PILOT UNIT TESTING PROGRAM AND RESULTS

PILOT STUDY OBJECTIVES

The main objective of the pilot study was to gather data that could be used to assess the feasibility, effectiveness, and cost of implementing a MBR treatment system at the HWWTP. Key considerations included the ability of the MBR pilot unit to meet effluent quality standards and assessment of power consumption. In addition, the pilot study documented the performance of the MBR system under varied conditions including cold and wet-weather flow periods. Another goal of the study was to demonstrate the ability of the MBR process to meet expected future permit limits on ammonia and nitrate. Goals for nitrogen removal were set at less than 2.0 mg/L ammonia and less than 8 to 10 mg/L nitrate. The pilot study was conducted at the HWWTP using an Enviroquip/Kubota MBR pilot unit from the fall of 2004 to the spring of 2005.

Current and Future Discharge Permit Limits

Table 2-1 summarizes the facility's current and potential future NPDES permit effluent limits. These limits are anticipated based on permits being issued in New Jersey watersheds that are downstream of the facility, permits being issued in other New York watersheds, and classification of the Ramapo River.

MBR Pilot Unit Description

The pilot unit used consisted of an anoxic zone and an aerobic/MBR zone. The selected flow range was 0 to 15.0 gpm, with an average flow of 6.0 gpm. The recycle flow was approximately 500% of average daily influent flow, pumped from the anoxic zone into the aerobic/MBR zone with a ½-hp submersible pump. The internal recycle flow was also approximately 500% of the average influent flow, gravity-flow from the MBR zone to the anoxic zone. Fine-bubble diffused aeration was used in the aerobic/MBR zone to provide oxygen for the treatment process. A positive displacement blower was used for the fine-bubble aeration and had a capacity of 40 scfm. A ½-hp submersible pump was used for mixing the aerobic/MBR zone.

Location and Influent Flow. The pilot unit was located next to the existing headworks building at the HWWTP. The influent for the pilot unit was pumped by a constant speed pump installed in the headworks channel. Upstream of this location, the wastewater was screened (coarse screens) and degritted (vortex) in the preliminary treatment facility. This influent also included backwash water from the sand filters. A constant-speed pump was installed in the headworks channel. The flow rate through the pilot unit was controlled with a motorized valve on the effluent pipe. The pilot unit operated by gravity (without the use of permeate pumps) for the majority of the study. The pilot unit influent flow was sent through an integral 3-mm fine screen before entering the anoxic zone.

Table 2-1

Current and Future NPDES Permit Effluent Limits

Effluent Characteristic	*Current Effluent Limits*		*Future Effluent Limits*	
	Outfall 001	*Outfall 002*	*Outfall 001*	*Outfall 002*
Flow Monthly Average, mgd	6.0	2.0	**9.0**	2.0
Biological Oxygen Demand - Monthly Average, mg/L	Monitor	5.0	Monitor	5.0
Biological Oxygen Demand - Daily Maximum, mg/L	5.0	Monitor	5.0	Monitor
Ultimate Oxygen Demand - Monthly Average, mg/L	Monitor	Monitor	Monitor	Monitor
Ultimate Oxygen Demand - Daily Maximum, mg/L	50	55	**45**	55
Total Suspended Solids Monthly Average, Jun – Oct, mg/L	Monitor	Monitor	Monitor	Monitor
Total Suspended Solids Monthly Average, Nov – May, mg/L	30	30	**20**	30
Total Suspended Solids 7-day Average, Nov – May, mg/L	45	45	**30**	45
Total Suspended Solids Daily Maximum, Jun – Oct, mg/L	10	10	10	10
Dissolved Oxygen – Maximum Day, mg/L	7.0	7.0	7.0	7.0
Ammonia Nitrogen - Monthly Average June – October, mg/L	1.3	1.1	**1.2**	1.1
Ammonia Nitrogen - Monthly Average November – May, mg/L	2.2	6.8	2.2	6.8
Total Kjeldahl Nitrogen Monthly Average, mg/L	Monitor	Monitor	Monitor	Monitor
Nitrate Monthly Average, mg/L	N/A	N/A	**10**	**10**
Total Phosphorus Monthly Average, mg/L	N/A	N/A	**0.5**	**0.5**
Temperature - Daily Maximum, °C	Monitor	21.1	Monitor	21.1
pH (Average Month, Range)	6.5 – 8.5	6.5 – 8.5	6.5 – 8.5	6.5 – 8.5
Fecal Coliform - 30-day Average, No/100 ml	200	200	200	200
Fecal Coliform - 7-day Average, No/100 ml	400	400	400	400
Total Copper - Daily Maximum, lb/d	1.0	1.0	**1.4**	**1.4**
Total Zinc - Daily Maximum, lb/d	8.4	8.4	**12.0**	**12.0**

Anoxic and Aerobic/MBR Zones. Wastewater entered the anoxic zone from the fine screen that was mounted on top of the pilot unit. The anoxic zone contained two pumps; a ½-hp mixing pump and a ½-hp recycle pump. The mixing pump was required in order to maintain an even distribution of solids in the anoxic zone. Wastewater was pumped via a ½-hp submersible pump into the Aerobic/MBR zone at a constant rate from the anoxic zone. A submerged membrane case in the zone contained 75 flat-plate Kubota membranes with a total surface area of 645 square feet. The nominal porosity of the flat-plate membrane was 0.4 µm with an estimated effective porosity of 0.1 µm. A 40 standard cubic feet per minute (SCFM), 2-hp positive displacement blower was integral to the pilot unit and provided process and scour air.

Effluent Flow. Wastewater passing through the membranes exited the pilot unit through a 2-inch diameter pipe. The effluent was discharged into the HWWTP's headworks channel. The flow rate was controlled by a PLC and was continuously monitored and recorded.

INVESTIGATION PROGRAM

Pilot Unit Start-up

The project began with a start-up period to allow the pilot unit to reach steady-state operating conditions and to finalize operating procedures and sample collection methods. During this time, the pilot unit was seeded with MLSS from the HWWTP sludge hopper. Grab samples from the MBR/aerobic zone were collected and tested for MLSS concentration by the operators during start-up. Once the target MLSS concentration of 8,000 mg/L was reached, activated sludge was wasted daily to maintain the target solids retention time (SRT) of 5 days. The recycle flow rate was approximately 500% of influent flow rate.

MBR Process with Varying SRTs

The average daily flow through the pilot unit was set at 6.0 gallons per minute (gpm), which is an average daily flux through the membranes of 14.7 gallons per square foot per day (gfd). The recycle rate was maintained at approximately 30 gpm. The initial SRT of 5 days was maintained with a waste activated sludge (WAS) rate of approximately 600 gallons per day (gpd). Sludge was wasted each day from the anoxic zone. The SRT was increased by decreasing the WAS rate. The WAS rates associated with the 5, 10, 15, and 20 day SRTs were 600, 260, 222, and 165 gpd, respectively. SRT is calculated from a mass balance of solids in the activated sludge system and is defined by the total mass in the system divided by the mass leaving the system. For each SRT, the system was stressed by increasing the flow rate through the pilot unit for 24 hours at the maximum daily flow rate (12.0 gpm). Additionally, the system was stressed by increasing the flow rate through the pilot unit for six hours at the peak hour flow rate (15.0 gpm).

Disinfected Effluent. Effluent samples were disinfected according to Ten States Standards.

Sludge Dewatering. WAS samples were analyzed for sludge settling and dewatering characteristics. The 30-minute settled sludge volume was measured three times per week. Time-to-filter tests were run on sludge samples from the anoxic tank at the end of the SRT testing periods and maximum day flux events.

Data Recording, Lab Analyses, and QA/QC Procedures

A Pilot Unit Operating Protocol and Safety Plan was prepared to provide guidelines for data collection, parameters to be analyzed, and Quality Analysis/Quality Control (QA/QC) procedures. This section provides an overview of the data collection process.

A daily log sheet was created to standardize collection of operating data. Daily monitoring of process parameters helped to maintain operational stability. Operational parameters recorded on a daily basis included flow rates, visual appearance of the two process zones, temperature, dissolved oxygen, and volume of sludge wasted. A sampling program was developed to monitor system operation and evaluate pilot unit performance as related to the pilot study goals. Influent and effluent composite samples were collected five days per week. Grab samples were collected from the anoxic and MBR/aerobic zones as required. Appendix B presents the parameters analyzed for each zone and the typical collection frequency.

Samples collected as part of the sampling program were processed by a combination of the County laboratory and independent certified laboratories. The results obtained were used to monitor system operation and evaluate pilot unit performance. The County laboratory and operation staff provided support throughout pilot unit operation by performing sample analyses and preparing samples for shipment to the independent laboratories. Samples were sent out each weekday to a certified independent laboratory. Orange County Laboratories (OCL) performed the independent laboratory analyses. The protocol for this project was consistent with recommendations made in the Pilot Unit Operating Protocol and Safety Plan.

PROCESS RESULTS AND TREATMENT PERFORMANCE SUMMARY

Investigations

After the pilot unit was delivered and installation was complete, the start-up period commenced. After one month of start-up, the 5-day solids retention time (SRT) testing began. The subsequent SRT testing (10-, 15-, and 20-day) required, on average, three weeks to build up an appropriate level of solids. Table 2-2 presents the general schedule of SRT testing with the average flow rates.

Table 2-2
General Schedule and Flow Rates

Phase	Start Date	End Date	Average Flow Rate, gpm
Start-up	October 22, 2004	November 22, 2004	3.0
5-day SRT	November 23, 2004	December 1, 2004	5.0
10-day SRT	December 2, 2004	January 31, 2005	5.0
15-day SRT	February 1, 2005	April 4, 2005	5.9
20-day SRT	April 5, 2005	May 14, 2005	5.8
5-day SRT, repeat	May 15, 2005	May 27, 2005	5.8

Start-up and General Operation

The pilot unit was delivered and unloaded at the site on September 22, 2004. Complications with the original influent feed and recycle pumps resulted in the need to acquire new pumps. The new pumps were installed on September 28, 2004. The PLC wiring was also not adequate and changes were made in the field by Enviroquip representatives.

Basic system checks and clean water testing were performed October 18 - 20, 2004. The unit was seeded with approximately 2,000 gallons of 3,000 mg/L of MLSS on October 20, 2004 from the main plant sludge hopper. The start-up period ended on November 22, 2004 when the MLSS concentration reached approximately 7,500 mg/L. This MLSS concentration signified a stabilized system.

The 5-day SRT testing began on November 23, 2004 by wasting 600 gallons per day from the pilot unit. Due to the low MLSS concentration and the short SRT, the pilot unit only operated in this mode for one week. After 5 days, the volume of effluent leaving the pilot unit (by gravity) was severely reduced due to membrane fouling thought to be caused by the "young" microorganisms sticking to the membranes. This fouling result was expected; however, running the unit by gravity expedited the timeframe.

The pilot unit was chemically cleaned on December 1, 2004 at the conclusion of the 5-day SRT test and was then set to build up the MLSS concentration in preparation for the 10-day SRT testing. The MBR unit reached the 10-day SRT MLSS concentration goal of approximately 4,900 mg/L on January 5, 2005. Wasting approximately 280 gallons per day, to maintain this SRT, started on January 6, 2005. Peak hour tests were performed on January 11 and January 13, 2005. The maximum day flux testing was performed on January 26 and January 28, 2005 by raising the effluent flow rate to 12 gpm (and the recycle rate to 50 gpm) for a period of 24 hours. During the second max day flux testing, the high transmembrane pressure (TMP) alarm was reached, signifying that the unit may have become fouled. The flux testing was halted and the flow rates were set at the intermediate conditions (effluent: 3.0 gpm, recycle: 20 gpm) to build up solids for the next SRT test phase.

On February 17, 2005 and February 25, 2005 approximately 1,200 gallons of sludge was transferred from the main plant into the MBR unit, increasing the MLSS concentration to 4,652 mg/L. The MLSS concentration measured on February 28, 2005 was 5,942 mg/L and average day flow testing under the 15-day SRT began on March 2, 2005. Sludge dewatering tests were performed on March 17, 2005. Maximum day flow testing was performed on March 21 and March 23, 2005. Peak hour flow testing was performed on March 29 and March 30, 2005.

On April 7, 2005 approximately 1,500 gallons of main plant sludge was added to the pilot unit to jump-start the MLSS concentration for the 20-day SRT testing. The MLSS concentration measured on April 13, 2005 was 4,259 mg/L and the average day testing under the 20-day SRT commenced on April 14, 2005. Peak hour flow testing was performed on May 3 and May 4, 2005. Maximum day flow testing was performed on May 9 and May 11, 2005. Sludge dewatering tests were performed on May 11, 2005. The 20-day SRT testing was completed on May 15, 2005. Starting on May 16, 2005, an additional 5-day SRT testing was performed for nine days. During this time, the unit began to foul only after the flow rate was raised to 12 gpm (maximum day conditions).

Chemical cleaning was performed twice during the pilot study. Overall, the cleaning procedure was not complicated and the pilot unit seemed to respond as expected (low TMPs and no restriction on gravity effluent flow) at the conclusion of cleaning. The unit could not discharge effluent during the 24 hour cleaning procedure. Due to the duration of the pilot study an evaluation of chemical cleaning frequency could not be made. The manufacturer states that typical cleaning frequency for membranes used in a municipal wastewater installation is every 6 months.

Flow and Flux

The average flow set-point through the pilot unit was 5.7 gpm. In accordance with the manufacturer's recommendation, the pilot unit was in a relax-mode for one minute out of every ten. Since no flow exits the unit during this time, the effective flow rate is lower than the set-point; 4.9 gpm. During the maximum day and peak hour flow tests, the flow rate set-point was increased to 12 and 15 gpm, respectively. The recycle flow rate was, on average, 27 gpm. Flux is defined as the amount of fluid that passes through one unit of effective membrane area. The typical units are gallons per square foot per day (gfd). The recommended maximum flux for the Enviroquip/Kubota pilot unit was 33.5 gfd, which corresponds with a flow rate of 15 gpm and the unit effective membrane area of 645 square feet. The average flux for the entire pilot unit study was 11.8 gfd, with a maximum of 24.1 gfd during the peak hour testing.

Transmembrane Pressure

TMP can be an indication of membrane fouling. A high TMP indicates that either the membranes are fouling or they are being stressed (i.e. peak hour or maximum day flow conditions). As expected, TMP spikes are observed during maximum day and peak hour flux testing. The average recorded TMP for the entire pilot study was 0.55 pounds per square inch (psi). The maximum and minimum observed TMPs were 3.5 and -0.20 psi, respectively, which occurred during the 10-day SRT.

Because the pilot unit was generally operated by gravity, high TMPs were not the first indicator of membrane fouling. Lack of flow in the effluent line was the primary indication of fouling. Ignoring the TMP peaks for maximum day and peak hour testing, there appears to be a slight increasing trend under average day conditions after the last chemical cleaning on January 31, 2005. While it is difficult to extract a TMP rise rate from the pilot data, some conclusions can be inferred. Monitoring TMP over long periods of time in a full-scale facility can lead to a prediction of when chemical cleaning should occur to prevent membrane fouling. Operating at the low SRTs (low MLSS concentrations) increased the fouling potential, so the pilot unit was preemptively cleaned at the beginning of the pilot study. The longest period of time that the pilot operated without chemical cleanings was 116 days (approximately four months from February 1, 2005 to the end of the pilot study on May 27, 2005).

Energy

An energy meter was installed on the pilot unit to monitor the amount of energy used by the entire system. The components monitored, as a group, were the fine screen, blower, influent pump, anoxic zone mixing pump, effluent pump, and control panel. The average power used per day was 88 kilowatt-hours (kWh). The average power used based on flow rate through the pilot unit was 15.6 kWh/gpm. The average power used based on volume treated was 0.011 kWh/gal. The average power used based on the mass of BOD removed (BOD_r) was 9.3 kWh/lb BOD_r. These averages exclude pre-SRT days when the average flow rate through the unit was only 2.7 gpm. This data is excluded because the purpose of the pre-SRT operating scenario was solely to build up the solids in the system and is not representative of actual operating conditions. For a majority of the testing phases, there did not appear to be a correlation between operating SRT and power consumption per gpm or lb BOD_r. Additionally, the air required for scouring the membranes was typically more than the air required for process control. If the influent characteristics were different, energy consumption may have varied to compensate for an influent flow with a higher oxygen demand.

Temperature, Dissolved Oxygen, pH, and Alkalinity

Temperature, dissolved oxygen (DO) concentration, pH, and alkalinity were monitored as basic operational and process parameters. The average Aerobic/MBR tank temperature was 14.3 degrees Celsius (°C), with a low of 10°C. The coldest influent temperatures were observed in March 2005 during the 15-day SRT testing. In most cases, the temperature in the Aerobic/MBR tank was higher than the temperature of the influent or the anoxic tank. The increase is attributed to the impact of aeration air from the positive displacement blower introduced in the aerobic/MBR tank.

The aerobic/MBR tank target DO concentration was 2.0 mg/L and the minimum airflow rate was 35 standard cubic feet per minute (scfm) for scouring the membranes. The target DO concentration in the anoxic tank was less than 0.2 mg/L. The DO in the aerobic/MBR tank was typically well above the target of 2.0 mg/L; however, scouring the membranes was a priority for the membranes and airflow was not decreased. The influent BOD, TKN, and TSS concentrations observed during the pilot study were less than the anticipated concentrations that were used to size the MBR pilot unit. Therefore, the aerobic/MBR tank and associated air supply was too large for the actual influent concentrations and process demands. The average DO concentration in the anoxic zone was 1.2 mg/L, while the aerobic/MBR tank was 8.1 mg/L. Increasing the MLSS concentration for the 20-day SRT resulted in lower DO concentrations in the anoxic tank (average: 0.86 mg/L).

The average influent and effluent pH results for the pilot study were 7.7 and 7.5, respectively. The average influent and effluent alkalinity concentrations for the pilot study were 210 and 101 mg/L, respectively. Table 2-3 presents the average influent and effluent temperature, DO concentration, pH, and alkalinity results for each of the testing phases. Generally, as the SRT was increased the effluent DO concentration decreased. The other parameters were unaffected by the changing SRT.

Total and Volatile Suspended Solids and Total Dissolved Solids

Total and volatile suspended solids (TSS and VSS) concentrations were monitored to evaluate treatment performance. Table 2-4 presents the average influent and effluent solids concentrations.

Table 2-3

Average Temperature, DO Concentration, pH, and Alkalinity

Phase	*Sample*	*Temperature, °C*	*DO, mg/L*	*pH*	*Alkalinity mg/L*
Pilot Study Average	Influent Composite	14.1	4.7	7.7	210
	Effluent Composite	14.7	8.2	7.5	101
5-day SRT	Influent Composite	16.8	2.3	7.5	172
	Effluent Composite	17.8	8.4	7.7	94
10-day SRT	Influent Composite	12.8	6.4	7.7	202
	Effluent Composite	12.3	9.2	7.5	125
15-day SRT	Influent Composite	11.5	6.3	7.7	201
	Effluent Composite	12.5	8.8	7.5	95
20-day SRT	Influent Composite	15.5	2.9	7.7	224
	Effluent Composite	17.1	7.0	7.4	95
5-day SRT, repeat	Influent Composite	17.2	1.9	7.8	237
	Effluent Composite	18.7	5.8	7.4	92

Table 2-4

Average Total and Volatile Suspended Solids Concentrations

Sample	*TSS, mg/L*	*VSS, mg/L*	*% Volatile*
Influent Composite	274	190	76%
Effluent Composite	<4.0	-	-
Percent Removal	*>98%*		

There was no target effluent TSS concentration established for the pilot study. The facility's permitted effluent TSS daily maximum limit is 10 mg/L. The detection limit for the TSS test was 4.0 mg/L and 91% of the samples were below this value during the pilot study. The average effluent TSS concentration presented in Table 2-6 takes the conservative approach of assuming that the actual TSS concentrations were

4.0 mg/L. Reduction of the TSS concentration was achieved for the purpose of the pilot study and was generally unaffected by the different SRTs and flow rates (maximum day and peak hour). The total dissolved solids (TDS) concentration is a direct measure of the organic and inorganic molecules and ions that are present in true solution in water. The average effluent TDS concentration was 777 mg/L. A high TDS concentration (500 to 1,500 mg/L) can inhibit nitrification; however, this did not appear to affect the pilot unit. It is unclear if a correlation between effluent TDS concentrations and SRT exists because TDS samples during the 5- and 10-day SRT phases were not analyzed.

Mixed Liquor Suspended Solids, Settled Sludge Volume, and Solids Volume Index

Mixed liquor suspended solids (MLSS), settled sludge volume (SSV) and solids volume index (SVI) are commonly measured on the contents of biological aeration tanks at wastewater treatment facilities. MLSS concentration was monitored to calculate the operating SRT. The SSV and the SVI were calculated to give some indication of the sludge settling characteristics. Table 2-5 presents the average MLSS concentrations in the anoxic and aerobic/MBR tanks during each SRT testing phase.

Table 2-5

Average MLSS Concentrations

Phase	*Anoxic MLSS, mg/L*	*Aerobic/MBR MLSS, mg/L*
5-day SRT	NM	4,029
10-day SRT	4,103	4,361
15-day SRT	3,429	4,576
20-day SRT	3,838	3,693
5-day SRT, repeat	1,877	2,009

NM: Not measured

Table 2-6 presents the average SSV and SVI for the aerobic/MBR tank for each SRT testing phase.

Table 2-6

Average Aerobic/MBR SSV and SVI

Phase	*SSV, mL/L*	*SVI, mL/g*
5-day SRT	793	202
10-day SRT	963	225
15-day SRT	968	220
20-day SRT	832	230
5-day SRT, repeat	293	146

The SSV values indicate that the 15-day SRT sludge was the hardest to settle (highest SSV value). The SSV value for the 20-day SRT sludge was expected to be higher than the value obtained for the 10- and 15-day SRT sludge samples because typically older sludge is harder to settle. Higher SVI values can be characteristic of poor settling sludge, and can result in higher effluent TSS concentrations in conventional treatment systems (i.e. settling tanks). There was no correlation between SVI and effluent TSS because the membranes consistently remove solids. Process failure is noted when the system is not discharging a constant flow rate (gravity operation) or when the TMP has reached a certain value (pumped operation).

Dewaterability/Filterability

The time-to-filter (TTF) test provides a quantitative measure of how readily sludge releases water. The results can be used to assist in sludge dewatering processes or to evaluate sludge conditioning aids and dosages. Only five TTF tests were completed during the pilot study (once under 15 day, three times under 20 day, and once under 5 day SRT). The average TTF a 200 mL sludge sample from the pilot unit was 22 seconds. The results for the five TTF tests may indicate that under lower SRTs, the sludge takes longer to filter. However, conclusive results of the TTF tests were not possible due to the limited number of completed tests and the variability of the air flow used to filter (therefore affecting the recorded times).

Yield

Yield computations were based on the mass of TSS per mass of BOD removed (BOD_r). The 10-day TSS and BOD_r averages were used to calculate the yield. The average yield for the pilot study was 0.33 lb/lb. These results are not consistent with the main plant historical net yield of 0.8 lb TSS/lb BOD_r, which was assumed during facilities and pilot study planning. However, the pilot unit was a 'young' mixed liquor system and the conditions were constantly changing. The average yields for the four different operating scenarios (5, 10, 15, and 20 day SRT) were 0.66, 0.32, 0.20, and 0.12 lb/lb, respectively. These averages show an overall trend of decreasing yield with increasing SRT; indicating that sludge production would also decrease with increasing SRT. The lower yield values justified re-seeding the pilot unit several times during the study to boost the MLSS concentration to the next desired level.

Biochemical and Chemical Oxygen Demand

The 5-day biochemical oxygen demand (BOD_5) is the most widely used parameter of organic pollution. The BOD_5 test results can be used to determine the approximate quantity of oxygen that will be required to biologically stabilize the organic matter, to determine the size of wastewater treatment facilities, to measure the efficiency of some treatment processes, and to determine compliance with wastewater discharge permits. The chemical oxygen demand (COD) test is also used to measure the content of organic matter of wastewater. The oxygen equivalent of the organic matter that can be oxidized is measured by using a strong chemical oxidizing agent in an acidic medium. The COD of a waste is, in general, higher than the BOD_5 because more compounds can be chemically oxidized than can be biologically oxidized.

COD and BOD_5 concentrations were measured on influent and effluent composite samples. The average influent and effluent COD concentrations were 500 and 21 mg/L, respectively, which indicate that the process was operating sufficiently to remove the COD (95% removal). The average influent and effluent

BOD_5 concentrations were 200 and 3.4 mg/L, respectively, which also indicate that the process was operating sufficiently to remove the BOD_5 (98% removal). The maximum day and peak hour testing did not have a measurable effect on the effluent COD or BOD_5 concentrations, nor did the different SRTs.

Total and Dissolved Organic Carbon

Other means for measuring the organic matter present in water are the total and dissolved organic carbon (TOC and DOC) tests. The TOC and DOC concentrations were analyzed approximately once a week on the effluent composite samples. The average effluent TOC and DOC concentrations were 6.1 and 5.5 mg/L, respectively. These averages indicate that the majority (90%) of the organic carbon in the effluent was dissolved and therefore not associated with the solids. Maximum day and peak hour flux testing did not affect the effluent TOC and DOC concentrations. These results were expected due to the solids removal efficiency of the membranes.

Nitrogen

Nitrogen removal was important throughout the pilot study. Elements in nitrogen are essential to the growth of protista and plants. The control of algal growths in receiving waters is necessary to protect beneficial uses (i.e. recreational, drinking water sources, etc.). Total nitrogen is comprised of organic nitrogen, ammonia, nitrite, and nitrate. TKN is the sum of the ammonia (NH_3-N) and organic nitrogen. The average influent TKN concentration was 28 mg/L and the average effluent concentration was 2.5 mg/L; resulting in an average removal of 93%. Only a minimal amount of TKN breakthrough was observed during the 20-day SRT maximum day flux testing. The concentration of NH_3-N in the effluent was typically below the effluent permit level goal of 1.1 mg/L. The majority of the influent nitrogen was NH_3-N and organic nitrogen. Table 2-7 presents the average influent and effluent TKN and ammonia concentrations for the different testing phases of the pilot study. Also presented are the percent removal efficiencies.

Table 2-7

Average TKN and Ammonia Concentrations

Phase	*Sample*	*TKN, mg/L*	*Ammonia, mg/L*
Pilot Study Average	Influent Composite	28	18
	Effluent Composite	2.5	1.1
	Percent Removal	*>87%*	*>90%*
5-day SRT	Influent Composite	42	15
	Effluent Composite	<1.0	<1.0
	Percent Removal	*>98%*	*>93%*
10-day SRT	Influent Composite	28	17
	Effluent Composite	1.1	1.1
	Percent Removal	*96%*	*94%*
15-day SRT	Influent Composite	27	16
	Effluent Composite	1.2	<1.0
	Percent Removal	*96%*	*>94%*
20-day SRT	Influent Composite	29	20
	Effluent Composite	1.3	1.2
	Percent Removal	*95%*	*94%*
5-day SRT, repeat	Influent Composite	50	28
	Effluent Composite	1.1	<1.0
	Percent Removal	*98%*	*>97%*

The target DO concentration in the anoxic zone was between zero and 0.2 mg/L because the presence of DO inhibits the enzyme system needed for denitrification. Denitrification was not attained during the pilot study because of high DO concentrations in the anoxic zone (average 1.2 mg/L). Scour air required in the aerobic/MBR zone (to help prevent the membranes from fouling) was higher than the air required for the nitrification process. Therefore, a significant amount of air was transferred to the anoxic zone via the recycle flow. The average DO concentration in the aerobic/MBR zone was 8.1 mg/L. Typically, a DO concentration of 2.0 mg/L is desired for an aerobic zone designed for nitrification. Table 2-8 presents the average influent, aerobic/MBR, anoxic, and effluent nitrate and nitrite concentrations during the entire pilot study period. The average results presented are very typical of each of the SRT testing results.

Table 2-8

Average Nitrate, Nitrite, and Total Nitrogen Concentrations

Sample	*Nitrate, mg/L*	*Nitrite, mg/L*	*Total Nitrogen, mg/L*
Influent Composite	0.21	0.09	18.1
Aerobic/MBR	3.35	0.19	14.1
Anoxic	1.60	0.20	14.0
Effluent Composite	11.3	0.20	12.7
Percent Removal	-	-	*29.8%*

Total nitrogen was calculated by adding the concentrations of TKN, NO_3-N and nitrite (NO_2-N). The average concentration of total nitrogen in the effluent composite samples was 12.7 mg/L and the majority of the nitrogen in the effluent was NO_3-N. Denitrification in the anoxic zone could have reduced the TN concentration significantly.

Phosphorus

Phosphorus is essential to the growth of algae and other biological organisms. The usual forms of phosphorus found in aqueous solutions include orthophosphate, polyphosphate, and organic phosphate. Total phosphorus (TP) and orthophosphate (OP) was measured on the influent and effluent composite samples. The average influent and effluent TP concentrations were 5.8 and 1.7 mg/L as P, respectively which is an average removal efficiency of 68%. The average influent and effluent OP concentrations were 2.5 and 1.4 mg/L as P, respectively which is an average removal efficiency of 35%. Table 2-9 presents the average TP and OP concentrations along with percent removal. There was no phosphorus effluent goal for the pilot study and no correlation appears to exist between phosphorus removal and SRT.

Phosphorus removal was primarily attributed to the low concentration of solids in the effluent and not biological uptake of phosphorus. Enhanced phosphorus removal requires an anaerobic zone in front of the anoxic zone as well as an internal recycle to promote the luxury uptake of phosphorus.

Ultimate Oxygen Demand

The average effluent UOD concentration for the pilot study was 8.2 mg/L. Like the TKN and BOD_5 concentrations, there does not appear to be a correlation between UOD concentration and SRT. Similarly, UOD concentration was generally unaffected by increased fluxes.

Table 2-9

Average Phosphorus Concentrations

Phase	*Sample*	*Total Phosphorus, mg/L as P*	*Orthophosphate, mg/L as P*
Pilot Study Average	Influent Composite	5.8	2.4
	Effluent Composite	1.7	1.4
	Percent Removal	*68%*	*35%*
5-day SRT	Influent Composite	5.7	1.3
	Effluent Composite	1.8	1.5
	Percent Removal	*57%*	*-20%*
10-day SRT	Influent Composite	5.6	2.2
	Effluent Composite	1.3	1.2
	Percent Removal	*76%*	*38%*
15-day SRT	Influent Composite	5.9	1.9
	Effluent Composite	1.6	1.2
	Percent Removal	*70%*	*40%*
20-day SRT	Influent Composite	5.3	2.9
	Effluent Composite	1.6	1.6
	Percent Removal	*70%*	*47%*
5-day SRT, repeat	Influent Composite	9.8	4.9
	Effluent Composite	1.7	1.4
	Percent Removal	*78%*	*56%*

Calcium, Magnesium and Silica

Table 2-10 presents the average influent and effluent calcium and magnesium concentrations. Significant removal of calcium or magnesium was not expected by the pilot unit. Some removal was noticed and could be attributed to either scale formation on the membranes or possibly biological uptake.

Table 2-10

Average Calcium and Magnesium Concentrations

Sample	*Calcium, mg/L*	*Magnesium, mg/L*
Influent Composite	65.8	14.1
Effluent Composite	57.4	13.3
Percent Removals	*5.8%*	*9.0%*

The average silica concentration in the aerobic/MBR zone was 134 mg/L and there was no increasing trend noticed. An increasing trend in silica concentration would have indicated a build up on the membranes.

Fecal and Total Coliform, *Giardia lamblia* and *Cryptosporidium parvum*

Pathogenic organisms found in wastewater may be discharged by humans who are infected with or carriers of a particular disease. The actual number of pathogenic organisms present in wastes and polluted waters are few and difficult to isolate and identify. The Coliform organism is commonly used as an indicator organism when testing water because it is more numerous and more easily tested for. The presence of Coliform organisms is taken as an indication that pathogenic organisms may also be present and the absence of Coliform organisms is taken as an indication that the water is free from disease-producing organisms. Concentrations of fecal and total Coliform results are presented as the "most probable number" per 100 mL (MPN/100 mL). The MPN is not the absolute concentration of organisms that are present but only a statistical estimate of that concentration. Table 2-11 presents the average influent, effluent and disinfected effluent fecal and total Coliform results for the entire pilot study. Disinfection of the effluent samples reduced the fecal and total Coliform counts below detection (5 and 20 MPN/100 mL, respectively).

Table 2-11

Average Fecal and Total Coliform Values

Sample	***Fecal Coliform, MPN/100 mL***	***Total Coliform, MPN/100 mL***
Influent Composite	38,212	420,783
Effluent Composite	38	130
Percent Removals	*99.8%*	*99.9%*
Log Removal	*2-log*	*3-log*
Disinfected Effluent Grab	5	20
Percent Removals	*~100%*	*~100%*

Fecal and total Coliform results during most of the maximum day and peak hour flux testing indicated some breakthrough of Coliform. The highest MPN observed was during a peak hour test: 217 MPN/100 mL. However, it appears that the MBR pilot unit would still meet the fecal Coliform permit limits: 7-day average of 200 MPN/100 mL and 30-day average of 400 MPN/100 mL.

The average influent *Cryptosporidium parvum* and *Giardia lamblia* values were 32 and 554 oocysts/1,000 mL, respectively. *Giardia lamblia* cysts have an average size of 8.8 μm by 12.3 μm and *Cryptosporidium parvum* oocysts have an average diameter of 5 μm. The nominal porosity of the membranes was 0.4 μm so it was expected that no cysts or oocysts would be present in the effluent samples. All effluent samples that were analyzed for *Cryptosporidium parvum* and *Giardia lamblia* were below the detection limits.

Treatment Performance Summary

Overall, the operation of the pilot unit was successful and generally the process performed as expected. The average day flux recommended by the manufacturer (14.7 gfd) was shown to be maintainable by gravity throughout the pilot study. To ensure the desired maximum day and peak hour fluxes, the unit was operated in the pressure mode during these tests. The major factors that influence the flux during gravity operation are hydraulic head available in the system and membrane fouling. Approximately two feet of head was required for gravity operation at the average flux. It is estimated that more than four feet of head was required for gravity operation at the peak hour flux.

The system provided good nitrification capabilities, indicated by the low ammonia (NH_3-N) concentrations in the effluent. Attaining denitrification in the anoxic zone would have lowered the effluent nitrate concentration below the goal of 8 to 10 mg/L. Denitrification was not achieved due to the high DO concentration in the anoxic zone. Because the amount of air required for scouring the membranes can be higher than what is required for process treatment, full scale design may need to incorporate a DO depletion zone. RAS from the membrane zone to the DO depletion zone would precede the anoxic zone.

Like BOD and COD, phosphorus removal was primarily dependent on the amount of solids physically removed by the membranes. The total phosphorus and orthophosphate effluent concentrations were similar throughout the pilot study. Biological phosphorus uptake in the system would have resulted in significantly lower total phosphorus and orthophosphate concentrations in the effluent. Future phosphorus effluent permit limits could be met by incorporating a chemical precipitation processes. The TSS concentration in the effluent composite samples was always below the current permit limit of 10 mg/L. As expected, sludge settling variations and issues within the anoxic or aerobic/MBR zones did not affect the effluent quality of the MBR pilot system.

The effects of maximum day and peak hour flow variations on the pilot unit effluent were minimal. Only small increases in fecal Coliform, total Coliform, and nitrogen were observed. The effluent results indicated that the pilot unit would meet the permit limits. The pilot unit was not operated during the summer months so the expected summer ammonia concentration was not confirmed. However, based on the results during the winter months, it is expected that a system with properly sized zones would meet the effluent limits.

Section 3

MODELING

This section presents the results of computer modeling that was used to compare two conceptual designs for the Phase II expansion of the HWWTP.

MODEL DESCRIPTION

The computer program, BioWin™ can solve a set of process model equations for activated sludge, anaerobic digestion, settling, pH, chemical precipitation, and gas transfer acting upon a uniform set of state variables. The complete model incorporates 45 state variables and 58 processes. With this "one model" approach, it is not required to transfer one model's output into another model's input through model interfaces. This significantly reduces the complexity of building full facility models consisting of many different process units within the computer program.

Influent Characteristics

Actual influent wastewater characteristics were used for all of the models developed. Sampling during the pilot study provided supplemental data to the influent variables that the OCDEFS regularly monitors. The influent COD concentration was monitored throughout the pilot study. This parameter was used as the basis for organic material fractions in the BioWin™ influent setup. The advantage of selecting COD as the parameter for quantifying the "strength" of organic material in the influent, as opposed to BOD or TOC, is that it provides a consistent basis for description of the activated sludge process.

BioWin™ requires input for several influent concentrations including: inorganic suspended solids (ISS), COD, TKN, nitrate, TP, magnesium, calcium and alkalinity. The data collected during the pilot study was used for the simulations. Average month concentrations and loads as well as maximum month and day loads were calculated from the pilot study data. In order for the peaking factors to be representative for the entire facility, the daily influent flow rate reported by OCDEFS was used. Table 3-1 presents the maximum month and maximum day peaking factors.

BioWin™ Parameters

Table 3-2 presents the BioWin™ default influent wastewater fractions used to specify the fractional composition of a typical municipal wastewater. Typically, these fractions are not altered unless significant data exists for recalculation. Since the major goal of this evaluation is to compare wastewater process alternatives, the majority of the fractions were not changed. Ammonia removal is a very important design criterion because of the facility's relatively low permit limits. Specifying the appropriate amount of ammonia in the influent wastewater affects the effluent model predictions as well as the size and operation of the process treatment tanks. The default influent fraction for ammonia with respect to total Kjeldahl nitrogen (TKN) is 0.66 (Fna). During the pilot study, influent wastewater ammonia and TKN concentrations were measured at least once a week.

Table 3-1

Influent Load Peaking Factors

Parameter	*Maximum Month*	*Maximum Day*
Total Suspended Solids (TSS)	1.81	2.81
Volatile Suspended Solids (VSS)	2.05	2.25
Inorganic Suspended Solids (ISS)	1.91	2.93
Chemical Oxygen Demand (COD)	1.37	1.95
Total Kjeldahl Nitrogen (TKN)	2.35	3.32
Nitrate (NO_3)	1.22	2.43
Total Phosphorus (TP)	1.74	3.62
Magnesium (Mg)	1.14	1.16
Calcium (Ca)	1.18	1.34
Dissolved Oxygen (DO)	1.39	2.00
Alkalinity (Alk)	1.03	1.11
Biochemical Oxygen Demand (BOD)	1.09	1.67
Ammonia (NH_3)	1.41	2.51

Table 3-2

BioWin™ Default Influent Wastewater Fractions

Fraction	*BioWin™ Symbol*	*BioWin™ Default Fraction*
Readily biodegradable (including Acetate), gCOD/g total COD	Fbs	0.16
Acetate, gCOD/g readily biodegradable COD	Fac	0.15
Non-colloidal biodegradable, gCOD/g slowly degradable COD	Fxsp	0.75
Unbiodegradable soluble, gCOD/g total COD	Fus	0.05
Unbiodegradable particulate, gCOD/g total COD	Fup	0.13
Ammonia, gNH_3-N/gTKN	Fna	0.66
Particulate organic nitrogen, gN/g Organic N	Fnox	0.50
Soluble unbiodegradable TKN, gN/gTKN	Fnus	0.02
Nitrogen:COD ratio for unbiodegradable part. COD, gN/gCOD	FupN	0.035
Phosphate, gPO4-P/gTP	Fpo4	0.50
Phosphorus:COD ratio, gP/gCOD	FupP	0.011
Non-poly-Phosphorus heterotrophs, gCOD/g total COD	FZbh	1.00E-04
Anoxic methanol utilizers, gCOD/g total COD	FZbm	1.00E-04
Autotrophs, gCOD/g total COD	FZba	1.00E-04
Poly-phosphorus heterotrophic organisms, gCOD/g total COD	FZbp	1.00E-04
Propionic acetogens, gCOD/g total COD	FZbpa	1.00E-04
Acetoclastic methanogens, gCOD/g total COD	FZbam	1.00E-04
H_2-utilizing methanogens, gCOD/g total COD	FZbhm	1.00E-04

The BioWin™ default fraction of 0.66 is twice the fraction calculated from the pilot study data for the maximum month and day conditions. Using the default fraction for these two conditions would result in twice the ammonia concentration in the model influent. In turn, this affects the predicted effluent ammonia concentrations as well as tank sizing for the proposed facility expansions. Therefore, the calculated Fna fractions of 0.29 and 0.32 for maximum month and day, respectively, were used for the simulations.

Model Scenarios

Four scenarios were simulated using BioWin™ for this evaluation:

- Model 1: Existing 4.5-mgd Facility (Trains 1 and 2)
- Model 2: Phase I 6.0-mgd Upgraded Facility (Trains 1, 2 and 3)
- Model 3: Phase II MBR Expanded Facility (Train 1 MBR Expansion, Existing Trains 2 and 3)
- Model 4: Phase II Step-Feed Treatment Expanded Facility (Train 1 Conventional Expansion, Existing Trains 2 and 3)

Both MBR and conventional treatment expansion scenarios are possible for a future Phase II expansion. The MBR scenario (Model 3) provides additional wastewater treatment capacity through the retrofit of the existing oxidation ditch tanks with an MBR process. The increased capacity estimate resulting from a MBR expansion was then used to evaluate the same capacity increase with conventional treatment (Model 4). The models were set-up using existing or conceptual tank dimensions. Several steady-state simulations were performed for each scenario including average month, maximum month, and maximum day conditions as well as influent temperature variations. Figures 3-1 through 3-4, at the end of this section, present the BioWin™ configurations.

MODEL RESULTS

Model 1: Existing 4.5-mgd Facility

Performance of the existing facility was simulated to show that the model results reasonably match the historical effluent concentrations. Treatment trains 1 and 2 were configured within the model with actual tank dimensions, approximate flow split ratios, recycle rates, wasting rates, and solids removal efficiencies. Figure 3-1 presents the Model 1 configuration. The existing facility (Trains 1 and 2) that has a capacity rating of 4.5 mgd was simulated for average month, maximum month, and maximum day influent conditions. Table 3-3 presents the steady-state influent characteristics as well as the source of each value. Model 1 assumed that: 44% of the design average day influent flow (2.0 mgd) is conveyed to the conventional activated sludge (CAS) system (Train 2), sand filter backwash is directed to the head of the facility, and side stream flows from the sludge thickeners and belt filter presses are directed to the Train 2 aeration tank.

Table 3-3
BioWin^{TM} Steady-State Model 1 and 2 Influent Characteristics

Parameter	Average Month	Maximum Month	Maximum Day	Source
Flow, mgd	4.7	7.1	13.4	2002-2004 Plant Data
Total Suspended Solids, lb/d	10,106	18,308	28,389	Pilot Study
Volatile Suspended Solids, lb/d	8,049	16,527	18,080	Pilot Study
Inorganic Suspended Solids, lb/d	2,528	4,818	7,416	Calculated
Chemical Oxygen Demand, lb/d	19,396	26,563	37,913	Pilot Study
Total Kjeldahl Nitrogen, lb/d	1,140	2,682	3,779	Pilot Study
Nitrate, lb/d	8.1	9.8	19.6	Pilot Study
Total Phosphorus, lb/d	227	395	820	Pilot Study
Magnesium, lb/d	541	614	627	Pilot Study
Calcium, lb/d	2,602	3,057	3,489	Pilot Study
Dissolved Oxygen, lb/d	188	261	376	Pilot Study
pH	7.7	8	8.6	Pilot Study
Alkalinity, lb/d	8,107	8,805	13,533	Pilot Study
Biological Oxygen Demand, lb/d	7,462	10,513	18,765	Pilot Study
Ammonia, lb/d	707	776	1,205	Pilot Study

The following assumptions were used for Oxidation Ditch system (Train 1): the return activated sludge (RAS) rate was 2.0 mgd (based on the capacity of the existing sludge pumps, per OCDEFS, which is 100% of the average capacity of Train 1) and the MLSS concentration was approximately 1,800 mg/L during average month and 2,400 mg/L during maximum month conditions. The following assumptions were used for CAS system (Train 2): the RAS rate was approximately 50% of the flow rate to the treatment train (based on typical RAS rates for conventional aeration treatment systems) and the MLSS concentration was approximately 1,800 mg/L during average month and 2,900 mg/L during maximum month conditions.

The waste activated sludge (WAS) rate from each of the treatment systems was estimated based on the desired MLSS concentrations listed above. The WAS rate is correlated to either the MLSS or final clarifier underflow suspended solids concentrations in an activated sludge system. For all simulations, the WAS rates required to achieve the target MLSS concentrations remained the same: 0.11 mgd from the oxidation ditches (WAS1) and 0.06 mgd from the CAS system (WAS2). These values are reasonable considering the reported average and maximum month dewatered sludge flow rates: 0.12 and 0.15 mgd, respectively. The model simulations were performed with influent wastewater temperatures of 12.5 and 16.9 degrees Celsius (°C). The lower temperature was chosen because it is less than the minimum recorded influent wastewater temperature (based on 2002 – 2004 data) of 15 °C.

Table 3-4 presents the model predicted and the actual plant data effluent concentrations, under steady state average month, maximum month, and maximum day conditions. The facility only monitors effluent TSS, ammonia, TKN, BOD, temperature, and pH on a regular basis. Final settling tank (FST) and sand filter performance, in terms of percent removal, were used to help correlate the model response to effluent data. The solids removal percentages for Train 1 FSTs and Train 2 FSTs were 99 and 98 percent, respectively, for all conditions. The solids removal percentage for the sand filters was 80 percent.

Generally, the steady state model effluent output was in agreement with actual effluent concentrations. Perfect correlation between model output and actual effluent data is generally unlikely since even complex mathematical models of the activated sludge process are gross simplifications of real systems. For the purpose of comparing process treatment scenarios, the results from Model 1 indicate that the model is performing adequately. Appendix C presents summary tables for each of the Model 1 simulations.

Model 2: Phase I Upgraded 6.0-mgd Facility

Building on Model 1, the treatment train currently being constructed at the HWWTP was added in BioWin™ (Train 3). Figure 3-2 presents the Model 2 configuration. Design dimensions from the Contract Drawings and/or design report were used. An even flow split between all three trains was applied. The results of this model are an estimate of what can be expected from the Phase I upgraded facility. The Phase I upgraded facility (Trains 1, 2 and 3) was simulated for average, design, and maximum month and maximum day influent conditions. Table 3-3 presented the steady-state influent characteristics. For the design month, an influent flow rate of 6.0 mgd was used along with average month concentrations. Model 2 assumed the following: approximately 33% of the influent flow is conveyed to each of the three treatment trains, sand filter backwash from Trains 1 and 2 is directed to the head of the facility, backwash from Train 3 is directed to the Train 3 primary settling tanks, and sidestream flows from the thickeners and belt filter presses are directed to the Train 3 primary settling tanks.

The following assumptions were used for Oxidation Ditch System (Train 1): the RAS rate was 2.0 mgd and the MLSS concentration was approximately 1,800 mg/L during average month and 2,400 mg/L during maximum month conditions. The following assumptions were used for CAS system (Train 2): the RAS rate was approximately 50% of the flow rate to the treatment train and the MLSS concentration was approximately 1,900 mg/L during average month and 2,300 mg/L during maximum month conditions. The following assumptions were used for CAS system (Train 3): the RAS rate was approximately 60% of the flow rate to the train and the internal recycle (IR) rate was set equal to the average design influent flow.

The WAS rate from each of the treatment systems was estimated based on reasonable MLSS concentrations. For all simulations, the WAS rates required to achieve the target MLSS concentrations remained the same: 0.11 mgd from the oxidation ditches (WAS1) and 0.04 mgd from each of the CAS systems (WAS2 and WAS3). The model simulations were performed with influent wastewater temperatures of 12.5 and 16.9 °C. The strictest permit limits to attain from a process standpoint, are the summertime and wintertime ammonia concentrations of 1.1 and 2.2 mg/L, respectively.

Table 3-5 presents the results of the Model 2 simulations performed with an influent wastewater temperature of 16.9 °C. Results include the effluent model concentrations under steady state average, design, and maximum month, and maximum day conditions. Additionally, the permit limits are also presented. The effluent concentrations presented represent the combined effluent from all process treatment trains – predicting what will be discharged from the facility at the completion of the Phase I upgrade. The simulations predict that under current average month conditions, the upgraded facility will meet permit limits. If the facility was to experience maximum month concentrations, the effluent ammonia concentration may rise above the permit limit of 1.1 mg/L. This is primarily due to the fact that the model is predicting that Train 2 does not have enough aeration capacity with respect to ammonia removal under maximum month and maximum day conditions. The existing facility data does not list individual treatment train effluent concentrations; however, the combined effluent ammonia concentration does rise above the permit limit during extreme flow events. Appendix D presents the summary information for Model 2.

Table 3-4

Model 1: Existing 4.5-mgd Facility Steady State Effluent Characteristics – Average Month, Maximum Month, and Maximum Day Conditions

	Average Month			*Maximum Month*			*Maximum Day*			
	Model	*Data* (1)	*% Difference*	*Model*	*Data* (2)	*% Difference*	*Model*	*Data* (3)	*% Difference*	*Permit* (4)
Total Suspended Solids, mg/L	10.7	9.2	15.9%	12.4	25.1	-50.7%	10.4	59	-82.4%	30 (5)
Volatile Suspended Solids, mg/L	7.3			7.8			6.6			NA
Ammonia, mg/L	2.9	2.6	10.0%	4.4	5.7	-22.3%	6.1	10.5	-42.1%	1.1 (6)
Total Kjeldahl Nitrogen, mg/L	5.4	4.3	25.3%	8.6	12.9	-33.3%	10.1	42	-76.0%	Monitor
Nitrate, mg/L	10.0			21.5			11.8			NA
Total Nitrogen, mg/L	15.4			30.1			21.9			NA
Magnesium, mg/L	13.8			10.4			5.6			NA
Calcium, mg/L	66.4			51.6			31.2			NA
Biological Oxygen Demand, mg/L	5.2	7.2	-28.2%	5.7	16.3	-64.8%	5.9	40.4	-85.5%	Monitor
Chemical Oxygen Demand, mg/L	37.8			36.4			29.7			NA
Total Phosphorus, mg/L	1.8			2.7			3.8			NA
Orthophosphate, mg/L	1.6			2.5			3.6			NA
Temperature, deg C	16.9	16.9		16.9			16.9			21.1
Alkalinity, mg/L	123			46			65			NA
pH	6.9	7.3	-5.2%	6.5	7.5	-13.1%	6.7	8.3	-19.4%	6.5 – 8.5 (7)
Inorganic suspended solids, mg/L	3.0			4.1			3.4			NA
Ultimate Oxygen Demand, mg/L	32.0	28.3	43.1%	47.3	64.2	-26.3%	54.2	116.7	-53.5%	50 (8)
Dissolved Oxygen, mg/L	1.9			1.9			1.9			7.0 (9)

Notes:
(1) Actual average month effluent data based on 2002 – 2004 average month values.
(2) Actual maximum month effluent data based on 2002 – 2004 maximum month values.
(3) Actual maximum day effluent data based on 2002 - 2004 maximum day values.
(4) Based on existing permit limits for the facility.
(5) Average month concentration to Outfall 001 or 002 from November through May.
(6) Average month concentration to Outfall 002 from June through October.
(7) Average month range.
(8) Daily maximum concentration to Outfall 001.
(9) Daily maximum concentration.

Table 3-5

Model 2: Phase I Upgraded 6.0-mgd Facility Steady State Effluent Characteristics – Average Month, Design Month, Maximum Month, and Maximum Day Conditions

	Average Month	*Design Month*	*Maximum Month*	*Maximum Day*	*Permit* [(1)]
Total Suspended Solids, mg/L	9.4	10.1	11.1	9.5	30 [(2)]
Volatile Suspended Solids, mg/L	6.4	6.9	7.0	6.0	NA
Ammonia, mg/L	0.75	0.81	1.3	2.5	1.1 [(3)]
Total Kjeldahl Nitrogen, mg/L	3.1	3.3	4.9	6.0	Monitor
Nitrate, mg/L	11.8	11.4	23.1	14.7	NA
Total Nitrogen, mg/L	14.9	14.6	28.0	20.6	NA
Magnesium, mg/L	13.8	13.8	10.4	5.6	NA
Calcium, mg/L	66.4	66.4	51.6	31.2	NA
Biological Oxygen Demand, mg/L	4.1	4.5	4.7	4.6	Monitor
Chemical Oxygen Demand, mg/L	35.9	36.7	34.6	27.8	NA
Total Phosphorus, mg/L	2.1	2.0	3.0	3.9	NA
Orthophosphate, mg/L	1.9	1.8	2.8	3.7	NA
Temperature, deg C	16.9	16.9	16.9	16.9	21.1
Alkalinity, mg/L	110	112	29	42	NA
pH	6.7	6.8	6.2	6.4	6.5 – 8.5 [(4)]
Inorganic suspended solids, mg/L	2.6	2.7	3.7	3.1	NA
Ultimate Oxygen Demand, mg/L	20.3	21.5	29.2	33.7	50 [(5)]
Dissolved Oxygen, mg/L	2.0	2.0	2.0	2.0	7.0 [(6)]

Notes:
(1) Based on existing permit limits for the facility.
(2) Average month concentration to Outfall 001 or 002 from November through May.
(3) Average month concentration to Outfall 002 from June through October.
(4) Average month range.
(5) Daily maximum concentration to Outfall 001.
(6) Daily maximum concentration.

Model 3: Phase II Expanded Facility - MBR

To replace the oxidation ditch treatment train with a MBR system, BioWin™ was used to estimate the potential capacity increase and simulate the effluent characteristics. Building on Model 2, the oxidation ditch treatment train (Train 1) was replaced with a MBR treatment train. Figure 3-3 presents the Model 3 configuration. A dissolved oxygen (DO) depletion zone, anoxic zone, aeration zone, and membrane zone were incorporated into the footprint of the existing oxidation ditches. The volume required for membranes was based on the Enviroquip/Kubota membrane cassettes and space requirements along with the actual dimensions of the oxidation ditches. A DO depletion zone was added so that the DO concentration in the MBR zone did not affect the denitrification capability of the anoxic zone. The Phase II MBR expanded facility was simulated for average month, maximum month, and maximum day influent conditions. The simulations were used to estimate the potential capacity increase and to predict the effluent characteristics if the oxidation ditch system was replaced with a MBR system.

Treatment Capacity Increase. Based on conceptual use of the oxidation ditch volume and dimensions, calculations were performed to estimate the capacity of a MBR system. Volumes for DO depletion and anoxic zones were considered as well as separate membrane zones to keep the membranes isolated from the process aeration zone. Characteristics and sizes of the Enviroquip/Kubota membrane cartridges were also incorporated. Figure 3-5, at the end of this section, presents a layout of the existing oxidation ditches. Placing membranes in Zone 4 of both ditches gives a membrane capacity (average day) of 5.0 mgd.

The volume of the DO depletion, anoxic, and aeration zones were manipulated in the model simulations to determine if the process zones could be configured to produce an effluent quality that meets or exceeds preliminary future permit limits. Model effluent goals of the MBR treatment system included an ammonia concentration of less than 0.5 mg/L, a nitrate (NO_3) concentration of less than 10 mg/L, a BOD concentration of 5.0 mg/L, and a TSS concentration of approximately 4.0 mg/L with an influent wastewater temperature of 12.5 °C. Because the model does not have a membrane function, the TSS concentration goal was set at the maximum detection limit. This allowed a certain amount of TSS in the effluent that is presumably higher than actual conditions; creating conservative effluent predictions. Effluent quality was evaluated and wasting rates were manipulated for different MBR solids retention time (SRT) simulations.

The proposed conceptual volumes for the MBR treatment zones are: 0.8 million gallons (mgal) Anoxic, 0.65 mgal Aerobic, 0.80 mgal Membranes, and 0.20 mgal DO Depletion. The configuration of the existing oxidation ditches was considered when estimating the volumes and the layout of the process zones is further explained in Section 4. The total volume available for the MBR system in the oxidation ditches would be 2.45 million gallons (not including the secondary clarifiers or decant tank). Further discussion of how the secondary clarifier area may be incorporated into the MBR treatment train is presented in Section 4. The Phase II MBR facility was simulated under average month, maximum month, and maximum day influent conditions. Table 3-6 presents the steady-state influent characteristics used for Phase II models.

Table 3-6
BioWin^{TM} Steady-State Models 3 and 4 (Phase II) Influent Characteristics

Parameter	Average Month	Maximum Month	Maximum Day	Source
Flow, mgd	9	13.6	18	N/A
Total Suspended Solids, lb/d	19,351	35,058	54,362	Pilot Study
Volatile Suspended Solids, lb/d	15,412	31,648	34,621	Pilot Study
Inorganic Suspended Solids, lb/d	4,840	9,225	14,201	Calculated
Chemical Oxygen Demand, lb/d	37,142	50,866	72,599	Pilot Study
Total Kjeldahl Nitrogen, lb/d	2,182	5,135	7,236	Pilot Study
Nitrate, lb/d	15.4	18.8	37.6	Pilot Study
Total Phosphorus, lb/d	434	757	1,571	Pilot Study
Magnesium, lb/d	1,036	1,176	1,201	Pilot Study
Calcium, lb/d	4,982	5,855	6,680	Pilot Study
Dissolved Oxygen, lb/d	360	499	721	Pilot Study
pH	7.7	8	8.6	Pilot Study
Alkalinity, lb/d	15,525	16,862	25,914	Pilot Study
Biological Oxygen Demand, lb/d	14,289	20,131	35,933	Pilot Study
Ammonia, lb/d	1,353	1,486	2,308	Pilot Study

The influent concentrations used for Models 3 and 4 are the not the same as concentrations used for Models 1 and 2 because they are based on the load peaking factors. Using load peaking factors to establish influent wastewater parameter concentrations is a more accurate approach to estimating future conditions at the facility. The average month influent flow includes 5.0 mgd to the MBR treatment train (Train 1) and 2.0 mgd to each of the remaining existing treatment trains (Trains 2 and 3). The maximum month influent flow rate of 13.6 mgd is based on the existing maximum month peaking factor of 1.51 (2002 – 2004 operating data). The maximum day influent flow rate includes the maximum day flow of 10.0 mgd to the MBR treatment train and 4.0 mgd to each of the two remaining existing treatment trains (total of 18 mgd).

The following flow split assumptions were used for Model 3 simulations. The MBR treatment train receives approximately 55% of the influent flow and Trains 2 and 3 each receive 50% of the remaining influent flow. For average day conditions, this flow split maintains the design influent flow rates of 2.0 mgd to Trains 2 and 3. Sand filter backwash flow from Train 2 is directed to the head of the facility and backwash flow from Train 3 is directed to the Train 3 primary settling tanks. Sidestream flows from the thickeners and belt filter presses are directed to the Train 1. The following assumptions were used for the MBR System (Train 1): the RAS rate was 300% of the MBR influent flow and the MLSS concentration was varied based on the solids retention time (SRT) evaluations. The following assumptions were used for the CAS system (Train 2): the RAS rate was approximately 50% of the flow rate to the treatment train and the MLSS concentration was approximately 3,000 mg/L during average month conditions. Additionally, an anoxic zone was added to Train 2. The anoxic zone volume was approximately 0.1 million gallons and was sized so that the train could provide an effluent with lower nitrate concentrations. Without this modification, the combined effluent would not meet the nitrate effluent goal (10 mg/L) because Trains 1 and 2 can only decrease the nitrate concentration so low under maximum month conditions. Implementation of this new zone is discussed in Section 4. The same modification is required for the step-feed process. The following assumptions were used for the CAS system (Train 3): the RAS3 rate was approximately 100% of the flow rate to the train and the IR rate was set equal to the average design influent flow of 2.0 mgd.

MBR Solids Retention Time (SRT). Predicted effluent quality was evaluated during BioWin™ simulations for different MBR aerobic solids retention times (SRTs). The steady state model was used to generate effluent results for five different SRTs – 5, 10, 15, 20, and 30 days. Simulations were completed for average month, maximum month, and maximum day conditions.

The primary parameters used to select the operating SRT were the effluent ammonia and nitrate concentrations. The anoxic zone and aeration zone sizes and the return sludge (RAS) flow rate were modified to produce an effluent with a nitrate concentration less than 10 mg/L during the maximum month condition. Furthermore, the MBR process operation was based on meeting the strictest ammonia effluent concentration (1.1 mg/L to Outfall 002 from June through October) during maximum month conditions at the design temperature of 12.5 °C. The current minimum temperature during the months of June through

October (based on 2002 – 2004 operating data) is 15 °C. Using a design temperature of 12.5 °C gives a temperature safety factor of 1.2.

Figure 3-6, at the end of this section, presents the MBR treatment train and combined effluent ammonia concentration results for the different SRT operating scenarios. Figure 3-6 indicates that the effluent ammonia permit limit could be met with a MBR system SRT as low as 10 days; however, designing for a SRT between 10 and 15 days provides a safety factor for potential process upsets and changing influent characteristics. Figure 3-6 can be interpreted to have a point of diminishing returns for ammonia concentration at a SRT of approximately 12 days. Additionally, pilot study results indicated that the MBR should be operated with a MLSS of at least 6,000 mg/L to prevent sticky sludge from fouling the membranes. The MBR manufacturer recommends that the system be operated with a MLSS concentration of at least 8,000 mg/L. With a recycle rate of 300%, the 15 day SRT operating scenario has an average month MLSS concentration of about 9,600 mg/L.

Expected Effluent Characteristics. Table 3-7 presents the model predicted effluent concentrations under average month, maximum month, and maximum day conditions for each of the three treatment trains. This table shows that the MBR (Train 1) produces the highest quality effluent. This is due to the optimization of the zone sizes as well as the membranes ability to remove solids.

Table 3-8 presents the model predicted effluent concentrations under steady state average month, maximum month, and maximum day conditions for the MBR expanded facility. Additionally, the preliminary future permit limits are also presented. The simulations were performed with an influent wastewater temperature of 12.5 °C and a MBR operating aerobic SRT of 15 days (MLSS concentration of approximately 9,600 mg/L). These simulations predict that under average month and maximum month expanded facility design conditions, the Phase II MBR facility is expected to meet the future preliminary permit limits even with an influent wastewater temperature of 12.5 °C. Influent wastewater temperature increases will help reduce the effluent ammonia concentration in all cases.

Alum may be used to chemically precipitate phosphorus to meet the future preliminary permit limit of 0.5 mg/L. Table 3-7 shows the predicted phosphorus concentration for each of the treatment trains without chemical addition. These concentrations were used to determine the amount of alum required to meet the phosphorus permit limit. Alum will be added to each train as follows: Train 1 at the MBR/aeration tank, Train 2 at the sand filters, and Train 3 at the sand filters. The amount of alum added to the MBR (Train 1) is based on the predicted phosphorus concentration that will not be removed by the membranes. The amount of alum added to Trains 2 and 3 is based on the predicted phosphorus concentration exiting the FSTs (and therefore entering the sand filters). New sand filters are not expected to be required for this option. The sand filters that currently serve the oxidation ditches will be reallocated for the Train 2 and/or Train 3 aeration systems. An analysis of the loading rates and the effect of alum on the filters will be required during the design process. Appendix E presents the simulation results for Model 3.

Table 3-7

Model 3: Phase II Expanded Facility (MBR)
Individual Treatment Train Steady State Effluent Characteristics
Average Month, Maximum Month, and Maximum Day Conditions

	Average Month	*Maximum Month*	*Maximum Day*
Temperature, °C	12.5	12.5	12.5
Train 1 Influent Flow, mgd	5.0	7.5	10.0
Train 2 Influent Flow, mgd	2.0	3.10	4.0
Train 3 Influent Flow, mgd	2.0	3.10	4.0
	Train 1 (MBR, 15 day SRT) - Effluent		
Total Suspended Solids, mg/L	1.9	3.0	4.6
Ammonia, mg/L	0.26	0.28	0.3
Nitrate, mg/L	3.9	8.0	8.7
Nitrite, mg/L	0.0	0.0	0.0
Total Kjeldahl Nitrogen, mg/L	2.1	2.8	2.9
Total Nitrogen, mg/L	6.0	10.8	11.6
Biological Oxygen Demand, mg/L	1.3	1.3	1.6
Total Phosphorus, mg/L (1)	0.3	3.0	6.0
Alkalinity, mg/L	133.0	77.0	88.0
Ultimate Oxygen Demand, mg/L	11.3	14.5	15.3
	Train 2 - Effluent		
Total Suspended Solids, mg/L	7.3	8.2	7.5
Ammonia, mg/L	2.4	3.2	5.8
Nitrate, mg/L	4.4	9.2	10.2
Nitrite, mg/L	0.0	0.0	0.0
Total Kjeldahl Nitrogen, mg/L	4.5	6.6	9.1
Total Nitrogen, mg/L	8.9	15.8	19.2
Biological Oxygen Demand, mg/L	4.0	4.2	4.0
Total Phosphorus, mg/L (1)	0.6	2.3	2.7
Alkalinity, mg/L	141.0	86.0	107.0
Ultimate Oxygen Demand, mg/L	26.3	35.9	46.9
	Train 3 - Effluent		
Total Suspended Solids, mg/L	3.1	4.4	4.3
Ammonia, mg/L	0.81	1.00	1.1
Nitrate, mg/L	5.2	13.3	14.1
Nitrite, mg/L	0.0	0.0	0.0
Total Kjeldahl Nitrogen, mg/L	2.7	4.0	4.1
Total Nitrogen, mg/L	7.9	17.3	18.3
Biological Oxygen Demand, mg/L	2.0	2.3	2.4
Total Phosphorus, mg/L (1)	1.7	2.8	5.1
Alkalinity, mg/L	132.0	63.0	76.0
Ultimate Oxygen Demand, mg/L	15.3	21.3	22.1

Notes:
(1) Total Phosphorus concentration does not account for chemical precipitation using alum. Chemical removal will decrease the effluent TP concentration to 0.5 mg/L to meet the expected permit limit.

Table 3-8

Model 3: Phase II Expanded Facility (MBR)
Combined Effluent Steady State Characteristics
Average Month, Maximum Month, and Maximum Day Conditions

	Average Month	*Maximum Month*	*Maximum Day*	
MBR SRT, days	15	15	15	
Temperature, deg C	12.5	12.5	12.5	
Flow to Train 1 (MBR), mgd	5.0	7.5	10	
Flow to Train 2, mgd	2.0	3.05	4.0	
Flow to Train 3, mgd	2.0	3.05	4.0	
Total Influent Flow, mgd	9.0	13.6	18.0	
Total Effluent Flow, mgd	8.88	13.48	17.90	
Sludge, mgd	0.12	0.12	0.10	
	Combined Effluent			*Permit* (1)
Total Suspended Solids, mg/L	3.0	4.3	5.0	10 (2)
Volatile Suspended Solids, mg/L	2.0	2.6	2.8	NA
Ammonia, mg/L	0.73	0.97	1.5	1.1 (3)
Total Kjeldahl Nitrogen, mg/L	2.6	3.8	4.3	Monitor
Nitrate, mg/L	4.4	9.6	10.4	10 (4)
Nitrite, mg/L	0.0	0.0	0.0	NA
Total Nitrogen, mg/L	7.0	13.4	14.7	NA
Magnesium, mg/L	13.3	10.2	7.6	NA
Calcium, mg/L	65.9	51.6	44.4	NA
Biological Oxygen Demand, mg/L	1.9	2.1	2.2	5 (5)
Chemical Oxygen Demand, mg/L	31.8	28.3	31.0	NA
Total Phosphorus, mg/L (6)	0.7	2.8	5.2	0.5 (7)
Orthophosphate, mg/L	0.7	2.7	5.0	NA
Alkalinity, mg/L	134.0	74.5	88.0	NA
pH	6.8	6.5	6.6	6.5 – 8.5 (8)
Inorganic Suspended Solids, mg/L (9)	1.0	1.7	2.2	NA
Ultimate Oxygen Demand, mg/L	14.6	20.0	22.8	50 (10)
Dissolved Oxygen, mg/L	5.5	4.7	4.0	7.0 (11)

Notes:

(1) Based on preliminary permit limits for the Phase II expanded facility (average day flow = 9.0 mgd).
(2) Maximum day concentration from June through October.
(3) Average month concentration to Outfall 002 from June through October.
(4) The preliminary future average month nitrate limit for the facility.
(5) Maximum day concentration to Outfall 001 from June through October.
(6) Total Phosphorus concentration does not account for chemical precipitation using alum. Chemical removal will decrease the effluent TP concentration to 0.5 mg/L to meet the expected permit limit.
(7) Average month concentration to either Outfall.
(8) Average month range to either Outfall.
(9) ISS = TSS - VSS.
(10) UOD = 1.5 * BOD + 4.5 * TKN. Daily maximum concentration to Outfall 001.
(11) Daily maximum concentration to either Outfall.

Model 4: Phase II Expanded Facility – Conventional Treatment

A step-feed biological nutrient removal (BNR) activated sludge process was simulated with BioWin™ as the conventional treatment scenario to expand the facility. Step-feed is a modification of the conventional activated sludge process in which influent wastewater is introduced at several points in the aeration tank to equalize the food to mass (F/M) ratio; thereby lowering the peak oxygen demand. Generally, three or more addition points are used. Flexibility of operation is one of the important features of this process. Anoxic zones provide denitrification capability. Figure 3-4 presents the Model 4 configuration. This is similar to Train 3 (Phase I upgrade) in terms of biological treatment capabilities; however, step-feed systems require a smaller aeration volume in exchange for more complex operations. Building on Model 2, the oxidation ditch treatment train was replaced with a step-feed treatment train. This train consists of a series of four anoxic and aerobic treatment zones within the existing oxidation treatment tanks. This setup requires final settling tanks and sand filters. For comparison purposes, the capacity of this system was based on the results of modeling the MBR treatment train (Model 3).

Expected Capacity and Preliminary Sizing. One of the goals of this evaluation was to compare a conventional treatment process with that of the MBR system. In order to complete this comparison, the capacity of the conventional treatment system was set equal to the MBR system capacity determined by Model 3 (5.0 mgd). Therefore, the Phase II step-feed BNR treatment facility was also simulated in BioWin™ for average month, maximum month, and maximum day influent conditions. Table 3-6 presented the steady-state influent characteristics used for the Phase II models.

The system was simulated to produce similar effluent results as the MBR system. Similar ammonia and nitrate removal were the primary comparison parameters. Matching the solids removal percentage between the MBR and the CAS system is not realistic because the CAS system is limited by the final settling tanks (FSTs) and sand filters. The solids removal in the CAS system is still acceptable for the facility since the average month permitted effluent TSS concentration is 20 mg/L. In order to meet the preliminary future permit limits and maintain the same expanded flow rate as the MBR system for comparison purposes, the step-feed system requires larger treatment zones (0.80 mgal Anoxic, 3.58 Aerobic) than the MBR treatment train. Additionally, the step-feed system requires additional FSTs.

In the step-feed scenario, the aeration volume alone exceeds the available capacity in the existing oxidation ditches. The following flow split assumptions were used for Model 4 simulations: the step-feed treatment train receives approximately 55% of the influent flow and Trains 2 and 3 each receive 50% of the remaining influent flow. For average day conditions, this flow split maintains the design influent flow rates of 2.0 mgd each to Trains 2 and 3. Sand filter backwash flows from Trains 1 and 2 are directed to the head of the facility. Backwash flow from Train 3 is directed to the Train 3 primary settling tanks. Sidestream flows from the thickeners and belt filter presses are directed to the Train 3 primary settling tanks.

The following assumptions were used for the Step-Feed System (Train 1): approximately 33% of the step-feed influent flow was directed to aeration zones 2, 3, and 4, the RAS rate was approximately 50% of the step-feed influent flow, returned to anoxic zone 1, the approximate MLSS concentrations for aeration zones 1, 2, 3, and 4 were 13,000 mg/L, 7,900 mg/L, 5,600 mg/L, and 4,400 mg/L, respectively. The following assumptions were used for the CAS system (Train 2): the RAS rate was approximately 100% of the flow rate to the treatment train and the MLSS concentration was approximately 3,300 mg/L during average month conditions. Additionally an anoxic zone was added to this treatment train. The anoxic zone volume was approximately 0.1 million gallons and was sized so that the train could provide an effluent with lower nitrate concentrations. Without this modification, the combined effluent would not meet the nitrate effluent goal (10 mg/L) because Trains 1 and 2 can only decrease the nitrate concentration so low under maximum month conditions. The same modification is required for the MBR process. The following assumptions were used for the CAS system (Train 3): RAS rate was approximately 100% of the flow rate to the train and the IR rate was set equal to the average design influent flow of 2.0 mgd.

Expected Effluent Characteristics. Table 3-9 presents the predicted effluent concentrations under average month, maximum month, and maximum day conditions for each of the three treatment trains. Table 3-9 shows that the step-feed (Train 1) produces an effluent with similar characteristics as the Train 3 effluent. The predicted effluent characteristics of Trains 2 and 3 in this model are not identical to the predicted effluent characteristics in Model 3 (MBR system) because the side stream flows are directed differently.

Table 3-10 presents the model predicted effluent concentrations, under steady state average month, maximum month, and maximum day conditions for the step-feed expanded facility with an influent wastewater temperature of 12.5 °C. Additionally, the preliminary future permit limits are also presented. The effluent values presented represent the combined effluent from all three process treatment trains. The step-feed facility operation was based on meeting the strictest ammonia effluent concentration (1.1 mg/L to Outfall 002 during June through October) during average month conditions at the design temperature (12.5 °C). The current minimum temperature during the months of June through October (based on 2002 – 2004 operating data) is 15 °C. Using a design temperature of 12.5 °C gives a temperature safety factor of 1.2.

The model results indicate that under maximum month influent conditions, the conventional facility is expected to meet permit limits even with an influent wastewater temperature of 12.5 °C. However, the ammonia permit condition only applies during the months of June through October – months that would most likely not see an influent temperature below 15 °C based on 2002 – 2004 operating data. The predicted average month effluent ammonia concentration at the current average temperature of 16.9 °C is 0.64 mg/L. Alum may be used to chemically precipitate phosphorus to meet the future preliminary permit limit of 0.5 mg/L. Table 3-9 shows the predicted phosphorus concentration for each of the treatment trains without chemical addition. These concentrations were used to determine the amount of alum required to meet the phosphorus permit limit. Appendix F presents the simulation results for Model 4.

Table 3-9
Model 4: Phase II Expanded Facility (Step-Feed)
Individual Treatment Train Steady State Effluent Characteristics
Average Month, Maximum Month, and Maximum Day Conditions

	Average Month	***Maximum Month***	***Maximum Day***
Temperature, °C	12.5	12.5	12.5
Train 1 Influent Flow, mgd	5.0	7.5	10.0
Train 2 Influent Flow, mgd	2.0	3.05	4.0
Train 3 Influent Flow, mgd	2.0	3.05	4.0
	Train 1 (Step-Feed) - Effluent		
Total Suspended Solids, mg/L	3.0	5.4	15.0
Ammonia, mg/L	0.63	0.69	0.7
Nitrate, mg/L	2.1	6.8	8.4
Nitrite, mg/L	0.0	0.0	0.0
Total Kjeldahl Nitrogen, mg/L	2.5	3.4	3.9
Total Nitrogen, mg/L	4.6	10.2	12.2
Biological Oxygen Demand, mg/L	1.5	1.7	2.9
Total Phosphorus, mg/L (1)	0.6	4.0	7.6
Alkalinity, mg/L	140.5	82.5	90.5
Ultimate Oxygen Demand, mg/L	13.4	17.9	21.8
	Train 2 - Effluent		
Total Suspended Solids, mg/L	7.4	8.7	10.7
Ammonia, mg/L	1.99	2.85	5.2
Nitrate, mg/L	4.4	9.8	11.0
Nitrite, mg/L	0.0	0.0	0.0
Total Kjeldahl Nitrogen, mg/L	4.2	6.2	8.7
Total Nitrogen, mg/L	8.5	16.0	19.7
Biological Oxygen Demand, mg/L	3.9	4.1	5.0
Total Phosphorus, mg/L (1)	0.5	2.2	2.6
Alkalinity, mg/L	139.5	82.0	101.5
Ultimate Oxygen Demand, mg/L	24.5	34.2	46.4
	Train 3 - Effluent		
Total Suspended Solids, mg/L	4.2	5.2	6.5
Ammonia, mg/L	0.60	0.77	0.9
Nitrate, mg/L	5.9	13.4	14.3
Nitrite, mg/L	0.0	0.0	0.0
Total Kjeldahl Nitrogen, mg/L	2.5	3.7	3.9
Total Nitrogen, mg/L	8.4	17.0	18.2
Biological Oxygen Demand, mg/L	2.0	2.3	2.7
Total Phosphorus, mg/L (1)	1.6	3.0	5.4
Alkalinity, mg/L	128.5	61.5	74.0
Ultimate Oxygen Demand, mg/L	14.4	20.0	21.6

Notes:

(1) Total Phosphorus concentration does not account for chemical precipitation using alum. Chemical removal will decrease the effluent TP concentration to 0.5 mg/L to meet the expected permit limit.

Table 3-10
Model 4: Phase II Expanded Facility (Step-Feed)
Combined Effluent Steady State Characteristics
Average Month, Maximum Month, and Maximum Day Conditions

	Average Month	*Maximum Month*	*Maximum Day*	
Temperature, deg C	12.5	12.5	12.5	
Flow to Train 1 (Step-Feed), mgd	5.0	7.5	10.0	
Flow to Train 2, mgd	2.0	3.05	4.0	
Flow to Train 3, mgd	2.0	3.05	4.0	
Total Influent Flow, mgd	9.0	13.6	18.0	
Total Effluent Flow, mgd	8.87	13.46	17.87	
Sludge, mgd	0.13	0.14	0.13	
	Combined Effluent			*Permit* (1)
Total Suspended Solids, mg/L	4.0	5.9	12.3	10 (2)
Volatile Suspended Solids, mg/L	2.5	3.4	6.5	NA
Ammonia, mg/L	0.8	1.1	1.6	1.1 (3)
Total Kjeldahl Nitrogen, mg/L	2.7	4.0	4.8	Monitor
Nitrate, mg/L	3.3	8.8	10.2	10 (4)
Nitrite, mg/L	0.0	0.0	0.0	NA
Total Nitrogen, mg/L	6.1	12.8	15.0	NA
Magnesium, mg/L	13.3	10.3	7.8	NA
Calcium, mg/L	65.9	51.6	44.5	NA
Biological Oxygen Demand, mg/L	2.0	2.3	3.3	5 (5)
Chemical Oxygen Demand, mg/L	33.2	29.2	35.9	NA
Total Phosphorus, mg/L (6)	0.8	3.5	6.2	0.5 (7)
Orthophosphate, mg/L	0.7	3.4	5.9	NA
Alkalinity, mg/L	137.5	77.5	89.0	NA
pH	6.7	6.5	6.5	6.5 – 8.5 (8)
Inorganic Suspended Solids, mg/L (9)	1.4	2.5	5.7	NA
Ultimate Oxygen Demand, mg/L	15.3	21.2	26.4	50 (10)
Dissolved Oxygen, mg/L	2.0	2.0	2.0	7.0 (11)

Notes:

(1) Based on preliminary permit limits for the Phase II expanded facility (average day flow = 9.0 mgd).
(2) Maximum day concentration from June through October.
(3) Average month concentration to Outfall 002 from June through October.
(4) The preliminary future average month nitrate limit for the facility.
(5) Maximum day concentration to Outfall 001 from June through October.
(6) Total Phosphorus concentration does not account for chemical precipitation using alum. Chemical removal will decrease the effluent TP concentration to 0.5 mg/L to meet the expected permit limit.
(7) Average month concentration to either Outfall.
(8) Average month range to either Outfall.
(9) ISS = TSS - VSS.
(10) UOD = 1.5 * BOD + 4.5 * TKN. Daily maximum concentration to Outfall 001.
(11) Daily maximum concentration to either Outfall.

Summary

The results of simulating the existing 4.5-mgd facility (Model 1) and the Phase I upgraded 6.0-mgd facility (Model 2) indicated that the BioWin™ models were configured appropriately to perform a conceptual process design comparison. For Model 1, the simulations provided effluent predictions that reasonably matched the existing facility's historical plant data. The effluent predictions from Model 2 indicated that the new Phase I upgraded facility will operate in a manner to meet the existing permit limits.

The results of simulating the Phase II expansion options (Model 3 and 4) provided general process configurations, tank sizes, and process parameters such as recycle rates. Model 3 was used to determine the expanded treatment capacity if a MBR system were to be installed within the existing oxidation ditches. Effluent quality predictions indicated that the 5.0 mgd MBR system along with an alum addition system for phosphorus removal would allow the facility to meet the preliminary future permit limits. The results of Model 4 simulations provided estimates of the tank sizes required if 5.0 mgd were to be treated with the step-feed BNR activated sludge system along with an alum addition system for phosphorus removal. The simulations indicated that this conventional system would not fit within the existing oxidation ditch volume and that additional secondary clarifier and sand filter capacity would also be required.

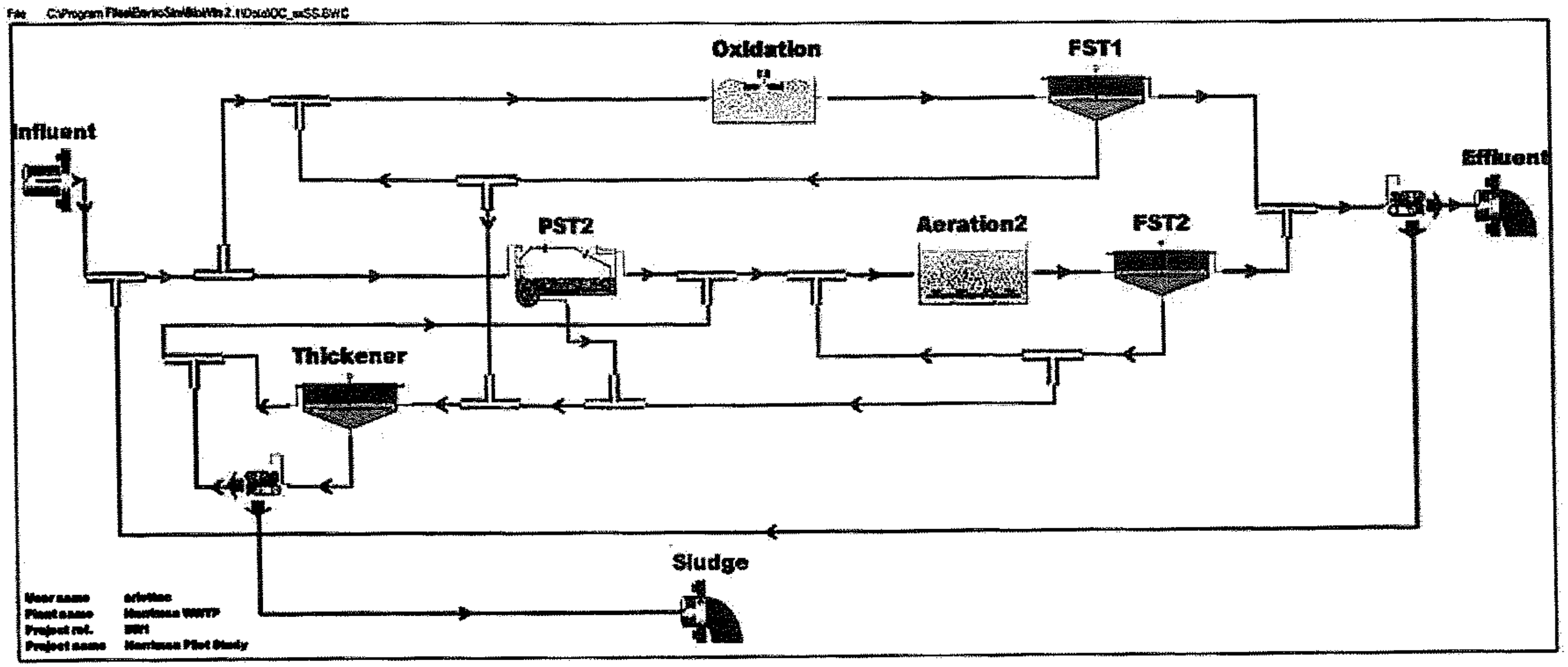

Figure 3-1
BioWin^{TM} Existing 4.5-mgd Facility Model Configuration

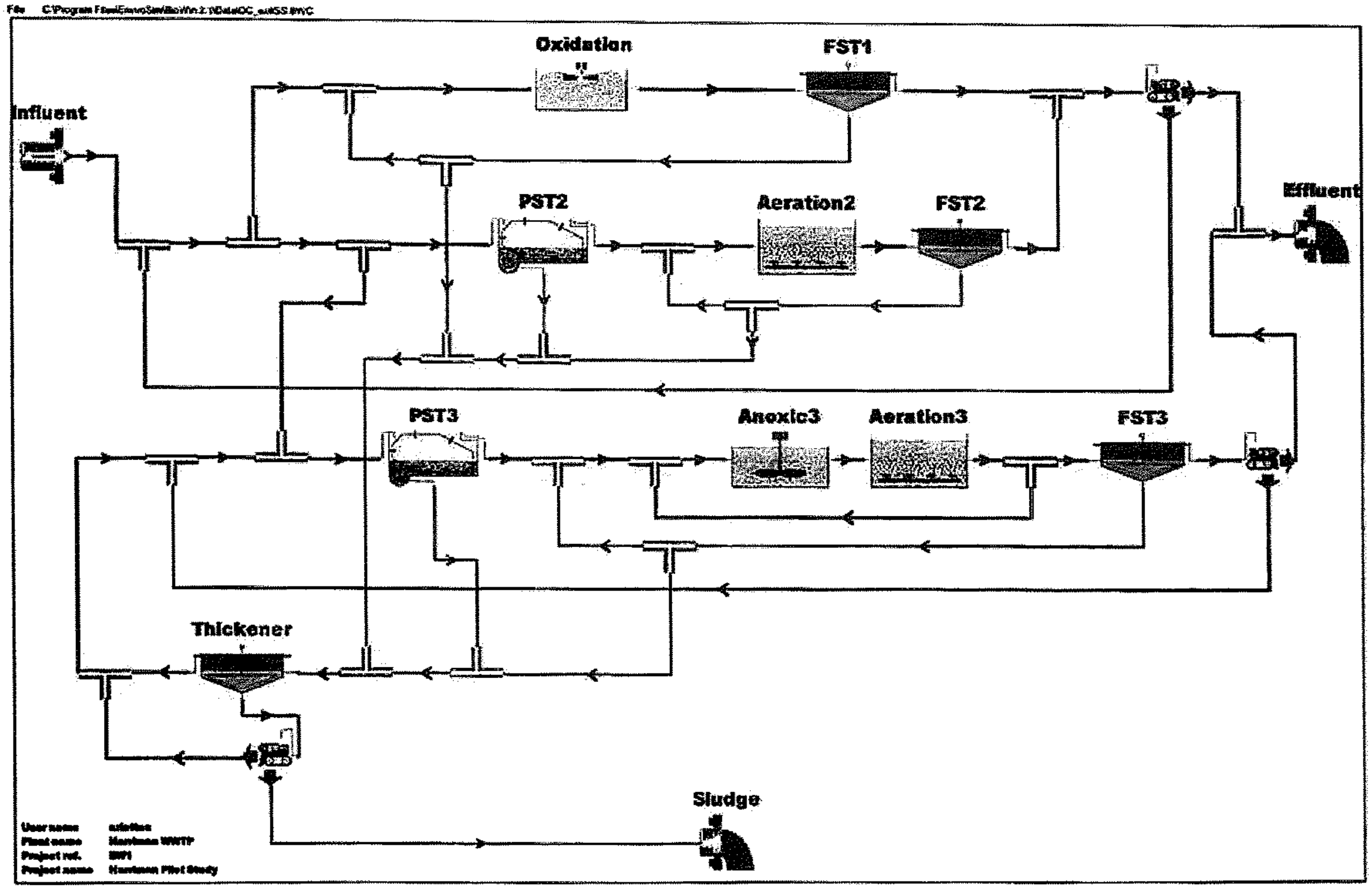

Figure 3-2
BioWin™ Phase I Upgraded 6.0-mgd Facility Model Configuration

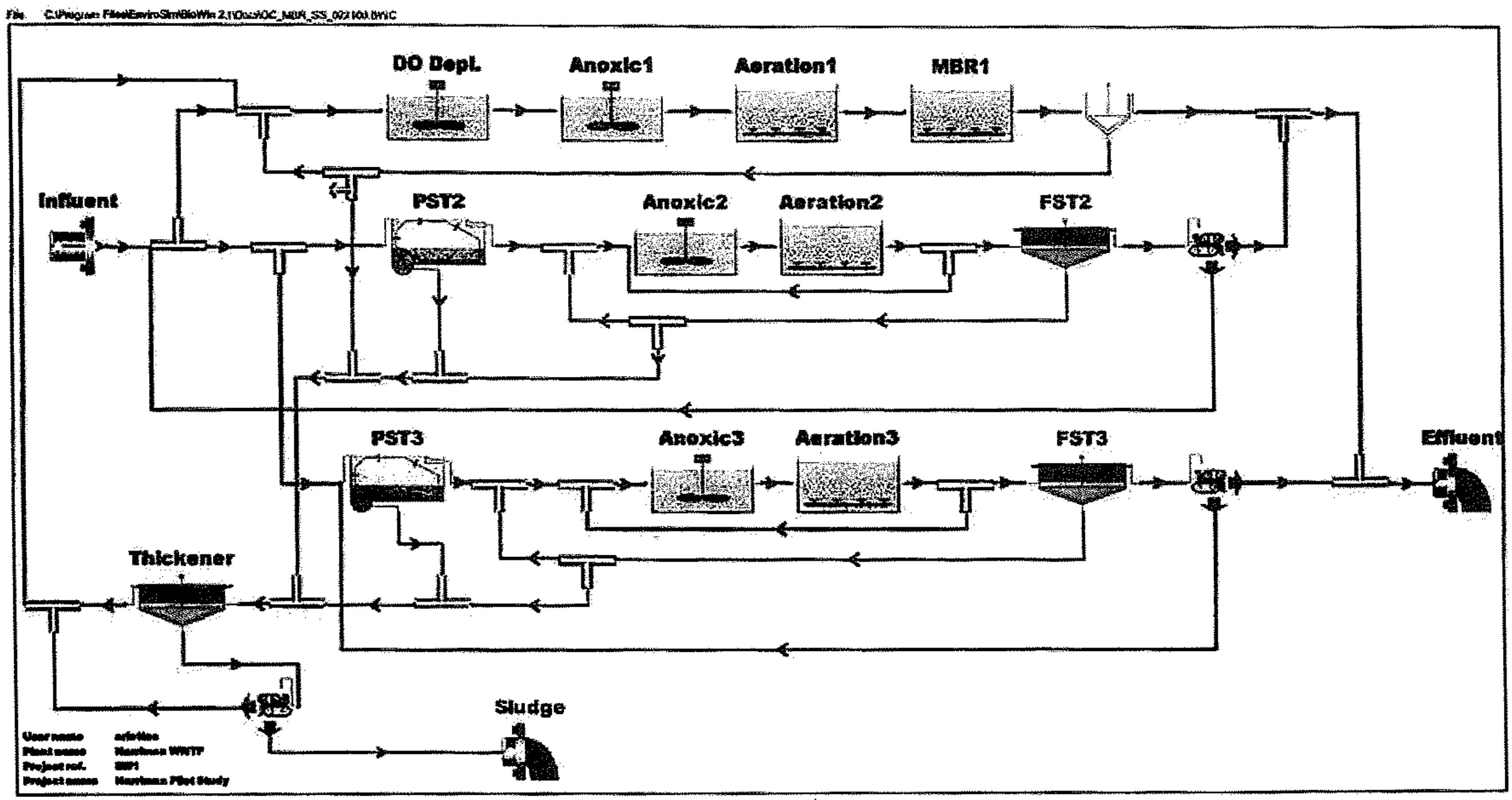

Figure 3-3
BioWin^{TM} Phase II Expanded Facility – MBR Model Configuration

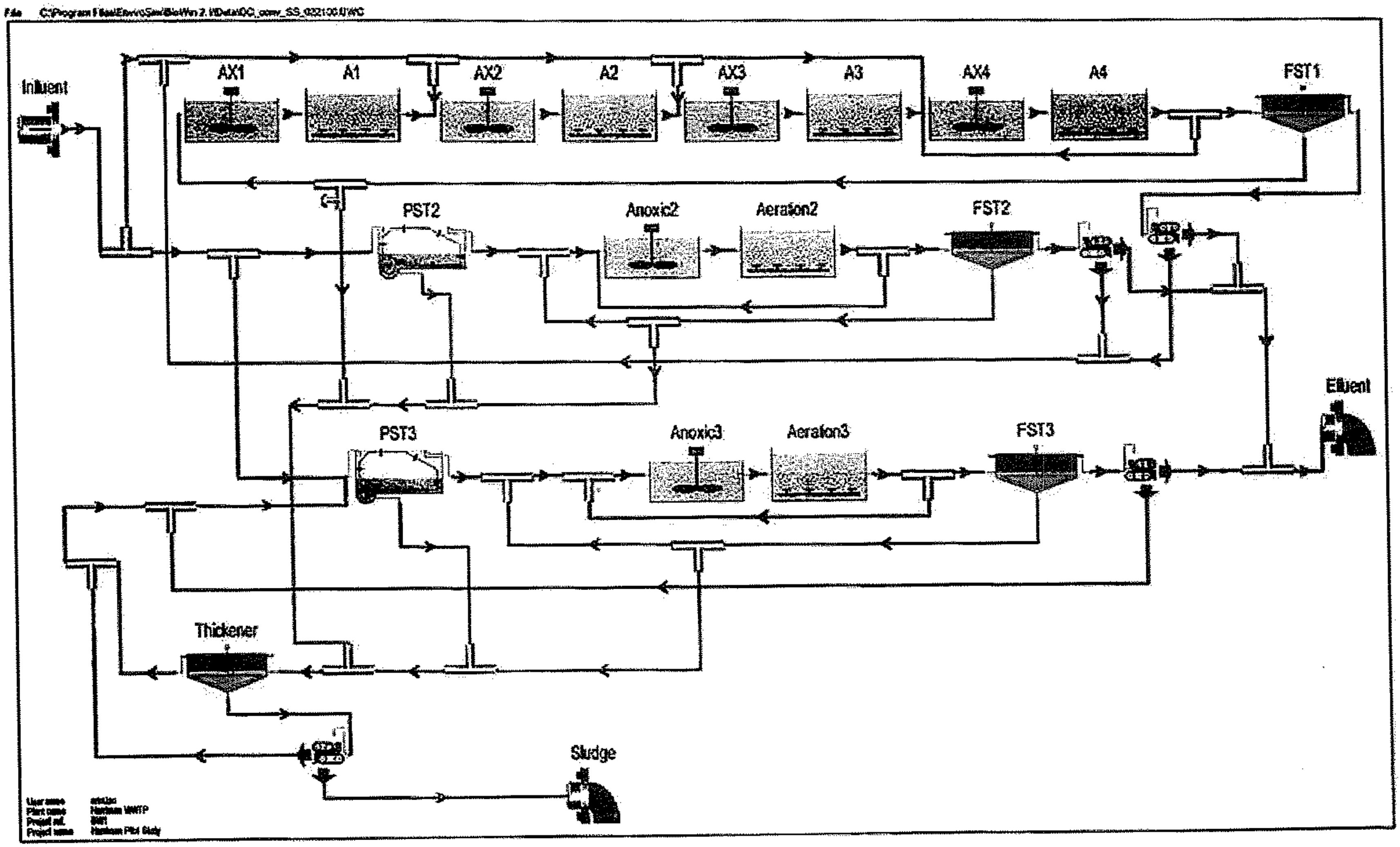

Figure 3-4
BioWin™ Phase II Expanded Facility – Step-Feed Model Configuration

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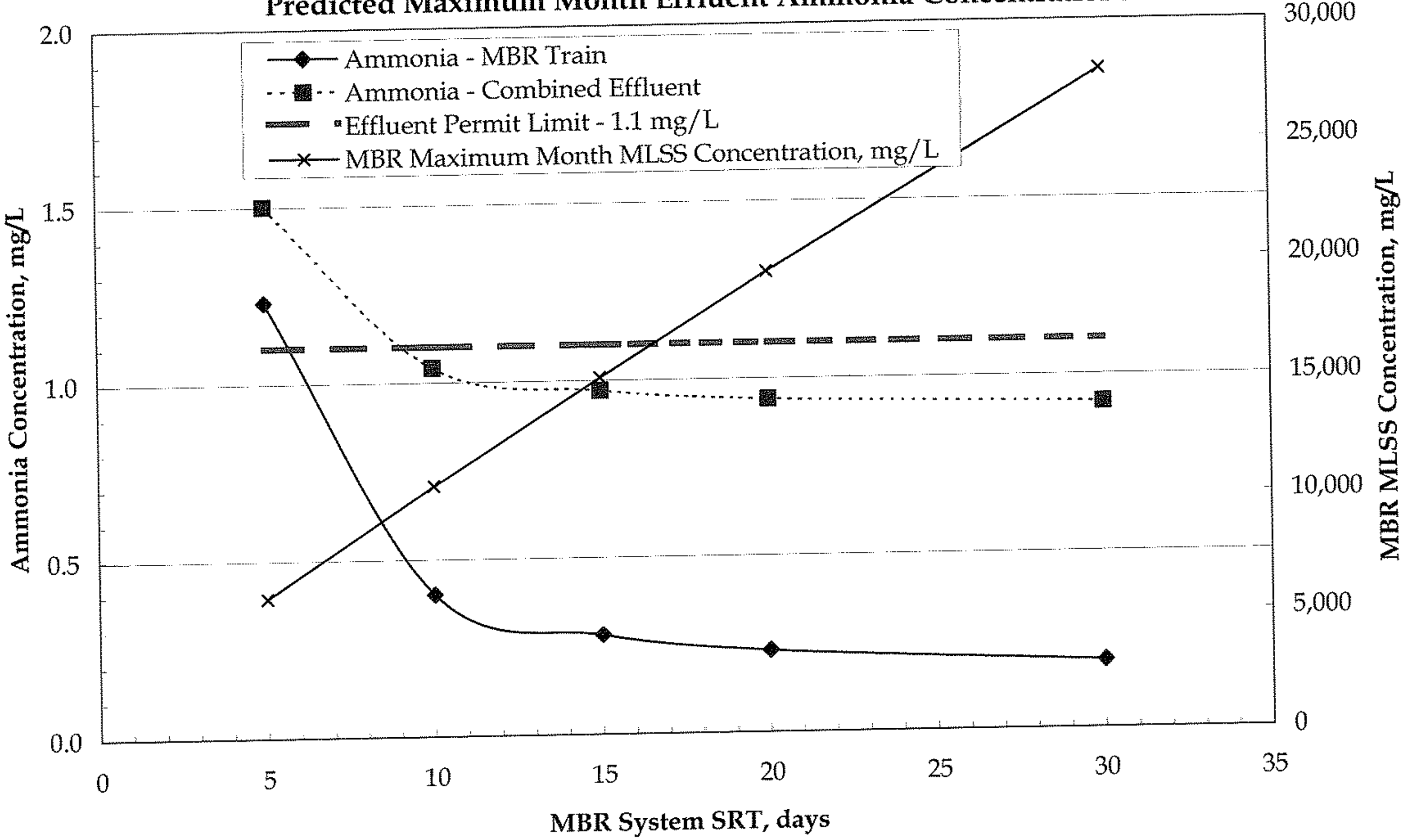
EXISTING OXIDATION SYSTEM LAYOUT
FIGURE 3-5

Figure 3-6
MBR Expanded Facility
Predicted Maximum Month Effluent Ammonia Concentrations



Section 4

PHASE II EXPANSION EVALUATION

This section incorporates the results of modeling presented in Section 3 into conceptual design layouts. Further analysis is required before these conceptual ideas can be modified into preliminary designs. This comparison is intended to provide a side by side analysis of two options to expand the facility's treatment capacity.

EXPANDED FACILITY - MBR

A MBR treatment system incorporated into the existing oxidation ditches could increase the average daily treatment capacity to 9.0 mgd. The two existing oxidation ditches (Train 1) have an average daily design capacity of 2.0 mgd and a new MBR treatment train would have a capacity of 5.0 mgd. The new MBR system would include dissolved oxygen (DO) depletion, anoxic, aeration, and membrane zones within the existing oxidation ditch tanks. New aeration and membrane blowers, RAS pumps, anoxic and DO depletions zone mixers, and effluent (permeate) pumps are required for this system. A fine-screen (3-millimeter) incorporated into an upgraded headwork facility would also be required for wastewater entering the MBR train to avoid damaging the membranes with large solids. An alum addition system will be required to meet the anticipated future effluent total phosphorus limit of 0.5 mg/L. Additionally, the capacity of the chlorine contact tanks would need to be increased to accommodate the expanded flow rate.

Layout

The preliminary layout and equipment selection is based on a MBR treatment train average capacity of 5.0 mgd. Wastewater from the upgraded headworks would flow through the existing influent splitter box and then to one of the three treatment trains. Trains 2 and 3 will treat the 2.0 mgd design average flow. Figure 4-1, at the end of this section, presents a conceptual layout of the MBR treatment system incorporated into the existing oxidation ditches. Flow from the existing splitter box would pass through a 3-mm fine screen to remove solids that may damage the membranes. There are two main MBR treatment tanks; one in each of the existing oxidation ditch tanks. Screened and degritted wastewater will enter the MBR system and would be immediately mixed with mixed liquor in the anoxic zones. The volume of each anoxic zone would be approximately 0.40 million gallons (system total of 0.80 million gallons). The contents will be mechanically mixed with mixers that will not add oxygen into the zones. From the anoxic zones, flow will enter the aeration zones. The aeration zones will be kept aerated and mixed by fine bubble diffusers installed in the bottom of the tanks. The volume of each aeration zone is approximately 0.325 million gallons (system total of 0.65 million gallons). Low head, high capacity submerged pumps will convey flow from the aeration zones into the MBR zones. Dimensions of the existing tanks may require pumps in the aeration zones to convey flow to the MBR zones. Several MBR zones (a total of eight) are recommended for maintenance and cleaning flexibility. Providing multiple zones will permit the membranes to be isolated for cleaning or membrane replacement and maximize the firm capacity of the facility when maintenance or chemical cleaning of the membranes is required.

The volume of each of the eight MBR zones will be approximately 0.10 million gallons (total MBR zone volume of 0.80 million gallons). Each MBR zone will contain 15 double stack MBR units (total of 120 double stack units). Coarse bubble diffusers will keep the MBR zones mixed and will provide scour air for the membranes. A channel between the north and south MBR zones in each main tank will be used to convey RAS by gravity to the DO depletion zone at the eastern end of each main tank. Each of the DO depletion zones will be approximately 0.10 million gallons (total volume of 0.20 million gallons). Recycle pumps will convey DO depleted RAS to the anoxic zone at the beginning of the treatment system.

Equipment

The average day flow through the MBR treatment train is 5.0 mgd. The manufacturer's recommended maximum day peaking factor is 2.0, giving a system maximum day capacity of 10 mgd.

Headworks. An upgraded headworks system is required for the entire facility if the treatment capacity is increased in any manner. Additional coarse screens are recommended as well as a new grit removal system. The coarse screens will have the capacity to handle the peak design flow with one unit as standby. A new aerated grit removal system consisting of two parallel tanks will also have capacity to handle the peak design flow. Additionally, a new influent flow meter is recommended. A new flow distribution system may also be required.

Fine Screens. Prior to MBR treatment, the influent flow would pass through a 2 or 3-millimeter (mm) fine screen. Three fine screen units that have a capacity of 5.0 mgd each are recommended for the MBR treatment train. This allows the units to handle the maximum day flow of 10 mgd with one unit as standby.

Anoxic and DO Depletion Zone Mixers. Mixers in the anoxic and DO depletion zones are required to keep the contents mixed. Mixing may be accomplished with paddle units, floating units, or with strategically placed pumps. For this conceptual evaluation, floating units are proposed. Each of the anoxic zones and DO depletion zones will require one 7.5-horsepower (hp) floating mixer.

Process Air Equipment. Based on model simulation results, approximately 11,700 scfm of air is required for process treatment during maximum day conditions. Each of the 120 membrane units requires about 99 scfm of air for scouring for a total of 11,880 scfm. Therefore, the process air will be provided in the MBR zones with the designated scour air blowers. Considering a water depth of 13 feet, the total blower capacity for the coarse bubble diffused air system is 675 hp. Four 250 hp, multi-stage blowers are recommended to provide the maximum demand with one unit as standby. The blowers would be manifold together with Motor actuated valves and air flow meters to provide operational flexibility.

MBR Zone Equipment. Four 15-hp submerged pumps are required to convey flow (influent plus recycle) to the MBR zones. Each pump will have a capacity of 15 mgd giving a total of 60 mgd – the maximum influent flow rate (10 mgd) plus the maximum recycle flow rate (50 mgd: 500 percent of 10 mgd) through the MBR system. The Enviroquip/Kubota EK400 unit was used to determine the size of the MBR zones in the new treatment train as presented in Section 3. This unit is a double stack of membranes that makes better use of the deep oxidation ditches than a single stack unit. The existing side water depth in the oxidation ditches is approximately 13 ft and will remain the same for this option. Approximately 120 of these units are required to treat the average flow of 5.0 mgd at the design influent wastewater temperature of 12.5 °C. Cold temperatures decrease the membrane flux and must be considered in the design of MBR systems. Approximately 2,700 diffusers are required for all the MBR zones proposed, evenly distributed under the membranes. Low-suction head permeate pumps are required to draw effluent from the membranes. Ten 1.0-mgd (10 hp each) pumps are recommended for the eight MBR basins to provide the maximum capacity of 10 mgd with two pumps as standby.

Return Activated Sludge (RAS) Pumps. Conveying flow from the DO depletion zone to the anoxic zone would be accomplished with non-clog, centrifugal RAS pumps. The MBR system typically requires RAS rates between 200 and 500 percent; therefore the pumps will be provided with variable speed drives. The maximum day flow rate to the MBR system is 10 mgd making the maximum RAS flow rate 50 mgd (500 percent of 10 mgd). The average day flow rate of 5.0 mgd has a typical operating RAS flow rate of 15 mgd (300 percent of 5.0 mgd based on BioWin™ simulations). Five 25-hp RAS pumps that have a capacity of 12.5 mgd each are recommended to provide the maximum RAS flow with one pump as standby.

Train 2 Modifications. Anoxic zones with new mixers and internal recycle pumps will be required for this treatment train to produce an effluent with a lower nitrate concentration. The anoxic zone volume required is approximately 0.1 million gallons. This zone can be created with the installation of a new wall. Without this modification, the combined effluent will not meet the nitrate effluent goal. Similar to Train 3 (currently under construction), 5 hp mixers and pumps will be required. The same modifications are required for the step-feed BNR process.

Chlorine Contact Tank. The capacity of the existing chlorine contact tanks would need to be increased to accommodate the expanded facility flow rate. The existing tank on the east side of the site that serves the existing Trains 1 and 2 has an average capacity of 4.0 mgd. The expanded average capacity of Trains 1 and 2 would be 7.0 mgd after Phase II construction; therefore an additional 3.0 mgd is required. This additional capacity could be provided with the construction of a parallel chlorine contact tank next to the existing tank. To accomplish this, the existing ultraviolet light disinfection building could be demolished since it is no longer used at the facility. The same modifications are required for the step-feed BNR process.

Electrical and Instrumentation and Controls. Upgraded electrical systems will be required to accommodate the power requirements of the new equipment. Further evaluation of the existing electrical system is required prior to final design. Likewise, coordinated instrumentation and controls are required for the new equipment. Similar modifications are required for the step-feed BNR process.

Site Work and Yard Piping. Site work will be required to demolish the existing UV building to allow space for a new chlorine contact tank and for a new fine screen building near the headworks. The major yard piping modifications include new piping from the existing influent splitter box to the new fine screen system and new piping from the MBR system to the chlorine contact tanks.

EXPANDED FACILITY – CONVENTIONAL TREATMENT

As described in Section 2 and modeled in Section 3, a conventional (step-feed BNR) activated sludge treatment system could increase the average day treatment capacity to 9.0 mgd. The new system would have an average day capacity of 5.0 mgd – comparable to the previously discussed MBR treatment system option. The general layout and equipment estimates are based on the assumption that there is physical space for this process at the existing facility. While retrofitting the existing oxidation ditches and creative use of remaining land may provide enough space; serious limitations include maintenaning plant operations during construction, significant excavation requirements, and practicality of this type of construction in the limited space available. The evaluation in this section is provided to demonstrate the components required to conventionally gain the same increase in treatment capacity as the MBR system.

Layout

The preliminary layout and equipment selection is based on an average month step-feed system capacity of 5.0 mgd. Wastewater from the upgraded headworks would flow through the existing influent splitter box and then to one of the three treatment trains. Trains 2 and 3 will each continue to treat an average month flow of 2.0 mgd (design flow rates for these systems). Therefore, the average flow rate to the new step-feed system (Train 1) would be 5.0 mgd (similar to the previously discussed MBR system). Figure 4-2, at the end of this section, presents a conceptual layout of the step-feed BNR treatment system.

The influent to the step-feed system is evenly distributed to anoxic zones 2, 3, and 4. The first anoxic zone is dedicated to denitrifying the RAS from the final settling tanks. Each anoxic zone is followed by an aeration zone. Table 4-1 presents the approximate volumes of each new treatment zone in the step-feed process as well as the total anoxic/aerobic volume required to treat the average month flow of 5.0 mgd. The anoxic zones are mixed with floating mixers that do not add dissolved oxygen. From each anoxic zone, flow enters the aeration zone. The aeration zones are kept aerated and mixed by fine bubble diffusers installed in the bottom of the tanks. Final settling tanks (FSTs) are necessary to settle the activated sludge from the fourth aeration zone. Recycle pumps are used to convey RAS from the final settling tank to the first anoxic zone at the beginning of the treatment system. Sand filters are required to meet the effluent TSS permit limit. Effluent from the FSTs would combine with effluent from Trains 2 and 3.

Table 4-1
Step-Feed System Anoxic/Aeration Volumes

Step-Feed Zones	*Volume per Sub-Train, million gallons*	*Total Volume, million gallons*
Anoxic Zone 1	0.05	0.10
Aeration Zone 1	0.20	0.40
Anoxic Zone 2	0.10	0.20
Aeration Zone 2	0.25	0.50
Anoxic Zone 3	0.25	0.50
Aeration Zone 3	0.35	0.70
Anoxic Zone 4	0.35	0.70
Aeration Zone 4	0.65	1.3
Total	**2.2**	**4.4**

In order to increase the volume of the oxidation ditches to 4.4 million gallons, several major construction activities must occur. The bottom of the decant and integral secondary clarifier tanks must be demolished and excavation for a new bottom that matches the elevation of the oxidation ditches. In addition, the internal walls must also be removed. To further increase the volume, the outside walls must be raised 5.55 feet. Structural and/or geotechnical analyses must be completed prior to finalizing the design for this system to determine the feasibility of performing the structural changes as required. Ultimately these analyses may conclude that the required construction activities are neither practical nor cost effective.

Equipment

Headworks. The headworks upgrades previously discussed, except for the fine screen, are also required for this option since the capacity increase is the same as a MBR expanded facility. Additionally, if the existing oxidation ditches are used for the step-feed process and the wall height can be raised by approximately 5.55 feet, the hydraulic grade line through the treatment train would not allow for gravity flow from the headworks to the aeration tanks. It is estimated that two duty 25 hp pumps will be required (with an additional standby pump) for this option and hydraulic analyses during design are required.

Anoxic Mixers. Mixers in the anoxic zone are required to keep the contents sufficiently mixed for the denitrification process. Similar to the MBR treatment train option, floating units are proposed for the anoxic zones. Each of the eight anoxic zones will require one 5-hp floating mixer.

Process Air Equipment. Based on the model simulation results, approximately 10,100 scfm of air is required for process treatment during maximum day conditions to maintain the desired DO concentration of 2.0 mg/L. To provide this much air, with an estimated water depth of 18.55 feet, the total blower capacity required is approximately 600 hp. Multiple blowers are recommended to provide appropriate quantities of air to each of the eight aeration zones. Supplying four 200-hp multi-stage centrifugal blowers would provide enough capacity and flexibility to meet the above operating conditions with one blower as standby. Air flow meters and motor actuated valves are required to control the amount of air to each aeration zone.

Final Settling Tank Components. Based on an average overflow rate of 300 gpd per square foot of clarifier surface area, approximately 16,700 square feet of clarifier area will be required for this option. There is not enough space at the site to provide traditional circular secondary clarifiers. Rectangular, stacked clarifiers could be incorporated into the site, as shown on Figure 4-2. Typical components of the FST include a scum collection system, overflow weirs, and RAS pumps (discussed separately). It is assumed that these clarifiers would be at least 30 feet deep to accommodate the stacked design.

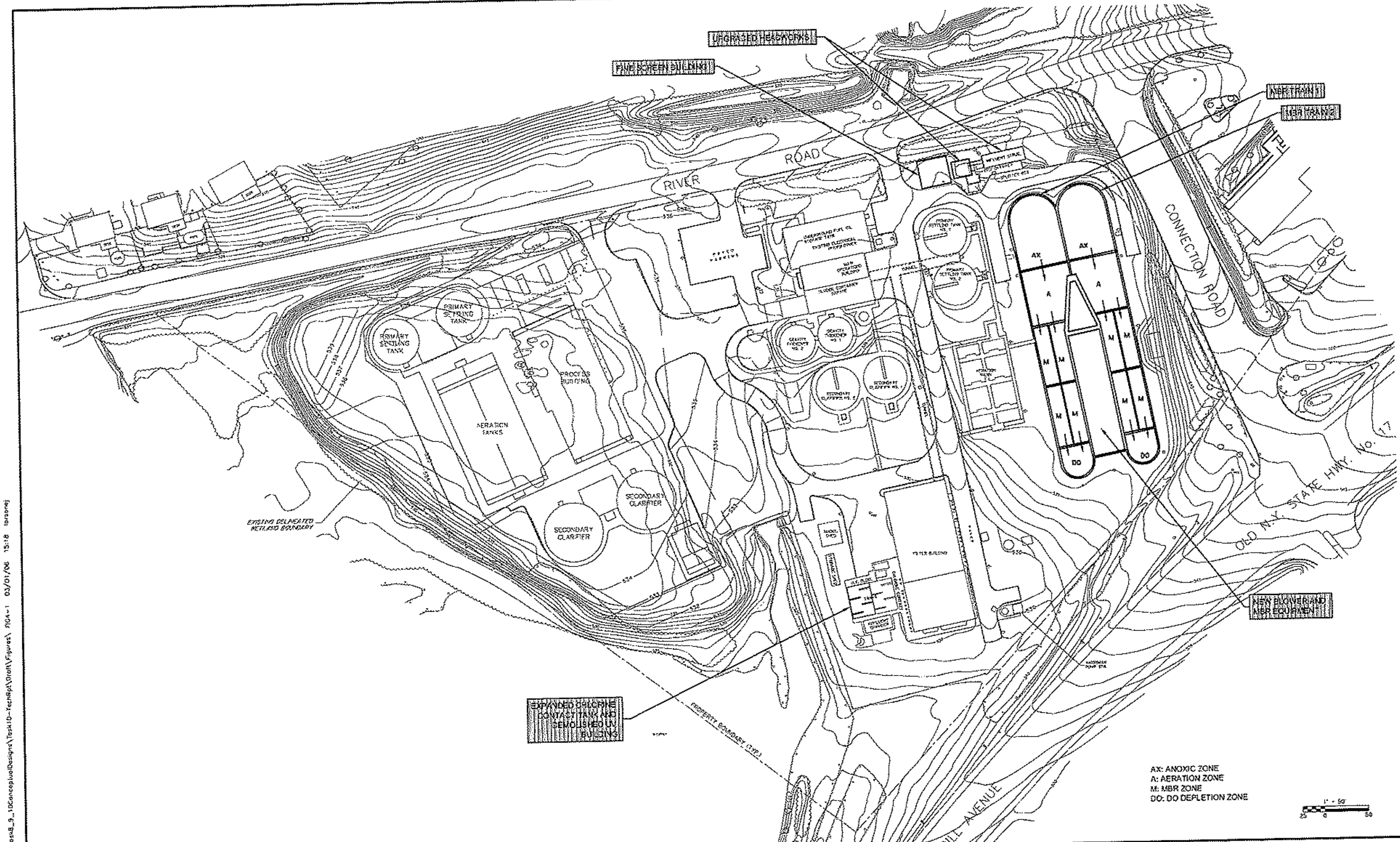
Return Activated Sludge (RAS) Pumps. Conveying return sludge flow from the FST to the anoxic zone would be accomplished with non-clog centrifugal RAS pumps. The step-feed system typically requires RAS rates between 50 and 150 percent; therefore the pumps will be provided with variable speed drives. The maximum month flow rate to the conventional system is 7.4 mgd making the maximum RAS flow rate 11 mgd (150 percent of 7.4 mgd). The average day flow rate of 5.0 mgd has a typical operating RAS flow rate of 2.5 mgd (50 percent of 5.0 mgd). Three 10-hp RAS pumps (with one as standby) that have a capacity of 7.5 mgd each are recommended to provide operating flexibility for the system.

Train 2 Modifications. Anoxic zones with new mixers and internal recycle pumps will be required for this treatment train to produce an effluent with a lower nitrate concentration. The anoxic zone volume required is approximately 0.1 million gallons. This zone can be created with the installation of a new wall. Without this modification, the combined effluent will not meet the nitrate effluent goal. Similar to Train 3 (currently under construction), 5 hp mixers and pumps will be required. The same modifications are required for the MBR process.

Upgraded and New Sand Filters. Additional sand filter capacity is required to treat the additional 3.0-mgd of flow through the facility. The existing sand filters designed for Trains 1 and 2 have an average capacity of 4.0 mgd. An additional 3.0 mgd of filter capacity is required for the step-feed system. Mechanical upgrades to the existing filters and the addition of two more units could provide the additional required capacity. It is expected that the new sand filters will have a total power requirement of approximately 20 hp (similar to the Train 3 sand filters currently under construction).

Chlorine Contact Tank, Electrical and Instrumentation and Controls. The chlorine contact tank upgrades previously discussed are also required for this option since the capacity increase is the same as a MBR expanded facility. Upgraded electrical systems will be required to accommodate the power requirements of the new equipment. Further evaluation of the existing electrical system is recommended prior to final design. Likewise, coordinated instrumentation and controls are required for new equipment.

Site Work and Yard Piping. Site work will be required for the new stacked secondary clarifier tanks, new sand filters, new equipment building, and to demolish the existing UV building to allow space for a new chlorine contact tank. The major yard piping modifications include new piping from the new step-feed system to the new stacked secondary clarifiers, from the new clarifiers to the existing and new sand filters, as well as additional piping from the sand filters to the new chlorine contact tank.



ORANGE COUNTY DEPARTMENT OF ENVIRONMENTAL FACILITIES AND SERVICES
HARRIMAN WASTEWATER TREATMENT PLANT

PHASE II MBR EXPANSION CONCEPTUAL SITE LAYOUT
FIGURE 4-1

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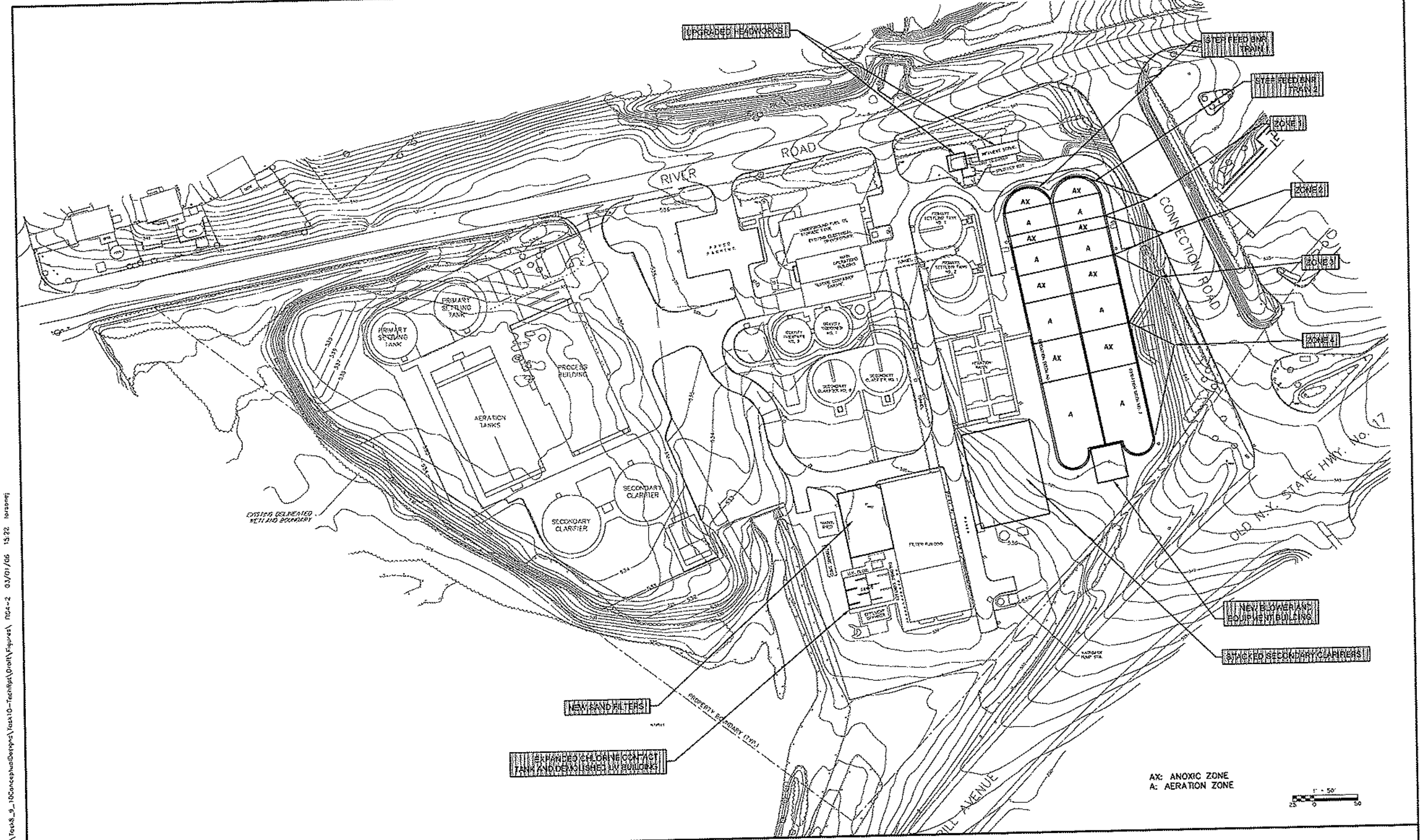

ORANGE COUNTY DEPARTMENT OF ENVIRONMENTAL FACILITIES AND SERVICES
HARRIMAN WASTEWATER TREATMENT PLANT

PHASE II STEP-FEED EXPANSION CONCEPTUAL SITE LAYOUT
FIGURE 4-2

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Section 5

SUMMARY AND RECOMMENDATIONS

This section presents the energy, environmental, and economic analyses for the Phase II expansion options.

ENERGY ANALYSIS

The major energy drawing components of the existing oxidation system include aerators, turbines and RAS pumps. The total power draw for the system is 730 hp (aerators: 200 hp, turbines: 500 hp, RAS pumps: 30 hp). The 2.0 mgd (1,389 gpm) oxidation system uses approximately 13,160 kilowatt-hours/day (kWh/d) or 9.47 kWh/gpm total. The power used based on the mass of BOD removed (BOD_r) is 2.42 kWh/BOD_r (actual oxidation ditch effluent BOD loads were not available so this power consumption value is based on the reported effluent BOD values from the existing facility). The following analyses present the estimated changes required for an MBR system expansion and a conventional treatment expansion. The values presented are in terms of the net increase or decrease in power consumption and treatment capacity.

MBR Expanded Facility. The MBR expanded facility is anticipated to increase the total amount of energy used which is not surprising since an increase in treatment capacity will typically result in higher power consumption. This increase will likely be more significant compared to an expansion using conventional technology because of the equipment required and mode operation of the MBR system (however, as discussed later in this section, the MBR facility is expected to out-perform the conventional system on an environmental basis).

The membrane air scour requirements for the MBR system are constant and generally higher than the air required for biological treatment (for the Harriman WWTP), resulting in an average blower horsepower higher than needed for conventional treatment. Conventional treatment can be optimized by decreasing the air during low-flow time periods (i.e. during the night). This is not an option with MBRs because of the air scour requirements. Table 5-1 presents a summary of the MBR system's power requirements; total, average month, and gravity operation of the MBR expanded facility. The total power capacity does not include spare pieces of equipment.

The total net power capacity increase of approximately 325 hp will necessitate electrical modifications to the facility. The capital cost estimates for the new equipment include estimates of required electrical modifications; however, further analysis of the facility's electrical situation is required during the design phase as more extensive modifications may be necessary. The energy demand from the new MBR treatment train assumes that all the new equipment will run at the average month conditions and includes a credit for the decommissioned oxidation ditch aerators, turbines and pumps. The net average month increase of 122 hp equals 2,200 kWh/d. The increased energy used based on the average month capacity of 5.0 mgd (3,472 gpm) is 0.63 kWh/gpm. At a cost of \$0.14/kWh, the average month capacity of 5.0 mgd will cost the facility an increase of approximately \$0.97/gpm of MBR treated water (\$112,000 net increase per year). The average power increase used based on the mass of BOD removed (BOD_r) is 0.28 kWh/lb BOD_r. If there are times when the MBR system can be operated by gravity (sufficient hydraulic head available), the estimated monthly power consumption decreases by 40 hp. A hydraulic analysis of the facility was not performed as part of this project and therefore the more conservative monthly power estimates are used for comparison to the step-feed system.

Table 5-1
MBR Expanded Facility Equipment Power Requirements

Equipment	*Total Capacity, hp*	*Average Month, hp*	*Gravity Operation, hp*
Fine Screen	15	7.5	7.5
Blowers	750	675	675
RAS Pumps	100	50	50
Aeration Pumps	60	30	30
Anoxic Zone Mixers	15	15	15
DO Depletion Zone Mixers	15	15	15
Permeate Pumps	80	40	0
Train 2 Anoxic Mixers	10	10	10
Train 2 Internal Recycle (IR) Pumps	10	10	10
Subtotal	**1,055**	**852**	**842**
Existing Decommissioned Aerators (Credit)	*(200)*	*(200)*	*(200)*
Existing Decommissioned Turbines (Credit)	*(500)*	*(500)*	*(500)*
Existing Decommissioned RAS Pumps (Credit)	*(30)*	*(30)*	*(30)*
Total Net Increase	**325**	**122**	**82**

Step-Feed Expanded Facility. Table 5-2 presents a summary of the power requirements of the new equipment required for the step-feed expanded facility (the technology to which the MBR system was compared for this feasibility study). The air requirement is less than for the MBR expanded facility as a result of the ability to optimize the system during low-flow time periods.

The energy demand from the new step-feed treatment train assumes that all the new equipment will run at the average month conditions and includes a credit for the decommissioned oxidation ditch aerators, turbines and pumps. A new fine bubble aeration system is expected to be far more efficient than the existing oxidation system aerators and turbines and subsequently to utilize less energy than the existing system even though treating more capacity. The net average month decrease of 58 hp equals 1,029 kilowatt-hours/day (kWh/d) saved. The energy saved based on the average month capacity of 5.0 mgd (3,472 gpm) is 0.30 kWh/gpm. At a cost of \$0.14/kWh, the average month capacity of 5.0 mgd will save the facility approximately \$0.04 per gpm of step-feed treated water (for a net credit of \$53,000 per year). The average power reduction used based on the mass of BOD removed (BOD_r) is 0.13 kWh/lb BOD_r.

Table 5-2
Step-Feed Expanded Facility Equipment Power Requirements

Equipment	*Total Capacity, hp*	*Average Month, hp*
Influent Pumps	50	20
Aeration Blowers	600	500
RAS Pumps	20	20
Anoxic Zone Mixers	40	40
Train 2 Anoxic Zone Mixers	10	10
Train 2 IR Pumps	10	10
New Secondary Clarifier Equipment	2.5	2.5
New Sand Filter Equipment	20	20
Subtotal	**773**	**670**
Existing Decommissioned Aerators (Credit)	*(200)*	*(200)*
Existing Decommissioned Turbines (Credit)	*(500)*	*(500)*
Existing Decommissioned RAS Pumps (Credit)	*(30)*	*(30)*
Total Net Increase	**43**	**-58**

Air Scour and Oxygen Transfer Efficiency

The majority of the air required for the MBR treatment train is for membrane air scour. The manufacturer recommends 99 standard cubic feet per minute (SCFM) per unit conceptually proposed for this project (Enviroquip EK400). With 120 units, the constant air required is approximately 11,880 SCFM. Under cold temperatures (most demanding air conditions) and a water depth of 13 ft, this translates into an approximate blower requirement of 675 hp. The estimated air required for biological demands (11,700 SCFM) results in a cold temperature blower requirement of 665 hp. During less demanding conditions (i.e. decreased wastewater flow rate, decreased biological demand, increased water temperature), the air required for biological treatment would be reduced. For conceptual design purposes, the constant blower capacity (675 hp) required for air scour is also enough for the maximum day biological demand. It appears advantageous, for this conceptual design, to combine the aeration volume with the MBR volume so that excess air is not wasted for mixing of separate aeration zones. Separate aerobic/MBR zones are still recommended so that the facility has operational flexibility (i.e. zones can be off-line without taking the entire system or train off-line).

Compared to the step-feed train, the MBR train requires more oxygen because of the air scour as well as the depth of the water. Deeper tanks will require less blower power because the oxygen transfer efficiency (OTE) is higher at deeper depths. The estimated OTE for the MBR system is approximately 10% based on the diffuser submergence of 12.25 ft. Increasing the water depth for the step-feed system (diffuser submergence of 17.8 ft) increases the OTE to approximately 14.6%. This difference is due to the difference in water depths since the two systems were evaluated to provide comparable biological treatment. The increased OTE for the step-feed system results in a maximum day, cold temperature blower power requirement of 585 hp; 90 hp less than the constant blower power required for the MBR system. During average day conditions, it is estimated that only 500 hp of blower capacity will be required for biological treatment to maintain mixing for the step-feed system.

ENVIRONMENTAL ANALYSIS

Environmentally, the MBR system produces a very clean effluent without the use of separate clarifiers or filters. Table 5-3 presents a comparison of the MBR and step-feed trains modeled for the facility.

Table 5-3

Phase II Expanded Facility Train 1 Comparison – MBR and Step-Feed Maximum Month Steady State Effluent Characteristics

	MBR, 15 day SRT	*Step-Feed*	*Difference*
Total Suspended Solids, mg/L	3.0	5.4	(2.4)
Ammonia, mg/L	0.28	0.69	(0.41)
Nitrate, mg/L	8.0	6.8	1.2
Total Kjeldahl Nitrogen, mg/L	2.8	3.4	(0.6)
Total Nitrogen, mg/L	10.79	10.24	0.5
Biological Oxygen Demand, mg/L	1.34	1.68	(0.34)
Total Phosphorus, mg/L (without chemicals)	3.0	4.0	(1.0)
Alkalinity, mg/L	77.0	82.5	(5.5)
Ultimate Oxygen Demand, mg/L	14.52	17.91	(3.39)

Based on the maximum month effluent characteristics for the two proposed trains, the MBR out-performs the step-feed system for the majority of the effluent parameters. The differences are not extremely large but the effluent from the MBR system would require less chlorine to disinfect and less coagulant to remove phosphorus to the desired level. The potential additional annual chemical costs for the MBR and step-feed expanded facilities are $89,200 and $111,000, respectively (as presented in the Economic Analysis below).

MBR Chemical Cleaning

The manufacturer indicates that typical cleaning frequency for membranes used in a municipal wastewater installation is every six months. Chemical cleaning was performed twice during the six-month pilot study – primarily so that the evaluation of different operating SRTs was not affected by fouled membranes. Chemical cleaning, with a dilute chlorine bleach solution, restores the membranes' capacity for filtration to 'near-new' conditions and can be performed many times over the life of a membrane. It is estimated that for the MBR conceptual design, approximately 985 gallons of 12.5% sodium hypochlorite would be required every six months to clean all the membranes.

Sludge Volume

The two systems evaluated (MBR and step-feed) produce similar quantities of waste sludge, according to the modeling performed. This is reasonable since the two systems were both modeled with an operating SRT of 15 days. The average MLSS concentration in the MBR system was 9,600 mg/L and the weighted average MLSS concentration in the step-feed system was 6,300 mg/L. However, the MBR can be operated at higher MLSS concentrations (higher SRTs) once the process is established. Higher MLSS concentrations will result in lower wasting rates and therefore less sludge processing.

Reduced Pathogen Risk

The MBR system will produce an effluent with significantly fewer pathogen indicators (Coliforms, *Giardia lamblia*, and *Cryptosporidium parvum*) than conventional wastewater treatment (i.e. aeration, clarification and sand filtration). The pilot study indicated average fecal and total Coliform removal of 2- and 3-log, respectively. All effluent samples that were analyzed for *Cryptosporidium parvum* and *Giardia lamblia* during the pilot study were below the detection limits. Due to the lower counts of fecal Coliforms in the MBR effluent, it is expected that the MBR system will require a smaller disinfection dose than a comparable conventional system (i.e. step feed).

ECONOMIC ANALYSIS

MBR Estimated Planning Level Capital and Operating Costs

Estimated costs are presented in February 2006 dollars (Engineering News Record (ENR) Index 7688.9). Present value is a method used to compare different design scenarios. For this analysis, the annual costs for the MBR may be different than other alternatives. Therefore, using a present value enables a common basis comparison in terms of cost.

Capital Cost. Table 5-4 presents a breakdown of the estimated planning level capital costs for the MBR facility. The estimated capital cost to treat the average day flow of 5.0 mgd (net gain of 3.0 mgd) through the MBR treatment train is $4.99 per gallon ($24,950,000/5,000,000 gpd).

Table 5-4

MBR Expanded Facility Planning Level Capital Cost Estimate

Item	*Capital Cost*
Upgraded Headworks	$1,369,000
New Fine Screen Facility	$1,840,000
MBR System	$12,099,000
New Chlorine Contact Tank	$742,000
Sludge Handling Allowance	$1,209,000
Instrumentation & Controls	$605,000
Yard Piping/Site Work	$1,330,000
Subtotal	**$19,194,000**
Contingency, 30 percent	$5,758,000
Capital Cost	**$24,950,000**

Annual and Life Cycle Costs. Table 5-5 presents the planning level annual cost estimate for the MBR facility. Including the net additional power, the estimated annual operating cost is $369,100. These costs are in addition to the existing annual operating costs of the facility.

Table 5-5

MBR Expanded Facility Planning Level Annual Operating Cost Estimate

Item	*Annual Cost*
Additional Average Power	$112,000
Additional Labor	$108,000
Membrane Replacement	$60,000
Additional Average Chemical	$89,100
Additional Annual Operating Cost	**$369,100**

Based on a 20 year life cycle and an interest rate of 4.9 percent, the present value of the estimated annual operating costs is $4,640,000. Combining this cost with the capital cost gives a total present value of $29,590,000. Therefore, the 20-year total present value cost to treat 5.0 mgd (net gain of 3.0 mgd) through the MBR treatment train is $5.92 per gallon ($29,590,000/5,000,000 gpd). The additional annual power cost considers the new equipment required as well as a credit for the decommissioned oxidation ditch equipment. The new equipment is assumed to be operating at average month conditions and the energy cost assumption is $0.14 per kilowatt-hours (kWh). The additional annual labor cost assumes that two new full-time operators will be required, at a rate of $45,000 per year plus 20 percent for benefits. Membrane replacement costs are estimated at one percent of the MBR system capital costs, per manufacturer recommendation for planning purposes. Additional estimated annual chemical costs include the alum required for phosphorus removal.

Step-Feed BNR Estimated Planning Level Capital and Operating Costs

Capital Cost. Table 5-6 presents a breakdown of the estimated planning level capital costs for the step-feed facility. The contingency cost for the step-feed expanded facility is greater than the MBR expanded facility because of the difficulties expected with construction. The stacked clarifiers and new sand filters would be constructed next to existing tanks and would require a significant amount of sheeting and protection. Additionally, geotechnical information is required prior to final design of any additional tanks. The capital cost to treat 5.0 mgd (net gain of 3.0 mgd) through the step-feed treatment train is $6.86 per gallon ($34,311,000/5,000,000 gpd). However, as discussed in Section 4, increasing the water depth for the step-feed option may not be practical for this facility and could be cost prohibitive (on a capital cost basis).

Table 5-6
Step-Feed Expanded Facility Planning Level Capital Cost Estimate

Item	*Capital Cost*
Headworks	$1,490,000
Step-Feed BNR System	$5,914,000
Stacked Final Settling Tanks	$8,580,000
Upgraded and New Sand Filters	$3,309,000
Chlorine Contact Tank	$742,000
Sludge Handling Allowance	$1,209,000
Instrumentation & Controls	$605,000
Yard Piping/Site Work	$1,814,000
Subtotal	**$23,663,000**
Contingency, 45 percent	$10,648,000
Capital Cost	**$34,311,000**

Annual and Life Cycle Costs. Table 5-7 presents the planning level annual cost estimate for the step-feed facility. These costs are in addition to the existing annual operating costs of the facility.

Table 5-7
Step-Feed Expanded Facility Planning Level Annual Operating Cost Estimate

Item	*Annual Cost*
Additional Average Month Power	$-53,000
Additional Labor	$108,000
Additional Chemical	$112,000
Additional Annual Operating Cost	**$167,000**

Based on a 20 year life cycle and an interest rate of 4.9 percent, the present value of the estimated annual costs is $2,099,000. Combining this cost with the capital cost gives a total present value of approximately

$36,410,000. The total 20-year present value cost to treat 5.0 mgd (net gain of 3.0 mgd) through the step-feed treatment train is $7.28 per gallon ($36,410,000/5,000,000 gpd). The additional annual power cost considers the new equipment required as well as a credit for the oxidation ditch equipment that would be decommissioned. The power cost is based on operating the new equipment at the estimated average month capacity and an energy cost of $0.14 per kWh. The additional annual labor cost assumes that two new full-time operators will be required. Additional annual chemical costs are estimates for the expanded facility including the alum required for phosphorus removal.

OTHER ISSUES

Barriers to Technology Acceptance

The largest barrier to acceptance of MBR technology within New York State is the lack of knowledge about the technology. Numerous individuals and organizations will have to be educated before there is acceptance of the technology including the New York State Department of Environmental Conservation (NYSDEC) (which has multiple regional offices in addition to its state office), county health departments, and the New York City Department of Environmental Protection (NYCDEP) (which has jurisdiction over a large upstate watershed). This education process will likely extend the time period for project review and approval, which is difficult for municipalities and developers who are often working on tight schedules. To date, implementation of MBR technology has been limited by the perceived lack of NYSDEC approval of the technology. However, the NYSDEC does not typically "approve" technologies but instead reviews projects based on their stated treatment objectives and sound engineering practices. This misconception seems to be limiting the use of MBRs in New York State. Since there are no operating facilities within the State, some municipalities and engineers are reluctant to consider the new technology because of the perceived regulatory hurdles.

Market Information

There are currently no municipally operated or private MBR wastewater treatment facilities in the New York State that are larger than 100,000 gpd. Several small facilities exist that serve areas like campgrounds. The New York City Regulatory Upgrade Program provided aid to facilities in the watershed to meet the Watershed Regulations' standards that were beyond any provision of federal or State law or enforceable standard. Treatment processes added included phosphorus removal, disinfection, *Giardia lamblia/Cryptosporidium* removal, and sand filtration. The Upgrade Program was designed to assist existing West-of-Hudson River facilities to meet the conditions of their respective effluent permits. Equipment that was unreliable, failing or reaching the end of its useful life was eligible for replacement under this program. At the end of 2002, the majority of the contracting and design consultant tasks were completed for the original 102 facilities west of the Hudson River. Upgrades to the facilities responsible for 83.5% of the non-City-owned discharges west of Hudson River were also completed. The Upgrade Program has made improvements to the facilities contributing to the NYC watershed and therefore the majority of the facilities will not require further improvements (per the State in the form of effluent regulations) in the near future. These previous upgrades impact the MBR market in the State because these facilities are essentially "off the table".

Existing facilities that are not in the NYC watershed should be a focus of the MBR manufacturers. Additionally, any new wastewater treatment facility in the State should also consider the use of MBRs for effective wastewater treatment. The current design of a new wastewater treatment facility for Rockland County incorporates very stringent, owner-imposed effluent limits. These limits are in response to comments by downstream interests including a major drinking water source for the State of New Jersey. While MBRs are not being used at this facility, this advanced facility is incorporating membranes as part of the tertiary treatment train. The treatment abilities of MBRs and membranes could be extremely useful to other facilities facing the same type of downstream constraints as Rockland County.

Technology Advancement

The design, permitting, construction, and startup phases of a WWTP improvement project can take years. A small retrofitted plant (less than 0.1 mgd) could improve the market for MBRs within the State of New York due to the knowledge transfer involved. The pilot study provided some knowledge transfer to interested parties within the State. One of the most important things that could be done to further the MBR technology in the State would be to retrofit a municipal facility on an expedited, funded basis. Funding for a small retrofit plant, as well as some regulatory support to expedite approvals for strategically important reasons, could significantly improve the market for MBRs within the State.

The MBR technology can be further advanced through operation forums presented throughout the different regions within the State. Manufacturers and engineering consultants could work together to provide these forums or workshops to interested parties. Likewise, case studies presented in regional and national industry magazines and conferences could also help to generate interest and advancement of the technology. Further advancements of the membrane air scour requirements could also help the technology become more attractive to wastewater treatment facilities.

RECOMMENDATION

As described in Section 3, the conceptual Phase II MBR and step-feed systems are both capable of treating an average flow of 5.0 mgd while meeting the preliminary future permit limits. The model simulations provided conceptual configurations including tank volumes. The MBR system could be installed at the facility as a phased retrofit project. Further evaluation of the two options for a Phase II expansion included facility layout, cost estimates and an energy analysis. Table 5-8 provides a summary of the two options.

Table 5-8
MBR and Step-Feed System Comparison

	MBR	*Step-Feed*
Average Treatment Capacity, mgd	5.0	5.0
Peak Day Flow Capacity, mgd	10.0	10.0
Total Treatment Tank Volume Required, million gallons	2.45	4.4
Additional Secondary Clarifier Area Required, square feet	0	16,700
Estimated Average Power Change, hp	122	-53
Estimated Capital Cost	$24,950,000	$34,311,000
Estimated Additional Annual Operating Cost	$369,100	$167,000
Estimated Present Worth Value	$29,590,000	$36,410,000

The MBR system estimated present worth value is $6,820,000 less than the step-feed system. Pending structural analyses, phased construction of the MBR system is possible; one of the oxidation ditches could be retrofitted while the other continues to process wastewater. Since the water depth in the tanks would be approximately the same as the existing operation, significant structural alternations may not be required. During the construction, the facility would have an estimated average capacity of approximately 5.0 mgd (50 percent of Train 1, and 100 percent of Trains 2 and 3). After the first MBR system is online, the second ditch could be retrofitted and the facility would have an average treatment capacity of 6.5 mgd (50 of the full Train 1, and 100 percent of Trains 2 and 3). Additionally, the phased retrofit of the oxidation ditches could extend over a number of years thereby making this option more cost effective. Retrofitting one oxidation ditch would increase the facility's average treatment capacity to 7.5 mgd (Train 1 MBR: 2.5 mgd, Train 1 Oxidation Ditch: 1.0 mgd, and 100 percent of Trains 2 and 3).

At the full conceptual average design capacity of 5.0 mgd to the MBR system, the estimated annual increase in operating cost to the OCDEFS is $369,100. This is approximately 2.2 times the increased annual cost to operate a step-feed system with the same capacity. Some annual cost savings may be realized when the MBR facility is first brought online because it may not be necessary to operate all of the MBR units. As the influent flow rate increases, more MBR units can be brought into operation.

Construction of the 5.0 mgd step-feed process would involve increasing the height of the existing oxidation ditch walls. If structural integrity analyses reveal that the existing ditch base slab and walls can not support an additional 5.55 feet of concrete and water, the tanks would need to be demolished to make space for new 20 feet deep tanks. It is estimated that new tanks would cost an additional $10 million. Challenging construction conditions are expected for the new stacked secondary clarifiers and sand filters, as well. Additionally, construction for the new stacked secondary clarifiers and sand filters will significantly decrease the green space at the existing site. During construction, the facility would have an estimated average capacity of only 4.0 mgd (100 percent of Trains 2 and 3) because unlike the MBR expansion, the step-feed expansion could not be phased. The construction period for the step-feed system would most likely be longer compared to the MBR system because of the additional work involved for the secondary clarifier and sand filter tanks. Again, structural and geotechnical analyses are required to asses the construction methods and materials required for this type of construction.

Based on the conceptual designs, cost estimates, and constructability issues, the MBR system has more potential benefits (compared to the step-feed system). On a present worth basis, the MBR system is approximately $6.8 million less than the step-feed system over a 20 year period even considering the higher annual estimated operating cost for this system.

Appendices

Appendix A-1
MBR Manufacturer Comparison

Design Feature	Aqua-Aerobics/Pall	Enviroquip/Kubota	Ionics/Mitsubishi	USFilter	Zenon
Membrane Type	Hollow Fiber	Flat Plate	Hollow Fiber	Hollow Fiber	Hollow Fiber
Membrane Orientation	Vertical	Vertical	Horizontal	Vertical	Vertical
Membrane Material	PVDF	Chlorinated polyethylene	Polyethylene	PVDF	Composite hollow fiber, PVDF cast over nylon reinforced core
Nominal Pore Size, µm	0.1	0.4	0.4	0.08	0.036
Absolute Pore Size, µm	N/A	0.1	0.5	0.2	0.1
Membrane Location	Membrane Tank	Aeration Tank	Aeration Tank	Membrane Tank	Membrane Tank
Fine Screen Size, mm	N/A	3	2	2	2
Maintenance Cleaning Time and Frequency	1 min/15 min	1 min/10 min	2 min/12 min	1 min/15 min	2 min/60 min
Maintenance Cleaning Method	Backpulse	Relax	Relax	Backpulse or Relax	Backpulse and Relax
Chemical (recovery) Cleaning Frequency	12 times/year	2 to 3 times/year	3 to 4 times/year	3 to 6 times/year	3 to 4 times/year
Chemical (recovery) Cleaning Time	N/R	1 to 2 hours/cassette	N/R	4 to 6 hours/tank	N/R
Chemical (recovery) Cleaning Method	CIP	CIP	CIP	CIP	CIP
Recommended cleaning chemicals	N/R	0.5% NaHOCl or Oxalic Acid	NaOCl 12%	NaOCl or Citric Acid	NaOCl @ 12% w/wcl
Permeate Pumps Required	Low-suction head pumps	Gravity or low-suction head pumps	Low-suction head pumps	Low-suction head pumps	Low-suction head pumps
Mfg. Recommended Solids Retention Time (SRT), days	10 – 20	15	20	10 - 15	10 - 15
Mfg. Recommended Design Flux Rate, gfd	48	10 - 15	5 - 7	10 - 15	10 - 15
Typical Peak Design Flux Rate, gfd (≤ 6 hours)	Requires EQ Tank	35	Requires EQ Tank	30	25
Maximum Peaking Factor	N/A	2.33	N/A	2	1.67
Aeration Cycle	Constant	Constant	Constant	Constant	10 sec On/ 10 sec Off
Expected Membrane Life, months	84	96 - 120	60	96	84
Estimated Energy Consumption (kWh) per 1,000 gal	2.0	2.59	3.05	N/R	N/R
Membrane Replacement Cost (current) per Module	$4,000	$4,500	$8,750	N/R	$2,650
Capital Cost (per mgd)	$1,200,000	N/R	$1,540,000	$1,000,000	N/R
Maximum Operating (TMP), psi	45	3	11.6	7	12
Expected Field Oxygen Transfer Efficiency, %	2	0.5/ft	9	3.3	6.54 @ 32C

N/A: Not applicable, N/R: No response from manufacturer.

Appendix A-2

MBR System Advantages and Disadvantages

Manufacturer	Advantages	Disadvantages
Aqua-Aerobics/Pall	- Microfiltration - Backpulse not required - Not piloted in NYS - Clean in place	- Hollow fiber membranes - Effluent pumps required
Enviroquip/Kubota	- Flat plate membranes - Gravity Operation - Microfiltration - Backpulse not required - Not piloted in NYS - Clean in place	
Ionics/Mitsubishi Rayon	- Not piloted in NYS - Clean in place	- Hollow fiber membranes - Effluent pumps required - Ultrafiltration - Backpulse required
USFilter	- Not piloted in NYS - Clean in place	- Hollow fiber membranes - Effluent pumps required - Ultrafiltration - Backpulse required
Zenon	- Clean in place	- Hollow fiber membranes - Effluent pumps required - Ultrafiltration - Backpulse required - Recent NYS pilot study completed

Appendix B

Sampling Program

Parameter	Influent	Fine Screened Influent	Anoxic Zone	MBR/ Aeration Zone	Effluent	Disinfected Effluent	Recycle
Flow Rate	D				D		D
Temperature and Dissolved Oxygen (DO)	D,T		D,T	D,T	D,T		
pH	3,C		D,T	D,T	3,C	DE	
Ultraviolet Absorption (UV)		2,G			2,C	DE	
Total Dissolved Solids (TDS) [1]					1,C		
Total Organic Carbon (TOC)					2,C		
Dissolved Organic Carbon (DOC)				2,G	2,C		
Alkalinity (Alk)	3,C				1,C	DE	
COD	3,C				2,C	DE	1,G
BOD_5	3,C				2,C	DE	
TKN	3,C	3,G			3,C	DE	
NH_3	3,C	3,G	3,G	3,G	2,C	DE	
Nitrate & Nitrite (NO_3 and NO_2)	3,C			3,G	1,C	DE	
Total Phosphorus (TP)	3,C				2,C	DE	
Orthophosphate (OP)	3,C				2,C	DE	
Total Suspended Solids (TSS)	3,C	3,G	1,G	3,G	3,C	DE	3,G
Volatile Suspended Solids (VSS)	1,C	1,G		1,G			1,G
Calcium and Magnesium	1,C					DE	
Silica				1,G			
Fecal and Total Coliform	1,C				1,C	DE	
Giardia lamblia [1]	1,C				1,C	DE	
Cryptosporidium [1]	1,C				1,C	DE	

Notes: [1] Measured approximately once per SRT

Legend

D: Daily

C: 24-hour Composite

G: Grab

T: In Tank

1: One sample per week

2: Two samples per week

3: Three samples per week

DE: Measured when effluent was disinfected

run date:	2/1/06

Model 1: Existing Facility Average Month

Temp:	12.5	deg C

Yellow boxes indicate parameters that may need to be changed in BioWin before running model.

Elements	Flow [mgd]	Total suspended solids [mgTSS/L]	Volatile suspended solids [mgVSS/L]	Total N [mgN/L]	Ammonia N [mgN/L]	Total Kjeldahl Nitrogen [mgN/L]	Nitrate N [mgN/L]	Magnesium [mg/L]	Calcium [mg/L]	Total Carbonaceous BOD [mg/L]	Total COD [mg/L]	Total P [mgP/L]	Soluble PO4-P [mgP/L]	Temperature [deg. C]	Alkalinity [mmol/L]	Dissolved oxygen [mg/L]	pH []	Inorganic S.S. [mgTSS/L]
Influent	4.70	257.47	193.44	29.31	18.04	29.1	0.21	13.8	66.4	243.14	495	5.8	2.9	12.5	4.14	4.8	7.7	64
Influent Mixer	3.90	238.95	177.32	28.32	15.3	26.52	1.8	13.8	66.4	205.57	434.08	5.55	2.6	12.5	3.85	4.21	7.48	60.18
Ox Mixer	5.19	1795.46	1210.17	118.37	10.08	112.86	5.51	13.8	66.4	632.31	1904.25	34.17	2.31	12.5	3.24	3.33	7.39	517.98
Oxidation	5.19	1774.61	1184.94	117.32	0.93	105.33	11.99	13.8	66.4	542.34	1774.17	34.17	1.79	12.5	2.17	1.8	7.18	517.98
RAS1	1.89	4516.48	3015.75	275.79	0.93	263.8	11.99	13.8	66.4	1378.33	4474.32	84.2	1.79	12.5	2.17	1.8	7.18	1318.28
FST1	3.19	57.72	38.54	18.09	0.93	6.1	11.99	13.8	66.4	18.87	83.4	2.84	1.79	12.5	2.17	1.8	7.18	16.85
PST2	2.57	120.87	89.7	24.81	15.3	23.02	1.8	13.8	66.4	148.87	295.36	4.1	2.6	12.5	3.85	4.21	7.48	30.44
Aeration Mixer	3.79	1705.97	1259.45	126.36	13.22	124.03	2.33	13.8	66.4	815.48	1968.94	36.37	2.11	12.5	3.7	3.5	7.19	369.37
Aeration2	3.79	1723.71	1272.73	125.84	9.09	122.71	3.13	13.8	66.4	760.58	1895.77	36.37	1.02	12.5	3.41	2	6.83	369.37
FST2	2.59	25.24	18.63	15.9	9.09	12.77	3.13	13.8	66.4	13.56	55.58	1.54	1.02	12.5	3.41	2	6.83	5.41
RAS2	1.13	5383.92	3975.31	362.76	9.09	359.63	3.13	13.8	66.4	2370.41	5861.39	111.41	1.02	12.5	3.41	2	6.83	1153.72
Sand Filters	4.58	10.9	7.48	15.18	4.58	7.16	8.02	13.8	66.4	5.51	38.33	1.65	1.45	12.5	2.73	1.89	6.9	2.96
Effluent	4.58	10.9	7.48	15.18	4.58	7.16	8.02	13.8	66.4	5.51	38.33	1.65	1.45	12.5	2.73	1.89	6.96	2.96
Thickener	0.04	1479.8	1050.21	93.41	5.71	85.83	7.58	13.8	66.4	597.15	1622.68	27.42	1.65	12.5	2.83	2.21	7.04	379.85
BFP	0.05	112.47	79.82	21.43	5.71	13.85	7.58	13.8	66.4	38.75	165.12	3.61	1.65	12.5	2.83	2.21	6.98	28.87
Sludge	0.12	9325.23	6618.06	506.42	5.71	498.84	7.58	13.8	66.4	3686.37	9985.74	164.06	1.65	12.5	2.83	2.21	7.04	2393.68

	Model	Data	% Difference	Permit	
Flow [mgd]	4.7	4.7	0.0%	6.0	
Total suspended solids [mgTSS/L]	10.9	9.2	18.5%	30	*11/1 - 5/31*
Volatile suspended solids [mgVSS/L]	7.5			NA	
Ammonia N [mgN/L]	4.6	2.6	76.2%	1.1	*outfall 002, 6/1 - 10/31*
Total Kjeldahl Nitrogen [mgN/L]	7.16	4.3	66.5%	monitor	
Nitrate N [mgN/L]	8.0			NA	
Total N [mgN/L]	15.2			NA	
Magnesium [mg/L]	13.8			NA	
Calcium [mg/L]	66.4			NA	
Total Carbonaceous BOD [mg/L]	5.5	7.2	-23.5%	monitor	
Total COD [mg/L]	38.3			NA	
Total P [mgP/L]	1.7			NA	
Soluble PO4-P [mgP/L]	1.5			NA	
Temperature [deg. C]	12.5	16.9		21.1	*outfall 002*
Alkalinity [mmol/L]	2.7			NA	
Dissolved oxygen [mg/L]	1.9	10		7.0	*daily max*
pH []	7.0	7.3	-4.7%	6.5 - 8.5	
Inorganic S.S. [mgTSS/L]	3.0			NA	*outfall 001 daily max,*
UOD, mg/L	40.5	28.3	43.1%	50	*4.5*TKN + 1.5*CBOD*

FST1	98.00%	removal
FST2	99.00%	
Filters	80.00%	removal

Elements	Model	Setpoint	
Influent	4.7		
Oxidation	5.19		
RAS1	2.0	2.0	per OCDEFS: pump runs at capacity
WAS1	0.11	0.11	match
FST1	3.19		
PST2	2.57		
Aeration2	3.79		
RAS2	1.2	1.2	
WAS2	0.07	0.07	match
FST2	2.59		
Effluent	4.58		
Thickener	0.04		
BFP	0.05		
Sludge	0.12	0.12	change BFP output

Model 1: Existing Facility Average Month

Temp:	16.9	deg C

Yellow boxes indicate parameters that may need to be changed in BioWin before running model.

Elements	Flow [mgd]	Total suspended solids [mgTSS/L]	Volatile suspended solids [mgVSS/L]	Total N [mgN/L]	Ammonia N [mgN/L]	Total Kjeldahl Nitrogen [mgN/L]	Nitrate N [mgN/L]	Magnesium [mg/L]	Calcium [mg/L]	Total Carbonaceous BOD [mg/L]	Total COD [mg/L]	Total P [mgP/L]	Soluble PO4-P [mgP/L]	Temperature [deg. C]	Alkalinity [mmol/L]	Dissolved oxygen [mg/L]	pH []	Inorganic S.S. [mgTSS/L]
Influent	4.7	257.47	193.44	29.31	18.04	29.1	0.21	13.8	66.4	243.14	495	5.8	2.9	16.9	4.14	4.8	7.7	64
Influent Mixer	5.9	238.21	176.63	28.32	14.95	26.11	2.21	13.8	66.4	204.84	433.04	5.55	2.63	16.9	3.8	4.21	7.49	60.18
Ox Mixer	5.19	1756.61	1174.12	115.11	9.72	109.07	6.04	13.8	66.4	595.99	1852.33	33.15	2.37	16.9	3.17	3.33	7.39	517.98
Oxidation	5.19	1733.16	1146.49	114.03	0.56	101.28	12.75	13.8	66.4	303.59	1718.78	33.15	1.93	16.9	2.09	1.8	7.18	517.98
RAS1	1.89	4411	2917.88	266.84	0.56	254.1	12.75	13.8	66.4	1279.78	4333.45	81.38	1.93	16.9	2.09	1.8	7.18	1318.28
FST1	3.19	56.37	37.29	18.34	0.56	5.59	12.75	13.8	66.4	17.57	81.53	2.94	1.93	16.9	2.09	1.8	7.18	16.85
PST2	2.57	120.5	89.35	24.84	14.95	22.63	2.21	13.8	66.4	148.49	294.82	4.11	2.63	16.9	3.8	4.21	7.49	30.44
Aeration Mixer	3.79	1678.06	1232.51	124.69	11.94	120.98	3.71	13.8	66.4	786.98	1927.75	35.82	2.15	16.9	3.5	3.5	7.18	369.37
Acration2	3.79	1694.34	1244.37	124.13	5.7	117.45	6.68	13.8	66.4	730.43	1852.18	35.82	1.09	16.9	2.91	2	6.78	369.37
FST2	2.59	24.81	18.22	16.01	5.7	9.32	6.68	13.8	66.4	12.91	54.64	1.6	1.09	16.9	2.91	2	6.78	5.41
RAS2	1.13	5292.18	3886.73	357.15	5.7	350.47	6.68	13.8	66.4	2276.7	5725.88	109.59	1.09	16.9	2.91	2	6.78	1153.72
Sand Filters	4.58	10.66	7.26	15.43	2.86	5.39	10.03	13.8	66.4	5.17	37.83	1.75	1.55	16.9	2.46	1.89	6.9	2.96
Effluent	4.58	10.66	7.26	15.43	2.86	5.39	10.03	13.8	66.4	5.17	37.83	1.75	1.55	16.9	2.46	1.89	6.92	2.96
Thickener	0.04	1456.08	1027.89	91.78	4.33	82.56	9.22	13.8	66.4	574.19	1389.72	26.92	1.75	16.9	2.61	2.21	7.02	379.85
BFP	0.05	110.66	78.12	21.54	4.33	12.32	9.22	13.8	66.4	56.91	162.48	3.66	1.75	16.9	2.61	2.21	6.99	28.87
Sludge	0.12	9175.73	6477.39	494.8	4.33	485.58	9.22	13.8	66.4	3542.22	9778.81	160.36	1.75	16.9	2.61	2.21	7.02	2393.68

	Model	Data	% Difference	Permit	
Flow [mgd]	4.7	4.7	0.0%	6.0	
Total suspended solids [mgTSS/L]	10.7	9.2	15.9%	30	*11/1 - 5/31*
Volatile suspended solids [mgVSS/L]	7.26			NA	
Ammonia N [mgN/L]	2.86	2.6	10.0%	1.1	*outfall 002, 6/1 - 10/31*
Total Kjeldahl Nitrogen [mgN/L]	5.39	4.3	25.3%	monitor	
Nitrate N [mgN/L]	10.0			NA	
Total N [mgN/L]	15.43			NA	
Magnesium [mg/L]	13.8			NA	
Calcium [mg/L]	66.4			NA	
Total Carbonaceous BOD [mg/L]	5.17	7.2	-28.2%	monitor	
Total COD [mg/L]	37.8			NA	
Total P [mgP/L]	1.75			NA	
Soluble PO4-P [mgP/L]	1.6			NA	
Temperature [deg. C]	16.9	16.9		21.1	*outfall 002*
Alkalinity [mmol/L]	2.5			NA	
Dissolved oxygen [mg/L]	1.9	10		7.0	*daily max*
pH []	6.92	7.3	-5.2%	6.5 - 8.5	
Inorganic S.S. [mgTSS/L]	3.0			NA	*outfall 001 daily max,*
UOD, mg/L	32.0	28.3	13.1%	50	*4.5*TKN + 1.5*CBOD*

FST1	98.00%	removal
FST2	99.00%	
Filters	80.00%	removal

Elements	Model	Setpoint	
Influent	4.7		
Oxidation	5.19		
RAS1	2.0	2.0	per OCDEFS: pump runs at capacity
WAS1	0.11	0.11	match
FST1	3.19		
PST2	2.57		
Aeration2	3.79		
RAS2	1.2	1.2	
WAS2	0.07	0.07	match
FST2	2.59		
Effluent	4.58		
Thickener	0.04		
BFP	0.05		
Sludge	0.12	0.12	change BFP output

run date: 2/1/06

Model 1: Existing Facility Maximum Month

Temp: 12.5 deg C

Yellow boxes indicate parameters that may need to be changed in BioWin before running model.

Elements	Flow [mgd]	Total suspended solids [mgTSS/L]	Volatile suspended solids [mgVSS/L]	Total N [mgN/L]	Ammonia N [mgN/L]	Total Kjeldahl Nitrogen [mgN/L]	Nitrate N [mgN/L]	Magnesium [mg/L]	Calcium [mg/L]	Total Carbonaceous BOD [mg/L]	Total COD [mg/L]	Total P [mgP/L]	Soluble PO4-P [mgP/L]	Temperature [deg. C]	Alkalinity [mmol/L]	Dissolved oxygen [mg/L]	pH []	Inorganic S.S. [mgTSS/L]
Influent	7.1	256.49	175.46	45.47	13.14	45.3	0.17	10.4	51.6	220.54	449	6.7	3.35	12.5	2.98	4.4	8	81
Influent Mixer	8.3	261.64	176.94	45.49	12.4	42.82	2.67	10.4	51.6	203.08	427.19	6.83	3.22	12.5	2.76	4.04	7.65	82.99
Ox Mixer	6.54	2309.88	1429.72	156.3	9.31	146.83	9.48	10.4	51.6	784.18	2230.4	41.71	3.09	12.5	2.07	3.39	7.41	798.39
Oxidation	6.54	2293.35	1407.98	155.2	1.7	129	26.2	10.4	51.6	691.8	2097.22	41.71	2.78	12.5	0.39	1.8	6.48	798.39
RAS1	1.89	7347.03	4510.63	428.82	1.7	402.62	26.2	10.4	51.6	2213.24	6664.96	127.49	2.78	12.5	0.39	1.8	6.48	2557.74
FST1	4.54	66.08	40.57	34.62	1.7	8.41	26.2	10.4	51.6	21.26	84.12	3.9	2.78	12.5	0.39	1.8	6.48	23.01
PST2	3.62	131.9	89.2	37.24	12.4	34.57	2.67	10.4	51.6	146.21	288.55	5.04	3.22	12.5	2.76	4.04	7.65	41.84
Aeration Mixer	5.41	2537.96	1732.04	184.66	13.51	180.6	4.06	10.4	51.6	1100.76	2655.5	50.79	2.81	12.5	2.77	3.37	7.16	697.98
Aeration2	5.41	2555.21	1745.01	184.14	16.03	177.6	6.54	10.4	51.6	1048.36	2585.76	50.79	1.97	12.5	2.84	2	6.78	697.98
FST2	3.61	38.29	26.15	29.08	16.03	22.54	6.54	10.4	51.6	18.13	64.28	2.7	1.97	12.5	2.84	2	6.78	10.46
RAS2	1.73	7605.85	5194.19	495.3	16.03	488.76	6.54	10.4	51.6	3115.71	7645.53	147.3	1.97	12.5	2.84	2	6.78	2077.61
Sand Filters	6.95	12.61	8.02	29.84	8.05	12.35	17.49	10.4	51.6	6.08	36.86	2.64	2.42	12.5	1.47	1.89	6.66	4.09
Effluent	6.95	12.61	8.02	29.84	8.05	12.35	17.49	10.4	51.6	6.08	36.86	2.64	2.42	12.5	1.47	1.89	6.72	4.09
Thickener	0.03	3030.57	1971.44	207.52	8	191.23	16.29	10.4	51.6	1131.94	2999.8	53.38	2.57	12.5	1.54	2.19	6.82	963.88
BFP	0.03	287.9	187.29	46.22	8	29.93	16.29	10.4	51.6	120.35	323.44	7.4	2.57	12.5	1.54	2.19	6.76	91.57
Sludge	0.15	11458.57	7454.01	703.17	8	686.89	16.29	10.4	51.6	4240.47	11224.05	194.68	2.57	12.5	1.54	2.19	6.82	3644.44

	Model	Data	% Difference	Permit	
Flow [mgd]	7.1	7.1	0.0%	6.0	
Total suspended solids [mgTSS/L]	12.6	25.1	-49.8%	30	*11/1 - 5/31*
Volatile suspended solids [mgVSS/L]	8.0			NA	
Ammonia N [mgN/L]	8.05	5.7	41.2%	1.1	*outfall 002, 6/1 - 10/31*
Total Kjeldahl Nitrogen [mgN/L]	12.4	12.9	-4.3%	monitor	
Nitrate N [mgN/L]	17.49			NA	
Total N [mgN/L]	29.8				
Magnesium [mg/L]	10.4			NA	
Calcium [mg/L]	51.6			monitor	
Total Carbonaceous BOD [mg/L]	6.08	16.3	-62.7%	NA	
Total COD [mg/L]	36.9			NA	
Total P [mgP/L]	2.6			NA	
Soluble PO4-P [mgP/L]	2.42			NA	
Temperature [deg. C]	12.5	23.6		21.1	*outfall 002*
Alkalinity [mmol/L]	1.47			NA	
Dissolved oxygen [mg/L]	1.9	13.3		7.0	*daily max*
pH []	6.72	7.5	-10.4%	6.5 - 8.5	
Inorganic S.S. [mgTSS/L]	4.09			NA	*outfall 001 daily max,*
UOD, mg/L	64.7	64.2	0.8%	50	*4.5*TKN + 1.5*CBOD*

Elements	Model	Setpoint	
Influent	7.1		
Oxidation	6.54		
RAS1	2.0	2.0	
WAS1	0.11	0.11	match
FST1	4.54		
PST2	3.62		
Aeration2	5.41		
RAS2	1.8	1.8	
WAS2	0.07	0.07	match
FST2	3.61		
Effluent	6.95		
Thickener	0.03		
BFP	0.03		
Sludge	0.15	0.15	change BFP output

FST1	98.00%	removal
FST2	99.00%	
Filters	80.00%	removal

Model 1: Existing Facility Maximum Month

Temp:	16.9	deg C

Yellow boxes indicate parameters that may need to be changed in BioWin before running model.

Elements	Flow [mgd]	Total suspended solids [mgTSS/L]	Volatile suspended solids [mgVSS/L]	Total N [mgN/L]	Ammonia N [mgN/L]	Total Kjeldahl Nitrogen [mgN/L]	Nitrate N [mgN/L]	Magnesium [mg/L]	Calcium [mg/L]	Total Carbonaceous BOD [mg/L]	Total COD [mg/L]	Total P [mgP/L]	Soluble PO4-P [mgP/L]	Temperature [deg. C]	Alkalinity [mmol/L]	Dissolved oxygen [mg/L]	pH []	Inorganic S.S. [mgTSS/L]
Influent	7.1	256.49	175.46	45.47	13.14	45.3	0.17	10.4	51.6	220.54	449	6.7	3.35	16.9	2.98	4.4	8	81
Influent Mixer	8.3	260.89	176.23	45.46	11.88	42.21	3.25	10.4	51.6	202.32	426.12	6.82	3.23	16.9	2.68	4.04	7.66	82.99
Ox Mixer	6.54	2265.38	1388.54	152.39	8.72	142.16	10.23	10.4	51.6	742.44	2170.9	40.52	3.14	16.9	1.97	3.39	7.4	798.39
Oxidation	6.54	2246.1	1364.05	151.26	0.94	123.85	27.4	10.4	51.6	647.27	2033.75	40.52	2.91	16.9	0.24	1.8	6.29	798.39
RAS1	1.89	7195.65	4369.91	415.34	0.94	387.94	27.4	10.4	51.6	2070.73	6461.78	123.38	2.91	16.9	0.24	1.8	6.29	2557.74
FST1	4.54	64.72	39.3	34.87	0.94	7.46	27.4	10.4	51.6	19.92	82.21	3.99	2.91	16.9	0.24	1.8	6.29	23.01
PST2	3.62	131.52	88.85	37.25	11.88	34	3.25	10.4	51.6	145.82	287.99	5.04	3.23	16.9	2.68	4.04	7.66	41.84
Aeration Mixer	5.41	2508.31	1703.02	182.33	10.82	175.45	6.88	10.4	51.6	1067.65	2610.25	50.26	2.83	16.9	2.38	3.37	7.1	697.98
Aeration2	5.41	2524.58	1715	181.8	8.81	167.75	14.04	10.4	51.6	1013.95	2538.75	50.26	2	16.9	1.78	2	6.58	697.98
FST2	3.61	37.83	25.7	29.17	8.81	15.12	14.04	10.4	51.6	17.4	63.28	2.73	2	16.9	1.78	2	6.58	10.46
RAS2	1.73	7514.66	5104.87	488.08	8.81	474.03	14.04	10.4	51.6	3013.71	7506.19	145.63	2	16.9	1.78	2	6.58	2077.61
Sand Filters	6.95	12.38	7.8	30.08	4.43	8.6	21.48	10.4	51.6	5.73	36.37	2.73	2.51	16.9	0.92	1.89	6.5	4.09
Effluent	6.95	12.38	7.8	30.08	4.43	8.6	21.48	10.4	51.6	5.73	36.37	2.73	2.51	16.9	0.92	1.89	6.52	4.09
Thickener	0.03	2989.88	1933.06	204.16	5.13	184.66	19.5	10.4	51.6	1091.59	2943.03	52.43	2.65	16.9	1.1	2.19	6.68	963.88
BFP	0.03	284.04	183.64	46.12	5.13	26.62	19.5	10.4	51.6	116.42	317.92	7.38	2.65	16.9	1.1	2.19	6.66	91.57
Sludge	0.15	11304.72	7308.89	689.8	5.13	670.3	19.5	10.4	51.6	4088.21	11009.8	190.84	2.65	16.9	1.1	2.19	6.68	3644.44

	Model	Data	% Difference	Permit	
Flow [mgd]	7.1	7.1	0.0%	6.0	
Total suspended solids [mgTSS/L]	12.4	25.1	-50.7%	30	*11/1 - 5/31*
Volatile suspended solids [mgVSS/L]	7.8			NA	
Ammonia N [mgN/L]	4.4	5.7	-22.3%	1.1	*outfall 002, 6/1 - 10/31*
Total Kjeldahl Nitrogen [mgN/L]	8.6	12.9	-33.3%	monitor	
Nitrate N [mgN/L]	21.5			NA	
Total N [mgN/L]	30.1				
Magnesium [mg/L]	10.4			NA	
Calcium [mg/L]	51.6			monitor	
Total Carbonaceous BOD [mg/L]	5.7	16.3	-64.8%	NA	
Total COD [mg/L]	36			NA	
Total P [mgP/L]	2.7			NA	
Soluble PO4-P [mgP/L]	2.51			NA	
Temperature [deg. C]	16.9	23.6		21.1	*outfall 002*
Alkalinity [mmol/L]	0.9			NA	
Dissolved oxygen [mg/L]	1.9	13.3		7.0	*daily max*
pH []	6.5	7.5	-13.1%	6.5 - 8.5	
Inorganic S.S. [mgTSS/L]	4.1			NA	*outfall 001 daily max,*
UOD, mg/L	47.3	64.2	-26.3%	50	*4.5*TKN + 1.5*CBOD*

FST1	98.00%	removal
FST2	99.00%	
Filters	80.00%	removal

Elements	Model	Setpoint	
Influent	7.1		
Oxidation	6.54		
RAS1	2.0	2.0	
WAS1	0.11	0.11	match
FST1	4.54		
PST2	3.62		
Aeration2	5.41		
RAS2	1.8	1.8	
WAS2	0.07	0.07	match
FST2	3.61		
Effluent	6.95		
Thickener	0.03		
BFP	0.03		
Sludge	0.15	0.15	change BFP output

run date:	2/1/06

Temp: 12.5 deg C — Yellow boxes indicate parameters that may need to be changed in BioWin before running model.

Model 1: Existing Facility Maximum Day

Elements	Flow [mgd]	Total suspended solids [mgTSS/L]	Volatile suspended solids [mgVSS/L]	Total N [mgN/L]	Ammonia N [mgN/L]	Total Kjeldahl Nitrogen [mgN/L]	Nitrate N [mgN/L]	Magnesium [mg/L]	Calcium [mg/L]	Total Carbonaceous BOD [mg/L]	Total COD [mg/L]	Total P [mgP/L]	Soluble PO4-P [mgP/L]	Temperature [deg. C]	Alkalinity [mmol/L]	Dissolved oxygen [mg/L]	pH []	Inorganic S.S. [mgTSS/L]
Influent	13.4	198.5	132.48	33.98	10.82	33.8	0.18	5.6	31.2	166.51	339	7.3	3.65	12.5	2.42	3.4	8.6	66
Influent Mixer	14.6	220.54	146.12	35.11	10.64	34.21	0.9	5.6	31.2	167.04	348.93	7.68	3.64	12.5	2.36	3.28	8.28	72.88
Ox Mixer	10.07	2340.85	1455	151.54	9.52	148.09	3.46	5.6	31.2	857.52	2252.26	44.43	3.71	12.5	2.1	3	7.9	801.04
Oxidation	10.07	2334.22	1442.94	150.63	4.7	136.1	14.52	5.6	31.2	780.75	2141.32	44.43	4	12.5	1	1.8	6.91	801.04
RAS1	1.89	11513.17	7117.08	655.24	4.7	640.72	14.52	5.6	31.2	3844.47	10485.93	203.41	4	12.5	1	1.8	6.91	3951.02
FST1	8.07	58.26	36.01	25.5	4.7	10.98	14.52	5.6	31.2	21.09	72.24	5.01	4	12.5	1	1.8	6.91	19.99
PST2	6.39	110.79	73.4	28.57	10.64	27.67	0.9	5.6	31.2	119.53	234.15	5.67	3.64	12.5	2.36	3.28	8.28	36.61
Aeration Mixer	8.38	2724.26	1859.83	186.91	11.29	185.72	1.19	5.6	31.2	1226.46	2845.28	55.43	3.5	12.5	2.4	2.97	7.39	755.23
Aeration2	8.38	2744.19	1875.87	186.51	13.56	184.6	1.91	5.6	31.2	1183.47	2789.12	55.43	3.04	12.5	2.56	2	6.76	755.23
FST2	6.38	36.04	24.64	21.86	13.56	19.95	1.91	5.6	31.2	18.85	58.04	3.73	3.04	12.5	2.56	2	6.76	9.92
RAS2	1.93	11388.61	7784.99	712.07	13.56	710.16	1.91	5.6	31.2	4900.97	11506.72	220.48	3.04	12.5	2.56	2	6.76	3134.28
Sand Filters	13.25	10.57	6.76	21.74	8.62	12.79	8.95	5.6	31.2	6.26	30.3	3.77	3.58	12.5	1.69	1.89	6.74	3.39
Effluent	13.25	10.57	6.76	21.74	8.62	12.79	8.95	5.6	31.2	6.26	30.3	3.77	3.58	12.5	1.69	1.89	6.8	3.39
Thickener	0.03	4620.04	2995.3	288.51	8.5	280.14	8.37	5.6	31.2	1799.13	4527.71	87.17	3.63	12.5	1.71	2.08	6.91	1480.18
BFP	0.03	438.9	284.55	46.75	8.5	38.38	8.37	5.6	31.2	181.96	461.11	11.57	3.63	12.5	1.72	2.08	6.85	140.62
Sludge	0.15	17468.37	11325.23	1031.41	8.5	1023.04	8.37	5.6	31.2	6768.56	17024.09	319.48	3.63	12.5	1.71	2.08	6.91	5596.55

	Model	Data	% Difference	Permit	
Flow [mgd]	13.4	13.4	0.0%	6.0	
Total suspended solids [mgTSS/L]	10.6	59	-82.1%	30	*11/1 - 5/31*
Volatile suspended solids [mgVSS/L]	6.8			NA	
Ammonia N [mgN/L]	8.62	10.5	-17.9%	1.1	*outfall 002, 6/1 - 10/31*
Total Kjeldahl Nitrogen [mgN/L]	12.8	42	-69.5%	monitor	
Nitrate N [mgN/L]	8.95			NA	
Total N [mgN/L]	21.7				
Magnesium [mg/L]	5.6			NA	
Calcium [mg/L]	31.2			monitor	
Total Carbonaceous BOD [mg/L]	6.26	40.4	-84.5%	NA	
Total COD [mg/L]	30.3			NA	
Total P [mgP/L]	3.8			NA	
Soluble PO4-P [mgP/L]	3.58			NA	
Temperature [deg. C]	12.5	23.6		21.1	*outfall 002*
Alkalinity [mmol/L]	1.69			NA	
Dissolved oxygen [mg/L]	1.9	13.8		7.0	*daily max*
pH []	6.8	8.3	-18.1%	6.5 - 8.5	
Inorganic S.S. [mgTSS/L]	3.39			NA	*outfall 001 daily max,*
UOD, mg/L	66.9	116.7	-42.6%	50	*4.5*TKN + 1.5*CBOD*

FST1	98.00%	removal
FST2	99.00%	
Filters	80.00%	removal

Elements	Model	Setpoint	
Influent	13.4		
Oxidation	10.07		
RAS1	2.0	2.0	
WAS1	0.11	0.11	match
FST1	8.07		
PST2	6.39		
Aeration2	8.38		
RAS2	2.0	2.0	
WAS2	0.07	0.07	match
FST2	6.38		
Effluent	13.25		
Thickener	0.03		
BFP	0.03		
Sludge	0.15	0.15	change BFP output

Model 1: Existing Facility Maximum Day

Temp:	16.9	deg C

Yellow boxes indicate parameters that may need to be changed in BioWin before running model.

Elements	Flow [mgd]	Total suspended solids [mgTSS/L]	Volatile suspended solids [mgVSS/L]	Total N [mgN/L]	Ammonia N [mgN/L]	Total Kjeldahl Nitrogen [mgN/L]	Nitrate N [mgN/L]	Magnesium [mg/L]	Calcium [mg/L]	Total Carbonaceous BOD [mg/L]	Total COD [mg/L]	Total P [mgP/L]	Soluble PO4-P [mgP/L]	Temperature [deg. C]	Alkalinity [mmol/L]	Dissolved oxygen [mg/L]	pH []	Inorganic S.S. [mgTSS/L]
Influent	13.4	198.5	132.48	33.98	10.82	33.8	0.18	5.6	31.2	166.51	339	7.3	3.65	16.9	2.42	3.4	8.6	66
Influent Mixer	14.6	219.92	145.52	35.07	10.43	33.93	1.14	5.6	31.2	166.39	347.99	7.67	3.65	16.9	2.33	3.28	8.35	72.88
Ox Mixer	10.07	2304.41	1420.74	148.32	8.76	144.02	4.3	5.6	31.2	821.62	2201.93	43.44	3.73	16.9	1.99	3	7.97	801.04
Oxidation	10.07	2295.42	1406.48	147.38	1.56	129.37	18.01	5.6	31.2	742.49	2087.7	43.44	4.09	16.9	0.52	1.8	6.63	801.04
RAS1	1.89	11321.8	6937.26	638.24	1.56	620.23	18.01	5.6	31.2	3656.12	10221.98	198.18	4.09	16.9	0.52	1.8	6.63	3951.02
FST1	8.07	57.29	35.1	25.67	1.56	7.66	18.01	5.6	31.2	20.04	70.77	5.07	4.09	16.9	0.52	1.8	6.63	19.99
PST2	6.39	110.47	73.1	28.56	10.43	27.42	1.14	5.6	31.2	119.2	233.67	5.67	3.65	16.9	2.33	3.28	8.35	36.61
Aeration Mixer	8.38	2683.42	1817.95	184.25	10.71	182.4	1.86	5.6	31.2	1182.03	2775.97	54.65	3.52	16.9	2.31	2.97	7.42	755.23
Aeration2	8.38	2701.94	1832.51	183.82	11.8	179.86	3.96	5.6	31.2	1137.2	2716.9	54.65	3.08	16.9	2.29	2	6.71	755.23
FST2	6.38	35.48	24.07	21.9	11.8	17.95	3.96	5.6	31.2	17.85	56.54	3.75	3.08	16.9	2.29	2	6.71	9.92
RAS2	1.93	11213.25	7605.04	700.65	11.8	696.69	3.96	5.6	31.2	4710.14	11208.75	217.12	3.08	16.9	2.29	2	6.71	3134.28
Sand Filters	13.25	10.39	6.59	21.9	6.08	10.1	11.8	5.6	31.2	5.86	29.72	3.83	3.64	16.9	1.3	1.89	6.67	3.39
Effluent	13.25	10.39	6.59	21.9	6.08	10.1	11.8	5.6	31.2	5.86	29.72	3.83	3.64	16.9	1.3	1.89	6.69	3.39
Thickener	0.03	4561.17	2938.12	283.89	6.24	272.98	10.91	5.6	31.2	1738.83	4439.47	85.77	3.69	16.9	1.37	2.08	6.82	1480.18
BFP	0.03	433.31	279.12	46.46	6.24	35.55	10.91	5.6	31.2	176.07	452.49	11.49	3.69	16.9	1.37	2.08	6.79	140.62
Sludge	0.15	17245.77	11109.03	1013.5	6.24	1002.58	10.91	5.6	31.2	6541.09	16691.16	314.04	3.69	16.9	1.37	2.08	6.82	5596.55

	Model	Data	% Difference	Permit	
Flow [mgd]	13.4	13.4	0.0%	6.0	
Total suspended solids [mgTSS/L]	10.4	59	-82.4%	30	*11/1 - 5/31*
Volatile suspended solids [mgVSS/L]	6.6			NA	
Ammonia N [mgN/L]	6.1	10.5	-42.1%	1.1	*outfall 002, 6/1 - 10/31*
Total Kjeldahl Nitrogen [mgN/L]	10.1	42	-76.0%	monitor	
Nitrate N [mgN/L]	11.8			NA	
Total N [mgN/L]	21.9				
Magnesium [mg/L]	5.6			NA	
Calcium [mg/L]	31.2			monitor	
Total Carbonaceous BOD [mg/L]	5.9	40.4	-85.5%	NA	
Total COD [mg/L]	30			NA	
Total P [mgP/L]	3.8			NA	
Soluble PO4-P [mgP/L]	3.64			NA	
Temperature [deg. C]	16.9	23.6		21.1	*outfall 002*
Alkalinity [mmol/L]	1.3			NA	
Dissolved oxygen [mg/L]	1.9	13.8		7.0	*daily max*
pH []	6.7	8.3	-19.4%	6.5 - 8.5	
Inorganic S.S. [mgTSS/L]	3.4			NA	*outfall 001 daily max,*
UOD, mg/L	54.2	116.7	-53.5%	50	*4.5*TKN + 1.5*CBOD*

FST1	98.00%	removal
FST2	99.00%	
Filters	80.00%	removal

Elements	Model	Setpoint	
Influent	13.4		
Oxidation	10.07		
RAS1	2.0	2.0	
WAS1	0.11	0.11	match
FST1	8.07		
PST2	6.39		
Aeration2	8.38		
RAS2	2.0	2.0	
WAS2	0.07	0.07	match
FST2	6.38		
Effluent	13.25		
Thickener	0.03		
BFP	0.03		
Sludge	0.15	0.15	change BFP output

run date:	2/1/06

Temp: 12.5 deg C

Yellow boxes indicate parameters that may need to be changed in BioWin before running model.

Model 2: Phase I Facility Average Month

Elements	Flow [mgd]	Total suspended solids [mgTSS/L]	Volatile suspended solids [mgVSS/L]	Total Carbonaceous BOD [mg/L]	Total COD [mg/L]	Ammonia N [mgN/L]	Nitrate N [mgN/L]	Total P [mgP/L]	Soluble PO4-P [mgP/L]	Total Kjeldahl Nitrogen [mgN/L]	Total N [mgN/L]	Inorganic S.S. [mgTSS/L]	Calcium [mg/L]	Magnesium [mg/L]	Temperature [deg. C]	Alkalinity [mmol/L]	pH []	Dissolved oxygen [mg/L]	Liquid volume [Mil. Gal]
Influent	4.7	257.47	193.44	243.14	495	17.75	0.21	5.8	2.9	29.1	29.31	64	66.4	13.8	12.5	4.14	7.7	4.8	0
Oxidation	3.86	1284.1	841.89	354.68	1270.15	0.68	13.2	24.9	2.06	74.89	88.09	392.26	66.4	13.8	12.5	2.08	7.17	2	2.36
FST1	1.86	53.35	34.98	15.88	78.11	0.68	13.2	3.01	2.06	5.51	18.71	16.3	66.4	13.8	12.5	2.08	7.17	2	0.33
RAS1	1.89	2426.52	1590.9	669.16	2376.63	0.68	13.2	45.22	2.06	139.29	152.49	741.23	66.4	13.8	12.5	2.08	7.17	2	0
PST2	1.94	115.02	85.68	146.73	289.38	14.63	2.43	4.03	2.65	22.14	24.58	28.86	66.4	13.8	12.5	3.78	7.46	4.23	0.24
Aeration2	3.1	1905.8	1393.39	787.92	2065.08	4.06	9.12	40.67	1.33	130.56	139.68	419.82	66.4	13.8	12.5	2.64	6.72	2	0.47
FST2	1.9	31.12	22.75	14.58	60.5	4.06	9.12	1.97	1.33	8.04	17.15	6.85	66.4	13.8	12.5	2.64	6.72	2	0.24
RAS2	1.16	4868.99	3559.87	2010.28	5233.6	4.06	9.12	101.86	1.33	324.22	333.34	1072.57	66.4	13.8	12.5	2.64	6.72	2	0
Sand Filters1&2	2.55	12.38	8.47	5.52	39.3	2.39	11.14	1.92	1.69	5.01	16.15	3.39	66.4	13.8	12.5	2.36	6.81	2	0
PST3	2.64	84.84	62.58	107.08	219.22	11.13	4.39	3.58	2.46	17.59	21.98	21.38	66.4	13.8	12.5	3.41	7.18	3.66	0.35
Aeration3	6.1	1495.83	1049.42	480.37	1563.83	0.81	9.93	31.36	1.91	95.91	105.84	378.05	66.4	13.8	12.5	2.33	6.65	2	1.09
FST3	2.6	23.6	16.56	8.58	50.46	0.81	9.93	2.38	1.91	4.07	14.01	5.96	66.4	13.8	12.5	2.33	6.65	2	0.59
RAS3	1.46	4044.52	2837.48	1297.11	4183.73	0.81	9.93	81.53	1.91	254.9	264.83	1022.2	66.4	13.8	12.5	2.33	6.65	2	0
Sand Filters3	2	6.14	4.31	2.99	32.51	0.81	9.93	2.03	1.91	2.99	12.92	1.55	66.4	13.8	12.5	2.33	6.59	2	0
Effluent	4.55	9.64	6.64	4.41	36.32	1.7	10.61	1.97	1.79	4.12	14.73	2.58	66.4	13.8	12.5	2.35	6.76	2	0
Thickener	0.07	844.14	603.11	354.96	971.32	4.17	9.68	15.63	2.04	46.18	55.85	218.42	66.4	13.8	12.5	2.57	6.98	2.47	0.14
BFP	0.03	187.12	133.69	94.26	256.63	4.17	9.68	5.05	2.04	15.3	24.98	48.42	66.4	13.8	12.5	2.57	6.92	2.47	0
Sludge	0.15	7447.25	5320.83	2975.07	8154.05	4.17	9.68	121.96	2.04	356.47	366.15	1927.01	66.4	13.8	12.5	2.57	6.98	2.47	0

	Model	Data	% Difference	Permit	
Flow [mgd]	4.7	4.7	0.0%	6.0	
Total suspended solids [mgTSS/L]	9.64	9.2	4.8%	30	*11/1 - 5/31*
Volatile suspended solids [mgVSS/L]	6.64			NA	
Ammonia N [mgN/L]	1.7	2.6	-34.6%	1.1	*outfall 002, 6/1 - 10/31*
Total Kjeldahl Nitrogen [mgN/L]	4.12	4.3	-4.2%	monitor	
Nitrate N [mgN/L]	10.61			NA	
Total N [mgN/L]	14.73			NA	
Total BOD [mg/L]	4.41	7.2	-38.8%	monitor	
Total COD [mg/L]	36.32			NA	
Total P [mgP/L]	1.97			NA	
Soluble PO4-P [mgP/L]	1.79			NA	
Magnesium [mg/L]	13.8			NA	
Calcium [mg/L]	66.4			monitor	
Temperature [deg. C]	12.5	16.9		21.1	*outfall 002*
Alkalinity [mmol/L]	2.35			NA	
Dissolved oxygen [mg/L]	2	10		7.0	*daily max*
pH []	6.76	7.3	-7.4%	6.5 - 8.5	
Inorganic S.S. [mgTSS/L]	2.58			NA	*outfall 001 daily max,*
UOD, mg/L	25.2	28.3	-11.1%	50	*4.5*TKN + 1.5*CBOD*

Elements	Model	Setpoint	
Influent	4.7		
Oxidation	3.86		
RAS1	2.0	2.0	
WAS1	0.11	0.11	match
FST1	1.86		
FST2	1.94		
Aeration2	3.1		
RAS2	1.2	1.2	
WAS2	0.04	0.04	match
FST2	1.9		
PST3	2.64		
Aeration3	6.1		
RAS3	1.5	1.5	
IR	2.0	2.0	
WAS3	0.04	0.04	match
FST3	2.6		
Effluent	4.55		
Thickener	0.07		
BFP	0.03		
Sludge	0.15	0.15	change BFP output

FST1	98.00%	removal
FST2	99.00%	removal
FST3	99.00%	removal
Filters	80.00%	removal

Temp:	16.9	deg C	Yellow boxes	indicate parameters that may need to be changed in BioWin before running model.

Model 2: Phase I Facility <u>Average Month</u>

Elements	Flow [mgd]	Total suspended solids [mgTSS/L]	Volatile suspended solids [mgVSS/L]	Total Carbonaceous BOD [mg/L]	Total COD [mg/L]	Ammonia N [mgN/L]	Nitrate N [mgN/L]	Total P [mgP/L]	Soluble PO4-P [mgP/L]	Total Kjeldahl Nitrogen [mgN/L]	Total N [mgN/L]	Inorganic S.S. [mgTSS/L]	Calcium [mg/L]	Magnesium [mg/L]	Temperature [deg. C]	Alkalinity [mmol/L]	pH []	Dissolved oxygen [mg/L]	Liquid volume [Mil. Gal]
Influent	4.7	257.47	193.44	243.14	495	17.75	0.21	5.8	2.9	29.1	29.31	64	66.4	13.8	16.9	4.14	7.7	4.8	0
Oxidation	3.86	1254.41	814.39	326.98	1230.62	0.44	13.82	24.19	2.19	71.99	85.81	392.26	66.4	13.8	16.9	2.02	7.18	2	2.36
FST1	1.86	52.12	33.83	14.69	76.42	0.44	13.82	3.1	2.19	5.15	18.97	16.3	66.4	13.8	16.9	2.02	7.18	2	0.33
RAS1	1.89	2370.42	1538.93	616.85	2301.98	0.44	13.82	43.76	2.19	134.03	147.85	741.23	66.4	13.8	16.9	2.02	7.18	2	0
PST2	1.94	114.78	85.46	146.49	289.03	14.33	2.79	4.05	2.68	21.82	24.62	28.86	66.4	13.8	16.9	3.73	7.46	4.23	0.24
Aeration2	3.1	1865.93	1356.07	748.94	2010.49	1.41	12.03	39.72	1.41	124.59	136.62	419.82	66.4	13.8	16.9	2.24	6.66	2	0.47
FST2	1.9	30.46	22.14	13.84	59.46	1.41	12.03	2.04	1.41	5.31	17.34	6.85	66.4	13.8	16.9	2.24	6.66	2	0.24
RAS2	1.16	4767.14	3464.53	1910.87	5094.36	1.41	12.03	99.29	1.41	313.13	325.16	1072.57	66.4	13.8	16.9	2.24	6.66	2	0
Sand Filters1&2	2.55	12.11	8.21	5.18	38.83	0.93	12.91	2.02	1.8	3.51	16.42	3.39	66.4	13.8	16.9	2.13	6.81	2	0
PST3	2.64	84.35	62.13	106.61	218.54	10.82	4.77	3.61	2.5	17.23	22	21.38	66.4	13.8	16.9	3.35	7.19	3.66	0.35
Aeration3	6.1	1454.61	1011.27	442.31	1509.11	0.51	10.29	30.29	2.01	91.91	102.19	378.05	66.4	13.8	16.9	2.28	6.65	2	1.09
FST3	2.6	22.95	15.95	7.95	49.56	0.51	10.29	2.45	2.01	3.7	13.99	5.96	66.4	13.8	16.9	2.28	6.65	2	0.59
RAS3	1.46	3933.07	2734.33	1194.25	4035.84	0.51	10.29	78.47	2.01	244.6	254.89	1022.2	66.4	13.8	16.9	2.28	6.65	2	0
Sand Filters3	2	5.97	4.15	2.8	32.25	0.51	10.29	2.12	2.01	2.66	12.94	1.55	66.4	13.8	16.9	2.28	6.63	2	0
Effluent	4.55	9.41	6.43	4.14	35.94	0.75	11.76	2.07	1.89	3.14	14.9	2.58	66.4	13.8	16.9	2.19	6.74	2	0
Thickener	0.07	831.92	591.76	343.43	954.9	3.52	10.56	15.39	2.13	44.44	55	218.42	66.4	13.8	16.9	2.46	6.98	2.47	0.14
BFP	0.03	184.41	131.17	91.67	252.94	3.52	10.56	5.07	2.13	14.4	24.96	48.42	66.4	13.8	16.9	2.46	6.95	2.47	0
Sludge	0.15	7339.43	5220.7	2873.63	8009.69	3.52	10.56	119.07	2.13	346.37	356.93	1927.01	66.4	13.8	16.9	2.46	6.98	2.47	0

	Model	Data	% Difference	Permit	
Flow [mgd]	4.7	4.7	0.0%	6.0	
Total suspended solids [mgTSS/L]	9.41	9.2	2.3%	30	*11/1 - 5/31*
Volatile suspended solids [mgVSS/L]	6.43			NA	
Ammonia N [mgN/L]	0.75	2.6	-71.2%	1.1	*outfall 002, 6/1 - 10/31*
Total Kjeldahl Nitrogen [mgN/L]	3.14	4.3	-27.0%	monitor	
Nitrate N [mgN/L]	11.76			NA	
Total N [mgN/L]	14.9			NA	
Total BOD [mg/L]	4.14	7.2	-42.5%	monitor	
Total COD [mg/L]	35.94			NA	
Total P [mgP/L]	2.07			NA	
Soluble PO4-P [mgP/L]	1.89			NA	
Magnesium [mg/L]	13.8			NA	
Calcium [mg/L]	66.4			monitor	
Temperature [deg. C]	16.9	16.9		21.1	*outfall 002*
Alkalinity [mmol/L]	2.19			NA	
Dissolved oxygen [mg/L]	2	10		7.0	*daily max*
pH []	6.74	7.3	-7.7%	6.5 - 8.5	
Inorganic S.S. [mgTSS/L]	2.58			NA	*outfall 001 daily max,*
UOD, mg/L	20.3	28.3	-28.1%	50	*4.5*TKN + 1.5*CBOD*

Elements	Model	Setpoint	
Influent	4.7		
Oxidation	3.86		
RAS1	2.0	2.0	
WAS1	0.11	0.11	match
FST1	1.86		
PST2	1.94		
Aeration2	3.1		
RAS2	1.2	1.2	
WAS2	0.04	0.04	match
FST2	1.9		
PST3	2.64		
Aeration3	6.1		
RAS3	1.5	1.5	
IR	2.0	2.0	
WAS3	0.04	0.04	match
FST3	2.6		
Effluent	4.55		
Thickener	0.07		
BFP	0.03		
Sludge	0.15	0.15	change BFP output

FST1	98.00%	removal
FST2	99.00%	removal
FST3	99.00%	removal
Filters	80.00%	removal

run date:	2/1/05

Model 2: Phase I Facility Design Month

Temp:	12.5	deg C

Yellow boxes indicate parameters that may need to be changed in BioWin before running model.

