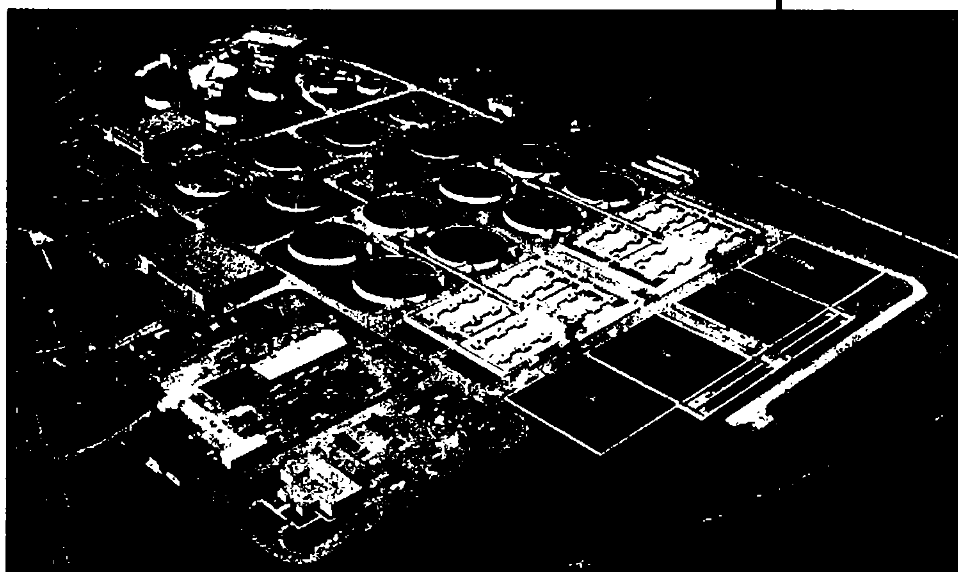

Draft Environmental Impact Statement

Onondaga County Wastewater Collection and Treatment

Submitted to:

New York State
Department of Environmental Conservation

January 11, 1996

Draft Environmental Impact Statement

Onondaga County
Wastewater Collection and Treatment

Prepared by

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LIST OF ACRONYMS

AADT	Annualized Average Daily Traffic
AAQS	Ambient Air Quality Standard
ASLF	Atlantic States Legal Foundation
BOD	Biological Oxygen Demand
BOD_5	Biological Oxygen Demand - 5 Day
BMP	Best Management Practices
BPJ	Best Professional Judgement
BTT	Best Treatment Technology
CBD	Central Business District
$CBOD_5$	Carbonaceous Biological Oxygen Demand
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CISER	Cornell Institute of Social and Economic Research
CPE	Comprehensive Plant Evaluation
CSO	Combined Sewer Overflow
CSS	Combined Sewer System
CWA	Clean Water Act
DEIS	Draft Environmental Impact Statement
DO	Dissolved Oxygen
EAF	Environmental Assessment Form
EBSS	Erie Boulevard Storm Sewer
EFC	Environmental Facilities Corporation
ELAP	Environmental Laboratory Accreditation Program
ENR	Engineering News Record
ETI	Environmental Technology Initiative
FCF	Floatables Control Facility
FDA	Food and Drug Administration
GEIS	Generic Environmental Impact Statement
HBIS	Harbor Brook Interceptor Sewer
HgT	Total Mercury
ISTEA	Intermodel Surface Transportation Efficiency Act
LOS	Level of Service
LTCP	Long-term Control Plan
MCP	Municipal Compliance Plan
MCRT	Mean Cell Residence Time
MDA	Metropolitan Development Authority
METRO	Metropolitan Syracuse Wastewater Treatment Plant
MIS	Main Interceptor Sewer
MSA	Metropolitan Statistical Area

LIST OF ACRONYMS (continued):