Elements	Flow [mgd]	Total suspended solids [mgTSS/L]	Volatile suspended solids [mgVSS/L]	Total Carbonaceous BOD [mg/L]	Total COD [mg/L]	Ammonia N [mgN/L]	Nitrate N [mgN/L]	Total P [mgP/L]	Soluble PO4-P [mgP/L]	Total Kjeldahl Nitrogen [mgN/L]	Total N [mgN/L]	Inorganic S.S. [mgTSS/L]	Calcium [mg/L]	Magnesium [mg/L]	Temperature [deg. C]	Alkalinity [mmol/L]	pH []	Dissolved oxygen [mg/L]	Liquid volume [Mil. Gal]
Influent	6	257.47	193.44	243.14	495	17.75	0.21	5.8	2.9	29.1	29.31	64	66.4	13.8	12.5	4.14	7.7	4.8	0
Oxidation	4.29	1512.66	999.79	436.51	1502.3	0.75	12.86	29.19	1.98	88.82	101.68	453.01	66.4	13.8	12.5	2.11	7.18	2	2.36
FST1	2.29	56.68	37.46	17.53	81.78	0.75	12.86	3	1.98	5.81	18.67	16.97	66.4	13.8	12.5	2.11	7.18	2	0.33
RAS1	1.89	3179.59	2101.53	916.19	3128.63	0.75	12.86	59.18	1.98	183.85	196.71	952.23	66.4	13.8	12.5	2.11	7.18	2	0
PST2	2.37	121.02	90.17	153.78	302.24	15.25	1.94	4.15	2.69	23.09	25.03	30.3	66.4	13.8	12.5	3.85	7.5	4.33	0.24
Aeration2	3.83	2357.5	1727.53	984.06	2553.71	4.74	8.34	50.06	1.28	161.1	169.44	515.12	66.4	13.8	12.5	2.74	6.73	2	0.47
FST2	2.33	38.75	28.4	17.93	68.81	4.74	8.34	2.08	1.28	9.22	17.56	8.47	66.4	13.8	12.5	2.74	6.73	2	0.24
RAS2	1.46	5959.48	4366.99	2484.86	6413.8	4.74	8.34	124.6	1.28	397.04	405.38	1302.17	66.4	13.8	12.5	2.74	6.73	2	0
Sand Filters1&2	3.42	12.87	8.89	5.89	39.95	2.76	10.58	1.87	1.62	5.43	16.01	3.43	66.4	13.8	12.5	2.43	6.82	2	0
PST3	3.04	94.84	70.02	118.79	240.66	12.2	3.51	3.77	2.51	19.23	22.74	23.8	66.4	13.8	12.5	3.54	7.24	3.84	0.35
Aeration3	6.5	1778.51	1254.7	591.43	1863.81	0.9	9.13	37.14	1.87	114.45	123.58	441.66	66.4	13.8	12.5	2.39	6.66	2	1.09
FST3	3	26.68	18.82	9.89	53.79	0.9	9.13	2.39	1.87	4.36	13.5	6.62	66.4	13.8	12.5	2.39	6.66	2	0.59
RAS3	1.46	5282.3	3726.57	1754.57	5483.99	0.9	9.13	106.64	1.87	334.63	343.76	1311.77	66.4	13.8	12.5	2.39	6.66	2	0
Sand Filters3	2.4	6.67	4.71	3.25	33.12	0.9	9.13	2	1.87	3.11	12.24	1.66	66.4	13.8	12.5	2.39	6.6	2	0
Effluent	5.82	10.31	7.16	4.8	37.13	1.99	9.98	1.92	1.72	4.47	14.45	2.7	66.4	13.8	12.5	2.42	6.77	2	0
Thickener	0.05	1518.76	1087.91	631.32	1710.46	4.53	9.11	26.6	2	78.77	87.87	389.64	66.4	13.8	12.5	2.64	7	2.5	0.14
BFP	0.02	360.7	258.38	166.23	448.17	4.53	9.11	7.84	2	23.97	33.08	92.54	66.4	13.8	12.5	2.64	6.94	2.5	0
Sludge	0.18	7975.58	5713.06	3224.48	8748.46	4.53	9.11	131.18	2	384.27	393.38	2046.14	66.4	13.8	12.5	2.64	7	2.5	0

	Model	Data	% Difference	Permit	
Flow [mgd]	6.0	4.7	27.7%	6.0	
Total suspended solids [mgTSS/L]	10.31	9.2	12.1%	30	*11/1 - 5/31*
Volatile suspended solids [mgVSS/L]	7.16			NA	
Ammonia N [mgN/L]	1.99	2.6	-23.5%	1.1	*outfall 002, 6/1 - 10/31*
Total Kjeldahl Nitrogen [mgN/L]	4.47	4.3	4.0%	monitor	
Nitrate N [mgN/L]	9.98			NA	
Total N [mgN/L]	14.45			NA	
Total BOD [mg/L]	4.8	7.2	-33.3%	monitor	
Total COD [mg/L]	37.13			NA	
Total P [mgP/L]	1.92			NA	
Soluble PO4-P [mgP/L]	1.72			NA	
Magnesium [mg/L]	13.8			NA	
Calcium [mg/L]	66.4			monitor	
Temperature [deg. C]	12.5	16.9		21.1	*outfall 002*
Alkalinity [mmol/L]	2.42			NA	
Dissolved oxygen [mg/L]	2	10		7.0	*daily max*
pH []	6.77	7.3	-7.3%	6.5 - 8.5	
Inorganic S.S. [mgTSS/L]	2.7			NA	*outfall 001 daily max,*
UOD, mg/L	27.3	28.3	-3.5%	50	*4.5*TKN + 1.5*CBOD*

Elements	Model	Setpoint	
Influent	6	6.0	
Oxidation	4.29		
RAS1	2.0	2.0	
WAS1	0.11	0.11	match
FST1	2.29		
PST2	2.37		
Aeration2	3.83		
RAS2	1.5	1.5	
WAS2	0.04	0.04	match
FST2	2.33		
PST3	3.04		
Aeration3	6.5		
RAS3	1.5	1.5	
IR	2.0	2.0	
WAS3	0.04	0.04	match
FST3	3		
Effluent	5.82		
Thickener	0.05		
BFP	0.02		
Sludge	0.18	0.18	change BFP output

FST1	98.00%	removal
FST2	99.00%	removal
FST3	99.00%	removal
Filters	80.00%	removal

Model 2: Phase I Facility <u>Design Month</u>

Temp:	16.9	deg C

Yellow boxes indicate parameters that may need to be changed in BioWin before running model.

Elements	Flow [mgd]	Total suspended solids [mgTSS/L]	Volatile suspended solids [mgVSS/L]	Total Carbonaceous BOD [mg/L]	Total COD [mg/L]	Ammonia N [mgN/L]	Nitrate N [mgN/L]	Total P [mgP/L]	Soluble PO4-P [mgP/L]	Total Kjeldahl Nitrogen [mgN/L]	Total N [mgN/L]	Inorganic S.S. [mgTSS/L]	Calcium [mg/L]	Magnesium [mg/L]	Temperature [deg. C]	Alkalinity [mmol/L]	pH []	Dissolved oxygen [mg/L]	Liquid volume [Mil. Gal]
Influent	6	257.47	193.44	243.14	495	17.75	0.21	5.8	2.9	29.1	29.31	64	66.4	13.8	16.9	4.14	7.7	4.8	0
Oxidation	4.29	1477.42	967.12	403.58	1455.32	0.47	13.53	28.33	2.11	85.4	98.92	453.01	66.4	13.8	16.9	2.04	7.18	2	2.36
FST1	2.29	55.36	36.24	16.26	79.97	0.47	13.53	3.09	2.11	5.4	18.93	16.97	66.4	13.8	16.9	2.04	7.18	2	0.33
RAS1	1.89	3105.5	2032.86	847.01	3029.92	0.47	13.53	57.23	2.11	176.98	190.5	952.23	66.4	13.8	16.9	2.04	7.18	2	0
PST2	2.37	120.75	89.91	153.51	301.85	14.96	2.28	4.16	2.71	22.77	25.06	30.3	66.4	13.8	16.9	3.81	7.5	4.33	0.24
Aeration2	3.83	2309.93	1682.93	937.14	2488.33	1.52	11.8	48.92	1.36	153.97	165.78	515.12	66.4	13.8	16.9	2.26	6.66	2	0.47
FST2	2.33	37.97	27.66	17.05	67.58	1.52	11.8	2.14	1.36	5.92	17.72	8.47	66.4	13.8	16.9	2.26	6.66	2	0.24
RAS2	1.46	5839.21	4254.23	2366.43	6248.77	1.52	11.8	121.59	1.36	383.96	395.77	1302.17	66.4	13.8	16.9	2.26	6.66	2	0
Sand Filters1&2	3.42	12.59	8.62	5.54	39.46	1	12.66	1.97	1.73	3.63	16.28	3.43	66.4	13.8	16.9	2.15	6.82	2	0
PST3	3.04	94.28	69.5	118.25	239.89	11.89	3.87	3.78	2.55	18.86	22.73	23.8	66.4	13.8	16.9	3.49	7.25	3.84	0.35
Aeration3	6.5	1729.4	1209.24	546.02	1798.56	0.55	9.51	35.85	1.96	109.7	119.21	441.66	66.4	13.8	16.9	2.34	6.66	2	1.09
FST3	3	25.94	18.14	9.18	52.77	0.55	9.51	2.47	1.96	3.94	13.45	6.62	66.4	13.8	16.9	2.34	6.66	2	0.59
RAS3	1.46	5136.46	3591.54	1619.75	5290.29	0.55	9.51	102.61	1.96	321.25	330.76	1311.77	66.4	13.8	16.9	2.34	6.66	2	0
Sand Filters3	2.4	6.49	4.53	3.05	32.83	0.55	9.51	2.09	1.96	2.73	12.24	1.66	66.4	13.8	16.9	2.34	6.64	2	0
Effluent	5.82	10.07	6.94	4.52	36.73	0.81	11.36	2.02	1.83	3.26	14.62	2.7	66.4	13.8	16.9	2.23	6.75	2	0
Thickener	0.05	1496.76	1067.47	610.53	1680.91	3.76	10.1	26.08	2.09	76.07	86.17	389.64	66.4	13.8	16.9	2.51	6.99	2.5	0.14
BFP	0.02	355.48	253.52	161.26	441.1	3.76	10.1	7.79	2.09	22.74	32.84	92.54	66.4	13.8	16.9	2.51	6.97	2.5	0
Sludge	0.18	7860.06	5605.72	3115.5	8593.57	3.76	10.1	128.09	2.09	373.42	383.52	2046.14	66.4	13.8	16.9	2.51	6.99	2.5	0

	Model	Data	% Difference	Permit	
Flow [mgd]	6.0	4.7	27.7%	6.0	
Total suspended solids [mgTSS/L]	10.07	9.2	9.5%	30	*11/1 - 5/31*
Volatile suspended solids [mgVSS/L]	6.94			NA	
Ammonia N [mgN/L]	0.81	2.6	-68.8%	1.1	*outfall 002, 6/1 - 10/31*
Total Kjeldahl Nitrogen [mgN/L]	3.26	4.3	-24.2%	monitor	
Nitrate N [mgN/L]	11.36			NA	
Total N [mgN/L]	14.62			NA	
Total BOD [mg/L]	4.52	7.2	-37.2%	monitor	
Total COD [mg/L]	36.73			NA	
Total P [mgP/L]	2.02			NA	
Soluble PO4-P [mgP/L]	1.83			NA	
Magnesium [mg/L]	13.8			NA	
Calcium [mg/L]	66.4			monitor	
Temperature [deg. C]	16.9	16.9		21.1	*outfall 002*
Alkalinity [mmol/L]	2.23			NA	
Dissolved oxygen [mg/L]	2	10		7.0	*daily max*
pH []	6.75	7.3	-7.5%	6.5 - 8.5	
Inorganic S.S. [mgTSS/L]	2.7			NA	*outfall 001 daily max,*
UOD, mg/L	21.5	28.3	-24.2%	50	*4.5*TKN + 1.5*CBOD*

Elements	Model	Setpoint	
Influent	6	6.0	
Oxidation	4.29		
RAS1	2.0	2.0	
WAS1	0.11	0.11	match
FST1	2.29		
PST2	2.37		
Aeration2	3.83		
RAS2	1.5	1.5	
WAS2	0.04	0.04	match
FST2	2.33		
PST3	3.04		
Aeration3	6.5		
RAS3	1.5	1.5	
IR	2.0	2.0	
WAS3	0.04	0.04	match
FST3	3		
Effluent	5.82		
Thickener	0.05		
BFP	0.02		
Sludge	0.18	0.18	change BFP output

FST1	98.00%	removal
FST2	99.00%	removal
FST3	99.00%	removal
Filters	80.00%	removal

run date:	2/1/06

Model 2: Phase I Facility Maximum Month

Temp: 12.5 deg C

Yellow boxes indicate parameters that may need to be changed in BioWin before running model.

Elements	Flow [mgd]	Total suspended solids [mgTSS/L]	Volatile suspended solids [mgVSS/L]	Total Carbonaceous BOD [mg/L]	Total COD [mg/L]	Ammonia N [mgN/L]	Nitrate N [mgN/L]	Total P [mgP/L]	Soluble PO4-P [mgP/L]	Total Kjeldahl Nitrogen [mgN/L]	Total N [mgN/L]	Inorganic S.S. [mgTSS/L]	Calcium [mg/L]	Magnesium [mg/L]	Temperature [deg. C]	Alkalinity [mmol/L]	pH []	Dissolved oxygen [mg/L]	Liquid volume [Mil. Gal]
Influent	7.1	256.49	175.46	220.54	449	13.14	0.17	6.7	3.35	45.3	45.47	81	51.6	10.4	12.5	2.98	8	4.4	0
Oxidation	4.66	1722.4	1031.25	466.24	1544.8	1.2	27.81	31.37	3.07	94.34	122.16	628.59	51.6	10.4	12.5	0.23	6.25	2	2.36
FST1	2.66	60.38	36.15	17.55	77.53	1.2	27.81	4.06	3.07	7.36	35.17	22.04	51.6	10.4	12.5	0.23	6.25	2	0.33
RAS1	1.89	3929.88	2352.92	1062.18	3493.63	1.2	27.81	67.65	3.07	209.87	237.68	1434.21	51.6	10.4	12.5	0.23	6.25	2	0
PST2	2.74	124.67	84.58	143.58	281.69	11.9	3.29	4.94	3.25	33.62	36.91	39.52	51.6	10.4	12.5	2.68	7.62	4.05	0.24
Aeration2	4.5	2713.02	1838.68	1056.16	2713.16	7.89	15.79	54.4	2.19	178.32	194.11	751.7	51.6	10.4	12.5	1.59	6.51	2	0.47
FST2	2.7	45.24	30.66	19.39	69.83	7.89	15.79	3.06	2.19	14.27	30.06	12.53	51.6	10.4	12.5	1.59	6.51	2	0.24
RAS2	1.76	6709.97	4547.51	2609.47	6673.46	7.89	15.79	131.31	2.19	424.11	439.9	1859.13	51.6	10.4	12.5	1.59	6.51	2	0
Sand Filters1&2	4.15	13.6	8.61	5.9	37.26	4.57	21.75	2.87	2.63	8.64	30.39	4.45	51.6	10.4	12.5	0.91	6.41	2	0
PST3	3.4	102.4	68.83	114.94	232.06	9.89	6.42	4.61	3.15	28.02	34.44	32.47	51.6	10.4	12.5	2.33	7.21	3.67	0.35
Aeration3	7.16	2141.22	1381.89	655.55	2046.84	1.15	19.61	41.75	2.72	127.99	147.59	668.42	51.6	10.4	12.5	0.82	6.2	2	1.09
FST3	3.36	32.89	21.23	11.09	55	1.15	19.61	3.32	2.72	5.93	25.54	10.27	51.6	10.4	12.5	0.82	6.2	2	0.59
RAS3	1.76	6073.03	3919.38	1857.4	5761.42	1.15	19.61	113.43	2.72	355.61	375.22	1895.79	51.6	10.4	12.5	0.82	6.2	2	0
Sand Filters3	2.76	8.01	5.17	3.49	31.49	1.15	19.61	2.86	2.72	4.49	24.09	2.5	51.6	10.4	12.5	0.82	6.15	2	0
Effluent	6.91	11.37	7.24	4.94	34.96	3.21	20.9	2.87	2.66	6.98	27.88	3.67	51.6	10.4	12.5	0.88	6.35	2	0
Thickener	0.04	2258.2	1474.62	852.64	2293.44	4.59	19.07	38.89	2.9	144.8	163.87	726.97	51.6	10.4	12.5	1.08	6.65	2.45	0.14
BFP	0.02	429.06	280.18	178.39	477.14	4.59	19.07	9.74	2.9	35.61	54.67	138.13	51.6	10.4	12.5	1.08	6.59	2.45	0
Sludge	0.19	8987.65	5869	3333.23	8975.63	4.59	19.07	146.14	2.9	546.51	565.58	2893.36	51.6	10.4	12.5	1.08	6.65	2.45	0

	Model	Data	% Difference	Permit	
Flow [mgd]	7.1	7.1	0.0%	6.0	
Total suspended solids [mgTSS/L]	11.37	25.1	-54.7%	30	*11/1 - 5/31*
Volatile suspended solids [mgVSS/L]	7.24			NA	
Ammonia N [mgN/L]	3.21	5.7	-43.7%	1.1	*outfall 002, 6/1 - 10/31*
Total Kjeldahl Nitrogen [mgN/L]	6.98	12.9	-45.9%	monitor	
Nitrate N [mgN/L]	20.9			NA	
Total N [mgN/L]	27.88			NA	
Total Carbonaceous BOD [mg/L]	4.94			monitor	
Total COD [mg/L]	34.96			NA	
Total P [mgP/L]	2.87	16.3		NA	
Soluble PO4-P [mgP/L]	2.66			NA	
Magnesium [mg/L]	10.4			NA	
Calcium [mg/L]	51.6			monitor	
Temperature [deg. C]	12.5	23.6		21.1	*outfall 002*
Alkalinity [mmol/L]	0.88			NA	
Dissolved oxygen [mg/L]	2	13.3		7.0	*daily max*
pH []	6.35	7.5	-15.3%	6.5 - 8.5	
Inorganic S.S. [mgTSS/L]	3.67			NA	*outfall 001 daily max,*
UOD, mg/L	38.8	64.2	-39.5%	50	*4.5*TKN + 1.5*CBOD*

Elements	Model	Setpoint	
Influent	7.1		
Oxidation	4.66		
RAS1	2.0	2.0	
WAS1	0.11	0.11	match
FST1	2.66		
PST2	2.74		
Aeration2	4.5		
RAS2	1.8	1.8	
WAS2	0.04	0.04	match
FST2	2.7		
PST3	3.4		
Aeration3	7.16		
RAS3	1.8	1.8	
IR	2.0	2.0	
WAS3	0.04	0.04	match
FST3	3.36		
Effluent	6.91		
Thickener	0.04		
BFP	0.02		
Sludge	0.19	0.19	change BFP output

FST1	98.00%	removal
FST2	99.00%	removal
FST3	99.00%	removal
Filters	80.00%	removal

Model 2: Phase I Facility Maximum Month

Temp:	16.9	deg C

Yellow boxes indicate parameters that may need to be changed in BioWin before running model.

Elements	Flow [mgd]	Total suspended solids [mgTSS/L]	Volatile suspended solids [mgVSS/L]	Total Carbonaceous BOD [mg/L]	Total COD [mg/L]	Ammonia N [mgN/L]	Nitrate N [mgN/L]	Total P [mgP/L]	Soluble PO4-P [mgP/L]	Total Kjeldahl Nitrogen [mgN/L]	Total N [mgN/L]	Inorganic S.S. [mgTSS/L]	Calcium [mg/L]	Magnesium [mg/L]	Temperature [deg. C]	Alkalinity [mmol/L]	pH []	Dissolved oxygen [mg/L]	Liquid volume [Mil. Gal]
Influent	7.1	256.49	175.46	220.54	449	13.14	0.17	6.7	3.35	45.3	45.47	81	51.6	10.4	16.9	2.98	8	4.4	0
Oxidation	4.66	1686.16	997.65	432.32	1496.46	0.82	28.61	30.47	3.2	90.59	119.2	628.59	51.6	10.4	16.9	0.14	6.05	2	2.36
FST1	2.66	59.11	34.98	16.33	75.79	0.82	28.61	4.16	3.2	6.81	35.42	22.04	51.6	10.4	16.9	0.14	6.05	2	0.33
RAS1	1.89	3847.21	2276.28	984.83	3383.4	0.82	28.61	65.43	3.2	201.86	230.48	1434.21	51.6	10.4	16.9	0.14	6.05	2	0
PST2	2.74	124.41	84.34	143.32	281.32	11.47	3.77	4.94	3.26	33.15	36.92	39.52	51.6	10.4	16.9	2.61	7.63	4.05	0.24
Aeration2	4.5	2670.09	1798.28	1011.68	2653.59	2.43	21.55	53.38	2.26	168.97	190.52	751.7	51.6	10.4	16.9	0.79	6.22	2	0.47
FST2	2.7	44.52	29.99	18.54	68.69	2.43	21.55	3.11	2.26	8.64	30.18	12.53	51.6	10.4	16.9	0.79	6.22	2	0.24
RAS2	1.76	6603.77	4447.57	2499.64	6526.36	2.43	21.55	128.7	2.26	409.18	430.73	1859.13	51.6	10.4	16.9	0.79	6.22	2	0
Sand Filters1&2	4.15	13.34	8.37	5.58	36.81	1.63	25.06	2.96	2.72	5.59	30.65	4.45	51.6	10.4	16.9	0.46	6.17	2	0
PST3	3.4	101.83	68.3	114.38	231.27	9.44	6.93	4.62	3.17	27.5	34.43	32.47	51.6	10.4	16.9	2.26	7.22	3.67	0.35
Aeration3	7.16	2087.23	1331.91	605.54	1975.13	0.68	20.13	40.3	2.8	122.55	142.69	668.42	51.6	10.4	16.9	0.74	6.18	2	1.09
FST3	3.36	32.06	20.46	10.29	53.85	0.68	20.13	3.38	2.8	5.33	25.47	10.27	51.6	10.4	16.9	0.74	6.18	2	0.59
RAS3	1.76	5919.9	3777.62	1715.61	5558.1	0.68	20.13	109.16	2.8	341.16	361.29	1895.79	51.6	10.4	16.9	0.74	6.18	2	0
Sand Filters3	2.76	7.81	4.98	3.27	31.18	0.68	20.13	2.94	2.8	3.95	24.08	2.5	51.6	10.4	16.9	0.74	6.15	2	0
Effluent	6.91	11.14	7.02	4.66	34.56	1.25	23.09	2.95	2.76	4.94	28.03	3.67	51.6	10.4	16.9	0.58	6.18	2	0
Thickener	0.04	2229.3	1447.76	825.06	2254.6	3.37	20.54	38.18	2.99	140.91	161.45	726.97	51.6	10.4	16.9	0.89	6.58	2.45	0.14
BFP	0.02	423.57	275.07	173.11	469.71	3.37	20.54	9.67	2.99	33.84	54.38	138.13	51.6	10.4	16.9	0.89	6.55	2.45	0
Sludge	0.19	8872.63	5762.07	3223.57	8821.22	3.37	20.54	143.04	2.99	534.81	555.36	2893.36	51.6	10.4	16.9	0.89	6.58	2.45	0

	Model	Data	% Difference	Permit	
Flow [mgd]	7.1	7.1	0.0%	6.0	
Total suspended solids [mgTSS/L]	11.14	25.1	-55.6%	30	11/1 - 5/31
Volatile suspended solids [mgVSS/L]	7.02			NA	
Ammonia N [mgN/L]	1.25	5.7	-78.1%	1.1	outfall 002, 6/1 - 10/31
Total Kjeldahl Nitrogen [mgN/L]	4.94	12.9	-61.7%	monitor	
Nitrate N [mgN/L]	23.09			NA	
Total N [mgN/L]	28.03			NA	
Total Carbonaceous BOD [mg/L]	4.66			monitor	
Total COD [mg/L]	34.56			NA	
Total P [mgP/L]	2.95	16.3		NA	
Soluble PO4-P [mgP/L]	2.76			NA	
Magnesium [mg/L]	10.4			NA	
Calcium [mg/L]	51.6			monitor	
Temperature [deg. C]	16.9	16.9		21.1	outfall 002
Alkalinity [mmol/L]	0.58			NA	
Dissolved oxygen [mg/L]	2	13.3		7.0	daily max
pH []	6.18	7.5	-17.6%	6.5 - 8.5	
Inorganic S.S. [mgTSS/L]	3.67			NA	outfall 001 daily max,
UOD, mg/L	29.2	64.2	-54.5%	50	4.5*TKN + 1.5*CBOD

Elements	Model	Setpoint	
Influent	7.1		
Oxidation	4.66		
RAS1	2.0	2.0	
WAS1	0.11	0.11	match
FST1	2.66		
PST2	2.74		
Aeration2	4.5		
RAS2	1.8	1.8	
WAS2	0.04	0.04	match
FST2	2.7		
PST3	3.4		
Aeration3	7.16		
RAS3	1.8	1.8	
IR	2.0	2.0	
WAS3	0.04	0.04	match
FST3	3.36		
Effluent	6.91		
Thickener	0.04		
BFP	0.02		
Sludge	0.19	0.19	change BFP output

FST1	98.00%	removal
FST2	99.00%	removal
FST3	99.00%	removal
Filters	80.00%	removal

run date:	2/1/06

Model 2: Phase I Facility Maximum Day

Temp:	12.5	deg C

Yellow boxes indicate parameters that may need to be changed in BioWin before running model.

Elements	Flow [mgd]	Total suspended solids [mgTSS/L]	Volatile suspended solids [mgVSS/L]	Total Carbonaceous BOD [mg/L]	Total COD [mg/L]	Ammonia N [mgN/L]	Nitrate N [mgN/L]	Total P [mgP/L]	Soluble PO4-P [mgP/L]	Total Kjeldahl Nitrogen [mgN/L]	Total N [mgN/L]	Inorganic S.S. [mgTSS/L]	Calcium [mg/L]	Magnesium [mg/L]	Temperature [deg. C]	Alkalinity [mmol/L]	pH []	Dissolved oxygen [mg/L]	Liquid volume [Mil. Gal]
Influent	13.4	198.5	132.48	166.51	339	10.82	0.18	7.3	3.65	33.8	33.98	66	31.2	5.6	12.5	2.42	8.6	3.4	0
Oxidation	6.76	1852.29	1114.62	559.52	1659.34	1.83	18.48	35.29	4.26	103.1	121.58	668.55	31.2	5.6	12.5	0.5	6.61	2	2.36
FST1	4.76	52.62	31.67	17.27	65.55	1.83	18.48	5.14	4.26	7.47	25.96	18.99	31.2	5.6	12.5	0.5	6.61	2	0.33
RAS1	1.89	6132.06	3689.98	1849.06	5449.52	1.83	18.48	106.99	4.26	330.5	348.98	2213.24	31.2	5.6	12.5	0.5	6.61	2	0
PST2	4.84	104.06	69.04	116.82	227.63	10.58	1.03	5.56	3.66	27.2	28.22	34.51	31.2	5.6	12.5	2.35	8.25	3.28	0.24
Aeration2	6.8	2935.66	1981.16	1195.98	2920.19	14.04	2.52	59.61	3.2	196.97	199.49	824.11	31.2	5.6	12.5	2.55	6.74	2	0.47
FST2	4.8	41.6	28.07	19.14	61.2	14.04	2.52	4	3.2	20.12	22.64	11.68	31.2	5.6	12.5	2.55	6.74	2	0.24
RAS2	1.96	9876.95	6665.55	4018.58	9777.35	14.04	2.52	192.98	3.2	621.15	623.67	2772.69	31.2	5.6	12.5	2.55	6.74	2	0
Sand Filters1&2	8.35	10.77	6.83	5.57	29.56	7.96	10.47	3.92	3.73	11.76	22.23	3.5	31.2	5.6	12.5	1.53	6.66	2	0
PST3	5.5	94.85	62.55	102.87	204.38	9.57	2.41	5.38	3.65	24.71	27.12	31.2	31.2	5.6	12.5	2.18	7.6	3.13	0.35
Aeration3	9.46	2479.23	1600.58	826.2	2358.35	1.79	12.8	49.15	3.54	148.95	161.75	771.77	31.2	5.6	12.5	0.93	6.27	2	1.09
FST3	5.46	33.88	21.87	12.4	50.52	1.79	12.8	4.16	3.54	6.43	19.23	10.55	31.2	5.6	12.5	0.93	6.27	2	0.59
RAS3	1.96	9151.27	5908.03	3046.6	8655.16	1.79	12.8	171.89	3.54	537.8	550.61	2848.72	31.2	5.6	12.5	0.93	6.27	2	0
Sand Filters3	4.86	7.61	4.91	3.66	25.73	1.79	12.8	3.68	3.54	4.9	17.7	2.37	31.2	5.6	12.5	0.93	6.21	2	0
Effluent	13.21	9.61	6.13	4.87	28.15	5.69	11.33	3.83	3.66	9.24	20.57	3.09	31.2	5.6	12.5	1.31	6.55	2	0
Thickener	0.04	3401.34	2198.15	1306.14	3377.42	5.76	11	65.28	3.83	207.62	218.62	1115.6	31.2	5.6	12.5	1.32	6.79	2.29	0.14
BFP	0.02	646.26	417.65	262.21	675.32	5.76	11	15.51	3.83	47.86	58.86	211.96	31.2	5.6	12.5	1.32	6.73	2.29	0
Sludge	0.19	13537.34	8748.64	5146.79	13318.46	5.76	11	248.41	3.83	795.38	806.38	4440.1	31.2	5.6	12.5	1.32	6.79	2.29	0

	Model	Data	% Difference	Permit	
Flow [mgd]	13.4	13.4	0.0%	6.0	
Total suspended solids [mgTSS/L]	9.61	59	-83.7%	30	*11/1 - 5/31*
Volatile suspended solids [mgVSS/L]	6.13			NA	
Ammonia N [mgN/L]	5.69	10.5	-45.8%	1.1	*outfall 002, 6/1 - 10/31*
Total Kjeldahl Nitrogen [mgN/L]	9.24	42	-78.0%	monitor	
Nitrate N [mgN/L]	11.33			NA	
Total N [mgN/L]	20.57			NA	
Total Carbonaceous BOD [mg/L]	4.87			monitor	
Total COD [mg/L]	28.15			NA	
Total P [mgP/L]	3.83	40.4		NA	
Soluble PO4-P [mgP/L]	3.66			NA	
Magnesium [mg/L]	5.6			NA	
Calcium [mg/L]	31.2			monitor	
Temperature [deg. C]	12.5	23.6		21.1	*outfall 002*
Alkalinity [mmol/L]	1.31			NA	
Dissolved oxygen [mg/L]	2	13.8		7.0	*daily max*
pH []	6.55	8.3	-21.1%	6.5 - 8.5	
Inorganic S.S. [mgTSS/L]	3.09			NA	*outfall 001 daily max,*
UOD, mg/L	48.9	116.7	-58.1%	50	*4.5*TKN + 1.5*CBOD*

Elements	Model	Setpoint	
Influent	13.4		
Oxidation	6.76		
RAS1	2.0	2.0	
WAS1	0.11	0.11	match
FST1	4.76		
PST2	4.84		
Aeration2	6.8		
RAS2	2.0	2.0	
WAS2	0.04	0.04	match
FST2	4.8		
PST3	5.5		
Aeration3	9.46		
RAS3	2.0	2.00	
IR	2.0	2.0	
WAS3	0.04	0.04	match
FST3	5.46		
Effluent	13.21		
Thickener	0.04		
BFP	0.02		
Sludge	0.19	0.19	change BFP output

FST1	98.00%	removal
FST2	99.00%	removal
FST3	99.00%	removal
Filters	80.00%	removal

Model 2: Phase I Facility Maximum Day

Temp:	16.9	deg C

Yellow boxes indicate parameters that may need to be changed in BioWin before running model.

Elements	Flow [mgd]	Total suspended solids [mgTSS/L]	Volatile suspended solids [mgVSS/L]	Total Carbonaceous BOD [mg/L]	Total COD [mg/L]	Ammonia N [mgN/L]	Nitrate N [mgN/L]	Total P [mgP/L]	Soluble PO4-P [mgP/L]	Total Kjeldahl Nitrogen [mgN/L]	Total N [mgN/L]	Inorganic S.S. [mgTSS/L]	Calcium [mg/L]	Magnesium [mg/L]	Temperature [deg. C]	Alkalinity [mmol/L]	pH []	Dissolved oxygen [mg/L]	Liquid volume [Mil. Gal]
Influent	13.4	198.5	132.48	166.51	339	10.82	0.18	7.3	3.65	33.8	33.98	66	31.2	5.6	16.9	2.42	8.6	3.4	0
Oxidation	6.76	1816.44	1081.25	525.38	1610.99	0.91	19.75	34.37	4.36	98.85	118.6	668.55	31.2	5.6	16.9	0.34	6.45	2	2.36
FST1	4.76	51.61	30.72	16.23	64.09	0.91	19.75	5.22	4.36	6.4	26.15	18.99	31.2	5.6	16.9	0.34	6.45	2	0.33
RAS1	1.89	6013.38	3579.5	1736.18	5289.66	0.91	19.75	103.71	4.36	318.71	338.46	2213.24	31.2	5.6	16.9	0.34	6.45	2	0
PST2	4.84	103.88	68.87	116.63	227.37	10.21	1.42	5.56	3.66	26.8	28.22	34.51	31.2	5.6	16.9	2.29	8.32	3.28	0.24
Aeration2	6.8	2911.77	1957.54	1164.57	2882.72	5.98	10.76	59.17	3.22	186.95	197.71	824.11	31.2	5.6	16.9	1.38	6.48	2	0.47
FST2	4.8	41.26	27.74	18.52	60.41	5.98	10.76	4.01	3.22	11.89	22.65	11.68	31.2	5.6	16.9	1.38	6.48	2	0.24
RAS2	1.96	9796.55	6586.1	3913.34	9651.91	5.98	10.76	191.46	3.22	606.83	617.59	2772.69	31.2	5.6	16.9	1.38	6.48	2	0
Sand Filters1&2	8.35	10.62	6.68	5.29	29.17	3.45	15.24	3.98	3.79	7.14	22.38	3.5	31.2	5.6	16.9	0.87	6.45	2	0
PST3	5.5	94.36	62.09	102.37	203.68	9.13	2.88	5.38	3.66	24.2	27.08	31.2	31.2	5.6	16.9	2.11	7.68	3.13	0.35
Aeration3	9.46	2420.82	1546.41	771.26	2280.38	0.89	13.72	47.55	3.6	142.72	156.44	771.77	31.2	5.6	16.9	0.8	6.22	2	1.09
FST3	5.46	33.08	21.13	11.61	49.4	0.89	13.72	4.2	3.6	5.4	19.13	10.55	31.2	5.6	16.9	0.8	6.22	2	0.59
RAS3	1.96	8935.67	5708.06	2843.93	8367.51	0.89	13.72	165.84	3.6	517.36	531.08	2848.72	31.2	5.6	16.9	0.8	6.22	2	0
Sand Filters3	4.86	7.43	4.75	3.45	25.43	0.89	13.72	3.74	3.6	3.93	17.65	2.37	31.2	5.6	16.9	0.8	6.19	2	0
Effluent	13.21	9.45	5.97	4.61	27.79	2.51	14.68	3.89	3.72	5.96	20.64	3.09	31.2	5.6	16.9	0.84	6.37	2	0
Thickener	0.04	3364.01	2163.18	1269.04	3326.23	3.82	13.12	64.32	3.89	202.31	215.43	1115.6	31.2	5.6	16.9	1.03	6.69	2.29	0.14
BFP	0.02	639.16	411	255.11	665.52	3.82	13.12	15.37	3.89	45.24	58.36	211.96	31.2	5.6	16.9	1.03	6.67	2.29	0
Sludge	0.19	13388.77	8609.44	4999.32	13115.03	3.82	13.12	244.42	3.89	780.18	793.3	4440.1	31.2	5.6	16.9	1.03	6.69	2.29	0

	Model	Data	% Difference	Permit	
Flow [mgd]	13.4	13.4	0.0%	6.0	
Total suspended solids [mgTSS/L]	9.45	59	-84.0%	30	*11/1 - 5/31*
Volatile suspended solids [mgVSS/L]	5.97			NA	
Ammonia N [mgN/L]	2.51	10.5	-76.1%	1.1	*outfall 002, 6/1 - 10/31*
Total Kjeldahl Nitrogen [mgN/L]	5.96	42	-85.8%	monitor	
Nitrate N [mgN/L]	14.68			NA	
Total N [mgN/L]	20.64			NA	
Total Carbonaceous BOD [mg/L]	4.61			monitor	
Total COD [mg/L]	27.79			NA	
Total P [mgP/L]	3.89	40.4		NA	
Soluble PO4-P [mgP/L]	3.72			NA	
Magnesium [mg/L]	5.6			NA	
Calcium [mg/L]	31.2			monitor	
Temperature [deg. C]	16.9	23.6		21.1	*outfall 002*
Alkalinity [mmol/L]	0.84			NA	
Dissolved oxygen [mg/L]	2	13.8		7.0	*daily max*
pH []	6.37	8.3	-23.3%	6.5 - 8.5	
Inorganic S.S. [mgTSS/L]	3.09			NA	*outfall 001 daily max,*
UOD, mg/L	33.7	116.7	-71.1%	50	*4.5*TKN + 1.5*CBOD*

Elements	Model	Setpoint	
Influent	13.4		
Oxidation	6.76		
RAS1	2.0	2.00	
WAS1	0.11	0.11	match
FST1	4.76		
PST2	4.84		
Aeration2	6.8		
RAS2	2.0	2.00	
WAS2	0.04	0.04	match
FST2	4.8		
PST3	5.5		
Aeration3	9.46		
RAS3	2.0	2.00	
IR	2.0	2.0	
WAS3	0.04	0.04	match
FST3	5.46		
Effluent	13.21		
Thickener	0.04		
BFP	0.02		
Sludge	0.19	0.19	change BFP output

FST1	98.00%	removal
FST2	99.00%	removal
FST3	99.00%	removal
Filters	80.00%	removal

run date: 2/23/06

Yellow boxes indicate parameters that may need to be changed in BioWin before running model.

Model 3: Phase II MBR Facility Average Month — Several MBR SRT Runs: 5, 10, 15, 20, 30 days

#1

MLSS 3,700 mg/L SRT 5.0 days

Elements	Flow [mgd]	Total suspended solids [mgTSS/L]	Volatile suspended solids [mgVSS/L]	Total COD [mg/L]	Total Carbonaceous BOD [mg/L]	Ammonia N [mgN/L]	Nitrate N [mgN/L]	Total Kjeldahl Nitrogen [mgN/L]	Total N [mgN/L]	Total P [mgP/L]	Soluble PO4-P [mgP/L]	Temperature [deg. C]	Alkalinity [mmol/L]	pH []	Dissolved oxygen [mg/L]	Magnesium [mg/L]	Calcium [mg/L]	Liquid volume [Mil. Gal]
Influent	9	257.47	193.44	495	243.14	18.04	0.21	29.1	29.31	5.8	2.9	12.5	4.14	7.7	4.8	13.8	66	0
DO Depl.	19.74	3768.09	2435.16	3640.16	1104.63	4.58	1.37	211.69	213.07	101.84	0.24	12.5	3.18	6.85	0.07	13.33	65.87	0.2
Anoxic1	19.74	3748.47	2428.4	3635.67	1096.06	5.78	0.01	211.69	211.7	101.84	7.9	12.5	3.35	6.83	0	15.07	66.35	0.8
Aeration1	19.74	3749.07	2418.82	3609.27	1084.96	3.26	1.54	210.04	211.58	101.84	2.21	12.5	3.07	6.77	2	13.77	65.99	0.65
MBR1	19.74	3741.98	2407.48	3588.33	1073.38	1.17	3.11	208.44	211.54	101.84	0.08	12.5	2.81	6.8	8.28	13.27	65.85	0.8
Membranes1	4.89	0.76	0.49	29.35	1.44	1.17	3.11	2.9	6	0.1	0.08	12.5	2.81	6.74	8.28	13.27	65.85	0
RAS1	14.63	4973.81	3200.01	4760.16	1426.33	1.17	3.11	276.11	279.22	135.33	0.08	12.5	2.81	6.8	8.28	13.27	65.85	0
PST2	2.35	96.07	72.1	284.85	150.42	16.47	0.62	23.32	23.94	3.77	2.64	12.5	4.01	7.51	4.52	13.77	65.99	0.24
Anoxic2	6.32	2966.81	2124.44	3151.24	1159.84	7.96	0.02	196.82	196.84	94.54	4.25	12.5	3.51	6.91	0	14.32	66.14	0.1
Aeration2	6.32	2957.31	2107.3	3108.86	1136.51	2.35	4.35	192.23	196.57	94.54	0.32	12.5	2.82	6.74	2	13.46	65.91	0.41
FST2	2.32	27.53	19.62	56.15	11.8	2.35	4.35	5.8	10.15	1.2	0.32	12.5	2.82	6.74	2	13.46	65.91	0.24
RAS2	1.97	6357.61	4530.25	6651.82	2441.86	2.35	4.35	408.59	412.94	202.86	0.32	12.5	2.82	6.74	2	13.46	65.91	0
Sand Filters2	1.32	7.25	5.17	35.02	4.01	2.35	4.35	4.51	8.86	0.55	0.32	12.5	2.82	6.68	2	13.46	65.91	0
PST3	3.19	83.47	62.33	242.05	124.18	13.55	1.47	19.79	21.25	3.5	2.45	12.5	3.75	7.28	4.05	13.75	65.99	0.36
Anoxic3	7.15	2044.43	1427.94	2136.21	662.49	6.55	0.04	132.82	132.86	47.88	2.22	12.5	3.4	6.88	0	13.81	66	0.14
Aeration3	7.15	2025.85	1407.53	2089.89	634.51	0.81	5.16	127.39	132.54	47.88	1.64	12.5	2.64	6.7	2	13.7	65.97	1.09
FST3	3.15	16.56	11.51	43.36	6.17	0.81	5.16	3.57	8.72	2.01	1.64	12.5	2.64	6.7	2	13.7	65.97	0.69
RAS3	1.96	5189.78	3605.77	5312.48	1623.93	0.81	5.16	322.36	327.51	120.1	1.64	12.5	2.64	6.7	2	13.7	65.97	0
Sand Filters3	2.55	3.07	2.13	29.62	1.95	0.81	5.16	2.74	7.89	1.71	1.64	12.5	2.64	6.64	2	13.7	65.97	0
Effluent	8.76	2.41	1.67	30.29	1.98	1.24	3.89	3.09	6.98	0.64	0.57	12.5	2.76	6.76	5.51	13.42	65.9	0
Thickener	0.05	2348.14	1618.15	2505.27	877.28	3.62	3.09	116.09	119.18	52.77	0.71	12.5	2.98	6.86	6.33	13.42	65.9	0.14
BFP	0.06	175.5	120.94	233.84	81.33	3.62	3.09	13.99	17.08	4.6	0.71	12.5	2.98	6.8	6.33	13.42	65.9	0
Sludge	0.24	8730.89	6016.61	9178.22	3215.6	3.62	3.09	416.04	419.13	194.28	0.71	12.5	2.98	6.86	6.33	13.42	65.9	0

Check	Permit	Combined Effluent	?
TSS	20	2.41	OK
Ammonia	1.1	1.24	NO
TKN	NA	3.09	OK
CBOD	NA	1.98	OK
UOD	45	16.9	OK
NO3	10	3.89	OK
Flow	8.8	mgd	

Zones	mgal		
DO Depl.	0.200		
Anoxic	0.800		
Aeration	0.650		
Membranes	0.800		
Total Vol Req'd	2.450		
Total Vol Avail.	2.450		
Vol. check:	OK		
MBR:	99.995%	removal	(enter manually)
FSTs:	99.50%	removal	(enter manually)
Filters:	85.00%	removal	(enter manually)
SRT MBR:	5.0	days	
MBR MLSS:	3,749	mg/L	

Elements	Model	Setpoint
Influent	9	
DO Depl.	19.74	
Anoxic1	19.74	
Aeration1	19.74	
MBR1	19.74	
Membranes1	4.89	
RAS1	14.63	
WAS1	0.22	
PST2	2.35	
Aeration2	6.32	
FST2	2.32	
RAS2	2.00	2.00
IR	2.00	2.00
WAS2	0.03	0.03
PST3	3.19	
Anoxic3	7.15	
Aeration3	7.15	
FST3	3.15	
RAS3	2.00	2.00
IR	2.00	2.00
WAS3	0.04	0.04
Effluent	8.76	

Elements	Model	Setpoint
Thickener	0.05	
Thickener Underflow	0.30	0.3
BFP	0.06	
Sludge	0.24	0.24
Sidestream	0.11	

Model 3: Phase II MBR Facility Average Month
#2

MLSS	6,700	mg/L	SRT	10.0	days

Elements	Flow [mgd]	Total suspended solids [mgTSS/L]	Volatile suspended solids [mgVSS/L]	Total COD [mg/L]	Total Carbonaceous BOD [mg/L]	Ammonia N [mgN/L]	Nitrate N [mgN/L]	Total Kjeldahl Nitrogen [mgN/L]	Total N [mgN/L]	Total P [mgP/L]	Soluble PO4-P [mgP/L]	Temperature [deg. C]	Alkalinity [mmol/L]	pH []	Dissolved oxygen [mg/L]	Magnesium [mg/L]	Calcium [mg/L]	Liquid volume [Mil. Gal]
Influent	9	257.47	193.44	495	243.14	18.04	0.21	29.1	29.31	5.8	2.9	12.5	4.14	7.7	4.8	13.8	66	0
DO Depl.	19.82	6779.34	4131.93	6177.04	1446.43	4.02	1.52	349.27	350.8	201.54	0.41	12.5	3.11	6.84	0.05	13.27	65.85	0.2
Anoxic1	19.82	6755.5	4123.78	6171.93	1436.63	5.37	0.01	349.27	349.28	201.54	9.72	12.5	3.31	6.82	0	15.39	66.44	0.8
Aeration1	19.82	6755.54	4112.21	6142.67	1424.43	2.13	2.3	346.84	349.15	201.54	3.16	12.5	2.92	6.75	2	13.87	66.02	0.65
MBR1	19.82	6748.08	4099.06	6119.28	1410.93	0.38	3.71	345.4	349.11	201.54	0.15	12.5	2.69	6.78	8.18	13.15	65.82	0.8
Membranes1	4.97	1.35	0.82	30.94	1.31	0.38	3.71	2.15	5.86	0.19	0.15	12.5	2.69	6.72	8.18	13.15	65.82	0
RAS1	14.74	9005.84	5470.52	8156.72	1882.66	0.38	3.71	460.26	463.97	268.92	0.15	12.5	2.69	6.78	8.18	13.15	65.82	0
PST2	2.35	96.07	72.1	284.85	150.42	16.47	0.62	23.32	23.94	3.77	2.64	12.5	4.01	7.51	4.52	13.77	65.99	0.24
Anoxic2	6.32	2966.81	2124.44	3151.24	1159.84	7.96	0.02	196.82	196.84	94.54	4.25	12.5	3.51	6.91	0	14.32	66.14	0.1
Aeration2	6.32	2957.31	2107.3	3108.86	1136.51	2.35	4.35	192.23	196.57	94.54	0.32	12.5	2.82	6.74	2	13.46	65.91	0.41
FST2	2.32	27.53	19.62	56.15	11.8	2.35	4.35	5.8	10.15	1.2	0.32	12.5	2.82	6.74	2	13.46	65.91	0.24
RAS2	1.97	6357.61	4530.25	6651.82	2441.86	2.35	4.35	408.59	412.94	202.86	0.32	12.5	2.82	6.74	2	13.46	65.91	0
Sand Filters2	1.32	7.25	5.17	35.02	4.01	2.35	4.35	4.51	8.86	0.55	0.32	12.5	2.82	6.68	2	13.46	65.91	0
PST3	3.19	83.47	62.33	242.05	124.18	13.55	1.47	19.79	21.25	3.5	2.45	12.5	3.75	7.28	4.05	13.75	65.99	0.36
Anoxic3	7.15	2044.43	1427.94	2136.21	662.49	6.55	0.04	132.82	132.86	47.88	2.22	12.5	3.4	6.88	0	13.81	66	0.14
Aeration3	7.15	2025.85	1407.53	2089.89	634.51	0.81	5.16	127.39	132.54	47.88	1.64	12.5	2.64	6.7	2	13.7	65.97	1.09
FST3	3.15	16.56	11.51	43.36	6.17	0.81	5.16	3.57	8.72	2.01	1.64	12.5	2.64	6.7	2	13.7	65.97	0.69
RAS3	1.96	5189.78	3605.77	5312.48	1623.93	0.81	5.16	322.36	327.51	120.1	1.64	12.5	2.64	6.7	2	13.7	65.97	0
Sand Filters3	2.55	3.07	2.13	29.62	1.95	0.81	5.16	2.74	7.89	1.71	1.64	12.5	2.64	6.64	2	13.7	65.97	0
Effluent	8.84	2.73	1.85	31.17	1.9	0.8	4.22	2.67	6.89	0.68	0.6	12.5	2.7	6.75	5.47	13.36	65.88	0
Thickener	0.04	2800.82	1890.57	2940.01	962.16	4.4	3.36	131.92	135.29	65.8	1.03	12.5	3	6.88	5.37	13.44	65.9	0.14
BFP	0.04	250.01	168.76	317.88	107.97	4.4	3.36	17.89	21.26	6.81	1.03	12.5	3	6.82	5.37	13.44	65.9	0
Sludge	0.16	12437.98	8395.69	12846.63	4189.34	4.4	3.36	562.74	566.1	288.67	1.03	12.5	3	6.88	5.37	13.44	65.9	0

Check	Permit	Combined Effluent	?
TSS	20	2.73	OK
Ammonia	1.1	0.8	OK
TKN	NA	2.67	OK
CBOD	NA	1.9	OK
UOD	45	14.9	OK
NO3	10	4.22	OK
Flow	8.8	mgd	

Zones	mgal		
DO Depl.	0.200		
Anoxic	0.800		
Aeration	0.650		
Membranes	0.800		
Total Vol Req'd	2.450		
Total Vol Avail.	2.450		
Vol. check:	OK		
MBR:	99.995%	removal	(enter manually)
FSTs:	99.50%	removal	(enter manually)
Filters:	85.00%	removal	(enter manually)
SRT MBR:	10.0	days	
MBR MLSS:	6,748	mg/L	

Elements	Model	Setpoint
Influent	9	
DO Depl.	19.82	
Anoxic1	19.82	
Aeration1	19.82	
MBR1	19.82	
Membranes1	4.97	
RAS1	14.74	
WAS1	0.11	
PST2	2.35	
Aeration2	6.32	
FST2	2.32	
RAS2	2.00	2.00
IR	2.00	2.00
WAS2	0.03	0.025
PST3	3.19	
Anoxic3	7.15	
Aeration3	7.15	
FST3	3.15	
RAS3	2.00	2.00
IR	2.00	2.00
WAS3	0.04	0.035
Effluent	8.84	

Elements	Model	Setpoint
Thickener	0.04	
Thickener Underflow	0.20	0.2
BFP	0.04	
Sludge	0.16	0.16
Sidestream	0.08	

Model 3: Phase II MBR Facility <u>Average Month</u>

#3

MLSS	9,600	mg/L	SRT	15.0	days

Elements	Flow [mgd]	Total suspended solids [mgTSS/L]	Volatile suspended solids [mgVSS/L]	Total COD [mg/L]	Total Carbonaceous BOD [mg/L]	Ammonia N [mgN/L]	Nitrate N [mgN/L]	Total Kjeldahl Nitrogen [mgN/L]	Total N [mgN/L]	Total P [mgP/L]	Soluble PO4-P [mgP/L]	Temperature [deg. C]	Alkalinity [mmol/L]	pH []	Dissolved oxygen [mg/L]	Magnesium [mg/L]	Calcium [mg/L]	Liquid volume [Mil. Gal]
Influent	9	257.47	193.44	495	243.14	18.04	0.21	29.1	29.31	5.8	2.9	12.5	4.14	7.7	4.8	13.8	66	0
DO Depl.	19.86	9629.84	5676.45	8498.97	1624.41	3.94	1.57	471.87	473.44	298.05	0.56	12.5	3.1	6.83	0.05	13.26	65.85	0.2
Anoxic1	19.86	9603.94	5667.62	8493.58	1614.15	5.36	0.01	471.86	471.88	298.05	10.66	12.5	3.3	6.82	0	15.56	66.48	0.8
Aeration1	19.86	9603.56	5655.25	8462.95	1601.26	1.8	2.66	469.07	471.73	298.05	3.88	12.5	2.86	6.74	2	13.98	66.05	0.65
MBR1	19.86	9596.24	5641.21	8438.39	1586.83	0.26	3.93	467.76	471.69	298.05	0.24	12.5	2.66	6.78	8.13	13.11	65.81	0.8
Membranes1	5.01	1.9	1.12	32.09	1.29	0.26	3.93	2.07	6	0.3	0.24	12.5	2.66	6.72	8.13	13.11	65.81	0
RAS1	14.78	12832.79	7543.84	11274.18	2121.69	0.26	3.93	624.85	628.79	398.5	0.24	12.5	2.66	6.78	8.13	13.11	65.81	0
PST2	2.35	96.07	72.1	284.85	150.42	16.47	0.62	23.32	23.94	3.77	2.64	12.5	4.01	7.51	4.52	13.77	65.99	0.24
Anoxic2	6.32	2966.81	2124.44	3151.24	1159.84	7.96	0.02	196.82	196.84	94.54	4.25	12.5	3.51	6.91	0	14.32	66.14	0.1
Aeration2	6.32	2957.31	2107.3	3108.86	1136.51	2.35	4.35	192.23	196.57	94.54	0.32	12.5	2.82	6.74	2	13.46	65.91	0.41
FST2	2.32	27.53	19.62	56.15	11.8	2.35	4.35	5.8	10.15	1.2	0.32	12.5	2.82	6.74	2	13.46	65.91	0.24
RAS2	1.97	6357.61	4530.25	6651.82	2441.86	2.35	4.35	408.59	412.94	202.86	0.32	12.5	2.82	6.74	2	13.46	65.91	0
Sand Filters2	1.32	7.25	5.17	35.02	4.01	2.35	4.35	4.51	8.86	0.55	0.32	12.5	2.82	6.68	2	13.46	65.91	0
PST3	3.19	83.47	62.33	242.05	124.18	13.55	1.47	19.79	21.25	3.5	2.45	12.5	3.75	7.28	4.05	13.75	65.99	0.36
Anoxic3	7.15	2044.43	1427.94	2136.21	662.49	6.55	0.04	132.82	132.86	47.88	2.22	12.5	3.4	6.88	0	13.81	66	0.14
Aeration3	7.15	2025.85	1407.53	2089.89	634.51	0.81	5.16	127.39	132.54	47.88	1.64	12.5	2.64	6.7	2	13.7	65.97	1.09
FST3	3.15	16.56	11.51	43.36	6.17	0.81	5.16	3.57	8.72	2.01	1.64	12.5	2.64	6.7	2	13.7	65.97	0.69
RAS3	1.96	5189.78	3605.77	5312.48	1623.93	0.81	5.16	322.36	327.51	120.1	1.64	12.5	2.64	6.7	2	13.7	65.97	0
Sand Filters3	2.55	3.07	2.13	29.62	1.95	0.81	5.16	2.74	7.89	1.71	1.64	12.5	2.64	6.64	2	13.7	65.97	0
Effluent	8.88	3.03	2.01	31.81	1.88	0.73	4.35	2.62	6.97	0.74	0.65	12.5	2.68	6.75	5.46	13.33	65.87	0
Thickener	0.06	1674.8	1118.92	1774.45	562.33	5.08	3.38	80.37	83.74	40.53	1.22	12.5	3.04	6.9	4.85	13.47	65.91	0.14
BFP	0.02	486.94	325.32	563.26	183.65	5.08	3.38	28.7	32.08	12.65	1.22	12.5	3.04	6.84	4.85	13.47	65.91	0
Sludge	0.12	16150.14	10789.76	16534.05	5176.85	5.08	3.38	709.97	713.35	380.36	1.22	12.5	3.04	6.9	4.85	13.47	65.91	0

Check	Permit	Combined Effluent	?
TSS	20	3.03	OK
Ammonia	1.1	0.7	OK
TKN	NA	2.62	OK
CBOD	NA	1.88	OK
UOD	45	14.6	OK
NO3	10	4.35	OK
Flow	8.9	mgd	

Zones	mgal		
DO Depl.	0.200		
Anoxic	0.800		
Aeration	0.650		
Membranes	0.800		
Total Vol Req'd	2.450		
Total Vol Avail.	2.450		
Vol. check:	OK		
MBR:	99.995%	removal	(enter manually)
FSTs:	99.50%	removal	(enter manually)
Filters:	85.00%	removal	(enter manually)
SRT MBR:	15.0	days	
MBR MLSS:	9,596	mg/L	

Elements	Model	Setpoint
Influent	9	
DO Depl.	19.86	
Anoxic1	19.86	
Aeration1	19.86	
MBR1	19.86	
Membranes1	5.01	
RAS1	14.78	
WAS1	0.07	
PST2	2.35	
Aeration2	6.32	
FST2	2.32	
RAS2	2.00	2.00
IR	2.00	2.00
WAS2	0.03	0.03
PST3	3.19	
Anoxic3	7.15	
Aeration3	7.15	
FST3	3.15	
RAS3	2.00	2.00
IR	2.00	2.00
WAS3	0.04	0.04
Effluent	8.88	

Elements	Model	Setpoint
Thickener	0.06	
Thickener Underflow	0.14	0.14
BFP	0.02	
Sludge	0.12	0.12
Sidestream	0.08	

Model 3: Phase II MBR Facility <u>Average Month</u>

#4

MLSS	12,400	mg/L	SRT	20.0	days

Elements	Flow [mgd]	Total suspended solids [mgTSS/L]	Volatile suspended solids [mgVSS/L]	Total COD [mg/L]	Total Carbonaceous BOD [mg/L]	Ammonia N [mgN/L]	Nitrate N [mgN/L]	Total Kjeldahl Nitrogen [mgN/L]	Total N [mgN/L]	Total P [mgP/L]	Soluble PO4-P [mgP/L]	Temperature [deg. C]	Alkalinity [mmol/L]	pH []	Dissolved oxygen [mg/L]	Magnesium [mg/L]	Calcium [mg/L]	Liquid volume [Mil. Gal]
Influent	9	257.47	193.44	495	243.14	18.04	0.21	29.1	29.31	5.8	2.9	12.5	4.14	7.7	4.8	13.8	66	0
DO Depl.	19.86	12408.81	7159.27	10733.63	1733.96	3.92	1.6	588.24	589.83	388.7	0.71	12.5	3.09	6.83	0.05	13.27	65.85	0.2
Anoxic1	19.86	12381.62	7150.02	10728.05	1723.42	5.38	0.01	588.23	588.25	388.7	11.34	12.5	3.3	6.82	0	15.69	66.52	0.8
Aeration1	19.86	12380.88	7137.18	10696.61	1710.1	1.62	2.86	585.23	588.1	388.7	4.49	12.5	2.83	6.73	2	14.1	66.08	0.65
MBR1	19.86	12373.8	7122.61	10671.35	1695.09	0.21	4.06	584	588.06	388.7	0.36	12.5	2.64	6.77	8.11	13.11	65.81	0.8
Membranes1	5.01	2.45	1.41	33.02	1.28	0.21	4.06	2.06	6.12	0.44	0.36	12.5	2.64	6.71	8.11	13.11	65.81	0
RAS1	14.8	16547.16	9524.88	14260.08	2266.47	0.21	4.06	780.31	784.37	519.67	0.36	12.5	2.64	6.77	8.11	13.11	65.81	0
PST2	2.35	96.07	72.1	284.85	150.42	16.47	0.62	23.32	23.94	3.77	2.64	12.5	4.01	7.51	4.52	13.77	65.99	0.24
Anoxic2	6.32	2966.81	2124.44	3151.24	1159.84	7.96	0.02	196.82	196.84	94.54	4.25	12.5	3.51	6.91	0	14.32	66.14	0.1
Aeration2	6.32	2957.31	2107.3	3108.86	1136.51	2.35	4.35	192.23	196.57	94.54	0.32	12.5	2.82	6.74	2	13.46	65.91	0.41
FST2	2.32	27.53	19.62	56.15	11.8	2.35	4.35	5.8	10.15	1.2	0.32	12.5	2.82	6.74	2	13.46	65.91	0.24
RAS2	1.97	6357.61	4530.25	6651.82	2441.86	2.35	4.35	408.59	412.94	202.86	0.32	12.5	2.82	6.74	2	13.46	65.91	0
Sand Filters2	1.32	7.25	5.17	35.02	4.01	2.35	4.35	4.51	8.86	0.55	0.32	12.5	2.82	6.68	2	13.46	65.91	0
PST3	3.19	83.47	62.33	242.05	124.18	13.55	1.47	19.79	21.25	3.5	2.45	12.5	3.75	7.28	4.05	13.75	65.99	0.36
Anoxic3	7.15	2044.43	1427.94	2136.21	662.49	6.55	0.04	132.82	132.86	47.88	2.22	12.5	3.4	6.88	0	13.81	66	0.14
Aeration3	7.15	2025.85	1407.53	2089.89	634.51	0.81	5.16	127.39	132.54	47.88	1.64	12.5	2.64	6.7	2	13.7	65.97	1.09
FST3	3.15	16.56	11.51	43.36	6.17	0.81	5.16	3.57	8.72	2.01	1.64	12.5	2.64	6.7	2	13.7	65.97	0.69
RAS3	1.96	5189.78	3605.77	5312.48	1623.93	0.81	5.16	322.36	327.51	120.1	1.64	12.5	2.64	6.7	2	13.7	65.97	0
Sand Filters3	2.55	3.07	2.13	29.62	1.95	0.81	5.16	2.74	7.89	1.71	1.64	12.5	2.64	6.64	2	13.7	65.97	0
Effluent	8.88	3.34	2.18	32.34	1.88	0.7	4.42	2.62	7.04	0.82	0.72	12.5	2.67	6.75	5.45	13.33	65.87	0
Thickener	0.04	2336.46	1551.71	2442.01	753.22	5.54	3.36	107.95	111.31	56.25	1.35	12.5	3.08	6.91	4.52	13.51	65.92	0.14
BFP	0.02	478.73	317.94	556.4	179.08	5.54	3.36	28.53	31.89	12.6	1.35	12.5	3.08	6.85	4.52	13.51	65.92	0
Sludge	0.12	15877.86	10544.95	16186.62	4938.24	5.54	3.36	686.92	690.27	374.46	1.35	12.5	3.08	6.91	4.52	13.51	65.92	0

Check	Permit	Combined Effluent	?
TSS	20	3.34	OK
Ammonia	1.1	0.7	OK
TKN	NA	2.62	OK
CBOD	NA	1.88	OK
UOD	45	14.6	OK
NO3	10	4.42	OK
Flow	8.9	mgd	

Zones	mgal		
DO Depl.	0.200		
Anoxic	0.800		
Aeration	0.650		
Membranes	0.800		
Total Vol Req'd	2.450		
Total Vol Avail.	2.450		
Vol. check:	OK		
MBR:	99.995%	removal	(enter manually)
FSTs:	99.50%	removal	(enter manually)
Filters:	85.00%	removal	(enter manually)
SRT MBR:	20.0	days	
MBR MLSS:	12,374	mg/L	

Elements	Model	Setpoint
Influent	9	
DO Depl.	19.86	
Anoxic1	19.86	
Aeration1	19.86	
MBR1	19.86	
Membranes1	5.01	
RAS1	14.8	
WAS1	0.05	
PST2	2.35	
Aeration2	6.32	
FST2	2.32	
RAS2	2.00	2.00
IR	2.00	2.00
WAS2	0.03	0.03
PST3	3.19	
Anoxic3	7.15	
Aeration3	7.15	
FST3	3.15	
RAS3	2.00	2.00
IR	2.00	2.00
WAS3	0.04	0.04
Effluent	8.88	

Elements	Model	Setpoint
Thickener	0.04	
Thickener Underflow	0.14	0.14
BFP	0.02	
Sludge	0.12	0.12
Sidestream	0.06	

Model 3: Phase II MBR Facility Average Month

#5

MLSS 17,800 mg/L SRT 30.0 days

Elements	Flow [mgd]	Total suspended solids [mgTSS/L]	Volatile suspended solids [mgVSS/L]	Total COD [mg/L]	Total Carbonaceous BOD [mg/L]	Ammonia N [mgN/L]	Nitrate N [mgN/L]	Total Kjeldahl Nitrogen [mgN/L]	Total N [mgN/L]	Total P [mgP/L]	Soluble PO4-P [mgP/L]	Temperature [deg. C]	Alkalinity [mmol/L]	pH []	Dissolved oxygen [mg/L]	Magnesium [mg/L]	Calcium [mg/L]	Liquid volume [Mil. Gal]
Influent	9	257.47	193.44	495	243.14	18.04	0.21	29.1	29.31	5.8	2.9	12.5	4.14	7.7	4.8	13.8	66	0
DO Depl.	19.92	17857.12	10057.44	15107.86	1865.15	3.9	1.63	814.05	815.68	542.52	1.08	12.5	3.08	6.83	0.04	13.33	65.87	0.2
Anoxic1	19.92	17828.47	10047.77	15102.03	1854.31	5.41	0.01	814.05	814.06	542.52	12.3	12.5	3.3	6.81	0	15.89	66.57	0.8
Aeration1	19.92	17827.19	10034.43	15069.79	1840.52	1.45	3.09	810.81	813.9	542.52	5.48	12.5	2.8	6.72	2	14.3	66.14	0.65
MBR1	19.92	17820.51	10019.27	15043.75	1824.87	0.17	4.2	809.66	813.86	542.52	0.75	12.5	2.62	6.77	8.08	13.17	65.83	0.8
Membranes1	5.07	3.5	1.97	34.42	1.27	0.17	4.2	2.09	6.29	0.85	0.75	12.5	2.62	6.71	8.08	13.17	65.83	0
RAS1	14.82	23902.89	13438.98	20167.65	2447.41	0.17	4.2	1085.35	1089.55	727.44	0.75	12.5	2.62	6.77	8.08	13.17	65.83	0
PST2	2.35	96.07	72.1	284.85	150.42	16.47	0.62	23.32	23.94	3.77	2.64	12.5	4.01	7.51	4.52	13.77	65.99	0.24
Anoxic2	6.32	2966.81	2124.44	3151.24	1159.84	7.96	0.02	196.82	196.84	94.54	4.25	12.5	3.51	6.91	0	14.32	66.14	0.1
Aeration2	6.32	2957.31	2107.3	3108.86	1136.51	2.35	4.35	192.23	196.57	94.54	0.32	12.5	2.82	6.74	2	13.46	65.91	0.41
FST2	2.32	27.53	19.62	56.15	11.8	2.35	4.35	5.8	10.15	1.2	0.32	12.5	2.82	6.74	2	13.46	65.91	0.24
RAS2	1.97	6357.61	4530.25	6651.82	2441.86	2.35	4.35	408.59	412.94	202.86	0.32	12.5	2.82	6.74	2	13.46	65.91	0
Sand Filters2	1.32	7.25	5.17	35.02	4.01	2.35	4.35	4.51	8.86	0.55	0.32	12.5	2.82	6.68	2	13.46	65.91	0
PST3	3.19	83.47	62.33	242.05	124.18	13.55	1.47	19.79	21.25	3.5	2.45	12.5	3.75	7.28	4.05	13.75	65.99	0.36
Anoxic3	7.15	2044.43	1427.94	2136.21	662.49	6.55	0.04	132.82	132.86	47.88	2.22	12.5	3.4	6.88	0	13.81	66	0.14
Aeration3	7.15	2025.85	1407.53	2089.89	634.51	0.81	5.16	127.39	132.54	47.88	1.64	12.5	2.64	6.7	2	13.7	65.97	1.09
FST3	3.15	16.56	11.51	43.36	6.17	0.81	5.16	3.57	8.72	2.01	1.64	12.5	2.64	6.7	2	13.7	65.97	0.69
RAS3	1.96	5189.78	3605.77	5312.48	1623.93	0.81	5.16	322.36	327.51	120.1	1.64	12.5	2.64	6.7	2	13.7	65.97	0
Sand Filters3	2.55	3.07	2.13	29.62	1.95	0.81	5.16	2.74	7.89	1.71	1.64	12.5	2.64	6.64	2	13.7	65.97	0
Effluent	8.94	3.93	2.49	33.14	1.87	0.67	4.49	2.63	7.13	1.05	0.94	12.5	2.66	6.74	5.45	13.36	65.88	0
Thickener	0.08	1160.61	766.47	1248.35	380.54	6.12	3.31	57.4	60.71	28.13	1.54	12.5	3.12	6.92	4.12	13.57	65.94	0.14
BFP	0.02	468.4	309.33	548.52	174.12	6.12	3.31	28.37	31.68	12.27	1.54	12.5	3.12	6.86	4.12	13.57	65.94	0
Sludge	0.06	31070.45	20519.16	31487.53	9299.8	6.12	3.31	1311.65	1314.96	713.32	1.54	12.5	3.12	6.92	4.12	13.57	65.94	0

Check	Permit	Combined Effluent	?
TSS	20	3.93	OK
Ammonia	1.1	0.67	OK
TKN	NA	2.63	OK
CBOD	NA	1.87	OK
UOD	45	14.6	OK
NO3	10	4.49	OK
Flow	8.9	mgd	

Zones	mgal		
DO Depl.	0.200		
Anoxic	0.800		
Aeration	0.650		
Membranes	0.800		
Total Vol Req'd	2.450		
Total Vol Avail.	2.450		
Vol. check:	OK		
MBR:	99.995%	removal	(enter manually)
FSTs:	99.50%	removal	(enter manually)
Filters:	85.00%	removal	(enter manually)
SRT MBR:	30.0	days	
MBR MLSS:	17,821	mg/L	

Elements	Model	Setpoint
Influent	9	
DO Depl.	19.92	
Anoxic1	19.92	
Aeration1	19.92	
MBR1	19.92	
Membranes1	5.07	
RAS1	14.82	
WAS1	0.03	
PST2	2.35	
Aeration2	6.32	
FST2	2.32	
RAS2	2.00	2.00
IR	2.00	2.00
WAS2	0.03	0.03
PST3	3.19	
Anoxic3	7.15	
Aeration3	7.15	
FST3	3.15	
RAS3	2.00	2.00
IR	2.00	2.00
WAS3	0.04	0.04
Effluent	8.94	

Elements	Model	Setpoint
Thickener	0.08	
Thickener Underflow	0.08	0.11
BFP	0.02	
Sludge	0.06	0.08
Sidestream	0.1	

run date:	2/23/06

Model 3: Phase II MBR Facility Maximum Month — Several MBR SRT Runs: 5, 10, 15, 20, 30 days

Yellow boxes indicate parameters that may need to be changed in BioWin before running model.

#1

MLSS 5,900 mg/L SRT 5.0 days

Elements	Flow [mgd]	Total suspended solids [mgTSS/L]	Volatile suspended solids [mgVSS/L]	Total COD [mg/L]	Total Carbonaceous BOD [mg/L]	Ammonia N [mgN/L]	Nitrate N [mgN/L]	Total Kjeldahl Nitrogen [mgN/L]	Total N [mgN/L]	Total P [mgP/L]	Soluble PO4-P [mgP/L]	Temperature [deg. C]	Alkalinity [mmol/L]	pH []	Dissolved oxygen [mg/L]	Magnesium [mg/L]	Calcium [mg/L]	Liquid volume [Mil. Gal]
Influent	13.6	256.1	175.07	448	220.05	13.14	0.17	45.3	45.47	6.7	3.35	12.5	2.98	8	4.4	10.4	51.6	0
DO Depl.	29.87	5875.45	3377.68	5031.17	1500.38	4.67	4.17	300.18	304.35	136.1	1.99	12.5	2.16	6.73	0.05	10.11	51.52	0.2
Anoxic1	29.87	5865.22	3370.21	5019.13	1490.86	7.29	0.04	300.18	300.22	136.1	3.71	12.5	2.63	6.83	0	10.48	51.62	0.8
Aeration1	29.87	5858.79	3361.57	5000.24	1481.47	4.12	3.58	296.52	300.1	136.1	2.77	12.5	2.15	6.64	2	10.26	51.56	0.65
MBR1	29.87	5850.62	3351.15	4981.77	1470.79	1.23	7.13	292.93	300.06	136.1	1.85	12.5	1.69	6.57	6.82	10.03	51.5	0.8
Membranes1	7.43	1.18	0.67	25.4	1.39	1.23	7.13	3.87	11	1.88	1.85	12.5	1.69	6.51	6.82	10.03	51.5	0
RAS1	22.22	7788.65	4461.23	6623.92	1957.63	1.23	7.13	388.7	395.83	180.57	1.85	12.5	1.69	6.57	6.82	10.03	51.5	0
PST2	3.32	98.65	67.4	265.69	140.77	12.46	0.79	33.5	34.29	4.58	3.27	12.5	2.89	7.71	4.24	10.39	51.6	0.24
Anoxic2	7.3	3959.45	2646.04	3908.24	1457.15	10.22	0.05	253.24	253.29	89.15	2.9	12.5	2.85	7	0	10.45	51.61	0.1
Aeration2	7.3	3943.36	2627.42	3865.14	1432.37	3.2	9.18	243.79	252.98	89.15	2.16	12.5	1.72	6.54	2	10.32	51.58	0.41
FST2	3.3	31.67	21.1	55.15	12.68	3.2	9.18	8.01	17.19	2.86	2.16	12.5	1.72	6.54	2	10.32	51.58	0.24
RAS2	1.97	10397.38	6927.66	10151.35	3774.75	3.2	9.18	632.82	642.01	231.52	2.16	12.5	1.72	6.54	2	10.32	51.58	0
Sand Filters2	2.3	8.18	5.45	32.27	4.16	3.2	9.18	6.59	15.78	2.34	2.16	12.5	1.72	6.48	2	10.32	51.58	0
PST3	4.26	91.53	62.29	238.17	123.23	10.85	2.54	29.72	32.26	4.44	3.19	12.5	2.66	7.36	3.92	10.39	51.6	0.36
Anoxic3	8.23	2876.7	1875.02	2779.43	900.07	8.02	3.09	180.51	183.6	55.21	2.68	12.5	2.49	6.94	0.01	10.4	51.6	0.14
Aeration3	8.23	2852.54	1849.75	2730.42	869.63	1	13.29	169.93	183.23	55.21	2.73	12.5	1.26	6.39	2	10.4	51.6	1.09
FST3	4.23	21.01	13.63	43.75	7.38	1	13.29	4.93	18.23	3.11	2.73	12.5	1.26	6.39	2	10.4	51.6	0.69
RAS3	1.96	8834.62	5728.87	8406.48	2691.29	1	13.29	518.52	531.82	165.27	2.73	12.5	1.26	6.39	2	10.4	51.6	0
Sand Filters3	3.63	4.41	2.86	27.99	2.32	1	13.29	3.97	17.26	2.81	2.73	12.5	1.26	6.33	2	10.4	51.6	0
Effluent	13.36	3.26	2.09	27.29	2.12	1.5	9.16	4.36	13.52	2.21	2.14	12.5	1.58	6.52	4.68	10.18	51.54	0
Thickener	0.05	3598.71	2239.67	3441.85	1200.73	3.21	6.95	209.42	216.37	72.03	2.21	12.5	1.84	6.66	5.47	10.15	51.53	0.14
BFP	0.05	316.4	196.91	345.03	120.9	3.21	6.95	25.56	32.51	8.35	2.21	12.5	1.84	6.6	5.47	10.15	51.53	0
Sludge	0.24	13117.48	8163.72	12422.67	4332.27	3.21	6.95	742.62	749.57	256.71	2.21	12.5	1.84	6.66	5.47	10.15	51.53	0

Check	Permit	Combined Effluent	?
TSS	20	3.26	OK
Ammonia	1.1	1.5	NO
TKN	NA	4.36	OK
CBOD	NA	2.12	OK
UOD	45	22.8	OK
NO3	10	9.16	OK
Flow	13.4	mgd	

Zones	mgal		
DO Depl.	0.200		
Anoxic	0.800		
Aeration	0.650		
Membranes	0.800		
Total Vol Req'd	2.450		
Total Vol Avail.	2.450		
Vol. check:	OK		
MBR:	99.995%	removal	(enter manually)
FSTs:	99.50%	removal	(enter manually)
Filters:	82.00%	removal	(enter manually)
SRT MBR:	5.0	days	
MBR MLSS:	5,851	mg/L	

Elements	Model	Setpoint
Influent	13.6	
DO Depl.	29.87	
Anoxic1	29.87	
Aeration1	29.87	
MBR1	29.87	
Membranes1	7.43	
RAS1	22.22	
WAS1	0.22	
PST2	3.32	
Aeration2	7.3	
FST2	3.3	
RAS2	2.00	2.00
IR	2.00	2.00
WAS2	0.03	0.025
PST3	4.26	
Anoxic3	8.23	
Aeration3	8.23	
FST3	4.23	
RAS3	2.00	2.00
IR	2.00	2.00
WAS3	0.04	0.035
Effluent	13.36	

Elements	Model	Setpoint
Thickener	0.05	
Thickener Underflow	0.30	0.30
BFP	0.05	
Sludge	0.24	0.24
Sidestream	0.1	

Model 3: Phase II MBR Facility Maximum Month

#2

MLSS	10,600	mg/L	SRT	10.0	days

Elements	Flow [mgd]	Total suspended solids [mgTSS/L]	Volatile suspended solids [mgVSS/L]	Total COD [mg/L]	Total Carbonaceous BOD [mg/L]	Ammonia N [mgN/L]	Nitrate N [mgN/L]	Total Kjeldahl Nitrogen [mgN/L]	Total N [mgN/L]	Total P [mgP/L]	Soluble PO4-P [mgP/L]	Temperature [deg. C]	Alkalinity [mmol/L]	pH []	Dissolved oxygen [mg/L]	Magnesium [mg/L]	Calcium [mg/L]	Liquid volume [Mil. Gal]
Influent	13.6	256.1	175.07	448	220.05	13.14	0.17	45.3	45.47	6.7	3.35	12.5	2.98	8	4.4	10.4	51.6	0
DO Depl.	29.95	10618.54	5693.6	8500.7	1925.73	4.23	4.38	485.98	490.36	238.57	2.47	12.5	2.1	6.72	0.04	10.12	51.52	0.2
Anoxic1	29.95	10605.32	5684.71	8488.05	1915.41	6.97	0.04	485.98	486.02	238.57	5.07	12.5	2.59	6.83	0	10.68	51.68	0.8
Aeration1	29.95	10598.03	5674.49	8466.58	1904.71	2.55	4.83	481.06	485.89	238.57	3.7	12.5	1.94	6.59	2	10.35	51.59	0.65
MBR1	29.95	10588.43	5662.11	8445.35	1892.07	0.4	7.78	478.06	485.84	238.57	2.44	12.5	1.57	6.53	6.8	10.03	51.5	0.8
Membranes1	7.51	2.11	1.13	26.37	1.34	0.4	7.78	2.92	10.7	2.49	2.44	12.5	1.57	6.47	6.8	10.03	51.5	0
RAS1	22.33	14133.62	7557.88	11264.73	2525.25	0.4	7.78	637.18	644.96	317.63	2.44	12.5	1.57	6.53	6.8	10.03	51.5	0
PST2	3.32	98.65	67.4	265.69	140.77	12.46	0.79	33.5	34.29	4.58	3.27	12.5	2.89	7.71	4.24	10.39	51.6	0.24
Anoxic2	7.3	3959.45	2646.04	3908.24	1457.15	10.22	0.05	253.24	253.29	89.15	2.9	12.5	2.85	7	0	10.45	51.61	0.1
Aeration2	7.3	3943.36	2627.42	3865.14	1432.37	3.2	9.18	243.79	252.98	89.15	2.16	12.5	1.72	6.54	2	10.32	51.58	0.41
FST2	3.3	31.67	21.1	55.15	12.68	3.2	9.18	8.01	17.19	2.86	2.16	12.5	1.72	6.54	2	10.32	51.58	0.24
RAS2	1.97	10397.38	6927.66	10151.35	3774.75	3.2	9.18	632.82	642.01	231.52	2.16	12.5	1.72	6.54	2	10.32	51.58	0
Sand Filters2	2.3	8.18	5.45	32.27	4.16	3.2	9.18	6.59	15.78	2.34	2.16	12.5	1.72	6.48	2	10.32	51.58	0
PST3	4.26	91.53	62.29	238.17	123.23	10.85	2.54	29.72	32.26	4.44	3.19	12.5	2.66	7.36	3.92	10.39	51.6	0.36
Anoxic3	8.23	2876.7	1875.02	2779.43	900.07	8.02	3.09	180.51	183.6	55.21	2.68	12.5	2.49	6.94	0.01	10.4	51.6	0.14
Aeration3	8.23	2852.54	1849.75	2730.42	869.63	1	13.29	169.93	183.23	55.21	2.73	12.5	1.26	6.39	2	10.4	51.6	1.09
FST3	4.23	21.01	13.63	43.75	7.38	1	13.29	4.93	18.23	3.11	2.73	12.5	1.26	6.39	2	10.4	51.6	0.69
RAS3	1.96	8834.62	5728.87	8406.48	2691.29	1	13.29	518.52	531.82	165.27	2.73	12.5	1.26	6.39	2	10.4	51.6	0
Sand Filters3	3.63	4.41	2.86	27.99	2.32	1	13.29	3.97	17.26	2.81	2.73	12.5	1.26	6.33	2	10.4	51.6	0
Effluent	13.44	3.77	2.33	27.82	2.09	1.04	9.51	3.83	13.34	2.55	2.47	12.5	1.51	6.5	4.68	10.18	51.54	0
Thickener	0.03	5847.54	3548.52	5459.24	1769.56	3.78	7.17	326.27	333.44	113.18	2.66	12.5	1.86	6.7	4.81	10.21	51.55	0.14
BFP	0.04	375.07	227.6	403.77	136.25	3.78	7.17	29.64	36.8	9.75	2.66	12.5	1.86	6.64	4.81	10.21	51.55	0
Sludge	0.16	18659.54	11323.34	17294.96	5593.42	3.78	7.17	1020.74	1027.91	355.31	2.66	12.5	1.86	6.7	4.81	10.21	51.55	0

Check	Permit	Combined Effluent	?
TSS	20	3.77	OK
Ammonia	1.1	1.04	OK
TKN	NA	3.83	OK
CBOD	NA	2.09	OK
UOD	45	20.4	OK
NO3	10	9.51	OK
Flow	13.4	mgd	

Zones	mgal		
DO Depl.	0.200		
Swing	0.800		
Aeration	0.650		
Membranes	0.800		
Total Vol Req'd	2.450		
Total Vol Avail.	2.450		
Vol. check:	OK		
MBR:	99.995%	removal	(enter manually)
FSTs:	99.50%	removal	(enter manually)
Filters:	82.00%	removal	(enter manually)
SRT MBR:	10.0	days	
MBR MLSS:	10,598	mg/L	

Elements	Model	Setpoint
Influent	13.6	
DO Depl.	29.95	
Anoxic1	29.95	
Aeration1	29.95	
MBR1	29.95	
Membranes1	7.51	
RAS1	22.33	
WAS1	0.11	
PST2	3.32	
Aeration2	7.3	
FST2	3.3	
RAS2	2.00	2.00
IR	2.00	2.00
WAS2	0.03	0.025
PST3	4.26	
Anoxic3	8.23	
Aeration3	8.23	
FST3	4.23	
RAS3	2.00	2.00
IR	2.00	2.00
WAS3	0.04	0.035
Effluent	13.44	

Elements	Model	Setpoint
Thickener	0.03	
Thickener Underflow	0.21	0.21
BFP	0.04	
Sludge	0.16	0.16
Sidestream	0.07	

Model 3: Phase II MBR Facility Maximum Month

#3

MLSS 15,100 mg/L SRT 15.0 days

Elements	Flow [mgd]	Total suspended solids [mgTSS/L]	Volatile suspended solids [mgVSS/L]	Total COD [mg/L]	Total Carbonaceous BOD [mg/L]	Ammonia N [mgN/L]	Nitrate N [mgN/L]	Total Kjeldahl Nitrogen [mgN/L]	Total N [mgN/L]	Total P [mgP/L]	Soluble PO4-P [mgP/L]	Temperature [deg. C]	Alkalinity [mmol/L]	pH []	Dissolved oxygen [mg/L]	Magnesium [mg/L]	Calcium [mg/L]	Liquid volume [Mil. Gal]
Influent	13.6	256.1	175.07	448	220.05	13.14	0.17	45.3	45.47	6.7	3.35	12.5	2.98	8	4.4	10.4	51.6	0
DO Depl.	29.99	15125.58	7809.64	11687.77	2139.25	4.22	4.44	652.31	656.75	318.32	2.85	12.5	2.08	6.72	0.03	10.16	51.53	0.2
Anoxic1	29.99	15110.94	7800.16	11674.93	2128.55	7	0.05	652.31	652.36	318.32	5.93	12.5	2.59	6.82	0	10.83	51.72	0.8
Aeration1	29.99	15103.29	7789.22	11652.19	2117.2	2.06	5.36	646.86	652.22	318.32	4.34	12.5	1.86	6.57	2	10.45	51.61	0.65
MBR1	29.99	15093.03	7775.92	11629.64	2103.64	0.28	8.01	644.16	652.17	318.32	2.91	12.5	1.54	6.52	6.79	10.08	51.51	0.8
Membranes1	7.55	3	1.54	27.26	1.34	0.28	8.01	2.78	10.79	2.98	2.91	12.5	1.54	6.46	6.79	10.08	51.51	0
RAS1	22.37	20173.34	10393.29	15535.78	2811.41	0.28	8.01	860.09	868.1	424.49	2.91	12.5	1.54	6.52	6.79	10.08	51.51	0
PST2	3.32	98.65	67.4	265.69	140.77	12.46	0.79	33.5	34.29	4.58	3.27	12.5	2.89	7.71	4.24	10.39	51.6	0.24
Anoxic2	7.3	3959.45	2646.04	3908.24	1457.15	10.22	0.05	253.24	253.29	89.15	2.9	12.5	2.85	7	0	10.45	51.61	0.1
Aeration2	7.3	3943.36	2627.42	3865.14	1432.37	3.2	9.18	243.79	252.98	89.15	2.16	12.5	1.72	6.54	2	10.32	51.58	0.41
FST2	3.3	31.67	21.1	55.15	12.68	3.2	9.18	8.01	17.19	2.86	2.16	12.5	1.72	6.54	2	10.32	51.58	0.24
RAS2	1.97	10397.38	6927.66	10151.35	3774.75	3.2	9.18	632.82	642.01	231.51	2.16	12.5	1.72	6.54	2	10.32	51.58	0
Sand Filters2	2.3	8.18	5.45	32.27	4.16	3.2	9.18	6.59	15.78	2.34	2.16	12.5	1.72	6.48	2	10.32	51.58	0
PST3	4.26	91.53	62.29	238.17	123.23	10.85	2.54	29.72	32.26	4.44	3.19	12.5	2.66	7.36	3.92	10.39	51.6	0.36
Anoxic3	8.23	2876.7	1875.02	2779.43	900.07	8.02	3.09	180.51	183.6	55.21	2.68	12.5	2.49	6.94	0.01	10.4	51.6	0.14
Aeration3	8.23	2852.54	1849.75	2730.42	869.63	1	13.29	169.93	183.23	55.21	2.73	12.5	1.26	6.39	2	10.4	51.6	1.09
FST3	4.23	21.01	13.63	43.75	7.38	1	13.29	4.93	18.23	3.11	2.73	12.5	1.26	6.39	2	10.4	51.6	0.69
RAS3	1.96	8834.62	5728.87	8406.48	2691.29	1	13.29	518.52	531.82	165.27	2.73	12.5	1.26	6.39	2	10.4	51.6	0
Sand Filters3	3.63	4.41	2.86	27.99	2.32	1.0	13.29	3.97	17.26	2.81	2.73	12.5	1.26	6.33	2	10.4	51.6	0
Effluent	13.48	4.26	2.56	28.31	2.09	0.97	9.63	3.75	13.38	2.82	2.74	12.5	1.49	6.49	4.69	10.2	51.55	0
Thickener	0.05	3029.97	1817.34	2836.48	887.99	4.37	7.14	172.16	179.3	57.88	2.88	12.5	1.9	6.73	4.43	10.27	51.56	0.14
BFP	0.02	729.67	437.64	731.35	235.66	4.37	7.14	49.41	56.55	16.13	2.88	12.5	1.9	6.67	4.43	10.27	51.56	0
Sludge	0.12	24200.59	14515.22	22210.83	6891.64	4.37	7.14	1301.86	1308.99	442.18	2.88	12.5	1.9	6.73	4.43	10.27	51.56	0

Check	Permit	Combined Effluent	?
TSS	20	4.26	OK
Ammonia	1.1	0.97	OK
TKN	NA	3.75	OK
CBOD	NA	2.09	OK
UOD	45	20.0	OK
NO3	10	9.63	OK
Flow	13.5	mgd	

Zones	mgal		
DO Depl.	0.200		
Swing	0.800		
Aeration	0.650		
Membranes	0.800		
Total Vol Req'd	2.450		
Total Vol Avail.	2.450		
Vol. check:	OK		
MBR:	99.995%	removal	(enter manually)
FSTs:	99.50%	removal	(enter manually)
Filters:	82.00%	removal	(enter manually)
SRT MBR:	15.0	days	
MBR MLSS:	15,103	mg/L	

Elements	Model	Setpoint
Influent	13.6	
DO Depl.	29.99	
Anoxic1	29.99	
Aeration1	29.99	
MBR1	29.99	
Membranes1	7.55	
RAS1	22.37	
WAS1	0.07	
PST2	3.32	
Aeration2	7.3	
FST2	3.3	
RAS2	2.00	2.00
IR	2.00	2.00
WAS2	0.03	0.025
PST3	4.26	
Anoxic3	8.23	
Aeration3	8.23	
FST3	4.23	
RAS3	2.00	2.00
IR	2.00	2.00
WAS3	0.04	0.035
Effluent	13.48	

Elements	Model	Setpoint
Thickener	0.05	
Thickener Underflow	0.14	0.14
BFP	0.02	
Sludge	0.12	0.12
Sidestream	0.07	

Model 3: Phase II MBR Facility Maximum Month
#4

MLSS	19,500	mg/L	SRT	20.0	days

Elements	Flow [mgd]	Total suspended solids [mgTSS/L]	Volatile suspended solids [mgVSS/L]	Total COD [mg/L]	Total Carbonaceous BOD [mg/L]	Ammonia N [mgN/L]	Nitrate N [mgN/L]	Total Kjeldahl Nitrogen [mgN/L]	Total N [mgN/L]	Total P [mgP/L]	Soluble PO4-P [mgP/L]	Temperature [deg. C]	Alkalinity [mmol/L]	pH []	Dissolved oxygen [mg/L]	Magnesium [mg/L]	Calcium [mg/L]	Liquid volume [Mil. Gal]
Influent	13.6	256.1	175.07	448	220.05	13.14	0.17	45.3	45.47	6.7	3.35	12.5	2.98	8	4.4	10.4	51.6	0
DO Depl.	30.03	19543.62	9852.2	14771.1	2269.09	4.23	4.47	811.26	815.74	385.63	3.13	12.5	2.08	6.72	0.03	10.2	51.54	0.2
Anoxic1	30.03	19528.16	9842.39	14758.16	2258.18	7.04	0.05	811.26	811.31	385.63	6.49	12.5	2.59	6.82	0	10.93	51.75	0.8
Aeration1	30.03	19520.29	9831.04	14734.68	2246.44	1.82	5.64	805.53	811.17	385.63	4.78	12.5	1.81	6.56	2	10.52	51.63	0.65
MBR1	30.03	19509.64	9817.2	14711.37	2232.34	0.23	8.13	802.98	811.12	385.63	3.26	12.5	1.52	6.52	6.78	10.12	51.52	0.8
Membranes1	7.59	3.86	1.94	28.05	1.35	0.23	8.13	2.75	10.88	3.34	3.26	12.5	1.52	6.46	6.78	10.12	51.52	0
RAS1	22.39	26111.36	13139.17	19680.93	2987.41	0.23	8.13	1073.82	1081.95	515.02	3.26	12.5	1.52	6.52	6.78	10.12	51.52	0
PST2	3.32	98.65	67.4	265.69	140.77	12.46	0.79	33.5	34.29	4.58	3.27	12.5	2.89	7.71	4.24	10.39	51.6	0.24
Anoxic2	7.3	3959.45	2646.04	3908.24	1457.15	10.22	0.05	253.24	253.29	89.15	2.9	12.5	2.85	7	0	10.45	51.61	0.1
Aeration2	7.3	3943.36	2627.42	3865.14	1432.37	3.2	9.18	243.79	252.98	89.15	2.16	12.5	1.72	6.54	2	10.32	51.58	0.41
FST2	3.3	31.67	21.1	55.15	12.68	3.2	9.18	8.01	17.19	2.86	2.16	12.5	1.72	6.54	2	10.32	51.58	0.24
RAS2	1.97	10397.38	6927.66	10151.35	3774.75	3.2	9.18	632.82	642.01	231.52	2.16	12.5	1.72	6.54	2	10.32	51.58	0
Sand Filters2	2.3	8.18	5.45	32.27	4.16	3.2	9.18	6.59	15.78	2.34	2.16	12.5	1.72	6.48	2	10.32	51.58	0
PST3	4.26	91.53	62.29	238.17	123.23	10.85	2.54	29.72	32.26	4.44	3.19	12.5	2.66	7.36	3.92	10.39	51.6	0.36
Anoxic3	8.23	2876.7	1875.02	2779.43	900.07	8.02	3.09	180.51	183.6	55.21	2.68	12.5	2.49	6.94	0.01	10.4	51.6	0.14
Aeration3	8.23	2852.54	1849.75	2730.42	869.63	1	13.29	169.93	183.23	55.21	2.73	12.5	1.26	6.39	2	10.4	51.6	1.09
FST3	4.23	21.01	13.63	43.75	7.38	1	13.29	4.93	18.23	3.11	2.73	12.5	1.26	6.39	2	10.4	51.6	0.69
RAS3	1.96	8834.62	5728.87	8406.48	2691.29	1	13.29	518.52	531.82	165.27	2.73	12.5	1.26	6.39	2	10.4	51.6	0
Sand Filters3	3.63	4.41	2.86	27.99	2.32	1	13.29	3.97	17.26	2.81	2.73	12.5	1.26	6.33	2	10.4	51.6	0
Effluent	13.52	4.74	2.78	28.75	2.09	0.94	9.7	3.73	13.42	3.03	2.93	12.5	1.48	6.49	4.69	10.23	51.55	0
Thickener	0.07	2080.06	1239.39	1961.49	603.31	4.79	7.08	121.28	128.36	39.41	2.98	12.5	1.93	6.75	4.18	10.3	51.57	0.14
BFP	0.02	716.84	427.13	720.36	228.67	4.79	7.08	49.19	56.27	15.54	2.98	12.5	1.93	6.69	4.18	10.3	51.57	0
Sludge	0.08	35663.02	21249.61	32536.94	9832.75	4.79	7.08	1897.28	1904.36	627.55	2.98	12.5	1.93	6.75	4.18	10.3	51.57	0

Check	Permit	Combined Effluent	?
TSS	20	4.74	OK
Ammonia	1.1	0.94	OK
TKN	NA	3.73	OK
CBOD	NA	2.09	OK
UOD	45	19.9	OK
NO3	10	9.7	OK
Flow	13.5	mgd	

Zones	mgal		
DO Depl.	0.200		
Swing	0.800		
Aeration	0.650		
Membranes	0.800		
Total Vol Req'd	2.450		
Total Vol Avail.	2.450		
Vol. check:	OK		
MBR:	99.995%	removal	(enter manually)
FSTs:	99.50%	removal	(enter manually)
Filters:	82.00%	removal	(enter manually)
SRT MBR:	20.0	days	
MBR MLSS:	19,520	mg/L	

Elements	Model	Setpoint
Influent	13.6	
DO Depl.	30.03	
Anoxic1	30.03	
Aeration1	30.03	
MBR1	30.03	
Membranes1	7.59	
RAS1	22.39	
WAS1	0.05	
PST2	3.32	
Aeration2	7.3	
FST2	3.3	
RAS2	2.00	2.00
IR	2.00	2.00
WAS2	0.03	0.025
PST3	4.26	
Anoxic3	8.23	
Aeration3	8.23	
FST3	4.23	
RAS3	2.00	2.00
IR	2.00	2.00
WAS3	0.04	0.035
Effluent	13.52	

Elements	Model	Setpoint
Thickener	0.07	
Thickener Underflow	0.11	0.11
BFP	0.02	
Sludge	0.08	0.08
Sidestream	0.09	

Model 3: Phase II MBR Facility Maximum Month

#5

MLSS	27,900	mg/L	SRT	30.0	days

Elements	Flow [mgd]	Total suspended solids [mgTSS/L]	Volatile suspended solids [mgVSS/L]	Total COD [mg/L]	Total Carbonaceous BOD [mg/L]	Ammonia N [mgN/L]	Nitrate N [mgN/L]	Total Kjeldahl Nitrogen [mgN/L]	Total N [mgN/L]	Total P [mgP/L]	Soluble PO4-P [mgP/L]	Temperature [deg. C]	Alkalinity [mmol/L]	pH []	Dissolved oxygen [mg/L]	Magnesium [mg/L]	Calcium [mg/L]	Liquid volume [Mil. Gal]
Influent	13.6	256.1	175.07	448	220.05	13.14	0.17	45.3	45.47	6.7	3.35	12.5	2.98	8	4.4	10.4	51.6	0
DO Depl.	30.05	27946.18	13696.1	20582.66	2414.53	4.25	4.51	1108.23	1112.74	498.93	3.48	12.5	2.07	6.72	0.03	10.25	51.56	0.2
Anoxic1	30.05	27929.81	13685.94	20569.61	2403.39	7.08	0.05	1108.23	1108.28	498.93	7.16	12.5	2.58	6.82	0	11.06	51.78	0.8
Aeration1	30.05	27921.7	13674.12	20545.29	2391.2	1.59	5.92	1102.21	1108.13	498.93	5.32	12.5	1.77	6.54	2	10.61	51.66	0.65
MBR1	30.05	27910.62	13659.7	20521.15	2376.51	0.19	8.27	1099.81	1108.08	498.93	3.7	12.5	1.5	6.51	6.76	10.19	51.54	0.8
Membranes1	7.61	5.51	2.7	29.43	1.35	0.19	8.27	2.75	11.01	3.8	3.7	12.5	1.5	6.45	6.76	10.19	51.54	0
RAS1	22.41	37379.96	18294.08	27474.82	3182.49	0.19	8.27	1472.09	1480.36	666.95	3.7	12.5	1.5	6.51	6.76	10.19	51.54	0
PST2	3.32	98.65	67.4	265.69	140.77	12.46	0.79	33.5	34.29	4.58	3.27	12.5	2.89	7.71	4.24	10.39	51.6	0.24
Anoxic2	7.3	3959.45	2646.04	3908.24	1457.15	10.22	0.05	253.24	253.29	89.15	2.9	12.5	2.85	7	0	10.45	51.61	0.1
Aeration2	7.3	3943.36	2627.42	3865.14	1432.37	3.2	9.18	243.79	252.98	89.15	2.16	12.5	1.72	6.54	2	10.32	51.58	0.41
FST2	3.3	31.67	21.1	55.15	12.68	3.2	9.18	8.01	17.19	2.86	2.16	12.5	1.72	6.54	2	10.32	51.58	0.24
RAS2	1.97	10397.38	6927.66	10151.35	3774.75	3.2	9.18	632.82	642.01	231.51	2.16	12.5	1.72	6.54	2	10.32	51.58	0
Sand Filters2	2.3	8.18	5.45	32.27	4.16	3.2	9.18	6.59	15.78	2.34	2.16	12.5	1.72	6.48	2	10.32	51.58	0
PST3	4.26	91.53	62.29	238.17	123.23	10.85	2.54	29.72	32.26	4.44	3.19	12.5	2.66	7.36	3.92	10.39	51.6	0.36
Anoxic3	8.23	2876.7	1875.02	2779.43	900.07	8.02	3.09	180.51	183.6	55.21	2.68	12.5	2.49	6.94	0.01	10.4	51.6	0.14
Aeration3	8.23	2852.54	1849.75	2730.42	869.63	1	13.29	169.93	183.23	55.21	2.73	12.5	1.26	6.39	2	10.4	51.6	1.09
FST3	4.23	21.01	13.63	43.75	7.38	1	13.29	4.93	18.23	3.11	2.73	12.5	1.26	6.39	2	10.4	51.6	0.69
RAS3	1.96	8834.62	5728.87	8406.48	2691.29	1	13.29	518.52	531.82	165.27	2.73	12.5	1.26	6.39	2	10.4	51.6	0
Sand Filters3	3.63	4.41	2.86	27.99	2.32	1	13.29	3.97	17.26	2.81	2.73	12.5	1.26	6.33	2	10.4	51.6	0
Effluent	13.54	5.67	3.21	29.53	2.09	0.92	9.77	3.73	13.5	3.28	3.18	12.5	1.47	6.49	4.68	10.26	51.56	0
Thickener	0.07	1969.63	1165.62	1856.66	557.96	5.3	6.99	115.44	122.43	35.84	3.05	12.5	1.97	6.77	3.88	10.33	51.58	0.14
BFP	0.02	701.29	415.02	707.82	221.3	5.3	6.99	48.99	55.99	14.72	3.05	12.5	1.98	6.71	3.88	10.33	51.58	0
Sludge	0.06	46518.94	27529.77	42208.77	12382.89	5.3	6.99	2449.36	2456.35	777.38	3.05	12.5	1.97	6.77	3.88	10.33	51.58	0

Check	Permit	Combined Effluent	?
TSS	20	5.67	OK
Ammonia	1.1	0.92	OK
TKN	NA	3.73	OK
CBOD	NA	2.09	OK
UOD	45	19.9	OK
NO3	10	9.77	OK
Flow	13.5	mgd	

Zones	mgal		
DO Depl.	0.200		
Swing	0.800		
Aeration	0.650		
Membranes	0.800		
Total Vol Req'd	2.450		
Total Vol Avail.	2.450		
Vol. check:	OK		
MBR:	99.995%	removal	(enter manually)
FSTs:	99.25%	removal	(enter manually)
Filters:	82.00%	removal	(enter manually)
SRT MBR:	30.0	days	
MBR MLSS:	27,922	mg/L	

Elements	Model	Setpoint
Influent	13.6	
DO Depl.	30.05	
Anoxic1	30.05	
Aeration1	30.05	
MBR1	30.05	
Membranes1	7.61	
RAS1	22.41	
WAS1	0.03	
PST2	3.32	
Aeration2	7.3	
FST2	3.3	
RAS2	2.00	2.00
IR	2.00	2.00
WAS2	0.03	0.025
PST3	4.26	
Anoxic3	8.23	
Aeration3	8.23	
FST3	4.23	
RAS3	2.00	2.00
IR	2.00	2.00
WAS3	0.04	0.035
Effluent	13.54	

Elements	Model	Setpoint
Thickener	0.07	
Thickener Underflow	0.09	0.09
BFP	0.02	
Sludge	0.06	0.06
Sidestream	0.09	

run date: 2/23/06

Model 3: Phase II MBR Facility Maximum Day MBR SRT : 15 days

Yellow boxes indicate parameters that may need to be changed in BioWin before running model.

#1

MLSS	23,000	mg/L	SRT	15.0	days

Elements	Flow [mgd]	Total suspended solids [mgTSS/L]	Volatile suspended solids [mgVSS/L]	Total COD [mg/L]	Total Carbonaceous BOD [mg/L]	Ammonia N [mgN/L]	Nitrate N [mgN/L]	Total Kjeldahl Nitrogen [mgN/L]	Total N [mgN/L]	Total P [mgP/L]	Soluble PO4-P [mgP/L]	Temperature [deg. C]	Alkalinity [mmol/L]	pH []	Dissolved oxygen [mg/L]	Magnesium [mg/L]	Calcium [mg/L]	Liquid volume [Mil. Gal]
Influent	18	284.17	189.14	484	237.73	15.42	0.25	48.2	48.45	10.5	5.25	12.5	3.46	8.6	4.8	8	44.5	0
DO Depl.	39.72	23025.53	11431.69	17091.6	3158.03	5	4.41	952.35	956.76	529.1	5.59	12.5	2.43	6.8	0.02	7.65	44.4	0.2
Anoxic1	39.72	23008.1	11421.46	17078.81	3146.66	7.87	0.04	952.35	952.4	529.1	9.97	12.5	2.93	6.88	0	8.6	44.66	0.8
Aeration1	39.72	23000.41	11409.37	17053.14	3134.14	2.22	5.97	946.27	952.24	529.1	7.9	12.5	2.1	6.62	2	8.07	44.52	0.65
MBR1	39.72	22989.87	11394.44	17027.77	3118.93	0.26	8.71	943.46	952.17	529.1	5.87	12.5	1.76	6.56	5.49	7.53	44.37	0.8
Membranes1	10.02	4.56	2.26	30.7	1.57	0.26	8.71	2.87	11.58	5.98	5.87	12.5	1.76	6.5	5.49	7.53	44.37	0
RAS1	29.63	30743.73	15237.48	22761.57	4170.54	0.26	8.71	1260.76	1269.47	705.57	5.87	12.5	1.76	6.56	5.49	7.53	44.37	0
PST2	4.26	111.34	74.05	291.47	154.67	14.91	0.77	36.66	37.43	7.21	5.1	12.5	3.39	8.36	4.65	7.97	44.49	0.24
Anoxic2	8.23	5171.64	3348.81	4941.42	1918.16	14.05	0.03	320.09	320.13	190.98	6.84	12.5	3.44	7.19	0	8.46	44.63	0.1
Aeration2	8.23	5158.81	3326.36	4887.1	1888.17	5.75	10.15	309.61	319.76	190.98	2.39	12.5	2.14	6.64	2	7.42	44.34	0.41
FST2	4.23	37.99	24.49	62.41	15.19	5.75	10.15	10.86	21.01	3.78	2.39	12.5	2.14	6.64	2	7.42	44.34	0.24
RAS2	1.97	15992.42	10311.77	15094.18	5850.65	5.75	10.15	941.63	951.78	587.02	2.39	12.5	2.14	6.64	2	7.42	44.34	0
Sand Filters2	3.23	7.46	4.81	33.65	4.02	5.75	10.15	9.08	19.23	2.67	2.39	12.5	2.14	6.58	2	7.42	44.34	0
PST3	5.28	107.14	71.04	269.28	139.95	13.36	2.28	33.44	35.72	7.12	5.09	12.5	3.18	7.8	4.35	7.97	44.49	0.36
Anoxic3	9.25	3676.03	2364.37	3497.33	1186.55	10.51	1.47	227.4	228.87	72.62	4.74	12.5	3.1	7.14	0.01	7.97	44.49	0.14
Aeration3	9.25	3647.07	2333.91	3438.14	1150.22	1.14	14.14	214.29	228.43	72.62	5.04	12.5	1.52	6.47	2	7.97	44.49	1.09
FST3	5.25	25.18	16.12	49.24	8.94	1.14	14.14	5.34	19.48	5.51	5.04	12.5	1.52	6.47	2	7.97	44.49	0.69
RAS3	1.96	13154.19	8417.91	12333.69	4145.98	1.14	14.14	762.76	776.9	248.76	5.04	12.5	1.52	6.47	2	7.97	44.49	0
Sand Filters3	4.65	4.26	2.73	29.67	2.35	1.14	14.14	4.13	18.27	5.12	5.04	12.5	1.52	6.41	2	7.97	44.49	0
Effluent	17.9	5.01	2.84	30.96	2.21	1.5	10.38	4.32	14.7	5.16	5.03	12.5	1.76	6.55	3.95	7.62	44.4	0
Thickener	0.06	3804.98	2209.02	3437.28	1085.74	5.52	7.63	204.18	211.82	89.61	5.02	12.5	2.24	6.82	4.08	7.73	44.43	0.14
BFP	0.03	724.66	420.71	711.59	232.74	5.52	7.63	48.47	56.11	21.13	5.02	12.5	2.24	6.76	4.08	7.73	44.43	0
Sludge	0.1	43262.49	25116.45	38352.15	12012.26	5.52	7.63	2198.77	2206.41	966.85	5.02	12.5	2.24	6.82	4.08	7.73	44.43	0

Check	Permit	Combined Effluent	?
TSS	20	5.01	OK
Ammonia	1.1	1.5	NO
TKN	NA	4.32	OK
CBOD	NA	2.21	OK
UOD	45	22.8	OK
NO3	10	10.38	NO
Flow	17.9	mgd	

Zones	mgal		
DO Depl.	0.200		
Anoxic	0.800		
Aeration	0.650		
Membranes	0.800		
Total Vol Req'd	2.450		
Total Vol Avail.	2.450		
Vol. check:	OK		
MBR:	99.995%	removal	(enter manually)
FSTs:	99.50%	removal	(enter manually)
Filters:	82.00%	removal	(enter manually)
SRT MBR:	15.0	days	
MBR MLSS:	22,990	mg/L	

Elements	Model	Setpoint
Influent	18	
DO Depl.	39.72	
Anoxic1	39.72	
Aeration1	39.72	
MBR1	39.72	
Membranes1	10.02	
RAS1	29.7	
WAS1	0.07	
PST2	4.26	
Aeration2	8.23	
FST2	4.23	
RAS2	2.00	2.00
IR	2.00	2.00
WAS2	0.03	0.025
PST3	5.28	
Anoxic3	9.25	
Aeration3	9.25	
FST3	5.25	
RAS3	2.00	2.00
IR	2.00	2.00
WAS3	0.04	0.035
Effluent	0.06	

Elements	Model	Setpoint
Thickener	0.06	
Thickener Underflow	0.14	0.14
BFP	0.03	
Sludge	0.10	0.1
Sidestream	0.09	

run date:	2/21/06

Model 4: Phase II Conv. Facility Average Month

Temp:	12.5	deg C

Yellow boxes indicate parameters that may need to be changed in BioWin before running model.

Elements	Flow [mgd]	Total suspended solids [mgTSS/L]	Volatile suspended solids [mgVSS/L]	Total COD [mg/L]	Total Carbonaceous BOD [mg/L]	Ammonia N [mgN/L]	Nitrate N [mgN/L]	Total Kjeldahl Nitrogen [mgN/L]	Total N [mgN/L]	Total P [mgP/L]	Soluble PO4-P [mgP/L]	Temperature [deg. C]	Alkalinity [mmol/L]	pH []	Dissolved oxygen [mg/L]	Magnesium [mg/L]	Calcium [mg/L]	Liquid volume [Mil. Gal]
Influent	9.0	257.47	193.44	495	243.14	18.04	0.21	29.1	29.31	5.8	2.9	12.5	4.14	7.7	4.8	13.8	66	0
InfluentSplit 1-2,3	4.0	257.47	193.44	495	243.14	18.04	0.21	29.1	29.31	5.8	2.9	12.5	4.14	7.69	4.8	13.8	66	0
AX1	3.24	13463.62	7832.75	11731.65	2018.26	1.69	0.03	644.64	644.67	409.09	6.04	12.5	3.03	6.7	0	14.4	66.17	0.1
A1	3.24	13427.63	7785.97	11652.01	1970.35	0.15	2.48	641.7	644.18	409.09	0.22	12.5	2.72	6.69	2	12.85	65.74	0.4
AX2	5.57	7893.89	4607.21	6928.18	1201.74	6.64	0.01	382.68	382.69	239.98	11.2	12.5	3.37	6.84	0	15.55	66.48	0.2
A2	5.57	7887.41	4584.08	6875.9	1175.96	0.98	4.44	377.96	382.4	239.98	1.89	12.5	2.66	6.69	2	13.4	65.89	0.5
AX3	7.91	5614.5	3282.91	4947.7	863.66	3.42	0.03	273.13	273.16	170.65	9.89	12.5	3.29	6.79	0	15.31	66.42	0.5
A3	7.91	5611.4	3265.21	4907.27	844.57	1.03	3.21	269.73	272.94	170.65	1.74	12.5	2.76	6.7	2	13.43	65.9	0.7
AX4	13.55	4374.7	2555.25	3854.13	673.02	3.46	0.05	212.68	212.74	132.9	4.78	12.5	3.16	6.76	0	14.16	66.1	0.7
A4	13.55	4368.12	2540.8	3824.39	657.55	0.63	2.13	210.44	212.57	132.9	0.53	12.5	2.81	6.71	2	13.17	65.83	1.3
RAS1	3.24	13482.58	7842.41	11739.86	2027.32	0.63	2.13	644.68	646.81	409.09	0.53	12.5	2.81	6.71	2	13.17	65.83	0
FST1	6.93	16.13	9.38	44.9	3.51	0.63	2.13	3.1	3.22	1.0	0.53	12.5	2.81	6.71	2	13.17	65.83	1.75
Sand Filters1	5.53	3.03	1.76	33.52	1.54	0.63	2.13	2.47	4.6	0.62	0.53	12.5	2.81	6.65	2	13.17	65.83	0
Inf Flow Split2-3	2.0	257.47	193.44	495	243.14	18.04	0.21	29.1	29.31	5.8	2.9	12.5	4.14	7.69	4.8	13.8	66	0
PST2	1.97	130.69	98.19	342.62	179.34	18.04	0.21	25.96	26.17	4.37	2.9	12.5	4.14	7.69	4.8	13.8	66	0.24
Anoxic2	5.94	3387.54	2366.24	3515.31	1238.76	7.76	0.02	215.54	215.57	102.57	4.89	12.5	3.49	6.9	0	14.46	66.18	0.1
Aeration2	5.94	3376.26	2346.03	3467.7	1212.83	1.99	4.36	210.9	215.27	102.57	0.3	12.5	2.79	6.74	2	13.44	65.9	0.41
RAS2	1.97	6621.41	4600.96	6774.2	2377.39	1.99	4.36	410.07	414.44	200.88	0.3	12.5	2.79	6.74	2	13.44	65.9	0
FST2	1.94	34.27	23.81	62.54	13.52	1.99	4.36	5.79	10.15	1.34	0.3	12.5	2.79	6.74	2	13.44	65.9	0.24
Sand Filters2	1.34	7.44	5.17	35.2	3.89	1.99	4.36	4.15	8.51	0.52	0.3	12.5	2.79	6.68	2	13.44	65.9	0
PST3	2.63	89.2	65.11	250.24	126.73	13.84	1.55	20.49	22.03	3.84	2.54	12.5	3.76	7.3	4.13	13.75	65.99	1.32
Anoxic3	5.6	2434.24	1633.49	2444.14	641.08	6.93	0.04	149.51	149.55	69.38	3.26	12.5	3.43	6.9	0	14.02	66.06	0.14
Aeration3	5.6	2413.36	1608.78	2391.82	609.66	0.6	5.9	143.29	149.19	69.38	1.47	12.5	2.57	6.69	2	13.6	65.95	1.09
RAS3	1.97	5521.88	3680.97	5438.1	1393.75	0.6	5.9	324.91	330.81	156.85	1.47	12.5	2.57	6.69	2	13.6	65.95	0
FST3	2.6	21.35	14.23	47.71	6.31	0.6	5.9	3.54	9.44	2.07	1.47	12.5	2.57	6.69	2	13.6	65.95	0.69
Sand Filters3	2.0	4.16	2.78	30.87	1.97	0.6	5.9	2.54	8.44	1.59	1.47	12.5	2.57	6.63	2	13.6	65.95	0
Effuent	8.87	3.95	2.51	33.18	1.99	0.83	3.32	2.74	6.06	0.83	0.71	12.5	2.75	6.71	2	13.31	65.86	0
Thickener	0.03	3626.85	2377.52	3701.22	1096.83	5.75	2.69	164.37	167.06	88.79	1.35	12.5	3.13	6.88	2.79	13.48	65.91	0.14
BFP	0.03	310.56	203.58	383.85	123.92	5.75	2.69	21.66	24.35	8.84	1.35	12.5	3.14	6.83	2.79	13.48	65.91	0
Sludge	0.13	14261.87	9349.14	14339.74	4216.89	5.75	2.69	622.05	624.74	345.21	1.35	12.5	3.13	6.88	2.79	13.48	65.91	0

Check	Permit	Combined Effluent	?
TSS	20	3.95	OK
Ammonia	1.1	0.83	OK
TKN	NA	2.74	OK
CBOD	NA	1.99	OK
UOD	45	15.3	OK
NO3	10	3.32	OK
Flow	8.9	mgd	

Elements	Model	Setpoint	Elements	Model	Setpoint
Influent	9.0		PST2	2.0	
AX1	3.24		Aeration2	5.94	
A1	3.24		IR	2.00	2.0
AX2	5.57		RAS2	2.00	2.0
A2	5.57		WAS2	0.03	0.03
AX3	7.91		FST2	1.94	
A3	7.91		PST3	2.63	
AX4	13.55		Anoxic3	5.6	
A4	13.55		Aeration3	5.6	
IR	3.31	3.31	IR	1.00	1.0
RAS1	3.24		RAS3	2.00	2.0
WAS1	0.07		WAS3	0.03	0.03
FST1	6.93		FST3	2.60	
			Effuent	8.87	
			Thickener	0.03	
			Thickener Underflow	0.16	0.16
			BFP	0.03	
			Sludge	0.13	0.13

Zones	mgal
AX1	0.100
A1	0.400
AX2	0.200
A2	0.500
AX3	0.500
A3	0.700
AX4	0.700
A4	1.300
FST1	1.750
Total Aer. Vol Req'd	4.400
Total Vol Avail.	3.080
Vol. check:	NO

FSTs:	99.50%	removal	(enter manually)
Filters:	85.00%	removal	(enter manually)
Step-Feed SRT	15	days	(enter manually)

Model 4: Phase II Conv. Facility Average Month						Temp:	16.9	deg C	Yellow boxes indicate parameters that may need to be changed in BioWin before running model.										
Elements	Flow [mgd]	Total suspended solids [mgTSS/L]	Volatile suspended solids [mgVSS/L]	Total COD [mg/L]	Total Carbonaceous BOD [mg/L]	Ammonia N [mgN/L]	Nitrate N [mgN/L]	Total Kjeldahl Nitrogen [mgN/L]	Total N [mgN/L]	Total P [mgP/L]	Soluble PO4-P [mgP/L]	Temperature [deg. C]	Alkalinity [mmol/L]	pH []	Dissolved oxygen [mg/L]	Magnesium [mg/L]	Calcium [mg/L]	Liquid volume [Mil. Gal]
Influent	9	257.47	193.44	495	243.14	18.04	0.21	29.1	29.31	5.8	2.9	16.9	4.14	7.7	4.8	13.8	66	0
InfluentSplit 1-2,3	4.0	257.47	193.44	495	243.14	18.04	0.21	29.1	29.31	5.8	2.9	16.9	4.14	7.69	4.8	13.8	66	0
AX1	3.24	13298.26	7673.97	11504.21	1864.64	1.5	0.03	629.02	629.05	408.08	6.21	16.9	3.01	6.7	0	14.42	66.17	0.1
A1	3.24	13262.75	7627.56	11425.53	1817.06	0.12	2.53	626.04	628.56	408.08	0.23	16.9	2.71	6.7	2	12.83	65.73	0.4
AX2	5.57	7797.34	4514.73	6796.14	1112.28	6.56	0.01	373.49	373.5	239.4	11.38	16.9	3.36	6.84	0	15.58	66.49	0.2
A2	5.57	7790.85	4491.3	6743.14	1086.18	0.66	4.65	368.55	373.21	239.4	1.91	16.9	2.62	6.69	2	13.38	65.89	0.5
AX3	7.91	5546.08	3217.14	4853.51	800.02	5.14	0.03	266.44	266.47	170.23	9.9	16.9	3.27	6.79	0	15.3	66.41	0.5
A3	7.91	5542.8	3199.2	4812.67	780.7	0.66	3.3	262.95	266.25	170.23	1.73	16.9	2.72	6.7	2	13.41	65.89	0.7
AX4	13.55	4321.24	2503.96	3780.71	623.41	3.16	0.05	207.42	207.47	132.58	4.87	16.9	3.14	6.76	0	14.17	66.1	0.7
A4	13.55	4314.64	2489.37	3750.67	607.78	0.41	2.08	205.22	207.3	132.58	0.54	16.9	2.8	6.72	2	13.16	65.82	1.3
RAS1	3.24	13317.52	7683.67	11512.27	1873.72	0.41	2.08	629.06	631.14	408.08	0.54	16.9	2.8	6.72	2	13.16	65.82	0
FST1	6.93	15.94	9.2	44.65	3.31	0.41	2.08	2.84	4.92	1.03	0.54	16.9	2.8	6.72	2	13.16	65.82	1.75
Sand Filters1	5.53	3	1.73	33.5	1.49	0.41	2.08	2.23	4.31	0.64	0.54	16.9	2.8	6.69	2	13.16	65.82	0
Inf Flow Split2-3	2.0	257.47	193.44	495	243.14	18.04	0.21	29.1	29.31	5.8	2.9	16.9	4.14	7.69	4.8	13.8	66	0
PST2	1.97	130.69	98.19	342.62	179.34	18.04	0.21	25.96	26.17	4.37	2.9	16.9	4.14	7.69	4.8	13.8	66	0.24
Anoxic2	5.94	3307.5	2288.94	3403	1162.85	7.06	0.02	207.72	207.74	102	4.7	16.9	3.44	6.9	0	14.4	66.17	0.1
Aeration2	5.94	3295.01	2267.92	3354.66	1136.31	0.95	4.8	202.64	207.43	102	0.32	16.9	2.68	6.73	2	13.42	65.9	0.41
RAS2	1.97	6462.07	4447.79	6552.65	2227.39	0.95	4.8	394.87	399.67	199.72	0.32	16.9	2.68	6.73	2	13.42	65.9	0
FST2	1.94	33.44	23.02	61.24	12.69	0.95	4.8	4.66	9.46	1.35	0.32	16.9	2.68	6.73	2	13.42	65.9	0.24
Sand Filters2	1.34	7.26	5	34.8	3.67	0.95	4.8	3.07	7.87	0.55	0.32	16.9	2.68	6.71	2	13.42	65.9	0
PST3	2.63	88.9	64.83	249.83	126.45	13.79	1.58	20.41	21.98	3.84	2.55	16.9	3.76	7.31	4.13	13.75	65.99	1.32
Anoxic3	5.6	2378.95	1581.31	2369.37	589.68	6.81	0.04	144.3	144.34	68.51	3.33	16.9	3.42	6.9	0	14.02	66.06	0.14
Aeration3	5.6	2357.48	1555.99	2316.24	557.72	0.41	6.03	137.95	143.98	68.51	1.51	16.9	2.54	6.69	2	13.59	65.94	1.09
RAS3	1.97	5394.02	3560.17	5265.18	1274.92	0.41	6.03	312.94	318.97	154.82	1.51	16.9	2.54	6.69	2	13.59	65.94	0
FST3	2.6	20.86	13.77	47.03	5.83	0.41	6.03	3.3	9.32	2.1	1.51	16.9	2.54	6.69	2	13.59	65.94	0.69
Sand Filters3	2	4.07	2.68	30.72	1.86	0.41	6.03	2.33	8.36	1.62	1.51	16.9	2.54	6.67	2	13.59	65.94	0
Effluent	8.87	3.88	2.44	33.07	1.91	0.49	3.38	2.38	5.76	0.84	0.73	16.9	2.72	6.71	2	13.3	65.86	0
Thickener	0.03	3587.72	2340.05	3647.4	1060.34	5.47	2.77	160.49	163.25	88.47	1.36	16.9	3.11	6.89	2.79	13.47	65.91	0.14
BFP	0.03	307.21	200.38	379.22	120.78	5.47	2.77	21.06	23.82	8.82	1.36	16.9	3.11	6.87	2.79	13.47	65.91	0
Sludge	0.13	14108.15	9201.89	14128.27	4073.48	5.47	2.77	607.63	610.4	343.89	1.36	16.9	3.11	6.89	2.79	13.47	65.91	0

Check	Permit	Combined Effluent	?
TSS	20	3.88	OK
Ammonia	1.1	0.49	OK
TKN	NA	2.38	OK
CBOD	NA	1.91	OK
UOD	45	13.6	OK
NO3	10	3.38	OK
Flow	8.9	mgd	

Zones	mgal
AX1	0.100
A1	0.400
AX2	0.200
A2	0.500
AX3	0.500
A3	0.700
AX4	0.700
A4	1.300
FST1	1.750
Total Aer. Vol Req'd	4.400
Total Vol Avail.	3.080
Vol. check:	NO

FSTs:	99.50%	removal	(enter manually)
Filters:	85.00%	removal	(enter manually)
Step-Feed SRT	15	days	(enter manually)

Elements	Model	Setpoint	Elements	Model	Setpoint
Influent	9.0		PST2	2.0	
AX1	3.24		Aeration2	5.94	
A1	3.24		IR	2.00	2.0
AX2	5.57		RAS2	2.00	2.0
A2	5.57		WAS2	0.03	0.03
AX3	7.91		FST2	1.94	
A3	7.91		PST3	2.63	
AX4	13.55		Anoxic3	5.6	
A4	13.55		Aeration3	5.6	
IR	3.31	3.31	IR	1.00	1.0
RAS1	3.24		RAS3	2.00	2.0
WAS1	0.07		WAS3	0.03	0.03
FST1	6.93		FST3	2.60	
			Effluent	8.87	
			Thickener	0.03	
			Thickener Underflow	0.16	0.16
			BFP	0.03	
			Sludge	0.13	0.13

run date:	2/21/06

Temp: 12.5 deg C

Yellow boxes indicate parameters that may need to be changed in BioWin before running model.

Model 4: Phase II Conv. Facility Maximum Month

Elements	Flow [mgd]	Total suspended solids [mgTSS/L]	Volatile suspended solids [mgVSS/L]	Total COD [mg/L]	Total Carbonaceous BOD [mg/L]	Ammonia N [mgN/L]	Nitrate N [mgN/L]	Total Kjeldahl Nitrogen [mgN/L]	Total N [mgN/L]	Total P [mgP/L]	Soluble PO4-P [mgP/L]	Temperature [deg. C]	Alkalinity [mmol/L]	pH []	Dissolved oxygen [mg/L]	Magnesium [mg/L]	Calcium [mg/L]	Liquid volume [Mil. Gal]
Influent	13.6	256.1	175.07	448	220.05	13.14	0.17	45.3	45.47	6.7	3.35	12.5	2.98	8	4.4	10.4	51.6	0
InfluentSplit 1-2,3	6.05	256.1	175.07	448	220.05	13.14	0.17	45.3	45.47	6.7	3.35	12.5	2.98	7.99	4.4	10.4	51.6	0
AX1	4.93	19186.14	9859.03	14756.88	2453.39	1.78	3.67	812.88	816.55	304.74	4.07	12.5	1.95	6.55	0.01	10.32	51.58	0.1
A1	4.93	19142.58	9814.82	14686.6	2409.24	0.14	8.21	807.83	816.04	304.74	4.54	12.5	1.48	6.43	2	10.21	51.55	0.4
AX2	8.11	11731.17	6035.93	9055.23	1514.64	7.52	0.03	505.73	505.76	187.73	5.75	12.5	2.6	6.83	0	10.68	51.68	0.2
A2	8.11	11713.15	6015.21	9013.05	1490.74	0.99	8.44	497.04	505.47	187.73	4.8	12.5	1.54	6.46	2	10.42	51.61	0.5
AX3	11.29	8479.94	4367.73	6560.14	1102.23	6.79	0.06	367.64	367.69	136.66	5.58	12.5	2.56	6.79	0	10.68	51.68	0.5
A3	11.29	8466.33	4351.53	6527.79	1084.57	1.2	6.72	360.76	367.48	136.66	4.6	12.5	1.69	6.5	2	10.43	51.61	0.7
AX4	19.48	6657.22	3429.45	5152.51	866.9	4.11	2.46	288.07	290.54	108.06	4.17	12.5	2.21	6.67	0.01	10.4	51.6	0.7
A4	19.48	6644.36	3415.36	5128.1	852.4	0.69	6.82	283.54	290.36	108.06	3.92	12.5	1.65	6.49	2	10.3	51.57	1.3
RAS1	4.93	19193.45	9865.9	14767.6	2460.44	0.69	6.82	813.02	819.84	304.74	3.92	12.5	1.65	6.49	2	10.3	51.57	0
FST1	9.48	25.37	13.04	43.77	4.24	0.69	6.82	4.27	11.08	4.31	3.92	12.5	1.65	6.49	2	10.3	51.57	1.75
Sand Filters1	8.08	5.36	2.75	28.4	1.68	0.69	6.82	3.42	10.24	4	3.92	12.5	1.65	6.43	2	10.3	51.57	0
Inf Flow Split2-3	3.03	256.1	175.07	448	220.05	13.14	0.17	45.3	45.47	6.7	3.35	12.5	2.98	7.99	4.4	10.4	51.6	0
PST2	3	129.33	88.41	309.36	162.01	13.14	0.17	37.05	37.22	5.04	3.35	12.5	2.98	7.99	4.4	10.4	51.6	0.24
Anoxic2	6.97	4635.36	2993.24	4428.12	1593.38	10.39	0.04	282.04	282.08	108.88	3.22	12.5	2.86	7.01	0	10.51	51.63	0.1
Aeration2	6.97	4616.81	2971	4378.95	1565.38	2.85	9.83	271.91	281.74	108.88	1.95	12.5	1.64	6.52	2	10.24	51.56	0.41
RAS2	1.97	11416.15	7346.5	10792.1	3869.02	2.85	9.83	663.95	673.78	266.37	1.95	12.5	1.64	6.52	2	10.24	51.56	0
FST2	2.97	38.63	24.86	60.8	14.28	2.85	9.83	7.94	17.77	2.84	1.95	12.5	1.64	6.52	2	10.24	51.56	0.24
Sand Filters2	2.37	8.71	5.61	32.59	4.14	2.85	9.83	6.22	16.04	2.15	1.95	12.5	1.64	6.46	2	10.24	51.56	0
PST3	3.64	96.92	64.45	244.94	125.29	11.01	2.4	30.34	32.74	4.62	3.28	12.5	2.68	7.41	3.99	10.4	51.6	1.32
Anoxic3	6.61	3153.65	1991.47	2956.41	851.51	8.71	1.97	189.66	191.63	58.38	2.8	12.5	2.61	7	0.01	10.4	51.6	0.14
Aeration3	6.61	3125.38	1962.24	2901.51	817.3	0.77	13.36	177.86	191.22	58.38	2.92	12.5	1.23	6.38	2	10.4	51.6	1.09
RAS3	1.97	8724.85	5477.81	8057.36	2279.94	0.77	13.36	490.43	503.79	157.76	2.92	12.5	1.23	6.38	2	10.4	51.6	0
FST3	3.61	24.28	15.24	46.1	7.26	0.77	13.36	4.74	18.1	3.35	2.92	12.5	1.23	6.38	2	10.4	51.6	0.69
Sand Filters3	3.01	5.24	3.29	28.56	2.29	0.77	13.36	3.68	17.04	3.01	2.92	12.5	1.23	6.32	2	10.4	51.6	0
Effuent	13.46	5.92	3.38	29.17	2.25	1.09	8.81	3.97	12.78	3.45	3.35	12.5	1.55	6.47	2	10.32	51.58	0
Thickener	0.03	5686.62	3368.87	5207.85	1548.72	4.67	6.49	308.9	315.4	93.36	3.3	12.5	1.96	6.72	2.71	10.34	51.58	0.14
BFP	0.02	701.05	415.32	700.37	218.12	4.67	6.49	47.79	54.28	14.4	3.3	12.5	1.96	6.66	2.71	10.34	51.58	0
Sludge	0.14	19929.83	11806.83	18085.24	5350.08	4.67	6.49	1054.87	1061.36	318.93	3.3	12.5	1.96	6.72	2.71	10.34	51.58	0

Check	Permit	Combined Effluent	?
TSS	20	5.92	OK
Ammonia	1.1	1.09	OK
TKN	NA	3.97	OK
CBOD	NA	2.25	OK
UOD	45	21.2	OK
NO3	10	8.81	OK
Flow	13.5	mgd	

Elements	Model	Setpoint
Influent	13.6	
AX1	4.93	
A1	4.93	
AX2	8.11	
A2	8.11	
AX3	11.29	
A3	11.29	
AX4	19.48	
A4	19.48	
IR	5.0	5.0
RAS1	4.93	
WAS1	0.06	
FST1	9.48	

Elements	Model	Setpoint
PST2	3.0	
Aeration2	6.97	
IR	2.00	2.0
RAS2	2.00	2.0
WAS2	0.03	0.025
FST2	2.97	
PST3	3.64	
Anoxic3	6.61	
Aeration3	6.61	
IR	1.00	1.0
RAS3	2.00	2.0
WAS3	0.03	0.03
FST3	3.61	
Effuent	13.46	
Thickener	0.03	
Thickener Underflow	0.15	0.15
BFP	0.02	
Sludge	0.14	0.014

Zones	mgal
AX1	0.100
A1	0.400
AX2	0.200
A2	0.500
AX3	0.500
A3	0.700
AX4	0.700
A4	1.300
FST1	1.750
Total Aer. Vol Req'd	4.400
Total Vol Avail.	3.080
Vol. check:	NO

FSTs:	99.50%	removal	(enter manually)
Filters:	82.00%	removal	(enter manually)
Step-Feed SRT	15	days	(enter manually)

Model 4: Phase II Conv. Facility Maximum Month

Temp:	16.9	deg C	Yellow boxes indicate parameters that may need to be changed in BioWin before running model.

Elements	Flow [mgd]	Total suspended solids [mgTSS/L]	Volatile suspended solids [mgVSS/L]	Total COD [mg/L]	Total Carbonaceous BOD [mg/L]	Ammonia N [mgN/L]	Nitrate N [mgN/L]	Total Kjeldahl Nitrogen [mgN/L]	Total N [mgN/L]	Total P [mgP/L]	Soluble PO4-P [mgP/L]	Temperature [deg. C]	Alkalinity [mmol/L]	pH []	Dissolved oxygen [mg/L]	Magnesium [mg/L]	Calcium [mg/L]	Liquid volume [Mil. Gal]
Influent	13.6	256.1	175.07	448	220.05	13.14	0.17	45.3	45.47	6.7	3.35	16.9	2.98	8	4.4	10.4	51.6	0
InfluentSplit 1-2,3	6.05	256.1	175.07	448	220.05	13.14	0.17	45.3	45.47	6.7	3.35	16.9	2.98	7.99	4.4	10.4	51.6	0
AX1	4.93	18917.27	9658.67	14469.66	2218.1	1.58	3.68	792.88	796.56	267.83	4.38	16.9	1.93	6.56	0.01	10.38	51.59	0.1
A1	4.93	18872.02	9613.59	14398.31	2173.11	0.11	8.22	787.82	796.04	267.83	5.29	16.9	1.47	6.44	2	10.36	51.59	0.4
AX2	8.11	11565.37	5911.22	8879.65	1371.58	7.6	0.02	493.51	493.53	165.3	5.6	16.9	2.59	6.83	0	10.61	51.66	0.2
A2	8.11	11547.21	5891.15	8834.95	1345.61	0.68	8.77	484.45	493.22	165.3	5.13	16.9	1.49	6.46	2	10.47	51.62	0.5
AX3	11.29	8365.37	4281.33	6433.03	999.36	6.14	0.57	358.46	359.03	120.56	4.6	16.9	2.48	6.8	0	10.46	51.62	0.5
A3	11.29	8349.33	4264.03	6402.17	981.51	0.7	7.13	351.67	358.8	120.56	4.44	16.9	1.62	6.5	2	10.39	51.6	0.7
AX4	19.48	6565.21	3360.67	5053.69	785.98	3.75	2.62	280.94	283.56	95.49	4.18	16.9	2.17	6.68	0.01	10.39	51.6	0.7
A4	19.48	6551.33	3346.06	5028.54	770.99	0.45	6.9	276.47	283.38	95.49	4.24	16.9	1.62	6.5	2	10.37	51.59	1.3
RAS1	4.93	18924.74	9665.71	14480.59	2225.3	0.45	6.9	793.05	799.95	267.83	4.24	16.9	1.62	6.5	2	10.37	51.59	0
FST1	9.48	25.02	12.78	43.09	3.92	0.45	6.9	4.01	10.91	4.59	4.24	16.9	1.62	6.5	2	10.37	51.59	1.75
Sand Filters1	8.08	5.28	2.7	28.01	1.6	0.45	6.9	3.18	10.09	4.32	4.24	16.9	1.62	6.47	2	10.37	51.59	0
Inf Flow Split2-3	3.03	256.1	175.07	448	220.05	13.14	0.17	45.3	45.47	6.7	3.35	16.9	2.98	7.99	4.4	10.4	51.6	0
PST2	3	129.33	88.41	309.36	162.01	13.14	0.17	37.05	37.22	5.04	3.35	16.9	2.98	7.99	4.4	10.4	51.6	0.24
Anoxic2	6.97	4495.46	2885.42	4271.37	1488.18	9.49	0.04	270.75	270.8	91.14	2.95	16.9	2.79	7.01	0	10.44	51.61	0.1
Aeration2	6.97	4474.61	2862.24	4221.53	1459.49	1.18	10.68	259.76	270.44	91.14	2.48	16.9	1.46	6.48	2	10.34	51.58	0.41
RAS2	1.97	11064.51	7077.57	10403.1	3607.27	1.18	10.68	636.43	647.11	221.73	2.48	16.9	1.46	6.48	2	10.34	51.58	0
FST2	2.97	37.44	23.95	59.31	13.33	1.18	10.68	6.13	16.81	3.22	2.48	16.9	1.46	6.48	2	10.34	51.58	0.24
Sand Filters2	2.37	8.44	5.4	32.11	3.88	1.18	10.68	4.48	15.16	2.64	2.48	16.9	1.46	6.46	2	10.34	51.58	0
PST3	3.64	96.56	64.15	244.5	124.97	10.96	2.44	30.25	32.69	4.61	3.29	16.9	2.67	7.43	3.99	10.4	51.6	1.32
Anoxic3	6.61	3079.22	1923.12	2858.29	783.01	8.6	1.96	182.75	184.72	55.98	2.82	16.9	2.6	7.02	0.01	10.4	51.6	0.14
Aeration3	6.61	3049.92	1892.95	2802.24	748.01	0.5	13.57	170.73	184.3	55.98	2.98	16.9	1.19	6.38	2	10.4	51.6	1.09
RAS3	1.97	8514.18	5284.36	7780.3	2086.54	0.5	13.57	471.08	484.65	150.93	2.98	16.9	1.19	6.38	2	10.4	51.6	0
FST3	3.61	23.7	14.71	45.29	6.71	0.5	13.57	4.39	17.95	3.39	2.98	16.9	1.19	6.38	2	10.4	51.6	0.69
Sand Filters3	3.01	5.11	3.17	28.36	2.16	0.5	13.57	3.37	16.93	3.07	2.98	16.9	1.19	6.36	2	10.4	51.6	0
Effuent	13.46	5.8	3.28	28.81	2.13	0.59	9.06	3.45	12.51	3.74	3.65	16.9	1.5	6.47	2	10.37	51.59	0
Thickener	0.03	5616.02	3313.35	5128.02	1488.63	4.3	6.68	303.09	309.77	85.54	3.5	16.9	1.92	6.72	2.71	10.38	51.59	0.14
BFP	0.02	692.36	408.48	690.41	210.71	4.3	6.68	46.74	53.42	13.62	3.5	16.9	1.92	6.7	2.71	10.38	51.59	0
Sludge	0.14	19682.71	11612.46	17806.09	5139.6	4.3	6.68	1035.46	1042.14	291.03	3.5	16.9	1.92	6.72	2.71	10.38	51.59	0

Check	Permit	Combined Effluent	?
TSS	20	5.8	OK
Ammonia	1.1	0.59	OK
TKN	NA	3.45	OK
CBOD	NA	2.13	OK
UOD	45	18.7	OK
NO3	10	9.06	OK
Flow	13.5	mgd	

Zones	mgal
AX1	0.100
A1	0.400
AX2	0.200
A2	0.500
AX3	0.500
A3	0.700
AX4	0.700
A4	1.300
FST1	1.750
Total Aer. Vol Req'd	4.400
Total Vol Avail.	3.080
Vol. check:	NO

FSTs:	99.50%	removal	(enter manually)
Filters:	82.00%	removal	(enter manually)
Step-Feed SRT	15	days	(enter manually)

Elements	Model	Setpoint
Influent	13.6	
AX1	4.93	
A1	4.93	
AX2	8.11	
A2	8.11	
AX3	11.29	
A3	11.29	
AX4	19.48	
A4	19.48	
IR	5.0	5.0
RAS1	4.93	
WAS1	0.06	
FST1	9.48	

Elements	Model	Setpoint
PST2	3.0	
Aeration2	6.97	
IR	2.00	2.0
RAS2	2.00	2.0
WAS2	0.03	0.025
FST2	2.97	
PST3	3.64	
Anoxic3	6.61	
Aeration3	6.61	
IR	1.00	1.0
RAS3	2.00	2.0
WAS3	0.03	0.03
FST3	3.61	
Effuent	13.46	
Thickener	0.03	
Thickener Underflow	0.15	0.15
BFP	0.02	
Sludge	0.14	0.014

run date:	2/20/06

Model 4: Phase II Conv. Facility Maximum Day

Temp:	12.5	deg C

Yellow boxes indicate parameters that may need to be changed in BioWin before running model.

Elements	Flow [mgd]	Total suspended solids [mgTSS/L]	Volatile suspended solids [mgVSS/L]	Total COD [mg/L]	Total Carbonaceous BOD [mg/L]	Ammonia N [mgN/L]	Nitrate N [mgN/L]	Total Kjeldahl Nitrogen [mgN/L]	Total N [mgN/L]	Total P [mgP/L]	Soluble PO4-P [mgP/L]	Temperature [deg. C]	Alkalinity [mmol/L]	pH []	Dissolved oxygen [mg/L]	Magnesium [mg/L]	Calcium [mg/L]	Liquid volume [Mil. Gal]
Influent	18	284.17	189.14	484	237.73	15.42	0.25	48.2	48.45	10.5	5.25	12.5	3.46	8.6	4.8	8	44.5	0
InfluentSplit 1-2,3	8.01	284.17	189.14	484	237.73	15.42	0.25	48.2	48.45	10.5	5.25	12.5	3.46	8.59	4.8	8	44.5	0
AX1	4.94	31327.02	15618.95	23347.38	3973.91	2.17	3.2	1290.67	1293.88	500.87	7.78	12.5	2.28	6.6	0	7.93	44.48	0.1
A1	4.94	31255.57	15546.67	23231.79	3901.57	0.14	9.82	1283.21	1293.03	500.87	9.24	12.5	1.6	6.46	2	7.83	44.45	0.4
AX2	8.94	17414.74	8691.72	13022.5	2225.24	10.51	0.01	728.7	728.71	281.7	12.16	12.5	3.08	6.96	0	8.94	44.76	0.2
A2	8.94	17393.32	8664.83	12963.28	2192.23	1.14	11.35	716.97	728.32	281.7	10.09	12.5	1.61	6.47	2	8.35	44.6	0.5
AX3	12.93	12120.33	6055.61	9074.35	1558.29	7.93	1.01	508.75	509.76	198.03	8.68	12.5	2.86	6.87	0	8.25	44.57	0.5
A3	12.93	12102.31	6034.79	9037.63	1536.89	1.18	8.84	500.65	509.49	198.03	7.99	12.5	1.81	6.53	2	7.99	44.5	0.7
AX4	21.93	9318.36	4656.96	6983.8	1201.55	5.04	3.06	390.97	394.03	153.86	7.42	12.5	2.51	6.75	0.01	7.98	44.49	0.7
A4	21.93	9302.15	4639.33	6953.44	1183.49	0.73	8.36	385.45	393.8	153.86	7.38	12.5	1.81	6.53	2	7.89	44.47	1.3
RAS1	4.94	31338.75	15629.8	23363.84	3984.75	0.73	8.36	1290.82	1299.18	500.87	7.38	12.5	1.81	6.53	2	7.89	44.47	0
FST1	11.93	66	32.92	75.39	9.41	0.73	8.36	5.98	14.34	8.4	7.38	12.5	1.81	6.53	2	7.89	44.47	1.75
Sand Filters1	10.53	14.96	7.46	37.37	2.92	0.73	8.36	3.88	12.24	7.62	7.38	12.5	1.81	6.47	2	7.89	44.47	0
Inf Flow Split2-3	4	284.17	189.14	484	237.73	15.42	0.25	48.2	48.45	10.5	5.25	12.5	3.46	8.59	4.8	8	44.5	0
PST2	3.97	143.16	95.29	333.85	174.87	15.42	0.25	39.75	40	7.89	5.25	12.5	3.46	8.59	4.8	8	44.5	0.24
Anoxic2	7.95	6051.68	3799.76	5615.49	2116.34	14.24	0.03	357.94	357.97	218.21	7.47	12.5	3.45	7.2	0	8.57	44.66	0.1
Aeration2	7.95	6036.31	3772.99	5553.52	2082.45	5.18	11.02	346.53	357.55	218.21	2.26	12.5	2.03	6.62	2	7.33	44.32	0.41
RAS2	1.97	17865.53	11166.82	16384.31	6160.84	5.18	11.02	1009.84	1020.85	641.42	2.26	12.5	2.03	6.62	2	7.33	44.32	0
FST2	3.95	45.47	28.42	68.33	16.97	5.18	11.02	10.6	21.62	3.88	2.26	12.5	2.03	6.62	2	7.33	44.32	0.24
Sand Filters2	3.35	10.72	6.7	36.52	5	5.18	11.02	8.65	19.67	2.64	2.26	12.5	2.03	6.56	2	7.33	44.32	0
PST3	4.62	111.95	72.53	274.86	141.39	13.45	2.13	33.92	36.05	7.33	5.25	12.5	3.19	7.89	4.42	8	44.5	1.32
Anoxic3	7.59	3978.53	2455.25	3644.41	1107.54	11.63	0.07	233.94	234.01	79.18	5.21	12.5	3.26	7.19	0	8.04	44.51	0.14
Aeration3	7.59	3947.56	2422.37	3577.15	1066.97	0.87	14.3	219.21	233.52	79.18	5.23	12.5	1.48	6.46	2	7.97	44.49	1.09
RAS3	1.97	12944.85	7943.43	11671.56	3496.64	0.87	14.3	710.8	725.1	247.73	5.23	12.5	1.48	6.46	2	7.97	44.49	0
FST3	4.59	28.34	17.39	51.22	8.61	0.87	14.3	5.08	19.38	5.76	5.23	12.5	1.48	6.46	2	7.97	44.49	0.69
Sand Filters3	3.99	6.52	4	31.59	2.72	0.87	14.3	3.89	18.19	5.35	5.23	12.5	1.48	6.4	2	7.97	44.49	0
Effuent	17.87	12.28	6.54	35.92	3.26	1.59	10.18	4.78	14.96	6.18	5.94	12.5	1.78	6.53	2	7.8	44.45	0
Thickener	0.03	7914.66	4569.37	7045.06	2143.56	6.02	7.31	409.24	416.55	156.59	5.57	12.5	2.3	6.82	2.88	7.86	44.46	0.14
BFP	0.02	1025.08	591.81	977.87	308.75	6.02	7.31	64.15	71.46	25.13	5.57	12.5	2.3	6.77	2.88	7.86	44.46	0
Sludge	0.13	31383.18	18118.45	27712.18	8393.63	6.02	7.31	1584.76	1592.07	604.39	5.57	12.5	2.3	6.82	2.88	7.86	44.46	0

Check	Permit	Combined Effluent	?
TSS	20	12.28	OK
Ammonia	1.1	1.59	NO
TKN	NA	4.78	OK
CBOD	NA	3.26	OK
UOD	45	26.4	OK
NO3	10	10.18	NO
Flow	17.9	mgd	

Zones	mgal
AX1	0.100
A1	0.400
AX2	0.200
A2	0.500
AX3	0.500
A3	0.700
AX4	0.700
A4	1.300
FST1	1.750
Total Aer. Vol Req'd	4.400
Total Vol Avail.	3.080
Vol. check:	NO

FSTs:	99.50%	removal	(enter manually)
Filters:	80.00%	removal	(enter manually)
Step-Feed SRT	15	days	(enter manually)

Elements	Model	Setpoint	Elements	Model	Setpoint
Influent	18.0		PST2	4.0	
AX1	4.94		Aeration2	7.95	
A1	4.94		IR	2.0	2.0
AX2	8.94		RAS2	2.0	2.0
A2	8.94		WAS2	0.02	0.025
AX3	12.93		FST2	3.95	
A3	12.93		PST3	4.62	
AX4	21.93		Anoxic3	7.59	
A4	21.93		Aeration3	7.59	
IR	5.00	5.0	IR	1.00	1.0
RAS1	4.94		RAS3	2.00	2.0
WAS1	0.06		WAS3	0.03	0.03
FST1	11.93		FST3	4.59	
			Effuent	17.87	
			Thickener	0.03	
			Thickener Underflow	0.14	0.14
			BFP	0.02	
			Sludge	0.13	0.13

Model 4: Phase II Conv. Facility Maximum Day

Temp: 16.9 deg C

Yellow boxes indicate parameters that may need to be changed in BioWin before running model.

Elements	Flow [mgd]	Total suspended solids [mgTSS/L]	Volatile suspended solids [mgVSS/L]	Total COD [mg/L]	Total Carbonaceous BOD [mg/L]	Ammonia N [mgN/L]	Nitrate N [mgN/L]	Total Kjeldahl Nitrogen [mgN/L]	Total N [mgN/L]	Total P [mgP/L]	Soluble PO4-P [mgP/L]	Temperature [deg. C]	Alkalinity [mmol/L]	pH []	Dissolved oxygen [mg/L]	Magnesium [mg/L]	Calcium [mg/L]	Liquid volume [Mil. Gal]
Influent	18	284.17	189.14	484	237.73	15.42	0.25	48.2	48.45	10.5	5.25	16.9	3.46	8.6	4.8	8	44.5	0
InfluentSplit 1-2,3	8.01	284.17	189.14	484	237.73	15.42	0.25	48.2	48.45	10.5	5.25	16.9	3.46	8.59	4.8	8	44.5	0
AX1	4.94	30901.53	15226.4	22785.22	3589.36	1.91	3.14	1251.51	1254.65	487.89	7.83	16.9	2.26	6.61	0	7.92	44.48	0.1
A1	4.94	30829.77	15134.04	22670.16	3516.93	0.11	9.66	1244.15	1253.81	487.89	9.28	16.9	1.6	6.47	2	7.81	44.45	0.4
AX2	8.94	17178.12	8473.87	12711.65	2012.31	10.46	0.01	706.97	706.98	274.51	12.41	16.9	3.07	6.97	0	8.98	44.77	0.2
A2	8.94	17156.69	8446.8	12651.33	1978.64	0.73	11.69	694.9	706.58	274.51	10.26	16.9	1.55	6.47	2	8.36	44.6	0.5
AX3	12.93	11956.39	5904.55	8858.11	1410.3	7.57	1.15	493.38	494.53	193.04	8.79	16.9	2.82	6.89	0	8.26	44.57	0.5
A3	12.93	11938.05	5883.32	8820.79	1388.5	0.72	9.09	485.17	494.26	193.04	8.06	16.9	1.75	6.53	2	7.99	44.5	0.7
AX4	21.93	9192.39	4540.79	6817.44	1087.74	4.67	3.14	379.07	382.21	150.05	7.48	16.9	2.48	6.75	0.01	7.98	44.49	0.7
A4	21.93	9175.9	4522.84	6786.6	1069.37	0.47	8.34	373.64	381.98	150.05	7.43	16.9	1.79	6.53	2	7.88	44.47	1.3
RAS1	4.94	30913.39	15237.35	22801.79	3600.3	0.47	8.34	1251.67	1260.02	487.89	7.43	16.9	1.79	6.53	2	7.88	44.47	0
FST1	11.93	65.11	32.09	74.18	8.59	0.47	8.34	5.63	13.97	8.45	7.43	16.9	1.79	6.53	2	7.88	44.47	1.75
Sand Filters1	10.53	14.75	7.27	37.08	2.73	0.47	8.34	3.6	11.94	7.66	7.43	16.9	1.79	6.51	2	7.88	44.47	0
Inf Flow Split2-3	4	284.17	189.14	484	237.73	15.42	0.25	48.2	48.45	10.5	5.25	16.9	3.46	8.59	4.8	8	44.5	0
PST2	3.97	143.16	95.29	333.85	174.87	15.42	0.25	39.75	40	7.89	5.25	16.9	3.46	8.59	4.8	8	44.5	0.24
Anoxic2	7.95	5853.91	3669.57	5424.08	1988.65	12.45	0.03	344.11	344.14	178.78	6.6	16.9	3.32	7.22	0	8.36	44.6	0.1
Aeration2	7.95	5834.29	3641.85	5362.25	1954.08	1.56	12.99	330.72	343.71	178.78	3.31	16.9	1.63	6.53	2	7.55	44.38	0.41
RAS2	1.97	17267.62	10778.71	15818.84	5781.04	1.56	12.99	970.22	983.21	522.63	3.31	16.9	1.63	6.53	2	7.55	44.38	0
FST2	3.95	43.95	27.43	66.57	15.93	1.56	12.99	6.84	19.84	4.64	3.31	16.9	1.63	6.53	2	7.55	44.38	0.24
Sand Filters2	3.35	10.36	6.47	35.85	4.69	1.56	12.99	4.96	17.96	3.63	3.31	16.9	1.63	6.51	2	7.55	44.38	0
PST3	4.62	111.53	72.16	274.33	141.03	13.4	2.18	33.83	36	7.32	5.26	16.9	3.18	8.01	4.42	8	44.5	1.32
Anoxic3	7.59	3882.77	2366.96	3517.88	1021.25	11.55	0.06	225.12	225.19	76.27	5.25	16.9	3.25	7.22	0	8.04	44.51	0.14
Aeration3	7.59	3850.68	2333.05	3449.11	979.65	0.55	14.59	210.09	224.69	76.27	5.3	16.9	1.43	6.46	2	7.97	44.49	1.09
RAS3	1.97	12627.18	7650.55	11251.79	3210.34	0.55	14.59	681.69	696.29	238.03	5.3	16.9	1.43	6.46	2	7.97	44.49	0
FST3	4.59	27.64	16.75	50.26	7.96	0.55	14.59	4.66	19.26	5.81	5.3	16.9	1.43	6.46	2	7.97	44.49	0.69
Sand Filters3	3.99	6.36	3.85	31.34	2.55	0.55	14.59	3.52	18.11	5.42	5.3	16.9	1.43	6.44	2	7.97	44.49	0
Effuent	17.87	12.06	6.36	35.57	3.06	0.69	10.61	3.83	14.45	6.41	6.19	16.9	1.68	6.52	2	7.84	44.46	0
Thickener	0.03	7814.8	4484.96	6923.66	2060.86	5.36	7.64	400.33	407.98	148.88	5.76	16.9	2.23	6.83	2.88	7.89	44.47	0.14
BFP	0.02	1012.11	580.86	962.07	298.02	5.36	7.64	62.4	70.04	24.29	5.76	16.9	2.23	6.81	2.88	7.89	44.47	0
Sludge	0.13	30986.23	17783.17	27230.12	8065.5	5.36	7.64	1551.41	1559.05	573.26	5.76	16.9	2.23	6.83	2.88	7.89	44.47	0

Check	Permit	Combined Effluent	?
TSS	20	12.06	OK
Ammonia	1.1	0.69	OK
TKN	NA	3.83	OK
CBOD	NA	3.06	OK
UOD	45	21.8	OK
NO3	10	10.61	NO
Flow	17.9	mgd	

Zones	mgal
AX1	0.100
A1	0.400
AX2	0.200
A2	0.500
AX3	0.500
A3	0.700
AX4	0.700
A4	1.300
FST1	1.750
Total Aer. Vol Req'd	4.400
Total Vol Avail.	3.080
Vol. check:	NO

FSTs:	99.50%	removal	(enter manually)
Filters:	85.00%	removal	(enter manually)
Step-Feed SRT	15	days	(enter manually)

Elements	Model	Setpoint	Elements	Model	Setpoint
Influent	18.0		PST2	4.0	
AX1	4.94		Aeration2	7.95	
A1	4.94		IR	2.0	2.0
AX2	8.94		RAS2	2.0	2.0
A2	8.94		WAS2	0.02	0.025
AX3	12.93		FST2	3.95	
A3	12.93		PST3	4.62	
AX4	21.93		Anoxic3	7.59	
A4	21.93		Aeration3	7.59	
IR	5.00	5.00	IR	1.00	1.0
RAS1	4.94		RAS3	2.00	2.0
WAS1	0.06		WAS3	0.03	0.03
FST1	11.93		FST3	4.59	
			Effuent	17.87	
			Thickener	0.03	
			Thickener Underflow	0.14	0.14
			BFP	0.02	
			Sludge	0.13	0.13

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Harriman Wastewater Treatment Facility Membrane Bioreactor Pilot Study

Final Report 06-08

State of New York
George E. Pataki, Governor

New York State Energy Research and Development Authority
Vincent A. DeIorio, Esq., Chairman
Peter R. Smith, President, and Chief Executive Officer

NYSERDA

Appendix L

INTER-OFFICE MEMORANDUM
ORANGE COUNTY DEPARTMENT OF PUBLIC WORKS
DIVISION OF ENVIRONMENTAL FACILITIES AND SERVICES

TO: File

FROM: Anthony R. Griffin, P.E., Principal Sanitary Engineer

DATE: February 16, 2006

SUBJECT: Harriman STP "Preliminary" 9 mgd SPDES Limits for 001 and 002 Outfalls.

Per my telephone conversation with Mr. Chuck St. Lucia for the NYSDEC in Albany, NY on Wednesday, February 15, 2006, the following SPDES limits were "preliminarily" proposed by him for the Harriman STP @ 9 mgd:

1. Flow (Monthly Average):
   a. 001 Outfall – **Change** from 6.0 to 9.0 mgd
   b. 002 Outfall – Same @ 2.0 mgd
   c. Note: Sum of 001 and 002 may not exceed 9 mgd)

2. CBOD5 (June 1 – Oct 31) (Daily Max):
   a. 001 Outfall – Same @ 5 mg/L (via intermittent stream standard)
   b. 002 Outfall – Same @ Monitor Only via mg/L

3. CBOD5 Flow (Monthly Average):
   a. 001 Outfall – Same @ Monitor Only via mg/L
   b. 002 Outfall – Same @ 5 mg/L

4. UOD (Nov 1 – May 31) (Daily Maximum):
   a. 001 Outfall – **Change** from 50 to 45 mg/L (via D.O. Profile Run)
   b. 002 Outfall – Same @ 55 mg/L

5. Solids, Suspended (June 1 – Oct 31) (Monthly Average):
   a. 001 Outfall – Same @ Monitor Only via mg/L
   b. 002 Outfall – Same @ Monitor Only via mg/L

6. Solids, Suspended (June 1 – Oct 31) (Daily Maximum):
   a. 001 Outfall – Same @ 10 mg/L (Could become more stringent)
   b. 002 Outfall – Same @ 10 mg/L (Could become more stringent)

7. Solids, Suspended (Nov 1 – May 31) (Monthly Average):
   a. 001 Outfall – **Change** from 30 to 20 mg/L (Based on Mass Loading)
   b. 002 Outfall – Same @ 30 mg/L (Based on Mass Loading)

8. Solids, Suspended (Nov 1 – May 31) (7-Day Average):
    a. 001 Outfall – **Change** from 45 to 30 mg/L (based on Mass Loading)
    b. 002 Outfall – Same @ 45 mg/L (Based on Mass Loading)

9. Solids, Settleable (Daily Maximum):
    a. 001 Outfall – Same @ 0.1 ml/l
    b. 002 Outfall – Same @ 0.1 ml/L

10. pH (Range):
    a. 001 Outfall – Same @ 6.5 – 8.5
    b. 002 Outfall – Same @ 6.5 - 8.5

11. Nitrogen, Ammonia (as NH3) (June 1 – Oct 31) (Monthly Average):
    a. 001 Outfall – **Change** from 1.3 to 1.2 mg/L
    b. 002 Outfall – Same @ 1.1 mg/L

12. Nitrogen, Ammonia (as NH3) (Nov 1 – May 31) (Monthly Average):
    a. 001 Outfall – Same @ 2.2 mg/L
    b. 002 Outfall – Same @ 6.8 mg/L

13. Nitrogen, TKN (as N) (Monthly Average):
    a. 001 Outfall – Same @ Monitor Only via mg/L
    b. 002 Outfall – Same @ Monitor Only via mg/L

14. Dissolved Oxygen (Daily Minimum):
    a. 001 Outfall – Same @ 7.0 mg/L
    b. 002 Outfall – Same @ 7.0 mg/L

15. Temperature (Daily Maximum):
    a. 001 Outfall – Same @ Monitor Only via Deg F
    b. 002 Outfall – Same @ 70 Def F

16. Copper, Total (Daily Maximum):
    a. 001 Outfall – **Change** from 1.0 to 1.4 lbs/Day (Based on Mass Loading via Water Quality Standard; limit is set for sum of 001 and 002.
    b. 002 Outfall – **(see above)**

17. Zinc, Total (Daily Maximum):
    a. 001 Outfall – **Change** from 8.4 to 12.0 lbs/Day (Based on Mass Loading via Water Quality Standard; limit is set for sum of 001 and 002.
    b. 002 Outfall – **(see above)**

18. Coliform, Fecal (30 Day Geometric Mean):

a. 001 Outfall – Same @ 200 No./100 ml
b. 002 Outfall – Same @ 200 No./100 ml

19. Coliform, Fecal (7 Day Geometric Mean):
    a. 001 Outfall – Same @ 400 No./100 ml
    b. 002 Outfall – Same @ 400 No./100 ml

20. Chlorine, Total Residual (Daily Maximum):
    a. 001 Outfall – Same @ 0.1 mg/L
    b. 002 Outfall – Same @ 0.1 mg/L

21. Total Phosphorus (TP as P) (Monthly Average):
    a. Computation was based on 2 methods as follows:
        i. First: Hold the line on the existing P loading to the Ramapo via 1 year plus results submitted to the DEC as follows:
            1. 001 Outfall – **Add** to Permit @ 0.8 mg/L
            2. 002 Outfall – **Add** to permit @ 0.8 mg/L
        ii. Second: Via NYSDEC Technical Operating Guidance Series (TOGS) 1.3.6:
            1. 001 Outfall - **Add** to Permit @ 0.5 mg/L
            2. 002 Outfall – **Add** to Permit @ 0.5 mg/L
    b. Important considerations that will be factored into imposing TP and TN limits by permit writers will be TMDL nutrient limits being sought by NJ for Ramapo River (due to Ramapo being used as a water supply) and the fact that a P1000 water body exists on lower reach of the Ramapo River.

22. Total Nitrogen (TN as Nitrate) (Monthly Average):
    a. 001 Outfall – **Add** to Permit @ 10 mg/L via Water Quality Standard via TOGS 1.1.1
    b. 002 Outfall – **Add** to Permit @ 10 mg/L via Water Quality Standard via TOGS 1.1.1
    c. See 21. (b) above.

The above changes were derived by Mr. St. Lucia via numerical calculation and/or narrative analysis.

---- End of Discussion ----

Appendix M

ARCHAEOLOGICAL REFINEMENT STUDY PROPOSED CATSKILL AQUEDUCT CONNECTION VILLAGE OF KIRYAS JOEL, ORANGE COUNTY, NEW YORK

ARCHAEOLOGICAL REFINEMENT STUDY
PROPOSED CATSKILL AQUEDUCT CONNECTION
VILLAGE OF KIRYAS JOEL, ORANGE COUNTY, NEW YORK

Prepared For:
Camp Dresser & McKee, Inc. (CDM)
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Author:
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Graphics:
Luc Litwinionek, AbD

November, 2008

Management Summary

SHPO Project Review Number (if available):

Involved State and Federal Agencies (DEC, CORPS,FHWA,etc.): DEC

Phase of Survey: Sensitivity Refinement - Addendum to Phase IA

Location Information
Location: Two corridors: A-Route 94, Route 32, Co. Rt 44; C- Route 208, Co. Rte 27; Route 94
Minor Civil Division: Cornwall, Woodbury, Monroe, and Blooming Grove
County: Orange

Survey Area (Metric & English)
Length: Two corridors at ca.11 miles per corridor
Width: Pipeline corridor will impact width less than 10'; Right-of-Way studied is 100' width
Depth (when appropriate): N/A
Number of Acres Surveyed: 22 miles @ 100' = 1,056,000 sq ft or 24.24 square acres
Number of Square M & F Excavated N/A
Percentage of the Site Excavated: N/A

U.S.G.S. 7.5 Minute Quadrangle Map: Walden, Maybrook, Cornwall-On-Hudson, Monroe, and Popolopen Lake

Archaeological Survey Overview
Number & Interval of Shovel Tests: N/A
Number & Size of units: N/A
Width of Plowed Transects: N/A
Surface Survey of Transect Interval: N/A

Results of Archaeological Survey
Number & name of Precontact sites identified: 33 Locations of Potential Precontact Sensitivity Identified
Number & name of historic sites identified: 91 Locations of Potential Historical Sensitivity Identified
Number & name of sites recommended for Phase II/Avoidance: N/A

Results of Architectural Survey
Number of buildings/structures/cemeteries within project area: Route C - 1 cemetery
Number of buildings/structures/cemeteries adjacent to project area: Route A-ca. 30; Route C -ca. 44
Number of previously determined NR listed or eligible buildings/structures/cemeteries 25
Number of identified eligible buildings/structures/cemeteries/districts: Route A - 10; Route C - 15

Report Author (s): Faline Schneiderman-Fox

Date of Report: Nov-08

EXECUTIVE SUMMARY

The proposed Catskill Aqueduct Connection Project (Project) will provide a new source of water for the Village of Kiryas Joel, Orange County, New York. The new pipeline will connect the existing Aqueduct in the Town of New Windsor with, either the existing water treatment plant (WTP) in the Village of Kiryas Joel, or with a new WTP to be constructed in the Village of Kiryas Joel. The SEQR review of the proposed construction of this 11-mile water pipeline requires the evaluation of project impact on areas of the alternative routes that are potentially sensitive for archaeological resources. Historical Perspectives, Inc. (HPI) conducted the required archaeological study of the sensitivity areas in a phased approach, correlating the extent of documentary research with the route-selection process (HPI 2003, 2004). Such a phased approach eliminated the possibility of unnecessary in-depth documentation and/or field testing on non-selected routes. To ensure that no adverse impacts to archaeological resources would result from construction of the Project, the New York State Office of Parks, Recreation, and Historic Preservation (OPRHP) approved an archaeological protocol, which provided for a sequence of testing, analysis, review, and avoidance. The protocol was incorporated as a special mitigation measure in the SEQRA Findings. Future state permits, including those by New York State Department of Environmental Conservation (NYSDEC), would incorporate this same protocol as a special condition.

In the fall of 2007, the New York State Appellate Division (Second Department), directed the Village, as SEQRA Lead Agency, to prepare an amended final environmental impact statement (FEIS) that includes site specific and design-specific Phase 1B archaeological study in appropriate sensitive areas along the proposed pipeline routes.

HPI's Phase IA technical report and a subsequent amendment identified sensitivity zones for three pipeline routes (HPI 2003, 2004). Subsequent to the Court's ruling, a more exhaustive pedestrian survey was undertaken, with the results presented herein. The major objective of this refinement study was to expertly narrow the sensitivity zones to reflect archival data, the current design plans, and existing conditions within the sensitivity zone alternative alignments A and C, with A being the easternmost corridor and C being the westernmost corridor. Alternative Route B has been eliminated from consideration due to the difficulty in siting the pipeline along the New York State Thruway.

To assist with this review, the engineering team further refined the Area of Potential Effect (APE) for both alignments. For both alternatives, the APE includes the road right-of-way (ROW) extending 15.25m (50ft) on either side of the paved road, as well as the area directly within the roadway itself. The engineers provided HPI with a detailed map delineating the two pipeline routes. The APE was determined in the field.

For this refinement study, mapped or identified historical resources more than 300' (roughly 90 meters) outside of the project site were excluded from the area of subsurface sensitivity. This included houses, barns, outbuildings, and other features that fronted onto old roads that paralleled the existing ROW, so that all portions of their yard were far removed from the APE. Exceptions to this were historical complexes that had their backyard areas abutting the APE, which were included as potentially sensitive areas.

In addition, especially where the APE coincided with modern roads that did not follow historical roads, areas in the APE that displayed extensive evidence of cutting and filling to create the existing roadbed were considered disturbed and lacking in archaeological sensitivity. Finally, potentially sensitive areas within the APE that are above or below the existing street bed corridor by more than 3m (roughly 10 ft) were excluded due to the impracticability of placing the pipeline in these areas. Therefore, the refinement study delineated the undisturbed areas within the APE identified as potentially sensitive for precontact and/or historical resources.

The refinement study found that Route C (western route) has more archaeologically sensitive areas than Route A (HPI 2008). The most significant difference between the two routes is that much of Route A (eastern route) travels along a 20th century road that has far fewer areas of historical sensitivity since it was laid out through what appears to have been undeveloped farmland. Route A had a total of 41 areas of historical sensitivity, and most of these were individual lots or structures, while Route C had 54 identified areas of historical sensitivity, with many of these actually representing multiple structures or lots. Route C also passes through a 19th century cemetery that was disturbed by the early 20th century rerouting of Route 208 across it. Although records indicate that graves were removed from the roadbed and reinterred when Route 208 was constructed, it is possible that human remains that were not recovered at that time still exist within the ROW (HPI 2004).

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I. INTRODUCTION

The proposed Catskill Aqueduct Connection Project (Project) will provide a new source of water for the Village of Kiryas Joel, Orange County, New York (Figure 1). The new pipeline will connect the existing Aqueduct in the Town of New Windsor with, either the existing water treatment plant (WTP) in the Village of Kiryas Joel, or with a new WTP to be constructed in the Village of Kiryas Joel. The SEQR review of the proposed construction of this 11-mile water pipeline requires the evaluation of project impact on areas of the alternative routes that are potentially sensitive for archaeological resources. Historical Perspectives, Inc. (HPI) conducted the required archaeological study of the sensitivity areas in a phased approach, correlating the extent of documentary research with the route-selection process (HPI 2003, 2004). Such a phased approach eliminated the possibility of unnecessary in-depth documentation and/or field testing on non-selected routes. To ensure that no adverse impacts to archaeological resources would result from construction of the Project, the New York State Office of Parks, Recreation, and Historic Preservation (OPRHP) approved an archaeological protocol, which provided for a sequence of testing, analysis, review, and avoidance. The protocol was incorporated as a special mitigation measure in the SEQRA Findings. Future state permits, including those by New York State Department of Environmental Conservation (NYSDEC), would incorporate this same protocol as a special condition.

In the fall of 2007, the New York State Appellate Division (Second Department), directed the Village, as SEQRA Lead Agency, to prepare an amended final environmental impact statement (FEIS) that includes site specific and design-specific Phase 1B archaeological study in appropriate sensitive areas along the proposed pipeline routes.

HPI's Phase IA technical report and a subsequent amendment identified sensitivity zones for three pipeline routes (HPI 2003, 2004). Subsequent to the Court's ruling, a more exhaustive pedestrian survey was undertaken, with the results presented herein. The major objective of this refinement study was to expertly narrow the sensitivity zones to reflect archival data, the current design plans, and existing conditions within the sensitivity zone alternative alignments A and C, with A being the easternmost corridor and C being the westernmost corridor (Figures 1, 2). Alternative Route B has been eliminated from consideration due to the difficulty in siting the pipeline along the New York State Thruway.

This study has allowed for a refinement of the potentially archaeologically sensitive areas originally identified in the Phase 1A report and a subsequent addendum (HPI 2003, 2004). In addition, the design team has stated that it may be possible to place the proposed pipeline in the roadway itself in some areas in order to avoid historic/archeological resources.

II. RESEARCH AND FIELD METHODS

Additional Documentary Research

Additional documentary research and more precise mapping of areas of potential archaeological sensitivity was undertaken in order to accomplish the goal of refining archaeologically sensitive areas in the two proposed alignments, A and C. To assist with this review, the engineering team further refined the Area of Potential Effect (APE) for both alignments. For both alternatives, the APE includes the road right-of-way (ROW) extending 15.25m (50ft) on either side of the paved road, as well as the area directly within the roadway itself. The engineers provided HPI with a detailed map delineating the two pipeline routes. The APE was determined in the field.

Additional documentary research was undertaken at the Orange County Historical Society, the Newburgh Free Public Library, and at various on-line sites. Although few additional maps and atlases were located, previously collected cartographic sources (Sidney 1851; Beers 1875; USGS 1903; Lathrop 1903) were more precisely correlated to each of the proposed alignments, and inventoried historical and precontact sites were keyed to each.

Field Inspection

To compliment this additional documentary research, a more intensive field survey of both alignments was undertaken in order to establish areas of prior disturbance, and areas of potential archaeological sensitivity. Each route was visually reviewed to determine the potential level of archaeological sensitivity as per the New York Archaeological Council's (NYAC) *Standards for Cultural Resource Investigations and the Curation of*

Archaeological Collections (*Standards*, 1994) adopted by OPRHP, and the New York State Historic Preservation Office's (SHPO) *Phase I Archaeological Report Format Requirements* (2005). According to the NYAC *Standards,* for a Sensitivity Assessment:

> An estimate of the archaeological sensitivity of a given area provides the archaeologist with a tool with which to design appropriate field procedures for the investigation of that area. These sensitivity projections are generally based upon the following factors: statements of local preferences or projections for particular settlement systems, characteristics of the local environment which provide essential or desirable resources (e.g., proximity to perennial water sources, well-drained soils, floral and faunal resources, raw materials, and/or trade and transportation routes), the density of known archaeological and historical resources within the general area, and the extent of known disturbances which can potentially affect the integrity of sites and the recovery of material from them. (NYAC 1994:4)

The previously prepared Phase 1A study of all three corridors concluded that few previously recorded precontact and historical archaeological sites have been inventoried near either Alternatives A or C, but that there was precontact potential in undisturbed areas due to the presence of water sources and landforms like those in the area with known precontact sites, and historical potential where there were mapped historical structures and visible historical features. This refinement study delineated the undisturbed areas within the APE that were previously identified as potentially sensitive for precontact and/or historical resources (HPI 2003, 2004).

The entire ROW was visually reviewed to assist with the assessment of precontact and historical archaeological sensitivity. Potentially sensitive areas in the ROW, but outside the paved portion of a road, that were found to be elevated above or recessed below the existing street bed by more than 3m (roughly 10 ft) were excluded from sensitivity, due to the impracticability of placing the pipeline in these areas. In these locations, according to the project design team, the pipeline would be placed within the paved portion of the roadbed. That is not to say that these locations outside the paved portion of the road are not necessarily sensitive for potential archaeological resources, but only that they would not experience any potential impacts due to these unique topographic conditions that would preclude their potential disturbance. In these areas the APE essentially contracts to the size of the pavement, so locations outside the roadbed would not be impacted and thus do not require further consideration.

<u>Precontact Archaeological Resources</u>

For precontact resources, all areas within the ROW were considered to have potential sensitivity unless they met one or more of the following criteria for lacking sensitivity (as per NYAC 1994:5):

- Possessed steep slopes (greater than 12%);
- Displayed obvious signs of extensive subsurface disturbance (e.g., historical and modern development, culverts, cutting, landscaping, construction, earth moving, etc…);
- Contained a standing structure;
- Contained standing water; and/or,
- Contained visible rock outcrops, excluding potential rockshelter sites.

Locations that did not meet any of these criteria were mapped as potentially sensitive for precontact archaeological resources.

<u>Historical Archaeological Resources</u>

For historic period archaeological resources, areas were considered to have potential sensitivity if they were in the vicinity of a Mapped Documented Structure (MDS – as defined by SHPO 2005:3), a standing historical structure, or had visible evidence of a historically built environment (e.g., stone walls, fences, foundations, etc...). However, mapped or identified historical resources more than 300' (roughly 90 meters) outside of the APE were excluded from the area of subsurface sensitivity. This included houses, barns, outbuildings, and other features that fronted onto old roads that paralleled the existing ROW, so that all portions of their yard were far removed from the APE. Exceptions to this were historical complexes that had their backyard areas abutting the APE, which were included as potentially sensitive areas. Large swaths lacked historical archaeological sensitivity, especially where the APE coincided with modern roads that did not follow historical roads.

Sensitivity Mapping

The visual field inspection of each of the two corridors was coupled with GIS mapping of the limits of sensitivity zones in relation to the APE. By utilizing GPS units in the field, 36 CFR 61 qualified archeologists were able to more accurately map sensitivity zones that fell within the APE. In addition, photographs were taken of select areas deemed as potentially sensitive for precontact and/or historical archaeological resources.

The GPS survey entailed utilizing a Trimble Geo XT pocket unit, calibrated for Newburgh, New York using the North American Vertical Datum (NAVD) 1927 Eastern Unites States. In an effort to receive the strongest satellite signal(s), a Hurricane antenna was employed that was kept level, and extended 1.9 meters (6.3 feet) above the ground surface. A unit count of 15 to 20 was achieved to further ensure point accuracy. During periods of poor Position Dilution of Precision (PDOP) that typically occurred mid-day, accuracy was reduced to no less than 6.5 meters (21.3 feet). GPS work was completed by two archaeologists over a one week period in late April/early May when trees had not yet fully foliated. Each area of sensitivity was also recorded on a modern USGS topographic map for cross referencing.

Collected GPS coordinate points were denoted using "start" and "stop" designations for archaeologically sensitive areas, and were sequentially numbered for each corridor, A and C. Collected attributes about each data point included the following:

Resource Type:	Precontact	Knoll, Floodplain, Rockshelter[1]
	Historic	House, Mill, Foundation, Bridge Above, Bridge Under
	Both	
	Other	
Resource Location:	East side of Road	
	West side of Road	
	Both East and West sides of Road	
	North side of Road	
	South side of Road	
	Both North and South side of Road	
Width of Sensitive Area:	0-3 meters	
(out from paved portion	3-5 meters	
of road)	5-10 meters	
	10-15 meters	
Date		
Name of Recorder		

Following the completion of data collection, data files were downloaded and Waypoint Technology Group of Albany, New York completed additional post-processing work. Shapefiles were generated from the data, and correlated to GIS maps provided by CDM. Finalized maps showing the locations of sensitivity along both corridors were completed by CDM in conjunction with HPI.

[1] Any location that met the criteria previously described was considered potentially sensitive for precontact archaeological resources. Many locations that did not fit into these three resource types were recorded under the category of "knoll."

III. RESULTS OF DOCUMENTARY RESEARCH AND FIELD SURVEY

The two proposed corridors were overlaid on historical maps and atlases dating to the 19th and 20th centuries. Because these graphics are so large, only one early 20th century USGS showing the two proposed corridors was set for this report (Figure 2; For additional historical maps and atlases showing Corridors A and C, see HPI 2003 and 2004). The locations of historically sensitive areas observed on historical maps and atlases were then transposed onto a modern USGS map for use in the field. Additionally, inventoried National Register (NR) and State Register (SR) listed sites along each route were also mapped, when their locations were known.

If a previously identified NR or SR resource was found to exist more than 300' (roughly 90 meters) outside of the project site, then it was assumed to be far enough removed to not warrant inclusion in the area of subsurface sensitivity. This included houses, barns, outbuildings, and other features that fronted onto old roads that paralleled the existing ROW, so that all portions of their yard were far removed from the APE. Exceptions to this were historical complexes that had their backyard areas abutting the APE, which were included as potentially sensitive areas.

In addition, if a potentially sensitive area was found to be elevated above the streetbed by more than ten feet (roughly three meters), or below the streetbed by more than ten feet, then it was not recorded because project engineers have indicated that they would place the piping in the streetbed rather than cut hillsides or bring in fill to raise steep grades. Many such locations like this were noted, especially where the APE coincided with modern roads that did not follow historical roads, and bore extensive evidence of cutting and filling to create the roadbed.

Tables of previously identified historical and archaeological sites for each of the corridor alignments were created, but these only include locations that are known to exist in or immediately adjacent to the APE. This, alone, allowed archaeologists to eliminate many potentially sensitive areas that were originally identified near the APE, but actually fall outside of it, as defined in 2008.

A discussion of each of the two routes is presented. The following tables for each route provide a list of previously known historical and archaeological sites in each of the APEs. Map numbers correspond to locations presented on Figures 3 and 4. In some cases, the locations of two distinct resources were so close that they were recorded as one location and given one Map number.

ROUTE A

This route begins at the Aqueduct in New Windsor, proceeds south along Riley Road to State Route 94, turns east to Vails Gate, turns south on State Route 32, turns west on County Route 44 in Highland Mills, and terminates at the potential WTP site in Kiryas Joel (Figure 1). The APE for this route, therefore, consists of the roadbed and the tangential land extending 50 feet out from the paved portion of the roads covered in this route. Part of this route follows old roads, many of which have since been straightened, while large swaths were built over farmland in the 20th century parallel to old roads (Figure 2).

PRECONTACT SENSITIVITY

Known Sites:

No known precontact sites that were previously identified in proximity to Route A in the original Phase IA assessment exist within proximity to the APE. Therefore, no table of known sites is presented.

Identified Sensitivity:

The field survey and collection of data points indicating areas of potential precontact sensitivity along Route A found that there were approximately 16 distinct areas that fell into this category (Figure 3). A description of each of these areas is provided in Appendix A, with Map numbers corresponding to those on Figure 3. In summary, these ranged from small knolls and terraces in proximity to water, to larger more level flood plains along larger streams and creeks. Many areas that were previously designated as potentially archaeologically sensitive for precontact resources were not recorded as such as they were either outside of the refined, 2008 APE or they were elevated more than 10' above or recessed more than 10' below the road ROW.

HISTORICAL SENSITIVITY

Known Sites:

Site numbers are keyed to the numbers on Figure 3

TABLE 1: KNOWN HISTORICAL SITES IDENTIFIED IN PROXIMITY TO ROUTE A

Site #	SITE # AND NAME	LOCATION	DESCRIPTION
A 2	NR Edmonston House, Rte 94	Vail's Gate, west of Temple Hill Road along Rte 94. Abutting Rte A.	National Register, historic house dating to 1755, used as a medical facility and headquarters during the Revolutionary War.
A 8	90NR03061, NR B. Woodruff House, NY32	Cornwall, West side of Rte 32 near town of New Windsor Line. Abuts project area.	National Register, historic house.
A 8	SHPO A071-15-0007, 90NR02309, NR Haskell House	West of Rte 32 north of Union Avenue. Immediately outside project area. NOTE – LOCATION IS QUESTIONABLE ON MAP	National Register John Haskell House.
A 10	USN # 07103.000063 Orr's Mills, Abandoned Mill	Cornwall, NY32, east side, near Moodna Creek Bridge, down private drive	Eligible for National Register status, grist and flour mill, current structure dates to 1866. Built on foundation of former revolutionary-era mill.
A 11	USN # 07103.000148 Parker Truss Bridge Bin 1-02224-0, Owner NYS-DOT, DOT PIN 8460.36 95PR0040	Cornwall, NY32, Orrs Mill, over Moodna Creek. Just outside project area.	No information available.
A 11	USN # 07103.000059 Orr's Summerhouse (Incanno Residence)	Cornwall, Orr's Mills Rd, at intersection Rte 32, west side, Moodna Creek to the east. Abuts project area.	Wood frame structure, wine cellar built into hill, remnants of mill structures surrounding. c. 1750, rebuilt 1872. Boat house turned into piano factory in early 20th c.
A 18	90NR03247, NR Mountainville Grange Hall, NY32	Cornwall, State Rte 32 at Star Entrance Road. Abuts project area.	National Register. Currently used as a Masonic Lodge. (Photograph 1)
A 21	USN # 07120.000207 Revolutionary Encampment	Woodbury, Rte 32, east side of Woodbury Creek.	No information available.
A 26	SHPO A07120.000241	Woodbury, east side of County Route 44. Abuts project area.	Historic period well.
A 30	USN # 07120.000227 Cemetery of the Highlands	Woodbury, Rte 32. Outside of project area.	National Register.

Identified Sensitivity:

The field survey and data collection identified a total of 41 distinct areas of potential historical archaeological sensitivity along Route A (Figures 3a-3e). These locations are detailed in Appendix A. To summarize, these sensitive areas included the yards around extant historical structures, foundation remains, and lots that bore evidence of historical settlement. Areas of development on historical maps and atlases were also included in the inventory. In some locations, several historical houses stood adjacent to each other, so these were identified as one larger historically sensitive area on the map (Figure 3). The inventory also included historical bridges over rivers, and historical bridges above the ROW, although these are not likely to be disturbed by excavations within the road ROW (Photograph 2). In many cases, historically significant sites were found near the APE, but since large sections of Route 32 were built parallel to, but removed from, historical roads, the historic sites were thus removed from the APE. It was also found that some of the historical dwellings were far uphill or down below the APE where pipe installation would not occur. These locations were precluded from the inventory since there would be no disturbance to potentially sensitive areas.

ROUTE C

This route begins at the Catskill Aqueduct in New Windsor, proceeds south along Riley Road to State Route 94, turns west to Clove Road at Salisbury Mills (County Route 27), turns south on Clove Road to State Route 208, turns south on State Route 208 to State Route 17, follows the Exit 130 north ramp to the trunk of State Route 17, follows State Route 17 to Schunnemunk Road, turns northeast on Schunnemunk Road to Berdichev Drive, and turns northwest on Berdichev Drive to Kiryas Joel's Village WTP.

PRECONTACT SENSITIVITY

Known Sites:

No known precontact sites that were previously identified in proximity to Route C in the original Phase IA assessment exist within proximity to the APE. Therefore, no table of known sites is presented.

Identified Sensitivity:

The field survey and collection of data points indicating areas of potential precontact sensitivity along Route C found that there were approximately 17 distinct areas that fell into this category (Figure 4; Photograph 5). A description of each of these areas is provided in Appendix B, with Map numbers corresponding to those on Figure 4. In summary, these ranged from small knolls and terraces in proximity to water, to larger more level flood plains along larger streams and creeks. Many areas that were previously designated as potentially archaeologically sensitive for precontact resources were not recorded as such as they were either outside of the APE or they were elevated more than 10' above or recessed more than 10' below the road ROW.

HISTORICAL SENSITIVITY

Known Sites:

Site numbers are keyed to the numbers on Figure 4

TABLE 2: KNOWN HISTORICAL SITES IDENTIFIED IN PROXIMITY TO ROUTE C

Site #	IDENTIFICATION	LOCATION	DESCRIPTION
?	USN # 07103.000119 Bethlehem School House	Cornwall, Rte 94.	National Register. No further information available.
?	USN # 07101.000109 Crawford House	Blooming Grove, NYS209 (208?)	Eligible for National Register status, no further information available.
C19	USN # 07101.000073 S.W. Moffat-James Kirby House (Morgan Residence)	Blooming Grove, Clove Rd, (Rte. 27), west side, north of Felter Hill Rd. Abuts project area.	Wood frame house, barn, well, railroad in rear. Ca. 1766.
C23	USN # 07101.000093 Benjamin S. Tuthill House	Blooming Grove, Clove Rd., CR 27, west side, south of Camp Lenni-Len-A-Pe	No further information available.
C25	USN # 07101.000094 David C. Smith House	Blooming Grove, Clove Rd, CR 27, east side, north of Camp Lenni-Len-A-Pe	No further information available.

TABLE 2: KNOWN HISTORICAL SITES IDENTIFIED IN PROXIMITY TO ROUTE C			
Site #	**IDENTIFICATION**	**LOCATION**	**DESCRIPTION**
just N of APE	A. Walsh Stone House and Farm Complex, Rte 94	1570 Rte 94, north side between Jackson Avenue and Shore Drive. Abuts project area.	National Registers, including a mid-19th century two-story Greek Revival stone house.
C27/ 28	USN # 07101.000002 Salisbury Mill	Blooming Grove, CR 27, east side, in bend of Otter Kill Creek, south of Salisbury Mills. Abuts project area.	Paper mill, early 18th/late 19th century.
C34	USN # 07101.000014 Hope Chapel	Blooming Grove, Clove Rd, Salisbury Mills	See USN # 07101.000072, Presbyterian Chapel, below.
C34	USN # 07101.000072 Presbyterian Chapel, also known as Hope Chapel	Blooming Grove, Clove Rd., Salisbury Mills (CR 27) west side, south of Orr's Mills Rd. Abuts project area.	Wood frame Gothic chapel, c. 1840.
C35	NYSM 565, Salisbury Mills	Cornwall, Salisbury Mills. Project area passes through east end of village.	Site of historic village.
C46	USN # 07103.000002 Bethlehem Presbyterian Church and Cemetery	Cornwall, Rte 94, north side, west side of Jackson Ave. Abuts project area.	National Register Church and Cemetery. Built ca. 1730, current structure ca. 1828. Structure fronts road, cemetery to the north and west of church. Washington reportedly attended services while headquartered at Ellison House in New Windsor.
C48 ?	USN # 07103.000071 Smith-Moffat House (Sauer Residence)	Cornwall, Rte 94, north side, east of Jackson Ave. Abuts project area.	Wood frame structure, stone fencing, c. 1750.
C49-55?	USN # 07103.000074 Thursten House (Makuen Residence)	Cornwall, Rte 94, north side, between Jackson Ave. and Mt. Airy Rd.	National Register. No further information available.
C56/ 57	USN # 07103.000072 J.W. Denniston House (De Ronde Residence)	Cornwall, Rte 94, south side, west of Meadowbrook RR crossing. Abuts project area	Simulated variegated cut stone front (grout), 1864.
C60	Survey # 294, Historic Stone House	Cornwall, hamlet of Meadowbrook, south of Rte 94 at Mt. Airy Road. Abuts project area.	Two-story brick dwelling dates prior to 1851.
C61	USN # 07103.000073 J. Denniston House (Costello Residence)	Cornwall, Rte 94, south side, east of Mt. Airy Rd.	Eligible for National Register status, stone structure, c. 1817. Built using salvaged timbers from the Temple of virtue on the New Windsor Cantonment. In 1916, sold to Frances Hodgeson Burnett, author of Little Lord Fauntleroy. Adjacent to project area.
C63 ?	USN # 07103.000117 Farrell House	Cornwall, Rte 94, Meadowbrook. Adjacent to project area.	National Register, Stone and stucco, 1825.

Identified Sensitivity:

The field survey and data collection identified a total of 54 distinct areas of potential historical archaeological sensitivity along Route C (Figure 3). These locations are detailed in Appendix B. To summarize, these sensitive areas included the yards around extant historical structures, foundation remains, and lots that bore evidence of historical settlement (Photograph 6). In addition, a 19th century historical cemetery was identified along Route C on either side of Route 208 (Photographs 3 and 4, Figure 4B – Site C8). Areas of development on historical maps and atlases were also included in the inventory. In some locations, several historical houses stood adjacent to each other, so these were identified as one larger historically sensitive area on the map (Figures 4a-4e). The inventory also included historical bridges over rivers, and historical bridges above the ROW, although these are not likely to be disturbed by excavations within the road ROW. In many cases, historically significant sites were found near the APE, but far enough removed that they were not included in the inventory. It was also found that some of the historical dwellings were far uphill or down below the APE where pipe installation would not occur. These locations were precluded from the inventory since there would be no disturbance to potentially sensitive areas.

IV. SUMMARY

In summary, it appears that Route C has more archaeologically sensitive areas than Route A. Route C had only one more area of precontact sensitivity identified than Route A; 17 as compared to 16. The more significant difference between the two routes is that much of Route A travels along a 20th century road that has far fewer areas of historical sensitivity since it was laid out through what appears to have been undeveloped farmland. Route A had a total of 41 areas of historical sensitivity, and most of these were individual lots or structures, while Route C had 54 identified areas of historical sensitivity, with many of these actually representing multiple structures or lots. Furthermore, Route C passes through a 19th century cemetery that was disturbed by the early 20th century rerouting of Route 208 across it (Photographs 3 and 4; Figure 4b). Although graves were removed from the roadbed and reinterred when Route 208 was constructed, it is possible that human remains that were not recovered at that time still exist within the ROW (HPI 2004). The differences between the two proposed corridors are more clearly evident by comparing Appendix A to Appendix B, and Figure 3 to Figure 4.

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www.davidrumsey.com
http://docs.unh.edu/nhtopos/nhtopos.htm

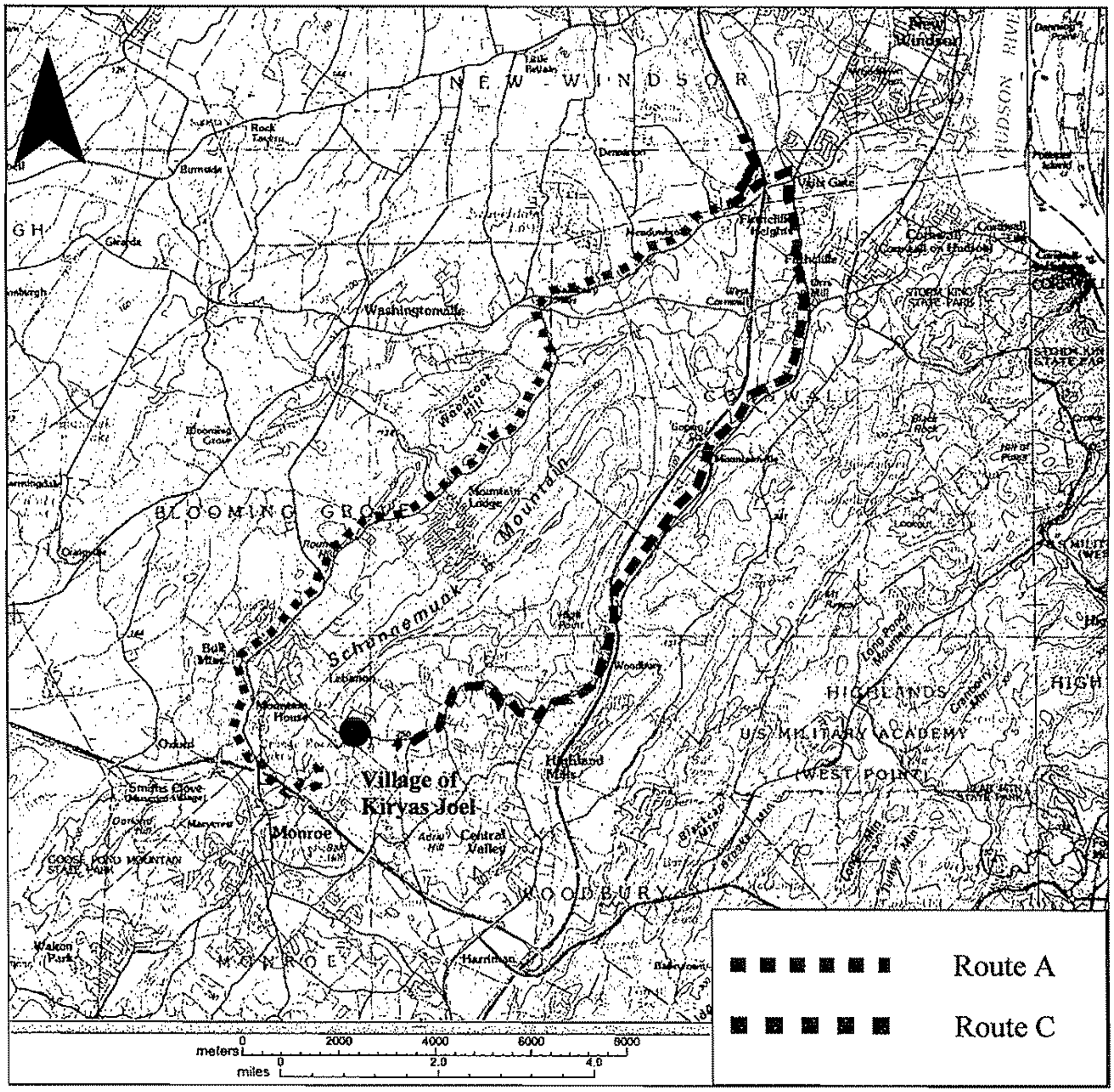


FIGURE 1

Proposed Catskill Aqueduct Connection Routes A and C. Walden, NY Quadrangle 1957; Maybrook, New York Quadrangle; Cornwall-On-Hudson Quadrangle 1957; Monroe Quadrangle 2000; and Popolopen Lake Quadrangle, 1999. United States Geological Survey.

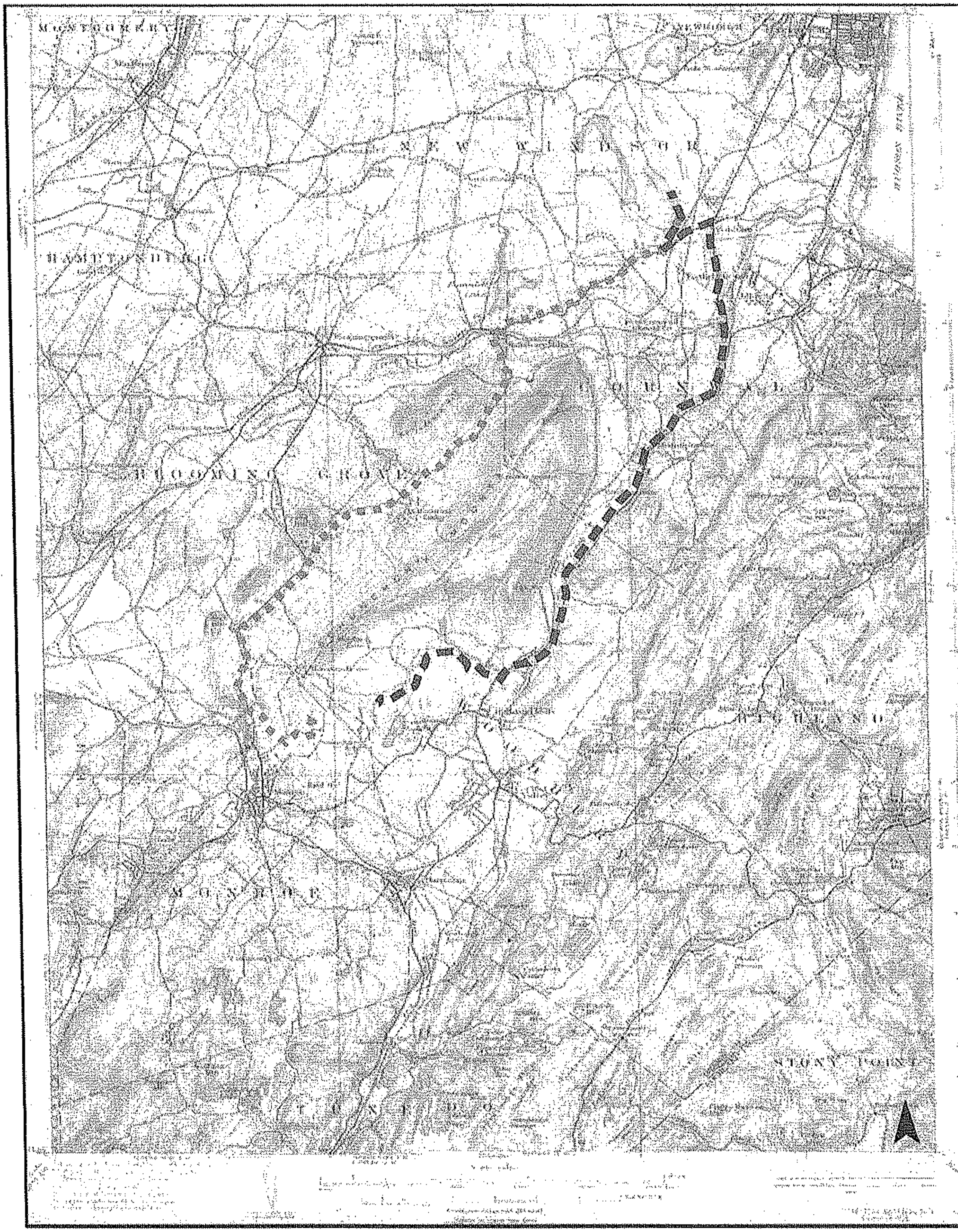
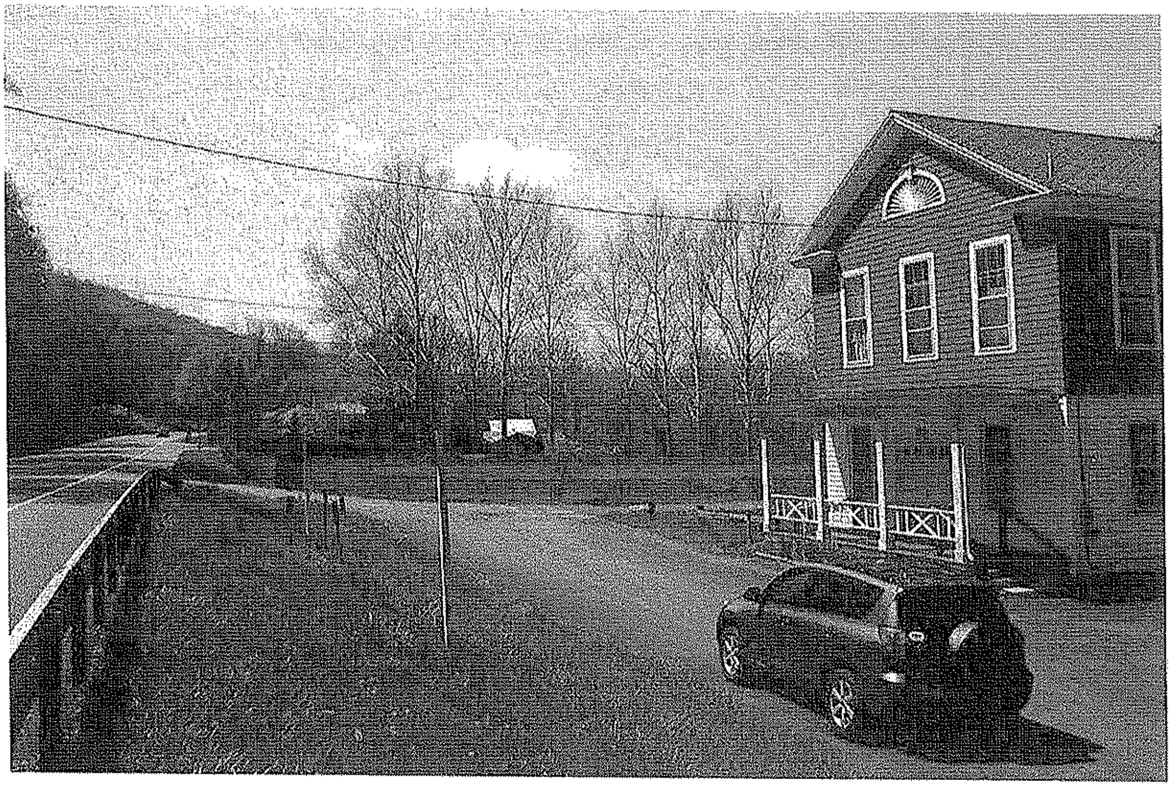
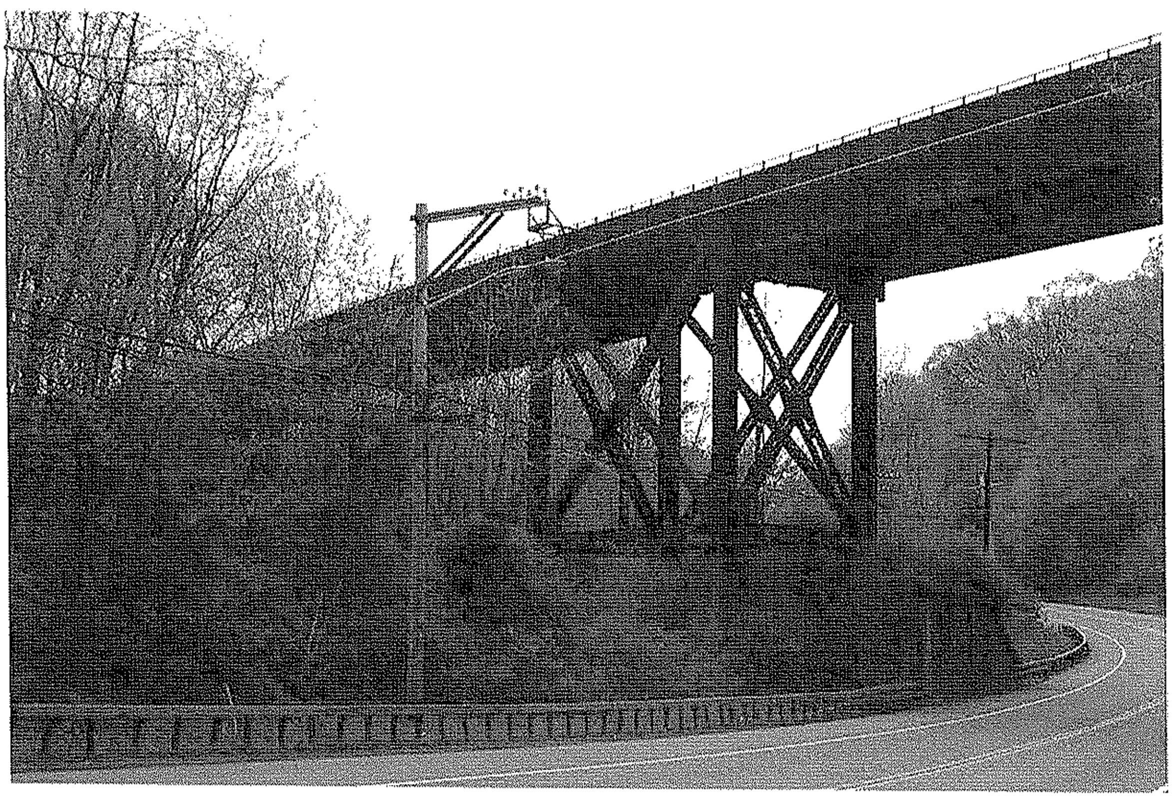


FIGURE 2

Proposed Catskill Aqueduct Connection Routes A and C. Schunemunk, NY Quadrangle, Edition of 1902, Reprinted 1931.



Photograph 1: NR Mountainville Grange Hall (currently used as a Masonic Temple) at 1641 Route 32 on its west side. Facing southwest. Corresponds to Appendix A and Figure 3b, Site Number A18.

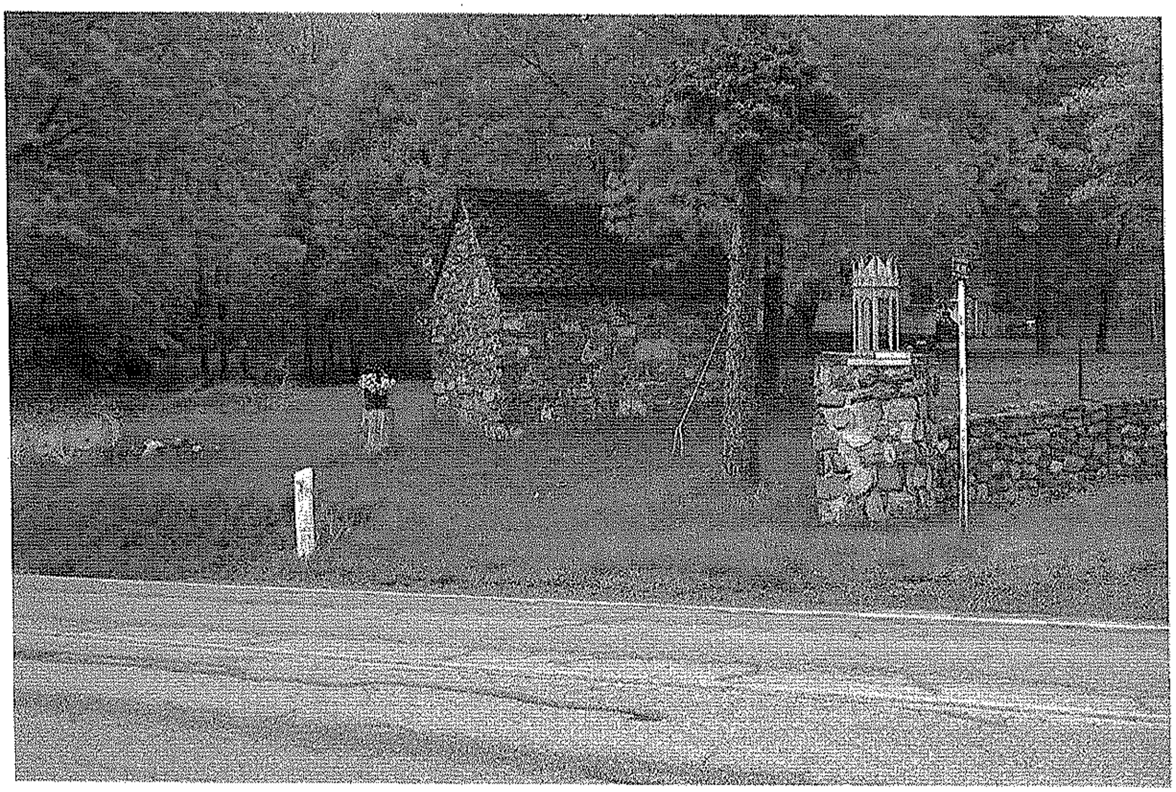


Photograph 2: Trestle Railroad Bridge over Route 32. Facing southeast. Corresponds to Appendix A and Figure 3d, Site Number A25.

Photograph 3: Western half of the identified 19th century cemetery on Route 208 on north side of Peddler Hill Road. Facing west. Corresponds to Appendix B and Figure 4b, Site Number C8.

Photograph 4: Eastern half of the identified 19th century cemetery on Route 208 opposite Peddler Hill Road. Facing northeast. Corresponds to Appendix B and Figure 4b, Site Number C8.

Photograph 5: Level floodplain sensitive for precontact resources, west side of Clove Road. Facing northwest. Corresponds to Appendix B and Figure 4d, Site Number C27.



Photograph 6: Stone building on west side of Clove Road, County Route 27, opposite Anne Lake Road. Facing southwest. Corresponds to Appendix B and Figure 4c, Site Number C13.

Site Numbers Correspond to Figure 3

Site #	Site Type	Description
A1	Precontact	Small area in level lawn on west side of Riley Road.
A2	Historic	Edmonston House, north side of Route 94 (NR).
A3	Historic	Location of dwellings on mid-19th century maps/atlases. No visible resources.
A4	Historic	Vacant lot on east side of Route 32 - appears to be former house site.
A5	Historic	house on east side of Route 32 - appears to be historic house site, but range on the lot is not entirely visible from the road.
A6	Historic	Possible historical dwelling on east side of Route 32 at #2392.
A7	Historic	Two house with stone foundation on east side of Route 32. #2372 appears historic; #2370 not definitively historic.
A8	Historic	Two historical dwellings on west side of Route 32. Probably Woodruff and Haskell houses. Included yard areas to north and south. North house stone, south house cape with clapboard and stone foundation.
A9	Both	Precontact knoll adjacent to Solid Rock Church. Site of former historical house.
A10	Historic	Site of Orrs Mills on east side of Route 32.
A11	Historic	Bridge over Moodna Creek at Orrs Mills.
A12	Historic	Historic mill and possible old bridge abutments.
A13	Historic	Saw mill on east side of Route 32. Currently in use as house; has stone foundation and is not on the water.
A14	Precontact	Knoll on west side of Route 32 overlooking Moodna Creek.
A15	Precontact	Knoll and level area along Moodna Creek on east and west sides of Route 32.
A16	Precontact	Knoll on west side of Route 32. Very small area due south immediately after Creamery Hill Road.
A17	Historic	Dwelling - house is far out of APE, but the barn and yard back up to Route 32.
A18	Historic	Masonic Temple at #1641 on west side of Route 32. Also Elias Hand house, but the house lot is set far back from the road.
A19	Historic	Two historical dwellings on west side of Route 32, just south of Industry Drive.
A20	Precontact	Flood Plain/terrace on east and west sides of Route 32.
A21	Both	Precontact area along creek, and fieldstone wall lined cattle run on west side of Route 32.
A22	Precontact	Small knoll on west side of Route 32, immediately south of Marantha Church and north of a small stream.
A23	Precontact	Small knoll on both sides of Route 32.
A24	Both	Stone wall and house on west side of Route 32, and level terrace sensitive for precontact on both sides of Route 32.
A25	Historic	Trestle bridge over Route 32.
A26	Historic	Sealed metal cap over well? More likely utilities, east side of Route 32.
A27	Historic	Possible stone foundation in woods on east side of Route 32. Large depression by mature trees, some stones aligned.
A28	Precontact	Knoll on east side of Route 32.
A29	Historic	Two dwellings at intersection of Route 32 and County Route 44. West side of Route 32, north side of County Route 44.
A30	Historic	Front yard of Highland Mills Church. Sign reads "Sanctuary built 1859." East side of Route 32, opposite County Route 44.
A31	Historic	Same house as in A29, but front yard facing Co. Rte. 44.
A32	Historic	Side yard along house at #349 Route 32, south side of Co. Rte. 44. Barn uphill. Includes another house on the south side of Co. Rte. 44 which was the Methodist parsonage in 1903.

A33	Both	Historic houses and terrace along stream, north side of Co. Rte. 44.
A34	Both	Historic houses and terrace along stream, both sides of Co. Rte. 44.
A35	Historic	Historic houses on the north side of Co. Rte. 44.
A36	Historic	Three historic houses on north side of Co. Rte. 44, # 132, 134, and 138.
A37	Historic	Two historic houses on south side of Co. Rte 44, prior to intersection with Seven Springs Road.
A38	Both	Historic house and terrace on north side of Co. Rte. 44/Seven Springs Road.
A39	Precontact	Level area on south side of Seven Springs Road
A40	Precontact	Level area on south side of Seven Springs Road, east of Bakertown Road.
A41	Historic	Vacant lot that is near mapped historic structure in 1859, east side of Route 32.
A42	Historic	House on west side of Route 32 at #2308.
A43	Historic	Two historic houses on east side of Route 32, immediately north of Boulder Road.
A44	Historic	Vacant lot that is near mapped historic structure in 1859, east side of Route 32.
A45	Historic	Vacant lot that is near mapped historic structure in 1859, east side of Route 32.
A46	Historic	Three dwellings on west side of Route 32, all on 1903 map. Now Savory Grill, next to 911 Route 32. Next to Highland Stone driveway to quarry. Much of the sensitive area is under pavement.
A47	Historic	Building on west side of Route 32, "Yesterday's Village Antiques." The back yard drops off precipitously away from APE, so only minimal area of sensitivity, and this is paved.
A48	Historic	Three historic structures on east side of Route 32, immediately south of Trestle.
A49	Historic	Vacant area, but looks like historic lot (ornamentals, etc...)
A50	Historic	Possible location of former school on west side of Ridge Road north of the intersection with Seven Springs Road.
A51	Historic	Foundation and lots on north side of Seven Springs Road, east of intersection with Bakerstown Road.

Site Numbers Correspond to Figure 4

Site #	Site Type	Description
C1	Historic	Historic foundation on east side of Route 208, and stone farm walls on west side of Route 208.
C2	Historic	House at 520 Route 208, east side.
C3	Historic	Vacant lot in location of former house site on west side of Route 208. May be
C4	Precontact	Knoll on west side of Route 208.
C5	Historic	Foundation on west side of Route 208 immediately north of Fairway Drive.
C6	Historic	House on west side of Route 208 north of Fairway Drive and historic dwelling (now "Mable Moran's Food and Drink") on east side of Route 208.
C7	Historic	Original road remains on west side of Route 208.
C8	Historic	Cemetery, both sides of Route 208, corner of Peddler Hill Road.
C9	Historic	House on east side of Route 208, set back from road with in area where mapped historical development may have been.
C10	Historic	Two structures on east side of Clove Road.
C11	Historic	West side of Clover road at Route 208, no visible remains but in area of mapped historic structures.
C12	Precontact	Knoll on east side of Clove Road.
C13	Both	Possible historical foundation and fieldstone building in area of mapped historical structures, and possible rockshelter areas on west side of Clove Road opposite Ann Lake Road.
C14	Historic	House on east side of Clove Road at #479.
C15	Both	Historic dwelling and knoll on west side of Clove Road. Note - house is set back
C16	Historic	Dwelling on east side of Clove Road, immediately south of Orchard Lake Drive.
C17	Historic	Vacant lots on west side of Clove Road where development shown in 1850s.
C18	Historic	House at #364 Clove Road. Included larger yard area where foundations/outbuildings may have once stood as per 1850 maps.
C19	Historic	Moffat-James-Kirby house on west side of Clover Road, north of Felter Hill Road, plus location of outbuilding foundations on the east side of the road, but south of Felter Hill Road.
C20	Historic	House on west side of Clover Road, and historic foundation on east side of road, adjacent to Woodard Road.
C21	Historic	House on West side of Clove Road.
C22	Precontact	Level terrace on east side of Clove Road.
C23	Historic	Dwelling at #292 Clove Road, on west side. Probably Tuthill House.
C24	Precontact	Level terrace on east side of Clove Road opposite gravel mining operation.
C25	Historic	House on east side of Clove Road, north of Lenape Camp. David C. Smith House.
C26	Historic	House on West side of Clove Road.
C27	Precontact	Level floodplain/terrace along west side of Clove Road along stream.
C28	Precontact	Level fields on east and west side of Clove Road near streams.
C29	Historic	Vacant lot on west side of Clove Road where there is demolition debris and swing set.
C30	Historic	Vacant area where mapped historic structures stood near Otterkill and Clove Road.
C31	Precontact	Fields on eat side of Clove Road.
C32	Both	House at #75 Clove Road on east side; West side has sensitive knoll.
C33	Historic	Stonehenge Farm on west side of Clove Road.
C34	Historic	Hope Chapel and Salisbury Mill, both sides of Clove Road.

C35	Historic	Salisbury Mills at Orrs Mill Road, immediately over Moodna Creek. Both sides of Clove Road.
C36	Historic	Dwellings on both sides of Clove Road north to Route 94.
C37	Historic	Houses on north and south sides of Route 94, #2073 and heading east.
C38	Historic	Dwellings at #2065 and #2061, south side of Route 94.
C39	Historic	Three houses on south side of Route 94.
C40	Historic	House on north side of Route 94, immediately west of large nursery.
C41	Historic	House on north side of Route 94, west side of Shore Drive.
C42	Historic	House on south side of Route 94, opposite Shore Drive.
C43	Historic	House on north side of Route 94.
C44	Historic	House on south side of Route 94, #1531.
C45	Historic	House on north side of Route 94, opposite C44.
C46	Historic	Bethlehem Church (NR) on north side of Route 94, and historical house on south side of Route 94.
C47	Precontact	Knoll near stream on north and south sides of Route 94.
C48	Historic	House on north side of Route 94, #1470.
C49	Both	House and barn located out of APE, although front of lot looks like outbuildings once stood there. Also precontact knoll. North side of Route 94.
C50	Historic	House north of Route 94 and east of Seaman Lane.
C51	Historic	House south of Route 94 at #1411. Immediately west of Crystal Court.
C52	Historic	House on the north side of Route 94 at #1396.
C53	Historic	House on the north side of Route 94 at #1390.
C54	Precontact	Knoll on north side of Route 94 west of Henry Lane.
C55	Historic	House on north side of Route 94 at #1360.
C56	Precontact	Knoll and house on south side of Route 94, opposite C55.
C57	Historic	House at corner of Route 94 and Meadowbrook Lane, South of Route 94, east of Meadowbrook.
C58	Historic	House on south side of Route 94 at corner of Shadowood Lane.
C59	Both	Possible historical house site and terrace on both sides of Route 94 between Shadowood Lane to Mt. Airy Road. Long flat area with parallel trees.
C60	Historic	House on south side of Route 94, immediately east of Mt. Airy Road. Historic Stone House
C61	Historic	House on south side of Route 94 at #1241.
C62	Historic	Possibly two historic houses on the south side of Route 94 at #1231 and #1229.
C63	Precontact	Knoll on both side of Route 94, and historic house on south side of Route 94. Possibly the Farrell House.
C64	Historic	Two dwellings on the north side of Route 94 at #1246 and #1240.
C65	Precontact	Small area in level lawn on west side of Riley Road.

PHASE IB ARCHAEOLOGICAL INVESTIGATION OF SENSITIVE AREA A-21

PROPOSED CATSKILL AQUEDUCT CONNECTION VILLAGE OF KIRYAS JOEL, ORANGE COUNTY, NEW YORK NYS 08PR04392

PHASE 1B ARCHAEOLOGICAL INVESTIGATION OF SENSITIVE AREA A-21

PROPOSED CATSKILL AQUEDUCT CONNECTION
VILLAGE OF KIRYAS JOEL
ORANGE COUNTY, NEW YORK
NYS 08PR04392

Prepared For:
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Prepared By:
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P.O. Box 3037
Westport, CT 06880

Author:
Faline Schneiderman-Fox, MA, RPA

Field Director:
William Sandy, MA, RPA

November, 2008

MANAGEMENT SUMMARY

SHPO Project Review Number (if available): **08PR04392 – formerly 02PR04346**

Involved State and Federal Agencies: **NYSDEC**

Phase of Survey: **Phase IB Archaeological Investigation**

Location Information
Location: **East and west sides of Route 32, immediately north of Cornwall/Woodbury border.**
Minor Civil Division: **07149, Cornwall**
County: **Orange**

Survey Area
Length: **225 m (738')**
Width: **30.5m or 15.25m on either side of highway (100'; 50' on either side of Route 32)**
Number of Acres Surveyed: **Surface Survey: 20; Shovel Tests: 19.5**

USGS 7.5 Minute Quadrangle Map: **Cornwall, NY**

Archaeological Survey Overview
Number & Interval of Shovel Tests: **30 Shovel Tests at 15m (49.5ft) intervals**
Number & Size of Units: **N/A**
Width of Plowed Strips: **N/A**
Surface Survey Transect Interval: **N/A**

Results of Archaeological Survey
Number & name of precontact sites identified: **None**
Number & name of historic sites identified: **Toll Gate Site**
Number & name of sites recommended for Phase II/Avoidance: **Toll Gate Site**

Report Authors(s): **Faline Schneiderman-Fox, M.A., R.P.A., Historical Perspectives, Inc.**

Date of Report: **November, 2008**

EXECUTIVE SUMMARY

The proposed Catskill Aqueduct Connection Project (Project) will provide a new source of water for the Village of Kiryas Joel, Orange County, New York. The new pipeline will connect the existing Catskill Aqueduct in the Town of New Windsor with, either the existing water treatment plant (WTP) in the Village of Kiryas Joel, or with a new WTP to be constructed in the Village of Kiryas Joel. The SEQRA review of the proposed construction of this 11-mile water pipeline requires the evaluation of project impact on areas of the alternative routes that are potentially sensitive for archaeological resources. Historical Perspectives, Inc. (HPI) conducted the required archaeological study of the sensitivity areas in a standard phased approach, correlating the extent of documentary research with the route-selection process (HPI 2003, 2004). Such a phased approach eliminated the possibility of unnecessary in-depth documentation and/or field testing on non-selected routes. To ensure that no adverse impacts to archaeological resources would result from construction of the Project, the New York State Office of Parks, Recreation, and Historic Preservation (OPRHP) approved an archaeological protocol , which provided for a sequence of testing, analysis, review, and avoidance. The protocol was incorporated as a special mitigation measure in the SEQRA Findings. Future state permits, including those by New York State Department of Environmental Conservation (NYSDEC), would incorporate this same protocol as a special condition.

In the fall of 2007, the New York State Appellate Division (Second Department), directed the Village, as SEQRA Lead Agency, to prepare an amended final environmental impact statement (AFEIS) that includes a site specific and design-specific Phase 1B archaeological study in appropriate sensitive areas along the proposed pipeline routes.

HPI's initial Phase IA technical report and a subsequent amendment identified sensitivity zones for three pipeline routes (HPI 2003, 2004). Subsequent to the Court's ruling, a more exhaustive pedestrian survey, additional documentary research, and detailed mapping of potentially sensitive areas were undertaken for two of the proposed routes, Routes A and C, with A being the easternmost corridor and C being the westernmost corridor (HPI 2008) (the "refinement study"). Alternative Route B has been eliminated from consideration due to the difficulty in siting the pipeline along the New York State Thruway. The goal of the refinement study was to expertly narrow the sensitivity zones to reflect archival data, the current design plans, and existing field conditions within the sensitivity zone of alignments A and C. To assist with this review, the engineering team further refined the Area of Potential Effect (APE) for both alignments. For both alternatives, the APE includes the road right-of-ways (ROW) extending 15.25m (50ft) on either side of the paved road, as well as the area directly within the roadway itself. The engineers provided HPI with a detailed map delineating the two pipeline routes. The APE was determined in the field.

For the refinement study, mapped or identified historical resources more than 300' (roughly 90 meters) outside of the project site were excluded from the area of subsurface sensitivity. This included houses, barns, outbuildings, and other features that fronted onto old roads that paralleled the existing ROW, so that all portions of their yard were far removed from the APE. Exceptions to this were historical complexes that had their backyard areas abutting the APE, which were included as potentially sensitive areas.

In addition, especially where the APE coincided with modern roads that did not follow historical roads, areas in the APE that exhibit extensive evidence of cutting and filling to create the existing roadbed were considered disturbed and lacking in archaeological sensitivity. Finally, potentially sensitive areas within the APE that are above or below the existing street bed corridor by more than 3m (roughly 10 ft) were excluded due to the impracticability of placing the pipeline in these areas. Therefore, the refinement study resulted in the delineation of the undisturbed areas within the APE identified as potentially sensitive for precontact and/or historical resources.

The refinement study found that Route C (western route) has more archaeologically sensitive areas than Route A (HPI 2008). The most significant difference between the two routes is that much of Route A (eastern route) travels along a 20th century road that has far fewer areas of historical sensitivity since it was laid out through what appears to have been undeveloped farmland. Route A had a total of 41 areas of historical sensitivity, and most of these were individual lots or structures, while Route C had 54 identified areas of historical sensitivity, with many of these actually representing multiple structures or lots. Route C also passes through a 19th century cemetery that was disturbed by the early 20th century rerouting of Route 208 across it. Although records indicate that graves were removed from the roadbed and reinterred when Route 208 was constructed, it is possible that human remains that were not recovered at that time still exist within the ROW (HPI 2004).

Pursuant to the testing protocol, sites or areas of sensitivity that have no documented or field verified disturbance were identified for standard Phase IB archaeological testing. For Route C, the area in the vicinity of the cemetery was identified as one such sensitive location. Due to the inherent difficulty of conducting a Phase 1B study of an area that may disturb human remains, the decision was made to defer study of this area pending results from other areas and final determination that this route would continue to be the preferred route for the pipeline. A Phase IB study of a sensitive area within Route A, the easternmost route, was undertaken. This area was selected based on a review of the sensitivity analysis conducted along this route. This area was identified as potentially undisturbed and sensitive for both precontact and historical resources during the prior refinement study, and was identified as location Area A-21.

The Phase IB archaeological study of this sensitive area was undertaken in August 2008 over the course of two days by a team of three archaeologists. Thirty 40x40cm (15.8x15.8in) hand excavated shovel tests (STs) were completed within the ROW along both sides of Route 32 in Cornwall, New York immediately north of the Cornwall-Woodbury border.

The Phase IB study found no precontact material in any of the 30 STs excavated. Historical and modern material was limited to a small assortment of 19th and 20th century artifacts, most post-dating the construction of Route 32 in the 1930s. Three STs on the east side of Route 32 contained 19th century material: STs 7, 11, and 12. A stone foundation was noted about 7.25m (24.6ft) east of the ROW boundary near ST3, so it is possible that these historic artifacts relate to this former structure. However, the positive STs are located 60, 129, and 135m (98.5, 425, and 443ft) north of ST3, so their relationship is not certain. A review of historical maps and atlases show that in 1851 a Toll Gate stood to the east of Route 32 in the approximate vicinity of the three positive STs, and that to the south of this was the F. Smith farmhouse. However, the exact locations of these former structures are uncertain given the age of the historic maps and changes to the landscape. By 1903 there were no structures in this area, although the "Houghton Farm" house may have stood near the north end of the APE on the east side of Route 32. Artifacts from the three positive STs are more likely related to one of these structures, and are hereafter referred to as the Toll Gate site.

Information gained by this Phase 1B testing will be used to locate the water pipeline so as not to impact the existing resources in this specific section of Route A. In the event that the final pipeline route is located on the east side of Route 32 in the vicinity of the positive STs and stone wall, then, additional archaeological investigations and documentary research would be required to determine the significance of the site, and to more firmly associate artifacts with a specific source.

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FIGURES

PHOTOGRAPHS

I. INTRODUCTION

The proposed Catskill Aqueduct Connection Project (Project) will provide a new source of water for the Village of Kiryas Joel, Orange County, New York. The new pipeline will connect the existing Catskill Aqueduct in the Town of New Windsor with, either the existing water treatment plant (WTP) in the Village of Kiryas Joel, or with a new WTP to be constructed in the Village of Kiryas Joel (Figure 1). The SEQRA review of the proposed construction of this 11-mile water pipeline requires the evaluation of project impact on areas of the alternative routes that are potentially sensitive for archaeological resources. Historical Perspectives, Inc. (HPI) conducted the required archaeological study of the sensitivity areas in a standard phased approach, correlating the extent of documentary research with the route-selection process (HPI 2003, 2004). Such a phased approach eliminated the possibility of unnecessary in-depth documentation and/or field testing on non-selected routes. To ensure that no adverse impacts to archaeological resources would result from construction of the Project, the New York State Office of Parks, Recreation, and Historic Preservation (OPRHP) approved an archaeological protocol, which provided for a sequence of testing, analysis, review, and avoidance. The protocol was incorporated as a special mitigation measure in the SEQRA Findings. Future state permits, including those by New York State Department of Environmental Conservation (NYSDEC), would incorporate this same protocol as a special condition.

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II. FIELD METHODS

Prior to the commencement of fieldwork, a State of New York Department of Transportation Highway Work Permit was obtained (Permit No. 08-08-0479 dated 8/20/2008). As per the Permit, archaeological field testing consisted of the completion of a series of hand-excavated STs to investigate the identified undisturbed sensitive site area for artifacts and/or features, which may exist beneath the surface within the ROW. As noted, for purposes of this investigation, the ROW extends to approximately 15m (50') on either side of Route 32. Fieldwork was designed to ascertain the presence or absence of prehistoric and historical cultural resources on the site.

Each soil stratum encountered during field testing was explored and documented and the cultural materials in each level were noted in order to determine their context and integrity as well as to further ascertain whether or not any potential *in situ* cultural resources or features were extant. All of the STs were hand excavated and soil was sifted through ¼-inch screen. Recovered modern material was noted on the field forms, but not all modern material was collected. All precontact material and the historical artifacts were collected and bagged in the field. The artifact assemblage was cataloged in the laboratory (see Appendix 2). Further, appropriate field notations, drawings, and photographs were made during field testing and the result of each ST was documented (see Appendix 1 and Photographs 1-3). All work was done in accordance with the 1994 New York Archaeological Council (NYAC) guidelines, and the May 2005 New York State Historic Preservation Office (SHPO) *Formatting Requirements.*

The location selected for the sample testing was chosen because it was designated as potentially sensitive for both precontact and historical archaeological resources in the previous refinement study (HPI 2008). Designated Area A-21 was considered potentially sensitive for precontact resources because there were no obvious signs of disturbance along either side of the highway, and there was minimal development within the ROW (Figure 2). The site also was considered potentially sensitive for historical archaeological resources because the corridor of existing Route 32 here parallels the historical corridor of Route 32, now immediately to the east. Therefore, the existing Route 32 corridor essentially runs across what would have been the back yards of historic dwellings, albeit somewhat removed from the structures. Also, a fieldstone foundation was observed on the east side of Route 32 in this area during the pedestrian review of the corridor during the refinement study. Finally, historical records report that there was a revolutionary war encampment somewhere east of Woodbury Creek (Smith 1936, depicting conditions pre-1810). The inventoried site, USN # 07120.000207, is reported in Woodbury, New York along Route 32, east of the Woodbury Creek. However, since no additional information was available about the encampment's whereabouts, it quite possibly could have extended north along the creek onto the terrace immediately west of Route 32 in this area.

III. FIELDWORK RESULTS

The Phase IB archaeological study of this sensitive area was undertaken in August 2008 over the course of two days by a team of three archaeologists under the direction of William Sandy, RPA. Thirty 40x40cm (15.8x15.8in) STs were completed within the ROW along either side of Route 32 (Figure 2). This area was identified as potentially undisturbed and sensitive for both precontact and historical resources during the prior refinement study.

STs were spaced at a 15-meter (49.2-foot) interval for a total testing area length of about 225m (738ft) on either side of Route 32 (Appendix 1 and Photographs 1-3). The STs were excavated in locations with less than 12 percent slope and without exposed bedrock or obvious signs of prior disturbance (e.g., an existing road with culvert). In addition to assigning coordinates to each ST, sequential numbers were assigned for ease of discussion. In the following discussion, ST numbers correspond to those demarcated in Appendices 1 and 2, and on Figure 3.

The Phase IB study found no precontact material in any of the 30 STs (Appendix 1). Historical and modern material was limited to a small assortment of 19th and 20th century artifacts, most post-dating the construction of Route 32 in the 1930s (Appendix 2). Three STs on the east side of Route 32 contained 19th century material: STs 7, 11, and 12 (Figure 3; Appendix 2). ST7 possessed one fragment of yellowware (ca.1830-1940), while STs 11 and 12 contained one cut nail each (ca.1820-1900). A stone foundation was observed about 7.25m (24.6ft) east of the ROW boundary near ST3, so it is possible that these historic artifacts relate to this former structure. However, the positive STs are located 60m, 129m, and 135m (98.5ft, 425ft, and 443ft) north of ST3, so their relationship, if any, is not certain.

A review of historical maps and atlases depicting the approximate location of the positive STs found that a Toll Gate and the F. Smith house stood on what is now the east side of Route 32 (Sidney 1851). While the Toll Gate was in the vicinity of the three positive STs, the F. Smith house appeared to have stood north of where the fieldstone foundation was observed (Sidney 1851). However, the exact location of these former structures is uncertain given the age of the historic maps and changes to the landscape. By 1903, there were no structures in this area, although the "Houghton Farm" house may have stood near the north end of the APE on the east side of Route 32 (Lathrop 1903). Therefore, the historical artifacts are more likely associated with one of these structures.

IV. CONCLUSIONS AND RECOMMENDATIONS

The Phase 1B study area was identified as potentially undisturbed and sensitive for both precontact and historical resources during the prior refinement study, and was identified as location Area A-21. The Phase IB archaeological study of this area was completed in August 2008 with the completion of 30 STs. These were completed within the ROW along both sides of Route 32 in Cornwall, New York immediately north of the Cornwall-Woodbury border.

The Phase IB study found no precontact material in any of the 30 STs excavated. Historical and modern material was limited to a small assortment of 19th and 20th century artifacts, most post-dating the construction of Route 32 in the 1930s. Three STs on the east side of Route 32 contained 19th century material: STs 7, 11, and 12. A stone foundation was noted about 7.25m (24.6ft) east of the ROW boundary near ST3, so it is possible that these historic artifacts relate to this former structure. However, the positive STs are located 60, 129, and 135m (98.5, 425, and 443ft) north of ST3, so their relationship is not certain. A review of historical maps and atlases show that in 1851 a Toll Gate stood to the east of Route 32 in the approximate vicinity of the three positive STs, and that to the south of this was the F. Smith farmhouse. However, the exact locations of these former structures are uncertain given the age of the historic maps and changes to the landscape. By 1903 there were no structures in this area, although the "Houghton Farm" house may have stood near the north end of the APE on the east side of Route 32. Artifacts from the three positive STs are more likely related to one of these structures, and are hereafter referred to as the Toll Gate site.

Information gained by this Phase 1B testing will be used to locate the water pipeline so as not to impact the existing resources in this specific section of Route A. In the event that the final pipeline route is located on the east side of Route 32 in the vicinity of the positive STs and stone wall, then, additional archaeological investigations and documentary research would be required to determine the significance of the site, and to more firmly associate artifacts with a specific source.

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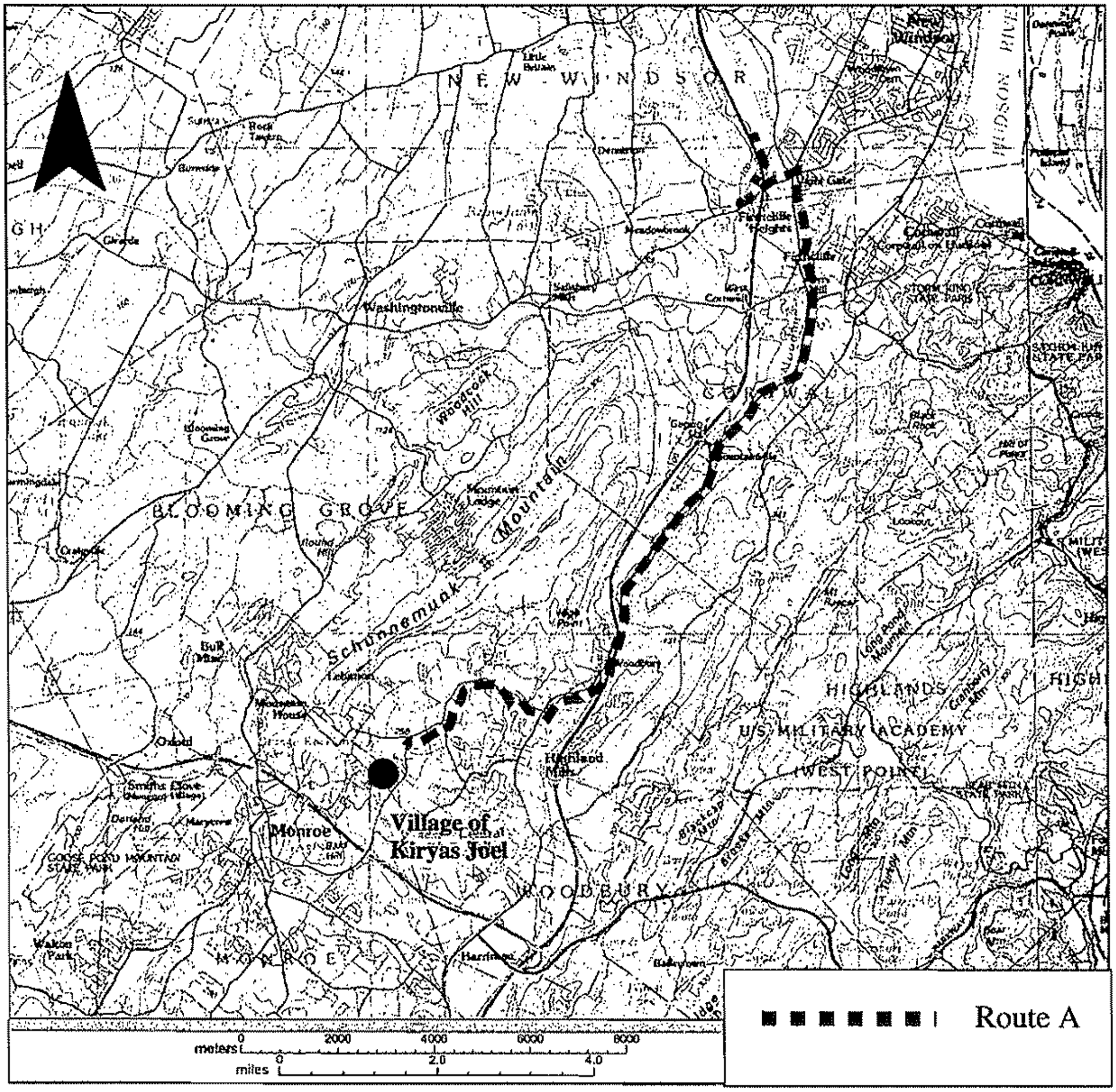
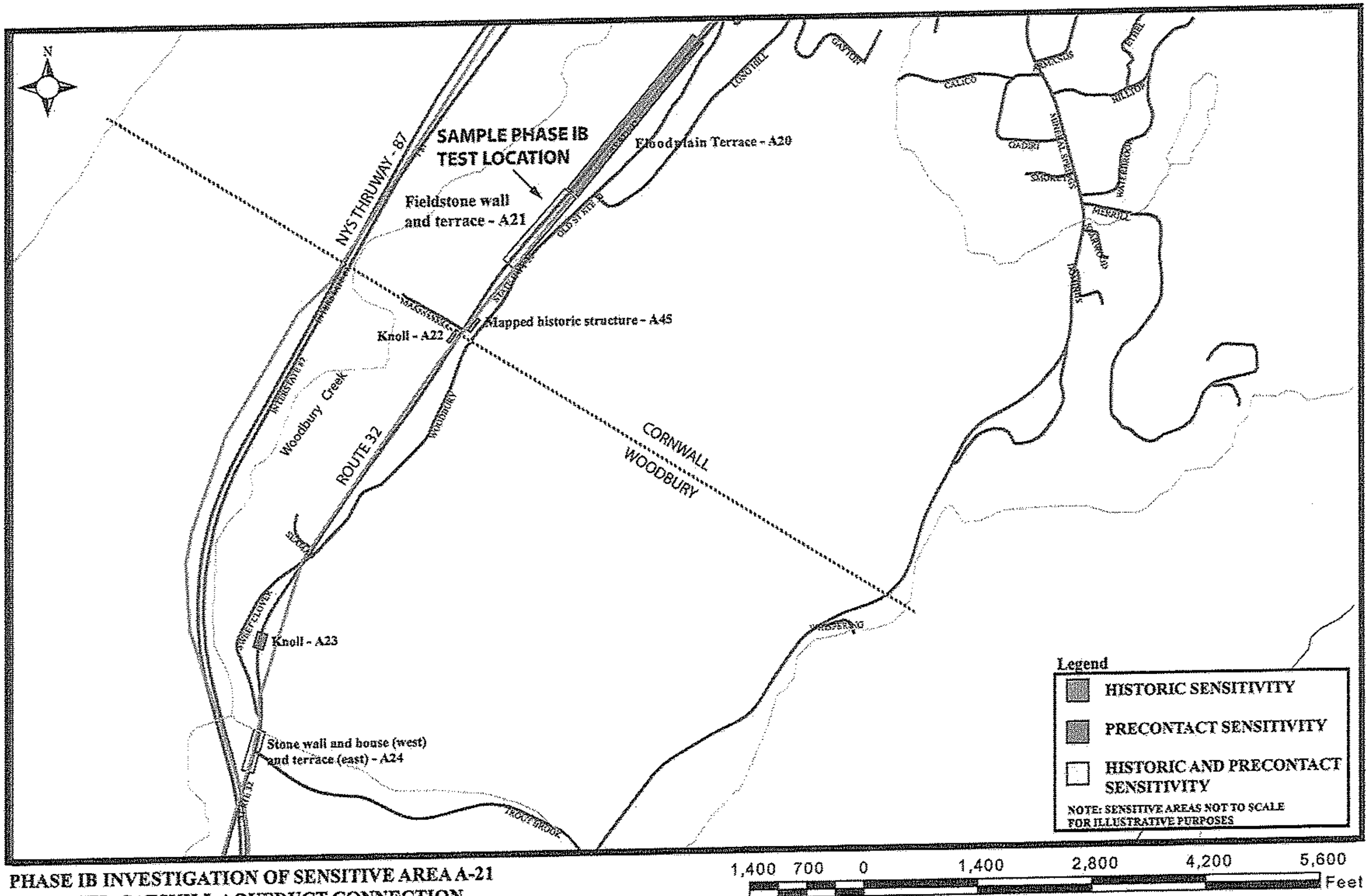


FIGURE 1

Proposed Catskill Aqueduct Connection Route A. Walden, NY Quadrangle 1957; Maybrook, New York Quadrangle; Cornwall-On-Hudson Quadrangle 1957; Monroe Quadrangle 2000; and Popolopen Lake Quadrangle, 1999. United States Geological Survey.



PHASE IB INVESTIGATION OF SENSITIVE AREA A-21
PROPOSED CATSKILL AQUEDUCT CONNECTION
VILLAGE OF KIRYAS JOEL, ORANGE COUNTY, NEW YORK

FIGURE 2: Route A Areas of Precontact and Historical Archaeological Sensitivity within the ROW in Cornwall, immediately north of Woodbury town line.

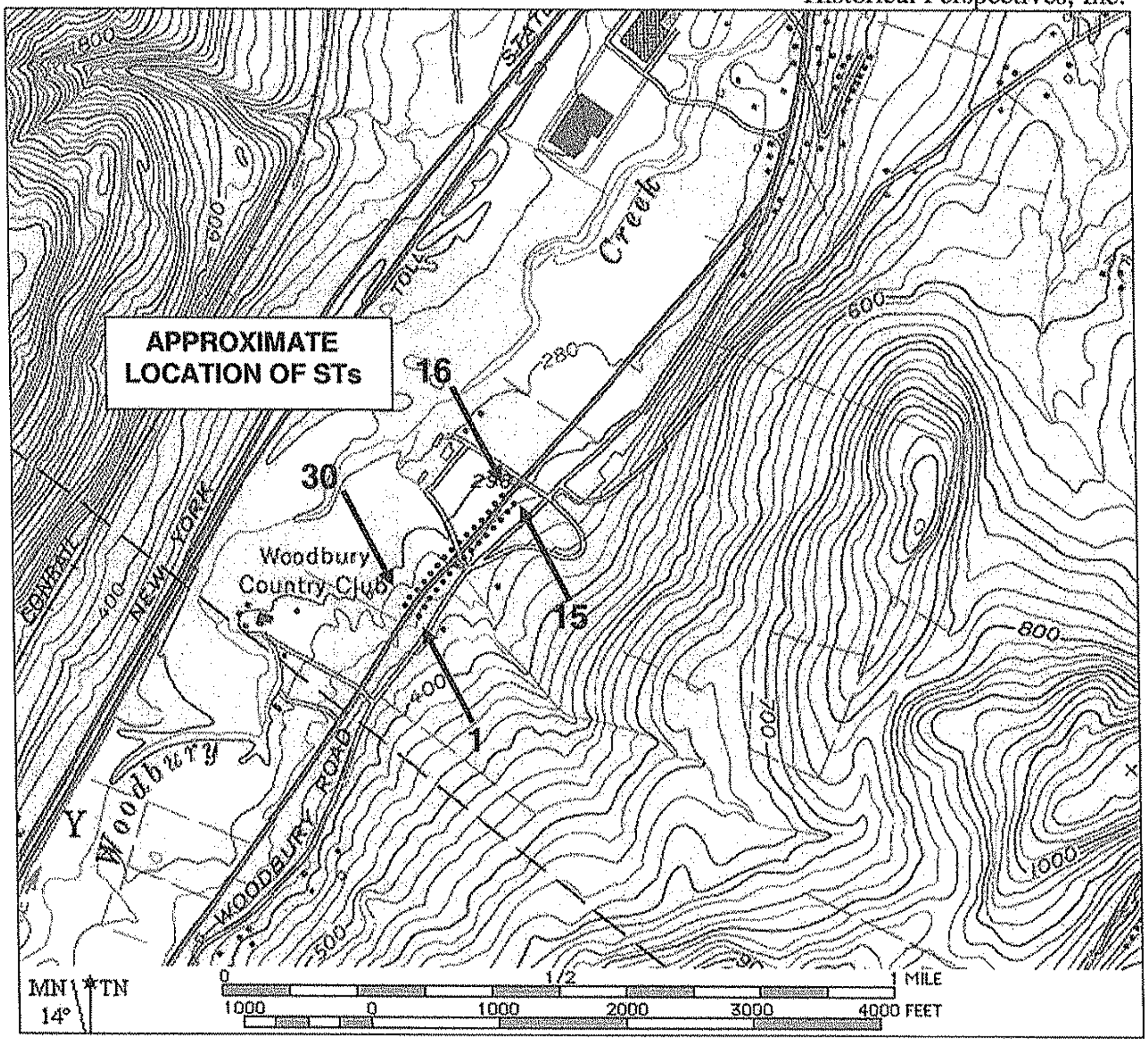


FIGURE 3:

Approximate Location of STs (1-30) Within Route 32 Right-of-Way.
Cornwall-On-Hudson Quadrangle, 1957. United States Geological Survey.

(Note: No engineering plans have yet been created for the proposed project. Therefore, no larger scale maps on which to plot ST locations are available).

Area	ST #	Grid Location	Level	Horizon	Depth cmbs	Soil Color	Soil Description	Cultural Material	Comments/Reason for Termination
A21	1	N0E3	1	C	0-35	10YR4/4	gravelly loam	bottle glass	Sterile Subsoil
A21	2	N15E1	1	A/Fill	0-29	10YR3/2	silty loam	Styrofoam, plastic, glass	
A21	2	N15E1	2	B	29-45	10YR5/3	gravelly loam sand	NCM	Sterile Subsoil
A21	3	N30E6	1	A	0-9	10YR3/2	silty loam	NCM	truncated A
A21	3	N30E6	2	B	9-46	10YR5/4	gravelly loam	NCM	Sterile Subsoil
A21	4	N45E5	1	A	0-14	10YR3/2	silty loam	auto glass	
A21	4	N45E5	2	B	14-58	10YR5/4	gravelly loam	NCM	Sterile Subsoil
A21	5	N60E6	1	A	0-14	10YR3/2	silty loam	barbed wire, plastic	
A21	5	N60E6	2	B	14-59	10YR5/4	gravelly loam	NCM	Sterile Subsoil
A21	6	N75E6	1	A	0-15	10YR3/2	silty loam	coal	
A21	6	N75E6	2	B	15-46	10YR5/4	gravelly loam	NCM	Sterile Subsoil
A21	7	N90E6	1	A	0-26	10YR3/2	silty loam	yellow ware glass	
A21	7	N90E6	2	B	26-55	10YR5/4	gravelly loam	NCM	Sterile Subsoil
A21	8	N105E6	1	A	0-9	10YR3/2	silty loam	NCM	truncated A
A21	8	N105E6	2	B	9-44	10YR6/4	silty loam	NCM	Sterile Subsoil
A21	9	N115E6	1	A	0-5	10YR3/3	silty loam	NCM	truncated A
A21	9	N115E6	2	B	5-40	10YR6/4	silty loam	NCM	Sterile Subsoil
A21	10	N135E7	1	A	0-9	10YR4/3	silty loam	fan belt, ceramic, nail, plastic	
A21	10	N135E7	2	B	9-40	10YR4/4	loam	NCM	Sterile Subsoil
A21	11	N159E7	1	A	0-14	10YR3/3	silty loam	glass, can, fabric, nail	
A21	11	N159E7	2	B	14-43	10YR4/6	gravelly loam	NCM	Sterile Subsoil
A21	12	N165E7	1	A	0-12	10YR3/3	silty loam	nail, coal, ceramic,	
A21	12	N165E7	2	B	12-44	10YR4/6	gravelly loam	NCM	Sterile Subsoil
A21	13	N180E5	1	A	0-8	10YR3/3	silty loam	NCM	
A21	13	N180E5	2	B	8-40	10YR4/6	compact stony loam	NCM	Sterile Subsoil
A21	14	N195E5	1	A	0-26	10YR3/3	silty loam	NCM	
A21	14	N195E5	2	B	26-56	10YR4/6	stony loam	NCM	Sterile Subsoil
A21	15	N210E5	1	A	0-18	10YR4/3	silty loam	NCM	
A21	15	N210E5	2	B	18-49	10YR4/6	stony loam	NCM	Sterile Subsoil
A21	16	N210W20	1	A	0-22	10YR3/3	silty loam	NCM	
A21	16	N210W20	2	B/C	22-42		gravelly loamy sand	NCM	Sterile Subsoil
A21	17	N195W20	1	A	0-29	10YR3/3	silty loam	NCM	
A21	17	N195W20	2	B	29-53	10YR4/6	gravelly silty loam	NCM	Sterile Subsoil
A21	18	N180W20	1	A	0-16	10YR3/3	silty loam	NCM	
A21	18	N180W20	2	B	16-40	10YR4/6	gravelly silty loam	NCM	Sterile Subsoil
A21	19	N165W20	1	A	0-10	10YR3/3	silty loam	Styrofoam	

RECORD OF ST
EXCAVATIONS

Area	ST #	Grid Location	Level	Horizon	Depth cmbs	Soil Color	Soil Description	Cultural Material	Comments/Reason for Termination
A21	19	N165W20	2	B	10-38	10YR4/4	compact loam	NCM	Sterile Subsoil
A21	20	N152W17	1	A	0-20	10YR3/3	silty loam	glass, coal ash	
A21	20	N152W17	2	B	20-42	10YR4/6	gravelly loam	NCM	Sterile Subsoil
A21	21	N125W15	1	A	0-16	10YR3/2	silty loam	Styrofoam, glass, bolt	offset South
A21	21	N125W15	2	B	16-49	10YR4/4	gravelly loam	NCM	Sterile Subsoil
A21	22	N120W19	1	A	0-13	10YR3/3	silty loam	NCM	
A21	22	N120W19	2	B	13-43	10YR5/6	sandy loam	NCM	
A21	22	N120W19	3	C	43-69	10YR4/6	gravelly loamy sand	NCM	Sterile Subsoil
A21	23	N105W20	1	A	0-22	10YR3/3	silty loam	container glass	
A21	23	N105W20	2	B	22-50	10YR5/6	sandy loam	NCM	Sterile Subsoil
A21	24	N90W19	1	A	0-25	10YR3/3	silty loam	Styrofoam, glass	
A21	24	N90W19	2	B	25-53	10YR4/6	sandy loam	NCM	Sterile Subsoil
A21	25	N75W18	1	A/Fill	0-43	10YR3/3	silty loam	Styrofoam	
A21	25	N75W18	2	B	43-51	10YR4/6	gravelly loam	NCM	Sterile Subsoil
A21	26	N60W19	1	A	0-20	10YR3/3	silty loam	Styrofoam, glass	
A21	26	N60W19	2	B	20-50	10YR4/6	silty loam	NCM	Sterile Subsoil
A21	27	N45W19	1	A	0-13	10YR3/3	silty loam	paper	
A21	27	N45W19	2	B	13-50	10YR5/4	gravelly sandy loam	NCM	Sterile Subsoil
A21	28	N30W19	1	A	0-15	10YR3/3	silty loam	paper	
A21	28	N30W19	2	B	15-48	10YR5/4	gravelly sandy loam	NCM	Sterile Subsoil
A21	29	N15W20	1	A	0-6	10YR3/3	silty loam	NCM	truncated A
A21	29	N15W20	2	B	6-32	10YR4/6	stony sandy loam	NCM	Sterile Subsoil
A21	30	N1W17	1	A	0-30	10YR3/3	silty loam	Styrofoam, glass, plastic, aluminum	offset 1m North
A21	30	N1W17	2	B	30-53	10YR4/6	gravelly sandy loam	NCM	Sterile Subsoil

CATALOG OF RECOVERED ARTIFACTS

Test Unit	Grid Location	Level/ Horizon	#	Functional Group	Class	Material	Type	Object	Part	Description
7	N90E60	1/A	1	food related	glass	clear	machine made	bottle	body fragment	
7	N90E60	1A	1	food related	ceramic	earthen ware	yellowware	vessel	fragment	(1830-1940)
10	N135E7	1/A	1	architectural	metal	steel	wire	nail	whole	asphalt nail
10	N135E7	1/A	1	unaffiliated/ personal	ceramic	earthen ware	red body	flower pot	fragment	
11	N159E7	1/A	1	architectural	metal	iron	cut	nail	whole	very rusted (1820-1900)
12	N165E7	1/A	1	architectural	metal	iron	cut	nail	whole	very rusted (1820-1900)
12	N165E7	1/A	1	architectural	metal	steel	wire	staple	whole	
12	N165E7	1/A	1	food related	ceramic	earthen ware	white bodied	plate	body fragment	undecorated
16	N210W20	1/A	4	food remains	organic	bone	mammal	vertebrae	whole	large mammal-probably cow
23	N105W20	1/A	1	food related	glass	clear	machine made	bottle	body fragment	thin
26	N60W19	1/A	1	food related	other	styrafoam	white	cup	fragment	
26	N60W19	1/A	1	food related	glass	clear	machine made	bottle	body fragment	

Photograph 1: East side of Route 32, facing northeast from west side of Route 32 to location of ST 14.

Photograph 2: East side of Route 32, facing north from ST14 to ST15.

Photograph 3: Close up of ST 14, facing north.
Note: Menu board is erroneously labeled Route B.

Appendix N

Growth Study for Village of Kiryas Joel Amended FEIS for the Proposed Connection to the New York City Catskill Aqueduct

Prepared for
Village of Kiryas Joel
Board of Trustees
Municipal Building
P.O. Box 566
Monroe NY 10950

Prepared by
AKRF, Inc.
440 Park Avenue South, 7th Fl.
New York NY 10016

January 2009

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AKRF is a multidisciplinary consulting firm specializing in environmental, planning, and engineering services. Founded in 1981, the firm brings together the talents of more than 220 employees in six locations to complete a wide variety of projects for public agencies, private clients, and municipalities. AKRF's professional staff—many of whom are recognized industry leaders with many years of experience—include urban planners, economists, historians, air quality and noise analysts, civil engineers, transportation planners, and hazardous materials specialists.

The AKRF Economics Division offers a variety of expert economic analysis services and crafts strategic, practical, and innovative solutions for a wide range of complex and challenging issues. The Economics Division team includes economists, planners, and real estate development specialists with expertise in economic impact analysis, modeling and forecasting, demographic analysis, market studies, public policy analysis, and long-range planning for a wide range of public sector clients, including municipal, state and federal governments, industrial development agencies, and port authorities, as well as private sector clients such as real estate developers, retailers, institutions, and lenders.

This report was prepared in response to the October 9, 2007 court order issued by the Supreme Court of the State of New York, mandating that the Village of Kiryas Joel prepare an amended Final Environmental Impact Statement (FEIS) that analyzes the growth-inducing effects of their proposed connection to the New York City Catskill aqueduct. In that decision and order, the Supreme Court found that "the DEIS and the FEIS provided no demographic analysis or projections with respect to the effect of the availability of a steady and stable supply of potable water on population movement into or out of the Village, other than a conclusory assumption that the Village birth rate would continue to grow at a steady rate of 6% per year, and thus failed to take a 'hard look' at the secondary impacts of the project." The following report presents detailed population projections for the Village of Kiryas Joel, as well as demographic data to supplement what was previously provided in the FEIS.

The report is organized into three sections. Section A presents demographic data for the Village of Kiryas Joel and compares the demographic characteristics of the Village to other communities with high concentrations of Hasidic population and to the counties in which these communities are located. Section B presents population projections for the Village from 2000 through 2030, and outlines the methodology and assumptions used to develop these projections. Section C considers whether the proposed Project would have the potential to significantly affect growth trends in the Village.

The analysis indicates that the rate of population growth in the Village of Kiryas Joel has been high over the past several decades, compared not only to Orange County but to other communities with substantial Hasidic populations, and that the Village will continue to grow at a substantial rate due primarily to the religious and social norms of Hasidic Judaism. As highlighted in Section A below, compared to the counties in which they are located, communities with a high concentration of Yiddish speakers (a proxy for Hasidic population) have a higher proportion of married-couple families, larger family sizes, and higher population growth rates. Many of these characteristics are magnified in Kiryas Joel where approximately 89 percent of the population is Hasidic.

Population projections for Kiryas Joel were based on three key factors: births, deaths, and migration. Custom tabulations using 2000 Census Public Use Microdata Sample (PUMS) data were used to estimate an average number of children born to Kiryas Joel households (6 children per household). Births were spread across the female population based on information from the Village and other sources on typical marrying age for Hasidic women (age 18 to 19), and extrapolated to 2030. Annual deaths were projected based on New York State data from the National Center for Health Statistics. Net in-migration was estimated based on data obtained through the Census and from household count and marriage records from the Village. These data indicate that in-migration is a small contributor to overall population growth in Kiryas Joel and that the percent of total population that is in-migrant will decrease further in the future. Overall, due primarily to the large family sizes encouraged through the social and religious norms of Hasidic Judaism, the Village population is expected to grow from 13,138 in 2000 to an estimated 50,530 in 2030.

These projections do not specifically consider the potential effect of factors such as availability of land, water, or other infrastructure on population growth. However, for reasons described below (e.g., large family sizes, social and religious norms) such potential constraints are unlikely to have a substantial effect on population trends in the Village of Kiryas Joel. This is evidenced by the significant population growth and decreasing rate of in-migration that has occurred during recent shortages in both water and sewer infrastructure. The constancy of population and in-migration patterns through fluctuations in water and sewer supply indicates that the proposed Project is unlikely to have a significant effect on internal growth and in-migration patterns in the Village.

A. COMMUNITY COMPARISON

As indicated in the 2004 FEIS, the Village of Kiryas Joel has notable demographic characteristics compared to neighboring municipalities. The Village's population growth between 1990 and 2000 (77 percent) dwarfed population growth in the balance of the Town of Monroe (17 percent) and in Orange County as a whole (11 percent). Median age (15 years) was less than half the county median (35 years) and the average household size (5.7 persons per household) was almost twice the county average of 3.0 persons per household.

These differences are primarily due to the relative youth (years in existence) of the Kiryas Joel community and the cultural customs and religious imperatives of its residents. Kiryas Joel was incorporated in 1977 as an offshoot of the Satmar Hasidic sect of Williamsburg, Brooklyn. During its first few years of existence, most of the growth in Kiryas Joel was driven by migration from New York City.[1] As this in-migration slowed, growth in the Village continued at a rapid pace due to the Hasidic religious imperative to bear children, and due to religious/social norms that encourage young women to remain in the Village to marry and have families of their own. These religious and cultural norms lead to large households with multiple children, lowering the overall median age in the community.

There are very few communities in the United States where the population is almost exclusively Hasidic. Communities such as the Williamsburg and Borough Park neighborhoods in Brooklyn, and the Hamlet of Monsey in Rockland County, contain a high proportion of Hasidic population but also are home to a substantial non-Hasidic Jewish and a non-Jewish population. This is demostrated by the data presented in Table 1 below. While the decennial Census does not ask religious affiliation, it does ask respondents to report the language they speak at home. As shown in Table 1, as of the 2000 Census, 89 percent of the population in Kiryas Joel spoke Yiddish at home. In comparison, only one third of Borough Park residents, 64 percent of Williamsburg residents, and 40 percent of Monsey residents spoke Yiddish at home. The proportion of Yiddish speaking population is higher in the communities of Kaser (73 percent) and New Square (86 percent) but still lower than in Kiryas Joel. Further, as shown in Table 2, based on 2007 population estimates from the Census Bureau, Kaser and New Square are small compared to Kiryas Joel, with the total population representing only 19 percent (Kaser) and 29 percent (New Square) of the Kiryas Joel population. These data indicate that Kiryas Joel is unusual in that it has both a substantial (and growing) population and a relatively high concentration of Hasidic Jewish population.

As shown in Table 2, the population of the Hasidic comparison communities generally grew more quickly over the past several decades than the population of the counties in which they are located. Although there were some instances where the county population growth outstripped growth in the comparison community—such as in Borough Park, Brooklyn from 1980 to 1990 and from 2000 to 2007—during most of the time periods and in most of the communities, population growth was more rapid at the community level than at the county level.

[1] *New York Times.* "Reverberations of a Baby Boom." August 27, 2006; conversations with Village officials, June 2008.

Table 1

Percent of Population Who Speak Yiddish at Home, 1990 and 2000

Area	1990	2000	Percent Change
Orange County	**2%**	**3%**	**47%**
Kiryas Joel	93%	89%	-5%
Kings County (Brooklyn)	**3%**	**3%**	**0%**
Borough Park	28%	33%	18%
Williamsburg	56%	64%	15%
Rockland County	**4%**	**5%**	**29%**
Kaser	N/A	73%	N/A
Monsey	42%	40%	-5%
New Square	91%	86%	-6%

Sources: U.S. Census Bureau, 1990 and 2000 Census, Summary File 3.

Table 2

Population, 1980, 1990, 2000, and 2007

Area	Number				Percent Change		
	1980	1990	2000	Estimated 2007	1980 - 1990	1990 - 2000	2000 – 2007
Orange County	**259,603**	**307,647**	**341,367**	**377,169**	**19%**	**11%**	**10%**
Kiryas Joel	2,088	7,437	13,138	20,989	256%	77%	60%
Kings County	**2,230,936**	**2,300,664**	**2,465,326**	**2,528,050**	**3%**	**7%**	**3%**
Borough Park	86,873	86,452	101,055	102,355	0%	17%	1%
Williamsburg	29,754	33,715	38,943	45,903	13%	16%	18%
Rockland County	**259,530**	**265,475**	**286,753**	**296,483**	**2%**	**8%**	**3%**
Kaser	N/A	N/A	3,316	3,945	N/A	N/A	19%
Monsey	12,380	13,986	14,504	14,949	13%	4%	3%
New Square	1,750	2,605	4,624	6,188	49%	78%	34%

Sources: 1990 and 2000 data are from the US Census Bureau, Summary File 1. 2007 data are Census population estimates for Orange County, Kings County, Rockland County, Kiryas Joel, Kaser, and New Square. 2007 data are from ESRI, Inc for Borough Park, Williamsburg, and the Hamlet of Monsey.

Among the Hasidic comparison communities, Kiryas Joel's population growth has been particularly rapid. The population of Kiryas Joel was, as of 2000, substantially smaller than Williamsburg and Borough Park, approximately 10 percent smaller than the population of Monsey, and substantially larger than the populations of Kaser and New Square. Its growth rate over the past several decades has far outpaced growth rates in the comparison communities. Between 1980 and 1990, the Village population more than tripled, while population growth in comparison communities was between zero and 49 percent. Between 1990 and 2000, population in Kiryas Joel increased by 77 percent. During this time, the comparison communities grew more slowly, except for New Square, where the population increased by 78 percent.

Population estimates for 2007 indicate that population growth in the Village has continued at a rapid pace since the 2000 Census. As shown in Table 2, the Village's 2007 population is estimated to be 20,989 by the U.S. Census Bureau. The Census estimate indicates that the population of Kiryas Joel grew by approximately 60 percent between 2000 and 2007, compared to an estimated 1 to 34 percent between 2000 and 2007 for the comparison communities. In keeping with established trends, most of the Hasidic comparison communities continued to grow at faster rates than the counties in which they are located.

Table 3 illustrates the decreasing rate of in-migration in the Village. As shown in the table, in 1990, 13 years after the Village's incorporation, 23.3 percent of the population age five and older was living in a different place five years earlier. By the 2000 Census, this figure had dropped to 6.6 percent. In comparison, 19.2 percent of Orange county residents were living in a different place five years prior to the 2000 Census. Kiryas Joel's proportion of in-migrants was also lower than comparison communities including Kaser (15.7 percent), Monsey (12.6 percent) and Borough Park (9.3 percent) though higher than New Square (3.2 percent) and Williamsburg (4.1 percent).

Table 3

Population Age 5 and Over Living in Different County or Abroad in 1985 & 1995

Area	1990 Census		2000 Census		Percent Change 1990-2000
	Number	Percent	Number	Percent	
Orange County	**67,837**	**24.1%**	**60,682**	**19.2%**	**-10.5%**
Kiryas Joel	1,425	23.3%	698	6.6%	-51.0%
Kings County	**279,001**	**13.1%**	**325,817**	**14.3%**	**16.8%**
Borough Park	9,031	11.6%	8,358	9.3%	-7.5%
Williamsburg	1,564	5.6%	1,342	4.1%	-14.2%
Rockland County	**41,044**	**16.7%**	**42,957**	**16.2%**	**4.7%**
Kaser	NA	NA	399	15.7%	N/A
Monsey	2,115	17.7%	1,627	12.6%	-23.1%
New Square	107	4.6%	120	3.2%	12.1%
Sources: US Census Bureau, 1990 and 2000 Census, Summary File 3.					

As shown in Table 4, the Hasidic comparison communities consistently had larger average family sizes than their counties in both 1990 and 2000. As discussed above, the large family size in all of the Hasidic comparison communities is primarily due to the Hasidic religious imperative to bear children.

Table 4

Average Family Size, 1990 and 2000

Area	1990	2000
Orange County	**3.4**	**3.4**
Kiryas Joel	6.5	5.8
Kings County	**3.4**	**3.4**
Borough Park	3.8	4.0
Williamsburg	4.7	4.8
Rockland County	**3.5**	**3.5**
Kaser	N/A	5.0
Monsey	5.1	5.2
New Square	6.1	5.8
Sources: US Census Bureau, 1990 and 2000 Census		

The average family size in Kiryas Joel is substantially larger than in most of the comparison communities. In 2000, Kiryas Joel had an average family size of 5.8 persons per family, 45 percent higher than the average for Borough Park (4.0), 21 percent higher than the average for Williamsburg (4.8), 16 percent high than the average for Kaser (5.0), and 12 percent higher than the average for Monsey. The average family size in Kiryas Joel was the same as in New Square which, as noted above, has a similarly homogenous Hasidic population.

The Hasidic comparison communities, and Kiryas Joel in particular, have a high percentage of families with children under the age of 18 (see Table 5). According to the 2000 Census, in Borough Park and Williamsburg, 56 and 70 percent of families had children under 18, respectively, compared to only 50 percent in Kings County overall. The percentages of families with children under 18 in Kaser (83 percent), Monsey (68 percent), and New Square (81 percent) were much higher than in Rockland County as a whole (49 percent). In Kiryas Joel, 83 percent of families had children under 18, which was higher than Orange County (54 percent) and all of the comparison communities except for Kaser.

Table 5

Percent of Families with Children Under 18, 1990 and 2000

Area	1990	2000
Orange County	**53%**	**54%**
Kiryas Joel	83%	83%
Kings County	**49%**	**50%**
Borough Park	51%	56%
Williamsburg	66%	70%
Rockland County	**48%**	**49%**
Kaser	N/A	83%
Monsey	66%	68%
New Square	76%	81%
Sources: US Census Bureau, 1990 and 2000 Census, Summary File 3.		

A higher proportion of families in the Hasidic comparison communities were headed by married couples rather than single parents as compared to their counties (see Table 6). Among the comparison communities, Kiryas Joel had the highest percentage of married couple families. As of the 2000 Census, 97 percent of families in the Village were headed by married couples, compared to approximately 83 to 95 percent in comparison communities.

Table 6

Married Couple versus Single Parent Families, 2000

Area	Married Couple		Single Parent	
	Number	Percent	Number	Percent
Orange County	**66,478**	**78.7%**	**17,979**	**21.3%**
Kiryas Joel	2,077	97.1%	61	2.9%
Kings County	**584,120**	**70.5%**	**244,163**	**29.5%**
Borough Park	18,297	82.7%	3,824	17.3%
Williamsburg	6,360	83.1%	1,295	16.9%
Rockland County	**70,944**	**84.7%**	**12,767**	**15.3%**
Kaser	618	95.4%	30	4.6%
Monsey	2,324	89.5%	273	10.5%
New Square	2,324	89.5%	273	10.5%
Sources: US Census Bureau, 2000 Census, Summary File 3.				

B. POPULATION PROJECTIONS

Population projections for 2000 to 2030 were developed for the Village using a combination of Census data, data provided by the Village of Kiryas Joel, information on marrying age and fertility rates for Hasidic women, and mortality data for New York State from the National Center for Health Statistics. The projections are based on three factors: births; deaths; and migration.

BIRTHS

2000 Census data showing female population by age bracket were used to estimate the number of females at every age in year 2000. This population was aged to year 2030.

Various sources including Village officials, newspaper and magazine articles, and academic papers indicate that the average number of children born to Hasidic women is between 6 and 8. This reported range is generally consistent with demographic data available through 2000 Census Public Use Microdata Sample (PUMS) data. PUMS is a set of data files provided by the U.S. Census that contains individual decennial Census responses, sorted by geographic area, which allows users to create custom tabulations of census sample data. In this case, PUMs data was used to isolate the Yiddish speaking population in New York State and Orange County (PUMs data is not available for geographic areas as small as Kiryas Joel).

The PUMS data was queried to determine the average number of children per Yiddish speaking household. Households were then sorted by age of householder to identify households that were old enough to have given birth to most or all of their children, but not so old that their oldest children would have left the house to start their own families. The average number of children in these households approximates the total number of children born to a Yiddish speaking household over its lifetime.

As shown in Table 7, Yiddish speaking households in New York State age 35 to 39 have the highest number of children living at home, with an average of approximately 5.3 children. Based on smaller samples for the Yiddish population of Orange County, households between the ages of 35 and 39 had approximately 6.8 children at home. The number of children per household declines after this age because the oldest children move out of the home to start their own household.

Table 7

Number of Children Per Yiddish Speaking Household by Age, 2000

Area	0-18	19-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60+	Total
NY State	1.00	1.16	2.96	4.55	5.30	4.84	3.16	1.96	0.76	0.01	1.58
Orange County	0.00	1.13	2.78	5.65	6.83	6.51	4.28	4.17	1.10	0.00	3.33

Sources: 2000 Census Public Use Microdata Sample data.

While the total sample size for the Yiddish-speaking population in Orange County was large enough to be statistically valid, the sample sizes for some individual age brackets were smaller, and therefore may not be as statistically reliable. Based on the New York State data, which indicate that Yiddish-speaking households have an average of 5.3 children, the Orange County data, which indicate that Yiddish-speaking households have an average of 6.8 children, and non-Census sources such as newspaper articles and Village officials, which indicate that Hasidic women bear between 6 and 8 children on average, this analysis assumes that each woman in the Village of Kiryas Joel would have 6 children.

Village officials and outside sources indicate that most Hasidic women marry soon after high school, around age 18 or 19, and begin bearing children soon thereafter.[1] For population projections, women in the Village were assumed to have a child every two years between the ages of 20 and 30. In reality, some proportion of women may not marry or bear children. However, the average number of children per household in each age bracket includes households that do not have children. Therefore, the effects of these households are built into the assumption about the number of children born to each household. If the average number of children per Yiddish speaking household in New York State excluded households without children, it would increase from 5.3 to 5.9 children.

Half of all children born were assumed to be girls. Because the projection period is 30 years and women living in the Village are assumed to start bearing children at age 20, girls born between 2000 and 2010 will begin having their own children between 2020 and 2030. These additional children were included in the projections.

DEATHS

Data from the National Center for Health Statistics were used to determine number of deaths in New York State by age bracket for year 2000. Using population data from the 2000 Census, a death rate per 1,000 persons was developed for each age bracket. These death rates were applied to the Kiryas Joel population projections to estimate number of deaths each year from 2000 through 2030.

MIGRATION

Census data reporting on the population living in a different place five years prior to the Census shows that the number of persons migrating to the Village decreased significantly between 1990 and 2000 (see Table 3). This Census data was supplemented by more recent data from the Village, and these two data sources were used to estimate the rate at which Village in-migration is likely to change through the 2030 projection year. The Village has compiled data on household growth and origin based on detailed Village phone book records and Village newspaper archives reporting all marriages in Kiryas Joel. This data was used to estimate total annual household growth between 1999 and mid-year 2008, and to determine the number of households in each year that were entirely new to the Village (rather than households that were formed by marriage of two Village residents or the marriage of a Village resident to a non-Village resident). According to the Village's data, between 2000 and 2007, an average of 1.1 percent of households in any given year were entirely new to Kiryas Joel. Another 4.9 percent of households were created through marriage each year—either by two Village residents marrying, or by a Village resident marrying a non-Village resident. Applying the 2000 average household size for Kiryas Joel to the in-migrant households, and assuming that one quarter of the population in households created through marriage were in-migrants, an average of 1.3 percent of the total Kiryas Joel population was new to the Village every year from 2000 through 2007.

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[1] Joseph Berter, *New York Times*, "Growing Pains for a Rural Hasidic Enclave," January 13, 1997; Fernanda Santos, *New York Times*, "Reverberations of a Baby Boom,"August 27, 2006; Jack Wertheimer, *Commentary Magazine*, "Jews and Jewish Birthrate," October 2005; Antony Gordon and Richard Horowitz, "Will Your Grandchild be Jewish?"

As indicated above, the Village's rate of in-migration is substantially lower than the rate of in-migration in Orange County and other nearby counties.

This data is generally consistent with the Census data presented above in Table 3. That data showed that as of the 2000 Census, approximately 6.6 percent of the Kiryas Joel population age five and older was living in a different place five years earlier. If, as stated above, over the past eight years approximately 1.3 percent of the total Kiryas Joel population was new to the Village each year, then based on the data provided by Kiryas Joel, approximately 5.8 percent of the population, if polled today, would say they had lived in a different place five years earlier.

Based on the Village data and the Census data presented above, it was assumed that approximately 1.3 percent of the 2000 population was in-migrant. For each year after 2000, the percent of in-migrants was reduced by approximately 0.02 percentage point so that by 2030, 0.8 percent of the projected population is considered to be in-migrant. This rate of in-migration approximates the rate for Williamsburg which contains a mature Hasidic community with more constraints on land/building space for new population – a condition that the Village of Kiryas Joel will likely face by 2030.

PROJECTIONS

As indicated above and reported in the 2004 FEIS, growth in Kiryas Joel today is primarily internally-driven, due to the religious imperatives and social norms of the Village population. Based on migration data from the Census Bureau and from the Village of Kiryas Joel, information on average age of marriage and number of children for Hasidic women, and average death rates for New York State residents, the population of Kiryas Joel is projected to be approximately 50,527 by 2030. If the average number of children born to each woman was 7 rather than 6, the estimated 2030 population would be 56,196. If the average number of children born to each woman was 5, the estimated 2030 population would be 44,340. Detailed projection tables are included as an appendix to this memo.

Table 8
Population Projections, 2000-2030

Year	Population	Year	Population
2000	13,138	**2016**	27,334
2001	13,923	**2017**	28,510
2002	14,605	**2018**	29,731
2003	15,296	**2019**	30,994
2004	16,051	**2020**	32,302
2005	16,814	**2021**	33,714
2006	17,661	**2022**	35,203
2007	18,516	**2023**	36,759
2008	19,388	**2024**	38,424
2009	20,270	**2025**	40,161
2010	21,169	**2026**	42,048
2011	22,120	**2027**	44,011
2012	23,088	**2028**	46,088
2013	24,099	**2029**	48,246
2014	25,128	**2030**	50,527
2015	26,200		

Sources: U.S. Census Bureau, 2000 Census; National Center for Health Statistics, Table 308, Deaths by State of Residence Distributed According to State or Country of Birth, By Age, 2000; Village of Kiryas Joel; AKRF, Inc.

C. INDUCED GROWTH

The projections presented in Table 8 are based on birth, death, and migration rates and do not specifically consider the potential effect of factors such as availability of land, water, or other infrastructure on population growth. However, for reasons cited above (e.g., large family sizes, social and religious norms) such potential constraints are unlikely to have a substantial effect on population trends in the Village of Kiryas Joel. This is evidenced by the significant population growth and decreasing rate of in-migration that occurred during recent shortages in both water and sewer infrastructure. For example, from the mid-1980s through mid-1990s, the New York State Department of Environmental Conservation (DEC) had imposed a moratorium on new public sewer connections to the Harriman Wastewater Treatment Plant, which serves portions of Orange County including the Village of Kiryas Joel.[1] Although the Village was subject to the moratorium, based on the decennial data available from the Census Bureau, the moratorium appears to have had little effect on the overall growth pattern in Kiryas Joel. Likewise, during this time period, the Village experienced shortages in well-water supply and was compelled to truck in water to the Village during periods of peak demand.[2] As described above in Section A, the population of Kiryas Joel more than tripled between 1980 and 1990, and increased by 77 percent between 1990 and 2000.

More recently, the Village has expanded its well-water supply in response to the noted water shortages. In 2001, DEC increased the permitted water supply for the Village from approximately 1.0 to 1.3 million gallons per day. Subsequent to the FEIS and Findings Statement, the permitted supply increased again by an additional 135,000 gallons per day in March 2005 and by another 486,000 gallons per day in August 2005, for a total permitted capacity of approximately 1.931 mgd. Data from both the Census Bureau and Village records indicate that, despite the significant increase in available water capacity (or the removal of the constraint), population growth has remained consistent during periods of water constraint, with population increasing by 77 percent between 1990 and 2000 (constraint) and approximately 60 percent between 2000 and 2007 (without constraint). At the same time, as shown in Table 3 and discussed above, the rate of in-migration has slowed in recent years, indicating that increases in water supply, similar to that proposed by the Project, has not spurred influxes of new population to the Village. These trends indicate that the proposed Project is unlikely to have a significant effect on internal growth and in-migration patterns in the Village. *

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[1] Pinecrest Assocs., Inc. v. Zagata, Partial Stipulation and Order, dated April 9, 1997 (N.D.N.Y Index No. 95 CV 8664).

[2] DEIS §1.2.1

APPENDIX

Population Projection Supporting Tables

2000 Female Population Ages 0 to 34, Plus Girls Born to Them - Aged to 2030																		
AGE	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
0	248	311	343	347	379	384	424	429	438	442	451	477	486	507	516	538	569	590
1	248	248	311	343	347	379	384	424	429	438	442	451	477	486	507	516	538	569
2	248	248	248	311	343	347	379	384	424	429	438	442	451	477	486	507	516	538
3	248	248	248	248	311	343	347	379	384	424	429	438	442	451	477	486	507	516
4	248	248	248	248	248	311	343	347	379	384	424	429	438	442	451	477	486	507
5	204	248	248	248	248	248	311	343	347	379	384	424	429	438	442	451	477	486
6	204	204	248	248	248	248	248	311	343	347	379	384	424	429	438	442	451	477
7	204	204	204	248	248	248	248	248	311	343	347	379	384	424	429	438	442	451
8	204	204	204	204	248	248	248	248	248	311	343	347	379	384	424	429	438	442
9	204	204	204	204	204	248	248	248	248	248	311	343	347	379	384	424	429	438
10	161	204	204	204	204	204	248	248	248	248	248	311	343	347	379	384	424	429
11	161	161	204	204	204	204	204	248	248	248	248	248	311	343	347	379	384	424
12	161	161	161	204	204	204	204	204	248	248	248	248	248	311	343	347	379	384
13	161	161	161	161	204	204	204	204	204	248	248	248	248	248	311	343	347	379
14	161	161	161	161	161	204	204	204	204	204	248	248	248	248	248	311	343	347
15	143	161	161	161	161	161	204	204	204	204	204	248	248	248	248	248	311	343
16	143	143	161	161	161	161	161	204	204	204	204	204	248	248	248	248	248	311
17	143	143	143	161	161	161	161	161	204	204	204	204	204	248	248	248	248	248
18	143	143	143	143	161	161	161	161	161	204	204	204	204	204	248	248	248	248
19	143	143	143	143	143	161	161	161	161	161	204	204	204	204	204	248	248	248
20	134	143	143	143	143	143	161	161	161	161	161	204	204	204	204	204	248	248
21	134	134	143	143	143	143	143	161	161	161	161	161	204	204	204	204	204	248
22	134	134	134	143	143	143	143	143	161	161	161	161	161	204	204	204	204	204
23	134	134	134	134	143	143	143	143	143	161	161	161	161	161	204	204	204	204
24	134	134	134	134	134	143	143	143	143	143	161	161	161	161	161	204	204	204
25	70	134	134	134	134	134	143	143	143	143	143	161	161	161	161	161	204	204
26	70	70	134	134	134	134	134	143	143	143	143	143	161	161	161	161	161	204
27	70	70	70	134	134	134	134	134	143	143	143	143	143	161	161	161	161	161
28	70	70	70	70	134	134	134	134	134	143	143	143	143	143	161	161	161	161
29	70	70	70	70	70	134	134	134	134	134	143	143	143	143	143	161	161	161
30	70	70	70	70	70	70	134	134	134	134	134	143	143	143	143	143	161	161
31	70	70	70	70	70	70	70	134	134	134	134	134	143	143	143	143	143	161
32	70	70	70	70	70	70	70	70	134	134	134	134	134	143	143	143	143	143
33	70	70	70	70	70	70	70	70	70	134	134	134	134	134	143	143	143	143
34	70	70	70	70	70	70	70	70	70	70	134	134	134	134	134	143	143	143

Estimated Number of Children Born per Year																		
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
# of Children	-	622	685	694	758	767	849	858	876	885	902	954	972	1,015	1,033	1,075	1,137	1,180

AGE	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
0	612	633	655	553	575	451	473	349	371	248	248	124	124
1	590	612	633	655	553	575	451	473	349	371	248	248	124
2	569	590	612	633	655	553	575	451	473	349	371	248	248
3	538	569	590	612	633	655	553	575	451	473	349	371	248
4	516	538	569	590	612	633	655	553	575	451	473	349	371
5	507	516	538	569	590	612	633	655	553	575	451	473	349
6	486	507	516	538	569	590	612	633	655	553	575	451	473
7	477	486	507	516	538	569	590	612	633	655	553	575	451
8	451	477	486	507	516	538	569	590	612	633	655	553	575
9	442	451	477	486	507	516	538	569	590	612	633	655	553
10	438	442	451	477	486	507	516	538	569	590	612	633	655
11	429	438	442	451	477	486	507	516	538	569	590	612	633
12	424	429	438	442	451	477	486	507	516	538	569	590	612
13	384	424	429	438	442	451	477	486	507	516	538	569	590
14	379	384	424	429	438	442	451	477	486	507	516	538	569
15	347	379	384	424	429	438	442	451	477	486	507	516	538
16	343	347	379	384	424	429	438	442	451	477	486	507	516
17	311	343	347	379	384	424	429	438	442	451	477	486	507
18	248	311	343	347	379	384	424	429	438	442	451	477	486
19	248	248	311	343	347	379	384	424	429	438	442	451	477
20	248	248	248	311	343	347	379	384	424	429	438	442	451
21	248	248	248	248	311	343	347	379	384	424	429	438	442
22	248	248	248	248	248	311	343	347	379	384	424	429	438
23	204	248	248	248	248	248	311	343	347	379	384	424	429
24	204	204	248	248	248	248	248	311	343	347	379	384	424
25	204	204	204	248	248	248	248	248	311	343	347	379	384
26	204	204	204	204	248	248	248	248	248	311	343	347	379
27	204	204	204	204	204	248	248	248	248	248	311	343	347
28	161	204	204	204	204	204	248	248	248	248	248	311	343
29	161	161	204	204	204	204	204	248	248	248	248	248	311
30	161	161	161	204	204	204	204	204	248	248	248	248	248
31	161	161	161	161	204	204	204	204	204	248	248	248	248
32	161	161	161	161	161	204	204	204	204	204	248	248	248
33	143	161	161	161	161	161	204	204	204	204	204	248	248
34	143	143	161	161	161	161	161	204	204	204	204	204	248

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
# of Children	1,224	1,267	1,311	1,417	1,493	1,560	1,668	1,740	1,889	1,966	2,079	2,160	2,283

Deaths per 1,000 Population, New York State

AGE	Under 5	5 to 14	15 to 24	25 to 34	35 to 44	45 to 54	55 to 64	65 to 74	75 to 84	85 and over	Total
Deaths	1,897	320	1,207	1,717	4,256	7,980	12,047	22,747	37,242	33,261	122,674
Population	1,239,417	2,684,290	2,531,853	2,757,324	3,074,298	2,552,936	1,687,987	1,276,046	860,818	311,488	18,976,457
Deaths per 1,000 pop	1.53	0.12	0.48	0.62	1.38	3.13	7.14	17.83	43.26	106.78	6.46

Source: Derived from US Census 2000 data and National Center for Health Statistics 2000

PROJECTION OF DEATHS IN THE VILLAGE OF KIRYAS JOEL, 2000 - 2030

AGE	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
TOTAL POPULATION - MALE & FEMALE																															
0	535	622	685	694	758	767	849	858	876	885	902	954	972	1,015	1,033	1,075	1,137	1,180	1,224	1,267	1,311	1,417	1,493	1,560	1,668	1,740	1,889	1,966	2,079	2,160	2,283
1	535	535	622	685	694	758	767	849	858	876	885	902	954	972	1,015	1,033	1,075	1,137	1,180	1,224	1,267	1,311	1,417	1,493	1,560	1,668	1,740	1,889	1,966	2,079	2,160
2	535	535	535	622	685	694	758	767	849	858	876	885	902	954	972	1,015	1,033	1,075	1,137	1,180	1,224	1,267	1,311	1,417	1,493	1,560	1,668	1,740	1,889	1,966	2,079
3	535	535	535	535	622	685	694	758	767	849	858	876	885	902	954	972	1,015	1,033	1,075	1,137	1,180	1,224	1,267	1,311	1,417	1,493	1,560	1,668	1,740	1,889	1,966
4	535	535	535	535	535	622	685	694	758	767	849	858	876	885	902	954	972	1,015	1,033	1,075	1,137	1,180	1,224	1,267	1,311	1,417	1,493	1,560	1,668	1,740	1,889
5	436	535	535	535	535	535	622	685	694	758	767	849	858	876	885	902	954	972	1,015	1,033	1,075	1,137	1,180	1,224	1,267	1,311	1,417	1,493	1,560	1,668	1,740
6	436	436	535	535	535	535	535	622	685	694	758	767	849	858	876	885	902	954	972	1,015	1,033	1,075	1,137	1,180	1,224	1,267	1,311	1,417	1,493	1,560	1,668
7	436	436	436	535	535	535	535	535	622	685	694	758	767	849	858	876	885	902	954	972	1,015	1,033	1,075	1,137	1,180	1,224	1,267	1,311	1,417	1,493	1,560
8	436	436	436	436	535	535	535	535	535	622	685	694	758	767	849	858	876	885	902	954	972	1,015	1,033	1,075	1,137	1,180	1,224	1,267	1,311	1,417	1,493
9	436	436	436	436	436	535	535	535	535	535	622	685	694	758	767	849	858	876	885	902	954	972	1,015	1,033	1,075	1,137	1,180	1,224	1,267	1,311	1,417
10	345	436	436	436	436	436	535	535	535	535	535	622	685	694	758	767	849	858	876	885	902	954	972	1,015	1,033	1,075	1,137	1,180	1,224	1,267	1,311
11	345	345	436	436	436	436	436	535	535	535	535	535	622	685	694	758	767	849	858	876	885	902	954	972	1,015	1,033	1,075	1,137	1,180	1,224	1,267
12	345	345	345	436	436	436	436	436	535	535	535	535	535	622	685	694	758	767	849	858	876	885	902	954	972	1,015	1,033	1,075	1,137	1,180	1,224
13	345	345	345	345	436	436	436	436	436	535	535	535	535	535	622	685	694	758	767	849	858	876	885	902	954	972	1,015	1,033	1,075	1,137	1,180
14	345	345	345	345	345	436	436	436	436	436	535	535	535	535	535	622	685	694	758	767	849	858	876	885	902	954	972	1,015	1,033	1,075	1,137
15	356	345	345	345	345	345	436	436	436	436	436	535	535	535	535	535	622	685	694	758	767	849	858	876	885	902	954	972	1,015	1,033	1,075
16	356	356	345	345	345	345	345	436	436	436	436	436	535	535	535	535	535	622	685	694	758	767	849	858	876	885	902	954	972	1,015	1,033
17	356	356	356	345	345	345	345	345	436	436	436	436	436	535	535	535	535	535	622	685	694	758	767	849	858	876	885	902	954	972	1,015
18	356	356	356	356	345	345	345	345	345	436	436	436	436	436	535	535	535	535	535	622	685	694	758	767	849	858	876	885	902	954	972
19	356	356	356	356	356	345	345	345	345	345	436	436	436	436	436	535	535	535	535	535	622	685	694	758	767	849	858	876	885	902	954
20	292	356	356	356	356	356	345	345	345	345	345	436	436	436	436	436	535	535	535	535	535	622	685	694	758	767	849	858	876	885	902
21	292	292	356	356	356	356	356	345	345	345	345	345	436	436	436	436	436	535	535	535	535	535	622	685	694	758	767	849	858	876	885
22	292	292	292	356	356	356	356	356	345	345	345	345	345	436	436	436	436	436	535	535	535	535	535	622	685	694	758	767	849	858	876
23	292	292	292	292	356	356	356	356	356	345	345	345	345	345	436	436	436	436	436	535	535	535	535	535	622	685	694	758	767	849	858
24	292	292	292	292	292	356	356	356	356	356	345	345	345	345	345	436	436	436	436	436	535	535	535	535	535	622	685	694	758	767	849
25	145	292	292	292	292	292	356	356	356	356	356	345	345	345	345	345	436	436	436	436	436	535	535	535	535	535	622	685	694	758	767
26	145	145	292	292	292	292	292	356	356	356	356	356	345	345	345	345	345	436	436	436	436	436	535	535	535	535	535	622	685	694	758
27	145	145	145	292	292	292	292	292	356	356	356	356	356	345	345	345	345	345	436	436	436	436	436	535	535	535	535	535	622	685	694
28	145	145	145	145	292	292	292	292	292	356	356	356	356	356	345	345	345	345	345	436	436	436	436	436	535	535	535	535	535	622	685
29	145	145	145	145	145	292	292	292	292	292	356	356	356	356	356	345	345	345	345	345	436	436	436	436	436	535	535	535	535	535	622
30	145	145	145	145	145	145	292	292	292	292	292	356	356	356	356	356	345	345	345	345	345	436	436	436	436	436	535	535	535	535	535
31	145	145	145	145	145	145	145	292	292	292	292	292	356	356	356	356	356	345	345	345	345	345	436	436	436	436	436	535	535	535	535
32	145	145	145	145	145	145	145	145	292	292	292	292	292	356	356	356	356	356	345	345	345	345	345	436	436	436	436	436	535	535	535
33	145	145	145	145	145	145	145	145	145	292	292	292	292	292	356	356	356	356	356	345	345	345	345	345	436	436	436	436	436	535	535
34	145	145	145	145	145	145	145	145	145	145	292	292	292	292	292	356	356	356	356	356	345	345	345	345	345	436	436	436	436	436	535
35	73	145	145	145	145	145	145	145	145	145	145	292	292	292	292	292	356	356	356	356	356	345	345	345	345	345	436	436	436	436	436
36	73	73	145	145	145	145	145	145	145	145	145	145	292	292	292	292	292	356	356	356	356	356	345	345	345	345	345	436	436	436	436
37	73	73	73	145	145	145	145	145	145	145	145	145	145	292	292	292	292	292	356	356	356	356	356	345	345	345	345	345	436	436	436
38	73	73	73	73	145	145	145	145	145	145	145	145	145	145	292	292	292	292	292	356	356	356	356	356	345	345	345	345	345	436	436
39	73	73	73	73	73	145	145	145	145	145	145	145	145	145	145	292	292	292	292	292	356	356	356	356	356	345	345	345	345	345	436
40	73	73	73	73	73	73	145	145	145	145	145	145	145	145	145	145	292	292	292	292	292	356	356	356	356	356	345	345	345	345	345
41	73	73	73	73	73	73	73	145	145	145	145	145	145	145	145	145	145	292	292	292	292	292	356	356	356	356	356	345	345	345	345
42	73	73	73	73	73	73	73	73	145	145	145	145	145	145	145	145	145	145	292	292	292	292	292	356	356	356	356	356	345	345	345
43	73	73	73	73	73	73	73	73	73	145	145	145	145	145	145	145	145	145	145	292	292	292	292	292	356	356	356	356	356	345	345
44	73	73	73	73	73	73	73	73	73	73	145	145	145	145	145	145	145	145	145	145	292	292	292	292	292	356	356	356	356	356	345
45	86	73	73	73	73	73	73	73	73	73	73	145	145	145	145	145	145	145	145	145	145	292	292	292	292	292	356	356	356	356	356
46	86	86	73	73	73	73	73	73	73	73	73	73	145	145	145	145	145	145	145	145	145	145	292	292	292	292	292	356	356	356	356
47	86	86	86	73	73	73	73	73	73	73	73	73	73	145	145	145	145	145	145	145	145	145	145	292	292	292	292	292	356	356	356
48	86	86	86	86	73	73	73	73	73	73	73	73	73	73	145	145	145	145	145	145	145	145	145	145	292	292	292	292	292	356	356
49	86	86	86	86	86	73	73	73	73	73	73	73	73	73	73	145	145	145	145	145	145	145	145	145	145	292	292	292	292	292	356
50	86	86	86	86	86	86	73	73	73	73	73	73	73	73	73	73	145	145	145	145	145	145	145	145	145	145	292	292	292	292	292

PROJECTION OF DEATHS IN THE VILLAGE OF KIRYAS JOEL, 2000 - 2030

AGE	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
51	86	86	86	86	86	86	86	73	73	73	73	73	73	73	73	73	73	145	145	145	145	145	145	145	145	145	145	292	292	292	292
52	86	86	86	86	86	86	86	86	73	73	73	73	73	73	73	73	73	73	145	145	145	145	145	145	145	145	145	145	292	292	292
53	86	86	86	86	86	86	86	86	86	73	73	73	73	73	73	73	73	73	73	145	145	145	145	145	145	145	145	145	145	292	292
54	86	86	86	86	86	86	86	86	86	86	73	73	73	73	73	73	73	73	73	73	145	145	145	145	145	145	145	145	145	145	292
55	9	86	86	86	86	86	86	86	86	86	86	73	73	73	73	73	73	73	73	73	73	145	145	145	145	145	145	145	145	145	145
56	9	9	86	86	86	86	86	86	86	86	86	86	73	73	73	73	73	73	73	73	73	73	145	145	145	145	145	145	145	145	145
57	9	9	9	86	86	86	86	86	86	86	86	86	86	73	73	73	73	73	73	73	73	73	73	145	145	145	145	145	145	145	145
58	9	9	9	9	86	86	86	86	86	86	86	86	86	86	73	73	73	73	73	73	73	73	73	73	145	145	145	145	145	145	145
59	9	9	9	9	9	86	86	86	86	86	86	86	86	86	86	73	73	73	73	73	73	73	73	73	73	145	145	145	145	145	145
60	9	9	9	9	9	9	86	86	86	86	86	86	86	86	86	86	73	73	73	73	73	73	73	73	73	73	145	145	145	145	145
61	9	9	9	9	9	9	9	86	86	86	86	86	86	86	86	86	86	73	73	73	73	73	73	73	73	73	73	145	145	145	145
62	9	9	9	9	9	9	9	9	86	86	86	86	86	86	86	86	86	86	73	73	73	73	73	73	73	73	73	73	145	145	145
63	9	9	9	9	9	9	9	9	9	86	86	86	86	86	86	86	86	86	86	73	73	73	73	73	73	73	73	73	73	145	145
64	9	9	9	9	9	9	9	9	9	9	86	86	86	86	86	86	86	86	86	86	73	73	73	73	73	73	73	73	73	73	145
65	10	9	9	9	9	9	9	9	9	9	9	86	86	86	86	86	86	86	86	86	86	73	73	73	73	73	73	73	73	73	73
66	10	10	9	9	9	9	9	9	9	9	9	9	86	86	86	86	86	86	86	86	86	86	73	73	73	73	73	73	73	73	73
67	10	10	10	9	9	9	9	9	9	9	9	9	9	86	86	86	86	86	86	86	86	86	86	73	73	73	73	73	73	73	73
68	10	10	10	10	9	9	9	9	9	9	9	9	9	9	86	86	86	86	86	86	86	86	86	86	73	73	73	73	73	73	73
69	10	10	10	10	10	9	9	9	9	9	9	9	9	9	9	86	86	86	86	86	86	86	86	86	86	73	73	73	73	73	73
70	10	10	10	10	10	10	9	9	9	9	9	9	9	9	9	9	86	86	86	86	86	86	86	86	86	86	73	73	73	73	73
71	10	10	10	10	10	10	10	9	9	9	9	9	9	9	9	9	9	86	86	86	86	86	86	86	86	86	86	73	73	73	73
72	10	10	10	10	10	10	10	10	9	9	9	9	9	9	9	9	9	9	86	86	86	86	86	86	86	86	86	86	73	73	73
73	10	10	10	10	10	10	10	10	10	9	9	9	9	9	9	9	9	9	9	86	86	86	86	86	86	86	86	86	86	73	73
74	10	10	10	10	10	10	10	10	10	10	9	9	9	9	9	9	9	9	9	9	86	86	86	86	86	86	86	86	86	86	73
75	10	10	10	10	10	10	10	10	10	10	10	9	9	9	9	9	9	9	9	9	9	86	86	86	86	86	86	86	86	86	86
76	10	10	10	10	10	10	10	10	10	10	10	10	9	9	9	9	9	9	9	9	9	9	86	86	86	86	86	86	86	86	86
77	10	10	10	10	10	10	10	10	10	10	10	10	10	9	9	9	9	9	9	9	9	9	9	86	86	86	86	86	86	86	86
78	10	10	10	10	10	10	10	10	10	10	10	10	10	10	9	9	9	9	9	9	9	9	9	9	86	86	86	86	86	86	86
79	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	9	9	9	9	9	9	9	9	9	9	86	86	86	86	86	86
80	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	9	9	9	9	9	9	9	9	9	9	86	86	86	86	86
81	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	9	9	9	9	9	9	9	9	9	9	86	86	86	86
82	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	9	9	9	9	9	9	9	9	9	9	86	86	86
83	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	9	9	9	9	9	9	9	9	9	9	86	86
84	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	9	9	9	9	9	9	9	9	9	9	86
85 +	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	9	9	9	9	9	9	9	9	9	9
TOTAL	13,138	13,750	14,426	15,110	15,859	16,616	17,455	18,303	19,169	20,044	20,937	21,881	22,844	23,849	24,872	25,937	27,065	28,235	29,449	30,706	32,008	33,415	34,899	36,450	38,110	39,842	41,722	43,679	45,749	47,901	50,175

PROJECTION OF DEATHS IN THE VILLAGE OF KIRYAS JOEL, 2000 - 2030

AGE	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
DEATHS																															
0	-	1.0	1.0	1.1	1.2	1.2	1.3	1.3	1.3	1.4	1.4	1.5	1.5	1.6	1.6	1.6	1.7	1.8	1.9	1.9	2.0	2.2	2.3	2.4	2.6	2.7	2.9	3.0	3.2	3.3	3.5
1	-	0.8	1.0	1.0	1.1	1.2	1.2	1.3	1.3	1.3	1.4	1.4	1.5	1.5	1.6	1.6	1.6	1.7	1.8	1.9	1.9	2.0	2.2	2.3	2.4	2.6	2.7	2.9	3.0	3.2	3.3
2	-	0.8	0.8	1.0	1.0	1.1	1.2	1.2	1.3	1.3	1.3	1.4	1.4	1.5	1.5	1.6	1.6	1.6	1.7	1.8	1.9	1.9	2.0	2.2	2.3	2.4	2.6	2.7	2.9	3.0	3.2
3	-	0.8	0.8	0.8	1.0	1.0	1.1	1.2	1.2	1.3	1.3	1.3	1.4	1.4	1.5	1.5	1.6	1.6	1.6	1.7	1.8	1.9	1.9	2.0	2.2	2.3	2.4	2.6	2.7	2.9	3.0
4	-	0.8	0.8	0.8	0.8	1.0	1.0	1.1	1.2	1.2	1.3	1.3	1.3	1.4	1.4	1.5	1.5	1.6	1.6	1.6	1.7	1.8	1.9	1.9	2.0	2.2	2.3	2.4	2.6	2.7	2.9
5	-	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2
6	-	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2
7	-	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2
8	-	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2
9	-	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2
10	-	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2
11	-	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2
12	-	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
13	-	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
14	-	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
15	-	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5
16	-	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5
17	-	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5
18	-	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5
19	-	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5
20	-	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4
21	-	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.4
22	-	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4
23	-	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4
24	-	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4
25	-	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.5	0.5
26	-	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.5
27	-	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4
28	-	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4
29	-	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4
30	-	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
31	-	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
32	-	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
33	-	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3
34	-	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3
35	-	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6
36	-	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6
37	-	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6
38	-	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.6
39	-	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6
40	-	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
41	-	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
42	-	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
43	-	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5
44	-	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5
45	-	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.9	0.9	0.9	0.9	0.9	1.1	1.1	1.1	1.1	1.1
46	-	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.9	0.9	0.9	0.9	0.9	1.1	1.1	1.1	1.1
47	-	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.9	0.9	0.9	0.9	0.9	1.1	1.1	1.1
48	-	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.9	0.9	0.9	0.9	0.9	1.1	1.1
49	-	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.9	0.9	0.9	0.9	0.9	1.1
50	-	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.9	0.9	0.9	0.9	0.9

PROJECTION OF DEATHS IN THE VILLAGE OF KIRYAS JOEL, 2000 - 2030

AGE	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
51	-	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
52	-	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2
53	-	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2
54	-	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2
55	-	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.5
56	-	0.1	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.5
57	-	0.1	0.1	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.5
58	-	0.1	0.1	0.1	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.5
59	-	0.1	0.1	0.1	0.1	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
60	-	0.1	0.1	0.1	0.1	0.1	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
61	-	0.1	0.1	0.1	0.1	0.1	0.1	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
62	-	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.6	0.6	0.6	0.6	0.6	0.6	0.6
63	-	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.6	0.6	0.6	0.6	0.6	0.6
64	-	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.6	0.6	0.6	0.6	0.6
65	-	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	1.5	1.5	1.5	1.5
66	-	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	1.5	1.5	1.5
67	-	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	1.5	1.5
68	-	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	1.5
69	-	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
70	-	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
71	-	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
72	-	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
73	-	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
74	-	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
75	-	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
76	-	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
77	-	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
78	-	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
79	-	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
80	-	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
81	-	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
82	-	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
83	-	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
84	-	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
85 +	-	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Total Deaths	-	19.1	20.1	21.1	22.1	23.2	24.4	25.4	26.5	27.5	28.5	30.5	32.5	34.5	36.5

AGE	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
51	0.2	0.2	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.9	0.9	0.9	0.9
52	0.2	0.2	0.2	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.9	0.9	0.9
53	0.2	0.2	0.2	0.2	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.9	0.9
54	0.2	0.2	0.2	0.2	0.2	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.9
55	0.5	0.5	0.5	0.5	0.5	0.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
56	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
57	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
58	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0
59	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1.0	1.0	1.0	1.0	1.0	1.0
60	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1.0	1.0	1.0	1.0	1.0
61	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1.0	1.0	1.0	1.0
62	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1.0	1.0	1.0
63	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1.0	1.0
64	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1.0
65	1.5	1.5	1.5	1.5	1.5	1.5	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
66	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
67	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
68	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.3	1.3	1.3	1.3	1.3	1.3	1.3
69	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.3	1.3	1.3	1.3	1.3	1.3
70	0.2	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.3	1.3	1.3	1.3	1.3
71	0.2	0.2	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.3	1.3	1.3	1.3
72	0.2	0.2	0.2	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.3	1.3	1.3
73	0.2	0.2	0.2	0.2	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.3	1.3
74	0.2	0.2	0.2	0.2	0.2	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.3
75	0.4	0.4	0.4	0.4	0.4	0.4	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7
76	0.4	0.4	0.4	0.4	0.4	0.4	0.4	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7
77	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7
78	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	3.7	3.7	3.7	3.7	3.7	3.7	3.7
79	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	3.7	3.7	3.7	3.7	3.7	3.7
80	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	3.7	3.7	3.7	3.7	3.7
81	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	3.7	3.7	3.7	3.7
82	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	3.7	3.7	3.7
83	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	3.7	3.7
84	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	3.7
85 +	1.0	1.0	1.0	1.0	1.0	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Total Deaths	38.6	40.8	43.1	45.4	47.7	50.1	54.9	59.8	64.8	69.9	75.0	80.4	85.9	91.4	97.0	102.6

POPULATION PROJECTIONS FOR VILLAGE OF KIRYAS JOEL, 2000 - 2030

Population Projections

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Base projection	13,138	13,731	14,405	15,089	15,837	16,593	17,431	18,278	19,143	20,017	20,908	21,851	22,811	23,814	24,835	25,899
Base with in-migration	13,138	13,923	14,605	15,296	16,051	16,814	17,661	18,516	19,388	20,270	21,169	22,120	23,088	24,099	25,128	26,200

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Base projection	27,024	28,192	29,404	30,659	31,957	33,360	34,839	36,386	38,040	39,767	41,641	43,593	45,658	47,804	50,072
Base with in-migration	27,334	28,510	29,731	30,994	32,302	33,714	35,203	36,759	38,424	40,161	42,048	44,011	46,088	48,246	50,527

Appendix O

HAZEN AND SAWYER
Environmental Engineers & Scientists

Hazen and Sawyer, P.C.
10 Mountainview Road
Upper Saddle River, NJ 07458
201 327-7400
Fax 201 327-3709

September 4, 1991

Mr. John T. Parnell, P.E.
Deputy Commissioner
Environmental Facilities
Orange County Department of Public Works
Route 17M - P.O. Box 509
Goshen, New York 10924

RE: Orange County Comprehensive Sewerage Study Report

Dear Mr. Parnell:

In accordance with our contract dated August 4, 1989 Hazen and Sawyer is pleased to submit 75 copies of the above-referenced Report.

The Orange County Comprehensive Sewerage Study Report is a single-bound volume. It contains an Executive Summary, supporting chapter text, figures, tables and appendices.

Hazen and Sawyer has enjoyed serving Orange County on this project and looks forward to providing assistance on future aspects of the project. Should you or other Orange County representatives have questions regarding our findings or require additional information, please feel free to contact us.

Very truly yours,

HAZEN AND SAWYER, P.C.

Glenn R. Di Giovanni, P.E.
Project Manager

Robert E. Hagadorn, P.E.
Project Officer

STATE OF NEW YORK
ROBERT EDWARD HAGADORN
No. 46116
LICENSED PROFESSIONAL ENGINEER

GRD:jb
cc: W.B. Sinnott, H&S
(c:ltrs:subm.ocs)

NOTE: *Alteration of this document, except by a licensed Professional Engineer, is illegal. (This statement is required by Section 7209, Subdivision 2 of the New York State Education Law.)*

orange county

ORANGE COUNTY, NEW YORK

COMPREHENSIVE SEWERAGE STUDY

SEPTEMBER 1991

HAZEN AND SAWYER
Environmental Engineers & Scientists

In Association With

EA Engineering, Science and Technology

KPMG Peat Marwick

Printed on recycled paper.

FOREWORD

FOREWORD

The development and issuance of the Orange County Comprehensive Sewage Study is the result of almost two years of research, planning, analysis and interactive decision-making by the Project Team. The Project Team consists of Hazen and Sawyer as lead environmental engineering consultant, EA Engineering, Science and Technology as scientific subconsultant and KPMG Peat Marwick as financial subconsultant.

The support from Hon. Mary McPhillips, Orange County Executive, throughout the work effort on this project is greatly appreciated.

The Project Team thanks the individual members of both the current and former Orange County Sewer Committee for their dedication to the project. The numerous meetings and working sessions conducted with the Sewer Committee provided a wealth of insight and information that is put to constructive use in this Study. Your efforts and contributions merit well-deserved recognition. The leadership of Hon. Spencer McLaughlin, Chairman of the current Sewer Committee, is particularly recognized. In addition, the input and guidance from Hon. Roberta Murphy, Legislator District #1, during the project is noted. The current Sewer Committee consists of the following individuals:

ORANGE COUNTY SEWER COMMITTEE

CHAIR	Hon. Spencer McLaughlin	Legislator, District #7
LEGISLATURE	Hon. Albert Favoino	Legislator, District #6
	Hon. Anthony Marino	Legislator, District #17
	Hon. Roberta Murphy	Legislator, District #1
	Hon. David Pardy	Legislator, District #8
	Hon. James Townsend	Chairman and Legislator, District #19
MUNICIPALITIES	Hon. Robert Bonney	Mayor, Village of Monroe
	Hon. Bruce Chichester	Mayor, Village of Harriman
	Hon. Timothy Diltz	Supervisor, Town of Chester
	Hon. Annette Dorozynski	Supervisor, Town of Tuxedo
	Hon. Michael Frerichs	Supervisor, Town of Monroe
	Hon. Joseph Rampe	Supervisor, Town of Warwick
	Hon. Richard Randazzo	Supervisor, Town of Cornwall
	Hon. Gilbert Shapiro	Mayor, Village of Greenwood Lake
	Hon. Robert Till	Supervisor, Town of Woodbury
	Hon. Myron Urbanski	Supervisor, Town of Goshen

<u>ORGANIZATIONS</u>	Mr. Jack Evans	Administrator, County Dept. of Health
	Mr. Peter Garrison	Commissioner, County Dept. of Planning
	Mr. Louis Mills	Former County Executive
	Mr. John Parnell	Asst. Commissioner, County Dept. of Public Works

Individuals that served on the former Sewer Committee include the following:

Mr. James Bondur	Former Mayor, Village of Walden
Ms. Nancy Calhoun	Former Supervisor, Town of Blooming Grove
Mr. Louis Cascino	Commissioner, County Dept. of Public Works
Mr. Barry Cheney	Wehran Company
Mr. Dennis Cosgrove	Former Supervisor, Town of Wallkill
Mr. Harold Grout	Monroe Tube Company
Hon. Carl Helstrom	Supervisor, Town of Montgomery
Hon. Graham Jamison	Supervisor, Town of Crawford
Mr. Nicholas Papaceno	Former Mayor, Village of Warwick
Mr. Matthew Schleifer	County Dept. of Health
Mr. William Trimble	Eastern Orange Chamber of Commerce
Mr. Donald Witfield	Eastern Orange Chamber of Commerce

Other individuals in Orange County who have contributed to the development of this Study are thanked for their efforts. In particular, the Project Team wishes to recognize the assistance provided by the following people:

Mr. Ronald Andryshak	County Dept. of Public Works
Mr. Robert Bradford	Exec. Director, County Water Authority
Mr. Thomas Cione	County Dept. of Law
Ms. Mary Dwyer	Assistant to the County Executive
Mr. Stephen Hunter	County Dept. of Law
Mr. Gordon Jones	County Dept. of Public Works
Ms. Vicki Mitchell	Assistant to Chairman of the Legislature
Hon. Roy Weyant	Legislator, District #5

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EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

Preface

The development of a comprehensive plan for future sewage collection, treatment and management in Orange County, New York is the foundation from which action can be taken and quality of life goals achieved. Recognizing this need, the County authorized Hazen and Sawyer, P.C. in late 1989 to undertake a scope of work necessary to produce the Orange County Comprehensive Sewerage Study.

The geographic scope of this Study is the three cities, 20 towns and 17 villages composing Orange County. The Study planning period consists of a 30 year interval from 1990 to 2020.

This Study examines salient background information and the status of existing sewage treatment facilities, reviews planning information and growth trends, describes various technology approaches, identifies and evaluates alternatives, defines a Recommended Plan and presents the financial, institutional and implementation issues associated with the Recommended Plan.

Introduction

The Orange County Comprehensive Sewerage Study is intended to give the County a framework from which actions can be taken to address current and projected sewage management needs. The Study looks at many potential alternatives for County-wide sewage management since it was recognized from the beginning that there is no single solution to the widely diverse needs of County residents.

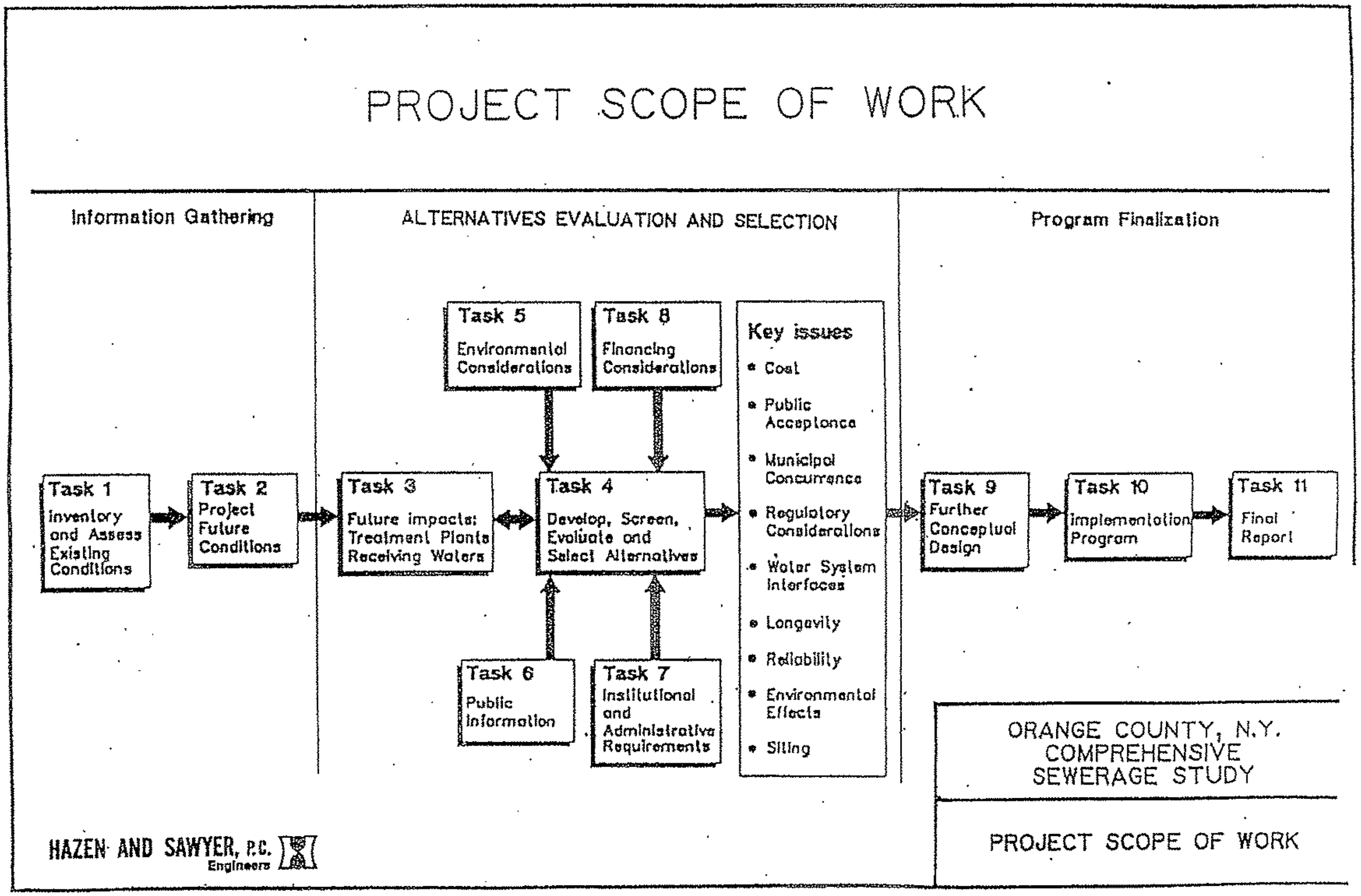
The Study consists of three major elements:

- Information Gathering;
- Alternatives Evaluation and Selection; and
- Program Finalization.

A schematic project flow chart depicting tasks in each of these elements is presented as Figure ES-1.

An Orange County Sewer Committee was formed to represent the County during the execution of the project scope of work. The Sewer Committee worked closely with the Project Team of Hazen and Sawyer, P.C., as lead consultant, and both EA Engineering, Science and Technology and KPMG Peat Marwick, as subconsultants. EA supported Hazen and Sawyer by providing water quality modeling, waste assimilation capacity analyses and defining effluent discharge criteria. KPMG Peat Marwick

FIGURE ES-1


PROJECT SCOPE OF WORK
Information Gathering
ALTERNATIVES EVALUATION AND SELECTION
Program Finalization
Task 1 Inventory and Assess Existing Conditions
Task 2 Project Future Conditions
Task 3 Future impacts: Treatment Plants Receiving Waters
Task 4 Develop, Screen, Evaluate and Select Alternatives
Task 5 Environmental Considerations
Task 6 Public Information
Task 7 Institutional and Administrative Requirements
Task 8 Financing Considerations
Key issues
• Cost
• Public Acceptance
• Municipal Concurrence
• Regulatory Considerations
• Water System Interfaces
• Longevity
• Reliability
• Environmental Effects
• Siting
Task 9 Further Conceptual Design
Task 10 Implementation Program
Task 11 Final Report
HAZEN AND SAWYER, P.C. Engineers
ORANGE COUNTY, N.Y. COMPREHENSIVE SEWERAGE STUDY
PROJECT SCOPE OF WORK

performed financial analyses and reviewed implementation and institutional alternatives for the Study recommendations.

Background Information

Orange County is realizing the fulfillment of its urban-rural growth concept as the percentage split between the two types of growth has remained fairly constant over the last ten years. The County is truly at the crossroads of the two types of growth with its rural areas and productive farmlands contrasted by its commercial/industrial base and commuting proximity to New York City and other urbanized locales.

In 1985, about 70 percent of the County's land area was in some form of use. Through the late 1980's, most of the residential growth has occurred along major transportation corridors in the County.

More than one-half of the citizens in the County are currently served by 36 sewage treatment plants (STPs) ranging in capacity from 20,000 gallons per day to 7 million gallons per day (mgd). The balance of the population uses septic tank systems or very small "package" type treatment plants.

There were more than 175 municipal and non-municipal potable water systems in the County servicing an average daily demand in excess of 30 mgd in 1987. In 1988, the Orange County Water Authority (OCWA) was formed to address future water use needs in the County. Figure ES-2 depicts the planned OCWA system for water service.

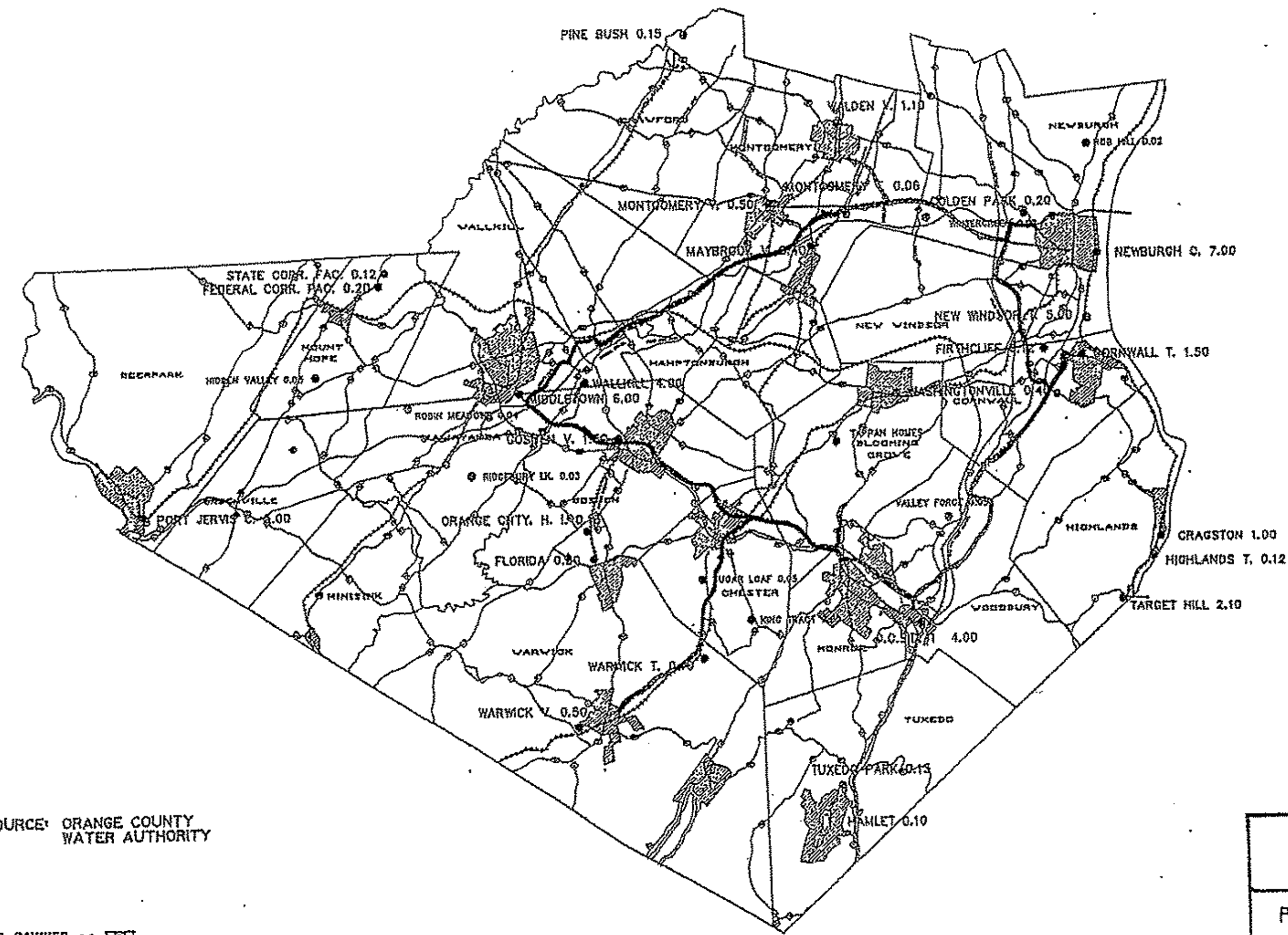
The topography and geology of Orange County is diverse. The County is bounded by mountain ranges on its eastern and western ends with the broad Wallkill River Valley located between them where the "black dirt" area is found. Soils in Orange County are generally of poor quality for the installation of septic tank leaching fields. In fact, at least 85 percent of the County soil is classified as having properties or features that are unfavorable for use in septic service, requiring special designs and/or involving significantly higher construction and maintenance costs.

Drainage basins in Orange County are oriented in a northeast-southwest direction. There are ten major drainage basins identified in Orange County with the largest being the Wallkill River basin.

Current Sewage Treatment

The 36 existing STPs in Orange County are depicted in Figure ES-3. The project scope of work includes an inventory and assessment of these facilities to determine their suitability to address future

FIGURE ES-2



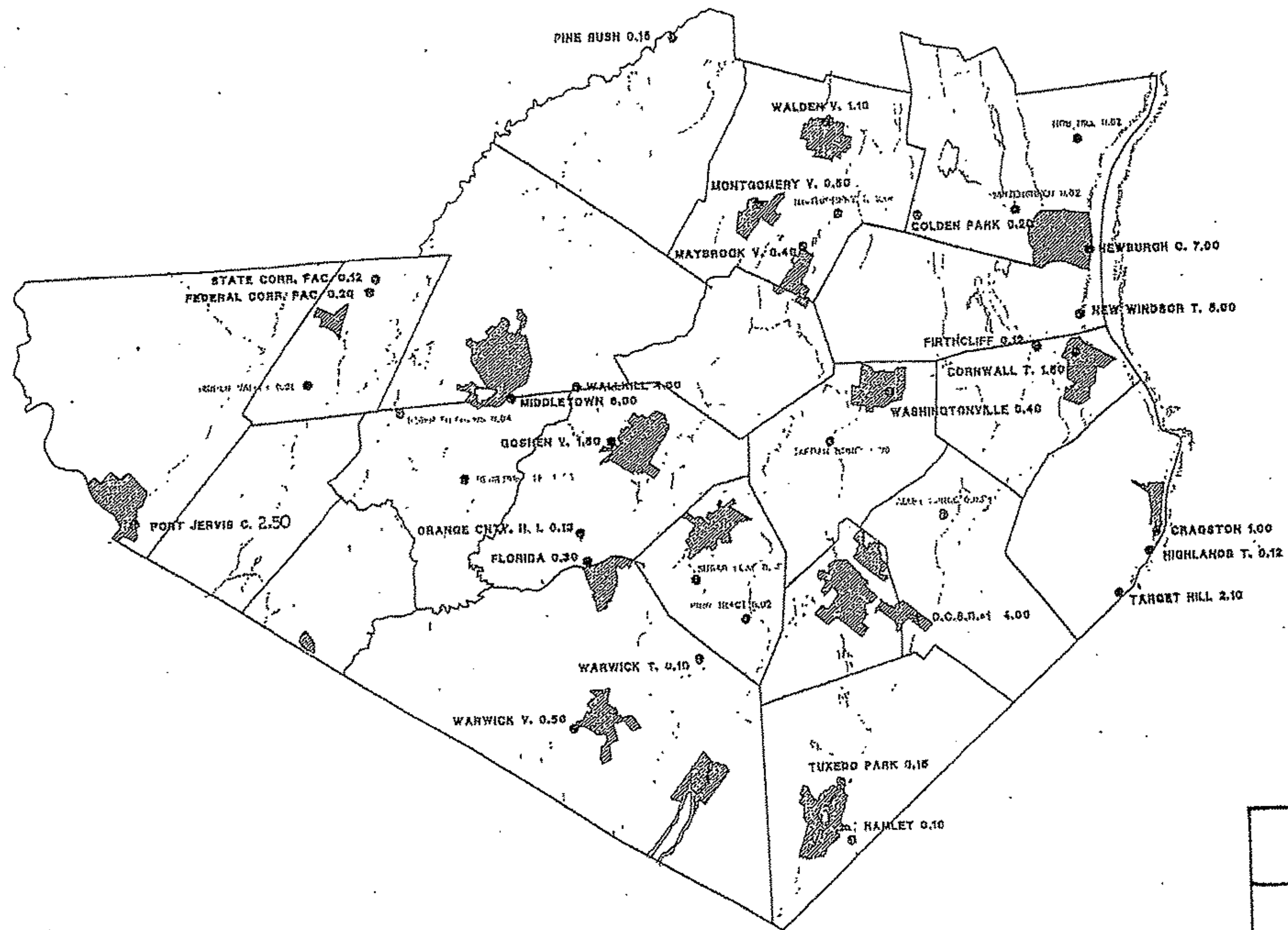
SOURCE: ORANGE COUNTY WATER AUTHORITY

HAZEN AND SAWYER, P.C. Engineers

ORANGE COUNTY, N.Y. COMPREHENSIVE SEWERAGE STUDY

PROPOSED ORANGE COUNT WATER SYSTEM ROUTE

FIGURE ES-3



ORANGE COUNTY, N.Y.
COMPREHENSIVE
SEWERAGE STUDY

EXISTING SEWAGE
TREATMENT PLANTS

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Engineers

sewage treatment needs. Accordingly, an STP database was constructed that processed information from such sources as facility operator questionnaires, telephone interviews, facility site visits and observation of equipment operations.

The database was subsequently condensed so as to identify infiltration/inflow, capacity and treatment problems, if any, at each facility. This revealed that greater than 63 percent of existing facilities have one or more of these problems.

For the purpose of this Study, 14 of the 36 STPs are deemed significant facilities meaning that they could conceivably serve as a "regional" type of operation either now or in the future. Regional is defined in the Study as serving more than one community.

The evaluation of current sewage treatment in the County also included the review of ten previous sewerage study reports prepared for either Orange County or particular communities therein. Each report was analyzed in-depth for pertinent planning and technical information that is of use to this Study.

Planning Information

Planning information for such variables as total population, sewered population, water consumption and sewage generation was developed in the Study. The sources of "baseline" information includes U.S. Census Bureau data, available County and New York State planning information, and previous reports, studies and data. Baseline is defined in the Study as using previously documented sources. Baseline planning information showed the total County population growing from 259,603 in the year 1990 to just over 400,000 in the year 2020, representing an average annual growth rate of 1.36 percent.

During the early stages of the Study, both the Sewer Committee and the Project Team recognized the necessity of updating the baseline planning information to form a more clear picture of the current situation and growth projections for each community in Orange County. As such, updated planning information was obtained by visiting the supervisor or mayor of every city, town and village in Orange County, along with visiting master planning consultants and municipal engineers for the communities.

The updated planning information and the baseline planning information is compared, assessed and analyzed to yield refined planning information for use in this Study. Refined planning information showed the year 2020 total County population to be just over 492,000, representing an average annual growth of 1.85 percent during the 30 year interval beginning in 1990. The County sewered population is expected to rise from about 62 percent in 1990 to about 77 percent in 2020. The County average per capita sewage generation rate is expected to remain level at 124 gallons per person per day, although there are wide differences among this variable between communities. The County sewage flow to be managed in the year 2020 is expected to be about 59 mgd.

The final, refined planning information was reviewed and accepted by both the Sewer Committee and officials from every city, town and village in Orange County.

__Sewage Treatment Technologies__

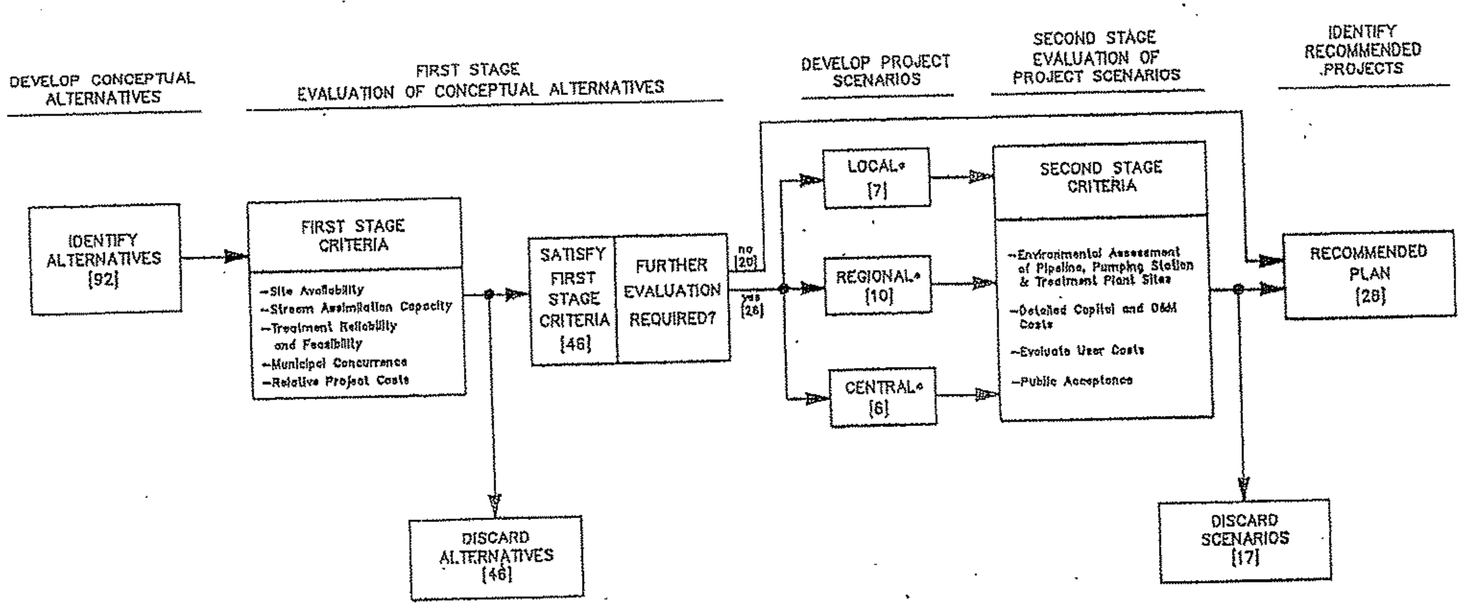
A descriptive overview of conventional and non-conventional or land-based sewage treatment technologies under consideration for Orange County is presented in the Study. Non-conventional technologies reviewed include infiltration-percolation, irrigation, overland flow, deep well injection and freshwater wetlands. A description of sewage sludge treatment and disposal technologies is also presented in the Study.

Through the consensus of its Sewer Committee, Orange County agreed to a multi-pronged approach for sewage management, in the following order:

- Maintain an active role in promoting water conservation and reuse;
- Encourage local communities to actively pursue the reduction of both infiltration and inflow (I/I) in existing sewer service areas;
- Maintain an industrial sewage pre-treatment program to minimize contaminants and variations in the constituents of sewage to be treated;
- Consider the use of small "package" type treatment plants as an alternative to septic systems in specific locations;
- Encourage rural communities to investigate the potential use of non-conventional sewage treatment technologies for small, local facilities;
- Require the use of conventional sewage treatment technologies for larger facilities such as those providing municipal regional or central service; and

FIGURE ES-5

EVALUATION PROCESS FOR ALTERNATIVE ACTIONS



* NOTE THAT THE 26 CONCEPTUAL ALTERNATIVES TO BE EVALUATED IN THE SECOND STAGE BECAME 23 PROJECT SCENARIOS. THIS IS BECAUSE SOME PROJECT SCENARIOS CAN ENCOMPASS MULTIPLE CONCEPTUAL ALTERNATIVES.

ORANGE COUNTY, N.Y.
COMPREHENSIVE
SEWERAGE STUDY

EVALUATION PROCESS FO
ALTERNATIVE ACTIONS

HAZEN AND SAWYER, P.C. Engineers

- Plan for the environmentally sound and economically feasible beneficial utilization and/or disposal of treated sewage sludge.

The above consensus from the Sewer Committee helped guide the development of alternative actions to meet the future sewage collection and treatment needs of Orange County.

Alternative Actions

Alternative actions were developed and identified to initiate the process of determining the most appropriate combination of sewage collection, treatment and disposal facilities for Orange County. Three primary factors justify the necessity of the County taking action to address future sewage management needs:

- Projected growth trends and areas in need of capacity;
- Adequacy of existing sewage treatment facilities; and
- Changing environmental regulations and their effect on treated effluent discharges.

The Study identifies 92 conceptual alternative actions for the municipalities in Orange County. For evaluation purposes, they are categorized as local, regional and central treatment alternatives.

Local sewage treatment implies that individual municipalities will maintain, expand and/or upgrade existing facilities, or create new independent sewage service areas as necessary. Regional treatment alternatives are defined as those serving more than one municipality. Central treatment alternatives

consider treatment for several municipalities at one central facility with an effluent discharge to the receiving water body with the largest waste assimilative capacity: the Hudson River.

Many of the 92 alternative actions identified require the use of either an existing or new conventional sewage treatment facility. Three levels of treatment are described for consideration at these facilities:

- Secondary treatment;
- Low advanced treatment; and
- High advanced treatment.

Under some of the alternative actions, certain existing facilities may have to undergo an upgrade from secondary to either low or high advanced treatment. In addition, identified potential new facilities are defined depending on what processes and levels of sewage treatment are needed.

Figure ES-4 depicts the alternative sewage collection pipeline routes considered for identified regional and central treatment alternative actions.

Receiving Water Limitations

This Study identifies the capabilities of various receiving water bodies in Orange County to drain and assimilate treated sewage effluent. A waste assimilative capacity (WAC) analysis is performed using water quality models for particular water bodies in the County.

The Hudson and Wallkill Rivers offer the greatest assimilative capacity for substantial treated effluent discharges, however the latter must receive advanced treated effluent while secondary treated effluent is adequate for the Hudson River. The Ramapo River, Wawayanda Creek, Shawangunk Kill, Moodna Creek and Woodbury Creek have little to no assimilative capacity remaining. Based on WAC analyses in this Study, the Hudson River is the best choice for effluent discharge from a regional or central treatment facility, provided such an alternative is warranted.

Evaluation of Alternative Actions

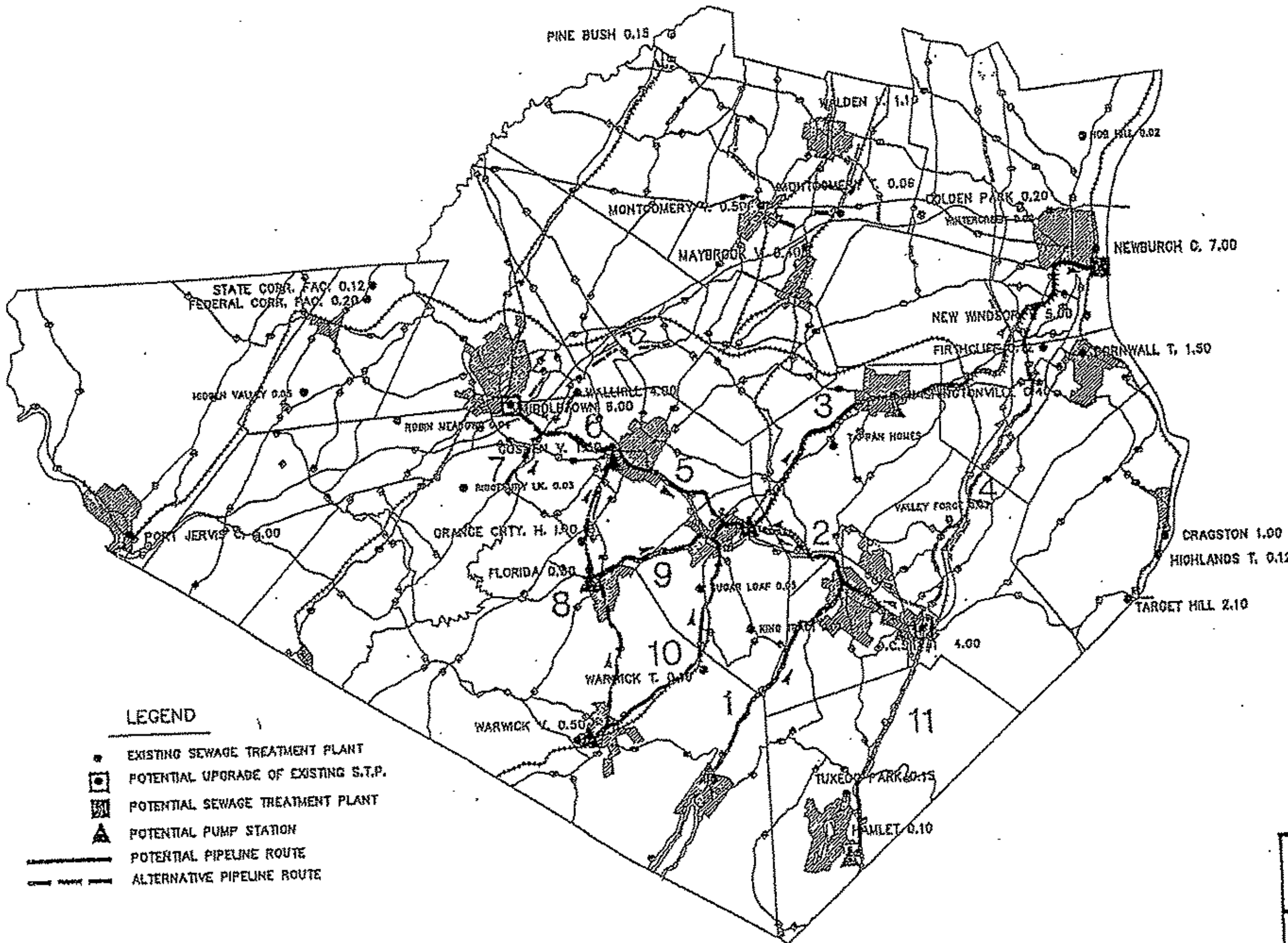
The 92 identified alternative actions are evaluated under a two-stage evaluation process. First stage criteria include site availability, treatment feasibility and reliability, perceived municipal concurrence and comparative cost. Second stage criteria include environmental impacts and detailed capital, operation and maintenance costs.

Figure ES-5 depicts the two-stage evaluation process used to analyze the 92 alternative actions. At the end of the first stage evaluation, 20 recommended actions are identified for inclusion as recommended actions. Of the remaining 72 alternative actions, 46 are discarded for not satisfying the first stage criteria and 26 are designated to undergo the second stage evaluation.

The 26 alternative actions entering the second stage evaluation are grouped into 23 "project scenarios" since regional and central alternative action encompass more than one municipality. The 23 project scenarios undergo both an environmental impact analysis and cost analysis in the second stage. In all, 7 local, 10 regional and 6 central project scenarios are evaluated.

The results from the environmental impact analysis showed few projected impacts that can not be mitigated. The results from the cost analysis showed the comparative annual cost per household or

FIGURE ES-4



ORANGE COUNTY, N.Y.
COMPREHENSIVE
SEWERAGE STUDY

CONVEYANCE ALTERNATIVES

HAZEN AND SAWYER, P.C.
Engineers

equivalent dwelling unit (EDU) for the various project scenarios. A review of the results from these analyses yields 3 central project scenarios and 2 regional project scenarios as the most appropriate to consider and select from.

After several meetings with the Orange County Sewer Committee to discuss the positive and negative aspects of each project scenario, the Sewer Committee voted to approve Central Project Scenario No. 1b as the preferred approach for central sewage collection and treatment in Orange County. Service under this scenario is to be provided to the OCSD#1 communities, MBSR communities, the Villages of Greenwood Lake and Washingtonville, and the Town of Goshen.

Recommended Plan

The Recommended Plan calls for the implementation of the following actions to meet the future sewage collection, treatment and management requirements of Orange County:

- A comprehensive sewage reduction program that encompasses both water conservation and infiltration/inflow management. Water conservation components include public education, leak detection and correction, enforcement through construction codes, reuse and recycling, and waste prevention programs. Infiltration and inflow should be prevented and controlled to within a cost-effective range;

- A comprehensive sewage pre-treatment program for significant and industrial users (SIUs) that discharge contaminants or heavy loadings into sewage collection and treatment systems. Such a program should monitor and limit several major types of contaminants;

- Local projects to address service associated with 20 individual municipalities where regionalization has been determined to be inappropriate due to geographic separation, inadequate population base, high cost or municipal outlook. Recommended local actions include the upgrading and/or expansion of existing municipal sewage treatment facilities, development of new facilities as needed, and the potential utilization of "package" type treatment systems in lieu of septic tank systems for larger site development projects. The development and maintenance costs of local collection systems associated with these local projects remain an internal municipal responsibility. These projects do not fall under County jurisdiction;

- Regional projects include the construction, expansion and/or upgrade of the following facilities: construct a new Mount Hope/Otisville STP at 0.60 mgd ADV(H); expand the Newburgh (C) STP to a capacity of 9.3 mgd; expand the New Windsor STP to a capacity of 12.0 mgd; expand the Wallkill STP to a capacity of 5.3 mgd; and expand and upgrade the Village of Warwick STP to 1.50 mgd ADV(L). The development and maintenance costs of local collection systems associated with these regional projects remain an internal municipal responsibility. These projects do not fall under County jurisdiction;

- The central County project involves the construction of a new conventional 12.0 mgd SEC sewage treatment plant located in the vicinity of the Town of New Windsor with a treated effluent discharge to the Hudson River and the construction of associated pumping stations and main collection pipelines. Figure ES-6 depicts the recommended central County sewage treatment action. The central County project plans include the abandonment of both the existing OCSD#1 and Washingtonville STPs and the resultant elimination of their effluent discharges to the Ramapo River and Moodna Creek, respectively. This project does fall under County jurisdiction since the County is to be responsible for its implementation. However, the development and maintenance costs of local collection systems associated with this central County project remain an internal municipal responsibility; and

- Continued separate development of a comprehensive sewage sludge plan for the environmentally sound and economically viable utilization and/or disposal of sewage sludge generated in Orange County during the Study period.

Figure ES-7 depicts the recommended sewage treatment actions for Orange County. Table ES-1 summarizes the local, regional and County actions for sewage treatment included in the Recommended Plan. Table ES-2 provides a cost summary for the recommended sewage treatment actions for Orange County.

Institutional and Financial Considerations

Creation of a new County sewer district for the central County sewage treatment action in the Recommended Plan can be preferable since a single new facility is planned and private financing may be used. This approach is more burdensome if a number of small facilities are developed. Private financing can avoid many of the debt issues related to financing under a County district. A district can also use the County's taxing ability as a secondary source of revenue,in addition to rates, to secure bonds. This can allow more favorable financing terms, such as lower interest rates and no debt service

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE ES-1

SUMMARY OF RECOMMENDED SEWAGE TREATMENT ACTIONS

TOWN OR CITY	CONSTITUENT COMMUNITIES	RECOMMENDED SEWAGE TREATMENT ACTION	DESCRIPTION
Blooming Grove (T)	Washingtonville (V) Blooming Grove (UT)	Central (County) Central (County)	Service by a new 12 mgd STP Service by a new 12 mgd STP
Chester (T)	Chester (V) Chester (UT)	Central (County) Central (County)	Service by a new 12 mgd STP Service by a new 12 mgd STP
Cornwall (T)	Cornwall-On-Hudson (V) Cornwall (UT)	Local Regional	Service by a maintained Cornwall STP Service by an expanded New Windsor STP and a maintined Firthcliff STP
Crawford (T)	Crawford (UT)	Local	Service by an expanded Pine Bush STP
Deerpark (T)	Deerpark (UT)	Local	Service by septic systems/package plants
Goshen (T)	Goshen (V) Goshen (UT)	Local Central (County)	Service by a maintained Goshen (V) STP Service by a new 12 mgd STP
Greenville (T)	Greenville (UT)	Local	Service by septic systems/package plants
Hamptonburgh (T)	Hamptonburgh (UT)	Local	Service by septic systems/package plants
Highlands (T)	Highland Falls (V) Highlands (UT)	Local Local	Service by a maintained Cragston STP Service by an expanded Fort Montgomery STP
Middletown (C)	Middletown (C)	Local	Service by a maintained Middletown STP
Minisink (T)	Unionville (V) Minisink (UT)	Local Local	Service by septic systems/package plants Service by septic systems/package plants
Monroe (T)	Harriman (V) Kiryas Joel (V) Monroe (V) Monroe (UT)	Central (County) Central (County) Central (County) Central (County)	Service by a new 12 mgd STP Service by a new 12 mgd STP Service by a new 12 mgd STP Service by a new 12 mgd STP
Montgomery (T)	Maybrook (V) Walden (V) Montgomery (V) Montgomery (UT)	Local Local Local Local	Service by an upgraded Maybrook STP Service by a maintained Walden STP Service by a maintained Montgomery (V) STP Service by a new 0.6 mgd STP
Mount Hope (T)	Otisville (V) Mount Hope (UT)	Regional Regional	Service by a new 0.6 mgd STP Service by a new 0.6 mgd STP

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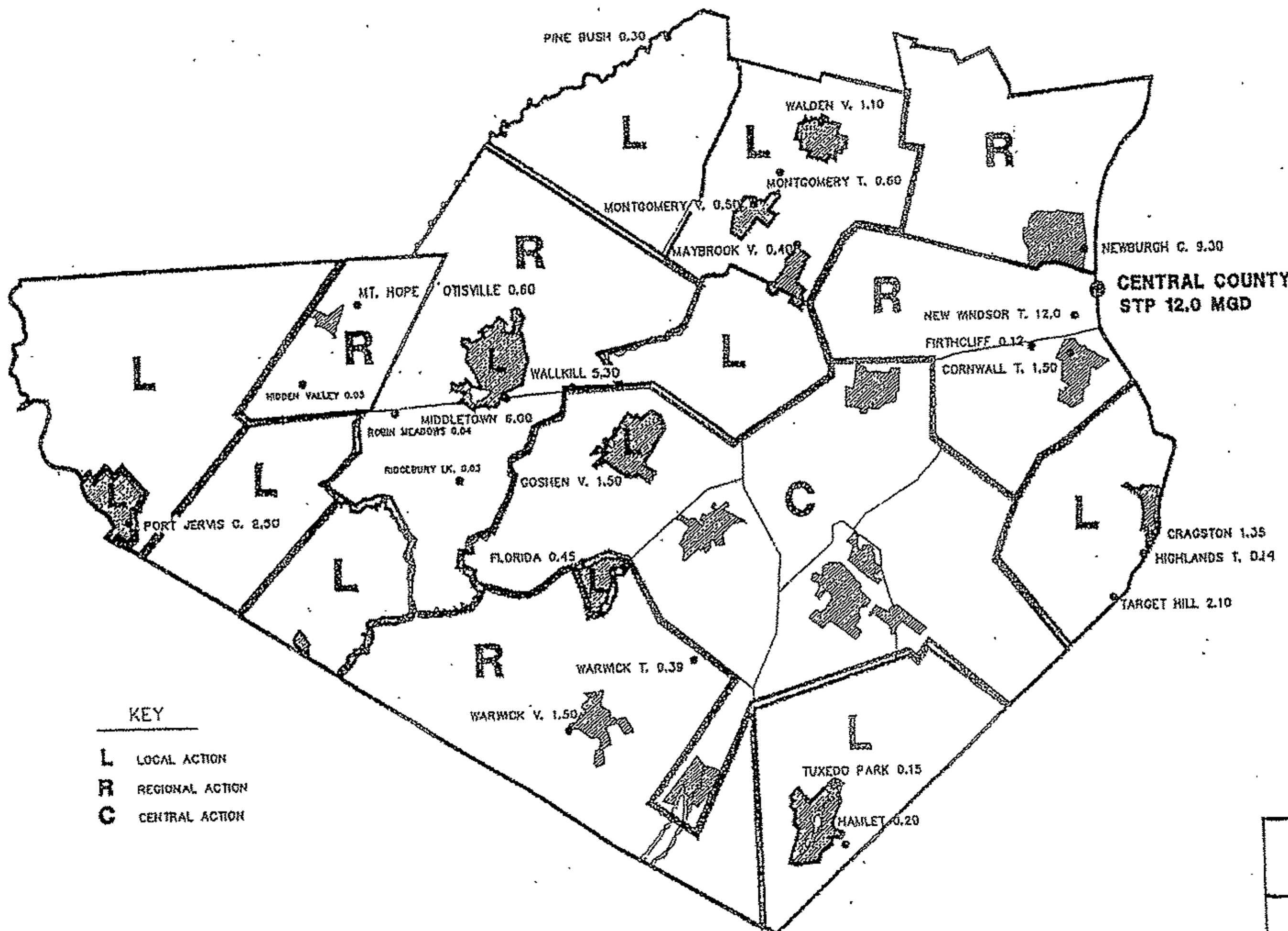
ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE ES-1 CONT'D.

SUMMARY OF RECOMMENDED SEWAGE TREATMENT ACTIONS

TOWN OR CITY	CONSTITUENT COMMUNITIES	RECOMMENDED SEWAGE TREATMENT ACTION	DESCRIPTION
Newburgh (C)	Newburgh (C)	Regional	Service by an expanded Newburgh (C) STP
Newburgh (T)	Newburgh (UT)	Regional	Service by an expanded Newburgh (C) STP
New Windsor (T)	New Windsor (UT)	Regional	Service by an expanded New Windsor STP
Port Jervis (C)	Port Jervis (C)	Local	Service by a maintained Port Jervis STP
Tuxedo (T)	Tuxedo Park (V) Tuxedo (UT)	Local Local	Service by an upgraded Tuxedo Park STP Service by an expanded, upgraded Hamlet STP
Wallkill (T)	Wallkill (UT)	Regional	Service by an expanded Wallkill STP
Warwick (T)	Florida (V) Greenwood Lake (V) Warwick (V) Warwick (UT)	Local Central (County) Regional Local	Service by an upgraded, expanded Florida STP Service by a new 12 mgd STP Service by an expanded, upgraded Warwick (V) STP Service by an expanded, upgraded Warwick (V) STP and a maintained Warwick (T) STP
Wawayanda (T)	Wawayanda (UT)	Regional	Service by an expanded Wallkill STP
Woodbury (T)	Woodbury (UT)	Central (County)	Service by a new 12 mgd STP

FIGURE ES-7



ORANGE COUNTY, N.Y.
COMPREHENSIVE
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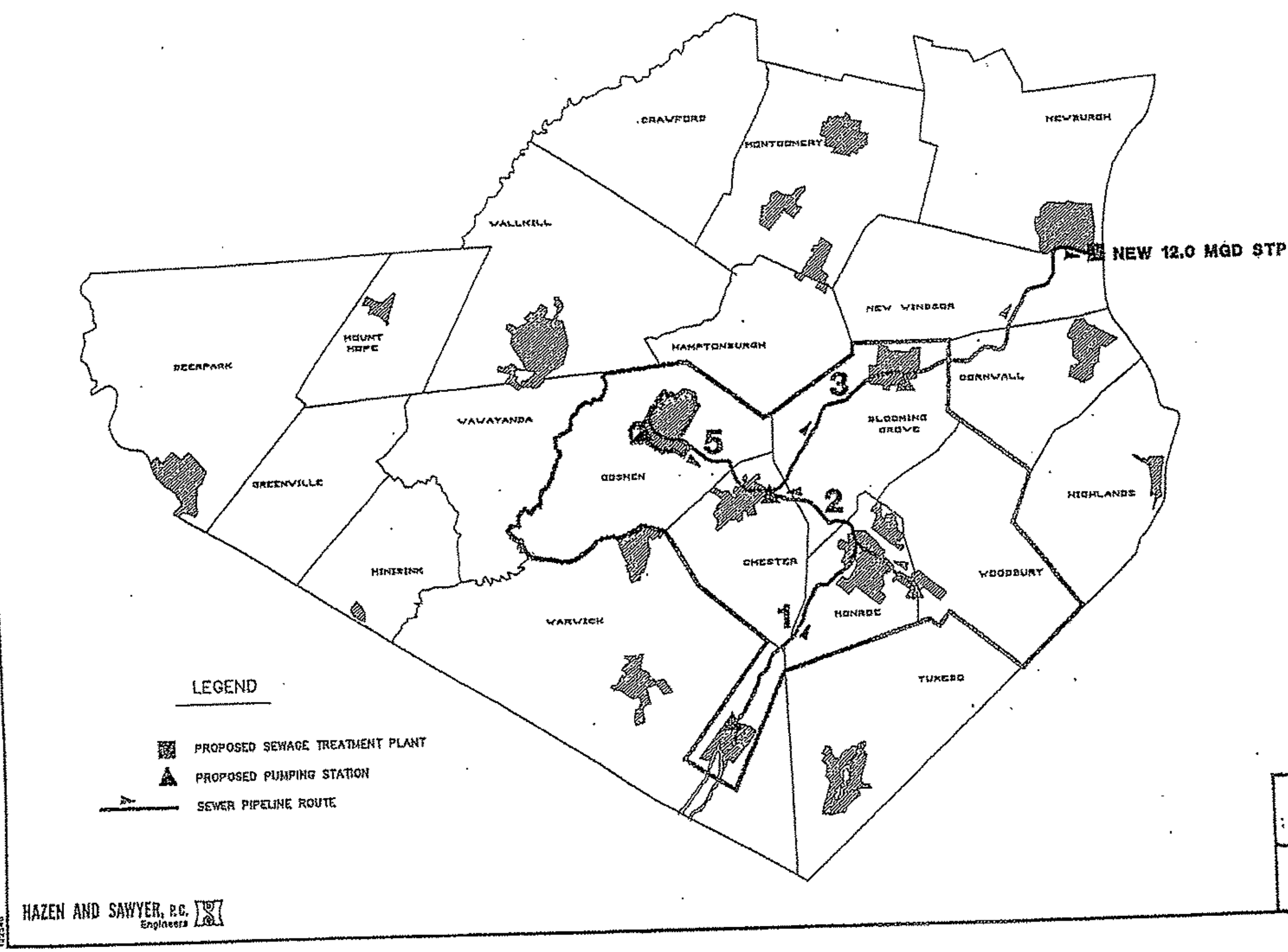
RECOMMENDED PLAN
FOR SEWAGE TREATMENT

FIGURE ES-6



ORANGE COUNTY, N.Y.
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RECOMENDED CENTRAL
COUNTY SEWAGE
TREATMENT ACTION

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE ES-2

COST SUMMARY FOR RECOMMENDED SEWAGE TREATMENT ACTIONS

RECOMMENDED SEWAGE TREATMENT ACTION	INVOLVED NUMBER OF COMMUNITIES	BUDGETARY CAPITAL COST ($ 1991) (MILLIONS)	BUDGETARY ANNUAL O&M COST ($ 1991) (MILLIONS)	
			1995	2020
Local	20	$26.5	$7.35	$8.95
Regional	9	$63.5	$5.85	$10.42
Central (County)	11	$86.4	$2.19	$4.75
TOTALS	40	$176.4	$15.39	$24.12

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reserve fund, than revenue bond financing by an authority.

On the other hand, a County sewer authority can be advantageous in providing wholesale sewage treatment services to different service areas within the County. The responsibilities of the authority can be initiated with a single project and can be expanded to a number of other areas of the County, as needed. An authority, having an independent management and financing structure, can operate more like a utility than a district can.

In the Program Finalization phase of the scope of work for this Study, the County, via the County Sewer Committee, examined the issues concerning district versus authority for the central County sewage treatment action in the Recommended Plan. After several months of review and discussion, the issue was put to a vote by the Sewer Committee with the result being that the district approach is deemed preferable for Orange County. As such, this Study proposes the district approach as the institutional form to be used by the central County sewage treatment action in the Recommended Plan.

The Sewer Committee also reviewed and discussed private sector participation considerations regarding the central County sewage treatment action in the Recommended Plan. While the Sewer Committee expressed interest in better understanding how different levels of private sector participation can be of benefit to the County, the general consensus was that they needed more information to form a policy position. As such, the Sewer Committee voted in favor of Orange County further studying the impacts of various levels of private sector participation for the central County sewage treatment action in the Recommended Plan.

Financial Analysis

The central County sewage treatment action described in the Recommended Plan involves the construction of a new conventional 12.0 mgd STP in the vicinity of the Town of New Windsor, providing a secondary (SEC) level of treatment, with treated effluent discharge to the Hudson River. This action also involves the construction of five pumping stations and approximately 39 miles of main collector pipelines.

Table ES-3 summarizes service and cost assumptions for the central County sewage treatment action.

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE ES-3

CENTRAL COUNTY SEWAGE TREATMENT ACTION:

SERVICE AND COST ASSUMPTIONS

PROJECT DESCRIPTION	New 12.0 mgd SEC STP located in the vicinity of the Town of New Windsor with effluent discharge to the Hudson River, 5 pumping stations and 39 miles of collection pipe (see Chapter 13 for details)		
PROPOSED SERVICE AREA	Service Area	1995 EDUs(1)	2020 EDUs(1)
	OCSD#1	8,440	18,280
	MBSR	10,640	20,760
	Washingtonville	1,680	3,600
	Greenwood Lake	200	1,560
	Goshen (T)	1,640	3,800
	Total	22,600	48,000
ESTIMATED CAPITAL CONSTRUCTION COST (Midpoint of Construction)	($ 1994)	$103,000,000	
LAND PURCHASES AND ENVIRONMENTAL STUDIES		$5,000,000	
EXISTING TREATMENT PLANT DEBT TO RETIRE	OCSD#1	1,900,000	
	MBSR(2)	1,620,000	
	Washingtonville	300,000	
	Total	$3,820,00	
ESTIMATED ANNUAL O&M COSTS	($ 1995)	$ 2,740,000	
	($ 2020)	$20,120,000	
ESTIMATED ANNUAL ADMINISTRATIVE COSTS	($ 1995)	$ 250,000	

Notes:

(1) For rate-setting purposes, equivalent dwelling units (EDUs) are based on flow estimates divided by 250 gallons per day per EDU.

(2) MBSR debt assumes the reimbursement of a $2.1 million outstanding grant with an acceptable grant closeout by USEPA and NYSDEC.

Source: KPMG Peat Marwick

The central County sewage treatment action is examined under three separate financing scenarios as follows:

- State Revolving Fund (SRF) loan financing from the New York State Environmental Facilities Corporation (NYSEFC);
- General obligation bond financing; and
- Revenue bond financing.

Table ES-4 presents a comparison of the financial impact analysis results for the three financing scenarios as applied to the central County sewage treatment action.

Figure ES-8 presents the annual debt service payments for the central County sewage treatment action.

Two specific variations of the central County sewage treatment action are also examined as depicted in Figure ES-9. Variation No. 1 of the central County sewage treatment action described in the Recommended Plan involves the construction of a new conventional STP at 19.0 mgd SEC in the vicinity of the Town of New Windsor, with a treated effluent discharge to the Hudson River. Variation No. 1 is also to serve municipalities currently in both the OCSD#1 and MBSR, the Town of Goshen and the Villages of Greenwood Lake and Washingtonville, plus the western portion of the Town of New Windsor service area (including Stewart Airport). The existing New Windsor STP would remain at 5.0 mgd treatment capacity.

Variation No. 2 of the central County sewage treatment action described in the Recommended Plan involves the construction of a new conventional STP at 24.0 mgd SEC in the vicinity of the Town of New Windsor, with a treated effluent discharge to the Hudson River. Variation No. 2 is also to serve municipalities currently in both the OCSD#1 and MBSR, the Town of Goshen and Villages of Greenwood Lake and Washingtonville, plus the entire Town of New Windsor service area. The existing New Windsor STP would be abandoned and converted into a pumping station.

Table ES-5 presents a comparison of cost results between financing either the central County sewage treatment action or Variation Nos. 1 and 2. Variation No. 2 is the most cost-effective approach since the economies of scale come into play from the larger customer base. The start-up annual cost per

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE ES-4

COMPARISON OF FINANCIAL IMPACT ANALYSIS RESULTS

FOR THE CENTRAL COUNTY SEWAGE TREATMENT ACTION

FINANCING SCENARIOS	ANNUAL COST PER EDU AT START-UP ($ 1995)	($ 1991)	CONNECTION FEE ($ 1995)	($ 1991)
• SRF Loan	$345	$284	$2,251	$1,852
• General Obligation Bond	$360	$296	$2,251	$1,852
• Revenue Bond	$360	$296	$2,251	$1,852

Notes:

(1) Costs do not include local municipal sewage collection costs
(2) Costs in $1991 are based on discounting 5 percent per year.

Source: KPMG Peat Marwick

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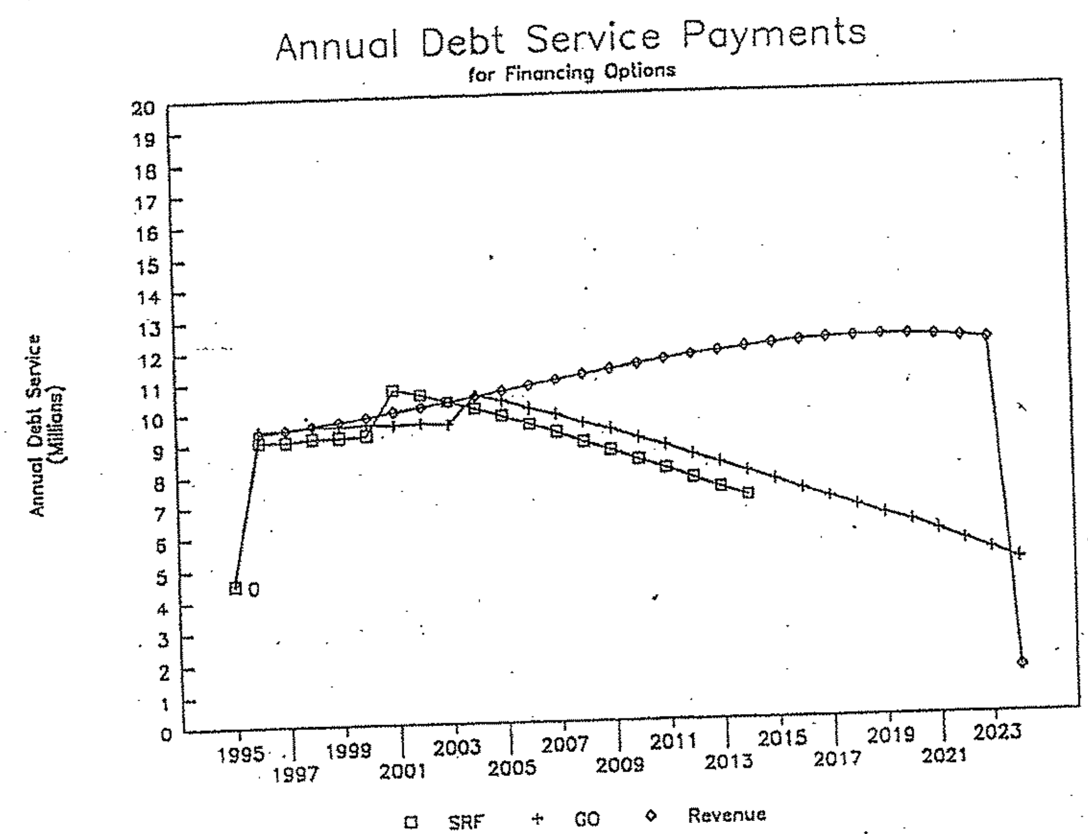
FIGURE ES-8



Source: KPMG Peat Marwick

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ORANGE COUNTY, N.Y.
COMPREHENSIVE SEWERAGE STUDY

ANNUAL DEBT SERVICE PAYMENTS FOR THE CENTRAL COUNTY SEWAGE TREATMENT ACTION

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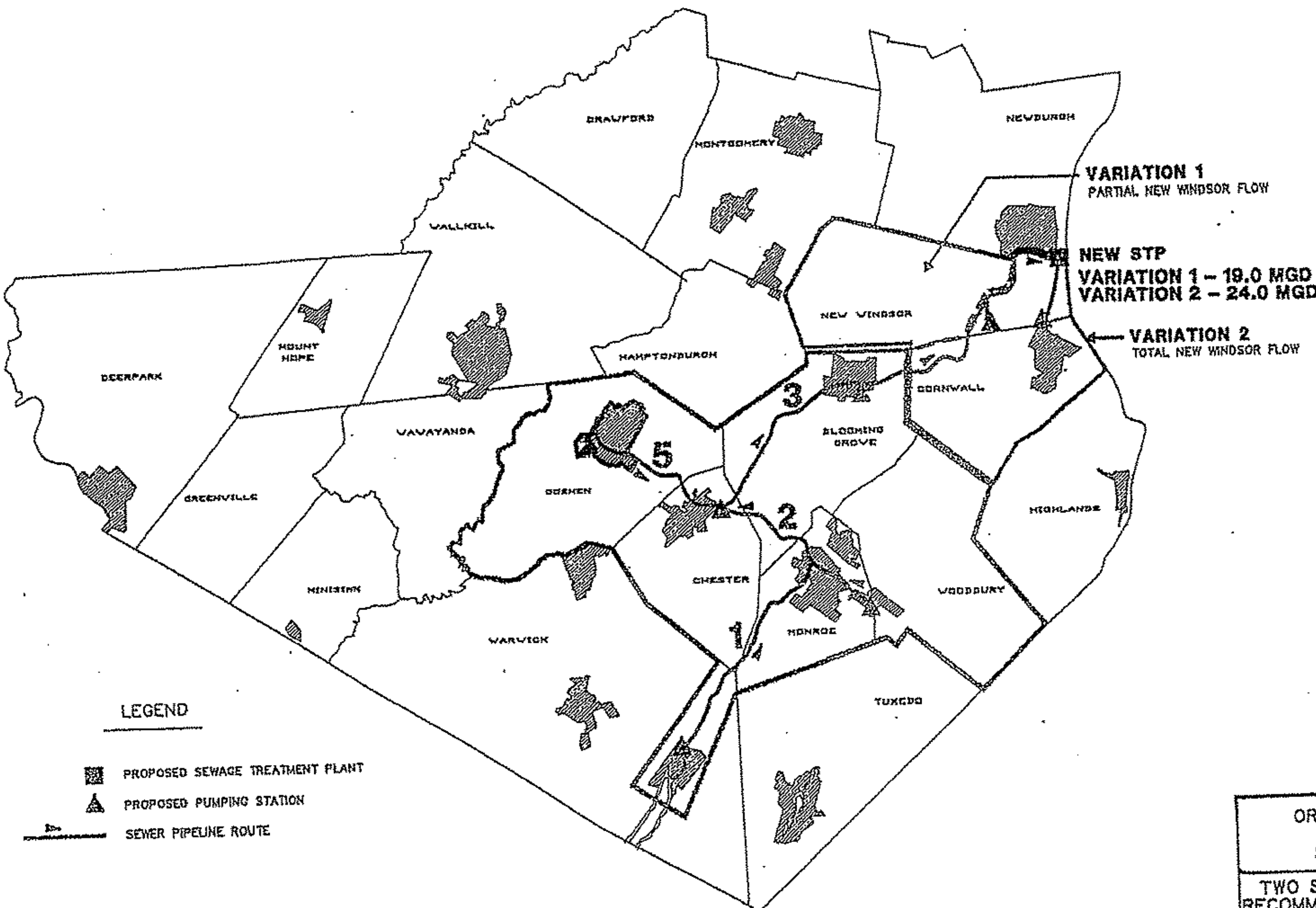
FIGURE ES-9



LEGEND

- PROPOSED SEWAGE TREATMENT PLANT
- PROPOSED PUMPING STATION
- SEWER PIPELINE ROUTE

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COMPREHENSIVE
SEWERAGE STUDY

TWO SPECIFIC VARIATIONS OF RECOMMENDED CENTRAL COUNTY SEWAGE TREATMENT ACTION

EDU of $197 (1991 dollars) for SRF financing of Variation No. 2 is the lowest cost presented. Thus, it would be advantageous to have the New Windsor service area join the central County service area from the economic viewpoint of communities to be served by the project.

However, since Variation No. 2 involves the abandonment of the existing New Windsor STP and diversion of all flow from the New Windsor area to a new 24.0 mgd STP, the decision will be made by New Windsor, from a financial standpoint, whether or not this is less costly to their customers than expanding their existing STP from 5.0 to 12.0 mgd. Table ES-6 attempts to make this comparison. It is seen that the New Windsor service area would be paying $145 (1991 dollars) per EDU in 1995 for the expansion of their existing STP. This compares to the $197 to $206 (1991 dollars) per EDU, depending on the financing scenario, if that facility were abandoned and the New Windsor service area became part of the central County service area. Thus, from the New Windsor service area's standpoint, it is financially preferable to remain a regional sewage treatment action and not participate in the central County sewage treatment action.

The central County sewage treatment action in the Recommended Plan is a cost-effective approach to meet the current and future needs of a large portion of Orange County's citizens. The project would be even more cost-effective if Variation No. 2 of the central County sewage treatment action was implemented. However, based on preliminary analyses at this time, there does not appear to be any economic incentive for the New Windsor service area to participate in the project as Variation No. 2 entails. Therefore, the central County sewage treatment action identified in the Recommended Plan remains unchanged after the financial impact analyses.

Table ES-7 presents the estimated annual costs per EDU, including local sewage collection costs, for various communities to be served by the central County sewage treatment action in the Recommended Plan.

The County has expressed an interest in assessing the potential benefits from various levels of private entity participation in the project. Typically, an equity contribution of up to 20 percent of a project's cost is provided by a privatizer as both a demonstrated commitment to the project and to allow debt financing of the remaining 80 percent. The equity can be either paid up front to offset debt financing needs or contributed annually to reduce debt service payments and customer rates. This equity, plus an agreed-upon return on investment, is then recovered by the privatizer through operation and management fees over the life of the service agreement. With private equity contributions provided annually over the first five years of the project, significant rate reductions can be obtained during this

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE ES-5

COMPARISON OF THE CENTRAL COUNTY SEWAGE TREATMENT ACTION

AND VARIATIONS UNDER THREE FINANCING SCENARIOS

FINANCING SCENARIOS	ANNUAL COST PER EDU ($1991) AT START-UP (1995)		
	CENTRAL COUNTY SEWAGE TREATMENT ACTION	VARIATION NO.1	VARIATION NO. 2
SRF LOAN	$284	$271	$197
GENERAL OBLIGATION BOND	$296	$280	$206
REVENUE BOND	$296	$284	$206

Notes:

(1) Costs do not include local municipal sewage collection costs.

Source: KPMG Peat Marwick

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ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE ES-6

COMPARISON BETWEEN THE CENTRAL COUNTY SERVICE AREA AND THE NEW WINDSOR SERVICE AREA

ACTION	ANNUAL COST PER EDU ($1991) AT START-UP (1995)			
	CENTRAL COUNTY SERVICE AREA			NEW WINDSOR SERVICE AREA(1)
	SRF LOAN	GENERAL OBL BOND	REVENUE BOND	
Central County Sewage Treatment Action (New 12.0 mgd STP) Regional New Windsor STP Expansion from 5.0 to 12.0 mgd	$284	$296	$296	$145
Variation No. 1 of the Central County Sewage Treatment Action (New 19.0 mgd STP) Maintain Existing New Windsor STP at 5.0 mgd	$271	$280	$284	$260
Variation No. 2 of the Central County Sewage Treatment Action (New 24.0 mgd STP) Abandon Existing New Windsor STP and Convert to a Pumping Station	$197	$206	$206	N/A

Notes:

(1) Assumes SRF loan financing for New Windsor STP expansion.

Source: KPMG Peat Marwick

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ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE ES-7

CENTRAL COUNTY SEWAGE TREATMENT ACTION:

ANNUAL COST PER EDU INCLUDING LOCAL SEWAGE COLLECTION

		ANNUAL COST PER EDU ($1995) INCLUDING LOCAL COLLECTION COSTS		
	Local Collection Costs ($1995)	SRF Loan	General Obligation Bond	Revenue Bond
OCSD#1 Communities	$33	$378	$393	$393
MBSR Example: Woodbury	$73	$418	$433	$433
Village of Washingtonville	$42	$387	$402	$402

Notes:

Local collection costs developed from municipal operating budgets and 1995 EDU data.

Source: KPMG Peat Marwick

time when the customer base is smaller. It is recommended that the use of private equity, either up front to reduce debt financing or through annual contributions, should be sought within any private financing scenario.

Implementation Approach

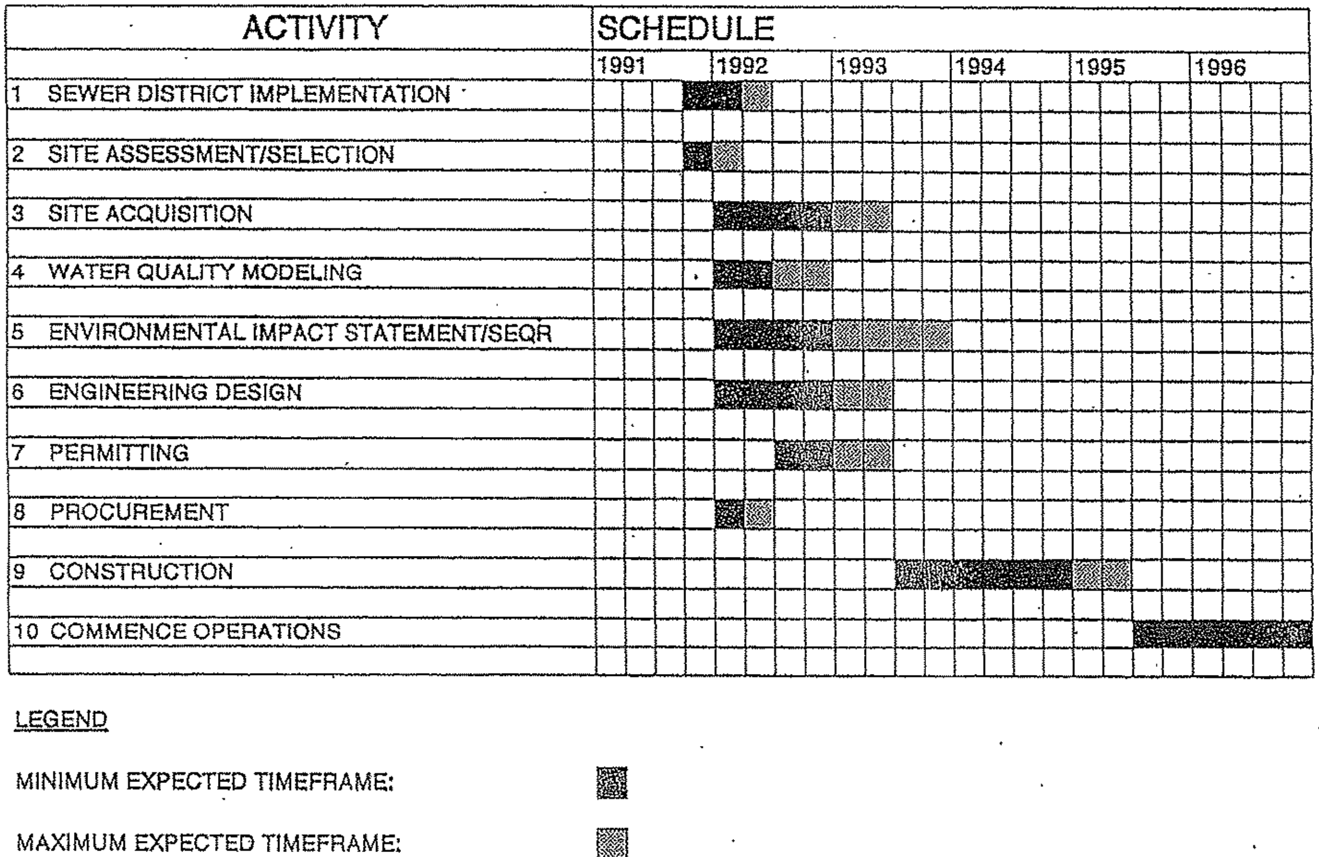
The County should begin as soon as possible to address implementation issues associated with the central County sewage treatment action outlined in the Recommended Plan. For instance, sewer district formation and the completion of interlocal agreements is key. The agreements should state which County agency has regulatory authority over the project.

The County should solicit information from private entities interested in entering into a public-private partnership. This can allow a preliminary assessment of benefits for the County under this procurement approach.

Siting of the project infrastructure is a critical implementation issue that should be addressed. An independent siting study may be warranted. Furthermore, for implementation of the central County sewage treatment action to occur, an environmental impact statement (EIS) as required under the New York State Environmental Quality Review (SEQR) Act will be required.

It is anticipated that overall project construction can begin in early 1993 with the commencement of operations in mid-1995. Figure ES-10 depicts the proposed project schedule.

FIGURE ES-10



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COMPREHENSIVE SEWERAGE
STUDY

PROPOSED IMPLEMENTATION
SCHED. FOR CENTRAL COUNTY
SEWAGE TREATMENT ACTION

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CHAPTER 1

1.0 INTRODUCTION

1.1 Study Purpose

Prepared under the auspices of the Orange County Department of Public Works, this Comprehensive Sewerage Study has been developed to provide Orange County with the framework for advancement of an implementable, long range approach to wastewater collection, treatment and disposal through the year 2020. In response to the varied nature of County topography, watershed characteristics, developmental patterns and wastewater treatment and disposal practices, this Study has considered that not only one, but a number of geographically separate projects could be developed under one Recommended Plan.

At the onset of the Study, an Orange County Sewer Committee was formed to provide guidance and feedback during the course of the project work. This Sewer Committee consisted of local officials, including County Legislators, Mayors, Supervisors, and representatives from various County agencies. The Sewer Committee was instrumental in helping the Project Team meet the Study objective of planning for long-range sewage treatment and management in Orange County.

The objective of the long range planning process is the identification of an approach to wastewater management that considers technical feasibility, while also fully weighing the water quality, environmental, financial, institutional and other concerns of Orange County. To assure objectivity, both municipal comment and public input were solicited at critical junctures during the development of this Study.

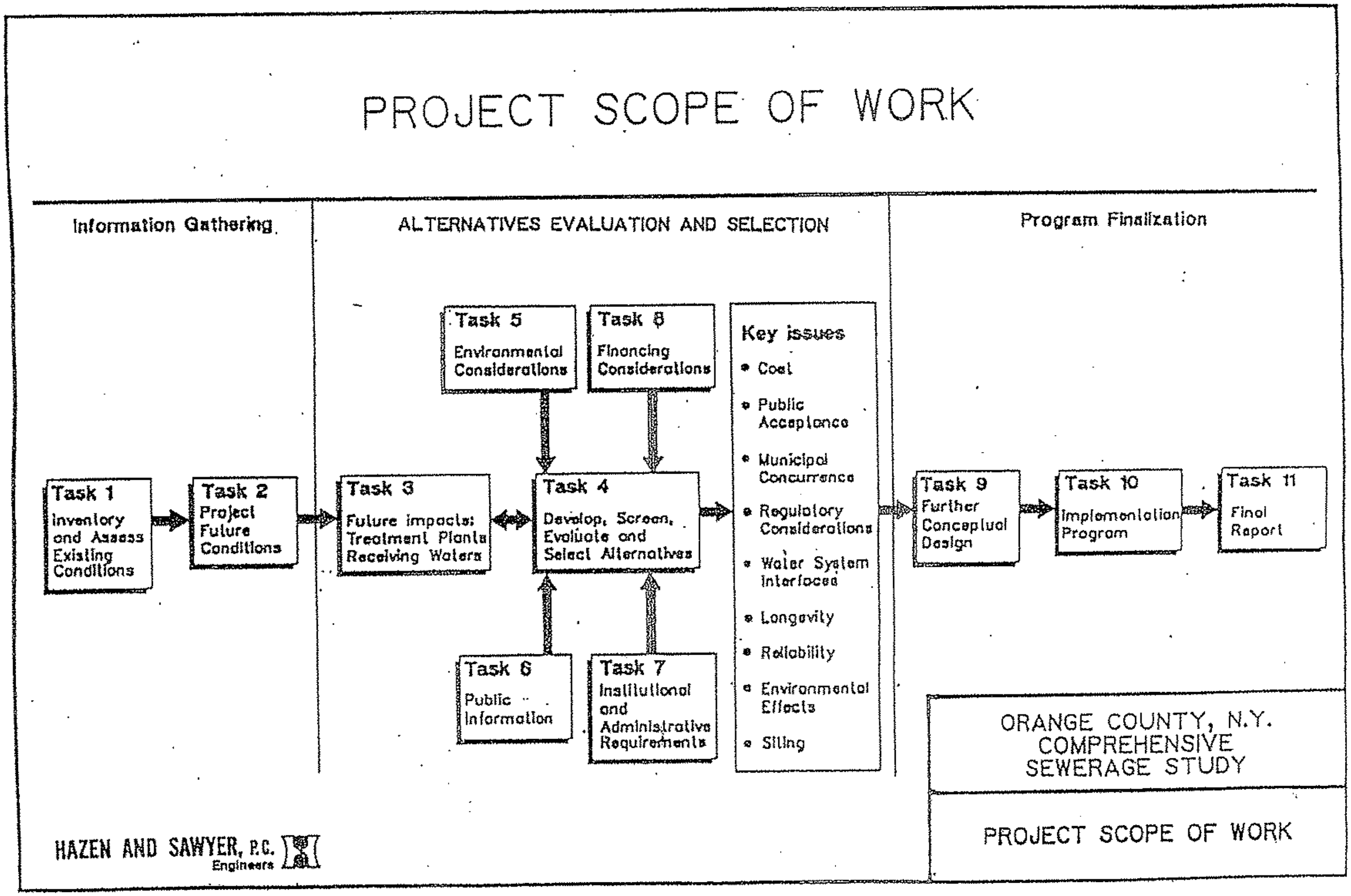
1.2 Project Scope

As portrayed in the schematic project flow chart in Figure 1-1, study elements were grouped into three phases: Information Gathering, Alternatives Evaluation and Selection, and Program Finalization. A brief description of each phase is provided in the following subsections.

1.2.1 Information Gathering

Initially, the Information Gathering phase was directed towards a review of the many studies that previously assessed Orange County population growth and wastewater management needs. However, in response to concerns of the Orange County Sewer Committee regarding the suitability of planning information available in the 1986 Orange County Data Book, the initial planning effort was redirected towards the development of a database that would more accurately depict the recent growth trends of Orange County's municipalities.

FIGURE I-I


PROJECT SCOPE OF WORK
Information Gathering
ALTERNATIVES EVALUATION AND SELECTION
Program Finalization
Task 1
Inventory and Assess Existing Conditions
Task 2
Project Future Conditions
Task 3
Future Impacts: Treatment Plants Receiving Waters
Task 4
Develop, Screen, Evaluate and Select Alternatives
Task 5
Environmental Considerations
Task 8
Financing Considerations
Task 6
Public Information
Task 7
Institutional and Administrative Requirements
Key issues
• Cost
• Public Acceptance
• Municipal Concurrence
• Regulatory Considerations
• Water System Interfaces
• Longevity
• Reliability
• Environmental Effects
• Siting
Task 9
Further Conceptual Design
Task 10
Implementation Program
Task 11
Final Report
ORANGE COUNTY, N.Y.
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SEWERAGE STUDY
PROJECT SCOPE OF WORK
HAZEN AND SAWYER, P.C.
Engineers

To accomplish this end, the following study activities were undertaken in this phase: (1) meetings were conducted with municipal officials to discuss growth-related issues; (2) questionnaires were sent to sewage treatment plant operators to secure basic design and operating data on existing, major wastewater treatment and collection facilities; and (3) facilities considered to be "key" in terms of location, siting, and receiving water assimilative capacity were visited to further investigate major plant elements.

Furthermore, background water quality data was gathered for significant receiving water bodies and, where necessary, field measurements were conducted and samples were collected to supplement published data.

Results from the Information Gathering phase, such as populations and percent sewered, were reviewed and confirmed by every city, town and village in Orange County. The Sewer Committee also carefully examined the results of this phase to verify the reasonableness of the planning information used for identifying and evaluating sewage collection and treatment alternatives.

1.2.2 Alternatives Evaluation and Selection

During the Alternatives Evaluation and Selection phase, project scenarios were identified and assessed to address such actions as development, upgrade and/or expansion of existing local sewage treatment facilities, expanded use of septic systems for on-site disposal, development of package sewage treatment plants for large site developments, regional development of joint drainage basin collection and treatment works and centralization of sewage treatment facilities.

The baseline for comparison of alternatives was the expansion potential of existing treatment and collection facilities. For those areas of the County where future growth could impose an excessive load on existing treatment facilities and receiving waters, regionalization of service areas was considered. Centralization was also considered in light of the possible advantages gained by greater assimilative capacity available from larger receiving bodies; broad base distribution of project costs; and possible coordination of construction sequences with the Orange County Water Authority project.

In assessing alternative actions, the following issues were fully addressed for each project element: municipal concurrence, site availability, receiving water assimilative capacity, stream discharge standards, treatment process technical feasibility, potential environmental impacts of pipeline routes and treatment plant sites, and cost. The end result of the Alternatives Evaluation and Selection phase is a Recommended Plan encompassing specific projects recommended for future sewage collection and treatment for each municipality in Orange County.

1.2.3 Program Finalization

Following the identification of the Recommended Plan, as part of the Program Finalization phase, engineering data was developed in greater detail, to more fully describe key project elements. Treatment process schematics, flow diagrams, and pipeline route drawings were developed. In addition, construction, upfront capital, and annual operations and maintenance costs were further refined for major elements of the Recommended Plan.

In addition to both technical and environmental factors, legal considerations have been addressed in the Program Finalization phase. New York State law provides for a number of institutional options under which the Recommended Plan can be implemented. These alternative mechanisms were assessed in light of several issues: the existing agreement between Orange County Sewer District No. 1 and the Moodna Basin Southern Region Joint Sewerage Board; the outstanding financial obligations of individual municipalities for debt incurred on existing sewage treatment facilities; and the potential impacts of the County's financial obligations to the Orange County Water Authority.

Financial investigations have been conducted to address such issues as range and mix of revenue sources, anticipated expenditures, outstanding County debt obligations, and the legal ceiling on future capital expenditures. Both cash flow and user cost projections were prepared to assess financial impacts on end users.

1.3 Project Team

As prime consultant, Hazen and Sawyer, P.C. coordinated all engineering activities and was responsible for overall project management and preparation of this Comprehensive Sewerage Study. EA Engineering, Science and Technology, as subconsultant, undertook receiving water quality analysis and environmental review activities. KPMG Peat Marwick also as a subconsultant, participated in the evaluation of financial, institutional and implementation issues.

CHAPTER 2

2.0 BACKGROUND SOCIOECONOMIC SETTING

2.1 Introduction

This Chapter presents an overview of the existing setting of Orange County in terms of demographics, economics, land use, and wastewater and water infrastructure. This information has been considered throughout the Study to help assess alternative sewage treatment programs.

2.2 Demographics

The "Urban - Rural Growth Concept" developed by the Orange County Department of Planning and Development calls for future residential, commercial and industrial growth to occur within urban areas of the developed cities and villages, where existing infrastructure can support the growth requirements. The majority of the remainder of the County would be maintained as rural area, with growth limited to those areas capable of being self-sufficient, i.e., without such facilities as public water and sewerage systems.

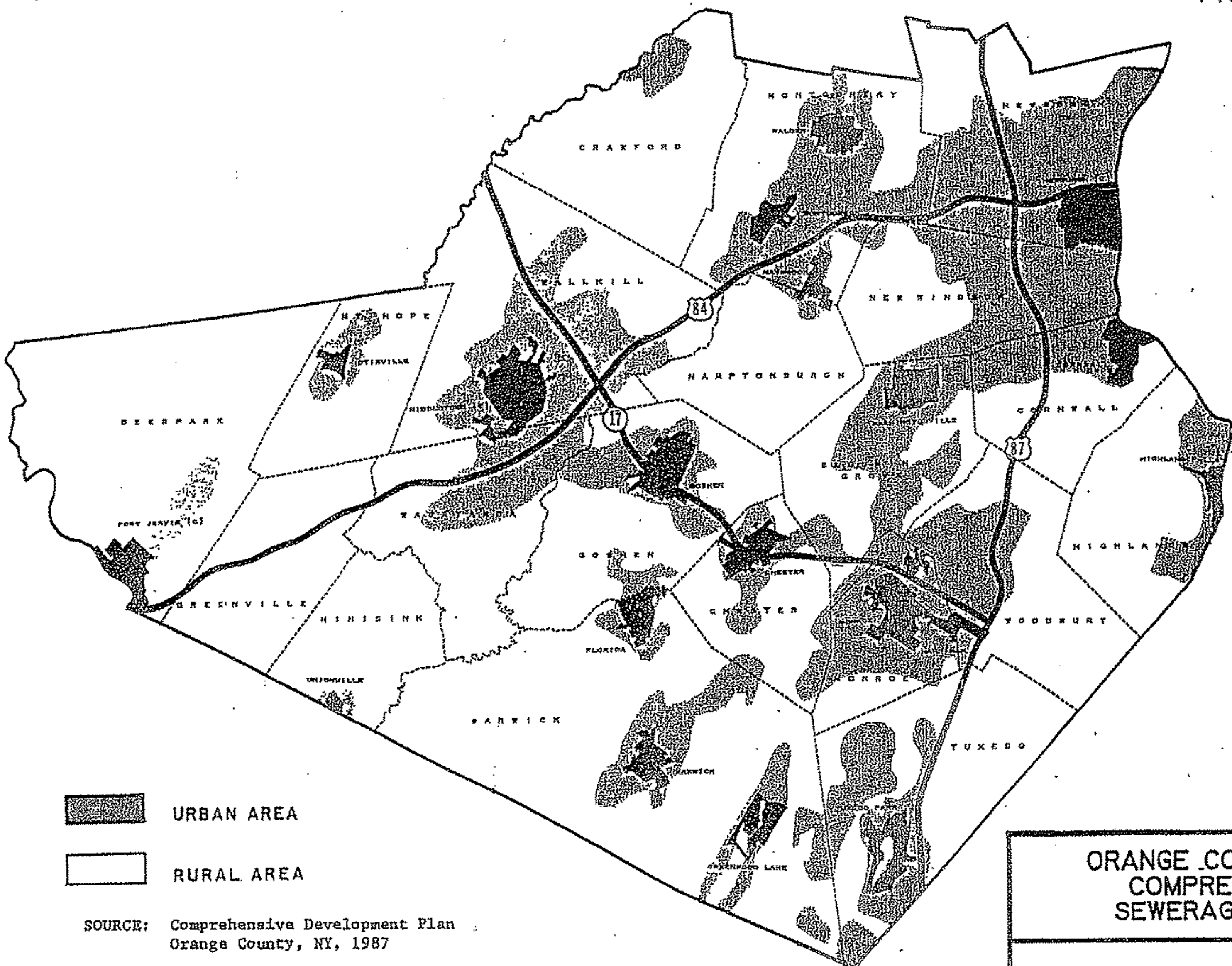
According to this concept, the proposed pattern of growth will maximize the use of existing public services and result in environmentally sound development. Local governments would direct growth in accordance with this concept by withholding approvals for major developments until adequate public services have been provided, by either construction of new or expansion of existing facilities.

Figure 2-1 illustrates the urban - rural planning concept, while Table 2-1 provides a breakdown of Orange County population by urban and rural areas, for the years 1980 and 1990. As the table shows, County population growth has developed along the lines of the "Urban - Rural Growth Concept". Urban areas experienced a higher growth rate (23 percent) than did rural areas (19 percent) from 1980 to 1990. As a result, the proportion of the 1990 County population residing within urban areas increased slightly from 1980.

2.3 Economics

Recent Orange County economic statistics reflect positive trends in the area of employment. Between January 1989 and January 1990, employment increased by one percent, from 105,600 to 106,500 positions. Unemployment rates dropped from 5.5 percent in January 1989 to 4.7 percent in January 1990, a decrease of 0.8 percentage points. Coincidentally, the neighboring counties of Ulster and Dutchess also exhibited decreasing levels of unemployment during the same period, dropping 1.5 and 1.3 percentage points, respectively.

FIGURE 2-1



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COMPREHENSIVE
SEWERAGE STUDY

URBAN - RURAL CONCEPT

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 2-1

BREAKDOWN OF ORANGE COUNTY
POPULATION BY URBAN AND RURAL AREAS

	Urban Areas	Rural Areas	Total
1980			
Population(1)	100,400	159,200	259,600
Percent of Total	39%	61%	100%
1990			
Population(2)	125,700 (+25%)	190,700 (+17%)	316,400 (+22%)
Percent of Total	40%	60%	100%

(1) Based on data available from the Orange County Department of Planning and Development.

(2) Based on refined population projections presented later in Chapter 8 of this document.

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The average 1990 family income for Orange County was $40,921 (from the Sourcebook for County Demographics, 5th Edition). The 1980 to 1990 average annual growth rate for household income in Orange County was 2.1 percent. The average tax rate for Orange County services is $8.78 per $1,000 of assessed value (1988/1989 assessed values and County levy). This tax rate represents a County tax of $965 on a home with a current market value of $100,000 when using the County's equalization ratio of 1.099. Taxes for schools and towns are in addition to the County amount.

2.4 Land Use

Orange County comprises approximately 511,480 acres. In 1985, 357,200 acres or about 70 percent of this land was in use; the remaining 154,280 acres were vacant. Table 2-2 provides the most recent available breakdown of land use by function for Orange County as a whole as cited by the Orange County Department of Planning and Development.

Table 2-3 provides a detailed breakdown of land usage by municipality in 1985, as reported by the Orange County Department of Planning and Development. As Table 2-3 shows, the Town of Highlands had the highest percentage of land in use (97.7 percent), while the Town of Greenville had the lowest land usage (49.1 percent). The Towns of Crawford, Goshen, Minisink and Wawayanda had the highest proportions of their land devoted to agriculture (from 43 to 66 percent), while the Cities of Middletown, Newburgh and Port Jervis had the highest percentages of combined commercial and industrial land uses (from 11 to 23 percent).

During the period from 1985 to 1990, Orange County experienced significant increases in residential development, especially in the State Route 17, New York State Thruway and State Route 84 corridors, thus affecting the land usage in the southeast, central and northwest regions. This increased development is not reflected in the County Department of Planning and Development land use data from 1985 presented in this section.

2.5 Wastewater Infrastructure

At present, there are 36 public sewage treatment plants (STPs) in Orange County, ranging in size from 0.02 mgd to 7.0 mgd. Two of these facilities, Otisville Federal Correctional Facility and West Point Military Academy, are owned by the federal government. One facility, Otisville State Correctional Facility, is owned by the State of New York. Combined, these 36 plants have treatment capacity for about 40 mgd, and presently treat about 29 mgd. Over 50 percent of the County population is now served by public sewerage systems. The remaining population is served by either individual subsurface disposal systems or small, privately owned STPs.

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 2-2

ORANGE COUNTY LAND USES BY FUNCTION

	Amount of Land in Use (1985)	
Land Use Function	Acreage	% of Total Area
Agricultural	118,000	23.1
Residential	102,000	19.9
Commercial	16,000	3.1
Industrial	3,800	0.7
Public Community Services	59,700	11.7
Parks and Recreation	57,700	11.3
Total Land in Use	357,200	69.8

Source: Orange County Department of Planning and Development

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ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY
TABLE 2-3
MUNICIPAL LAND USES BY FUNCTION

Community[1]	Total Acres	PERCENT OF TOTAL AREA (1985) Agriculture	Residential	Commercial	Industrial	Community Services	Parks and Recreation	Total In Use	Total Vacant
Blooming Grove	22627	22.3%	22.4%	6.8%	0.2%	6.5%	1.2%	59.4%	40.6%
Chester	15514	26.6	18.7	4.4	1.4	5.1	10.5	66.7	33.3
Cornwall	16576	7.7	29.1	2.2	0.7	22.3	11.2	73.3	26.7
Crawford	24927	42.8	24.4	0.7	0.2	2.3	0.6	71.1	28.9
Deerpark	42399	2.6	23.1	4.1	0.4	9.3	35.6	75.0	25.0
Goshen	27240	57.9	12.9	3.1	0.6	8.2	2.5	85.1	14.9
Greenville	18312	19.1	25.0	1.5	0.1	3.3	0.1	49.1	50.9
Hamptonburgh	16509	45.5	19.3	0.9	0.6	4.1	4.9	75.4	24.6
Highlands	19728	0.0	3.5	1.3	0.0	63.6	29.3	97.7	2.3
Middletown (C)	2841	0.0	33.0	16.4	3.9	22.5	0.2	76.1	23.9
Minisink	14518	65.7	15.6	0.3	1.3	0.7	0.6	84.2	15.8
Monroe	12656	2.4	30.5	9.0	0.3	5.4	4.4	52.0	48.0
Montgomery	31309	36.8	20.5	3.4	1.4	4.7	3.0	69.8	30.2
Mount Hope	14624	24.2	28.2	0.6	0.0	6.1	0.1	59.2	40.8
Newburgh (C)	2365	0.0	26.8	15.1	8.3	27.8	3.2	81.2	18.8
Newburgh	26804	8.3	31.4	6.6	0.9	12.3	3.2	62.6	37.4
New Windsor	21892	15.6	13.8	3.0	1.8	43.9	2.0	80.1	19.9
Port Jervis (C)	1833	0.0	23.7	5.9	5.2	33.1	18.8	86.6	13.4
Tuxedo	30747	0.0	7.6	1.5	0.5	2.2	50.4	62.2	37.8
Wallkill	38607	22.8	20.8	3.0	0.9	6.8	10.3	64.5	35.5
Warwick	66385	28.3	20.9	2.4	0.5	9.6	2.9	64.6	35.4
Wawayanda	21604	48.6	16.1	2.1	0.9	2.0	0.3	70.1	29.9
Woodbury	21463	1.9	16.6	3.0	0.8	23.4	30.8	76.6	23.4
TOTALS	511480	23.1%	19.9%	3.1%	0.7%	11.7%	11.3%	69.8%	30.2%

(1) Includes villages, if any.
Source: Orange County Department of Planning and Development

(rpts:orsewer:tab23:070591:jb)

Many industrial establishments in Orange County are equipped with sewage treatment plants as well, either pretreating wastewater and discharging to a public sewer system, or treating and discharging directly to a water body. This Study includes only publicly owned, municipal sewage treatment facilities, with capacities over 0.02 mgd. As such, industrial and other private wastewater treatment plants are not summarized herein. However, the publicly owned State and Federal STPs within the County have been included because, in some instances, they could serve as part of a regional sewerage system.

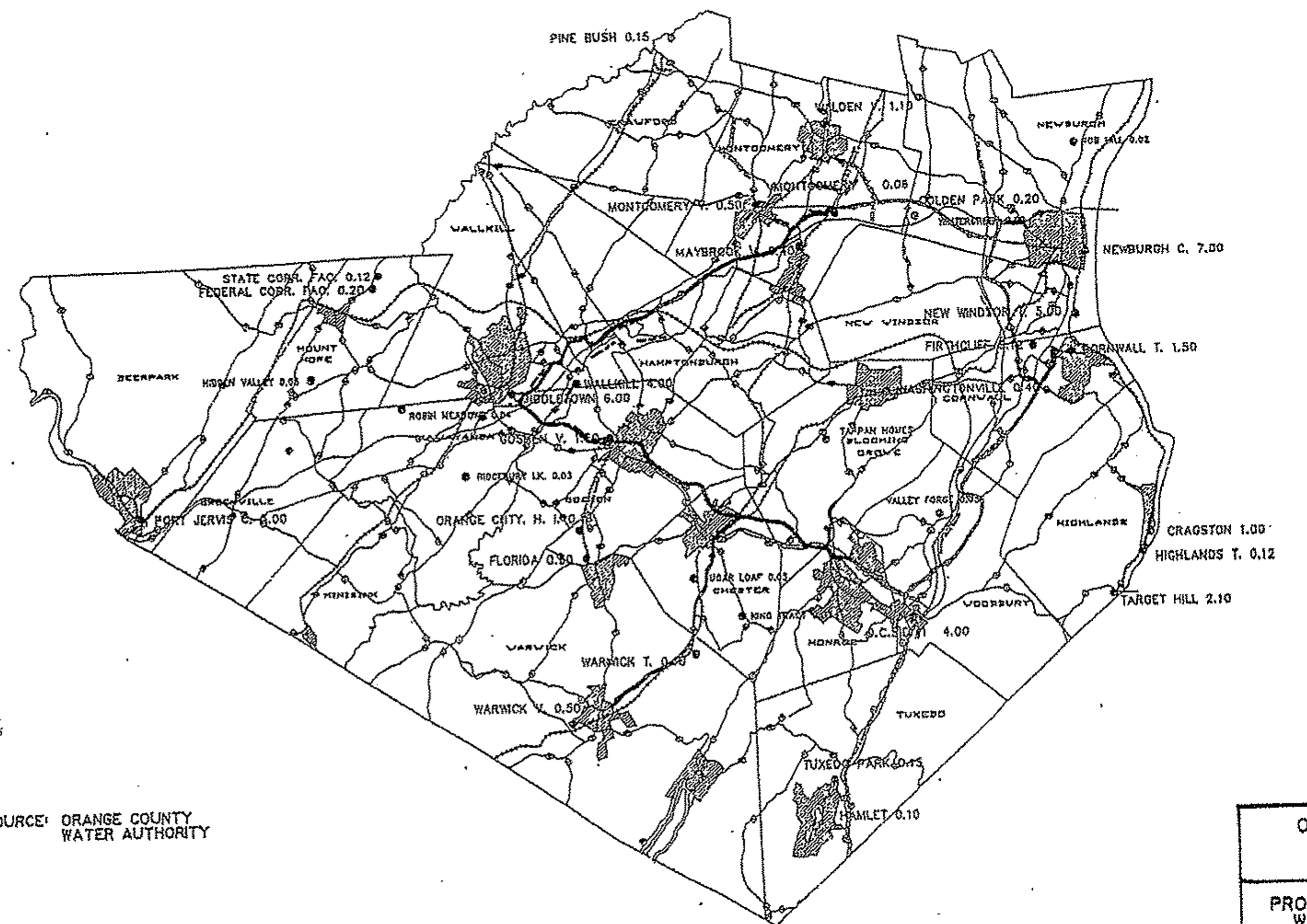
2.6 Water Infrastructure

As of 1987, there were 95 municipal and 76 non-municipal water systems located within Orange County. Overall, the total County population of approximately 275,000 in 1987 had an average daily demand of about 31.3 mgd. Municipal water systems at that time served 66 percent of the population, with an average daily demand of 24.5 mgd. The non-municipal systems (each with 5 or more service connections, or at least 25 customers) provided water to 3 percent of the County population, with an average daily demand of about 0.8 mgd. The remainder of the County population, 31 percent of the total, was served from private wells, with an average daily demand of about 6 mgd.

Of the 95 municipal water systems, 10 are considered major systems (i.e., serving 5,000 or more customers). In 1987, these 10 systems provided water to 45 percent of the County population. Three of the major systems (New Windsor Consolidated Water Department, City of Newburgh Water Department, and Newburgh Consolidated Water Department) are being supplied from the New York City Catskill Aqueduct. Two other major systems (the Village of Walden and the Town of Wallkill) derive their supply solely from groundwater sources. The remaining five major systems are supplied by both surface and groundwater sources. In 1987, surface water supplies amounted to approximately 55 percent of the County's total safe yield.

The Orange County Water Authority (OCWA) was established in 1988 with responsibility for administration of the planning, design, construction and operation of water supply, treatment and transmission facilities to supplement the existing capacity of several towns, villages and cities within the County. The planned system includes a tap into the New York City Catskill Aqueduct, a 670-acre reservoir in the Town of Crawford, a 21 mgd raw water treatment facility, and 65 miles of both raw and finished water transmission main. The proposed route for transmission of water supplied by the OCWA is shown in Figure 2-2.

FIGURE 2-2



SOURCE: ORANGE COUNTY WATER AUTHORITY

HAZEN AND SAWYER, P.C. Engineers

ORANGE COUNTY, N.Y.
COMPREHENSIVE
SEWERAGE STUDY

PROPOSED ORANGE COUNTY
WATER SYSTEM ROUTE

2.7 Summary

Background socioeconomic information about Orange County is important with regard to the development of accurate planning data for use in assessing future sewage collection and treatment needs. Demographic, economic and land use information presented in this Chapter is factored into the development and recommendation of sewage management alternatives. The understanding of the County's wastewater and water infrastructure also presented in this Chapter is vitally important for the same reasons.

CHAPTER 3

3.0 BACKGROUND ENVIRONMENTAL SETTING

3.1 Introduction

This Chapter presents an overview of the existing setting of Orange County in terms of topography, geology, soils, climate and hydrology. This information has been considered throughout the Study to identify potential areas for sewage collection and treatment facilities. More detailed data with reference to receiving water body waste assimilation capacity, potential environmental impacts and critical wildlife habitats are presented elsewhere in this document.

3.2 Topography

Orange County consists of a land area of approximately 835 square miles. It extends 38 miles east to west and 34 miles north to south. It is bordered by Sullivan and Ulster Counties to the north, Dutchess and Putnam Counties to the east, Rockland County and New Jersey to the South, and Pennsylvania to the west. The central portion of the County is approximately 50 miles from New York City. The County is traversed by over 1,200 miles of rivers and streams, contains more than 120 lakes and ponds, and is bounded by two major mountain ranges on its eastern and western borders.

The Ramapo Mountains run in an 8-mile wide strip along the eastern border with Rockland County, and are joined with the Highlands Mountains to form a single chain. Elevations within the southeastern area of the County vary from near sea level at the Hudson River, to a range of 500 to over 1,600 feet within the Ramapo-Highlands Mountains chain. The highest elevation (1,664 feet) in this area occurs southwest of Newburgh at the top of Schunnemunk Mountain.

The Shawangunk Mountains occupy an 8-mile wide strip along the western border of the County. These mountains are an extension of the Kitatinny Mountains in New Jersey and connect with the Catskill Mountains further upstate. Elevations in this area typically range from 800 to 1,500 feet.

The broad central valley between the two mountain ranges lies at an average elevation of about 150 feet. This area, known as the Wallkill River Valley, consists largely of gently rolling farms and woodlands. The southwestern section of this valley includes about 28,000 acres of farmland composed of fertile "black dirt" or "muckland", on which crops such as onion, celery and lettuce are grown. This land was created from deposits of vegetation that grew in shallow lakes formed by the action of continental glaciers.

3.3 Geology

Orange County was moderately affected by glaciation during a period from 12,000 to 300,000 years ago; its topography and soil composition was modified by the movement of the ice. Advances of ice resulted in the deepening of valleys oriented in the direction of the advance. Glacial till, the dominant overburden throughout the County (occupying 86 percent of the land surface), was deposited from the bottom of the glacial ice during its advances and retreats. Erie, Swartswood, Arnot and Nassau type soils formed in this till.

Melting ice resulted in the deposition of sand and gravel, along with the ponding of water in several areas, and formed Hoosic and Middlebury type soils. Vegetation grew rapidly in many shallow water and semi-swamp areas, and its decay resulted in the deposition of organic materials, forming soils such as the Carlisle type. Other soils, such as the Wayland type, formed from alluvial deposits made by running water in streams and rivers.

Bedrock is exposed in both the eastern and western parts of the County. The bedrock throughout the western region of Orange County, dominated by the Shawangunk Formation, is comprised largely of sandstones and conglomerates in a narrow band along the eastern edge of the Neversink River Valley. The bedrock within the eastern third of the County is a complex of folded and faulted metamorphic and other rock, formed during the Pre-Cambrian to Triassic eras. The central valley between the mountainous regions is a relatively uniform area whose bedrock is composed of the Trenton Group of shales.

3.4 Soils

Orange County soils are generally of poor quality for the installation of septic tank absorption fields. According to the publication entitled "Soils Survey of Orange County", issued by the Soil Conservation Service, U.S. Department of Agriculture, at least 85 percent of the County soils are classified as having properties or site features that are unfavorable for use in septic service, require special designs, and/or involve significantly higher construction and maintenance costs.

Table 3-1 summarizes the soil groups found in Orange County, along with their properties and suitability for community development. Only the Pittsfield, Hoosic, Riverhead and Chenango soil types are considered appropriate for the installation of septic leaching fields. These soils comprise only 15 percent or less of the County's soils. Figure 3-1 depicts the areas of the County in which these soil types are located. It should be noted that a portion of these areas may still be unsuitable for septic

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 3-1

ORANGE COUNTY SOIL GROUPS

SOIL GROUP	PERCENT OF ORANGE COUNTY LANDS	LOCATION	PERMEABILITY* (Inches/Hour)	SOIL GROUP CHARACTERISTICS
Mardin-Erie	45%	Marden - hillsides, hill-tops, ridges and knolls	0.6 - 2.0	Slow water movement in substratum Seasonal wetness
		Erie - foot slopes, board flats, drainageways	0.6 - 2.0	Slow water movement in substratum Seasonal wetness
Swartswood-Alden	4	Swartswood - ridges, hill-tops, hillsides	0.6 - 2.0	Slow water movement in substratum
		Alden - depressions, low	0.6 - 2.0	Soils experience high water table (prolonged wetness)
Pittsfield-Farmington	5	Pittsfield - hilltops, hill-sides, ridges, sloping areas	2.0 - 6.0	Soils have rapid water movement through substratum and are suit-able for community development
		Farmington - hillcrests, ridges, knolls, sloping to hilly areas; limestone bedrock at 10-20 inches	0.6 - 2.0	Soils are limited for develop-ment due to potential pollution where limestone bedrock is close to the surface
Nassau-Bath-Rock Outcrop	8	Nassau - sloping to steep areas tops of hills, ridges tilted bedrock at 10-20 inches	0.6 - 2.0	Soils limited for development due to shallow bedrock
		Bath - gently sloping; inter-ridge areas; bedrock at 48-60 inches; dense fragipan	0.6 - 2.0	Soils limited due to dense fragi-pan, where water moves slowly

* Permeability of upper layer = 0-10 inches ±.

(rpts:orsewer:tab31:032091:jb)

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 3-1

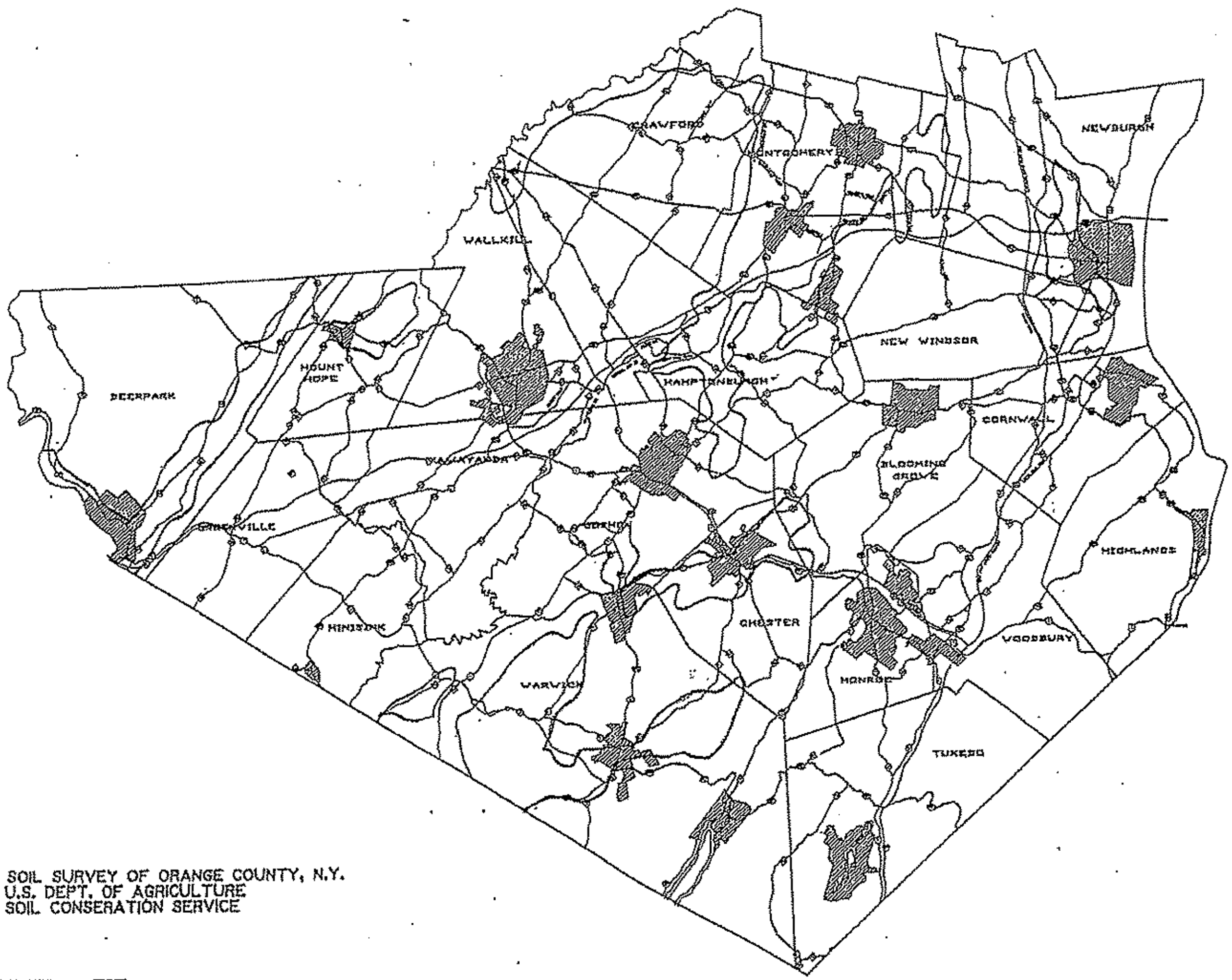
ORANGE COUNTY SOIL GROUPS

SOIL GROUP	PERCENT OF ORANGE COUNTY LANDS	LOCATION	PERMEABILITY* (Inches/Hour)	SOIL GROUP CHARACTERISTICS
Nassau-Bath- (continued) Rock Outcrop		Rock Outcrop - ledges on side slopes and pointed blocks on ridge crests and hilltops	--	Rock outcrop limited due to poor water movement
Arnot-Swartswood-Hollis	10	Arnot - sides and tops of hills and ridges, bedrock at 10-20 inches	0.6 - 2.0	Soils have moderate water movement
		Swartswood - hilltops, hillsides	0.6 - 2.0	Soils have slow movement in sub-stratum
		Hollis - hills, ridges, valley slopes, 10-20 inch mantle over bedrock	0.6 - 6.0	Soils have moderate to rapid water movement, but are limited due to shallow bedrock
Hollis-Rock Outcrop	15	Hollis - soils are in mountainous uplands; 10-20 inch bedrock depth	0.6 - 6.0	Soils have moderate to rapid water movement, but are limited due to shallow bedrock
		Rock Outcrop - ledges on side slopes and pointed blocks on ridge crests and hilltops	--	Rock outcrop limited due to poor water movement
Hoosic-Mardin-Canandaigua	8	Hoosic - deep glacial out-wash; high sand and gravel content	2.0 - 6.0	Rapid water movement in substratum; potential problem with pollution of ground water from septic tank influent

* Permeability of upper layer = 0-10 inches ±.

(rpts:orsewer:tab31:032091:jb)

FIGURE 3-1



SOURCE: SOIL SURVEY OF ORANGE COUNTY, N.Y.
U.S. DEPT. OF AGRICULTURE
SOIL CONSERATION SERVICE

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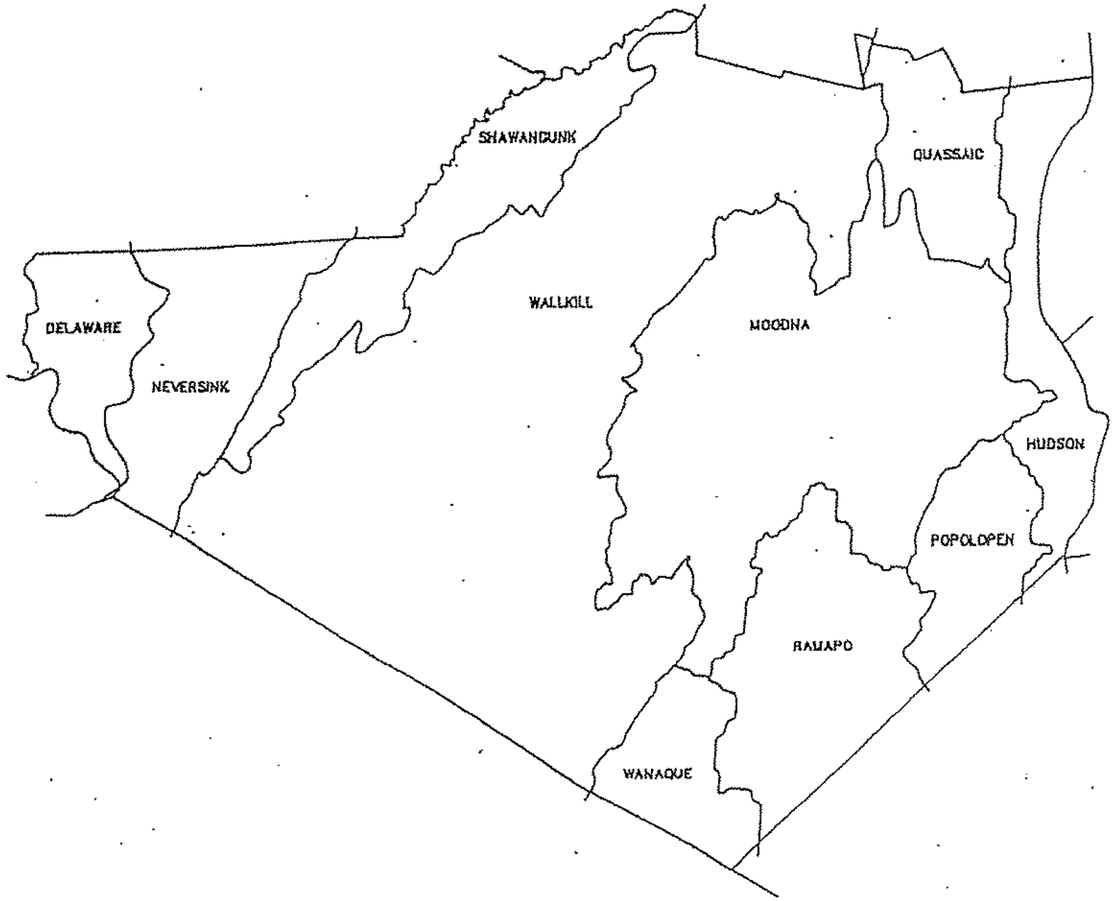
ORANGE COUNTY, N.Y.
COMPREHENSIVE
SEWERAGE STUDY

PREDOMINANT SOILS SUITABLE
FOR SEPTIC SYSTEM USE

FIGURE 3-2



PREPARED BY

EA ENGINEERING, SCIENCE, AND TECHNOLOGY

FOR

HAZEN AND SAWYER, P.C.
Engineers

ORANGE COUNTY, N.Y.
COMPREHENSIVE SEWERAGE STUDY

Location of major watershed drainage basins in Orange County, N.Y.

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ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 3-2

MAJOR DRAINAGE BASINS IN ORANGE COUNTY

BASIN	AREA	
	Square Miles	Percentage
Delaware	25.7	3.1
Hudson	31.9	3.8
Moodna	180.4	21.6
Neversink	54.3	6.5
Popolopen	28.4	3.4
Quassaic	34.2	4.1
Ramapo	68.8	8.3
Shawangunk	59.5	7.1
Wallkill	328.2	39.3
Wanaque	23.6	2.8
TOTAL	835.0	100.0

Source: Comprehensive Sewerage Study,
Orange County, NY, Alexander Potter Associates

(rpts:orsewer:tab32:070591:jb)

installation (even though their soils are acceptable), due to topographical and other unfavorable site conditions.

As shown in Table 3-1, the remainder of the County's soils are reported as not suitable for widespread septic service. Soils exhibiting high water table, high permeability, shallow bedrock, and/or flooding, ponding and wetness have the potential for groundwater pollution by septic system effluent, as well as yielding poor absorption capabilities. Soils exhibiting slow or impeded water movement would also result in poor septic system efficiency due to slow absorption, surfacing of effluent, hillside seepage, etc., all of which could adversely affect public health.

3.5 Climate

Climatological conditions vary throughout Orange County, in accordance with its topology. The mountainous regions on the eastern and western borders of the County are significantly colder than the main agricultural areas in the central part of the County.

Precipitation is well distributed throughout the County, although the mid-eastern region receives somewhat higher monthly, as well as annual, precipitation. As a County-wide average, peak rainfall occurs from April through September. Normal precipitation in the western region of the County (as measured by the Port Jervis weather station) varies from about 3 to 4 inches per month, with an annual average of about 43 to 45 inches. In contrast, the West Point weather station, located in the eastern part of the County, has reported normal precipitation ranging from 3.5 to 4.5 inches per month, with an annual average of about 47 to 49 inches. The lowest precipitation typically occurs in the north-eastern region of the County (as measured at the Stewart Air Force Base in Newburgh). Normal monthly precipitation typically ranges from 2.5 to 3.5 inches at this location, with an annual average of about 40 inches. Mean annual snowfalls throughout the County range from approximately 42 to 48 inches, with the eastern regions receiving the most snowfall.

Minimum mean temperatures for January (typically the coldest month) vary from 16 to 20 degrees Fahrenheit, with the lowest temperatures occurring in the mid-western region. Maximum mean temperatures for July (the hottest month) range from 84 to 87 degrees Fahrenheit with the highest temperatures being reported in the mid-eastern region.

3.6 Hydrology

Drainage throughout Orange County is oriented in a northeast-southwest direction. In the western region of the County, the Neversink River flows southward along the Shawangunk Mountains, emptying into the Delaware River at Port Jervis, while the Shawangunk River flows north to the Hudson River. In the eastern region, the Woodbury, Cromline and Moodna Creeks flow northerly and easterly, emptying into the Hudson River, south of Newburgh. Also in the east, the Ramapo River, which has its headwaters in Monroe, flows south to New Jersey.

The Wallkill River drains the central region of the County, including the black dirt area. Originating in Sparta, New Jersey, the Wallkill enters Orange County east of Unionville, and flows in a northeast direction to the Hudson River at Kingston in Ulster County. The Wallkill River drainage basin is characterized by relatively low topographic gradients, although its tributaries are fairly steep, due to the underlying folded bedrock, which is resistant to erosion.

Table 3-2 lists the ten major drainage basins comprising Orange County, each named for the principal waterway located within the basin. The approximate area occupied by each basin is also provided in the table.

Figure 3-2 depicts these location of the ten drainage basins. It is noted that the border lines marking the limits of each basin have been determined soley by topographical considerations. Hence, several towns are situated in more than one drainage basin. Table 3-3 shows the distribution of communities among the basins and indicates those that are situated into multiple basins.

3.7 Summary

Background environmental information is important with regard to the understanding of how future sewage collection and treatment needs can be met within the basic environmental framework of Orange County. Topography, geology and soils, climate and hydrology all contribute to the development and recommendation of sewage management alternatives for the County.

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 3-3

DISTRIBUTION OF COMMUNITIES BY DRAINAGE BASIN

BASINS	CITIES	TOWNS	VILLAGES	HAMLETS
Quassaic	Newburgh (part)	Newburgh (part) New Windsor (part)		Balmville Glenwood Park
Moodna		Blooming Grove Chester (part) Cornwall (part) Goshen (part) Hamptonburgh (part) Monroe (part) Montgomery (part) New Windsor (part) Woodbury (part) Warwick (part)	Chester Cornwall Maybrook Monroe (part) Washingtonville	Campbell Hall Central Valley Cornwall Southwest Craigsville Firthcliffe Highland Mills Mountainville Vails Gate
Popolopen		Highlands (part) Woodbury (part)		
Ramapo		Monroe (part) Tuxedo Woodbury (part)	Harriman Monroe (part) Tuxedo	Arden Southfields
Wallkill	Middletown	Crawford (part) Goshen (part) Greenville (part) Minisink Montgomery (part) New Windsor (part) Wallkill (part) Warwick (part) Wawayanda Chester (part) Hamptonburgh	Florida Goshen Montgomery Unionville Walden Warwick	Durlandsville East Middletown Johnson New Hampton New Milford Pine Island Ridgebury Slate Hill Washington Heights

(rpts:orsewer:tab33:070591:jb)

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 3-3

DISTRIBUTION OF COMMUNITIES BY DRAINAGE BASIN

BASINS	CITIES	TOWNS	VILLAGES	HAMLETS
Shawangunk		Crawford (part) Greenville (part) Mount Hope (part) Wallkill (part)	Otisville	Bullville Circleville Howells Pine Bush Thompson Ridge
Delaware	Port Jervis (part)	Deerpark (part)		Sparrow Bush
Hudson	Newburgh (part)	Newburgh (part) Cornwall (part) New Windsor (part) Highlands (part) Woodbury (part) Tuxedo (part)	Highland Falls	Middle Hope Fort Montgomery
Wanaque		Warwick (part) Tuxedo (part)	Greenwood Lake	
Neversink	Port Jervis (part)	Greenville (part) Mount Hope (part) Deerpark (part)		Huguenot Cuddebackville

(rpts:orsewer:tab33:070591:jb)

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 3-1

ORANGE COUNTY SOIL GROUPS

SOIL GROUP	PERCENT OF ORANGE COUNTY LANDS	LOCATION	PERMEABILITY* (Inches/Hour)	SOIL GROUP CHARACTERISTICS
Hoosic-Mardin-Canandaigua	(continued)	Marden - hills, ridges, glacial outwash terraces, lake plains; dense frangipan 14 - 25 inches below surface	0.6 - 2.0	Slow water movement through frangipan and substratum
		Canandaigua - depressions, low plains	0.2 - 2.0	Moderate to slow water movement surface; moderately rapid in substratum. High water table throughout year; ponding in spring
Riverhead-Middlebury-Chenango	2	Riverhead - terraces, plains, low sloping ridges and hills	2.0 - 6.0	Very rapid water movement through substratum
		Middlebury - silty alluvial deposits in floodplains, along streams	0.6 - 2.0	Subject to flooding; high water table in Spring
		Chenango - terraces, plains and rounded sloping knolls and ridges; water table at more than 6 feet below surface	0.6 - 6.0	Rapid movement through substratum, suitable for community development
Carlisle-Wayland	3	Carlisle - level muck soils in depressions, lowlands; deep and poorly drained, high water table	0.2 - 6.0	Water movement slow to moderately rapid, depending upon degree of compaction; usually wet
		Wayland - level, in low areas; deep and poorly drained. Subject to frequent flooding	0.2 - 2.0	Not suitable for development due to ponding, flooding, wetness and structural instability
TOTAL	100%			

* Permeability of upper layer = 0-10 inches ±.

Source: Soil Survey of Orange County, NY
U.S. Department of Agriculture, Soil Conservation Service

4.0 INVENTORY AND ASSESSMENT OF EXISTING SEWAGE TREATMENT FACILITIES

4.1 Introduction

There are 36 sewage treatment plants (STPs) evaluated in this Study, encompassing a considerable range of sizes, locations and treatment processes. Table 4-1 lists these treatment plants, the communities served by each and estimated 1990 population served based on discussions with operators at each facility. Plant sizes range from 0.02 mgd to 7.0 mgd. STP locations are extensive, reaching as far north as Pine Bush, as far south as Tuxedo Junction, as far west as Port Jervis, and as far east as Target Hill at the West Point Military Academy. Figure 4-1 shows the geographic location of each STP included in this Study. The processes used for treatment at these facilities are diverse, including trickling filters, oxidation ditches, conventional aeration and overland flow. At some facilities, such as the City of Middletown and the Orange County District No. 1 STPs, two different treatment processes are operated in parallel.

Each of the 36 treatment facilities has been inventoried and assessed, so as to determine adequacy of treatment quality provided, capacity available to handle future flows, and the expandability of the plant depending on process adaptation, site characteristics and geographic suitability.

4.2 Inventory of Existing Sewage Treatment Facilities

The inventory of existing sewage treatment plants in Orange County addresses several key items, including service area boundaries, population served, average and peak flows, treatment processes and equipment employed, receiving water data, operational problems, and other general information. To obtain the most up-to-date information on each facility, data was solicited from treatment plant operators through questionnaires, telephone discussions and site visits where necessary.

The first step was to issue a sewage treatment plant questionnaire to the chief operator of each facility. A copy of the questionnaire is included as Table 4-2. Next, telephone interviews with plant personnel and municipal officials were conducted, as necessary, to verify or supplement information provided in the completed questionnaires. Lastly, site visits were made to a number of key facilities, to observe plant conditions and site availability, and discuss operational characteristics. Site visits were very important, as process control, flexibility and site potential could be determined.

The result of the above outlined process is a detailed STP inventory or "database" of the 36 facilities. This comprehensive STP database is presented in Appendix A. Table 4-3 summarizes the flow data

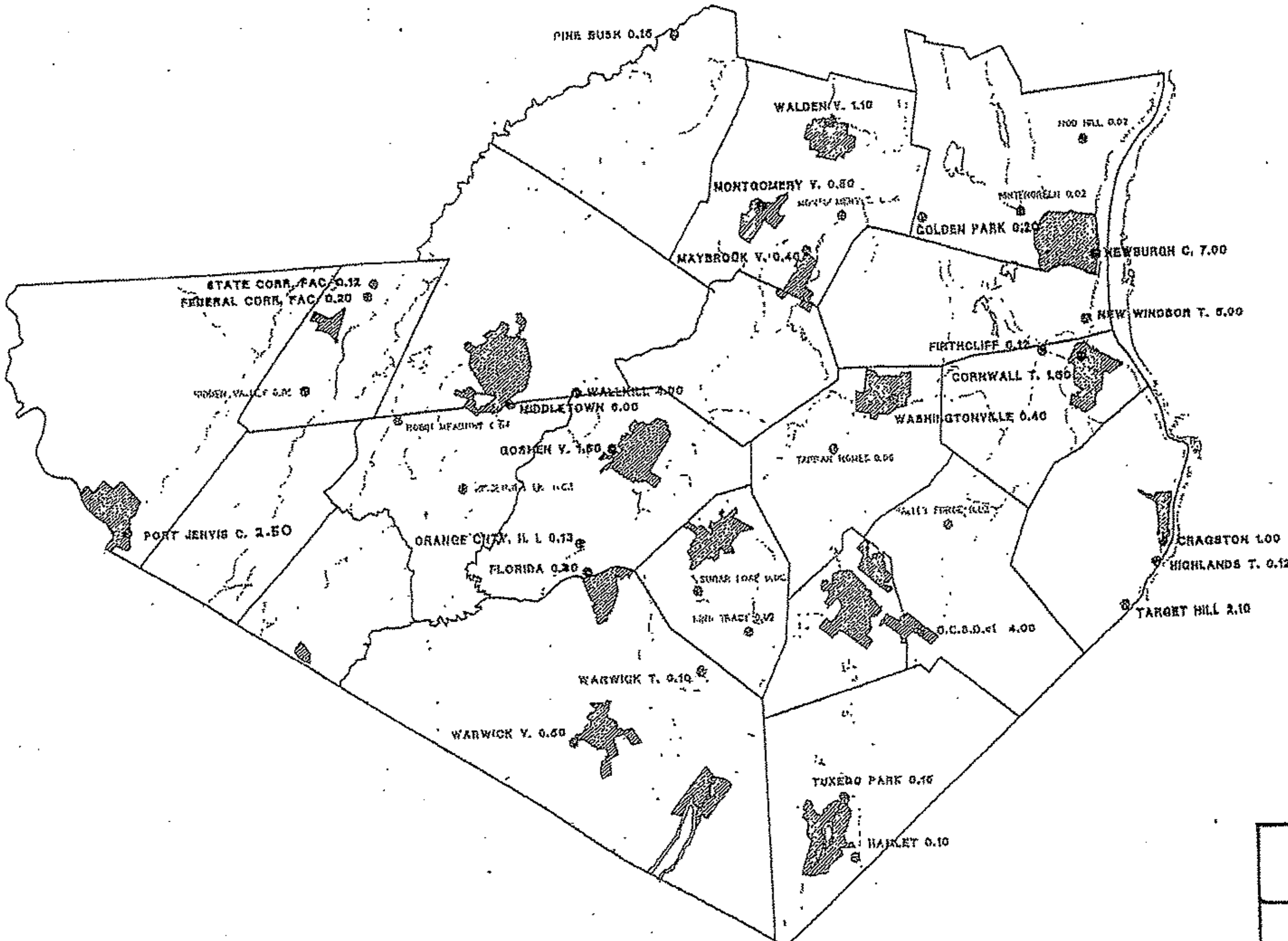
ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 4-1

SURVEY OF ORANGE COUNTY STPs

No.	Sewage Treatment Facility	Communities Served	Reported Population Served
1	Colden Park STP	Newburgh (UT)	1,000
2	Cornwall STP	Cornwall (V)	2,000
		Cornwall (UT)	5,500
3	Cragston STP	Highland Falls	4,200
4	Firthcliffe STP	Cornwall (UT)	1,500
5	Florida STP	Florida	2,500
6	Fort Montgomery STP	Highlands	1,000
7	Goshen (V) STP	Goshen (V)	5,500
		Goshen (UT)	1,800
8	Hamlet STP	Tuxedo	2,500
9	Hidden Valley Estates STP	Mount Hope	400
10	King Tract STP	Chester (UT)	100
11	Maybrook STP.	Maybrook	2,000
12	Middletown STP	Middletown	25,000
		Wallkill	1,500
13	Montgomery (UT) STP	Montgomery (UT)	600
14	Montgomery (V) STP	Montgomery (V)	3,000
15	New Windsor STP	New Windsor	20,000
		Cornwall (UT)	700
16	Newburgh STP	Newburgh (C)	22,900
		Newburgh (UT)	4,200
17	Nob Hill STP	Newburgh (UT)	200
18	Orange County Home & Infirmary STP	Goshen (UT)	1,400
19	Orange County Sewer District No. 1 STP	Blooming Grove	3,000
		Chester (V)	2,900
		Chester (UT)	2,300
		Woodbury	5,200
		OCSD#1 (Harriman, Kiryas Joel, Monroe (V), Monroe (UT))	20,800
20	Otisville State Correctional Facil STP	State Jail	700
21	Otisville Federal Correctional Facil STP	Federal Jail	2,000
22	Pine Bush STP	Crawford	2,000
23	Port Jervis STP	Port Jervis	8,800
24	Ridgebury Lake Acres STP	Wawayanda	200
25	Robinn Meadows STP	Wawayanda	300
26	Sugar Loaf STP	Chester (UT)	400
27	Tappan Homes STP	Blooming Grove	600
28	Target Hill STP	West Point Military Academy	7,000
29	Tuxedo Park STP	Tuxedo Park	900
30	Valley Forge STP	Woodbury	200
31	Walden STP	Walden	6,200
32	Wallkill STP	Wallkill	12,000
33	Warwick (UT) STP	Warwick (UT)	1,500
34	Warwick (V) STP	Warwick (V)	4,300
35	Washingtonville STP	Washingtonville	3,800
36	Wintergreen STP	Newburgh (UT)	200
		TOTAL	194,800

FIGURE 4-1



HAZEN AND SAWYER, P.C. Engineers

ORANGE COUNTY, N.Y.
COMPREHENSIVE
SEWERAGE STUDY

EXISTING SEWAGE
TREATMENT PLANTS

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY
TABLE 4-2

FACILITIES DATA QUESTIONNAIRE

Facility Name: ____________________
Address: ____________________

Contact Person: ____________________
Address: ____________________
____________________ Phone (   ) ________

SPDES No.: ____________ Receiving Water: ____________

A. SERVICE AREA

List municipalities served (Town or Village), number of service connections in each and population served in each

Municipality	No. of Connections	Population

What types of industries are served and how much flow does each contribute? ____________________

Does collection system have combined or separate sewers? ____________

Is future expansion of service area proposed? Yes ______ No ______

B. DESIGN BASIS

Design Flow: __________ MGD
Average Flow: __________ MGD
Peak Flow: __________ MGD

Year Facility Built: __________ Year Facility Expanded: __________

C. TREATMENT

Type of Treatment: ____________________

What are periods of high flow? ____________________

Do you monitor any effluent parameters not reported on DMRs? If so, what parameters and how often? ____________________

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY
TABLE 4-2

(C. TREATMENT...continued)

Discuss general problems and needs concerning:

Capacity: ______

Treatability/Effluent Quality: ______

Infiltration/Inflow: ______

Limitations of Receiving Water Body: ______

Equipment: ______

D. SLUDGE

Sludge Treatment and Handling Facilities: ______

Sludge Disposal: ______

Are there heavy metals or toxics in the sludge? (if so, specify): ______

What is the EPA classification type of this sludge? ______

E. FINANCIAL

What has been the operating budget for the last two years?*

Year	Amount

What are capital improvement plans for the next five years?*

Year	Amount	For What?

*Please note if the above costs relate to:

______ Treatment Facilities Only
______ Collection Facilities Only
______ Treatment and Collection Facilities
______ Other (if so, specify): ______

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY
TABLE 4-2

(E. FINANCIAL continued)

What are the customer fees currently charged:

Residential Monthly or Annual Charges ______________________
Residential Connection or Hookup Charges ______________________
Commercial Charges ______________________
Other Related Charges ______________________

If taxes are used to recover sewerage costs, what is the related tax rate per $1,000 of assessed value? ______________________

F. COMMENTS

____
____
____
____
____

Please enclose a process schematic for your facility, a service area map, and site plan, if possible.

Thank you for taking the time to provide us with this important information.

* * * * *

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 4-3

EXISTING STP DATABASE SUMMARY

Number	Sewage Treatment Plant	Level of(1) Treatment	Design Flow, MGD	1989 Average Flow, MGD	Problems? I/I	Problems? Capacity/Treatment
1	Colden Park	SEC	0.100	0.190	No	Capacity
2	Cornwall	SEC	1.500	1.250	Yes	-
3	Cragston	SEC	1.350	0.400	Yes	-
4	Firthcliffe	SEC	0.120	0.075	No	-
5	Florida	SEC	0.300	0.250	Yes	Treatment
6	Fort Montgomery	SEC	0.125	0.050	No	-
7	Goshen	ADV(L)	1.500	1.144	Yes	Capacity
8	Hamlet	SEC	0.100	0.070	Yes	-
9	Hidden Valley Estates	SEC	0.060	0.035	No	-
10	King Tract SD#5	SEC	0.020	0.007	No	-
11	Maybrook	SEC	0.400	0.250	No	Treatment
12	Middletown	ADV(L)	6.000	5.000	Yes	Treatment
13	Montgomery (T)	SEC	0.060	0.032	No	-
14	Montgomery (V)	ADV(L)	0.500	0.300	Yes	-
15	New Windsor	SEC	5.000	3.250	Yes	-
16	Newburgh	SEC	7.000	5.300	Yes	-
17	Nob Hill	SEC	0.012	0.009	No	-
18	Orange Co. Home & Inf.	SEC	0.130	0.050	No	-
19	Orange County SD#1	ADV(L)	4.000	3.700	Yes	Capacity, Treatment
20	Otisville State Correctional Facility	SEC	0.115	0.237	Yes	Capacity, Treatment
21	Otisville Federal Correctional Facility	SEC	0.200	0.180	Yes	Capacity
22	Pine Bush	ADV(L)	0.150	0.120	No	-
23	Port Jervis	SEC	2.500	1.300	No	-
24	Ridgebury Lake Acres	ADV(L)	0.030	0.015	Yes	-

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ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 4-3 CONT'D.

EXISTING STP DATABASE SUMMARY

Number	Sewage Treatment Plant	Level of[1] Treatment	Design Flow, MGD	1989 Average Flow, MGD	Problems? I/I	Problems? Capacity/Treatment
25	Robinn Meadows	ADV(L)	0.040	0.000	No	-
26	Sugar Loaf SD#4A	SEC	0.050	0.020	No	-
27	Tappan Homes	SEC	0.064	0.042	Yes	-
28	Target Hill	SEC	2.060	1.500	No	-
29	Tuxedo Park	SEC	0.150	0.060	Yes	-
30	Valley Forge CSD#1	SEC	0.036	0.021	Yes	-
31	Walden	SEC+	1.100	0.700	Yes	-
32	Wallkill	ADV(L)	4.000	2.000	Yes	-
33	Warwick (T)	ADV(L)	0.390	0.240	Yes	-
34	Warwick (V)	SEC	0.500	0.640	Yes	Capacity, Treatment
35	Washingtonville	SEC	0.400	0.330	Yes	-
36	Wintergreen	SEC	0.020	0.010	No	-

(1) Levels of sewage treatment are defined in Section 10.5

and problems experienced at each treatment plant inventoried and included in Appendix A.

4.3 Assessment of Existing Sewage Treatment Facilities

A careful examination of the 36 facilities listed in Table 4-3 shows variation in such criteria as size, level of treatment and performance. To determine which facilities have sufficient treatment capability and the potential for expansion to handle future regional needs, treatment plant data was further analyzed. Specifically, the following criteria were applied to assess treatment capability and expandability of each facility:

- Design flow capacity equaling or exceeding 0.300 mgd;
- Excess capacity available or site available for expansion; and
- Situation in a geographic area conducive to regional or expanded service.

The application of the above criteria to the 36 sewage treatment facilities in Orange County is presented in Table 4-4. Fourteen facilities satisfy the outlined criteria: Cornwall, Cragston, Florida, Goshen, Middletown, Montgomery, New Windsor, Newburgh, OCSD#1, Port Jervis, Walden, Wallkill, Warwick and Washingtonville. These facilities are termed "significant" which, by definition in this Study, are those which can conceivably serve as a regional wastewater treatment operation. A description of the treatment capability and expandability of each of the significant facilities is provided in the following subsections.

4.3.1 Cornwall STP

The Cornwall STP provides secondary treatment, and is designed to treat 1.5 mgd using trickling filters. Discharge of treated effluent is to the Hudson River in the vicinity of Moodna Creek. The Village of Cornwall owns one-third of the STP; the Town of Cornwall owns two-thirds. The existing parcel can accomodate a limited expansion of treatment works, but significant expansion would require the acquisition of an adjacent parcel. In addition, it is likely that the effluent outfall would need to be extended farther into the Hudson River for any significant expansion of the facility.

4.3.2 Cragston STP

The Cragston STP is designed to treat 1.35 mgd of wastewater. The STP provides secondary treatment with rotating biological contactors, and discharges to the Hudson River. The plant presently serves the Village of Highland Falls, treating an average daily flow of 0.5 mgd, well below design capacity. As the Village is close to population saturation, there appears to be

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 4-4

DETERMINATION OF SIGNIFICANT TREATMENT FACILITIES

Number	Sewage Treatment Plant	Design ≥ 0.3 mgd?	Land Available for Site Expansion?	Location Conducive to Regionalization?	Significant Facility?
1	Colden Park	No	-	-	No
2	Cornwall	Yes	Yes	Yes	Yes
3	Cragston	Yes	Yes	Yes	Yes
4	Firthcliffe	No	-	-	No
5	Florida	Yes	Yes	Yes	Yes
6	Fort Montgomery	No	-	-	No
7	Goshen	Yes	Yes	Yes	Yes
8	Hamlet	No	-	-	No
9	Hidden Valley Estates	No	-	-	No
10	King Tract SD#5	No	-	-	No
11	Maybrook	Yes	Yes	No	No
12	Middletown	Yes	Yes	Yes	Yes
13	Montgomery (T)	No	-	-	No
14	Montgomery (V)	Yes	Yes	Yes	Yes
15	New Windsor	Yes	Yes	Yes	Yes
16	Newburgh	Yes	Yes	Yes	Yes
17	Nob Hill	No	-	-	No
18	Orange Co. Home & Inf.	No	-	-	No
19	Orange County SD#1	Yes	Yes	Yes	Yes
20	Otisville State Corr. Fac.	No	-	-	No
21	Otisville Fed. Corr. Fac.	No	-	-	No
22	Pine Bush	No	-	-	No
23	Port Jervis	Yes	Yes	Yes	Yes
24	Ridgebury Lake Acres	No	-	-	No
25	Robin Meadows	No	-	-	No
26	Sugar Loaf SD#4A	No	-	-	No

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 4-4 CONT'D.

DETERMINATION OF SIGNIFICANT TREATMENT FACILITIES

Number	Sewage Treatment Plant	Design ≥ 0.3 mgd?	Land Available for Site Expansion?	Location Conducive to Regionalization?	Significant Facility?
27	Tappan Homes	No	-	-	No
28	Target Hill	Yes	Yes	No	No
29	Tuxedo Park	No	-	-	No
30	Valley Forge CSD#1	No	-	-	No
31	Walden	Yes	Yes	Yes	Yes
32	Wallkill	Yes	Yes	Yes	Yes
33	Warwick (T)	Yes	Yes	No	No
34	Warwick (V)	Yes	Yes	Yes	Yes
35	Washingtonville	Yes	Yes	Yes	Yes
36	Wintergreen	No	-	-	No

substantial treatment capacity available for the future, and some wastewater flow from the Town of Highlands could be treated at the Cragston STP without expansion of the facility. Treatment at the facility for communities other than the Town and Village would not be feasible due to topographic conditions.

4.3.3 Florida STP

The Florida STP is designed to treat 0.3 mgd of wastewater at a secondary level using trickling filters and discharges treated effluent to the Quaker Creek. The facility is required to limit its ammonia discharge during the summer period (June through October) although, at present it is not designed as an ammonia-removing facility. The Village of Florida plans for the addition of equipment in order to meet the summer period ammonia permit limit. Any expansion of the Florida facility will require an upgrade in the level of treatment provided at the plant. The Quaker Creek, while presently a Class D stream, is expected to be upgraded to Class C by the NYSDEC. Furthermore, expansion of the Florida STP will be restricted because Quaker Creek is a relatively small receiving stream.

4.3.4 Goshen STP

The Village of Goshen STP is designed to treat 1.5 mgd of wastewater and discharge an advanced-secondary treated effluent into the Rio Grande Creek. Oxidation ponds at the end of the treatment process provide additional detention time for the treated wastewater, producing a slightly polished effluent. The Goshen STP serves the Village and approximately 600 homes in the Town. The sewage collection system in Goshen has been subject to significant inflow and infiltration (I/I) which can overload biological treatment processes and cause permit excursions at the plant. If I/I can be controlled, it is possible that the Goshen STP can produce an advanced quality effluent at present design flow without any plant modifications. Although the existing parcel can accommodate an expanded advanced wastewater treatment facility, the Rio Grande Creek is a small water body, and is limited in its ability to assimilate treated effluent. In addition, the NYSDEC is proposing reclassification in the Rio Grande Creek from Class D to Class C, which may require an upgrade in the level of treatment provided by the Goshen STP.

4.3.5 Middletown STP

The Middletown STP is designed to treat 6.0 mgd and discharge treated effluent to the Wallkill River. The present operation of the facility is split into two parallel processes, with one half of the incoming flow cycling through a trickling filter and one half through an oxidation ditch. There is a great deal of open land around the plant, which ultimately could accommodate an expanded treatment plant designed for 10.0 mgd or more with an advanced level of treatment.

The current facility operation produces a low-level advanced treatment effluent. The plant is subject to occasional permit excursions and work to correct this is has been undertaken by the City of Middletown. It is likely that any expansion of the facility will have to provide advanced treatment of wastewater for discharge into the Wallkill River.

4.3.6 Montgomery STP

The Village of Montgomery STP is designed to treat 0.5 mgd and, utilizing oxidation ditches, produces an advanced quality effluent discharge to the Wallkill River. The STP consistantly meets permitted standards at present. There is space available on the existing site to add one more oxidation ditch and clarifier to the treatment process, thereby providing a total treatment capacity of approximately 0.8 mgd. Any further expansion would require the acquisition of an adjacent parcel of land.

4.3.7 New Windsor STP

The New Windsor STP is presently designed for 5.0 mgd and discharges treated secondary effluent to the Hudson River at the mouth of the Moodna Creek. Treatment operations at the plant, which utilize trickling filters, have yielded consistent compliance with permit limitations.The existing facility site is restrictive to expansion due to topography and boundary limitations. However, two developed parcels adjacent to the existing facility grounds can accommodate some additional treatment works. With acquisition of this additional land, the New Windsor site could accommodate a 10 to 20 mgd secondary treatment facility. Expansion of the plant up to this size range will require that the effluent outfall be extended into midstream of the Hudson River in order to get complete mixture and dilution of the discharge.

4.3.8 Newburgh STP

The City of Newburgh STP presently serves all of the City and part of the Town of Newburgh. This conventional aeration plant is designed to treat 7.0 mgd of wastewater at a secondary level, with discharge to the Hudson River. Much of the sewage collection system for the City is made up of combined sewers handling both sewage and storm run-off. During periods of rain or snow-melt, this combined sewer system allows excess water inflow to the treatment facility, which can overload the biological treatment processes and cause excursions from permitted effluent limits. The existing site can accommodate a moderate expansion of the treatment facility.

4.3.9 Orange County Sewer District No. 1 STP

The Orange County Sewer District No. 1 (OCSD#1) sewage treatment plant is designed to treat up to 4.0 mgd of wastewater, providing a low advanced effluent quality. The present facility operates two treatment processes in parallel; one half of the flow is treated by traditional extended aeration, and one half is treated by extended aeration using oxidation ditches. Effluent discharge is designed to be split between outfalls to the Woodbury Creek and Ramapo River. However, at present all discharge is to the Ramapo River due to restrictions placed on the Woodbury Creek outfall by NYSDEC. Discharge to the Woodbury Creek will not be feasible, since Woodbury Creek has been determined to be a trout-spawning waterbody by NYSDEC. The OCSD#1 facility faces limitations on expandability due to restrictions that will be imposed when the Ramapo River is reclassified by NYSDEC from Class D to Class C, demanding a higher quality effluent.

The site and surrounding area of the OCSD#1 sewage treatment facility can accommodate up to a 12.0 mgd plant providing secondary treatment, or an 8.0 mgd advanced treatment plant. However, the assimilative capacity of the Ramapo River is limited even under a high advanced treated effluent discharge. A 12.0 mgd secondary effluent would have to be pumped to the Hudson River, where dilution of the discharge would be of sufficient magnitude so as not to cause an adverse environmental impact.

4.3.10 Port Jervis STP

The Port Jervis STP is a secondary treatment facility that is designed for 5.0 mgd, but presently only permitted for 2.5 mgd. The STP is owned and operated by the City of New York, as part of its watershed protection program. Treatment is accomplished with trickling filters, and treated effluent is discharged to the Neversink River. Average daily flow at the plant is about 1.3 mgd. As Port Jervis is near saturation population, there appears to be adequate treatment capacity at the STP for areas outlying the City. It is possible that portions of Deerpark could be served by the STP with no expansion of the existing Port Jervis facility.

4.3.11 Walden STP

The Village of Walden STP is a secondary treatment facility designed for a flow of 1.1 mgd. Treated effluent from the plant is discharged into the Wallkill River. The facility is presently required to monitor ammonia-nitrogen content in the summer only. Since the plant was not designed for ammonia-nitrogen removal, there are occasional excursions beyond allowable permit limits for ammonia.

The Walden STP uses two trickling filters operating in series. The facility is designed to be expandable by re-routing the flow path to operate the trickling filters in parallel. This, however, will further reduce the ability of the plant to meet the permit limits for ammonia removal. It is likely that an upgrade of the level of treatment will be necessary if the plant is expanded significantly. Expansion of the plant will also require the acquisition of additional land. The Village owns land adjacent to the treatment plant, and could possibly use this space for expansion.

4.3.12 Wallkill STP

The Wallkill STP is a 4.0 mgd advanced treatment facility discharging to the Wallkill River. The plant utilizes oxidation ditches and presently produces an effluent that consistently meets permit limits. Most of the pumps and piping at the facility have been designed to handle flows of up to 6.0 mgd, so that an expansion of the plant could be accomplished primarily by adding a new oxidation ditch and clarifier. However, the size of the existing site is limiting to expansion beyond 6.0 mgd. Acquisition of a suitable adjacent parcel would allow for an expansion up to 8.0 mgd or more while providing advanced treatment.

4.3.13 Warwick STP

The Village of Warwick STP provides secondary treatment of wastewater using a trickling filter, and is presently designed for 0.5 mgd. The facility discharges to the Wawayanda Creek, which is presently classified as C(T). Average daily flows at the plant presently exceed design capacity, and the Village is operating under a sewer connection moratorium. It is likely that any expansion of the Warwick (V) STP beyond 0.5 mgd will require an upgrade to provide advanced traetment, reducing ammonia and increasing dissolved oxygen in the effluent. There is room at the present site for some expansion of treatment works. In addition, there is land adjacent to the STP that appears to be suitable for additional facilities.

4.3.14 Washingtonville STP

The Washingtonville STP is designed to treat 0.4 mgd of wastewater at a secondary level, with discharge to the Moodna Creek. The plant presently utilizes trickling filters for treatment. It is likely that expansion of the facility will require an upgrade in treatment level to provide an advanced quality effluent. Additional land will be necessary for expansion of the Washingtonville STP, as the existing site is extremely limited. A parcel adjacent to the existing plant is suitable for construction of additional treatment works.

4.4 Summary

The facilities described in this Chapter are capable, to some degree, of providing extended service at a regional level. The assessment of "significant" facilities will be considered in the development of conceptual alternatives. It should be noted that while Table 4-3 shows that approximately 12 mgd of treatment capacity is available, it becomes apparent that the bulk of the available capacity is not located in areas with greatest need for wastewater treatment in the future. A summary of the projected future wastewater treatment needs and deficiencies for communities in Orange County is presented later in Chapter 10.

CHAPTER 5

5.0 REVIEW OF PREVIOUS SEWERAGE STUDY REPORTS

5.1 Introduction

The assessment of current sewage treatment practices and management in Orange County can be assisted by a review of existing reports and studies prepared previously for the County, its sewer district, town and village systems. Information contained in existing reports and studies can be useful in the analyses undertaken in this Study from both a planning and technical basis. Accordingly, each study is presented in sections and organized into a planning data summary followed by a technical data summary.

Ten significant sewerage studies have been identified for review. Chronologically, they are as follows:

- Comprehensive Sewerage Study, Orange County, New York, 1976;
- Orange County Sewer District No. 1 and Moodna Basin Southern Region Joint Sewerage Board Facilities Expansion Engineering Report and Feasibility Study, 1988;
- Round Lake Interceptor Sewer Study, 1989;
- Design and Operations Review, Orange County Sewer District No.1 Water Pollution Control Facility, 1989;
- Town of Wawayanda Sewer District Report, 1989;
- Town of Montgomery Report on Sewerage Study, 1989;
- Wastewater Facilities Plan for the Northeast Study Area of the Town of Wallkill, 1989;
- Development Potential with Central Sewers for the Southeast Area of Goshen, 1990;
- Sterling Forest Comprehensive Plan, 1991; and
- Infiltration/Inflow Study, Orange County Sewer District No. 1, 1991.

A discussion of each is presented in the following sections.

5.2 Comprehensive Sewerage Study, Orange County, New York

The purpose of this report was to provide an assessment of Orange County's present and future needs for both the transmission and treatment of wastewater. The report was issued in December, 1976 by Alexander Potter Associates.

In the report, options were assessed based upon the natural boundaries formed by the ten drainage basins in the County: the Wallkill, Moodna, Delaware, Neversink, Shawangunk, Ramapo, Wanaque, Popolopen, Hudson and Quassaic. The report anticipated sewerage needs of the County through the year 2020 in terms of expected population growth, determined potential service areas, made recommendations on both interceptor systems and plants, and gave preliminary predictions on site locations and capacities. The recommended alternative in some basins required cooperation from several adjoining communities and, it was noted in the report, such recommended alternatives might need to be re-evaluated if some of the considered communities do not choose to participate.

5.2.1 Planning Data

The 1976 study projected the County population to be 534,400 in the year 2020. Projections for the years 1990 and 2000 were estimated at 333,500 and 404,200, respectively. These population estimates were based upon then current data available from the Orange County Department of Planning and Development.

5.2.2 Technical Data

The 1976 study recommends that existing service areas be expanded and the level of treatment be upgraded. Service areas and treatment requirements were determined according to drainage basin boundaries, and is presented below.

Delaware River Basin
The Delaware Basin consists of part of the Town of Deerpark and the City of Port Jervis. Since the existing treatment plant for the City of Port Jervis is located on the Neversink River, a discussion of the City's sewerage needs was included in the chapter covering the Neversink Basin. It was projected in the report that future development in the Delaware Basin outside of the City of Port Jervis will be of such low density that sewerage needs can be adequately addressed by individual septic systems.

Hudson River Basin
According to the report, the sewerage needs of the Hudson Basin are expected to be met by the construction of a joint plant at Fort Montgomery in the Town of Highlands, to serve the Village of Highland Falls and the Fort Montgomery Sewer District. In addition, the Hudson River would be subject to discharge from the treatment plant proposed for the Moodna Creek Basin.

Moodna Creek Basin
The report states that of the Moodna Basin communities of Blooming Grove, Chester, Hamptonburgh, Maybrook, Monroe, Washingtonville and Woodbury, in addition to Stewart Airport can be served by a sewerage system consisting of gravity flow to the Hudson River from a new treatment plant with capacity of 6.0 mgd, under the control of a county sewer district.

Neversink River Basin
The Neversink Basin consists largely of the Town of Deerpark and sections of the Towns of Greenville and Mount Hope. At the confluence of the Neversink and Delaware Rivers, the basin also includes part of the City of Port Jervis. The Port Jervis plant is a secondary treatment plant with a rated capacity of 2.5 mgd, and was projected to be adequate to serve the needs of

Port Jervis until the year 2020. The facility is owned and operated by the City of New York and, according to the report, can only treat sewerage from the City of Port Jervis under a contractual agreement with the City of New York. As with the Delaware River Basin the report concludes that any significant future development that will occur outside of the City can be served by individual septic systems.

Popolopen Brook Basin

The northern half of the Popolopen Basin is owned by the United States Military Academy and is the source of water for West Point. The southern half of this basin is part of Palisades Interstate Park. The report concluded that there is no reason to develop immediate or long range projects in the Popolopen Basin, as present use of the area is not expected to change.

Quassaic Creek Basin

The report notes that, at the time of writing, a study was underway to determine whether the Town of Newburgh should build its own facility or join the City of Newburgh in utilizing their plant. Deferring to the local study, the report made no recommendation for the Quassaic Creek Basin.

Ramapo River Basin

The Ramapo Basin is served by the combined capacity of the Orange County Sewer District No. 1 plant in Harriman and smaller plants in the Village of Tuxedo Park and Town of Tuxedo. The report concludes that there are no major service areas in the Ramapo Basin where there is an immediate need for collection and treatment of wastewater.

Shawangunk River Basin

The report concludes that there are no immediate needs for sewerage projects in the Shawangunk Basin. However, it is noted that possible future developments along the Shawangunk Kill, particularly in the Town of Crawford and Village of Otisville, might require sewer systems.

Wallkill River Basin

One foreseen service area in the Wallkill Basin included Middletown, the Village of Goshen and five existing sewer districts in Wallkill served by a new plant located in New Hampton at the junction of the Wallkill River and Monhagen Brook. The report states that the plant would require tertiary treatment and have an initial capacity of 6.0 mgd, with a ultimate capacity of 12.0 mgd. It was recommended that: (1) the existing Florida STP, with a capacity of 0.3 mgd and secondary treatment, be expanded and upgraded to 0.5 mgd and tertiary treatment; (2) either the Florida interceptor be extended to serve the adjacent areas of the Towns of Warwick and Goshen, or that the existing Village of Warwick plant be upgraded to tertiary treatment and expanded from 0.5 to 1.0 mgd to serve the Towns of Warwick and Goshen; and (3) a joint plant be constructed adjacent to the present Village of Montgomery plant to serve the Villages of Montgomery and Maybrook and the Town of Montgomery. The initial capacity of this plant was set at 0.8 mgd with an ultimate capacity of 1.6 mgd.

Wanaque River Basin

For the Wanaque Basin, the report concludes that sewerage facilities will be required to serve Greenwood Lake and adjacent areas of the Town of Warwick. Possible alternatives considered to accomplish this included a treatment plant at Greenwood Lake with discharge to either Greenwood Lake or the Wanaque River, or a pumping station at Greenwood Lake to pump to the Wanaque Valley Regional Sewerage Authority in New Jersey.

5.3 Orange County Sewer District No. 1 and Moodna Southern Region Joint Sewerage Board Facilities Expansion Engineering Report and Feasibility Study

This report, completed by Camp, Dresser and McKee (CDM) in April, 1988, focuses on the Orange County Sewer District No. 1 (OCSD#1) sewage treatment plant, located in the Village of Harriman. The OCSD#1 STP was originally designed and constructed to treat up to 2.0 mgd, serving the Villages of Harriman, Kiryas Joel and Monroe, and part of the Town of Monroe. The plant capacity was expanded to 4.0 mgd in 1987 to serve the expanded Moodna Basin Southern Region (MBSR) service area, including the Town of Blooming Grove, the Town and Village of Chester, part of the Town of Monroe, and the Town of Woodbury. Following the 1987 upgrade and expansion of the facility, rapid growth in the OCSD#1 and MBSR areas caused flows at the STP to increase at an accelarated rate. Subsequently, municipal officials and the Orange County Department of Public Works estimated that the proposed development in the expanded area would generate flows in the vicinity of 5.0 mgd by 1989 to 1990. As a result, NYSDEC imposed a moratorium on sewer extensions within the service area. In an effort to provide adequate treatment capacity for the proposed developments, the OCSD#1 and MBSR jointly commissioned CDM to study the situation.

The report assessed growth projections in the combined OCSD#1/MBSR service area and predicted the required future sewage treatment capacity. It considered alternative treatment processes, outfall options and siting alternatives to determine how treatment requirements should be met.

5.3.1 Planning Data

Sewage flow projections, based upon population projections, were made for each Town and Village within OCSD#1 and MBSR through the year 2010. Table 5-1, adopted directly from the CDM report shows the "maximum possible population according to the zoning for each town and village compared to the population projected for the 20-year planning period studied." As shown in Table 5-1, the year 2010 population totals 82,150 for OCSD#1 and MBSR communities.

The report also provides December 1986 through February 1988 sewage flows into the OCSD#1 STP. The average monthly flows calculated during this timeframe are shown in Table 5-2. As shown, the MBSR and OCSD#1 each contributed one-half of the total average 3.06 mgd of sewage flow to the facility in 1987. The report concludes that "a per capita value of 100 gpd, as listed in 'Recommended Standard for Sewerage Works 1987 Edition', is .... consistent for use in this study." That conclusion was based upon an average total plant inflow of 3,064,667 gallons per day (gpd) attributable to an estimated 38,750 users, resulting in an average per capita flow of approximately 80 gpd. The calculation included inflow and infiltration, since it

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 5-1

PROJECTED POPULATION VERSUS ZONING (1988 REPORT)

	2010 POPULATION	MAXIMUM ZONED POPULATION
Blooming Grove, Town of	12,000	--(1)
Chester, Village of	5,100	5,160
Chester, Town of(2)	8,200	18,650
Harriman, Village of	3,750	--(1)
Kiryas Joel, Village of	18,000	--(1)
Monroe, Village of	11,900	12,080
Monroe, Town of(2)	12,000	46,780
Woodbury, Town of	11,200	11,680
TOTAL OCSD NO. 1 & MBSR	82,150	

NOTES:

(1) Information unavailable.

(2) Includes benefit areas, as described in the source document.

SOURCE:

Adapted from Table 3-1, Facilities Expansion Engineering Report and Feasibility Study for Orange County Sewer District No. 1 and Moodna Southern Region Joint Sewerage Board, April 1988, Camp Dresser and McKee.

(rpts:orsewer:tab51a:070591:jb)

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 5-2

EXISTING FLOW INTO OCSD #1 STP (1988 REPORT)

	1987 AVERAGE MONTHLY FLOW (Gallons Per Day)
Blooming Grove, Town of	354,011
Chester, Village of	233,610
Chester, Town of	320,486
Monroe, Town of (part)	99,062
Woodbury, Town of	528,123
MBSR SUBTOTAL	1,535,292
OCSD No. 1	1,529,375
OCSD No. 1 SUBTOTAL	1,529,375
TOTAL	3,064,667

SOURCE:

Adapted from Facilities Expansion Engineering Report and Feasibility Study for Orange County Sewer District No. 1 and Moodna Southern Region Joint Sewerage Board, April 1988, Camp Dresser and McKee.

(rpts:orsewer:tab52a:070591:jb)

was based upon the metered flow entering the facility. Using the 100 gallons per capita per day sewage generation rate, the report projects year 2010 sewage generation at 10.0 mgd for the OCSD#1 and MBSR communities. Table 5-3 shows the breakdown of flow by municipality for the design period.

5.3.2 Technical Data

Assuming a 10.0 mgd design flow for the STP service area, the report presents various alternatives for sewage treatment. Treatment processes considered were diffused air activated sludge, oxidation ditch activated sludge, and rotating biological contactors. It was determined in the report that an oxidation ditch activated sludge process was the preferable design for a treatment plant of this capacity, discharging to a Class D watercourse.

Table 5-4 presents the alternatives that were evaluated by CDM for expansion of the OCSD#1 STP. The final recommendation of the report is that Alternative 2, Scenario B be implemented. It is concluded in the report that the efficiencies to be gained from the expansion of the existing facility outweigh the advantages of both the new construction and partial duplication of operations at a second site. It is also noted in the report that, although expansion of the OCSD#1 STP may face public opposition, it will be equally difficult to construct a new facility in another location.

The report also notes that the cost effective method for effluent discharge from the OCSD#1 STP to the Hudson River at Cornwall would be via 64,000 feet of force main and one pumping station. The effluent pipe could utilize a portion of the existing outfall to Woodbury Creek. The cost of the outfall pipe and pumping station was estimated at approximately $11.8 million in 1988 dollars. The pipe route suggested is along U.S. Route 6, the New York State Thruway and New York State Route 32 to the Hudson River.

5.4 Round Lake Interceptor Sewer Study

This report was issued by Clark Engineers to the Orange County Department of Public Works in March, 1989. The report examines wet weather surcharging occurring at Manhole M-22 on the Round Lake Interceptor Sewer Main located in the Town of Monroe. Alternative solutions to address this existing main capacity were evaluated. However, the scope of the report does not address the identification of infiltration/inflow sources.

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 5-3

SUMMARY OF
CURRENT AND PROJECTED FLOWS (1988 REPORT)

	1987 AVERAGE FLOW (Gallons Per Day)	2010 PROJECTED FLOW(1) (Gallons Per Day)
OCSD No. 1	1,529,375	4,410,000
Harriman, Village of	—	460,000(2)
Kiryas Joel, Village of	—	1,800,000(2)
Monroe, Village of	—	1,200,000(2)
Monroe, Town of (partial)	—	950,000(2)
MBSR		
Blooming Grove, Town of	354,011	1,250,000
Chester, Village of	233,630	1,200,000
Chester, Town of	320,486	1,440,000
Monroe, Town of (partial)	99,042	450,000
Woodbury, Town of	528,123	1,250,000
TOTALS	3,064,667	10,000,000

NOTES:

(1) Includes Current Flow

(2) Included in Total for OCSD No. 1

SOURCE:

Adapted from Facilities Expansion Engineering Report and Feasibility Study for Orange County Sewer District No. 1 and Moodna Southern Region Joint Sewerage Board, April 1988, Camp Dresser and McKee.

(rpts:orsewer:tab53a:070591:jb)

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 5-4

ALTERNATIVES FOR EXPANSION OF
CAPACITY AT OCSD #1 STP (1988 REPORT)

ALTERNATIVE	SCENARIO	DESCRIPTION	PRESENT WORTH
1	A	Two Plants: Chester Plant -- 6.0 mgd Harriman Plant -- 4.0 mgd at tertiary treatment (Ramapo River discharge)	$50,818,900
	B	Two Plants: Chester Plant -- 6.0 mgd Harriman Plant -- 4.0 mgd at secondary treatment (Hudson River discharge)	$57,895,100
2	A	One Plant: Harriman Plant -- 10.0 mgd at tertiary treatment (Ramapo River discharge)	$43,003,900
	B	One Plant: Harriman Plant -- 10.0 mgd at secondary treatment (Hudson River discharge)	$45,091,900

SOURCE:

Adapted from Facilities Expansion Engineering Report and Feasibility Study for Orange County Sewer District No. 1 and Moodna Southern Region Joint Sewerage Board, April, 1988, Camp Dresser anbd McKee.

(rpts:orsewer:tab54a:070591:jb)

Manhole M-22 is located between the north shoreline of Round Lake and Shore Drive. It is the transition point between the 15-inch diameter Walton Lake Interceptor and the 10-inch diameter Round Lake Interceptor. It also receives flow from an 8-inch diameter collector lateral. The hydraulic capacity of the incoming 15-inch diameter interceptor is 1.63 mgd and exceeds the downstream 10-inch diameter interceptor, which is 1.25 mgd. As a result, surcharging is reported to occur periodically.

5.4.1 Planning Data

The report focuses on the problems involving the Round Lake Interceptor and as such, its scope did not address the detailed planning issues and projections.

5.4.2 Technical Data

Five permanent alternatives were examined to address the surcharging problem. Two temporary alternatives were also considered. These alternatives are as follow:

Permanent Alternatives

- Relief pumping station/force main;
- Enlarge interceptor sewer;
- Parallel transmission main gravity;
- Parallel gravity collector main; and
- New Lakes Road interceptor.

Temporary Alternatives

- Inline retention/holding basin; and
- Temporary bypass force main.

The report concludes that construction of a parallel 10-inch gravity main from manhole M-22 to the Brooklyn Avenue sewer is the preferred alternative.

5.5 Design and Operations Review, Orange County Sewer District No. 1 Water Pollution Control Facility

This report summarizes a design and operations overview of the OCSD#1 sewage treatment plant for facility performance. It was issued in May, 1989 by Malcolm Pirnie, Inc.

5.5.1 Planning Data

The report focuses on the detailed unit operations of the facility and, as such, its scope of work did not involve the detailed examination of planning issues and projections. However, the report did present some relevant planning information, with respect to the 1988 plant influent average flow rates and precipitation. This information is shown in Table 5-5.

5.5.2 Technical Data

The report concluded that, overall, the original STP design was sound. However, the following deficiencies were noted in the newer, expanded portion of the plant:

- Inability to measure the flow split between the original and expanded portions of the plant;
- Inadequate depth and short-circuiting of flow in the final clarifiers;
- Dedicated piping from oxidation ditch to clarifier imposes a lack of process flexibility;
- Lack of a structural wall between ditch and clarifier creates added lack of process flexibility;
- Transfer of primary sludge from the original plant to the oxidation ditches adversely affects performance of the ditches; and
- Ultraviolet disinfection system experiences difficulty attaining permitted maximum fecal coliform limit.

To correct the above problems, the report recommended the following actions be undertaken:

- Calibrate and maintain the new flow metering devices installed on each of the oxidation ditch influent lines;
- Develop and implement an internal process sampling program for all major unit operations;
- Consider the design and construction of separate, external final clarifiers for the oxidation ditch system. The design should consider plant hydraulics and the possibility of interconnecting the original plant's final clarifiers with the new facilities proposed to provide increased process redundancy;
- Pending hydraulic evaluation, modifications to the original plant's final clarifier flow distribution system should be incorporated into the redesign effort. This should include new flow distribution chambers to permit the conveyance of mixed liquor to either set of clarifiers for enhanced operational flexibility. Return sludge pumping facilities should be provided to allow settled secondary sludge pumped to either biological process;
- With the modified facilities, it may not be necessary to convey waste secondary sludges to the oxidation ditch system for stabilization. The decant tank could be operated as an

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 5-5

ORANGE COUNTY SEWER DISTRICT NO. 1 STP
1988 MONTHLY AVERAGE FLOW RATES AND TOTAL PRECIPITATION (1989 REPORT)

MONTH	AVERAGE FLOW (MGD)	INSTANTANEOUS FLOW		TOTAL PRECIPITATION(1)	MAXIMUM AVERAGE DAILY FLOW (MGD)
		Maximum	Minimum		
January	2.745	4.75	0.50	26"	3.545
February	3.252	6.75	0.50	20-3/4"	5.497
March	3.054	7.30	0.50	3-1/2"	4.203
April	2.844	6.00	0.25	--	3.914
May	3.428	7.50	0.25	7"	4.830
June	3.094	6.00	0.50	1-1/2"	4.631
July	2.774	6.80	0.25	11"	4.399
August	3.255	9.00	0.50	2-3/4"	4.132
September	2.856	7.00	0.25	2-1/2"	3.517
October	2.882	6.00	0.50	5"	3.352
November	3.485	8.50	0.50	6-1/4"	6.349
December	2.914	6.00	0.75	1-1/2"	3.346
AVERAGE	3.049	6.80	0.44	8"	6.349

NOTES:

(1) Includes inches of snowfall, as recorded by plant.

SOURCE:

Adapted from Table 3-1, Design and Operations Review, Orange County Sewer District No. 1 Water Pollution Control Facility, May 1989, Malcolm Pirnie

(rpts:orsewer:tab55a:070591:jb)

aerobic digester for this purpose;

- Waste primary sludge from the original plant should be pumped directly to the gravity thickeners, removing the burden of primary sludge treatment from the oxidation ditch system;
- If external clarifiers are constructed, the oxidation ditch clarifiers should be further studied to determine whether they should be structurally reinforced, deepened or removed from service (filled) to permit the draining of a single oxidation ditch;
- The UV system should be modified to provide direct disconnect of lamps. The "hard-wiring" of lamps should be eliminated. All lamps in an individual unit should be replaced simultaneously and in accordance with manufacturer's scheduled intervals. Additionally, leak detection and alarms should be provided in the UV room to announce the presence of rising water to plant personnel. The electrical equipment in this room warrants the notification of plant management in the event of a piping system failure. In addition, the UV system configuration should be modified to elimate the problems of "pulsing", potential short circuiting and inefficient lamp utilization;
- The sludge dewatering belt filter press system should be modified so that the sludge feed pumps allow both filter presses to be used simultaneously. In addition, the conveyor belt used to transport dewatered sludge should be modified to allow a more efficient and reliable operation; and
- The elevation of the effluent sand filter bypass channel slide gates should be raised to eliminate recurrent problems of undesired filter bypassing.

Cost calculations for the above tasks were not included as part of the report.

5.6 Town of Wawayanda Sewer District Report

This report, issued by Eustance and Horowitz, P.C. in September 1989, summarizes the results of an analysis of potential sewage flows from each of six parcels of land within the Town of Wawayanda, in accordance with current zoning and land availability for development therein.

5.6.1 Planning Data

The report discusses the flow path and peak rates of flow for each parcel, and advises as to the extent of new trunk main that would be required to serve the parcel. The information provided by this report is summarized in Table 5-6.

TABLE 5-6

SUMMARY OF DATA PRESENTED IN TOWN OF WAWAYANDA SEWER DISTRICT REPORT (1989 REPORT)

PARCEL NO.	TOTAL AREA (acres)	WETLANDS (acres)	NET DEVELOPABLE (acres)	ZONING	SEWERAGE FLOW (gpd)
1	525	34	491	PD-387 RA-57 HC-47	244,500 average 534,500 maximum
2	550	63	487	PD-395.2 R1-56.0 HC-35.8	241,100 average 526,100 maximum
3	490	6	484	PD-484	242,000
4	410	0	410	PD-172 R1-130 HC-108	208,200
5	280	0	280	PD-280	140,006
6	820	14	806	R1-415 PD-362 LB-15 M1-7 RA-7	Not Given

Key:
- PD = Planned Development, 5 acre lot minimum
- HC = Highway Commercial
- LB = Local Business
- RA = Residential/Agricultural - 1+ acres
- R1 = Residential, 1 acre
- M1 = Manufacturing

Source: Town of Wawayanda Sewer District Report, September, 1989, Eustance and Horowitz, P.C.

rpts:orsewer:tab56:070591:jb

5.6.2 Technical Data

The report recommended a trunk sewer ranging from 18 to 27 inches in diameter to collect sewage jointly from the six parcels in Wawayanda and a portion of flow from Wallkill, and to convey the flow to a treatment site in the vicinity of Echo Lakes on the Wallkill River. Details on the sewage treatment facility were not provided as part of the report. Town of Wawayanda officials indicate that either a new facility or the existing Wallkill STP may be employed to provide sewage treatment.

The cost of the Wawayanda/Wallkill trunk sewer was estimated at $4,039,200 in 1989 dollars. Local collectors for each parcel were estimated at $11, 898,900 in 1989 dollars.

5.7 Town of Montgomery Report on Sewerage Study

The firm of Lawler, Matusky and Skelly Engineers (LMS) prepared a sewerage study for the Town of Montgomery in October, 1989. The study focuses on the areas east of the Wallkill River and south of the Village of Walden, excluding the Villages of Walden, Montgomery and Maybrook. The general objective of the study is to establish a sewerage master plan or preferred sewer development pattern for the study area. The report establishes a foundation for sewerage planning with recommendations based on topography and economic considerations. Of key importance, the locations of major sewers and sewage treatment facilities were determined and/or recommended.

The Town was divided into several drainage sub-areas within the Wallkill River drainage basin. Sewerage options and anticipated needs for the Town under fully developed conditions were evaluated. The report established a collection system plan to be completed in stages as development progresses in the Town. In general, sewers will be located along major drainage courses.

In December, 1989 LMS prepared a supplemental report addressing the Village of Maybrook sewerage needs. This supplemental report presents details regarding the inclusion of Maybrook sewage flow at a proposed facility in the Town of Montgomery.

5.7.1 Planning Data

According to the report, existing development in the Town is comprised of 1,491 residential and non-residential lots. Except for 893 lots located in the general vicinity of Scotts Corners, proposed developments are scattered. It is assumed in the report that current development trends will continue.

Projected sewage flows were established for the entire Town assuming full development of all areas in accordance with current zoning laws. Sewage flow computations were based on an "equivalent dwelling unit" (EDU) approach with an assumed unit sewage flow rate of 100 gallons per capita per day (gpcd).

5.7.2 Technical Data

The report recommends a new STP with discharge to the Wallkill River be built at a site located approximately one mile upstream of the State Route 52 bridge crossing. This STP would provide service to the developing areas of the Town of Montgomery. Future flows from areas of the Town east of the Wallkill River (e.g., Maybrook) can also be accommodated at a STP at this location. The proposed size of the new STP is between 0.2 mgd to 0.4 mgd to serve the current need, with future flows possibly exceeding 8.0 mgd. The report states that treatment requirements, according to NYSDEC guidelines, would be "effluent limiting" thereby requiring secondary treatment. However, if the flows increase substantially, treatment requirements will become "water quality limiting," and may include a requirement for nitrification.

For the initial phases of operation of the STP (i.e., flows less than 0.5 mgd), the extended aeration treatment process is recommended in the report. For intermediate phases (i.e., flows from 0.5 mgd to about 1.5 mgd), a change to the contact stabilization process is recommended. When the STP flows increase further, the report states that it may prove desirable to convert to a full activated sludge process, including primary settling. As stated before, tertiary treatment with nitrification may ultimately become a requirement. According to the report, based on both siting and mechanical considerations, future plant expansions should be neither very difficult nor costly.

Initial cost estimates for providing outlet sewers and sewage treatment service to five areas of the Town were prepared to compare the cost of independent action by each with the cost of providing combined service as proposed by Hanover Associates, a privatization proposal.

Table 5-7 summarizes the preliminary cost estimates found in the report. The additional capital cost associated with including Maybrook for participation in the Town STP is estimated at over $5 million. In general, the supplemental report finds that the inclusion of Maybrook is prohibitive due to high costs.

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 5-7

PRELIMINARY COST ESTIMATES
FOR TOWN OF MONTGOMERY
SEWAGE COLLECTION AND TREATMENT FACILITIES (1989 REPORT)

SERVICE AREA	TOTAL CAPITAL COSTS	
	Hanover Associates	Independently
Coldenham	$1.04 million	$1.48 million
Bracken Road	N/A[1]	$0.27 million
Southeast of Walden	$0.43 million	$0.59 million
Southeast of Village	$1.92 million	$2.32 million
Neelytown Road	$1.86 million	$2.37 million
TOTALS	$5.52 million	$7.03 million

[1] Not applicable.

Source: Town of Montgomery Report on Sewerage Study, Lawler, Matusky and Skelly, 1989

rpts:orsever:tab57:070591:jb

5.8 Wastewater Facilities Plan for the Northeast Study Area of the Town of Wallkill

This study evaluates options for sewage transmission and treatment facilities to serve the northeast planning area of the Town of Wallkill under present flows and projected future conditions through the year 2010. The study was completed by Lewis and Zimmerman Associates, Inc. and issued in November, 1989.

5.8.1 Planning Data

The Northeast Planning Area of the Town of Wallkill is defined as shown on the location map, Figure 5-1. The area is bordered on the northwest by Highland Lakes State Park. The planning area encompasses approximately 3,800 acres, or about 10 percent of the Town's total area.

The population of the planning area is estimated at 480 persons in 1980. This represents about two percent of the Town's population. The 1990 population is estimated at 590, by counting the number of housing units and then multiplying by an average of 3.22 persons per household. The authors estimated the 1990 wastewater flows for the planning area and also for the Scotchtown part of Wallkill. This projection is shown on Table 5-8.

The Town of Wallkill population information presented in the report is identical to the Orange County Department of Planning and Development projection for 1990.

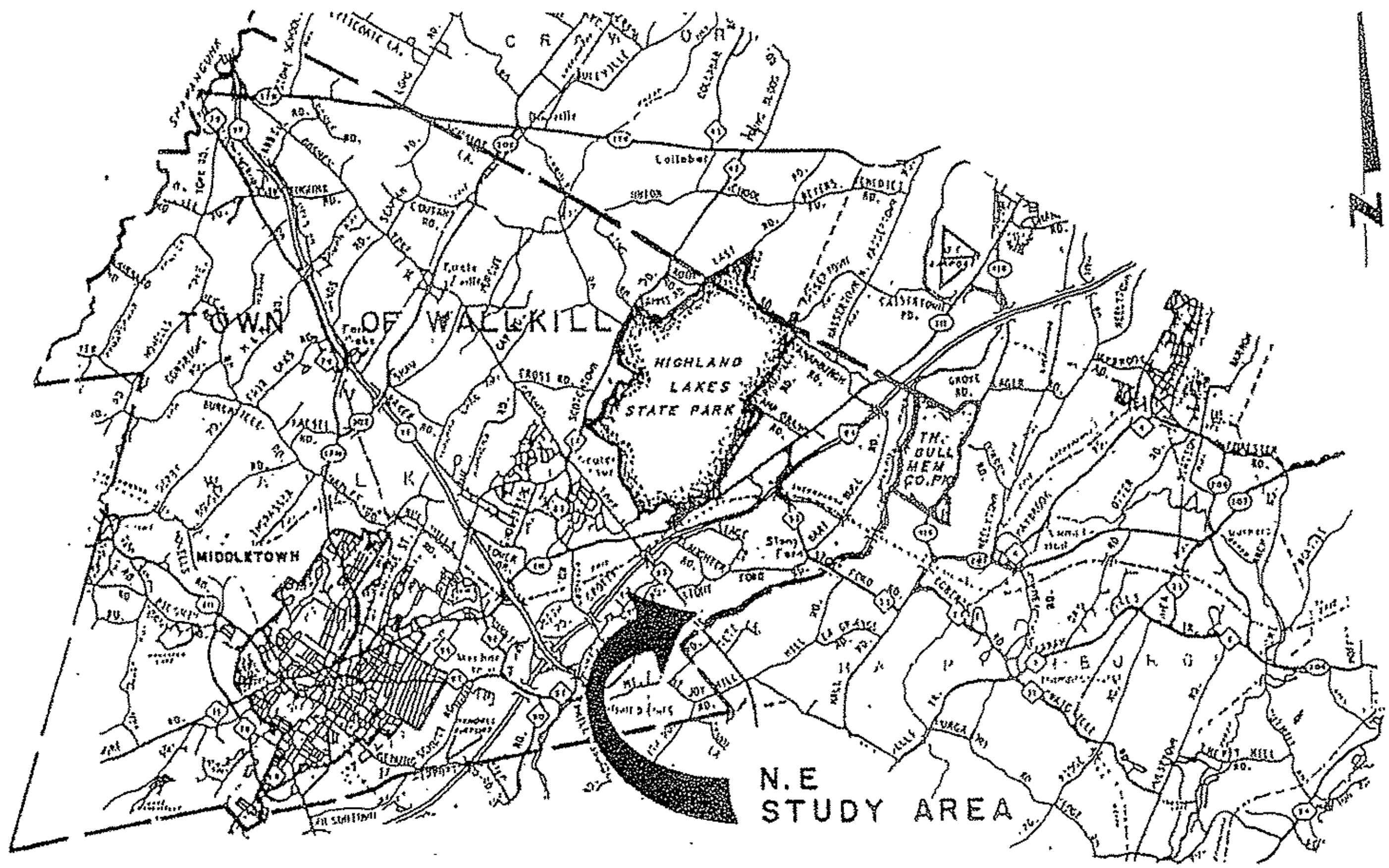
5.8.2 Technical Data

Four alternatives for sewage conveyance improvements and four alternatives for sewage treatment process improvements are identified and considered in the report. An economic analysis was also done for each sewage conveyance and treatment process alternative, using the present worth method of comparison.

The report recommends wastewater flows from the Northeast Planning Area be treated at the existing Wallkill STP, after expansion of the plant from 4.0 to 6.0 mgd by the addition of a new oxidation basin, final clarifier, and filtration and disinfection equipment. Conveyance of sewage from the planning area to the STP would be accomplished by four pumping stations and pipes running along Stoney Ford Road with a connection to Route 211 via Route 53. The total capital cost of the project in 1989 dollars was estimated by Lewis and Zimmerman at $19,891,920. Initial annual operation and maintenance of the facility was estimated at $507,584 per year.

It is determined in the report that there will be no long-term negative environmental impacts of any significance with the recommended alternatives.

FIGURE 5-1



HAZEN AND SAWYER, P.C. Engineers

SOURCE: WASTEWATER MANAGEMENT STUDY
TOWN OF WALLKILL, N.Y.
LEWIS & ZIMMERMAN ASSOC., INC.

ORANGE COUNTY, N.Y.
COMPREHENSIVE
SEWERAGE STUDY

NORTHEAST STUDY AREA IN
THE TOWN OF WALLKILL
(1989 REPORT)

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 5-8

NORTHEAST WALLKILL STUDY AREA
SEWERAGE FLOWS AT BUILD-OUT CONDITIONS (1989 REPORT)

	POPULATION	ACRES	FACTOR(1)	FLOW
Study Area	590		70	41,300
To Be Developed		228.5	1,500	342,750
Scotchtown(2)				760,000
		TOTAL -- Gallons Per Day		1,144,050

Notes:

(1) Factor as determined in the source document is multiplied by either the appropriate population or acreage to yield sewerage flow in gallons per day.

(2) Existing flow based on flow monitoring.

SOURCE:

Wastewater Facilities Plan for the Northeast Study Area of the Town of Wallkill, November 1989, Lewis and Zimmerman Associates, Inc.

(rpts:orsewer:tab58a:070591:jb)

The report also examines various means for funding the recommended alternatives. Possible funding methods listed in the report included a $12,000,000 grant from the Town of Wallkill. Even with this grant, a $363,897 annual deficit (between annual obligations and available revenues) is predicted in the report. The report notes that the Town of Wallkill might consider delaying construction for a few years until development plans are sufficient to secure additional grant funds from the development assessment to make up this deficit. Other means of funding considered in the report include increasing the cost of water from $1.10 to $1.36 per 1,000 gallons consumption, and increasing tap fees from $2,500 to $3,300.

The report anticipated the schedule for implementation of the recommended plan, if started in January, 1990, could be completed by June, 1992.

5.9 Development Potential with Central Sewers for the Southeast Area of Goshen

This report was issued to the Town of Goshen in January, 1990 by Garling Associates. The report analyzes the number of dwelling units in the southeast portion of the town that could be served by a future sewage treatment plant in the area. The study area for the report is bordered by Coleman Road, Millburn Road, Village of Goshen border, and Village and Town of Chester borders. The report was prepared in order to address a Town of Goshen resolution that requires all new developments to tie into or construct an economically viable, area-wide sewage treatment facility.

5.9.1 Planning Data

The report accounted for existing, proposed and potential site development in the study area.

Non-residential developments were converted to equivalent dwelling units to obtain the following assessment:

• Existing Development Units	457
• Proposed Development Units	473
• Potential Development Units	1,362
Total Units	2,292

Total development of the study area is anticipated by the year 2010.

5.9.2 Technical Data

The study recommends, based upon a previous engineering report, construction of a 0.48 mgd advanced sewage treatment facility with effluent discharge located 1,000 feet downstream from the confluence of the Otterkill and Black Meadow Creeks. The proposed STP would consist of an oxidation ditch, sand filter, post aeration and pH/alkalinity control system. Capital cost of the STP was estimated at $5.4 million with an annual figure of $165,000 for operation and maintenance, in 1988 dollars.

The recommended STP could handle flows from proposed and potential developments, with the existing developments of Arcadia Hills and Hambletonian Park continuing to be served by the Village of Goshen STP. However, the study states that these existing developments could be served by the new STP on an interim basis, while a long term solution is further investigated.

5.10 Sterling Forest Comprehensive Plan

The comprehensive plan for development of Sterling Forest was issued in March, 1991 by Sterling Forest Corporation (SFC). The plan calls for development of about one quarter of the 17,524 acres owned by SFC to encompass residential, commerical, light industrial, recreational and community services, over a period of 25 to 30 years. Development will be distributed among five new hamlets, within the existing Towns of Warwick, Tuxedo and Monroe. The Sterling Forest Community, as planned, will be self-sufficient and not rely on local towns for utilities, schools or civic services.

5.10.1 Planning Data

The Sterling Forest comprehensive plan calls for development of 4,187 acres of land, leaving 13,337 acres for open space. The projected breakdown of land use is as follows:

- Roads/Utilities - 227 acres
- Community Facilities - 179 acres
- Retail/Service Centers - 175 acres
- Commerical/Industrial - 447 acres
- Residential - 3,159 acres

When fully developed, it is expected that Sterling Forest will house over 34,550 people in 14,200 housing units. The distribution among Towns will be as follows:

		Housing Units	Population
•	Tuxedo -	9,104	21,187
•	Warwick -	4,402	11,695
•	Monroe -	694	1,669

Housing types will be diverse, including estate, single family detached, paired, multifamily and town homes.

5.10.2 Technical Data

The SFC development will ultimately make use of five sewage treatment plants, treating a total of 6.0 mgd. Construction, expansion and abandonment of facilities will be staged to suit the phases of development. A summary of existing and proposed STPs for Sterling Forest is presented in Table 5-9.

All treatment plants will provide an advanced level of treatment. Those facilities that discharge to the Ramapo Basin (Indian Kill, Sterling Gardens and Central Indian Kill) will be equipped for nitrification and denitrification to achieve New York State's nitrate nitrogen standard for Class A waters. Facilities discharging to the Wanaque Basin (Sterling Lake, Blue Lake and Summit Creek) will perform nitrification and phosphorus removal.

5.11 Infiltration/Inflow Study, Orange County Sewer District No. 1

This report, prepared by Clinton Bogert Associates in May, 1991 quantifies infiltration and inflow in Orange County Sewer District No. 1 and tributary sewers from the Moodna Basin Southern Region, and recommends specific, cost-effective measures to reduce this I/I in the collection system.

5.11.1 Planning Data

The report states that the OCSD#1 STP presently serves a population of about 32,000 people, including about 13,600 people from the Moodna Basin Southern Region.

5.11.2 Technical Data

The report estimates present sewage flow to the OCSD#1 STP at 3.0 mgd, consisting of 2.2 mgd average base flow and 0.8 mgd average I/I. The report states that peak I/I can range up to 15 times average base flow during extreme wet weather periods. Base sewage flow to the OCSD#1 STP is stated to be comprised of 90 percent from residential sources and 10 percent from commerical and industrial sources.

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 5-9

EXISTING AND PROPOSED STPs
SERVING STERLING FOREST (1991 REPORT)

TREATMENT FACILITY	EXISTING PERMITTED CAPACITY (mgd)	REQUIRED CAPACITY (mgd)	PROPOSED CHANGES
Indian Kill	0.20	0.20	No change.
Sterling Gardens	0.06	--	Ultimately abandoned and service will be provided by Central Indian Kill.
Central Indian Kill	--	2.90	New facility located on Indian Kill upstream of Indian Kill Reservoir with the discharge downstream of the Reservoir.
NYU Housing	0.004	--	Ultimately abandoned and service will be provided by Central Indian Kill.
Sterling Lake	0.07	2.00	Relocated to the east side of Route 84.
Blue Lake	0.02	0.30	Relocated south along Route 84.
Summit Creek	--	0.64	New facility located on Summit Creek.

Source:

Clarke & Rapuano, Inc.

rpts:orsewer:tab59:070591:jb

Elimination of I/I under a two-phase program is recommended in the report. The first phase entails only cost-effective work and includes the repair of inspected manholes with major leakage and rehabilitation of sewer segments with average I/I rates exceeding 3,333 gallons per day per inch-mile. First phase rehabilitation would also include work recommended for Woodbury determined by an earlier survey in 1987. Rehabilitation entails sealing of sewer joints and defects, and repair of manholes that are within rehabilitation areas. It is estimated that the first phase of work would cost $140,700 and result in the removal of about 8 percent, or 67,500 gallons per day of the present average I/I in the collection system.

The second phase of I/I elimination consists of the rehabilitation of identified sewer and manhole defects in areas tributary to both the Round Lake and Mill Pond interceptors. It is estimated that this work can be done at a cost of $287,100 and result in the removal of an additional 7 percent or 55,200 gallons per day of the present average I/I in the collection system. However, the report notes that removal of this additional I/I will not eliminate surcharging of both the Round Lake and Mill Pond interceptors during wet weather periods. To accomodate present and projected peak sewage flows in these areas, the report recommends the construction of two new interceptor sewer segments. The report further states that these two new sewer segments could be designed to interconnect with and/or supplement portions of the recommendations from the then in-progress Orange County Comprehensive Sewerage Study.

5.12 Summary

The review of previous sewerage study reports prepared for communities in Orange County can provide additional insight into sewage treatment practices therein. Furthermore, they can yield specific data or projections which may offer clues as to the future sewage treatment needs of the County. The review undertaken in this Chapter augments the inventory and assessment of existing sewage treatment facilities.

CHAPTER 6

6.0 BASELINE PLANNING PROJECTIONS

6.1 Introduction

A major consideration that must be addressed in the development of this Study is the analysis of current and projected future sewage quantities and sources. This information is vital to the evaluation of the long-term sewage treatment needs of Orange County. Sewage quantification is necessary to determine the sizes and types of treatment and transmission facilities required to accommodate growth-related future needs.

The following sections present current published information regarding population, sewered housing units, estimated per capita sewage generation rates as well as projections for the planning period from 1990 through the year 2020. Information is based on U.S. Census Bureau data, available County and State planning information, and previous reports, studies and data.

Sources of background data include:

- U.S. Census Bureau Data for the years 1950, 1960, 1970 and 1980;
- Comprehensive Sewerage Study, Orange County, December 1976;
- Comprehensive Master Plan for Orange County, February 1980;
- Update of the Comprehensive Master Plan for Orange County, July 1986;
- Report on Water Supply System Development for the Orange County Water Task Force, March 1987;
- Delaware-Lower Hudson Region Water Resources Management Study, New York State Department of Environmental Conservation, September 1987;
- Facilities Expansion Engineering Report and Feasibility Study for Orange County Sewer District No. 1 and Moodna Southern Region Joint Sewerage Board, April 1988;
- Wastewater Facilities Plan for the Northeast Study Area of the Town of Wallkill, November 1989; and
- Sterling Forest Comprehensive Plan, 1991.

In addition, Hazen and Sawyer worked closely with officials of Orange County to obtain available pertinent information from the County Department of Planning and Development, County Department of Public Works and County Board of Health. Salient information received from the various sources is cited in the following sections, where appropriate.

6.2 Baseline Population Estimates and Projections

It is essential to develop accurate population estimates and projections for Orange County due to the inherent relationship between population and quantity of sewage generated. This section presents both baseline 1990 population estimates and baseline 2020 projections for Orange County over the thirty-year planning period. For Study purposes, the term "baseline" implies the use of documented estimates and projections to form the basis upon which later modifications and refinements can be made, as appropriate, to reflect current growth expectations in the County.

6.2.1 County Historical Census Data

To understand the potential future changes in the population of the County, it is important to look at the documented historical growth therein. Accordingly, Table 6-1 presents U.S. Census Bureau data for the years 1950, 1960, 1970 and 1980. Census data for 1990 was not available during the Information Gathering phase of this Study, and is not presented herein.

Orange County experienced continuing growth between each of the census years. For example, the County experienced a 15.27 percent growth between 1950 and 1960, followed by an 18.84 percent growth between 1960 and 1970, and a subsequent 18.89 percent growth between 1970 and 1980. The total population gain of the County during the census data periods shown in Table 6-1 was 100,214 people, or on average about 3,340 people per year.

As a means of comparing the County's historical population growth to related geographic areas, Table 6-1 also shows census data for both New York State and the United States. Review of this data indicates that the County's percentage population growth surpassed that of New York State throughout the entire thirty-year period. While the County's 1950 to 1960 percent population growth of 15.27 percent is only slightly higher than the 13.16 percent growth for New York State on the whole, the 1960 to 1970 percent population growth of the County is more notable (18.84 percent versus 8.69 percent for New York State). The 1970 to 1980 percent population growth comparison keenly illustrates the continued divergence between the County and the State (18.89 percent for the County versus a 3.75 percent loss for New York State). Based on the reported statistics, it can be concluded that, while New York State has experienced a slight increase in percentage population growth during the 1950 to 1980 period, Orange County, by comparison, experienced an accelerated rate of population growth. Although the United States' growth rate exceeded that of New York State during the period from 1950 to 1980, it is still well below the growth rate for Orange County.

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 6-1

U.S. CENSUS BUREAU DATA

GEOGRAPHIC AREA	CENSUS YEAR 1950	1960	1970	1980	TOTAL 1950-1980
ORANGE COUNTY, NEW YORK					
Population	159,389	183,734	218,358	259,603	--
Numerical Change	--	+24,345	+34,624	+41,245	+100,214
Percent Change	--	+15.27%	+18.84%	+18.89%	+62.87%
Average Annual Percent Change	--	+1.53% (1950-1960)	+1.88% (1960-1970)	+1.89% (1970-1980)	+2.10% (1950-1980)
NEW YORK STATE					
Population	14,830,192	16,782,304	18,241,391	17,558,165	--
Numerical Change	--	+1,952,112	+1,459,087	-683,226	+2,727,973
Percent Change	--	+13.16%	+8.69%	-3.75%	+18.39%
Average Annual Percent Change	--	+1.32% (1950-1960)	+0.87% (1960-1970)	-0.38% (1970-1980)	+0.61% (1950-1980)
UNITED STATES					
Population	151,325,798	179,323,175	203,302,031	226,542,203	--
Numerical Change	--	+27,997,377	+23,978,856	+23,240,172	75,216,405
Percent Change	--	+18.50%	+13.37%	+11.43%	+49.70%
Average Annual Percent Change	--	+1.85% (1950-1960)	+1.34% (1960-1970)	+1.14% (1970-1980)	+1.66% (1950-1980)

SOURCES:

U.S. Census Bureau, Department of Commerce
New York State Planning Department
Orange County Department of Planning and Development
1990 World Almanac

(rpts:orsewer:tab61a:070591:jb)

During the thirty-year period from 1950 to 1980, overall Orange County population increased by 62.87 percent. This growth rate is significantly higher than the comparable 18.39 percent for New York State. The County population growth rate also surpassed that of the United States (49.70 percent). These statistical comparisons confirm that a rapid population growth rate has been experienced by Orange County since 1950.

6.2.2 City and Town Historical Census Data

The historical census data for Orange County can be further analyzed by assessing the population growth at the city and town level. The County has three cities (Middletown, Newburgh and Port Jervis) and twenty towns. Most of the towns also have various villages incorporated within the town boundaries. A profile of the County historical population by city and town is presented in Table 6-2. Constituent community populations for villages and unincorporated town areas have not been segregated for presentation in Table 6-2.

As illustrated by Table 6-2, the County has experienced an average annual population growth rate of 2.10 percent between 1950 and 1980. Upon examining the data presented in Table 6-2, it can be seen that the majority of towns have at least doubled in size between 1950 and 1980. Towns that have had threefold or higher increases in population growth include Blooming Grove, New Windsor, Wallkill and Woodbury. However, the robust growth of the towns in the County may have contributed to the population losses experienced by each of the three cities in the County.

To better understand historical city and town census data provided in Table 6-2, the information contained therein has been further sorted to rank the communities from highest to lowest in terms of both numerical population change and average annual percent growth over the thirty-year period.

In Table 6-3, towns and cities have been arranged from highest to lowest in terms of numerical population change from 1950 to 1980. As shown, the numerical change ranges from a net gain of 14,534 people for the Town of Wallkill to a net loss of 8,518 people for the City of Newburgh. Dividing the total numerical population change for the County (+100,214 people) by a total of 23 communities (20 Towns and 3 Cities) results in a simple average population gain of 4,357 people per community from 1950 to 1980. Therefore, the first ten towns listed in Table 6-3 either equal or exceed the average County population gain (assuming that the Woodbury's gain of 4,356 is

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 6-2

HISTORICAL POPULATION OF ORANGE COUNTY

CITIES AND TOWNS : 1950-1980

TOWN OR[1] CITY	U.S. CENSUS DATA POPULATION				1950-1980 NUMERICAL CHANGE	1950-1980 PERCENT CHANGE	1950-1980 AVERAGE ANNUAL PERCENT CHANGE
	Year						
	1950	1960	1970	1980			
Blooming Grove (T)	2,410	3,777	8,740	12,339	+9,929	+311.99%	+10.40%
Chester (T)	2,878	3,494	4,665	6,850	+3,972	+138.01	+4.60
Cornwall (T)	6,154	8,094	9,614	10,774	+4,620	+75.07	+2.50
Crawford (T)	2,410	2,574	3,760	4,910	+2,500	+103.73	+3.46
Deerpark (T)	2,519	2,777	4,263	5,633	+3,114	+123.62	+4.12
Goshen (T)	5,832	6,835	8,470	10,463	+4,631	+79.41	+2.65
Greenville (T)	737	890	1,345	2,085	+1,348	+182.90	+6.10
Hamptonburgh (T)	1,272	1,695	2,175	2,945	+1,673	+131.53	+4.38
Highlands (T)	10,467	11,990	14,549	14,004	+3,537	+33.79	+1.13
Middletown (C)	22,586	23,475	22,284	21,454	-1,132	-5.01	-0.17
Minisink (T)	1,367	1,433	1,871	2,488	+1,121	+82.00	+2.73
Monroe (T)	5,257	5,965	8,827	14,948	+9,691	+184.34	+6.14
Montgomery (T)	9,868	11,672	13,888	16,576	+6,708	+67.98	+2.27
Mount Hope (T)	2,298	2,291	2,952	4,398	+2,100	+91.38	+3.05
Newburgh (C)	31,956	30,979	25,919	23,438	-8,518	-26.66	-0.89

(rpts:orsewer:tab62a:070591:jb)

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 6-2

HISTORICAL POPULATION OF ORANGE COUNTY

CITIES AND TOWNS : 1950-1980

TOWN OR (1) CITY	U.S. CENSUS DATA POPULATION				1950-1980 NUMERICAL CHANGE	1950-1980 PERCENT CHANGE	1950-1980 AVERAGE ANNUAL PERCENT CHANGE
	Year						
	1950	1960	1970	1980			
Newburgh (T)	14,277	15,547	21,348	22,747	+8,470	+59.33%	+1.98%
New Windsor (T)	5,100	11,908	16,240	19,534	+14,434	+283.02	+9.43
Port Jervis (C)	9,372	9,268	8,768	8,699	-673	-7.18	-0.24
Tuxedo (T)	2,281	2,227	2,928	3,069	+788	+34.55	+1.15
Wallkill (T)	5,947	8,176	11,429	20,481	+14,534	+244.39	+8.15
Warwick (T)	9,828	12,551	16,437	20,976	+11,148	+113.43	+3.78
Wawayanda (T)	2,435	3,229	3,419	4,298	+1,863	+76.51	+2.55
Woodbury (T)	2,138	2,887	4,467	6,494	+4,356	+203.74	+6.79
COUNTY TOTALS (2)	159,389	183,734	218,358	259,603	+100,214	+62.87%	+2.10%

NOTES:

(1) Town or City is denoted by (T) or (C), respectively, after each entry in this column. The figures shown for each Town include the population attributed to constituent communities, such as villages in each town, if applicable.

(2) County totals represent the actual sums of each column, except for both the 1950-1980 percent change and 1950-1980 average annual percent change.

SOURCES:

U.S. Census Bureau, Department of Commerce
Orange County Department of Planning and Development

(rpts:orsewer:tab62a:070591:jb)

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 6-3

RANKINGS OF NUMERICAL CHANGE IN POPULATION AND AVERAGE ANNUAL PERCENT CHANGES FOR ORANGE COUNTY CITIES AND TOWNS : 1950-1980

POPULATION GROWTH			AVERAGE ANNUAL PERCENT CHANGE		
Town or City (1)	1950-1980 Numerical Change	Rank	Town or City (1)	1950-1980 Average Annual Percent Change	Rank
Wallkill (T)	+14,534	1	Blooming Grove (T)	+10.40%	1
New Windsor (T)	+14,434	2	New Windsor (T)	+9.43	2
Warwick (T)	+11,148	3	Wallkill (T)	+8.15	3
Blooming Grove (T)	+9,929	4	Woodbury (T)	+6.79	4
Monroe (T)	+9,691	5	Monroe (T)	+6.14	5
Newburgh (T)	+8,470	6	Greenville (T)	+6.10	6
Montgomery (T)	+6,708	7	Chester (T)	+4.60	7
Goshen (T)	+4,631	8	Hamptonburgh (T)	+4.38	8
Cornwall (T)	+4,620	9	Deerpark (T)	+4.12	9
Woodbury (T)	+4,356	10	Warwick (T)	+3.78	10
Chester (T)	+3,972	11	Crawford (T)	+3.46	11
Highlands (T)	+3,537	12	Mount Hope (T)	+3.05	12
Deerpark (T)	+3,114	13	Minisink (T)	+2.73	13
Crawford (T)	+2,500	14	Goshen (T)	+2.65	14
Mount Hope (T)	+2,100	15	Wawayanda (T)	+2.55	15
Wawayanda (T)	+1,863	16	Cornwall (T)	+2.50	16
Hamptonburgh (T)	+1,673	17	Montgomery (T)	+2.27	17
Greenville (T)	+1,348	18	Newburgh (T)	+1.98	18
Minisink (T)	+1,121	19	Tuxedo (T)	+1.15	19
Tuxedo (T)	+788	20	Highlands (T)	+1.13	20
Port Jervis (C)	-673	21	Middletown (C)	-0.17	21
Middletown (C)	-1,132	22	Port Jervis (C)	-0.24	22
Newburgh (C)	-8,518	23	Newburgh (C)	-0.89	23
COUNTY TOTAL	+100,214		COUNTY TOTAL	+2.10%	

(1) Town or City is denoted by (T) or (C), respectively, after each entry in this column. The figures shown for each Town include the population attributed to constituent communities, such as Villages in each Town, if applicable.

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equivalent to the County average). The sum of the respective numerical population gains for the top ten communities is 88,521 people, or 88.3 percent of the total County population gain during this timeframe.

Table 6-3 also displays the towns and cities ranked from highest to lowest, in terms of average annual percent population growth during 1950 to 1980. As shown, the average annual growth rate ranges from an increase of 10.40 percent per year for the Town of Blooming Grove to a decrease of 0.89 percent per year for the City of Newburgh. As previously discussed, the County has experienced an average annual growth rate of 2.10 percent per year. Therefore, the seventeen highest-ranked towns in Table 6-3 have exceeded the County average annual percent population growth.

6.2.3 County Population Projections by City and Town

The County, through its Department of Planning and Development, has developed population projections by city and town through the year 2010. This information is contained in the Orange County Data Book as part of the 1986 Update of the Comprehensive Master Plan for Orange County, originally issued in 1980. Manipulation of this published data allows the population projections to be further scrutinized down to the village level.

Table 6-4 presents the "baseline" County population projections for the years 1980, 1990, 2000 and 2010, as published in the Orange County Data Book. For purposes of this Study, the projections have been allocated among the constituent communities of each town to enhance the projections of growth on the local municipal level. As shown, the total County population is projected to be 293,800 in year 1990, 329,100 in year 2000, and 365,150 in year 2010.

Unfortunately, the Orange County Data Book does not provide population projections for the year 2020 - the end year of the planning period for this Study. Therefore, to complete the baseline population analyses, the projected year 2020 population for each community was computed by applying the average annual growth rates for the period 1980 to 2010 to the years 2011 through 2020. For example, the Village of Washingtonville population is projected to grow from 2,380 in 1980 to 3,900 in the year 2010. This growth corresponds to an average annual growth rate of 2.13 percent per year. Assuming the rate remains constant over the next decade results in a population projection of 4,410 for the year 2020. Computation of year 2020 population projections

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 6-4

BASELINE ORANGE COUNTY POPULATION PROJECTIONS

TOWN OR[1] CITY	CONSTITUENT[2] COMMUNITIES	ORANGE COUNTY DEPARTMENT OF PLANNING AND DEVELOPMENT POPULATION PROJECTIONS				AVERAGE[3] ANNUAL GROWTH RATE	COMPUTED[4] POPULATION PROJECTION
		Year				Percent	Year
		1980	1990	2000	2010		2020
Blooming Grove (T)	Washingtonville (V)	2,380	3,700	3,500	3,900	2.13%	4,410
	Blooming Grove (UT)	9,959	10,600	13,100	14,750	1.60	16,330
Chester (T)	Chester (V)	1,910	3,100	4,300	4,750	4.96	5,670
	Chester (UT)	4,940	5,600	7,100	7,900	2.00	8,890
Cornwall (T)	Cornwall-On-Hudson (V)	3,164	3,400	3,500	3,900	0.78	4,150
	Cornwall (UT)	7,610	8,400	9,800	11,850	1.86	13,270
Crawford (T)	Crawford (UT)	4,910	5,700	6,600	7,350	1.66	8,170
Deerpark (T)	Deerpark (UT)	5,633	6,200	6,900	7,650	1.19	8,310
Goshen (T)	Goshen (V)	4,874	5,500	6,200	6,900	1.39	7,580
	Goshen (UT)	5,589	6,300	7,500	8,200	1.56	9,080
Greenville (T)	Greenville (UT)	2,085	3,700	3,300	3,650	2.50	4,170
Hamptonburgh (T)	Hamptonburgh (UT)	2,945	3,800	4,600	5,100	2.44	5,820
Highlands (T)	Highland Falls (V)	4,187	4,400	4,500	5,000	0.65	5,280
	Highlands (UT)	9,817	10,000	10,300	11,900	0.71	12,600
Middletown (C)	Middletown (C)	21,454	21,400	21,600	22,950	0.23	23,430
Minisink (T)	Unionville (V)	574	600	700	800	1.31	870
	Minisink (UT)	1,914	2,300	2,800	3,100	2.07	3,500
Monroe (T)	Harriman (V)	796	900	1,000	1,100	1.27	1,200
	Kiryas Joel (V)	2,088	4,000	6,000	6,700	7.36	8,230
	Monroe (V)	5,996	7,700	8,500	9,450	1.92	10,600
	Monroe (UT)	6,068	7,800	9,500	11,500	2.98	13,300

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ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 6-4

BASELINE ORANGE COUNTY POPULATION PROJECTIONS

TOWN OR CITY [1]	CONSTITUENT COMMUNITIES [2]	ORANGE COUNTY DEPARTMENT OF PLANNING AND DEVELOPMENT POPULATION PROJECTIONS				AVERAGE ANNUAL GROWTH RATE [3]	COMPUTED POPULATION PROJECTION [4]
		Year				Percent	Year
		1980	1990	2000	2010		2020
Montgomery (T)	Maybrook (V)	1,994	2,400	2,600	2,900	1.51%	3,200
	Walden (V)	5,659	6,000	6,500	7,400	1.03	7,990
	Montgomery (V)	2,316	2,500	2,900	3,200	1.27	3,490
	Montgomery (UT)	6,607	7,400	8,500	9,750	1.59	10,810
Mount Hope (T)	Otisville (V)	953	1,000	1,200	1,300	1.21	1,410
	Mount Hope (UT)	3,445	3,800	4,500	5,000	1.50	5,510
Newburgh (C)	Newburgh (C)	23,438	22,900	22,700	22,600	(0.12)	22,310
Newburgh (T)	Newburgh (UT)	22,747	24,200	25,800	28,600	0.86	30,570
New Windsor (T)	New Windsor (UT)	19,534	21,900	24,800	28,300	1.50	31,250
Port Jervis (C)	Port Jervis (C)	8,699	8,800	8,900	8,900	0.08	8,980
Tuxedo (T)	Tuxedo Park (V)	809	900	1,000	1,100	1.20	1,200
	Tuxedo (UT)	2,260	2,500	2,900	3,350	1.61	3,710
Wallkill (T)	Wallkill (UT)	20,481	25,100	29,800	33,500	2.12	37,850
Warwick (T)	Florida (V)	1,947	3,400	3,900	4,300	4.03	5,090
	Greenwood Lake (V)	2,809	3,000	3,300	3,700	1.06	4,000
	Warwick (V)	4,320	5,800	6,500	7,300	2.30	8,290
	Warwick (UT)	11,900	14,300	17,000	18,900	1.96	21,230
Wawayanda (T)	Wawayanda (UT)	4,298	4,900	5,500	6,100	1.40	6,700
Woodbury (T)	Woodbury (UT)	6,494	7,900	9,500	10,550	2.08	11,900
	COUNTY TOTALS [5]	259,603	293,800	329,100	365,150	1.36%	400,350

NOTES:

(1) Town or City is denoted by (T) or (C), respectively, after each entry in this column.

(rpts:orsever:tab64a:070591:jb)

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 6-4

BASELINE ORANGE COUNTY POPULATION PROJECTIONS

NOTES: (continued)

(2) Village or Unincorporated Town or City is denoted by (V), (UT) or (C), respectively, after each entry in this column.

(3) The average percent annual growth rate is the quantity year 2010 population less the year 1980 population, divided by the year 1980 population, then multiplied by the difference in years between 2010 and 1980, then multiplied by 100%. Mathematically,

$$\text{Average \% Annual Growth Rate} = \frac{(\text{Pop. } 2010 - \text{Pop. } 1980) \times 100\%}{\text{Pop. } 1980 \times (2010 - 1980)}$$

(4) The year 2020 projections are based upon an identical average percent annual growth rate during year 2011 through year 2020 as was computed during the period between year 1980 and year 2010. Mathematically,

$$\text{Pop. } 2020 = \text{Pop. } 1980 + \frac{\text{Average \% Annual Growth Rate}}{100\%} \times (\text{Pop. } 1980 \times [2020 - 1980])$$

and the computed value of Pop. 2020 is rounded to nearest ten before being entered in the column.

(5) County totals represent the actual sums of each column, except for the average percent annual growth rate. The sums shown in the Orange County Data Book provided by the Orange County Department of Planning and Development for 1990, 2000 and 2010 differ slightly from the actual County totals shown in this row. The Orange County Data Book shows County totals of 292,775 (1990), 329,109 (2000) and 365,130 (2010). No explanation for this small discrepancy is offered.

SOURCES:

U.S. Census Bureau, Department of Commerce
Orange County Department of Planning and Development

(rpts:orsewer:tab64a:070591:jb)

for each of the individual communities was achieved by following this same mathematical procedure.

Based upon the aforementioned computed population projections, the total County baseline population projection for the year 2020 is 400,350.

Comparison of the published Orange County Data Book population projections shown in Table 6-4 to the historic population growth shown in Table 6-2 indicates that the 1980-2010 County growth rate of 1.36 percent per year projected by the County Department of Planning and Development is significantly less than the 2.10 percent per year growth rate documented for the years 1950 to 1980. Possible reasons for this lower projection include an overall reduction in the birthrate, higher divorce rates, anticipated zoning changes to lower-density housing, and a reduced influx of population movement into the County for various socioeconomic reasons.

6.3 Baseline Sewered Population Estimates

This section assesses the fraction or percentage of baseline population that is served by public sewerage systems. Obviously, if the entire population of the County is served by public sewerage systems, the percentage sewered population would be 100 percent. However, not every residence, business, or industry in the County is serviced by a public sewerage system, and for practical reasons, it is unrealistic to assume that every person will be so served in the future. Therefore, to set the basis for current and future capacity requirements, this section presents an analysis of baseline County sewered population and discusses future projections. Again, "baseline" implies that these estimates form the basis from which modifications and refinements can be later made, as appropriate, to better reflect current expectations in the County.

The County, through its Department of Planning and Development, has provided 1980 information concerning year-round and vacant seasonal, migratory housing units by source of water and sewage disposal. This information is contained in the 1986 Orange County Data Book. Interpretation of the tabulated data therein permits the total reported number of 1980 housing units to be allocated between the city, town and village levels. A total of 90,437 housing units is indicated for the County. The percent total sewered housing units range from 99.1 percent in City of Middletown to 1.6 percent in the Town of Crawford. The County averaged 61.2 percent total sewered housing units in 1980. As this data is based upon U.S. Census Bureau information, there are some instances where it appears misinformation was reported by residents. For example, although positively reported, no public sewers exist within the Towns of Deerpark, Greenville, Hamptonburgh, Minisink, and the Villages of Otisville and Unionville.

Historical data of percent total sewered housing units for the years prior to 1980 was not available in the 1986 Orange County Data Book. Attempts to locate this data elsewhere were inconclusive as local records were incomplete. As such, a profile of the historic growth of percent total sewered housing units prior to 1980 is not presented herein.

The breakdown of the 1980 County sewered population by community can be determined by multiplying the number of 1980 public sewered housing units by the average number of persons per sewered housing unit for each community. As shown by Table 6-5, the reported sewered County population in 1980 was 153,830 people, representing 59.3 percent of the total County population of 259,603.

6.4 Baseline Water Consumption Estimates

The determination of sewage quantities can be directly correlated with water usage within the same area. In general, sewage generation from water use alone can be expected to be between 70 to 90 percent of consumption. The purpose of this section is to examine baseline water consumption rates in terms of gallons per capita per day (gpcd) and total water quantities, to facilitate estimations of existing and projected sewage generation for the County.

The water consumption of a community can be categorized into residential, commercial, industrial, and agricultural uses. Each community has a different proportion of their water use contributed to by each of these categories. Due to a lack of local data, it is not possible to estimate the amount of flow attributable to each of these categories for each community in the County. However, total flow for each community is available from facility data, and can be divided by the population therein to yield a per capita water consumption rate. This gallons per capita value inherently accounts for the total of the residential, commercial, industrial water use, plus extraneous consumption.

The total number of public water supply system accounts in the County in 1980 was 42,705, as shown in Table 6-6. The corresponding average water demand was 24.98 million gallons per day, resulting in an average County water consumption rate of about 205 gallons per capita per day. As stated, in addition to residential water consumption, these quantities also include commercial, industrial, and agricultural water consumption. Peak water consumption in the County totaled 35.87 million gallons

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 6-5

BASELINE ORANGE COUNTY SEWERED POPULATION

TOWN OR[1] CITY	CONSTITUENT[2] COMMUNITIES	1980 POPULATION	1980 TOTAL HOUSING UNITS	1980 HOUSING[3] UNIT POPULATION MEASURE	1980 PUBLIC SEWERED HOUSING UNITS	1980[4] PUBLIC SEWERED POPULATION
Blooming Grove (T)	Washingtonville (V)	2,380	873	2.73	770	2,102
	Blooming Grove (UT)	9,959	3,036	3.28	1,074	3,523
Chester (T)	Chester (V)	1,910	712	2.68	204	547
	Chester (UT)	4,940	1,391	3.55	630	2,237
Cornwall (T)	Cornwall-On-Hudson (V)	3,164	1,233	2.57	1,016	2,611
	Cornwall (UT)	7,610	2,801	2.72	1,642	4,466
Crawford (T)	Crawford (UT)	4,910	1,645	2.98	26	77
Deerpark (T)	Deerpark (UT)	5,633	2,186	2.58	133	343
Goshen (T)	Goshen (V)	4,874	1,760	2.77	1,675	4,640
	Goshen (UT)	5,589	1,460	3.83	400	1,532
Greenville (T)	Greenville (UT)	2,085	764	2.73	22	60
Hamptonburgh (T)	Hamptonburgh (UT)	2,945	988	2.98	34	101
Highlands (T)	Highland Falls (V)	4,187	1,660	2.52	1,590	4,007
	Highlands (UT)	9,817	1,749	5.61	1,244	6,979
Middletown (C)	Middletown (C)	21,454	8,282	2.59	8,204	21,248
Minisink (T)	Unionville (V)	574	206	2.79	21	59
	Minisink (UT)	1,914	631	3.03	25	76
Monroe (T)	Harriman (V)	796	324	2.46	269	662
	Kiryas Joel (V)	2,088	373	5.60	367	2,055
	Monroe (V)	5,996	1,909	3.14	1,592	4,999
	Monroe (UT)	6,068	2,006	3.02	594	1,794

(rpts:orsewer:tab65a;070591;jb)

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 6-5

BASELINE ORANGE COUNTY SEWERED POPULATION

TOWN OR[1] CITY	CONSTITUENT[2] COMMUNITIES	1980 POPULATION	1980 TOTAL HOUSING UNITS	1980 HOUSING[3] UNIT POPULATION MEASURE	1980 PUBLIC SEWERED HOUSING UNITS	1980[4] PUBLIC SEWERED POPULATION
Montgomery (T)	Maybrook (V)	1,994	755	2.64	744	1,964
	Walden (V)	5,659	2,136	2.65	2,043	5,414
	Montgomery (V)	2,316	767	3.02	750	2,265
	Montgomery (UT)	6,607	2,221	2.97	121	359
Mount Hope (T)	Otisville (V)	953	336	2.84	24	68
	Mount Hope (UT)	3,445	933	3.69	48	177
Newburgh (C)	Newburgh (C)	23,438	9,893	2.37	9,610	22,776
Newburgh (T)	Newburgh (UT)	22,747	7,623	2.98	2,253	6,714
New Windsor (T)	New Windsor (UT)	19,534	7,013	2.79	5,625	15,694
Port Jervis (C)	Port Jervis (C)	8,699	3,621	2.40	3,574	8,578
Tuxedo (T)	Tuxedo Park (V)	809	342	2.37	328	777
	Tuxedo (UT)	2,260	899	2.51	581	1,458
Wallkill (T)	Wallkill (UT)	20,481	6,797	3.01	4,610	13,876
Warwick (T)	Florida (V)	1,947	708	2.75	666	1,832
	Greenwood Lake (V)	2,809	1,319	2.13	187	398
	Warwick (V)	4,320	1,627	2.66	1,593	4,237
	Warwick (UT)	11,900	3,904	3.05	333	1,016
Wawayanda (T)	Wawayanda (UT)	4,298	1,459	2.95	119	351
Woodbury (T)	Woodbury (UT)	6,494	2,095	3.10	567	1,758
	COUNTY TOTALS[5]	259,603	90,437	2.87	55,308	153,830

NOTES:

(1) Town or City is denoted by (T) or (C), respectively, after each entry in this column.

(rpts:orsewer:tab65a:070591:jb)

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 6-5

BASELINE ORANGE COUNTY SEWERED POPULATION

NOTES: (continued)

(2) Village or Unincorporated Town or City is denoted by (V), (UT) or (C), respectively, after each entry in this column.

(3) Entries in this column are computed by dividing the 1980 population by the 1980 total housing units.

(4) Entries in this column are computed by multiplying the 1980 housing unit population measure by the 1980 public sewered housing units. This computation assumes that the 1980 housing unit population measure is equivalent to the 1980 sewered housing unit population measure.

(5) County totals represent the actual sums of each column, except for the 1980 housing unit population measure.

SOURCE:

Orange County Department of Planning and Development

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 6-6

BASELINE ORANGE COUNTY WATER CONSUMPTION

TOWN OR CITY[1]	CONSTITUENT COMMUNITIES[2]	1980 NO. OF WATER ACCOUNTS[3]	1980 WATER CONSUMPTION (MGD)[3]		1980 HOUSING UNIT POPULATION MEASURE	1980 WATER CONSUMPTION RATE (GAL/CAP/DAY)[4]	
			Average	Maximum		Average	Maximum
Blooming Grove (T)	Washingtonville (V)	589	0.25	0.38	2.73	155	236
	Blooming Grove (UT)	952	0.32	0.48	3.28	102	154
Chester (T)	Chester (V)	650	0.58	0.70	2.68	333	402
	Chester (UT)	N/A[5]	N/A	N/A	3.55	N/D[6]	N/D
Cornwall (T)	Cornwall-On-Hudson (V)	2,000	1.33	2.00	2.57	259	389
	Cornwall (UT)	N/A	N/A	N/A	2.72	N/D	N/D
Crawford (T)	Crawford (UT)	350	0.11	0.21	2.98	105	201
Deerpark (T)	Deerpark (UT)	N/A	N/A	N/A	2.58	N/D	N/D
Goshen (T)	Goshen (V)	1,300	0.77	0.98	2.77	214	272
	Goshen (UT)	N/A	N/A	N/A	3.83	N/D	N/D
Greenville (T)	Greenville (UT)	N/A	N/A	N/A	2.73	N/D	N/D
Hamptonburgh (T)	Hamptonburgh (UT)	N/A	N/A	N/A	2.98	N/D	N/D
Highlands (T)	Highland Falls (V)	1,200	0.75	0.90	2.52	248	298
	Highlands (UT)	N/A	N/A	N/A	5.61	N/D	N/D
Middletown (C)	Middletown (C)	5,975	4.48	5.38	2.59	289	348
Minisink (T)	Unionville (V)	182	0.07	0.17	2.79	138	335
	Minisink (UT)	N/A	N/A	N/A	3.03	N/D	N/D
Monroe (T)	Harriman (V)	550	0.17	0.23	2.46	126	170
	Kiryas Joel (V)	250	0.13	0.15	5.60	93	107
	Monroe (V)	1,700	0.62	1.50	3.14	116	281
	Monroe (UT)	N/A	N/A	N/A	3.02	N/D	N/D

(rpts:orsewer:tab66a:070591:jb)

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 6-6

BASELINE ORANGE COUNTY WATER CONSUMPTION

TOWN OR[1] CITY	CONSTITUENT[2] COMMUNITIES	1980 NO.[3] OF WATER ACCOUNTS	1980 WATER[3] CONSUMPTION (MGD)		1980 HOUSING UNIT POPULATION MEASURE	1980 WATER[4] CONSUMPTION RATE (GAL/CAP/DAY)	
			Average	Maximum		Average	Maximum
Montgomery (T)	Maybrook (V)	650	0.23	0.45	2.64	134	262
	Walden (V)	1,500	0.72	1.41	2.65	181	355
	Montgomery (V)	676	0.21	0.41	3.02	103	201
	Montgomery (UT)	N/A	N/A	N/A	2.97	N/D	N/D
Mount Hope (T)	Otisville (V)	300	0.20	0.40	2.84	235	469
	Mount Hope (UT)	N/A	N/A	N/A	3.69	N/D	N/D
Newburgh (C)	Newburgh (C)	6,210	4.51	5.60	2.37	306	380
Newburgh (T)	Newburgh (UT)	2,900	2.30	3.45	2.98	266	399
New Windsor (T)	New Windsor (UT)	3,500	1.00	1.75	2.79	102	179
Port Jervis (C)	Port Jervis (C)	3,100	1.65	2.15	2.40	222	289
Tuxedo (T)	Tuxedo Park (V)	450	0.50	0.76	2.37	469	713
	Tuxedo (UT)	N/A	N/A	N/A	2.51	N/D	N/D
Wallkill (T)	Wallkill (UT)	3,000	1.70	1.98	3.01	188	219
Warwick (T)	Florida (V)	550	0.35	0.64	2.75	231	423
	Greenwood Lake (V)	1,658	0.42	0.82	2.13	119	232
	Warwick (V)	1,313	0.73	0.97	2.66	209	277
	Warwick (UT)	N/A	N/A	N/A	3.05	N/D	N/D
Wawayanda (T)	Wawayanda (UT)	N/A	N/A	N/A	2.95	N/D	N/D
Woodbury (T)	Woodbury (UT)	1,200	0.88	1.40	3.10	237	376
	COUNTY TOTALS[7]	42,705	24.98	35.87	2.87	205	295

NOTES:

(1) Town or City is denoted by (T) or (C), respectively, after each entry in this column.

(rpts:orsewer:tab66a:070591:jb)

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 6-6

BASELINE ORANGE COUNTY WATER CONSUMPTION

NOTES: (continued)

(2) Village or Unincorporated Town or City is denoted by (V), (UT) or (C), respectively, after each entry in this column.

(3) Entries in this column regarding the 1980 number of water accounts for each purveyor and 1980 water consumption are based upon information provided from the Orange County Department of Health.

(4) Entries in this column are computed by multiplying the 1980 number of water accounts by the 1980 housing unit population measure, and then dividing this quantity into the water demand in mgd and then rounding the result to the nearest 5 gal/cap/day. This computation assumes that the 1980 housing unit population measure is equivalent to the 1980 population measure of a water account.

(5) N/A = Not Available

(6) N/D = Not Determined

(7) County totals represent the actual sums of each column, except for the 1980 housing unit population measure and the 1980 water consumption rate, both average and maximum.

SOURCE:

Orange County Department of Planning and Development
Orange County Department of Health

per day, equivalent to a peak County water consumption rate of about 295 gallons per person per day.

From the information presented in Table 6-6, it can be seen that communities exhibit varying water consumption rates depending upon the type of community. For example, the more rural areas of the County such as unincorporated towns typically have water consumption rates ranging between 100 to 125 gallons per person per day. Suburban areas such as incorporated villages show a higher consumption range of 125 to 200 gallon per person per day indicating more commercial and industrial contributions, while the most urbanized areas, cities, have rates exceeding 200 gallons per person per day due to even more commerce and industry.

6.5 Summary

The baseline planning information presented in this Chapter is vital to the development of an approach to sewerage treatment and management in the County. The baseline planning information addressed in this section is summarized as follows:

Total County Population:	1950 - 159,389 1980 - 259,603 Percent Growth - 62.87% Average Annual Growth - 2.10%
	2020 - 400,350 Percent Growth - 54.22% Average Annual Growth - 1.36%
1980 Sewered Population:	Total Housing Units - 90,437 Sewered Housing Units - 55,308 Sewered Population - 153,830 Percent Sewered Population - 59.30%
1980 Water Consumption:	Typical County Average - 205 gal/cap/day Typical County Maximum - 295 gal/cap/day

The above summary is considered in the updating and analysis of planning information done in the next two Chapters of this Study.

CHAPTER 7

7.0 UPDATED PLANNING INFORMATION

7.1 Introduction

This Chapter presents an account of up-to-date information pertaining to planning for sewage treatment in Orange County. This information is also used to comment on the soundness of the baseline population projections, baseline sewered population estimates, and baseline sewage generation quantities reported in Chapter 6 of this Study. The updated planning information presented herein, when analyzed with the baseline information, will yield refined planning information in Chapter 8 of this Study that better reflects current knowledge of the situation in the communities comprising the County.

The following sources of data were used to obtain updated planning information:

- Information collected through a January, 1990 Orange County Sewerage Study Facilities Questionnaire survey;
- Meetings and discussions with municipal officials from the communities comprising Orange County;
- Discussions with various community planning consultants;
- Discussions with operators of sewage treatment and processing facilities during facility site visits;
- Discussions, meetings and correspondence with the NYSDEC; and
- Discussions with State and County agencies.

Orange County Sewerage Study Facilities Questionnaire surveys were conducted to obtain current information about the operation and condition of existing facilities. These surveys involved both sewage treatment plant questionnaires and plant site visits. This information was discussed in Chapter 4 of this Study.

Prior sewerage reports were reviewed in Chapter 5 of this Study to identify documented planning information that may be of further use. Numerous documents were examined, but only a few contained pertinent, up-to-date information.

In addition to reviewing prior reports and plant surveys, the project team met with local municipal officials in each community. When a meeting was not practical, telephone discussions were held. Planning consultants were also contacted to obtain and confirm updated master plan information.

The updated planning information obtained from these sources is presented in the following section.

7.2 Contact with Municipal Officials

The purpose of this section is to present relevant updated planning information for the communities in Orange County. This information is presented for each city, town and village in the County in the following subsections. The abbreviations (T), (V), (UT) and (C) are defined as Town, Village, Unincorporated Town and City, respectively.

7.2.1 Blooming Grove (T)

Washingtonville (V)

The following information was obtained from the Mayor, Engineer and other municipal officials from the Village of Washingtonville.

1. The following population estimates were collected:

   - 1990 : 5,000 people;
   - 1995 to 2000 : 8,000 people;
   - 2000 to 2020 : 8,000 people (assumes no annexation of adjacent property); and
   - Buildout : 9,000 people.

2. Currently, more than 95 percent of the Village is sewered, and all future growth will be required to be sewered.

3. Village sewage is virtually all residential. The only past industrial contribution was from Brotherhood Winery, but it is not currently serviced.

4. Current connection fee is $3,000 per unit. Sewer rates are based on 171% of the water rate.

5. The Village sewerage treatment plant is designed for a flow of 0.4 mgd, and the current average flow rate ranges from 0.32 to 0.35 mgd, excluding infiltration/inflow (I/I). The plant has been having difficulty meeting SPDES limits. As such, the Village has engaged a consultant to design an expansion and upgrade of the facility.

6. The planned upgrade and expansion requires an ultimate plant design capacity of 0.9 to 1.0 mgd, based upon planning projections.

7. Plans for the Village sewerage treatment plant expansion and upgrade may permit some contiguous development in the Town of Blooming Grove to connect to it. Treatment is to be tertiary with oxidation ditch and ultraviolet (UV) disinfection. I/I will be addressed as part of the plant expansion. The plant upgrade and expansion will eliminate the sludge digester and possibly by the trickling filter. In addition, the transite main interceptor installed in 1972 may have to be replaced.

8. Presently, 75 percent of all Village land has been developed. The balance will probably be incorporated into several planned developments, including at the time an undetermined number of Rieger single family housing cluster lots, Schoonmaker, another Rieger development (280 townhouses and 100 acres), Hub, and Barn Street Farms (100 single family housing units).

9. The Village officials were interested in being represented on the County Sewer Committee.

<u>Blooming Grove (UT)</u>

The following information was provided by the Supervisor of Blooming Grove:

1. The total Town population for 1990 was estimated to range from 17,000 to 18,000, with the Washingtonville portion at from 5,000 to 6,000. The proposed Oxford Manor development (213 units) is located in Blooming Grove.

2. According to the updated Master Plan, the proposed residential lot size for future development is 45,000 to 100,000 square feet. Cluster units with a gross lot coverage equal to the above would be acceptable in lieu of single family housing.

3. The present Town sewer district cannot be expanded under the Moodna accord. However, if a pipeline were developed from Chester, additional districts would be considered. This could encourage the development of needed commercial rateables.

7.2.2 Chester (T)

Chester (V)

The following information was provided by the Mayor and the Engineer for the Village of Chester:

1. Estimated population for 1990 is from 3,000 to 3,300. Build-out is expected to occur at 4,000 to 5,000 (this leaves room for only about 150 more single-family homes on one-quarter acre lots).

2. The Village is approximately 90 percent residential in terms of land area (10 percent industrial/commercial). In terms of wastewater production, industry and commerce account for nearly 30 percent of the flow from the Village (90,000 out of 320,000 gallons per day). Industries of note include Chester Meat Packing and Chester Cable Company. Chester Meat Packing company has recently cut wastewater production from 30,000 gpd to 15,000 gpd.

3. There are now about 1500 homes in the Village that are sewered, accounting for about 100 percent of the population.

4. Residential sewerage fees are based on a point system. The average single family home is rated at 10 points and is charged approximately $300 per year. Two-thirds of the fee pays for debt service, with one-third allocated to operation and maintenance. Commercial and industrial fees are based upon water use, number of employees, and BOD content of wastewater.

5. The Village is anxious for additional sewage treatment plant capacity. The Village has been forced to turn away industry and commercial development because of lack of sewage treatment capacity.

6. The county-wide approach to sewering is acceptable, but the Village officials feel any authority or district created in the future will need to have much more control than the present Orange County Sewer District No. 1 situation.

7. If a regional sewerage system is developed, there should not be a restriction on the flows allotted each contributing community. Each municipality should be allowed to develop at its own pace.

Chester (UT)

The following information was obtained from the Supervisor and staff of the Town of Chester:

1. It is estimated that there presently are 8,000 people in the Town and 2,500 people in the Village of Chester. The master plan for the Town (prepared in 1974) predicted a build-out population of 35,000, but it is anticipated that actual build-out will be higher, since the Town is zoned for 75,000 to 100,000 people.

2. Currently about 45 percent of the unincorporated Town population is sewered.

3. The quantity of septage that is hauled to the Harriman plant from septic tanks from the Town is estimated to be 20,000 gpd.

4. There are presently over 3000 housing units planned for construction in the Town of Chester. In addition, a 2.2 million sqare foot industrial park is planned as part of the Cold Spring Farms development.

5. Members of a religious community have recently purchased approximately 300 acres of land in the Town; proposals for the development of this property have not yet been presented to the Town.

7.2.3 Cornwall (T)

Cornwall-on-Hudson (V)

The following data was obtained from an official of the Village Department of Public Works:

1. Current Village population is estimated at 3,000 to 3,800. The Village wishes to remain limited in its growth. Population projections for the year 2020 are estimated at about 4,200.

2. There is not much developable land left in the Village, although some large lots could be subdivided at a later date. Annexation of Town land would not be feasible.

3. The Village is virtually 100 percent sewered. There are some scattered septic systems, primarily on top of the mountains in the western portion of the Village.

4. Village sewer service is billed at a rate of 70 percent of water consumption. The current cost of water in the Village is $2.82 per 1,000 gallons.

5. There is no industry in the Village. The few commercial establishments such as restaurants are equipped with grease traps. Sewage flow can be considered to be 100 percent residential.

6. The Cornwall STP is owned one-third by the Village and two-thirds by the Town. It provides secondary treatment and is reported to run well. The plant is located in both the Village and the Town.

Cornwall (UT)

The following information was provided by the Supervisor of the Town of Cornwall:

1. The population in the Town is approximately 12,000 at present, including about 3,400 in the Village.

2. About 70-80 percent of the Town population is currently sewered. The Town is strict in the enforcement of existing septic system compliance.

3. The Cornwall STP currently has an average flow of 1.1 mgd. Design capacity of the plant is 1.5 mgd. The plant serves part of the Town and part of the Village of Cornwall-on-Hudson. Treatment capacity at the plant is adequate at present and there are no plans for capital improvements.

4. The residential areas of Vails Gate, Firthcliffe Heights, and Beaver Dam Lake in the Town are served by the New Windsor STP. The Majestic Sewer District, comprised of light manufacturing facilities and warehouses is also served by the New Windsor treatment plant. The Town has a contract with New Windsor for up to 1.0 mgd from the Majestic District.

5. The Firthcliffe STP serves the Firthcliffe Sewer District in the Town of Cornwall, and is designed for a flow of 0.12 mgd.

6. Semi-annual sewer rates for the various sewer districts in Town are as follows:

- Beaver Dam Lake - \$23.0332 per unit;
- Firthcliffe Heights - \$24.2465 per unit;
- Firthcliffe District - \$137.4926 per unit;
- Majestic District - \$4.2446 per unit; and
- Cornwall District - \$0.7539 (Operation + Maintenance) + 0.6467 (Debt Service) per \$1000 of assessed value.

7. Two major developments are presently proposed in the Town. The first is a 50-60 unit condominium development; the second is a development called Canterbury Ranch and includes a conference center, golf course, condominiums and single family homes (300-400 housing units total). The proposed site is located southeast of Route 9W and Angola Road.

8. The area of the Town called Mountainville is the only area suitable for industrial development.

7.2.4 Crawford (T)

The following items were discussed with the Supervisor of the Town of Crawford:

1. The 1990 population in Crawford is estimated at 6,000, including 2,000 in the Hamlet of Pine Bush. The Orange County Data Book projection of 8,100 people in the year 2020 may be slightly underestimated.

2. The Hamlet of Pine Bush is 100 percent sewered. There are now 468 metered units and 20 community buildings connected to the sewerage system. All homes served by the public water supply are in the sewer district.

3. The Hamlet of Pine Bush constructed its sewer system and treatment plant in 1977 with a federal grant. Each house within the sewer district is equipped with a septic tank, and discharge from the tank overflow is connected to the collection system. The tank and sewer lateral connection are the property of the Town. Septage is taken to a DEC-approved lagoon in the Town. This lagoon also receives solids from the sludge digester at the Town treatment plant.

4. The Town's STP consists of a 112,000 gallon oxidation ditch, final clarifiers and aerobic sludge digestion tank. The plant does not include sludge dewatering facilities. The plant is reported to be operating well. Total suspended solids in the effluent range from 0-10 mg/l. Ammonia-

nitrogen concentration is about 0.7 mg/l. The plant is not presently required to report ammonia concentration to the DEC, but has been informed that when their existing permit is renewed, a limit on ammonia discharge will be enforced.

5. Town sewer fees are presently $12.50 (minimum fee) for the first 1000 cubic feet, and $10 per 1000 cubic feet thereafter. These rates will be changed shortly to a uniform rate of $12.50 per 1000 cubic feet. A connection fee of $200 is also collected for each new connection to the sewer system.

6. Annual debt service for sewerage facilities is calculated on a point basis, with a single family home being worth 10 points. The fee is $7.40 per point.

7. Within the present boundaries of the sewer district, there are approximately 64 undeveloped acres that are zoned for multi-family housing (5 units per acre) near the high school, and 60 acres zoned for single family housing (about 100 units) by the sewerage treatment plant. In addition, there is a 100 unit condominium development on Boniface Drive which has been approved and will utilize the remaining capacity at the Pine Bush STP.

8. The area outside of Pine Bush is currently zoned for one unit per acre, depending on the suitability of the soils on each site.

9. The area of Bullville (at Routes 17k and 302 near Wallkill) may require sewering at some future time. There are presently 10-15 small businesses in the area, presently served by septic systems. The soils in that region of town are poor for septic disposal. It is possible that Wallkill would be willing to serve this area.

10. There is no heavy industry in the Town of Crawford. There is some land zoned for light industrial and commercial development near the high school at Ulsterville Road and Route 302.

7.2.5 Deerpark (T)

The following information was discussed with the Supervisor and Building Inspector from the Town of Deerpark:

1. It is estimated that the Town presently has between 6,000 to 6,500 people. There is a slight seasonal increase of 300 to 400 people due to summer camps, campgrounds, and vacation homes. It is anticipated that the population in 2020 will exceed the Orange County Data Book projection of 8,400.

2. Existing zoning in the Town provides for a minimum lot size of one acre, except for houses built prior to the adoption of the zoning ordinance. The Town is served primarily by septic, but does have some small community package treatment plants serving trailer parks.

3. Unless a developer proposes a treatment facility, Deerpark will most likely be entirely dependent on septic systems for wastewater treatment for the next 20 years.

4. The areas of Sparrowbush and Hawk's Nest are the fastest growing parts of Town. There have recently been several building permits issued for lots off of Wilson Road in Sparrowbush.

5. A proposed senior/retirement community development of 1200 units is proposed in Sparrowbush. The development will likely support 1500 to 1600 residents. The developer is proposing to build a sewerage treatment plant for the community that will discharge into the Delaware River, if possible. The developer would be willing to oversize the plant so that other parts of Town could be served. If constructed by the developer, ownership of the facility would be turned over to the Town.

6. A new master plan and zoning plan for the Town has recently been completed. The master plan suggests a sewerage treatment plant in Sparrowbush or Hugenot, which would allow for higher density zoning. A plant in the Sparrowbush area could serve properties along Route 42, up to and including Rio and Cahoonzie.

7. It is possible for part of Deerpark to be served by the Port Jervis STP. However, it is unlikely that Port Jervis would offer capacity at the plant, given restrictions imposed on the plant by New York City.

8. There are only two major industries in the Town: C&D Industries and Dow Chemical. C&D has its own treatment facility and discharges to the Neversink River. Dow does not discharge wastewater, but holds its wastes in tanks and hauls to off-site treatment.

7.2.6 Goshen (T)

Goshen (V)

The following issues were discussed with the Mayor and a Trustee of the Village of Goshen:

1. The Orange County Data Book population estimate for 1990 was felt to be reasonably accurate. The stated current population in the Village is about 5,500. A recent projection estimated that build-out for the Village would occur at a population of about 7,200.

2. There are about 2,000 total acres in the Village, 68 percent of which is presently developed. Undeveloped or vacant land presently accounts for about 32 percent of the area in the Village. The following breakdown is advocated for development: 45 percent residential; 10 percent public property; 7 percent industrial; 5 percent commercial; 1 percent recreation/open space.

3. At present, over 95 percent of the Village population is sewered. In addition, the Village STP presently serves the Town of Goshen developments of Hambletonia Park and Arcadia Hills under a service contract.

4. The STP in summer has an average daily flow of 0.7 mgd. On an annual basis, the STP experiences an average flow of 1.1 to 1.2 mgd. Infiltration/inflow (I/I) causes flow peaks as high as 2.5 mgd.

5. Sorrento Cheese is the only industry in the Village. Wastewater is discharged to the Village STP after on-site pretreatment.

6. The Village presently has a substantial I/I problem. A study has been performed to locate significant contributing sources. The Village expects the study to be completed in three months.

7. The NYSDEC has been in contact with the Village about its I/I problem. However, a consent order has not been issued by the NYSDEC.

8. Village officials favor a regional approach to sewering.

Goshen (UT)

The Supervisor and Engineer from the Town of Goshen provided the following information:

1. The total Village and Town population is estimated at around 11,000, with an equal split between the Village and the Town of Goshen. Build-out population of the unincorporated Town is expected to be near 12,000, if sewered.

2. The Town expects to limit multi-family development, and expects to grow moderately by approximately 35 families per year.

3. There are presently applications for over 2400 new housing units before the Town planning board. All considerations are on hold until the County Comprehensive Sewerage Study is completed.

4. The Town has been investigating sites for one or two new treatment plants. Three sites have been identified as being feasible. All sites involve discharge to the Wallkill River.

5. The Town developments of Arcadia Hills and Hambletonia Park (approx. 1800 people) are presently contracted with the Village of Goshen STP for treatment capacity. These two developments and several others (Sunset Ridge, Serulo, The Pointe - 800 units total) are looking for alternate treatment capacity. Town officials stated that the Town of Wallkill stated they will accept hookups for $10/gal. The Town will investigate the possibility of connecting to the Wallkill STP.

6. The Town has approached the Village about using some of their available transmission capacity for piping to a future plant near the Wallkill.

7. Florida does not want to abandon their plant and join with Goshen. The Village of Florida plant is planning to expand from 350,000 to 400,000 gpd.

7.2.7 Greenville (T)

The following items were discussed with the Supervisor and Building Inspector of the Town of Greenville:

1. The Town population is presently estimated at about 3,500 to 4,000. The projection for 2020 population is 8,000 to 12,000.

2. Very few of the undeveloped parcels left in the Town have demonstrated acceptable percolation rates.

3. The Lake Hathorn area of the Town is a community similar to Greenwood Lake, which has many converted summer homes. Of the total of 95 homes, approximately 75 percent of them are experiencing problems with their septic systems. The area, if sewered, would be better served by Deerpark, due to topographical features.

4. The Castle Hill Trailer Park presently operates its own sewage treatment plant, serving about 100 units. The owner is planning to double the size of the park, along with and the STP.

5. A seven unit development called Base Hill Estates will need to construct a treatment plant due to unacceptable percolation tests, precluding installation of septic systems.

6. A small mall is planned in Town, north of Route 84, for which a sewage treatment plant will be needed.

7. A commercial/light industrial area is developing in the vicinity of the Route 84 interchange in Greenville.

8. There are five water bodies in the Town, none of which is suitable for significant wastewater discharge. They are all Class A streams.

9. If a joint municipal sewerage treatment facility were proposed, it would be more feasible to join with Wawayanda or Minisink to the east, or Mount Hope to the north, since a mountainous area physically separates Greenville from Port Jervis and Deerpark.

10. There are two small industries in the Town. One is an electronics firm; the other is a wood laminating operation. Neither produces wastewater from its process.

7.2.8 Hamptonburgh (T)

The Supervisor of the Town of Hamptonburgh offered the following information:

1. Current population is estimated to be just under 4,000. The Orange County Data Book was generally on target in terms of future growth.

2. None of the Town is sewered at this time. However, much of the soils in Town currently used for septic tanks are not suitable for such purposes.

3. Hamptonburgh is a rural community. The present situation and projected population growth for the Town does not appear to warrant development of an extensive sewage district or connection to proposed regional system in the near term.

4. There are only two general areas slated for significant development (one building lot per acre). These are Windsor Estates, located by the Wallkill River, and Campbell Hall, in the center of the Town off of Route 207.

5. Windsor Estates is currently the only development in Town. There will about 50 homes developed in the near future, with 200 units total possible, since the developer recently purchased 130 additional acres adjacent to the site. A small package treatment plant will be constructed to serve the development, and its discharge point will be the Wallkill River.

6. Campbell Hall is an area of row houses and similar units off of Route 207. This area is the central business district of Town (a post office, church, general store and gas station). All of these buildings are presently on septic systems, most of which are failing due to poor soils. A relatively small sewerage treatment plant on the Otter Kill Creek could serve the area of Campbell Hall.

7.2.9 Highlands (T)

Highland Falls (V)

The following information was obtained from the Deputy Mayor and Village Clerk of the Village Highland Falls:

1. The 1990 population is estimated at between 4,000 and 4,200 people. Build-out is estimated at 4,400 to 4,500. There is no buildable land available for development unless the Village annexes property, which is not foreseen according to these officials. It may be possible to build a few clustered or affordable housing units in the mountainous region of the Village. This area is currently considered to be undevelopable.

2. The Marines are dislocating Army personnel from Stewart Air Force Base housing. The Town of Highlands will probably experience an influx of military personnel due to this.

3. Overall, the Town of Highlands will experience growth similar to Orange County as a whole.

4. The Village is nearly 100 percent sewered.

5. There is no industry in the Village. All wastewater is residential in nature.

6. An infiltration/inflow study and sewer system evaluation survey were performed in 1980. All corrective action recommended as part of that study has been completed.

7. Sewer fees are calculated as 175 percent of the water bill. The average 3-person home pays a water fee of about $200 per year. A typical sewer bill is now $175 every six months. It is likely that rates will double in 1991.

8. The Village sewerage treatment plant (Cragston STP) is relatively new, and has been experiencing problems with odors and noise. It presently meets permit limits. The facility is oversized, designed for 1.35 mgd. Present average daily flow is 400,000 gpd. The Cragston STP is not yet fully operational (the plant was started up before completion of the facility) and belt filter dewatering equipment is not yet on-line. Plant operation and maintenance budgets for sewerage treatment are as follows:

   - 1989 - $640,000; and
   - 1990 - $675,000.

<u>Highlands (UT)</u>

The following issues were discussed with the Supervisor of the Town of Highlands:

1. Population projections in the Orange County Data Book were felt to be accurate. Currently there are about 10,000 people in the Town, excluding the Village of Highland Falls. It is estimated that the Town will grow by about 100 people every ten years, primarily in the Fort Montgomery area.

2. The buildable land is presently about 80-90 percent developed. There is no industry in the Town.

3. Present development pending in the Town include:

   - 50 acres for single family housing units;
   - 120 multi-family units; and
   - 60 unit motel in Fort Montgomery.

4. West Point is located in Highlands, but is totally self-sufficient, and does not rely on Town services. The population of West Point is estimated to be about 7,000. There is no significant fluctuation in residential summertime population.

5. The Town is currently about one-third sewered and is served by the Fort Montgomery STP. The plant runs well, with no major problems.

6. Sewer fees are calculated on a point basis. With the average single family home worth 10 points, the sewer bill is on the order of $300 per year and is collected semi-annually.

7.2.10 <u>Middletown (C)</u>

The Mayor and City Engineer of the City of Middletown offered the following information:

1. The 1990 population is estimated at 25,000 to 26,000. Population in 2020 is projected to be over 30,000. According to officials, the City has historically been undercounted in the U.S. Census.

2. The City is 100 percent sewered. The only significant residential development planned in the City is for 1500 condominiums, to be built over the next 10 years. These units will be sewered.

3. Sewer rates in the City are based upon 100 percent of the water bill. The typical household pays $100 to $125 per year, but this is expected to increase in the near future.
4. The Middletown plant is presently having problems meeting the discharge permit limit for ammonia (6 mg/l). Repairs to the final tank traveling bridges are expected to be completed by June 1990.

5. The plant presently treats an average flow of 5 mgd, with peaks from 12 to 14 mgd. Design flow is 6 mgd. The plant could be readily expanded to 7 or 8 mgd, and with the addition of sand filters, could accomplish more complete tertiary treatment. The Middletown STP outfall discharges about one-half mile upstream of the Wallkill STP outfall.

6. Industrial wastewater flow to the City plant is approximately 5-7 percent of total flow. A fragrance company and cooling water from plastic injection molding companies contribute most of this flow.

7. A $7 million project is presently underway to remove I/I, estimated to be as much as 1 mgd.

8. Within two years, Wawayanda will probably be contributing a substantial portion of their 250,000 gpd contracted allotment to the Middletown STP.

9. Approximately 15 percent of the City's usable land is undeveloped. This includes 126 acres of property that was recently annexed from the Town of Wawayanda.

10. Middletown has been entertaining the idea of forming a joint industrial park with Wallkill (25 percent in City, 75 percent in Town) for light industrial and manufacturing activity.

7.2.11 Minisink (T)

Unionville (V)

The following items were discussed with the Mayor of the Village of Unionville:

1. The population of the Village is estimated at about 700 people. Build-out population for the Village is expected to be about 1,000.

2. The Village encompasses 180 acres. Minimum lot size is now 15,000 square feet, but will be increased to 20,000 square feet in the near future.

3. There are no sewage treatment plants in the Village at this time. The Village relies entirely on septic systems. The Mayor does not anticipate that a sewage collection system with associated treatment works will be necessary for the Village at any time in the future.

Minisink (UT)

The following items were discussed with the Supervisor of the Town of Minisink:

1. The Town is 100 percent residential. Homes in the town are served 100 percent by septic systems.

2. The preliminary 1990 U.S. Census population of 4,840 is fairly accurate for the Town. Annual population growth is projected to be in the 2-3 percent range and a population of 10,000 in the year 2020 is expected.

3. Town engineers have recently assisted in preparing a revised zoning plan. Minimum lot size for septic systems is 1 or 1½ acre, depending on location. Townhouse and condominium units must have public sewer and water to be permitted and, as such, none of these types of units have been built in the Town.

4. Native soils do not percolate very well for septic systems.

5. Construction of a sewage treatment plant to serve the Town is not expected to happen any time soon. If one is to be built eventually, the areas most likely to require service are the Hamlets of Johnson and Westtown and the Village of Unionville. Effluent discharge could be to the Indigot Creek or Rutgers Creek (south of Gardnersville).

6. The Town does not have a master plan.

7. All water use is from private wells. No public water supply exists at this time.

7.2.12 Monroe (T)

Harriman (V)

The Mayor and Engineer of the Village of Harriman provided the following information:

1. The 1990 Harriman population is estimated at 3,000. Only about 50 acres in the Village remain vacant, which at most, could be developed at 10 units/acre, adding approximately 1,500 people to the Village. More likely, development will result in the addition of 500 people, bringing the Village build-out population to 3,500.

2. The Village is not receptive to an expansion of the Harriman plant, even with piped discharge to the Hudson River. A preferable alternative would be to redirect the Moodna Basin Group from the sewer district and to have the plant upgraded to meet new requirements.

Kiryas Joel (V)

The following data was obtained from Kiryas Joel officials:

1. The present population of the Village is about 8,000 people.

2. At this point, the Village is about 50 percent developed.

3. The Village is projected to grow annually at a rate of 100 families, or an average of 800 people per year. Total population at build-out is estimated at between 25,000 and 30,000.

4. At present, about 1,000 single and multi-family dwelling units exist in the Village. Many multi-family areas are under construction and there are proposals for 1,000 to 1,500 additional units before the Village at present.

Monroe (V)

Monroe Village officials offered the following information:

1. There are presently 2,000 single family housing units and 200 commercial establishments in the Village.

2. The only new residential site development that has been proposed to the Village is a multi-family complex of 16 buildings, with a total of 464 one and two-bedroom units.

Monroe (UT)

The Supervisor of the Town of Monroe provided the following:

1. Data Book estimates for the Town and Village of Monroe are fairly reasonable.

2. Harriman's 1990 population is about 2,500. The majority of the growth occurred in 1985 when permits were issued for almost 600 new dwelling units. The year 2020 population must also be adjusted to reflect this growth.

3. The population for Kiryas Joel in 1990 is estimated at about $\pm$ 8000. A build-out figure of from 30,000 to 35,000 did not seem unrealistic. Kiryas Joel may be considering annexations from Woodbury and Blooming Grove in the future.

4. The Town is looking to develop an industrial park along Route 17M in addition to senior citizen and low income housing. The Town has received a HUD grant for planning of the low income project. If rezoning to larger lot size occurs, clustering can be anticipated.

5. Orange County should take over full control of the OCSD#1 STP and trunk sewers. The issue of "Who's In Charge?" must be addressed.

6. Expansion at the present OCSD#1 STP site is not acceptable. Partitioning the west of the system may be a good idea.

7.2.13 Montgomery (T)

Maybrook (V)

The following data was provided by the Mayor of the Village of Maybrook:

1. The 1990 population is estimated at 2,700 people. The Village is close to build-out, and will not grow beyond 3,500 people within the present Village boundaries. All new housing in the Village will consist of single family units.

2. The Village has recently annexed industrial property from the Town of Hamptonburgh. Most of the property is owned by a lighting equipment manufacturer. Annexation from the Town of Montgomery is not likely in the future.

3. The Village is essentially 100 percent sewered.

4. The Village is planning to upgrade and possibly expand the 0.4 mgd STP, if additional adjacent land can be annexed. The upgrade will include a new trickling filter and sludge dewatering equipment. The STP has had problems meeting its winter permit limits. Mid-Hudson Pollution Control has recently taken over the operation of the plant under a 3-year contract.

5. About 90 percent of the wastewater flow to the plant is residential. Osram is the only significant industrial discharger at present. There are several dry-cleaning operations in the Village as well.

6. Yellow Freight, which now hauls their wastewater out of the Village, would like to join the Village sewerage system and may contribute funding. Yellow's wastewater production is estimated at 6,000 gpd. Their wastewater is from a wash-down operation and an oil separator would be installed at their facility if they join the Maybrook STP.

Walden (V)

The Village Manager of Walden provided the following information:

1. The present population in the Village is between 6,000 and 6,400. Build-out will occur when the population is approximately 8,500. The Village is 100 percent sewered.

2. The Village encompasses a total of 2.5 square miles. About 90 percent of the buildable land is developed.

3. About 700 new single family homes are planned to be constructed in Walden in the near future, virtually exhausting the remaining supply of undeveloped land.

4. The Village has recently applied to the DEC for a permit for expansion of the Village STP from 1.1 to 1.2 mgd. The plan has been approved verbally, but the Village is still waiting to

receive the final permit. The expansion will not involve any mechanical or retrofitting work at the facility. The plant runs two trickling filters, presently operating in series, but was designed so that the filters can also be operated in parallel, providing more treatment capacity. The facility was originally built in 1934 and upgraded in 1967. In 1985, trickling filters were added.

5. There is room near the plant for future expansion if necessary. The Village owns property adjacent to the existing facility grounds.

6. The plant currently operates at an average flow of 0.7 mgd, with peak flows over 3.0 mgd during "floodwatch" conditions. Residential contribution to the facility is over 90 percent of the total flow.

7. Industrial flow accounts for approximately 10 percent of the total flow to the plant. Industrial dischargers are required to pretreat prior to discharging to the sanitary sewer. The following companies contribute industrial flow to the Village STP:

   - Hudson Wire International - wire manufacturers;
   - Nelco - computer laminated boards;
   - Spence Engineering - pipe fittings;
   - Champion International - bags;
   - Metalex Corporation - furniture (abandoned);
   - Package Lighting - theater lights; and
   - Assorted small printing shops.

8. As of June 1990, sewer charges were $1.20 per 100 cubic feet.

Montgomery (V)

The following data was provided by the Mayor and Deputy Mayor of the Village of Montgomery:

1. The Village has experienced rapid growth in the past decade. The 1990 population is estimated at 3,000 with build-out estimated at 4,500 people. The Village is 100 percent sewered.

2. The Village STP has a design capacity of 0.5 mgd and an average flow of 0.3 mgd. Peak flows have been as high as 0.75 mgd.

3. Industries served by the Village STP include Nabisco, Allpack Boxes, and Brescia Lumber. A few industrial parcels along Route 208 are not yet developed.

4. There are several developable tracts remaining in the Village, which could amount to over 300 possible new housing units.

5. The Village is satisfied with the operation of their treatment plant, which is reported to have adequate treatment capacity for present needs. The Village does not want to serve outside areas, stating that the resulting growth induced around the Village would contribute to both traffic problems and school district overcrowding in the Village.

6. The Village is interested in joining a regional sewer district plant located outside the Village, if the cost of joining such a plant was more beneficial than the cost required to expand its plant.

Montgomery (UT)

The Supervisor of the Town of Montgomery offered the following items:

1. The Orange County Data Book population projections are reasonably accurate for the Town of Montgomery.

2. A recently completed sewerage plan proposes that a new sewage treatment plant be constructed on the Wallkill River, about half-way between the Villages of Montgomery and Walden. The service area for the new sewer district would eventually extend from Coldenham to Walden, bordered on the west by the Wallkill River.

3. Treatment capacity needed by the Town is projected at 3.76 mgd in the short-term, and 6.82 mgd in the long-term.

4. A private utility is considering installing a sewerage treatment plant on the Wallkill River to serve a development (Hanover Associates) of 450 units, with possible service to some of the Town.

7.2.14 Mount Hope (T)

Otisville (V)

The Mayor and a Trustee of the Village of Otisville offered the following information:

1. The population in the Village is estimated at 1,000 to 1,200 for the year 1990. Otisville is near build-out, given its existing one-acre zoning. It is estimated that 20 new houses would be constructed over the next 20 years. Annexation of land is not expected to occur.

2. The Village relies entirely on septic systems. Residents are responsible for cleanout and maintenance.

3. There is no industry in Otisville.

4. A committee of four members has been formed to evaluate the feasibility of creating a joint sewer district to serve the State and Federal jails, the Village of Otisville and the Town of Mount Hope. A treatment plant serving Otisville, Mount Hope, and the two jails would most likely discharge to the Shawangunk Kill. The federal prison reportedly is willing to contribute \$3 million, and the state prison offered \$2 million towards construction of a new treatment facility.

5. Grant money is also being sought for a joint treatment facility. It is believed that 94.5 percent of the construction costs would be available from the federal government.

Mount Hope (UT)

The following items were provided by the Supervisor and a Councilman from the Town of Mount Hope:

1. Residential population estimates in the Orange County Data Book were felt to be valid for the Town and Village of Otisville. However, they do not include the following prison populations: (1) Federal prison: 1,600-1,800 inmates, plus up to 200 employees; (2) State Prison: unknown.

2. Mount Hope is unsewered except for the Hidden Valley Estates package STP. The Town is interested in building a central sewerage treatment plant with discharge to the Shawangunk Kill. It is felt that one plant is better than several small package plants in the Town.

However, the Town is reluctant to build a sewer plant if it is going to induce growth. The current Town officials are seeking to keep the area rural in nature.

3. A development in the planning stages, Millpond Grove, is proposing a private sewer district for their community.

7.2.15 Newburgh (C)

The following items were discussed with the City Engineer:

1. The County Department of Planning data are accurate for both current and projected populations of the City.

2. The City is 100 percent sewered. I/I is a substantial problem since many of the lines date to the turn of the century and several lines are combined storm and sanitary sewers. The I/I problems were identified in a 1976 study.

3. The City STP is located on the Hudson River, north of the Quassaic Creek on River Road. The plant provides secondary treatment with an activated sludge process. Primary and secondary sludge is handled by gravity thickeners and then dewatered by two belt filter presses. Dewatered sludge is trucked to the County landfill.

4. The City STP is rated at 7 mgd biologically and at 11 mgd hydraulically. The Town of Newburgh currently contributes about 0.9 mgd to the City STP. A 2.0 mgd expansion of the plant will occur when the Town contribution reaches 1.6 mgd.
5. It was felt that the STP has capacity for growth in both the City and Town of Newburgh through the year 2020.

6. Sewer fees are based upon 75 percent of water use.

7. Industrial contribution to the wastewater flow is under 5 percent; pretreatment is required. Of the seven known industrial discharges, only three are considered significant in terms of discharge quantity: a metal plating company, and two textile dyeing companies.

8. There are only about 25 acres of vacant land in the City, not all of which is buildable. Some proposed developments include a 70 single family home piece, a 35 unit condominium parcel,

a 17 single family home parcel, and 14 acres for possibly locating about 60 to 70 affordable housing units. The City has also been approached regarding the development of mixed residential/marina facilities along the Hudson River on currently zoned industrial property.

7.2.16 Newburgh (T)

The Town Supervisor of Newburgh provided the following information:

1. Current Town population is estimated at 28,000. The 1980 population was 24,000. The majority of growth has occurred in the last three to four years; this growth is not expected to taper off soon. The Town expects between 45,000 and 50,000 people by the year 2000. To some extent, the Town has been growing at the expense of the City; however, an influx of people from northern New Jersey, Long Island and Westchester County seeking affordable homes is also a contributing factor.

2. The Town has no heavy industry. The largest ratable is Central Hudson Gas & Electric, providing 51 percent of the Town tax base.

3. Development plans include about 1,000 single family homes on the eastern shore of Orange Lake and also development in the Coldenham Park area.

4. Local STPs that have been closed and are scheduled to be razed include Meadow Hill North, Meadow Hill South and Algonquin. Colden Park, Wintergreen and Nob Hill will be phased out of service in the future. The Town will be brought into the Crossroads Sewer District for treatment at the City of Newburgh plant.

5. The Town has a contract with the City to permit up to 6 mgd discharge to the City plant. This revised contract was signed in December 1988 and provided for two expansions (2 mgd each) from the original 2 mgd allotment to achieve the 6 mgd total.

6. The City plant has adjacent land available for expansion.

7.2.17 New Windsor (T)

The Supervisor and Engineer for Town of New Windsor provided the following information:

1. It is estimated that the present Town population is near 26,500. Year 2020 population is projected to be above 40,000.

2. The plant is over-committed in terms of future capacity, although at present the plant is only operating at about two-thirds of capacity. The Town is under contract with the Majestic Sewer District in Cornwall for 1.25 mgd and with Stewart International Airport for 3.3 mgd. The Cornwall sewer districts of Beaver Dam Lake and Firthcliffe Heights are expected to connect new housing units to the plant.

3. The Town is making progress in planning for expansion of the New Windsor sewage treatment plant. The proposed plant expansion will be to 10 mgd, and it is likely that NYSDEC will require the plant to extend its outfall further into the Hudson River. The plant presently discharges to the Hudson at the mouth of the Moodna Creek. It is expected that a new outfall will have to extend at least 1,000 feet into the Hudson River.

4. Development of the New Windsor STP into a regional facility initially is not considered favorable by Town officials.

7.2.18 Port Jervis (C)

The following items were discussed with the Commissioner of Public Works and a Councilman from the City of Port Jervis:

1. There are between 9,000 to 10,000 residents in the City at present. There has been a boom in conversion of houses from single family units to duplex or multi-family units. In addition to housing conversions, many formerly abandoned buildings are now being renovated.

2. The City is presently trying to annex about 18 acres of land from the Town of Deerpark. The land, known as Carpenter's Point, is now vacant. If incorporated into the City, it would be zoned for 1/4 acre lots, and could support as many as 500 new homes.

3. The City encompasses nearly 3 square miles. Breakdown of vacant land, excluding possible annexation land, is as follows:

   - 6 vacant industrial parcels;
   - 63 vacant commercial parcels;

- 53 abandoned residential parcels; and
- 220 vacant residential parcels.

4. The City is essentially 100 percent sewered.

5. Significant industries that contribute to the Port Jervis STP include:

   - Kolmar - cosmetics;
   - Skydyne - shipping containers;
   - A&W Products - school supplies;
   - Flexible Fabricators - hydraulic and gas fittings; and
   - Andmore - sportswear.

   All industries are required to pretreat process wastewater before discharging into the municipal sewer.

6. The Port Jervis STP is owned and operated by the City of New York.

7. It is believed that, while New York City is planning to upgrade the Port Jervis STP, it is not planning to expand the plant. It was uncertain if New York would allow expansion of the plant. The only possible service area expansion for the STP would be into Deerpark.

8. The City does not separately bill for sewer service; it is included as part of the general property tax. There is no charge for connecting to the existing sewer system.

7.2.19 Tuxedo (T)

Tuxedo Park (V)

The Deputy Mayor and Supervisor of Public Works from the Village of Tuxedo Park provided the following information:

1. Village population is estimated to be 1,100 to 1,200 people. Build-out population is expected to be 1,300 to 1,400.

2. The build-out population projection is based upon the construction of only 25 to 30 new homes within the current Village boundaries. This additional construction is controlled by zoning ordinances, including minimum lot size, which was recently changed from 2 to 4 acres.

3. The Village is 100 percent residential, and there are no seasonal changes in population. At this time, the Village is self-sufficient with regard to sewage treatment.

4. There are currently about 300 total housing units in the Village. All are sewered with the exception of perhaps a dozen units on the southern end of Tuxedo Lake. In addition, 4 housing units from outside the Village are connected to the Village sewerage system. The dozen or so homes on the southern end of Tuxedo Lake that are on septic systems are periodically inspected by Village officials, but maintenance and cleanout are done privately.

5. Many of the sewer lines in the Village are over 100 years old and I/I is a major problem. The plant has a design capacity of 0.15 mgd and includes a trickling filter and chlorination. Flows in the range of 0.04 to 0.25 mgd have been experienced during rainfall events.

Tuxedo (UT)

The Supervisor of the Town of Tuxedo offered the following information:

1. The population of the town was estimated at 3,100 to 3,400 in 1985, based upon school attendance. However, population may have declined somewhat since then. Build-out could be as high as 25,000 persons.

2. The Tuxedo Hamlet STP is designed for a flow of 0.1 mgd. A consent order by NYSDEC has been issued for upgrade of the plant. No provision has been made, as yet, to expand the plant. The plant serves 279 units, including a nursing home and a school (400 equivalent units). The Hamlet STP was formerly owned and operated by Tuxedo Park, but was given to the Town in 1986. An unknown quantity of the Park's wastewater still flows into the plant.

3. There are three major developments proposed for the Town.

   - Tuxedo Park Associates is planning to develop 2380 units on as many acres, for the property bordered by Maplebrook, Tuxedo Park, and Rockland County. Water demand is projected as 950,000 gpd and sewage treatment capacity will be required for an estimated 850,000 gpd. One or more plants are proposed for Warwick Brook and/or Ramapo River;

- Tuxedo Fields is a proposed development of 265 homes southeast of the intersection of Orange Turnpike and Route 17. The developer is proposing one or two package plants; and

- Sterling Forest Corporation will be developing approximately 4,000 acres of its property. Most of this area is expected to fall within the Town of Tuxedo. It is expected that as many as 14,000 housing units will be built at completion of the development.

4. Union Carbide (Route 84), International Paper (Warwick Brook Road), and Cintichem (Indian Kill Reservoir) are industries located in the Town of Tuxedo. None of these discharge to the existing Hamlet STP.

7.2.20 Wallkill (T)

The following points were made by the Supervisor and Superintendent of Water and Sewer for the Town of Wallkill:

1. The Wallkill STP capacity is 4.0 mgd, expandable to 6.0 mgd at the present site. The 6.0 mgd capacity is expected to support town growth through year 2025. At build-out, sewage treatment capacity is estimated at 6.9 mgd. Any expansion of plant capacity beyond 6.0 mgd would require the purchase of an adjacent parcel.

2. Effluent ammonia limits for the Wallkill plant are presently 8.3 mg/l winter, and 5 mg/l summer.

3. Wallkill is presently engaged in negotiations to provide service to the Town of Wawayanda.

4. In addition to Wawayanda, Wallkill has been approached by private developers in both Hamptonburgh and Goshen, and the Mid-Hudson Psychiatric Center. Possible sewage service for a new County Jail has also been considered.

5. Land at Stony Brook Farm at Stony Ford Road and Bart Bull Road could be available as a future treatment plant site.

7.2.21 Warwick (T)

Florida (V)

The following information was provided by the Mayor of the Village of Florida:

1. The 1990 population is estimated at about 2,500 persons. Build-out is expected to occur when the population reaches 4,000, unless the Village annexes more property. There are only about 250 acres left in the current Village boundaries to be developed; this property is zoned for one-half to one acre lots, with no provision for high-density development.

2. It is estimated that, at present, approximately 98 percent of the Village is sewered. A building moratorium is presently in-place due to problems at the sewage treatment plant.

3. The Village is under a NYSDEC consent order to upgrade the plant. Coincident with the upgrade is a planned expansion of the plant from 300,000 to 450,000 gpd capacity.

4. The Mayor expects the upgrade and expansion of the plant to cost about $1,000,000. This expansion is expected to handle all future wastewater treatment needed by the Village, enabling it to be self-sufficient.

5. Sewer rates are presently based on a formula of $10.55 per $1000 land value, plus $0.35 per foot of frontage, plus $143.22 per unit charge. This formula has been used for 18 years, although adjustments have been made for inflation.

6. The Village planning board has received two development proposals. One proposal is for 72 single family homes on one-half acre lots, and the other is for 45 single family homes on 1.5 acre lots.

7. The Village is considering the possibility of an industrial park. At present, the only industrial discharge to the plant is from Zircar, an insulation manufacturer. The plant also receives wastes from ShopRite corporate headquarters and Brock Knitting Mills.

Greenwood Lake (V)

The Mayor of Greenwood Lake provided the following information:

1. The 1990 population is estimated at 3,200. Build-out is expected to occur with 5,000 to 6,000 people. During the summer the population increases by about 2,000.

2. A developer is proposing a 480-unit development on 208 acres in the Village, located on the northeastern side of the lake. A small treatment plant to handle sewage from the development is proposed, with an outfall located in Trout Brook. The Village is negotiating with the developer to provide sewage treatment capacity for hookups from the homes immediately surrounding the lake. The flow from the lake homes would add approximately 15 percent more to that flow from the development.

3. The Village is considering the benefits of having the developer run a pipe to OCSD#1 main in Lakes Road (Route 5) instead of to Trout Brook.

4. There is only one major parcel left to be developed in the Village. This is a 16-acre parcel located to the west of the Lake. Several other parcels of one acre or less are still available for development.

Warwick (V)

The Mayor of the Village of Warwick provided the following items:

1. Estimated present population is 7,800 to 8,000. Build-out is estimated at 9,000, unless the Village annexes land from the Town. This estimate is based on 2,015 water customers, multiplied by 3.5-4.0 persons/house.

2. The Village sewage treatment plant is planned to be expanded to 1.0 mgd. Present flow is estimated at 560,000 gpd. The additions include a rotating biological contractor and appurtenances. The expanded plant is expected to handle all future needs of the Village. The site has room for upgrade, if required by NYSDEC in the future.

3. Several developments, totaling over 500 units, will most likely require sewer service in the future.

Warwick (UT)

The following information was available from the Supervisor of the Town of Warwick:

1. The estimated total 1990 population is 25,000, including Villages of Florida, Greenwood Lake, and Warwick. Incorporated villages make up about half of the total population.

2. The Town sewerage treatment plant presently operates at 200,000 gpd. Capacity of the plant is 400,000 gpd. The plant has experienced minor problems meeting its winter ammonia standard. The plant is expandable, and sufficient space is available to do so.

3. There are several areas expected to contribute additional flow to the Town STP: over 400 new single family homes, a new senior citizen home, and a 600 acre farm to be subdivided (clustering possible). In addition, the prison served by the STP is starting to "double bunk", which will contribute more flow.

4. Other sewering concerns will need to be addressed for Blue Lake (150 homes) and Sterling Forest. These fall within the southeast corner of Town.

7.2.22 <u>Wawayanda (T)</u>

The Supervisor and Chairman of the Planning Board of the Town of Wawayanda provided the following information:

1. The 1990 population is estimated at 5,000. Build-out will occur with a population of 15,000. These projections do not account for growth that may be induced by water and sewer availability.

2. Wawayanda presently has an allotment of 250,000 gpd for treatment at the City of Middletown STP.

3. Wawayanda is discussing Wallkill treatment of sewerage from a proposed Wawayanda sewer district. The new sewer district is planned for an area where many septic tanks are failing, in the area of the Routes 17M/84/6 interchange.

4. Wawayanda will require 6,800 feet of sewer pipe to serve the area of Bradley's Corners. The bulk of the sewering costs will have to be borne by developers.

5. A development along McVeigh Road is expected to have 550-650 single family units.

6. Wallkill is presently building a trunk sewer along Dolson Town Road from the plant to Route 17M. A significant portion of the pipe will run through Wawayanda. Wawayanda's share of the costs will be $400,000, and the Town will be allotted 1 mgd transmission through this trunk. Treatment costs, however, are as-yet undetermined.

7.2.23 Woodbury (T)

The Supervisor and Superintendent of Water and Sewer for the Town of Woodbury provided the following information:

1. The 1990 population is about 8,500. Population presently sewered is estimated at 70 percent. Build-out is expected to occur with 14,000 to 15,000 people.

2. Town zoning is being revamped to require larger lot sizes (1/2 to 3/4 acre in sewer district). However, as a result of clustering and poor percolation of soils, sewered population will peak at about 90 percent of total.

3. Total future sewage flow, including existing package plants, could total 1.25 mgd. This includes developments that are sewered, but not yet built. The present allocation for Woodbury at the Harriman STP is 635,000 gpd.

4. Woodbury has received proposals for over 400,000 gpd sewage treatment from outside of the present sewer district.

7.3 Summary

The updated planning information presented in this Chapter was obtained through comprehensive meetings and discussions with local municipal officials in Orange County. Current understanding of local wastewater treatment needs and projected future requirements was discussed with these municipal leaders to better comprehend the policies and positions of the communities they represent.

This updated planning information is used for comparison to the baseline planning information presented in Chapter 6 of this Study. The consolidation of the baseline planning information with the current updated planning information allows for the determination of "refined" planning data to be used for the remainder of this Study. The refined planning data is presented in Chapter 8 of this Study and forms the basis for determining future wastewater treatment needs in Orange County.

CHAPTER 8

8.0 REFINED PLANNING PROJECTIONS

8.1 Introduction

This Chapter defines the "refined" planning projections of total population, sewered population and sewage generation in Orange County. The projections presented herein are the result of the integration of baseline planning projections (Chapter 6) with updated planning information (Chapter 7) from local municipal officials. The refined planning information is presented down to the city, town and village level to identify individual needs in all areas of the County. The refined data are presented as current estimates (year 1990) and planning projections (through year 2020).

It should be noted that the refined planning projections were summarized for the Orange County Sewer Committee prior to the release of final 1990 U.S. Census Bureau data. Final 1990 U.S. Census Bureau data was released in January 1991, well after the refined projections for this Study were made. Overall, the final 1990 U.S. Census Bureau data concurred with the Project Team's estimate of 1990 population to within three percent of the actual total County population.

Each city , town and village in Orange County was afforded the opportunity to review, comment upon and provide further insight about the refined population projections presented in this Chapter. A complete set of concise refined planning projections was given to every supervisor and mayor in Orange County's 40 communities for this purpose. Feedback from this interaction helped finalize the data presented during the Project Team's numerous working sessions with the County Sewer Committee. In addition, meetings were conducted with the Orange County Department of Planning and Development to review and discuss projections. The result of this effort is a compilation of conservative, realistic expectations for future growth trends in the County.

The refined planning projections presented herein are used for the remainder of this Study solely for structuring, sizing and subsequent cost estimating of potential sewage conveyance and treatment facilities.

8.2 Refined Population Estimates and Projections

Baseline population projections developed from the Orange County Data Book estimates presented in Chapter 6 show that the County population could reach over 400,000 by the year 2020. Chapter 7 presents a summary of the updated planning information obtained through contact with local municipal officials. Using this information, the baseline projections were adjusted to reflect assessments of local municipal growth and future development potential for the Study period. This merging of the baseline population projections with the updated planning information is summarized herein to define the refined County population projections.

Table 8-1 displays the 1990 baseline population, updated population range, and refined population estimates developed for this Study. As shown, a total population of 316,400 is estimated for the County in the year 1990, an increase of 10,000 over the baseline estimate.

Table 8-2 displays the 2020 baseline population, updated population range, and refined population projections developed for this Study. As shown, a total population of over 492,200 is projected for the County in the year 2020, an increase of 91,850 over the baseline projection.

Table 8-3 summarizes the refined Orange County populations projected for this Study for years 1990 through 2020, in ten year increments.

Due to the inherent element of uncertainty in planning, it is seen that municipal officials in many instances gave a range of potential populations for the year 2020. It is noted that while some municipal officials disagree with the County's growth estimates and projections, others expect population growth in their communities to closely reflect the baseline projections made by the Orange County Department of Planning and Development.

8.3 Refined Sewered Population Estimates and Projections

Baseline sewered population estimates for 1980 developed using the Orange County Data Book were presented in Chapter 6 of this Study. As shown therein, the sewered County population in 1980 was 153,830 representing approximately 59 percent of the total County population of 259,603 that time. Baseline sewered population projections were not available from the Orange County Data Book, so refined projections for 1990 are based upon updated information obtained through discussions with municipal and planning officials throughout the County. The 1980 baseline and 1990 updated sewered population estimates were then conservatively projected forward to reflect recent local municipal growth and future development potential.

Table 8-4 displays the refined sewered population for the years 1990, 2000, 2010 and 2020. The sewered County population is projected to grow from an estimated 64 percent in 1990 to approximately 77 percent of the total population in 2020.

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 8-1

REFINED 1990 ORANGE COUNTY POPULATION ESTIMATES

TOWN OR[1] CITY	CONSTITUENT[2] COMMUNITIES	1990 BASELINE POPULATION ESTIMATES	1990 UPDATED[3] PLANNING POPULATION ESTIMATES		DEVIATION[4] FROM BASELINE POPULATION ESTIMATES		1990 REFINED[5] POPULATION ESTIMATES
			Low	High	Low	High	
Blooming Grove (T)	Washingtonville (V)	3,700	5,000	5,000	+1,300	+1,300	5,000
	Blooming Grove (UT)	10,600	11,000	13,000	+400	+2,400	12,000
Chester (T)	Chester (V)	3,100	3,000	3,300	-100	+200	3,200
	Chester (UT)	5,600	5,000	8,000	-600	+2,400	6,000
Cornwall (T)	Cornwall-On-Hudson (V)	3,400	3,000	3,800	-400	+400	3,400
	Cornwall (UT)	8,400	8,600	8,600	+200	+200	8,600
Crawford (T)	Crawford (UT)	5,700	6,000	6,000	+300	+300	6,000
Deerpark (T)	Deerpark (UT)	6,200	6,000	6,500	-200	+300	6,300
Goshen (T)	Goshen (V)	5,500	5,500	5,500	0	0	5,500
	Goshen (UT)	6,300	6,300	6,300	0	0	7,700[6]
Greenville (T)	Greenville (UT)	3,700	3,500	4,000	-200	+300	3,800
Hamptonburgh (T)	Hamptonburgh (UT)	3,800	3,800	4,000	0	+200	3,900
Highlands (T)	Highland Falls (V)	4,400	4,000	4,200	-400	-200	4,100
	Highlands (UT)	10,000	10,000	10,000	0	0	10,000[7]
Middletown (C)	Middletown (C)	21,400	25,000[8]	26,000[8]	+3,600	+4,600	25,500
Minisink (T)	Unionville (V)	600	700[9]	700[9]	+100	+100	700
	Minisink (UT)	2,300	2,300[9]	2,300[9]	0	0	2,300
Monroe (T)	Harriman (V)	900	3,000	3,000	+2,100	+2,100	3,000
	Kiryas Joel (V)	4,000	8,000[10]	10,000[10]	+4,000	+6,000	9,000
	Monroe (V)	7,700	7,700	7,700	0	0	7,700
	Monroe (UT)	7,800	6,500	7,000	-1,300	-800	6,700

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ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 8-1

REFINED 1990 ORANGE COUNTY POPULATION ESTIMATES

TOWN OR[1] CITY	CONSTITUENT[2] COMMUNITIES	1990 BASELINE POPULATION ESTIMATES	1990 UPDATED[3] PLANNING POPULATION ESTIMATES		DEVIATION[4] FROM BASELINE POPULATION ESTIMATES		1990 REFINED[5] POPULATION ESTIMATES
			Low	High	Low	High	
Montgomery (T)	Maybrook (V)	2,400	2,700	2,700	+300	+300	2,700
	Walden (V)	6,000	6,000	6,400	0	+400	6,200
	Montgomery (V)	2,500	3,000	3,000	+500	+500	3,000
	Montgomery (UT)	7,400	7,400	7,400	0	0	7,400
Mount Hope (T)	Otisville (V)	1,000	1,000	1,200	0	+200	1,100
	Mount Hope (UT)	3,800	3,800	3,800	0	0	5,700[11]
Newburgh (C)	Newburgh (C)	22,900	22,900	22,900	0	0	22,900
Newburgh (T)	Newburgh (UT)	24,200	24,000[12]	28,000[12]	-200	+3,800	25,000
New Windsor (T)	New Windsor (UT)	21,900	26,000[13]	26,000[13]	+4,100	+4,100	26,000
Port Jervis (C)	Port Jervis (C)	8,800	9,000	10,000	+200	+1,200	9,000
Tuxedo (T)	Tuxedo Park (V)	900	900	1,200	0	+300	1,000
	Tuxedo (UT)	2,500	2,400	2,400	-100	-100	2,400
Wallkill (T)	Wallkill (UT)	25,100	25,100	25,100	0	0	25,100
Warwick (T)	Florida (V)	3,400	2,500	2,500	-900	-900	2,500
	Greenwood Lake (V)	3,000	3,200	3,200	+200	+200	3,200
	Warwick (V)	5,800	5,800	8,000	0	+2,200	6,000
	Warwick (UT)	14,300	12,300	14,300	-2,000	0	13,300
Wawayanda (T)	Wawayanda (UT)	4,900	5,000	5,000	+100	+100	5,000
Woodbury (T)	Woodbury (UT)	7,900	8,500	8,500	+600	+600	8,500
	COUNTY TOTALS[14]	293,800	305,400	326,500	+11,600	+32,700	316,400

NOTES:

(1) Town or City is denoted by (T) or (C), respectively, after each entry in this column.

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ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 8-1

REFINED 1990 ORANGE COUNTY POPULATION ESTIMATES

NOTES: (continued)

(2) Village or Unincorporated Town or City is denoted by (V), (UT) or (C), respectively, after each entry in this column.

(3) The 1990 updated planning population estimates are based upon contact and discussions with local municipal officials and/or community planners. If a population estimate range was given, it is shown as the low and high estimates. If a population estimate range was not given, the given numerical estimate is shown as both the low and high estimates.

(4) Deviation from baseline population estimates compares the 1990 updated planning population estimates to the 1990 baseline population estimates. Both the low and high 1990 updated planning population estimates are compared individually to the baseline population estimates. It should be noted that entries in this column that have a value of zero are typically a result of municipal officials concurring with the 1990 baseline population estimates.

(5) The 1990 refined population estimates represent the estimation of values, rounded to the nearest 100, to be used for planning purposes in this document. Generally, the entries in this column represent an average of the low and high 1990 updated planning population estimates.

(6) Goshen (UT) 1990 refined population estimate includes the Orange County Home and Infirmary population of 1,400 people.

(7) Highlands (UT) 1990 refined population estimate includes the U.S. Military Academy at West Point population of 7,000 people.

(8) Middletown (C) officials believe that their community has historically been undercounted by the U.S. Census Bureau. These entries reflect this situation.

(9) Minisink (UT) is unable to provide a 1990 updated planning population estimate. As such, the 1990 baseline population estimate is used.

(10) Kiryas Joel (V) has undergone rapid growth that was not addressed in the 1990 baseline population estimate according to municipal officials in the Village.

(11) Mount Hope (UT) updated planning population estimates include the population of both the Federal and State correctional facilities located therein of approximately 1,900 inmates.

(12) Newburgh (UT) has undergone rapid growth that was not addressed in the 1990 baseline population estimates.

(13) New Windsor (UT) has undergone rapid growth that was not addressed in the 1990 baseline population estimates.

(14) County totals represent the actual sums of each column.

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ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 8-2

REFINED 2020 ORANGE COUNTY POPULATION PROJECTIONS

TOWN OR[1] CITY	CONSTITUENT[2] COMMUNITIES	2020 BASELINE POPULATION PROJECTION	2020 UPDATED[3] PLANNING POPULATION PROJECTION		DEVIATION[4] FROM BASELINE POPULATION PROJECTION		2020 REFINED[5] POPULATION PROJECTION
			Low	High	Low	High	
Blooming Grove (T)	Washingtonville (V)	4,410	9,000	9,000	+4,590	+4,590	9,000
	Blooming Grove (UT)	16,330	16,000	17,000	-330	+670	16,500
Chester (T)	Chester (V)	5,670	4,000	5,000	-1,670	-670	4,500
	Chester (UT)	8,890	15,000(6)	19,000(6)	+6,110	+10,110	17,000(6)
Cornwall (T)	Cornwall-On-Hudson (V)	4,150	4,150	4,150	0	0	4,200
	Cornwall (UT)	13,270	13,270	13,270	0	0	13,300
Crawford (T)	Crawford (UT)	8,170	8,300	8,800	+130	+630	8,600
Deerpark (T)	Deerpark (UT)	8,310	9,000	10,000	+690	+1,690	9,500
Goshen (T)	Goshen (V)	7,580	7,200	7,200	-380	-380	7,200
	Goshen (UT)	9,080	9,600	10,000	+520	+920	11,200(7)
Greenville (T)	Greenville (UT)	4,170	6,000	9,000	+1,830	+4,830	7,500
Hamptonburgh (T)	Hamptonburgh (UT)	5,820	5,820	5,820	0	0	5,800
Highlands (T)	Highland Falls (V)	5,280	4,400	4,500	-880	-780	4,500
	Highlands (UT)	12,600	12,600	12,600	0	0	12,600(8)
Middletown (C)	Middletown (C)	23,430	30,000(9)	32,000(9)	+6,570	+8,570	31,000
Minisink (T)	Unionville (V)	870	870(10)	1,100(10)	0	+230	1,000
	Minisink (UT)	3,500	3,500(10)	3,500(10)	0	0	3,500
Monroe (T)	Harriman (V)	1,200	3,250	3,750	+2,050	+2,550	3,500
	Kiryas Joel (V)	8,230	25,000(11)	30,000(11)	+16,770	+21,770	28,000
	Monroe (V)	10,600	10,000	10,000	-600	-600	10,000
	Monroe (UT)	13,300	14,000	14,000	+700	+700	14,000

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ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 8-2

REFINED 2020 ORANGE COUNTY POPULATION PROJECTIONS

TOWN OR[1] CITY	CONSTITUENT[2] COMMUNITIES	2020 BASELINE POPULATION PROJECTION	2020 UPDATED[3] PLANNING POPULATION PROJECTION		DEVIATION[4] FROM BASELINE POPULATION PROJECTION		2020 REFINED[5] POPULATION PROJECTION
			Low	High	Low	High	
Montgomery (T)	Maybrook (V)	3,200	3,500	3,500	+300	+300	3,500
	Walden (V)	7,990	8,500	8,500	+510	+510	8,500
	Montgomery (V)	3,490	4,500	4,500	+1,010	+1,010	4,500
	Montgomery (UT)	10,810	10,810	10,810	0	0	10,800
Mount Hope (T)	Otisville (V)	1,410	1,100	1,300	-310	-110	1,200
	Mount Hope (UT)	5,510	5,510	5,510	0	0	7,400(12)
Newburgh (C)	Newburgh (C)	22,310	22,310	26,500	0	+4,190	24,000
Newburgh (T)	Newburgh (UT)	30,570	30,000(13)	40,000(13)	-570	+9,430	35,000
New Windsor (T)	New Windsor (UT)	31,250	38,000(14)	42,000(14)	+6,750	+10,750	40,000
Port Jervis (C)	Port Jervis (C)	8,980	11,500	12,500	+2,520	+3,520	12,000
Tuxedo (T)	Tuxedo Park (V)	1,200	1,200	1,200	0	0	1,200
	Tuxedo (UT)	3,710	5,000(15)	25,000(15)	+1,290	+21,290	15,000(15)
Wallkill (T)	Wallkill (UT)	37,850	37,850	37,850	0	0	39,700(16)
Warwick (T)	Florida (V)	5,090	4,000	4,000	-1,090	-1,090	4,000
	Greenwood Lake (V)	4,000	5,000	6,000	+1,000	+2,000	5,500
	Warwick (V)	8,290	7,000	9,000	-1,290	+710	7,100
	Warwick (UT)	21,230	21,230	30,000(17)	0	+8,770	28,900(17)
Wawayanda (T)	Wawayanda (UT)	6,700	7,000	9,000	+300	+2,300	8,000
Woodbury (T)	Woodbury (UT)	11,900	13,000	14,000	+1,100	+2,100	13,500
	COUNTY TOTALS[18]	400,350	447,970	520,860	+47,620	+120,510	492,200

NOTES:

(1) Town or City is denoted by (T) or (C), respectively, after each entry in this column.

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 8-2

REFINED 2020 ORANGE COUNTY POPULATION PROJECTIONS

NOTES: (continued)

(2) Village or Unincorporated Town or City is denoted by (V), (UT) or (C), respectively, after each entry in this column.

(3) The 2020 updated planning population projections are based upon contact and discussions with local municipal officials and/or community planners. If a population projection range was given, it is shown as the low and high projections. If a population projection range was not given, the given numerical estimate is shown as both the low and high projections.

(4) Deviation from baseline population projections compares the 2020 updated planning population projections to the 2020 baseline population projections. Both the low and high 2020 updated planning population projections are compared individually to the baseline population projections. It should be noted that entries in this column that have a value of zero are typically a result of municipal officials concurring with the 2020 baseline population projections.

(5) The 2020 refined population projections represent the estimation of values, rounded to the nearest 100, to be used for planning purposes in this document. Generally, the entries in this column represent an average of the low and high 2020 updated planning population projections.

(6) Municipal officials in Chester (UT) anticipate significant growth, as currently evidenced by the many proposed developments planned therein. The 2020 updated planning high population projection is based upon current zoning and the possibility of the development of a high density religious community, similar to that of Kiryas Joel (V).

(7) Goshen (UT) 2020 refined population projection includes the Orange County Home and Infirmary population of 1,400 people.

(8) Highlands (UT) 2020 refined population projection includes the U.S. Military Academy at West Point population of 7,000 people.

(9) Middletown (C) officials believe that their community has historically been undercounted by the U.S. Census Bureau. These entries reflect this situation.

(10) Minisink (UT) is unable to provide 2020 updated planning population projections. As such, the 2020 baseline population projections are used for this purpose.

(11) Kiryas Joel (V) is expected to undergo rapid growth that is not addressed in the 2020 baseline population projections.

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ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE B-2

REFINED 2020 ORANGE COUNTY POPULATION PROJECTIONS

NOTES: (continued)

(12) Mount Hope (UT) updated planning population projections include the populations of both the Federal and State correctional facilities located therein of approximately 2,400 inmates.

(13) Newburgh (UT) is expected to undergo rapid growth that is not addressed in the 2020 baseline population projections.

(14) New Windsor (UT) is expected to undergo rapid growth that is not addressed in the 2020 baseline population projections.

(15) Tuxedo (UT) may experience significant growth, depending upon the level of development in Sterling Forest. Based upon the 2020 updated planning low and high population projections and the assumption that the Sterling Forest Corporation's "principles-based concept" will be adopted, a 2020 refined population projection of 15,000 was estimated.

(16) Wallkill (UT) updated planning population projections include the population of the future Orange County Prison located therein of approximately 1,800 inmates.

(17) Part of Warwick (UT) may experience significant growth, depending upon the level of development in Sterling Forest. Based upon the 2020 updated planning low and high population projections and the assumption that the Sterling Forest Corporation's "principles-based concept" will be adopted, a 2020 refined population projection of 27,000 was estimated.

(18) County totals represent the actual sums of each column.

(rpts:orsewer:tab82:070591:jb)

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 8-3

REFINED ORANGE COUNTY POPULATION PROJECTIONS : 1990-2020

TOWN OR [1] CITY	CONSTITUENT [2] COMMUNITIES	REFINED POPULATION PROJECTIONS — Year 1990	2000 [4]	2010 [4]	2020	REFINED [3] GROWTH RATE — Annual Percent	Total Percent
Blooming Grove (T)	Washingtonville (V)	5,000	6,300	7,700	9,000	2.67%	80.0%
	Blooming Grove (UT)	12,000	13,500	15,000	16,500	1.25	37.5
Chester (T)	Chester (V)	3,200	3,600	4,100	4,500	1.35	40.6
	Chester (UT)	6,000	9,700	13,300	17,000	6.11	183.3
Cornwall (T)	Cornwall-On-Hudson (V)	3,400	3,700	3,900	4,200	0.78	23.5
	Cornwall (UT)	8,600	10,200	11,700	13,300	1.82	54.7
Crawford (T)	Crawford (UT)	6,000	6,900	7,700	8,600	1.44	43.3
Deerpark (T)	Deerpark (UT)	6,300	7,300	8,400	9,500	1.69	50.8
Goshen (T)	Goshen (V)	5,500	6,100	6,600	7,200	1.03	30.9
	Goshen (UT)	7,700	8,900	10,000	11,200	1.52	45.4
Greenville (T)	Greenville (UT)	3,800	5,000	6,300	7,500	3.25	97.4
Hamptonburgh (T)	Hamptonburgh (UT)	3,900	4,500	5,200	5,800	1.62	48.7
Highlands (T)	Highland Falls (V)	4,100	4,200	4,400	4,500	0.33	9.8
	Highlands (UT)	10,000	10,900	11,700	12,600	0.87	26.0
Middletown (C)	Middletown (C)	25,500	27,300	29,200	31,000	0.72	21.6
Minisink (T)	Unionville (V)	700	800	900	1,000	1.43	42.9
	Minisink (UT)	2,300	2,700	3,100	3,500	1.74	52.2
Monroe (T)	Harriman (V)	3,000	3,200	3,300	3,500	0.56	16.7
	Kiryas Joel (V)	9,000	15,000	21,700	28,000	7.04	211.1
	Monroe (V)	7,700	8,500	9,200	10,000	1.00	29.9
	Monroe (UT)	6,700	9,100	11,600	14,000	3.63	109.0

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ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 8-3

REFINED ORANGE COUNTY POPULATION PROJECTIONS : 1990-2020

TOWN OR[1] CITY	CONSTITUENT[2] COMMUNITIES	REFINED POPULATION PROJECTIONS				REFINED[3] GROWTH RATE	
		Year				Annual Percent	Total Percent
		1990	2000[4]	2010[4]	2020		
Montgomery (T)	Maybrook (V)	2,700	3,000	3,200	3,500	0.99%	29.6%
	Walden (V)	6,200	7,000	7,700	8,500	1.24	37.1
	Montgomery (V)	3,000	3,500	4,000	4,500	1.67	50.0
	Montgomery (UT)	7,400	8,500	9,700	10,800	1.53	45.9
Mount Hope (T)	Otisville (V)	1,100	1,100	1,200	1,200	0.30	9.1
	Mount Hope (UT)	5,700	6,300	6,800	7,400	0.99	29.8
Newburgh (C)	Newburgh (C)	22,900	23,300	23,600	24,000	0.16	4.8
Newburgh (T)	Newburgh (UT)	25,000	28,300	31,700	35,000	1.33	40.0
New Windsor (T)	New Windsor (UT)	26,000	30,700	35,300	40,000	1.79	53.8
Port Jervis (C)	Port Jervis (C)	9,000	10,000	11,000	12,000	1.11	33.3
Tuxedo (T)	Tuxedo Park (V)	1,000	1,100	1,200	1,200	0.67	20.0
	Tuxedo (UT)	2,400	6,600	10,800	15,000	17.50	525.0
Wallkill (T)	Wallkill (UT)	25,100	30,000	34,800	39,700	1.70	51.0
Warwick (T)	Florida (V)	2,500	3,000	3,500	4,000	2.00	60.0
	Greenwood Lake (V)	3,200	4,000	4,700	5,500	2.40	71.9
	Warwick (V)	6,000	6,400	6,700	7,100	0.61	18.3
	Warwick (UT)	13,300	18,500	23,700	28,900	3.91	117.3
Wawayanda (T)	Wawayanda (UT)	5,000	6,000	7,000	8,000	2.00	60.0
Woodbury (T)	Woodbury (UT)	8,500	10,200	11,800	13,500	1.96	58.8
	COUNTY TOTALS[5]	316,400	375,200	433,400	492,200	1.85%	55.6%

NOTES:

(1) Town or City is denoted by (T) or (C), respectively, after each entry in this column.

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 8-3

REFINED ORANGE COUNTY POPULATION PROJECTIONS : 1990-2020

NOTES: (continued)

(2) Village or Unincorporated Town or City is denoted by (V), (UT) or (C), respectively, after each entry in this column.

(3) The refined annual percent growth rate is the quantity year 2020 population less the year 1990 population, divided by the quantity of year 1990 population multiplied by the difference in years between 2020 and 1990, then multiplied by 100%. Mathematically,

$$\text{Refined Average \% Annual Growth Rate} = \frac{(\text{Refined Pop. 2020} - \text{Refined Pop. 1990}) \times 100\%}{\text{Refined Pop. 1990} \times (2020 - 1990)}$$

The refined total percent growth rate is the quantity year 2020 population less the year 1990 population, divided by the year 1990 population, then multiplied by 100%. Mathematically,

$$\text{Refined Average \% Total Growth Rate} = \frac{(\text{Refined Pop. 2020} - \text{Refined Pop. 1990}) \times 100\%}{\text{Refined Pop. 1990}}$$

(4) The refined population projections, rounded to the nearest 100, for both the years 2000 and 2010 have been estimated by interpolation between the planning period endpoint populations in the years 1990 and 2020.

(5) County totals represent the actual sums of each column, except for the refined average percent annual growth rate.

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

Table 8-4

Refined Orange County Sewered Population Projections: 1990-2020

	1990			2000			2010			2020		
Municipality	Total Population	Percent Sewered	Sewered Population	Total Population	Percent Sewered	Sewered Population	Total Population	Percent Sewered	Sewered Population	Total Population	Percent Sewered	Sewered Population
Blooming Grove												
Washingtonville (V)	5,000	90%	4,500	6,300	93%	5,900	7,700	97%	7,400	9,000	100%	9,000
Blooming Grove (UT)	12,000	33%	4,000	13,500	45%	6,100	15,000	58%	8,700	16,500	70%	11,600
Chester												
Chester (V)	3,200	99%	3,200	3,600	99%	3,600	4,100	100%	4,100	4,500	100%	4,500
Chester (UT)	6,000	49%	2,900	9,700	56%	5,400	13,300	63%	8,400	17,000	70%	11,900
Cornwall												
Cornwall on Hudson (V)	3,400	95%	3,200	3,700	97%	3,600	3,900	98%	3,800	4,200	100%	4,200
Cornwall (UT)	8,600	80%	6,900	10,200	82%	8,300	11,700	83%	9,800	13,300	85%	11,300
Crawford (T)	6,000	30%	1,800	6,900	33%	2,300	7,700	37%	2,800	8,600	40%	3,400
Deerpark (T)	6,300	0%	0	7,300	3%	200	8,400	7%	600	9,500	10%	1,000
Goshen (1)												
Goshen (V)	5,500	95%	5,200	6,100	97%	5,900	6,600	98%	6,500	7,200	100%	7,200
Goshen (UT)	7,700	42%	3,200	8,900	50%	4,400	10,000	57%	5,700	11,200	65%	7,300
Greenville (T)	3,800	0%	0	5,000	3%	200	6,300	7%	400	7,500	10%	800
Hamptonburgh (T)	3,900	0%	0	4,500	3%	200	5,200	7%	300	5,800	10%	600
Highlands												
Highland Falls (V)	4,100	99%	4,100	4,200	99%	4,200	4,400	100%	4,400	4,500	100%	4,500
Highlands (UT)(2)	10,000	80%	8,000	10,900	77%	8,400	11,700	73%	8,600	12,600	70%	8,800
Middletown (C)	25,500	100%	25,500	27,300	100%	27,300	29,200	100%	29,200	31,000	100%	31,000
Minisink												
Unionville (V)	700	0%	0	800	10%	100	900	20%	200	1,000	30%	300
Minisink (UT)	2,300	0%	0	2,700	3%	100	3,100	7%	200	3,500	10%	400
Monroe												
Harriman (V)	3,000	95%	2,900	3,200	97%	3,100	3,300	98%	3,200	3,500	100%	3,500
Kiryas Joel (V)	9,000	100%	9,000	15,300	100%	15,300	21,700	100%	21,700	28,000	100%	28,000
Monroe (V)	7,700	90%	6,900	8,500	93%	7,900	9,200	97%	8,900	10,000	100%	10,000
Monroe (UT)	6,700	30%	2,000	9,100	40%	3,600	11,600	50%	5,800	14,000	60%	8,400

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

Table 8-4

Refined Orange County Sewered Population Projections: 1990-2020

Municipality	1990 Total Population	1990 Percent Sewered	1990 Sewered Population	2000 Total Population	2000 Percent Sewered	2000 Sewered Population	2010 Total Population	2010 Percent Sewered	2010 Sewered Population	2020 Total Population	2020 Percent Sewered	2020 Sewered Population
Montgomery												
Maybrook (V)	2,700	99%	2,700	3,000	99%	3,000	3,200	100%	3,200	3,500	100%	3,500
Walden (V)	6,200	99%	6,100	7,000	99%	7,000	7,700	100%	7,700	8,500	100%	8,500
Montgomery (V)	3,000	99%	3,000	3,500	99%	3,500	4,000	100%	4,000	4,500	100%	4,500
Montgomery (UT)	7,400	5%	400	8,500	20%	1,700	9,700	35%	3,400	10,800	50%	5,400
Mount Hope												
Otisville (V)	1,100	0%	0	1,100	7%	100	1,200	13%	200	1,200	20%	200
Mount Hope (UT)(3)	5,700	39%	2,200	6,300	39%	2,500	6,800	40%	2,700	7,400	40%	3,000
Newburgh (C)	22,900	100%	22,900	23,300	100%	23,300	23,600	100%	23,600	24,000	100%	24,000
Newburgh (T)	25,000	35%	8,800	28,300	48%	13,700	31,700	62%	19,500	35,000	75%	26,300
New Windsor (T)	26,000	58%	15,200	30,700	67%	20,700	35,300	76%	26,900	40,000	85%	34,000
Port Jervis (C)	9,000	100%	9,000	10,000	100%	10,000	11,000	100%	11,000	12,000	100%	12,000
Tuxedo												
Tuxedo Park (V)	1,000	95%	1,000	1,100	97%	1,100	1,200	98%	1,200	1,200	100%	1,200
Tuxedo (UT)(4)	2,400	25%	600	6,600	74%	4,900	10,800	85%	9,200	15,000	90%	13,500
Wallkill (T)(5)	25,100	60%	15,100	30,000	67%	20,000	34,800	73%	25,500	39,700	80%	31,800
Warwick												
Florida (V)	2,500	98%	2,500	3,000	99%	3,000	3,500	99%	3,500	4,000	100%	4,000
Greenwood Lake (V)	3,200	0%	0	4,000	23%	900	4,700	47%	2,200	5,500	70%	3,900
Warwick (V)	6,000	100%	6,000	6,400	100%	6,400	6,700	100%	6,700	7,100	100%	7,100
Warwick (UT)(4)	13,300	11%	1,500	18,500	31%	5,800	23,700	43%	10,200	28,900	50%	14,500
Wawayanda (T)	5,000	10%	500	6,000	27%	1,600	7,000	43%	3,000	8,000	60%	4,800
Woodbury (T)	8,500	65%	5,500	10,200	72%	7,300	11,800	78%	9,200	13,500	85%	11,500
TOTALS	316,400	62%	196,300	375,200	67%	252,600	433,400	72%	313,600	492,200	77%	381,40[illegible]

NOTES:
(1) Town of Goshen includes constant Orange County Home & Infirmary population of 1,400 people.
(2) Town of Highlands includes constant West Point Military Academy population of 7,000 people.
(3) Town of Mount Hope includes constant state and federal prison populations of 1,900 people.
(4) The Towns of Tuxedo and Warwick include populations of 11,500 [illegible]7,600, respectively, for Sterling Forest by year 2020.
(5) Town of Wallkill includes Goshen jail population of 1,800 peop[illegible] years 2000-2020.

8.4 Refined Sewage Generation Rates and Quantities

As discussed in Chapter 6 of this Study, sewage production is a function of residential, commercial and industrial water use, combined with any infiltration or inflow into the collection system. Typically, about 70 to 90 percent of the water used in a community makes its way into the sewer system. In general, sewage generation rates can be assessed in terms of a daily per-capita flow rate, described as gallons per capita per day. Sewage generation is generally higher for communities that have significant industry, and lower for communities that are mostly residential. Typical sewage generation rates range from 50 gallons per capita per day for a rural community to 250 gallons per capita per day or more for a well developed city.

To calculate the refined sewage generation rates, the average daily flow recorded at each municipal sewage treatment facility (see Chapter 4) was divided by the 1990 refined sewered population estimate (Table 8-4) for each municipality. This produced a refined per-capita sewage generation rate for each municipality in the County as shown in Table 8-5. A comparison was also made in Table 8-5 between the refined sewage generation rate and the estimated average water use rate to confirm that the refined per-capita sewage generation rate fell within a reasonable percentage of per-capita water use. The estimated average water use rate is based upon planning information used by the Orange County Water Authority.

From the year 1990 refined sewage generation rate, a judgement of the year 2020 refined sewage generation rate was made based upon four criteria:

- Projected growth trends in the area;
- Comparison to existing water use data;
- Predicted water conservation measures; and
- Anticipated removal of infiltration and inflow in areas, where significant.

To ensure a conservative approach, minimum values of 80 gallons per capita per day were assigned for rural areas, and 100 gallons per capita per day for more developed areas, for the year 2020. Values for the years 2000 and 2010 were interpolated between the 1990 and 2020 endpoints.

Refined sewage generation projections for the years 1990, 2000, 2010 and 2020 were calculated by multiplying the refined sewered population projections from Table 8-4 by the corresponding refined sewage generation rates from Table 8-5 (note that years 2000 and 2010 refined sewage generation rates are interpolated approximations). The resulting projected sewage production for each community

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 8-5

Refined Orange County Per-Capita Sewage Generation Rates: 1990 and 2020

Municipality	Average Water Use, gpcd (1)	Expected Sewage Generation Range as a Percentage of Water Use, gpcd @ 70 %	to @ 90 %	1990 STP Reported Sewage Generation Rate, gpcd (2)	1990 Refined Sewage Generation Rate, gpcd (3)	2020 Refined Sewage Generation Rate, gpcd (4)
Blooming Grove						
Washingtonville (V)	193	135	174	87	76	100
Blooming Grove (UT)	88	62	79	101	100	100
Chester						
Chester (V)	286	200	257	108	113	130
Chester (UT)	N/A	N/A	N/A	99	77	100
Cornwall						
Cornwall-on-Hudson (V)	237	166	214	167	153	150
Cornwall (UT)	N/A	N/A	N/A	142	136	140
Crawford (T)	96	67	87	60	60	80
Deerpark (T)	N/A	N/A	N/A	N/A	N/A	80
Goshen						
Goshen (V)	170	119	153	157	161	150
Goshen (UT)(5)	N/A	N/A	N/A	104	103	130
Greenville (T)	N/A	N/A	N/A	N/A	N/A	80
Hamptonburgh (T)	N/A	N/A	N/A	N/A	N/A	80
Highlands						
Highland Falls (V)	246	172	222	95	122	120
Highlands (UT)(6)	N/A	N/A	N/A	194	194	190
Middletown (C)	272	191	245	189	185	190
Minisink						
Unionville (V)	126	89	114	N/A	N/A	100
Minisink (UT)	N/A	N/A	N/A	N/A	N/A	80
Monroe						
Harriman (V)	125	87	112	108	90	100
Kiryas Joel (V)	81	57	73	108	70	100
Monroe (V)	113	79	102	108	100	100
Monroe (UT)	N/A	N/A	N/A	108	100	100

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 8-5

Refined Orange County Per-Capita Sewage Generation Rates: 1990 and 2020

Municipality	Average Water Use, gpcd (1)	Expected Sewage Generation Range as a Percentage of Water Use, gpcd @ 70 %	to @ 90 %	1990 STP Reported Sewage Generation Rate, gpcd (2)	1990 Refined Sewage Generation Rate, gpcd (3)	2020 Refined Sewage Generation Rate, gpcd (4)
Montgomery						
Maybrook (V)	138	96	124	125	94	100
Walden (V)	187	131	168	113	114	120
Montgomery (V)	106	74	95	100	101	100
Montgomery (UT)	N/A	N/A	N/A	53	86	100
Mount Hope						
Otisville (V)	168	118	151	N/A	N/A	120
Mount Hope (UT)(7)	N/A	N/A	N/A	212	206	180
Newburgh (C)	290	203	261	191	196	200
Newburgh (T)	225	158	203	153	166	170
New Windsor (T)(8)	119	84	107	163	286	250
Port Jervis (C)	213	149	192	148	144	150
Tuxedo						
Tuxedo Park (V)	358	251	322	69	57	100
Tuxedo (UT)	N/A	N/A	N/A	67	67	100
Wallkill (T)	184	129	166	167	151	150
Warwick						
Florida (V)	191	134	172	102	112	110
Greenwood Lake (V)	140	98	126	N/A	N/A	100
Warwick (V)	214	150	193	148	107	120
Warwick (UT)	N/A	N/A	N/A	160	162	140
Wawayanda (T)	N/A	N/A	N/A	75	75	100
Woodbury (T)	194	136	174	109	140	140
NUMERICAL AVERAGES:	183	128	165	124	124	124

Notes:
(1) For the period of 1980 to 1990, from Orange County Report on Water Supply System Development, 1987.
(2) Calculated from STP Survey reported service area population and average daily flow.
(3) Calculated from STP Survey reported average daily flow and 1990 refined sewered population.
(4) Based upon local conditions and professional judgement of growth, water conservation and infiltration/inflow.
(5) 1990 Goshen (UT) rate = 161 gpcd; Orange County Home & Infirmary rate = 36 gpcd.
(6) 1990 Highlands (UT) rate = 50 gpcd; West Point Military Academy rate = 214 gpcd.
(7) 1990 Mount Hope (UT) rate = 117 gpcd; State and Federal Jails rate = 228 gpcd.
(8) 2020 New Windsor (T) gpcd rate does not include the effect of [illegible]cted Stewart Airport flow of 3.36 mgd.

in Orange County is shown in Table 8-6.

8.5 Summary

The use of up-to-date accurate planning information is vital to the development of a suitable approach towards sewage treatment and management in the County. This Chapter defines this planning information.

The refined planning projections addressed in this section and are summarized as follows:

Total County Population:

1990 - 316,400

2020 - 492,200

Percent Growth - 55.60%

Average Annual Growth - 1.85%

Sewered County Population:

1990 Sewered Population - 196,300

1990 Percent Population Sewered - 62%

2020 Sewered Population - 381,400

2020 Percent Population Sewered - 77%

Sewage Generation Rates and Quantities:

1990 Average Sewage Generation Rate - 124 gpcd

1990 County Sewage Flow - 30 mgd

2020 Average Sewage Generation Rate - 124 gpcd

2020 County Sewage Flow - 59 mgd

This data is used in the development, identification and evaluation of alternatives for sewage collection and treatment works in Orange County.

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 8-6

Refined Orange County Sewage Production Projections: 1990-2020

	1990			2000			2010			2020		
Municipality	Sewered Population	Gallons/ Person/Day	Average Flow, mgd	Sewered Population	Gallons/ Person/Day	Average Flow, mgd	Sewered Population	Gallons/ Person/Day	Average Flow, mgd	Sewered Population	Gallons/ Person/Day	Average Flow, mgd
Blooming Grove												
Washingtonville (V)	4,500	76	0.34	5,900	84	0.50	7,400	92	0.68	9,000	100	0.90
Blooming Grove (UT)	4,000	100	0.40	6,100	100	0.61	8,700	100	0.87	11,600	100	1.16
Chester												
Chester (V)	3,200	113	0.36	3,600	119	0.43	4,100	124	0.51	4,500	130	0.59
Chester (UT)	2,900	77	0.22	5,400	85	0.46	8,400	92	0.78	11,900	100	1.19
Cornwall												
Cornwall on Hudson (V)	3,200	153	0.49	3,600	152	0.55	3,800	151	0.57	4,200	150	0.63
Cornwall (UT)	6,900	136	0.94	8,300	137	1.14	9,800	139	1.36	11,300	140	1.58
Crawford (T)	1,800	60	0.11	2,300	67	0.15	2,800	73	0.21	3,400	80	0.27
Deerpark (T)	0	0	0.00	200	80	0.02	600	80	0.05	1,000	80	0.08
Goshen												
Goshen (V)	5,200	161	0.84	5,900	157	0.93	6,500	154	1.00	7,200	150	1.08
Goshen (UT)(1)	3,200	103	0.33	4,400	112	0.49	5,700	121	0.69	7,300	130	0.95
Greenville (T)	0	0	0.00	200	80	0.02	400	80	0.03	800	80	0.06
Hamptonburgh (T)	0	0	0.00	200	80	0.02	300	80	0.02	600	80	0.05
Highlands												
Highland Falls (V)	4,100	122	0.50	4,200	121	0.51	4,400	121	0.53	4,500	120	0.54
Highlands (UT)	1,000	50	0.05	1,400	60	0.08	1,600	70	0.11	1,800	80	0.14
West Point Academy	7,000	214	1.50	7,000	214	1.50	7,000	214	1.50	7,000	214	1.50
Middletown (C)	25,500	185	4.72	27,300	187	5.10	29,200	188	5.50	31,000	190	5.89
Minisink												
Unionville (V)	0	0	0.00	100	100	0.01	200	100	0.02	300	100	0.03
Minisink (UT)	0	0	0.00	100	80	0.01	200	80	0.02	400	80	0.03
Monroe												
Harriman (V)	2,900	90	0.26	3,100	93	0.29	3,200	97	0.31	3,500	100	0.35
Kiryas Joel (V)	9,000	70	0.63	15,300	80	1.22	21,700	90	1.95	28,000	100	2.80
Monroe (V)	6,900	100	0.69	7,900	100	0.79	8,900	100	0.89	10,000	100	1.00
Monroe (UT)	2,000	100	0.20	3,600	100	0.36	5,800	100	0.58	8,400	100	0.84

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 8-6

Refined Orange County Sewage Production Projections: 1990-2020

Municipality	1990			2000			2010			2020		
	Sewered Population	Gallons/ Person/Day	Average Flow, mgd	Sewered Population	Gallons/ Person/Day	Average Flow, mgd	Sewered Population	Gallons/ Person/Day	Average Flow, mgd	Sewered Population	Gallons/ Person/Day	Average Flow, mgd
Montgomery												
Maybrook (V)	2,700	94	0.25	3,000	96	0.29	3,200	98	0.31	3,500	100	0.35
Walden (V)	6,100	114	0.70	7,000	116	0.81	7,700	118	0.91	8,500	120	1.02
Montgomery (V)	3,000	101	0.30	3,500	101	0.35	4,000	100	0.40	4,500	100	0.45
Montgomery (UT)	400	86	0.03	1,700	91	0.15	3,400	95	0.32	5,400	100	0.54
Mount Hope												
Otisville (V)	0	0	0.00	100	100	0.01	200	100	0.02	200	120	0.02
Mount Hope (UT)(2)	2,200	206	0.45	2,500	197	0.49	2,700	189	0.51	3,000	180	0.54
Newburgh (C)	22,900	196	4.49	23,300	197	4.60	23,600	199	4.69	24,000	200	4.80
Newburgh (T)	8,800	166	1.46	13,700	167	2.29	19,500	169	3.29	26,300	170	4.47
New Windsor (T)	15,200	286	4.35	20,700	274	5.67	26,900	262	7.05	34,000	250	8.50
Stewart Airport	N/A	N/A	0.00	N/A	N/A	3.36	N/A	N/A	3.36	N/A	N/A	3.36
Port Jervis (C)	9,000	144	1.30	10,000	146	1.46	11,000	148	1.63	12,000	150	1.80
Tuxedo												
Tuxedo Park (V)	1,000	57	0.06	1,100	71	0.08	1,200	86	0.10	1,200	100	0.12
Tuxedo (UT)	600	67	0.04	1,100	78	0.09	1,500	89	0.13	2,000	100	0.20
part Sterling Forest	0	100	0.00	3,800	100	0.38	7,700	100	0.77	11,500	100	1.15
Wallkill (T)(3)	15,100	151	2.28	20,000	151	3.01	25,500	150	3.83	31,800	150	4.77
Warwick												
Florida (V)	2,500	112	0.28	3,000	111	0.33	3,500	111	0.39	4,000	110	0.44
Greenwood Lake (V)	0	0	0.00	900	100	0.09	2,200	100	0.22	3,900	100	0.39
Warwick (V)	6,000	107	0.64	6,400	111	0.71	6,700	116	0.77	7,100	120	0.85
Warwick (UT)	1,500	162	0.24	3,300	155	0.51	5,100	147	0.75	6,900	140	0.97
part Sterling Forest	0	100	0.00	2,500	100	0.25	5,100	100	0.51	7,600	100	0.76
Wawayanda (T)	500	75	0.04	1,600	100	0.16	3,000	100	0.30	4,800	100	0.48
Woodbury (T)	5,500	140	0.77	7,300	140	1.02	9,200	140	1.29	11,500	140	1.61
TOTALS (4)	196,300	154	30	252,600	163	41	313,600	159	50	381,400	155	59

NOTES: (1) Town of Goshen includes constant Orange County Home & Infirmary population of 1,400 people.
(2) Town of Mount Hope includes state and federal prison populations totaling 1,900 people.
(3) Town of Wallkill includes Goshen jail population of 1,800 people [illegible] years 2000-2020.
(4) Gallons per person per day is presented as a weighted average.

CHAPTER 9

9.0 DESCRIPTION OF SEWAGE TREATMENT TECHNOLOGIES

9.1 Introduction

The purpose of this Chapter is to provide an overview of conventional sewage treatment technologies, non-conventional sewage treatment technologies and sewage sludge treatment and disposal technologies. This Chapter will also present the sewage treatment approach advocated by Orange County for the Study as recommended by the Sewer Committee.

Orange County recognizes the importance of addressing sewage management through a multi-pronged approach summarized as follows:

- Water conservation and reuse;
- Reduction of infiltration and inflow;
- Industrial sewage pre-treatment programs;
- Sewage treatment; and
- Sewage sludge utilization and/or disposal.

Water conservation and reuse can help minimize the amount of sewage generated at the source thereby reducing sewage treatment requirements. The reduction of infiltration and inflow into sewage collectors can also provide a reduction in the volume of sewage requiring treatment. Industrial sewage pre-treatment programs offer the opportunity to the County to limit the levels of certain industrial wastewater pollutants entering the municipal sewage collection system. All of these processes are important in that they reduce either the volumetric quantity of or contaminant concentration in sewage requiring treatment. Chapter 13 further discusses how these processes are integrated into the Recommended Plan. The balance of Chapter 9 describes sewage and sludge treatment technologies.

Sewage constitutes liquid waste generated by residential, commercial, institutional and industrial sources, in addition to storm water and groundwater that makes its way into sewage collection systems. If left untreated, anaerobic conditions can develop and biological decomposition will occur, resulting in foul odors and the release of organics and pathogenic organisms that may be hazardous to human health and the environment. Conventional sewage treatment involves the use of physical, biological and chemical unit processes to remove solids and organics from wastewater, thereby decreasing the potential for adverse health and environmental impacts. In essence, conventional sewage treatment is an acceleration of the natural purification mechanisms that occur in water bodies, performed under controlled conditions and in a comparatively small area. Non-conventional sewage treatment primarily involves land-based wastewater systems for small volumetric flows in areas of with suitable conditions. While these land-based systems are sometimes referred to as "natural" treatment, they largely employ the same physical and biological mechanisms as most conventional treatment, but in an indigenous setting.

Sewage contains bacteria that utilize organic material as a food source. With adequate oxygen, the bacteria eventually oxidize the organic material found in sewage into stable end products such as carbon dioxide and water. The amount of oxygen used in this process is called biochemical oxygen demand (BOD). BOD depletes dissolved oxygen (DO) in a water body, which can be detrimental to resident animal and plant species. Sewage treatment primarily involves the removal of carbonaceous and nitrogenous oxygen demands (CBOD and NBOD, respectively) which make up BOD. The type of treatment process employed is dependent upon local conditions, needs of the community, state and federal regulations, performance record and cost.

Levels of conventional sewage treatment quality are typically identified as primary, secondary and advanced (or tertiary). Primary treatment utilizes physical separation processes to remove trash, grit, floatables and settlable solids from sewage. Secondary treatment follows primary treatment and utilizes biological and/or chemical unit processes to remove organic matter, and colloidal and dissolved solids. Advanced treatment is supplemental to secondary treatment and utilizes further biological and/or chemical unit processes to increase the removal of additional wastewater constituents, typically nitrogen and phosphorus, which are only partially removed by secondary treatment.

Both conventional and non-conventional sewage treatment generate a residue called sludge during the purification process. Sludge is an accumulation of solids and organic material carried by wastewater, that is removed in a sewage treatment facility. Sludge must be treated prior to beneficial use or disposal. Sludge treatment, like sewage treatment, is achieved by various physical, biological and chemical unit processes.

9.2 Conventional Sewage Treatment Technologies

Conventional sewage treatment refers to a modern technological approach for sewage processing and management. This type of sewage treatment is well proven as demonstrated by thousands of facilities throughout the United States. Conventional treatment makes use of physical, biological and chemical treatment unit processes as described in the following subsections.

9.2.1 Physical Treatment Unit Processes

Physical treatment unit processes include screening, sedimentation, flotation and filtration, typically in that order. Screening removes trash and other large objects carried by the sewage. Next, grit is removed in a grit chamber, where the velocity of the sewage flow is controlled so that sand and similar heavy materials fall out. Sedimentation makes use of clarifiers to remove settlable solids by providing sufficient quiescence and detention time for organic matter to settle out from the sewage. Clarifiers also achieve the removal of floatables and grease which rise to the surface of the sewage for removal by skimming. Flotation is used to remove lighter materials from sewage by the introduction of air. The air bubbles rise and attach to particulate matter in the sewage, thereby allowing the buoyant matter to float on the surface for removal. Flotation is used both to remove particulate matter from sewage and to concentrate the solids content of sludge. Filtration involves the passing of sewage through a fine screen or bed of filter media that traps small particles and suspended solids within the void spaces.

9.2.2 Biological Treatment Unit Processes

Biological treatment unit processes accomplish treatment in a reactor vessel where microbial activity is controlled. Biological treatment unit processes promote the growth of microbial organisms so that they can digest the organic solids in sewage. Biological operations are performed under either aerobic (oxygen-present) or anaerobic (oxygen-deficient) conditions. In either case, two general types of biological reactors are used: fixed growth and suspended growth. Fixed growth reactors such as trickling filters, packed towers and rotating biological contactors perform biological treatment with a microbial cell population that is maintained as a "slime" attached to rock, plastic or wood surfaces, over which the sewage is passed. Suspended growth reactors such as aeration tanks, oxidation ditches and anaerobic digesters provide an environment in which a microbial cell population is mixed with the sewage to form an agglomerated biomass that can be settled out with clarification.

9.2.3 Chemical Treatment Unit Processes

Chemical treatment unit processes are employed to remove sewage contaminants by initiating either a chemical reaction or transfer. The most common types of chemical unit processes are precipitation, gas transfer, adsorption and disinfection. Precipitation involves the introduction of chemical coagulants to facilitate the removal of contaminants by sedimentation. Coagulants promote aggregation of colloidal and dissolved solids thereby creating a larger mass which more readily precipitates or settles out in a clarifier. Gas transfer is the process by which a gas (e.g., oxygen in air) is transferred from one phase to another, usually from the gaseous phase to the liquid phase. Gas transfer is used in several chemical treatment unit processes including aerobic digestion, chlorine gas disinfection, effluent aeration and nitrogen removal. Adsorption involves the collection of soluble material onto a suitable medium, usually activated carbon. Disinfection is the process that destroys disease-causing pathogenic organisms. Chemical disinfection can be achieved for example by chlorination and ozonation.

9.3 Preliminary Sewage Treatment

Preliminary treatment involves the physical removal of large solids and organics, and floatables from sewage, and prepares sewage for subsequent treatment processes. Preliminary treatment can include large solids removal, grit removal, flow equalization and pre-aeration.

Large solids can be removed from sewage with a bar screen or comminutor. The bar screen is a rack mounted at an angle to the sewage flow, with vertical slats typically spaced about one inch apart. Bar screens are often mechanically cleaned with a rake arm that carries removed large solids to a container for disposal. The comminutor shreds large solids and coarse material via the action of cutting teeth over shear bars that either oscillate or rotate. Small particles which pass through the comminutor are removed in subsequent treatment processes.

Grit removal allows heavy solids such as sand and coffee grounds to settle out. Grit removal is beneficial because it reduces wear on downstream pumps and other mechanical equipment that may be damaged by such materials. Grit removal is typically accomplished in either a horizontal flow or aerated grit chamber. The horizontal flow grit chamber maintains sewage flow in a straight line at a constant velocity such that grit is removed while the organics stay in the sewage for subsequent treatment. The aerated grit chamber utilizes a spiral flow path where the velocity of the sewage is controlled by both the volume of air and the dimensions of the chamber. Mechanical removal of grit from both chambers is often performed with either a scraper or grab bucket which empties into a container for disposal.

Flow equalization basins may be warranted when either diurnal flows or storm event flows cause significant variations in the quantity of sewage to be treated. Equalization basins typically are continuously mixed and aerated, to prevent both the deposition of solids and anaerobic or septic conditions. Equalization basins can be operated either on- or off-line with the treatment process, and usually feature automatic pump control.

Pre-aeration tanks are desirable when sewage has been pumped a long distance and anaerobic conditions may have developed. Sewage should be properly pre-aerated to ensure effective treatment in subsequent operations. Pre-aeration can be accomplished in modified aerated grit chambers, flow equalization basins or separate aerated channels.

9.4 Primary Sewage Treatment

Primary sewage treatment follows preliminary treatment. Primary treatment involves the skimming of oil and grease and sedimentation of organics and suspended solids in a primary clarifier. Typically, between 50 to 70 percent of total suspended solids (TSS) and between 25 to 40 percent of the BOD5 from influent sewage is removed in primary treatment.

Primary clarifiers can be designed as rectangular or circular basins, and use skimming and scraping arms to collect scum and sludge. When primary clarifiers are used prior to biological treatment systems, shorter detention times and higher surface loading rates may be used.

Primary sewage treatment is followed by secondary and/or advanced sewage treatment and disinfection.

9.5 Secondary Sewage Treatment

Secondary sewage treatment achieves an effluent concentration of 30 mg/l maximum of both TSS and BOD5 in the effluent or 85 percent individual removal of both TSS and BOD5, whichever is less. Secondary sewage treatment follows preliminary and primary treatment, and is typically followed by secondary sedimentation and effluent disinfection. Secondary treatment removes mainly CBOD and can be accomplished by biological or physical-chemical treatment systems, depending on the characteristics of the sewage that is to be treated. Both biological and physical-chemical treatment systems are discussed in more detail in the following subsections.

9.5.1 Biological Treatment Systems

Biological treatment systems remove colloidal and dissolved biodegradable organic material from sewage by both the synthesis of microbial cell tissue and conversion of organic matter to gases. Synthesized microbial cell tissue can be settled out in clarifiers and gases released during biological conversion enter the atmosphere. Most types of sewage can be treated with biological treatment systems.

Removal of carbonaceous organic matter from sewage is accomplished by heterotrophic bacteria under either aerobic or anaerobic conditions. Aerobic processes are typically considered preferable for BOD removal because conditions are more easily controlled, have less potential for odors and smaller reactor vessels are sufficient. Aerobic processes entail the following biological reactions:

- Oxidation of organic matter to obtain energy for the synthesis of new microbial cells, resulting in the conversion of organic carbon to carbon dioxide and water;

- Synthesis of bacterial cell mass, which when withdrawn from the system as waste sludge, results in the removal of organic material and nutrients; and

- Oxidation of cells (endogenous respiration) to provide energy for the maintenance of remaining microbial cells, resulting in the destruction of cells to form carbon dioxide and water, and the return of nutrients to the sewage.

Biological treatment systems employ either a fixed growth or suspended growth reactor to achieve its objectives. The following subsections describe the two types of reactors in more detail.

9.5.1.1 Fixed Growth Reactors

Fixed growth reactors should be used after primary sedimentation. Two types of fixed growth reactors are widely used in biological treatment systems for sewage: trickling filters and rotating biological contactors.

Trickling filters uniformly distribute sewage over a filter media (usually rock or plastic). Sewage flows trickle over biological growth, or slime, attached to the filter media, removing soluble organics in the process. Trickling filters are generally used where a secondary level of sewage treatment is required. More stringent treatment requirements demand additional filter media contact area, which has to be compared to site availability. Careful design and operating consideration must be given to the organic and hydraulic loading rates, ventilation, media selection and available nutrients.

Rotating biological contactors (RBCs) utilize either plastic or metal media discs mounted on a shaft and placed in a horizontal cylindrical vessel. The RBC is slowly rotated with approximately 40 percent of the media surface area submerged in the sewage at any one time. The balance of the media surface area is exposed to the air. RBC's have demonstrated the ability to consistently achieve secondary, and higher, sewage treatment effluent quality.

9.5.1.2 Suspended Growth Reactors

Suspended growth reactors can be used with or without prior primary sedimentation. However, primary sedimentation can lower reactor power costs and help economically size reactors by reducing the organic and solids loading, so it is typically included in treatment plant design. Suspended growth reactors are widely used in biological sewage treatment systems, and include activated sludge and its variations, oxidation ponds and sludge digestion systems (discussed in Section 9.11 - Sludge Treatment and Disposal Technologies).

Activated sludge reactors utilize the oxygenation and mixing of sewage with a suspended biological growth mass, called mixed liquor suspended solids (MLSS). During this process, the mass of cells, contact time and available oxygen must be controlled to ensure the proper environment for microbial activity. Aeration techniques used in the activated sludge process include conventional aeration, step aeration, tapered aeration, contact stabilization and extended aeration. Following sewage aeration, the MLSS flows to sedimentation tanks where the MLSS is separated from the wastewater effluent by gravity settling. Some of the separated MLSS is recycled back to the activated sludge reactor to maintain an adequate concentration of MLSS for cell synthesis. The portion not recycled is removed as waste activated sludge for further processing.

Extended aeration reactors are a form of activated sludge process which is designed to minimize the production of waste sludge by providing a longer period of endogenous respiration for the MLSS. By definition, extended aeration has a hydraulic detention time of 24 hours, which is also applicable to the removal of NBOD. One example of an extended aeration reactor is the racetrack-shaped oxidation ditch.

Sequential batch reactors (SBRs), also known as "fill and draw" systems, utilize a batch method of operation, as opposed to the continuous method of operation for typical activated sludge reactors. SBRs usually operate in either conventional aeration or extended aeration treatment mode. During SBR operation, one tank is filled and treats the sewage while subsequent tanks are staged accordingly to provide further treatment. Flow equalization of an SBR is warranted to meet diurnal and wet weather flow patterns, and provide the necessary batch reaction times. Primary clarification is also usually included as an up-front part of the SBR process.

9.5.2 Physical-Chemical Treatment Systems

Chemical processes, in conjunction with certain physical processes, have been developed for the complete secondary treatment of sewage in addition to nitrogen and/or phosphorus removal. This type of treatment is known as physical-chemical treatment. Physical-chemical treatment systems are generally used where industrial wastes have rendered sewage untreatable by biological treatment. Physical-chemical treatment systems have potential advantages over biological treatment systems: they are not upset by the presence of heavy metals in sewage which can be toxic to biological growth; they can remove certain organic matter which is not biologically degradable; and they can remove phosphorus when iron salts, aluminum salts or lime are used for coagulation in the clarification stage. However, experience has demonstrated that chemical treatment systems can be more expensive to employ than biological treatment systems when removal of industrial contaminants is not of concern. Furthermore, when adsorption is specified as part of the treatment process, thermal regeneration and/or replacement of activated carbon is required and adds to the operational cost.

Most processes for physical-chemical treatment include chemical precipitation, adsorption, filtration and breakpoint chlorination. Chemical precipitation and adsorption are discussed below. Filtration and breakpoint chlorination are considered advanced sewage treatment and discussed later in this Chapter.

Chemical precipitation achieves the removal of organic and suspended solids from sewage with the addition of chemicals that promote agglomeration of the materials, which are then more readily removed by sedimentation. Chemical coagulants used for precipitation include alum, polymers, lime, ferric or ferrous sulfate, and ferric chloride. Typical equipment for this process includes a mixing tank, flocculation tank and sedimentation tank.

Adsorption is the process of accumulating soluble substances onto suitable medium. In physical-chemical treatment, adsorption would follow chemical precipitation, providing further removal of soluble BOD. Activated carbon is the most common media selected for adsorption, as it provides an extremely porous surface to which matter can adhere. The activated carbon adsorption unit typically consists of a packed-bed tower, with effluent applied across the top of the tower and removed from the bottom. Provisions for backwashing of the media bed are required.

9.6 Advanced Sewage Treatment

Advanced sewage treatment is required when effluent TSS and BOD must exceed secondary treatment effluent quality in order to ensure receiving water body quality. Advanced treatment processes are specified according to the waste assimilation capacity of the receiving water body, and can include nitrification, nitrogen removal, phosphorus removal and/or effluent polishing, depending on local instream conditions. Advanced sewage treatment follows preliminary, primary and secondary treatment, and is usually followed by effluent disinfection.

9.6.1 Nitrification and Nitrogen Removal Systems

Nitrogen is found in sewage in many forms: organic nitrogen, ammonia, nitrate and occasionally nitrite. Most of the nitrogen in sewage is in the form of ammonia. When present as ammonia or organic nitrogen, nitrogen exerts an oxygen demand. Nitrification, which removes ammonia by converting it to nitrate, is often adequate to meet water quality limitations since the NBOD is satisfied. Denitrification may be necessary where the removal of nitrate is warranted, as in a treated effluent discharge to drinking water supplies. Only a small amount of ammonia is removed during a secondary level of sewage treatment. Therefore, nitrification is typically considered part of an advanced level of sewage treatment. Nitrification and can be accomplished by either biological processes such as suspended and fixed growth reactors, or with chemical processes such as ammonia stripping, ion exchange and breakpoint chlorination. Denitrification is typically accomplished by biological processes.

Nitrification occurs only after the CBOD is satisfied, and nitrifying organisms (e.g., Nitrosomonas and Nitrobacter) dominate, oxidizing ammonia into nitrate. Nitrification can occur as a separate process following secondary treatment or in combined processes in which both carbonaceous and nitrogenous organisms are removed. Nitrogen removal is dependent on sludge age, temperature, dissolved oxygen and pH.

Suspended and fixed growth biological reactors can both be used for nitrification. The extended aeration activated sludge process is typically designed for nitrification by increasing both solids retention and hydraulic detention time. To achieve nitrification in a RBC, the system is sized such that the lead discs support heterotrophic bacteria and remove carbonaceous organic matter, while subsequent discs support nitrifying organisms. Trickling filters have also been used to nitrify. However, kinetic theory for combined BOD removal and nitrification by trickling filters currently can not be applied with a high degree of confidence.

Denitrification is the process by which nitrogen is removed by conversion of nitrate to nitrogen gas under oxygen deficient conditions. Denitrification usually follows nitrification. Carbonaceous matter is required for microbial cell synthesis during denitrification, and since nitrified matter is low in carbon content, a supplemental source of carbon such as methanol or glucose must be added.

Denitrification can be accomplished with either suspended or fixed growth reactors. Suspended growth denitrification utilizes a plug-flow type of activated sludge reactor, followed by a short period of aeration to strip out gaseous nitrogen that might otherwise inhibit sludge settling in the final clarifier. Fixed growth denitrification uses a reactor column packed with rock or synthetic media to support the biological slime of denitrifying bacteria. When sufficiently fine media is used, the process is analogous to filtration and a clear effluent is produced.

Ammonia stripping can be used to remove nitrogen from sewage by mass transfer in a forced draft stripping tower, which removes ammonia from the sewage into the air. Ammonia removal and transfer is achieved by bringing small droplets of sewage in contact with large amounts of stripping air. Removal efficiency is dependent upon the inlet air temperature, with poorer results obtained in colder climates.

Ion exchange can achieve ammonia removal by using a bed or packed column of natural ion exchange material to selectively remove ammonia ions from the sewage. The process has yet to see widespread use due to its still developmental nature and projected operational cost.

Breakpoint chlorination can remove ammonia by oxidizing it with chlorine in concentrations greater than that needed strictly for disinfection. This chemical process is relatively simple and has a low capital cost. However, disadvantages include: high operating costs, potential toxicity of chlorine byproducts in the receiving water, and increased dissolved solids which can foul subsequent filtration equipment, if employed.

9.6.2 Phosphorus Removal

Phosphorus is a nutrient used by aquatic plants, and when present in excessive quantities, can stimulate uncontrolled growth of algae, leading to oxygen depletion and eutrophication of lakes and ponds. Phosphorus can be removed by precipitation with chemicals or polymers, applied either to untreated sewage, in biological treatment processes or in separate facilities following secondary treatment. Chemicals that have been used in phosphorus removal include alum, lime, ferric sulfate and ferric chloride. Treatment processes for phosphorus removal generally include a mixing chamber for addition of the selected coagulant, a flocculation tank and a sedimentation tank.

9.6.3 Effluent Polishing

Wastewater effluent from both secondary and advanced treatment processes can be further treated to remove residual solids through the use of physical polishing processes. Filtration and microstraining are the two most common effluent polishing processes.

Filtration provides a good means of residual suspended or colloidal solids control by passing the sewage through a filtering media. In a typical sewage treatment facility, filtration is most often accomplished with automatic backwash, mixed media filters. Another type of filter is the deep bed filter, which can provide filtration and, due to the deep filter media, denitrification in the same vessel.

Microstraining uses a horizontal rotating, drum-mounted, fine screen media to remove residual suspended solids from sewage. To achieve the desired removal efficiency on a consistent basis, microstraining requires that chemical coagulants be added to the sewage.

9.7 Effluent Disinfection

Effluent disinfection is employed to destroy pathogenic microbes in sewage effluent. From a public health viewpoint, disinfection is considered to be a very important process. It is this chemical treatment process that provides the barrier to the transmission of waterborne disease by destroying pathogens before they can be released in the effluent to the environment. Methods of effluent disinfection applicable to sewage treatment include chlorine and sodium hypochlorite addition, ozonation and ultraviolet radiation.

9.7.1 Chlorination

Chlorination is the most common method of effluent disinfection. Disinfection is achieved by bringing chlorine gas, a strong oxidizing agent, into contact with sewage effluent for a specific period of time. Chlorine is usually supplied as a compressed liquid and is then drawn into an evaporator on-site and vaporized into gas. The chlorine gas is then mixed with a portion of the sewage effluent to form a chlorine solution. This chlorine solution is then fed into the main sewage effluent for disinfection. For small applications, liquid chlorine is directly mixed with a sidestream effluent flow and applied to the main sewage effluent without undergoing intermediate evaporation. It should be noted that elemental chlorine is a poisonous, corrosive, yellow-green gas at ambient temperature and atmospheric pressure. As such, great care must be taken in the transport, storage and handling of chlorine cylinders, tanks and injection systems.

Safety considerations associated with use of chlorine have resulted in the use of sodium hypochlorite as an alternative disinfectant. The application of sodium hypochlorite to sewage effluent achieves disinfection in the same manner as chlorine. Sodium hypochlorite can either be delivered in liquid form or generated on-site. Generation of sodium hypochlorite solution on-site introduces salt water or brine to an electrolytic reaction. Advantages of sodium hypochlorite are its relative ease of handling and reduced safety concerns. A disadvantage of sodium hypochlorite is that it is somewhat more expensive than chlorine gas. Also, sodium hypochlorite, like chlorine, can form chlorinated byproducts in the treated effluent which may need to be subsequently removed by dechlorination. Dechlorination can be accomplished with either sulphur dioxide or activated carbon.

9.7.2 Ozonation

Ozonation makes use of ozone, an unstable gas derived from oxygen, that exists in the atmosphere and can be dissolved in some liquids such as water. Like chlorine, ozone is a powerful oxidant which acts as an effective bactericide. Ozone disinfection has been increasingly used and its effectiveness is widely accepted. Although it is a relatively safe disinfection method, releases of ozone can be extremely irritating and harmful. Therefore, ozonation must be performed under a covered tank and offgases vented to an ozone destruction unit before discharge to the atmosphere. Residual ozone is typically not found in either the sewage effluent or receiving water as it rapidly breaks down into oxygen. The concentration of dissolved oxygen in the sewage effluent is significantly elevated after ozonation.

Ozone must be generated on-site because of its chemical instability. Ozone generation is accomplished by utilizing an electric discharge technique which involves passing either air or oxygen across an electrode under high voltage. Ozone is then transferred into the sewage effluent by mechanical diffusers. A drawback to disinfection with ozone is that both capital and operational power costs are relatively high.

9.7.3 Ultraviolet Radiation

Ultraviolet radiation (UV) as a means for sewage effluent disinfection has been increasingly used over the last several years. A UV system consists of banks of ultraviolet lamps mounted in a frame. The lamps, which resemble fluorescent bulbs, are installed within sealed quartz tubes to protect them from the sewage effluent. Each bank of lamps is mounted into either an open channel or enclosed conduit frame, providing close proximity to the sewage effluent sufficient enough to destroy pathogenic microorganisms. The lamps emit UV light at a destructive energy level, destroying the microorganisms by damaging cells. UV disinfection systems can be used with lamps oriented either parallel or perpendicular to the sewage effluent flow.

UV dosages depend upon sewage effluent characteristics. Suspended solids tend to shield bacteria from UV radiation, hence, this parameter is used in factoring the UV dosage needed. The potential recovery of only partially damaged cells by subsequent exposure to light, a phenomenon known as photoregeneration, must also be taken into consideration when using a UV disinfection system. Unlike disinfection with chlorine or sodium hypochlorite, which may require subsequent dechlorination or reaeration to remove residual byproducts, UV disinfection adds no residual byproducts to the sewage effluent.

9.8 Non-Conventional Sewage Treatment Technologies

Non-conventional sewage treatment technology generally refers to land-based treatment alternatives for sewage. Land-based sewage systems have gained recognition in some parts of the United States by providing low cost treatment for small sewerage systems. These technologies are usually designed for treating less than 200,000 gallons per day, but in some select cases have been sized for larger flows. The combination of colder winter climate and predominantly unsuitable soil conditions may make most types of non-conventional sewage treatment technologies inappropriate for use in Orange County. However, for small localized development, select sites can be considered on an individual basis.

Land-based sewage treatment involves the combined use of vegetation, surface and a subsurface soil matrix for processing. A primary or secondary level of sewage treatment must often be used prior to land-based treatment, thereby making it necessary to have access to sewage sludge handling facilities for processing and disposal. Other factors to be considered for non-conventional sewage treatment technologies include large land requirements, odor and vector control, and mosquito breeding.

Non-conventional sewage treatment technologies typically include: infiltration-percolation; irrigation; overland flow; deep well injection; and freshwater wetlands. The following subsections describe these technologies in more detail.

9.8.1 Infiltration-Percolation

Infiltration-percolation has the dual objective of providing further sewage effluent treatment and groundwater recharge. Primary treatment, and sometimes secondary treatment, of sewage must precede the infiltration-percolation process. In the latter case, percolation rates are somewhat greater due to decreased suspended solids in the sewage effluent. Treated sewage effluent is applied to land for several days to several weeks, followed by a rest period to allow the soil profile to dry out. The effluent infiltrates the soil and percolates down through the subsoil. Vegetation may be grown on the land but this is not necessary as there is little or no consumptive use of the sewage effluent by plants. Factors affecting the use of this technology include:

- Infiltration-percolation loading may have to be reduced or storage provided during cold weather conditions when application is not possible;

- Application is best on topography with level to slightly rolling terrain;

- Acceptable soils for infiltration-percolation include sand, sandy loams, loamy sands, and gravels. Soils that are too coarse allow the sewage effluent to pass too quickly through the first few feet of soil where the most biological and chemical action occurs. Dense soils have limited percolation capacity, which restricts the amount of sewage effluent that can be applied;

- Application is best on land with moderate to rapid soil drainage;

- A uniform depth of between 10 to 15 feet of a suitable soil type is preferred;

- Geologic formation continuity is desirable; and

- A minimum depth of 15 feet to the existing groundwater table is necessary. Groundwater should not be allowed to rise within 4 feet of the ground surface once the land is being used. Control by underdrains may be required.

It is estimated that at a desired average percolation rate of 5 to 6 inches per week, a secondary treatment sewage effluent flow of 1.0 mgd would require between 50 and 75 acres of land. In addition, a sufficient buffer zone of a minimum 500 feet wooded or 1,000 feet open land around the perimeter would be needed.

9.8.2 Irrigation

Irrigation involves applying treated sewage effluent to land either by spraying or surface spreading for the purpose of supporting plant growth. In most cases, a secondary level of sewage treatment is required prior to irrigation with the sewage effluent. While the primary objective of this process is to maximize crop production, a secondary benefit becomes additional effluent treatment. Elements of irrigation systems include a spray irrigation pipeline and discharge network, a drainage system of wells and underground tiles to drain the groundwater, an aerobic zone in the soil of at least 5 feet in depth, and storage capacity for several months to hold the sewage effluent in cold weather when irrigation cannot be employed.

It is estimated that treatment of 1.0 mgd of secondary treatment sewage effluent would require more than 300 acres of land for irrigation. Buffering is also required. Additional considerations include odors and potential health effects from airborne pathogens occurring during irrigation.

9.8.3 Overland Flow

Overland flow technology involves spraying or distribution of treated sewage effluent over the upper reaches of sloped terraces and allowing it to flow across vegetated surfaces to runoff collection ditches. Primary sewage treatment is often required prior to application. Overland flow treatment is accomplished by physical and biological means as the sewage effluent flows in a thin sheet through the vegetation. To prepare a site for an overland flow application, the land should be cleared, graded and replanted with appropriate vegetation. Disinfection of the collected sewage effluent runoff is required prior to its discharge to a receiving water body.

It is estimated that overland flow land requirements would be greater than 150 acres for treating a primary treatment sewage effluent flow of 1.0 mgd. Buffering is also required.

9.8.4 Deep Well Injection

Deep well injection involves the pumping of sewage effluent, which has undergone a secondary level of treatment, into underground wells. The conditions required for successful discharge via deep well injection include a thick, permeable strata that is not used for water supply, isolation from strata used for water supply, no major faulting or seismic activity, and low hydrodynamic gradients. With these conditions present, the potential risk of groundwater contamination is minimized and sewage effluent is confined to the disposal formation. Current information about chemical attenuation or modification of contaminants in a deep well injection disposal formation is limited.

9.8.5 Freshwater Wetlands

As with all land-based sewage treatment technologies, freshwater wetlands usage is site-specific and depends upon influent characteristics, soil types, climate and effluent standards. Freshwater wetlands are usually used for sewage effluent that has undergone a secondary level of treatment. Typically, freshwater wetlands consist of shallow free-surface basins with an impermeable liner on the basin bottom covered with soil to prevent percolation into the water table. Vegetation is selected based upon local climate and sewage effluent quality requirements and must be periodically harvested, as effective treatment is limited to the active growth phase of the plants.

One version of the freshwater wetlands is the submerged or gravel bed system. With this type of treatment, a lined trench is filled with crushed stone, gravel or other suitable medium which offers the advantage of sewage effluent flowing below the surface, generating less odors and fewer mosquitoes. It is estimated that freshwater wetlands requirements would be approximately 20 acres to treat 1.0 mgd of a secondary treatment sewage effluent.

Another version of freshwater wetlands is the solar aquatic system (SAS), which uses sunlight, plants and animals in a controlled environment to treat sewage to a secondary or advanced treatment level. A greenhouse covers the entire system, which consists of series of interconnected tanks containing diverse aquatic and non-aquatic plants, zooplankton, algae, bacteria, fish, crustaceans and mollusks which can remove organic materials and heavy metals, if present. The solar aquatic system utilizes some of the same unit processes found in conventional treatment, including preliminary screening and degritting. Initial tanks in the system are aerated constantly to keep most organic matter is suspension, in the presence of seeded bacteria, snails, algae, aquatic plants and woody plants supported on floating racks. Following the initial aeration tanks, wastewater flows to constructed marsh tanks made up of coarse sand and gravel, and suitable semi-aquatic vegetation. Algae and organic wastes from prior tanks are filtered out and degraded in the marsh tanks, and nutrients are taken up by the plants. The third stage of treatment in the SAS is equipped with aeration, plant racks, and plant and animal species including fish. The final stage of treatment is another constructed marsh, planted with suitable vegetation. While much of the organic material in the aeration tanks is kept in suspension, some settles to the bottom of the tank or forms a floating sludge blanket, and must be removed for sludge treatment.

The solar aquatic system is an experimental and innovative technology at present. Due to its still developmental nature, regulatory agencies have not yet endorsed the technology as proven for providing acceptable sewage treatment quality. As such, there are commercialization and permitting problems associated with implementation of the solar aquatic system for treatment.

It is estimated that to treat 0.1 mgd of sewage with a solar aquatic system would require about one acre of greenhouse space, plus buffering area.

9.9 Package Sewage Treatment Plants

So-called "package" sewage treatment plants are specified when sewage generation is extremely localized, remote or no municipal treatment facilities are available. Package plants are available in pre-fabricated units, and are available in a wide variety of types of treatment, the most prevalent being some form of the extended aeration process. Package plants are typically designed for unmanned operation, with maintenance required only to empty sludge holding tanks, record flow meter readings or refresh chlorine cylinders.

9.10 Individual Subsurface Disposal Systems

Individual subsurface disposal systems, also called septic systems, usually treat sewage on a per-household basis, although systems can be designed to provide treatment for campgrounds, schools or other larger facilities. Sewage treatment is achieved under anaerobic conditions in one tank where sedimentation, sludge digestion and sludge storage occur. The sludge accumulation in the septic tank must be pumped out about every two to three years. Effluent from the septic tank is usually discharged to a leaching field where it is allowed to percolate into the ground and undergo further biological decomposition through the soil matrix. Subsurface soil characteristics are extremely important in the design and siting of septic systems, as dense and compacted soil will not allow the leachate effluent to percolate into the ground, and ponding will occur, creating health and pollution hazards.

9.11 Sewage Sludge Treatment and Disposal Technologies

Sewage sludge is a mixture of water and solids, originally present in the sewage and concentrated during the sewage treatment process. Raw sludge from sewage treatment plant unit operations is predominantly water, ranging from 95 to 99 percent moisture by weight. Subsequent dewatering of sewage sludge into a cake can reduce the water content to between 60 to 80 percent by weight. Thus, consideration must be given to both the liquid and solid portions of sewage sludge when evaluating treatment and disposal technologies.

The characteristics of raw sewage sludge and its potential impacts on the environment must be understood. Sewage sludge characteristics can be grouped into three general categories: organic material, inorganic material and pathogenic microorganisms.

Organic material in sewage sludge consists of organic carbon compounds, proteins, fats, carbohydrates, and other substances. These can be decomposed by bacteria which are normally present in soil and water. In the presence of oxygen, this decomposition produces innocuous carbon dioxide and water. If sufficient oxygen is not available, decomposition will produce methane and other compounds (e.g., hydrogen sulfide) which can create odors, and health and safety concerns.

Inorganic material in sewage sludge consists primarily of silica, metal oxides, nitrates, phosphates and sulfates. The presence of nitrogen, phosphorus and some trace metals make sewage sludge potentially useful as a low grade fertilizer. Copper and lead, which can leach from household water supply systems, are typically the most common metals found in sewage sludge. High concentrations of heavy metals and nitrates, if present, can be toxic to plant life and may be of concern if the beneficial use of sludge is considered.

Sewage sludge also contains bacteria, viruses and other microorganisms normally found in sewage. Many of these microorganisms are pathogenic. Sewage sludge treatment, use and/or disposal must be properly controlled to prevent sewage sludge from serving as a means to transmit disease to man through such pathways as direct contact, groundwater supplies or food crop consumption.

Sewage sludge treatment and disposal technologies typically include:

- Conditioning and Dewatering;
- Stabilization;
- Thermal Reduction; and
- Utilization and Disposal.

The following subsections describe these technologies in more detail.

9.11.1 Conditioning and Dewatering

Sewage sludge is often first conditioned with either chemicals or heat to aid in the subsequent dewatering process. Chemical conditioning can be accomplished through the addition of reactants such as ferric chloride, lime or organic polymers. Heat conditioning involves heating the sewage sludge under pressure to break down the gel structure and reduce water affinity. Past experience and previous cost-effectiveness analyses have shown that the power intensive nature of heat conditioning typically costs more than the potential benefits from chemical savings. Furthermore, malodorous fumes from heat conditioning usually require treatment with air pollution control equipment.

After sewage sludge is conditioned, water can be more readily removed by dewatering. Dewatering is described as the process of decreasing water content in sewage sludge, changing its physical form from a liquid to a damp solid. The choice of dewatering process is dependent upon the means of ultimate sludge disposition. For example, if thermal reduction of dewatered sewage sludge is planned prior to disposal, a very low moisture content is needed to minimize auxiliary fuel requirements. On the other hand, if the dewatered sewage sludge is to be land disposed, a higher moisture content is acceptable. Systems presently utilized for dewatering include drying beds, centrifuges, vacuum filters, belt filter presses, and plate and frame filter presses.

Drying beds consist of a system of underdrains constructed beneath sand beds onto which sewage sludge is spread and remains until a cake of 40 to 50 percent solids by weight is obtained. Dewatering occurs over time as water in the sewage sludge evaporates, or percolates through the sand to the underdrains. This process is considered labor intensive, with land requirements much greater than that for mechanical dewatering. Colder climatic conditions would require covering of drying beds to prevent freezing.

Centrifuges separate sewage sludge solids from the water by sedimentation via centrifugal force. Advantages inherent with centrifugation equipment include a relatively low capital cost in comparison to other mechanical dewatering equipment and a flexible operation in handling varying solids content with little operator supervision. Drawbacks associated with centrifuges are lower solids capture without prior chemical conditioning, high power usage and comparatively short useful life.

Vacuum filters consist of a rotating horizontal drum, covered with filter media, through which a vacuum (i.e., subatmospheric pressure) is applied to accomplish sewage sludge water removal, solids capture and drying. Vacuum filtration requires a high degree of operator skill, but flexibility of application, uniformity of product and process reliability have made vacuum filters the method of choice for many facilities. Drawbacks include large space requirements and a relatively high capital cost.

Belt filter presses dewater sewage sludge by exerting pressure with rollers as the sludge is passed between two conveying belts. Various designs are available that use both gravity and pressure to reduce moisture content. Ease of operation, combined with moderate capital cost and minimal power usage, make belt filter presses a popular choice for dewatering.

Plate and frame filter presses are comprised of a series of parallel plates, covered on both sides by filter media, through which the sewage sludge is fed. This process has been shown to produce a drier sewage sludge cake than that from centrifugation, vacuum filtration or belt filter presses. This is a distinct advantage if the dewatered sewage sludge is to undergo thermal reduction. However, this advantage must be evaluated against the higher capital and operating costs of plate and frame filter presses.

9.11.2 Stabilization

Before dewatered sewage sludge can either be utilized or disposed, it must be stabilized to both reduce potential adverse impacts on the environment and address public health concerns. Dewatered sewage sludge is stabilized to reduce pathogens, eliminate odors, and reduce, inhibit or eliminate the potential for putrefaction. Without stabilization, microorganisms in dewatered sewage sludge can flourish and the sludge may putrefy, releasing both odors and pathogens. The processes used to achieve stabilization include either anaerobic or aerobic digestion, composting, lime or cement kiln dust stabilization and heat treatment.

Anaerobic digestion provides for the biological decomposition of organic and inorganic materials in an environment devoid of oxygen. This decomposition results from the activities of two major groups of bacteria. One group is termed the "acid-formers" which convert carbohydrates, fats and proteins to organic acids, alcohols and carbon dioxide. The second group is methane bacteria which convert organic acids and alcohol to methane gas and carbon dioxide. Anaerobic digestion is well proven for providing sewage sludge stabilization.

Aerobic digestion is similar to the extended aeration activated sludge process and involves the oxidation of dewatered sewage sludge using aerobic bacteria. With aerobic digestion, cell synthesis is extended as the microorganisms are forced to feed on all available carbon cell matter. Oxygen is supplied directly by either mechanical aerators or compressed air. If digestion temperatures are 50°F or less, retention times in excess of 20 days are required. If digestion temperatures are in the thermophilic range (organisms whose optimum growth temperature is 135° to 160°F) retention times of less than 10 days may be used. Aerobic digestion is well proven for providing sewage sludge stabilization. However, operational costs are relatively high due to aeration requirements.

Composting is an aerobic process for stabilizing dewatered sewage sludge by the actions of thermophilic, aerobic bacteria. A large portion of the organic matter in dewatered sewage sludge is oxidized to carbon dioxide, water, nitrates and phosphates in the process of decomposition. Prior to composting, the dewatered sewage sludge is mixed with a bulking agent such as wood chips, sawdust, shredded paper or leaves. The bulking agent provides a carbon source for the organisms and provides void space to enhance air flow. Types of composting processes include windrow, aerated static pile, in-vessel and vermicomposting.

Windrow composting is accomplished by laying the dewatered sewage sludge/bulking agent mixture into rows of trapezoidal cross-section which are turned periodically for aeration and mixing. Static pile composting is performed by positioning the mix over a forced ventilation system with blowers. In-vessel systems carry out composting within an enclosed vessel using oxygen provided through a built-in aeration system. Vermicomposting utilizes earthworms to digest material.

Composting can offer attractive benefits. First, microbial decomposition reduces odors and produces a fairly stable material. Second, heat produced during aerobic decomposition (e.g., temperatures of greater than 140°F for 2 to 5 days) kills all pathogens. Third, an organic material is produced which is generally a good soil conditioner having a fertilizer value typically equivalent to that of cattle manure.

However, some potential drawbacks of composting include:

- End use is limited by the level of contamination from heavy metals and toxic chemicals in the sewage sludge from such sources as industrial contamination, metals leached from household and public water systems, and storm water contamination (when cross connections between storm and sanitary sewer exist);

- Secondary pathogens such as aspergillus fumigatus and thermophilic actinomycetes can grow in the outer zones of windrows or static piles, thus posing a potential health problem to humans. Since the spores of these organisms may reach high densities in the air during composting, individuals with a history of health problems such as severe diabetes or any lung difficulties are more likely to contract disease associated with secondary pathogens;

- The placement of windrows or static piles and the removal of finished compost can be interrupted by rain and snow. Excess moisture may cause an aerobic composting process to turn anaerobic because of an insufficient air supply, thus causing foul odors, a decrease in compost temperature and a slowing of the decomposition process;

- A steady and reliable source of bulking materials must be assured at reasonable cost; and

- The composting operation should include adequate facilities for end-product distribution.

Lime stabilization involves the addition of lime (calcium hydroxide) to untreated sewage sludge to raise the pH to 12 or higher. A high pH is not conducive to the survival of microorganisms, so the sewage sludge will not putrefy, cause odors or pose a health hazard as long as the pH is maintained at this level. However, bacterial growth can reoccur when the pH drops, so planning for the ultimate disposition of the sewage sludge must take this into account.

Cement kiln dust (CKD) stabilization uses CKD, also called fly ash, which is a byproduct of the cement manufacturing industry. Sewage sludge stabilization using CKD is done in a manner similar to that of lime. The amendment of CKD to sewage sludge deodorizes, stabilizes and/or pasteurizes the material. Pathogen reduction is reported to be 10 to 1,000 times greater than that of sewage sludge digestion. Heavy metals are immobilized in the process. In addition, CKD adds potassium, calcium, sulfur and magnesium, which are not normally found in sewage sludge, and can enhance the agricultural value of the end-product. CKD stabilization is a proprietary process that can be applied via two methods.

The first method of CKD stabilization falls under the some category as lime stabilization, since CKD possesses the same alkaline characteristics as lime. This method calls for mixing CKD with dewatered sewage sludge to produce a pH of 12 after 2 hours, and maintaining this pH for at least 24 hours. As with lime stabilization, biological decay will resume if the pH drops.

The second method of CKD stabilization is called advanced alkaline stabilization with subsequent accelerated drying (AASSAD). The CKD AASSAD process requires that the mixture of dewatered sewage sludge and CKD, at pH 12, be heated to at least 125°F for a minimum of 12 hours, while being mixed continuously to ensure uniform temperature. The product is then air dried for at least 72 hours until a solids content of 50 percent has been achieved. This process produces a pasteurized sludge product and permanently reduces odors and pathogens to an acceptable level.

Heat treatment achieves both conditioning and stabilization of dewatered sewage sludge through cell destruction and the release of organic compounds and ammonia at high temperature and pressure. An adaptation of the heat treatment stabilization process is pelletization. Two proprietary types of pelletization make use of rotary and vertical tray dryers. Pathogens are destroyed by pelletization and the end-product is significantly reduced in volume and weight. The pelletized end-product can be used as a fertilizer amendment or as a sludge- derived fuel.

9.11.3 Thermal Reduction

After sewage sludge is either conditioned, dewatered or stabilized, it can be thermally processed to further reduce its volume. Thermal reduction methods include incineration and pyrolysis.

Incineration is a combustion process which accomplishes the complete destruction of organic material in dewatered sewage sludge. Incineration eliminates the need for dewatered sewage sludge stabilization: it need only be thickened and dewatered. The resultant product from incineration is a stable ash which may be directly land disposed. Unless excessive quantities of heavy metals were originally present in the dewatered sewage sludge, the inert ash may be disposed of in landfills without special consideration.

The cost of incineration is dependent upon the moisture content of the dewatered sewage sludge cake, chemicals present and required emissions control. An auxiliary fuel source is often required for start-up and to maintain sufficient temperatures for complete burning. Two incineration systems, the fluidized bed and the multiple hearth, are most commonly used. Both systems require highly trained personnel, and capital and operational costs are similar.

Fluidized bed incineration uses a fluid bed of sand as a heat reservoir to combust dewatered sewage sludge solids. The bed of sand must be preheated by an auxiliary fuel to approximately 1200°F before the injection of sludge at various heights in the incinerator. Combustion takes place in the suspended bed of sand at a temperature of 1500°F. Air is blown into the vessel from below, causing the bed to expand and fluidize. Most of the ash created by fluidized bed incineration is swept out with the flue gas. The flue gas, ash and water vapor enter a scrubber, where the ash is removed, and the gas is then exhausted through a stack. When a fluidized bed incinerator is in constant operation, no auxiliary fuel is required after start-up.

Multiple hearth furnaces consist of a series of hearths arranged vertically, with rakes that slowly comb dewatered sewage sludge from the top to the bottom of the furnace. Preheated air is admitted to the lowest hearth and is further heated by the dewatered sewage sludge as it rises to where combustion is occurring. The air cools as it rises, giving up heat to the dewatered sewage sludge on the upper hearths. Ash is collected at the bottom, and combustion gases enter a scrubber before being vented to a stack. Auxiliary fuel is required for start-up and also for sustained combustion if the inlet dewatered sewage sludge is less than 30 percent solids by weight.

Pyrolysis is a process of destructive distillation and decomposition of organic matter by heating dewatered sewage sludge in an oxygen deficient atmosphere. Three distinct advantages have been claimed for the pyrolytic process. The first is that the potential for air pollution is less for pyrolysis than for incineration. Second, the gaseous, liquid and solid residues from pyrolysis may have value as fuels. The third is that char, a solid residue, may be used in lightweight aggregate manufacturing. Commercial scale pyrolysis is considered still in the developmental phase.

9.11.4 Utilization and Disposal

The ultimate disposition of sewage sludge can be categorized as either utilization or disposal. Beneficial sewage sludge utilization generally involves adapting the final end-product for either fertilizer or soil conditioner purposes. Disposal of sewage sludge would occur in a landfill, since ocean dumping as a disposal method is now banned by EPA with the adoption of the "Ocean Dumping Ban Act of 1988".

Sewage sludge utilization requires suitable sludge characteristics. Heavy metal concentration is usually the limiting parameter for determining the suitability of sewage sludge utilization. Potential uses for the end-product include crop and agricultural applications, road and highway construction, bagging for sale and landfill cover. The sensitivity of end-use markets must be investigated when considering a long-term commitment to sewage sludge utilization.

Sanitary landfilling is at present an acceptable disposal method for both stabilized, dewatered sewage sludge and ash from thermal reduction. Sewage sludge solids content must be at least 20 percent by weight for proper disposal in a landfill. Sanitary landfilling provides for the deposition of material, spreading and compacting it, covering it daily with a layer of clean fill, and compacting the cover material. If the sewage sludge has been properly processed, it may be used in place of clean fill as either landfill daily cover or capping material. Primary factors to be considered are the sewage sludge haul distance to the landfill and transportation and disposal costs.

For both utilization and disposal, important public health and nuisance conditions that must be examined include water pollution, vector control, odors and gas production.

9.12 Summary

This Chapter provided a description of both conventional and non-conventional sewage treatment technologies along with sewage sludge treatment and disposal technologies.

During the course of the Study, numerous technology approaches were discussed with the Orange County Sewer Committee. Advantages and drawbacks of specific systems were investigated and presented. Subsequent to this process, the Project Team and the Sewer Committee formed a joint consensus on how various technologies should plan to be used to meet the long-term sewage management needs of Orange County. A summary of this consensus is as follows:

- The County needs to maintain an active role in promoting water conservation and reuse;
- Communities in the County should continue to actively seek the reduction of I/I problems at existing sewage treatment facilities;
- The County should promote an industrial sewage pre-treatment program to reduce industrial contaminant concentrations in the sewage;
- Communities in the County primarily utilizing septic tank systems should explore the possibility

of using either small package treatment plants or non-conventional, land-based treatment technologies;

- The County should encourage local communities to investigate the use of non-conventional, land-based sewage treatment technologies for small, sewage treatment facilities;

- The County should require the use of proven conventional sewage treatment technologies for larger sewage treatment facilities such as the those serving more than one community; and

- The County should continue separate planning efforts for both the environmentally safe and secure use of treated sewage sludge as a valuable end product and anticipated disposal requirements of any unusable or unmarketable material.

The above guidance helped the Project Team conduct the subsequent process of identifying alternative actions for future sewage treatment in Orange County as presented in the next Chapter.

CHAPTER 10

10.0 DEVELOPMENT AND IDENTIFICATION OF ALTERNATIVE ACTIONS

10.1 Introduction

This Chapter describes how alternative actions have been developed and identified to begin the process of determining the most appropriate combination of sewage collection, treatment, and disposal facilities for Orange County. Many possibilities for Orange County are described in this Chapter. The number of alternative actions for each community was developed by taking an independent outlook at individual situations and needs, initiating ongoing dialogue with local officials and planners, and exploring ideas jointly with the Orange County Sewer Committee.

The process of developing and identifying alternative actions included the following key elements:

- Determination of community need for sewage collection and treatment;
- Conceptual development of alternative actions;
- Identification and categorization of alternative sewage treatment actions; and
- Identification of alternative sewage collection routes.

The following sections summarize these elements used to develop and identify alternative actions.

10.2 Determination of Need for Sewage Collection and Treatment

The need for enhanced sewage treatment facilities during the Study planning period can be assessed by examining three primary factors: projected growth, adequacy of existing facilities, and the ability of existing facilities to meet the changing requirements of the NYSDEC for effluent discharge to regulated water bodies. This section summarizes the implications of each of these factors, illustrates Orange County's future sewage management needs, and as a result provides the framework used to develop alternative actions.

10.2.1 Projected Growth and Areas of Expansion

As shown in Chapter 6, Orange County has experienced extraordinary population growth over the past 30 years, outpacing the northeast U.S., and other areas of the nation. This growth can be largely attributed to the relatively affordable housing in the County and its proximity to New York City. As evidence of this, the areas of the County which have experienced the most rapid growth are mainly situated along the major transportation corridors of State Routes 17, Interstate Route 84, and the New York State Thruway (Route 87). It is expected that future growth will follow this trend, especially in light of such factors as the recent commercialization of Stewart International Airport, the potential availability of an adequate potable water supply from the proposed Orange County Water Authority project, and the fulfillment of the County's "urban-rural" growth concept.

Presently, many communities in Orange County are considering the construction of new or expanded sewage treatment facilities to meet their growing needs. The creation of new treatment facilities and sewer districts is being independently considered by the Towns of Goshen, Montgomery, Mount Hope and Wawayanda; and the Villages of Greenwood Lake and Otisville. Communities considering the expansion of existing sewage treatment facilities include: the Villages of Florida, Maybrook, Warwick and Washingtonville; the Town of New Windsor; the City of Newburgh; and municipalities contributing to the OCSD#1 STP (Blooming Grove, Town and Village of Chester, Harriman, Kiryas Joel, Town and Village of Monroe, and Woodbury).

Detailed statistics on population growth projections during the Study planning period were presented in Chapter 8, and illustrate the positive growth rate and areas of expansion in Orange County.

10.2.2 Adequacy of Existing Sewage Treatment Facilities

The adequacy of existing sewage treatment facilities to manage future sewage volume can be determined by comparing the flow projections during the Study planning period for each municipality to present available treatment plant capacity. Table 10-1 performs this comparison and quantifies the projected future deficit in treatment capacity for each community in Orange County.

As shown, it is projected that nearly one-half of the communities in the County will need additional sewage treatment capacity by the year 2000. By the year 2020, it is projected that most of the STPs in Orange County will experience a shortfall in treatment capacity for a combined total of about 21 mgd. More importantly, greater than three quarters of this projected deficit lies within the central and eastern portion of the County in areas directly tributary to the Moodna Creek, Ramapo River and Hudson River.

10.2.3 Changing Regulations and Their Effect

In response to USEPA mandate, the NYSDEC is proposing to reclassify many water bodies in the State of New York. These reclassifications will dictate that some existing STPs upgrade

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TABLE 10-1

Projected Treatment Capacity Deficits

Municipality	1990 Average Flow, mgd	Capacity of Existing Treatment Facilities, mgd (1)(2)	2020 Projected Flow, mgd	2020 Projected Treatment Deficit, mgd	Projected Time to Reach Treatment Capacity
Blooming Grove					
Washingtonville (V)	0.34	0.40	0.90	0.50	1990 - 1995
Blooming Grove (UT)	0.40	0.77	1.16	0.39	2000 - 2005
Chester					
Chester (V)	0.36	0.36	0.59	0.23	1990 - 1995
Chester (UT)	0.22	0.67	1.19	0.52	2000 - 2005
Cornwall					
Cornwall on Hudson (V)	0.49	0.40	0.63	0.23	1990 - 1995
Cornwall (UT)	0.94	1.33	1.58	0.25	2010 - 2015
Crawford (T)	0.11	0.15	0.27	0.12	1995 - 2000
Deerpark (T)	0.00	N/A	0.08	0.08	1995 - 2000
Goshen					
Goshen (V)	0.84	1.13	1.08	N/A	N/A
Goshen (UT)(3)	0.33	0.50	0.95	0.45	1995 - 2000
Greenville (T)	0.00	N/A	0.06	0.06	2000 - 2005
Hamptonburgh (T)	0.00	N/A	0.05	0.05	2000 - 2005
Highlands					
Highland Falls (V)	0.50	1.35	0.54	N/A	N/A
Highlands (UT)	0.05	0.12	0.14	0.02	2015-2020
West Point Academy	1.50	2.06	1.50	N/A	N/A
Middletown (C)	4.72	5.86	5.89	0.03	N/A
Minisink					
Unionville (V)	0.00	N/A	0.03	0.03	2005 - 2010
Minisink (UT)	0.00	N/A	0.03	0.03	2005 - 2010
Monroe					
Harriman (V)	0.26	0.19	0.35	0.16	1990 - 1995
Kiryas Joel (V)	0.63	0.61	2.80	2.19	1990 - 1995
Monroe (V)	0.69	0.47	1.00	0.53	1990 - 1995
Monroe (UT)	0.20	0.16	0.84	0.68	1990 - 1995

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TABLE 10-1

Projected Treatment Capacity Deficits

Municipality	1990 Average Flow, mgd	Capacity of Existing Treatment Facilities, mgd (1)(2)	2020 Projected Flow, mgd	2020 Projected Treatment Deficit, mgd	Projected Time to Reach Treatment Capacity
Montgomery					
Maybrook (V)	0.25	0.40	0.35	N/A	N/A
Walden (V)	0.70	1.10	1.02	N/A	N/A
Montgomery (V)	0.30	0.50	0.45	N/A	N/A
Montgomery (UT)	0.03	0.06	0.54	0.48	1990 - 1995
Mount Hope					
Otisville (V)	0.00	N/A	0.02	0.02	2005 - 2010
Mount Hope (UT)(4)	0.45	0.38	0.54	0.17	1990 - 1995
Newburgh (C)	4.49	5.92	4.80	N/A	N/A
Newburgh (T)	1.46	1.22	4.47	3.25	1990 - 1995
New Windsor (T)	4.35	4.83	8.50	3.67	1990 - 1995
Stewart Airport	0.00	N/A	3.36	3.36	1990 - 1995
Port Jervis (C)	1.30	2.50	1.80	N/A	N/A
Tuxedo					
Tuxedo Park (V)	0.06	0.15	0.12	N/A	N/A
Tuxedo (UT)	0.04	0.10	0.20	0.10	2000 - 2005
part Sterling Forest (6)	0.00	N/A	1.15	N/A	N/A
Wallkill (T)(5)	2.28	4.14	4.77	0.63	2010 - 2015
Warwick					
Florida (V)	0.28	0.30	0.44	0.14	2000 - 2005
Greenwood Lake (V)	0.00	N/A	0.39	0.39	1995 - 2000
Warwick (V)	0.64	0.50	0.85	0.35	1990 - 1995
Warwick (UT)	0.24	0.39	0.97	0.58	1995 - 2000
part Sterling Forest (6)	0.00	N/A	0.76	N/A	N/A
Wawayanda (T)	0.04	0.25	0.48	0.23	2005 - 2010
Woodbury (T)	0.77	0.93	1.61	0.68	2005 - 2010
TOTALS	30	40	59	21	

NOTES:
(1) Where a STP is shared by communities, design flow is based upon fraction of population served in each community.
(2) Design flow for communities in OCSD1 are based upon estimated design flows found in the Moodna Intermunicipal Agreement, dated Sept 8, 1978. Use caution when applying design flow data for OCSD1, as designed flow allotments may not represent true flows from each community.
(3) Town of Goshen includes constant Orange County Home & Infirmary population of 1,400 people.
(4) Town of Mount Hope includes state and federal prison populations totaling 1,900 people.
(5) Town of Wallkill includes Goshen jail population of 1,800 people for years 2000-2020.
(6) Sterling Forest treatment deficit is not applicable, as independent construction of facilities is planned.

their level of treatment in order to provide the effluent quality necessary for compliance with the revised standards. An example of existing sewage treatment facilities in Orange County discharging to receiving waters that will be affected by the proposed NYSDEC water body reclassification is presented in Table 10-2.

As shown, several of the facilities that will require attention are both in projected growth areas and likely to have future shortfalls in treatment capacity (e.g., OCSD#1, Florida and Warwick STPs). Therefore, communities served by these facilities may be faced with both expansion and upgrade requirements due to positive population growth, projected treatment deficits and tighter restrictions on effluent discharge. The problem may be exacerbated based on effluent loading limitations on particular water bodies. Chapter 11 of the Study examines the waste assimilative capacity of Orange County's water bodies.

10.3 Conceptual Development of Alternative Actions

There are many alternatives available to address the sewage management needs of the 40 towns, villages, and cities of Orange County. Alternatives can range from choosing no action, to implementing one very large central facility to treat wastewater from the entire County. The number of intermediate possibilities are limitless. To narrow these down, conceptual alternatives have been developed under the principle that they must be technically feasible and based upon sound engineering judgement.

For the purposes of this Study, it is presumed that sewage is primarily domestic in nature. Therefore, metals, inorganic and volatile organic compounds are considered not present in sufficient enough quantities to disrupt treatment or require special removal. This decision is based upon the continued fulfillment of the urban-rural growth concept, the refined planning projections presented in Chapter 8 and the future use of industrial pre-treatment programs to minimize industrial wastewater contributions.

It is neither practical nor possible to provide sewage collection and treatment to the entire County during the planning Study period. On the other hand, not all communities can be adequately serviced by individual subsurface disposal systems. Thus, the development of conceptual alternatives is shaped by the individual needs of each community, through consideration of growth projections, adequacy of existing facilities, and level of treatment required to meet discharge standards. The Orange County Sewer Committee helped provide valuable insight into individual community needs.

TABLE 10-2

STPs THAT DISCHARGE TO WATER BODIES AFFECTED BY NYSDEC RECLASSIFICATIONS

EXISTING STP	RECEIVING WATER BODY	PROPOSED RECLASSIFICATION (1)	UPGRADE REQUIRED (2)
Florida	Quaker Creek	from D to C	SEC to ADV(L)
Goshen	Rio Grande	from D to C	None: maintain ADV(L)
OCSD#1	Ramapo River	from D to C	ADV(L) to ADV(H)
Maybrook	Otter Kill Trib.	from D to C	SEC to ADV(L)
Pine Bush	Shawangunk Kill	from B to B(T)	None: maintain ADV(L)
Tuxedo Park	Warwick Brook	from D to C	SEC to ADV(L)
Warwick (UT)	Longhouse Creek	from B(T) to B(TS)	None: maintain ADV(L)

(1) Water body classifications are defined in Table 11-1.
(2) Assumes no expansion of capacity at existing STP. Levels of treatment are defined in Section 10.5.

A comprehensive listing of 92 conceptual alternatives identified for Orange County municipalities is shown in Table 10-3. These conceptual alternatives are categorized by local, regional and central treatment capabilities. A concise identification of these conceptual alternative categories is presented in the next section.

10.4 Identification of Alternative Actions for Sewage Treatment

The conceptual alternative actions developed by this Study can be identified by three categories of service: local, regional and central. These three categories are noted on Table 10-3. A discussion of each follows.

10.4.1 Local Treatment

Local sewage treatment implies that individual municipalities will maintain, expand and/or upgrade existing facilities, or create new independent sewage service areas as necessary. These alternatives do not involve joint treatment with other municipalities. Local sewage treatment may be appropriate where anticipated growth patterns do not dictate the need for regional treatment.

A potential advantage of local sewage treatment is that the municipality can control its own destiny by being responsible for the operation and maintenance of its facilities. Another possible advantage is that local treatment plants are typically smaller than regional facilities and, as such, may be easier to site since they pose less impact on surrounding areas.

Potential disadvantages of local sewage facilities include the limited assimilation capacity of smaller, local receiving waters and lack of a broad customer base over which costs can be distributed.

It should be noted that local treatment also includes the expanded use of septic systems and/or package sewage treatment plants for large subdivisions in particular areas where the projections of future development do not warrant municipal collection and treatment.

10.4.2 Regional Treatment

Regional treatment alternatives are defined as projects serving more than one municipality. Regional facilities may be appropriate where areas of growth are not constrained by municipal boundaries, and sewage treatment can be achieved at a common location with effluent discharge to an acceptable receiving water body.

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TABLE 10-3

COMPREHENSIVE LIST OF DEVELOPED CONCEPTUAL ALTERNATIVES

Area	Locality	No.	Alternative	Type of Alternative	Municipalities Included (1)	2020 Projected Flow, mgd	Receiving Water Body	Present Level Of Treatment Provided (2)	2020 Level Of Treatment Required (2)
SOUTH	Greenwood Lake	1	new Trout Brook STP	local	Greenwood Lake	0.39	Trout B.	-	ADV(H)
		2	pipe & treat at OCSD#1 STP	regional	Greenwood Lake	0.39	Hudson R.	-	SEC
		3	pipe & treat at new Hudson R. STP	central	Greenwood Lake	0.39	Hudson R.	-	SEC
	Tuxedo (w/o SFC)	4	upgrade/expand STP	local	Tuxedo	0.20	Ramapo R.	SEC	ADV(L)
		5	pipe & treat at OCSD#1 STP	regional	Tuxedo, Tuxedo Park	0.20	Hudson R.	-	SEC
		6	pipe & treat at new Hudson R. STP	central	Tuxedo, Tuxedo Park	0.20	Hudson R.	-	SEC
	Tuxedo Park	7	upgrade STP	local	Tuxedo Park	0.12	Warwick B.	SEC	ADV(L)
		8	pipe & treat at OCSD#1 STP	regional	Tuxedo Park	0.12	Hudson R.	-	SEC
		9	pipe & treat at new Hudson R. STP	central	Tuxedo Park	0.12	Hudson R.	-	SEC
	Warwick (U) (w/o SFC)	10	upgrade/expand STP	local	Warwick (U)	0.97	Longhouse C.	ADV(L)	ADV(H)
		11	pipe & treat at Warwick (V) STP	regional	Warwick (U)	0.97	Wawayanda C.	-	ADV(L)
		12	pipe & treat at Wallkill R. STP	regional	Warwick (U)	0.97	Wallkill R.	-	ADV(L)
		13	pipe & treat at OCSD#1 STP	regional	Warwick (U), Warwick (V)	1.82	Hudson R.	-	SEC
		14	pipe & treat at new Hudson R. STP	central	Warwick (U), Warwick (V)	1.82	Hudson R.	-	SEC
	Warwick (V)	15	upgrade/expand STP	local	Warwick (V)	0.85	Wawayanda C.	SEC	ADV(L)
		16	upgrade/expand STP for region	regional	Warwick (U), Warwick (V)	1.82	Wawayanda C.	SEC	ADV(L)
		17	pipe & treat at Wallkill R. STP	regional	Warwick (U), Warwick (V)	0.85	Wallkill R.	-	ADV(L)
		18	pipe & treat at OCSD#1 STP	regional	Warwick (V)	0.85	Hudson R.	-	SEC
		19	pipe & treat at new Hudson R. STP	central	Warwick (V)	0.85	Hudson R.	-	SEC
CENTRAL	Florida	20	upgrade/expand STP	local	Florida	0.44	Quaker C.	SEC	ADV(L)
		21	pipe & treat at OCSD#1 STP	regional	Florida	0.44	Hudson R.	-	SEC
		22	pipe & treat at Wallkill R. STP	regional	Florida, Warwick (U), Warwick (V)	2.26	Wallkill R.	-	ADV(L)
		23	pipe & treat at new Hudson R. STP	central	Florida	0.44	Hudson R.	-	SEC
	Goshen (U)	24	new Otter Kill C. STP	local	Goshen (U)	0.95	Otter Kill C.	-	ADV(H)
		25	pipe & treat at (V) STP	regional	Goshen (U)	0.95	Rio Grande C.	-	ADV(H)
		26	pipe & treat at (V) STP w/ Wallkill dis	regional	Goshen (U)	0.95	Wallkill R.	-	ADV(L)
		27	pipe & treat at OCSD#1 STP	regional	Goshen (U), Goshen (V)	2.03	Hudson R.	-	SEC
		28	pipe & treat at Wallkill R. STP	regional	Goshen (U)	0.95	Wallkill R.	-	ADV(L)
		29	pipe & treat at new Hudson R. STP	central	Goshen (U), Goshen (V)	2.03	Hudson R.	-	SEC
	Goshen (V)	30	maintain STP for Village only	local	Goshen (V)	1.08	Rio Grande C.	ADV(L)	ADV(L)
		31	upgrade/expand STP for region	regional	Goshen (U), Goshen (V)	2.03	Rio Grande C.	ADV(L)	ADV(H)
		32	expand & pipe to Wallkill R.	regional	Goshen (U), Goshen (V)	2.03	Wallkill R.	ADV(L)	ADV(L)
		33	pipe & treat at OCSD#1 STP	regional	Goshen (V)	1.08	Hudson R.	-	SEC
		34	pipe & treat at Wallkill R. STP	regional	Florida, Goshen (U), Goshen (V)	2.47	Wallkill R.	-	ADV(L)
		35	pipe & treat at new Hudson R. STP	central	Goshen (V)	1.08	Hudson R.	-	SEC

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 10-3

COMPREHENSIVE LIST OF DEVELOPED CONCEPTUAL ALTERNATIVES

Area	Locality	No.	Alternative	Type of Alternative	Municipalities Included (1)	2020 Projected Flow, mgd	Receiving Water Body	Present Level Of Treatment Provided (2)	2020 Level Of Treatment Required (2)
CENTRAL	Hamptonburgh	36	new Otter Kill C. STP	local	Hamptonburgh	0.05	Otter Kill C.	-	ADV(L)
		37	new septic, package STPs as required	local	Hamptonburgh	0.05	various	-	varies
		38	pipe & treat at Wallkill R. STP	regional	Hamptonburgh	0.05	Wallkill R.	-	ADV(L)
		39	pipe & treat at new Hudson R. STP	central	Hamptonburgh	0.05	Hudson R.	-	SEC
	OCSD#1 & MBSR	40	expand STP & pipe to Hudson R.	central	Blooming Grove, Chester (U&V), Florida, Goshen (U&V), Greenwood Lk, Harriman, Kiryas Joel, Monroe (U&V), Tuxedo (U&V), Warwick (U&V), Woodbury	14.54	Hudson R.	ADV(L)	SEC
		41	pipe & treat at New Windsor STP	regional	Blooming Grove, Chester (U&V), Greenwood Lk, Harriman, Kiryas Joel, Monroe (U&V), Woodbury	9.93	Hudson R.	-	SEC
		42	pipe & treat at new Hudson R. STP	central	Blooming Grove, Chester (U&V), Greenwood Lk, Harriman, Kiryas Joel, Monroe (U&V), Tuxedo (U&V), Woodbury	10.25	Hudson R.	-	SEC
	OCSD#1 alone	43	upgrade/expand STP	regional	Harriman, Kiryas Joel, Monroe (V), part Monroe (U)	4.57	Ramapo R.	ADV(L)	ADV(H)
	MBSR alone	44	pipe & treat at new Moodna C. STP	regional	Blooming Grove, Chester (U&V), part Monroe (U), Woodbury	4.97	Moodna C.	-	ADV(H)
		45	pipe & treat at Washingtonville STP	regional	Blooming Grove, Chester (U&V), part Monroe (U), Woodbury	4.97	Moodna C.	-	ADV(H)
		46	pipe & treat at new Hudson R. STP	regional	Blooming Grove, Chester (U&V), part Monroe (U), Woodbury	4.97	Hudson R.	-	SEC
	Washingtonville	47	upgrade/expand STP	local	Washingtonville	0.90	Moodna C.	SEC	ADV(L)
		48	upgrade/expand STP for region	regional	Blooming Grove, Chester (U&V), part Monroe (U), Washingtonville, Woodbury	5.87	Moodna C.	SEC	ADV(H)
		49	new Moodna C. STP for region	regional	Blooming Grove, Chester (U&V), part Monroe (U), Washingtonville, Woodbury	5.87	Moodna C.	-	ADV(H)
		50	pipe & treat at new Hudson R. STP	central	Blooming Grove, Chester (U&V), Florida, Goshen (U&V), Greenwood Lk, Hamptonburgh, Harriman, Kiryas Joel, Monroe (U&V), Tuxedo (U&V), Warwick (U&V), Washingtonville, Woodbury	15.49	Hudson R.	-	SEC

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 10-3

COMPREHENSIVE LIST OF DEVELOPED CONCEPTUAL ALTERNATIVES

Area	Locality	No.	Alternative	Type of Alternative	Municipalities Included (1)	2020 Projected Flow, mgd	Receiving Water Body	Present Level Of Treatment Provided (2)	2020 Level Of Treatment Required (2)
WEST	Deerpark	51	new Neversink R. STP	local	Deerpark	0.08	Neversink R.	-	SEC
		52	new septic, package STPs as required	local	Deerpark	0.08	various	-	varies
		53	pipe & treat at Port Jervis STP	regional	Deerpark	0.08	Neversink R.	-	SEC
	Greenville	54	new Rutgers C. STP	local	Greenville	0.06	Rutgers C.	-	ADV(L)
		55	new septic, package STPs as required	local	Greenville	0.06	various	-	varies
		56	new regional Rutgers C. STP	regional	Greenville	0.06	Rutgers C.	-	ADV(L)
	Middletown	57	maintain STP	local	Middletown	5.89	Wallkill R.	ADV(L)	ADV(L)
	Minisink / Unionville	58	new So. Wallkill R. STP	local	Minisink, Unionville	0.06	Wallkill R.	-	SEC
		59	new Rutgers C. STP	local	Minisink, Unionville	0.06	Rutgers C.	-	ADV(L)
		60	new septic, package STPs as required	local	Minisink, Unionville	0.06	various	-	varies
	Mount Hope / Otisville	61	upgrade/expand STPs	local	Mt. Hope, Otisville	0.56	Shawangunk K.	SEC	ADV(H)
		62	new septic, package STPs as required	regional	Mt. Hope, Otisville	0.56	various	-	varies
		63	new regional Shawangunk K. STP	regional	Mt. Hope, Otisville	0.56	Shawangunk K.	-	ADV(H)
	Port Jervis	64	maintain STP	local	Port Jervis	1.80	Neversink R.	SEC	SEC
		65	maintain STP for region	regional	Deerpark, Port Jervis	1.88	Neversink R.	SEC	SEC
	Wallkill	66	expand STP	local	Wallkill	4.77	Wallkill R.	ADV(L)	ADV(L)
		67	expand STP for region	regional	Florida, Goshen (U&V), Wallkill, Wawayanda	7.72	Wallkill R.	ADV(L)	ADV(L)
	Wallk/Middtn Area	68	new mid-Wallkill R. STP for region	regional	Florida, Goshen (U&V), Wawayanda	2.95	Wallkill R.	-	ADV(L)
	Wawayanda	69	new mid-Wallkill R. STP	local	Wawayanda	0.48	Wallkill R.	-	ADV(L)
		70	pipe & treat at new mid-Wallkill R. STP	regional	Wawayanda	0.48	Wallkill R.	-	ADV(L)
		71	pipe & treat at Wallkill R. STP	regional	Wawayanda	0.48	Wallkill R.	-	ADV(L)
NORTH	Crawford	72	expand STP	local	Crawford	0.27	Shawangunk K.	ADV(L)	ADV(L)
	Maybrook	73	upgrade STP	local	Maybrook	0.35	Otter Kill C.Tr.	SEC	ADV(L)
		74	pipe & treat at Montgomery V. STP	regional	Maybrook	0.35	Wallkill R.	-	ADV(L)
	Montgomery (U)	75	upgrade/expand STP	local	Montgomery (U)	0.54	Maybrook Res.Tr.	ADV(L)	ADV(L)
		76	new No. Wallkill R. STP	local	Montgomery (U)	0.54	Wallkill R.	-	SEC
		77	pipe & treat at Montgomery V. STP	regional	Maybrook, Montgomery (U)	0.89	Wallkill R.	-	ADV(L)

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 10-3

COMPREHENSIVE LIST OF DEVELOPED CONCEPTUAL ALTERNATIVES

Area	Locality	No.	Alternative	Type of Alternative	Municipalities Included (1)	2020 Projected Flow, mgd	Receiving Water Body	Present Level Of Treatment Provided (2)	2020 Level Of Treatment Required (2)
NORTH	Montgomery (V)	78	maintain STP only for local	local	Montgomery (V)	0.45	Wallkill R.	ADV(L)	ADV(L)
		79	expand STP for region	regional	Maybrook, Montgomery (U&V)	1.34	Wallkill R.	ADV(L)	ADV(L)
	Walden	80	maintain STP	local	Walden	1.02	Wallkill R.	SEC	SEC
EAST	Cornwall (U) / Cornwall (V)	81	expand STPs for region	local	Cornwall (U&V)	2.21	Moodna C.	SEC	SEC
		82	pipe & treat portion at New Windsor STP	regional	part Cornwall (U&V)	0.59	Hudson R.	-	SEC
		83	pipe & treat portion at new Hudson R. STP	central	part Cornwall (U&V)	0.59	Hudson R.	-	SEC
	Highland Falls	84	maintain STP	local	Highland Falls	0.54	Hudson R.	SEC	SEC
		85	maintain STP for region	regional	Highland Falls, Highlands	0.68	Hudson R.	SEC	SEC
	Highlands (w/o West Pt)	86	expand STP	local	Highlands	0.14	Hudson R.	SEC	SEC
		87	pipe & treat at Highland Falls STP	regional	Highlands	0.14	Hudson R.	SEC	SEC
	Newburgh (C) / Newburgh (U)	88	expand STP for region	regional	Newburgh (C&U)	9.27	Hudson R.	SEC	SEC
	New Windsor (w/ Stewart)	89	expand STP for region	regional	part Cornwall (U&V), New Windsor	12.00	Hudson R.	SEC	SEC
		90	expand STP to be central facility	central	Blooming Grove, Chester (U&V), part Cornwall (U&V), Greenwood Lk, Harriman, Kiryas Joel, Monroe (U&V), New Windsor, Woodbury	21.93	Hudson R.	SEC	SEC
	Hudson R. Area	91	new regional Hudson R. STP	regional	Blooming Grove, Chester (U&V), part Monroe (U), Washingtonville, Woodbury	5.87			
		92	new central Hudson R. STP	central	Blooming Grove, Chester (U&V), Florida, Goshen (U&V), Greenwood Lk, Hamptonburgh, Harriman, Kiryas Joel, Monroe (U&V), Tuxedo (U&V), Warwick (U&V), Washingtonville, Woodbury	15.49	Hudson R.	SEC	SEC

NOTES: (1) For "pipe & treat" options, municipalities included are those being piped from or through the locality. For "new/upgrade/expand STP" options, municipalities included are all participant municipalities.

(2) Levels of treatment are defined in Section 10.5.

Potential advantages of regionalization include the distribution of costs over a broader customer base (i.e., improved economy of scale), and the ability to either upgrade or expand treatment at a regional facility as opposed to several smaller, local facilities.

A potential disadvantage of regionalization is that a participating municipality may be required to relinquish some control to an adjacent municipality or regional district. Also, it may be more difficult to find a suitable site for a regional facility.

10.4.3 Central Treatment

Central treatment alternatives consider treatment for several municipalities at one facility with a substantial discharge to the best-suited receiving water body with the greatest waste assimilative capacity (i.e., the Hudson River). The expansion of existing sewage treatment facilities as well as the construction of new facilities are both considered.

Potential advantages and disadvantages of central treatment are similar to those for regional treatment. However, the potential for reduced costs through an even better economy of scale may be more significant.

10.5 Alternative Action Levels of Sewage Treatment

10.5.1 Description of Levels of Sewage Treatment

For this Study, three levels of sewage treatment quality are considered for applicability to Orange County's long-term needs. These three levels are:

- Secondary (SEC) treatment;
- Low Advanced (ADV(L)) treatment; and
- High Advanced (ADV(H)) treatment.

The choice of which level of sewage treatment is needed is based upon sewage flow quantities and effluent characteristics required to meet NYSDEC classifications for specific receiving water bodies.

SEC treatment is defined as achieving both 30 mg/l or less of BOD5 and 30 mg/l or less of total suspended solids (TSS) in the sewage effluent, or 85 percent removal of both BOD5 and TSS from the sewage influent, whichever is less. SEC treatment is typically applicable for sewage effluent discharge to a receiving water body classified as "effluent limiting". As such, SEC treatment is acceptable when the treated effluent discharged is less than one-twelfth of the minimum average 7-day flow with a recurrence interval of 10 years. This level of treatment is applicable to all NYSDEC water body classifications, except both trout and trout-spawning waters.

ADV(L) treatment is defined as achieving, in total, 10 mg/l or less of BOD5, 10mg/l or less of TSS and 2 mg/l or less (summer period only) of nitrate (NO_3) in the sewage effluent. ADV(L) treatment is typically applicable for sewage effluent discharge to a receiving water body classified as "water quality limiting". As such, ADV(L) treatment is acceptable when the treated effluent discharged is greater than one-twelfth of the minimum average 7-day flow with a recurrence interval of 10 years, provided that the effluent can be assimilated by the receiving water body without degradation per the NYSDEC classification.

ADV(H) treatment is defined as achieving, in total, 5 mg/l or less of BOD5, 5 mg/l or less of TSS and 1.3 mg/l or less (summer period only) of nitrate in the sewage effluent. ADV(H) treatment is applicable to a receiving water body classified as water quality limiting. As such, ADV(H) treatment is needed where ADV(L) treatment is insufficient to assure that the sewage effluent discharge can be assimilated by the receiving water body without degradation per the NYSDEC classification. ADV(H) treatment produces an effluent that meets ambient in-stream water quality standards as defined by NYSDEC.

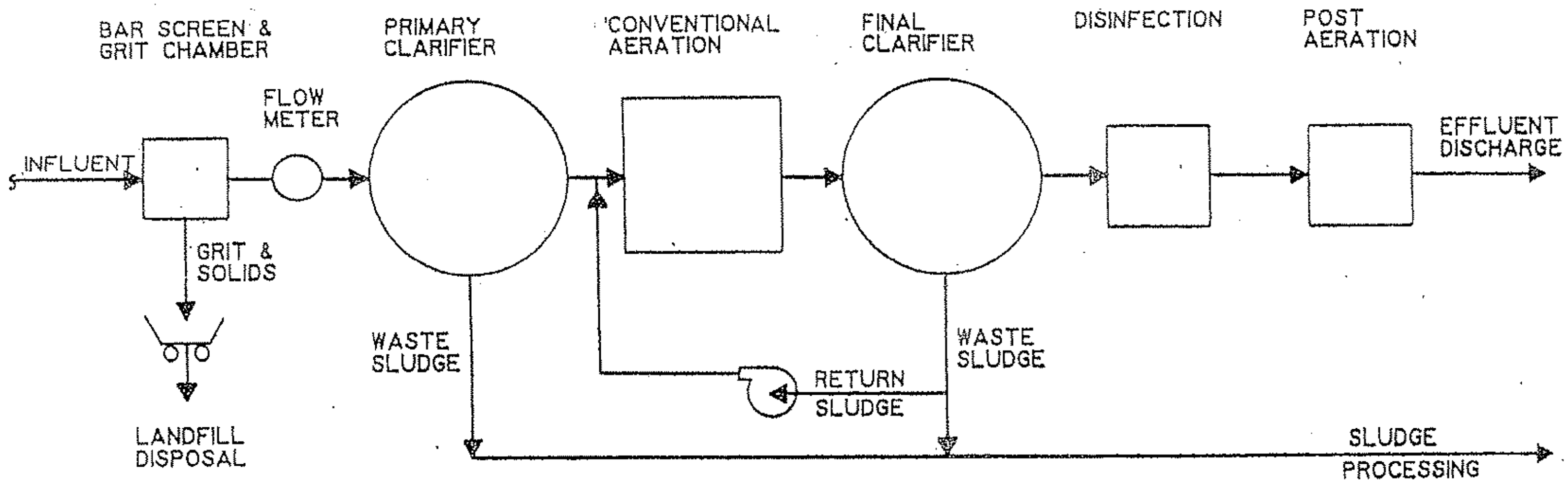
Figures 10-1, 10-2 and 10-3 illustrate typical process flowsheets for SEC, ADV(L) and ADV(H) levels of sewage treatment, respectively.

10.5.2 Levels of Treatment for Existing Sewage Treatment Facilities

The expansion and/or upgrade of existing sewage treatment facilities in Orange County to accommodate future needs will be necessary in some instances. For example, Table 10-2 delineated facilities that will be effected by proposed NYSDEC water body reclassifications.

For the alternative actions identified in this Chapter that involve the continued use of existing sewage treatment facilities, an assessment will be made about each individual facility with regard to both what modifications are required and what equipment is needed to achieve the level of treatment necessary for NYSDEC compliance. For instance, if an existing SEC level sewage treatment facility needs to be upgraded to ADV(L) treatment to

FIGURE 10-1



ORANGE COUNTY, N.Y.
COMPREHENSIVE SEWERAGE STUDY

SECONDARY TREATMENT PROCESS DIAGRAM

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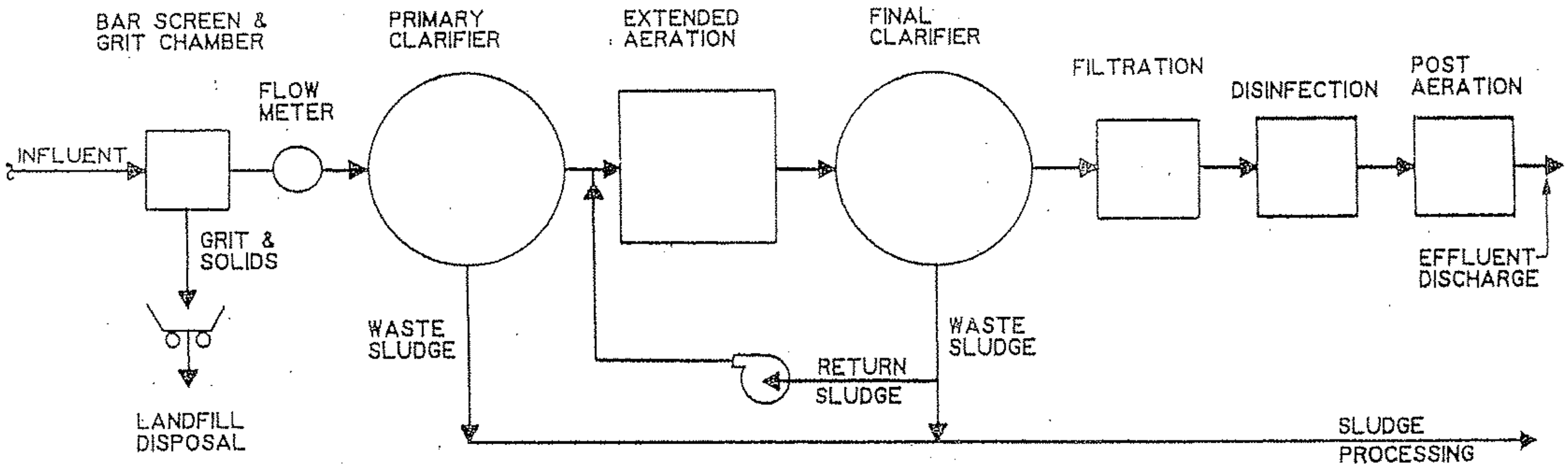
FIGURE 10-2



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ORANGE COUNTY, N.Y.
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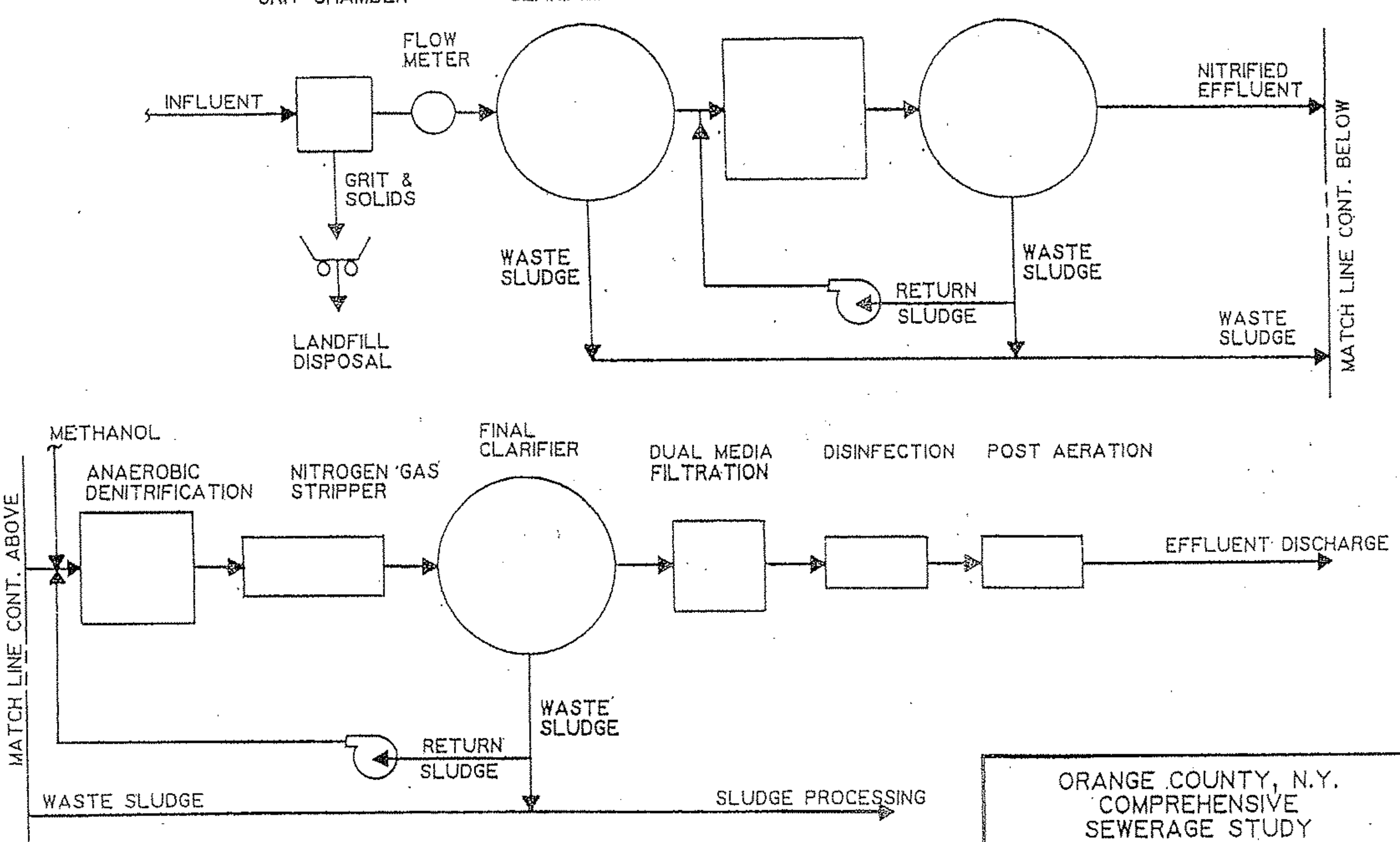
LOW ADVANCED TREATMENT PROCESS DIAGRAM

FIGURE 10-3



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ORANGE COUNTY, N.Y.
COMPREHENSIVE
SEWERAGE STUDY

HIGH ADVANCED TREATMENT
PROCESS DIAGRAM

132546

meet regulatory limits, a recommendation would include both new activated sludge reactors for nitrification and new automatic backwash sand filters.

Generally, it is preferable to upgrade and/or expand an existing sewage treatment facility rather than to abandon it and build a new facility. However, this is not always the case given such specific constraints as facility age and condition, room for expansion, capacity for growth and local economic resources to finance modifications. Therefore, this Study will carefully examine each existing facility identified for possible upgrade and/or expansion during the evaluation of identified alternative actions presented in Chapter 12.

10.5.3 Levels of Treatment for New Sewage Treatment Facilities

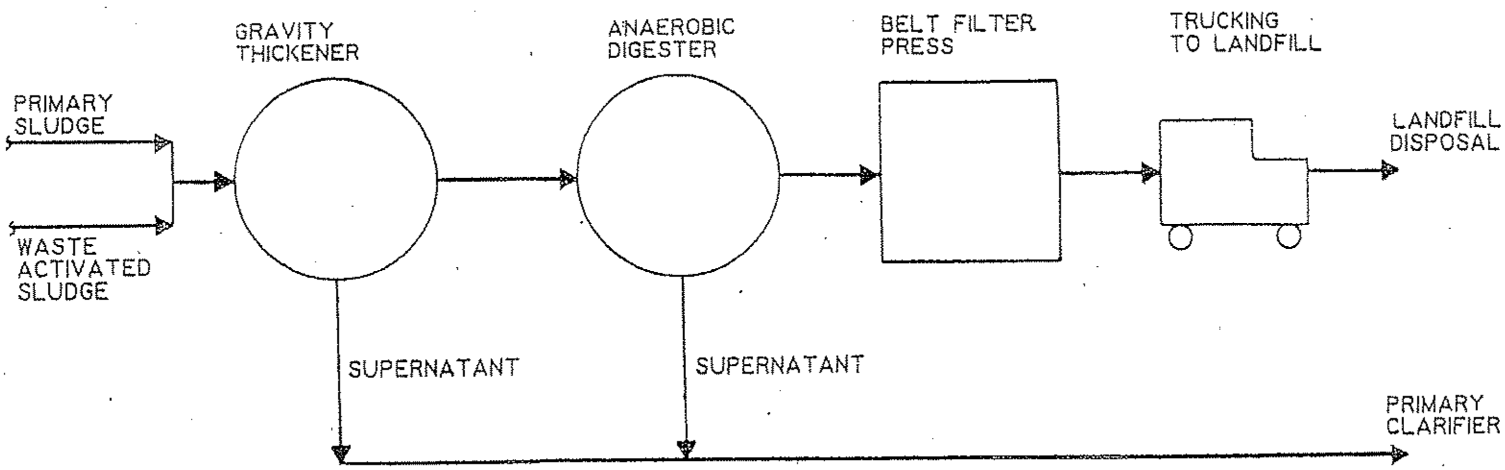
For the alternative actions identified in this Chapter that involve the use of new sewage treatment facilities, a Study basis must be defined with regard to what processes and levels of sewage treatment will be assumed. Alternative actions that require new sewage treatment facilities willfeature either SEC, ADV(L) or ADV(H) levels of treatment.

Common unit processes assumed for each of the three levels of sewage treatment considered for new sewage treatment facilities in this Study include:

- Flow metering;
- Screening;
- Grit removal;
- Primary clarification;
- Ultraviolet radiation disinfection;
- Post-aeration;
- Gravity sludge thickeners;
- Anaerobic sludge digestion; and
- Belt filter presses sludge dewatering.

In addition, new sewage treatment facilities being considered in this Study which utilize any of the three levels of treatment are assumed to transport the resulting sludge to the County's designated sewage sludge management facility. While this facility is currently the Orange County Landfill in the Town of Goshen, it is recognized in this Study that the future utilization and/or disposal of sewage sludge will be based upon recommendations from a separate sludge management plan acted upon by the County. Figure 10-4 illustrates a typical

FIGURE 10-4



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ORANGE COUNTY, N.Y.
COMPREHENSIVE SEWERAGE STUDY

SLUDGE PROCESSING DIAGRAM

process flowsheet for sewage sludge treatment.

Differences assumed between each of the three levels of sewage treatment considered for new sewage treatment facilities in this Study are discussed below.

SEC treatment is to be accomplished with the activated sludge process through the use of diffused aeration. Activated sludge is selected because the process can handle variations in loading and, in the event that an upgrade to advanced treatment becomes necessary in the future, it can be readily accomplished by both providing parallel tankage and increasing the return sewage sludge pumping capacity. This process would be located prior to final clarification, ultraviolet radiation disinfection and post-aeration.

ADV(L) treatment is to be accomplished with the extended aeration activated sludge process. This process achieves single-stage nitrification which effectively removes the carbonaceous and nitrogenous biochemical oxygen demand in one tank. Furthermore, the final clarifier effluent is to undergo filtration with dual media, automatic backwash sand filters, prior to ultraviolet radiation disinfection and post-aeration.

ADV(H) treatment is to be accomplished by a two-stage, activated sludge process. The extended aeration activated sludge process is to be used for the removal of carbonaceous and nitrogenous biochemical oxygen demand. Denitrification is to be accomplished in mixed anaerobic reactors followed by an aerated nitrogen stripping channel. The final clarifier effluent is to undergo filtration with dual media, automatic backwash sand filters, prior to ultraviolet radiation disinfection and post-aeration.

10.6 Identification of Alternative Sewage Collection Routes

The 92 individual sewage treatment alternative actions developed and identified in this Chapter require, to various degrees, a sewage collection pipe network. On the local level, existing municipal collection systems may suffice and the responsibility of maintaining and improving such collectors is that of the municipality. However, the categorization of some alternatives as either regional or central requires some new, properly located collection pipes. The identification of alternative sewage collection routes for regional and central treatment alternatives then is the objective of this section.

In structuring both regional and central treatment alternatives, only the most practical locations, in terms of perceived ease of construction and limited environmental impact, were selected for pipeline routes and pumping station sites. Figure 10-5 identifies alternative sewage collection pipeline routes and pumping station sites for the identified regional and central treatment alternatives. A brief description of each pipeline route follows (refer to Figure 10-5).

10.6.1 Greenwood Lake to Monroe

This pipeline is designated Pipe Route 1. This pipeline follows County Route 5 from Greenwood Lake at State Route 17A, to an abandoned railroad right-of-way (ROW) in the Village of Monroe, where it connects to Pipe Route 2. The first section of this pipe consists of a pumping station (designated PS 1.1) and about 31,000 feet of force main from Route 17A to School Road in the Town of Monroe. The second section of this pipe consists of 17,000 feet of gravity interceptor from School Road to the railroad ROW.

10.6.2 Greenwood Lake to Warwick

This pipeline is designated Pipe Route 1A. This pipeline follows County Route 5 from Greenwood Lake at State Route 17A to a proposed Trout Brook STP site, behind the Middle School on Route 5 in Warwick. This pipe route requires a pumping station (designated PS 1A.1) and approximately 14,000 feet of force main.

10.6.3 Harriman to Chester

This pipeline is designated Pipe Route 2. This pipeline generally follows an abandoned railroad ROW from the OCSD#1 STP in Harriman to a proposed pumping station site in the Town of Chester, near Camp LaGuardia. The first section of this pipe requires a pumping station (designated PS 2.1) and approximately 13,000 feet of force main from OCSD#1 STP to the intersection of Pipe Route 1 at Lake Street. The second section of this pipe consists of 20,000 feet of gravity interceptor along the ROW from Lake Street to Chester.

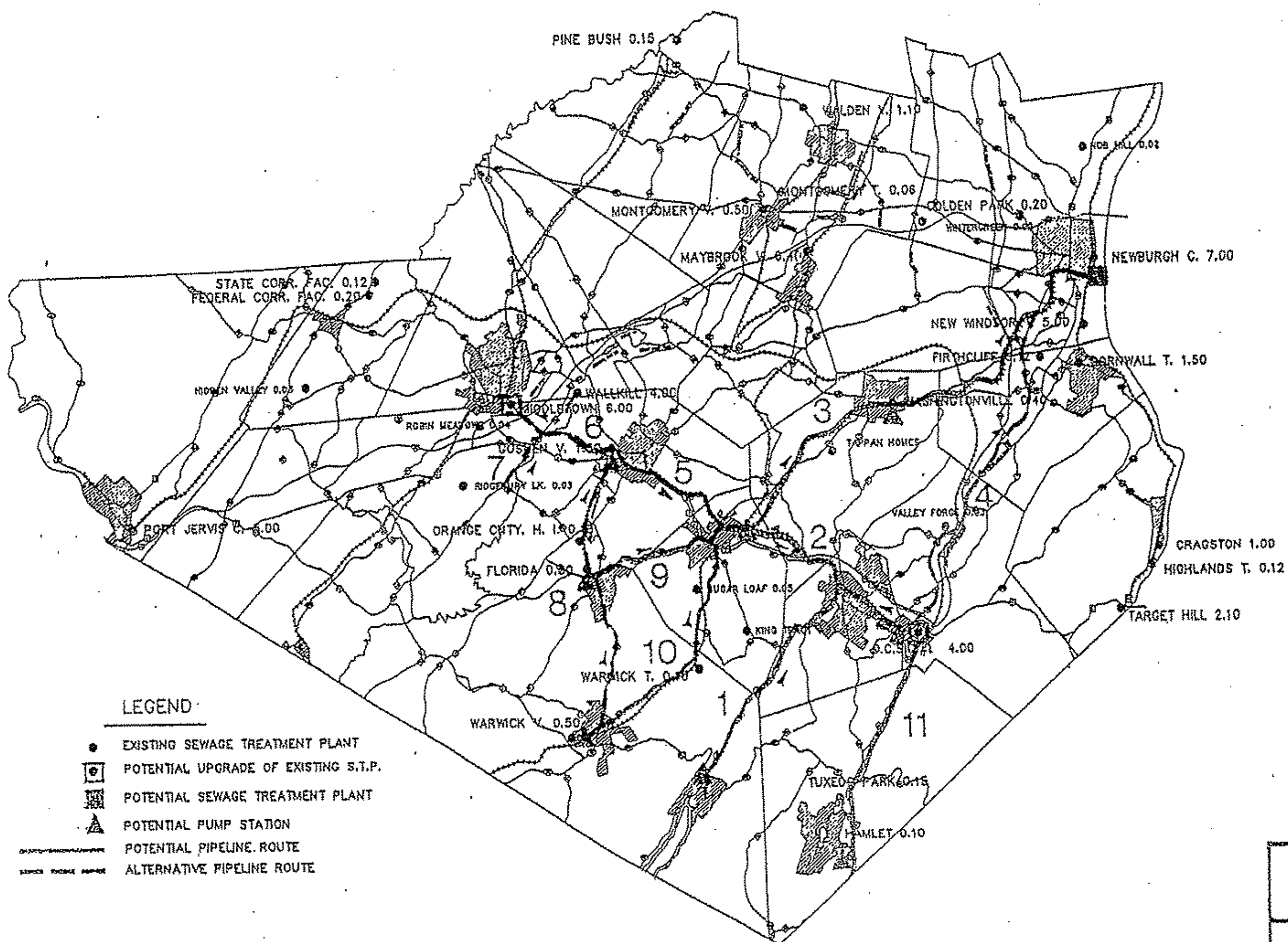
10.6.4 Chester to Harriman

This pipeline is designated Pipe Route 2A. This pipeline follows the same path as Pipe Route 2, but in the reverse direction. Accordingly, the first section of this pipe requires a pumping station (designated PS 2A.1) and 20,000 feet of force main, and the second section of this pipe consists of 13,000 feet of gravity interceptor to the OCSD#1 STP.

10.6.5 Chester to New Windsor

This pipeline is designated Pipe Route 3. This pipeline follows an abandoned railroad ROW, from a proposed pumping station site near Camp LaGuardia in the Town of Chester, to a

FIGURE 10-5



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central sewage treatment plant site in the Town of New Windsor. The first section of this pipe requires a pumping station (designated PS 3.1) and about 40,000 feet of force main from Camp LaGuardia to the Village of Washingtonville. The second section of this pipe consists of about 57,000 feet of pressure sewer from Washingtonville to a central STP site in New Windsor. The third section of this pipe serves to connect Washingtonville to the second section of pipe and consists of a pumping station (designated PS 3.3) and about 1,000 feet of force main.

10.6.6 Harriman to New Windsor

This pipeline is designated Pipe Route 4. This pipeline follows State Route 32 from the OCSD#1 STP in Harriman to a proposed effluent outfall or STP site in New Windsor. The route consists of a pumping station (designated PS 4.1) and approximately 85,000 feet of force main.

10.6.7 Goshen to Chester

This pipeline is designated Pipe Route 5. This pipeline generally follows an abandoned railroad ROW from the Village of Goshen STP to the proposed pump station (designated PS 3.1) in the Town of Chester. The route consists of a pumping station (designated PS 5.1) and about 36,000 feet of force main.

10.6.8 Goshen to Middletown/Wallkill

This pipeline is designated Pipe Route 6. This pipeline generally follows an abandoned railroad ROW from the Village of Goshen STP to either the Middletown or Wallkill STPs. The first section of pipe consists of a pumping station (designated PS 6.1) and 11,000 feet of force main to the Wallkill River. The second section of pipe consists of about 14,000 feet of force main from the Wallkill River to either the Middletown or Wallkill STPs.

10.6.9 Wawayanda to Wallkill

This pipeline is designated Pipe Route 7. This pipeline runs along County Route 50 and an abandoned railroad ROW from Denton Hill Road to the Wallkill River at Echo Lake. The first section of pipe requires a pumping station (designated PS 7.1) and 3,000 feet of force main in paved roads. The second section of pipe calls for 6,000 feet of force main in the railroad ROW.

10.6.10 Warwick to Goshen

This pipeline is designated Pipe Route 8. This pipeline follows State Route 17A and an abandoned railroad ROW from the Village of Warwick STP, past the Village of Florida STP, and north to meet Pipe Route 6 at the Village of Goshen STP. The first section of pipe requires a pumping station (designated PS 8.1) and 36,000 feet of force main. The second section of pipe requires 28,000 feet of force main.

10.6.11 Florida to Chester

This pipeline is designated Pipe Route 9. This pipeline mainly follows State Route 94 from the Village of Florida STP to the proposed pumping station (designated PS 3.1) in the Town of Chester. The route entails a pumping station (designated PS 9.1) and 35,000 feet of force main.

10.6.12 Warwick to Chester

This pipeline is designated Pipe Route 10. This pipeline generally follows County Route 13 from the Village of Warwick STP to the proposed pumping station (designated PS 3.1) in the Town of Chester. The route entails a pumping station (designated PS 10.1) and 62,000 feet of force main.

10.6.13 Tuxedo to Harriman

This pipeline is designated Pipe Route 11. This pipeline follows State Route 17 from the Town of Tuxedo's Hamlet STP to the OCSD#1 STP in Harriman. The route consists of a pumping station (designated PS 11.1) and 51,000 feet of force main.

10.7 Summary

The preceding demonstrates that much of Orange County faces a genuine need for expanded and/or upgraded sewage treatment facilities during the Study planning period. The elements of continued population growth, more stringent receiving water body regulations, and projected deficiencies of existing sewage treatment facilities each contribute to the realization of this need.

To initiate the discussion of what course of action is most appropriate for each municipality in Orange County, a conceptual list of alternative actions was developed. The conceptual alternatives were further identified as 92 unique options categorized as local, regional and central treatment alternatives.

A brief discussion highlighted the benefits and drawbacks of each category of treatment: local, regional and central.

Most of the 92 options require either the modification of existing sewage treatment facilities or construction of new facilities. Various levels of sewage treatment were described and the applicability of each treatment level was discussed.

Specific alternative sewage collection routes were identified for both regional and central treatment alternatives.

CHAPTER 11

11.0 RECEIVING WATER QUALITY AND EFFLUENT LIMITATIONS

11.1 Introduction

This Chapter describes the process used to identify the capacity of selected drainage systems within Orange County to assimilate treated wastewater effluent. The results of water quality modeling are an aide for evaluating and prioritizing alternative discharge locations, volumes, and loadings and are used for this purpose in Chapter 12. The U.S. Environmental Protection Agency (USEPA) has provided guidance for waste assimilative capacity (WAC) analysis as one tool for developing water quality-based effluent limits.

Regulations promulgated in response to the Clean Water Act of 1972 set technology-based effluent treatment standards (BAT/BPT) in order to meet the national goal of fishable/swimmable waters. For municipal wastewater treatment plants, technology-based effluent limits (85+ percent BOD removal) could be achieved through secondary treatment technology. However, as discharges to surface water began to meet these technology-based levels of treatment under National Pollutant Discharge Elimination System (NPDES) permitting, experience indicated for conditions in many receiving waters that these levels of treatment were not adequate to achieve numerical and descriptive ambient (instream) water quality standards and criteria. The 1987 revision of the Clean Water Act redirected regulatory agency efforts and the permitting process toward ambient water quality-based effluent limits in order to achieve designated water uses (Figure 11-1). WAC analysis, waste load allocation, and whole effluent toxicity testing have become the tools used to assess and assure compliance with water quality-based effluent limits.

In New York, the classification of use and associated numerical standards for surface waters (Table 11-1) are defined in the Water Quality Regulations (NYCRR Title 6, Chapter X, Parts 700-702, 704, and 705). The New York State Department of Environmental Conservation (NYSDEC) sets NPDES permit limits for discharges to surface water with the objective of maintaining or improving water quality to achieve the minimum ambient standards set for the stream classification to which the effluent is discharged. As part of a state-wide review of water quality standards and surface water use classifications, NYSDEC has proposed reclassification for many stream segments in the lower Hudson River and Passaic-Newark drainage basins in Orange County (Appendix B).

The majority of these proposals involve reclassification of Class D segments to Class C and are currently undergoing agency review and public comment. NYSDEC Division of Water Quality has indicated that, although no firm deadline exists, those proposed reclassifications which are accepted

FIGURE II-1

WASTE ASSIMILATIVE CAPACITY ANALYSIS

REGULATORY HISTORY/BASIS

Clean Water Act of 1972

Technology Based Effluent Limits
- Secondary Treatment
- 85 % + BOD Removal

Ambient Water Quality Standards not consistently achieved through technology alone

Clean Water Act of 1987

Water Quality Based Effluent Limits
- WAC Analysis
- Whole Effluent Toxicity
- Waste Load Allocations

FACTORS EVALUATED	REGULATORY STANDARD
Ultimate Biochemical Oxygen Demand (UBOD) Carbonaceous Oxygen Demand (CBOD) Nitrogeous Oxygen Demand (NBOD)	Dissolved Oxygen Standards
Ammonia	Ammonia Toxicity Standards
Other Toxics (Whole Effluent Toxicity) Metals Organics Etc.	Ambient WQ Standards Acute/Chronic Criteria

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Regulatory background and basis for level of treatment for wastewater effluent to acheive ambient water quality standards.

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TABLE 11-1

SUMMARY OF NEW YORK STATE SURFACE WATER CLASSIFICATION (FRESHWATER) BEST USE AND ASSOCIATED WATER QUALITY STANDARDS

CLASS A	CLASS C
Best Use: Drinking water supply. Any other use. Water Quality Standards 1. pH – 6.5-8.5 2. DO: Trout spawning- minimum of 7 mg/l at any time Trout waters- daily average minimum 6 mg/l instantaneous minimum 5 mg/l Non-trout waters- daily average minimum 5 mg/l instantaneous minimum 4 mg/l 3. TDS – $\leq$ 500 mg/l 4. Ammonia - @ pH = 7.5, T = 10C, NH_3 = 3.78 mg/l T = 25C, NH_3 = 1.25 mg/l 5. Nitrite: Trout waters - 0.02 mg/l Non-trout waters - 0.1 mg/l 6. Nitrate – 10 mg/l	Best Use: Fishing and Fish Propagation. Secondary Contact Recreation. All other uses except drinking water supply and primary contact recreation. Water Quality Standards: 1. pH – 6.5-8.5 2. DO – Same as Class A 3. TDS – Same as Class B 4. Ammonia – Same as Class A 5. Nitrite – Same as Class A 6. Nitrate – N/A
CLASS B	**CLASS D**
Best Use: Primary contact recreation. Any other use except drinking water supply. Water Quality Standards: 1. pH – 6.5-8.5 2. DO – Same as Class A 3. TDS – If presently < 500 mg/l, not to exceed 500 mg/l and not to interfere with growth and progagation 4. Ammonia – Same as Class A 5. Nitrite – Same as Class A 6. Nitrate - N/A	Best Use: Fishing and Fish Progagation. Secondary Contact Recreation. Not conducive to propagation of game fishery or fish due to natural conditions: • intermittant flow • bed structure • water conditions. Water must be suitable to fish survival. Water Quality Standards: 1. pH – 6.5-9.5 2. DO – Instantaneous minimum, 3 mg/l 3. Ammonia @ pH = 7.5: T = 10C, NH_3 = 15.5 mg/l T = 25C, NH_3 = 5.15 mg/l 4. TDS, Nitrite, Nitrate – N/A

Source: NYSDEC

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are likely to become final during late 1990 to 1991.

A review of the New York State Pollutant Discharge Elimination System (SPDES) permit conditions for the major municipal sewage treatment plants in Orange County indicate considerable variability among current permits in those water quality parameters with written discharge limits or monitoring requirements; units in which limits are written (loadings versus concentration); and the magnitude of limits. The reliability of these facilities in complying with these limits is also quite variable based on review of the discharge monitoring reports (DMRs) and monthly facility reports (MFRs). The majority of permits have a limit for some measure of biochemical oxygen demand (BOD) and ammonia. Since most of the municipal facilities have no or minimal industrial influent, few have any limits or monitoring requirements for organic or inorganic toxic materials. For the purpose of screening the relative suitability of alternative treatment plant sites, the focus of this Study has been on the ambient dissolved oxygen (DO) and ammonia standards.

11.2 Conceptual Approach

The level of sophistication in various WAC models can range from very simplistic desk-top dilution ratio models to very complex hydrodynamic multidimensional models. The appropriate model for a given situation depends on the available data and study objectives, which in this case are to screen alternatives, identify problematic sites, and assess a group of sites for potential expanded discharges based on water quality factors. A steady-state, one-dimensional model has been used to analyze those receiving waters for which adequate ambient water quality flow and time of transit data existed. At some sites with potential for regional treatment, additional cross-section flow data was collected in order to calibrate the flow balance portion of the model. Where little or no data were available, a simple analysis was used based on the dilution ratio of effluent flow to ambient flow.

Due to the tidal nature of the Hudson River in the vicinity of Orange County, a multi-dimensional, hydrodynamic model would be necessary to assess the WAC and interactions among other discharges or water withdrawals. The necessary data collection and modeling for such an analysis are beyond the scope of this Study; however, dilution capacity was assessed based on estimated fresh water flows at the Federal Dam at Troy, New York and the zone of tidal influence relative to NYSDEC guidelines for the treatment levels and effluent-limited receiving waters. Final discharge sites and engineering treatment alternatives will be identified in other sections of this document. Once these decisions are made, additional water quality data collection and more detailed analysis will likely be necessary to comply with the State Environmental Quality Review Act (SEQRA) regulations by means of an environmental impact study (EIS).

11.2.1 Dissolved Oxygen Standard

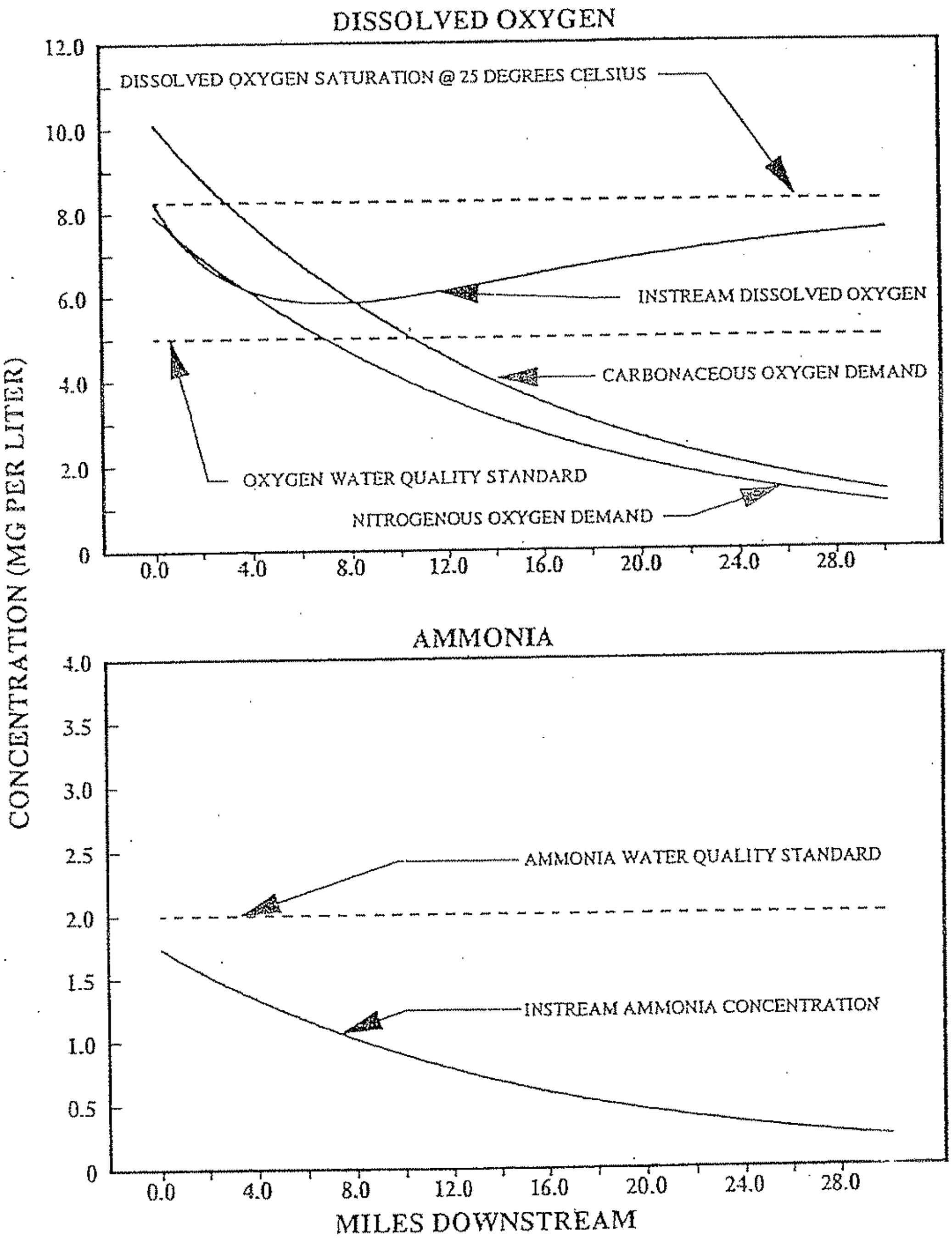
The primary mainstem surface waters in Orange County identified as potential regional alternative receiving waters are the Ramapo River, Wallkill River, Moodna Creek, and the Hudson River; one-dimensional models were developed for the first three of these waterbodies and a dilution ratio approach was used for the Hudson River. Secondary tributaries considered for local treatment included Wawayanda Creek, Woodbury Creek, and Shawangunk Kill for which dilution ratio analyses were used.

The one-dimensional model is used to predict dissolved oxygen (DO) along a stream reach (a length of stream within which conditions such as flow, gradient, and ambient water quality can reasonably be assumed to remain relatively constant) under steady-state conditions for specified stream and effluent water quality and quantity (Figure 11-2). The DO concentration in a stream reach is affected by a number of factors including water temperature, BOD, flow rate, and re-aeration rates. The DO saturation level is a function of water temperature and thus seasonal SPDES permit limits are written for many facilities. The observed or predicted instream DO will deviate from saturation as a result of interaction between DO losses (e.g., BOD decay, algal respiration, sediment oxygen demand, etc.) and DO gains (e.g., re-aeration, photosynthesis, etc.).

BOD is a measure of DO required for the biological oxidation (decay) of dissolved or particulate organic matter in the water column, and is the primary effluent water quality parameter influencing ambient DO from a regulatory perspective. The two primary components of BOD are nitrogenous (NBOD) and carbonaceous (CBOD) organic matter. Permits have been variably written throughout Orange County with limits and/or monitoring requirements for CBOD, NBOD, ultimate BOD (UOD), or 5-day BOD (BOD_5). Secondary wastewater treatment primarily reduces the CBOD component; significant reduction of NBOD requires some level of advanced treatment.

In a simple example, progressing downstream from a given point-source, instream BOD will decrease at some predictable rate. DO will also decrease to a minimum at some location downstream, and then begin to recover when the re-aeration exceeds deoxygenation (Figure 11-2). Modeling can be used to help predict the BOD loading (concentration multiplied by flow) at which the minimum predicted instream DO will not decline below the oxygen standard (e.g., instantaneous minimum of 5 mg/l for A, B, and C Class trout waters). In order to provide a level of safety, regulatory guidelines specify that WAC predictive modeling be conducted for

FIGURE II-2



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Example of typical projections from WAC analysis of dissolved oxygen and ammonia for a point source discharge.

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critical low flow conditions, the statistical MA7Q10 (the minimum average 7-day flow with a recurrence interval of 10 years). Engineering design criteria can then be selected to achieve these loading conditions.

11.2.2 Ammonia Standard

Ammonia is one component of the NBOD and can be particularly toxic to aquatic organisms. Ammonia discharge limits are related to ammonia toxicity standards which are a function of both pH and temperature of the receiving water. Whether a violation of the ambient water quality standard occurs is related to the dilution capacity of the receiving water and background ammonia levels. Relative to a point source discharge of ammonia, the highest associated instream concentration occurs within the regulatory-defined mixing zone; this maximum concentration must be maintained below the ambient standard. In the presence of DO, ammonia is oxidized to nitrite and then nitrate.

This decrease in ammonia downstream from the discharge can be modeled as demonstrated in Figure 11-2, and the effect of interactions between multiple point and non-point sources can be used to predict the location of possible violations of the ambient ammonia standards. The critical low flow conditions for ammonia WAC analysis is the MA30Q10 (the minimum average 30-day flow with a 10 year recurrence interval) and is less restrictive than the MA7Q10 used for DO predictions.

11.3 General Model Structure

The analytical approach selected for this Study is a one-dimensional, steady-state mathematical model to simulate the behavior of the hydrologic and water quality components of a stream system under various scenarios of sewage treatment plant (STP) discharges. While no model can capture the total complexity of stream water quality dynamics, models such as this can be of sufficient accuracy for assessment of the potential effects of discharges from STPs on basic water quality constituents of a stream or river (USEPA 1983). Such models can be used to define the level of treatment required to ensure that in-stream water quality conditions are not degraded to a point deleterious to humans or aquatic life. Such waste assimilative capacity analyses can be conducted prior to treatment plant design, thus avoiding potentially costly plant modifications or upgrades. For this Study, the primary concern was to insure that the effluent from any proposed STP additions or modifications would neither cause the in-stream dissolved oxygen concentrations to drop below, nor ammonia concentration to rise above, applicable stream water quality standards as established by the NYSDEC.

Four stream systems within Orange County were evaluated for waste assimilation capacity using this model (Table 11-2). Three of these systems (Wawayanda Creek, Moodna Creek, and Wallkill River) discharge to the Hudson River, while the fourth (Ramapo River) enters New Jersey at the southern border of Rockland County, ultimately discharging to Newark Bay through the Passaic River. Wawayanda Creek is a tributary of the Wallkill River, entering through Pochuck Creek at a point well upstream of the Middletown and Wallkill STPs. For each system, sections of concern were defined beginning just upstream of the first major STP discharge (existing or proposed) and extending downstream to a point were the stream exhibits almost complete recovery. Each of these sections of concern were then divided into reaches of similar hydrological and biological characteristics (Figure 11-3). These reaches can be of varying length depending on stream conditions. A steady-state model assumes that all input parameters are constant within each of these reaches, thus, it is important to set reach boundaries where such an assumption is likely to be correct.

For graphical and mathematical consistency, all model calculations were based upon segments of uniform length, each 0.1 mile long (Figure 11-4). Parameters for each of the model segments were assigned based upon the values for the stream reach containing that model segment. Consequently, all model segments within any specific stream reach would be assigned the same model parameters. The various STP and tributary inputs were assumed to enter at the head of each model segment and the predicted output from each model segment was used as an input to the next model segment downstream.

The values selected for each model parameter were based upon existing models developed for the Wallkill River (NYSDEC 1988), the Ramapo River (NYSDEC 1989), and Wawayanda Creek (NYSDEC 1990). As originally used, these models only addressed the effects of existing discharges to dissolved oxygen levels within each of these systems and not the expanded regional discharge options addressed in this report. While the results of the model runs presented in this report provide a means of comparing the potential effects of various treatment and discharge options, they should not be viewed as a final assessment of the water quality impacts of any proposed discharge level. Such an assessment requires compilation of more detailed site-specific data for model parameter estimation as well as a calibration of the model to existing stream conditions.

11.3.1 Model Inputs

The principal input to each model segment is water flow, whether it originates from upstream, tributaries, STPs, or other sources. For this assessment, flow was incorporated using advective mass-balance equations in which the flow leaving any model segment was assumed to be the

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 11-2

SUMMARY OF GEOGRAPHIC BOUNDARIES AND LENGTH OF MODELED REACHES OF ORANGE COUNTY RECEIVING WATERS EVALUATED FOR WAC USING ONE-DIMENSIONAL STEADY-STATE MODEL

RECEIVING STREAM	UPSTREAM BOUNDARY	DOWNSTREAM BOUNDARY	LENGTH (Miles)
Ramapo River	NYS Route 17M Village of Harriman	NY/NJ State Line	22.5
Moodna Creek	Entrance of Satterly Creek (2.6 miles above Washingtonville STP)	200 ft. elevation (0.2 miles below Woodbury Creek)	10.2
Wallkill River	Echo Lake Road Bridge Town of Wallkill	5 miles below Walden STP	23.5
Wawayanda Creek	Source at Wickham Lake Town of Warwick	Junction with Pochuck Creek, Vernon Township, NJ	13.8

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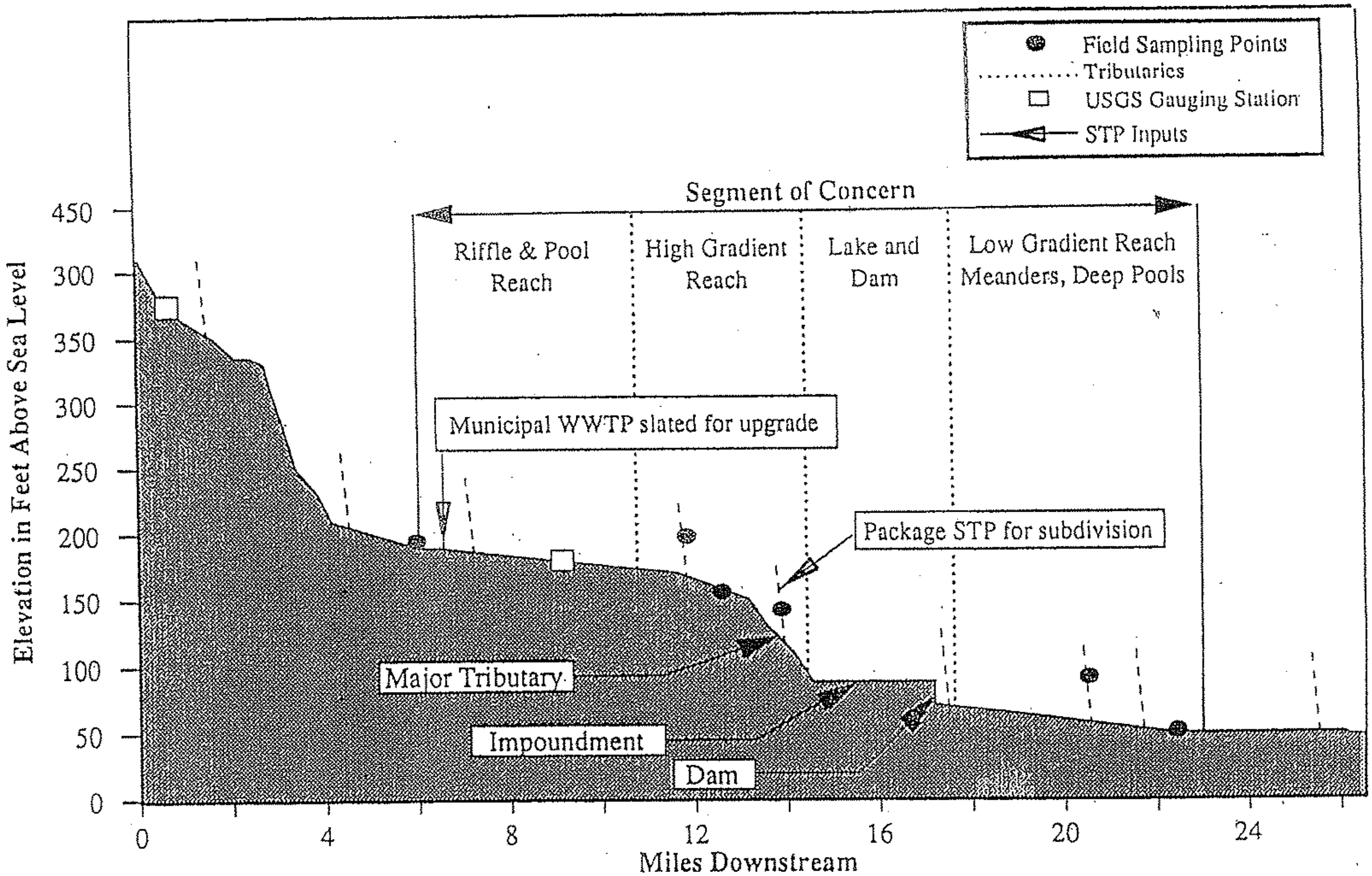
FIGURE II-3



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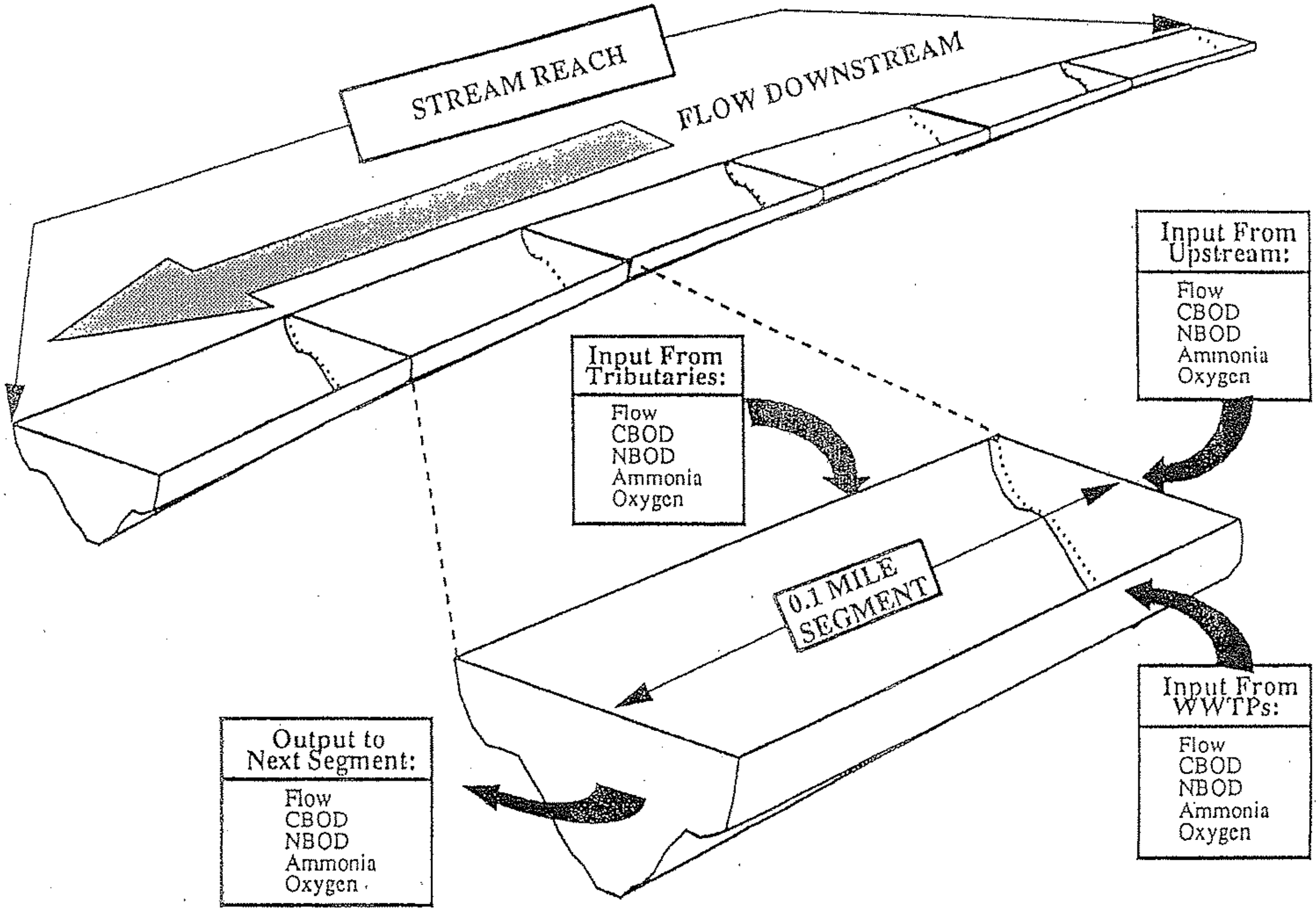
Longitudinal section of a hypothetical river showing divisions of section of concern based on physical features important to waste assimilation modeling.

FIGURE II - 4



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Schematic of model segmentation and inputs.

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sum of flows from all sources. Flow can have a pronounced effect upon model behavior through its effects on loading concentrations, in-stream velocity and resulting transport rates, and rate constants within each model segment.

For this assessment, flow rates in the mainstem of the stream, as well as for each tributary, were assumed to be MA7Q10 flows. These minimum flows which are available from the NYSDEC or USGS, most commonly occur during late summer or fall in Orange County. Use of this low flow assures that stream water quality parameters will be equal to or higher than that predicted by the model under all but the most extreme drought conditions. Flow from each STP was assumed to be equal to design flow for that plant.

Inputs of biochemical oxygen demand to each segment can come from upstream, tributaries, or STPs. This BOD can be divided into to components; those from carbonaceous sources and those from nitrogenous sources. While both of these sources of BOD reduce the oxygen content in a stream, the reaction rates for each are sufficiently different so that they must be treated separately in the modeling process.

For convenience, both total BOD and CBOD are typically measured over a 5-day period. However, their affects upon stream oxygen concentrations can continue for some time beyond five days. Consequently, this assessment was conducted using the full oxygen equivalency (ultimate oxygen demand or UOD) for each source. Where data on the ultimate oxygen demand was not available, ultimate CBOD is assumed equal to 2 times the 5-day CBOD value as observed under typical conditions. In all cases, ultimate NBOD was assumed to be equal to 4.57 times the total Kjeldahl nitrogen (TKN) concentration in the effluent. This assumption is based upon the requirement of 4.57 milligrams/liter (mg/l) of oxygen to completely oxidize organic nitrogen or ammonia to nitrates. For this assessment, TKN was assumed to be all as ammonia. Generally, 5-day CBOD and ammonia levels were assumed to be equal to current SPDES permit limits. Background levels for 5-day CBOD and ammonia were assumed to be 3.0 mg/l and 0.1 mg/l, respectively, for areas upstream of any point sources. The total ultimate oxygen demand is the sum of the CBOD and NBOD values.

The effects of proposed STP effluents on stream oxygen and ammonia concentrations are determined by the reaction rates for each of the effluent constituents. All reactions are assumed to follow first-order kinetics, with the rate constants determining the rate of change with respect to time for each modeled constituent. All rate constants are temperature dependent and are adjusted to the prevailing water temperatures within each stream segment. Rate constants are specified in limits per time (e.g., mg/liter/day), thus the velocity of the water within each model segment determines the amount of time a portion of water remains within each segment and, consequently, the effect each constituent will have within each model segment.

For this assessment, four reaction rate constants were define for each of the stream reaches. The BOD removal rate (K_r) determines the rate at which the total biochemical oxygen demand is removed from the water body per unit time. The CBOD oxidation rate (K_d) determines the rate at which the carbonaceous component of the BOD is oxidized by natural processes within each stream reach. Differences between the K_r and K_d rate constants are determined by the amount of physical settling of the BOD which can occur within each reach. For effluent treated at a secondary or higher level such that most of the BOD is in dissolved form, coupled with high gradient stream segments such as commonly found throughout Orange County, the K_r and K_d rate constants are assumed to be equal. The NBOD oxidation rate (K_n) determines the rate at which the nitrogenous component of the BOD is oxidized by natural processes within each stream reach. The K_n rate constant was also applied to ammonia concentrations within each stream reach. The re-aeration rate (K_a) determines the rate at which oxygen re-enters the stream from the atmosphere. For this assessment we have assumed that virtually all of the oxygen inputs are through physical processes and that additions through photosynthesis are negligible. Being a result of physical processes, K_a is affected by factors controlling the rate of gas transfer such as the surface-to-volume ratio, the water velocity, and turbulence for each reach. In the modeling process, K_a defines the rate at which dissolved oxygen concentrations recover from BOD inputs.

11.3.2 Model Outputs

Concentrations of CBOD, NBOD and ammonia were predicted for the beginning of each model segment. These concentrations include all inputs to that segment and assume complete mixing. Saturation dissolved oxygen concentrations were calculated based upon water temperatures, with lower water temperatures producing higher dissolved oxygen concentrations. The dissolved oxygen deficit (the difference between the saturation concentration of dissolved oxygen and the observed/predicted dissolved oxygen) produced by the predicted CBOD and NBOD concentrations was estimated using a modified classic Streeter-Phelps oxygen balance equation. Dissolved oxygen concentrations for each stream segment were calculated by subtracting the estimated dissolved oxygen deficit from the calculated temperature-specific saturation concentration. The resulting dissolved oxygen and ammonia concentration estimates for each of the segments of a stream section were then graphically compared to existing water quality standards for that stream section.

11.4 Ramapo River Basin

The Ramapo River originates in Orange County flowing south into Rockland County and New Jersey. The watershed is relatively narrow and transects the Ramapo Mountains in southeastern Orange County. Much of the drainage basin in Orange County is wooded, including portions of the Harriman State Park. The Ramapo River is currently classified B immediately upstream of the Orange County Sewer District No. 1 STP (OCSD#1 STP) summer outfall, Class D for the 1.4 miles between the summer and winter OCSD#1 outfalls, and Class A(T) below the winter outfall (Figure 11-5). The Class D reach has been nominated by the NYSDEC for upgrade to Class C; this reclassification is likely to occur during late 1990 or early 1991 according to NYSDEC.

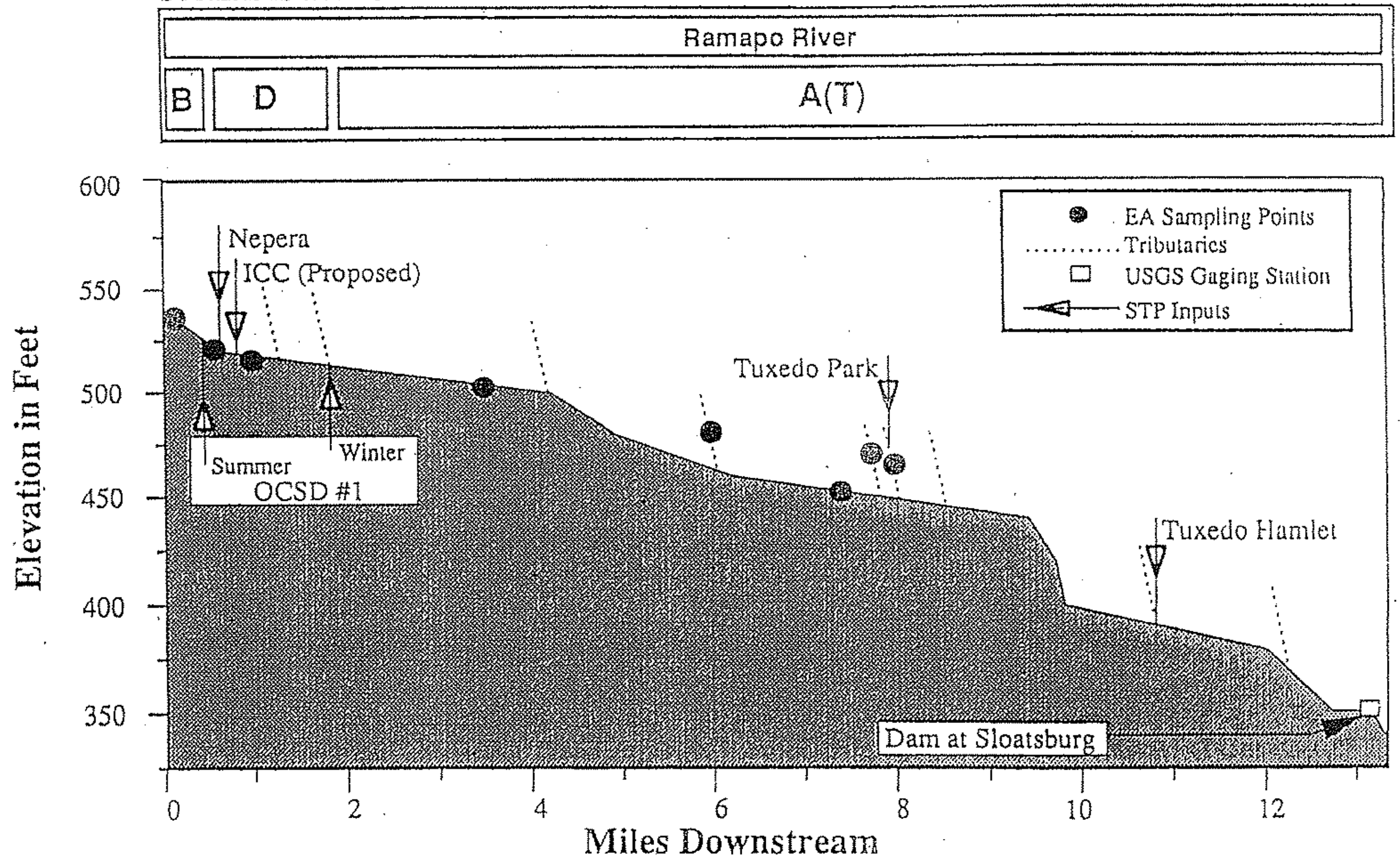
11.4.1 Model Conditions

Two major municipal STPs and one industrial discharge enter the modeled section of the Ramapo River in Orange County OCSD#1, Tuxedo Hamlet STP, and Nepera Chemical); the Sloatsburg STP and Suffern/Thruway STP discharge downstream in Rockland County. In addition, the Tuxedo Park STP enters via the Tuxedo Lake Outlet and a new STP has been proposed for the Interchange Commerce Center (Figure 11-5). WAC analyses were conducted for a 22-mile segment of the mainstem Ramapo River from the upstream summer outfall of OCSD#1 STP to the dam at Sloatsburg. The current SPDES permit conditions and compliance history for a 1-year period (1988-1989) are summarized in Appendix C-1 for each of these operating facilities. The steady-state, one-dimensional model was run for summer (25°C) and winter (10°C) water temperature conditions. Information from the Nepera, Tuxedo Hamlet, Tuxedo Park, Sloatsburg, and Suffern/Thruway STPs are input to their respective model segments at current permit limits for BOD and ammonia and flow. The OCSD#1 STP was set to discharge at four flow rates with current SPDES permit conditions for BOD and ammonia. The critical low flow condition (MA7Q10) for DO modeling in the Ramapo River was 0.2 cfs at OCSD#1 STP and for ammonia modeling (MA30Q10) was 0.4 cfs. The critical flow conditions were provided by NYSDEC and are those assumed for setting SPDES permit conditions.

For the purpose of this assessment, it has been assumed that the reclassification of the reach in the vicinity of OCSD#1 STP from D to C will occur as proposed. This reclassification could affect a considerable increase in the frequency of excursions of the current permit limit and

FIGURE II-5

STREAMS AND STREAM CLASSIFICATIONS:



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Longitudinal section of the Ramapo River with tributary and municipal/industrial discharge locations used for WAC analysis of DO and ammonia.

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ambient ammonia standards based on facilities report monitoring data (1988-1989) from OCSD#1 (Figure 11-6).

11.4.2 Projections Under Current Permit Conditions and a Range of Flow Scenarios

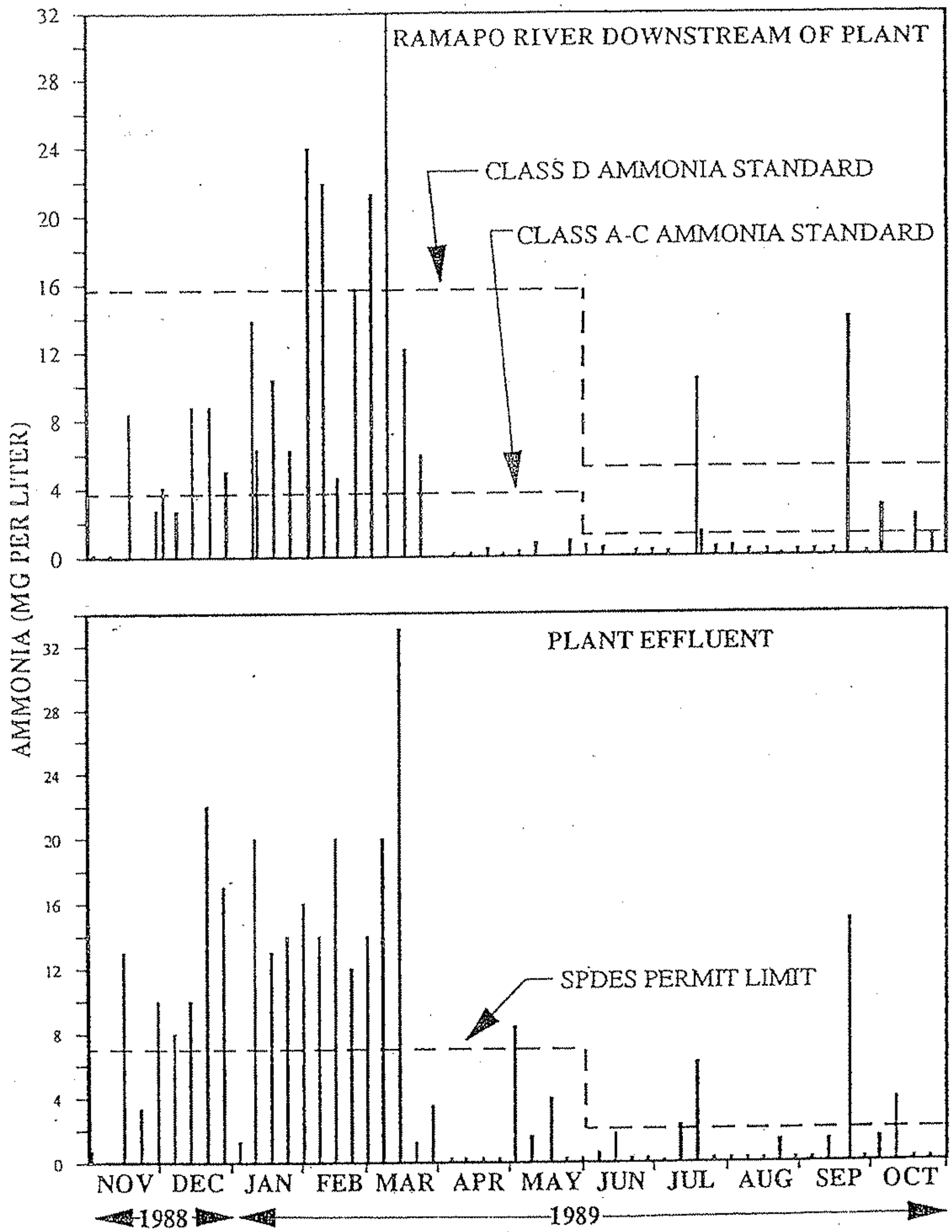
Discharge from the OCSD#1 summer outfall at the current SPDES permit summer limits for flow (4.0 mgd), ammonia (2.0 mg/l), and CBOD (5.0 mg/l) is predicted to result in a 0.5 mg/l violation of the average ambient DO standard (6.0 mg/l) in the upper 1-2 miles of the Class A(T) section (Figure 11-8). No violation is predicted immediately downstream of the outfall within the Class C section (Figure 11-7). At the current winter CBOD (20 mg/l) and ammonia (7.0 mg/l) limits, the predicted minimum DO would be approximately 4.0 mg/l, 2.0 mg/l below the ambient standard. During both winter and summer, DO recovers to 6.0 mg/l within 3-4 miles of the outfall.

An increase in the discharge rate at these same CBOD and ammonia concentration limits results in a predicted violation of the DO standard which is progressively smaller in magnitude, but extends farther downstream. The area of violation extends approximately 9 miles downstream at 10 mgd, (Figure 11-7). At 10 mgd, the minimum DO is 5.0 mg/l compared to 4.0 mg/l at 4.0 mgd and no violation is predicted in the Class C section.

Analyses for ammonia assimilative capacity indicate a similar pattern of excursions as predicted for DO. A 4.0 mgd discharge results in violation of the ambient standard of 1.3 mg/l for approximately 2 miles downstream of the outfall during summer, if this section were to be reclassified from D to C. If the D classification remains, only a slight excursion in the first 0.5 miles of the Class A(T) section is predicted (Figure 11-8). For winter conditions at 4.0 mgd, a deviation above the 3.8 mg/l limit for ammonia would occur for approximately 5 miles downstream (Figure 11-8).

Similar to DO, the extent of the ammonia excursion is predicted to increase with increasing discharge ratio as shown in Figure 11-8. During winter, the excursion would extend 12 miles downstream at 10 mgd. For these expanded discharge scenarios, the reclassification of the D section to C would have little additional regulatory impact since the predicted violation of the ambient standard extends well downstream into the Class A(T) section.

FIGURE II-6



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Instream and effluent ammonia at the OCSD #1 STP relative to the ambient ammonia standards and permit conditions, 1988 - 1989.

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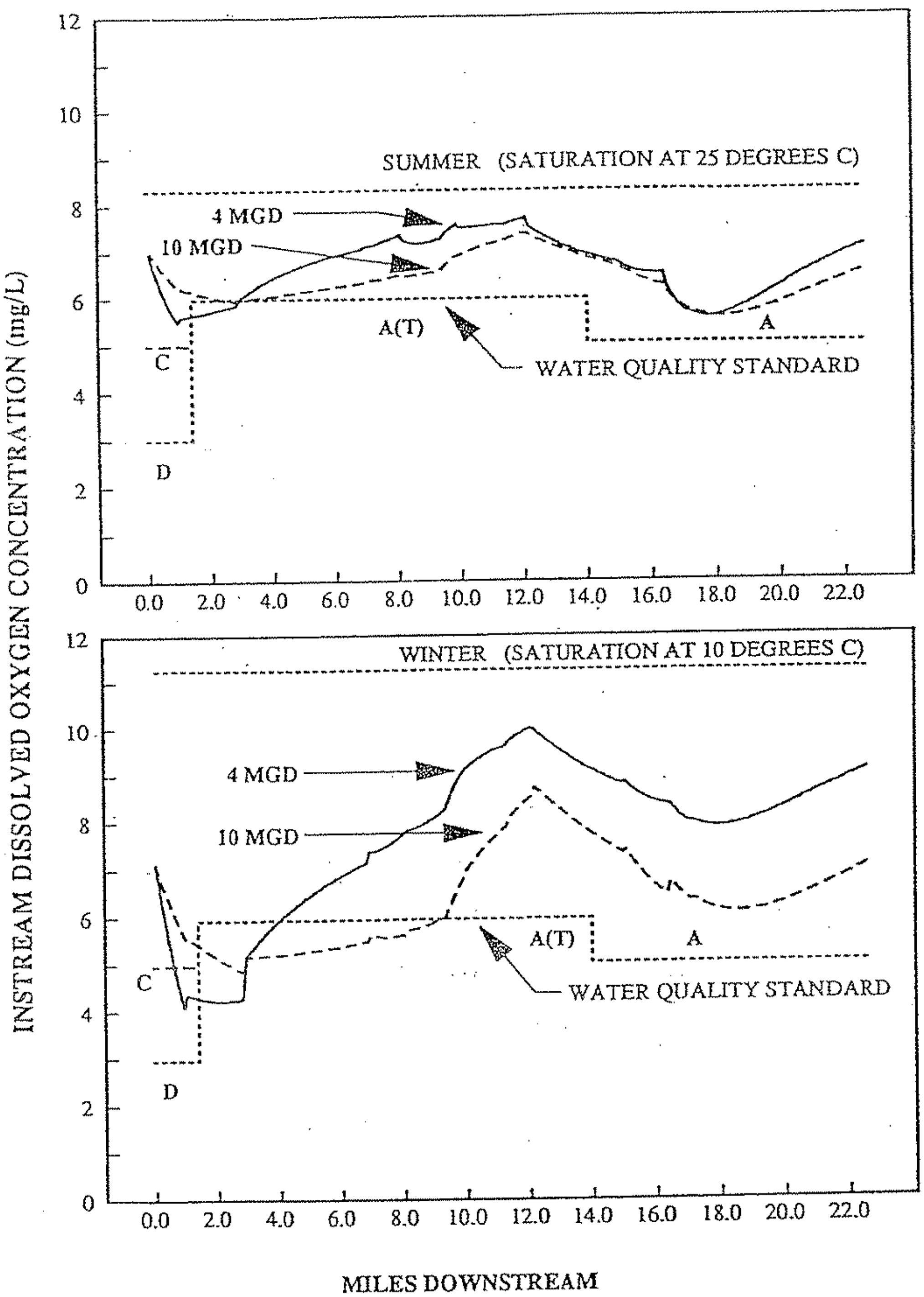
FIGURE II-7



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Predicted instream response of DO at the SPDES permit limits for CBOD and ammonia and a discharge rate of 4 MGD from OCSD # 1 STP.

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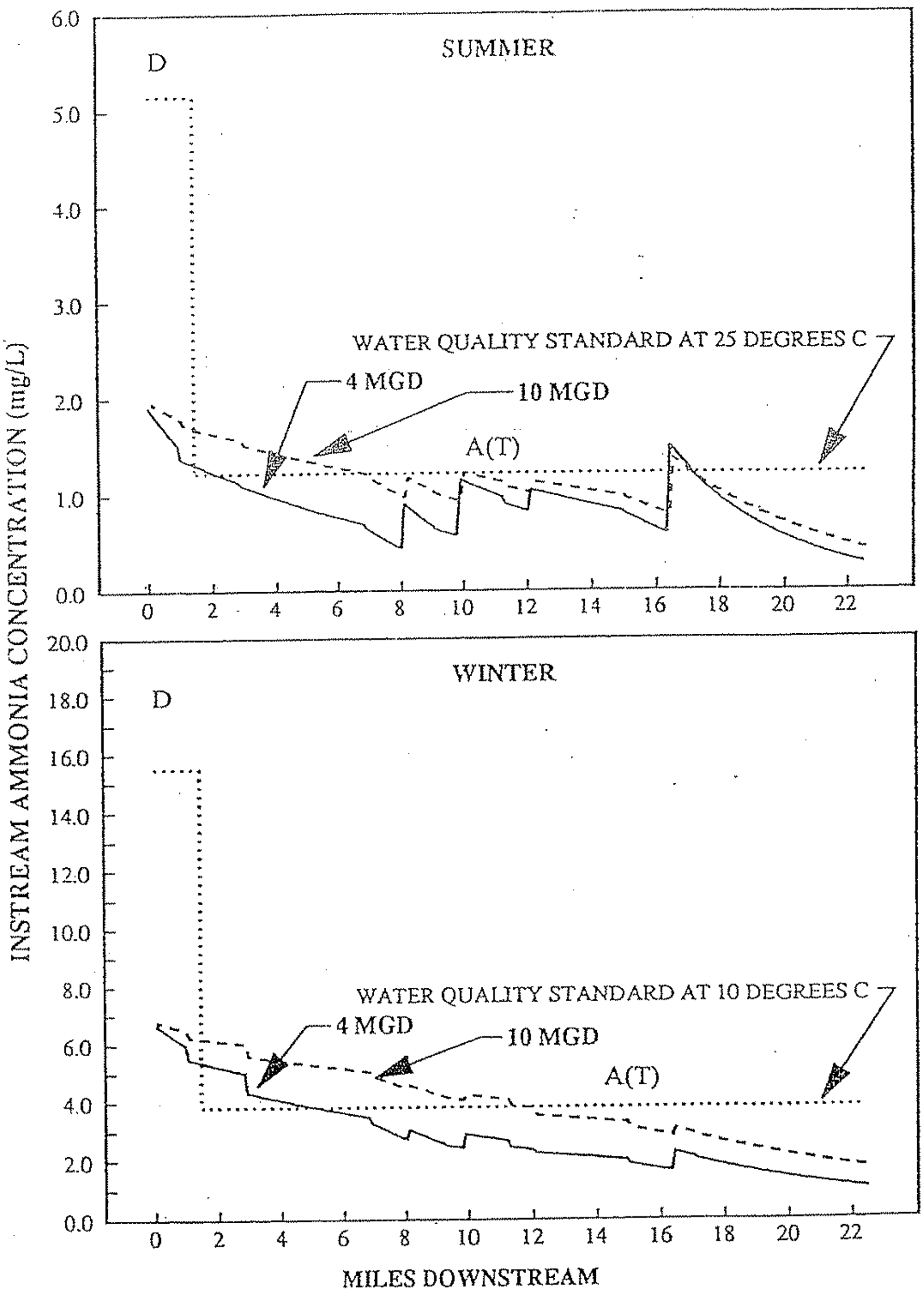
FIGURE II-8



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FOR
HAZEN AND SAWYER, P.C.
Engineers

ORANGE COUNTY, N.Y.
COMPREHENSIVE SEWERAGE STUDY

Predicted instream ammonia concentration at the SPDES permit limits for CBOD and ammonia and discharge rates of 4 and 10 MGD from OCSD # 1 STP.

132546

11.4.3 Predicted Effluent Conditions for Compliance with Ambient Water Quality Standards

WAC analysis indicates that advanced wastewater treatment will be necessary at OCSD#1 STP in order to maintain ambient water quality relative to the ammonia standard. The relationship between plant effluent flow rate and effluent ammonia concentration to achieve 1.3 mg/l summer and 3.8 mg/l winter water quality standards is shown in Figure 11-9. During the summer, effluent discharged to the reclassified C section from the upstream OCSD#1 STP outfall will need to achieve treatment to 1.3-1.5 mg/l ammonia in order to comply with the instream ambient standard; the winter limits are predicted to be 3.8-4.3 mg/l ammonia. At this treatment level, and an associated 20 mg/l ultimate CBOD, the 7.0 mg/l current SPDES permit limit for DO will maintain ambient DO standards (5.0 mg/l) in the reclassified C section only at discharge flows in excess of approximately 7.5 mgd during summer and at all flows from above 2.0 mgd during winter (Figure 11-10). Downstream in the A(T) section, the minimum DO predicted instream during summer is approximately 5.0 mg/l; at least 1.0 mg/l less than the A(T) ambient standard of 6.0 mg/l. During winter, no violation of the ambient standard is predicted in the Class A(T) section of the Ramapo River (Figure 11-10).

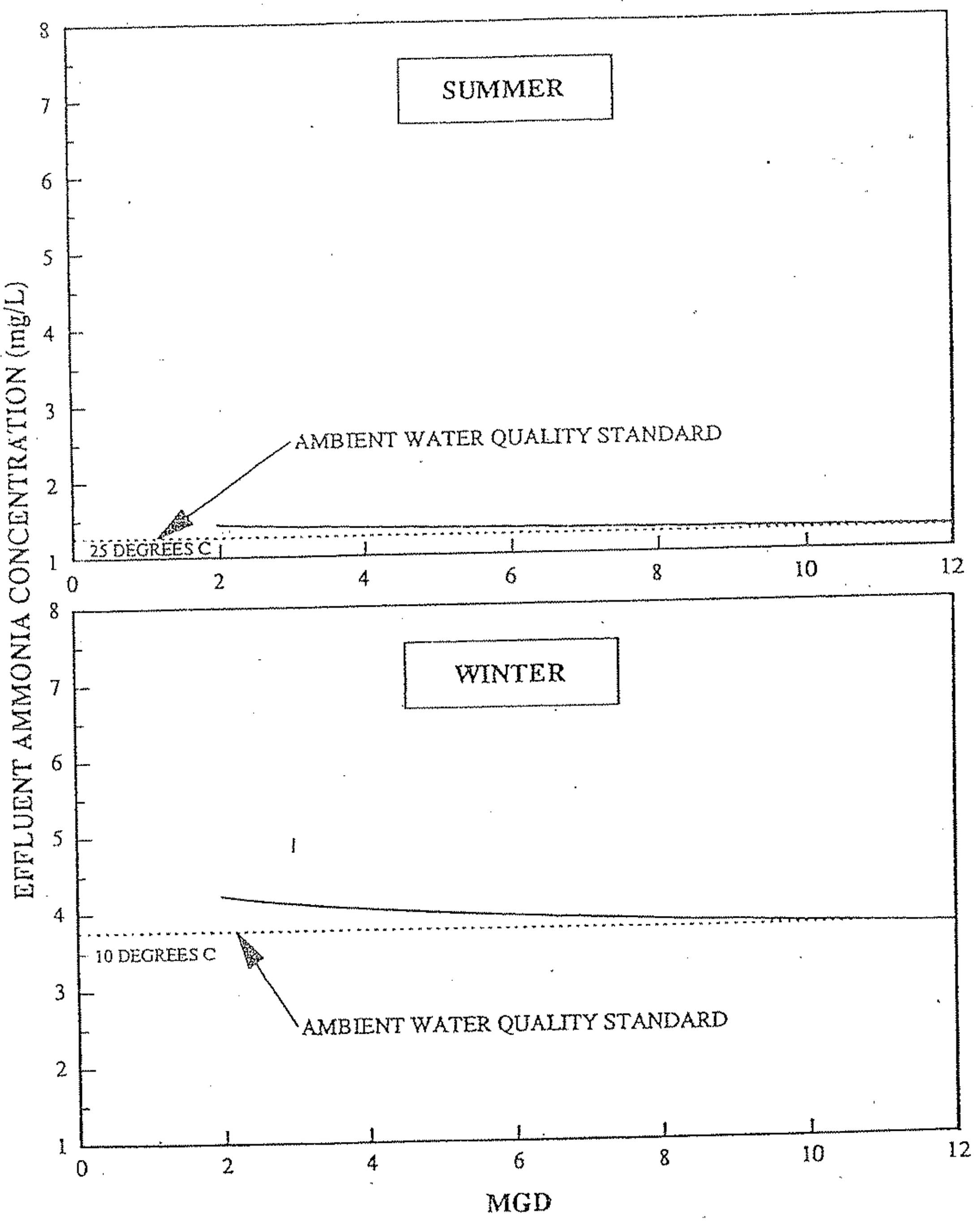
11.5 Wallkill River Basin

The Wallkill River has the largest drainage area within Orange County. Originating in northern New Jersey, the Wallkill River flows north through Orange County and enters the Roundout Creek in Ulster County. Much of the watershed is rural and agricultural; most noticeably the black dirt agricultural area of the Towns of Warwick, Minisink, Chester, Goshen, and Wawayanda. From New Jersey to the Middletown area near Rio Grande Creek, the Wallkill has a C classification; downstream from this point to Rondout Creek, it is classified B (Figure 11-11).

Four sewerage treatment plants currently discharge directly to the mainstem of the Wallkill River in Orange County: City of Middletown, Town of Wallkill, Village of Montgomery, and the Village of Walden. The largest discharges to the Wallkill River occur from the Middletown and Wallkill STPs. In addition, nine other STPs in Orange County discharge to five tributaries of the Wallkill River (Figure 11-11).

WAC analyses were conducted for three areas in the Wallkill River Basin: the Middle Wallkill River downstream from the Middletown STP; Wawayanda Creek in the vicinity of Warwick; and the Shawangunk Kill in the vicinity of Otisville.

FIGURE II-9



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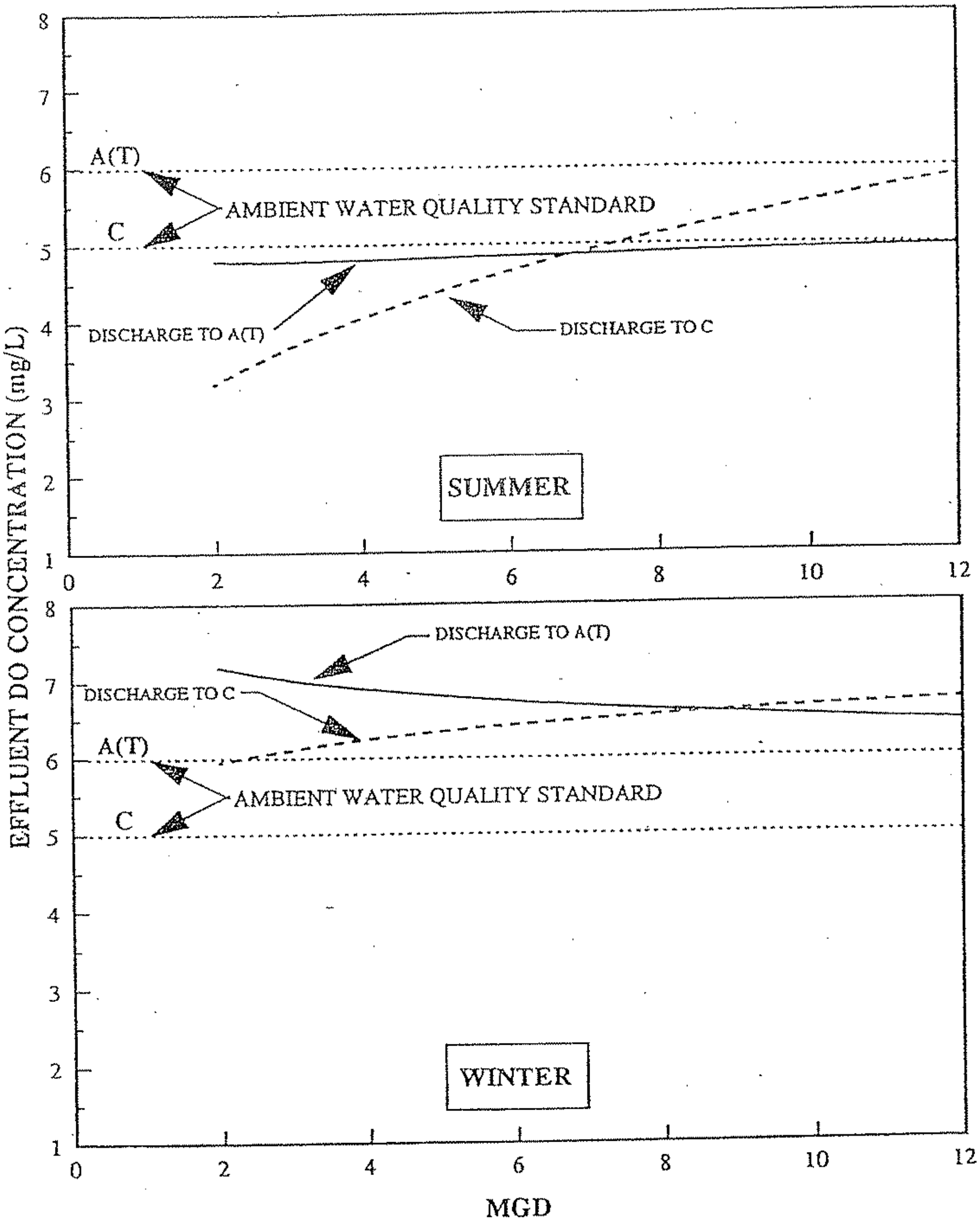
COMPREHENSIVE SEWERAGE STUDY

Effluent ammonia concentration limits relative to a range of discharge rates necessary to maintain respective ambient water quality standards for discharge from the OCSD #1 STP upstream outfall on the Ramapo River.

132546

FIGURE II-10



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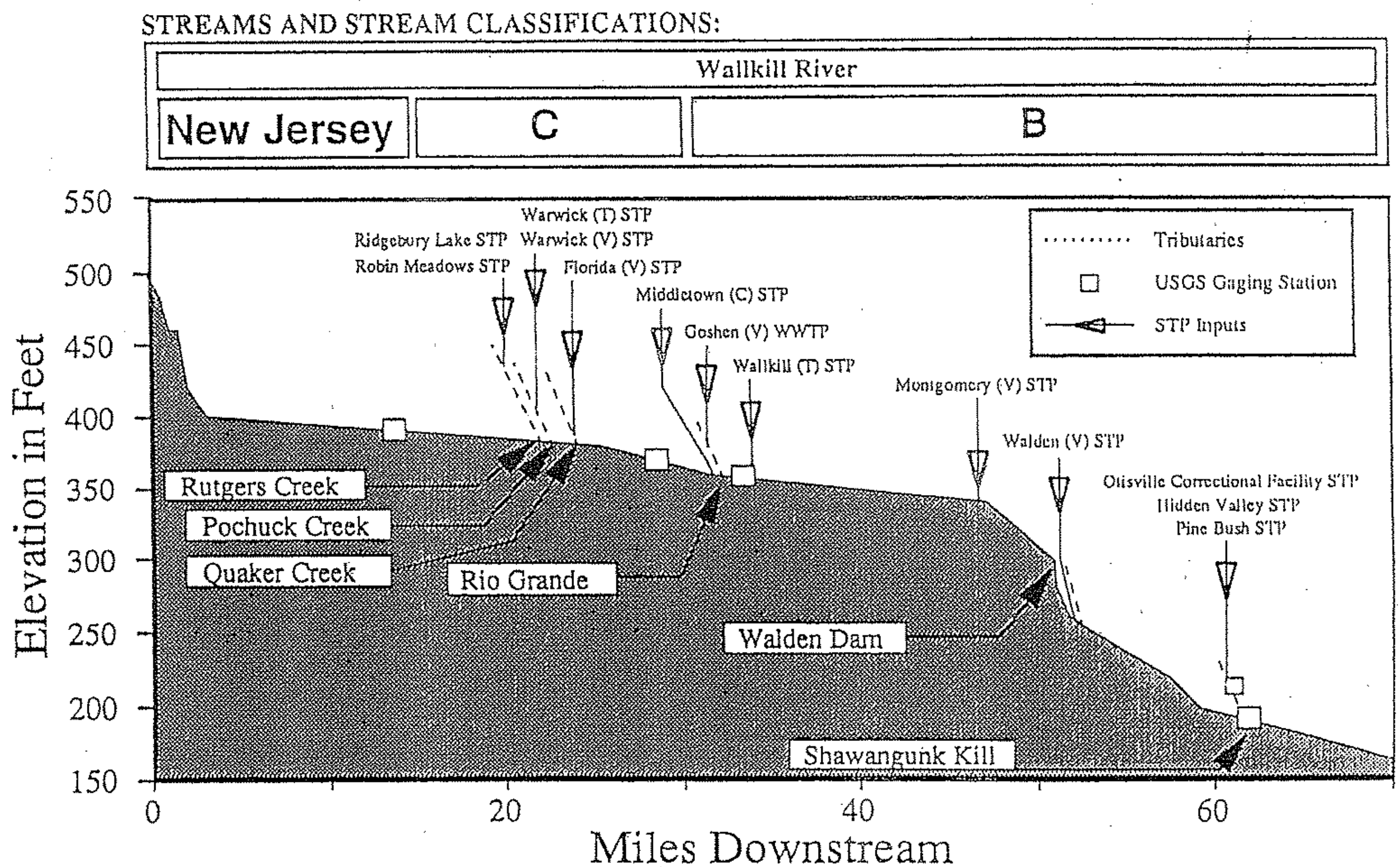
COMPREHENSIVE SEWERAGE
STUDY

Effluent and dissolved oxygen limits relative to a range of discharge rates necessary to maintain respective ambient water quality standards for discharge from the OCSD #1 STP upstream outfall on the Ramapo River.

32546

FIGURE II-II



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COMPREHENSIVE SEWERAGE STUDY

Longitudinal section of the Wallkill River with major tributaries and wastewater treatment plant discharges.

11.5.1 Middle Wallkill River

11.5.1.1 Model Conditions

The Wallkill River section encompassed within the model extends 23 miles downstream from the City of Middletown STP outfall near Echo Lake Road to a point downstream of the Village of Walden. This section receives effluent from Middletown, Wallkill, Montgomery (V) and Walden (V) plus Goshen (V) via Rio Grande Creek. The current SPDES permit conditions and compliance history for a 1-2 year period from 1987-1989 is summarized in Appendix C-2 for each of these facilities.

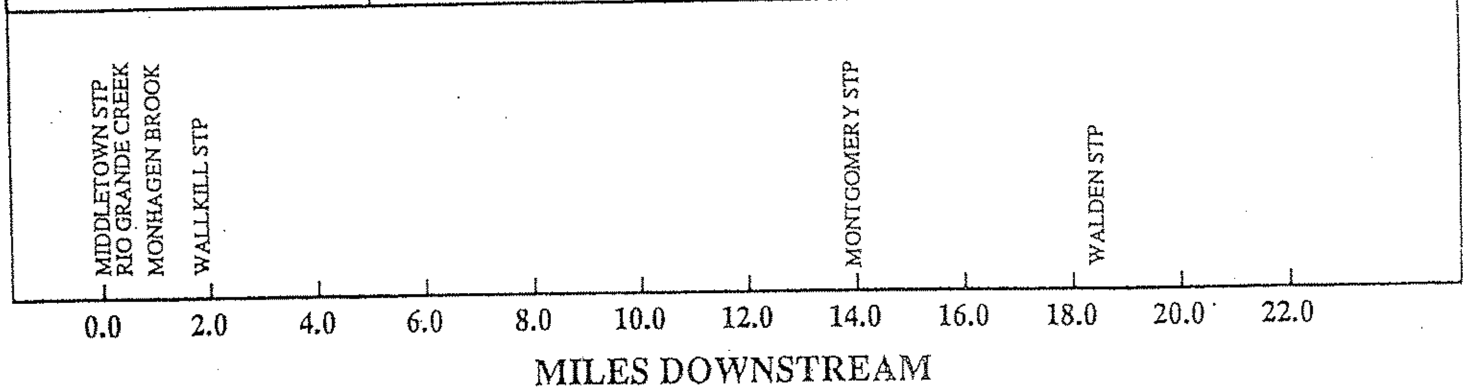
Eight model runs were made using four different discharge rates from the Wallkill STP (Figure 11-12) under summer and winter conditions. These include the current permit flow of 4.3 mgd and three flows representative of various regional treatment alternatives ranging from 4.8 to 10 mgd. One series of runs was made at summer ambient water temperature (25°C) and a second series at winter temperature (10°C). The critical low flow (MA7Q10) for DO analysis was 13.3 cfs and for ammonia (MA30Q10) was 18.5 cfs based on the U.S. Geological Survey (USGS) gaging station at Pellets Island near the head of the modeled section.

11.5.1.2 Projections Under Current Permit Conditions and a Range of Flow Scenarios

Under Scenario #1 (discharges set at current SPDES permit limits for BOD, ammonia, and flow), the model predicts no violation of ambient DO and ammonia instream standards under winter conditions. However, under summer conditions, violations of DO and ammonia are predicted downstream of both the Middletown and Wallkill STPs (Figure 11-13). The ammonia excursions extend approximately 1 mile downstream of the Middletown outfall and 4 miles downstream of the Wallkill outfall. At the highest Wallkill STP flow scenario (10 mgd), the magnitude of the excursion is greater and extends approximately 6 miles downstream (Figure 11-14). The excursions predicted downstream of the Wallkill STP are exacerbated by the upstream proximity of the Middletown outfall, i.e., the model predicts elevated ambient ammonia and depressed DO immediately upstream of the Wallkill STP outfall associated with assimilation of the Middletown STP effluent. The DO excursions extend approximately 1.5 miles below Middletown and 2-4 miles below Wallkill for flows from 4.3 to 10 mgd. No excursions are predicted downstream in the vicinity of the Montgomery or Walden STPs, although the influence of these two facilities on ambient water quality is apparent in the model

FIGURE 11-12

SCENARIO #1	SCENARIO #2	SCENARIO #3	SCENARIO #4
WALLKILL R. @ MI. 0	WALLKILL R. @ MI. 0	WALLKILL R. @ MI. 0	WALLKILL R. @ MI. 0
7Q10 (DO) = 13.3 CFS	7Q10 (DO) = 13.3 CFS	7Q10 (DO) = 13.3 CFS	7Q10 (DO) = 13.3 CFS
30Q10 (NH3) = 18.5 CFS	30Q10 (NH3) = 18.5 CFS	30Q10 (NH3) = 18.5 CFS	30Q10 (NH3) = 18.5 CFS
RIO GRANDE CREEK	RIO GRANDE CREEK	RIO GRANDE CREEK	RIO GRANDE CREEK
7Q10 (DO) = 2.6 CFS	7Q10 (DO) = 0.3 CFS	7Q10 (DO) = 0.3 CFS	7Q10 (DO) = 0.3 CFS
30Q10 (NH3) = 2.72 CFS	30Q10 (NH3) = 0.42 CFS	30Q10 (NH3) = 0.42 CFS	30Q10 (NH3) = 0.42 CFS
MONHAGEN BROOK	MONHAGEN BROOK	MONHAGEN BROOK	MONHAGEN BROOK
7Q10 (DO) = 0.3 CFS	7Q10 (DO) = 0.3 CFS	7Q10 (DO) = 0.3 CFS	7Q10 (DO) = 0.3 CFS
30Q10 (NH3) = 0.42 CFS	30Q10 (NH3) = 0.42 CFS	30Q10 (NH3) = 0.42 CFS	30Q10 (NH3) = 0.42 CFS
MIDDLETOWN(C) STP 6.2 MGD	MIDDLETOWN(C) STP 6.2 MGD	MIDDLETOWN(C) STP 6.2 MGD	MIDDLETOWN(C) STP 6.2 MGD
WALLKILL(T) STP 4.3 MGD	WALLKILL(T) STP 4.8 MGD	WALLKILL(T) STP 7.0 MGD	WALLKILL(T) STP 10.0 MGD
MONTGOMERY STP 2.2 MGD	MONTGOMERY STP 2.2 MGD	MONTGOMERY STP 2.2 MGD	MONTGOMERY STP 2.2 MGD
WALDEN STP 1.3 MGD	WALDEN STP 1.3 MGD	WALDEN STP 1.3 MGD	WALDEN STP 1.3 MGD



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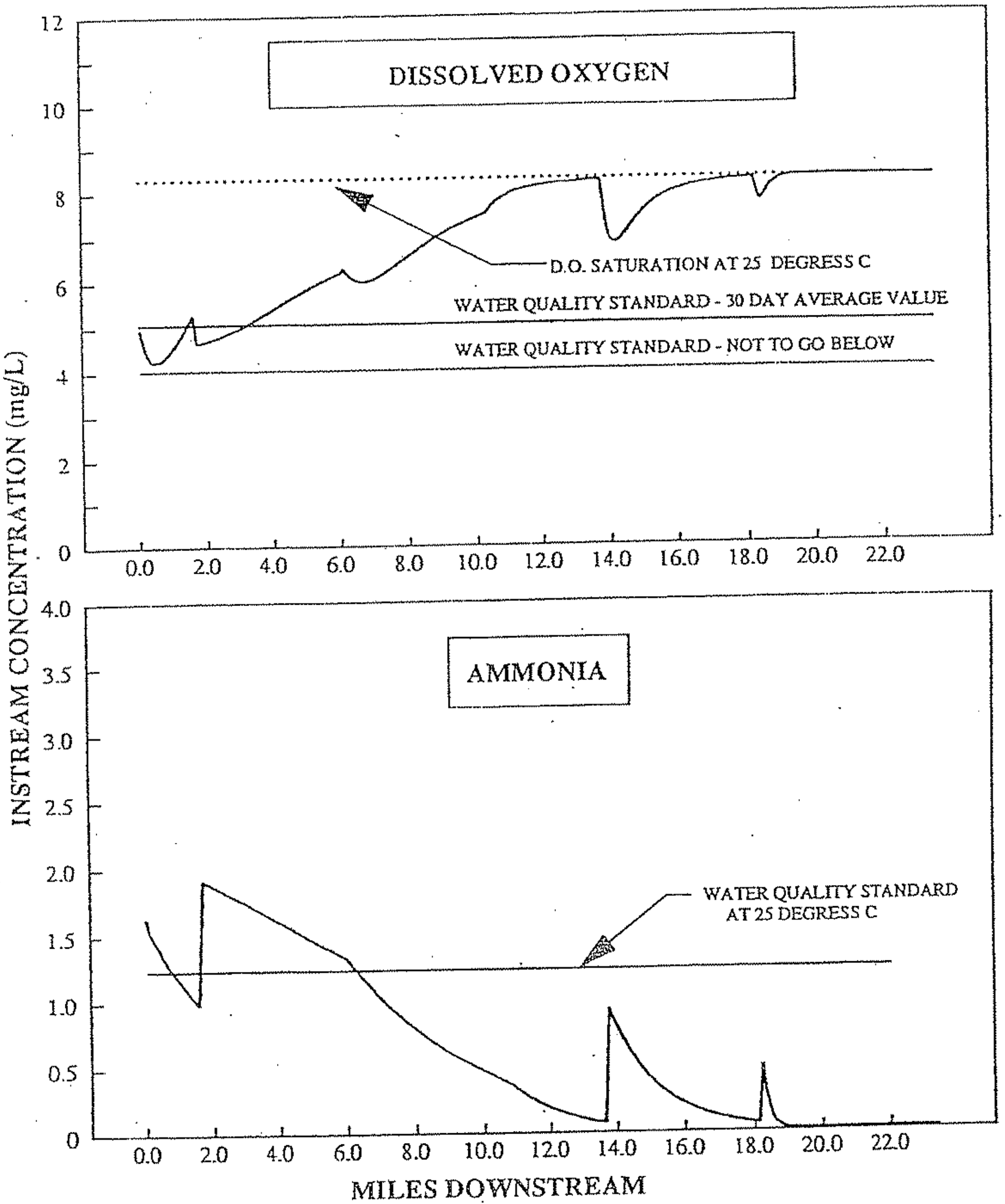
COMPREHENSIVE SEWERAGE STUDY

Model flow inputs and locations for the Wallkill River WAC analysis scenarios.

FIGURE 11-13



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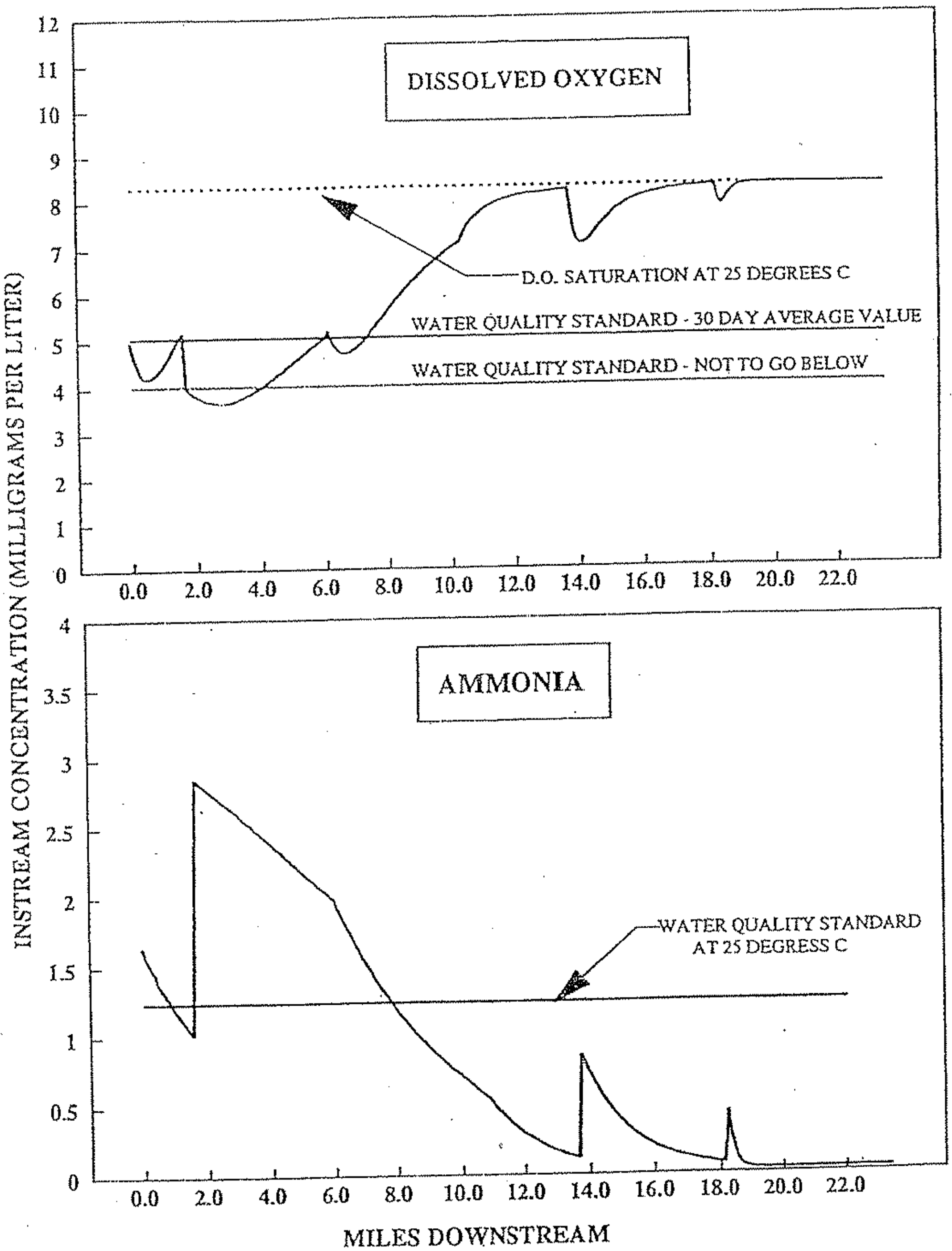
Predicted summer water quality response to current SPDES permit loadings and flows to the Wallkill River under WAC analysis scenario # 1, with Wallkill STP at 4.3 MGD.

132546

FIGURE II-14



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Predicted summer water quality response to current SPDES Permit loadings and projected flows to the Wallkill River under WAC analysis scenario # 4, with Wallkill STP at 10 MGD.

132546

predictions (Figures 11-13 and 11-14).

11.5.1.3 Predicted Effluent Conditions for Compliance with Ambient Water Quality Standards

Given the dilution available at MA30Q10 with an effluent flow of 6.2 mgd at the Middletown STP, the model predicts that effluent ammonia must be limited to 3.15 mg/l at a pH of 7.5 and a summer temperature of 25°C (Table 11-3) in order to maintain instream ambient water quality downstream of the Middletown STP outfall with respect to ammonia. In order to assess the relationship between discharge flow, effluent ammonia, and ambient water quality with respect to an expanded Wallkill STP discharge, the Middletown effluent was fixed during predictive model runs at 3.15 mg/l ammonia (loading predicted to result in no ambient excursion due to the Middletown STP).

Under the four flow scenarios examined for the Wallkill STP, the effluent ammonia limit is predicted to range from 3.83 mg/l to 2.30 mg/l at 4.3-10.0 mgd (Table 11-3, Figure 11-15). In addition, the effluent must be discharged at minimum DO levels of 2.5-4.1 mg/l for the same flow rates in order to maintain ambient DO levels of at least 5.0 mg/l (30-day average water quality standard).

11.5.2 Wawayanda Creek

Wawayanda Creek is a tributary to Pochuck Creek which enters the Wallkill River near Pine Island, New York. Wawayanda Creek flows out of Wickham Lake southwest through the Village of Warwick into New Jersey, then northwest into Pochuck Creek and New York. A major tributary, Longhouse Creek, enters the Wawayanda Creek approximately 1.5 miles downstream of Wickham Lake. The gradient is relatively steep (11 ft/mile) for the first 9 miles and then becomes slow and meandering in the black dirt agricultural area with a gradient of less than 0.5 ft/mile to the Wallkill River (Figure 11-16).

Wawayanda Creek is classified B(T) from Wickham Lake to the Village of Warwick and C(T) from there to the New Jersey state line (Figure 11-16). Longhouse Creek is currently classified B(T) but has been proposed to be upgraded to B(TS).

The Town of Warwick STP discharges to a small tributary of Longhouse Creek. The Village of Warwick discharges to the Class C(T) section near the western village boundary.

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

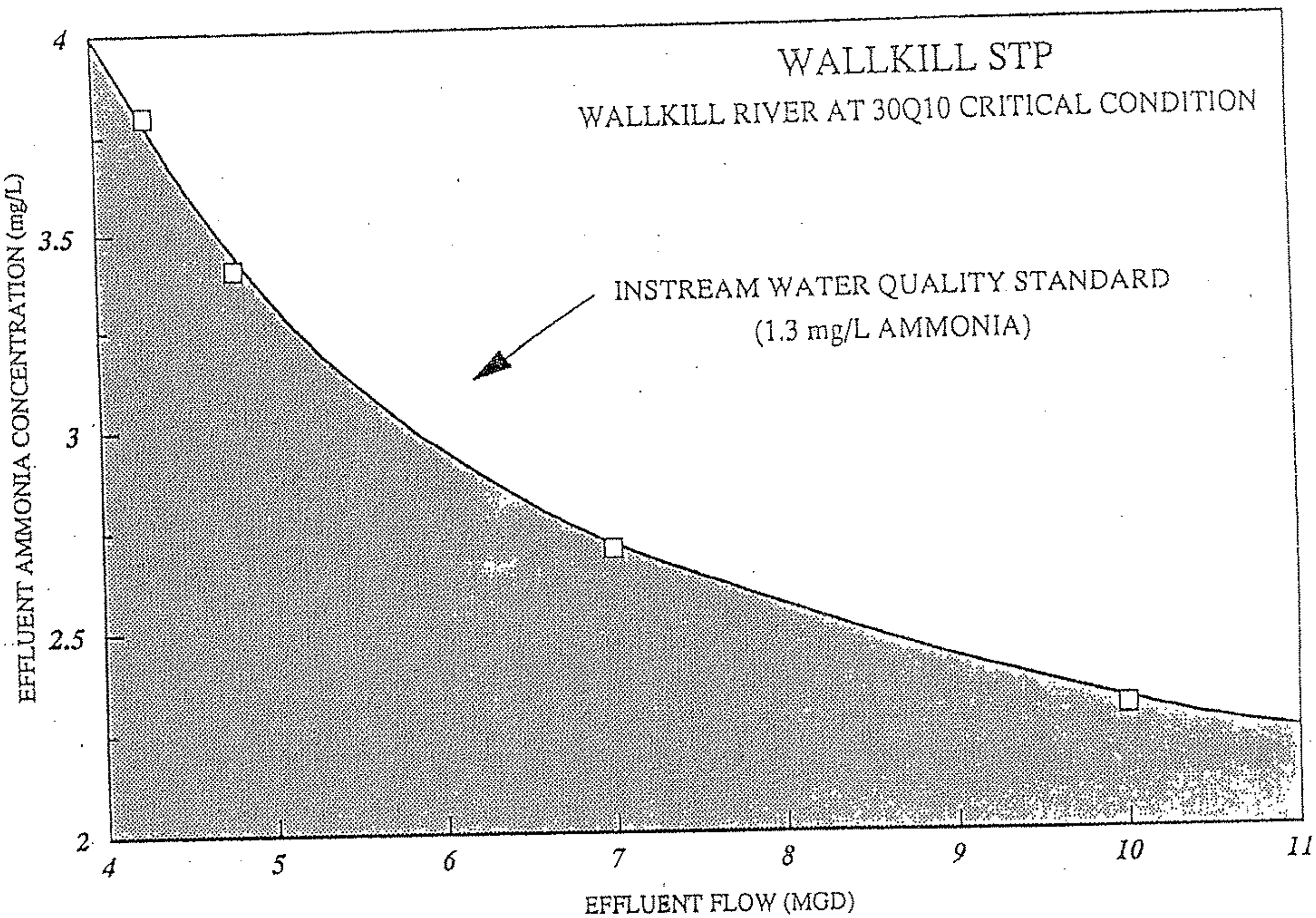
TABLE 11-3

EFFLUENT LIMITATIONS FOR THE MIDDLETOWN (C) STP AND WALLKILL (T) STP REQUIRED TO MEET WALLKILL RIVER WATER QUALITY STANDARDS UNDER FOUR FLOW SCENARIOS AT THE WALLKILL (T) STP.

ALL PROJECTED FLOW SCENARIOS	
PLANT: MIDDLETOWN (C) STP FLOW: 6.2 MGD AMMONIA: 3.15 mg/L CBOD(u): 20.0 mg/L MAX. DISSOLVED OXYGEN DEFICIT: 3.4 mg/L MIN. EFFLUENT DISSOLVED OXYGEN: 4.9 mg/L	
FLOW SCENARIO #1 PLANT: WALLKILL (T) STP FLOW: 4.3 MGD AMMONIA: 3.83 mg/L CBOD(u): 20.0 mg/L MAX. DISSOLVED OXYGEN DEFICIT: 5.8 mg/L MIN. EFFLUENT DISSOLVED OXYGEN: 2.5 mg/L	**FLOW SCENARIO #3** PLANT: WALLKILL (T) STP FLOW: 7.0 MGD AMMONIA: 2.74 mg/L CBOD(u): 20.0 mg/L MAX. DISSOLVED OXYGEN DEFICIT: 4.6 mg/L MIN. EFFLUENT DISSOLVED OXYGEN: 3.7 mg/L
FLOW SCENARIO #2 PLANT: WALLKILL (T) STP FLOW: 4.8 MGD AMMONIA: 3.38 mg/L CBOD(u): 20.0 mg/L MAX. DISSOLVED OXYGEN DEFICIT: 5.2 mg/L MIN. EFFLUENT DISSOLVED OXYGEN: 3.1 mg/L	**FLOW SCENARIO #4** PLANT: WALLKILL (T) STP FLOW: 10.0 MGD AMMONIA: 2.30 mg/L CBOD(u): 20.0 mg/L MAX. DISSOLVED OXYGEN DEFICIT: 4.2 mg/L MIN. EFFLUENT DISSOLVED OXYGEN: 4.1 mg/L

r:or:tble11.3:070991:jv

FIGURE 11-15



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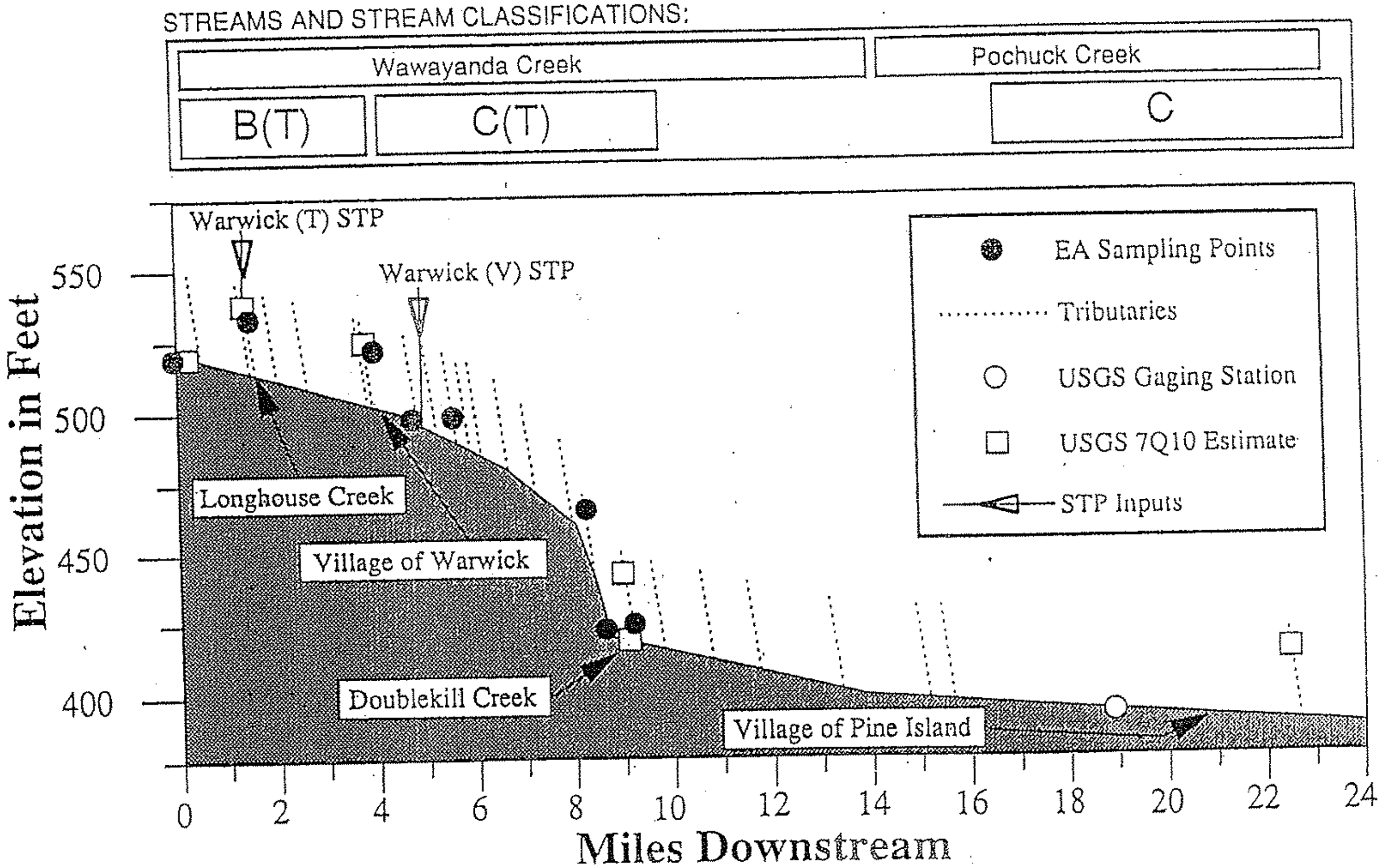
Relationship of effluent ammonia concentration predicted to be necessary to acheive ambient ammonia water quality standards.

132546

FIGURE 11-16



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ORANGE COUNTY, N.Y.
COMPREHENSIVE SEWERAGE STUDY

Longitudinal section of Wawayanda Creek/ Pochuck Creek with major tributaries and wastewater treatment plant discharges.

132546

11.5.2.1 Model Conditions

The reach encompassed within the one-dimensional steady-state model extends from the Town of Warwick STP on a tributary of Longhouse Creek to a point approximately 9 miles downstream of the Village of Warwick STP on Wawayanda Creek at the junction with Pochuck Creek. The current SPDES permit conditions and compliance history for the 1988 to 1989 period is summarized in Appendix C-3 for both of these plants.

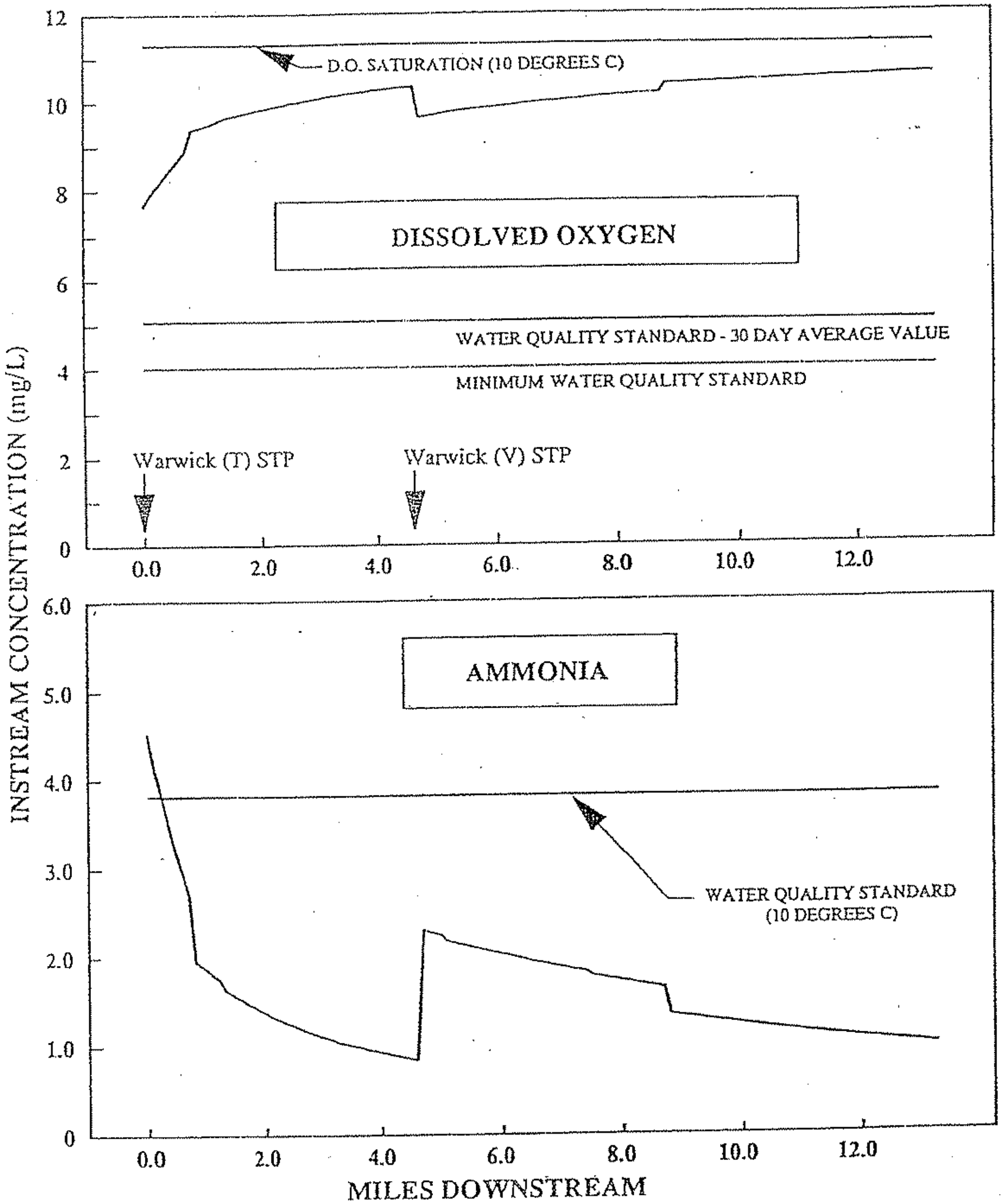
Instream DO and ammonia were modeled for a range of discharges from current permit levels to approximately 3 mgd. The estimated critical low flow (MA7Q10) for DO analysis was 0.1 cfs and 1.3 cfs, and for ammonia (MA30Q10) was 0.13 cfs and 1.8 cfs at the Town and Village plants, respectively. These low flow estimates were provided by NYSDEC.

11.5.2.2 Projections Under Current Permit Conditions and Range of Flow Scenarios

No violations of ambient water quality standards are predicted during winter for the Village plant (Figure 11-17). The model predicts that the current relatively stringent Town of Warwick STP summer discharge limits (2.0 mg/l ammonia and 10 mg/l ultimate CBOD) may result in a slight violation of the summer instream ambient ammonia limit (Figure 11-18). Winter violations are also predicted below the Town plant outfall (Figure 11-17).

A violation of the ambient DO standard may also occur at the Town STP outfall; however, water quality recovers to ambient levels within a very short distance (less than 1 mile) as a result of the low flow, long transit time, and low ammonia and BOD effluent loadings (Figure 11-18).

At the location of the Village plant, the predicted ammonia violation is larger and may extend approximately 3 miles downstream. No violation of the DO standard is predicted although the minimum is predicted to just reach the 5.0 mg/l summer standard and recovery to near saturation DO levels may not occur with the model boundary (Figure 11-18).



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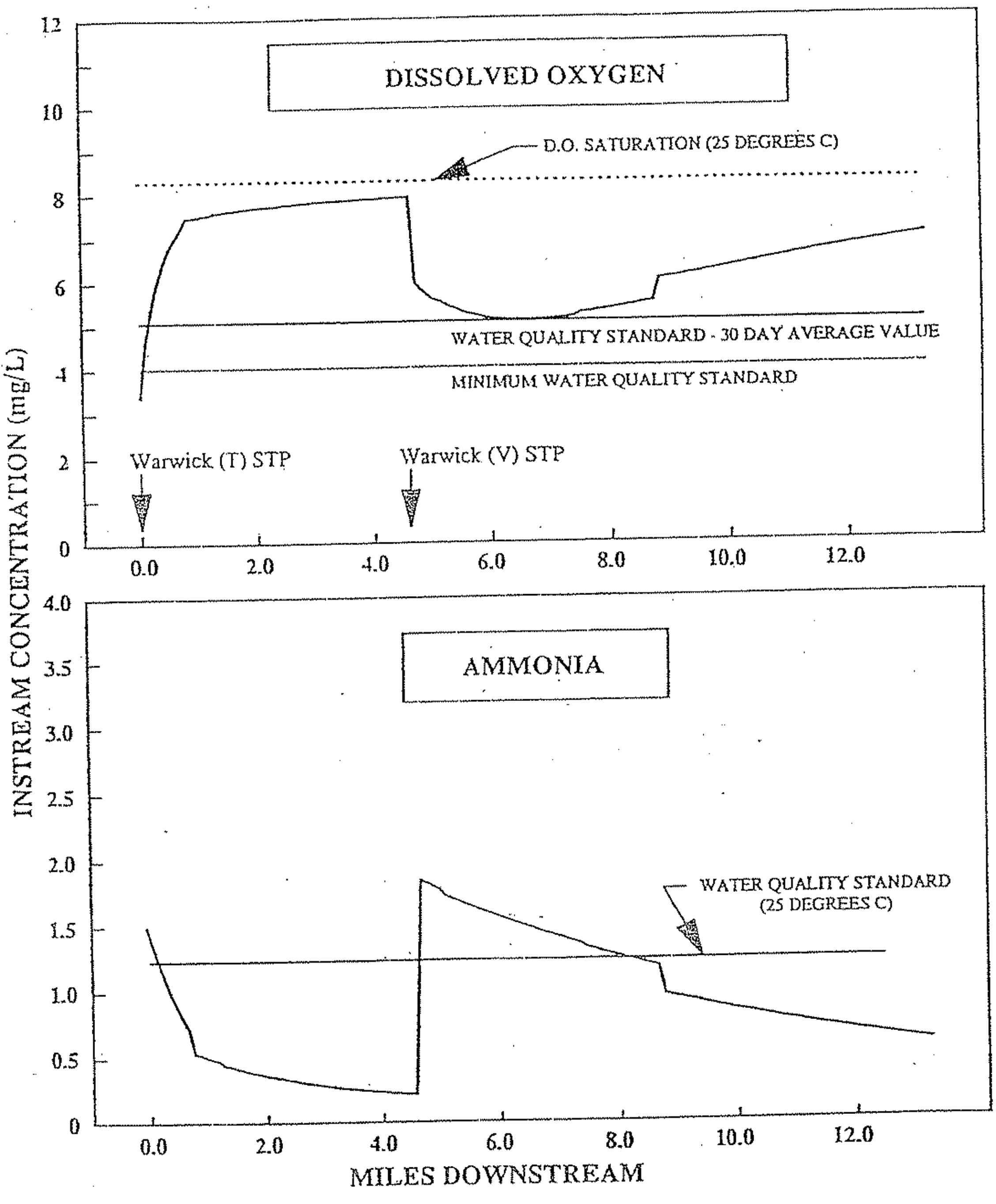
Predicted winter water quality response to current SPDES permit loadings and flows to the Wawayanda Creek.

132546

FIGURE II-18



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ORANGE COUNTY, N.Y.: COMPREHENSIVE SEWERAGE STUDY

Predicted summer water quality response to current SPDES permit loadings and flows to the Wawayanda Creek.

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11.5.2.3 Predicted Effluent Conditions for Compliance with Ambient Water Quality Standards

In order to meet summer ambient ammonia standards at the current permitted Town discharge rate (0.39 mgd), the predicted effluent ammonia concentration would need to be reduced slightly from the current permitted level of 2.0 mg/l to 1.75 mg/l (Figure 11-19). The DMRs indicated that the effluent ammonia has typically been less than 0.2 mg/l during the summer. In order to meet the winter ambient ammonia standard downstream of the Town STP, the predicted effluent ammonia concentration must be less than 4.6 mg/l at the current flow rates (Figure 11-19). At flows above 3.0 mgd, the Town plant must discharge at or below the winter ambient standard of 3.78 mg/l. If the effluent from the Town plant is aerated to at least 4.5 mg/l, no violation of the ambient DO standard is predicted at discharge rates up to 3.0 mgd (Figure 11-20).

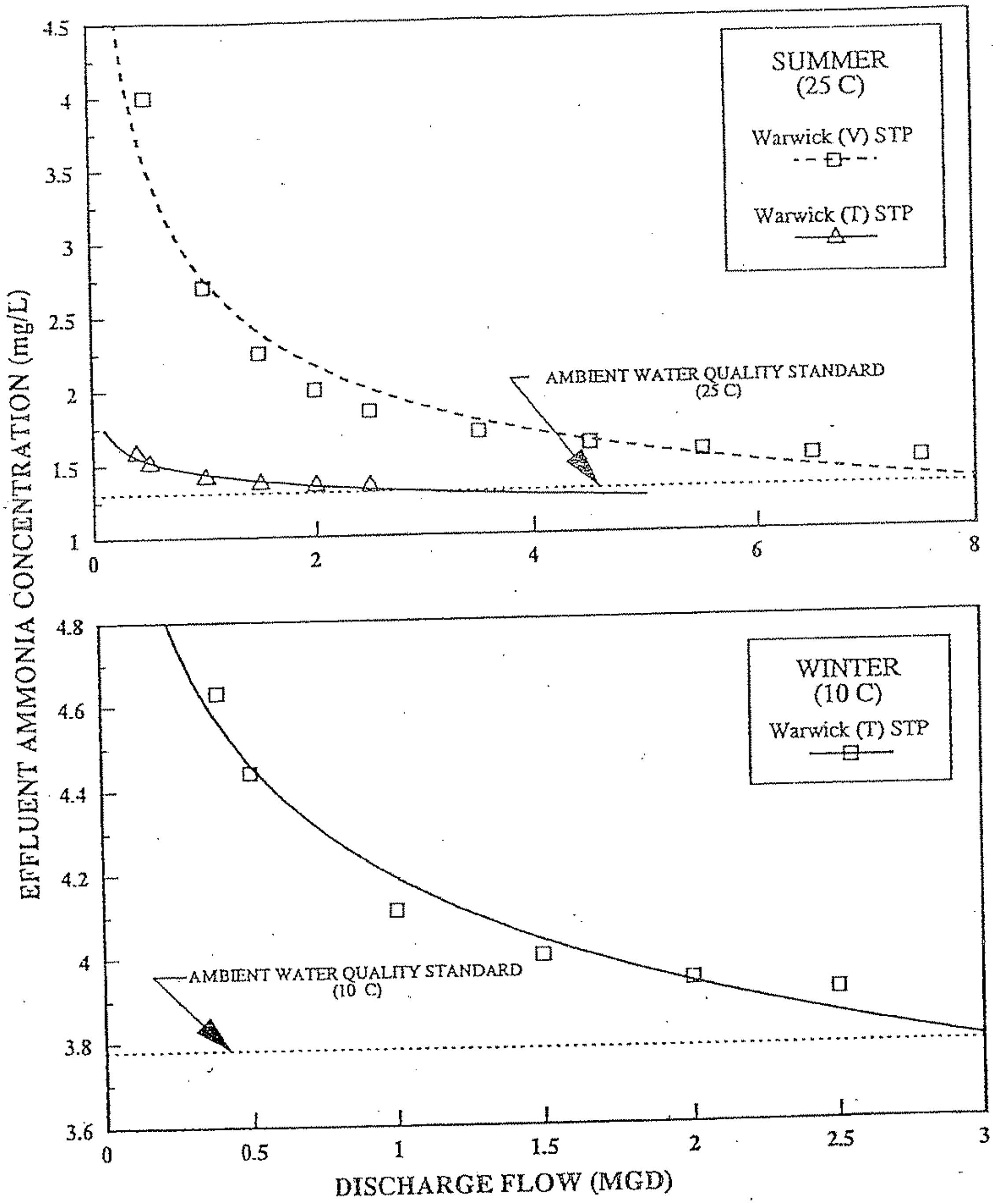
In order to meet summer ambient standards downstream of the Village plant at a projected flow of 1.0 mgd, the effluent ammonia needs to be less than 2.75 mg/l (Figure 11-19). As stated previously, no violations of ambient water quality standards are predicted under current permit limits during the winter at the Village of Warwick STP.

11.5.3 Upper Shawangunk Kill

The Shawangunk Kill flows north and is a tributary to the Wallkill River at Gardiner, Ulster County, New York. It has a relatively narrow watershed lying to the east of, and paralleling the Shawangunk Mountains, along the northwestern boundary of Orange County with Sullivan and Ulster Counties. Most of the watershed is rural and agricultural from headwaters in the upland areas west-southwest of Middletown. The current classification of the Shawangunk Kill from the Wallkill River to just upstream of Mill Pond near Mount Hope is B; above Mill Pond the classification changes to A. Much of the Shawangunk Kill has been proposed for reclassification from B to B(T); a 1.5-mile reach at the junction of Pakanasink Creek, encompassing the proposed Shawangunk water supply diversion, would become Class A.

Treated effluent is discharged to the Shawangunk Kill from the Otisville State Correctional Facility STP, Hidden Valley Estates STP, and the Pine Bush/Crawford STP (Appendix C-4). A consolidated STP is being considered by the Town of Mount Hope which would replace the state and federal correctional facilities' STPs at Otisville, and the Hidden Valley STP in addition to some minimal expanded sewage capacity for the Town and possibly the Village of Otisville.

FIGURE 11-19



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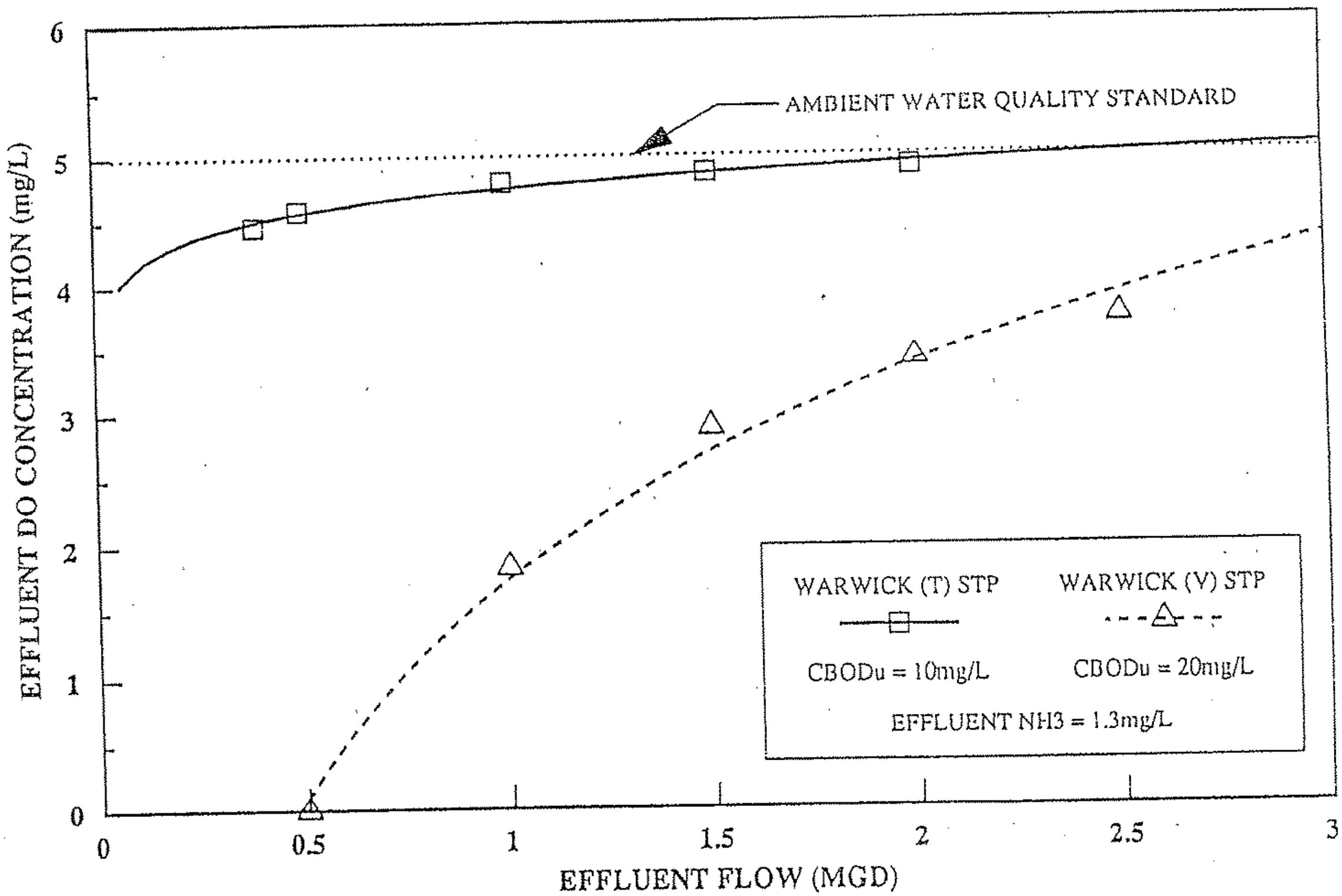
COMPREHENSIVE SEWERAGE STUDY

Relationship of effluent ammonia concentration predicted to be necessary to achieve ambient water quality standards during summer and winter.

132546

FIGURE II-20



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ORANGE COUNTY, N.Y.
COMPREHENSIVE SEWERAGE STUDY

Relationship of effluent dissolved oxygen concentration predicted to be necessary to acheive ambient water quality standards during summer (25 degrees C).

132546

The WAC assessment of the Shawangunk Kill was performed for a potential outfall in the vicinity of Route 211 near the Village of Mount Hope, based on the ratio of the critical low flow and projected discharge rates from the proposed STP. There is insufficient data available to use the one-dimensional, steady-state model. The MA7Q10 (0.11 cfs) was estimated based on watershed area, mean elevation, and proportion of area covered by stratified drift (Barnes 1986). The MA30Q10 (0.15 cfs) was scaled from the MA7Q10 based on the relationship of these two low flow estimates for other sites in Orange County. Based on NYSDEC guidance (1988), the background level of ammonia was set at 0.1 mg/l.

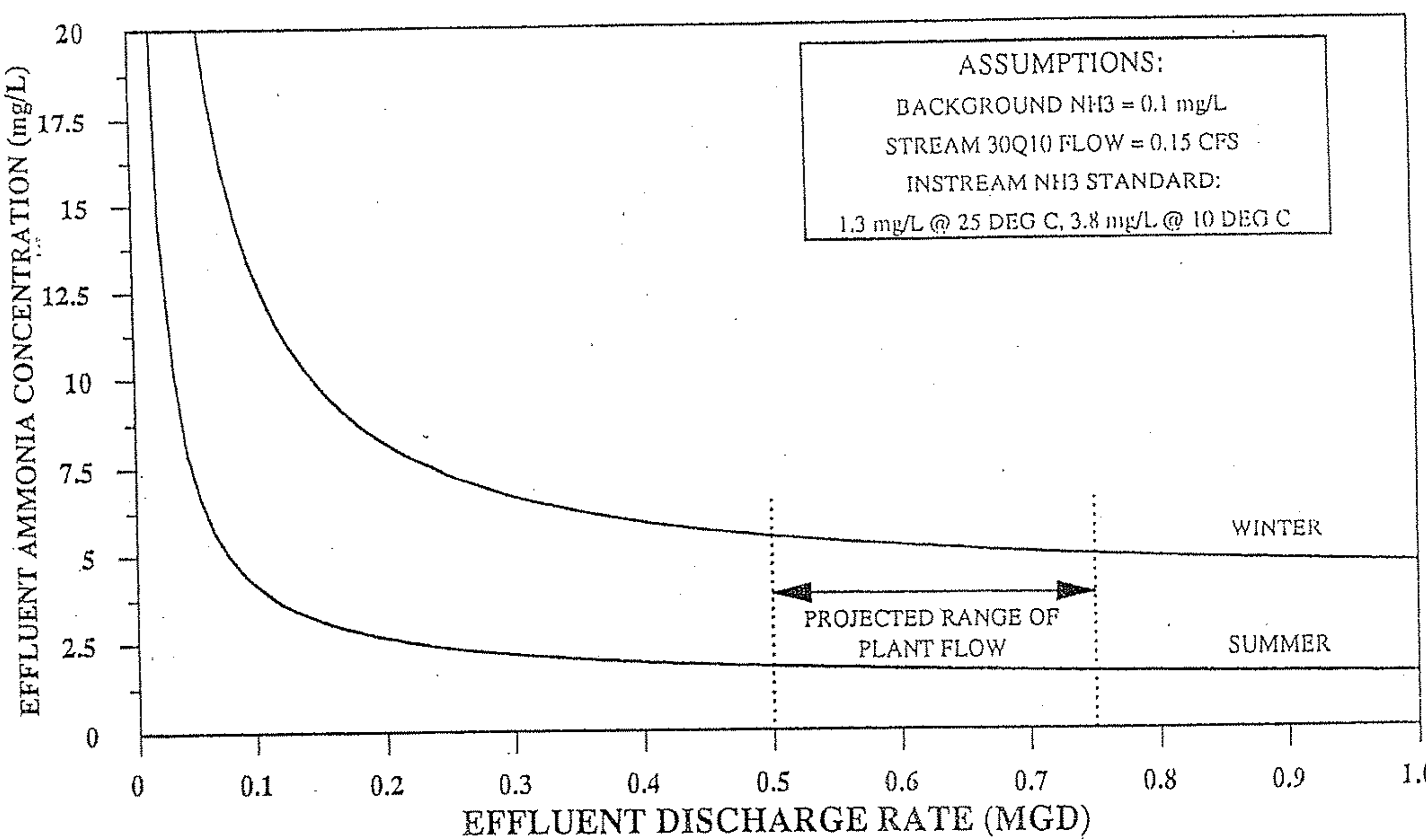
For summer conditions (25°C) over the projected range of potential flows (0.5-0.75 mgd) from the proposed Mount Hope STP, treatment technology would need to reduce effluent ammonia to approximately 1.8 mg/l or less (Figure 11-21) in order to maintain ambient water quality below the 1.3 mg/l standard. During winter, effluent ammonia could be as high as 5.0 mg/l and still achieve the ambient ammonia standard of 3.8 mg/l.

11.6 Moodna Creek Basin

Moodna Creek and its two primary headwater tributaries, Cromline Creek and Otter Kill, drain the central portion of Orange County and enter the Hudson River in the vicinity of Cornwall, New York. Much of the watershed is rural and agricultural, with extensive areas of residential and commercial development. There is considerable relief (approximately 700 ft) from the upper headwater of Trout Brook to the Hudson River with long, low gradient reaches interspersed with the shorter steep gradient reaches (Figure 11-22). The entire length of Moodna Creek from the junction of Otter Kill and Cromline Creek to the Hudson River is classified C. Woodbury Creek, a tributary to the lower Moodna Creek is classified C(T) downstream of Tributary 7 at Highland Mills but is proposed to be reclassified to C(TS), suitable for trout spawning; upstream of Highland Mills, the classification would change from D to C.

The Washingtonville STP, New Windsor STP, and Firthcliffe STP discharge directly to the Moodna Creek; King Tract STP, Sugarloaf STP, Tappan Homes STP, Maybrook STP, Montgomery Town STP, Stewart Army Subpost STP, and Valley Forge STP discharge to various tributaries or sub-tributaries of Moodna Creek. In addition, an STP has been evaluated at Trout Brook from the Greenwood Lake area. An outfall pipe from the OCSD#1 STP, which is reported to have a capacity of 2 mgd, is located on a tributary of upper Woodbury Creek. This has not been permitted to operate by the NYSDEC.

FIGURE II-21



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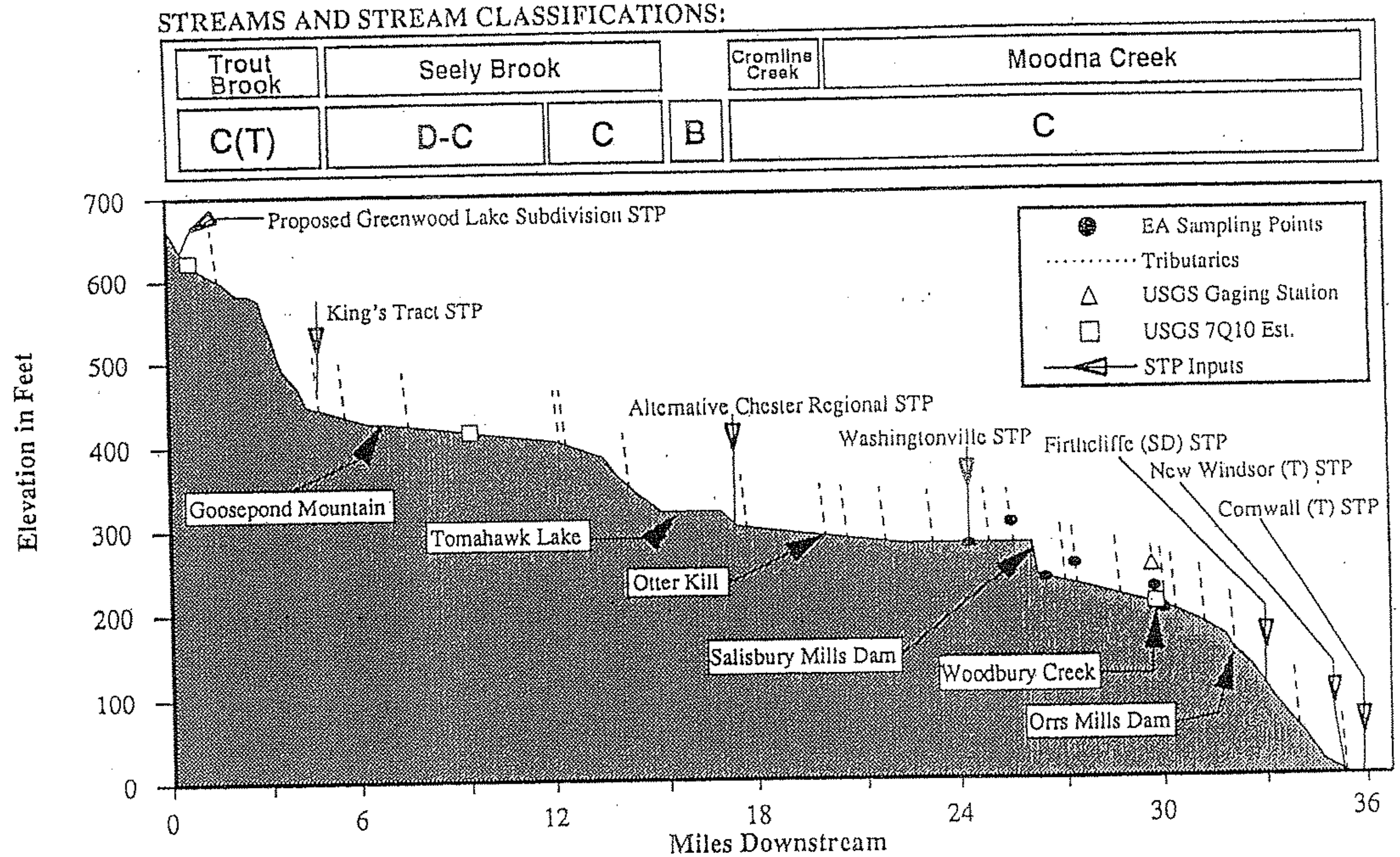
COMPREHENSIVE SEWERAGE STUDY

Predicted maximum discharge concentration of ammonia-permitted over a range offlows from a wastewater treatment plant discharging to the Shawangunk Kill at Route 211 in the Town of Mt. Hope in order to comply with ambient water quality standards.

132546

FIGURE II-22



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COMPREHENSIVE SEWERAGE STUDY

Longitudinal section of Cromline Creek/ Moodna Creek with major tributaries and wastewater treatment plant discharges.

132546

WAC analyses were conducted for upper Moodna Creek downstream from the Washingtonville STP, and for Woodbury Creek in the vicinity of the inactive OCSD#1 STP outfall.

11.6.1 Upper Moodna Creek

11.6.1.1 Model Conditions

The reach encompassed within the one-dimensional, steady-state model extends downstream from the Washingtonville STP to below the confluence of the Woodbury Creek and includes the Salisbury Mills Dam and backwater approximately 2 miles below the Washingtonville STP. The current SPDES permit conditions and compliance history for the one year period 1988-1989 is summarized in Appendix C-5 for the Washingtonville STP.

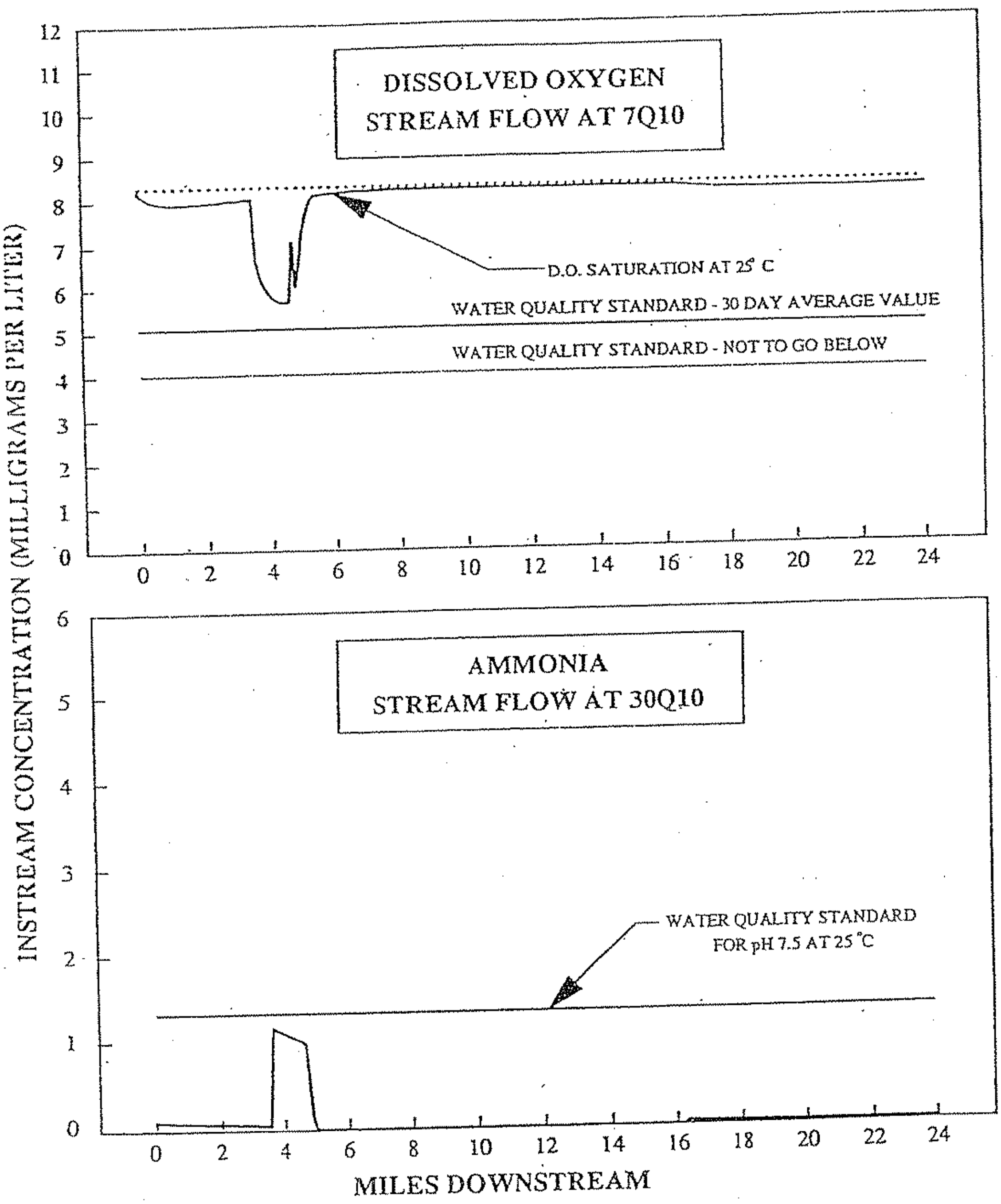
Three discharge scenarios were modeled under critical low flow summer conditions with discharge rates from the Washingtonville STP ranging from 0.4 mgd, the current permit limit, through various proposed levels of regionalization to 7 mgd. The estimated critical low flow (MA7Q10) for DO analysis was 2.0 cfs and for ammonia analysis (MA30Q10) was 2.7 cfs at the Washingtonville STP site. The low flow estimates were provided by NYSDEC.

11.6.1.2 Projections Under Current Permit Conditions and a Range of Flow Scenarios

No excursions of the ambient DO and ammonia standards in Moodna Creek are predicted at the current BOD, ammonia, and flow (0.4 mgd) limits for the Washingtonville STP (Figure 11-23). However, low flow conditions in this area of the Moodna Creek would provide poor dilution at higher flows (4.5 and 7.0 mgd) resulting in significant violations for both DO and ammonia at 4 and 2 miles, respectively, downstream of the outfall (Figure 11-24). Complete deoxygenation is predicted within the area under both 4.5 and 7.0 mgd discharge scenarios.

The effect of instream flow velocity (transit time) in this model is apparent in the 1-mile long backwater area above the dam at Salisbury Mills. In this area, transit time and re-aeration decrease sharply which results in an associated decrease of instream DO. A rapid recovery in both DO and ammonia occurs over the 60-ft drop in elevation over the 0.2 miles downstream of the dam where re-aeration and flow rates are considerably higher.

FIGURE II-23



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EA ENGINEERING, SCIENCE, AND TECHNOLOGY

FOR

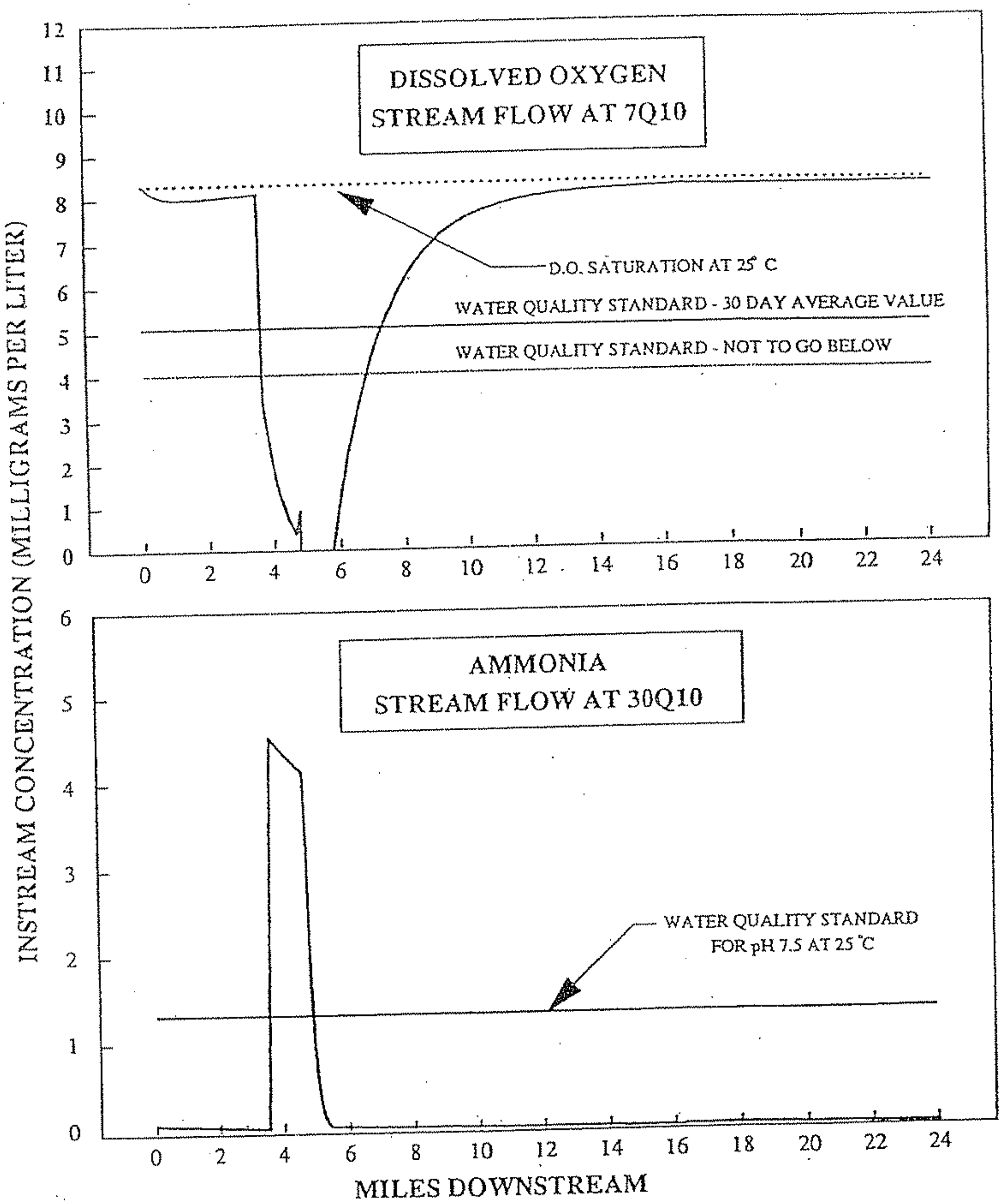
HAZEN AND SAWYER, P.C.
Engineers

ORANGE COUNTY, N.Y.
COMPREHENSIVE SEWERAGE STUDY

Predicted summer ambient water quality response to the current 0.4 MGD discharge from the Washingtonville (V) STP to Moodna Creek under current SPDES permit limits.

137546

FIGURE II-24



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COMPREHENSIVE SEWERAGE STUDY

Predicted summer ambient water quality response to the projected 7.0 MGD discharge from the Washingtonville STP to Moodna Creek under current SPDES permit limits.

132546

11.6.1.3 Predicted Effluent Conditions for Compliance with Ambient Water Quality Standards

In order to maintain ammonia levels in Moodna Creek below the summer ambient water quality standard (1.3 mg/l) at the projected 4.5 and 7.0 mgd discharge rates, it would be necessary for wastewater treatment to achieve the ambient water quality standard in the outfall of the plant. With effluent water quality at 1.3 mg/l ammonia and an associated 10 mg/l BOD (20 mg/l ultimate CBOD), maintenance of instream DO would still be a problem at high discharge rates due to the backwater effect of the dam. If the effluent is raised to a minimum of 5.0 mg/l DO at the outfall, a maximum allowable discharge rate of 3.0 mgd would assure a minimum DO of 5.0 mg/l downstream (Figure 11-25).

Relocation of the Washingtonville STP outfall 2 miles downstream to a point at or over the dam could provide greater assimilative capacity with respect to the DO standard. A discharge of 7.0 mgd at 1.3 mg/l ammonia and 5.0 mg/l DO is predicted to result in no violation of the respective ambient water quality standards (Figure 11-26).

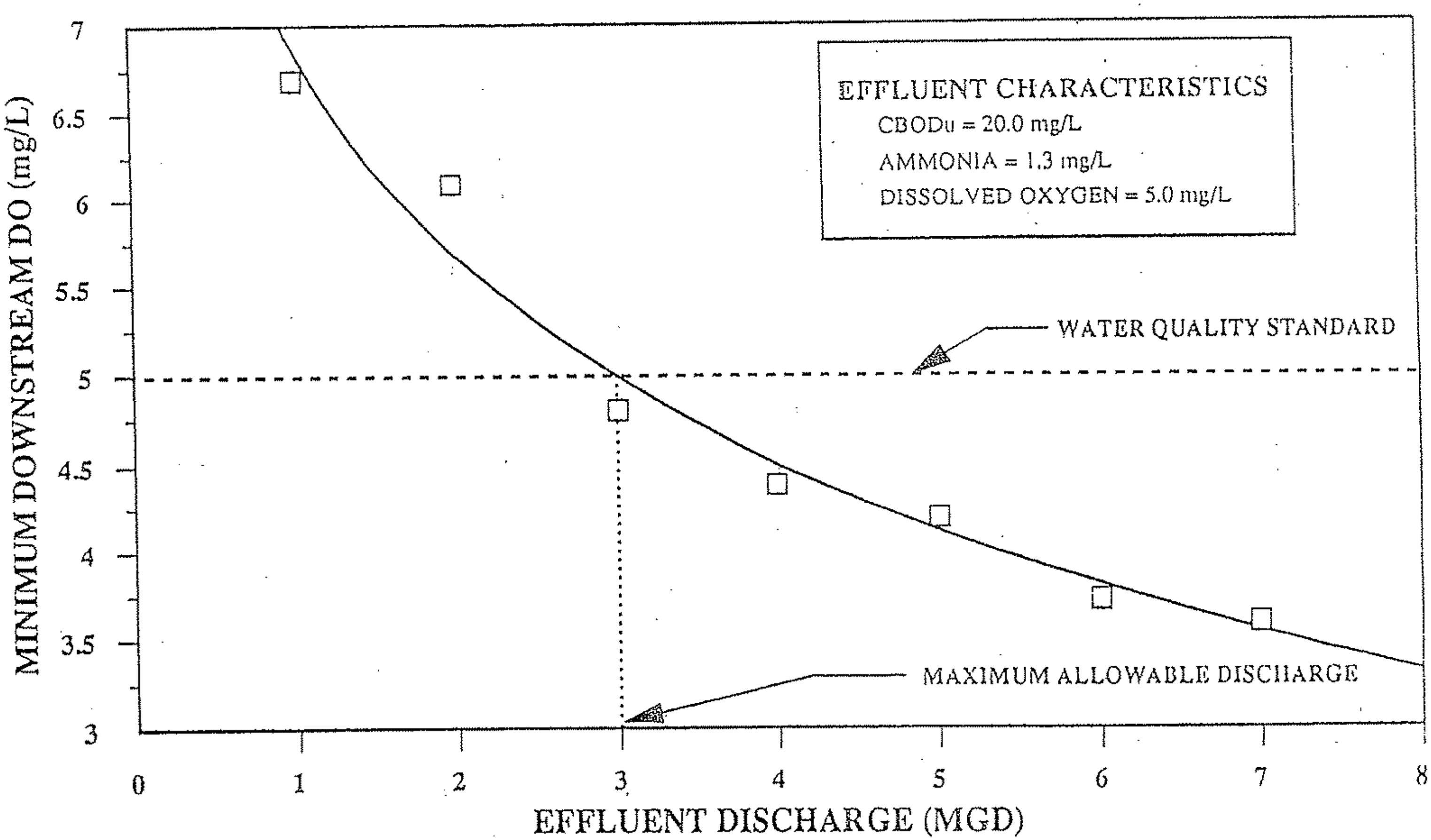
11.6.2 Woodbury Creek

Woodbury Creek is a major tributary to lower Moodna Creek. An outfall pipe from OCSD#1 STP designed to discharge 2.0 mgd to a headwater tributary of Woodbury Creek remains inactive. This area of Woodbury Creek is Class D and proposed for reclassification to Class C; with downstream areas proposed for reclassification from C(T) to C(TS). The MA7Q10 is estimated at 0.5 cfs and the MA30Q10 is 0.65 cfs. At these critical flow conditions, 2.0 mgd effluent would have to meet approximately 2.0 mg/l ammonia in order to maintain the ambient water quality standard in Woodbury Creek during the summer (Figure 11-27). Advanced treatment necessary to meet the 2.0 mg/l ammonia effluent limit would result in approximately 20 mg/l ultimate CBOD. The treated effluent would require aeration to approximately saturation during the summer in order to achieve ambient standards for DO.

11.7 Hudson River

The Hudson River is the largest receiving water body accessible to Orange County for discharge of treated wastewater. The maximum tidal excursion for the middle Hudson River estuary in the vicinity of Cornwall is approximately 13 miles, that is one tidal cycle would transport effluent approximately 6.5 miles up and downstream of the discharge site (TI 1975; McFadden et al. 1978; LMS 1988). For a discharge in the vicinity of New Windsor, New York, river mile (RM) 57, this zone of tidal influence would extend from RM 51 to RM 64 (Figure 11-28). With an average tidal amplitude

FIGURE II-25



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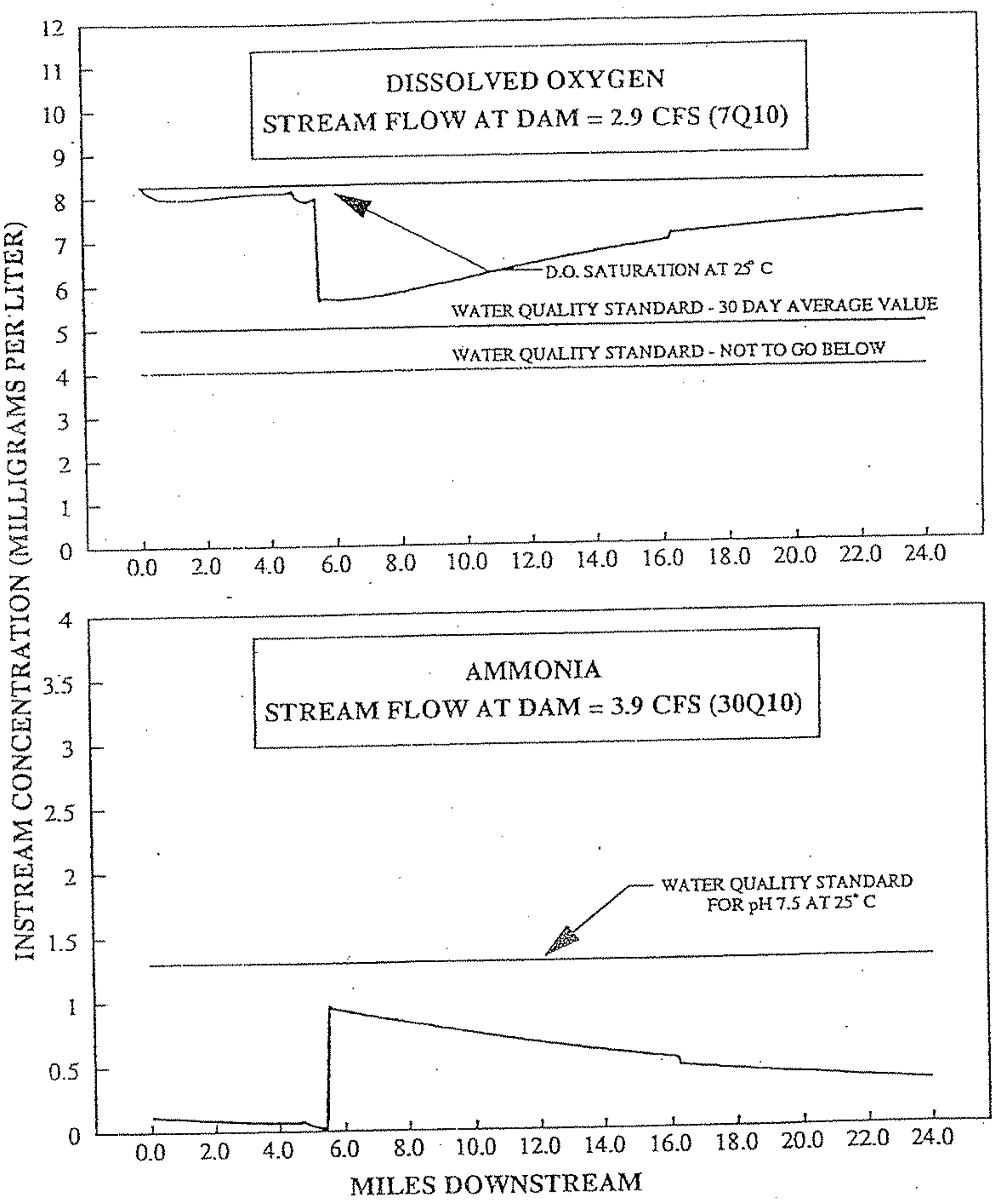
ORANGE COUNTY, N.Y.
COMPREHENSIVE SEWERAGE STUDY

Predicted relationship between minimum instream DO and discharge rate from the Washingtonville STP outfall to Moodna Creek.

132546

FIGURE II-26



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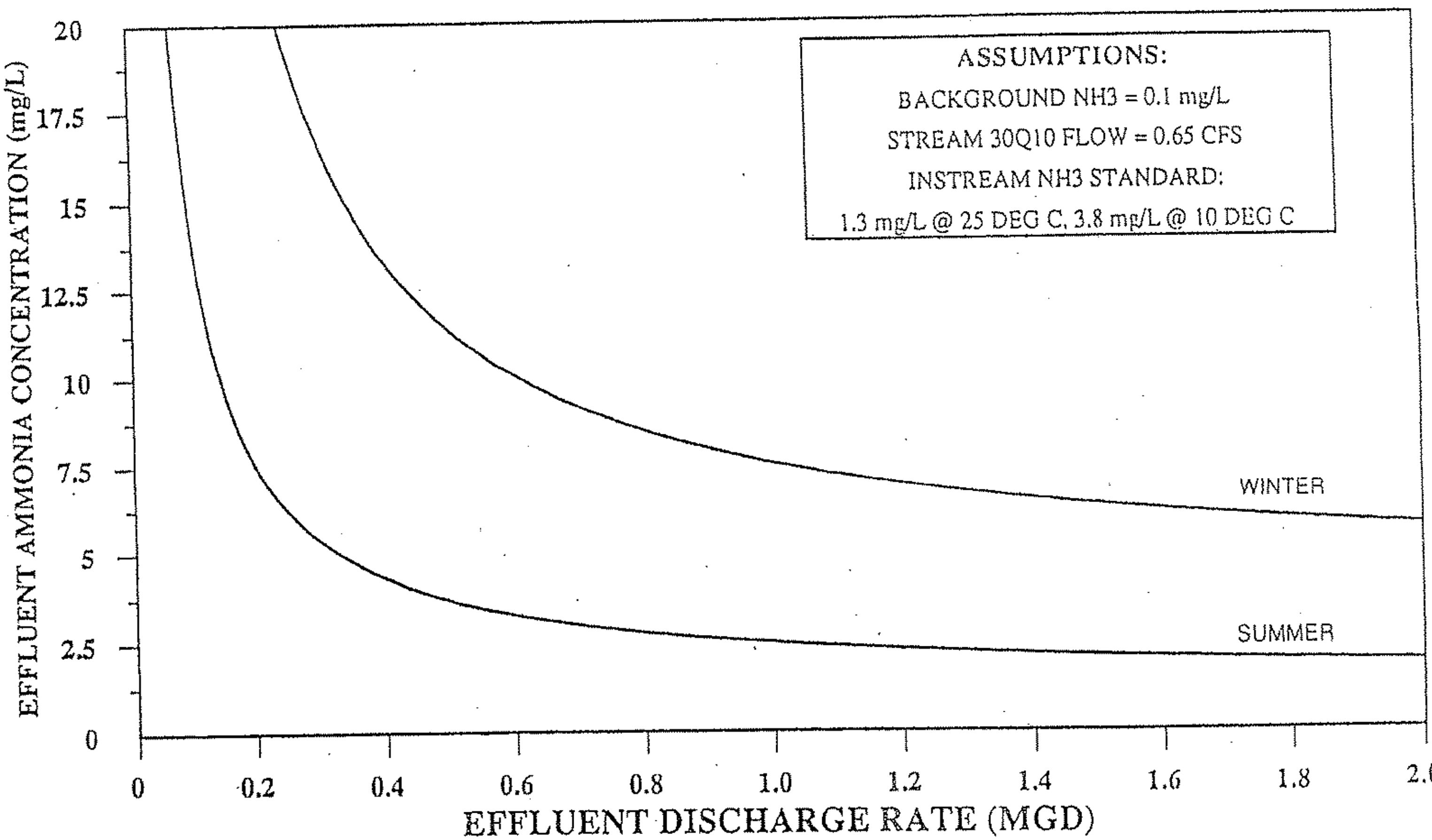
COMPREHENSIVE SEWERAGE STUDY

Predicted summer ambient water quality response to a projected 7.0 MGD discharge from the Washingtonville STP with the outfall relocated 2 miles downstream to the Salisbury Mills dam and effluent quality of 1.3 mg/L ammonia and 5 mg/L DO.

132546

FIGURE II-27



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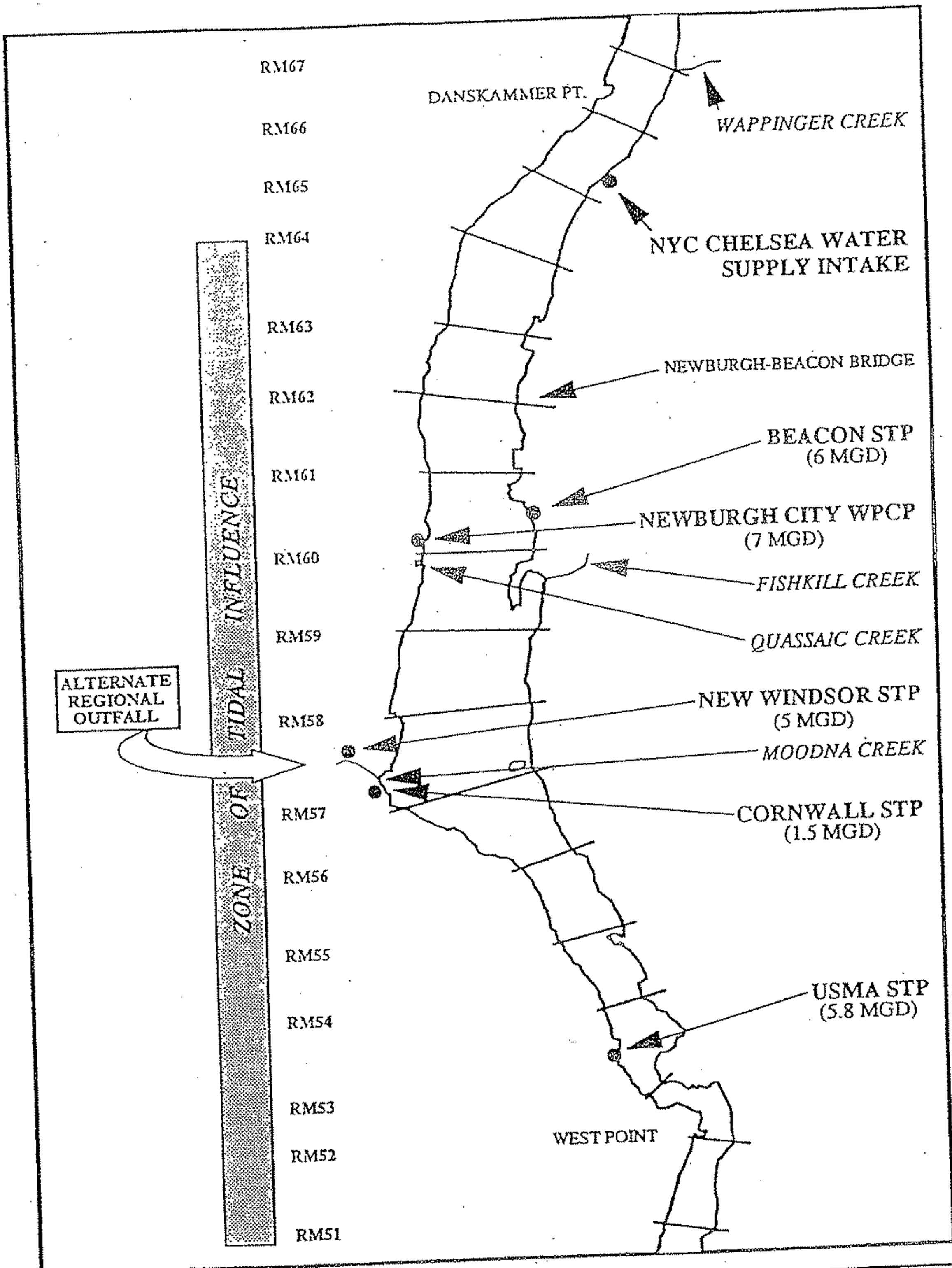
ORANGE COUNTY, N.Y.
COMPREHENSIVE SEWERAGE STUDY

Predicted maximum discharge concentration of ammonia permitted over a range of OCSD # 1 discharges to upper Woodbury Creek in order to comply with ambient water quality standards.

FIGURE 11-28



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ORANGE COUNTY, N.Y.
COMPREHENSIVE SEWERAGE STUDY

The Hudson River estuary in the vicinity of Newburgh with existing wastewater treatment plant discharges, the NYC Chelsea water supply intake and the zone of tidal inluence for an alternate expanded discharge into RM 57.

132546

of 2.7 ft near Cornwall (Lawler, Matusky & Skelly, 1988), the inter-tidal volume in this zone is approximately 19,603 acre-ft with an average tidal flow of 39,500 cfs. The estimated MA7Q10 freshwater flow is 3,000 cfs.

A proposed 20-30 mgd (31-46 cfs) STP in this area would have a dilution ratio relative to the MA7Q10 of 97:1 to 65:1. The Hudson River in this area is a class B water. NYSDEC (1987) provides guidance that for waters with a stream flow-to-effluent ratio of 12:1 or greater are effluent limiting and that, "...secondary treatment limits are generally appropriate," to meet ambient DO standards. Similarly, effluent limits for toxic substances into effluent limiting segments can also be "...satisfied by implementation of technology-based treatment as opposed to water quality-based limits for water quality limiting segments." It is likely that secondary treatment would be adequate to meet DO and ammonia standards at this location under NYSDEC guidance. However, NYSDEC does reserve the right to make case-by-case modifications under their guidance. Five existing STP's currently discharge within the zone of tidal influence of RM 57; U.S. Military Academy STP (5.8 mgd), Cornwall STP (1.5 mgd), New Windsor STP (5.0 mgd), Newburgh City WPCP (7.0 mgd), and Beacon STP (6.0 mgd). The upstream extent of the zone of tidal influence, RM 64, is downstream of the Chelsea Water Supply Pump Station (RM 66) in Dutchess County (Figure 11-28).

11.8 Summary

A summary of Orange County's receiving water bodies waste assimilative capacity is presented in Table 11-4. As shown, all need an advanced level of sewage treatment for the effluent, with the sole exception of the Hudson River where secondary treatment is sufficient.

Receiving water quality and effluent limitations confirm that either regional or central sewage treatment facilities in the County are limited in their discharge to the Wallkill and Hudson Rivers. However, the Wallkill River has less available capacity and requires an advanced level of treatment. Therefore, for a larger, central type of sewage treatment facility, the Hudson River appears to be the best receiving water body for effluent discharge, based upon WAC analyses.

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 11-4

SUMMARY OF ORANGE COUNTY'S
RECEIVING WATER BODIES WASTE ASSIMILATIVE CAPACITY

RECEIVING WATER BODY	TREATMENT LEVEL FOR AMMONIA	DISSOLVED OXYGEN LIMITS (mg/l)	AVAILABLE CAPACITY (mgd)
Ramapo River	Advanced	>5	5
Wallkill River	Advanced	2.5-4	10-20
Wawayanda Creek	Advanced	>5	2-4
Shawangunk Kill	Advanced	>5	1
Moodna Creek	Advanced	>5	3
Woodbury Creek	Advanced	Saturated	None
Hudson River	Secondary	N/A[1]	20-30

(1) Not applicable.

CHAPTER 12

12.0 EVALUATION OF IDENTIFIED ALTERNATIVE ACTIONS

12.1 Introduction

The 92 alternative actions identified in Chapter 10 are to be evaluated using a two-stage evaluation process. In the first stage, basic environmental, cost and implementation criteria are used to evaluate the 92 actions and eliminate unsuitable ones based on these criteria. Only those alternatives that warrant continued analysis after the first stage evaluation are further analyzed in the second stage evaluation. Figure 12-1 presents a flowsheet illustrating how alternative actions are identified and evaluated to determine comparative merit.

It is important to note that the alternative actions evaluated herein include only those comprised of sewage treatment facilities, required pumping stations and primary collection lines. As such, local collection systems are to remain a local responsibility, and are not included as part of the alternative actions. It should also be noted that costs associated with the retirement of any existing debt, the land acquisition for treatment facility and pumping station sites and administration costs are not included in the evaluation of alternative actions. These types of costs are to be addressed in Chapter 15 for any recommended Orange County sewage treatment actions described in Chapter 13.

12.2 First Stage Evaluation

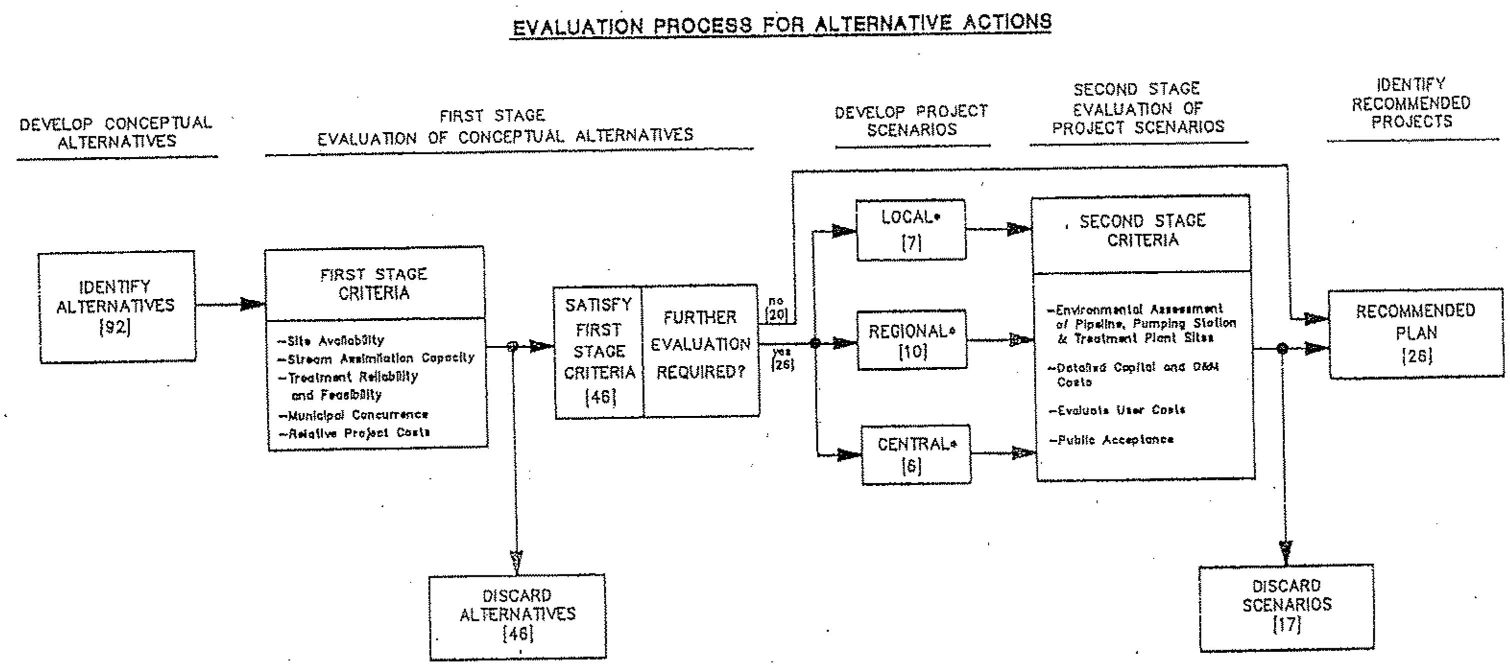
The first stage evaluation of identified alternative actions to address future sewage collection and treatment needs in Orange County is intended to compare basic criteria. The satisfaction of criteria in this first stage evaluation is determined by considering how the identified alternative actions for each municipality in the County compare to one another.

Criteria used to evaluate alternative actions in this first stage are as follows:

- Site availability;
- Treatment feasibility and reliability;
- Perceived municipal concurrence; and
- Comparative cost.

The above first stage criteria are fundamental in assessing the appropriateness of the 92 alternative actions identified in Chapter 10.

FIGURE 12-1



* NOTE THAT THE 26 CONCEPTUAL ALTERNATIVES TO BE EVALUATED IN THE SECOND STAGE BECAME 23 PROJECT SCENARIOS. THIS IS BECAUSE SOME PROJECT SCENARIOS CAN ENCOMPASS MULTIPLE CONCEPTUAL ALTERNATIVES.

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ORANGE COUNTY, N.Y.
COMPREHENSIVE SEWERAGE STUDY

EVALUATION PROCESS FOR ALTERNATIVE ACTIONS

For the first stage evaluation, criteria are weighted equally. Each alternative action is rated in one of three ways for each criteria: satisfactory, more satisfactory or less satisfactory. Based upon the relative rating of criteria for each alternative action, it is determined whether the alternative action is appropriate for recommendation, further evaluation or dismissal. It should be explained that for the comparative cost criteria evaluation in this first stage, project costs for each municipality (note: OCSD#1 and MBSR are considered municipal entities) are determined in the following manner. First, a common service area is defined, and all costs for conveyance and treatment for the service area are assessed on a "flow-share" basis (i.e., individual municipal sewage flow divided by total service area sewage flow). Second, the cost for each individual municipality to connect to the service area is assessed directly onto the municipalities in the service area.

Table 12-1 shows the results of the first stage evaluation for the 92 identified alternative actions. There are 20 recommended actions as a result of passing the first stage evaluation. There are 26 alternative actions passing the first stage evaluation that require further consideration in the second stage evaluation. Finally, 46 alternative actions are discarded as comparatively unsatisfactory.

12.3 Second Stage Evaluation

The second stage evaluation of 26 alternative actions passing the first stage evaluation involves a more comprehensive analysis. The second stage evaluation entails an analysis of potential pumping station and treatment facility sites, pipeline profiles and sizes, and specific equipment required for the expansion, upgrade or construction of facilities. A listing of potential pipeline and pumping station sizes for the regional and central types of alternative actions among the 26 entering the second stage evaluation is shown in Table 12-2.

Criteria used to evaluate alternative actions in this second stage are as follows:

- Environmental impacts; and
- Detailed capital, operation and maintenance costs.

The 26 alternative actions undergoing second stage evaluation are grouped into 7 local, 10 regional and 6 central "project scenarios". Note that since regional and central alternative actions encompass several municipalities, the number of project scenarios (23) does not equal the number of alternative actions (26), although all alternative actions are included in the project scenarios. A concise description of the 23 project scenarios to be evaluated in the second stage is provided as follows:

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 12-1
FIRST STAGE EVALUATION OF ALTERNATIVE ACTIONS

KEY: +++ more satisfactory
++ satisfactory
+ less satisfactory

Area	Locality	No.	Alternative	Type of Alternative	Receiving Water Body	Site Available	Treatment Feasibility & Reliability (1)	Perceived Municipal Concurrence	Relative Budgetary Cost (2)	Further Screening Necessary?	Comments
SOUTH	Greenwood Lake	1	new Trout Brook STP	local	Trout B.	+++	+	++	+++	Y	
		2	pipe & treat at OCSD#1 STP	regional	Hudson R.	+	++	++	++	Y	
		3	pipe & treat at new Hudson R. STP	central	Hudson R.	+++	+++	++	++	Y	
	Tuxedo (w/o SFC)	4	upgrade/expand STP	local	Ramapo R.	+++	++	+++	+++	N	RECOMMENDED ACTION
		5	pipe & treat at OCSD#1 STP	regional	Hudson R.	+	++	++	+	N	high conveyance cost; OCSD#1 site is restrictive
		6	pipe & treat at new Hudson R. STP	central	Hudson R.	+++	+++	++	+	N	high conveyance cost
	Tuxedo Park	7	upgrade STP	local	Ramapo R. Trib.	+++	++	+++	+++	N	RECOMMENDED ACTION
		8	pipe & treat at OCSD#1 STP	regional	Hudson R.	+	++	++	+	N	high conveyance cost; OCSD#1 site is restrictive
		9	pipe & treat at new Hudson R. STP	central	Hudson R.	+++	+++	++	+	N	high conveyance cost
	Warwick (U) (w/o SFC)	10	upgrade/expand STP	local	Longhouse C.	+++	+	+++	+++	Y	
		11	pipe & treat at Warwick (V) STP	regional	Wawayanda C.	+++	++	+++	++	Y	
		12	pipe & treat at Wallkill R. STP	regional	Wallkill R.	++	++	++	+	N	high conveyance cost
		13	pipe & treat at OCSD#1 STP	regional	Hudson R.	+	++	++	+	N	high conveyance cost; OCSD#1 site is restrictive
		14	pipe & treat at new Hudson R. STP	central	Hudson R.	+++	+++	++	+	N	high conveyance cost
	Warwick (V)	15	upgrade/expand STP	local	Wawayanda C.	+++	++	++	+++	Y	
		16	upgrade/expand STP for region	regional	Wawayanda C.	+++	++	++	+++	Y	
		17	pipe & treat at Wallkill R. STP	regional	Wallkill R.	++	++	++	+	N	high conveyance cost
		18	pipe & treat at OCSD#1 STP	regional	Hudson R.	+	++	++	+	N	high conveyance cost; OCSD#1 site is restrictive
		19	pipe & treat at new Hudson R. STP	central	Hudson R.	+++	+++	++	+	N	high conveyance cost
CENTRAL	Florida	20	upgrade/expand STP	local	Quaker C.	+++	++	+++	+++	N	RECOMMENDED ACTION
		21	pipe & treat at OCSD#1 STP	regional	Hudson R.	+	++	++	+	N	high conveyance cost; OCSD#1 site is restrictive
		22	pipe & treat at Wallkill R. STP	regional	Wallkill R.	++	++	++	+	N	high conveyance cost
		23	pipe & treat at new Hudson R. STP	central	Hudson R.	+++	+++	++	+	N	high conveyance cost
	Goshen (U)	24	new Otter Kill C. STP	local	Otter Kill C.	+++	+	++	+	N	high treatment cost; lower treatment reliability
		25	pipe & treat at (V) STP	regional	Rio Grande C.	++	+	++	+	N	high treatment cost; lower treatment reliability
		26	pipe & treat at (V) STP w/ Wallkill dis	regional	Wallkill R.	++	++	++	+	N	high cost for Goshen (V)
		27	pipe & treat at OCSD#1 STP	regional	Hudson R.	+	+++	++	++	Y	
		28	pipe & treat at Wallkill R. STP	regional	Wallkill R.	++	++	++	+++	Y	
		29	pipe & treat at new Hudson R. STP	central	Hudson R.	+++	+++	++	+++	Y	
	Goshen (V)	30	maintain STP for Village only	local	Rio Grande C.	+++	++	+++	+++	N	RECOMMENDED ACTION
		31	upgrade/expand STP for region	regional	Rio Grande C.	++	+	++	+	N	high treatment cost; lower treatment reliability
		32	expand & pipe to Wallkill R.	regional	Wallkill R.	++	++	++	+	N	high conveyance cost
		33	pipe & treat at OCSD#1 STP	regional	Hudson R.	+	++	+	+	N	high conveyance cost; OCSD#1 site is restrictive
		34	pipe & treat at Wallkill R. STP	regional	Wallkill R.	++	++	++	+	N	high conveyance cost
		35	pipe & treat at new Hudson R. STP	central	Hudson R.	+++	+++	++	+	N	high conveyance cost

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

KEY: +++ more satisfactory
++ satisfactory
+ less satisfactory

TABLE 12-1
FIRST STAGE EVALUATION OF ALTERNATIVE ACTIONS

Area	Locality	No.	Alternative	Type of Alternative	Receiving Water Body	Site Available	Treatment Feasibility & Reliability (1)	Perceived Municipal Concurrence	Relative Budgetary Cost (2)	Further Screening Necessary?	Comments
CENTRAL	Hamptonburgh	36	new Otter Kill C. STP	local	Otter Kill C.	+++	++	++	+++	N	municipal treatment not warranted
		37	new septic, package STPs as required	local	various	+++	++	+++	+++	N	RECOMMENDED ACTION
		38	pipe & treat at Wallkill R. STP	regional	Wallkill R.	++	++	++	+	N	municipal treatment not warranted
		39	pipe & treat at new Hudson R. STP	central	Hudson R.	+++	+++	++	+	N	municipal treatment not warranted
	OCSD#1 & HBSR	40	expand STP & pipe to Hudson R.	central	Hudson R.	+++	++	++	+++	Y	
		41	pipe & treat at New Windsor STP	regional	Hudson R.	+	+++	++	+++	N	New Windsor site is restrictive
		42	pipe & treat at new Hudson R. STP	central	Hudson R.	+++	+++	++	+++	Y	
	OCSD#1 alone	43	upgrade/expand STP	regional	Ramapo R.	+	+	++	+++	Y	
	HBSR alone	44	pipe & treat at new Moodna C. STP	regional	Moodna C.	+++	+	++	+	N	high conveyance cost; lower treatment reliability
		45	pipe & treat at Washingtonville STP	regional	Moodna C.	++	+	++	+	N	high treatment cost; lower treatment reliability
		46	pipe & treat at new Hudson R. STP	regional	Hudson R.	+++	+++	++	+++	Y	
	Washingtonville	47	upgrade/expand STP	local	Moodna C.	+++	++	+++	+	Y	
		48	upgrade/expand STP for region	regional	Moodna C.	++	+	++	+	N	high treatment cost; lower treatment reliability
		49	new Moodna C. STP for region	regional	Moodna C.	+++	+	++	+	N	high treatment cost; lower treatment reliability
		50	pipe & treat at new Hudson R. STP	central	Hudson R.	+++	+++	+++	+++	Y	
WEST	Deerpark	51	new Neversink R. STP	local	Neversink R.	+++	+++	++	+++	N	municipal treatment not warranted
		52	new septic, package STPs as required	local	various	+++	++	+++	++	N	RECOMMENDED ACTION
		53	pipe & treat at Port Jervis STP	regional	Neversink R.	++	++	+	+	N	municipal treatment not warranted
	Greenville	54	new Rutgers C. STP	local	Rutgers C.	+++	++	++	++	N	municipal treatment not warranted
		55	new septic, package STPs as required	local	various	+++	++	++	+++	N	RECOMMENDED ACTION
		56	new regional Rutgers C. STP	regional	Rutgers C.	+++	++	++	++	N	municipal treatment not warranted
	Middletown	57	maintain STP	local	Wallkill R.	+++	++	+++	++	N	RECOMMENDED ACTION
	Minisink / Unionville	58	new So. Wallkill R. STP	local	Wallkill R.	+++	++	++	++	N	municipal treatment not warranted
		59	new Rutgers C. STP	local	Rutgers C.	+++	++	++	++	N	municipal treatment not warranted
		60	new septic, package STPs as required	local	various	+++	++	++	+++	N	RECOMMENDED ACTION
	Mount Hope / Otisville	61	upgrade/expand STPs	local	Shawangunk K.	+++	++	++	+	Y	
		62	new septic, package STPs as required	regional	various	+++	++	++	+++	Y	
		63	new regional Shawangunk K. STP	regional	Shawangunk K.	+++	++	+++	+	Y	
	Port Jervis	64	maintain STP	local	Neversink R.	+++	+++	+++	+++	N	RECOMMENDED ACTION
		65	maintain STP for region	regional	Neversink R.	++	+++	+	+++	N	high conveyance cost for Deerpark
	Wallkill	66	expand STP	local	Wallkill R.	+++	++	+++	+	Y	
		67	expand STP for region	regional	Wallkill R.	++	++	++	+++	Y	

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

KEY: +++ more satisfactory
++ satisfactory
+ less satisfactory

TABLE 12-1
FIRST STAGE EVALUATION OF ALTERNATIVE ACTIONS

Area	Locality	No.	Alternative	Type of Alternative	Receiving Water Body	Site Available	Treatment Feasibility & Reliability (1)	Perceived Municipal Concurrence	Relative Budgetary Cost (2)	Further Screening Necessary?	Comments
WEST	Walik/Middtn Area	68	new mid-Wallkill R. STP for region	regional	Wallkill R.	++	++	++	++	Y	
	Wawayanda	69	new mid-Wallkill R. STP	local	Wallkill R.	+++	++	++	+	N	high treatment cost
		70	pipe & treat at new mid-Wallkill R. STP	regional	Wallkill R.	+++	++	++	++	Y	
		71	pipe & treat at Wallkill R. STP	regional	Wallkill R.	++	++	++	+++	Y	
NORTH	Crawford	72	expand STP	local	Shawangunk K.	+++	++	++	+++	N	RECOMMENDED ACTION
	Maybrook	73	upgrade STP	local	Otter Kill Tr.	++	++	+++	+++	N	RECOMMENDED ACTION
		74	pipe & treat at Montgomery V. STP	regional	Wallkill R.	++	++	++	+++	N	Village is proceeding with local option
	Montgomery (U)	75	upgrade/expand STP	local	Maybrk Res. Tr.	+	++	++	+++	N	Town is proceeding with new local Wallkill R. STP
		76	new No. Wallkill R. STP	local	Wallkill R.	+++	+++	+++	+++	N	RECOMMENDED ACTION
		77	pipe & treat at Montgomery V. STP	regional	Wallkill R.	++	++	++	+++	N	Town is proceeding with new local Wallkill R. STP
	Montgomery (V)	78	maintain STP only for local	local	Wallkill R.	+++	+++	+++	+++	N	RECOMMENDED ACTION
		79	expand STP for region	regional	Wallkill R.	++	++	++	++	N	STP will not have to expand to handle future local flow
	Walden	80	maintain STP	local	Wallkill R.	+++	+++	+++	+++	N	RECOMMENDED ACTION
EAST	Cornwall (U) / Cornwall (V)	81	expand STPs for region	local	Hudson R.	+	+++	++	+++	N	Cornwall sites are restrictive
		82	pipe & treat portion at New Windsor STP	regional	Hudson R.	++	+++	++	+++	N	RECOMMENDED ACTION
		83	pipe & treat portion at new Hudson R. STP	central	Hudson R.	+++	+++	++	+	N	high conveyance cost
	Highland Falls	84	maintain STP	local	Hudson R.	+++	++	++	+++	N	RECOMMENDED ACTION
		85	maintain STP for region	regional	Hudson R.	+++	++	++	+++	N	high conveyance cost for Town of Highlands
	Highlands (w/o West Pt)	86	expand STP	local	Hudson R.	++	++	++	+++	N	RECOMMENDED ACTION
		87	pipe & treat at Highland Falls STP	regional	Hudson R.	+++	++	++	+	N	high conveyance cost
	Newburgh (C) / Newburgh (U)	88	expand STP for region	regional	Hudson R.	++	++	++	+++	N	RECOMMENDED ACTION
	New Windsor (w/ Stewart)	89	expand STP for region	regional	Hudson R.	++	++	++	+++	N	RECOMMENDED ACTION
		90	expand STP to be central facility	central	Hudson R.	+	++	++	+++	N	New Windsor site is restrictive
	Hudson R. Area	91	new regional Hudson R. STP	regional	Hudson R.	+++	+++	++	+++	Y	
		92	new central Hudson R. STP	central	Hudson R.	+++	+++	++	+++	Y	

NOTES: (1) Treatment feasibility & Reliability is ranked as follows: +++ Secondary STP, ++ Low Advanced STP, + High Advanced STP.
(2) Relative Cost is ranked as follows: +++ least cost option(s)
++ 15-25% greater than least cost alternative
+ > 25% greater than least cost alternative
(3) Feasibility & Reliability for expansion of OCSD#1 STP with Hudson River discharge is ranked ++ due to difficulties associated with piping treated effluent.

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 12-2

CENTRAL AND REGIONAL ALTERNATIVE PIPELINES AND PUMPING STATIONS FOR SECOND STAGE EVALUATION

PIPE ROUTE (1)	SUB-ROUTE	DESCRIPTION	PIPE LENGTH, FT	PIPE DIAMETER (2)	PUMPING STATION CAPACITY, MGD
1	1.1	Greenwood Lake to School Rd. - Monroe (U)	31,000	2 @ 10" DIP	2.0
	1.2	School Rd. to Railroad ROW - Monroe (V)	17,000	24" RCP	-
1A	1A.1	Greenwood Lake to Trout Brook STP	14,000	2 @ 10" DIP	2.0
2	2.1	OCSD#1 STP to Lake Street - Monroe (V)	13,000	30" DIP	14.0
	2.2	Lake Street to Chester (V)	20,000	54" RCP	-
	2.1(R)	Regional OCSD#1 to Lake Street - Monroe (V)	13,000	18" DIP	5.0
	2.2(R)	Regional Lake Street to Chester (V)	20,000	30" RCP	-
2A	2A.1	Chester (V) to Lake Street - Monroe (V)	20,000	24" DIP	9.0
	2A.2	Lake Street to OCSD#1 STP	13,000	36" RCP	-
3	3.1	Chester (V) to Washingtonville	40,000	36" DIP	22.0
	3.2	Washingtonville to New Windsor STP	57,000	36" DIP	-
	3.3	Washingtonville STP to Sub-Route 3.2	1,000	12" DIP	4.5
	3.1(R)	Regional Chester (V) to Washingtonville	40,000	24" DIP	14.5
	3.2(R)	Regional Washingtonville to New Windsor STP	57,000	30" DIP	-
4	4.1	OCSD#1 STP to New Windsor	85,000	36" DIP	22.0
5	5.1	Goshen (V) border to Chester (V)(3)	26,000	12" DIP	3.5
6	6.1	Goshen (V) STP to Wallkill River	11,000	12" DIP	4.0
	6.2	Wallkill R. to Middletown or Wallkill STP	14,000	12" DIP	-
7	7.1	Wawayanda to Railroad ROW	3,000	10" DIP	2.0
	7.2	Railroad ROW to Wallkill STP	6,000	10" DIP	-

(1) Pipe Routes are defined in Chapter 10.
(2) Pipe sizes are designated as RCP (reinforced concrete pipe) for gravity interceptors and DIP (ductile iron pipe) for force mains.
(3) Pipe length has changed from Chapter 10 description since Goshen (V) no longer included.

a:pipe1s.xl:kw

1. Local Project Scenario No. 1 - Construct a new 0.4 mgd ADV(H) STP with effluent discharge to the Trout Brook to serve the Village of Greenwood Lake.

2. Local Project Scenario No. 2 - Construct a new 0.2 mgd ADV(H) STP with effluent discharge to the Shawangunk Kill to serve both the Village of Otisville and the Town of Mount Hope.

3. Local Project Scenario No. 3 - Expand the Wallkill ADV(L) STP to 4.8 mgd to serve the Town of Wallkill.

4. Local Project Scenario No. 4 - Expand and upgrade the Town of Warwick STP to 1.0 mgd ADV(H) to serve the Town of Warwick.

5. Local Project Scenario No. 5 - Maintain the Town of Warwick ADV(L) STP at 0.39 mgd to serve the Town of Warwick.

6. Local Project Scenario No. 6 - Expand and upgrade the Village of Warwick STP to 0.9 mgd ADV(L) to serve the Village of Warwick.

7. Local Project Scenario No. 7 - Expand and upgrade the Village of Washingtonville STP to 0.9 mgd ADV(L) to serve the Village of Washingtonville.

8. Regional Project Scenario No. 1a - Expand and upgrade the OCSD#1 STP to 4.6 mgd ADV(H) to serve only Orange County Sewer District #1 (the Villages of Monroe, Harriman and Kiryas Joel and part of the Town of Monroe).

9. Regional Project Scenario No. 1b - Expand and upgrade the OCSD#1 STP to 5.0 mgd ADV(H) to serve only Orange County Sewer District #1 and the Village of Greenwood Lake.

10. Regional Project Scenario No. 2a - Construct a new 6.0 mgd SEC STP in the vicinity of the Town of New Windsor with effluent discharge to the Hudson River to serve the MBSR (the Towns of Blooming Grove, Chester and Woodbury and the Village of Chester) and the Village of Washingtonville.

11. Regional Project Scenario No. 2b - Construct a new 6.5 mgd SEC STP in the vicinity of the Town of New Windsor with effluent discharge to the Hudson River to serve the MBSR and the Villages of Washingtonville and Greenwood Lake.

12. Regional Project Scenario No. 2c - Construct a new 7.5 mgd SEC STP in the vicinity of the Town of New Windsor with effluent discharge to the Hudson River to serve the MBSR, the Villages of Washingtonville and Greenwood Lake, and the Town of Goshen.

13. Regional Project Scenario No. 3 - Construct a new 1.5 mgd ADV(L) STP with effluent discharge to the Wallkill River to serve both the Towns of Goshen and Wawayanda.

14. Regional Project Scenario No. 4 - Construct a new 0.6 mgd ADV(H) STP with effluent discharge to the Shawangunk Kill to serve the Village of Otisville, the Town of Mount Hope and both the Otisville State and Federal correctional facilities.

15. Regional Project Scenario No. 5a - Expand the Wallkill ADV(L) STP to 5.3 mgd to serve both the Towns of Wallkill and Wawayanda.

16. Regional Project Scenario No. 5b - Expand the Wallkill ADV(L) STP to 6.2 mgd to serve the Towns of Wallkill, Wawayanda and Goshen.

17. Regional Project Scenario No. 6 - Expand and upgrade the Village of Warwick STP to 1.5 mgd ADV(L) to serve both the Village of Warwick and part of the Town of Warwick.

18. Central Project Scenario No. 1a - Construct a new 10.9 mgd SEC STP in the vicinity of the Town of New Windsor with effluent discharge to the Hudson River to serve OCSD#1, MBSR, and the Villages of Washingtonville and Greenwood Lake, with primary pipeline conveyance along abandoned railroad rights-of-way between Chester and New Windsor.

19. Central Project Scenario No. 1b - Construct a new 11.8 mgd SEC STP in the vicinity of the Town of New Windsor with effluent discharge to the Hudson River to serve OCSD#1, MBSR, the Villages of Washingtonville and Greenwood Lake, and the Town of Goshen, with primary pipeline conveyance along abandoned railroad rights-of-way between Chester and New Windsor.

20. Central Project Scenario No. 2a - Construct a new 10.0 mgd SEC STP in the vicinity of the Town of New Windsor with effluent discharge to the Hudson River to serve OCSD#1, MBSR, and the Village of Greenwood Lake, with primary pipeline conveyance along State Route 32 between Harriman and New Windsor.

21. Central Project Scenario No. 2b - Construct a new 11.0 mgd SEC STP in the vicinity of the Town of New Windsor with effluent discharge to the Hudson River to serve OCSD#1, MBSR, the Village of Greenwood Lake and the Town of Goshen, with primary pipeline conveyance along State Route 32 between Harriman and New Windsor.

22. Central Project Scenario No. 3a - Expand the OCSD#1 SEC STP to 10.0 mgd to serve OCSD#1, MBSR, and the Village of Greenwood Lake, with the treated effluent piped in an outfall along State Route 32 from Harriman to New Windsor with discharge to the Hudson River.

23. Central Project Scenario No. 3b - Expand the OCSD#1 SEC STP to 11.0 mgd to serve OCSD#1, MBSR, the Village of Greenwood Lake and the Town of Goshen, with the treated effluent piped in an outfall along State Route 32 between Harriman and New Windsor with discharge to the Hudson River.

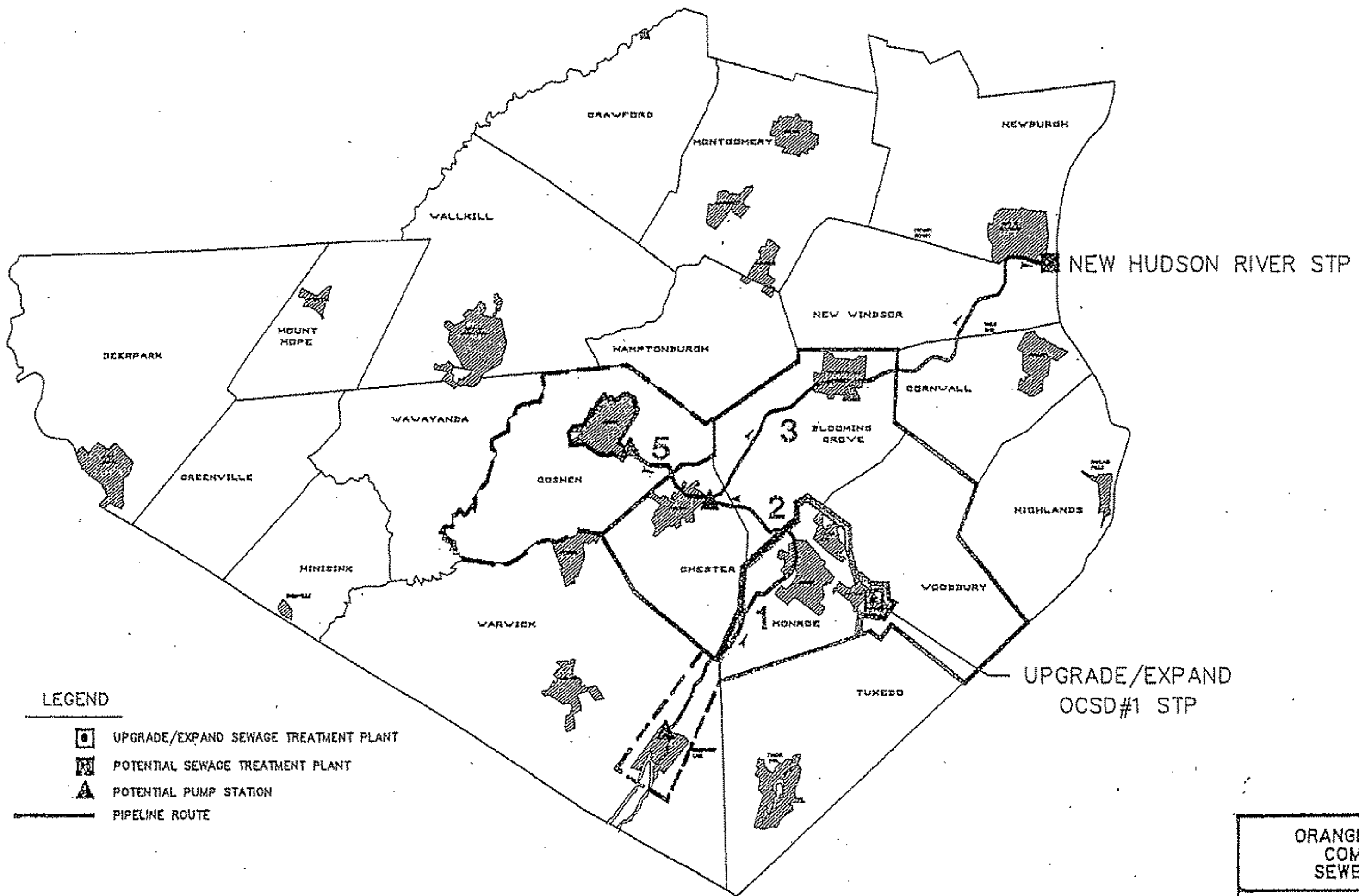
Figures 12-2, 12-3, 12-4, 12-5 and 12-6 illustrate the service areas, pipeline routes, pumping station and sewage treatment facility locations associated with the regional and central types of project scenarios in the above. The next two subsections discuss the environmental impact analyses and the cost analyses, respectively, of the 23 project scenarios in the second stage evaluation.

12.3.1 Project Scenario Environmental Impact Analysis

This part of the second stage evaluation involves an assessment of potential environmental impacts ensuing from any of the pipeline routes, sewage pumping and treatment facility sites associated with the 23 project scenarios. The assessment of sites is based upon field reconnaissance and a review of both NYSDEC wetlands maps and Significant Habitat and Natural Heritage Program databases.

The field reconnaissance effort consisted of visits to existing sewage treatment plant and pumping station sites, potential sewage treatment plant and pumping station sites, plus driving and walking along proposed pipeline routes. Except for the potential Trout Brook

FIGURE 12-2

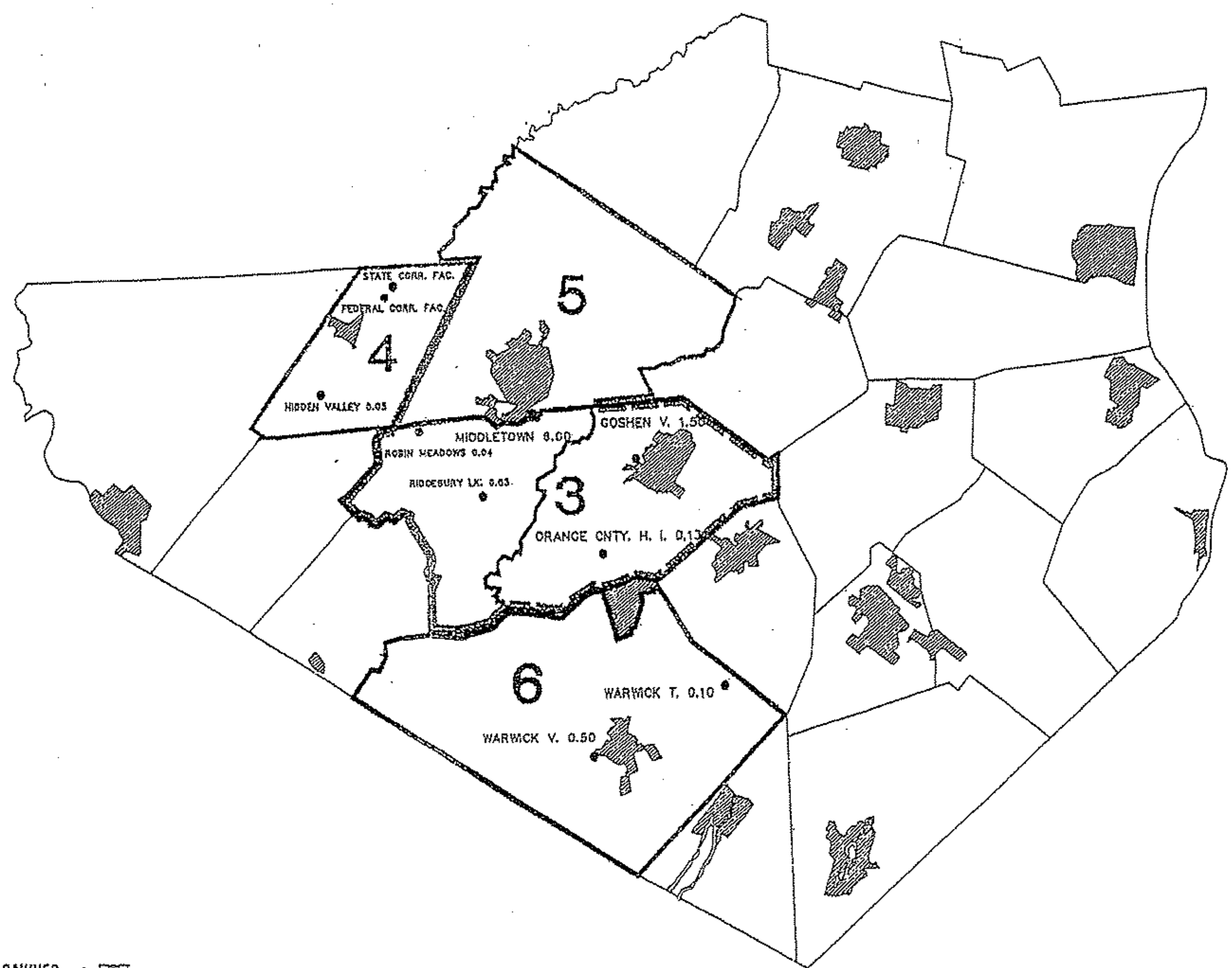


HAZEN AND SAWYER, P.C. Engineers

ORANGE COUNTY, N.Y.
COMPREHENSIVE
SEWERAGE STUDY

REGIONAL TREATMENT
SCENARIO NOS. 1 & 2

FIGURE 12-3



ORANGE COUNTY, N.Y.
COMPREHENSIVE
SEWERAGE STUDY

REGIONAL TREATMENT
SCENARIO NOS. 3,4,5,&6

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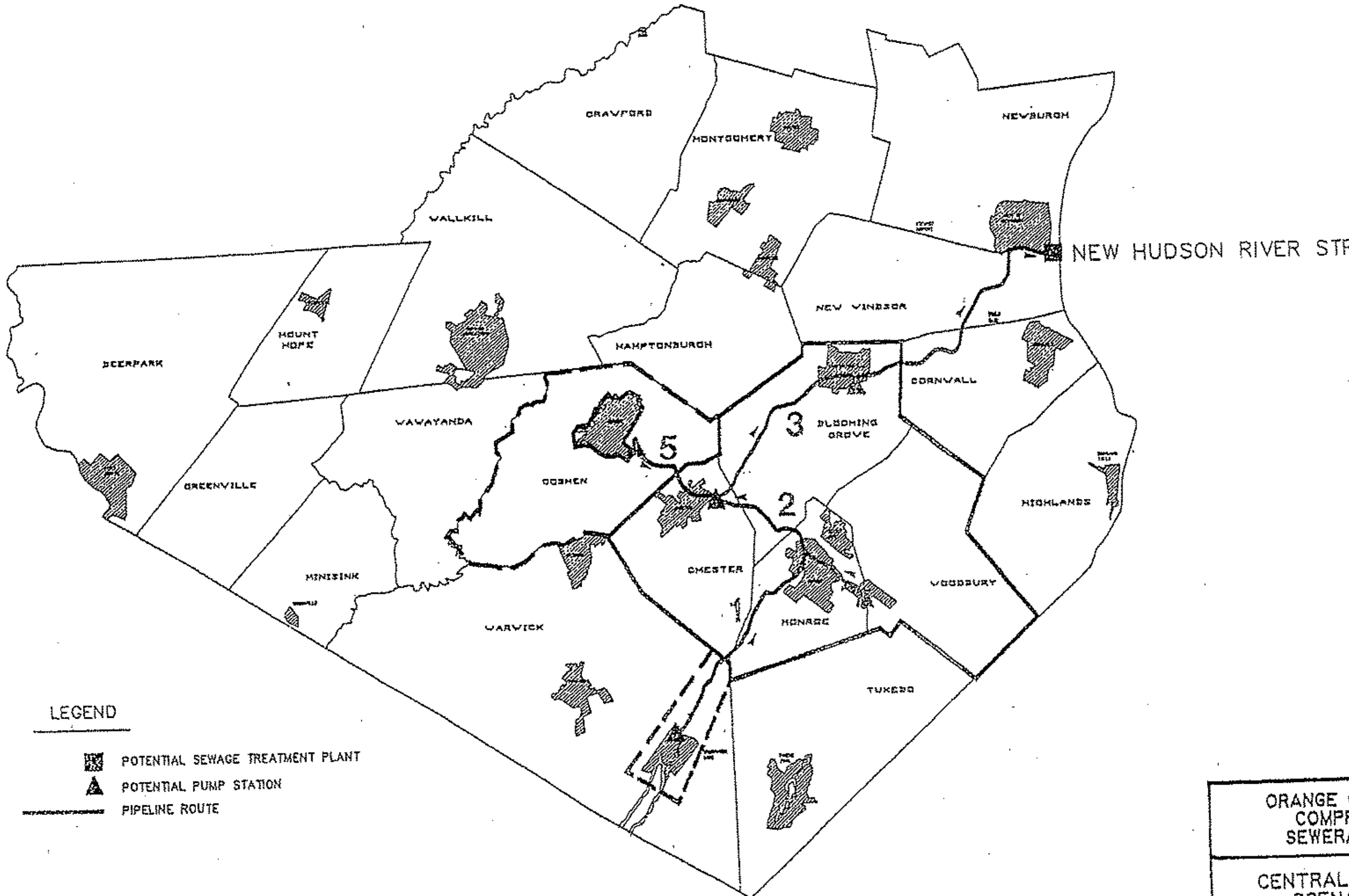
FIGURE 12-4



LEGEND

- POTENTIAL SEWAGE TREATMENT PLANT
- POTENTIAL PUMP STATION
- PIPELINE ROUTE

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SEWERAGE STUDY

CENTRAL TREATMENT
SCENARIO NO. 1

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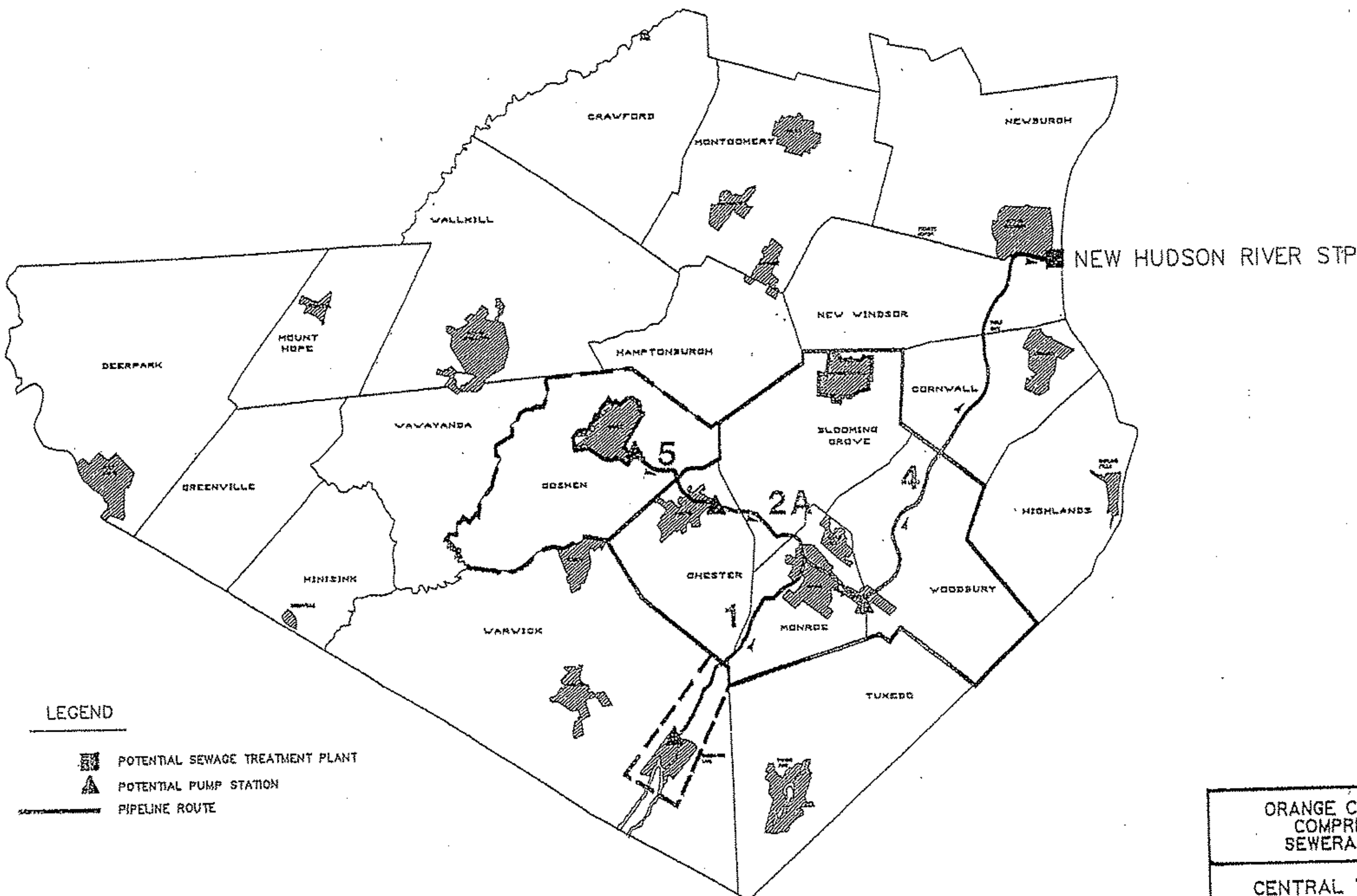
FIGURE 12-5



ORANGE COUNTY, N.Y.
COMPREHENSIVE
SEWERAGE STUDY

CENTRAL TREATMENT
SCENARIO NO. 2

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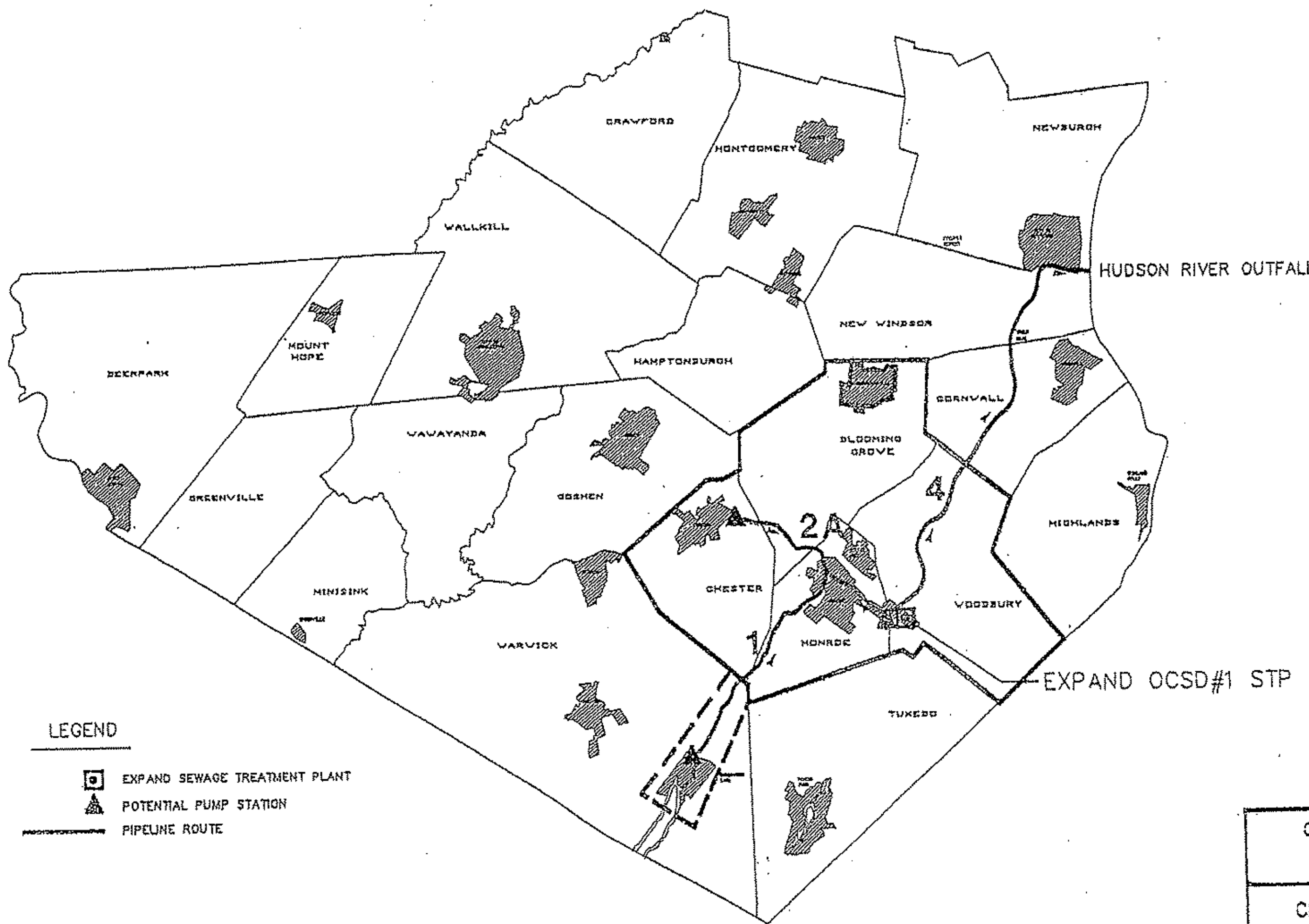
FIGURE 12-6



ORANGE COUNTY, N.Y. COMPREHENSIVE SEWERAGE STUDY

CENTRAL TREATMENT SCENARIO NO. 3

HAZEN AND SAWYER, P.C. Engineers

treatment plant site (a local project scenario to serve the Village of Greenwood Lake), no significant conditions were noted which can restrict either pipeline or facility siting due to environmental impacts. Low flow during dry weather months at the Trout Brook site will set an effective upper limit for effluent discharge quality equal to ambient instream standards and thus dismisses this project scenario.

The review of NYSDEC wetlands maps showed that several of the potential pipeline routes would pass through New York State-regulated wetlands using an existing right-of-way. However, installation of an underground utility such as a sewer pipeline in an existing right-of-way is allowable under New York State law, providing a proper permit is first obtained. None of the sites considered for either the potential expansion of existing STPs or the construction of new facilities appear to be located in areas where their proximity to wetlands should restrict such action. However, it is noted that the final determination of permitting requirements at some sites depends on the project scope and required survey of wetland boundaries.

The review of the Significant Habitat Program and Natural Heritage Program databases maintained by NYSDEC Information Services provided listings of sensitive habitats and sightings of rare, endangered or threatened species of plants and animals. For Orange County, only those listings found in the vicinity of the mouth of the Moodna Creek near the Hudson River appear to have the potential to be impacted by either facility construction or effluent discharge. Specifically, the Moodna Creek marsh, adjacent waters of the Hudson River and nearby terrestrial habitats appear on the database listing as a waterfowl nesting area, brackish intertidal mudflat, habitat for the spongy arrowhead (a rare aquatic plant), waterfowl concentration area, raptor concentration area, and an anadromous fish concentration area.

Table 12-3 presents a summary of the environmental impact assessment findings in the second stage evaluation. It should be noted that the wetlands listed in Table 12-3 use the NYSDEC identification system which provides map quadrangle (two-letter abbreviation), identification (I.D.) number and importance ranking (I-IV, in that order of importance). Potential adverse environmental impacts are associated with an effluent discharge to the Trout Brook for a local Greenwood Lake scenario (Local Project Scenario No. 1), and scenarios which involve an effluent discharge to the Hudson River tidal flats near the mouth of the Moodna Creek (Regional Project Scenario No. 2 and Central Project Scenario Nos. 1, 2 and 3).

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 12-3

SUMMARY OF ENVIRONMENTAL IMPACT ASSESSMENT FINDINGS

Pipe Route No. or Site Name	Wetlands Map Review	Significant Habitat Program	Natural Heritage Program	Field Reconnaissance Findings
1A	GR-3III	None	None	None
1	GR-3III,MO-15I	None	None	None
2	Ramapo River · Orange & Rockland Lakes	None	None	None
2A	Ramapo River Orange & Rockland Lakes	None	None	None
3	MB-55IV,MB-50II	None	None	None
4	MB-44III,MB-45II	None	None	None
5	WR-44II	None	None	None
6	GO-331,MD-24II Cheechink Creek Wallkill River	None	None	None
Florida STP	–	None	None	None
Goshen (V) STP	–	None	None	None
OCSD#1 STP	–	None	None	None
New Windsor STP	–	Yes - See Text	Yes - See Text	None
Hudson River Outfall	–	Yes - See Text	Yes - See Text	None
Trout Brook Site	–	None	None	Low Flow in Trout Brook
Wallkill STP	–	None	None	None
Warwick (V) STP	–	None	None	None
Warwick (T) STP	–	None	None	None

Source: EA Engineering, Science and Technology

r:or:tble12.3:082991:jv

To meet the stringent requirements for effluent discharge to the Trout Brook, a costly ADV(H) sewage treatment facility would be required. Because of this, Local Project Scenario No. 1 is discarded and the recommendation made that the Village of Greenwood Lake be served by either a regional or central project scenario. Thus, regional and central project scenarios are now required to include service for the Village of Greenwood Lake.

Although there is a potential for environmental impacts associated with scenarios that discharge effluent to the Hudson River, these impacts can be mitigated. For example, the short-term impacts associated with effluent outfall construction can be mitigated by utilization of minimally invasive construction methods and proper timing of construction. Long-term water quality impacts can be avoided by both proper location of the effluent outfall and sizing of the required outfall diffuser. Location and design of both the effluent outfall and diffuser will require detailed modeling of Hudson River flow characteristics in the area and include dye flow testing to determine dispersion.

12.3.2 Project Scenario Cost Analysis

In this part of the second stage evaluation, detailed project cost analyses have been developed for all 23 project scenarios. These analyses include construction costs for pipeline, sewage pumping and treatment facilities. The basis for these analyses includes knowledge of costs for similar projects in and around Orange County, cost estimates used for the Orange County Water Authority project, and published cost information and adjustment factors. Project scenario capital costs include construction, design, engineering supervision, interest during construction, financing fees and contingencies. The capital costs are escalated using a 5 percent annual inflation rate to an assumed mid-point of construction, the year 1994. The escalated capital costs are then amortized based on 7.25 percent interest rate over a 25-year term with an assumed equal payment schedule. Annual operation and maintenance costs for project scenarios are calculated for both assumed start-up year (1995) and design year (2020) conditions.

For the purpose of continuity, detailed project cost analyses have also been developed for the 20 recommended actions resulting from the first stage evaluation. These analyses make the same capital cost estimation, amortization and operation and maintenance cost estimation assumptions as those used for the 23 project scenarios. Table 12-4 presents the project costs for the 20 recommended sewage treatment actions as a result of the first stage evaluation.

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 12-4

PROJECT COSTS FOR RECOMMENDED SEWAGE TREATMENT ACTIONS AS A RESULT OF FIRST STAGE EVALAUATION

		Total Project Costs (1)(2)(3)			
Service Area	Project Description	Capital Cost ($1991)	Amortized Capital, $(1994)/yr	Average Annual O&M over Project Life $(1991)/yr	Average Annual Cost per Customer (4) $(1991)/EDU/yr
Cornwall/Cornwall-Hudson	Maintain Cornwall and Firthcliffe STPs at 1.72 mgd SEC	$0	$0	$650,000	$170
Crawford	Expand Pine Bush STP from 0.15 to 0.3 mgd ADV(L)	$3,500,000	$360,000	$320,000	$470
Deerpark	New package STPs for 0.08 mgd	$1,400,000	$140,000	$50,000	$413
Florida	Expand/Upgrade Florida STP from 0.3 to 0.45 mgd ADV(L)	$3,500,000	$360,000	$420,000	$469
Goshen (V)	Maintain Goshen (V) STP at 1.5 mgd ADV(L)	$0	$0	$680,000	$305
Greenville	New package STPs for 0.06 mgd	$1,200,000	$120,000	$40,000	$437
Hamptonburgh	New package STPs for 0.05 mgd	$1,100,000	$110,000	$40,000	$562
Highland Falls	Maintain Cragston STP for 1.35 mgd SEC	$0	$0	$330,000	$219
Highlands	Expand Fort Montgomery STP from 0.12 to 0.14 mgd SEC	$400,000	$40,000	$150,000	$226
Maybrook	Upgrade Maybrook STP at 0.4 mgd ADV(L)	$2,900,000	$290,000	$400,000	$464
Middletown	Maintain Middletown STP at 6.0 mgd ADV(L)	$0	$0	$2,350,000	$234
Minisink/Unionville	New package STPs for 0.06 mgd	$1,200,000	$120,000	$40,000	$504

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 12-4

PROJECT COSTS FOR RECOMMENDED SEWAGE TREATMENT ACTIONS AS A RESULT OF FIRST STAGE EVALAUATION

Service Area	Project Description	Total Project Costs (1)(2)(3) Capital Cost ($1991)	Amortized Capital, $(1994)/yr	Average Annual O&M over Project Life $(1991)/yr	Average Annual Cost per Customer (4) $(1991)/EDU/yr
Montgomery (UT)	New 0.6 ADV(L) mgd Wallkill R. STP	$6,400,000	$650,000	$380,000	$481
Montgomery (V)	Maintain Montgomery (V) STP at 0.5 mgd ADV(L)	$0	$0	$420,000	$309
Newburgh (C) and Newburgh (UT)	Expand Newburgh (C) STP from 7.0 to 9.3 mgd SEC	$8,300,000	$840,000	$1,830,000	$144
New Windsor (5) and part Cornwall (UT&V)	Expand New Windsor STP from 5.0 to 12.0 mgd SEC	$25,700,000	$2,610,000	$3,360,000	$333
Port Jervis	Maintain Port Jervis STP at 2.5 mgd SEC	$0	$0	$630,000	$168
Tuxedo (UT)	Expand/Upgrade Hamlet STP from 0.1 to 0.2 mgd ADV(L)	$3,200,000	$330,000	$260,000	$726
Tuxedo Park (V)	Upgrade Tuxedo Park STP at 0.15 mgd ADV(L)	$1,700,000	$170,000	$230,000	$752
Walden	Maintain Walden STP at 1.1 mgd SEC	$0	$0	$430,000	$163

NOTES:
(1) Capital Costs do not include: site aquisition for treatment plant and pumping stations, retirement of existing debt, and local collection system costs.
(2) Amortized Capital Costs have been escalated to mid-point of construction assuming a 5% annual inflation rate. Capital Costs are amortized based upon a 7.25%, 25-year bond.
(3) Average O&M is depicted as year 2008 annual cost. O&M Costs include sludge treatment and disposal. O&M Costs do not include local collection system maintenance, and administrative costs of a sewer district or authority.
(4) Average Annual Cost per Customer includes residential, commercial and industrial customers. One equivalent dwelling unit equals 2.87 people for evaluation purposes.
(5) New Windsor Customer Cost reflects Stewart Airport representation of 4880 EDUs at design year 2020.

Table 12-5 presents the 23 project scenario costs developed for use in the second stage evaluation. As shown, the project scenarios are segregated into 7 local, 10 regional and 6 central actions. Average annual cost per customer is also presented as dollars per equivalent dwelling unit (EDU) per year. For evaluation purposes, one EDU equals 2.87 people, the County-wide average.

Detailed data used for the cost calculations of both the 20 recommended projects resulting from the first stage evaluation and the 23 project scenarios used in the second stage evaluation is presented in Appendix D.

12.4 Discussion of Results

Table 12-6 shows a comparison of the average annual cost per household among the 23 project scenarios. In addition, the mitigation of potential adverse environmental impacts associated with each is shown. The narrow range of annual costs per EDU for the central and regional project scenarios merits further discussion of each as provided below.

Central Project Scenario No. 1

Central Project Scenario No. 1 is the lowest cost central scenario and eliminates existing effluent discharges to the Ramapo River and Moodna Creek by conveying sewage to a new SEC sewage treatment facility with effluent discharge to the Hudson River. Pipeline routes for this project scenario mostly follow abandoned railroad rights-of-way from both Harriman and Goshen to Chester, and then from Chester to New Windsor. The routing of pipes in these rights-of-way provides a convenient means with which to develop a central sewage collection network in Orange County.

The sewage treatment plant site needed for this scenario should be within an area where the potential for environmental impact is minimized. It is estimated that the required area for this facility, including buffering, is approximately 25 to 40 acres.

Central Project Scenario No. 2

Central Project Scenario No. 2 is more costly than Central Project Scenario No. 1. This scenario calls for a new SEC sewage treatment plant with effluent discharge to the Hudson River. Collected sewage is to be conveyed from Harriman to the vicinity of the Town of New Windsor via State Route 32. The Village of Washingtonville would not be served under this scenario and therefore the Washingtonville

TABLE 12-5

PROJECT SCENARIO COSTS FOR SECOND STAGE EVALUATION

Project Scenario	No.	Description	Service Area	Total Project Costs (1)(2)(3) Capital Cost ($1,991)	Amortized Capital, $(1994)/yr	Average Annual O&M over Project Life, $(1991)/yr	Average Annual Cost per Customer (4) $(1991)/EDU/yr
Local	1.	New 0.4 mgd ADV(H) Trout Brook STP	Greenwood Lake	$9,500,000	$970,000	$420,000	$850
Local	2.	New 0.2 mgd ADV(H) Shawangunk K. STP	Mt. Hope/Otisville	$4,300,000	$440,000	$320,000	$1,396
Local	3.	Expand/Upgrade Wallkill STP to 4.8 mgd	Wallkill	$8,900,000	$900,000	$1,760,000	$238
Local	4.	Exp/Up Warwick (U) STP from 0.39 to 1.0 mgd ADV(H)	Warwick (UT)	$8,300,000	$840,000	$610,000	$529
Local	5.	Maintain Warwick (U) STP at 0.39 mgd ADV(L)	Warwick (UT)	$0	$0	$410,000	$482
Local	6.	Exp/Up Warwick (V) STP from 0.5 to 0.9 mgd ADV(L)	Warwick (V)	$6,500,000	$660,000	$620,000	$299
Local	7.	Exp/Up Wash-ville STP from 0.4 to 0.9 mgd ADV(L)	Washingtonville	$6,400,000	$650,000	$520,000	$297
Regional	1a.	Expand/Upgrade OCSD#1 STP to 4.6 mgd ADV(H)	OCSD#1	$13,300,000	$1,350,000	$1,720,000	$177
Regional	1b.	Expand/Upgrade OCSD#1 STP to 5.0 mgd ADV(H) Pipeline Routes: 1.1,1.2 Pumping Stations: 1.1	OCSD#1 Greenwood Lake	$19,300,000	$1,960,000	$1,860,000	$192
Regional	2a.	New 6.0 mgd SEC Hudson R. STP Pipeline Routes: 1.2,2.1(R),2.2(R),3.1(R), 3.2(R),3.3 Pumping Stations: 2.1(R),3.1(R),3.3	MBSR Washingtonville	$54,200,000	$5,510,000	$1,540,000	$241

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 12-5

PROJECT SCENARIO COSTS FOR SECOND STAGE EVALUATION

Project Scenario	No.	Description	Service Area	Total Project Costs (1)(2)(3) Capital Cost ($1,991)	Amortized Capital, $(1994)/yr	Average Annual O&M over Project Life $(1991)/yr	Average Annual Cost per Customer (4) $(1991)/EDU/yr
Regional	2b.	New 6.5 mgd SEC Hudson R. STP Pipeline Routes: 1.1,1.2,2.1(R),2.2(R),3.1(R), 3.2(R),3.3 Pumping Stations: 1.1,2.1(R),3.1(R),3.3	MBSR Washingtonville Greenwood Lake	$61,500,000	$6,250,000	$1,630,000	$248
Regional	2c.	New 7.5 mgd SEC Hudson R. STP Pipeline Routes: 1.1,1.2,2.1(R),2.2(R),3.1(R), 3.2(R),3.3,5.1 Pumping Stations: 1.1,2.1(R),3.1(R),3.3,5.1	MBSR Washingtonville Greenwood Lake Goshen (UT)	$65,700,000	$6,670,000	$1,830,000	$240
Regional	3.	New 1.5 mgd ADV(L) Wallkill River STP Pipeline Routes: 6.1, 7.1, 7.2 Pumping Stations: 6.1,7.1	Goshen (UT) Wawayanda	$15,500,000	$1,570,000	$770,000	$419
Regional	4.	New 0.6 mgd ADV(H) Shawangunk K. STP Pipeline Routes: none Pumping Stations: none	Mount Hope Otisville State & Fed. Jails	$7,100,000	$720,000	$440,000	$725
Regional	5a.	Exp/Upgr Wallkill STP from 4 to 5.3 mgd ADV(L). Pipeline Routes: 6.2, 7.1 Pumping Stations: 7.1	Wallkill Wawayanda	$13,400,000	$1,360,000	$1,800,000	$231

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 12-5

PROJECT SCENARIO COSTS FOR SECOND STAGE EVALUATION

Project Scenario	No.	Description	Service Area	Total Project Costs (1)(2)(3): Capital Cost ($1,991)	Total Project Costs (1)(2)(3): Amortized Capital, $(1994)/yr	Total Project Costs (1)(2)(3): Average Annual O&M over Project Life $(1991)/yr	Average Annual Cost per Customer (4) $(1991)/EDU/yr
Regional	5b.	Exp/Upgr Wallkill STP from 4 to 6.2 mgd ADV(L) Pipeline Routes: 6.1, 6.2, 7.1 Pumping Stations: 6.1, 7.1	Wallkill Wawayanda Goshen (UT)	$19,100,000	$1,940,000	$2,120,000	$237
Regional	6.	Exp/Up Warwick (V) STP from 0.5 to 1.5 mgd ADV(L) Pipeline Routes: none Pumping Stations: none	Warwick (UT) Warwick (V)	$9,000,000	$910,000	$710,000	$332
Central	1a.	New 10.9 mgd SEC Husdon R. STP Pipeline Routes: 1.1,1.2,2.1,2.2,3.1,3.2,3.3 Pumping Stations: 1.1,2.1,3.1,3.3	OCSD#1 MBSR Washingtonville Greenwood Lake	$78,500,000	$7,970,000	$2,470,000	$189
Central	1b.	New 11.8 mgd SEC Husdon R. STP Pipeline Routes: 1.1,1.2,2.1,2.2,3.1,3.2,3.3,5.1 Pumping Stations: 1.1,2.1,3.1,3.3,5.1	OCSD#1 MBSR Washingtonville Greenwood Lake Goshen (UT)	$83,300,000	$8,460,000	$2,670,000	$188
Central	2a.	New 10.0 mgd SEC Husdon R. STP Pipeline Routes: 1.1,1.2,2A.1,2A.2,4.1 Pumping Stations: 1.1,2A.1,4.1	OCSD#1 MBSR Greenwood Lake	$78,500,000	$7,970,000	$2,380,000	$204

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 12-5

PROJECT SCENARIO COSTS FOR SECOND STAGE EVALUATION

Project Scenario	No.	Description	Service Area	Total Project Costs (1)(2)(3) Capital Cost ($1,991)	Amortized Capital, $(1994)/yr	Average Annual O&M over Project Life $(1991)/yr	Average Annual Cost per Customer (4) $(1991)/EDU/yr
Central	2b.	New 11.0 mgd SEC Husdon R. STP Pipeline Routes: 1.1,1.2,2A.1,2A.2,4.1,5.1 Pumping Stations: 1.1,2A.1,4.1,5.1	OCSD#1 MBSR Greenwood Lake Goshen (UT)	$82,700,000	$8,400,000	$2,550,000	$201
Central	3a.	Expand OCSD#1 STP from 4 to 10.0 mgd SEC Pipeline Routes: 1.1,1.2,2A.1,2A.2,4.1 Pumping Stations: 1.1,2A.1,4.1 w/re-aer & disinf	OCSD#1 MBSR Greenwood Lake	$70,500,000	$7,160,000	$2,550,000	$200
Central	3b.	Expand OCSD#1 STP from 4 to 11.0 mgd SEC Pipeline Routes: 1.1,1.2,2A.1,2A.2,4.1,5.1 Pumping Stations: 1.1,2A.1,4.1,5.1 w/re-aer & disinf	OCSD#1 MBSR Greenwood Lake Goshen (UT)	$73,300,000	$7,450,000	$2,720,000	$195

NOTES:
(1) Capital Costs do not include: site aquisition for treatment plant and pumping stations, retirement of existing debt, and local collection system costs.
(2) Amortized Capital Costs have been escalated to mid-point of construction assuming a 5% annual inflation rate. Capital Costs are amortized based upon a 7.25%, 25-year bond.
(3) Average O&M is depicted as year 2008 annual cost. O&M Costs include sludge treatment and disposal. O&M Costs do not include local collection system maintenance, and administrative costs of a sewer district or authority.
(4) Average Annual Cost per Customer includes residential, commercial and industrial customers. One equivalent dwelling unit equals 2.878 people for evaluation purposes.

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 12-6

SECOND STAGE EVALUATION OF PROJECT SCENARIOS

Municipality	Project Scenario		Average Annual Cost Per Customer $(1991)/yr	Can Environmental Impacts Be Mitigated ?	Sewer Committee Approved Action ?	Recommended Action
GOSHEN (UT)	Pipe & treat at new Regional Hudson R. STP	R2c	$240	Yes		
	Construct new Regional Wallkill R. STP with Wawayanda	R3	$419	Yes		
	Pipe & treat at Wallkill STP with Wawayanda	R5b	$237	Yes		
	Pipe along RR ROW & treat at new Central Hudson R. STP	C1b	$188	Yes	Yes	C1b
	Pipe along Route 32 & treat at new Central Hudson R. STP	C2b	$201	Yes		
	Pipe & treat at OCSD#1 STP with discharge to Hudson R.	C3b	$195	Yes		
GREENWOOD LAKE	Construct new Trout Brook STP	L1	$850	No		
	Pipe & treat at OCSD#1 STP with discharge to Ramapo R.	R1b	$192	Yes		
	Pipe & treat at new Regional Hudson R. STP	R2b	$248	Yes		
	Pipe & treat at new Regional Hudson R. STP	R2c	$240	Yes		
	Pipe along RR ROW & treat at new Central Hudson R. STP	C1a	$189	Yes		
	Pipe along RR ROW & treat at new Central Hudson R. STP	C1b	$188	Yes	Yes	C1b
	Pipe along Route 32 & treat at new Central Hudson R. STP	C2a	$204	Yes		
	Pipe along Route 32 & treat at new Central Hudson R. STP	C2b	$201	Yes		
	Pipe & treat at OCSD#1 STP with discharge to Hudson R.	C3a	$200	Yes		
	Pipe & treat at OCSD#1 STP with discharge to Hudson R.	C3b	$195	Yes		
MBSR	Pipe & treat at new Regional Hudson R. STP	R2a	$241	Yes		
	Pipe & treat at new Regional Hudson R. STP	R2b	$248	Yes		
	Pipe & treat at new Regional Hudson R. STP	R2c	$240	Yes		
	Pipe along RR ROW & treat at new Central Hudson R. STP	C1a	$189	Yes		
	Pipe along RR ROW & treat at new Central Hudson R. STP	C1b	$188	Yes	Yes	C1b
	Pipe along Route 32 & treat at new Central Hudson R. STP	C2a	$204	Yes		
	Pipe along Route 32 & treat at new Central Hudson R. STP	C2b	$201	Yes		
	Pipe & treat at OCSD#1 STP with discharge to Hudson R.	C3a	$200	Yes		
	Pipe & treat at OCSD#1 STP with discharge to Hudson R.	C3b	$195	Yes		
MT. HOPE/OTISVILLE	Construct new Shawangunk Kill STP	L2	$1,396	Yes		
	Construct new Shawangunk Kill STP with State & Federal Jails	R4	$725	Yes		R4
OCSD#1	Expand OCSD#1 STP for OCSD only and discharge to Ramapo R.	R1a	$177	Yes		
	Expand OCSD#1 with Greenwd Lake and discharge to Ramapo R.	R1b	$192	Yes		
	Pipe along RR ROW & treat at new Central Hudson R. STP	C1a	$189	Yes		
	Pipe along RR ROW & treat at new Central Hudson R. STP	C1b	$188	Yes	Yes	C1b
	Pipe along Route 32 & treat at new Central Hudson R. STP	C2a	$204	Yes		
	Pipe along Route 32 & treat at new Central Hudson R. STP	C2b	$201	Yes		
	Pipe & treat at OCSD#1 STP with discharge to Hudson R.	C3a	$200	Yes		
	Pipe & treat at OCSD#1 STP with discharge to Hudson R.	C3b	$195	Yes		

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 12-6

SECOND STAGE EVALUATION OF PROJECT SCENARIOS

Municipality	Project Scenario		Average Annual Cost Per Customer $(1991)/yr	Can Environmental Impacts Be Mitigated ?	Sewer Committee Approved Action ?	Recommended Action
WALLKILL	Expand Wallkill STP	L3	$238	Yes		R5a
	Expand Wallkill STP for Wawayanda	R5a	$231	Yes		
	Expand Wallkill STP for Goshen (UT) and Wawayanda	R5b	$237	Yes		
WARWICK (UT)	Expand/upgrade Town of Warwick STP	L4	$529	Yes		L5& R6
	Maintain Town STP and pipe & treat at Warwick (V) STP (1)	L5 & R6	$390	Yes		
WARWICK (V)	Expand/upgrade Village of Warwick STP for Village only	L6	$299	Yes		R6
	Expand/upgrade Village STP for Village and part of Town	R6	$332	Yes		
WASHINGTONVILLE	Expand/upgrade Washingtonville STP	L7	$297	Yes		
	Pipe & treat at new Regional Hudson R. STP	R2a	$241	Yes		
	Pipe & treat at new Regional Hudson R. STP	R2b	$248	Yes		
	Pipe & treat at new Regional Hudson R. STP	R2c	$240	Yes		
	Pipe along RR ROW & treat at new Central Hudson R. STP	C1a	$189	Yes		
	Pipe along RR ROW & treat at new Central Hudson R. STP	C1b	$188	Yes	Yes	C1b
WAWAYANDA	New Wallkill R. STP for Wawayanda & Goshen (UT)	R3	$419	Yes		R5a
	Pipe & treat at Wallkill STP	R5a	$231	Yes		
	Pipe & treat at Wallkill STP with Goshen (UT)	R5b	$237	Yes		

(1) Anverage Annual Cost per EDU calculated based upon portion of flow to each system.

STP would need to be expanded and upgraded for continued effluent discharge to the Moodna Creek (Local Project Scenario No. 7).

The routing of pipes along State Route 32 restricts the access to any future extension of service, if needed, by the north-central communities, which would necessitate the construction of an alternate pipeline to the proposed Hudson River STP site to serve these communities. The sewage treatment plant site description is the same as described in Central Project Scenario No. 1 above.

Central Project Scenario No. 3

Central Project Scenario No. 3 involves the expansion of the existing OCSD#1 STP at SEC treatment, and construction of a treated effluent pipeline along State Route 32 to a Hudson River outfall in the vicinity of the Town of New Windsor. The Village of Washingtonville would not be served under this scenario and therefore the Washingtonville STP would need to be expanded and upgraded for continued discharge to the Moodna Creek (Local Project Scenario No. 7).

Both the sewage treatment plant location and pipe routing for this scenario generally do not provide an acceptable infrastructure for long term sewage service. The OCSD#1 STP site is not well-suited for an expanded facility since its close proximity to residential and commercial developments, as well as limited land area for future expansion, make this scenario difficult. Also, maintaining the quality of treated effluent in a long pipeline (nearly 16 miles) can prove to be difficult. Long distance conveyance in force mains can cause anaerobic conditions which can degrade the effluent quality.

Regional Project Scenario Nos. 1 and 2

Regional Project Scenario Nos. 1 and 2 can be considered as one central project scenario due to the present relationship between OCSD#1 and MBSR.

Regional Project Scenario No. 1 includes the upgrade and expansion of the OCSD#1 STP to provide ADV(H) treatment, with continued effluent discharge to the Ramapo River. Although this scenario upgrades effluent discharge quality entering the Ramapo River, the effluent must still meet ambient instream standards which require a high degree of operator sophistication and process control. In addition, site limitations with regards to expansion may be a disadvantage, as cited under Central Project Scenario No. 3.

Regional Project Scenario No. 2 calls for the construction of a new regional SEC Hudson River STP. Pipeline routing is mostly along abandoned railroad ROWs. The sewage treatment plant site and pipeline route description are the same as Central Project Scenario No. 1.

Regional Project Scenario No. 1 is the least cost option for OCSD#1. However, Regional Project Scenario No. 2 is one of the most expensive options for MBSR. Proportioning these costs (weighted by share of EDUs served) results in a cost of $216 per EDU per year, more expensive than each of the central project scenarios discussed above.

12.5 Summary

The Orange County Sewer Committee reviewed the central and regional project scenarios for several months to consider the advantages and drawbacks of each. After extensive discussion, the Sewer Committee voted approval of Central Project Scenario No. 1b as the preferred approach for central sewage collection and treatment in Orange County. This approved approach is to be incorporated into the Recommended Plan presented in Chapter 13.

CHAPTER 13

13.0 DESCRIPTION OF THE RECOMMENDED PLAN FOR COMPREHENSIVE SEWAGE MANAGEMENT IN ORANGE COUNTY

13.1 Introduction

The purpose of this Chapter is to describe the Recommended Plan for comprehensive sewage collection, treatment and disposal for the Study period years of 1990 through 2020 in Orange County. The Recommended Plan consists of a multi-faceted approach as presented by the Project Team and approved by the County via its Sewer Committee. This Recommended Plan approach includes:

- Sewage reduction, water conservation and reuse;
- Reduction of infiltration and inflow;
- Industrial sewage pre-treatment programs;
- Sewage collection, treatment and discharge; and
- Sewage sludge utilization and/or disposal.

Specific information about the Recommended Plan is presented in the balance of this Chapter.

13.2 Sewage Reduction Programs

Sewage reduction programs are essential to optimizing the useful life of sewage conveyance and treatment facilities and preserving the County's water resources. With programs put into place that emphasize water conservation and infiltration/inflow prevention, the active life of sewage conveyance and treatment facilities may be extended beyond projected design life, providing extended reliability and significant cost savings. Infiltration/inflow prevention and water conservation programs are strongly suggested as part of the Recommended Plan for all of Orange County. A discussion of the sewage reduction programs is provided in the following subsections.

13.2.1 Water Conservation

Water conservation is an important part of the Recommended Plan which, when effectively implemented, can significantly extend the productive life of sewage and water treatment facilities. The conservation of water use can be achieved in a variety of ways, including public education, rate structuring, leak detection and correction, enforcement through construction codes, reuse and recycling of water and wastewater, and waste prevention programs. Each of these approaches is discussed in greater detail below.

13.2.1.1 Public Education

The most fundamental method for promoting water conservation is through public education. Effective public education makes use of various media for conveying the importance of reducing water use. Making brochures available to the public and including informational flyers with water bills are two common practices. Another practice is to designate an individual to make on-going presentations, slide shows and lectures to various sectors of the community such as schools, senior citizen clubs, religious groups and commerce organizations. Providing activities and hands-on exhibits that demonstrate the significance of water conservation can help reinforce presentation information. The County recognizes the importance of public education and its value in the Recommended Plan.

13.2.1.2 Rate Structuring

One effectual way to attain reduction in water use is to implement a tiered water billing system, wherein consumers who use more water pay a higher dollar rate per gallon. Consumers are invariably more attuned to water conservation issues when they understand better how their own money is being spent.

13.2.1.3 Leak Detection and Correction

While not directly related to the reduction of sewage generation, water system leak detection and correction can play a role in water conservation. Leakage of water systems can be quantified by comparing the sum of home water meter readings to the amount of water produced and distributed. When leaks are suspected, sonic detection and other methods can be used to locate broken or misaligned water pipes that need repair. The County recognizes it is important to detect and correct leaking water systems in a prompt and efficient manner.

13.2.1.4 Enforcement Through Construction Codes

Enactment and enforcement of a uniform construction code requiring the installation of water saving fixtures for both the new construction and rehabilitation of buildings can reduce water use substantially. However, there is a time lag effect before a reduction in water use is noticeable throughout a community, since new fixtures are not mandated in existing buildings. The County encourages its communities to consider water saving fixture code requirements as part of the Recommended Plan.

13.2.1.5 Reuse and Recycling

The reuse and recycling of both water and wastewater typically can best be accomplished by industrial and commercial water users, where non-potable water use is involved. For example, where a business may reuse its process water such as a car wash recycling its wastewater, a significant reduction in potable water use can be realized. The County recognizes the importance of water reuse and recycling in the Recommended Plan and encourages such programs for industrial and commercial entities.

13.2.1.6 Waste Prevention Programs

Communities in Orange County can benefit from waste prevention programs that maintain the minimization of the amount of water lost through leakage and improper conditions. Similar to leak detection and correction, this type of conservation will not directly affect sewage generation, but does play an important role in sustaining water supply resources. Waste prevention programs may include:

- General maintenance such as requiring regularly scheduled maintenance and prompt repair of water service pipes, fixtures and connections;
- Water user duties such as requiring the immediate notification to the water supplier of any defective water service pipes, fixtures and connections;
- Water system owner duties such as undertaking the immediate repair of any water service pipe, fixture or connection upon receiving notice of defects from the water user;
- Repairs made by either the water system operator or municipality that allow them to backcharge repair costs to the water system owner;
- Water use restrictions such as limiting the frequency and extent that water can be used for washing cars, filling swimming pools, watering lawns, etc.; and
- Penalty fees such as imposing fines for violations of the waste prevention program.

The County considers waste prevention programs to be an important means of water conservation and is interested in testing them as part of the Recommended Plan.

13.2.2 Infiltration and Inflow Management

Infiltration and inflow (I/I) is extraneous water that can enter a sanitary sewer collection system through poor joints, cracked pipes, leaking manhole walls and covers, and cross connections with storm drainage systems. Infiltration is the portion of extraneous sewage flow that comes from indirect sources such as through cracks and joints. Inflow is the portion of extraneous sewage flow from sources such as storm water entering through direct connections with the sanitary sewer via sump pumps, floor and roof drains, perforated manhole covers and catch basins. I/I can occur from both groundwater and storm water, and can greatly affect the amount of sewage that must be pumped or treated. I/I is typically greatest during the spring season, when precipitation is frequent and the groundwater table is relatively high.

I/I is undesirable in a sanitary sewer system since the cost of pumping and treating the extraneous sewage flow must be borne by the system users. The quantity of I/I in a sewage collection system is directly related to the quality of its construction, age of the system, soil conditions and groundwater elevation. Infiltration and inflow can be detected in a collection system in a variety of ways, including strategic flow monitoring, smoke testing and internal television inspection. Once detected, I/I sources can be eliminated several ways, including correction of improper cross connections with storm drainage systems, replacement of manhole covers, rehabilitation by patching or in-situ lining of leaking manholes and pipes, and replacement of badly deteriorated pipes. The amount of I/I that can be effectively removed from a sanitary sewer collection system is dependent on the extent of system decline and cost-effectiveness cut-off for its removal. In some instances, it may be less expensive to pump and treat a certain volume of I/I rather than to remove it.

Severe I/I has been documented in sanitary sewer collection systems throughout Orange County. Systems for the Town and Village of Goshen, Village of Washingtonville, OCSD#1 and MBSR are subject to extreme variations in the volume of sewage flow during heavy storm events. As discussed in Chapter 5, peak flows of up to 15 times average daily flow have occurred at the OCSD#1 STP. Conveying a peak flow such as this necessitates the installation of flood pumps at pumping stations that are included in the recommended central County sewage treatment action. Equalization of such peak storm flows at pumping stations is not considered feasible due to the large volume of storage required. Treatment of a peak storm flow at a larger, central STP will require significant recycling of wastewater through the aerated, activated sludge basins to prevent "wash-out" of the solids therein.

The prevention and control of I/I in existing and proposed Orange County sanitary sewer collection systems can result is significant savings, particularly in power costs at sewage pumping and treatment facilities. The Recommended Plan includes evaluations for system-wide I/I in existing and proposed new sewer districts, the imposition of specific limits for allowable extraneous flow, and setting up and enforcing a construction practices code that will ensure minimal infiltration and inflow.

13.2.3 Summary

The direct reduction of sewage generation and associated conservation of water are part of the Recommended Plan for Orange County. Often it can take several years before the effects of a comprehensive sewage reduction/water conservation program are noticed in a community, since it takes time both to detect and correct I/I and for the population to adjust and comply with the requirements for conservation. However, the eventual benefits obtained, most notably the preservation of potable water resources and securing the longevity of collection and treatment facilities, support the enactment of water conservation measures and I/I prevention.

13.3 Sewage Pre-Treatment Programs

Sewage treatment facilities are designed to operate within specific parameters with respect to both sewage influent quality and quantity. While a sewage treatment facility can be designed to process a broad range of acceptable constituents in sewage, it can not tolerate extreme variations such as those sometimes produced by individual industrial and commercial facilities in Orange County. In addition, industrial/commercial users may sometimes discharge contaminants that can not be readily removed or treated at a sewage treatment facility. For these reasons, the County deems it desirable to institute a sewage pre-treatment program for particular significant and/or industrial users of County sewage collection and treatment systems. The term Significant/Industrial User (SIU) discharge refers to any industrial, commercial or other significant user of a sewerage system that produces either a high strength sewage or atypical sewage discharge to the collection and treatment system.

Certain sewage characteristics are considered undesirable in public sewerage systems, depending on the strength and amount of each SIU discharge. Some of these constituents are already found in domestic sewage, but are typically weaker and more readily removed with treatment than those found in a discharge from a SIU. The following sewage characteristics may need to be monitored and/or pre-treated by SIUs in Orange County prior to discharge to a sewage collection and treatment system:

- Suspended solids which can settle out in calm areas to receiving waters to form sludge or a blanket of scum which will decompose, creating odors and causing oxygen depletion;

- Soluble organics which are readily biodegradable by bacteria in sewage and utilize oxygen, thus depleting dissolved oxygen in receiving waters;

- Nitrogen and phosphorus which are nutrients that create both unwanted algae blooms and oxygen depletion in receiving waters;

- Heavy metals, cyanide, and toxic organic compounds which are priority pollutants regulated by the EPA and subject to specific permit limits for discharge to the environment;

- Volatile organic substances which can create air pollution problems and may be restricted by discharge regulations;

- Refractory substances which are not easily biodegradable and either may be toxic or create otherwise undesirable conditions in receiving waters;

- Trace organics such as phenol which can create odors and taste problems where the receiving water body is used as a potable water supply;

- Oil, scum and floatables which can be unsightly and may be restricted by discharge regulations; and

- Color and turbidity which can create aesthetic problems or other undesirable conditions in receiving water bodies.

The elimination and/or reduction of undesirable characteristics in sewage can be accomplished with the implementation of a SIU pre-treatment program. A successful pre-treatment program can identify SIUs relying on the sewerage system, respond to which constituents need to be monitored and/or removed by the SIU, evaluate SIU processes where water reuse and conservation can effectively reduce discharges to the sewerage system, actively monitor the collection system for the presence of unacceptable discharges and react to unacceptable discharges promptly with corrective measures and/or penalties.

Since both existing and proposed sewage treatment plants in Orange County are subject to specific permitted discharge limits, communities in and/or the County can impose similar limits upon SIUs. Implementation of such programs will help communities and the County protect themselves from permit excursions, enabling the quick location and correction of unacceptable discharges to the systems, and prevent discharges that could otherwise disrupt operations. Therefore, a sewage pre-treatment program for SIUs in Orange County is an important component of the Recommended Plan.

13.4 Sewage Treatment: Local Actions

The Recommended Plan includes many important local sewage treatment actions to help meet the future needs of Orange County. Specifically, it is recommended that two cities, nine towns and nine villages in the County proceed with local sewage treatment actions. Table 13-1 lists these 20 communities and summarizes the recommended local sewage treatment action and associated costs for each.

A concise description of the recommended local sewage treatment actions for these communities is provided below.

Cornwall-on-Hudson

The Village of Cornwall-on-Hudson and part of the Town of Cornwall are served by the Cornwall STP. It is recommended that the facility be maintained at 1.50 mgd while providing SEC treatment, with continued effluent discharge to the Hudson River. Future excess sewage flow from both the Village and Town is expected to be treated at the Town of New Windsor regional STP as discussed in Section 13.5.

There is no budgetary capital cost for Cornwall STP projects since no expansion or upgrade of facilities is warranted. Budgetary operation and maintenance costs in 1991 dollars are estimated at $0.55 million in the year 1995 and $0.61 million in the year 2020.

Crawford

The Town of Crawford is served by the Pine Bush STP. It is recommended that the facility be expanded from 0.15 mgd to 0.30 mgd while maintaining ADV(L) treatment, with continued effluent

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 13-1

RECOMMENDED LOCAL SEWAGE TREATMENT ACTIONS

NO.	COMMUNITY	RECOMMENDED ACTION	BUDGETARY CAPITAL COST ($ 1991) (millions)	BUDGETARY ANNUAL O&M COSTS ($ 1991) (millions)	
				1995	2020
1	Cornwall-on-Hudson	Maintain Cornwall STP at 1.50 mgd SEC	0	0.55	0.61
2	Crawford	Expand Pine Bush STP from 0.15 mgd to 0.30 mgd ADV(L)	3.5	0.26	0.37
3	Deerpark	Develop new septic systems/package plants as needed	1.4	0.02	0.08
4	Florida	Expand and upgrade Florida STP from 0.30 mgd to 0.45 mgd ADV(L)	3.5	0.38	0.45
5	Goshen (V)	Maintain Goshen STP at 1.50 mgd SEC	0	0.64	0.71
6	Greenville	Develop new septic systems/package plants as needed	1.2	0.02	0.06
7	Hamptonburgh	Develop new septic systems/package plants as needed	1.1	0.02	0.05
8	Highland Falls	Maintain Cragston STP at 1.35 mgd SEC	0	0.30	0.36
9	Highlands	Expand Fort Montgomery STP from 0.12 mgd to 0.14 mgd SEC	0.4	0.09	0.21
10	Maybrook	Upgrade Maybrook STP to 0.40 mgd ADV(L)	2.9	0.40	0.41
11	Middletown	Maintain Middletown STP at 6.0 mgd ADV(L)	0	2.19	2.50
12	Minisink	Develop new septic systems/package plants as needed	0.6	0.01	0.03
13	Montgomery (V)	Maintain Montgomery (V) STP at 0.50 mgd ADV(L)	0	0.40	0.45
14	Montgomery (T)	Construct new STP at 0.60 mgd ADV(L) Abandon existing Montgomery (T) STP	6.4	0.25	0.51
15	Port Jervis	Maintain Port Jervis STP at 2.5 mgd SEC	0	0.60	0.65
16	Tuxedo	Expand and upgrade Hamlet STP from 0.10 mgd to 0.20 mgd ADV(L)	3.2	0.20	0.32
17	Tuxedo Park	Upgrade Tuxedo Park STP to 0.15 mgd ADV(L)	1.7	0.20	0.27
18	Unionville	Develop new septic systems/package plants as needed	0.6	0.01	0.03
19	Walden	Maintain Walden STP at 1.1 mgd SEC	0	0.40	0.47
20	Warwick (part T)	Maintain Warwick (T) STP at 0.39 mgd ADV(L)	0	0.41	0.41
		TOTALS	26.5	7.35	8.95

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discharge to the Shawangunk Kill.

The budgetary capital cost in 1991 dollars for the Pine Bush STP expansion is estimated at $3.5 million. Budgetary operation and maintenance costs in 1991 dollars are estimated at $0.26 million in the year 1995 and $0.37 million in the year 2020.

Deerpark

The Town of Deerpark is not expected to generate sewage in quantities that would warrant municipal treatment facilities by the year 2020. For this reason, it is recommended that the Town continue the use of individual subsurface disposal systems, with package sewage treatment plants constructed as necessary in accordance with local provisions and developmental need. The Town may wish to consider non-conventional, land-based treatment as an alternative to package plant construction on a site-specific basis.

It is projected that 90 percent of the Town's population in the year 2020 will be unsewered and therefore rely upon septic systems for sewage disposal. Estimated sewage generation for the balance of the population requiring treatment at package plants is only 0.08 mgd by the year 2020. The budgetary capital cost in 1991 dollars for new septic systems and package treatment plants is estimated at $1.4 million. Budgetary operation and maintenance costs in 1991 dollars are estimated at $0.02 million in the year 1995 and $0.08 million in the year 2020.

Florida

The Village of Florida is served by the Florida STP. It is recommended that the facility be expanded and upgraded from 0.30 mgd to 0.45 mgd to provide ADV(L) treatment, with continued effluent discharge to the Quaker Creek.

The budgetary capital cost in 1991 dollars for the Florida STP expansion and upgrade is estimated at $3.5 million. Budgetary operation and maintenance costs in 1991 dollars are estimated at $0.38 million in the year 1995 and $0.45 million in the year 2020.

Goshen (V)

The Village of Goshen and about 600 homes in the Town of Goshen are served by the Goshen STP. Since it is recommended in Section 13.6 that the Town of Goshen participate in the central County sewage treatment action, these 600 homes in the Town are to be eliminated from the Village system, allowing more treatment capacity for the Village. It is recommended that the facility be maintained at 1.50 mgd while providing ADV(L) treatment, with continued effluent discharge to the Rio Grande.

There is no budgetary capital cost for Goshen STP projects since no expansion or upgrade of facilities is warranted. Budgetary operation and maintenance costs in 1991 dollars are estimated at $0.64 million in the year 1995 and $0.71 million in the year 2020.

Greenville

The Town of Greenville is not expected to generate sewage in quantities that would warrant municipal treatment facilities by the year 2020. For this reason, it is recommended that the Town continue the use of individual subsurface disposal systems, with package sewage treatment plants constructed as necessary in accordance with local provisions and developmental need. The Town may wish to consider non-conventional, land-based treatment as an alternative to package plant construction on a site-specific basis.

It is projected that 90 percent of the Town's population in the year 2020 will be unsewered and therefore rely upon septic systems for sewage disposal. Estimated sewage generation for the balance of the population requiring treatment at package plants is only 0.06 mgd by the year 2020. The budgetary capital cost in 1991 dollars for new septic systems and package treatment plants is estimated at $1.2 million. Budgetary operation and maintenance costs in 1991 dollars are estimated at $0.02 million in the year 1995 and $0.06 million in the year 2020.

Hamptonburgh

The Town of Hamptonburgh is not expected to generate sewage in quantities that would warrant municipal treatment facilities by the year 2020. For this reason, it is recommended that the Town continue the use of individual subsurface disposal systems, with package sewage treatment plants constructed as necessary in accordance with local provisions and developmental need. The Town may wish to consider non-conventional, land-based treatment as an alternative to package plant construction on a site-specific basis.

It is projected that 90 percent of the Town's population in the year 2020 will be unsewered and therefore rely upon septic systems for sewage disposal. Estimated sewage generation for the balance of the population requiring treatment at package plants is only 0.05 mgd by the year 2020. The budgetary capital cost in 1991 dollars for new septic systems and package treatment plants is estimated at $1.1 million. Budgetary operation and maintenance costs in 1991 dollars are estimated at $0.02 million in the year 1995 and $0.05 million in the year 2020.

Highland Falls

The Village of Highland Falls is served by the Cragston STP. It is recommended that the facility be maintained at 1.35 mgd while providing SEC treatment, with continued effluent discharge to the Hudson River.

There is no budgetary capital cost for Cragston STP projects since no expansion or upgrade of facilities is warranted. Budgetary operation and maintenance costs in 1991 dollars are estimated at $0.30 million in the year 1995 and $0.36 million in the year 2020.

Highlands

The Town of Highlands is served by the Fort Montgomery STP. It is recommended that the facility be expanded from 0.12 mgd to 0.14 mgd while maintaining SEC treatment, with continued effluent discharge to the Hudson River.

The budgetary capital cost in 1991 dollars for the Fort Montgomery STP expansion is estimated at $0.4 million. Budgetary operation and maintenance costs in 1991 dollars are estimated at $0.09 million in the year 1995 and $0.21 million in the year 2020.

Maybrook

The Village of Maybrook is served by the Maybrook STP. It is recommended that the facility be upgraded at 0.40 mgd to provide ADV(L) treatment, with continued effluent discharge to a tributary of the Otter Kill.

The budgetary capital cost in 1991 dollars for the Maybrook STP upgrade is estimated at $2.9 million. Budgetary operation and maintenance costs in 1991 dollars are estimated at $0.40 million in the year 1995 and $0.41 million in the year 2020.

Middletown

The City of Middletown is served by the Middletown STP. It is recommended that the facility be maintained at 6.0 mgd while providing ADV(L) treatment, with continued effluent discharge to the Wallkill River.

There is no budgetary capital cost for Middletown STP projects since no expansion or upgrade of facilities is warranted. Budgetary operation and maintenance costs in 1991 dollars are estimated at $2.19 million in the year 1995 and $2.50 million in the year 2020.

Minisink

The Town of Minisink is not expected to generate sewage in quantities that would warrant municipal treatment facilities by the year 2020. For this reason, it is recommended that the Town continue the use of individual subsurface disposal systems, with package sewage treatment plants constructed as necessary in accordance with local provisions and developmental need. The Town may wish to consider non-conventional, land-based treatment as an alternative to package plant construction on a site-specific basis.

It is projected that 90 percent of the Town's population in the year 2020 will be unsewered and therefore rely upon septic systems for sewage disposal. Estimated sewage generation for the balance of the population requiring treatment at package plants is only 0.03 mgd by the year 2020. The budgetary capital cost in 1991 dollars for new septic systems and package treatment plants is estimated at $0.6 million. Budgetary operation and maintenance costs in 1991 dollars are estimated at $0.01 million in the year 1995 and $0.03 million in the year 2020.

Montgomery (V)

The Village of Montgomery is served by the Village of Montgomery STP. It is recommended that the facility be maintained at 0.50 mgd while providing ADV(L) treatment, with continued effluent discharge to the Wallkill River.

There is no budgetary capital cost for Village of Montgomery STP projects since no expansion or upgrade of facilities is warranted. Budgetary operation and maintenance costs in 1991 dollars are estimated at $0.40 million in the year 1995 and $0.45 million in the year 2020.

Montgomery (T)

The Town of Montgomery is now served by the Town of Montgomery overland flow STP. It is recommended that the Town proceed with plans for both the abandonment of this overland flow facility and construction of a new ADV(L) conventional treatment facility, with effluent discharge to the Wallkill River.

Based on projections in this Study, Town of Montgomery sewage generation in the year 2020 is expected to be 0.6 mgd. The budgetary capital cost in 1991 dollars for a new, conventional ADV(L) STP of this size is estimated at $6.4 million. Budgetary operation and maintenance costs in 1991 dollars are estimated at $0.25 million in the year 1995 and $0.51 million in the year 2020.

Port Jervis

The City of Port Jervis is served by the Port Jervis STP. It is recommended that the facility be maintained at 2.5 mgd while providing SEC treatment, with continued effluent discharge to the Neversink River.

There is no budgetary capital cost for Port Jervis STP projects since no expansion or upgrade of facilities is warranted. Budgetary operation and maintenance costs in 1991 dollars are estimated at $0.60 million in the year 1995 and $0.65 million in the year 2020.

Tuxedo

The Town of Tuxedo and approximately 20 homes in the Village of Tuxedo Park are served by the Hamlet STP. It is recommended that the facility be expanded and upgraded from 0.10 mgd to 0.20 mgd to provide ADV(L) treatment, with continued effluent discharge to the Ramapo River.

The budgetary capital cost in 1991 dollars for the Hamlet STP expansion and upgrade is estimated at $3.2 million. Budgetary operation and maintenance costs in 1991 dollars are estimated at $0.20 million in the year 1995 and $0.32 million in the year 2020.

Tuxedo Park

The Village of Tuxedo Park is served by the Tuxedo Park STP. It is recommended that the facility be upgraded at 0.15 mgd to provide ADV(L) treatment, with continued effluent discharge to the Warwick Brook.

The budgetary capital cost in 1991 dollars for the Tuxedo Park STP upgrade is estimated at $1.7 million. Budgetary operation and maintenance costs in 1991 dollars are estimated at $0.20 million in the year 1995 and $0.27 million in the year 2020.

Unionville

The Village of Unionville is not expected to generate sewage in quantities that would warrant municipal treatment facilities by the year 2020. For this reason, it is recommended that the Village continue the use of individual subsurface disposal systems, with package sewage treatment plants constructed as necessary in accordance with local provisions and developmental need. The Village may wish to consider non-conventional, land-based treatment as an alternative to package plant construction on a site-specific basis.

It is projected that 70 percent of the Village population in the year 2020 will be unsewered and therefore rely upon septic systems for sewage disposal. Estimated sewage generation for the balance of the population requiring treatment at package plants is only 0.03 mgd by the year 2020. The budgetary capital cost in 1991 dollars for new septic systems and package treatment plants is estimated at $0.6 million. Budgetary operation and maintenance costs in 1991 dollars are estimated at $0.01 million in the year 1995 and $0.03 million in the year 2020.

Walden

The Village of Walden is served by the Walden STP. It is recommended that the facility be maintained at 1.1 mgd while providing SEC treatment, with continued effluent discharge to the Wallkill River.

There is no budgetary capital cost for Walden STP projects since no expansion or upgrade of facilities is warranted. Budgetary operation and maintenance costs in 1991 dollars are estimated at $0.40 million in the year 1995 and $0.47 million in the year 2020.

Warwick (T)

The Town of Warwick is served by the Town of Warwick STP. It is recommended that the facility be maintained at 0.39 mgd while providing ADV(L) treatment, with continued effluent discharge to the Longhouse Creek. The remainder of sewage generated by the Town of Warwick is expected to be treated at the Village of Warwick regional STP as discussed in Section 13.5.

There is no budgetary capital cost for Town of Warwick STP projects since no expansion or upgrade of facilities is warranted. Budgetary operation and maintenance costs in 1991 dollars are estimated at $0.41 million in the year 1995 and $0.41 million in the year 2020.

13.5 Sewage Treatment: Regional Actions

The Recommended Plan includes several important regional sewage treatment actions to help meet the future needs of Orange County. Specifically, it is recommended that one city, six towns and two villages in the County proceed with regional sewage treatment actions. Table 13-2 lists these 9

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 13-2

RECOMMENDED REGIONAL SEWAGE TREATMENT ACTIONS

NO.	COMMUNITIES	RECOMMENDED ACTION	BUDGETARY CAPITAL COST ($ 1991) (millions)	BUDGETARY ANNUAL O&M COSTS ($ 1991) (millions) 1995	2020
1 and 2	Mount Hope and Otisville	Constuct new STP at 0.60 mgd ADV(H) in conjunction with correctional facilities	7.1	0.30	0.58
3 and 4	Newburgh (C) and Newburgh (T)	Expand Newburgh (C) STP from 7.0 mgd to 9.3 mgd SEC Abandon the Colden Park, Nob Hill and Wintergreen STPs.	8.3	1.30	2.35
5 and 6	New Windsor and Cornwall	Expand New Windsor STP from 5.0 mgd to 12.0 mgd SEC	25.7	2.39	4.33
7 and 8	Wallkill and Wawayanda	Expand Wallkill STP from 4.0 mgd to 5.3 mgd ADV(L)	13.4	1.32	2.27
9	Warwick (V) and adjacent areas of Warwick (T) not serviced by the recommended local sewage treatment action	Expand and upgrade Warwick (V) STP from 0.50 mgd to 1.50 mgd ADV(L)	9.0	0.54	0.89
		TOTALS	63.5	5.85	10.42

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communities and summarizes the recommended regional sewage treatment action and associated cost for each.

A concise description of the recommended regional sewage treatment actions for these communities is provided below.

Mount Hope/Otisville

The Town of Mount Hope and the Village of Otisville presently host three STPs: Hidden Valley Estates and both the Otisville State and Federal correctional facilities. At present, the correctional facilities are planning the construction of a joint regional sewage treatment facility, which could be sized to treat sewage from adjoining areas of Mount Hope and all of Otisville. Since federal funds are available for a portion of this new regional STP's construction costs, it is recommended that Mount Hope and Otisville benefit from participation in this project. It is estimated that the combined sewage generation from the Town, Village and both correctional facilities will total 0.6 mgd and require ADV(H) treatment for effluent discharge to the Shawangunk Kill.

The budgetary capital cost in 1991 dollars for the Mount Hope/Otisville regional STP construction is estimated at $7.1 million. Budgetary operation and maintenance costs in 1991 dollars are estimated at $0.30 million in the year 1995 and $0.58 million in the year 2020.

Newburgh(C)/Newburgh (T)

The City and the Town of Newburgh are to continue to be served by the City of Newburgh regional STP. It is recommended that the facility be expanded from 7.0 mgd to 9.3 mgd while maintaining SEC treatment, with continued effluent discharge to the Hudson River. It is also recommended that the Town should thereafter abandon the following facilities: Colden Park, Nob Hill and Wintergreen.

The budgetary capital cost in 1991 dollars for the City of Newburgh regional STP expansion is estimated at $8.3 million. Budgetary operation and maintenance costs in 1991 dollars are estimated at $1.30 million in the year 1995 and $2.35 million in the year 2020.

New Windsor/Cornwall

The Town of New Windsor and part of the Town of Cornwall are to continue to be served by the New Windsor regional STP. It is recommended that the facility be expanded from 5.0 mgd to 12.0 mgd while maintaining SEC treatment, with effluent discharge being moved further out from the mouth of the Moodna Creek to an appropriate location in the Hudson River. It is recommended that the Firthcliffe STP be maintained as part of this regional sewage treatment action.

The budgetary capital cost in 1991 dollars for the New Windsor regional STP expansion is estimated at $25.7 million. Budgetary operation and maintenance costs in 1991 dollars are estimated at $2.39 million in the year 1995 and $4.33 million in the year 2020.

Wallkill/Wawayanda

The Town of Wallkill and the Town of Wawayanda are expected to be served by the Wallkill regional STP. It is recommended that the facility be expanded from 4.0 mgd to 5.3 mgd while providing ADV(L) treatment, with continued effluent discharge to the Wallkill River. Note that this regional expansion entails the construction of both pumping station PS 7.1 and Pipe Routes 6.2 and 7.1 (refer to Chapter 12) as part of the two Town's regional expansion cost.

The budgetary capital cost in 1991 dollars for the Wallkill regional STP expansion, including the pump station and pipelines, is estimated at $13.4 million. Budgetary operation and maintenance costs in 1991 dollars are estimated at $1.32 million in the year 1995 and $2.27 million in the year 2020.

Warwick (V)

The Village of Warwick and part of the Town of Warwick are to be served by the Village of Warwick regional STP. It is recommended that the facility be expanded and upgraded from 0.50 mgd to 1.50 mgd to provide ADV(L) treatment, with continued effluent discharge to the Wawayanda Creek.

The budgetary capital cost in 1991 dollars for the Village of Warwick regional STP expansion and upgrade is estimated at $9.0 million. Budgetary operation and maintenance costs in 1991 dollars are estimated at $0.54 million in the year 1995 and $0.89 million in the year 2020.

13.6 Sewage Treatment: Central County Action

The Recommended Plan includes one major central sewage treatment action to help meet the future needs of Orange County. Specifically, it is recommended that five towns and six villages with common sewage management needs look to the County to proceed with a central sewage treatment action. Table 13-3 lists these 11 communities and summarizes the recommended central County sewage treatment action and associated cost. Figure 13-1 depicts the participant communities, principal pipeline routes and approximate sewage treatment facility location for the recommended central County sewage treatment action. The following subsections provide a description, conceptual

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 13-3

RECOMMENDED CENTRAL COUNTY SEWAGE TREATMENT ACTION

NO.	COMMUNITIES	RECOMMENDED ACTION	BUDGETARY CAPITAL COST ($ 1991) (millions)	BUDGETARY ANNUAL O&M COSTS ($ 1991) (millions)	
				1995	2020
1	Blooming Grove (T)	Construct new County STP at 12.0 mgd SEC with associated pumping stations and main collection pipelines. Abandon the King Tract STP, Orange County Home and Infirmary STP, OCSD#1 STP, Sugar Loaf STP, Tappan Homes STP, Valley Forge STP and Washingtonville STP.	86.4	2.19	4.75
2	Chester (V)				
3	Chester (T)				
4	Goshen (T)				
5	Greenwood Lake (V)				
6	Harriman (V)				
7	Kiryas Joel (V)				
8	Monroe (V)				
9	Monroe (T)				
10	Washingtonville (V)				
11	Woodbury (T)				
		TOTALS	**86.4**	**2.19**	**4.75**

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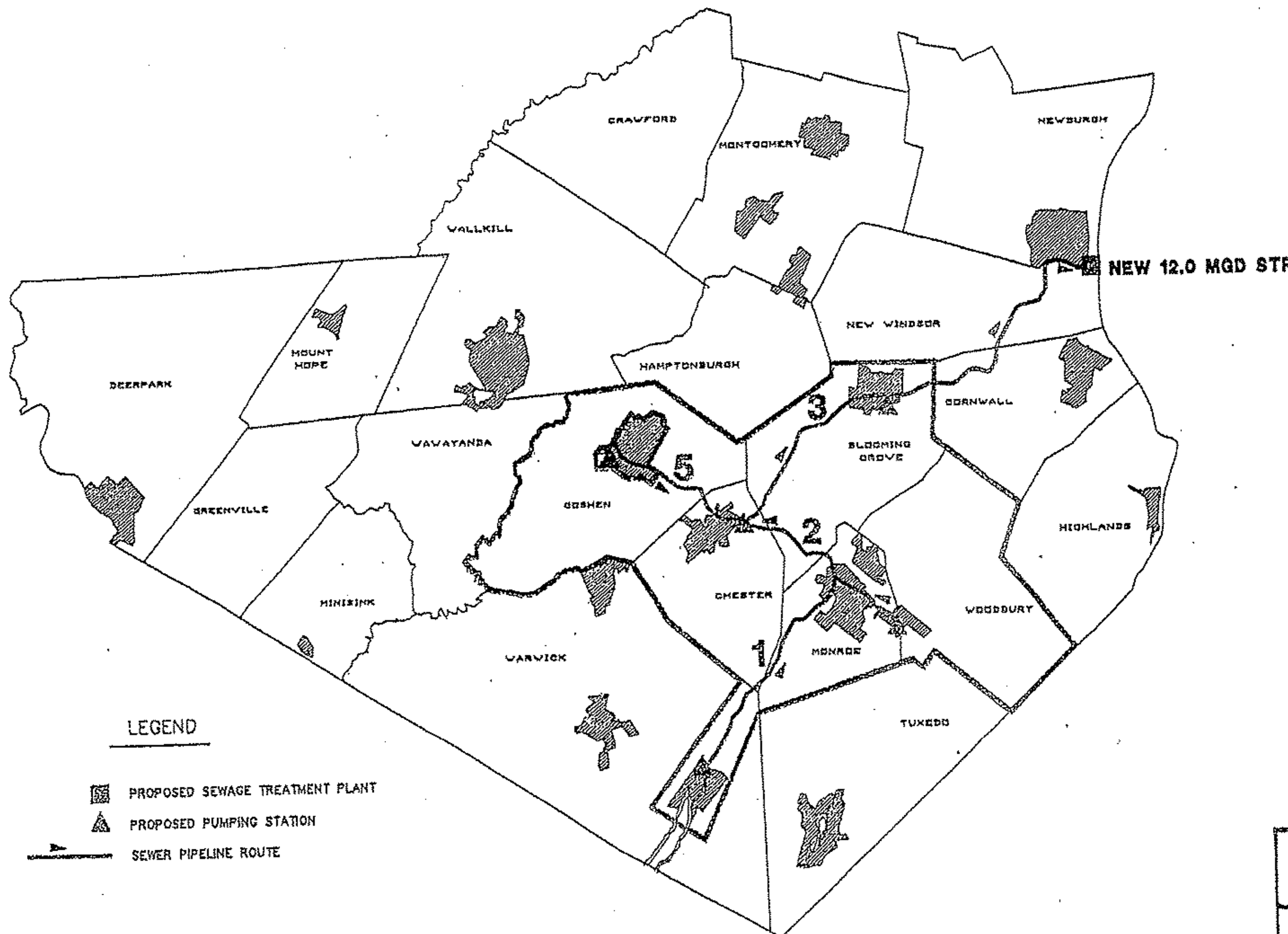
FIGURE 13-1



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RECOMENDED CENTRAL
COUNTY SEWAGE
TREATMENT ACTION

engineering design, estimated costs and project variations for the recommended central County sewage treatment action.

13.6.1 Description

It is recommended that a new central Orange County STP to serve the Towns of Blooming Grove, Chester, Goshen, Monroe, and Woodbury, and the Villages of Chester, Greenwood Lake, Harriman, Kiryas Joel, Monroe and Washingtonville be built. It is recommended that this new central facility be constructed in the vicinity of the Town of New Windsor at 12.0 mgd capacity to provide SEC treatment, with effluent discharge to the Hudson River. This new central County project also entails the construction of pumping stations PS 1.1, PS 2.1, PS 3.1, PS 3.3 and PS 5.1, and Pipe Routes 1.1, 1.2, 2.1, 2.2, 3.1, 3.2, 3.3 and 5.1 (refer to Chapter 12) as part of the County's centralization cost. It is also recommended that the King Tract STP, Orange County Home and Infirmary STP, OCSD#1 STP, Sugar Loaf STP, Tappan Homes STP, Valley Forge STP and Washingtonville STP all be abandoned.

13.6.2 Conceptual Engineering Design

The recommended central County sewage treatment action in this Study forms the basis for a more in-depth assessment of facilities sizing and layout. The conceptual sewage treatment facility design presented reflects expected, relevant influent sewage flow characteristics, peak flows and required effluent quality. This conceptual design directly affects both the project capital and operations and maintenance costs as presented.

The conceptual design of the project is based on the review of planning information in this Study, including an analysis of daily discharge monitoring reports for the past year (1990) from the OCSD#1 STP, Goshen (V) STP and Washingtonville (V) STP. The review of such information permitted the characterization of anticipated influent sewage BOD and TSS at a new central facility, and projection of diurnal and storm-related sewage flow variations. This data was used to check and modify the sizes of pipes, pumping stations and treatment facility unit operations for the central project. The required length and diameter of pipelines and the anticipated dry weather average and peak sewage flows they are to transport are shown in Table 13-4. Pumping station size information is also included in Table 13-4 .

A conceptual design layout of the new central sewage treatment facility is depicted in Figure 13-2. Note that the facility includes pre-aeration to improve sewage treatability and post-aeration to increase dissolved oxygen content in the treated effluent discharge to the Hudson

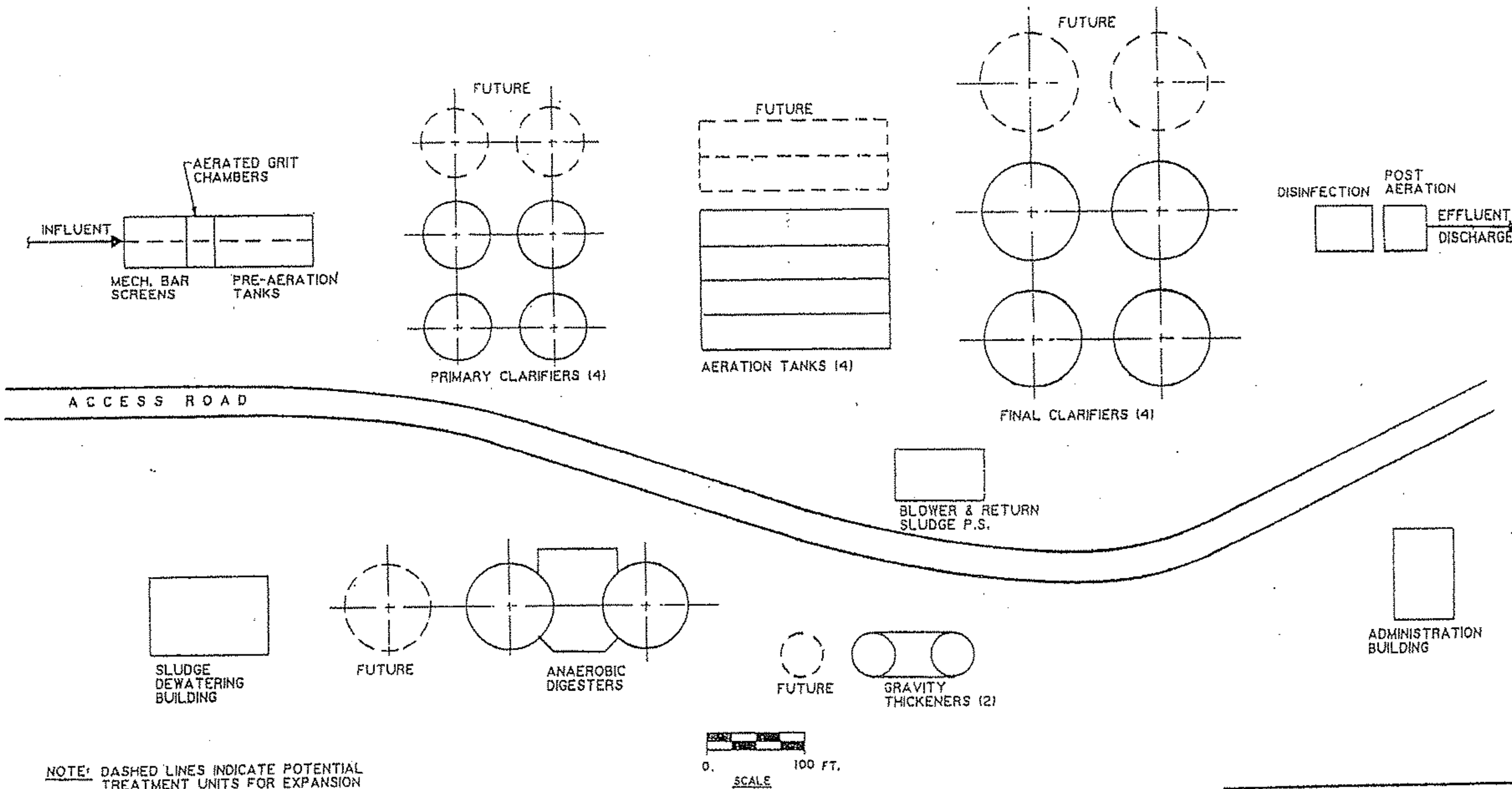
TABLE 13-4

PIPELINES AND PUMPING STATIONS FOR THE RECOMMENDED CENTRAL COUNTY SEWAGE TREATMENT ACTION

PIPE ROUTE (1)	SUB-ROUTE	DESCRIPTION	1995 Start-Up Flow Avg, mgd	1995 Start-Up Flow Peak, mgd	2020 Design Flow Avg, mgd	2020 Design Flow Peak, mgd	Pumping Station Capacity, mgd	Pipe Length, Ft	Pipe Diameter and Material (2)
1	1.1	Greenwood Lake to School Rd. - Monroe (U)	0.1	0.2	0.4	1.3	2.0	31,000	2 @ 10" DIP
	1.2	School Rd. to Railroad ROW - Monroe (V)	0.7	2.1	1.8	4.8	-	17,000	24" RCP
2	2.1	OCSD#1 STP to Lake Street - Monroe (V)	2.7	6.8	5.5	12.4	13.0	13,000	30" DIP
	2.2	Lake Street to Chester (V)	3.8	9.0	8.2	17.2	-	20,000	54" RCP
3	3.1	Chester (V) to Washingtonville	4.9	11.1	10.3	20.8	21.0	40,000	36" DIP
	3.2	Washingtonville to New Windsor STP	5.4	12.0	11.8	23.2	-	57,000	36" DIP
	3.3	Washingtonville STP to Sub-Route 3.2	0.5	1.5	1.5	4.1	4.5	1,000	12" DIP
5	5.1	Goshen (V) border to Chester (V)	0.4	1.3	1.0	3.1	3.5	26,000	12" DIP

(1) Pipe Routes are defined in Chapter 10. Profiles of pipelines are shown in Appendix E.
(2) Pipe sizes are designated as RCP (reinforced concrete pipe) for gravity interceptors and DIP (ductile iron pipe) for force mains.

FIGURE 13-2



NOTE: DASHED LINES INDICATE POTENTIAL TREATMENT UNITS FOR EXPANSION OF FACILITY BEYOND YEAR 2020.

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CONCEPTUAL LAYOUT OF 12.0 MGD CENTRAL SEWAGE TREATMENT PLANT

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River. In addition, ultraviolet radiation disinfection is specified instead of chlorination, to reduce concerns over the potential presence of chlorinated byproducts in the effluent. Preliminary unit operation sizes and design criteria for the new central sewage treatment facility are provided in Table 13-5.

13.6.3 Estimated Costs

A complete component cost breakdown of the central County sewage treatment action is shown in Table 13-6. The total budgetary capital cost in 1991 dollars for the project is estimated to be $86.4 million. Total budgetary operation and maintenance costs in 1991 dollars are estimated at $2.19 million in the year 1995 (start-up conditions) and $4.75 million in the year 2020 (design conditions).

While SEC treatment is adequate for effluent discharge to the Hudson River from this new central sewage treatment facility, the County has received correspondence during this Study from local organizations advocating an advanced level of treatment. Thus, at the request of the Orange County Sewer Committee, ancillary project cost estimates for the provision of ADV(L) treatment at this new central sewage treatment facility is made. It is estimated that an additional 10 percent above the budgetary treatment facility capital cost of $36.7 million is needed to provide single stage nitrification at the facility. Operation and maintenance costs are estimated to increase approximately 20 percent above the $1.93 million treatment facility costs in the year 1995 (start-up conditions). These cost increases are associated with the provision of extended aeration equipment instead of conventional aeration equipment, plus larger sludge thickening and digestion tanks.

If filtration is provided at the facility in addition to single stage nitrification, it is estimated that the budgetary capital cost will increase by as much as 30 percent over the $36.7 million treatment facility cost. Operation and maintenance costs including both single stage nitrification and filtration are estimated to increase by approximately 30 percent above the $1.93 million treatment facility cost in the year 1995 (start-up conditions).

13.6.4 Project Variations

Subsequent to the finalization of the recommended action for central sewage collection and treatment in Orange County, it was brought to the County's attention that the existing Town of New Windsor service area might be interested in being part of the central County sewage treatment action. As such, two specific variations of the recommended central County sewage

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TABLE 13-5

CONCEPTUAL ENGINEERING DESIGN FOR THE RECOMMENDED

CENTRAL COUNTY SEWAGE TREATMENT FACILITY

Treatment Capacity	12.0 mgd
Hydraulic Capacity	36.0 mgd
Influent Sewage Characteristics	
BOD	250 mg/l
TSS	300 mg/l
Sewage Treatment Units	
Mechanical Bar Screens	3 Units
Aerated Grit Chambers	2 Units
Pre-aeration Tanks	2 Units
Primary Clarifiers	4 Units - 65 ft. Diameter x 10 ft. Depth
Aeration Tanks	4 Units - 35 ft. Width x 192 ft. Length x 22 ft. Depth
Final Clarifiers	4 Units - 100 ft. Diameter x 14 ft. Depth
UV Disinfection	2 Channels
Cascade Aeration	1 Unit
Sewage Sludge Treatment Units	
Gravity Thickeners	2 Units - 45 ft. Diameter x 33 ft. Depth
Anaerobic Digesters	2 Units - 90 ft. Diameter x 36 ft. Avg. Depth
Belt Filter Presses	3 Units

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ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 13-6

COMPONENT BUDGETARY COST BREAKDOWN FOR THE RECOMMENDED

CENTRAL COUNTY SEWAGE TREATMENT ACTION

	CAPITAL COST ($ 1991) (millions)	ANNUAL OPERATION AND MAINTENANCE COST ($ 1991)	
		1995 Start-Up (millions)	2020 Design (millions)
Pipelines	$37.3	$0.05	$0.06
Pumping Stations	$12.4	$0.21	$0.30
Sewage Treatment Plant (1)	$36.7	$1.93	$4.39
TOTAL	$86.4	$2.19	$4.75

Note:

(1) STP includes a 54-inch diameter, 4000 ft effluent outfall into the Hudson River.

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treatment action were developed around the New Windsor service area's potential participation.

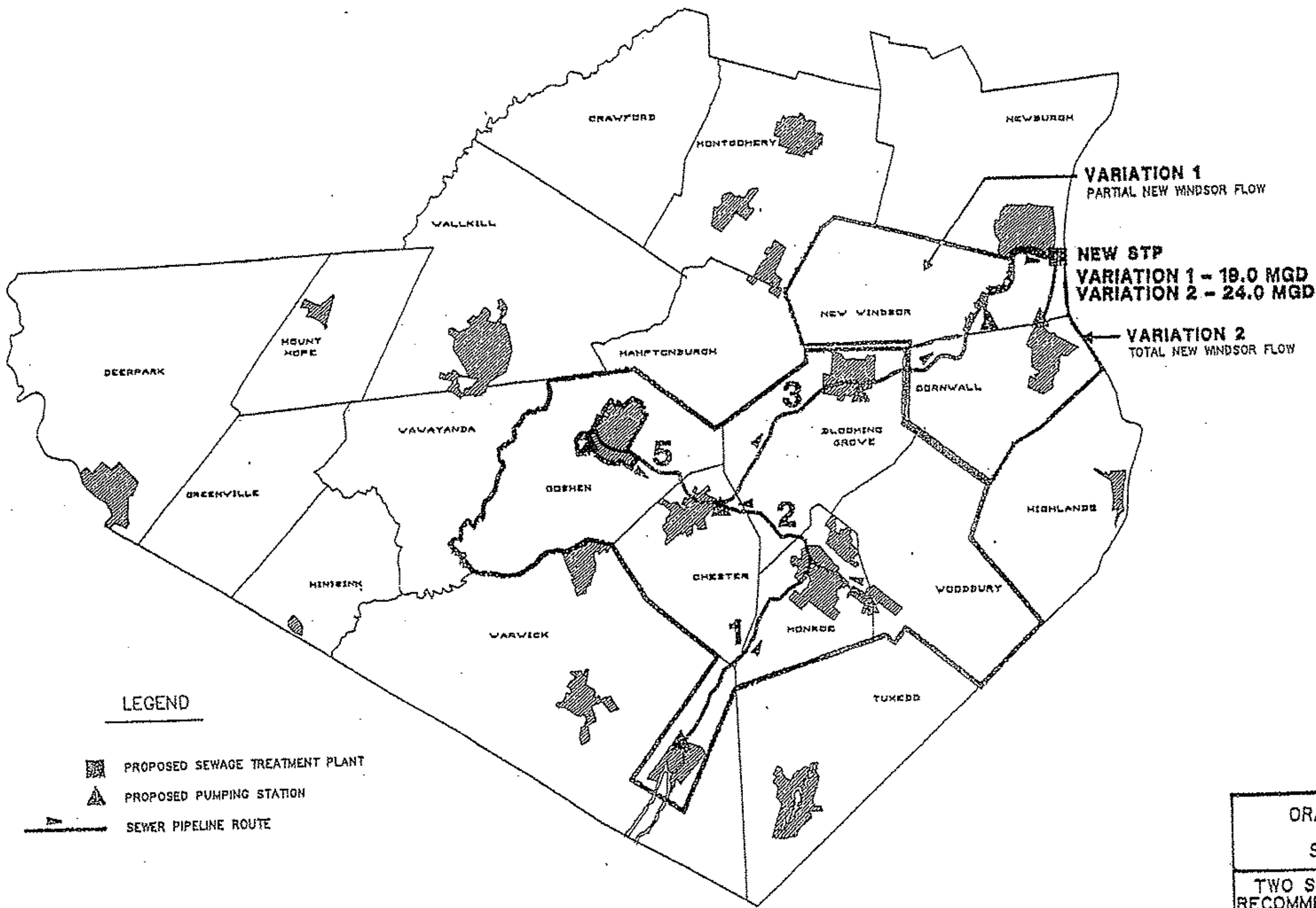
The first variation (Variation 1) involves the inclusion of 7.0 mgd of sewage flow from the New Windsor service area equaling their year 2020 projected flow that is above and beyond the existing New Windsor STP's treatment capacity. The second variation (Variation 2) involves the inclusion of all 12.0 mgd of sewage flow from the New Windsor service area, equaling their year 2020 projected flow, and the abandonment of the existing New Windsor STP. Figure 13-3 shows these two variations of the recommended central County sewage treatment action. Descriptions and budgetary cost estimates for these two specific variations of the recommended central County sewage treatment action are provided below.

Variation 1 involves a sewage flow of 7.0 mgd from the western portion of the Town of New Windsor service area, including Stewart Airport, to the new central sewage treatment facility. Diversion of this sewage flow would require the construction of a pumping station in the vicinity of State Route 94 and Forge Hill Road and intercepting flow from both the Stewart Airport and Beaver Dam Lake areas. From the Vails Gate area, sewage would then be pumped approximately 4,000 feet to meet Pipe Route 3.2 (refer to Chapter 12) where it crosses Temple Hill Road. The additional budgetary capital cost in 1991 dollars for conveyance and treatment associated with Variation 1 is estimated to be $21.7 million. The additional budgetary operation and maintenance costs in 1991 dollars associated with Variation 1 are estimated at $0.78 million in the year 1995 (start-up conditions) and $2.99 million in the year 2020 (design conditions). A summary for Variation 1 of the recommended central County sewage treatment action is presented in Table 13-7.

Variation 2 involves a sewage flow of 12.0 mgd from the entire Town of New Windsor service area. This can be achieved by the abandonment and conversion of the existing New Windsor STP into a large pumping station for conveying this sewage flow to the new central sewage treatment facility. The additional budgetary capital cost in 1991 dollars for conveyance and treatment associated with Variation 2 is estimated to be $39.1 million. The additional budgetary operation and maintenance costs in 1991 dollars associated with Variation 2 are estimated at $2.51 million in the year 1995 (start-up conditions) and $5.12 million in the year 2020 (design conditions). A summary for Variation 2 of the recommended central County sewage treatment action is presented in Table 13-8.

FIGURE 13-3

Draft Report Issued for Client Review
July 15, 1991



ORANGE COUNTY, N.Y.
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TWO SPECIFIC VARIATIONS OF
RECOMMENDED CENTRAL COUNTY
SEWAGE TREATMENT ACTION

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Engineers

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 13-7

VARIATION NO. 1 OF THE

RECOMMENDED CENTRAL COUNTY SEWAGE TREATMENT ACTION

NO.	COMMUNITIES	RECOMMENDED ACTION	BUDGETARY CAPITAL COST ($ 1991) (millions)	BUDGETARY ANNUAL O&M COSTS ($ 1991) (millions) 1995	2020
1	Blooming Grove (T)	Construct new County STP at 19.0 mgd SEC with associated pumping stations and main collection pipelines. Abandon the King Tract STP, Orange County Home and Infirmary STP, OCSD#1 STP, Sugar Loaf STP, Tappan Homes STP, Valley Forge STP and Washingtonville STP. Maintain the New Windsor STP at 5.0 mgd.	108.1	2.97	7.74
2	Chester (V)				
3	Chester (T)				
4	Goshen (T)				
5	Greenwood Lake (V)				
6	Harriman (V)				
7	Kiryas Joel (V)				
8	Monroe (V)				
9	Monroe (T)				
10	Washingtonville (V)				
11	Woodbury (T)				
12	New Windsor (T), part				
		TOTALS	108.1	2.97	7.74

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ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 13-8

VARIATION NO. 2 OF THE

RECOMMENDED CENTRAL COUNTY SEWAGE TREATMENT ACTION

NO.	COMMUNITIES	RECOMMENDED ACTION	BUDGETARY CAPITAL COST ($ 1991) (millions)	BUDGETARY ANNUAL O&M COSTS ($ 1991) (millions) 1995	2020
1	Blooming Grove (T)	Construct new County STP at 24.0 mgd SEC with associated pumping stations and main collection pipelines. Abandon the King Tract STP, New Windsor STP, Orange County Home and Infirmary STP, OCSD#1 STP, Sugar Loaf STP, Tappan Homes STP, Valley Forge STP and Washingtonville STP.	125.5	4.70	9.87
2	Chester (V)				
3	Chester (T)				
4	Goshen (T)				
5	Greenwood Lake (V)				
6	Harriman (V)				
7	Kiryas Joel (V)				
8	Monroe (V)				
9	Monroe (T)				
10	Wahingtonville (V)				
11	Woodbury (T)				
12	Cornwall (T), part				
13	New Windsor (T), all				
		TOTALS	125.5	4.70	9.87

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The determination of whether or not either variation of the recommended central County sewage treatment action benefits both the recommended new central service area and the New Windsor area depends upon the results of financial impact analyses. These analyses are provided in Chapter 15.

13.7 Sewage Sludge Management

Sewage sludge is and will continue to be generated by sewage treatment facilities in Orange County. Currently, most sewage sludge is being disposed of at the Orange County Landfill in the Town of Goshen. However, it is recognized that this sewage sludge management practice may change during the planning period examined in this Study.

Therefore, it is recommended that Orange County continue to study, separate of this document, various approaches to comprehensive sewage sludge management. One suggested general approach of doing this is to include an examination of sewage sludge beneficial utilization methods such as composting, etc. (as described in Chapter 9) while maintaining back-up provisions for sewage sludge disposal should future difficulties be encountered in areas such as end use market availability and product quality.

It is also recommended that the County balance environmental/technological issues against what are the most economically viable means of sewage sludge management. This can permit sewage treatment facilities in the County to keep costs to a minimum. The County may find it advantageous to explore the concept of regionalization of sewage sludge management facilities with other nearby counties or communities, regardless of whether or not such facilities would be located in the County.

In conclusion, the Recommended Plan calls for Orange County to maintain an active role in sewage sludge management planning by examining all available alternatives, and deciding on and implementing the most appropriate course of action to meet the County's future needs.

13.8 Summary

The Recommended Plan calls for the implementation of the following actions to meet the future sewage collection, treatment and management requirements of Orange County:

- A comprehensive sewage reduction program that encompasses both water conservation and infiltration/inflow management. Water conservation components include public education, leak detection and correction, enforcement through construction codes, reuse and recycling, and waste prevention programs. Infiltration and inflow should be prevented and controlled to within a cost-effective range;

- A comprehensive sewage pre-treatment program for significant and industrial users (SIUs) that discharge atypical or high-strength wastes into sewage collection and treatment systems. Such a program should monitor and limit several key constituents;

- Local projects to address service associated with 20 individual municipalities where regionalization has been determined to be inappropriate due to geographic separation, inadequate population base, high cost or municipal outlook. Recommended local actions shown in Table 13-1 include the upgrading and/or expansion of existing municipal sewage treatment facilities, development of new facilities as needed, and the expanded utilization of "package" type treatment systems in lieu of septic tank systems for larger site development projects. The development and maintenance costs of local collection systems associated with these local projects remain an internal municipal responsibility. These projects do not fall under County jurisdiction;

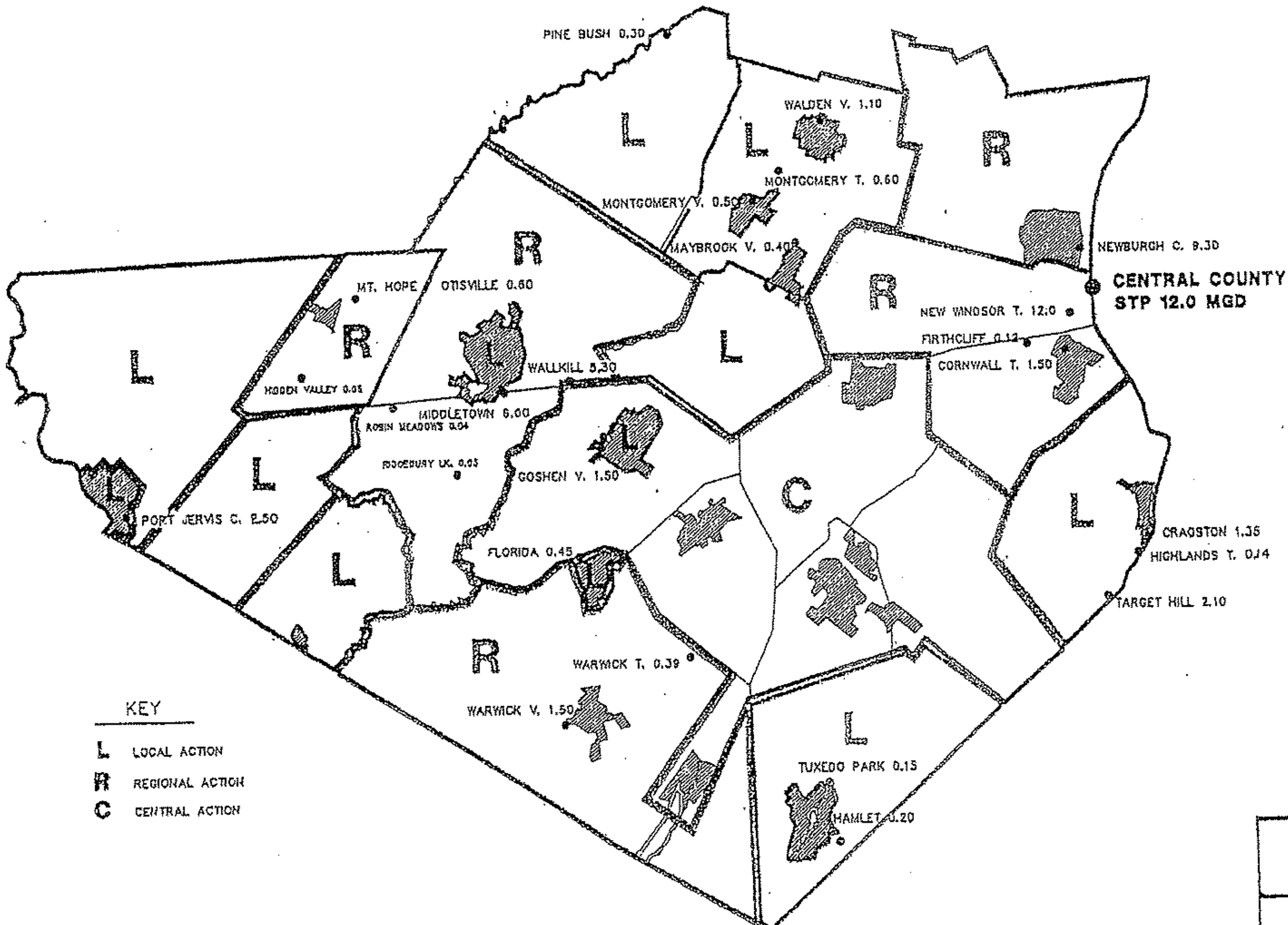
- Regional projects include the construction, expansion and/or upgrade, as shown in Table 13-2, of the following facilities: construct a new Mount Hope/Otisville STP at 0.60 mgd ADV(H); expand the Newburgh (C) STP to a capacity of 9.3 mgd; expand the New Windsor STP to a capacity of 12.0 mgd; expand the Wallkill STP to a capacity of 5.3 mgd; and expand and upgrade the Village of Warwick STP to 1.50 mgd ADV(L). The development and maintenance costs of local collection systems associated with these regional projects remain an internal municipal responsibility. These projects do not fall under County jurisdiction;

- The central County project involves the construction of a new conventional 12.0 mgd SEC sewage treatment plant located in the vicinity of the Town of New Windsor with a treated effluent discharge to the Hudson River and the construction of associated pumping stations and main collection pipelines. As shown in Table 13-3, the central County project plans include the abandonment of both the existing OCSD#1 and Washingtonville STPs and the resultant elimination of their effluent discharges to the Ramapo River and Moodna Creek, respectively. This project does fall under County jurisdiction since the County is to be responsible for its implementation. However, the development and maintenance costs of local collection systems associated with this central County project remain an internal municipal responsibility; and

- Continued separate development of a comprehensive sewage sludge plan for the environmentally sound and economically viable utilization and/or disposal of sewage sludge generated in Orange County during the Study period.

Figure 13-4 depicts the recommended sewage treatment actions for Orange County. Table 13-9 summarizes the local, regional and County actions for sewage treatment included in the Recommended Plan. Table 13-10 provides a cost summary for the recommended sewage treatment actions for Orange County.

FIGURE 13-4



KEY

L LOCAL ACTION
R REGIONAL ACTION
C CENTRAL ACTION

HAZEN AND SAWYER, P.C. Engineers

ORANGE COUNTY, N.Y.
COMPREHENSIVE
SEWERAGE STUDY

RECOMMENDED PLAN
FOR SEWAGE TREATMENT

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 13-9

SUMMARY OF RECOMMENDED SEWAGE TREATMENT ACTIONS

TOWN OR CITY	CONSTITUENT COMMUNITIES	RECOMMENDED SEWAGE TREATMENT ACTION	DESCRIPTION
Blooming Grove (T)	Washingtonville (V) Blooming Grove (UT)	Central (County) Central (County)	Service by a new 12 mgd STP Service by a new 12 mgd STP
Chester (T)	Chester (V) Chester (UT)	Central (County) Central (County)	Service by a new 12 mgd STP Service by a new 12 mgd STP
Cornwall (T)	Cornwall-On-Hudson (V) Cornwall (UT)	Local Regional	Service by a maintained Cornwall STP Service by an expanded New Windsor STP and a maintined Firthcliff STP
Crawford (T)	Crawford (UT)	Local	Service by an expanded Pine Bush STP
Deerpark (T)	Deerpark (UT)	Local	Service by septic systems/package plants
Goshen (T)	Goshen (V) Goshen (UT)	Local Central (County)	Service by a maintained Goshen (V) STP Service by a new 12 mgd STP
Greenville (T)	Greenville (UT)	Local	Service by septic systems/package plants
Hamptonburgh (T)	Hamptonburgh (UT)	Local	Service by septic systems/package plants
Highlands (T)	Highland Falls (V) Highlands (UT)	Local Local	Service by a maintained Cragston STP Service by an expanded Fort Montgomery STP
Middletown (C)	Middletown (C)	Local	Service by a maintained Middletown STP
Minisink (T)	Unionville (V) Minisink (UT)	Local Local	Service by septic systems/package plants Service by septic systems/package plants
Monroe (T)	Harriman (V) Kiryas Joel (V) Monroe (V) Monroe (UT)	Central (County) Central (County) Central (County) Central (County)	Service by a new 12 mgd STP Service by a new 12 mgd STP Service by a new 12 mgd STP Service by a new 12 mgd STP
Montgomery (T)	Maybrook (V) Walden (V) Montgomery (V) Montgomery (UT)	Local Local Local Local	Service by an upgraded Maybrook STP Service by a maintained Walden STP Service by a maintained Montgomery (V) STP Service by a new 0.6 mgd STP
Mount Hope (T)	Otisville (V) Mount Hope (UT)	Regional Regional	Service by a new 0.6 mgd STP Service by a new 0.6 mgd STP

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 13-9 CONT'D.

SUMMARY OF RECOMMENDED SEWAGE TREATMENT ACTIONS

TOWN OR CITY	CONSTITUENT COMMUNITIES	RECOMMENDED SEWAGE TREATMENT ACTION	DESCRIPTION
Newburgh (C)	Newburgh (C)	Regional	Service by an expanded Newburgh (C) STP
Newburgh (T)	Newburgh (UT)	Regional	Service by an expanded Newburgh (C) STP
New Windsor (T)	New Windsor (UT)	Regional	Service by an expanded New Windsor STP
Port Jervis (C)	Port Jervis (C)	Local	Service by a maintained Port Jervis STP
Tuxedo (T)	Tuxedo Park (V) Tuxedo (UT)	Local Local	Service by an upgraded Tuxedo Park STP Service by an expanded, upgraded Hamlet STP
Wallkill (T)	Wallkill (UT)	Regional	Service by an expanded Wallkill STP
Warwick (T)	Florida (V) Greenwood Lake (V) Warwick (V) Warwick (UT)	Local Central (County) Regional Local	Service by an upgraded, expanded Florida STP Service by a new 12 mgd STP Service by an expanded, upgraded Warwick (V) STP Service by an expanded, upgraded Warwick (V) STP and a maintained Warwick (T) STP
Wawayanda (T)	Wawayanda (UT)	Regional	Service by an expanded Wallkill STP
Woodbury (T)	Woodbury (UT)	Central (County)	Service by a new 12 mgd STP

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 13-10

COST SUMMARY FOR RECOMMENDED SEWAGE TREATMENT ACTIONS

RECOMMENDED SEWAGE TREATMENT ACTION	INVOLVED NUMBER OF COMMUNITIES	BUDGETARY CAPITAL COST ($ 1991) (MILLIONS)	BUDGETARY ANNUAL O&M COST ($ 1991) (MILLIONS)	
			1995	2020
Local	20	$26.5	$7.35	$8.95
Regional	9	$63.5	$5.85	$10.42
Central (County)	11	$86.4	$2.19	$4.75
TOTALS	**40**	**$176.4**	**$15.39**	**$24.12**

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CHAPTER 14

14.0 INSTITUTIONAL AND FINANCIAL CONSIDERATIONS OF THE CENTRAL COUNTY SEWAGE TREATMENT ACTION

14.1 Introduction

This Chapter presents institutional and financial considerations of the central County sewage treatment action in the Recommended Plan. These considerations include the following major items:

- Key Issues;
- Institutional Options;
- Private Sector Participation Options;
- Public Versus Private Ownership; and
- Financial Options.

The following sections discuss these items in more detail.

14.2 Key Issues

An essential ingredient of the central County sewage treatment action in the Recommended Plan is the need to develop a reliable and effective institutional and financing strategy for providing sewage treatment. This strategy is influenced by a range of legal, financial, management, and political considerations that must be balanced against the need for improved service. Key issues affecting the selection of an institutional and financial strategy for this part of the Recommended Plan are as follows:

- The current moratorium on development in certain areas of the County due to either inadequate or lack of sewer service;

- The additional costs of upgrading/expanding existing facilities and/or constructing new facilities to both meet receiving water quality standards and handle increased sewage flows from growth;

- The possible effects of the County's planned capital improvement program and the resulting debt levels that may occur; and

- The likely concerns of municipalities about future sewer capacity, water quality, costs of improvements, and tax impacts of moratoriums.

As a result of the above key issues, it is proposed that an institutional and financial strategy for the Recommended Plan should contain at least the following items:

- It should allow any new or upgraded facilities to be financially self-supporting through customer fees and other revenue sources;
- It should be able to be implemented in an efficient manner and across municipal jurisdictions, when necessary;
- It should minimize the effect on the County's debt level capacity;
- It should instill the public's confidence in the management, operation and performance of facilities; and
- It should both fairly allocate costs related to facilities among the benefiting public and private entities and reflect investments made by existing customers.

The above items are reflected in the discussion of various institutional and financial options under consideration for the central County sewage treatment action in the Recommended Plan.

14.3 Institutional Options

14.3.1 Introduction

A number of different public and private institutional options are available to carry out the recommendations made in the Recommended Plan. The institutional options available to the County have two primary components. First, there is the institutional form of the organization that is to provide sewage treatment services to the County. Second, there is the level of private sector participation in the design, construction, operation, maintenance, and ownership of facilities. These two components, the institutional form of organization and the level of private sector participation, affect both the institutional and financial options available to the County.

14.3.2 Institutional Form

The central County sewage treatment action as presented in the Recommended Plan can be undertaken through one of three institutional forms:

- A County District;
- A County Authority; or
- A Joint Municipal Arrangement.

Of the above three, this discussion does not cover joint municipal arrangements because they are considered both difficult to implement on a County-wide level and not capable of addressing the County's planning, management, financial, and legal issues. Therefore, the discussion of institutional form will revolve around a district and authority comparison. As such, Table 14-1 presents comparison factors associated with either a County district or a County authority.

The County Legislature can establish a County service district, subject to a permissive referendum. A district is formed for a specific service area (e.g., the existing Orange County Sewer District #1) for which a project is implemented. Formation of a County sewer district requires the execution and adoption of local petitions for each service area created. A County district can be administered by a director appointed by the County Executive and with budget oversight by the County Legislature.

A County authority must be created by the New York State Legislature, as a subdivision of the State. An authority can be created for a large area such as the entire County to provide service to either the entire County or develop projects for specific geographic areas therein. An authority is administered by an independent board selected by the County Executive and confirmed by the County Legislature.

A district and an authority share many financial options. Both can obtain tax exempt financing, issue revenue bonds, obtain a New York State revolving fund loan, or utilize private financing. In addition, both can obtain financing that is excluded from County debt limitations which allows flexibility in debt service payment schedules (note: a district must obtain an exclusion from the State for sewer debt). Finally, both can establish rates and collect fees as needed to obtain necessary revenues.

In terms of financing, a district and an authority are different in three ways:

- A district can issue both revenue bonds and general obligation (G.O.) bonds, while an authority can issue only revenue bonds;

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 14-1

COMPARISON FACTORS FOR A DISTRICT AND AN AUTHORITY

INSTITUTIONAL OPTION	ESTABLISHMENT	ADMINISTRATION	FINANCING
County District	• Established to provide service or benefit to a specific geographic area • County Legislature adopts resolution that is subject to permissive referendum	• Administered by County Legislature • Accountable to both the County Executive and Legislature	• Tax exempt debt using G.O. or revenue bonds • Ability to set rates and charge assessments • Debt service schedule payments using G.O. must conform with the New York State 50% Rule
County Authority (Public Benefit Corporation)	• Created by County and State legislature • Can serve entire County or selected benefit areas therein	• Administered by an independent board selected by the County Executive and confirmed by the County Legislature	• Revenue bond financing only • Debt not considered County debt • Debt service schedule payments can increase with growth

Source: KPMG Peat Marwick

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- A district can serve as a "benefit district" to collect property taxes or special assessments, while an authority has no taxing or assessment capabilities; and

- A district is subject to New York State's "50 percent rule" for any public financing, while this rule does not apply to an authority.

The 50 percent rule states that the maximum principal payment in a bond repayment schedule can be no greater than 50 percent of the minimum principal payment. When combined with interest payments, this causes higher debt service payments in the early years of a repayment schedule, when a project's customer base may be smaller, than in the later years. Although districts are subject to the rule, there are two options for avoiding the impacts of the 50 percent rule under a district approach. First, private financing (for example, with tax-exempt industrial development bonds can be used. Second, it is possible to establish an authority only as a financing agent for publicly financed bonds, while a district is established for the management and operations responsibility and contracts directly with the authority for its financing.

14.3.3 Advantages and Disadvantages of a District Approach

A district approach toward providing sewerage services in Orange County can have the following advantages and disadvantages:

Advantages

- A district can be created quickly under the authority of the County Legislature;

- A district can give the County more control over facility capacities, operations, and costs; and

- A district has the ability to set rates, taxes, and assessments. Establishment of a benefit assessment district can allow the taxing ability of the district to serve as a secondary source of security for bond financing in addition to rates.

Disadvantages

- Publicly financed debt under a district must meet the New York State 50 percent rule;

- District debt financing can be subject to the County debt capacity limit if a sewer debt exclusion is not allowed by the State;

- A district approach falls under Wick's Law, which requires publicly owned facilities to be constructed under separate bids for general, electrical, plumbing, and HVAC (heating, ventilation and air conditioning) contractor categories. This can make a turnkey project more costly to accomplish under public ownership.

- A district is administered under the County budget process and may have to compete for funding with other pressing County needs (however, the district could be self-sustaining in nature).

14.3.4 <u>Advantages and Disadvantages of an Authority Approach</u>

An authority approach to provide sewerage services in Orange County can have the following advantages and disadvantages:

<u>Advantages</u>

- An authority has flexibility in structuring debt repayments and is not subject to New York State's 50 percent rule;

- An authority is not subject to Wick's Law;

- An authority can make financial decisions independent of the County;

- Both revenue and debt of an authority are independent from that of the County; and

- An authority can be established for the entire County or to provide service to specific areas of need within the County.

<u>Disadvantages</u>

- An authority must be created by State legislation which may be a lengthy process;

- An authority can charge only user fees or related charges; and

- An authority will maintain control over facility capacities, operations, and costs independent of the County legislature.

14.4 Private Sector Participation Options

14.4.1 Introduction

Whether the legal form of administering sewage treatment operations is a district or authority, the County has several options for involving the private sector. Among these options are various forms of public-private partnership arrangements. The nature of public-private partnerships can affect the financing options available for projects.

14.4.2 Forms of Public-Private Partnerships

A public-private partnership is a contractual relationship between a public body and a private company that commits both parties to providing a service that traditionally was provided only by the public body.

Five general forms of public-private partnerships are available:

- Contract services;
- Turnkey projects;
- Developer financing;
- Privatization or a full service contract; and
- Merchant facilities.

Each of the above types of partnerships represent different roles for the public and private sectors in the decision to provide the design, financing, construction, ownership, operation and maintenance of service facilities.

Characteristics of the primary forms of public-private partnerships are listed in Table 14-2 showing the roles of each partner. Each form is discussed in more detail in the following subsections.

14.4.2.1 Contract Services

Under this form, a public entity can contract with a private party to operate and/or maintain a publicly owned facility. Such an arrangement can overcome a public entity's limited ability to meet regulatory standards or address high operating and maintenance costs. A single private service contractor can also be used to efficiently provide services to several publicly owned facilities. Drawbacks of contracting for

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TABLE 14-2

CHARACTERISTICS OF PUBLIC-PRIVATE PARTNERSHIPS

	Contract Services	Turnkey Facility	Developer Financing	Privatization (Service Contract)	Merchant Facility
Decision to Provide Services	public	public	public	public	private
Design	public	private	either	private	private
Fianancing	public	public	private	private	private
Construction	public	private	either	private	private
Ownership	public	public	either	private	private
Operation and Maintenance	private	either	either	private	private

Source: U.S. Environmental Protection Agency, Public-Private Partnerships for Environmental Facilities, June, 1989.

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services include government's loss of day-to-day control over services and potential conflicts between private management and local government objectives.

14.4.2.2 Turnkey Facilities

Under this form, the private sector would design, construct, and (may) operate a facility that is owned by the public sector. Performance risks are assumed by the private partner, with guarantees of both minimum service levels and environmental standards typical. Turnkey construction, in contrast to a multiple contract procurement, is usually completed more quickly and at lower cost. A turnkey approach can be combined with a tax-exempt lease/purchase to provide reasonable financing costs without debt restrictions. There are questions about the present ability to use this type of financing mechanism. The State legislature is considering making these transactions easier to implement.

14.4.2.3 Developer Financing

Under this form, private developers finance the new construction, expansion or upgrade of a publicly owned facility in return for the right to develop property. For instance, a municipality can address the growth-related demand for added capacity by selling sewage capacity credits to developers. Some municipalities can require full capacity prepurchase, while others supplement capacity credits with local financing, which may or may not be sold later. Another related example is impact fees. Impact fees are a one-time charge usually levied at the issuance of building permits to cover either full or partial costs of the development's fair share of the public construction of sewage or water treatment facilities. The use of impact fees has been legally challenged in New York State, and ruled against in a number of cases.

14.4.2.4 Privatization or Full-Service Contract

Under this form, the public sector signs a full service contract with a private entity that builds, owns and operates the facility. The private partner typically assumes all financing, though sometimes the public sector contributes partial financing. The most common type of privatization is the franchise, which is a privately financed, regulated utility. Specific to the area of sewage treatment, a hybrid form of privatization has evolved: the private entity finances, owns, and operates the sewage treatment facility and the public entity retains ownership of the sewage collection systems. However, the Tax Reform Act of 1986 reduced tax incentives for privatization and, as a consequence, this form of public-private partnership has become less attractive to privatizers strictly from a tax perspective.

14.4.2.5 Merchant Facilities

Under this form, the private sector makes a business decision to use its own facilities to provide services to the public sector without a guaranteed contract from the municipalities. The public sector may participate marginally by providing land or benefiting by profit sharing in the form of reduced fees or receipt of royalties. Merchant facilities are often used in the solid waste areas of collection and disposal. This form of public-private partnership represents a high risk to the developer.

14.4.3 Potential Benefits of Private Sector Participation

With regard to the central County sewage treatment action in the Recommended Plan, potential benefits of public-private partnerships can include:

- Advanced technologies and specialized design/operational expertise not readily available by the public sector;
- Construction and operational guarantees provided by the private sector;
- Potential for combining economic development projects with an infrastructure project to obtain lower costs on the infrastructure work;
- Efficiencies from turnkey contracts in which design, construction, and operations are provided by a single firm, thus eliminating the need for multiple procurements;
- Efficiencies from bulk purchases, centralized administration, and the use of highly trained staff;
- Flexible financing options; and
- Delegation of procurement approvals and day-to-day operations to a private entity thereby allowing communities to focus on more urgent governmental responsibilities.

In two of the five public-private partnerships (contract services and turnkey facilities), the public sector finances and owns the facility. For developer-financed arrangements, either the private or public sector may provide the financing for and/or own the facility. With privatization and merchant facilities, the private entity owns the facility.

Issues affecting the consideration of a public-private partnership are summarized in Table 14-3.

14.5 Public Versus Private Ownership

Public ownership entails public financing and management control over facilities. Under private ownership, the public agency establishes a long-term service contract to ensure that its needs are met, to delineate terms for service payments, and to assist in securing private sector financing.

Public ownership of facilities, under either the district or authority approach, offers the following advantages and disadvantages:

Advantages

- A district or authority can have control over facility capacities, operations and costs; and

- A district can use tax-exempt financing and possibly below market financing from the State revolving loan fund.

Disadvantages

- A district is responsible for site acquisition and permitting as well as compliance and operational performance;

- District financing (not authority financing) is subject to the New York State 50 percent rule making higher debt service payments in the early years of the payment schedule than the later years;

- District debt financing can be subject to the County debt capacity limit, if a sewer debt exclusion is denied by the State; and

- Ownership under a district approach falls under Wick's Law, which requires separate bidding processes in New York State and is considered to add to construction costs (by some estimates as much as 25%).

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TABLE 14-3

ISSUES AFFECTING THE CONSIDERATION OF A PUBLIC-PRIVATE PARTNERSHIP

ISSUES	HOW IT MANIFESTS ITSELF	SOLUTIONS	HOW IT SOLVES THE PROBLEM
Growth	• Inadequate Near Term Revenue Stream • Inadequate Tax Base to Support Debt	• Service Contract or connection • Impact Fees • Developer Contributions	• Tailors Payments to Growth Patterns • Reduces Cost Burden on Existing Customers • Lowers Costs to be Financed
Debt Capacity Limits	• Can not Borrow Enough to Support Bond Issue Due to too Much Debt Outstanding or too Small a Tax Base	• Tax-Exempt Lease Purchase • Privatization	• Converts Capital Cost to Operating Cost and Lowers Borrowing Cost • Uses Private Financing
Poor Credit	• Need to Offer High Interest Rates to Sell Bonds	• Credit Enhancement via Letters of Credit, Bond Insurance, Other Support Structures from Developers or Private Parties	• Enhances Credit of the Issue
Lack of Time	• Facility Needed Quickly (e.g., Moratoriums, Enforcement, etc.)	• Turnkey Construction • Privatization	• Ability to Bring Facilities On-line More Quickly
Price too High	• Conventional Approaches Appear too Costly	• Turnkey	• Efficiencies Gained Through Design/Build/Operate Contract
High Unit Costs	• Revenue Base too Small	• Regionalization • Service Contract	• Economies of Scale

Source: KPMG Peat Marwick

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Private ownership of the facility offers the following advantages and disadvantages:

Advantages

- Private financing is not subject to either the New York State 50 percent rule or Wick's Law;
- Projects can be developed efficiently because of private procurement processes and the handling of siting and permitting issues; and
- With private financing, performance guarantees are provided for construction and operation.

Disadvantages

- Private contractor maintains control over both facility capacity and operations; and
- The public sector will be responsible for the facilities in case of default or nonperformance by the private entity.

14.6 Financial Options

14.6.1 Introduction

Sewage collection and treatment projects can be financed by one or more financial mechanisms. Financing options available to the County depend on whether the institutional form is a district or an authority, and whether the facility is publicly or privately owned. This section discusses the institutional limitations on financing that accompany either a district or an authority, and presents the specific sources of financing available to the County under various institutional/public-private partnerships.

As discussed below, the institutional form can affect the debt service payment terms, while the ownership of the facility determines which sources of financing are available.

14.6.2 County Debt Level Considerations

The governmental and financial ability of the County to obtain additional debt significantly affects financing approaches. Two key issues are:

- The debt limit imposed by New York State law; and

- The ability and willingness of taxpayers and customers to pay for increases related to improvements.

The current debt limit imposed on the County's general obligation debt is about $350 million. The County's existing general obligation debt level is less than $10 million, however, significant capital spending is planned over the next five years. For example, the following projects are planned:

- New County jail - $60 million;

- County landfill improvements - $45 million over five years and more than $100 million for long-range improvements; and

- New County administrative buildings - $30 million.

The County Finance Commissioner has estimated that about $150 million of debt may be needed for the above projects. Although this amount is below the debt limit imposed by the value of assessed property, it represents a significant amount of debt for the County, which traditionally has had low debt.

The Orange County Water Authority (OCWA) plans for a new reservoir and distribution system represent an additional $200 million bond issue. Since the OCWA is not a unit of the County government, this debt would not affect the County's debt limit. Nevertheless, the project has significant financial implications for the County. The County is purchasing all water from the system and then reselling water under purchase and sale agreements with municipalities. As such, the County is responsible for paying for any shortfall in the debt service obligations of the OCWA until such time that municipal water sales are sufficient to cover the obligations. During the first ten years of the OCWA project, it is estimated that over $50 million of subsidy may be necessary from the County's general revenue. The County has established a sinking fund, contributing about $20 million to help offset these start-up costs. Additional general revenues of $25 to $35 million may be necessary over the start-up period until sufficient water is sold to municipal customers.

The additional $150 million of debt for County projects could produce a 17 percent increase in the property tax levy to pay the annual debt service. This estimate is based on the assumption that two-thirds of the debt is tax-based and is financed over 30 years at 7.5 percent interest. The current tax levy ($51 million) produces an average County tax rate of $8.783 per $1,000 of assessed value. This means that, after adjusting for equalization, the annual County property tax on a home with an assessed value of $100,000 is $790. The 17 percent increase in taxes would mean an additional $131 per household per year based on a home with a $100,000 assessed value.

Table 14-4 shows tax and debt data for Orange County compared with some other counties in New York. On the basis of general revenue per capita, Orange County is less than the average of the ten counties shown.

14.6.3 Institutional Limitations

A County district may obtain debt financing through general obligation (G.O.) bonds, revenue bonds, or a New York State revolving fund loan. New York State municipal law also stipulates that for public financing by a County district (i.e., G.O. bonds or revenue bonds), no principal payment to bondholders may be less than 50 percent of the largest scheduled payment. This requirement results in a debt service schedule that is weighted towards the earlier years of repayment and can make it expensive to start-up facilities expecting significant future growth.

A County authority may obtain debt financing through revenue bonds or a New York State revolving fund loan. An authority may only issue revenue bonds secured by the revenue of the system. The debt service under such bonds can either be level or weighted toward later years to accommodate growth in the customer base. Debt issued by a County authority is not considered a County government debt and, thus, is not subject to the County's debt capacity limits.

14.6.4 Public Ownership and Financing

Most of the sources of financing available when a sewage treatment facility is publicly owned are the same for both a district and authority. A district, however, may issue G.O. bonds, whereas an authority may not. The following sources of financing are available to publicly owned facilities under either a district or authority approach:

- State Revolving Loan Financing: New York State has recently initiated a State Revolving Fund (SRF) Program to provide financing for wastewater projects under

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TABLE 14-4

FINANCIAL DATA FOR SELECTED NEW YORK COUNTIES

County	General Tax[1] Revenue ($ millions)	Population[1] (thousands)	General Tax[1] Revenue Per Capita ($)	G.O. Debt[2] Per Capita ($)	Non-[2] Guaranteed Debt Per Capita ($)
Orange	194	281	690	105	150
Rockland	254	265	957	289	253
Westchester	861	863	998	312	344
Putnam	37	81	460	N/A	N/A
Dutchess	145	256	567	113	145
Sullivan	63	68	924	N/A	N/A
Cortland	34	47	728	N/A	N/A
Ulster	103	164	629	76	262
Columbia	42	60	697	N/A	N/A
Greene	40	42	940	N/A	N/A

(1) Data from The 1990 Municipal Year Book is from 1986 and 1987; ICMA, Washington, D.C.
(2) Data from 1985-1986 County Government Finances; U.S. Bureau of the Census

Source: KPMG Peat Marwick

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Title VI of the Clean Water Act. The State is currently offering loans at 67 percent of the local government's market interest rate. The maximum schedule for repaying the bonds is 20 years and the State charges 3 percent of the bond amount for administrative fees. The project must be on the State's project priority list (PPL) and sufficiently ranked to be funded. The State is funding about $220 million of projects from its 1990 PPL (Category B - communities with populations from 3,500 to 2 million). Conversations with NYSDEC indicate that loan funding could likely be available for Orange County if the County was ready to proceed with the design and construction of the central County sewage treatment action in the Recommended Plan.

- General Obligation (G.O.) Bond Financing: Most commonly used by County/municipal projects, G.O. financing is secured by the general taxing ability of the County (or district), but can be repaid fully by revenues generated from the project. These bonds are generally less costly than revenue bonds and may require voter referendum to issue. An advantage of G.O. financing is that the interest rate charged is typically lower than that of a revenue bond. Also, a debt service reserve fund, often 5 to 10 percent of the bond issue, is not required.

- Revenue Bond Financing: Revenue bonds are secured by revenues generated from the services provided by the facilities. Interest rates are generally about 0.25 to 0.50 percent higher than those for G.O. bonds and a reserve fund is required for supplemental security. A revenue bond issue could also receive supplemental security from the taxing authority of a County or municipality to obtain more favorable financing terms.

- Pay-as-you-go: Sewage collection and treatment projects can be funded by current tax or system revenues. This is a form of public equity financing that may be suitable for a portion of a project's costs (e.g., planning and design) or if construction costs can be spread out over time and are nominal in size. Impacts on tax levies and user fees are the key issues related to the pay-as-you-go financing approach.

- Tax-exempt Leases: If properly structured, tax-exempt leases are not considered debt. Therefore, restrictions on the issuance of debt (e.g., bond referenda, debt ceilings, etc.) do not apply. Financing must meet the criteria for a "governmental purpose" bond to be tax-exempt, thus affording a lower interest rate than commercial financing. No revenue or taxing authority is pledged, but the financing is secured by a government's annual promise to pay within the lease. Figure 14-1 shows the financing structure of a lease purchase financing compared to a traditional general obligation bond financing. The use of a tax-exempt lease may be difficult to implement under current New York law; however, legislative proposals are being considered to encourage these mechanisms.

- Impact or connection fees: Impact fees are often called hookup and/or connection fees and may range from $100 to several thousand dollars for a single family residence. Fees can be designed to recover the costs of connection to a sewer line, the collection system necessary to connect to a main line, and/or the growth-related costs of a treatment facility. In the absence of specific legislative authority for impact fees in New York State, courts in the State have ruled against the use of impact fees for uses such as roads and parks. A key in defending connection fees for sewer facilities is the ability to tie the fees to the incremental costs related to the new collection system or increase in treatment capacity. Several municipalities in Orange County (e.g., the Town of Wallkill and the Village of Washingtonville) currently charge from $1,000 to $3,000 for initial connection fees.

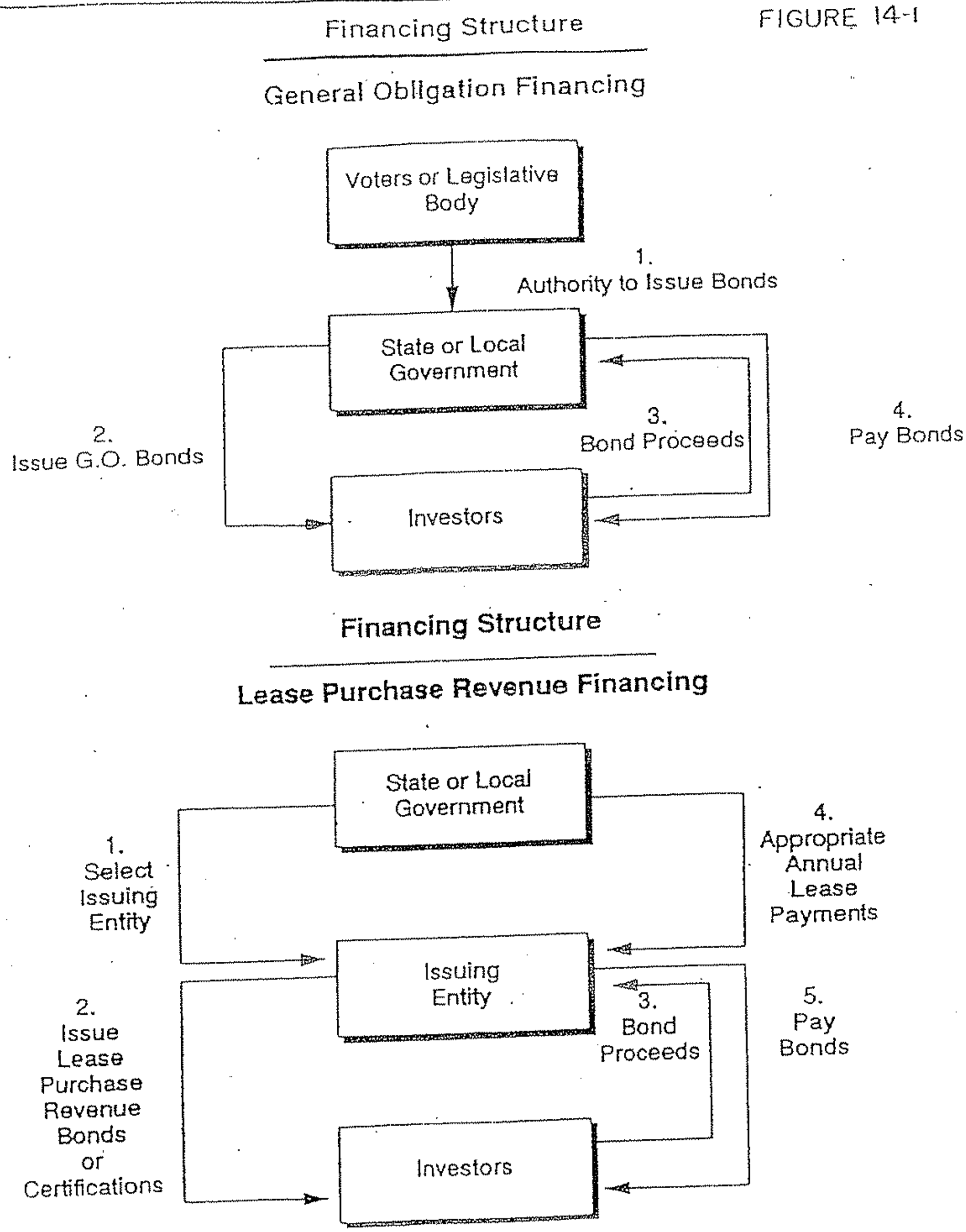
- Private Contribution of Capital Facilities: Developers build a facility and donate it to the municipality, generally after receiving some of the tax-benefits. This is more common with collection systems or package plants associated with a development.

In summary, a district differs from an authority in the use of publicly issued debt. Debt financing for a district can involve either G.O. debt (secured by the taxing authority of the issuer), revenue debt (secured by the revenue stream of the issuing agency) or a combination of both (generally referred to as double-barreled bonds). An authority can use only revenue bonds secured by fees and charges from its customers but could obtain the County's G.O. as a secondary pledge for payment, from municipalities or districts through contractual arrangements.

14.6.5 Private Ownership and Financing

The following sources of financing are available to privately owned facilities under either a district or authority approach:

FIGURE 14-1



Source: KPMG Peat Marwick

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LEASE PURCHASE FINANCING VERSUS GENERAL OBLIGATION FINANCING

- Equity Contributions: Equity payments from private parties typically equal 15 to 25 percent of a project's cost and demonstrate their commitment on behalf of the project. Typically, private investors in infrastructure look for 10 to 20 percent return on equity before taxes. This equity contribution can either be contributed upfront to offset the debt financing requirements of the facility or spread over a period, such as the first 5 to 8 years, to lower the debt repayments during those years. This latter option may be attractive to lower upfront customer impacts.

- Tax-exempt Bonds: Industrial development bonds (IDBs) are supported by revenues generated by privately owned projects. These bonds can be obtained for qualified projects through either the New York State Environmental Facilities Corporation or a local development agency. State caps on the level of these bond issues limit the use of tax-exempt IDBs and have motivated private parties to use taxable bonds to finance sewage projects. New York State was able to meet its requests for tax-exempt private activity bonds in 1989 and had an $897 million cap for 1990. Thus, these types of bonds can be a feasible alternative for a privately financed project.

- Commercial Taxable Financing: Many larger companies obtain external financing from corporate bonds with interest rates that can range from 10 to 14 percent or more in today's financial market. Taxable financing can be combined with a tax-exempt private activity bond to pay for certain costs not eligible for tax-exempt financing. Bank loans can also be used and can receive credit support from State loan guarantee programs or the Small Business Administration (SBA). The net cost to the owner using taxable financing is lowered by the tax rate (e.g., 34 percent) since interest is tax deductible against income. The tax savings can be passed through to the public entity in terms of lower service charges.

In summary, although the private entity can supply the equity and debt financing, the County would first need to sign a service agreement with the private entity guaranteeing a service charge over the life of the financing. This agreement would then be used to secure the private financing.

14.6.6 Private Sector Participation Issues

Many of the financing options involving private sector participation are influenced by federal and State laws. New York State municipal law (Section 120-W) does allow local governments to establish long-term contracts with private parties for the provision of services such as sewage treatment. Major legal areas that need to be considered if further steps are taken towards the implementation of a public-private partnership include:

- Grant funding at the OCSD #1 STP facility: If this STP is closed and replaced by a private facility, NYSDEC must approve the modification since grants have been used.

- New York State procurement law: Wick's Law requires publicly owned facilities to be constructed under separate bids for general, electrical, plumbing, and HVAC (heating, ventilation and air conditioning) contractor categories. This can make a turnkey project more costly to accomplish under public ownership.

- Tax-exempt financing: With the use of IDBs, safeguards must be taken to maintain their tax-exempt status. For example, no more than 10 percent of the bond proceeds can be used to benefit a private user of the facilities. Also, a uniform method of cost recovery must be applied to all users of the facility. Thus, in structuring the private arrangement with tax-exempt financing, care is required to ensure that any concessions made to the developer do not violate the tax-exempt financing issues.

14.7 Summary

Creation of a new County sewer district for the central County sewage treatment action in the Recommended Plan can be preferable since a single new facility is planned and private financing may be used. This approach can be more burdensome if a number of small facilities (and separate districts) are required. Private financing can avoid many of the debt issues related to financing under a County district. A district can also use the County's taxing ability as a secondary source of revenue,in addition to rates, to secure bonds. This can allow more favorable financing terms, such as lower interest rates and no debt service reserve fund, than revenue bond financing by an authority.

On the other hand, a County sewer authority can be advantageous in providing wholesale sewage treatment services to different service areas within the County. The responsibilities of the authority can be initiated with a single project and can be expanded to a number of other areas of the County, as needed. An authority, having an independent management and financing structure, can operate more like a public utility.

In the Program Finalization phase of the scope of work for this Study, the County, via the County Sewer Committee, examined the issues concerning district versus authority for the central County sewage treatment action in the Recommended Plan. After several months of review and discussion, the issue was put to a vote by the Sewer Committee with the result being that the district approach is deemed preferable for Orange County. As such, this Study proposes the district approach as the institutional form to be used by the central County sewage treatment action in the Recommended Plan.

The Sewer Committee also reviewed and discussed private sector participation considerations regarding the central County sewage treatment action in the Recommended Plan. While the Sewer Committee expressed interest in better understanding how different levels of private sector participation can be of benefit to the County, the general consensus was that they needed more information to form a policy position. As such, the Sewer Committee voted in favor of Orange County further studying the impacts of various levels of private sector participation for the central County sewage treatment action in the Recommended Plan.

CHAPTER 15

15.0 FINANCIAL IMPACT ANALYSIS OF THE CENTRAL COUNTY SEWAGE TREATMENT ACTION

15.1 Introduction

The purpose of this Chapter is to present the results of the financial impact analysis performed on the central County sewage treatment action outlined in the Recommended Plan. This analysis examines different financing scenarios and calculates the annual rate per household or equivalent dwelling unit (EDU).

The Recommended Plan's central County sewage treatment action is for a new 12.0 mgd STP to be built in the vicinity of the Town of New Windsor with a SEC level of treatment and effluent discharge to the Hudson River. The central County sewage treatment action also includes the associated sewage collection pipelines and pumping stations.

This Chapter also presents the financial impact analyses on two specific variations of the central County sewage treatment action involving the New Windsor service area as discussed in the Recommended Plan (refer to Section 13.6). These analyses also examine different financing scenarios and calculate the annual rate per household or EDU.

Finally, a comparison is made between the central County sewage treatment action and the two specific variations thereof to determine if modifying the project is appropriate.

15.2 The Central County Sewage Treatment Action

15.2.1 Description

The central County sewage treatment action described in the Recommended Plan involves the construction of a new conventional STP at 12.0 mgd SEC in the vicinity of the Town of New Windsor, with a treated effluent discharge to the Hudson River. This action also involves the construction of five pumping stations and approximately 39 miles of main collector pipelines. Section 13.6 of this Study provided the conceptual engineering and design details. Figure 13-1 illustrated the central County sewage treatment action.

15.2.2 Service and Cost Assumptions

Table 15-1 summarizes the service and cost assumptions for the central County sewage treatment action.

As shown, the central County sewage treatment action is to serve municipalities currently in both the OCSD #1 and MBSR (i.e., the Towns of Blooming Grove, Chester, Monroe and Woodbury and the Villages of Chester, Harriman, Kiryas Joel and Monroe), plus the Town of Goshen and the Villages of Greenwood Lake and Washingtonville.

It is projected that the facility will begin operations in 1995 and serve approximately 22,600 EDUs at that time. By the end of this Study period, the year 2020, the facility is projected to serve approximately 48,000 EDUs.

The capital construction cost for this central project is estimated to be $86.4 million in 1991 dollars, as described in Chapter 13. Upon escalation to the midpoint of construction, assumed to be the year 1994, the estimated capital construction cost is $103 million.

Land purchases for a facility site, pumping station sites and the abandoned railroad ROW sites are needed. In addition, there is the required environmental impact statement, site-specific studies and permitting to be done. Therefore, a lump sum cost of $5 million has been assumed to address both land purchases and environmental work.

The central County sewage treatment action is also assumed to cover the outstanding debts of OCSD #1 and MBSR member communities for the OCSD #1 STP (approximately $3.52 million) and also Washingtonville residents for the Washingtonville (V) STP (approximately $300,000).

The estimated annual O&M costs in 1991 dollars for this central project are estimated to be $2.19 million in the year 1995 (start-up) and $4.75 million in the year 2020. In addition, the estimated annual administrative cost for the new district administering this central sewage treatment action is $250,000 beginning in the year 1995 (start-up).

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TABLE 15-1

CENTRAL COUNTY SEWAGE TREATMENT ACTION:

SERVICE AND COST ASSUMPTIONS

PROJECT DESCRIPTION	New 12.0 mgd SEC STP located in the vicinity of the Town of New Windsor with effluent discharge to the Hudson River, 5 pumping stations and 39 miles of collection pipe (see Chapter 13 for details)		
PROPOSED SERVICE AREA	**Service Area**	**1995 EDUs(1)**	**2020 EDUs(1)**
	OCSD#1	8,440	18,280
	MBSR	10,640	20,760
	Washingtonville	1,680	3,600
	Greenwood Lake	200	1,560
	Goshen (T)	1,640	3,800
	Total	22,600	48,000
ESTIMATED CAPITAL CONSTRUCTION COST (Midpoint of Construction)	($ 1994)	$103,000,000	
LAND PURCHASES AND ENVIRONMENTAL STUDIES		$5,000,000	
EXISTING TREATMENT PLANT DEBT TO RETIRE	OCSD#1	1,900,000	
	MBSR(2)	1,620,000	
	Washingtonville	300,000	
	Total	$3,820,00	
ESTIMATED ANNUAL O&M COSTS	($ 1995)	$ 2,740,000	
	($ 2020)	$20,120,000	
ESTIMATED ANNUAL ADMINISTRATIVE COSTS	($ 1995)	$ 250,000	

Notes:

(1) For rate-setting purposes, equivalent dwelling units (EDUs) are based on flow estimates divided by 250 gallons per day per EDU.

(2) MBSR debt assumes the reimbursement of a $2.1 million outstanding grant with an acceptable grant closeout by USEPA and NYSDEC.

Source: KPMG Peat Marwick

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15.2.3 Financing Scenarios

The central County sewage treatment action is examined under three separate financing scenarios as follows:

- State Revolving Fund (SRF) loan financing from the New York State Environmental Facilities Corporation (NYSEFC);
- General obligation bond financing; and
- Revenue bond financing.

The first two financing scenarios assume the formation of a County district, subject to the New York State 50 percent rule as described in Chapter 14, to administer the central County sewage treatment action. The third financing scenario also assumes the formation of a County district to administer the central County sewage treatment action, however private sector participation via private tax-exempt financing is used.

Table 15-2 presents a summary of assumptions to be used in the three financing scenarios for the central County sewage treatment action. The key assumptions of each financing scenario are as follows:

- A New York State Revolving Fund (SRF) loan financing assumes a subsidized loan from the NYSEFC having an interest rate of 5 percent and a term of 20 years (Note: a 3.05 percent administrative fee is charged by the NYSEFC);
- A general obligation (G.O.) bond financing assumes a County bond issue having a 7 percent interest rate and a 30 year term with no debt service reserve fund required; and
- A revenue bond financing assumes issuance by either the County or the NYSEFC (for a privatizer) having a long-term interest rate of 7.25 percent and a 30 year term with a debt service reserve fund of one year's worth of debt service required.

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 15-2

CENTRAL COUNTY SEWAGE TREATMENT ACTION:

ASSUMPTIONS FOR THREE FINANCING SCENARIOS

FINANCING ASSUMPTIONS	County District w/Public Financing State Revolving Fund (SRF) Loan	General Obligation Bond	County Authority or Private Financing Revenue Bond
Interest rate	3.7% - 5.00%	5.1% - 7.00%	5.50% - 7.25%
Term (years)	20(1)	30	30
Issuance costs	3.05%	1.50%	2.00%
Bond insurance costs	N/A	N/A	0.75%
Debt service reserve fund required?	No	No	Yes
Bonds issuance	01-Jan-92	01-Jan-92	01-Jan-91
First debt service payment	01-Jan-96	01-Jan-96	01-Jan-96
Years for capitalized interest	3.5	3.5	3.5
Construction proceeds	$108,000,000	$108,000,000	$108,000,000
Defeasance of existing debt	$3,820,000	$3,820,000	$3,820,000
Interest during construction	$8,235,000	$11,529,000	$11,940,750
Debt service reserve fund costs	$0	$0	$11,368,858
Issuance & insurance costs	$3,661,678	$1,850,235	$2,475,215
TOTAL BOND ISSUE	$123,716,678	$125,199,235	$137,604,823
ANNUAL PAYMENT	$9,048,278 to $7,107,034	$9,469,449 to $4,889,410	$9,963,692 to $13,051,196

Source: KPMG Peat Marwick

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Under each of these scenarios, financing is assumed to begin in January 1992 with repayments beginning in July 1995. The interest accrued during construction is assumed to be financed and is added to the construction cost to estimate the bond issue amount.

The estimated bond issue amount for the central County sewage treatment action ranges from about \$123.7 to \$125.2 million for SRF loan and G.O. bond financing scenarios to \$137.6 million for the revenue bond financing scenario. The debt service reserve fund contributes to the revenue bond issue amount being significantly higher.

The annual debt service payments shown in Table 15-2 also differ substantially. Under the SRF loan and G.O. bond financing scenarios, debt service schedules using the New York State 50 percent rule are used thereby causing the early years of the debt repayment schedule to require larger payments than the later years. Under the revenue bond financing scenario, debt service can be increased over the 30-year term to reduce the annual payments in the early years of the project. This causes, the impact on customers to be less during the early years of the debt repayment schedule when the user base is smaller.

A graph of annual debt service payments for the central County sewage treatment action under each of the three financing scenarios is presented in Figure 15-1.

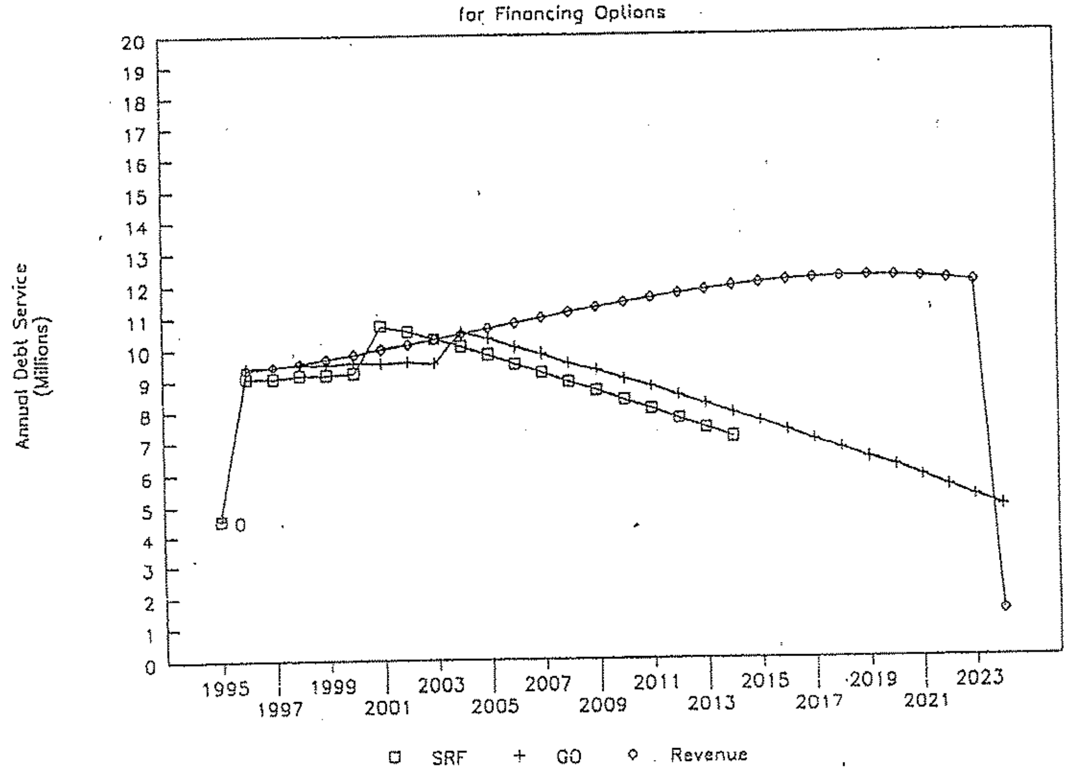
As shown, a comparison of the annual financing costs for SRF, G.O., and revenue bond options shows that SRF and G.O. bonds offer slightly less debt service costs than revenue bonds in the first 5 to 10 years and then significantly less costs in the remaining years. SRF financing with repayments over a 20 year maximum term (versus 30 years for other options) also provides the lowest total financing costs. Thus, if the assumed term (e.g. 5% interest) can be obtained (as indicated by the NYSEFC), SRF financing offers the most cost-effective financing option for the central County sewerage project.

The revenue bond debt service payments include interest earnings on the debt service reserve fund; this revenue fund is then used in the final year to offset the annual payment (see Figure 15-1).

As mentioned previously, SRF financing is only available for publicly-owned treatment facilities and can not be used for a privately owned and financed facility. While revenue bonds

FIGURE 15-1

Annual Debt Service Payments
for Financing Options



Source: KPMG Peat Marwick

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COMPREHENSIVE SEWERAGE STUDY

ANNUAL DEBT SERVICE PAYMENTS FOR THE CENTRAL COUNTY SEWAGE TREATMENT ACTION

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have higher financing costs assuming the same construction costs, privatization with tax-exempt revenue bond financing offers potential savings of construction costs that must be weighed against the costs for a publicly financed and constructed facility.

The table below shows that, over the entire financing life, revenue bond financing is approximately 32% more costly than SRF financing on a present value basis. A privately financed/owned facility will also require a return on equity investment that is not included in these numbers (refer to discussion at the end of this section). Thus, on a cost basis, a private facility financed with revenue bonds may need to be roughly 30% less in construction costs to offset the lower SRF financing costs available to a publicly owned and financed facility.

Comparison of Financing Option Costs

	Total Debt Service	Present Value Of Debt Service	Difference
SRF Financing	$176,676,607	$91,842,743	-
General Obligation Bond Financing	$245,476,061	$105,144,750	14.5%
Revenue Bond Financing	$317,693,389	$121,557,189	32.4%

15.2.4 Financial Impact Analysis

A financial impact analysis of the estimated annual cost per EDU upon start-up of the central County sewage treatment action was done for the three financing scenarios. Tables 15-3, 15-4 and 15-5 present the financial impact analyses for the central County sewage treatment action under the financing scenarios of SRF loan, G.O. bond and revenue bond, respectively.

The financial impact analysis determines the estimated annual user fee revenue required for coverage of both the operations and maintenance costs and debt service costs related to the project. Note that a connection fee is also determined based on the construction cost of the project per unit of capacity provided. The legal basis in New York State for the use of connection fees in this manner should be further investigated by the County, as discussed in Chapter 14.

Two key assumptions affecting the results of Tables 15-3, 15-4 and 15-5 include that:

- One year's worth of connection fees is collected in advance of project start-up in 1995; and

- Fund balances are dedicated to the project and can be used to make debt service and other required payments, as needed.

The resulting estimated user fees (i.e., annual costs per EDU) presented in Tables 15-3, 15-4 and 15-5 are calculated to provide adequate cash flow over the first five years of the analysis timeframe.

15.2.5 Results

Table 15-6 presents a comparison of the financial impact analysis results for the three financing scenarios as applied to the central County sewage treatment action.

15.3 Variations of the Central County Sewage Treatment Action

15.3.1 Descriptions

15.3.1.1 Variation 1

Variation 1 of the central County sewage treatment action described in the Recommended Plan involves the construction of a new conventional STP at 19.0 mgd SEC in the vicinity of the Town of New Windsor, with a treated effluent discharge to the Hudson River. This action also involves the construction of six pumping stations and approximately 40 miles of main collector pipelines. Figure 13-3 illustrated Variation 1 of the central County sewage treatment action.

15.3.1.2 Variation 2

Variation 2 of the central County sewage treatment action described in the Recommended Plan involves the construction of a new conventional STP at 24.0 mgd SEC in the vicinity of the Town of New Windsor, with a treated effluent discharge to the Hudson River. This action also involves the construction of seven pumping

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 15-3

CENTRAL COUNTY SEWAGE TREATMENT ACTION:

FINANCIAL IMPACT ANALYSIS UNDER SRF LOAN FINANCING

	1994	1995	1996	1997	1998	1999
REVENUE						
User Fees		$7,797,000	$8,437,163	$9,129,086	$9,879,484	$10,690,626
Connection Fees	1,555,250	1,555,250	1,835,047	2,023,535	2,231,383	2,460,580
Transfer from Fund Balance	0	1,605,250	3,499,544	1,676,702	514,295	11,481
Interest on Fund Balance	50,000	56,184	122,484	58,685	18,000	402
Subtotal	1,605,250	11,013,683	13,894,239	12,888,807	12,643,162	13,163,089
EXPENDITURES						
Administration & Operations	0	2,990,000	3,139,500	3,296,475	3,461,299	3,634,364
Debt Service	0	4,524,139	9,078,037	9,078,037	9,170,382	9,175,028
Subtotal	0	7,514,139	12,217,537	12,374,512	12,631,681	12,809,392
NET REVENUES	1,605,250	3,499,544	1,676,702	514,295	11,481	353,697
Debt Service Coverage from All Revenue		1.77	1.18	1.06	1.00	1.04
Beginning Fund Balance	0	0	0	0	0	0
Net Funds Available	$1,605,250	$3,499,544	$1,676,702	$514,295	$11,481	$353,697
Fund Balance Reserved	$0	$0	$0	$0	$0	$0
Projected Flow (mgd)	NA	5.65	5.82	6.00	6.18	6.37
Estimated EDUs	21,909	22,600	23,291	24,003	24,737	25,493
New EDU's annually	691	691	712	734	756	779
Estimated Connection Fee/EDU	$2,251	$2,408	$2,577	$2,757	$2,950	$3,157
Estimated User Fee ($/EDU/YR)		$345	$362	$380	$399	$419

Note: Operating costs are escalated at 5%.
Connection fees are escalated @ 7% per year to account for financing costs; user fees are escalated @ 5% per year.
EDUs are based on an average of 250 gallons per day per EDU for rate-setting purposes.

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ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 15-4

CENTRAL COUNTY SEWAGE TREATMENT ACTION:

FINANCIAL IMPACT ANALYSIS UNDER GENERAL OBLIGATION BOND FINANCING

	1994	1995	1996	1997	1998	1999
REVENUE						
User Fees		$8,136,000	$8,803,996	$9,526,837	$10,309,026	$11,155,436
Connection Fees	1,555,250	1,555,250	1,835,047	2,023,535	2,231,383	2,460,580
Transfer from Fund Balance	0	1,605,250	3,625,959	1,825,820	713,919	285,633
Interest on Fund Balance	50,000	56,184	126,909	63,904	24,987	9,997
Subtotal	1,605,250	11,352,683	14,391,911	13,440,096	13,279,315	13,911,646
EXPENDITURES						
Administration & Operations	0	2,990,000	3,139,500	3,296,475	3,461,299	3,634,364
Debt Service	0	4,736,725	9,426,591	9,429,702	9,532,384	9,515,150
Subtotal	0	7,726,725	12,566,091	12,726,177	12,993,683	13,149,513
NET REVENUES	1,605,250	3,625,959	1,825,820	713,919	285,633	762,132
Debt Service Coverage from All Revenue		1.77	1.19	1.08	1.03	1.08
Beginning Fund Balance	0	0	0	0	0	0
Net Funds Available	$1,605,250	$3,625,959	$1,825,820	$713,919	$285,633	$762,132
Fund Balance Reserved	$0	$0	$0	$0	$0	$0
Projected Flow (mgd)	NA	5.65	5.82	6.00	6.18	6.37
Estimated EDUs	21,909	22,600	23,291	24,003	24,737	25,493
New EDU's annually	691	691	712	734	756	779
Estimated Connection Fee/EDU	$2,251	$2,408	$2,577	$2,757	$2,950	$3,157
Estimated User Fee ($/EDU/YR)		$360	$378	$397	$417	$438

Note: Operating costs are escalated at 5%.
Connection fees are escalated @ 7% per year to account for financing costs; user fees are escalated @ 5% per year.
EDUs are based on an average of 250 gallons per day per EDU for rate-setting purposes.

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ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 15-5

CENTRAL COUNTY SEWAGE TREATMENT ACTION:

FINANCIAL IMPACT ANALYSIS UNDER REVENUE BOND FINANCING

	1994	1995	1996	1997	1998	1999
REVENUE						
User Fees		$8,136,000	$8,803,996	$9,526,837	$10,309,026	$11,155,436
Connection Fees	1,555,250	1,555,250	1,835,047	2,023,535	2,231,383	2,460,580
Transfer from Fund Balance	0	1,605,250	3,702,951	1,999,378	877,446	423,633
Interest on Fund Balance	50,000	56,184	129,603	69,978	30,711	14,827
Subtotal	1,605,250	11,352,683	14,471,598	13,619,728	13,448,566	14,054,476
EXPENDITURES						
Administration & Operations	0	2,990,000	3,139,500	3,296,475	3,461,299	3,634,364
Debt Service	0	4,659,732	9,332,720	9,445,807	9,563,633	9,698,781
Subtotal	0	7,649,732	12,472,220	12,742,282	13,024,932	13,333,144
NET REVENUES	1,605,250	3,702,951	1,999,378	877,446	423,633	721,332
Debt Service Coverage from All Revenue		1.79	1.21	1.09	1.04	1.07
Beginning Fund Balance	0	0	0	0	0	0
Net Funds Available	$1,605,250	$3,702,951	$1,999,378	$877,446	$423,633	$721,332
Fund Balance Reserved	$0	$0	$0	$0	$0	$0
Projected Flow (mgd)	NA	5.65	5.82	6.00	6.18	6.37
Estimated EDUs	21,909	22,600	23,291	24,003	24,737	25,493
New EDU's annually	691	691	712	734	756	779
Estimated Connection Fee/EDU	$2,251	$2,408	$2,577	$2,757	$2,950	$3,157
Estimated User Fee ($/EDU/YR)		$360	$378	$397	$417	$438

Note: Operating costs are escalated at 5%.
Connection fees are escalated @ 7% per year to account for financing costs; user fees are escalated @ 5% per year.
EDUs are based on an average of 250 gallons per day per EDU for rate-setting purposes.

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ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 15-6

COMPARISON OF FINANCIAL IMPACT ANALYSIS RESULTS

FOR THE CENTRAL COUNTY SEWAGE TREATMENT ACTION

FINANCING SCENARIOS	ANNUAL COST PER EDU AT START-UP		CONNECTION FEE	
	($ 1995)	($ 1991)	($ 1995)	($ 1991)
• SRF Loan	$345	$284	$2,251	$1,852
• General Obligation Bond	$360	$296	$2,251	$1,852
• Revenue Bond	$360	$296	$2,251	$1,852

Notes:

(1) Costs do not include local municipal sewage collection costs
(2) Costs in $1991 are based on discounting 5 percent per year.

Source: KPMG Peat Marwick

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stations and approximately 42 miles of main collector pipelines. Figure 13-3 also illustrated Variation 2 of the central County sewage treatment action.

15.3.2 Service and Cost Assumptions

15.3.2.1 Variation 1

Table 15-7 summarizes the service and cost assumptions for Variation 1 the central County sewage treatment action.

As shown, Variation 1 of the central County sewage treatment action is to serve municipalities currently in both the OCSD #1 and MBSR (i.e., the Towns of Blooming Grove, Chester, Monroe and Woodbury and the Villages of Chester, Harriman, Kiryas Joel and Monroe), plus the Town of Goshen and the Villages of Greenwood Lake and Washingtonville, and the western portion of the Town of New Windsor service area (including Stewart Airport). The existing New Windsor STP is to remain at 5.0 mgd treatment capacity.

It is projected that the facility will begin operations in 1995 and serve approximately 30,000 EDUs at that time. By the end of this Study period, the year 2020, the facility is projected to serve approximately 76,000 EDUs.

The capital construction cost for Variation 1 of the central project is estimated to be $108.1 million in 1991 dollars, as described in Chapter 13. Upon escalation to the midpoint of construction, assumed to be the year 1994, the estimated capital construction cost is $129 million.

Land purchases for a facility site, pumping station sites and the abandoned railroad ROW sites are needed. In addition, there is the required environmental impact statement, site-specific studies and permitting to be done. Therefore, a lump sum cost of $5 million has been assumed to address both land purchases and environmental work.

Variation 1 of the central County sewage treatment action is also assumed to cover the outstanding debts of OCSD #1 and MBSR member communities for the OCSD #1 STP

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 15-7

VARIATION NO. 1 OF THE CENTRAL COUNTY SEWAGE TREATMENT ACTION:

SERVICE AND COST ASSUMPTIONS

PROJECT DESCRIPTION	New 19.0 mgd SEC STP located in the vicinity of the Town of New Windsor with effluent discharge to the Hudson River, 6 pumping stations and 40 miles of collection pipe (see Chapter 13 for details)		
PROPOSED SERVICE AREA	Service Area	1995 EDUs(1)	2020 EDUs(1)
	OCSD#1	8,440	18,280
	MBSR	10,640	20,760
	Washingtonville	1,680	3,600
	Greenwood Lake	200	1,560
	Goshen (T)	1,640	3,800
	New Winsdor, part	7,400	28,000
	Total	30,000	76,000
ESTIMATED CAPITAL CONSTRUCTION COST (Midpoint of Construction)	($ 1994)	$129,000,000	
LAND PURCHASES AND ENVIRONMENTAL STUDIES		$5,000,000	
EXISTING TREATMENT PLANT DEBT TO RETIRE	OCSD#1	1,900,000	
	MBSR(2)	1,620,000	
	Washingtonville	300,000	
	Total	$3,820,00	
ESTIMATED ANNUAL O&M COSTS	($ 1995)	$ 3,710,000	
	($ 2020)	$32,800,000	
ESTIMATED ANNUAL ADMINISTRATIVE COSTS	($ 1995)	$ 250,000	

Notes:

(1) For rate-setting purposes, equivalent dwelling units (EDUs) are based on flow estimates divided by 250 gallons per day per EDU.

(2) MBSR debt assumes the reimbursement of a $2.1 million outstanding grant with an acceptable grant closeout by USEPA and NYSDEC.

Source: KPMG Peat Marwick

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(approximately $3.52 million) and also Washingtonville residents for the Washingtonville (V) STP (approximately $300,000).

The estimated annual O&M costs in 1991 dollars for this variation of the central project are estimated to be $2.97 million in the year 1995 (start-up) and $7.74 million in the year 2020. In addition, the estimated annual administrative cost for the new district administering this variation of the central sewage treatment action is $250,000 beginning in the year 1995 (start-up).

15.3.2.2 <u>Variation 2</u>

Table 15-8 summarizes the service and cost assumptions for the central County sewage treatment action.

As shown, Variation 2 of the central County sewage treatment action is to serve municipalities currently in both the OCSD #1 and MBSR (i.e., the Towns of Blooming Grove, Chester, Monroe and Woodbury and the Villages of Chester, Harriman, Kiryas Joel and Monroe), plus the Town of Goshen and the Villages of Greenwood Lake and Washingtonville, and the entire Town of New Windsor service area. The existing New Windsor STP is to be abandoned and converted into a pumping station.

It is projected that the facility will begin operations in 1995 and serve approximately 49,200 EDUs at that time. By the end of this Study period, the year 2020, the facility is projected to serve approximately 96,000 EDUs.

The capital construction cost for Variation 2 of the central project is estimated to be $125.5 million in 1991 dollars, as described in Chapter 13. Upon escalation to the midpoint of construction, assumed to be the year 1994, the estimated capital construction cost is $150 million.

Land purchases for a facility site, pumping station sites and the abandoned railroad ROW sites are needed. In addition, there is the required environmental impact statement, site-specific studies and permitting to be done. Therefore, a lump sum cost of $5 million has been assumed to address both land purchases and environmental work.

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 15-8

VARIATION NO. 2 OF THE CENTRAL COUNTY SEWAGE TREATMENT ACTION:

SERVICE AND COST ASSUMPTIONS

PROJECT DESCRIPTION	New 24.0 mgd SEC STP located in the vicinity of the Town of New Windsor with effluent discharge to the Hudson River, 7 pumping stations and 42 miles of collection pipe (see Chapter 13 for details)		
PROPOSED SERVICE AREA	Service Area	1995 EDUs(1)	2020 EDUs(1)
	OCSD#1	8,440	18,280
	MBSR	10,640	20,760
	Washingtonville	1,680	3,600
	Greenwood Lake	200	1,560
	Goshen (T)	1,640	3,800
	New Winsdor, all	26,600	48,000
	Total	49,200	96,000
ESTIMATED CAPITAL CONSTRUCTION COST (Midpoint of Construction)	($ 1994)	$150,000,000	
LAND PURCHASES AND ENVIRONMENTAL STUDIES		$5,000,000	
EXISTING TREATMENT PLANT DEBT TO RETIRE	OCSD#1	1,900,000	
	MBSR(2)	1,620,000	
	Washingtonville	300,000	
	New Windsor	1,700,000	
	Total	$5,520,00	
ESTIMATED ANNUAL O&M COSTS	($ 1995)	$ 5,880,000	
	($ 2020)	$41,830,000	
ESTIMATED ANNUAL ADMINISTRATIVE COSTS	($ 1995)	$ 250,000	

Notes:

(1) For rate-setting purposes, equivalent dwelling units (EDUs) are based on flow estimates divided by 250 gallons per day per EDU.

(2) MBSR debt assumes the reimbursement of a $2.1 million outstanding grant with an acceptable grant closeout by USEPA and NYSDEC.

Source: KPMG Peat Marwick

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Variation 2 of the central County sewage treatment action is also assumed to cover the outstanding debts of OCSD #1 and MBSR member communities for the OCSD #1 STP (approximately $3.52 million), Washingtonville residents for the Washingtonville (V) STP (approximately $300,000), and New Windsor residents for the New Windsor STP (approximately $1.70 million).

The estimated annual O&M costs in 1991 dollars for this variation of the central project are estimated to be $4.70 million in the year 1995 (start-up) and $9.87 million in the year 2020. In addition, the estimated annual administrative cost for the new district administering this variation of the central sewage treatment action is $250,000 beginning in the year 1995 (start-up).

15.3.3 Financing Scenarios

15.3.3.1 Variation 1

Variation 1 of the central County sewage treatment action is examined under three separate financing scenarios as follows:

- State Revolving Fund (SRF) loan financing from the New York State Environmental Facilities Corporation (NYSEFC);
- General obligation bond financing; and
- Revenue bond financing.

The first two financing scenarios assume the formation of a County district, subject to the New York State 50 percent rule as described in Chapter 14, to administer this variation of the central County sewage treatment action. The third financing scenario also assumes the formation of a County district to administer this variation of the central County sewage treatment action, however private sector participation via private tax-exempt financing is used.

Table 15-9 presents a summary of assumptions to be used in the three financing scenarios for Variation 1 of the central County sewage treatment action. The key assumptions of each financing scenario are as follows:

- A New York State Revolving Fund (SRF) loan financing assumes a subsidized loan from the NYSEFC having an interest rate of 5 percent and a term of 20 years (Note: a 3.05 percent administrative fee is charged by the NYSEFC);

- A general obligation (G.O.) bond financing assumes a County bond issue having a 7 percent interest rate and a 30 year term with no debt service reserve fund required; and

- A revenue bond financing assumes issuance by either the County or the NYSEFC (for a privatizer) having a long-term interest rate of 7.25 percent and a 30 year term with a debt service reserve fund of one year's worth of debt service required.

Under each of these scenarios, financing is assumed to begin in January 1992 with repayments beginning in July 1995. The interest accrued during construction is assumed to be financed and is added to the construction cost to estimate the bond issue amount.

The estimated bond issue amount for Variation 1 of the central County sewage treatment action ranges from about $152.6 to $154.4 million for SRF loan and G.O. bond financing scenarios to more than $169.7 million for the revenue bond financing scenario. The debt service reserve fund contributes to the revenue bond issue amount being significantly higher.

The annual debt service payments shown in Table 15-9 also differ substantially. Under the SRF loan and G.O. bond financing scenarios, debt service schedules using the New York State 50 percent rule are used thereby causing the early years of the debt repayment schedule to require larger payments than the later years. Under the revenue bond financing scenario, debt service can be increased over the 30-year term to reduce the annual payments in the early years of the project. Although the total

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 15-9

VARIATION NO. 1 OF THE CENTRAL COUNTY SEWAGE TREATMENT ACTION: ASSUMPTIONS FOR THREE FINANCING SCENARIOS

FINANCING ASSUMPTIONS	County District w/Public Financing State Revolving Fund (SRF) Loan	General Obligation Bond	County Authority or Private Financing Revenue Bond
Interest rate	3.7% - 5. 00%	5.1% - 7.00%	5.50% - 7.25%
Term (years)	20(1)	30	30
Issuance costs	3.05%	1.50%	2.00%
Bond insurance costs	N/A	N/A	0.75%
Debt service reserve fund required?	No	No	Yes
Bonds issuance	01-Jan-92	01-Jan-92	01-Jan-91
First debt service payment	01-Jan-96	01-Jan-96	01-Jan-96
Years for capitalized interest	3.5	3.5	3.5
Construction proceeds	$134,000,000	$134,000,000	$134,000,000
Defeasance of existing debt	$3,820,000	$3,820,000	$3,820,000
Interest during construction	$10,217,500	$14,304,500	$14,815,375
Debt service reserve fund costs	$0	$0	$14,021,327
Issuance & insurance costs	$4,515,144	$2,281,868	$3,052,708
TOTAL BOND ISSUE	$152,552,644	$154,406,368	$169,709,410
ANNUAL PAYMENT	$11,179,597 to $8,768,107	$11,682,749 to $6,024,667	$12,291,486 to $16,094,984

Source: KPMG Peat Marwick

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payments are greater, the impact on customers is less during the early years of the debt repayment schedule when the user base is smaller.

15.3.3.2 Variation 2

Variation 2 of the central County sewage treatment action is examined under three separate financing scenarios as follows:

- State Revolving Fund (SRF) loan financing from the New York State Environmental Facilities Corporation (NYSEFC);
- General obligation bond financing; and
- Revenue bond financing.

The first two financing scenarios assume the formation of a County district, subject to the New York State 50 percent rule as described in Chapter 14, to administer this variation of the central County sewage treatment action. The third financing scenario also assumes the formation of a County district to administer this variation of the central County sewage treatment action, however private sector participation via private tax-exempt financing is used.

Table 15-10 presents a summary of assumptions to be used in the three financing scenarios for Variation 2 of the central County sewage treatment action. The key assumptions of each financing scenario are as follows:

- A New York State Revolving Fund (SRF) loan financing assumes a subsidized loan from the NYSEFC having an interest rate of 5 percent and a term of 20 years (Note: a 3.05 percent administrative fee is charged by the NYSEFC);
- A general obligation (G.O.) bond financing assumes a County bond issue having a 7 percent interest rate and a 30 year term with no debt service reserve fund required; and

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 15-10

VARIATION NO. 2 OF THE CENTRAL COUNTY SEWAGE TREATMENT ACTION: ASSUMPTIONS FOR THREE FINANCING SCENARIOS

FINANCING ASSUMPTIONS	County District w/Public Financing State Revolving Fund (SRF) Loan	County District w/Public Financing General Obligation Bond	County Authority or Private Financing Revenue Bond
Interest rate	3.7% - 5.00%	5.1% - 7.00%	5.50% - 7.25%
Term (years)	$20^{(1)}$	30	30
Issuance costs	3.05%	1.50%	2.00%
Bond insurance costs	N/A	N/A	0.75%
Debt service reserve fund required?	No	No	Yes
Bonds issuance	01-Jan-92	01-Jan-92	01-Jan-91
First debt service payment	01-Jan-96	01-Jan-96	01-Jan-96
Years for capitalized interest	3.5	3.5	3.5
Construction proceeds	$155,000,000	$155,000,000	$155,000,000
Defeasance of existing debt	$5,520,000	$5,520,000	$5,520,000
Interest during construction	$11,818,750	$16,546,250	$17,137,188
Debt service reserve fund costs	$0	$0	$16,319,870
Issuance & insurance costs	$5,256,332	$2,655,994	$3,553,144
TOTAL BOND ISSUE	$177,595,082	$179,722,244	$197,530,202
ANNUAL PAYMENT	$12,904,820 to $10,184,992	$13,594,297 to $7,017,428	$14,303,766 to $18,731,722

Source: KPMG Peat Marwick

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- A revenue bond financing assumes issuance by either the County or the NYSEFC (for a privatizer) having a long-term interest rate of 7.25 percent and a 30 year term with a debt service reserve fund of one year's worth of debt service required.

Under each of these scenarios, financing is assumed to begin in January 1992 with repayments beginning in July 1995. The interest accrued during construction is assumed to be financed and is added to the construction cost to estimate the bond issue amount.

The estimated bond issue amount for Variation 2 of the central County sewage treatment action ranges from about $177.6 to $179.7 million for SRF loan and G.O. bond financing scenarios to more than $197.5 million for the revenue bond financing scenario. The debt service reserve fund contributes to the revenue bond issue amount being significantly higher.

The annual debt service payments shown in Table 15-10 also differ substantially. Under the SRF loan and G.O. bond financing scenarios, debt service schedules using the New York State 50 percent rule are used thereby causing the early years of the debt repayment schedule to require larger payments than the later years. Under the revenue bond financing scenario, debt service can be increased over the 30-year term to reduce the annual payments in the early years of the project. Although the total payments are greater, the impact on customers is less during the early years of the debt repayment schedule when the user base is smaller.

15.3.4 Financial Impact Analyses

15.3.4.1 Variation 1

A financial impact-analysis of the estimated annual cost per EDU upon start-up of Variation 1 of the central County sewage treatment action was done for the three financing scenarios. Tables 15-11, 15-12 and 15-13 present the financial impact analyses for Variation 1 of the central County sewage treatment action under the financing scenarios of SRF loan, G.O. bond and revenue bond, respectively.

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 15-11

VARIATION NO. 1 OF THE CENTRAL COUNTY SEWAGE TREATMENT ACTION:

FINANCIAL IMPACT ANALYSIS UNDER SRF LOAN FINANCING

	1994	1995	1996	1997	1998	1999
REVENUE						
User Fees		$9,900,000	$10,712,827	$11,592,390	$12,544,169	$13,574,092
Connection Fees	1,929,662	1,929,662	2,276,816	2,510,682	2,768,567	3,052,942
Transfer from Fund Balance	0	1,979,662	4,327,313	2,091,651	683,267	103,497
Interest on Fund Balance	50,000	69,288	151,456	73,208	23,914	3,622
Subtotal	1,979,662	13,878,612	17,468,414	16,267,931	16,019,918	16,734,154
EXPENDITURES						
Administration & Operations	0	3,960,000	4,158,000	4,365,900	4,584,195	4,813,405
Debt Service	0	5,591,298	11,218,764	11,218,764	11,332,226	11,337,517
Subtotal	0	9,551,298	15,376,764	15,584,664	15,916,421	16,150,922
NET REVENUES	1,979,662	4,327,313	2,091,651	683,267	103,497	583,231
Debt Service Coverage from All Revenue		1.77	1.19	1.06	1.01	1.05
Beginning Fund Balance	0	0	0	0	0	0
Net Funds Available	$1,979,662	$4,327,313	$2,091,651	$683,267	$103,497	$583,231
Fund Balance Reserved	$0	$0	$0	$0	$0	$0
Projected Flow (mgd)	NA	7.50	7.73	7.97	8.21	8.46
Estimated EDUs	29,083	30,000	30,917	31,863	32,837	33,841
New EDU's annually	917	917	945	974	1,004	1,035
Estimated Connection Fee/EDU	$2,104	$2,251	$2,409	$2,577	$2,758	$2,951
Estimated User Fee ($/EDU/YR)		$330	$347	$364	$382	$401

Note: Operating costs are escalated at 5%.
Connection fees are escalated @ 7% per year to account for financing costs; user fees are escalated @ 5% per year.
EDUs are based on an average of 250 gallons per day per EDU for rate-setting purposes.

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ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 15-12

VARIATION NO. 1 OF THE CENTRAL COUNTY SEWAGE TREATMENT ACTION:

FINANCIAL IMPACT ANALYSIS UNDER GENERAL OBLIGATION BOND FINANCING

	1994	1995	1996	1997	1998	1999
REVENUE						
User Fees		$10,200,000	$11,037,458	$11,943,675	$12,924,295	$13,985,429
Connection Fees	1,929,662	1,929,662	2,276,818	2,510,682	2,768,567	3,052,942
Transfer from Fund Balance	0	1,979,662	4,377,237	2,061,734	593,504	0
Interest on Fund Balance	50,000	69,288	153,203	72,161	20,773	(1,140)
Subtotal	1,979,662	14,178,612	17,844,717	16,588,251	16,307,140	17,037,230
EXPENDITURES						
Administration & Operations	0	3,960,000	4,158,000	4,365,900	4,584,195	4,813,405
Debt Service	0	5,841,374	11,624,983	11,628,847	11,755,514	11,734,291
Subtotal	0	9,801,374	15,782,983	15,994,747	16,339,709	16,547,696
NET REVENUES	1,979,662	4,377,237	2,061,734	593,504	(32,570)	489,534
Debt Service Coverage from All Revenue		1.75	1.18	1.05	1.00	1.04
Beginning Fund Balance	0	0	0	0	0	(32,570)
Net Funds Available	$1,979,662	$4,377,237	$2,061,734	$593,504	($32,570)	$456,965
Fund Balance Reserved	$0	$0	$0	$0	($32,570)	$0
Projected Flow (mgd)	NA	7.50	7.73	7.97	8.21	8.46
Estimated EDUs	29,083	30,000	30,917	31,863	32,837	33,841
New EDU's annually	917	917	945	974	1,004	1,035
Estimated Connection Fee/EDU	$2,104	$2,251	$2,409	$2,577	$2,758	$2,951
Estimated User Fee ($/EDU/YR)		$340	$357	$375	$394	$413

Note: Operating costs are escalated at 5%.
Connection fees are escalated @ 7% per year to account for financing costs; user fees are escalated @ 5% per year.
EDUs are based on an average of 250 gallons per day per EDU for rate-setting purposes.

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ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 15-13

VARIATION NO. 1 OF THE CENTRAL COUNTY SEWAGE TREATMENT ACTION:

FINANCIAL IMPACT ANALYSIS UNDER REVENUE BOND FINANCING

	1994	1995	1996	1997	1998	1999
REVENUE						
User Fees		$10,350,000	$11,199,774	$12,119,317	$13,114,359	$14,191,097
Connection Fees	1,929,662	1,929,662	2,276,818	2,510,682	2,768,567	3,052,942
Transfer from Fund Balance	0	1,979,662	4,619,265	2,586,229	1,287,995	839,179
Interest on Fund Balance	50,000	69,288	161,674	90,518	45,080	29,371
Subtotal	1,979,662	14,328,612	18,257,531	17,306,746	17,216,001	18,112,589
EXPENDITURES						
Administration & Operations	0	3,960,000	4,158,000	4,365,900	4,584,195	4,813,405
Debt Service	0	5,749,347	11,513,303	11,652,851	11,792,627	11,962,335
Subtotal	0	9,709,347	15,671,303	16,018,751	16,376,822	16,775,740
NET REVENUES	1,979,662	4,619,265	2,586,229	1,287,995	839,179	1,336,849
Debt Service Coverage from All Revenue		1.80	1.22	1.11	1.07	1.11
Beginning Fund Balance	0	0	0	0	0	0
Net Funds Available	$1,979,662	$4,619,265	$2,586,229	$1,287,995	$839,179	$1,336,849
Fund Balance Reserved	$0	$0	$0	$0	$0	$0
Projected Flow (mgd)	NA	7.50	7.73	7.97	8.21	8.46
Estimated EDUs	29,083	30,000	30,917	31,863	32,837	33,841
New EDU's annually	917	917	945	974	1,004	1,035
Estimated Connection Fee/EDU	$2.104	$2,251	$2,409	$2,577	$2,758	$2,951
Estimated User Fee ($/EDU/YR)		$345	$362	$380	$399	$419

Note: Operating costs are escalated at 5%.
Connection fees are escalated @ 7% per year to account for financing costs; user fees are escalated @ 5% per year.
EDUs are based on an average of 250 gallons per day per EDU for rate-setting purposes.

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The financial impact analysis determines the estimated annual user fee revenue required for coverage of both the operations and maintenance costs and debt service costs related to the project. Note that a connection fee is also determined based on the construction cost of the project per unit of capacity provided. The legal basis in New York State on the use of connection fees in this manner should be further investigated by the County, as discussed in Chapter 14.

Two key assumptions affecting the results of Tables 15-11, 15-12 and 15-13 include that:

- One year's worth of connection fees is collected in advance of project start-up in 1995; and

- Fund balances are dedicated to the project and can be used to make debt service and other required payments, as needed.

The resulting estimated user fees (i.e., annual costs per EDU) presented in Tables 15-11, 15-12 and 15-13 are calculated to provide adequate cash flow over the first five years of the analysis timeframe.

15.3.4.2 Variation 2

A financial impact analysis of the estimated annual cost per EDU upon start-up of Variation 2 of the central County sewage treatment action was done for the three financing scenarios. Tables 15-14, 15-15 and 15-16 present the financial impact analyses for Variation 2 of the central County sewage treatment action under the financing scenarios of SRF loan, G.O. bond and revenue bond, respectively.

The financial impact analysis determines the estimated annual user fee revenue required for coverage of both the operations and maintenance costs and debt service costs related to the project. Note that a connection fee is also determined based on the construction cost of the project per unit of capacity provided. The legal basis in New York State on the use of connection fees in this manner should be further investigated by the County, as discussed in Chapter 14.

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 15-14

VARIATION NO. 2 OF THE CENTRAL COUNTY SEWAGE TREATMENT ACTION:

FINANCIAL IMPACT ANALYSIS UNDER SRF LOAN FINANCING

	1994	1995	1996	1997	1998	1999
REVENUE						
User Fees		$11,808,000	$12,777,481	$13,826,560	$14,961,773	$16,190,190
Connection Fees	3,164,645	3,164,645	3,733,982	4,117,519	4,540,451	5,006,824
Transfer from Fund Balance	0	3,214,645	5,659,393	2,869,564	1,092,882	342,197
Interest on Fund Balance	50,000	112,513	198,079	100,435	38,251	11,977
Subtotal	3,214,645	18,299,803	22,368,935	20,914,078	20,633,356	21,551,188
EXPENDITURES						
Administration & Operations	0	6,130,000	6,436,500	6,758,325	7,096,241	7,451,053
Debt Service	0	6,510,410	13,062,871	13,062,871	13,194,918	13,201,034
Subtotal	0	12,640,410	19,499,371	19,821,196	20,291,159	20,652,087
NET REVENUES	3,214,645	5,659,393	2,869,564	1,092,882	342,197	899,101
Debt Service Coverage from All Revenue		1.87	1.22	1.06	1.03	1.07
Beginning Fund Balance	0	0	0	0	0	0
Net Funds Available	$3,214,645	$5,659,393	$2,869,564	$1,092,882	$342,197	$899,101
Fund Balance Reserved	$0	$0	$0	$0	$0	$0
Projected Flow (mgd)	NA	12.30	12.68	13.06	13.46	13.87
Estimated EDUs	47,696	49,200	50,704	52,255	53,852	55,499
New EDU's annually	1504	1,504	1,550	1,598	1,647	1,697
Estimated Connection Fee/EDU	$2,104	$2,251	$2,409	$2,577	$2,758	$2,951
Estimated User Fee ($/EDU/YR)		$240	$252	$265	$278	$292

Note: Operating costs are escalated at 5%.
Connection fees are escalated @ 7% per year to account for financing costs; user fees are escalated @ 5% per year.
EDUs are based on an average of 250 gallons per day per EDU for rate-setting purposes.

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ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 15-15

VARIATION NO. 2 OF THE CENTRAL COUNTY SEWAGE TREATMENT ACTION:

FINANCIAL IMPACT ANALYSIS UNDER GENERAL OBLIGATION BOND FINANCING

	1994	1995	1996	1997	1998	1999
REVENUE						
User Fees		$12,300,000	$13,309,876	$14,402,667	$15,585,180	$16,864,782
Connection Fees	3,164,645	3,164,645	3,733,982	4,117,519	4,540,451	5,006,824
Transfer from Fund Balance	0	3,214,645	5,864,655	3,150,080	1,490,354	892,463
Interest on Fund Balance	50,000	112,513	205,263	110,253	52,162	31,236
Subtotal	3,214,645	18,791,803	23,113,776	21,780,518	21,668,147	22,795,305
EXPENDITURES						
Administration & Operations	0	6,130,000	6,436,500	6,758,325	7,096,241	7,451,053
Debt Service	0	6,797,148	13,527,196	13,531,839	13,679,443	13,654,912
Subtotal	0	12,927,148	19,963,696	20,290,164	20,775,684	21,105,965
NET REVENUES	3,214,645	5,864,655	3,150,080	1,490,354	892,463	1,689,340
Debt Service Coverage from All Revenue		1.86	1.23	1.11	1.07	1.12
Beginning Fund Balance	0	0	0	0	0	0
Net Funds Available	$3,214,645	$5,864,655	$3,150,080	$1,490,354	$892,463	$1,689,340
Fund Balance Reserved	$0	$0	$0	$0	$0	$0
Projected Flow (mgd)	NA	12.30	12.68	13.06	13.46	13.87
Estimated EDUs	47,696	49,200	50,704	52,255	53,852	55,499
New EDU's annually	1504	1,504	1,550	1,598	1,647	1,697
Estimated Connection Fee/EDU	$2,104	$2,251	$2,409	$2,577	$2,758	$2,951
Estimated User Fee ($/EDU/YR)		$250	$263	$276	$289	$304

Note: Operating costs are escalated at 5%.
Connection fees are escalated @ 7% per year to account for financing costs; user fees are escalated @ 5% per year.
EDUs are based on an average of 250 gallons per day per EDU for rate-setting purposes.

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ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 15-16

VARIATION NO. 2 OF THE CENTRAL COUNTY SEWAGE TREATMENT ACTION:

FINANCIAL IMPACT ANALYSIS UNDER REVENUE BOND FINANCING

	1994	1995	1996	1997	1998	1999
REVENUE						
User Fees		$12,300,000	$13,309,876	$14,402,667	$15,585,180	$16,864,762
Connection Fees	3,164,645	3,164,645	3,733,982	4,117,519	4,540,451	5,006,824
Transfer from Fund Balance	0	3,214,645	5,968,977	3,387,236	1,706,607	1,067,348
Interest on Fund Balance	50,000	112,513	208,914	118,553	59,731	37,357
Subtotal	3,214,645	18,791,803	23,221,749	22,025,975	21,891,969	22,976,311
EXPENDITURES						
Administration & Operations	0	6,130,000	6,436,500	6,758,325	7,096,241	7,451,053
Debt Service	0	6,692,826	13,398,013	13,561,043	13,728,379	13,925,705
Subtotal	0	12,822,826	19,834,513	20,319,368	20,824,620	21,376,759
NET REVENUES	3,214,645	5,968,977	3,387,236	1,706,607	1,067,348	1,599,552
Debt Service Coverage from All Revenue		1.89	1.25	1.13	1.08	1.11
Beginning Fund Balance	0	0	0	0	0	0
Net Funds Available	$3,214,645	$5,968,977	$3,387,236	$1,706,607	$1,067,348	$1,599,552
Fund Balance Reserved	$0	$0	$0	$0	$0	$0
Projected Flow (mgd)	NA	12.30	12.68	13.06	13.46	13.87
Estimated EDUs	47,696	49,200	50,704	52,255	53,852	55,499
New EDU's annually	1504	1,504	1,550	1,598	1,647	1,697
Estimated Connection Fee/EDU	$2,104	$2,251	$2,409	$2,577	$2,758	$2,951
Estimated User Fee ($/EDU/YR)		$250	$263	$276	$289	$304

Note: Operating costs are escalated at 5%.
Connection fees are escalated @ 7% per year to account for financing costs; user fees are escalated @ 5% per year.
EDUs are based on an average of 250 gallons per day per EDU for rate-setting purposes.

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Two key assumptions affecting the results of Tables 15-14, 15-15 and 15-16 include that:

- One year's worth of connection fees is collected in advance of project start-up in 1995; and

- Fund balances are dedicated to the project and can be used to make debt service and other required payments, as needed.

The resulting estimated user fees (i.e., annual costs per EDU) presented in Tables 15-14, 15-15 and 15-16 are calculated to provide adequate cash flow over the first five years of the analysis timeframe.

15.3.5 Results

15.3.5.1 Variation 1

Table 15-17 presents a comparison of the financial impact analysis results for the three financing scenarios as applied to Variation 1 of the central County sewage treatment action.

15.3.5.2 Variation 2

Table 15-18 presents a comparison of the financial impact analysis results for the three financing scenarios as applied to Variation 2 of the central County sewage treatment action.

15.4 Comparison of Results

Table 15-19 presents a comparison of results from financing the central County sewage treatment action and two specific variations thereof: Variation No. 1 and Variation No. 2. As shown, Variation No. 2 is the most cost-effective approach since the economies of scale come into play from the larger customer base. The start-up annual cost per EDU of $197 (1991 dollars) for SRF financing of Variation No. 2 is the lowest cost presented. Thus, it would be advantageous to have the New Windsor service area join the central County service area from the economic vantage point of communities to be served by the project.

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 15-17

COMPARISON OF FINANCIAL IMPACT ANALYSIS RESULTS

FOR VARIATION NO. 1 OF THE CENTRAL COUNTY SEWAGE TREATMENT ACTION

FINANCING SCENARIOS	ANNUAL COST PER EDU AT START-UP ($ 1995)	($ 1991)	CONNECTION FEE ($ 1995)	($ 1991)
• SRF Loan	$330	$271	$2,104	$1,783
• General Obligation Bond	$340	$280	$2,104	$1,783
• Revenue Bond	$345	$284	$2,104	$1,783

Notes:

(1) Costs do not include local municipal sewage collection costs
(2) Costs in $1991 are based on discounting 5 percent per year.

Source: KPMG Peat Marwick

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ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 15-18

COMPARISON OF FINANCIAL IMPACT ANALYSIS RESULTS

FOR VARIATION NO. 2 OF THE CENTRAL COUNTY SEWAGE TREATMENT ACTION

FINANCING SCENARIOS	ANNUAL COST PER EDU AT START-UP ($ 1995)	ANNUAL COST PER EDU AT START-UP ($ 1991)	CONNECTION FEE ($ 1995)	CONNECTION FEE ($ 1991)
• SRF Loan	$240	$197	$2,104	$1,783
• General Obligation Bond	$250	$206	$2,104	$1,783
• Revenue Bond	$250	$206	$2,104	$1,783

Notes:

(1) Costs do not include local municipal sewage collection costs
(2) Costs in $1991 are based on discounting 5 percent per year.

Source: KPMG Peat Marwick

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ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 15-19

COMPARISON OF THE CENTRAL COUNTY SEWAGE TREATMENT ACTION

AND VARIATIONS UNDER THREE FINANCING SCENARIOS

FINANCING SCENARIOS	ANNUAL COST PER EDU ($1991) AT START-UP (1995)		
	CENTRAL COUNTY SEWAGE TREATMENT ACTION	VARIATION NO.1	VARIATION NO. 2
SRF LOAN	$284	$271	$197
GENERAL OBLIGATION BOND	$296	$280	$206
REVENUE BOND	$296	$284	$206

Notes:

(1) Costs do not include local municipal sewage collection costs.

Source: KPMG Peat Marwick

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However, since Variation No. 2 involves the abandonment of the existing New Windsor STP and diversion of all flow from the New Windsor area to a new 24.0 mgd STP, the decision will be made by New Windsor, from a financial standpoint, whether or not this is less costly to their customers than expanding their existing STP from 5.0 to 12.0 mgd. Table 15-20 attempts to make this comparison. It is seen that the New Windsor service area would be paying $145 (1991 dollars) per EDU in 1995 for the expansion of their existing STP with SRF financing. This compares to the $197 to $206 (1991 dollars) per EDU, depending on the financing scenario, if that facility were abandoned and the New Windsor service area became part of the central County service area. Thus, from the New Windsor service area's standpoint, it is financially preferable to remain a regional sewage treatment action and not participate in the central County sewage treatment action.

15.5 Summary

The central County sewage treatment action in the Recommended Plan is a cost-effective approach to meet the current and future needs of a large portion of Orange County's citizens. The project would be even more cost-effective if Variation No. 2 of the central County sewage treatment action was implemented. However, based on preliminary analyses at this time, there does not appear to be any economic incentive for the New Windsor service area to participate in the project as Variation No. 2 entails. Therefore, the central County sewage treatment action identified in the Recommended Plan in Chapter 13 remains unchanged after the financial impact analyses.

Table 15-21 presents the estimated annual costs per EDU, including local sewage collection costs, for various communities to be served by the central County sewage treatment action in the Recommended Plan.

The County has expressed an interest in assessing the potential benefits from various levels of private entity participation in the project. Typically, an equity contribution of up to 20 percent of a project's cost is provided by a privatizer as both a demonstrated commitment to the project and to allow debt financing of the remaining 80 percent. The equity can be either paid upfront to offset debt financing needs or contributed annually to reduce debt service payments and customer rates. This equity, plus an agreed-upon return on investment, is then recovered by the privatizer through operation and management fees over the life of the service agreement. With private equity contributions provided annually over the first five years of the project, significant rate reductions can be obtained during this time when the customer base is smaller. It is recommended that the use of private equity, either

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 15-20

COMPARISON BETWEEN THE CENTRAL COUNTY SERVICE AREA AND THE NEW WINDSOR SERVICE AREA

ACTION	ANNUAL COST PER EDU ($1991) AT START-UP (1995)			
	CENTRAL COUNTY SERVICE AREA			NEW WINDSOR SERVICE AREA[1]
	SRF LOAN	GENERAL OBL. BOND	REVENUE BOND	
Central County Sewage Treatment Action (New 12.0 mgd STP) Regional New Windsor STP Expansion from 5.0 to 12.0 mgd	$284	$296	$296	$145
Variation No. 1 of the Central County Sewage Treatment Action (New 19.0 mgd STP) Maintain Existing New Windsor STP at 5.0 mgd	$271	$280	$284	$260
Variation No. 2 of the Central County Sewage Treatment Action (New 24.0 mgd STP) Abandon Existing New Windsor STP and Convert to a Pumping Station	$197	$206	$206	N/A

Notes:

(1) Assumes SRF loan financing for New Windsor STP expansion.

Source: KPMG Peat Marwick

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ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 15-21

CENTRAL COUNTY SEWAGE TREATMENT ACTION:

ANNUAL COST PER EDU INCLUDING LOCAL SEWAGE COLLECTION

		ANNUAL COST PER EDU ($1995) INCLUDING LOCAL COLLECTION COSTS		
	Local Collection Costs ($1995)	SRF Loan	General Obligation Bond	Revenue Bond
OCSD#1 Communities	$33	$378	$393	$393
MBSR Example: Woodbury	$73	$418	$433	$433
Village of Washingtonville	$42	$387	$402	$402

Notes:

Local collection costs developed from municipal operating budgets and 1995 EDU data.

Source: KPMG Peat Marwick

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upfront to reduce debt financing or through annual contributions, should be sought within any private financing scenario.

Previous analyses showed that, over the entire financing life, revenue bond financing is roughly 30% more costly than SRF financing on a present value basis (this does not include adjustments for equity contributions or the return on equity investment discussed above). Thus, on a cost basis, a private facility financed with revenue bonds may need to be roughly 30% less in construction costs than a publicly financed facility to offset the lower costs of SRF financing that is available only to a publicly owned and financed facility. Thus, the most-effective institutional and financing structure for the regional project may be a privately designed, constructed, and operated facility (e.g., a single prime contractor providing turnkey services) and District ownership and financing.

CHAPTER 16

16.0 IMPLEMENTATION CONSIDERATIONS OF THE CENTRAL COUNTY SEWAGE TREATMENT ACTION

16.1 Introduction

The purpose of this Chapter is to outline several implementation considerations associated with the central County sewage treatment action described in the Recommended Plan. These considerations include the following major items:

- Sewer District Formation;
- Potential Privatization Approach;
- Siting;
- Regulatory Framework; and
- Schedule.

The following sections discuss these items in more detail.

16.2 Sewer District Formation

The County Sewer Committee approved the recommendation that Orange County use a district approach for administering the central County sewage treatment action in the Recommended Plan. The major factors to be considered in forming a new district are organizational, legal, institutional and regulatory.

While the district organizational structure does not need to be large, the district will have some major responsibilities:

- Management and oversight of a large construction program;
- Negotiating with the contractor;
- Negotiating and implementing interlocal agreements;
- Substantial financial and accounting responsibilities; and
- Coordination and oversight of regulatory responsibilities.

Because of the importance of the programs overseen by the district, it is recommended that the position of District Director be created. This position should be a high visibility one reporting directly to the County Executive and accountable to the County Legislature. It is possible that the remainder of the district staff can be lean with certain functions (e.g., finance, accounting, etc.) either supported by other County departments or handled separately by subcontractors.

Creation of a district requires that the County Legislature adopt a resolution to do so, subject to a permissive referendum. Once the district is created, an important next step is the negotiation of interlocal agreements with the participating towns and villages of the central County sewage treatment action in the Recommended Plan. These agreements are required to constitute the revenue stream either as a financial guarantee that the district can rely upon for financing or to form the basis for the district's ability to negotiate with a privatizer, should that decision be made by the County. The key elements of interlocal agreements include:

- Minimum sewage quantities;
- Maximum sewage quantities or maximum sewage capacity;
- Quality standards for treated effluent including guarantees regarding local regulation;
- Responsibilities and corrective actions to be taken in the event of regulatory non-compliant effluent discharges;
- Rate and payment terms, including cost escalation formulas; and
- Capacity based reporting (e.g., number of customers by class, annual system growth, etc.).

The central County sewage treatment action in the Recommended Plan will likely require additional regulation as sewage is to be collected and piped across political boundaries. Within New York State, such regulatory powers typically reside either with a county health department or public works department.

The decision as to which County department should assume this role needs to be made at the organizational stage and incorporated into the process of creating the County district. Interlocal agreements entered into by the County district should specifically cite which County department has local enforcement and regulatory authority.

16.3 Potential Privatization Approach

The County Sewer Committee approved the recommendation that the County should further investigate privatization for the central County sewage treatment action in the Recommended Plan. A general analysis of successful privatization projects shows the following common characteristics:

- A set of clearly defined technical, financial and institutional criteria; and
- A strong team of specialists (e.g., technical, legal and financial, etc.) supporting the governmental body; and
- A fortuitous combination of business circumstances (e.g., land ownership, complementary interests, etc.).

Privatization should be considered for implementation only if it offers positive benefits to the County (e.g., technical, cost, risk, schedule, regulatory, etc.) over the alternative of governmental ownership. Table 16-1 summarizes a typical distribution of responsibilities under a privatization approach. A review of the County's responsibilities, through a district, reveals the interrelationship between the privatizer and the district's necessary interlocal agreements.

As a first step towards privatization, a district should form its own specialist team (e.g, technical, legal and financial, etc.) using the best available combination of internal and external resources. Entering into a privatization agreement typically means entering into a long term relationship of 20 or more years in a high cost, high risk endeavor. The County's ability to achieve economic growth is dependent on a successful project. To that end, it is prudent that the district have detailed information regarding the privatizer. Table 16-2 is a suggested list of the information that the County and its district will need to begin evaluating potential privatizers.

More detailed information from potential privatizers can be obtained through a process which includes the issuance of a Request of Qualifications (RFQ), followed by the issuance of a Request for Proposals (RFP) from those respondents deemed qualified to submit a proposal. Examples of general outlines for such documents are provided as Tables 16-3 and 16-4, respectively.

16.4 Siting

The siting of the sewage treatment facility, pumping stations and main collection pipelines associated with the central County sewage treatment action is a significant issue. The County should recognize

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 16-1

DISTRIBUTION OF RESPONSIBILITIES WITHIN TYPICAL

SERVICE CONTACT PROVISIONS

SERVICE CONTRACT PROVISION	COUNTY RESPONSIBILITY	PRIVATIZER RESPONSIBILITY
Design, construction & permitting	Conducts planning: Approves site and design	Conducts design, construction & permitting
Delivery & acceptance of sewage	Guarantees a level (or levels) of sewage flow	Guarantees treatment capacity. May have own capacity needs
Maintenance of transmission lines/collection system	May maintain transmission; Municipalities maintain collection systems	Could own & maintain transmission lines
Operation/compliance of facility	Provides acceptable sewage	Responsible for operation & compliance of facility
Expansion or modification of facility	Responsible for improvements related to new regulations (costs added to service fee)	Responsible for expansion for own purposes & improvements to meet existing regulations
Service charges	Pays fee based on minimum flow guarantee plus additional flow	Pays portion of costs related to own use
Purchase option	May purchase at market value or for $1 if lease/purchase	N/A

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ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 16-2

SUGGESTED INFORMATION NEEDED FROM PRIVATIZERS FOR PRELIMINARY ASSESSMENT

1. How many and what types of organizations do you anticipate using throughout the privatization process, e.g., corporation, limited partnership, etc.?

2. If you anticipate separate organizations for different phases of the project, please describe how many and for what purpose, e.g., construction, ownership and operation.

3. Please provide verification of the current financial condition of resources to be pledged to this project by either an auditor, external accountant or other comparable source.

4. Please provide three pertinent financial references including your principal banker.

5. Please provide verification of the ability to pay or finance the work required up to the receipt of bond funds.

6. Describe the financial assurance mechanism that you anticipate using during construction. Please provide some verification (e.g., letter, etc.) of the ability to employ the described mechanism(s).

7. Provide a brief description of nearby or related businesses in which you are currently or expect to be involved and the relationship of that business to this project.

8. Describe your target rate of return or net margin (as appropriate) for the various aspects of the project. Also, describe the rationale for these goals.

9. Describe the risks by project stage that you expect to be borne by the County and the risks that you expect to bear.

10. Describe through a summary of related experience and the makeup of your organization, the management and technical capability of your team to successfully complete this project. Provide more detailed information regarding:

    - the construction experience of the principal firm, i.e., projects of a similar nature and percent of the work undertaken for each; and

    - the type and size of similar projects undertaken by the principal firm involving design, permitting, environmental studies, etc.

11. Provide brief (1-2 pages) resumes of the principal personnel that will be involved in the project.

12. Describe your approach to construction. How will construction management be provided? Describe the type and amount of work to be given to subcontractors.

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 16-3

GENERAL OUTLINE OF A REQUEST FOR QUALIFICATIONS (RFQ) FROM PRIVATIZERS

1. Scope and Purpose
2. Project Information
   - Background
   - Proposed Facility
   - Site and Facility Ownership
   - Financing
   - Project Schedule
3. Instructions for Preparing Qualifications Statement
   - General Instructions
   - Information to be Provided by the Respondent
     - General Information
     - Sewage Treatment Project Experience
     - Project Personnel
     - Financial Statement
4. Evaluation and Selection Criteria
   - General Information
   - Procurement
   - Sewage Treatment Facility Experience
   - Specialized Experience
   - Financial Statement
   - Minimum Acceptable Qualifications

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ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 16-4

GENERAL OUTLINE OF A REQUEST FOR PROPOSALS (RFP) FROM PRIVATIZERS

PROPOSAL INFORMATION

Introduction and Description of Procurement Process
General Scope of Work
Selection Process
Award Process
Project Schedule/Time For Performance
Commitments of the County
Vendor Commitments
Project Team
Submission of Proposals

CONTENTS OF THE PROPOSAL

Business Organization
The Service Agreement
The Operation and Maintenance Agreement
Technical Specifications
Influent Flow and Concentrations
Effluent Criteria
Bypass Provisions
Technical Information Requirements
Existing Facilities
Plant Staffing Requirements
Costs
Future Expandability
Financial Specifications
Financing Arrangements
Equity Structures

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

TABLE 16-4

GENERAL OUTLINE OF A REQUEST FOR PROPOSALS (RFP) FROM PRIVATIZERS

EVALUATION OF THE PROPOSAL

Evaluation Criteria
Management Qualifications
Technical Reliability of the Proposed System
Financial Qualifications
Contractual Conditions

ADDITIONAL PROPOSAL REQUIREMENTS

Proposer Costs
Proposer's Personal Investigations
County Rights and Options
Addenda and Amendments
Interpretations and Clarifications
Correction of Errors
Withdrawal From Negotiations
Delay in Negotiations to Proposer
Disposition of Materials

GENERAL PROJECT REQUIREMENTS

Assignment and Sub-Contracting
Indemnification
Materials, Appliances, Employees
Equal Employment Opportunity
Royalties and Patents
Explosives
Accidents and Damages
Project Information and Community Relations Requirements

this by developing an approach to site identification, evaluation and selection as part of its adoption of the Recommended Plan.

The project scope of work of this Study did not include a comprehensive siting analysis task. Therefore, this Study can not recommend any particular site or sites at which the central County sewage treatment action should be located. It is suggested that Orange County undertake a separate siting study to accomplish this objective.

When conducting a siting study and assessment, criteria that must be taken into consideration include, but are not limited to the following:

- Proximity to residential areas;
- Direction of prevailing winds;
- Accessibility;
- Area available for future expansion;
- Local zoning requirements;
- Soil characteristics, topography and hydrology;
- Environmental sensitivity and historical significance;
- Access to the designated receiving water body (i.e., the Hudson River);
- Downstream uses of the receiving water and zone of tidal influence; and
- Compatibility of treatment processes with present and planned local land uses, including noise, odor control, air quality protection, sludge treatment and utilization/disposal considerations.

The primary objective when siting the central County sewage treatment action facilities is to minimize adverse impacts on the surrounding areas. A well planned and executed assessment of suitable sites can both help to streamline the regulatory review process and address the issues raised by public and private concerns that, left unanswered, may otherwise impede the siting process. Thus, it is suggested that a proactive role be taken that allows for substantial public participation and review.

In conclusion, the identification of suitable sites for facilities associated with the central County sewage treatment action is crucial to ensuring the implementation of a successful project. Many siting criteria need to be examined via a siting study. While a full-scale siting assessment was beyond the project scope of work for this Study, both inspections of existing facilities and environmental assessment reconnaissance trips made during the Study revealed that there are a sufficient number of sites in the vicinity of the Town of New Windsor which appear to have the potential to accommodate the new central County sewage treatment facility described in the Recommended Plan.

16.5 Regulatory Framework

The implementation of the central County sewage treatment action must be done within the framework of New York State environmental regulations enforced by the NYSDEC. Due to the comprehensive scope of this project, it will be required to undergo a regulatory review process outlined in the New York State Environmental Quality Review (SEQR) Act.

The basic purpose of the SEQR Act is to incorporate the consideration of environmental factors into the existing planning, review and decision-making processes of State, regional and local government agencies at the early stage of a planned project. To accomplish this goal, the SEQR Act requires all involved agencies to determine whether the actions they undertake, fund or approve may have a significant effect on the environment, in terms of air, water, land, habitat and living resources. If it is determined by NYSDEC that the action may have a significant effect upon the environment, an environmental impact statement (EIS) must be prepared.

It is not the intention of the SEQR Act that environmental factors be the sole consideration in the decision-making process. Rather, the process attempts to shape public policy by considering the protection and enhancement of environmental, human and community resources in light of demonstrated social and economic needs. Thus, it allows for a balance of social, economic and environmental factors to be incorporated into the planning process.

The regulatory framework for implementation of the SEQR Act requirements includes the following:

- Procedural requirements for compliance with the law;
- Provisions for coordinating multiple agency environmental reviews through a single lead agency;
- Criteria to determine whether a proposed action may have a significant effect on the environment;
- Model assessment forms to aid in determining whether an action may have a significant effect on the environment; and

- Examples of actions and classes of actions which are likely to require an EIS.

The central County sewage treatment action in the Recommended Plan will be classified as a "Type I" action under the SEQR Act, thereby requiring the preparation of an EIS. As such, the lead agency (e.g., County, district or private entity) must make every reasonable effort to involve applicants, other agencies and the public in the process. Early consultations initiated by the lead agency can serve to narrow the issues of significance and identify areas of potential difficulty related to environmental issues. This will permit the EIS to focus on issues requiring in-depth analysis.

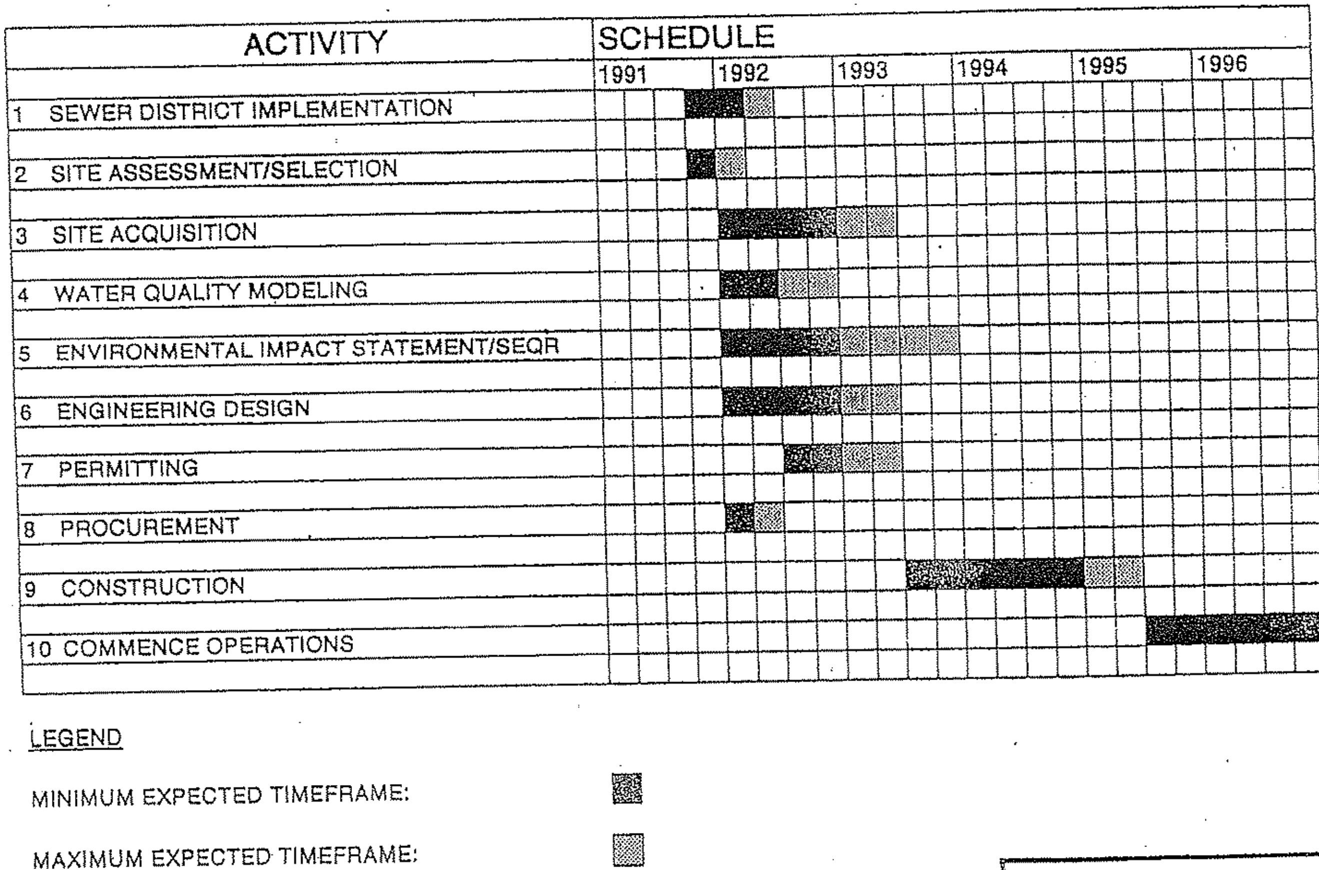
Following the preparation of a draft EIS, the lead agency needs to commence with public review. The public review period involves a public hearing in which substantive or significant environmental impacts, adequacy of mitigation measures proposed and the consideration of alternatives are discussed. Following the public comment period, a final EIS is issued. The lead agency must file a written finding which demonstrates that requirements of the SEQR Act have been met and that the planned action is one which minimizes adverse environmental impacts to the maximum extent practicable in consideration of social, economic and other essential considerations, and reasonable alternatives thereto.

16.6 Schedule

A proposed implementation schedule for the central County sewage treatment action described in the Recommended Plan is presented in Figure 16-1. This schedule takes into consideration the fact that serveral of the communities to be served by the central County sewage treatment action are under voluntary or obligatory moratoria for sewer connections. As shown, there are ten primary steps in implementing the project as follows:

- Sewer district implementation and interlocal agreements;
- Site assessment/selection;
- Site acquisition;
- Water quality modeling including a hydrodynamic analysis to determine tidal influence;
- Environmental impact statement (SEQR Act);
- Engineering and design;
- Permitting;
- Procurement;
- Construction; and
- Operations commencement.

FIGURE 16-I



HAZEN AND SAWYER, P.C. Engineers

ORANGE COUNTY, N.Y.
COMPREHENSIVE SEWERAGE STUDY

PROPOSED IMPLEMENTATION SCHED. FOR CENTRAL COUNTY SEWAGE TREATMENT ACTION

132546

It is recommended that the County proceed as soon as possible in initiating some of the above steps, particularly sewer district implementation and siting. The County also needs to reach a consensus on the involvement of the private sector in the central County sewage treatment action in order to begin the procurement process.

Overall, it is anticipated that the construction of facilities can begin in mid-1993 and take between 18 to 24 months to complete. This timeframe results in the commencement of project operation by mid-1995.

Consideration has been made as to possible sequencing of the central County sewage treatment action construction with the planned Orange County Water Authority project. The only parallel between the two is the pipeline route from Harriman to Goshen, mainly along abandoned railroad ROWs. While common trench construction is not acceptable, it may be possible to place both water and sewer pipes during the same construction sequence. At this stage, it is not possible to project the amount of cost savings that could occur from joint construction of both water and sewer pipelines.

16.7 Summary

The County needs to being examining several major implementation issues with regard to the central County sewage treatment action in the Recommended Plan.

Sewer district formation is a recommended first step in effecting the successful implementation of the project. In addition, the County needs to empower either the Department of Health or the Department of Public Works to regulate the operation of the project.

The County has indicated an interest in assessing the benefits attainable with various types of public-private partnerships for the project. To do so, it is suggested that key information be requested from interested private entities to gauge the benefits of such an approach.

Siting of the sewage treatment facility, pumping stations and pipelines associated with the central County sewage treatment action is a major implementation issue. It is recommended that the County begin to take steps to address this issue, such as siting study, as soon as possible.

The central County sewage treatment action will fall within the regulatory framework of the New York SEQR Act. As such, an EIS process will need to be undertaken to address planning, environmental, technical and social issues.

Ten primary steps in a proposed schedule to implement the central County sewage treatment action are identified. It is anticipated that project construction can begin in mid-1993 with the commencement of operations in mid-1995.

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GLOSSARY

GLOSSARY

ADV(H)	Abbreviation for high advanced (tertiary) treatment.
ADV(L)	Abbreviation for low advanced treatment.
BAT	Abbreviation for best available technology.
BPT	Abbreviation for best practicable technology.
BOD	Abbreviation for biochemical oxygen demand. A measure of the quantity of oxygen used during the biochemical oxidation of organic matter (biodegradable organics) in wastewater. A standard test used for assessing wastewater strength.
CBOD	Abbreviation for carbonaceous biochemical oxygen demand.
COD	Abbreviation for chemical oxygen demand. A quantitative measure of the amount of oxygen required for the chemical oxidation of carbonaceous material in wastewater.
DIP	Abbreviation for ductile iron pipe.
DMR	Abbreviation for discharge monitoring report.
EDU	Abbreviation for equivalent dwelling unit. For Orange County, an average equivalent dwelling unit is 2.87 people.
EIS	Abbreviation for environmental impact statement.
force main	A sewer that conveys flow with pressure, joined by a pumping station at one end and a point of gravity flow at the other.
gpcd	Abbreviation for gallons per capita per day.
gpd	Abbreviation for gallons per day.
I/I	Abbreviation for infiltration/inflow. Extraneous water that enters a sewer system through leaking pipes and manholes, and through cross-connections with storm sewers.
interceptor	A sewer that receives flow from a number of transverse sewers and conveys such flow by gravity to a point of discharge or treatment.
MA7Q10	Abbreviation for the minimum average, seven consecutive day flow with a recurrence interval of ten years. A measure of critical low flow in streams used in determining effluent discharge criteria for dissolved oxygen.
MA30Q10	Abbreviation for the minimum average, thirty consecutive day flow with a recurrence interval of ten years. A measure of critical low flow in streams used in determining effluent discharge criteria for ammonia.

mainstem	The primary branch of a river or stream.
MFR	Abbreviation for monthly facility report.
mgd	Abbreviation for millions of gallons per day.
mg/l	Abbreviation for milligrams per liter.
NBOD	Abbreviation for nitrogenous biochemical oxygen demand.
NPDES	Abbreviation for National Pollutant Discharge Elimination System.
NYSDEC	Abbreviation for New York State Department of Environmental Conservation.
PS	Abbreviation for pumping station.
RCP	Abbreviation for reinforced concrete pipe.
reach	A designated segment of a river or stream, usually having similar flow and water quality characteristics throughout the segment.
SEC	Abbreviation for secondary treatment.
SEQRA	Abbreviation for State Environmental Quality Review Act.
SIU	Abbreviation for significant or industrial user (of the sewerage system).
SPDES	Abbreviation for State Pollutant Discharge Elimination System.
SSES	Abbreviation for sewer system evaluation survey.
STP	Abbreviation for sewage treatment plant.
TOC	Abbreviation for total organic carbon.
TSS	Abbreviation for total suspended solids. The sum of suspended constituents in water or wastewater.
UOD	Abbreviation for ultimate oxygen demand. Commonly, the total quantity of oxygen required to satisfy completely the first-stage (carbonaceous) biochemical oxygen demand. More strictly, the total quantity of oxygen required to satisfy both the first-stage and second-stage (carbonaceous and nitrogenous) biochemical oxygen demands.
USEPA	Abbreviation for United Stated Environmental Protection Agency.
USGS	Abbreviation for United States Geological Survey.
WAC	Abbreviation for waste assimilation capacity. A quantitative analysis of instream conditions to assist in determining effluent discharge criteria to meet ambient instream water quality standards.

APPENDICES

APPENDIX A

COLDEN PARK STP

SERVICE AREA: Newburgh (T) 1011 persons

TREATMENT INFORMATION:

Design Flow:	0.100 MGD	Receiving Body:	Colden Park Stream
Average Flow:	0.190 MGD	Stream Class:	D
Peak Flow:	0.314 MGD	Sewer Type:	Separate
GPCD reported:	188	Built/Rehab:	1961

Type of Treatment: Imhoff tank; intermittant sand filter; seasonal chlorine disinfection

Sludge Treatment: No sludge treatment on site

Sludge Disposal: Scavenger

Industries Served: None

Industrial Flow: 0 %

Problems: Plant is overloaded.

COMMENTS:

- o This is an old facility.
- o The Colden Park STP maintains a satisfactory operation at present
- o The plant is expected to be incorporated into the City of Newburgh STP as part of the extension plan for the Crossroads Sewer District.

CORNWALL STP

SERVICE AREA: Cornwall (T) 5500 persons
Cornwall-on-Hudson (V) 2000 persons

TREATMENT INFORMATION:

Design Flow:	1.500 MGD	Receiving Body:	Hudson River
Average Flow:	1.250 MGD	Stream Class:	B
Peak Flow:	2.000 MGD	Sewer Type:	Separate
GPCD reported:	167	Built/Rehab:	1970

Type of Treatment: Primary clarifier; trickling filter; secondary clarifier; chlorine disinfection

Sludge Treatment: Anaerobic digestion; centrifuge dewatering

Sludge Disposal: Landfill

Industries Served: None

Industrial Flow: 0 %

Problems: 50 year old collection system causes I/I.

COMMENTS:

- o This is an old facility.
- o The Cornwall STP maintains a satisfactory operation at present.
- o Site area is extremely limiting to future expansion due to topography and proximity to Hudson River.
- o Outfall length is 30-40 feet into mouth of Moodna Creek

CRAGSTON STP

SERVICE AREA: Highland Falls 4200 persons

TREATMENT INFORMATION:

Design Flow:	1.350 MGD	Receiving Body:	Hudson River
Average Flow:	0.400 MGD	Stream Class:	B
Peak Flow:	0.750 MGD	Sewer Type:	Separate
GPCD reported:	95	Built/Rehab:	1988mx2^G^&f&atment:

Primary clarifier; rotating biological contactor; secondary clarifier

Type of Treatment: Primary clarifier, rotating biological contactors, secondary clarifiers, seasonal chlorine disinfection

Sludge Treatment: Anaerobic digestion, belt filter dewatering

Sludge Disposal: Landfill

Industries Served: None

Industrial Flow: 0 %

Problems: None reported

COMMENTS:

- o This facility is oversized.
- o The Cragston STP maintains a satisfactory operation at present.
- o Site has limited space available for potential future expansion.
- o Outfall length is about 300 feet into Hudson River.

FIRTHCLIFFE WTP

SERVICE AREA: Cornwall (T) 1500 persons

TREATMENT INFORMATION:

Design Flow:	0.120 MGD	Receiving Body:	Moodna Creek
Average Flow:	0.075 MGD	Stream Class:	C
Peak Flow:	0.085 MGD	Sewer Type:	Separate
GPCD reported:	50	Built/Rehab:	1966

Type of Treatment: Extended aeration; seasonal chlorine disinfection

Sludge Treatment: Aerobic digestion

Sludge Disposal: Scavenger

Industries Served: None

Industrial Flow: 0 %

Problems: None reported

COMMENTS:

- o This is an old facility.
- o The Firthcliffe STP maintains a satisfactory operation at present.
- o Site characteristics are unknown.
- o It is likely that an expansion of the facility will require some level of advanced treatment.

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FLORIDA STP

SERVICE AREA:	Florida		2450 persons

TREATMENT INFORMATION:

Design Flow:	0.300 MGD	Receiving Body:	Quaker Creek
Average Flow:	0.280 MGD	Stream Class:	D
Peak Flow:	0.550 MGD	Sewer Type:	Separate
GPCD reported:	102	Built/Rehab:	1974

Type of Treatment: Primary clarifier; trickling filter; secondary clarifier; chlorine disinfection

Sludge Treatment: Gravity sludge thickening; centrifuge sludge dewatering

Sludge Disposal: Landfill; scavenger

Industries Served: Zircar insulation

Industrial Flow: 5%

Problems: Study and I/I correction are on-going

COMMENTS:

- o The Florida STP has experienced problems meeting allowable permit limits for ammonia and ultimate oxygen demand. The plant presently operates under an order of consent from NYSDEC.
- o Expansion and upgrade plans for the plant are being prepared by the Village of Florida.
- o It is expected that the Quaker Creek will be reclassified from class D to class C, requiring a more strict ammonia limitation.
- o Site appears to have adequate space for potential future expansion of the plant.
- o Plant operation by Professional Services Group.

FORT MONTGOMERY STP

SERVICE AREA:	Highlands		1000 persons

TREATMENT INFORMATION:

Design Flow:	0.125 MGD	Receiving Body:	Hudson River
Average Flow:	0.050 MGD	Stream Class:	B
Peak Flow:	0.150 MGD	Sewer Type:	Separate
GPCD reported:	50	Built/Rehab:	1985

Type of Treatment: Extended aeration; chlorine disinfection

Sludge Treatment: Diffused air aerobic digestion; covered drying beds

Sludge Disposal: Landfill

Industries Served: None

Industrial Flow: 0 %

Problems: None reported

COMMENTS:

- o The Fort Montgomery STP maintains as satisfactory operation at present.
- o Site has limited space available for potential future expansion.

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GOSHEN (V) STP

SERVICE AREA: Goshen (V) — 5500 persons; Goshen (T) — 1800 persons

TREATMENT INFORMATION:

Design Flow:	1.500 MGD	Receiving Body:	Rio Grande Creek
Average Flow:	1.144 MGD	Stream Class:	D
Peak Flow:	2.490 MGD	Sewer Type:	Separate
GPCD reported:	157	Built/Rehab:	1969

Type of Treatment: Primary clarifier; trickling filter; secondary clarifier; chlorine disinfection; oxidation pond

Sludge Treatment: Anaerobic sludge digestion; open drying beds

Sludge Disposal: Fertilizer; on-site disposal

Industries Served: Sorrento Cheese 100,000 GPD

Industrial Flow: 10%

Problems:
- o Need more capacity due to I/I problems
- o High infiltration - collection system built in 1914

COMMENTS:
- o This is an old plant.
- o The Goshen STP maintains a satisfactory operation at present.
- o Site appears to have adequate space available for potential future expansion.

HAMLET STP

SERVICE AREA: Tuxedo (T) — 600 persons

TREATMENT INFORMATION:

Design Flow:	0.100 MGD	Receiving Body:	Ramapo River
Average Flow:	0.040 MGD	Stream Class:	A (T)
Peak Flow:	0.250 MGD	Sewer Type:	Separate
GPCD reported:	28	Built/Rehab:	1931; Upgraded 1988

Type of Treatment: Imhoff tank; trickling filter; final clarifier; chlorine disinfection

Sludge Treatment: No sludge treatment on site

Sludge Disposal: Scavenger

Industries Served: None

Industrial Flow: 0 %

Problems: Significant I/I - clay pipe with mortar joints

COMMENTS:
- o This is an old plant.
- o The Hamlet STP maintains a satisfactory operation at present.
- o Site has limited space available for potential future expansion.

HIDDEN VALLEY ESTATES STP

SERVICE AREA: Mount Hope 350 persons

TREATMENT INFORMATION:

Design Flow:	0.060 MGD	Receiving Body:	Shawangunk Kill Trib
Average Flow:	0.035 MGD	Stream Class:	B
Peak Flow:	0.060 MGD	Sewer Type:	Separate
GPCD reported:	100	Built/Rehab:	1969

Type of Treatment: Extended aeration; rapid sand filtration; chlorine disinfection

Sludge Treatment: Diffused air aerobic digestion

Sludge Disposal: Scavenger

Industries Served: None

Industrial Flow: 0%

Problems: None reported

COMMENTS:

- o This is an old plant.
- o The Hidden Valley Estates STP maintain a satisfactory operation at present.

KING TRACT STP

SERVICE AREA: Chester (T) 120 persons

TREATMENT INFORMATION:

Design Flow:	0.020 MGD	Receiving Body:	Seely Brook Trib
Average Flow:	0.007 MGD	Stream Class:	D
Peak Flow:	0.014 MGD	Sewer Type:	Separate
GPCD reported:	58	Built/Rehab:	1982

Type of Treatment: Septic tank overflow to intermittent sand filter; overland flow treatment on site

Sludge Treatment: No sludge treatment on site

Sludge Disposal: Scavenger

Industries Served: None

Industrial Flow: 0 %

Problems:
- o Grit creates problems with sludge
- o About 10% of flow is infiltration

COMMENTS:

- o The King Tract STP maintains a satisfactory operation at present.
- o Grit problems could be due to sand that can enter system with infiltration.
- o It is expected that this tributary to the Seely Brook will be reclassified from Class D to Class C, which may require an upgrade in the level of treatment provided by the plant.

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MAYBROOK STP

SERVICE AREA:	Maybrook		2007 persons

TREATMENT INFORMATION:

Design Flow:	0.400 MGD	Receiving Body:	Otter Kill Trib
Average Flow:	0.250 MGD	Stream Class:	D
Peak Flow:	0.375 MGD	Sewer Type:	Separate
GPCD reported:	125	Built/Rehab:	1971

Type of Treatment: Primary clarifier; trickling filter; secondary clarifer; no disinfection

Sludge Treatment: Anaerobic sludge digestion; open drying beds

Sludge Disposal: Landfill

Industries Served:

Industrial Flow: 3%

Problems: Study of I/I is needed.

COMMENTS:

- o This is an old plant.
- o The Maybrook STP has experienced problems meeting the allowable permit limit for 5-day biochemical oxygen demand.
- o Expansion and upgrade of the Maybrook STP is being considered by the Village.
- o It is expected that his Tributary to the Otter Kill will be reclassified from class D to class C, which may require an upgrade in the level of treatment required at the plant.
- o Site has limited space available for potential future expansion. An adjacent parcel may be suitable for additional treatment works.
- o Plant operation is by Mid-Hudson Pollution Control.

MIDDLETOWN STP

SERVICE AREA:	Middletown	25000 persons
	Wallkill	1500 persons

TREATMENT INFORMATION:

Design Flow:	6.000 MGD	Receiving Body:	Wallkill River
Average Flow:	5.000 MGD	Stream Class:	B
Peak Flow:	13.000 MGD	Sewer Type:	Separate
GPCD reported:	189	Built/Rehab:	1951; Expanded/Upgraded 1989

Type of Treatment: Primary clarifier; trickling filter; oxidation ditch; secondary clarifier; seasonal UV disinfection

Sludge Treatment: Anaerobic sludge digestion; belt filter press

Sludge Disposal: Now landfilled; proposed vitrification process

Industries Served: Light industrial flow

Industrial Flow: 7%

Problems: None reported

COMMENTS:

- o The Middletown STP has experienced problems meeting allowable permit limits for ammonia and ultimate oxygen demand.
- o Remedial action has been undertaken to elimate permit excursions.
- o Middletown is considering engaging in sludge stabilization process that will convert sludge for use as an aggregate product.
- o Site appears to have adequate space for potential future expansion of the plant.

MONTGOMERY (T) STP

SERVICE AREA: Montgomery (T) 600 persons

TREATMENT INFORMATION:

Design Flow:	0.060 MGD	Receiving Body:	Maybrook Reserv Trib
Average Flow:	0.032 MGD	Stream Class:	D
Peak Flow:	0.060 MGD	Sewer Type:	Separate
GPCD reported:	53	Built/Rehab:	1982

Type of Treatment: Septic tank overflow to intermittent sand filter; overland flow

Sludge Treatment: From septic tank by private hauler

Sludge Disposal: Scavenger

Industries Served: None

Industrial Flow: 0%

Problems: None reported

COMMENTS:

- o The Town of Montgomery STP has experienced problems meeting the allowable summer permit limit for ammonia.
- o The Town of Montgomery has completed a study which proposes an expanded sewer district and a new treatment plant located on the Wallkill River.
- o It is expected this Tributary to the Maybrook Reservoir will be reclassified from class D to class C, which may require an upgrade in the level of treatment provided by the plant.
- o Site appears to have adequate space for potential future expansion.

MONTGOMERY (V) STP

SERVICE AREA: Montgomery (V) 3000 persons

TREATMENT INFORMATION:

Design Flow:	0.500 MGD	Receiving Body:	Wallkill River
Average Flow:	0.300 MGD	Stream Class:	B
Peak Flow:	0.750 MGD	Sewer Type:	Separate
GPCD reported:	100	Built/Rehab:	1985

Type of Treatment: Oxidation ditch; final clarifier; seasonal chlorine disinfection

Sludge Treatment: Open drying beds

Sludge Disposal: Landfill

Industries Served: Allpack Boxes; Brescia Lumber; Nabisco

Industrial Flow: 3%

Problems: None reported

COMMENTS:

- o The Village of Montgomery STP maintains a satisfactory operation at present.
- o Correction of I/I is underway.
- o Site appears to have adequate space for potential future expansion of plant. An adjacent parcel may also be suitable for additional treatment works.

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NEWBURGH STP

SERVICE AREA:	Newburgh (C)		23500 persons
	Newburgh (T)		4200 persons

TREATMENT INFORMATION:

Design Flow:	7.000 MGD	Receiving Body:	Hudson River
Average Flow:	5.300 MGD	Stream Class:	B
Peak Flow:	15.000 MGD	Sewer Type:	Combined
GPCD reported:	191	Built/Rehab:	1970

Type of Treatment: Primary clarifier; conventional aeration; secondary clarifier; seasonal chlorine disinfection

Sludge Treatment: Belt filter press

Sludge Disposal: Landfill

Industries Served: None

Industrial Flow: 20%

Problems: None reported

COMMENTS:

- This is an old plant.
- The City of Newburgh STP maintains a satisfactory operation at present.
- The City of Newburgh is presently preparing for expansion of the plant to 9 MGD to incorporate an expanded sewer district from the Town of Newburgh.
- Site appears to have adequate space for future expansion of the plant.
- Plant operation is by Metcalf & Eddy Services.

NEW WINDSOR STP

SERVICE AREA:	New Windsor		20,000 persons
	Cornwall (T)		650 persons

TREATMENT INFORMATION:

Design Flow:	5.000 MGD	Receiving Body:	Moodna Creek
Average Flow:	3.250 MGD	Stream Class:	C
Peak Flow:	10.000 MGD	Sewer Type:	Separate
GPCD reported:	163	Built/Rehab:	1970

Type of Treatment: Primary clarifier; trickling filter; secondary clarifier; seasonal chlorine disinfection

Sludge Treatment: Gravity sludge thickening; centrifuge dewatering

Sludge Disposal: Landfill

Industries Served: Mt.1 cont; Alum can; Felt & Filter Dying; Lights; Meat Pkg; AFB r/o; Mobil Oil; Anh-Busch

Industrial Flow: 10%

Problems: High I/I

COMMENTS:

- The New Windsor STP maintains a satisfactory operation at present.
- The Town of New Windsor is presently preparing for expansion of the plant to approximately double the design capacity.
- Site has limited space available for future expansion of the plant. An adjacent parcel may be suitable for additional treatment works.
- Plant operation is by Camo Pollution Control.

HOB HILL STP

SERVICE AREA: Newburgh (T) 180 persons

TREATMENT INFORMATION:

Design Flow:	0.012 MGD	Receiving Body:	Hudson River Trib
Average Flow:	0.009 MGD	Stream Class:	D
Peak Flow:	0.012 MGD	Sewer Type:	Separate
GPCD reported:	50	Built/Rehab:	1985

Type of Treatment: Septic tank overflow to intermittent sand filter; overland flow

Sludge Treatment: No sludge treatment on site

Sludge Disposal: Scavanger

Industries Served: None

Industrial Flow: 0%

Problems: None reported

COMMENTS:

- o The Hob Hill STP maintains a satisfactory operation at present.
- o The plant is expected to be incorporated into the City of Newburgh STP as part of the extension plan for the Crossroads Sewer District.

ORANGE COUNTY HOME & INFIRMARY STP

SERVICE AREA: OC Home & Infirmary 1400 persons

TREATMENT INFORMATION:

Design Flow:	0.130 MGD	Receiving Body:	McKnight Ditch
Average Flow:	0.050 MGD	Stream Class:	D
Peak Flow:	0.070 MGD	Sewer Type:	Separate
GPCD reported:	36	Built/Rehab:	1929; Expanded 1988

Type of Treatment: Primary clarifier; RBC; trickling filter; secondary clarifier; tertiary filter

Sludge Treatment: Covered drying beds

Sludge Disposal: Scavenger

Industries Served: None

Industrial Flow: 0%

Problems: Must recirculate flow to keep trickling filter active.

COMMENTS:

- o The Orange County Home & Infirmary STP has experienced problems meeting the allowable permit limit for 5-day carbonaceous biochemical oxygen demand.
- o It is expected that the McKnight Ditch will be reclassified from class D to class C, which will require an upgrade in the level of treatment provided by the plant.
- o Site characteristics are unknown.

ORANGE COUNTY SEWER DISTRICT NO. 1 STP

SERVICE AREA: Blooming Gr - 3000, Chester (V) - 2300, Harriman, Kiryas Joel, Monroe (T&V) - 20800, Chester (T) - 2900, Woodbury - 5200

TREATMENT INFORMATION:

Design Flow:	4.000 MGD	Receiving Body:	Ramapo River
Average Flow:	3.700 MGD	Stream Class:	D
Peak Flow:	15.000 MGD	Sewer Type:	Separate
GPCD reported:	108	Built/Rehab:	1978

Type of Treatment: Primary clarifier; oxidation ditch; extended aeration; secondary clarifier; sand filter; UV disinfection

Sludge Treatment: Belt filter press

Sludge Disposal: Landfill

Industries Served: Chester Meat Packing 28,000 GPD; Metal plating-32,000 GPD; Nepara Chemical-24,000 GPD

Industrial Flow: 5%

Problems:

- Woodbury discharge prohibited, allowable discharge decreased from 6 to 4 MGD.
- Due to wet year, average flow close to capacity.
- Wet weather flow can exceed 15 MGD

COMMENTS:

- The Orange County District No. 1 STP has experienced problems meeting allowable permit limits for 5-day carbonaceors biochemical oxygen demand, ultimate oxygen demand, and ammonia.
- It is expected that the Ramapo River will be reclassified from class D to class C, which may require an upgrade in the level of treatment provided by the plant.
- Site has limited space available for potential future expansion. An adjacent parcel may be suitable for additional treatment works.

OTISVILLE FEDERAL CORRECTIONAL FACILITY STP

SERVICE AREA: Federal Jail — 1200 persons

TREATMENT INFORMATION:

Design Flow:	0.200 MGD	Receiving Body:	Basher Kill Sub-Trib
Average Flow:	0.185 MGD	Stream Class:	D
Peak Flow:	0.210 MGD	Sewer Type:	Separate
GPCD reported:	150	Built/Rehab:	

Type of Treatment: Secondary

Sludge Treatment: Digestion

Sludge Disposal: Landfill

Industries Served: None

Industrial Flow: 0%

Problems: None reported

COMMENTS:

- A task force has been created to evaluate the feasibility of creating a joint sewerage district serving the state and federal prisons, Village of Otisville, and Town of Mount Hope.
- It is expected that this subtributary of the Basher Kill will be reclassified from class D to class C, which may require an upgrade in the level of treatment provided at the plant.

OTISVILLE STATE CORRECTIONAL FACILITY STP

SERVICE AREA: State Jail 645 persons

TREATMENT INFORMATION:

Design Flow:	0.115 MGD	Receiving Body:	Shawangunk Kill Trib
Average Flow:	0.237 MGD	Stream Class:	B
Peak Flow:	1.000 MGD	Sewer Type:	Combined
GPCD reported:	367	Built/Rehab:	1962; Expanded 1989

Type of Treatment: Primary clarifier; trickling filter; secondary clarifier; sand filter; seasonal chlorine disinfection

Sludge Treatment: Digestion; sludge drying beds

Sludge Disposal: Landfill

Industries Served: None

Industrial Flow: 0%

Problems: Plant subject to very bad infiltration.

COMMENTS:

- o This plant is overloaded.
- o The Otisville Correctional Facility STP has experienced problems meeting allowable permit limits for 5-day carbonaceous biochemical oxygen demand.

PINE BUSH STP

SERVICE AREA: Crawford 2000 persons

TREATMENT INFORMATION:

Design Flow:	0.150 MGD	Receiving Body:	Shawangunk Kill
Average Flow:	0.120 MGD	Stream Class:	B
Peak Flow:	0.155 MGD	Sewer Type:	Separate
GPCD reported:	60	Built/Rehab:	1983

Type of Treatment: Septic tank overflow to oxidation ditch; final clarifier; seasonal UV disinfection

Sludge Treatment: Diffused air aerobic digestion

Sludge Disposal: Scavenger

Industries Served: None

Industrial Flow: 0%

Problems: None reported

COMMENTS:

- o The Pine Bush STP maintains a satisfactory operation at present.
- o Site appears to have adequate space available for potential future expansion.

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PORT JERVIS STP

SERVICE AREA: Port Jervis 8800 persons

TREATMENT INFORMATION:

Design Flow:	2.500 MGD	Receiving Body:	Neversink River
Average Flow:	1.300 MGD	Stream Class:	B
Peak Flow:	3.500 MGD	Sewer Type:	Separate
GPCD reported:	148	Built/Rehab:	1966

Type of Treatment: Imhoff tank; trickling filter; secondary clarifier; chlorine disinfection

Sludge Treatment: Anaerobic digestion; covered drying beds; centrifuge dewatering.

Sludge Disposal: Landfill

Industries Served: Cosmetics, metal working

Industrial Flow: 10%

Problems: None reported

COMMENTS:

- o This is an old plant.
- o Plant owned and operated by NYCDEP.
- o The Port Jervis STP maintains a satisfactory operation at present.
- o Site characteristics are unknown.

RIDGEBURY LAKE ACRES STP

SERVICE AREA: Wawayanda 200 persons

TREATMENT INFORMATION:

Design Flow:	0.030 MGD	Receiving Body:	Ridgebury Stream
Average Flow:	0.015 MGD	Stream Class:	D
Peak Flow:	0.030 MGD	Sewer Type:	Separate
GPCD reported:	75	Built/Rehab:	1973

Type of Treatment: Extended aeration package plant

Sludge Treatment: No sludge treatment on site

Sludge Disposal: Scavenger

Industries Served: None

Industrial Flow: 0%

Problems: Occasional infiltration during extended rain

COMMENTS:

- o This is an old plant.
- o The Ridgebury Lake Acres STP has experienced problems meeting permit limits for 5-day biochemical oxygen demand and ammonia.
- o Site characteristics are unknown.

ROBINN MEADOWS STP

SERVICE AREA: Wawayanda 300 persons

TREATMENT INFORMATION:

Design Flow:	0.040 MGD	Receiving Body:	Indigot Creek Trib
Average Flow:	0.023 MGD	Stream Class:	D
Peak Flow:	MGD	Sewer Type:	Separate
GPCD reported:	77	Built/Rehab:	

Type of Treatment: Extended aeration package plant

Sludge Treatment: No sludge treatment on site

Sludge Disposal: Scavenger

Industries Served: None

Industrial Flow: 0%

Problems: Occasional at rainy times

COMMENTS:

- o The Robinn Meadows STP maintains a satisfactory operation at present.
- o Site characteristics are unknown.

SUGAR LOAF STP

SERVICE AREA: Chester (T) 400 persons

TREATMENT INFORMATION:

Design Flow:	0.050 MGD	Receiving Body:	Ridgebury Stream
Average Flow:	0.020 MGD	Stream Class:	D
Peak Flow:	0.040 MGD	Sewer Type:	Separate
GPCD reported:	50	Built/Rehab:	1982

Type of Treatment: Subsurface sand filter; overland flow

Sludge Treatment: No sludge treatment on site

Sludge Disposal: Scavenger

Industries Served: None

Industrial Flow: 0%

Problems:
- o Grit creates problems with sludge
- o About 10% of flow is infiltration

COMMENTS:

- o The Sugar Loaf STP maintains a satisfactory operation at present.
- o It is expected that this Tributary to the Black Meadow Creek will be reclassified from class D to class C, which may require an upgrade in the level of treatment provided by the plant.
- o Site is limited in space available for potential future expansion of plant. An adjacent parcel may be suitable for additional treatment works.

TAPPAN HOMES STP

SERVICE AREA: Blooming Grove 628 persons

TREATMENT INFORMATION:

Design Flow:	0.064 MGD	Receiving Body:	Satterly Creek
Average Flow:	0.042 MGD	Stream Class:	D
Peak Flow:	MGD	Sewer Type:	Separate
GPCD reported:	67	Built/Rehab:	1973

Type of Treatment: Conventional aeration

Sludge Treatment: Aerobic digestion

Sludge Disposal: Scavenger

Industries Served: None

Industrial Flow: 0%

Problems:
- o Some surface inflow - rehabilitation underway

COMMENTS:
- o This is an old plant.
- o The Tappan Homes STP maintains a satisfactory operation at present.
- o It is expected that the Satterly Creek will be reclassified from class D to class C, which may require an upgrade in the level of treatment provided by the plant.
- o Site characteristics are unknown.

TARGET HILL STP

SERVICE AREA: West Point Military Academy 7000 persons

TREATMENT INFORMATION:

Design Flow:	2.060 MGD	Receiving Body:	Hudson River
Average Flow:	1.500 MGD	Stream Class:	B
Peak Flow:	4.000 MGD	Sewer Type:	Separate
GPCD reported:	214	Built/Rehab:	

Type of Treatment: Secondary

Sludge Treatment: Digestion

Sludge Disposal: Landfill

Industries Served: None

Industrial Flow: 0%

Problems: None reported

COMMENTS: None

TUXEDO PARK STP

SERVICE AREA: Tuxedo Park (V) 875 persons

TREATMENT INFORMATION:

Design Flow:	0.150 MGD	Receiving Body:	Ramapo Tributary
Average Flow:	0.060 MGD	Stream Class:	D
Peak Flow:	0.300 MGD	Sewer Type:	Separate
GPCD reported:	69	Built/Rehab:	1933; Expanded 1986

Type of Treatment: Imhoff tank; trickling filter; recirculating tank; chlorine disinfection

Sludge Treatment: Open drying beds

Sludge Disposal: On-site disposal

Industries Served: None

Industrial Flow: 0%

Problems: Have problem with I/I - old collection system

COMMENTS:

- o The Tuxedo Park STP maintains a satisfactory operation at present.
- o Plant was oversized in original design. Tricking filter recycle helps system treat well.
- o It is expected that this Tributary to the Ramapo River will be reclassified from class D to class C, requiring an upgrade in the level of treatment provided by the plant.
- o Site appears to have adequate space for potential future expansion of the plant.

VALLEY FORGE STP

SERVICE AREA: Woodbury 160 persons

TREATMENT INFORMATION:

Design Flow:	0.036 MGD	Receiving Body:	Woodbury Creek Trib
Average Flow:	0.021 MGD	Stream Class:	D
Peak Flow:	0.060 MGD	Sewer Type:	Separate
GPCD reported:	131	Built/Rehab:	1967

Type of Treatment: Extended aeration; intermittent sand filter; seasonal chlorine disinfection

Sludge Treatment: Two holding tanks

Sludge Disposal: Scavenger

Industries Served: None

Industrial Flow: 0%

Problems: Need inflow correction

COMMENTS:

- o This is an old plant.
- o The Valley Forge STP maintains a satisfactory operation at present.
- o Expansion of the facility is planned by developer in order to accomodate 82 new homes.
- o It is expected that the Tributary to the Woodbury Creek will be reclassified from class D to class C, which may require and upgrade in the level of treatment provided by the plant.
- o Site characteristics are unknown.

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WALDEN STP

SERVICE AREA: Walden 6200 persons

TREATMENT INFORMATION:

Design Flow:	1.100 MGD	Receiving Body:	Wallkill River
Average Flow:	0.700 MGD	Stream Class:	B
Peak Flow:	2.000 MGD	Sewer Type:	Separate
GPCD reported:	113	Built/Rehab:	1968; Expanded 1985

Type of Treatment: Primary clarifier; trickling filter; secondary clarifier; seasonal chlorine disinfection

Sludge Treatment: Anaerobic sludge digestion; open drying beds

Sludge Disposal: Landfill

Industries Served: Wires; computer broads; pipe fittings; bags; lights; printing

Industrial Flow: 10%

Problems: None reported

COMMENTS:

- The Walden STP maintains a satisfactory operation at present.
- Walden has a capital improvement program in place to remedy I/I.
- Site has limited space available for potential future expansion. An adjacent parcel may be suitable for additional treadment works.

WALLKILL STP

SERVICE AREA: Wallkill 12,000 persons

TREATMENT INFORMATION:

Design Flow:	4.000 MGD	Receiving Body:	Wallkill River
Average Flow:	2.000 MGD	Stream Class:	B
Peak Flow:	12.000 MGD	Sewer Type:	Separate
GPCD reported:	167	Built/Rehab:	1988

Type of Treatment: Extended air oxidation basins; final clarifiers; UV disinfection

Sludge Treatment: Thickening of WAS; belt filter press

Sludge Disposal: Landfill

Industries Served: Lead recyc, Alum cans; ceramic/mt1 bonding; wire; tape; A1SO4; printing

Industrial Flow: 30%

Problems: I/1 problem during large storm events

COMMENTS:

- Plant is expandable to 6.0 MGD.
- The Wallkill STP maintains a satisfactory operation at present.
- Site has limited space available for potential future expansion. An adjacent parcel may be suitable for additional treatment works.

WARWICK (T) STP

SERVICE AREA:	Warwick (T)		1500 persons

TREATMENT INFORMATION:

Design Flow:	0.390 MGD	Receiving Body:	Longhouse Creek
Average Flow:	0.240 MGD	Stream Class:	B
Peak Flow:	0.500 MGD	Sewer Type:	Separate
GPCD reported:	160	Built/Rehab:	1988

Type of Treatment: Oxidation ditch; final clarifier; ABW sand filter; UV disinfection

Sludge Treatment: Anaerobic digestion; dissolved air floation; belt filter press

Sludge Disposal: Landfill

Industries Served: None

Industrial Flow: 0%

Problems:
- o Strict ammonia limitation (2.0 mg/l summer; 6.0 mg/l winter)
- o High I/I due to 30 year old collection system

COMMENTS:
- o The Town of Warwick STP maintains a satisfactory operation at present, although some problems meeting the winter permit limit for ammonia have been experienced.
- o Plant is expandable to 1.5 MGD.
- o The site appears to have adequate space available for potential future expansion of plant. An adjacent parcel may also be suitable for additional treatment works.
- o Plant operation is by Kesco.

WARWICK (V) STP

SERVICE AREA:	Warwick (V)		4,320 persons

TREATMENT INFORMATION:

Design Flow:	0.500 MGD	Receiving Body:	Wawayanda Creek
Average Flow:	0.640 MGD	Stream Class:	C (T)
Peak Flow:	1.000 MGD	Sewer Type:	Separate
GPCD reported:	148	Built/Rehab:	1973

Type of Treatment: Primary clarifer; trickling filter; secondary clarifier; seasonal chlorine disinfection.

Sludge Treatment: Anaerobic sludge digestion; open drying beds; belt filter press

Sludge Disposal: Landfill

Industries Served: Paper process - 20,000 GPD/mo.

Industrial Flow: 3%

Problems: Significant I/I - corrective action being taken.

COMMENTS:
- o This is an old plant.
- o The plant is overloaded.
- o The Village of Warwick STP has experienced problems meeting the permit limit for 5-day biochemical oxygen demand.
- o The facility is operating under a consent order from DEC and plans for expansion and upgrade are now being prepared by the Village.
- o Site appears to have adequate space available for potential future expansion of plant. An adjacent parcel may also be suitable for additional treatment works.
- o Plant operation is by Camo Pollution Control.

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WASHINGTONVILLE STP

SERVICE AREA: Washingtonville 3800 persons

TREATMENT INFORMATION:

Design Flow:	0.400 MGD	Receiving Body:	Moodna Creek
Average Flow:	0.330 MGD	Stream Class:	C
Peak Flow:	0.750 MGD	Sewer Type:	Separate
GPCD reported:	87	Built/Rehab:	1972

Type of Treatment: Primary clarifier; trickling filter; secondary clarifier; seasonal chlorine disinfection

Sludge Treatment: Anaerobic sludge digestion; open drying beds

Sludge Disposal: Landfill

Industries Served: Brotherhood Winery (107,200 GPD in 1989 but recently cut from system)

Industrial Flow: 0%

Problems: Significant I/I

COMMENTS:

- o The Washingtonville STP maintains a satisfactory operation at present, although some problems meeting the permit limit for 5-day biochemical oxygen demand have been experienced.
- o Plans for expansion and upgrade of the plant are presently being prepared by the Village of Washingtonville.
- o Site has limited space available for future expansion. An adjacent parcel may be suitable for additional treatment works.

WINTERGREEN STP

SERVICE AREA: Newburgh (T) 178 persons

TREATMENT INFORMATION:

Design Flow:	0.020 MGD	Receiving Body:	Quassaic Creek
Average Flow:	0.010 MGD	Stream Class:	D
Peak Flow:	0.014 MGD	Sewer Type:	Separate
GPCD reported:	56	Built/Rehab:	1940

Type of Treatment: Septic tank overflow to trickling filter; secondary clarifier; seasonal chlorine disinfection

Sludge Treatment: No sludge treatment on site

Sludge Disposal: Scavenger

Industries Served: None

Industrial Flow: 0%

Problems: None reported

COMMENTS:

- o This is an old plant.
- o The Colden Park STP maintains a satisfactory operation at present.
- o The plant is expected to be incorporated into the City of Newburgh STP as part of the extension plan for the crossroads sewer district.
- o It is expected that the Quassaic Creek will be reclassified from class D to class C, which may require an upgrade in the level of treatment provided by the plant.

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APPENDIX B

PROPOSED RECLASSIFICATION OF SURFACE WATERS
LOWER HUDSON RIVER DRAINAGE BASIN -- REGION 3
NEW FILE CALLED ACT\LHSOUTH SORTED FROM ACT\LOWHUD
NO PUBLIC PETITIONS ADDED YET FROM ACT\LOWHUD2

Section	Item #	Name	Class Now	Class Proposed	Water Index #	Municipality	County
855.4	139	Trib. of Sandburg Creek	B(T)	B(TS)	139-14-38-24	Fallsburgh(T)	Sullivan
855.4	133.1	Trib. of Silver Lake	B	B	P 907-4	Fallsburgh(T)	Sullivan
855.4	134	Trib. of Rondout Creek	C	B(TS)	139-14-39a: entire 0.4 mi.	Wawarsing(T)	Ulster
855.5	34.1	Subtrib. of Wallkill River	UNCLAS	C(TS)	139-13-17-1a	Gardiner(T)	Ulster
855.5	6	Tribs. of Swarte Kill	D	C	139-13-2-2, 3, 4, 5, 6, 8, 9 and all tribs. except P453b.	Esopus(T), New Paltz(T)	Ulster
855.5	9	Trib. of Wallkill River	D	C	139-13-3	Esopus(T)	Ulster
855.5	10	Trib. of Wallkill River	D	C	139-13-4 and all tribs.	Esopus(T)	Ulster
855.5	11	Trib. of Wallkill River	D	C	139-13-5 and all tribs.	Rosendale(T)	Ulster
855.5	13	Trib. of Wallkill River	D	C	139-13-7 and all tribs.	Rosendale(T)	Ulster
855.5	14	Trib. of Wallkill River	D	C	139-13-8a and all tribs.	New Paltz(T)	Ulster
855.5	15	Trib. of Wallkill River	D	C	139-13-9	Rosendale(T), New Paltz(T)	Ulster
855.5	16	Trib. of Wallkill River	D	C	139-13-9a	New Paltz(T)	Ulster
855.5	17	Trib. of Wallkill River	D	C	139-13-10 and all tribs. except trib. designated as item no. 16	New Paltz(T), Esopus(T)	Ulster
855.5	19	Unnamed pond	D	C	P457	New Paltz (T)	Ulster
855.5	20	Trib. of Wallkill River	D	C	139-13-11 and all tribs. below trib. designated as item no. 24, except portion of Kleine Kill designated as item no. 22.	New Paltz(T)	Ulster
855.5	22	Kleine Kill	[illegible]	[illegible]	139-13-11-4	New Paltz(T)	Ulster
855.5	24	Subtrib. of Wallkill River	D	C	139-13-11-6	New Paltz(T)	Ulster
855.5	25	Trib. of Wallkill River	D	[illegible]	139-13-12 and all tribs.	New Paltz(T), New Paltz(V)	Ulster
855.5	27	Trib. of Wallkill River	[illegible]	C	139-13-13a	New Paltz(T), New Paltz(V)	Ulster
855.5	28	Tric. of Wallkill River	[illegible]	[illegible]	139-13-15b and all tribs.	New Paltz(T), New Paltz(V)	Ulster
855.5	29	Trib. of Wallkill River	[illegible]	[illegible]	139-13-15c and all tribs.	New Paltz(T)	Ulster
855.5	30	Unnamed pond	[illegible]	C	P462a	Plattekill(T)	Ulster
855.5	32	Trib. of Wallkill River	[illegible]	[illegible]	139-13-16a	New Paltz(T)	Ulster
855.5	34	Trib. of Wallkill River	[illegible]	[illegible]	139-13-17 and all tribs.	Gardiner(T)	Ulster
855.5	35	Trib. of Wallkill River	D	C	139-13-17a	Gardiner(T)	Ulster
855.5	[illegible]	Trib. of Wallkill River	[illegible]	[illegible]	139-13-17[illegible] and all tribs.	Gardiner(T)	Ulster
855.5	[illegible]	Trib. of Wallkill River	[illegible]	[illegible]	139-13-17[illegible]	Gardiner(T)	Ulster
855.5	[illegible]	Trib. of Wallkill River	[illegible]	[illegible]	139-13-17[illegible]	Gardiner(T)	Ulster
855.5	[illegible]	Trib. of Wallkill River	[illegible]	[illegible]	139-13-17[illegible]	Gardiner(T)	Ulster
855.5	[illegible]	Trib. of Wallkill River	[illegible]	[illegible]	[illegible]	Gardiner(T)	Ulster
855.5	[illegible]	Trib. of Wallkill River	[illegible]	[illegible]	[illegible] portion from [illegible]	[illegible]	[illegible]
855.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] of trib. [illegible]	[illegible]	[illegible]

5.5	36	Trib. of Wallkill River	D	C	139-13-17d	Gardiner(T)	Ulster
5.5	37	Trib. of Wallkill River	D	C	139-13-17e	Gardiner(T)	Orange
5.5	38	Trib. of Wallkill River	D	C	139-13-18	Crawford(T)	Ulster
5.5	39	Trib. of Wallkill River	D	A	H 139-13-19: portion from I.v		
5.5	40						

PROPOSED RECLASSIFICATION OF SURFACE WATERS
LOWER HUDSON RIVER DRAINAGE BASIN -- REGION 3
NEW FILE CALLED ACTWLRSOUTH SORTED FROM ACTWLOWHUD
NO PUBLIC PETITIONS ADDED YET FROM ACTWLOWHUD2

Section	Item #	Name	Class Now	Class Proposed	Water Index #	Municipality	County
855.5	41.2	Shawangunk Kill	B	B(T)	H-139-13-19: From 0.5 mile upstream of trib. 9 to trib. 30.	Crawford(T), Wallkill(T), Mount Hope(T), Mamakating(T)	Orange, Sullivan
855.5	47	Trib. of Shawangunk Kill	B	B(T)	139-13-19-2 entire	Gardiner(T)	Ulster
855.5	55	Trib. of Shawangunk Kill	D	C	139-13-19-5a	Gardiner(T), Shawangunk(T)	Ulster
855.5	56	Trib. of Shawangunk Kill	D	C	139-13-19-6 and all tribs.	Shawangunk(T)	Ulster
855.5	57	Unnamed pond	D	C	P464	Shawangunk(T)	Ulster
855.5	60	Trib. of Shawangunk Kill	D	C	139-13-19-8a	Shawangunk(T)	Ulster
855.5	61	Unnamed pond	D	C	P465	Shawangunk(T)	Ulster
855.5	62.1	Pakanasink Creek	D	C	139-13-19-9: From trib. 1 to Branch Pakanasink Creek.	Crawford(T), Wallkill(T)	Orange
855.5	63	Pakanasink Creek	D	C	139-13-19-9-?	Wallkill(T)	Orange
855.5	64	Trib. of Pakanasink Creek	D	C	139-13-19-9-1 and tribs. except P465c designated as Item No. 65	Crawford(T), Wallkill(T)	Orange
855.5	66	Unnamed ponds	D	C	P465b and P465c	Crawford(T)	Orange
855.5	67	Trib. of Pakanasink Creek	D	C	139-13-19-9-8a	Wallkill(T), Crawford(T)	Orange
855.5	68	Branch Pakanasink Creek	D	C	139-13-19-9: From Pakanasink Creek to trib. 9.	Wallkill(T)	Orange
855.5	69	Branch Pakanasink Creek	C	C	139-13-19-9: From trib. 9 to source.	Wallkill(T)	Orange
855.5	70	Trib. of Branch Pakanasink Creek	D	C	139-13-19-9-?	Wallkill(T)	Orange
855.5	75	Trib. of Shawangunk Kill	D	C	139-13-19-14 and all tribs.	Crawford(T)	Orange
855.5	82	Unnamed pond	D	C	P474a	Wallkill(T)	Orange
855.5	98	Unnamed ponds	D	C	P497 and P498	Mount Hope(T)	Orange
855.5	100	Unnamed ponds	D	C	P501, P502	Mount Hope(T)	Orange
855.5	109	Tribs. of Wallkill River	D	C	139-13-20, 21, 21a, 21b, 21c, 22a, 23 and all tribs.	Gardiner(T), Shawangunk(T)	Ulster
855.5	109	Trib. of Wallkill River	D	C	139-13-22b	Shawangunk(T)	Ulster
855.5	109	Trib. of Wallkill River	D	C	139-13-20a	Gardiner(T)	Ulster
855.5	109	Trib of Wallkill River	D	Delete	139-13-22	Gardiner(T)	Ulster
855.5	110	Unnamed ponds	D	C	P529a, P529b, P529c, P529d	Gardiner(T)	Ulster
855.5	111	Unnamed pond	D	C	P529?	Shawangunk(T)	Ulster
855.5	114	Tribs. of Dwaar Kill	D	C	139-13-24-1, 4, 4a and all tribs.	Shawangunk(T), Montgomery(T), Crawford(T)	Ulster, Orange
855.5	115	Trib. of Dwaar Kill	D	C	139-13-24-? and all tribs. except trib. 1 and portion designated as Item No. 11?	Crawford(T)	Orange
855.5	1??	Subtrib. of Dwaar Kill	D		139-13-24-?-1	Crawford(T)	Orange

PROPOSED RECLASSIFICATION OF SURFACE WATERS
LOWER HUDSON RIVER DRAINAGE BASIN -- REGION 3
NEW FILE CALLED ACT\LHSOUTH SORTED FROM ACT\LOWHUD
NO PUBLIC PETITIONS ADDED YET FROM ACT\LOWHUD2

Section	Item #	Name	Class Now	Class Proposed	Water Index #	Municipality	County
855.5	117	Trib. of Dwaar Kill	[illegible]	[illegible]	139-13-24-5 (half mile stream section below trib. 2)	Crawford	Orange
855.5	118	Unnamed pond	B	C	P531a	Crawford	Orange
855.5	119	Tribs. of Dwaar Kill	[illegible]	C	139-13-24-6, 9a, 10, 11 and all tribs.	Crawford	Orange
855.5	120	Trib. of Dwaar Kill	B	C	139-13-24-11a	Crawford	Orange
855.5	122	Unnamed pond	B	C	[illegible]	Wallkill	Orange
855.5	125	Trib. of Wallkill River	D	C	139-13-25	Shawangunk	Ulster
855.5	125	Trib. of Wallkill River	B	B	139-13-26	Shawangunk	Ulster
855.5	126	Trib. of Wallkill River	D	C	139-13-28 and all tribs.	Shawangunk	Ulster
855.5	130	Latterette Pond	C	C	P542	Shawangunk	Ulster
855.5	131	Unnamed Pond	D	C	P542a	Shawangunk	Ulster
855.5	132	Tribs. of Wallkill River	D	C	139-13-29, 30, 32, 34 and all tribs.	Shawangunk	Ulster
855.5	133	Trib. of Wallkill River	B	C	139-13-31: From mouth to P544	Montgomery	Orange
855.5	135	Sorcer's Ice House Pond	[illegible]	C	P544	Montgomery	Orange
855.5	140	[illegible] Brook	[illegible]	C	139-13-33: From mouth to overflow of Walden STP pumping station.	Montgomery	Orange
855.5	146	Tribs. of Wallkill River	D	C	139-13-34-36-and 36a and all tribs.	Shawangunk	Ulster
855.5	147	Trib. of Wallkill River	D	C	139-13-37 except P554.	Montgomery	Orange
855.5	148	Subtrib. of Wallkill River	D	C	139-13-37-1	Walden	Orange
855.5	149	Unnamed pond	D	C	P554	Montgomery	Orange
855.5	150	Trib. of Wallkill River	B	C	139-13-37a	Montgomery	Orange
855.5	151	Muddy Kill	D	C	139-13-38 and all tribs.	Montgomery	Orange
855.5	153	Tribs. of Wallkill River	[illegible]	C	139-13-39a, 39b, 39c, 40, 41a and all tribs.	Montgomery	Orange
855.5	154	Unnamed pond	[illegible]	[illegible]	P556a	Montgomery	Orange
855.5	155	Unnamed pond	[illegible]	[illegible]	P555	Montgomery	Orange
855.5	156	[illegible] Kill	[illegible]	[illegible]	139-13-41 and all tribs.	Montgomery	Orange
855.5	157	Unnamed pond	[illegible]	[illegible]	[illegible]	Hamptonburgh	Orange
855.5	158	Tribs. of Wallkill River	[illegible]	[illegible]	[illegible] and all tribs.	Montgomery	Orange
855.5	159	Unnamed pond	[illegible]	[illegible]	[illegible]	Wallkill	Orange
855.5	161	Unnamed pond	[illegible]	[illegible]		Montgomery	Orange
						Wallkill	Orange
						Crawford	Orange
						Wallkill	Orange
						Hamptonburgh	
						Wallkill	
						[illegible]	
						Wallkill	
						Hamptonburgh	
						[illegible]	
						[illegible]	

855.5 16[illegible] Unnamed pond D C P576a Wallkill(T)
855.5 167 Unnamed pond D C P576b Wallkill(T)
855.5 168 Unnamed pond

PROPOSED RECLASSIFICATION OF SURFACE WATERS
LOWER HUDSON RIVER DRAINAGE BASIN -- REGION 3
NEW FILE CALLED ACT\LHSOUT- SORTED FROM ACT\LOWHUD
NO PUBLIC PETITIONS ADDED YET FROM ACT\LOWHUD2

Section	Item #	Name	Class Now	Class Proposed	Water Index #	Municipality	County
855.5	169	Unnamed pond	D	C	P576c	Wallkill(T)	Orange
855.5	17[illegible]	Tribs. of Wallkill River	D	C	139-13-48, 49 and all tribs.	Wallkill(T)	Orange
855.5	17[illegible]	Unnamed pond	D	C	P577a and trib.	Wallkill(T)	Orange
855.5	17[illegible]	Unnamed pond	D	C	P577b	Wallkill(T)	Orange
855.5	17[illegible]	Unnamed pond	D	C	P581a	Wallkill(T)	Orange
855.5	180	Monhagen Brook	D	C	139-13-52 and tribs.: From mouth to trib. 2.	Wawayanda(T), Wallkill(T), Middletown(C)	Orange
855.5	181	Monhagen Brook	D	C	139-13-52, portion: From trib. 2 to west side of Mulberry St. in city of Middletown.	Wawayanda(T), Wallkill(T), Middletown(C)	Orange
855.5	182	Monhagen Brook	D	C	139-13-52 portion as described and all tribs. above trib. 5.: From west side of Mulberry St. in city of Middletown to source.	Wallkill(T), Middletown(C)	Orange
855.5	185	Unnamed pond	D	C	P714	Wawayanda(T)	Orange
855.5	186	Tribs. of Monhagen Brook	D	C	139-13-52-[illegible], [illegible]a	Wawayanda(T)	Orange
855.5	187	Trib. of Monhagen Brook	D	C	139-13-52-[illegible]	Middletown(C), Wallkill(T)	Orange
855.5	18[illegible]	Unnamed pond	D	C	P[illegible] and trib.	Middletown(C), Wallkill(T)	Orange
855.5	190	Unnamed pond	D	C	P6[illegible]a	Goshen(T)	Orange
855.5	191	Unnamed pond	D	C	P624a	Goshen(T)	Orange
855.5	192	Unnamed pond	D	C	P624b	Wawayanda(T)	Orange
855.5	193	Rio Grande	D	C	139-13-53 and tribs. up to trib. 1	Goshen(T)	Orange
855.5	194	Rio Grande	D	C	139-13-53: From trib. 1 to outlet of Goshen STP.	Goshen(T)	Orange
855.5	195	Trib. of Rio Grande	D	C	139-13-53-1 and tribs.	Goshen(T)	Orange
855.5	19[illegible]	Tribs. of Rio Grande	D	C	139-13-53-1a, 1c, 2 and tribs.	Goshen(T)	Orange
855.5	19[illegible]	Trib. of Rio Grande	D	C	139-13-53-1b	Goshen(T)	Orange
855.5	197	Rio Grande	D	C	139-13-53 and tribs. except P6[illegible]. : Above outlet of Goshen STP.	Goshen(T), Goshen(V)	Orange
855.5	199	Pond	D	C	P6[illegible]	Goshen(V)	Orange
855.5	200	Tribs. of Wallkill River	D	C	139-13-54b, 54c, 54[illegible], 54, 55, 56a, 56b, 56c, 57.	Wawayanda(T), Goshen(T)	Orange
855.5	20[illegible]	Pond	D	C	P6[illegible]	Wawayanda(T)	Orange
855.5	20[illegible]	Quaker Creek	D	C	139-13-59 and tribs. except P6[illegible]a.	Goshen(T), Warwick(T)	Orange
855.5	204	[illegible] Creek	D	C	P645-2 and tribs. except P653a	Warwick(T)	Orange
855.5	205	[illegible] Creek	D	C	P645-1 and all tribs.	Warwick(T)	Orange
855.5	20[illegible]	Pond	D	C	P64[illegible]	Warwick(T)	Orange

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855.5	211	Trib. of Wallkill River	[illegible]	C	139-13-60a and tribs.	Warwick	Orange
855.5	213	Tribs of Pochuck Creek	[illegible]	[illegible]	139-13-61-1, 2, 3, 5, 6, 7, 8 and all tribs.	Warwick	Orange
855.5	213	Trib. to Pochuck Creek	[illegible]	D	139-13-61-4	Warwick	Orange
855.5	217	Trib. of Wawayanda Creek	[illegible]	[illegible]	139-13-61-[illegible]-7	Warwick	Orange
855.5	219	Tribs. of Wawayanda Creek	[illegible]	C	139-13-61-[illegible]-10, 11, 12, 13, 14 and tribs.	Warwick	Orange
855.5	221	Trib. of Wawayanda Creek	[illegible]	C	139-13-61-[illegible]-17 and tribs.	Warwick	Orange
855.5	222	Ponds	D	C	P651a, P682	Warwick	Orange
855.5	239	Trib. of Rutgers Creek	D	C	139-13-62-1b	Wawayanda	Orange
855.5	239	Trib. of Rutgers Creek	[illegible]	D	139-13-62-1a	Wawayanda	Orange
855.5	239	Trib. of Rutgers Creek	D	D	139-13-62-2a	Wawayanda	Orange
855.5	240	Catlin Creek	D	C	139-13-62-2 and all tribs. except tribs. 1 and 4.	Wawayanda	Orange
855.5	241	Trib. of Catlin Creek	[illegible]	C	139-13-62-2-1	Wawayanda	Orange
855.5	242	Trib. of Catlin Creek	[illegible]	C	139-13-62-2-4	Wawayanda	Orange
855.5	243	Joe Creek	[illegible]	[illegible]	139-13-62-2-5 and tribs.	Wawayanda	Orange
855.5	244	Pond	[illegible]	C	P714	Wawayanda	Orange
855.5	245	Indigot Creek	[illegible]	C	139-13-62-3 and tribs., except trib. 11 and P720, P721, P721a, P721b, P721c.: From mouth to 0.5 mile below trib. 11.	Wawayanda, Minisink, Greenville	Orange
855.5	245.2	Indigot Creek	D	C	139-13-62-3: From trib. 13 to source.	Greenville	Orange
855.5	245.4	Subtrib. of Indigot Creek	D	D	139-13-62-3-11-1, 2 and all tribs.	Mount Hope	Orange
855.5	251	Ponds	[illegible]	C	P730a, P733	Mount Hope	Orange
855.5	252	Tribs. of Rutgers Creek	[illegible]	C	139-13-62-4,5,7,8,9,10,11,12,13,14,15,16,17,18,19 and all tribs. except ponds P735a, P736a, P741, P753a, P754, P756a, P75[illegible]	Greenville, Minisink, Unionville	Orange
855.5	[illegible]	Trib. of Rutgers Creek	[illegible]	Delete	139-13-62-[illegible] P43a	Minisink	Orange
855.5	[illegible]	Tribs. of Rutgers Creek	[illegible]	[illegible]	139-13-62-22a, 23, 23a, 24 and all tribs.	Greenville	Orange
[illegible]	[illegible]	Tribs. to Wallkill River	[illegible]	[illegible]	139-13-[illegible], 64, 65, 65a, 65b, [illegible] and all tribs.	Minisink, Warwick	Orange
[illegible]	[illegible]	Subtrib. to Wallkill River	[illegible]	Delete	139-13-[illegible]	Minisink	Orange
[illegible]	[illegible]	[illegible] Creek	[illegible]	[illegible]	[illegible] portion: From Valentine Avenue, [illegible] to trib. 2a.	Orangetown	Rockland
[illegible]	[illegible]	Trib. [illegible] Creek	[illegible]	[illegible]	[illegible]	[illegible]	Rockland

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B61.4	131	Subtrib. of Esopus Creek	D	C	171-34-1 and trib., 2	Marbletown(T)	Ulster
B61.4	133	Trib. of Esopus Creek	D	C	171-36	Marbletown(T)	Ulster
B61.4	135	Spillway Channel	[illegible]	[illegible]	171-37 portion: Trib. 1 to Ashokan Reservoir.	Marbletown(T)	Ulster
B61.4	137	Tribs. of Esopus Creek	D	C	171-38, 39	Marbletown(T), Olive(T)	Ulster
B61.4	139	Subtribs. of Esopus Creek	D	C	171-40-1 and trib., 2, 3	Marbletown(T), Olive(T)	Ulster
B61.4	139	Subtrib. of Esopus Creek	D	C	--171-40-4	Olive(T)	Ulster
B61.4	141	Trib. of Esopus Creek	D	C	171-41 portion: Trib. 1 to source.	Olive(T)	Ulster
B61.4	144	Trib. of Mink Hollow Brook	A(T)	A(TS)	171-43-16	Woodstock(T), Hunter(T)	Ulster, Greene
B62.6	1	Popolopen Creek or Hellhole Brook	D	C	H 61 portion: From mouth to P 184e outlet.	Highlands(T)	Orange
B62.6	10	Queensboro Brook	D	C	H-61-3 portion: From mouth to P 184j outlet.	Highlands(T)	Orange
B62.6	21	Unnamed pond	D	C	H 61-5-P 134b	Highlands(T)	Orange
B62.6	27	Unnamed pond	D	C	H 61-P 188-1-P 189-2-P 190-P 191a	Woodbury(T)	Orange
B62.6	29	Unnamed ponds	[illegible]	[illegible]	H 61-P 188-1-P 189c and P 188c	Highlands(T)	Orange
B62.6	32	Unnamed pond	[illegible]	[illegible]	H 61-P 188-1-P 191-3-P 191a	Cornwall(T)	Orange
B62.6	33	Trib. of Hudson River	[illegible]	[illegible]	H 62	Phillipstown(T)	Putnam
B62.6	35	Subtrib of Hudson River, unnamed ponds.	[illegible]	[illegible]	[illegible] including P 195 and trib. 1	Highlands(T)	Orange
B62.6	37	Trib. of Hudson River and unnamed ponds.	D	C	[illegible] 63b including P 196	Highlands(T)	Orange
B62.6	38	Tribs. to Hudson River	[illegible]	C	H 64, 66	Phillipstown(T)	Putnam
B62.6	40	Trib. of Hudson River	D	C	H 67 portion and trib. 1: From inlet of P 197 to source.	Highlands(T)	Orange
B62.6	42	Subtribs. of Hudson River	[illegible]	C	H 67-2a, 2b, 2c, 2d	Highlands(T)	Orange
B62.6	44	Tribs. of Hudson River	[illegible]	C	H 69, [illegible] and tribs	Phillipstown(T)	Putnam
B62.6	62	Sawmill Brook(Crowsnest Brook)	D	C	H 91 and tribs.	Highlands(T)	Orange
B62.6	63	Trib. of Hudson River	D	C	H 92a	Highlands(T)	Orange
B62.6	64	Foundry Brook	[illegible]	[illegible]	H 93 portion: From mouth to 0.[illegible] mile upstream.	Cold Spring(V)	Putnam
B62.6	67	Tribs. of Hudson River	[illegible]	[illegible]	H 94 and tribs.	Phillipstown(T), Cornwall(T)	Putnam, Orange
B62.6	69	Tribs. of Hudson River, unnamed ponds.	[illegible]	[illegible]	H [illegible], 86a, 87 and tribs.	Phillipstown(T), Fishkill(T), Cornwall(T)	Putnam, Dutchess, Orange
[illegible]	[illegible]	Tribs. of Hudson River	[illegible]	[illegible]	[illegible]	Cornwall(T)	Orange
[illegible]	74	Subtrib. of Hudson River	[illegible]	[illegible]	[illegible] P 228a, 2	Cornwall(T)	Orange
[illegible]	74	Subtribs. of Hudson River	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Cornwall(T)

862.6 | Trib. of Hudson River
862.6 | Subtrib. of Hudson River

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NEW FILE [illegible] SORTED [illegible]

NO PUBLIC [illegible]

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862.6	78	Trib. of Moodna Creek	D	C	H 89-1: From mouth to outlet of P 223a.	New Windsor(T)	Orange
862.6	80	Subtribs. of Moodna Creek, unnamed pond	D	C	H 89-1-P 223a-1 including trib. 1 and P 223b	New Windsor(T)	Orange
862.6	81	Subtrib. of Moodna Creek	D	C	H 89-1-P 223a-2 portion: From mouth to outlet of P 223c.	New Windsor(T)	Orange
862.6	83	Subtrib. of Moodna Creek	D	C	H 89-1-P 223a-2 portion including trib. 1: From P 223c inlet to source.	New Windsor(T)	Orange
862.6	84	Silver Stream, unnamed pond	D	C	H 89-2 including P 224	New Windsor(T)	Orange
862.6	88.1	Trib. to Silver Stream Reservoir	UNCLAS	C	P226a-1	New Windsor(T)	Orange
862.6	91	Unnamed pond	D	C	P 225-1-3-P 226c	New Windsor(T)	Orange
862.6	94	Trib. and subtribs. of Moodna Creek, unnamed pond.	D	C	H 89-3 including tribs., P 226i, P 226n, P 226t.	New Windsor(T), Cornwall(T)	Orange
862.6	96	Tribs. of Moodna Creek, unnamed pond.	D	C	H 89-4a, 5, 6 and P 226p	Cornwall(T)	Orange
862.6	98	Woodbury Creek	D	C	H 89-7 portion: From trib. 7 to outlet of P 228.	Woodbury(T)	Orange
862.6	99	Tribs. and subtribs. of Woodbury Creek	D	C	H 89-7-1a, 1	Cornwall(T), Blooming Grove(T)	Orange
862.6	95	Trib and subtribs of Woodbury Creek	D	C	H-89-7-1a-P 226q and 7-1b, 7-1b-1	Cornwall(T)	Orange
862.6	101	Trib. of Woodbury Creek	D	C	H 89-7-3a	Woodbury(T)	Orange
862.6	102	Mineral Spring Brook	D	C(T)	H-89-7-4: From trib. 1a to outlet of P228.	Cornwall(T), Woodbury(T)	Orange
862.6	104	Tribs. of Mineral Spring Brook, unnamed pond.	D	C	H 89-7-4-1b to including P 227c 1	Woodbury(T)	Orange
862.6	106	Subtrib. of Mineral Spring Brook and unnamed ponds	D	C	H 89-7-4-1-P 227a 2 and P 231h	Woodbury(T)	Orange
862.6	107	Trib of Mineral Spring Brook	D	Delete	H-89-7-4-1a	Cornwall(T)	Orange
862.6	109	Trib. of Woodbury Creek	D	C	H 89-7-5	Woodbury(T)	Orange
862.6	111	Trib. of Woodbury Creek	C(T)	C(TS)	H-89-7-6: From mouth to P229a.	Woodbury(T)	Orange
862.6	112	Trib. of Woodbury Creek	D	C	H 89-7-6 portion and trib. 1: From 1.5 miles upstream to P 229a outlet.	Woodbury(T)	Orange
862.6	115	Trib. of Earl's Pond	D	C	H 89-7-6-P 229a-1	Woodbury(T)	Orange
862.6	117	Tribs. and subtrib. of Earl's Pond	D	C	H 89-7-6-P 229a-2 and trib.	Woodbury(T)	Orange
862.6	118	Spring Lake(P 229e), unnamed ponds.	D	C	H 89-7-P 229e, P 229f, P 229g.	Woodbury(T)	Orange
862.6	120	Trib. of Woodbury Creek	D	C	H 89-7-7 portion: From 1.5 miles upstream to source.	Woodbury(T)	Orange

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862.6	121	Subtrib. of Woodbury Creek	[illegible]	C	H 89-7-7-2: From mouth to P 231 outlet.	Woodbury(T)	Orange
862.6	123	Hillside Lake	UNCLAS	[illegible]	P 231b	Blooming Grove	Orange
862.6	123	Subtrib. of Woodbury Creek	[illegible]	C	H 89-7-7-4	Woodbury(T)	Orange
862.6	125	Tribs. of Woodbury Creek, Filers Lake(P 231d),pond	D	[illegible]	H 89-7-9 10 including P 231d, P 231a	Woodbury(T)	Orange
862.6	127	Trib. of Woodbury Creek, unnamed pond	[illegible]	[illegible]	H 89-7-11 and P 231_	Woodbury(T)	Orange
862.6	129	Tribs. of Woodbury Creek, unnamed pond	D	C	H 89-7-12 including P 231m, 13, 15	Woodbury, T	Orange
862.6	131	Unnamed ponds	[illegible]	[illegible]	H 89-7-8 [illegible] 232o, P 232p	Woodbury, T Blooming Grove T	Orange
862.6	132	Tribs. of Moodna Creek, Fab. Brook(trib. 9), ponds	[illegible]	[illegible]	H 89-9 and P 232a, P 232n, 10 and tribs., 11	Cornwall T, New Windsor T Cornwall	Orange Orange
862.6	132	Trib of Moodna Creek	[illegible]	Delete	H-89-9a.	Blooming Grove T	
862.6	134	Trib. and subtribs. of Moodna Creek, unnamed ponds	D	C	H 89-12 and 1 including P 233 and trib.	New Windsor T New Windsor T	Orange
862.6	136	Crest View Lake	UNCLAS	C	P 234c	New Windsor T	Orange
862.6	136	Tribs. and subtribs. of Ramsdell Lake, ponds.	[illegible]	[illegible]	H 89-12-P 234-1b and P 234b, 1c. 1 including tribs., P234l, P234n, P234m, P234_, P234n, P234o, P234p 1a inc. P234d, P234e, P234f.	Newburgh T, Cornwall T, Blooming Grove T	
862.6	137	Perry Brook and tribs.	[illegible]	C	H 89-15 and tribs. 1,2	Blooming Grove(T)	Orange
862.6	139	Tribs. of Perry Brook	D	C	H 89-15-2 and trib., 4	Blooming Grove(T)	Orange
862.6	140	Trib. and subtrib. of Moodna Creek, unnamed ponds.	D	C	H 89-16 including P 236b, P 236d, trib. 1, and P 236f.	Blooming Grove(T), New Windsor T	Orange
		Slatterly Creek and trib.	D	C	H 89-17 and trib. 1a	Blooming Grove(T)	Orange
862.6	141		D	C	H 89-17-2 and trib.	Blooming Grove(T)	Orange
862.6	143	Trib. and subtrib. of Slatterly Creek				Blooming Grove T	Orange
862.6	145	Trib. of Slatterly Creek	[illegible]	C	H 89-17-7	Blooming Grove T	Orange
862.6	147	Subtribs. of Slatterly Creek, unnamed pond.	[illegible]	[illegible]	H 89-17-7-2, 3, P 237e.	Blooming Grove T	Orange
862.6	149	Trib. of Slatterly Creek	[illegible]	[illegible]	H 89-17-4	Blooming Grove T	Orange
862.6	151	Subtribs. of Slatterly Creek	[illegible]	[illegible]	H 89-17-4-1, 2, 3	Blooming Grove T	Orange
862.6	153	Trib. of Slatterly Creek	[illegible]	[illegible]	H 89-17-5	Monroe T	Orange
862.6	155	Subtrib. of Slatterly Creek	[illegible]	[illegible]	H 89-17-5-P 239b-1	Blooming [illegible]	Orange
862.6	157	Tribs. of Moodna Creek unnamed ponds	[illegible]	[illegible]	H [illegible] 17a and P 239c, 19 and P 239_, P 239n, P 240	New Windsor Chester	Orange
862.6	159	[illegible] Brook	[illegible]	[illegible]	[illegible] portion: From trib. [illegible] to P 259 outlet.	Warwick [illegible]	Orange
862.6	161	[illegible] and subtribs. of [illegible] Creek, ponds	[illegible]	[illegible]	[illegible] and P 2__b, [illegible] and P [illegible]	[illegible]	Orange
862.6	162	Trib. and subtribs. of	[illegible]	C	[illegible] including trib. [illegible]	[illegible]	

862.6	163	Tribs. and subtribs. of Indiana Creek, ponds	D	[illegible]	H 89-19-[illegible] and P [illegible], 1b including trib. 1 and P 240b.	Hamptonburgh(T), Blooming Grove(T)	Orange
	1[illegible]	Trib. and subt[illegible]			H 89-19-[illegible]		

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			D	C	H 89-19-P 240d-P 240e	Blooming Grove(T)	Orange
862.6	163	Unnamed pond					
862.6	164	Tribs. and subtribs. of Indiana Creek, ponds.	D	C	H 89-19-1c and P240h 2 inc. tribs., and P240c, P245, P249a, P246, P247a P250a 4 inc. P250, P250b, P250c, P251 P254 7 & trib. 3	Blooming Grove(T), Goshen(T), Chester(T)	Orange
862.6	167	Tribs. of Seely Brook, unnamed ponds.	D	C	H 89-19-8 and P 254c 8a and P 254c 8b	Chester(T)	Orange
862.6	169	Tribs. and subtribs. of Seely Brook	D	C	H 89-19-9 10 including trib. 1	Chester(T), Monroe(T)	Orange
862.6	171	Walton Lake	A	A(T)	H-89-19-10-P 257	Monroe(T)	Orange
862.6	172	Trib. to Seely Brook	D	C	H 89-19-11	Chester(T)	Orange
862.6	175	Unnamed pond	D	C	H 89-19-P 258-1-P 258c	Chester(T)	Orange
862.6	178	Tribs. and subtribs. of Trout Brook, unnamed pond	D	C	H 89-19-P 258-1-2 and trib. 1, P 259, 3 and trib. 1	Chester(T), Monroe(T), Warwick(T)	Orange
862.6	181	Black Meadow Creek, unnamed ponds	D	C	H 89-20 portion including P222a, P 222b, P 222f.	Chester(T), Warwick(T)	Orange
862.6	182	Tribs. of Otter Kill	D	C	H 89-20-1 including P259c, P259e, P259f, P259g 1a including P260c, P260a 2 and P260b 3 inc. P261, and tribs. 1,2,3 & 4 & P261b	Hamptonburgh(T), New Windsor(T)	Orange
862.6	184	Tribs. of Otter Kill	D	C	H 89-20-5 portion: From 2.0 miles upstream to P 263a outlet.	Montgomery(T)	Orange
862.6	185	Subtribs. of Otter Kill, unnamed pond	D	C	H 89-20-5-1 and P 262 1a and P 261a P 266c P 263f P 263e	Hamptonburgh(T), Montgomery(T)	Orange
862.6	185	Subtrib. of Otter Kill	D	Delete	H-89-20-5-P 263g	Montgomery(T)	Orange
862.6	187	Beaverdam Brook	D	C	H 89-20-6 portion: From mouth to trib. 1.	Hamptonburgh(T)	Orange
862.6	189	Beaverdam Brook	D	C	H 89-20-6 portion: From 2.6 miles above mouth to source.	Montgomery(T)	Orange
862.6	190	Trib. and subtrib. of Beaverdam Brook, ponds.	D	C	H 89-20-6-1 including trib. 1 and P 263c P265	Hamptonburgh(T), Montgomery(T)	Orange
862.6	191	Tribs. and subtribs. of Otter Kill, unnamed ponds.	D	C	H89-20-P 268	Hamptonburgh(T), Goshen(T), Goshen(V)	Orange

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862.6	191	Subtrib of Otter Kill	D	Delete	H-89-20-17-1	Goshen(T)	Orange
862.6	192	Trib. and subtribs. of Otter Kill, unnamed pond.	D	C	H 89-20-17 portion including trib. 2 and P 303: From mouth to P 304b outlet.	Goshen(T)	Orange
862.6	194	Unnamed ponds	[illegible]	C	H 89-20-P 303b, P 303a	Goshen(T)	Orange
862.6	195	Tribs and subtribs. of Otter Kill, unnamed ponds.	D	C	H 89-20-19 & P307a 20 & [illegible], &P312(c,b), P312, P312a, P313, P 314, P314(a,b) P312d 21 & T & P315(b-f), P312e, P315, P316 22 & T & P315a, P320c	Goshen(T), Chester(T)	Orange
862.6	197	Tribs. of Black Meadow Brook, unnamed ponds.	D	C	H 89-20-23 and P 320, 24 including P 3[illegible], P 319, 24a, P 322, P 322a, P 322[illegible], P 322h, P 322c, P 322d.	Chester(T), Warwick(T)	Orange
862.6	198	Tribs. of Hudson River, Wades Brook(H 91)	D	C	H 89-90 91	Fishkill(T), New Windsor(T)	Dutchess, Orange
862.6	199	Gordons Brook	[illegible]	C	H 92 portion: From mouth to P 330 outlet	Fishkill(T)	Dutchess
862.6	203	Unnamed pond	[illegible]	[illegible]	H-P 330b	Fishkill(T)	Dutchess
862.6	205	Quassaic Creek	[illegible]	[illegible]	H 94 portion: From P 333a inlet to P 341a outlet.	Newburgh(T)	Orange
862.6	208	Quassaic Creek	[illegible]	[illegible]	H 94 portion: From P 344 inlet to source.	Newburgh(T), Plattekill(T)	Ulster
862.6	209	Trib. of Quassaic Creek, unnamed pond.	[illegible]	C	H 94-1 and P 332a	Newburgh(T), New Windsor(T)	Orange
862.6	211	Trib. of Quassaic Creek	[illegible]	C	H 94-3	Newburgh(T), New Windsor(T)	Orange
862.6	214	Subtrib of Quassaic Creek	[illegible]	Delete	H-94-3-1	New Windsor(T), Newburgh(T)	Orange
862.6	215	Gidneytown Brook and tribs., unnamed ponds	D	C	H 94-4 including 1a P [illegible] [illegible] and P [illegible] [illegible] and trib. [illegible] and tribs., P 336[illegible] [illegible] and tribs.	Newburgh(T), Plattekill(T), Marlborough(T)	Orange, Ulster
[illegible]	218	Trib. of Gidneytown Brook	[illegible]	Delete	[illegible]	Newburgh(T)	Orange
[illegible]	[illegible]	[illegible] of Quassaic Creek	[illegible]	[illegible]	[illegible] and trib.	Newburgh(T)	Orange
[illegible]	[illegible]	Trib. of Quassaic Creek	[illegible]	[illegible]	[illegible] portion: From mouth to [illegible] gate.	Newburgh(T)	Orange

862.6 [illegible] Trib. of Quassaic Creek [illegible] "diversion data"

[illegible]
[illegible]
NEW FILE CALLED [illegible] SORTED FROM [illegible]
[illegible] PUBLIC PETITIONS ADDED [illegible]

Section	Item #	Name	Class Now	Class Proposed	Water Index #	Municipality	County
862.6	[illegible]	Trib. of Quassaic Creek	UNCLAS	C	H-94-6a	Newburgh(T)	Orange
862.6	[illegible]	Tribs. of Orange Lake Outlet	D	C	H 94-6-1 and tribs., P 235d, 6a and trib., [illegible]	Newburgh(T)	Orange
862.6	229	Tribs. of Orange Lake, [illegible] Creek(trib. 1)	D	C	H 94-6-P 340-1a and tribs., 1b and tribs., 1 and tribs.	Newburgh(T), New Windsor(T), Plattekill(T)	Orange, Ulster
862.6	[illegible]	Tribs. of Quassaic Creek	D	[illegible]	H 94-6?, 6d, 6e	Newburgh(T)	Orange
862.6	231	Tribs of Quassaic Creek	D	Delete	H-94-6a, 6b	Newburgh(T)	Orange
862.6	[illegible]	Trib. and subtribs. of Quassaic Creek, ponds.	D	C	H 94-9 including 1a and P 344b, 1b and P 344c, 1c, P 344a; 1d and P 344e 1i and tribs.	Plattekill(T)	Ulster
862.6	[illegible]	Trib. and subtribs. of Quassaic Creek	D	C	H 94-13, 13a, 13b and trib., 16 and trib.	Plattekill(T)	Ulster
862.6	240	Fishkill Creek	C(T)	B	H-95-P 351a,P 356,P 357,P 359	Union Vale(T)	Dutchess
862.6	241	unnamed pond	D	C	H 95-P 345rr	Beacon(C)	Dutchess
862.6	242	[illegible] Brook	D	[illegible]	H 95-2 portion: From mouth to P 345q outlet.	Fishkill(T), Beacon(C)	Dutchess
862.6	244	Tribs. and subtribs. of Fishkill Creek, ponds.	D	C	H 95-3a 4 including trib. and P 345qqq, P 345rrr	Fishkill(T)	Dutchess
862.6	[illegible]	Trib. of Fishkill Creek	UNCLAS	C	H-95-3b	Fishkill(T)	Dutchess
862.6	[illegible]	Tribs of Fishkill Creek	D	Delete	H-95-P 345r, P 345s	Fishkill(T)	Dutchess
862.6	245	Clove Creek	C(T)	C(TS)	H-95-5: From mouth to trib. 3a	Philipstown(T), Fishkill(T)	Putnam, Dutchess
862.6	246	Clove Creek	C(T)	C(TS)	H-95-5: From trib. 3a to trib. 4	Philipstown(T)	Putnam
862.6	247	Clove Creek	C(T)	C(TS)	H-95-5: From trib. 4 to outlet of P 345c	Philipstown(T)	Putnam
862.6	248	Clove Creek	D	C	H 95-5 portion: From P 345c inlet to source.	Phillipstown(T)	Putnam
862.6	248	Clove Creek	D	C(TS)	H-95-5: From inlet of P 345c to source	Philipstown(T)	Putnam
862.6	249	Subtrib. of Clove Creek	UNCLAS	C	H-95-5-1-a	Fishkill(T)	Dutchess
862.6	249	Trib. and subtrib. of Clove Creek	D	C	H 95-5-1 and trib. 1	Fishkill(T)	Dutchess
862.6	251	Trib. of Clove Creek	D	C	H 95-5-1a	Fishkill(T)	Dutchess
862.6	[illegible]	Trib. of Clove Creek	UNCLAS	C	H-95-5-1d and trib. 1	Fishkill(T)	Dutchess
862.6	[illegible]	Trib. and subtrib. of Clove Creek	D	C	H 95-5-1c and trib.	Fishkill(T)	Dutchess
862.6	254	Wall Hollow Creek	D	C	H 95-5-2 portion: From mouth to P 345j outlet.	Phillipstown(T)	Putnam
862.6	257	Unnamed pond	D	C	H 95-5-3-1a-P 345aa	Phillipstown(T)	Putnam
862.6	261	Tribs. of Trout Creek, unnamed ponds.	D	C	H 95-5-3a including P 345i, P 345ii, P 345pp, P 345oo	Phillipstown(T)	Putnam

[illegible]
[illegible]
NEW FILE CALLED [illegible] SORTED FROM [illegible]
[illegible]

Section	Item #	Name	Class Now	Class Proposed	Water Index #	Municipality	County
862.6	[illegible]	Trib. and subtrib. of Clove Valley Creek	D	C	H 95-23 and tribs.	Union Vale(T)	Dutchess
862.6	350	Trib. of Clove Valley Creek	C	C(TS)	H-95-25 and tribs.	Union Vale(T)	Dutchess
862.6	352	Trib. and subtrib. of Sweezy Creek, unnamed pond	D	C	H 95-26-1 and trib, P 309a	Union Vale(T)	Dutchess
862.6	354	Trib. of Clove valley Creek	D	C(T)	H-95-28	Union Vale(T)	Dutchess
862.6	354	Trib. of Clove Valley Creek	D	C(T)	H-95-29	Union Vale(T)	Dutchess
862.6	354	Subtribs. of Clove Valley Creek	UNCLAS	C	H-95-29-[illegible] and 29a-[illegible]		
862.6	354	Tribs. of Clove Valley Creek, unnamed ponds	D	C	H 95-27, P 348L, 28a, 29a and P 360a, 30a, 30	Union Vale(T)	Dutchess
862.6	355	Unnamed ponds	D	C	H-P 345tt, P 345ss	Beacon(C)	Dutchess
862.6	357	Unnamed pond	D	C	H-P 345fff	Fishkill(T)	Dutchess
862.6	358	Trib. to Hudson River, unnamed pond	D	C	H 96 and P 362a	Newburgh(T)	Orange
862.6	[illegible]	Trib. of Hudson River	UNCLAS	C	H-97a	Fishkill(T)	Dutchess
862.6	360	Trib. and subtribs. of Hudson River, unnamed ponds	D	C	H 97 including P 363a, tribs., P 363	Newburgh(T)	Orange
862.6	361	Subtrib. of Hudson River	UNCLAS	D	H-98-[illegible] and trib. [illegible]	Fishkill(T)	Dutchess
862.6	362	Unnamed pond	D	C	H 98-P 345aaa	Fishkill(T)	Dutchess
862.6	364	Tribs. and subtribs. of Hudson River, unnamed ponds	D	C	H 99 and trib., 100 including P 364a, trib. 1, P 364	Wappinger(T), Fishkill(T)	Dutchess
862.6	[illegible]	Lattintown Creek, unnamed pond	D	C	H 103 portion including P 414: From trib. 7 to source	Marlborough(T)	Ulster
862.6	[illegible]	Trib. of Lattintown Creek	D	C	H 103-1 portion: From mouth to P 364g outlet.	Marlborough(T)	Ulster
862.6	[illegible]	Trib. of Lattintown Creek	D	C	H 103-1 portion: From trib. [illegible] to source.	Newburgh(T)	Orange
862.6	[illegible]	Subtribs. of Lattintown Creek, unnamed ponds.	D	C	H 103-1-1a, [illegible] including tribs., P 363c, P363d, [illegible] and tribs., 3a, P 412, P 412a	Marlborough(T), Newburgh(T)	Ulster, Orange
862.6	375	Tribs. of Lattintown Creek	D	C	H 103-2, 4	Marlborough(T)	Ulster
862.6	377	Tribs. of Lattintown Creek	D	C	H 103-4a, 5	Marlborough(T)	Ulster
862.6	378	Trib. of Lattintown Creek	D	C	H 103-6 portion: From mouth to outlet of P 413.	Marlborough(T)	Ulster
862.6	380	Subtribs. of Lattintown Creek	D	C	H 103-6-1, 2 and tribs.	Marlborough(T)	Ulster
862.6	382	Tribs. and subtrib. of Lattintown Creek, pond.	D	C	H 103-7, P 414a, 7a, 7b and trib.	Marlborough(T)	Ulster
862.6	383	Trib. of Hudson River, unnamed pond	D	C	H 104 and P 364f	Marlborough(T)	Ulster
862.6	385	Casper Creek, unnamed ponds.	D	C	H 105 portion including P 415a, P 415e: From Cobalt Lake(P 415c) inlet to source.	Poughkeepsie(T), Poughkeepsie(C)	Dutchess

RECLASSIFICATION OF SURFACE WATERS
PASSAIC-NEWARK DRAINAGE BASIN

Section	Item #	Name	Class Now	Class Proposed	Water Index #	Municipality	County
860.4	2	Subtribs of Mahwah River	D	C	NJ-10, NJ-10a, portion from 100 feet above state line to source, inc. P 995c & P 995d	Ramapo(T)	Rockland
860.4	5	Tribs of Mahwah River	D	C	NJ-11-1a, 1 inc. P 996 & P 997	Ramapo(T), Suffern(V)	Rockland
860.4	8	Subtribs of Mahwah River	D	C	NJ-11-2-1, 2, 3	Ramapo(T)	Rockland
860.4	11	Trib of Mahwah River	D	C	NJ-11-4a inc. P 998a	Ramapo(T)	Rockland
860.4	19	Ramapo River	D	C	NJ-12, portion from trib. 23 to outlet of P 1016m	Woodbury(T), Harriman(V)	Orange
860.4	21	Ramapo River	D	C	NJ-12, portion from outlet of P 1016m to outlet of P 1021 (Round Lake)	Monroe(T), Monroe(V)	Orange
860.4	22	Trib of Ramapo River	D	C	NJ-12-1	Ramapo(T), Hillburn(V)	Rockland
860.4	27	Trib of Ramapo River	D	C	NJ-12-D1	Ramapo(T)	Rockland
860.4	50	Trib of Ramapo River	D	C	NJ-12-7 & tribs.	Ramapo(T), Tuxedo(T)	Rockland, Orange
860.4	52	Tribs of Ramapo River	D	C	NJ-12-9, 9a & tribs.	Ramapo(T), Tuxedo(T)	Rockland, Orange
860.4	53	Trib of Ramapo River	D	C	NJ-12-10 & trib. 1	Tuxedo(T)	Orange
860.4	56	Black Ash Creek, Upper Deep Hollow Brook	D	C	NJ-12-12 & tribs.	Tuxedo(T)	Orange
860.4	57	Trib of Ramapo River	D	C	NJ-12-13	Tuxedo(T)	Orange
860.4	59	Trib of Ramapo River	D	C	NJ-12-15	Tuxedo(T)	Orange
860.4	61	Warwick Brook	D	C	NJ-12-15-P 1005-1 & tribs.	Tuxedo(T)	Orange
860.4	65	Indian Kill Brook	D	C	NJ-12-16, portion from 1.2 miles above mouth to source, & tribs. inc. P 1007a	Tuxedo(T), Monroe(T)	Orange
860.4	65	Indian Kill Reservoir	D	A	P 1007a	Tuxedo(T)	Orange
860.4	68	Subtrib of Ramapo River	D	C	NJ-12-17-1, 1a, 1b, 2 & trib., 3 inc. P 1007d	Tuxedo(T)	Orange
860.4	70	Pond	D	C	NJ-12-17-P 1008-P 1009a	Tuxedo(T), Monroe(T)	Orange
860.4	73	Pond	D	C	NJ-12-17-P 1008-3-P 1010e	Monroe(T)	Orange
860.4	78	Trib of Ramapo River	D	D	NJ-12-19 & trib.	Tuxedo(T)	Orange
860.4	79	Trib of Ramapo River	D	C	NJ-12-20, portion from mouth to 0.9 mile above mouth.	Tuxedo(T)	Orange
860.4	83	Trib of Echo Lake	D	C	NJ-12-20-P 1014-1, portion from trib. 3 to outlet of P 1016 (Forest Lake)	Woodbury(T)	Orange
860.4	86	Subtribs of Echo Lake	D	C	NJ-12-20-P 1014-1-1a, 1b, 2 & trib., 3 & tribs. inc. P 1014c & P 1016b	Tuxedo(T), Woodbury(T)	Orange
860.4	90	Island Pond	C	C(T)	NJ-12-20-P 1014-3-P 1016a & tribs.	Tuxedo(T)	Orange
860.4	91	Trib of Ramapo River	D	D	NJ-12-21 & tribs.	Tuxedo(T)	Orange
860.4	91	Trib of Ramapo River	D	D	NJ-12-22	Tuxedo(T)	Orange
860.4	94	Subtrib of Ramapo River	D	C	NJ-12-23-1 & trib. inc. P 1016f, P 1016g, P 1016h & P 1016k	Monroe(T)	Orange

RECLASSIFICATION OF SURFACE WATERS
PASSAIC-NEWARK DRAINAGE BASIN

Section	Item #	Name	Class Now	Class Proposed	Water Index #	Municipality	County
860.4	95	Tribs of Ramapo River	D	C	NJ-12-23a,23b,24 & trib.,24b,24c,25 & tribs. inc. P10161,P1017a,P 1017b,P 1017c,P 1017d,P 1017e,P 1017f,P 1017g,P 1017h	Blooming Grove(T), Woodbury(T), Monroe(T), Harriman(V), Monroe(V)	Orange
860.4	95	Subtrib of Ramapo River	UNCLAS	C	NJ-12-23a-3	Woodbury(T)	Orange
860.4	95	Tribs. of Ramapo River	D	Delete	NJ-12-24a, P1016o	Blooming Grove(T), Woodbury(T), Monroe(T)	Orange
860.4	96	Trib of Ramapo River	D	C	NJ-12-26, portion from mouth to 0.6 mile above mouth	Monroe(T)	Orange
860.4	98	Trib of Ramapo River	D	C	NJ-12-27 & tribs. inc. P 1018a, P 1018b, P 1018c	Monroe(T), Monroe(V)	Orange
865.6	1	Trib. of Hackensack River	D	Delete	NJ-1b	Orangetown(T)	Rockland
865.6	2	Trib	D	C	NJ-1a	Orangetown(T)	Rockland
865.6	3	Trib	D	C	NJ-1c & trib. 1	Orangetown(T)	Rockland
865.6	9	Trib of Hackensack River	D	C	NJ-1-1	Orangetown(T)	Rockland
865.6	12	Subtrib of Hackensack River	D	C	NJ-1-2-1, portion from trib. 1 to source, & trib. 1	Orangetown(T)	Rockland
865.6	14	Trib of Hackensack River	D	C	NJ-1-2a, portion from Convent Road to source	Orangetown(T)	Rockland
865.6	16	Trib of Hackensack River	D	C	NJ-1-3, portion from railroad to source	Orangetown(T)	Rockland
865.6	23	Nauraushaun Brook	D	C	NJ-1-4, portion from trib. 3a to trib. 4b	Clarkstown(T)	Rockland
865.6	29	Subtrib of Nauraushaun Brook	D	C	NJ-1-4-P 971-1	Clarkstown(T)	Rockland
865.6	31	Subtrib of Nauraushaun Brook	D	C	NJ-1-4-3a-1	Clarkstown(T)	Rockland
865.6	32	Tribs of Nauraushaun Brook	D	C	NJ-1-4-3b, 4a, 4b	Orangetown(T), Clarkstown(T)	Rockland
865.6	34	Trib of Nauraushaun Brook	D	C	NJ-1-4-5, portion from 0.6 mile above mouth to source	Clarkstown(T)	Rockland
865.6	35	Trib of Nauraushaun Brook	D	C	NJ-1-4-6	Clarkstown(T)	Rockland
865.6	38	Trib of Hackensack River	D	C	NJ-1-5, portion from Sickletown Road to source	Orangetown(T)	Rockland
865.6	44	Trib of Hackensack River	D	C	NJ-1-6, portion from 0.7 mile above mouth to source	Orangetown(T), Clarkstown(T)	Rockland
865.6	48	Trib of Hackensack River	D	C	NJ-1-7, portion from 0.6 mile above mouth to source	Orangetown(T)	Rockland
865.6	51	Trib of Hackensack River	D	C	NJ-1-7a, portion from 600 ft above mouth to source	Orangetown(T)	Rockland
865.6	53	Trib of Hackensack River	D	C	NJ-1-7b, portion from 1600 ft above mouth to source	Orangetown(T)	Rockland
865.6	55	Trib of Hackensack River	D	C	NJ-1-8, portion from 600 ft above mouth to source	Clarkstown(T)	Rockland
865.6	57	Trib of Hackensack River	D	C	NJ-1-9, portion from trib. 1 to source	Clarkstown(T)	Rockland

RECLASSIFICATION OF SURFACE WATERS
PASSAIC-NEWARK DRAINAGE BASIN

Section	Item #	Name	Class Now	Class Proposed	Water Index #	Municipality	County
865.6	193	Trib of Saddle River	D	C	NJ-7-4	Ramapo(T)	Rockland
865.6	195	West Branch Saddle River	D	C	NJ-8	Ramapo(T)	Rockland
865.6	196	Trib of West Branch Saddle River	D	C	NJ-8-1 & trib. P 995d, 2 & trib. P 993c, P 993, P 993b, P 993a, P 994	Ramapo(T)	Rockland
865.6	201	Ringwood River	D	C	NJ-13	Tuxedo(T), Warwick(T)	Orange
865.6	204	Subtrib of Ringwood River	D	C	NJ-13-1-P 1021f	Tuxedo(T)	Orange
865.6	205	Trib of Ringwood River	D	C	NJ-13-2, portion from mouth to Sterling Forest Lake outlet	Warwick(T)	Orange
865.6	212	Trib of Ringwood River	D	C	NJ-13-2a	Warwick(T)	Orange
865.6	216	Trib of Ringwood River	D	C	NJ-13-4 & trib. 2	Tuxedo(T), Warwick(T)	Orange
865.6	217	Subtribs of Ringwood River	D	C	NJ-13-4-P 1025a, P 1025b	Tuxedo(T), Warwick(T)	Orange
865.6	218	Trib	D	C	NJ-14 & trib. 1	Warwick(T)	Orange
865.6	219	Trib	D	C	NJ-15	Warwick(T)	Orange
865.6	221.1	Furnace Brook	UNCLAS	C(TS)	P 1026-4	Warwick(T)	Orange
865.6	222	Tribs of Greenwood Lake	D	C	P 1026-6 & trib. P 1026e, 6b, 6c, 7b, 8 & tribs. 1 & tribs. P 1026a, P 0126b, P 1026c, P 1026d	Warwick(T), Greenwood Lake(V)	Orange

APPENDIX C-1

EFFLUENT CHARACTERISTICS OF WASTEWATER TREATMENT PLANTS DISCHARGING TO SURFACE STREAMS IN THE **RAMAPO RIVER DRAINAGE BASIN** ORANGE COUNTY, NEW YORK

DATA SUMMARIZED FROM MONTHLY DISCHARGE REPORTS SUBMITTED UNDER THE N.Y.S.P.D.E.S. PROGRAM

FACILITY NAME: ORANGE COUNTY SEWER DISTRICT # 1
DRAINAGE BASIN: RAMAPO
PERMIT NUMBER: NY0027901
PERIOD MONITORED: 8/87 - 7/89

OUTFALL # 1 ACTIVE 6/1 - 10/31 ONLY
OUTFALL # 2 ACTIVE 11/1 - 5/31

PARAMETER	PERIOD	UNITS	PERMIT LIMITS	MONTHLY VALUES MAX	MIN	MEAN	PEAK DAY	# RECORDS	VIOLATIONS
FLOW	NOV-MAY	MGD	2	4.842	2.914	3.509		7	7
	JUN-OCT	"	2	4.424	2.774	3.254		10	10
CBOD5	NOV-MAY	mg/L	20	28.5	8.9	14.9		7	2
	JUN-OCT	"	5	36.4	4	14.9		10	9
CBOD5	NOV-MAY	LBS/DAY	334	1627	223	561.3		7	4
	JUN-OCT	"	83	1267	98	412.6		10	10
NH3	NOV-MAY	mg/L	7	22	<0.5	16.8		7	6
	JUN-OCT	"	2	34	1	6		10	5
TKN	NOV-MAY	mg/L	-----	57	2.3	23.2		7	-----
	JUN-OCT	"							
UOD	NOV-MAY	mg/L	72	273	22	121.4		7	5
	JUN-OCT	"							
UOD	NOV-MAY	LBS/DAY	1200	7484	819	3691		7	6
	JUN-OCT	"							

FACILITY NAME: NEPERA CHEMICAL
DRAINAGE BASIN: RAMAPO
PERMIT NUMBER: NY0006670
PERIOD MONITORED: 8/87 - 7/89

PARAMETER	PERIOD	UNITS	PERMIT LIMITS	MONTHLY VALUES MAX	MIN	MEAN	PEAK DAY	# RECORDS	VIOLATIONS
FLOW	NOV-MAY	MGD	----	0.1397	0.0596	0.091		14	----
	JUN-OCT	"	----	0.1036	0.0295	0.081		10	----
BOD5	NOV-MAY	mg/L	----	32	9.8	20.7	40	14	----
	JUN-OCT	"	----	25	7.9	16.3	52	10	----
BOD5	NOV-MAY	LBS/DAY	24/36	24.5	4.3	14.1	14	2	
	JUN-OCT	"	24/36	22.8	2.1	10.2	36.8	10	1
NH3	NOV-APR	mg/L	----	16.1	1.23	8.4		12	----
	MAY-OCT	"	----	17.6	0.051	4.5		12	----
NH3	NOV-APR	LBS/DAY	31	12	1.2	6.2		12	0
	MAY-OCT	"	5.6	16.2	0	3.5		12	2

FACILITY NAME: HAMLET OF TUXEDO (T) WWTP
DRAINAGE BASIN: RAMAPO
PERMIT NUMBER: NY0031224
PERIOD MONITORED: 1/88 - 8/89

PARAMETER	PERIOD	UNITS	PERMIT LIMITS	MONTHLY VALUES MAX	MIN	MEAN	PEAK DAY	# RECORDS	VIOLATIONS
FLOW	NOV-MAY	MGD	0.1	0.088	0.031	0.051		7	0
	JUN-OCT	"	0.1	0.148	0.054	0.073		11	1
BOD5	NOV-MAY	mg/L	45/60	49	7	24.9	49	11	1
	JUN-OCT	"	45/60	150	16	51.4		7	3
BOD5	NOV-MAY	LBS/DAY	37.5/54	29	5	13.9	29	11	0
	JUN-OCT	"	37.5/54	21	7	12.3	26	6	0

FACILITY NAME: TUXEDO PARK (V) WWTP
DRAINAGE BASIN: RAMAPO
PERMIT NUMBER: NY0031216
PERIOD MONITORED: 6/88 - 8/89

PARAMETER	PERIOD	UNITS	PERMIT LIMITS	MONTHLY VALUES MAX	MIN	MEAN	PEAK DAY	# RECORDS	VIOLATIONS
FLOW	NOV-MAY	MGD	0.15	0.29	0.1	0.18		10	5
	JUN-OCT	"	0.15	0.23	0.02	0.08		7	1
BOD5	NOV-MAY	mg/L	20	<3.0	<3.0	<3.0	8.1	9	0
	JUN-OCT	"	20	<3.0	<3.0	<3.0	5.4	8	0
BOD5	NOV-MAY	LBS/DAY	25	----------------		NO DATA		----------------	----------------
	JUN-OCT	"	25	----------------		NO DATA		----------------	----------------
CBOD5	NOV-MAY	mg/L	5	----------------		NO DATA		----------------	----------------
	JUN-OCT	"	5	----------------		NO DATA		----------------	----------------
CBOD5	NOV-MAY	LBS/DAY	6.3	----------------		NO DATA		----------------	----------------
	JUN-OCT	"	6.3	----------------		NO DATA		----------------	----------------
NH3	NOV-MAY	mg/L	MONITOR ONLY	0.3	0.2	0.25		2	-----
	JUN-OCT	"							

APPENDIX C-2

EFFLUENT CHARACTERISTICS OF WASTEWATER TREATMENT PLANTS DISCHARGING TO SURFACE STREAMS IN THE **WALLKILL RIVER DRAINAGE BASIN** ORANGE COUNTY, NEW YORK

DATA SUMMARIZED FROM MONTHLY DISCHARGE REPORTS
SUBMITTED UNDER THE N.Y.S.P.D.E.S. PROGRAM

FACILITY NAME: MIDDLETOWN(C) OUTFALL #3
DRAINAGE BASIN: WALLKILL
PERMIT NUMBER: NY0026328
PERIOD MONITORED: 7/88-7/89

PARAMETER	PERIOD	UNITS	PERMIT LIMITS	MONTHLY VALUES MAX	MIN	MEAN	PEAK DAY	# RECORDS	VIOLATIONS
FLOW	NOV-MAY	MGD	6	6.73	4.28	5.09		7	1
	JUN-OCT	"	6	6.1	3.9	4.43		6	1
BOD5	NOV-MAY	mg/L	-	39	19	26.9	65	7	-
	JUN-OCT	"	-	74	9	39.5	153	6	-
BOD5	NOV-MAY	LBS/DAY	-	1492	874	1148	2515	7	-
	JUN-OCT	"	-	2877	469	1492	4595	6	-
TKN	NOV-MAY	mg/L	-	61	19	32		6	-
	JUN-OCT	"	-	49	10	23.6		5	-
NH3	NOV-MAY	mg/L	3.6	16	9	13.6		7	7
	JUN-OCT	"	3.6	18	7.1	13.4		6	6
UOD	NOV-MAY	mg/L	37.4	219	93	140		7	7
	JUN-OCT	"	37.4	122	48	78		3	3
UOD	NOV-MAY	LBS/DAY	1871	6898	4700	5573		7	7
	JUN-OCT	"	1871	3470	2137	2673		3	3

FACILITY NAME: GOSHEN (V) STP
DRAINAGE BASIN: WALLKILL
PERMIT NUMBER: NY0031518
PERIOD MONITORED: 11/88 - 10/89

PARAMETER	PERIOD	UNITS	PERMIT LIMITS	MONTHLY VALUES MAX	MONTHLY VALUES MIN	MONTHLY VALUES MEAN	PEAK DAY	# RECORDS	VIOLATIONS
FLOW	NOV-MAY	MGD	1.5	1.86	1.07	1.36		7	1
	JUN-OCT	"	1.5	1.84	1.02	1.35		5	1
BOD5	NOV-MAY	mg/L	?	32	14	23.6		7	?
	JUN-OCT	"	?	14	8	11		5	?
BOD5	NOV-MAY	LBS/DAY	?	355	186	258		7	?
	JUN-OCT	"	?	128	85	110		5	?
CBOD5	NOV-MAY	mg/L							
	JUN-OCT	"	25/38	<3.0	<3.0	<3.0		3	0
CBOD5	NOV-MAY	LBS/DAY							
	JUN-OCT	"	313/475	---------------		NO DATA		---------------	

C2-3

FACILITY NAME: WALKILL (T) STP
DRAINAGE BASIN: WALLKILL
PERMIT NUMBER: NY0024422
PERIOD MONITORED: 8/87-8/89

PARAMETER	PERIOD	UNITS	PERMIT LIMITS	MONTHLY VALUES MAX	MIN	MEAN	PEAK DAY	# RECORDS	VIOLATIONS
FLOW	NOV-MAY	MGD	?	2.4	1.1	1.78		14	?
	JUN-OCT	"	?	2.4	1.4	1.74		11	?
BOD5	NOV-MAY	mg/L	-	322	43	85.5	675	14	-
	JUN-OCT	"	-	132	30	67.7	248	11	-
BOD5	NOV-MAY	LBS/DAY	-	5371	640	1532	5371	7	-
	JUN-OCT	"	-	2085	884	1436	7443	4	-
TKN	NOV-MAY	mg/L		----------------		MONITOR ONLY		----------------	
	JUN-OCT	"		----------------		NO DATA		----------------	
NH3	NOV-MAY	mg/L	5.1	----------------		NO DATA		----------------	
	JUN-OCT	"	5.1	----------------		NO DATA		----------------	
UOD	NOV-MAY	mg/L	67.2	----------------		NO DATA		----------------	
	JUN-OCT	"	67.2	----------------		NO DATA		----------------	
UOD	NOV-MAY	LBS/DAY	1681	----------------		NO DATA		----------------	
	JUN-OCT	"	1681	----------------		NO DATA		----------------	

FACILITY NAME: MONTGOMERY (V) STP
DRAINAGE BASIN: WALLKILL
PERMIT NUMBER: NY0026433
PERIOD MONITORED: 8/87 - 7/89

PARAMETER	PERIOD	UNITS	PERMIT LIMITS	MONTHLY VALUES MAX	MIN	MEAN	PEAK DAY	# RECORDS	VIOLATIONS
FLOW	NOV-MAY	MGD	0.5	0.58	0.23	0.31		14	1
	JUN-OCT	"	0.5	0.47	0.19	0.26		11	0
BOD5	NOV-MAY	mg/L	30/45	14.8	1.7	7.4	18	14	0
	JUN-OCT	"	30/45	7	<3.0	3.7	11	11	0
BOD5	NOV-MAY	LBS/DAY	125/188	32.7	5.8	18.2	37.7	14	0
	JUN-OCT	"	125/188	13.9	4.5	8.2	21.2	11	0

FACILITY NAME: WALDEN (V) STP
DRAINAGE BASIN: WALLKILL
PERMIT NUMBER: NY0030490
PERIOD MONITORED: 8/87-7/89

PARAMETER	PERIOD	UNITS	PERMIT LIMITS	MONTHLY VALUES MAX	MIN	MEAN	PEAK DAY	# RECORDS	VIOLATIONS
FLOW	NOV-MAY	MGD	1.1	1.5	0.65	0.92		14	1
	JUN-OCT	"	1.1	1.35	0.61	0.81	10	10	1
BOD5	NOV-MAY	mg/L	30/45	24.5	8.9	16	35	14	0
	JUN-OCT	"	30/45	16.9	3.8	8.3	23	10	0
BOD5	NOV-MAY	LBS/DAY	275/413	224.7	63.8	122.4	333.6	14	0
	JUN-OCT	"	275/413	89.4	19.9	54.6	168	10	0
CBOD5	NOV-MAY	mg/L	30/45	----------------		CONTESTED		----------------	
	JUN-OCT	"	30/45	----------------		NO DATA		----------------	
CBOD5	NOV-MAY	LBS/DAY	275/413	----------------		CONTESTED		----------------	
	JUN-OCT	"	275/413	----------------		NO DATA		----------------	
TKN	NOV-MAY	mg/L		----------------		SUMMER ONLY		----------------	
	JUN-OCT	"	9.5	11	3.1	5.5		10	2

FACILITY NAME: AL TURI LANDFILL
DRAINAGE BASIN: WALLKILL
PERMIT NUMBER: NY0166511
PERIOD MONITORED: 1/89-7/89

PARAMETER	PERIOD	UNITS	PERMIT LIMITS	MONTHLY VALUES MAX	MIN	MEAN	PEAK DAY	# RECORDS	VIOLATIONS
FLOW	NOV-MAY	MGD	-	0.025	0.008	0.015		5	-
	JUN-OCT	"	-	0.013	0.011	0.012		2	-
BOD5	NOV-MAY	mg/L	30/50	22	10	16.7		3	0
	JUN-OCT	"	30/50	----------		NO DATA		----------	
TOD	NOV-MAY	LBS/DAY	40	35.9	0.8	11.5		5	0
	JUN-OCT	"	40	4.2	0.9	2.5		2	0

FACILITY NAME: FLORIDA (V) STP
DRAINAGE BASIN: WALLKILL
PERMIT NUMBER: NY0020273
PERIOD MONITORED: 2/89-

PARAMETER	PERIOD	UNITS	PERMIT LIMITS	MONTHLY VALUES MAX	MIN	MEAN	PEAK DAY	# RECORDS	VIOLATIONS
FLOW	NOV-MAY	MGD	0.3	0.4	0.26	0.31		3	1
	JUN-OCT	"	0.3	0.39	0.25	0.3		3	1
CBOD5	NOV-MAY	mg/L	25/40	25	23	24.3		4	0
	JUN-OCT	"	25	39	13	23.7		3	1
CBOD5	NOV-MAY	LBS/DAY		----------	SUMMER ONLY	----------		----------	
	JUN-OCT	"	63	82	40	54.7		3	1
TKN	NOV-MAY	mg/L	-	28.8	18.5	25.8		4	-
	JUN-OCT	"	-	32.8	10.4	21.6		3	-
NH3	NOV-MAY	mg/L		----------	SUMMER ONLY	----------		----------	
	JUN-OCT	"	7.4	26	7.3	16.9		3	2
UOD	NOV-MAY	mg/L	136	164	119	149.4		4	3
	JUN-OCT	"	95	206	70.2	134.7		3	2
UOD	NOV-MAY	LBS/DAY	340	339	273	309		4	0
	JUN-OCT	"	238	432	232	305.5		3	2

FACILITY NAME: O.C.INFIRMARY
DRAINAGE BASIN: WALLKILL
PERMIT NUMBER: NY0022101
PERIOD MONITORED: 3/87-6/89

PARAMETER	PERIOD	UNITS	PERMIT LIMITS	MONTHLY VALUES MAX	MIN	MEAN	PEAK DAY	# RECORDS	VIOLATIONS
FLOW	NOV-MAY	MGD	0.13	0.04	0.03	0.035		7	0
	JUN-OCT	"	0.13	0.04	0.03	0.037		4	0
CBOD5	NOV-MAY	mg/L	5	11	3	4.7		7	2
	JUN-OCT	"	5	13	3	7.3		6	4
CBOD5	NOV-MAY	LBS/DAY	5.3	2.9	0.9	1.4		7	0
	JUN-OCT	"	5.3	5	0.9	2.4		6	0
NH3	NOV-MAY	mg/L	2	20.2	<0.5	3.6		7	2
	JUN-OCT	"	2	4.9	<0.5	0.3		5	1

FACILITY NAME: RIDGEBURY LAKE ACRES
DRAINAGE BASIN: WALLKILL
PERMIT NUMBER: NY0062278
PERIOD MONITORED: 9/87-8/89

PARAMETER	PERIOD	UNITS	PERMIT LIMITS	MONTHLY VALUES MAX	MIN	MEAN	PEAK DAY	# RECORDS	VIOLATIONS
FLOW	NOV-MAY	MGD	0.03	0.027	0.014	0.021		14	0
	JUN-OCT	"	0.03	0.024	0.016	0.02		10	0
BOD5	NOV-MAY	mg/L	10	83	1	22.6		14	8
	JUN-OCT	"	10	29	2	14		10	5
BOD5	NOV-MAY	LBS/DAY	2.5	11.4	0.16	3.75		13	6
	JUN-OCT	"	2.5	5.8	0.4	2.34		10	5
CBOD5	NOV-MAY	mg/L	10	----------------		CONTESTED		----------------	
	JUN-OCT	"	10	----------------		NO DATA		----------------	
CBOD5	NOV-MAY	LBS/DAY	2.5	----------------		CONTESTED		----------------	
	JUN-OCT	"	2.5	----------------		NO DATA		----------------	
NH3	NOV-MAY	mg/L	2	19.9	<0.1	7.7		14	10
	JUN-OCT	"	2	27	<0.1	4.8		9	3

FACILITY NAME: ROBINN MEADOWS STP
DRAINAGE BASIN: WALLKILL
PERMIT NUMBER: NY0029149
PERIOD MONITORED: 1/88-7/89 (INITIAL)

PARAMETER	PERIOD	UNITS	PERMIT LIMITS	MONTHLY VALUES MAX	MONTHLY VALUES MIN	MONTHLY VALUES MEAN	PEAK DAY	# RECORDS	VIOLATIONS
FLOW	NOV-MAY	MGD	0.04/0.08	0.032	0.004	0.017		14	0
	JUN-OCT	"	0.04/0.08	0.023	0.002	0.013		10	0
BOD5	NOV-MAY	mg/L	2/5	7	6	6.5		2	0
	JUN-OCT	"	2/5	1.8	1.8	1.8		1	0
BOD5	NOV-MAY	LBS/DAY	6.7/3.3	0.9	0.6	0.78		2	0
	JUN-OCT	"	6.7/3.3	0.2	0.2	0.2		1	0
NH3	NOV-OCT	mg/L	2	---------------		NO DATA		---------------	

APPENDIX C-3

EFFLUENT CHARACTERISTICS OF WASTEWATER TREATMENT PLANTS DISCHARGING TO SURFACE STREAMS IN THE
WAWAYANDA CREEK DRAINAGE BASIN
ORANGE COUNTY, NEW YORK

DATA SUMMARIZED FROM MONTHLY DISCHARGE REPORTS SUBMITTED UNDER THE N.Y.S.P.D.E.S. PROGRAM

FACILITY NAME: WARWICK (T) OUTFALL #2
DRAINAGE BASIN: WAYWAYANDA
PERMIT NUMBER: NY0021890
PERIOD MONITORED: 7/88-5/89

PARAMETER	PERIOD	UNITS	PERMIT LIMITS	MONTHLY VALUES MAX	MIN	MEAN	PEAK DAY	# RECORDS	VIOLATIONS
FLOW	NOV-MAY	MGD	0.39	0.24	0.19	0.21		6	0
	JUN-OCT	"	0.39	0.27	0.16	0.22		8	0
BOD5	NOV-MAY	mg/L	-	7.8	3.2	5.6		6	-
	JUN-OCT	"	5	5.6	<1.0	1.9		8	0
BOD5	NOV-MAY	LBS/DAY	-	12.1	6.1	9.4		5	-
	JUN-OCT	"	16	5.1	0.8	2.9		7	0
TKN	NOV-MAY	mg/L	-	14	0.8	9.5		6	-
	JUN-OCT	"							
NH3	NOV-MAY	mg/L	6.1	17	10.2	8.4		6	4
	JUN-OCT	"	2	0.3	<0.2	0.1		8	0
TOD	NOV-MAY	mg/L	100	74.7	8.9	50.3		6	0
	JUN-OCT	"							
TOD	NOV-MAY	LBS/DAY	325	117	17	81.4		6	0
	JUN-OCT	"							

FACILITY NAME: WARWICK (V) WWTP
DRAINAGE BASIN: WAYWAYANDA
PERMIT NUMBER: NY0023680
PERIOD MONITORED: 9/87-8/89

PARAMETER	PERIOD	UNITS	PERMIT LIMITS	MONTHLY VALUES MAX	MIN	MEAN	PEAK DAY	# RECORDS	VIOLATIONS
FLOW	NOV-MAY	MGD	0.5	0.65	0.28	0.38		14	1
	JUN-OCT	"	0.5	0.48	0.08	0.28		10	0
BOD5	NOV-MAY	mg/L	30/45	45	30	36.7	48	14	13
	JUN-OCT	"	30/45	40	23	30.1	45	10	4
BOD5	NOV-MAY	LBS/DAY	125/188	201	95	116	250	14	1
	JUN-OCT	"	125/188	141	38	85	143	10	1

APPENDIX C-4

EFFLUENT CHARACTERISTICS OF WASTEWATER TREATMENT PLANTS DISCHARGING TO SURFACE STREAMS IN THE

SHAWANGUNK KILL DRAINAGE BASIN

ORANGE COUNTY, NEW YORK

DATA SUMMARIZED FROM MONTHLY DISCHARGE REPORTS
SUBMITTED UNDER THE N.Y.S.P.D.E.S. PROGRAM

FACILITY NAME: PINE BUSH (H) STP
DRAINAGE BASIN: WALLKILL
PERMIT NUMBER: NY0110019
PERIOD MONITORED: 8/87 - 8/89

PARAMETER	PERIOD	UNITS	PERMIT LIMITS	MONTHLY VALUES MAX	MIN	MEAN	PEAK DAY	# RECORDS	VIOLATIONS
FLOW	NOV-MAY	MGD	0.15	0.12	0.1	0.1		14	0
	JUN-OCT	"	0.15	0.13	0.1	0.11		11	0
BOD5	NOV-MAY	mg/L	30/45	28	2.6	17	58	14	1
	JUN-OCT	"	30/45	20	1.8	6.8	20	10	0
BOD5	NOV-MAY	LBS/DAY	38/56	25	2.2	14.7	49	14	0
	JUN-OCT	"	38/56	17.6	1.7	6		10	0
CBOD5	NOV-MAY	mg/L	30/45	----------------		CONTESTED		----------------	----------------
	JUN-OCT	"	30/45	----------------		CONTESTED		----------------	----------------
CBOD5	NOV-MAY	LBS/DAY	38/56	----------------		CONTESTED		----------------	----------------
	JUN-OCT	"	38/56	----------------		CONTESTED		----------------	----------------

FACILITY NAME: OTISVILLE CORRECTIONAL FACILITY
DRAINAGE BASIN: WALLKILL
PERMIT NUMBER: NY0033154
PERIOD MONITORED: 8/87 - 7/89

PARAMETER	PERIOD	UNITS	PERMIT LIMITS	MONTHLY VALUES MAX	MIN	MEAN	PEAK DAY	# RECORDS	VIOLATIONS
FLOW	NOV-MAY	MGD	0.115	0.935	0.083	0.193		13	9
	JUN-OCT	"	0.115	0.228	0.11	0.138		8	5
BOD5	NOV-MAY	mg/L	20/30	190	3	50.4		14	9
	JUN-OCT	"	20/30	40	<3.0	10.6		8	1
BOD5	NOV-MAY	LBS/DAY	19/29	190	0.89	51.3		14	11
	JUN-OCT	"	19/29	48	<3.0	12.8		7	1

FACILITY NAME: HIDDEN VALLEY ESTATES STP
DRAINAGE BASIN: WALLKILL
PERMIT NUMBER: NY0034436
PERIOD MONITORED: 8/87 - 7/89

PARAMETER	PERIOD	UNITS	PERMIT LIMITS	MONTHLY VALUES MAX	MONTHLY VALUES MIN	MONTHLY VALUES MEAN	PEAK DAY	# RECORDS	VIOLATIONS
FLOW	NOV-MAY	MGD	0.06	0.166	0.035	0.071		14	4
	JUN-OCT	"	0.06	0.155	0.03	0.075		10	3
BOD5	NOV-MAY	mg/L	10/15			NO DATA			
	JUN-OCT	"	10/15	6.9	3	5		2	0
BOD5	NOV-MAY	LBS/DAY	5/7			NO DATA			
	JUN-OCT	"	5/7	8.5	4.1	6.3		2	1
CBOD5	NOV-MAY	mg/L	10/15	38	1.4	10.6		13	4
	JUN-OCT	"	10/15	22	0.3	8.4		8	3
CBOD5	NOV-MAY	LBS/DAY	5/7.5	18	0.4	5.3		13	4
	JUN-OCT	"	5/7.5	10.2	0.4	3.3		8	2

APPENDIX C-5

EFFLUENT CHARACTERISTICS OF WASTEWATER TREATMENT PLANTS DISCHARGING TO SURFACE STREAMS IN THE MOODNA CREEK DRAINAGE BASIN ORANGE COUNTY, NEW YORK

DATA SUMMARIZED FROM MONTHLY DISCHARGE REPORTS SUBMITTED UNDER THE N.Y.S.P.D.E.S. PROGRAM

FACILITY NAME: WASHINGTONVILLE (V) WWTP
DRAINAGE BASIN: MOODNA
PERMIT NUMBER: NY0023671
PERIOD MONITORED: 8/88 - 7/89

PARAMETER	PERIOD	UNITS	PERMIT LIMITS	MONTHLY VALUES MAX	MONTHLY VALUES MIN	MONTHLY VALUES MEAN	PEAK DAY	# RECORDS	VIOLATIONS
FLOW	NOV-MAY	MGD	0.4	0.55	0.33	0.4		8	3
	JUN-OCT	"	0.4	0.53	0.24	0.34		8	1
BOD5	NOV-MAY	mg/L	30/45	48	7	22		6	2
	JUN-OCT	"	30/45	43	4	16.3	175	8	3
BOD5	NOV-MAY	LBS/DAY	100/150	81	13.6	59	105	7	0
	JUN-OCT	"	100/150	56	1.5	24	97	7	0

FACILITY NAME: NEW WINDSOR (T) STP
DRAINAGE BASIN: MOODNA
PERMIT NUMBER: NY0022446
PERIOD MONITORED: 8/88 - 7/89

PARAMETER	PERIOD	UNITS	PERMIT LIMITS	MONTHLY VALUES MAX	MIN	MEAN	PEAK DAY	# RECORDS	VIOLATIONS
FLOW	NOV-MAY	MGD	5	5.33	2.99	3.63		8	1
	JUN-OCT	"	5	4.54	2.6	3.06		7	0
BOD5	NOV-MAY	mg/L	30/45	39	24	30.3	50	8	4
	JUN-OCT	"	30/45	31	16	23.9	58	7	3
BOD5	NOV-MAY	LBS/DAY	1250/1875	1182	762	887	1548	8	0
	JUN-OCT	"	1250/1875	868	382	606	1370	7	0
CBOD5	NOV-MAY	mg/L	------------	------------	CONTESTED			------------	------------
	JUN-OCT	"	------------	------------	CONTESTED			------------	------------
CBOD5	NOV-MAY	LBS/DAY	------------	------------	CONTESTED			------------	------------
	JUN-OCT	"	------------	------------	CONTESTED			------------	------------

FACILITY NAME: MAYBROOK (V) WWTP
DRAINAGE BASIN: MOODNA
PERMIT NUMBER: NY0023272
PERIOD MONITORED: 8/87 - 7/89

PARAMETER	PERIOD	UNITS	PERMIT LIMITS	MONTHLY VALUES MAX	MIN	MEAN	PEAK DAY	# RECORDS	VIOLATIONS
FLOW	NOV-MAY	MGD	0.4	0.77	0.25	0.37		14	3
	JUN-OCT	"	0.4	0.7	0.19	0.31		10	1
BOD5	NOV-MAY	mg/L	30/45	85	6	48		14	12
	JUN-OCT	"	30/45	56	12.7	.33		10	4
BOD5	NOV-MAY	LBS/DAY	100/150	189	98	147		14	13
	JUN-OCT	"	100/150	156	48	80	196	10	2

FACILITY NAME: MONTGOMERY (T) STP, SD #2 & 2A
DRAINAGE BASIN: MOODNA
PERMIT NUMBER: NY0109622
PERIOD MONITORED: 8/87 - 7/89

PARAMETER	PERIOD	UNITS	PERMIT LIMITS	MONTHLY VALUES MAX	MIN	MEAN	PEAK DAY	# RECORDS	VIOLATIONS
FLOW	NOV-MAY	MGD	0.06	0.03	0.03	0.03		14	0
	JUN-OCT	"	0.06	0.03	0.03	0.03		7	0
BOD5	NOV-MAY	mg/L	5	3.7	1.2	2.9		6	0
	JUN-OCT	"	5	4.3	2.7	3.3		3	0
BOD5	NOV-MAY	LBS/DAY	2.5	0.92	0.3	0.7		6	0
	JUN-OCT	"	2.5	1	0.7	0.8		3	0
CBOD5	NOV-MAY	mg/L	5	9.8	0.75	3.9		9	1
	JUN-OCT	"	5	17	2.7	6.3		6	2
CBOD5	NOV-MAY	LBS/DAY	2.5	2.4	0.75	1		9	0
	JUN-OCT	"	2.5	1	0.7	0.8		4	0
TKN	NOV-MAY	mg/L	20	2.6	0.05	0.75		14	0
	JUN-OCT	"	20	5	2.1	3.2		4	0
NH3	NOV-MAY	mg/L	2	0.2	0.03	0.17		6	0
	JUN-OCT	"	2	3.7	1.2	2.6		6	5

FACILITY NAME: KING TRACT STP, SD #5
DRAINAGE BASIN: MOODNA
PERMIT NUMBER: NY0109410
PERIOD MONITORED: 8/87 - 7/89

PARAMETER	PERIOD	UNITS	PERMIT LIMITS	MONTHLY VALUES MAX	MIN	MEAN	PEAK DAY	# RECORDS	VIOLATIONS
FLOW	NOV-MAY	MGD	0.02	0.007	0.007	0.007		13	0
	JUN-OCT	"	0.02			NO DATA			
BOD5	NOV-MAY	mg/L	---			NO DATA			
	JUN-OCT	"	---			NO DATA			
BOD5	NOV-MAY	LBS/DAY	---			NO DATA			
	JUN-OCT	"	---			NO DATA			
CBOD5	NOV-MAY	mg/L	5			NO DATA			
	JUN-OCT	"	5			NO DATA			
CBOD5	NOV-MAY	LBS/DAY	0.8			NO DATA			
	JUN-OCT	"	0.8			NO DATA			
NH3	NOV-MAY	mg/L	2			NO DATA			
	JUN-OCT	"	2			NO DATA			

FACILITY NAME: SUGAR LOAF STP (SD # 4)
DRAINAGE BASIN: MOODNA
PERMIT NUMBER: NY0109401
PERIOD MONITORED: 8/87 - 7/89

PARAMETER	PERIOD	UNITS	PERMIT LIMITS	MONTHLY VALUES MAX	MIN	MEAN	PEAK DAY	# RECORDS	VIOLATIONS
FLOW	NOV-MAY	MGD	0.05	0.019	0.018	0.018		14	0
	JUN-OCT	"	0.05	0.019	0.018	0.018		10	0
BOD5	NOV-MAY	mg/L	30/45	17.4	0.9	8.9		11	0
	JUN-OCT	"	----	----------------		NOT MONITORED		--------------	------------------
BOD5	NOV-MAY	LBS/DAY	12.5/18.3	2.8	0.06	1.4		11	0
	JUN-OCT	"	----	----------------		NOT MONITORED		--------------	------------------
CBOD5	NOV-MAY	mg/L	----	----------------		NOT MONITORED		--------------	------------------
	JUN-OCT	"	5	6.4	0.62	2.7		10	1
CBOD5	NOV-MAY	LBS/DAY	----	----------------		NOT MONITORED		--------------	------------------
	JUN-OCT	"	2.1	1.02	0.09	0.42		10	0
NH3	NOV-MAY	mg/L	----	----------------		NOT MONITORED		--------------	------------------
	JUN-OCT	"	2	1.5	0.02	0.8		10	0

FACILITY NAME: TAPPAN HOMES STP (TOWN OF BLOOMING GROVE)
DRAINAGE BASIN: MOODNA
PERMIT NUMBER: NY0062251
PERIOD MONITORED: 8/88 - 7/89

PARAMETER	PERIOD	UNITS	PERMIT LIMITS	MONTHLY VALUES MAX	MIN	MEAN	PEAK DAY	# RECORDS	VIOLATIONS
FLOW	NOV-MAY	MGD	0.064	1.09	0.03	0.05		14	4
	JUN-OCT	"	0.064	0.071	0.03	0.05		8	1
BOD5	NOV-MAY	mg/L	20/40	17.7	6	10.6	28.8	3	0
	JUN-OCT	"	20/40	14	4.6	9.5	18	4	0
BOD5	NOV-MAY	LBS/DAY	10.7/16	9.7	3	5.6		3	0
	JUN-OCT	"	10.7/16	4.1	4.1	4.1		1	0

FACILITY NAME: VALLEY FORGE STP
DRAINAGE BASIN: MOODNA
PERMIT NUMBER: NY0020478
PERIOD MONITORED: 8/87 - 7/89

PARAMETER	PERIOD	UNITS	PERMIT LIMITS	MONTHLY VALUES MAX	MIN	MEAN	PEAK DAY	# RECORDS	VIOLATIONS
FLOW	NOV-MAY	MGD	0.056	0.034	0.019	0.023		14	0
	JUN-OCT	"	0.056	0.025	0.014	0.018		10	0
BOD5	NOV-MAY	mg/L	5	1.9	0.6	1.3		2	0
	JUN-OCT	"	5	4.6	1.2	2.4		3	0
BOD5	NOV-MAY	LBS/DAY	1.5	0.53	0.22	0.34		3	0
	JUN-OCT	"	1.5	0.33	0.1	0.22		2	0
CBOD5	NOV-MAY	mg/L	5	15.6	1.3	4.1		11	1
	JUN-OCT	"	5	10	<1.0	3.8		7	1
CBOD5	NOV-MAY	LBS/DAY	2.5	3.12	0.23	0.8		11	1
	JUN-OCT	"	2.5	1.58	0.18	0.59		7	0
NH3	NOV-MAY	mg/L	2	0.85	0.02	0.23		12	0
	JUN-OCT	"	2	0.2	<0.02	0.12		7	0

APPENDIX D

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

APPENDIX D

PROJECT SCENARIO COMPONENT COSTS FOR SECOND STAGE EVALUATION
All Costs in 1991 Dollars

Approach No.	Description	Service Area	Pipeline Costs Capital, $1000	Pipeline Costs 1995 O&M, $1000/yr	Pipeline Costs 2020 O&M $1000/yr	Pumping Station Costs Capital, $1000	Pumping Station Costs 1995 O&M, $1000/yr	Pumping Station Costs 2020 O&M $1000/yr	Treatment Related Costs Capital, $1000	Treatment Related Costs 1995 O&M, $1000/yr	Treatment Related Costs 2020 O&M $1000/yr	Total Project Costs Capital, $1000	Total Project Costs 1995 O&M, $1000/yr	Total Project Costs 2020 O&M $1000/yr
Stage 1 Rec.	Maint Cornwall & Firthclff STPs at 1.72 mgd SEC	Cornwall (UT&V)	$0	$0	$0	$0	$0	$0	$0	$630	$670	$0	$630	$670
Stage 1 Rec.	Exp Pine Bush STP from 0.15 to 0.3 mgd ADV(L)	Crawford	$0	$0	$0	$0	$0	$0	$3,500	$260	$370	$3,500	$260	$370
Stage 1 Rec.	New pkg STPs & septics for 0.08 mgd	Deerpark	$0	$0	$0	$0	$0	$0	$1,400	$17	$80	$1,400	$20	$80
Stage 1 Rec.	Exp/Up Florida STP from 0.3 to 0.45 mgd ADV(L)	Florida	$0	$0	$0	$0	$0	$0	$3,500	$380	$450	$3,500	$380	$450
Stage 1 Rec.	Maintain Goshen (V) STP for 1.5 mgd ADV(L)	Goshen (V)	$0	$0	$0	$0	$0	$0	$0	$640	$710	$0	$640	$710
Stage 1 Rec.	New pkg STPs & septics for 0.06 mgd	Greenville	$0	$0	$0	$0	$0	$0	$1,200	$17	$60	$1,200	$20	$60
Stage 1 Rec.	New pkg STPs & septics for 0.05 mgd	Hamptonburgh	$0	$0	$0	$0	$0	$0	$1,100	$17	$50	$1,100	$20	$50
Stage 1 Rec.	Maintain Cragston STP for 1.35 mgd SEC	Highland Falls	$0	$0	$0	$0	$0	$0	$0	$300	$360	$0	$300	$360
Stage 1 Rec.	Exp Fort Montgom. STP from 0.12 to 0.14 mgd SEC	Highlands	$0	$0	$0	$0	$0	$0	$400	$90	$210	$400	$90	$210
Stage 1 Rec.	Upgrade Maybrook STP for 0.4 mgd ADV(L)	Maybrook	$0	$0	$0	$0	$0	$0	$2,900	$400	$410	$2,900	$400	$410
Stage 1 Rec.	Maintain Middletown STP at 6.0 mgd ADV(L)	Middletown	$0	$0	$0	$0	$0	$0	$0	$2,190	$2500	$0	$2,190	$2,500
Stage 1 Rec.	New pkg STPs & septics for 0.06 mgd	Minisink/Unionvl	$0	$0	$0	$0	$0	$0	$1,200	$17	$60	$1,200	$20	$60
Stage 1 Rec.	New 0.6 ADV(L) mgd Wallkill R. STP	Montgomery (UT)	$0	$0	$0	$0	$0	$0	$6,400	$250	$510	$6,400	$250	$510
Stage 1 Rec.	Maint. Montgomery (V) STP for 0.5 mgd ADV(L)	Montgomery (V)	$0	$0	$0	$0	$0	$0	$0	$400	$450	$0	$400	$450

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

APPENDIX D

PROJECT SCENARIO COMPONENT COSTS FOR SECOND STAGE EVALUATION
All Costs in 1991 Dollars

			Pipeline Costs			Pumping Station Costs			Treatment Related Costs			Total Project Costs		
Approach No.	Description	Service Area	Capital, $1000	1995 O&M, $1000/yr	2020 O&M $1000/yr	Capital, $1000	1995 O&M, $1000/yr	2020 O&M $1000/yr	Capital, $1000	1995 O&M, $1000/yr	2020 O&M $1000/yr	Capital, $1000	1995 O&M, $1000/yr	2020 O&M $1000/yr
Stage 1 Rec.	Expand Newburgh (C) STP from 7.0 to 9.3 mgd SEC	Newburgh (C) Newburgh (UT)	$0	$0	$0	$0	$0	$0	$8,300	$1,300	$2350	$8,300	$1,300	$2,350
Stage 1 Rec.	Expand New Windsor STP from 5 to 12.0 mgd SEC	New Windsor Cornwall (UT) Cornwall (V)	$0	$0	$0	$0	$0	$0	$25,700	$2,390	$4330	$25,700	$2,390	$4,330
Stage 1 Rec.	Maintain Port Jervis STP for 2.5 mgd SEC	Port Jervis	$0	$0	$0	$0	$0	$0	$0	$600	$650	$0	$600	$650
Stage 1 Rec.	Exp/Upgr Hamlet STP from 0.1 to 0.2 mgd ADV(L)	Tuxedo (UT)	$0	$0	$0	$0	$0	$0	$3,200	$200	$320	$3,200	$200	$320
Stage 1 Rec.	Upgrade Tuxedo Park STP at 0.15 mgd ADV(L)	Tuxedo Park (V)	$0	$0	$0	$0	$0	$0	$1,700	$200	$270	$1,700	$200	$270
Stage 1 Rec.	Maintain Walden STP for 1.1 mgd SEC	Walden	$0	$0	$0	$0	$0	$0	$0	$400	$470	$0	$400	$470
Local 1.	New 0.4 mgd ADV(H) Trout Brook STP	Greenwood Lake	$2,400	$2	$3	$1,200	$21	$29	$5,900	$300	$490	$9,500	$320	$520
Local 2.	New 0.2 mgd ADV(H) Shawangunk Kill STP	Mt.Hope/Otisville	$0	$0	$0	$0	$0	$0	$4,300	$280	$350	$4,300	$280	$350
Local 3.	Expand Wallkill STP from 4.0 to 4.8 mgd	Wallkill	$0	$0	$0	$0	$0	$0	$8,900	$1,330	$2190	$8,900	$1,330	$2,190
Local 4.	Exp/Up Warwick (U) STP from 0.39 to 1.0 mgd ADV(H)	Warwick (UT)	$0	$0	$0	$0	$0	$0	$8,300	$450	$770	$8,300	$450	$770
Local 5.	Maintain Warwick (U) STP at 0.39 mgd ADV(L)	Warwick (UT)	$0	$0	$0	$0	$0	$0	$0	$410	$410	$0	$410	$410
Local 6.	Exp/Up Warwick (V) STP from 0.5 to 0.9 mgd ADV(L)	Warwick (V)	$0	$0	$0	$0	$0	$0	$6,500	$600	$640	$6,500	$600	$640

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

APPENDIX D

PROJECT SCENARIO COMPONENT COSTS FOR SECOND STAGE EVALUATION

All Costs in 1991 Dollars

Approach No.	Description	Service Area	Pipeline Costs			Pumping Station Costs			Treatment Related Costs			Total Project Costs		
			Capital, $1000	1995 O&M, $1000/yr	2020 O&M $1000/yr	Capital, $1000	1995 O&M, $1000/yr	2020 O&M $1000/yr	Capital, $1000	1995 O&M, $1000/yr	2020 O&M $1000/yr	Capital, $1000	1995 O&M, $1000/yr	2020 O&M $1000/yr
Local 7.	Exp/Up Wash-ville STP from 0.4 to 0.9 mgd ADV(L)	Washingtonville	$0	$0	$0	$0	$0	$0	$6,400	$400	$640	$6,400	$400	$640
Regional 1a.	Expand/Upgrade OCSD#1 STP to 4.6 mgd ADV(H)	OCSD#1	$0	$0	$0	$0	$0	$0	$13,300.	$1,200	$2240	$13,300	$1,200	$2,240
Regional 1b.	Pipelines Routes: 1.1,1.2 Pumping Stations: 1.1 Expand/Upgrade OCSD#1 STP to 5.0 mgd ADV(H)	OCSD#1 Greenwood Lake	$4,700	$5	$6	$1,200	$21	$29	$13,400	$1,300	$2350	$19,300	$1,330	$2,390
Regional 2a.	Pipelines Routes: 1.2,2.1(R),2.2(R),3.1(R), 3.2(R),3.3 Pumping Stations: 2.1(R),3.1(R),3.3 New 6.0 mgd SEC Hudson R. STP	HBSR Washingtonville	$23,600	$30	$37	$7,100	$119	$211	$23,500	$1,000	$1680	$54,200	$1,150	$1,930
Regional 2b.	Pipelines Routes: 1.1,1.2,2.1(R),2.2(R),3.1(R), 3.2(R),3.3 Pumping Stations: 1.1,2.1(R),3.1(R),3.3 New 6.5 mgd SEC Hudson R. STP	HBSR Washingtonville Greenwood Lake	$28,300	$35	$40	$8,300	$140	$240	$25,000	$1,000	$1790	$61,600	$1,180	$2,070
Regional 2c.	Pipelines Routes: 1.1,1.2,2.1(R),2.2(R),3.1(R), 3.2(R),3.3,5.1 Pumping Stations: 1.1,2.1(R),3.1(R),3.3,5.1 New 7.5 mgd SEC Hudson R. STP	HBSR Washingtonville Greenwood Lake Goshen (UT)	$29,900	$38	$43	$9,800	$165	$278	$26,000	$1,100	$2040	$65,700	$1,300	$2,360

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

APPENDIX D

PROJECT SCENARIO COMPONENT COSTS FOR SECOND STAGE EVALUATION
All Costs in 1991 Dollars

Approach No.	Description	Service Area	Pipeline Costs Capital, $1000	Pipeline Costs 1995 O&M, $1000/yr	Pipeline Costs 2020 O&M $1000/yr	Pumping Station Costs Capital, $1000	Pumping Station Costs 1995 O&M, $1000/yr	Pumping Station Costs 2020 O&M $1000/yr	Treatment Related Costs Capital, $1000	Treatment Related Costs 1995 O&M, $1000/yr	Treatment Related Costs 2020 O&M $1000/yr	Total Project Costs Capital, $1000	Total Project Costs 1995 O&M, $1000/yr	Total Project Costs 2020 O&M $1000/yr
Regional 3.	Pipeline Routes: 6.1, 7.1, 7.2 Pumping Stations: 6.1,7.1 New 1.5 mgd ADV(L) Wallkill River STP	Goshen (UT) Wawayanda	$2,000	$2	$3	$2,800	$48	$85	$10,700	$500	$900	$15,500	$550	$990
Regional 4.	Pipelines Routes: none Pumping Stations: none New 0.6 mgd ADV(H) Shawangunk K. STP	Mount Hope Otisville State & Fed. Jails	$0	$0	$0	$0	$0	$0	$7,100	$300	$580	$7,100	$300	$580
Regional 5a.	Pipelines Routes: 6.2, 7.1 Pumping Stations: 7.1 Exp/Upgr Wallkill STP from 4 to 5.3 mgd ADV(L)	Wallkill Wawayanda	$1,200	$2	$2	$1,100	$20	$25	$11,100	$1,300	$2240	$13,400	$1,320	$2,270
Regional 5b.	Pipelines Routes: 6.1, 6.2, 7.1 Pumping Stations: 6.1, 7.1 Exp/Upgr Wallkill STP from 4 to 6.2 mgd ADV(L)	Wallkill Wawayanda Goshen (UT)	$2,000	$3	$4	$2,800	$48	$85	$14,300	$1,500	$2600	$19,100	$1,550	$2,690
Regional 6.	Pipelines Routes: none Pumping Stations: none Exp/Upgr Warwick (V) STP from 0.5 to 1.5 mgd ADV(L)	Warwick (UT) Warwick (V)	$0	$0	$0	$0	$0	$0	$9,000	$540	$890	$9,000	$540	$890
Central 1a.	Pipelines Routes: 1.1,1.2,2.1,2.2,3.1,3.2,3.3 Pumping Stations: 1.1,2.1,3.1,3.3 New 11.1 mgd SEC Husdon R. STP	OCSD#1 HBSR Washingtonville Greenwood Lake	$35,600	$44	$54	$11,300	$186	$337	$31,600	$1,500	$2810	$78,500	$1,730	$3,200

ORANGE COUNTY COMPREHENSIVE SEWERAGE STUDY

APPENDIX D

PROJECT SCENARIO COMPONENT COSTS FOR SECOND STAGE EVALUATION
All Costs in 1991 Dollars

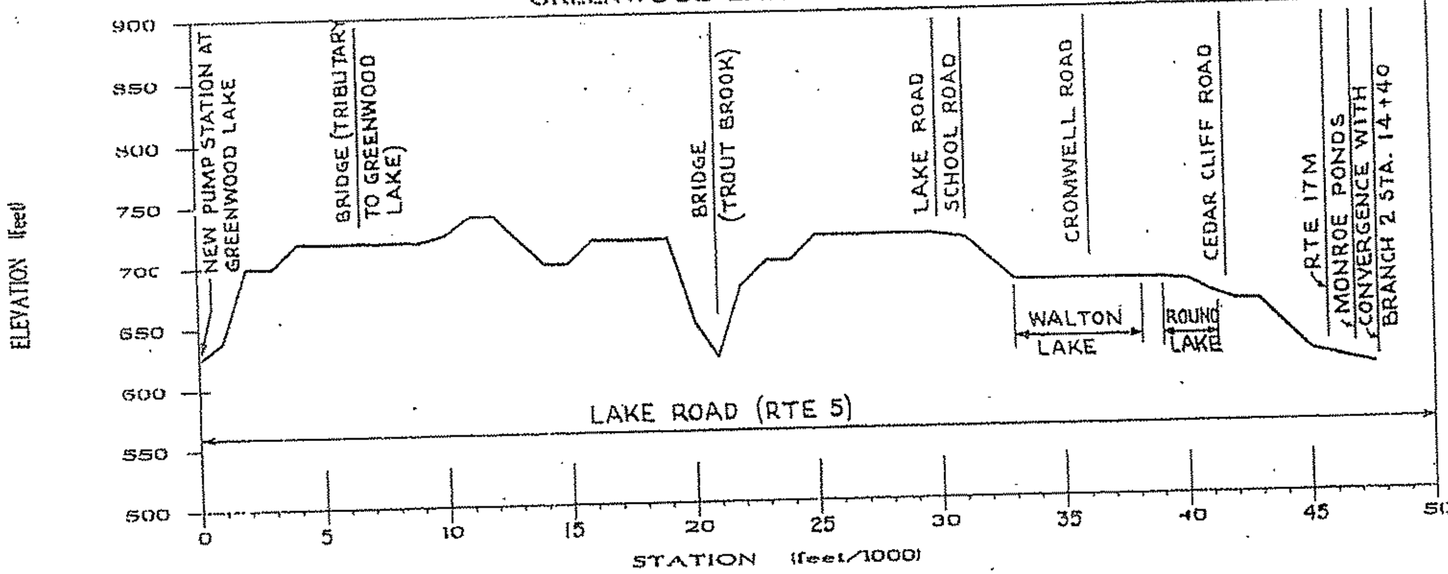
Approach	No.	Description	Service Area.	Pipeline Costs Capital, $1000	Pipeline Costs 1995 O&M, $1000/yr	Pipeline Costs 2020 O&M $1000/yr	Pumping Station Costs Capital, $1000	Pumping Station Costs 1995 O&M, $1000/yr	Pumping Station Costs 2020 O&M $1000/yr	Treatment Related Costs Capital, $1000	Treatment Related Costs 1995 O&M, $1000/yr	Treatment Related Costs 2020 O&M $1000/yr	Total Project Costs Capital, $1000	Total Project Costs 1995 O&M, $1000/yr	Total Project Costs 2020 O&M $1000/yr
Central	1b.	Pipelines Routes: 1.1,1.2,2.1,2.2,3.1,3.2,3.3,5.1 Pumping Stations: 1.1,2.1,3.1,3.3,5.1 New 12.0 mgd SEC Husdon R. STP	OCSD#1 HBSR Washingtonville Greenwood Lake Goshen (UT)	$37,300	$46	$58	$12,900	$210	$375	$33,200	$1,600	$3060	$83,400	$1,860	$3,490
Central	2a.	Pipelines Routes: 1.1,1.2,2A.1,2A.2,4.1 Pumping Stations: 1.1,2A.1,4.1 New 10.2 mgd SEC Husdon R. STP	OCSD#1 HBSR Greenwood Lake	$38,800	$34	$35	$9,200	$189	$465	$30,600	$1,400	$2650	$78,600	$1,620	$3,150
Central	2b.	Pipelines Routes: 1.1,1.2,2A.1,2A.2,4.1,5.1 Pumping Stations: 1.1,2A.1,4.1,5.1 New 11.1 mgd SEC Husdon R. STP	OCSD#1 HBSR Greenwood Lake Goshen (UT)	$40,400	$37	$38	$10,700	$213	$504	$31,600	$1,500	$2810	$82,700	$1,750	$3,350
Central	3a.	Pipelines Routes: 1.1,1.2,2A.1,2A.2,4.1 Pumping Stations: 1.1,2A.1,4.1 w/re-aer & disinf Expand OCSD#1 STP from 4 to 10.2 mgd SEC	OCSD#1 HBSR Greenwood Lake	$38,800	$34	$35	$11,600	$318	$660	$20,100	$1,400	$2650	$70,500	$1,750	$3,350
Central	3b.	Pipelines Routes: 1.1,1.2,2A.1,2A.2,4.1,5.1 Pumping Stations: 1.1,2A.1,4.1,5.1 w/re-aer & disinf Expand OCSD#1 STP from 4 to 11.1 mgd SEC	OCSD#1 HBSR Greenwood Lake Goshen (UT)	$40,400	$37	$38	$13,500	$343	$699	$19,500	$1,500	$2810	$73,400	$1,880	$3,550

APPENDIX E

FIGURE E-1

PROFILE

GREENWOOD LAKE TO MONROE



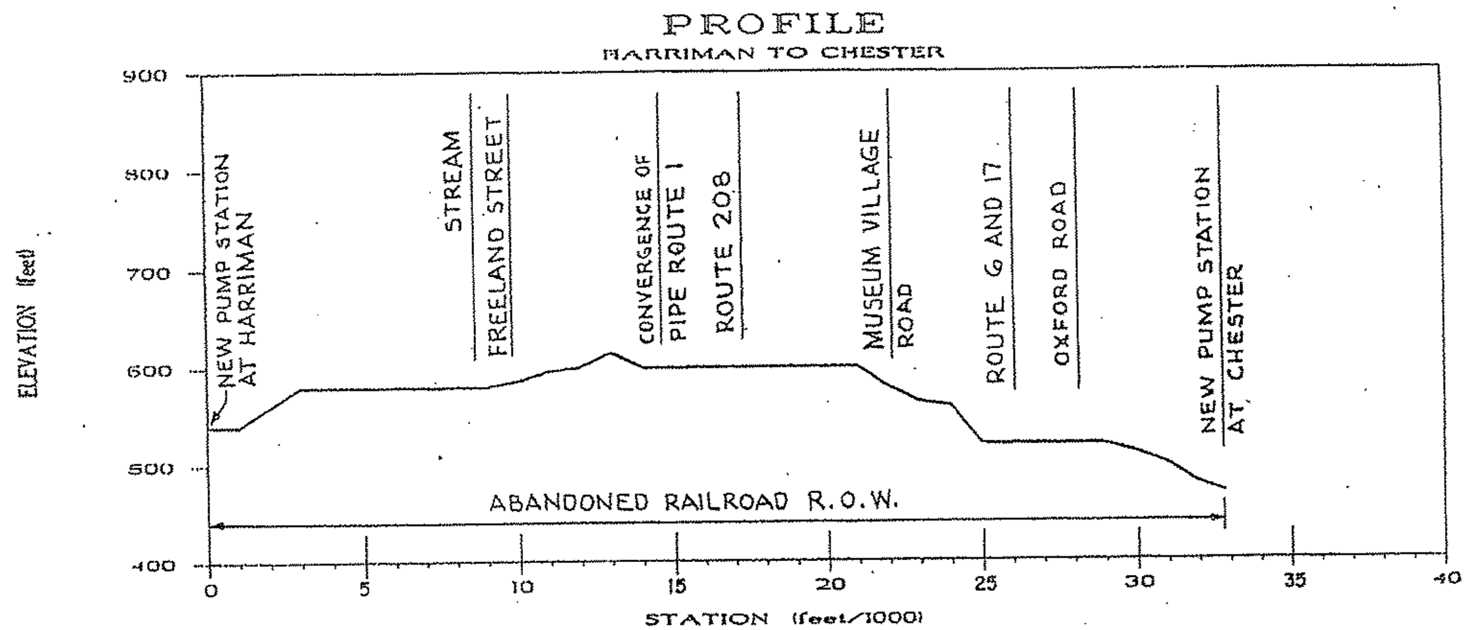
ORANGE COUNTY, N.Y.
COMPREHENSIVE
SEWERAGE STUDY

PIPE ROUTE I

HAZEN AND SAWYER, P.C.
Engineers

132546

FIGURE E-2



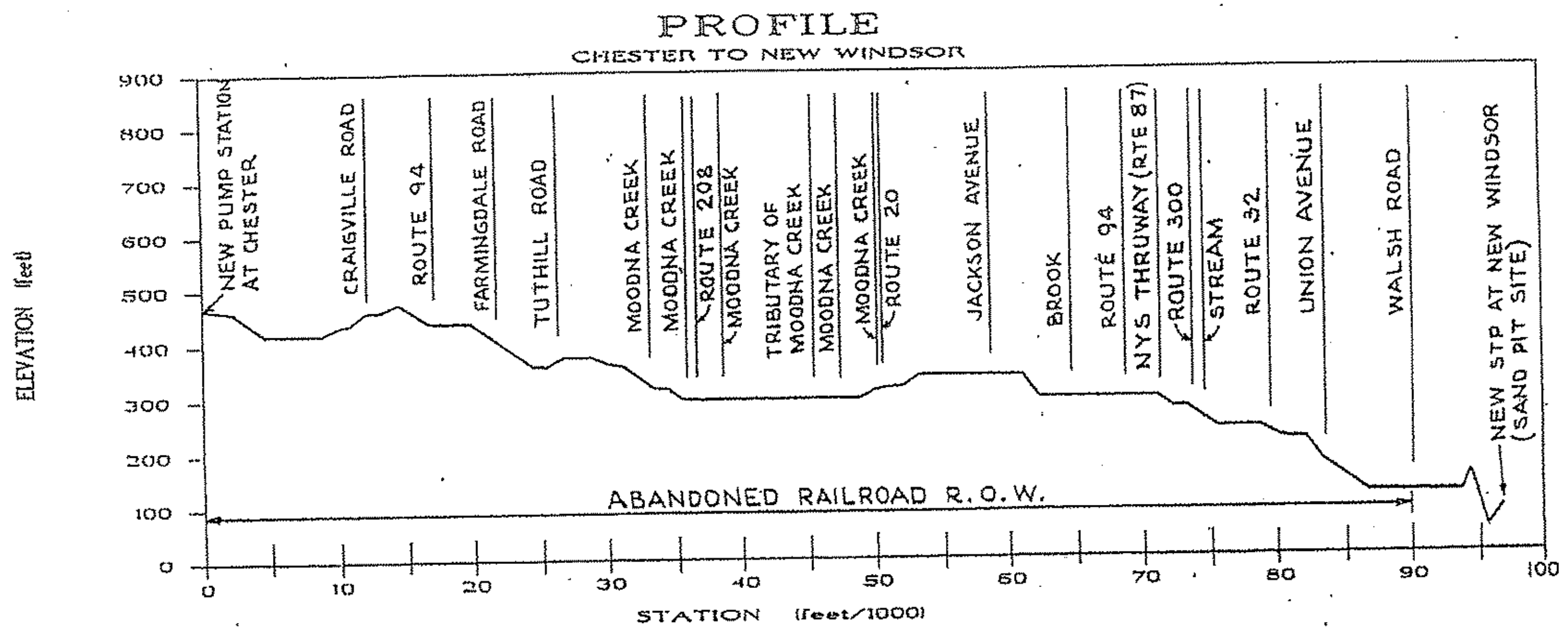
ORANGE COUNTY, N.Y.
COMPREHENSIVE
SEWERAGE STUDY

PIPE ROUTE 2

HAZEN AND SAWYER, P.C.
Engineers

132546

FIGURE E-3



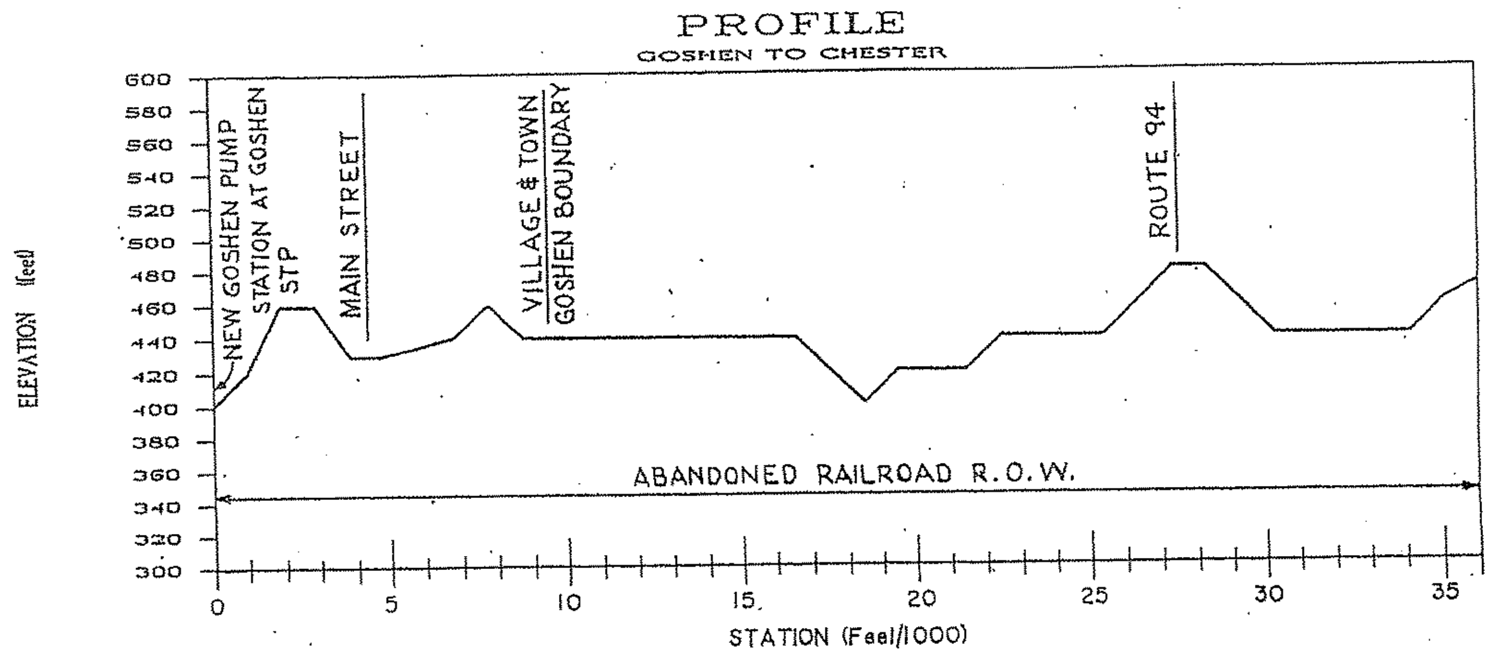
ORANGE COUNTY, N.Y.
COMPREHENSIVE
SEWERAGE STUDY

PIPE ROUTE 3

HAZEN AND SAWYER, P.C.
Engineers

132546

FIGURE E-4



ORANGE COUNTY, N.Y.
COMPREHENSIVE
SEWERAGE STUDY

PIPE ROUTE 5

HAZEN AND SAWYER, P.C.
Engineers

132546

APPENDIX F

HAZEN AND SAWYER, P.C.
10 MOUNTAINVIEW ROAD
UPPER SADDLE RIVER, N.J. 07458

DATE: February 20, 1990

MEMORANDUM

FOR: File - Orange County Sewerage Study

FROM: Kristin Wheaton KW

SUBJECT: SEWER COMMITTEE MEETING MINUTES

On February 14, 1990, a meeting of the Orange County Sewer Committee was held at the County Offices in Goshen, New York. John Parnell, Deputy Commissioner for Environmental Facilities at the County Department of Public Works, presided over the meeting. The following members of the project team were present:

Bill Dey	-	EA Engineering, Science and Technology
Paul Muessig	-	EA Engineering, Science and Technology
George Bisbano	-	Hazen and Sawyer, P.C.
Bob Hagadorn	-	Hazen and Sawyer, P.C.
Roger Manners	-	Hazen and Sawyer, P.C.
Kristin Wheaton	-	Hazen and Sawyer, P.C.
Sheldon Yuan	-	Hazen and Sawyer, P.C.

Mr. Parnell opened the meeting with a brief introduction and stated that the focus of this meeting was to be the southeast portion of the County. He then allowed Cesar Manfredi of the NYSDEC (White Plains), who was present for the beginning of the meeting, to speak out on action that is being taken by the DEC regarding the Harriman plant.

Mr. Manfredi stated that the DEC was presently preparing for court action against the Harriman STP to correct plant operation problems and eliminate permit excursions. He stated that no expansion of the plant would be considered by the DEC until the plant proves that it can consistently meet existing permit limits. Mr. Manfredi stated that, additionally, a separate court action was being prepared to require OCSD1 and the Moodna Group to remove excessive I/I from the collection system. Until action on these issues is taken, the DEC-imposed sewer connection moratorium will remain in place for this area. (Mr. Parnell confirmed that an I/I study is about to be started for the OCSD1 service area.)

Mr. Manfredi discussed the pending reclassifications of the Woodbury Creek and the Ramapo River, saying that the allowable NH_3 effluent concentration from the Harriman plant to the Ramapo River (being reclassified from "D" to "C") will have to be decreased from 1.6 mg/l to 1.3 mg/l. Hearings for the reclassification of the Woodbury (from "C" to "C-TS") are scheduled for March 7, at the Rockland County Health Center. Beth Zicca at DEC White Plains (914-761-6660) can provide more information on times and locations of this and other reclassification hearings.

Roger Manners gave a brief overview of the scope of the study, and project status, stating that the project had gotten underway in September 1989 and that at this point the study was approximately 15% complete. Mr. Manners then introduced project team members and gave the floor to Bill Dey of EA Engineering, Science and Technology.

Bill Dey began with a basic definition of what a Waste Assimilation Capacity (WAC) analysis is, and then discussed the implications of the new stream reclassifications which are being implemented by the DEC. Mr. Dey went through illustrations of what the proposed stream classifications are and how they affect permitted discharges to the water. The illustrations in his handout depicted the concepts of biochemical oxygen demand and its nitrogenous and carbonaceous components, making it easier for the audience to understand how stream reclassifications will affect their treatment plant(s).

Among Mr. Dey's handouts was a graph showing the severe impacts of infiltration and inflow at the OCSD1 treatment plant. Graphs of permit limits versus actual effluent conditions for a one-year period were informational to many in the audience.

One audience member asked what impact the Nepera Company had upon the OCSD1 STP. Mr. Dey responded that Nepera discharges part of its wastewater to the OCSD1 STP and also operates its own plant which discharges to the Ramapo River. Looking at the graph on page 8 of his handout, Mr. Dey pointed out the large difference between ammonia levels in the River and the effluent for a portion of the year. He stated that it was strange to see such a large change in the effluent concentrations, and that he had questioned OCSD1 plant personnel to see if any change in operations had caused this variance. Mr. Dey said it was the opinion of plant personnel that Nepera may have been discharging an ammonia-based waste stream to the STP during this period, as there had been no change in operations at the plant.

Roger Manners presented the alternatives being considered for the OCSD1 and Moodna Basin Southern Region (MBSR). The alternatives and preliminary population and flow estimates were presented in a handout. One audience member pointed out that the 1990 population figures for the Village of Kiryas Joel was incorrect and that the actual number was closer to 8,000. Two other population estimates were pointed out as incorrect for 1990. These were the Town of Monroe (population should be about 9,000) and the Village of Harriman (population about 3,000). Mr. Manners stated that these were merely <u>preliminary</u> numbers and that they had yet to be adjusted to take into consideration comments received from municipal planners.

Ms. Nancy Calhoun, Supervisor from Blooming Grove, referring to the handout, stated that some of the comments made by the planning firm of Garling Associates were incorrect; at least one of the developments indicated by them to be in Chester, for example, was actually in Blooming Grove. Mr. Manners said that one of the main reasons for presenting these preliminary numbers was to solicit comments from townspeople in order to gain further insight to population growth within the County. Ms. Calhoun said that the opinions of planners often do not agree with the opinions of town personnel, and that she wished to be consulted about growth projections for Blooming Grove. Mr. Robert Tills, Supervisor for Woodbury, also stated that he would like to have a meeting with Hazen and Sawyer to discuss growth projections. Mr. Manners said he would be pleased to set up meetings with Ms. Calhoun and Mr. Till and others, as necessary.

Mr. Manners then reviewed six options available for OCSD1 AND MBSR.

Mayor Nicolas Papaceno, of the Village of Warwick, stated that he had heard enough about the Harriman plant, and wanted to know what options Hazen and Sawyer was considering for the Village and Town of Warwick. Mr. Manners explained that Warwick was not the focus of this presentation, as Mr. Parnell had stated at the beginning of the meeting.

Several others in the audience voiced concern that H&S was spending too much time on the OCSD1 plant and should concentrate on the how to build one county plant on the Hudson. Ms. Roberta Murphy, Chairwoman of the Physical Services Committee and Legislator for County District No. 1, said that even though many people think that one plant is the best option, all alternatives must be considered in order to satisfy the NYSDEC. Mr. Parnell stated that the other areas of the county will be addressed at a later date, and that the intent of this meeting was to focus on the changing stream criteria and how they affected the options available to the OCSD1 plant.

Mr. Manners introduced Sheldon Yuan to explain what Hazen and Sawyer had determined is needed at the OCSD1 plant if it is decided to upgrade and/or expand the facilities.

Mr. Yuan stated that, for the plant to be upgraded to meet new stream criteria, the best approach would be to put in series the presently parallel operations of conventional aeration and oxidation ditches. This would require the addition of final clarifiers following the oxidation ditches and an equalization basin at the head of the plant to soften peak flows. Mr. Yuan and Mr. George Bisbano then proceeded to explain how expansion of the plant could be accomplished.

Mr. Bruce Chichester, Mayor of the Village of Harriman, said that he would not even consider a plant expansion, given the problems the OCSD1 plant has experienced with operation by the County. Mr. Chichester stated that his first concern is the people who live near the plant and with the odors present in the area. Mr. Yuan and Mr. Bisbano stated that odors can be controlled by enclosing certain operations and adjusting operations. Mr. Chichester said that he would like to meet with Mr. Manners to discuss this issue further.

KW:jb
cc: R.E. Hagadorn, R.S. Manners - Hazen and Sawyer
M. Paret - KPMG Peat Marwick
P. Muessig - EA Engineering, Science and Technology

(c:memos:ocmemo8)

HAZEN AND SAWYER, P.C.
10 MOUNTAINVIEW ROAD
UPPER SADDLE RIVER, N.J. 07458

DATE: April 9, 1990

MEMORANDUM

FOR: File - Orange County Sewerage Study

FROM: Kristin G. Wheaton

SUBJECT: SEWERAGE COMMITTEE MEETING MINUTES

On Friday, April 6, 1990, a meeting of the Orange County Sewer Committee was held at the County Government Center in Goshen, New York. The following project team members were in attendance:

Roger Manners	-	Hazen and Sawyer, P.C.
Bob Hagadorn	-	Hazen and Sawyer, P.C.
Glenn Di Giovanni	-	Hazen and Sawyer, P.C.
Kristin Wheaton	-	Hazen and Sawyer, P.C.
Paul Muessig	-	EA Engineering, Science and Technology
Bill Dey	-	EA Engineering, Science and Technology
Bruce Muchmore	-	EA Engineering, Science and Technology
Myron Olstein	-	KPMG Peat Marwick
Mel Paret	-	KPMG Peat Marwick

John Parnell opened the meeting and introduced the members of the project team.

Bob Hagadorn started by suggesting that a regular schedule be set up to hold monthly meetings. It was recommended that regular meetings could be held on the third Friday of each month, i.e., the next meeting on May 18, 1990.

Mr. Hagadorn discussed the project schedule, percent completion of tasks, and explained that the data-gathering process has been far more involved than originally anticipated.

Roger Manners began the presentation, stating that Hazen and Sawyer has been meeting with municipal officials in order to get a better handle on the growth that is occurring in the County. He pointed out that Hazen and Sawyer still has not met with all officials, but that the intention was to hear the thoughts of as many as possible.

Referring to the H&S handout, Mr. Manners discussed the treatment facilities and problem areas of the County, stating that several municipalities do not face an immediate crisis in terms of wastewater treatment. He noted that the average flow figures shown in the table do not reflect infiltration and inflow events that impact some of the plants.

Mr. Manners then presented a table showing estimated 1990 population, projected 2020 population, and estimated sewage flow at year 2020. He repeated that the population estimates reflect comments of municipal officials, and that it is important for each municipal official to evaluate Hazen and Sawyer's projections to see that they accurately reflect what they perceive is happening in terms of growth.

Mr. Manners unveiled the alternatives being considered for regional and county-wide sewer service. He discussed the communities potentially served by each of the regional plants, and made note that all of these preliminary alternatives depend on the waste assimilation capacity (WAC) findings of EA. He pointed out that in the event a pipeline is planned to run from the OCSD1 plant to New Windsor, the Route 94 path will allow for more connections to the trunk than a pipe along Route 32.

Nancy Calhoun, Supervisor of the Town of Blooming Grove, asked whether the proposed upgrade in some stream standards was being considered in Hazen and Sawyer's study. Mr. Manners replied that Hazen and Sawyer is very aware of the proposed new stream standards and that stream standards are a key consideration limiting the treatment options available.

Bob Bradford, Executive Director of the Orange County Water Authority, asked what considerations had been made for industrial wastewater flow. Mr. Manners explained that industrial contributions were reflected in the gallons per capita per day, and varied for each municipality. Ms. Calhoun suggested that it may be wise to boost some of the per capita flow figures for those areas along a pipe route, as the availability of sewer service may encourage industrial development.

Mr. Bradford inquired as to how infiltration and inflow are being addressed in projecting sewage flows. Mr. Manners said that at this stage, I/I cannot be accurately incorporated into the flow figures. Mr. Hagadorn stated that the determination of flow attributable to I/I was beyond the scope of this study, and that I/I was something that will have to be addressed at the design stage.

Don Witfield, of the Eastern Orange County Chamber of Commerce, suggested a criteria could be established that, in the event a community wants to join a County sewer system, there be a limit on the amount of I/I acceptable in a collection system. Mr. Manners agreed with this concept, and stated that this was something that could be considered at the implementation phase of the study.

Paul Muessig started EA's portion of the presentation with a review of the drainage basins and major streams in the County, defining what a WAC analysis entails, and describing the characteristics of an effluent discharge and how a receiving stream naturally recovers as it flows downstream. He explained how modeling of a stream is accomplished, noting that for this study, streams are being modeled using existing permit limits. This is generally a conservative approach (most discharges are below permit limits), but in some cases, actual effluent concentrations are higher than those permitted.

Mr. Bradford pointed out that EA's handout showed that some facilities are immediately exceeding the instream limits. Mr. Muessig said that, indeed, in some cases this is true, but that at the time the original permit limits were written, best available control technology (BACT) was limited, and the permits writers could not propose limits that were not technologically feasible. Mr. Muessig said that as BACT improves, new permit limitations are being proposed by DEC in some cases.

Mr. Bradford asked where background stream data came from. Mr. Muessig replied that information was taken from limited sampling performed by the DEC. He noted that non-point pollution was not directly accounted for in the modeling of streams, but that the background data will factor-in some of the effects of non-point sources. Mr. Muessig stated that due to the agricultural activities along the Wallkill River, a significant amount of background BOD and NH_3 may be present.

Mr. Witfield asked if the effects of acid rain had any bearing on the WAC of a stream. Mr. Muessig stated that, historically, acid rain has not been a significant threat to rivers and flowing water bodies in this area of the State.

Mr. Muessig discussed the ramifications of discharging treated wastewater to the Hudson River. He stated that the DEC usually will require only secondary treatment if the river to effluent ratio is greater than 12:1. If a regional load of 30 MGD were proposed in the area of Newburgh/New Windsor, the ratio would be 65:1. However, all decisions by the DEC are made on a case-by-case basis, and given that the Hudson River is tidal in this reach, a detailed hydrodynamic modeling of the Hudson will most likely be required (which is not within the scope of this Study). The tidal influence of the Hudson in the area of New Windsor is 1.75 miles south of the Chelsea Pump Station water supply.

Roberta Murphy, Legislator of County District No. 1, inquired if the Woodbury Creek was being evaluated in terms of WAC. Mr. Muessig replied that it was not planned, as the reclassification of the Woodbury Creek from C-T to C-TS will allow no new discharges unless the river/effluent dilution ratio is greater than 10:1. Ms. Murphy responded that she still thought we should look at the Woodbury Creek as a potential receiving body because it is a fair-sized stream with good reaeration capacity.

Mr. Paret began KPMG Peat Marwick's portion of the presentation and reviewed the options available for financing the project.

Mr. Paret stated that the state revolving loan program is available to provide low-interest loans to municipalities seeking to design and construct wastewater transmission or treatment facilities. It appears that the State of New York will make available loans at one-third of market rate. At present, there is a very long list of projects waiting for funding, and only those that meet priority criteria will qualify for a loan. It is possible to start a project and refinance when the project gets on the priority list, but this can be risky as the project may never qualify for the loan.

Dennis Cosgrove, former Supervisor of the Town of Wallkill, said that the recently constructed Wallkill STP is going to be refinanced with the revolving fund program; it is number five on the state list.

Ms. Calhoun said that any financing scheme should be sure to take into consideration the present sewage treatment indebtedness of some municipalities. Mel said that it will be considered, stating that municipalities should not have to pay for more than their own growth-related costs.

Mr. Paret said that one way to balance costs of the project throughout the County would be to impose an unsewered fee on those using individual subsurface disposal. This is common in some parts of the country. Ms. Calhoun suggested that if this was done, it may be advantageous to provide some incentive, such as a free septic tank pump-out. Mr. Bradford stated that some areas impose an across-the-board fee per acre of land, noting that providing sewage treatment capacity is a benefit to the entire county.

Myron Olstein explained the implementation alternatives presently available to the County.

Mr. Olstein stated that due to the 1986 tax act, privatization of treatment facilities is not as desirable as it once was, but that it still may prove to be an attractive plan.

Mr. Olstein said that design-build contracts are often the least expensive way to plan for and construct a facility.

Developer or capacity fees are restrictive in terms of what money can be used to finance growth-related costs.

General obligation bond capacity is limited due to the multiple County projects planned at this time.

Mr. Manners stated that it is time to get municipal officials involved if the implementation plan is going to work. Ms. Calhoun agreed, saying that public participation is the key to this plan becoming reality. Mr. Olstein suggested that the private sector (developers) should be involved in discussions as well, because they may play a key role.

Mr. Cosgrove stated that it will be difficult to prove to some municipalities that they are better-off joining a County-wide sewer system, instead of being self-sufficient.

Mr. Witfield said that as a start, it would be helpful just to get the complete sewer committee to attend. (There were several committee members absent.)

KW:jb
Attach.
cc: J. Parnell - Orange County DEP
W. Sinnott, R. Hagadorn, R. Manners, G. Di Giovanni - Hazen and Sawyer
P. Muessig - EA Engineering, Science and Technology
M. Paret - KPMG Peat Marwick

(c:memos:pubmtg2:jb)

HAZEN AND SAWYER, P.C.
10 MOUNTAINVIEW ROAD
UPPER SADDLE RIVER, N.J. 07458

DATE: October 24, 1990

MEMORANDUM

FOR: Orange County Sewer Committee Members

FROM: Kristin G. Wheaton KW

SUBJECT: Minutes of Sewer Committee Meeting

On October 23, 1990, a meeting of the reconstituted Orange County Sewer Committee was held at the County Government Offices in Goshen, New York to discuss project status of the Orange County Comprehensive Sewerage Study being prepared by Hazen and Sawyer, P.C. The following persons were in attendance:

SEWER COMMITTEE MEMBERS

Al Favoino - Legislator
Spencer McLaughlin - Legislator
Tony Marino - Legislator
Tim Diltz - Supervisor, Town of Chester
Joe Rampe - Supervisor, Town of Warwick
David Pardy - Legislator
Gil Shapiro - Mayor, Village of Greenwood Lake
Roberta Murphy - Legislator
Bob Bonney - Mayor, Village of Monroe
Annette Dorozynski - Supervisor, Town of Tuxedo
Dick Randazzo - Supervisor, Town of Cornwall

OTHERS

Mary McPhillips - County Executive
John Parnell - Dep. Comm. of Public Works
Vicki Mitchell - for Jim Townsend, Legislator
Peter Garrison - Commissioner of Planning
Mary Dwyer - Asst. to County Executive
Jack Evans - Department of Health
Mat Schleifer - Department of Health
Simon Gruber - Town of Chester
Tom Cione - Department of Law

PROJECT TEAM

Glenn Di Giovanni - Hazen and Sawyer, P.C.
Robert Hagadorn - Hazen and Sawyer, P.C.
Paul Muessig - EA Science & Technology, Inc.
Mel Paret - Peat Marwick Main, Inc.
Roger Manners - Hazen and Sawyer, P.C.
Kristin Wheaton - Hazen and Sawyer, P.C.

Mrs. Mary McPhillips began the meeting with a welcome to the new Committee members in attendance.

Mr. John Parnell opened the meeting with an explanation of what the Orange County Comprehensive Sewerage Study entails, and introduced Mr. Roger Manners, Project Manager.

Mr. Manners introduced the members of the Project Team from Hazen and Sawyer, EA Engineering Science & Technology, and Peat Marwick Main. He then presented an overview of the tasks being undertaken as part of the Study, and detailed what the status of the project was to date. Mr. Manners then introduced Mr. Glenn Di Giovanni, Project Engineer, to present the project work in detail.

Mr. Di Giovanni referred to an available handout throughout his presentation. Mr. Di. Giovanni began his presentation by showing the population projections that Hazen and Sawyer had developed as part of the Study, explaining that the projections had been generated as a result of meetings with key personnel from each City, Town and Village within the County. Mr. Di Giovanni stated that the populations stated were open to review, and that any comments regarding their validity would be evaluated. Mr. Di Giovanni stated that Hazen and Sawyer's projection of 312,500 in 1990 was slightly above the preliminary U.S. Census count of 304,000, but noted that several communities are contesting the Census count for being low.

Mr. Peter Garrison, referring to the population tables, pointed out that the population of the proposed County jail was erroneously added to the Town of Wallkill, that the jail is actually to be in the Town of Goshen. Mrs. McPhillips stated that the population projected for the jail was also incorrect, that the figure should be 1400, not 1800 inmates.

Mr. Di Giovanni continued, reviewing sewage generation rates and projected sewage flow for 2020.

Mr. Joe Rampe asked if infiltration and inflow (I/I) were considered in the projection of sewage flows. Mr. Di Giovanni responded that the gallons per capita sewage figures reflected present problems with I/I. Mr. Rampe asked if Hazen and Sawyer should adjust the figures to account for potential removal of I/I from the collection system. Mr. Manners responded that EPA has determined that the cost of I/I removal can be prohibitive. Infiltration is often difficult to isolate and in many cases rehabilitation has been found to be both short-lived and costly. Mr. Manners stated that for the purposes of this Study, removal of I/I will not be considered.

Mr. Di Giovanni continued his presentation, describing the screening processes used for the evaluation of alternatives, and the results of the first stage screening.

Mr. Spencer McLaughlin asked who ranked the criteria listed in the first stage screening table. Mr. Di Giovanni responded that Hazen and Sawyer had done this. Mr. McLaughlin inquired why in some cases, for example Hamptonburgh, a more favorably ranked alternative was not judged the preferred alternative. Mr. Di Giovanni replied that in the case of Hamptonburgh, growth projections for the area, as supported by Supervisor Robert Jankowsky, did not reflect the kind of development that would warrant a municipal sewerage system, and hence the decision to not to screen certain alternatives any further.

Ms. Annette Dorozynski stated that the projections for the Towns of Tuxedo and Warwick should include contributions for the planned development at Sterling Forest Corporation. Ms. Dorozynski stated that the Indian Kill sewage treatment plant (STP) was recently brought back on-line, and is permitted for 200,000 gallons per day. Ms. Dorozynski inquired if any consideration had been given to the proposed Ramapo River STPs upstream (R.H. Tuxedo and Sterling Forest) of the Town of Tuxedo, and how they will affect the discharge limits for the Town of Tuxedo STP. Mr. Di Giovanni stated that the waste assimilation capacity analysis performed by EA should show the impact from upstream STPs on the Town of Tuxedo STP, however, due to the uncertainty of the extent of development at Sterling Forest, it was difficult to assess this impact at this time. Mr. Di Giovanni stated that this information would be evaluated as it becomes available.

Mr. Bob Bonney inquired if any consideration had been given to the possibility that the Village of Kiryas Joel may annex land from the Town of Woodbury, and how this will affect the distribution of flows under the alternative scenarios presented by Hazen and Sawyer. Mr. Di Giovanni stated that he was unaware of the possible annexation. Mr. Manners stated that the projections for Kiryas Joel were based upon present population trends, and that it is impossible to account for the redefinition of Village and Town boundaries in the future.

Mr. Bonney asked what could be done to prevent and/or correct problems attributed to particular communities contributing to a large, County sewerage system. Mr. Manners replied that some sort of "policing" authority would need to have control over the system, and be able to enforce compliance with the requirements of the system.

Mr. Di Giovanni concluded his presentation and Mr. Manners introduced Mr. Paul Muessig to talk about the environmental impact analysis performed by EA.

Mr. Paul Muessig made a brief presentation describing waste assimilation capacity (WAC) analysis, and how a water body reacts when wastewater is discharged.

Mr. Simon Gruber, referring to the last page in EA's handout, asked if the allowable sewage flows reflected present discharges to the water bodies shown. Mr. Muessig responded that the allowable flows shown took into account the contributions from existing STPs.

Mr. Muessig concluded his presentation, and Mr. Manners introduced Mr. Mel Paret to discuss the financial and implementation issues that will be addressed as part of this Study.

Mr. Paret made a brief presentation on the various features of implementing a County authority vs. a County district, the revenue-generating aspects of each method, and the relative benefits of privatizing public projects.

Mr. Garrison inquired why there was no mention of intermunicipal agreements included in the financing alternatives. Mr. Paret responded that intermunicipal agreements may be appropriate on the smaller scale, but that for a regional or county-wide system, these types of agreements would not be preferable.

Mr. Dick Randazzo asked if an authority could be made up of a group of communities instead of the whole County. Mr. Paret replied that, yes, this was possible, but that it is better to be able to distribute costs over a larger base.

Mr. Paret concluded his presentation and Mr. Manners again took the floor. Mr. Manners asked that everyone review the material presented in the handout, and stressed that feedback was needed on the projections made and the methodologies used for evaluation of the alternatives. Mr. Rampe suggested that copies of all population and flow projections be delivered to municipal officials of all the communities in the County. Mr. Manners said this was a good idea.

Mr. Manners suggested that another meeting be scheduled in the near future to discuss comments from Sewer Committee members. It was agreed that the next meeting of the Sewer Committee would be held on November 19, 1990 at 9:00 AM, in the same location.

Mr. Tom Cione suggested that the Committee may wish to elect a chairperson to head the group. Ms. Roberta Murphy suggested that the chairperson should be a legislator because the final decision to enact a county-wide district or authority would rest with the legislature. Ms. Mary Dwyer suggested that since Mrs. McPhillips had appointed the Committee that perhaps the County Executive should be entitled to nominate a chairperson. It was agreed that a vote for chairperson would take place at the next meeting of the Sewer Committee.

It was agreed that minutes of all Sewer Committee meetings would be distributed to all members of the Committee.

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HAZEN AND SAWYER, P.C.
10 MOUNTAINVIEW ROAD
UPPER SADDLE RIVER, N.J. 07458

DATE: November 26, 1990

MEMORANDUM

FOR: Orange County Sewer Committee Members

FROM: Kristin G. Wheaton KW

SUBJECT: Minutes of November 20, 1990 Meeting

A meeting of the Orange County Sewer Committee was held on November 20, 1990 at the County Government Offices in Goshen, New York to discuss the Orange County Comprehensive Sewerage Study. The following people were in attendance:

SEWER COMMITTEE MEMBERS

Spencer McLaughlin - Legislator, District No. 7
Bruce Chichester - Mayor, Village of Harriman
Robert Bonney - Mayor, Village of Monroe
Bob Till - Supervisor, Town of Woodbury
Joe Rampe - Supervisor, Town of Warwick
Roberta Murphy - Legislator, District No. 1
Al Favoino - Legislator, District No. 6
Tim Diltz - Supervisor, Town of Chester
Richard Randazzo - Supervisor, Town of Cornwall
Tony Marino - Legislator, District No. 17
Jim Townsend - Chairman, Orange County Legislature
Louis Mills - Former County Executive
David Pardy - Legislator, District No. 8

OTHERS

Peter Garrison - Commissioner of Planning
Roy Weyant - Legislator, District No. 5
Tom Cione - Department of Law
Mat Schleifer - Department of Health
John Parnell - Deputy Commissioner of Public Works
Simon Gruber - Town of Chester

PROJECT TEAM

Walter Sinnott - Hazen and Sawyer
Roger Manners - Hazen and Sawyer
Glenn Di Giovanni - Hazen and Sawyer
Kristin Wheaton - Hazen and Sawyer

Spencer McLaughlin, newly appointed Chairman of the Sewer Committee, opened the meeting. Mr. McLaughlin stated that it was apparent that representation from several communities was missing from the Committee, and that, with the consent of the present Committee members, representation from New Windsor, Wallkill, Blooming Grove, Washingtonville, and Wawayanda will be sought. It was agreed that this is a good idea, and will be pursued with the County Executive.

Mr. McLaughlin stated that Hazen and Sawyer would make no formal presentation at this meeting, and that the intent of the meeting was to gain feedback on H&S population and flow projections, and the screening of conceptual alternatives. With this, Mr. McLaughlin opened the floor for comments.

Roberta Murphy made reference to the "alternative" treatment methods, such as land-application, being considered as a means for handling the County's sewage treatment needs. She stated that the County had tried these types of treatment on many occasions, and that there were problems with the operations, especially with odor control. Mrs. Murphy stated that she felt the possibility of land-based treatment should not be considered in light of these past failures. Mr. McLaughlin concurred.

Bruce Chichester stated that in the Village of Harriman, as well as other OCSD#1 communities, there are homes presently served by septic systems that have sewer service available to use, but are unable to hook up due to the moratorium on new connections. He inquired if Hazen and Sawyer's flow projections take into account the sudden increase in flow that will occur when these home owners are able to hook into a community sewer system. Roger Manners replied that the population and flow projections do account for all future connections to the system. Robert Bonney stated that this is a major concern, that the sudden influx of flow from these hook-ups will be detrimental. Mr. Manners stated that facilities will be sized for the year 2020, and that this will accommodate the flow. Kristin Wheaton stated that the projections made for sewered population address both new household connections as well as existing households connecting to the system. Referring to Table 2 in the handout booklet, Ms. Wheaton pointed out that the Village of Harriman is shown as 95% sewered at present and reaches 100% sewered at year 2010. It is the increase in percent of population sewered that accounts for present septic homes connecting to the sewer system.

Bob Till said that this Study is supposed to cover the entire County, and that it appears that Hazen and Sawyer is duplicating the study prepared by Camp Dresser and McKee for OCSD#1 and the Moodna Basin Southern Region in 1988. Mr. Manners replied that this is indeed a study of the wastewater treatment needs for the entire County, and that numerous options have been considered for the communities in the County. Referring to a presentation board (Figure 3, page 13 of the handout), Mr. Manners cited that 94 conceptual alternatives have been screened down to 46, and that of those 46, only 22 options are suitable for inclusion in some sort of regional or central treatment plan.

Mrs. Murphy asked Peter Garrison if he had reviewed the population projections made by Hazen and Sawyer. Mr. Garrison replied that he had met with Hazen and Sawyer, and that the population estimates and projections made by Hazen and Sawyer had been compared to 1990 estimates prepared by the Planning Department, and that material from several sources was made available to the consultant.

Al Favoino asked what new issues were planned to be discussed at this meeting. Mr. McLaughlin replied that the intent of this meeting was not to present new material, but to review the material that Hazen and Sawyer had already made available to the Committee.

Mr. Till stated that he felt the projections Hazen and Sawyer had made for the Town of Woodbury looked correct.

Mr. Chichester asked how the flow projections for each municipality will be affected by an influx of non-resident workers. Mr. Manners responded that the per-capita flow rates for each community reflect residential, commercial and industrial contributions to flow, and that these rates had been comprehensively developed by examining present sewage treatment plant records and projections made for water usage for the Orange County Water Authority. Mr. Di Giovanni, referring to Table 3 in the handout, pointed out that for Harriman, the gallons per capita sewage generation increases from 90 to 100 gallons per person, reflecting an expected flow increase due to commercial or industrial activity.

Mr. Chichester stated that he would like to have his Village Engineer sit with him at Sewer Committee meetings. Mr. McLaughlin said that these Committee meetings are open meetings and that each person is welcome to bring representation as they see fit.

Tim Diltz inquired if financing options and recommendations are to be covered as part of this Study. Mr. Manners replied that financial concerns are included in the Study, and that subconsultants Peat Marwick Main will be discussing this in detail at a later date.

Mr. Bonney asked how the Study will address the issue of sewer hook-ups that occur beyond the projections made by Hazen and Sawyer, and how to assure that capacity is not given to areas that were not intended to receive sewer service. Mrs. Murphy stated that this would have to be a local issue, and would have to be addressed in the zoning ordinances and master plans for each community. (It is noted that this issue will also need to be addressed in the bylaws of a District or Authority, and in the Agreements made between municipalities. It is intended that hook-up fees for new users will provide the necessary monies to expand the capacity of a central treatment facility as required.)

Tom Cione again raised the issue of getting input from communities not presently appointed to the Committee by the County Executive. He pointed to the possibility of a STP in New Windsor, noting that no representation from New Windsor was present. He stated that no real discussion of alternatives should be undertaken without their presence.

Jim Townsend stated that the Committee should contact all communities and solicit their comments on the alternatives presented thus far in the Study. Mr. McLaughlin asked if Mr. Townsend would be willing to make this request directly to the County Executive. Mr. Townsend said he would.

Mr. Chichester asked about water body reclassification, and what effect this would have upon Hazen and Sawyer's recommendations for sewage treatment. Mr. Manners responded that subconsultants EA Science and Technology have evaluated the impacts of potential discharges to streams using all information available from DEC on the proposed reclassification of water bodies. Discharge criteria for each stream are based upon the assumption that all DEC presently proposed stream upgrades will be put into effect.

Walter Sinnott inquired of Mr. Manners, what will be the preferred alternative if cost is not an option, and what will be the most economical option. Mr. Manners replied that one option satisfies both questions. Mr. Manners stated that the best, and most economical, option is to abandon the Harriman and Washingtonville STPs, pump raw wastewater along the abandoned railroad right-of-way from Chester to New Windsor, and treat at a new STP along the Hudson River.

Mr. Till asked what consideration had been given to the development of Sterling Forest Corporation in the preparation of population and flow projections. Mr. Manners replied that the development of Sterling Forest was considered, but that it was not reflected in the alternative actions conceived for Tuxedo or Warwick, as it is a private entity, and will not be conveying sewerage to municipal treatment plants. Mr. Manners stated that a meeting with Sterling Forest Corporation is planned for the week of November 26 to further review their wastewater disposal plans, and to ensure that the development will not impact local municipal sewage treatment plants.

Mr. Weyant stated that it is clear that no progress can be made on this Study if proper municipal representation is not present on the Committee. He stated that the Sewer Committee should solicit this representation quickly and come to a consensus on the issues so that a recommended plan can be presented to the County.

Mr. Cione suggested that perhaps Hazen and Sawyer should make a formal presentation to the Committee of the preferred option, stating that the consultant's opinion may carry some weight, and lessen the amount of debate required to come forth with a recommended plan.

Mr. Favoino suggested that to really get some reaction and feedback from the Committee, Hazen and Sawyer should make a recommendation for the preferred plan.

Mrs. Murphy stated that the DEC is narrowing down the County's options by reclassifying streams, and seems to be pushing the County towards discharge into the Hudson River.

Mr. Weyant asked what DEC's opinion is about a new STP discharging to the Hudson River, and if secondary treatment will be adequate. Mr. Manners responded that the waste assimilation capacity of the River is large, and that according to DEC regulations, secondary treatment will be adequate to meet the established discharge criteria. However, this issue will no doubt be the subject of further scrutiny by the DEC and other concerns.

Richard Randazzo stated that he did not understand how Hazen and Sawyer had arrived at this point in the Study. It was not clear how from a comprehensive, County-wide Study, that the list of alternatives being considered was so narrow. Mr. Manners stated that the process used in the screening of alternatives was presented at the previous meeting, held October 23, 1990.

Others in the audience agreed that they did not discern how Hazen and Sawyer screened the available alternatives. It became clear that people who had not been in attendance at the last meeting were not clear on the progress of the Study.

Mr. Randazzo stated that he also had questions on the financing of the project. Will everyone in the County have to pay, similar to the Water Authority, or will the project be paid for only by the users of the system.

Mrs. Murphy said that Hazen and Sawyer should treat these Sewer Committee meetings like public hearings. The results need to be justified. The people need to be told why the "central" County approach to sewage treatment includes what it does.

Mr. Manners said that this was supposed to be accomplished at the October 23 meeting, but it was clear that those who missed part of the presentation or were unable to attend that meeting did not understand the alternatives screening process.

It was agreed that another presentation on the development and screening of alternatives will be made by Hazen and Sawyer for the benefit of those not informed and also for the new members who are to be invited to the next meeting.

Next meeting planned for 2:30 PM, January 8, 1991, at the Orange County Government Offices in Goshen, New York.

*****

cc: M. McPhillips, J. Parnell, M. Dwyer, T. Cione - Orange County
M. Paret - Peat Marwick Main
P. Muessig - EA Engineering, Science & Technology
W. Sinnott, R. Hagadorn - Hazen and Sawyer

HAZEN AND SAWYER, P.C.
10 MOUNTAINVIEW ROAD
UPPER SADDLE RIVER, N.J. 07458

DATE: January 9, 1991

MEMORANDUM

FOR: Orange County Sewer Committee

FROM: Kristin G. Wheaton

SUBJECT: Minutes of January 8, 1991 Meeting

A meeting of the Orange County Sewer Committee was held on January 8, 1991 at the County Government Offices in Goshen, New York to discuss the Orange County Comprehensive Sewerage Study. No attendance list of Committee members was available for the meeting. The following members of the Hazen and Sawyer Project Team were in attendance:

Robert Hagadorn	- Senior Vice President
Roger Manners	- Associate
Glenn Di Giovanni	- Principal Engineer
Kristin Wheaton	- Project Engineer

Mr. Helmut Nimke, Councilman for Town of Tuxedo, suggested that for the options involving discharge to the Hudson River, that the costs for advanced wastewater treatment, in addition to costs for secondary treatment, be prepared by Hazen and Sawyer, in light of the possibility that NYSDEC may decide that secondary treatment is not sufficient. Mr. Roger Manners stated that, based upon present information available from DEC for determining discharge permit limits, secondary treatment was deemed acceptable for effluent discharge to the Hudson River. Mr. Manners stated that additional equipment (post aeration and dechlorination), beyond the "standard" secondary treatment process, has been included in cost data for these options. However, the final determination of discharge permit criteria will require a hydrodynamic evaluation of the tidal influences in the Hudson (beyond the scope of this Study). It is likely that such an evaluation will be necessary only to determine the location of an effluent outfall, not to determine the level of treatment necessary for discharge. Mr. Bob Hagadorn stated any recommendation Hazen and Sawyer makes will address the technical capabilities required to meet the limits of proposed effluent receiving water bodies.

Mr. Nimke stated that local treatment options may be preferable to a massive Hudson River discharge, siting that smaller streams can suffer when flow is removed from their natural drainage basins and discharged to other drainage basins. Mr. Manners stated that the small local streams are likely to suffer more from wastewater effluent discharge and treatment reliability problems associated with the high-advanced treatment processes necessary for discharge to these small water bodies.

Mr. Nimke asked if Hazen and Sawyer had addressed diversification factors (eg: variation of flow over time) in its determination of treatment facilities. Mr. Hagadorn stated that any recommendation that Hazen and Sawyer makes will address variation of flows and peaks, and implications of such pertaining to treatment requirements. (However, this Study does not include actual design of such treatment facilities.)

Mr. Tim Diltz, Supervisor for Town of Chester, expressed concern over removing water from Orange County's drainage basins and discharging to the Hudson River basin. Mr. Diltz stated that he could not support an alternative that would allow millions of gallons of water per day to flow down the Hudson. Mr. Diltz asked why more attention has not been paid to alternative methods of treatment, such as land-based treatment, or ponding, especially in light of the cost savings that could occur. Mr. Manners replied that alternative treatment has been considered, but land-based treatment will be unsuitable for most of Orange County due to prevalent soil conditions, and the use of marsh ponds for treatment is restrictive due to the large area requirements. In addition, it was noted at a previous meeting that the County has previously attempted land-based treatment, and found the process to be unsuitable, particularly due to odor control problems.

Mr. Diltz inquired about the use of "gray" water re-use, particularly in industrial areas. Mr. Manners stated that to be effective, industry would have to be centralized in one area, that it would be cost-prohibitive to construct a wastewater recycling system for a broad, dispersed customer base. Mr. Hagadorn stated that Hazen and Sawyer has designed such a gray-water system for the Pepsico plant in Somers, NY. The requirements for a 40,000 gallon per day plant at that site included a 103 acre marsh pond. Total project cost was on the order of $4,000,000. Mr. Hagadorn stated that alternative treatment methods can be appropriate where conditions are amenable to such treatment, but that this is not the case for Orange County.

Mr. Robert Till, Supervisor for Town of Woodbury, inquired if it was included in the scope of work of Hazen and Sawyer's contract that all alternatives would be studied, and that an "alternative/ innovative" method for treatment would be suggested as an option to the preferred plan. Mr. Hagadorn replied that such language would not necessarily be specifically mentioned in Hazen and Sawyer's contract, but that as a matter of course in project development, all possibilities for wastewater treatment, whether conventional or alternative, will be considered. Mr. Hagadorn stated that where special conditions permit the use of alternative treatment technologies (eg: golf course irrigation; Pepsico), that they will be considered and recommended if deemed preferable.

Mr. Till asked if federal funding is still available for "Innovative and Alternative" wastewater treatment plant design. Mr. Hagadorn replied that very little, if any, money is presently available from the Federal government for water pollution control projects at present.

Mr. Till asked that Hazen and Sawyer look into some alternative treatment methods and their costs, and report back to the Committee on why they are not appropriate for the County.

Mr. Spencer McLaughlin, Chairman of the Sewer Committee and Legislator for District No. 7, stated that the Committee can not realistically expect Hazen and Sawyer to study in detail the costs for the myriad of options available to the County.

Mr. Manners stated that Hazen and Sawyer has studied several alternative treatment technologies as part of its work on another project for the USEPA. It is based upon this experience that Hazen and Sawyer has rejected the options of alternative technologies, not an off-hand decision.

Mr. Bruce Chichester, Mayor for the Village of Harriman, stated that all treatment systems can work, but not all systems do work. Mr. Chichester stated that he is skeptical of any recommendation that will come from the discussions of the Sewer Committee, even that of the Harriman STP becoming a pumping station.

Ms. Roberta Murphy, Legislator for District No. 1, stated that alternative and innovative technologies should be placed in those communities that want to explore them, not tested out on those communities that want a viable solution.

Mr. Diltz again brought up the issue of inter-basin transfers of water. Mr. McLaughlin asked if Hazen and Sawyer could provide information on a water balance estimate for Orange County. Mr. Manners stated that this information was not readily available, but that the issue would be further studied.

Mr. Jack Evans, Administrator of Public Health for Orange County, stated that in comparison to the flows for this project, New York City removes 1.5 billion gallons per day from upstate New York for use in the City.

Mr. Manners reviewed the development and evaluation of alternatives process that was used to screen 94 initial conceptual alternatives down to a recommended plan. Mr. Manners stated that Hazen and Sawyer has determined the preferred Central Plan to be

Alternative C1b. - construction of a new 12 mgd STP on the Hudson River, and abandonment of the Harriman STP.

Mr. Weyant asked if the pipelines indicated for Alternative C1b were entirely new. Mr. Manners stated that all construction would be new construction, no utilization of existing facilities is planned.

Mr. Chichester stated that it was their understanding that the flow in pipes now being pumped to OCSD1 from Chester and Blooming Grove cound be reversed to flow by gravity back towards Chester. Mr. Manners stated that this had been looked into, and that the existing pipes are not capable of handling the projected flows in the reverse direction.

Mr. Chichester asked if the conversion of the Harriman STP to a pumping station take up more space than the present STP site. Mr. Manners said that it would not.

Mr. Till asked if any calculations had been done for final costs to the customer for the various alternatives . Mr. Manners stated that summary costs had not yet been developed, as this will be part of the next phase of study, performed by financial sub-consultants Peat Marwick Main.

Ms. Murphy stated that Hazen and Sawyer can not be expected to study costs in detail for all the alternatives, noting that what is required is for the Sewer Committee to come up with a recommended plan, and then to have Hazen and Sawyer generate final costs.

Mr. Till pointed out that the final recommended plan should be a balance of environmental and economic benefits, not based entirely upon costs.

Ms. Murphy stated she would like the Sewer Committee to obtain confirmation from towns and villages which are not included in the Central Treatment Plan saying that they are content to handle their own wastewater treatment needs, and not be served by the County system. Ms. Murphy stated that this is particularly important for those communities which are to be served by the Water Authority, since they must guarantee adequate wastewater treatment capacity before receiving water from the Authority.

Ms. Annette Dorozinsky, Supervisor for Town of Tuxedo, asked if there will be a plan to take in outside users into the Central system in the event that it becomes necessary. Mr. Manners and Mr. Hagadorn replied that within the time-frame of this Study, no allowance for the connection of outside users is planned for. Some Committee members argued that growth in the County may not go as predicted. Mr. Manners replied that this is why Hazen and Sawyer had made population projections available for comment and stated that based upon feedback on the projections, Hazen and Sawyer felt comfortable with municipal flow projections prepared through the year 2020. Based upon these projections, Hazen and Sawyer has determined where and when treatment capacity is needed, and whether local water bodies are adaquate to receive projected wastewater discharges.

The next meeting of the Sewer Committee is scheduled for Tuesday, January 29, 1991, at 2:30 PM. Committee members are asked to review the alternatives evaluation drafted by Hazen and Sawyer, and to be prepared to further discuss recommended sewage treatment plans for the entire County at the next meeting.

* * * * *

cc: M. McPhillips, J. Parnell, T. Cione, M. Dwyer - Orange County
M. Paret - Peat Marwick Main
P. Muessig - EA Engineering, Science & Technology
W. Sinnott, R. Hagadorn - Hazen and Sawyer

HAZEN AND SAWYER, P.C.
10 MOUNTAINVIEW ROAD
UPPER SADDLE RIVER, N.J. 07458

DATE: January 30, 1991

MEMORANDUM

FOR: Orange County Sewer Committee Members

FROM: Kristin G. Wheaton

SUBJECT: Minutes of January 29, 1991 Meeting

A meeting of the Orange County Sewer Committee was held on January 29, 1991 at the County Government Offices in Goshen, New York to discuss the Orange County Comprehensive Sewerage Study. The following people were in attendance:

SEWER COMMITTEE MEMBERS

Spencer McLaughlin - Committee Chariman and Legislator, Dist. No. 7
Roberta Murphy - Legislator, District No. 1
Tony Marino - Legislator, District No. 17
Louis Mills - Former County Executive
Bruce Chichester - Mayor, Village of Harriman
David Pardy - Legislator, District No. 8
Robert Till - Supervisor, Town of Woodbury
Tim Diltz - Supervisor, Town of Chester
Annette Dorozynski - Supervisor, Town of Tuxedo
Gil Shapiro - Mayor, Greenwood Lake
Robert Bonney - Mayor, Village of Monroe
Mike Frerichs - Supervisor, Town of Monroe

OTHER ATTENDEES

Vicki Mitchell - for James Townsend, Chairman of the Legislature
Roy Weyant - Legislator, District No. 5
Tom Cione - Department of Law
John Parnell - Deputy Commissioner of Public Works
Simon Gruber - Town of Chester
Charles Robbins - Times Herald Record
Harvey Davis - Metcalf & Eddy Services
Gordon Jones - Orange County DPW
Phil Salerno - MBJ O&M Committee
Larry Delarose - Councilman, Town of Blooming Grove
Andrew Barone - Trustee, Village of Monroe
Ed Fares - Blooming Grove and Washingtonville

PROJECT TEAM

Robert Hagadorn - Hazen and Sawyer
Roger Manners - Hazen and Sawyer
Glenn Di Giovanni - Hazen and Sawyer
Kristin Wheaton - Hazen and Sawyer

Spencer McLaughlin opened the meeting by stating that a speaker from Massachusetts had been invited to make a presentation on "alternative" (land-based) treatment methods, for those who are interested, on Friday, February 1, 1991, at 10 AM, in the Legislative Conference Room. Mr. McLaughlin stated that this type of treatment may not be applicable for all of Orange County, and that the presentation is for informational purposes only. Anyone who is interested is welcome to attend.

Spencer McLaughlin then asked Roger Manners to review Hazen and Sawyer's findings on the potential reversibility of the existing sewer force main traveling from Chester to Monroe. This question is of importance because Hazen and Sawyer is proposing a NEW force main to convey sewage from Harriman through Chester and to a treatment plant in New Windsor. As such, Hazen and Sawyer addressed the possibility of reducing project costs by using this existing force main.

Mr. Manners referred to a profile drawing of the pipe (Attachment 1), illustrating the capacity of the 14-inch force main at various sections of the pipe. Hazen and Sawyer has projected flows from that area will range from and average of 3.2 mgd in 1995 to 8.3 mgd in 2020. The findings were twofold:

1) If the pipe was to flow by gravity from Monroe to Chester, the average capacity of the pipe would be about 4 mgd, significantly less than projected flows.

2) If the flow was to be pumped, the necessary pumping head (TDH) and velocity in the pipe to carry the projected flows would be excessive.

Mr. McLaughlin asked if the County Department of Public Works concurs with Hazen and Sawyer's findings. John Parnell said yes, they do.

Robert Till stated that Hazen and Sawyer's cost estimate for the central County project is $98 million for a 12 mgd STP on the Hudson River, and that a prior study by CDM proposed expanding the OCSD#1 STP from 4 mgd advanced to 10 mgd secondary treatment at a cost of $24 million. Mr. Till stated that CDM had also looked into extending service of the OCSD#1 STP to other municipalities, and had concluded that it would be no benefit to the existing MBSR/OCSD communities to bring in other municipalities. Mr. Till again stated that he felt Hazen and Sawyer's study has been a duplication of this prior study.

Roberta Murphy stated that Hazen and Sawyer's study encompasses a much broader scope than the CDM study, evaluating the needs of the entire County, not just MBSR/OCSD communities.

Mr. Till stated that the County Sewer Committee is not a voting body, and does not have the authority to spend taxpayers' dollars. Mr. Till also questioned the significance of the Sewer

Committee voting on and recommending a plan, given that official community approval has not yet been received.

Ms. Murphy stated that neither Woodbury nor any community will not be bound to the recommendations of the Sewer Committee, that each municipal board will have to vote on whether to join the County system. Ms. Murphy pointed out that while there may be other options available to Woodbury, a central system may make the most sense because costs can be distributed over a over a broad customer base.

Mr. McLaughlin explained to the Sewer Committee members that they're not asking communities to "sign-off" on the project. The intent is to review the central treatment alternatives prepared by Hazen and Sawyer and to recommend a preferred County project so that Hazen and Sawyer can move along onto developing more detailed costs and address financial and institutional concerns.

Mike Frerichs, referring to Mr. Till's comments on the CDM study, stated that he believed the CDM study was much smaller in scope than the project Hazen and Sawyer is performing, and that the CDM study only evaluated options for the MBSR/OCSD communities, not for any outside communities. Mr. Frerichs also reiterated that it is up to each individual municipality to decide how they are going to handle their sewerage needs; it is not going to be the decision of some higher authority to force this project upon a community.

Ed Fares, expanding upon Mr. Frerichs statement, said that depending upon the construction schedule, the Village of Washingtonville may or may not be interested in the County's central project. If the County's project is significantly delayed, Washingtonville will not be able to wait for treatment capacity, and will be forced to upgrade and expand their own sewage treatment plant.

Mr. Till pointed out that there are going to be significant legal intricacies involved sorting out the present Moodna Agreement.

Bruce Chichester stated that the Villages of Harriman, Kiryas Joel and Monroe do not have decision-making powers under the present County sewer district because, under the original OCSD#1 Agreement, the County was given the authority to oversee the system. Mr. Chichester hopes that all participant municipalities of the new County project will have representation.

Mr. Chichester also stated that he felt the County should protect participant communities from adverse environmental impacts that may result from certain aspects of the project.

Referring back to the Chester/Monroe pipe issue, Phil Salerno pointed out that it was not intended for the pipe to be reversible to handle flow from the entire area; it was only sized for the MBSR portion of the flow. Mr. Salerno stated that Hazen and Sawyer should not discredit the original design for this reason. Mr. Manners stated that it was not Hazen and Sawyer's intent to question the design of the pipe, but only to show that it is inadequately sized to handle the regional flows projected by Hazen and Sawyer.

Mr. Fares inquired about the time-frame for implementation of a County sewerage system. Mr. McLaughlin stated that it is hoped that the Sewer Committee will be able to "wrap-up" outstanding issues with two to three more meetings, and make a presentation to the Orange County Legislature by April, 1991.

Mr. McLaughlin asked Mr. Manners to review the three options available to the County for central treatment that were presented at the January 8, 1991 meeting, and stated that a vote would be taken to determine the most favorable action, which Hazen and Sawyer will evaluate in detail.

Mr. Manners reviewed a table titled "Comparison of Project Costs for Hudson/Ramapo Alternatives" from the handout for the January 8, 1991 Sewer Committee Meeting (Attachment 2).

Mr. Salerno asked if any cost allowance had been made for odor control facilities for options which include keeping the OCSD#1 STP in operation. Mr. Manners said that a percentage had been added for odor control equipment, but that a more detailed analysis would be in order if this option is selected.

Mr. Till inquired what type of odor control equipment had been considered for the alternative which proposes conversion of the OCSD#1 STP to an 11 mgd secondary treatment facility. Mr. Manners stated that odor control would most likely include covering tanks and scrubbing equipment for off-gases, but again, a more detailed determination would be made if this is the selected project.

Mr. Till asked if Hazen and Sawyer could provide the dollar amount estimated for odor control equipment at the next meeting. Mr. Manners stated he would.

Mr. McLaughlin asked for a show of hands, from Sewer Committee members only, to vote for the preferred County alternative. The following tally was taken:

Option	Votes For
C1b	9
C3b/L15a	0
R1b/R2a	1
Abstain	2

The preferred option is C1b - New 12 mgd secondary STP on Hudson River, serving the Towns of Blooming Grove, Chester, Goshen, Monroe and Woodbury, and Villages of Chester, Harriman, Greenwood Lake, Kiryas Joel, Monroe and Washingtonville. This is the option that Hazen and Sawyer will continue to study in detail, performing environmental impact analysis, treatment plant and pipeline layout, and financial, administrative and institutional analysis.

The next Sewer Committee meeting is scheduled for 2:30 PM on February 27, 1991, at the Orange County Government Center. The preliminary agenda is as follows:

- Presentation of recommendations for communities outside of the proposed central County system;

- Presentation of specific project costs for proposed County system; and

- Presentation of additional costs associated with retirement of existing debt, local collection system costs, and administration costs of either a sewer authority or district.

* * * * *

Attach.

cc: M. McPhillips, J. Parnell, M. Dwyer, T. Cione - Orange County
M. Paret - Peat Marwick Main
P. Muessig - EA Engineering, Science & Technology
W. Sinnott, R. Hagadorn - Hazen and Sawyer

HAZEN AND SAWYER, P.C.
10 MOUNTAINVIEW ROAD
UPPER SADDLE RIVER, N.J. 07458

DATE: March 6, 1991

MEMORANDUM

FOR: Orange County Sewer Committee Members

FROM: Kristin G. Wheaton. KW

SUBJECT: Minutes of February 28, 1991 Meeting

A meeting of the Orange County Sewer Committee was held on February 28, 1991 at the County Government Offices in Goshen, New York to discuss the Orange County Comprehensive Sewerage Study. The following people were in attendance:

SEWER COMMITTEE MEMBERS

Spencer McLaughlin - Committee Chariman and Legislator, Dist. No. 7
Roberta Murphy - Legislator, District No. 1
Tony Marino - Legislator, District No. 17
James Townsend - Chairman of the Legislature
Bruce Chichester - Mayor, Village of Harriman
David Pardy - Legislator, District No. 8
Robert Till - Supervisor, Town of Woodbury
Tim Diltz - Supervisor, Town of Chester
Annette Dorozynski - Supervisor, Town of Tuxedo
Robert Bonney - Mayor, Village of Monroe
Richard Randazzo - Supervisor, Town of Cornwall
Mike Frerichs - Supervisor, Town of Monroe
Al Favoino - Legislator, District 6
Joe Rampe - Supervisor, Town of Warwick

OTHER ATTENDEES

Roy Weyant - Legislator, District No. 5
Tom Cione - Department of Law
John Parnell - Deputy Commissioner of Public Works
Gordon Jones - Department of Public Works
Cesare Manfredi - NY Department of Environmental Conservation
Simon Gruber - Town of Chester
Nick Papaceno - Mayor, Village of Warwick
Charles Robbins - Times Herald Record
Ron Andryshak - Department of Budget
Matt Schliefer - Department of Health

PROJECT TEAM

Myron Olstein - KPMG Peat Marwick
Mel Paret - KPMG Peat Marwick
Robert Hagadorn - Hazen and Sawyer
Roger Manners - Hazen and Sawyer
Glenn Di Giovanni - Hazen and Sawyer
Kristin Wheaton - Hazen and Sawyer

Spencer McLaughlin opened the meeting and introduced Roger Manners, Project Manager from Hazen and Sawyer.

Mr. Manners announced that this meeting would address financing and implementation issues for the Recommended County Plan - Alternative C1b, which involves construction of pipelines and pumping stations along abandoned railroad rights-of-way from Harriman and Goshen, to Chester, and to a new secondary treatment plant on the Hudson River in New Windsor. At this time, the intended communities to be served include: the Villages of Chester, Greenwood Lake, Harriman, Kiryas Joel, Monroe and Washingtonville; and the Towns of Blooming Grove, Chester, Goshen, Monroe, and Woodbury.

Mr. Manners introduced Mel Paret, Financial Analyst from KPMG Peat Marwick, to make this presentation.

Mr. Paret referred to an available handout throughout his presentation.

Mr. Paret stated that there were two major options for implementation of the Recommended Project: a Sewer District, or a Sewer Authority. There are advantages to each, as detailed in the handout. Of key importance may be that an authority may not be subject to Wick's Law, which requires that a project be bid separately for general contracting, mechanical/HVAC, electrical, and plumbing work. Avoiding Wick's Law may save between 10 and 30 percent of construction cost.

Tim Diltz asked what fees might be applicable for septic system users within the sewer system limits. Mr. Paret responded that only actual users of the sewer system will be charged. No fee will be assessed to households with septic systems.

Roberta Murphy asked if this would be the case even if a sewer district was formed, where septic sytems may be within district boundaries. Mr. Paret stated again that no fee had been assumed for non-users of the sewerage system. This would be the case if either a district or authority approach is taken.

Dick Randazzo stated that the way the present County sewer district is set up, all properties within the district are assessed a "benefit" charge. Mr. Paret replied that this was not planned to be the case for this project. However, if the County wanted to establish a special benefit district to charge for septic systems, it could do so under a district approach.

Mr. Paret reviewed the option of privatization of the proposed sewer project. He stated that construction costs may be lower, but that financing may be more expensive, and the public may have less control over the system.

Bob Hagadorn, referring to page 4 of the handout, asked, if reveneue bonds were assumed under the authority approach, and if backed by the full faith and credit of the

County, does this affect the County debt limit? Mr. Paret replied that this type of bond issuance would most likely affect the County debt limit, but that lower interest rates would likely be obtainable.

Mr. Paret discussed Impact and Connection fees, stating that New York State had ruled against the assessment of "Impact" fees for recovering certain growth-related infrastructure costs. However, several communities presently use "Connection" fees to recover sewer system improvement costs.

Ms. Murphy stated that Impact fees are usually associated with transportation projects, and that this was different from a sewerage sytem which has definitive limitations. Mr. Paret said yes, the two types of infrastructure improvements are different, and this is why the proposed connection fees should be acceptable to the State.

Mr. Diltz asked what was meant by the statement, on page 5 of the handout, that connection fees are calculated based on total contruction cost and design year sewage flows. Mr. Paret responded that facilities will be designed and constructed to accomodate flows up to the year 2020, but the customer base will be smaller at start-up. Capital costs are assumed to be evenly distributed over the design-year customer base, resulting in a lower cost per customer. Connection fees should be adjusted to offset the difference between design-year customer costs and actual operational year costs.

Roy Weyant asked if Washingtonville, for example, would have to pay a connection fee for each of the 3,000 existing customers that would be hooking into the sewerage system. Mr. Paret replied that connection fees would only apply to new connections to the system, not customers who are already serviced by sewers and a treatment facility.

Ms. Murphy stated that the project would be set up to be a wholesale system, and that municipalities such as Washingtonville will only have to hook into the system at one place. Connection fees can be assessed at the developers level, when new houses are connected to the system.

Cesare Manfredi asked what the planned timeframe would be, for someone who wanted to connect, to pay in advance for their connection fee. Often, connection fees are sold in advance, and no construction takes place for several years. Mr. Paret responded that it would be desirable, at the beginning of the project, to sell capacity in advance with connection fees used to help offset start-up costs. Mr. Paret stated that assurances must be given that capacity will be available within a reasonable time-frame before charging connection fees in advance of availability of service. Typically, advance capacity is sold within a 3 year period for services provided.

Robert Bonney inquired how customers would be monitored for the purposes of billing. Mr. Manners replied that municipalities would be metered, and that it would be up to each town or village to keep track of it's own customers. However, this is an issue that would be decided upon after a district or authority is formed.

Mr. Bonney asked how he could be guaranteed that some communities would not "steal" capacity from other communites. Ms. Murphy responded that as this was to be a wholesale system, there would not be allotments to each community. Mr. Frerichs agreed, stating that communities should be willing to give up some of their autonomy in order for the group to function better as a whole. Mr. Paret stated that communities should not have to worry about having capacity "stolen"; the system is intended to be structured so that new growth within the system will pay for growth-related costs for expansion of facilities if required at a later date.

Mr. Till noted that the cost per unit is constant for each community in the system, while some communities will be receiving grant monies to help offset their costs. Mr. Manners stated that all costs and benefits will be shared throughout the system. NYSDEC has stated that it is willing to close-out the grant on the existing Harriman STP, with the stipulation that certain criteria are met. The retirement of existing debt for facilities to be abandoned would be shared by all participant communities.

Mr. McLaughlin noted that the sharing of costs is the significance of wholesale facilities. Mr. Manners stated again that it is not intended for the County to take over local collection facilities. Each community will pay for its share of County treatment in addition to its own collection system costs. For example, the Moodna Basin Southern Region Joint Sewerage Board debt for the Harriman STP will be shared among the entire County system, but it is likely that the MBSR as it now exists will be defunct, and each participant community will handle it's own local system.

Mr. Till asked if the EPA has stated that a County authority or district can absorb the existing debt on local facilities. Mr. Manners said yes, he had spoken with Mr. Dassatti, and that if the grant is closed-out properly, then the STP can be abandoned and the grant monies will be left in place.

Mr. Diltz asked what is included as part of the County system. Mr. Manners stated that the County system would include gravity interceptor and force main pipe, pumping stations, and secondary treatment on the Hudson River. Mr Diltz asked what would be left for the local share. Mr. Manners stated that all collector sewers, local lift and pumping stations would be the responsibility of the local community.

Mr. Weyent noted that the pumping station and force main proposed for Greenwood Lake was quite extensive for such a small community, and most likely expensive. He questioned why other users should have to bear the brunt of the cost for that village. Mr. Manners stated that there are trade-offs within the porposed system. Greenwood Lake will be helping to pay a portion of the Harriman STP's outstanding debt, for example.

Ms. Murphy asked who would receive the connection fees imposed; why should a community give up money to the District or Authority. Mr. Paret replied that connection fees for the County system would go to the District or Authority. If a municipality wanted to collect connection fees for local system costs, that would be separate from the County connection fee.

Joe Rampe stated that Greenwood Lake would be subject to astronomical local collection costs, due to bedrock around the Lake. Mr. Rampe questioned why service would be extended to Greenwood Lake, but then answered his own question by pointing out that there is basically no other practical choice for the Village. Mr. Manners noted that a discharge cannot be developed to the Lake or downstream due to water quality restrictions; Trout Brook is a very small stream, and does not have the assimilative capacity necessary; topography and geography do not allow for an effective solution by treatment at either the Town of Warwick or Tuxedo STPs. In discussing when service should be extended, it was agreed that construction of a local collection system should be underway before the County system main is extended.

Myron Olstein stated that is seems that the question of allocation of capacity keeps coming up. Mr. Olstein stated that what has been done is to try to identify customers at start-up conditions, and to customers and provide for enough capacity in the system through year 2020. If a town grows more rapidly than expected, costs will be recovered by user and connection fees. At start-up of the facility, all existing sewer users from jurisdictions and municipalities committing to the system would be entitled to capacity by paying user charges (volume-based) and not connection or capacity fees. After start-up, additional users must pay for their share of capacity in the system through connection fees.

Mr. Randazzo noted that it would be similar to the way a community sets up a "special district".

Mr. Diltz asked if Peat Marwick had studied the financial reports of the MBSR O&M Commission. Mr. Paret replied that a questionaire had been mailed to all communities for them to provide information on local sewerage system costs.

Mr. Diltz asked that Peat Marwick look into the local system costs for the three towns included in the MBSR O&M Commission. Mr. Diltz stated that he felt the local share for these towns may be as much as three times the costs shown for Woodbury on page 12 of the handout. Mr. Paret said that Peat Marwick has included whatever information communities have already provided them with. It may be necessary to study this data in greater detail.

Ms. Murphy asked if the Project Team was recommending that a combined water and sewer authority be formed. Mr. Manners said that this decision was not up to the Project Team and that Hazen and Sawyer would not make a reccomendation either way.

Mr. McLaughlin adjourned the meeting. Next meeting scheduled for March 28, 1991 at 2:00 PM. Preliminary agenda: Further discussion of rates setting, reserve capacity issues, and implementation concerns.

cc: M. McPhillips, J. Parnell, M. Dwyer, T. Cione - Orange County
M. Olstein, M. Paret - KPMG Peat Marwick
P. Muessig - EA Engineering, Science & Technology
W. Sinnott, R. Hagadorn - Hazen and Sawyer

HAZEN AND SAWYER, P.C.
10 MOUNTAINVIEW ROAD
UPPER SADDLE RIVER, N.J. 07458

DATE: April 4, 1991

MEMORANDUM

FOR: Orange County Sewer Committee

FROM: Kristin G. Wheaton KW

SUBJECT: Minutes of March 28, 1991 Meeting

A meeting of the Orange County Sewer Committee was held at the County Offices in Goshen, New York on March 28, 1991. The following people were in attendance:

SEWER COMMITTEE MEMBERS

Spencer McLaughlin - Committee Chair and Legislator, District No. 7
Tony Marino - Legislator, District No. 17
Louis Mills - Former County Executive
Bruce Chichester - Mayor, Village of Harriman
Roberta Murphy - Legislator, District No. 1
Robert Bonney - Mayor, Village of Monroe
David Pardy - Legislator, District No. 8

OTHER ATTENDEES

John Parnell - Deputy Commissioner of Public Works
Gordon Jones - Department of Public Works
Ron Andryshak - Department of Public Works
Tom Cione - Department of Law
Simon Gruber - Town of Chester
Charles Robbins - Times Herald Record
Frank McGowan - Lawler, Matusky & Skelley
David Plotkin - Steel Style
Vicki Ann Mitchell - for James Townsend, Chairman of Legislature
Roy Weyant - Legislator, District No. 5

PROJECT TEAM

Myron Olstein - KPMG Peat Marwick
Melvin Paret - KPMG Peat Marwick
Robert Hagadorn - Hazen and Sawyer
Roger Manners - Hazen and Sawyer
Glenn Di Giovanni - Hazen and Sawyer
Kristin Wheaton - Hazen and Sawyer

Spencer McLaughlin opened the meeting, stating that the focus of the meeting would be on institutional and financial considerations for implementing the central project in the recommended County plan.

Roger Manners began the presentation, stating that the project has progressed beyond technical and environmental issues, and that discussion should center on the key financial/institutional options that were investigated by KPMG Peat Marwick. Mr. Manners introduced Myron Olstein, Principal from KPMG Peat Marwick.

Myron Olstein presented Peat Marwick's findings, referring to an available handout throughout the meeting (attached).

Mr. McLaughlin, referring to page 4 of the handout, pointed out that the central sewerage plan will not necessarily require a County-wide Agency, as stated. Mr. Olstein said this was correct, and as now planned, the central system would not be County-wide.

Mr. Manners stated that, if a district approach is taken, this will not be an expansion of the original district (OCSD#1); a new County District will be formed and OCSD#1 would likely be subordinate to it.

Roberta Murphy stated that in the future, it is possible that the central system could become a County-wide system. Mr. Olstein stated that the project team has identified and recommended projects, but that the final policy decision as to who is included in the central system is up to the County. Mrs. Murphy stated that this policy decision will affect the overall control and regulation of the district. Mr. Olstein said that this is true, and that the appropriate solution will no doubt require a great deal of forethought and regulation by the County.

Louis Mills asked Mr. Olstein to comment on some of the strengths and weaknesses of either a district or authority.

Mr. Olstein stated that the main disadvantage to an authority is that control is indirect. This is a concern; but it is difficult to quantify. The main advantages to an authority are that it is not subject to Wick's Law (separate bidding) and debt service payments do not have to conform with New York State's 50% Rule. Mr. Olstein stated that, in recent experience on a New York City job, Wick's Law added approximately 25% to the cost of the project.

Mr. Olstein stated that under a district approach, the County would have more control over the facility, but that project construction would be subject to Wick's Law under public financing and ownership. Also, if public financing is used under the district approach, financing is subject to Davis Bacon Law, which sets the labor wage rates under which a project must be bid, and debt service payments must conform with the NYS 50% Rule. Mr. Olstein stated that the Davis-Bacon Law can add approximately 15% to the total project by setting labor wage rates.

Mel Paret explained that the NYS 50% Rule dictates that payments be level or declining over the life of a bond, and that payment towards principal cannot vary by more than 50% from any other year in the life of the bond. This usually results in higher user costs for the start-up of a project, when the customer base is typically smallest. Mr. Paret stated that when applying the NYS 50% Rule for a project, the payments in the first few years are about 17% higher than with level debt service.

Mr. Olstein stated that the State Revolving Fund (SRF) provides an attractive, low interest rate (approx. 2/3 of market rate), tax exempt loan for public financing, but that the administrative fee of 3% and a maximum 20 year repayment schedule almost negate the benefits of the low interest rate.

By privatizing the project, cost savings can result, particularly under the district approach, by not having to comply with the Davis-Bacon Law and NYS 50% Rule. Mr. Olstein stated that is unknown how much of this savings will be seen by the County, as the privatizer may not always pass on these benefits.

Mr. Olstein stated that private financing, however, may be more expensive, as interest rates are usually higher than rates obtained with public financing. The exception to this is if the privatizer can obtain Industrial Development Bonds (IDBs). Mr. Paret stated that if IDBs can be obtained, then private financing costs could be similar to public financing. Mr. Olstein stated that IDBs can be issued in the name of a public entity, but actually be made to a private entity and can be tax exempt.

Mr. Olstein stated that the decision of the County to go with a district vs. an authority, or public vs. private ownership and/or operation, depends on the "comfort zone" of the County. In essence, it boils down to the amount of control the County wants to have over the central facility, versus the potential cost savings of using an authority or some form of privatization.

Mr. Olstein explained that Peat Marwick had taken an aggressive approach to developing the higher connection fees shown in the handout. It has been assumed that the use of connection fees (new hook-ups only) fees will be legally acceptable for use to offset growth-related costs.

Mrs. Murphy asked how connection fees would be collected for the project, as it seems that they would have to be collected at the municipal level. She inquired if it would be possible for the County to set the fees and collect them as income towards the project. Mr. Olstein replied that it is intended for the County to receive the fees for just this purpose, and that the agreement between the County and participant municipalities will have to be set up to address this.

Mr. Olstein again stressed that only NEW sewer service hook-ups would be subject to the connection fee. Existing users of sewer systems that are joining the County system will not have to pay this fee.

Roy Weyant related that Blooming Grove customers, for example, presently pay $180 for basic collection and treatment, plus $95 for Moodna Basin Southern Region Joint Sewerage Board (MBSR) treatment costs, on an annual basis. Mr. Weyant inquired how this relates to the (approximate) $300 customer cost estimated by Peat Marwick, and if Blooming Grove's existing costs will be added onto that figure. Mr. Paret explained that local collection costs are not included in the costs for this project. The present $95 MBSR fee and a portion of the $180 fee will be absorbed into the overall defeasance of existing debt for the County project. It can be reasonably assumed that two-thirds of the $180 fee is attributable to treatment-related costs, and one-third is for the local collection system. All existing treatment-related debts will be added into the total cost of the County project and distributed evenly among all users of the County system. What Blooming Grove may have to pay is their local collection costs (about $60 per unit), plus the County system fee (about $300 per unit).

Mr. Olstein explained that the customer costs for this project should be affordable, it is just the initial shock of the price increase that it hard to accept. He stated that to be conservative, inflation of 5% per year was used to escalate user fees, but that in actuality, after 2-3 years, when the project becomes self-sufficient, user fees can level off.

Mrs. Murphy stressed that it must be clear to each municipality why they have to accept these user fees. It must be understood that this project is the best option for them, given the multiple alternatives investigated for each community as part of this project. Mrs. Murphy stated that this was not done for the Orange County Water Authority Project, and that it is very important for all to understand why it is in their best interest to join the County system.

Simon Gruber asked if the proposed County district or authority would have the jurisdiction to draw boundaries around or through existing sewer districts (for example - those using package plants) and to make them pay for the County system. Tom Cione stated that the decision of each community to join the County system will be totally voluntary. Mr. Paret stated that, however, once the district is defined, if the County wants to, it can charge non-users within the system a "benefit" charge to encourage connections and/or to help secure financing.

Mr. McLaughlin stated that as there was not a quorum of the Sewer Committee present (only 7 of 21 members), a vote on the decision to choose public vs. private or district vs. authority could not be taken.

Mrs. Murphy asked that Peat Marwick study further the benefits and drawbacks of possibly expanding the present Water Authority to encompass the sewerage project as well.

It was stated that it is important to get the input of both Myron Urbanski (Supervisor - Town of Goshen) and George Green (Supervisor - Town of New Windsor) before proceeding further on the project.

TO ALL SEWER COMMITTEE MEMBERS: STUDY THESE FINANCING AND IMPLEMENTATION ISSUES, DISCUSS THEM WITH YOUR CONSTITUENTS AND BOARD MEMBERS, AND COME PREPARED TO VOTE AT THE NEXT MEETING OF THE ORANGE COUNTY SEWER COMMITTEE, SCHEDULED FOR 2:30 PM, APRIL 25,1991. IF YOU HAVE ANY QUESTIONS, CALL EITHER MEL PARET OF KPMG PEAT MARWICK AT (703) 442-0030, OR TOM CIONE FROM THE ORANGE COUNTY DEPARTMENT OF LAW AT (914) 294-5151 x 1185.

* * * * *

cc: M. McPhillips, J. Parnell, M. Dwyer, T. Cione - Orange County
M. Olstein, M. Paret - KPMG Peat Marwick
P. Muessig - EA Engineering, Science & Technology
W. Sinnott, R. Hagadorn - Hazen and Sawyer

HAZEN AND SAWYER, P.C.
10 MOUNTAINVIEW ROAD
UPPER SADDLE RIVER, N.J. 07458

DATE: April 29, 1991

MEMORANDUM

FOR: Orange County Sewer Committee

FROM: Kristin G. Wheaton

SUBJECT: Minutes of April 25, 1991 Meeting

A meeting of the Orange County Sewer Committee was held at the County Offices in Goshen, New York on April 25, 1991. The following people were in attendance:

SEWER COMMITTEE MEMBERS

Spencer McLaughlin - Committee Chair and Legislator, District No. 7
Tony Marino - Legislator, District No. 17
Roberta Murphy - Legislator, District No. 1
Robert Bonney - Mayor, Village of Monroe
David Pardy - Legislator, District No. 8
Richard Randazzo - Supervisor, Town of Cornwall
Annette Dorozynski - Supervisor, Town of Tuxedo
Louis Mills - Former County Executive
Robert Till - Supervisor, Town of Woodbury
Al Favoino - Legislator, District No. 6

OTHER ATTENDEES

Tom Cione - Department of Law
John Parnell - Deputy Commissioner of Public Works
Gordon Jones - Department of Public Works
Ron Andryshak - Department of Public Works
Dan Bloomer - Administrative Officer
Simon Gruber - Town of Chester
Charles Robbins - Times Herald Record
Frank McGowan - Lawler, Matusky & Skelley
David Plotkin - Steel Style
Vicki Ann Mitchell - for James Townsend, Chairman of Legislature
Roy Weyant - Legislator, District No. 5
Richard McGoey - Town Engineer, New Windsor
Burd Brunyard - Hudson Valley News
Terry Jones
C.A. Johnson

PROJECT TEAM

Myron Olstein - subconsultant to KPMG Peat Marwick
Melvin Paret - KPMG Peat Marwick
Robert Hagadorn - Hazen and Sawyer
Roger Manners - Hazen and Sawyer
Glenn Di Giovanni - Hazen and Sawyer
Kristin Wheaton - Hazen and Sawyer

Spencer McLaughlin opened the meeting and stated that the intent of this meeting was to address implementation issues for the recommended central sewerage project for Orange County. Discussion should focus on the differences between a district and an authority, and whether public or private financing and/or ownership of the project should be pursued.

Mr. McLaughlin stated that both Hudson River Sloop Clearwater and Sewer Committee member Louis Mills had prepared statements in opposition to either part or all of the recommended County Sewerage Project. These released statements were made available to the Committee, and are attached.

Roger Manners began the discussion by noting that New Windsor Supervisor George Green has indicated that he is interested in participating in the County project, with either all or part of New Windsor's sewage flow, depending upon the economics of each of the options. Mr. Green was invited to today's meeting, but did not attend. Myron Urbansky, Supervisor for the Town of Goshen, has also expressed his interest in the proposed County system, but also did not attend.

Myron Olstein once again reviewed the institutional and financial options available to the County, referring to an available handout (attached). Mr. Olstein stated that either a district or authority could be used as the institutional structure to administer the project. The advantages and disadvantages of each are listed in Exhibit 1 in the handout. In addition, Mr. Olstein reviewed the debt financing options pertaining to both private and public financing and/or ownership, and possibilities for rate structures (Exhibit 2).

Mr. Olstein stated that Peat Marwick had performed a preliminary analysis of two additional scenarios in which New Windsor would participate at either 5 or 10 mgd, to examine the effect each option would have on rates charged per dwelling unit (Exhibit 3). As shown, the option presenting full New Windsor participation results in a significantly reduced cost per dwelling unit compared to the original selected plan. This is largely due to the substantial existing customer base in New Windsor, over which costs could be distributed.

Roberta Murphy asked Mr. Manners if the New York State Department of Environmental Conservation (DEC) had been consulted regarding the level of treatment required for discharge to the Hudson River, and how much more this could cost if DEC requires advanced treatment. Mr. Manners replied that DEC had been consulted, and that Cesar Manfredi, DEC Regional Director, had stated that secondary treatment is the maximum level of treatment that is required on the Hudson River. As to additional cost, that depends upon the definition of "advanced" treatment. Mr. Manners stated that if advanced treatment meant ammonia removal, than this could add approximately 30 percent to the treatment portion of the project costs. Treatment costs account for about 50 percent of the overall project costs, so the resulting increase for this type of treatment would be approximately 15 percent.

Mr. Manners stated that Hazen and Sawyer's preliminary design of the treatment facility provides for additional features beyond what a typical secondary treatment facility would normally include. These are: additional post aeration to ensure adequate dissolved oxygen content in the effluent; and utilization of ultraviolet disinfection instead of chlorination to eliminate any concerns regarding toxicity to aquatic life.

Robert Till asked if the total debt for all municipalities is included in the costs of the recommended project. Mr. Manners replied that existing debts for all treatment facilities that would be abandoned under the recommended plan are incorporated into the project costs. Mr. Till asked if this included local collection. Mr. Manners stated that local collection system costs will remain a local municipal responsibility, and this is not included in the overall project costs.

Mr. Till asked why all users of the system should pay for the length of pipe serving Greenwood Lake. Mr. Manners stated that there are areas of Chester and Monroe that can be served by this pipeline as well. Also, this pipe will alleviate existing overflow problems now occurring at Round Lake.

Mr. Till stated that DEC has changed or proposed new water quality classifications on several water bodies. This being the case, how could Hazen and Sawyer be sure that DEC would not do the same for the Hudson River? Also, what about providing a higher level of treatment so as to help improve the Hudson? Mr. Manners stated that the Hudson River is such a massive water body that secondary treatment is adequate, and that the notion of improving the Hudson by providing tertiary treatment was not correct. The proposed discharge is so small in relation to the volume of the Hudson, that no improvement would be realized. Mr. Manners stated that proper location of the effluent outfall, and proper design of the diffuser section of the outfall will ensure that there would be no degradation of the Hudson. Kristin Wheaton added that the DEC determines the level of treatment required in one of two ways. If there is enough dilution of the effluent discharge with the receiving water (12 parts river : 1 part effluent), the water body is known as "effluent limiting", and secondary treatment is adequate, no matter what the classification of the water. If there is not enough dilution, the water body is said to be "water quality limiting" and an evaluation of how much effluent the receiving body can assimilate while meeting classification criteria must be performed, thereby determining the level of treatment required. (The proposed effluent discharge to the Hudson River is between 12 to 22 million gallons per day. The minimum average 7Q10 flow in the Hudson River near New Windsor is 1,940 mgd, providing an effluent dilution of at least 88:1.)

Al Favoino asked what would happen if the majority of communities that are identified as participants choose not to join the County system. Mr. McLaughlin stated that the Sewer Committee is making a recommendation only, and that each municipality can look at the cost of other options and determine if they can accommodate growth without joining the system. Mr. Manners stated that Hazen and Sawyer has evaluated multiple alternatives for each community (presented October 23, 1990 and January 8, 1991). These alternatives included construction or expansion of local treatment facilities. If it was cost effective and environmentally sound for a community to handle sewage on a local level, then this is the recommendation for that community. Central County treatment is only proposed for areas where local alternatives are not practical.

Ms. Murphy stated that one of the primary incentives for undertaking this comprehensive sewerage study was to satisfy the requirements for the Orange County Water Authority project, which dictates that a community prove it has adequate sewage disposal means before purchasing water from the Authority.

Richard Randazzo stated that perhaps the Committee should get a commitment from each community before making a recommendation.

Mr. McLaughlin stated that the Committee is made up largely of representatives from communities that will be served by this project, and has had a great deal of time to discuss these issues with their constituents. Negative feedback has been minimal, suggesting that most communities are interested in the County sewerage project. Mr. McLaughlin stated that it is time to move along, to approach the next phase of implementation of the project.

David Pardy inquired if the Committee vote was going to indicate approval by the communities for the County project. Mr. McLaughlin stated that the Committee had previously voted to recommend a County project, and was now to vote on whether a district or authority institutional form was to be recommended to the legislature. Again, the Committee's vote is not binding, it is only a recommendation.

Ms. Murphy moved to adopt a district as the preferred approach for implementation of the County sewerage project. Mr. Robert Bonney seconded the motion. A vote of 6 for, 2 against, and 2 abstain, was taken for recommendation of a County sewer district.

Mr. Till stated that he felt another motion was in order to suggest further study of the issue of privatization under a district approach. Mr. Till moved that privatization of the proposed County sewer project be investigated, and the potential costs savings resulting from such be presented. Ms. Murphy seconded the motion. After a vote, the motion was approved.

Ms. Murphy stated that she felt Hazen and Sawyer may be getting close to exceeding their budget for the project because it is now running several months beyond the original schedule. Mr. Manners stated that Hazen and Sawyer and its subconsultants have exceeded the allowable contract amount for this project. Mr. Manners stated that the cost overrun is largely due to the revision of population projections required as a result of the significant deviation of population growth from County Data Book projections. Also, revision to the recommended plan to include New Windsor flows, after previous adoption by the committee of a recommended plan, is sighted as additional work. Mr. Manners stated that Hazen and Sawyer is presently preparing documentation outlining the additional work activities.

* * * * *

cc: M. McPhillips, J. Parnell, M. Dwyer, T. Cione - Orange County
M. Olstein, M. Paret - KPMG Peat Marwick
P. Muessig - EA Engineering, Science & Technology
W. Sinnott, R. Hagadorn - Hazen and Sawyer

HAZEN AND SAWYER, P.C.
10 MOUNTAINVIEW ROAD
UPPER SADDLE RIVER, N.J. 07458

DATE: June 4, 1991

MEMORANDUM

FOR: Orange County Sewer Committee

FROM: Kristin G. Wheaton

SUBJECT: Minutes of May 30, 1991 Meeting

A meeting of the Orange County Sewer Committee was held at the County Offices in Goshen, New York on May 30, 1991. The following people were in attendance:

SEWER COMMITTEE MEMBERS

Spencer McLaughlin - Committee Chair and Legislator, District No. 7
Tony Marino - Legislator, District No. 17
Roberta Murphy - Legislator, District No. 1
David Pardy - Legislator, District No. 8
Louis Mills - Former County Executive
Robert Till - Supervisor, Town of Woodbury
James Townsend - Chairman of the Legislature
Bruce Chichester - Mayor, Village of Harriman

OTHER ATTENDEES

Roy Weyant - Legislator, District No. 5
George Green - Supervisor, Town of New Windsor
Richard McGoey - Town Engineer, New Windsor
Hector Cintron - Trustee, Village of Washingtonville
Tom Cione - Department of Law
Helmut Nimke - Councilman, Town of Tuxedo
Simon Gruber - Town of Chester
Charles Robbins - Times Herald Record
Frank McGowan - Lawler, Matusky & Skelley
David Plotkin - Steel Style
Vicki Mitchell - Legislative Assistant

PROJECT TEAM

Myron Olstein - subconsultant to KPMG Peat Marwick
Walter Sinnott- Hazen and Sawyer
Roger Manners - Hazen and Sawyer
Glenn Di Giovanni - Hazen and Sawyer
Kristin Wheaton - Hazen and Sawyer

Spencer McLaughlin opened the meeting and handed out an agenda for the day's discussion.

Mr. McLaughlin stated that interim meetings had been held with the Village of Washingtonville and the Town of New Windsor regarding their potential involvement in the County Sewerage Project. Mr. McLaughlin stated that Washingtonville has decided to proceed with their own STP expansion, but their minimal amount of flow and population will still be included in the central system design, so that they may join in the future. Washingtonville cites time constraints as the primary factor in deciding to move ahead on their own.

Mr. McLaughlin stated that New Windsor would like to be considered for inclusion in the central County Sewerage Plan, either sending all or a portion of their flow. New Windsor's final decision on whether or not they will participate will be based on the anticipated time frame for construction and final costs calculations.

Mr. McLaughlin stated that, at present, the central County Sewerage Plan includes the Villages of Harriman, Kiryas Joel, Monroe, Chester, Greenwood Lake and Washingtonville, and the Towns of Chester, Monroe, Woodbury, Blooming Grove, Goshen and perhaps New Windsor and Cornwall. The plant is intended to provide secondary treatment, with discharge to the Hudson River in the vicinity of Moodna Creek. STP size will be between 12 and 25 mgd, depending upon New Windsor's involvement.

Mr. McLaughlin stated that the institutional and financial implementation recommendation for the County Project will be some form of privatization. The approach to be taken for privatization procurement (ie: sole source; request for proposals; competitive negotiations) will be decided upon by the Legislature.

Mr. McLaughlin stated that "alternative" wastewater treatment options (eg: overland flow) have not been ruled out for smaller systems. Alternative treatment should be considered by municipalities whose flows are less than 100,000 mgd, and where site conditions are favorable for such treatment. However, for the central County Project, alternative treatment has been ruled out.

Mr. McLaughlin noted that the final report will state the importance of water conservation to preserve resources and extend wastewater treatment capacity at the new plant.

Mr. McLaughlin reported on interim correspondence received from Scenic Hudson and the Museum of the Hudson Highlands (attached). Previous submissions have been made by the Hudson Sloop Clearwater and Louis Mills. (Aside: Scenic Hudson stated, incorrectly, that the Hudson River is Class A in the vicinity of the proposed discharge. The Hudson River is Class B in the location of the proposed discharge.)

Mr. McLaughlin invited comments and questions from attendees.

Louis Mills said that there has been considerable study done on alternatives involving the natural treatment of wastewater. He stated that alternative treatment should not be considered an experimental process, as it has been used in many instances in various parts of the country. Mr. Mills said he is not criticizing the work of the County's consultants and the Sewer Committee, but stated there is a need for more use of natural treatment.

Roger Manners responded that the proven treatment process that Hazen and Sawyer is proposing <u>is</u> a natural, biological treatment process. Mr. Manners noted that Hazen and Sawyer's recommended treatment process utilizes the same biota, or organisms, that are used in alternative treatment processes. With the proven treatment process, conditions are controlled so that treatment occurs more quickly and in a smaller area than with alternative treatment.

Roberta Murphy stated that the County has tried alternative treatment before, with marsh ponds at Harriman, and at the Marion bluegrass sod farm. In both cases, public nuisances, mainly odors, forced the cessation of these projects.

Ms. Murphy stated that the Sewer Committee is only making a recommendation to the Legislature and to municipalities. If communities decide not to follow the recommendations of the Committee, so be it.

Bob Till stated that he is in favor of providing tertiary treatment at the proposed Hudson River sewage treatment plant, to help to clean up the river, if it would not add too much to the project cost. Mr. Manners stated that it would be impossible to improve the Hudson with such a relatively small discharge. In addition, Mr. Manners said it depends upon how "tertiary" treatment is defined. Mr. Manners stated that the estimate for providing nitrification (ammonia removal) at the facility is an additional 30-40 percent of the STP capital cost. To provide typical advanced treatment, with nitrification and sand filtration, about 50-60 percent of the STP capital cost should be added. Mr. Till asked if this would include disinfection of the effluent. Mr. Manners said that all wastewater effluent discharges must be disinfected.

Mr. Manners stated that the treatment process proposed for the Hudson River STP calls for additional provisions beyond what a secondary treatment facility would typically include. For example, post aeration to provide additional dissolved oxygen in the effluent, and use of ultraviolet disinfection instead of chlorination to eliminate concerns regarding effluent toxicity, are included.

Mr. Till asked what would happen if DEC requires an upgrade in the future. Mr. Manners stated that based upon information obtained from Cesar Manfredi and DEC, advanced treatment is not justified on a water-quality basis. Walt Sinnott stated that if the level of treatment required is eventually upgraded, Orange County should consult with other counties along the Hudson River to oppose the action, because a higher level of treatment is not justified on a technical basis.

Mr. Till stated that he feels it may be worth the additional $9 to $12 million (for a 12 mgd STP) to provide nitrification, in case it is called for in the future.

Mr. McLaughlin stated that from a public and political standpoint, it may make the SEQRA process easier if advanced treatment is provided from the outset, as environmental organizations should not voice as much opposition to advanced effluent discharge. Mr. McLaughlin asked that Hazen and Sawyer provide an estimate of the cost to provide nitrification and effluent filtration in the final report.

Mr. McLaughlin stated that Hazen and Sawyer will complete a draft of the study in approximately 6 weeks, at which point it will be available for review by Sewer Committee members.

* * * * *

cc: M. McPhillips, J. Parnell, M. Dwyer, T. Cione - Orange County
M. Olstein - Reznick, Fedder & Silverman
M. Paret - KPMG Peat Marwick
P. Muessig - EA Engineering, Science & Technology
W. Sinnott, R. Hagadorn, G. Di Giovanni - Hazen and Sawyer

HAZEN AND SAWYER, P.C.
10 MOUNTAINVIEW ROAD
UPPER SADDLE RIVER, N.J. 07458

DATE: August 5, 1991

MEMORANDUM

FOR: Orange County Sewer Committee

FROM: Kristin G. Wheaton KW

SUBJECT: Minutes of July 30, 1991 Meeting

A meeting of the Orange County Sewer Committee was held at the County Offices in Goshen, New York on July 30, 1991. The following people were in attendance:

SEWER COMMITTEE MEMBERS

Spencer McLaughlin - Committee Chair and Legislator, District No. 7
Robert Bonney - Mayor, Village of Monroe
Mike Frerichs - Supervisor, Town of Monroe
Tim Diltz - Supervisor, Town of Chester
Tony Marino - Legislator, District No. 17
David Pardy - Legislator, District No. 8
Louis Mills - Former County Executive
Bruce Chichester - Mayor, Village of Harriman
Al Favoino - Legislator, District 6

OTHER ATTENDEES

Vicki Mitchell - Legislative Assistant
Roy Weyant - Legislator, District No. 5
Tom Cione - Department of Law
John Parnell - Deputy Commissioner, Department of Public Works
Ron Andryshak - Department of Public Works
Simon Gruber - Town of Chester
Michael Sussman - Town of Chester
Fred Adams - Town of Woodbury
Charles Robbins - Times Herald Record
Frank McGowan - Lawler, Matusky & Skelley
David Plotkin - Steel Style

PROJECT TEAM

Bob Hagadorn - Hazen and Sawyer
Glenn Di Giovanni - Hazen and Sawyer
Kristin Wheaton - Hazen and Sawyer

Spencer McLaughlin began by stating that this meeting was not for the purpose of voting or decision making by the Sewer Committee, but for discussing comments on the draft Orange County Sewerage Study report, issued for client review on July 15, 1991. Mr. McLaughlin then opened the floor for comments by committee members and other attendees.

Louis Mills said that he felt that this draft Sewerage Study and the Water Authority report do not adequately address the issue of water conservation. Mr. Mills stressed the need for the County to pursue water conservation and reuse of water, and that an appropriate vehicle for achieving this may be through the newly reorganized County Planning Board. Mr. Mills said that he felt that over the long term, water conservation will become an issue of extreme significance, and that more consideration should be given to it.

Tim Diltz stated that it seems foolhardy to have to pay for supply of potable water and then to have to pay for disposal of the same water, when it seems possible that some of this wastewater could be reused in the County. Mr. Diltz stated that he feels new developmental technology in wastewater treatment is worth exploring, and that the types of conventional treatment that are now widely employed will be outdated soon. Mr. Diltz further stated that he feels the project cost is too great, and that there are some communities, Chester for one, that may wish to explore their own alternatives for sewage treatment before considering whether to join the County's proposed central project. Mr. Diltz said that it has not been adequately addressed what will happen if certain communities bow out of the proposed central project.

Mr. McLaughlin affirmed that the Sewerage Study has, indeed, addressed alternative treatment technologies. He acknowledged that there are no guarantees as to community inclusion in the proposed central project, and stated that the representatives on the Sewer Committee were only making recommendations for their constituents. Mr. McLaughlin said that the next step is for the County Legislature and County Executive to review the final report, and for public hearings to be held, which will allow for the continuing discussion of the recommended sewerage plan.

Bruce Chichester said that, as both representative from a current STP host community and observer of NYSDEC actions, he supports the proposed central project. Mr. Chichester stated that he feels that the NYSDEC is effectively ceasing effluent discharge to local tributaries. While on one hand improving the quality of life by reclassifying local water bodies, regulations are in turn imposing a hardship upon the users of local treatment facilities every time upgrade is required to meet changing water quality standards. Mr. Chichester stated that, if properly implemented, treatment with discharge to the Hudson River is the best alternative for the County. Mr. Chichester stated that all of the key issues discussed by the Sewer Committee are addressed in the Report.

Al Favoino stated that he, too, has some reservations about the central project, and inquired about Mr. Mills' discussion of alternatives. Mr. Mills stated that he had no specific alternatives to present, but that a Dr. Schaeffer recently gave a presentation on Chicago area treatment plants "where they used spraying, and that sort of thing, in rather large operations, not small quantities," but stated that he didn't have any specifics to support this.

Mr. Favoino then inquired of Mr. Diltz what type of systems he was proposing. Mr. Diltz stated that he didn't have anything specific in mind, but that Simon Gruber, who works for the Town of Chester in environmental areas, is more familiar with the issues, and has met with various groups around New York. According to Mr. Diltz, there are some very interesting and exciting technologies coming along which can be used in wastewater treatment, and many of these technologies are on the brink of breaking through. Mr. Diltz stated that Orange County, recognizing the cost and tremendous problems with public works projects in New York, should pursue systems that are not as costly and are more efficient. Mr. Diltz said that as Mr.

Gruber looks into the issues further, more information will become available. It's just a matter of becoming aware and looking around at what other parts of the country are doing, Mr. Diltz stated.

Mr. Favoino inquired if some new technology comes along in the next one, two or six months, what does that have to do with adoption of this Sewerage Study; does it jeopardize the project? Mr. Diltz responded that there is no going back once the County starts this, unless the project is abandoned at a tremendous cost. Mr. Diltz stressed a cautious approach be taken by the County Legislature before rushing into a project of this sort.

Bob Bonney asked if there were any installations on the east coast of the types of projects that Dr. Schaeffer is promoting. Mr. McLaughlin responded that the Chicago area is the closest installation with a climate similar to Orange County's. Mr. Bonney stated that he agrees that he doesn't like to see water leaving Orange County, but that unless treatment systems can be seen actually in place, there are significant uncertainties to be faced. Mr. Bonney stressed the need to escape the sewer moratorium now in place in OCSD#1 and the Moodna Basin Southern Region, and asked if the County can really afford to wait and see what new technology comes along.

Bob Hagadorn stated that Hazen and Sawyer has worked on several projects along the east coast and that much of the work performed touches directly on observations made by the Sewer Committee. Mr. Hagadorn stated that in terms of water conservation, the most effective means to achieve conservation is to eliminate wasting water by both charging more for water and actively metering the service area population. In terms of return of wastewater to local water bodies, often a very high level of advanced treatment is required, which is very costly to build, very costly to operate and very labor intensive. In Florida, where Hazen and Sawyer has engineered the reuse of wastewater for agricultural irrigation, a high level of treatment is also required, beyond that proposed for the recommended Hudson River STP. Another Florida wastewater reuse plant designed by Hazen and Sawyer is a 75 mgd secondary treatment facility that discharges into a subsurface aquifer 3,000 feet below ground level. The effluent must be injected into an isolated aquifer so as not to endanger the drinking water supply. The discharge zone penetrates through the drinking water aquifer, through an impermeable layer, and into a zone that is in contact with salt water. This type of discharge prevents direct discharge to the ocean, while at the same time provides a barrier against salt water intrusion to the drinking water supply. Mr. Hagadorn stated that Hazen and Sawyer will recommend alternative types of treatment facilities when feasible and cost effective, but that these designs are engineering intensive, and that the geology, climate and population distribution in Orange County are not conducive to these types of treatment for the central project. Mr. Hagadorn stated that Hazen and Sawyer is confident that the types of treatment recommended in the draft Sewerage Study will satisfy the needs of Orange County for sewage treatment.

Mr. Diltz asked if deep well injection requires any type of special treatment for discharge. Mr. Hagadorn replied that it is usually secondary treated effluent with disinfection. Mr. Diltz asked about the track record of this type of technology. Mr. Hagadorn replied that the Florida plant has been in use for 10-20 years and that it works fine, but that it operates in a totally different type of geology than found in Orange County.

Mr. McLaughlin asked if Hazen and Sawyer had looked over the information prepared by Dr. Schaeffer, and if there were any comments. Glenn Di Giovanni replied that upon review of the information, there appears to be a number of facilities either planned, under construction or in operation. Of the approximately thirty plants outlined, roughly seven or eight of the facilities are operating. The operating facilities are in the Chicago, suburban Illinois areas, and most are between 50,000 to 200,000 gallon per day facilities, much smaller than the 12 mgd central facility recommended for the County. Mr. Di Giovanni stated that the largest facility planned is about 5 mgd in size. The rule of thumb for design of Dr. Schaeffer's treatment facilities is about 1 acre per 10 equivalent dwelling units (EDUs), so that for the approximate 48,000 EDUs participating in the central project by the year 2020, nearly 5,000 acres would be required for treatment. In addition, Dr. Schaeffer's treatment approach requires that the sewage undergo secondary treatment prior to discharge in his lagoons, and disinfection prior to the release of effluent. This is the same type of treatment required for discharge to the Hudson River, as outlined in the draft Sewerage Study.

Simon Gruber stated that there needs to be a political and public call for providing advanced treatment on the Hudson River, aside from the technical requirements for discharge by the NYSDEC. Mr. Gruber stated that the County should do whatever it can to show "good faith" that the County is concerned about potential impacts on the Hudson River. In addition, Mr. Gruber stated that this measure may improve acceptance of the project by environmental organizations. Mr. Gruber further stated that he felt the final Sewerage Study should reflect this call for advanced treatment.

Mr. McLaughlin inquired what Mr. Gruber was asking for to be included in the document. Mr. Gruber said he wasn't sure, but he wanted to discuss this further. Mr. Di Giovanni stated that in Chapter 13 of the draft Sewerage Report, estimates of the equipment required and associated cost for providing advanced treatment at the proposed Hudson River STP are included. Mr. McLaughlin stated that, again, it will be the ultimate decision of the County Executive and the County Legislature to make policy decisions for the central project, and to ultimately determine the activities to be undertaken by the County as recommended in the final Sewerage Study.

Michael Sussman stated that he did not see any assessment in the draft Sewerage Study as to the total impact on users of the central project. For example, what it would cost Town of Chester residents in terms of local collection system costs and their share of central project costs? Mr. Di Giovanni stated that in Chapter 15, specifically Table 15-21, some examples of what the total system user fees will be, based upon dollars per EDU. Kristin Wheaton pointed out that the dollars per EDU presented are based upon an average sewage production value of 250 gallons per EDU; the actual cost to residential users of the system would decrease according to the extent of commercial and industrial use of the system in each community.

Mr. Sussman further questioned the "benefit area" deemed to benefit from the recommended central project, and asked how charges would be assessed to the rest of the County. Mr. McLaughlin stated that it is not planned to assess a benefit charge to areas outside of the proposed new sewer district.

Mr. Di Giovanni stated that this comprehensive sewerage study has taken a multi-pronged approach to sewage management, encompassing: sewage reduction through water conservation and infiltration/inflow reduction; a pre-treatment program for significant and industrial users of the central project; local treatment actions for areas where this approach is acceptable in terms of environmental impact and cost; regional treatment actions where appropriate; and the central project only for communities that will most benefit from a centralized approach.

Roy Weyant asked what the next step was for implementation of the Recommended Plan. Mr. McLaughlin replied that it is for the draft Sewerage Study to be finalized and reviewed by the County Legislature and County Executive before a decision on further action is taken.

Mr. McLaughlin closed the meeting by thanking the Sewer Committee for their participation and input on the project.

* * * * *

cc: M. McPhillips, J. Parnell, M. Dwyer, T. Cione - Orange County
M. Olstein - Reznick, Fedder & Silverman
M. Paret - KPMG Peat Marwick
P. Muessig - EA Engineering, Science & Technology
W. Sinnott, R. Hagadorn, G. Di Giovanni - Hazen and Sawyer

APPENDIX G

Hudson River Sloop
CLEARWATER Inc.

112 Market Street, Poughkeepsie, N.Y. 12601 Tel.: 914/454-7673 Fax: 914-454-7953

April 23, 1991

Mr. Spencer McLaughlin, Chair
Orange County Sewer Committee
Legislative Offices, 2nd Floor
County Government Center
Goshen, NY 10924

FOR DISTRIBUTION TO COUNTY SEWER COMMITTEE MEMBERS

Dear Mr. Mclaughlin:

Hudson River Sloop Clearwater is a not-for-profit environmental education and advocacy organization, with over 11,000 members, working for the protection and preservation of the Hudson River and it shorelines.

It is our understanding that the Orange County Sewer Committee is currently considering a range of options to increase sewage treatment capacity throughout the County. We commend the County for taking steps to protect water quality by ensuring that the County will have adequate capacity and that all municipal sewage treatment plants will be able to comply with state and federal water quality standards.

However, we are concerned to see that the County appears to be leaning towards a large, centralized system discharging in to the Hudson River. According to the County Comprehensive Sewerage Study, possible scenarios include discharges of 9.8 to 12.1 million gallons per day of secondary treated sewage being discharged in to the Hudson River in the New Windsor area. We are very concerned about the impacts of the resultant decrease in dissolved oxygen levels and increases in coliform and other bacteria, chlorine and chlorinated hydrocarbons, nutrients and industrial wastes (including metals and organic chemicals) caused by the increased discharges.

We would strongly urge the County, as part of this evaluation, to consider actions that would help to minimize amounts of, and impacts of, sewage wastes treated in the County. First and foremost we urge the County to consider aggressive water conservation measures to reduce the amount of waste water s generated. Not only will this help to reduce the need itional wastewater treatment capacity, conservation will elp to reduce water supply treatment and distribution costs . Steps to control intrusion and infiltration into County ines should also be addressed.

e also encourage the County to evaluate the development of ed, or tertiary, treatment levels and to consider nities to develop alternative sewage treatment methods, s the use of artificial wetlands to further treat sewage ent from small treatment plants. An additional advantage of er, localized plants that should be considered is that d wastewater can be returned to local water bodies, thus ing negative impacts to water quality and habitat that can with water diversions.

e hope the County Sewer Committee will consider these nts. If we can provide further information, please do not te to contact me.

Sincerely,

Bridget Barclay

Bridget Barclay,
Environmental Director

For release, thursday, April 25

After much thought, I have decided as a member of the Orange County Sewer Committee, appointed by the County Executive, to vote against the proposals brought forward by the consultants, and instead to urge the County Executive and County Legislators to seek more innovative, cost effective, and ecologically sound ways of handling sewage treatment in our county.

I do not pretend to be a professional in these matters, nor do I criticize the quality of the consultants' work or their methodology. I surely understand the quandry faced by the elected representatives of the fast growing towns of Orange County and I can appreciate the fact that they need responsible solutions and soon.

My reasons for voting against the proposals are as follows;

a. I fear that, a decade from now, the 150 million dollar project proposed here will be an obsolete method of treating waste water and sewage and that different and more natural techniques will then be employed as a standard procedure. Also, I suspect that the major treatment plant proposed for the Hudson River at New Windsor will be opposed in the courts by a variety of environmental organizations.

b. The county master plan, like those elsewhere, calls for clustering our growth around existing communities and preserving the intervening open space. This proposal will simply lead to more urban sprawl.

County legislators might well consider proposals now being discussed by experts in land use planning of instituting sewer tie-in fees based on the distance of the applicants from existing systems. It would save county taxpayers millions of dollars.

c. I oppose the proposals for a third reason. I speak as a city resident, and I must draw attention to the plight of all older communities in Orange County. On the one hand, they must house the poor, the elderly, and the disadvantaged. On the otherhand, both in terms of the water loop and now the sewer study, these communities, which have bought and paid for their own systems, must now directly or indirectly help underwrite new systems to aid new residents who have made no prior investment in our county.

d. Finally, both the Environmental Protection Agency and the Department of Environmental Conservation recognize the value of natural rather than chemical treatment of waste, and also the logic of protecting stream flow in its natural setting. In the long run, these agencies will be forced to do more than they have to date to develop new natural systems of waste water and sewage treatment.

I feel sure that our legislators would prefer not to face these difficult decisions and choices, but in the long run they will be doing our county a great service if they weigh the alternatives with care.

Louis V. Mills
4/20/91

Museum of the Hudson Highlands

P.O. Box 181
The Boulevard, Cornwall-on-Hudson, New York 12520
(914) 534-7781

May 7, 1991

Honorable Mary McPhillips
Orange County Executive
255-275 Main Street
Goshen, NY 10924

Dear Honorable McPhillips:

Our Museum has received several grants for field studies relating to the restoration or construction of wetlands for their use as biological filters. In the process of conducting these studies we have reviewed the use of specially designed and constructed wetlands for municipal waste water treatment.

There is no doubt that wetland creation is a cost effective and environmentally sound method for improving water quality and will be more widely used in the future. Because the use of wetlands for improving water quality is somewhat of a "new" science not many public officials fully understand the potential of this technology. As you develop Orange County's future plans for waste water treatment, I would urge you to consider the use of specially designed constructed wetlands to supplement the engineered systems. If wetlands such as these are installed at the regional treatment facilities, the water once treated and passed through the biological filter can be discharged back into its rightful or natural watershed where nature can purify the water even further.

Orange County is unique in that it has a vast acreage of lowlands and already protected wetlands that might be put to work for us. If these wetlands are well managed, they may not only reduce the cost of future waste water treatment facilities, but also provide a strong measure of flood control as well as a variety of recreational opportunities for members of our community.

As you know environmental problems can reach staggering proportions when left unchecked. In this case, however, Orange County easily has the ability to produce an ecologically sound solution to waste water management.

Sincerely,

Charles Keene

Charles I. Keene
Director of Natural History

c.c. J. Townsend
S. McLaughlin

9 Vassar Street
Poughkeepsie, NY
12601
(914) 473-4440
FAX (914) 473-2648

May 29, 1991

Mr. Spencer McLaughlin
Chairman
Orange County Sewer Committee
Legislative Offices, 2nd Floor
County Government Center
Goshen, NY 10924

Dear Mr. McLaughlin:

Scenic Hudson is a not-for-profit environmental organization dedicated to the protection of the resources of the Hudson River and its Valley.

We understand that the Orange County Sewer Committee is currently considering alternatives to increase sewage treatment for the county. While this step is certainly prerequisite to the County moving forward with its supply expansion plans, we have concerns about the way the Committee's decisions appear to be heading.

Of greatest concern is that the County is planning to discharge sewage effluent into the Hudson River from a large centralized treatment facility. We understand that the original proposal to discharge up to 12 million gallons per day (mgd) in the New Windsor area, has recently been increased to 25 mgd because of the Town of New Windsor's desire to be linked into the system. We are concerned about the impacts on water quality posed by both proposals as only secondary treatment is being considered. Clearly, in light of the additional discharge created by the New Windsor link, a tertiary treatment option should be reconsidered.

While it has been argued that the assimilative capacity of the Hudson would mitigate the impacts of decreased dissolved oxygen, industrial pollutants and increased coliform levels, it is important to remember that the receiving waters in this section of the Hudson are class A and water is withdrawn just upstream as New York City's emergency supply. The fact that the discharge is downstream offers little reassurance in an estuarine system that contaminants will not be carried within proximity of the water intake.

In the County's evaluation, it is absolutely critical that thorough attention be given to the benefits of water conservation planning as it relates to waste water management and treatment. Water conservation can extend the life expectancy of plants, as well as improve the efficiency of treatment, thus reducing the impacts of effluents discharged. Water conservation planning is thus both economically and environmentally sound from the wastewater management perspective.

Finally, we question the advisability of relying on a large centralized facility as opposed to smaller more localized plants, as it will represent a significant diversion of water away from natural watersheds areas. We urge the County to evaluate alternatives that are smaller scale in order to avoid diversions and to allow for consideration of a variety of technologies.

Please feel free to call us if you have any questions about our comments.

Sincerely,

Cara Lee

Cara Lee
Environmental Director

cc: Commissioner Albert F. Appleton, NYC DEP
Ralph Manna, Regional Director, NYS DEC

To; Orange County Executive and Legislature

From; Louis V. Mills, Sewer Committee member

date; July 5, 1991

The July 2 presentation on waste water treatment by Dr. John Sheaffer, of Sheaffer and Roland, makes very clear the fact that waste water reclamation at or near its source is far past experimentation and is in extensive use everywhere in the country and in all kinds of conditions(e. g. Chicago). While the private sector is ahead of the public sector, there is nothing to prevent town governments in Orange County from exploring the technology as a less costly and more environmentally sound method of recycling their waste water.

Interestingly enough, both EPA and DEC efforts to upgrade stream and river water quality in Orange County would be enhanced by the implementation of water reclamation processes whereas the collection, treatment, and discharge of our waste waters in the Hudson River at New Windsor would tend to work against these very objectives.

Finally, such a process places the fiscal responsibility for dealing with waste water on the same level of government (the town or city) which determines the amount and type of growth which will be permitted in its jurisdiction.

For these reasons, I urge the County government to defer accepting the Hazen and Sawyer recommendations until the various impacted towns have thoroughly explored the possibility of solving their waste water problems within their own boundaries.

Louis V. Mills

SCENIC 1963 1991 HUDSON INC.

9 Vassar Street
Poughkeepsie, NY
12601
(914) 473-4440
FAX (914) 473-2648

July 8, 1991

Mr. Spencer McLaughlin
Chairman
Orange County Sewer Committee
Legislative Offices, 2nd floor
County Government Center
Goshen, NY 10924

Dear Mr. McLaughlin:

Scenic Hudson submitted a letter to you dated May 29, 1991, in which we expressed concerns about the discharge of sewage effluent into the Hudson River from the proposed treatment facility. Additionally, we mentioned the rationale for water conservation planning as it relates to waste water management and treatment alternatives.

We remain interested in the County's ongoing evaluation of alternatives and would like to request that a copy of the Final Orange County Sewerage Study be mailed to us upon its upcoming release.

Again, please feel free to call us if you have any questions about our comments.

Sincerely,

Beth Gelber

Beth Gelber
Environmental Associate

/rmm