NMC	Nine Minimum Controls
NPDES	National Pollution Discharge Elimination System
NPL	National Priorities List
NYCRR	New York Code of Rules and Regulations
NYSDEC	New York State Department of Environmental Conservation
NYSDOL	New York State Department of Law
NYSDOH	New York State Department of Health
NYSDOT	New York State Department of Transportation
NYSERDA	New York State Energy Research and Development Authority
NYSOPRHP	New York State Office of Parks, Recreation and Historical Preservation
OCDDS	Onondaga County Department of Drainage and Sanitation
OCIDA	Onondaga County Industrial Development Agency
OLMC	Onondaga Lake Management Conference
PAH	Poly Aromatic Hydrocarbons
POTW	Publicly Owned Treatment Works
PWP	Priority Water Problem
PTI	PTI Environmental Services, Inc.
REMI	Regional Economic Models, Inc.
RI/FS	Remedial Investigation/Feasibility Study
ROW	Right of Way
RTF	Regional Treatment Facility
SCADA	Supervisory Control and Data Acquisition
SEQR	State Environmental Quality Review
SIDA	Syracuse Industrial Development Agency
SOD	Sediment Oxygen Demand
SORWG	Senaca/Oswego River Working Group
SPDES	State Pollution Discharge Elimination System
SRF	State Revolving Loan Fund
SRP	Soluble Reactive Phosphorus
SSO	Sanitary Sewer Overflow
STP	Sewage Treatment Plant
SWMM	Storm Water Management Model
TKN	Total Kjeldahl Nitrogen
TMDL	Total Maximum Daily Load
TOGS	Technical and Operational Guidance Series
TP	Total Phosphorus
TSS	Total Settleable Solids
UDC	Urban Development Corporation
UFI	Upstate Freshwater Institute
USACOE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geologic Survey
WEF	Water Environment Federation
WQS	Water Quality Standards
WSE	Waste Stream Environmental, Inc.
WWTP	Wastewater Treatment Plant

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EXECUTIVE SUMMARY

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DESCRIPTION OF THE PROPOSED ACTION

General

This Draft Environmental Impact Statement (DEIS) analyzes the environmental impacts associated with implementation of the preliminary Municipal Compliance Plan (MCP) for Onondaga County, New York. The MCP is the County's proposal for upgrading and expanding the Metropolitan Syracuse Wastewater Treatment Plant (METRO) and implementing remedial actions for the combined sewer overflows (CSOs). Once approved by the Onondaga County Legislature, the preliminary MCP will become the County's formal proposal for these improvements to the wastewater infrastructure.

Onondaga County has developed this MCP to fulfill its responsibility for bringing wastewater discharges from METRO and the CSOs into compliance with applicable state requirements consistent with achieving designated uses in a cost-effective manner. The MCP has been developed to be consistent with the policy adopted by the Onondaga County Legislature in August 1995. The objective of the Legislature's policy is to provide for improved conditions in the lake and its tributaries in a manner consistent with the County's legal obligations. However, the MCP must protect the County against adverse economic impacts.

A series of actions is proposed to improve the County's wastewater collection and treatment infrastructure, combined with a process for measuring improvements to Onondaga Lake, the lake's tributaries, and the Seneca River. The Environmental Protection Agency's phased total maximum daily load (TMDL) approach to complex water quality problems such as Onondaga Lake is used as a framework for the County's MCP. The TMDL strategy reduces pollution inputs to surface waters in a step-wise manner, followed by environmental monitoring to measure improvements. The need for additional reductions is evaluated based on progress towards meeting water quality standards and attainment of designated uses.

The County's MCP proposes a sequence of specific actions at METRO and the CSOs to address water quality issues in Onondaga Lake and its tributaries attributable to discharges of municipal wastewater. Water quality issues (ammonia and nitrite, dissolved oxygen, bacteria, and floatables) preclude the attainment of the lake's designated uses. These uses, as defined by state and federal objectives, are the protection and propagation of aquatic life and provision of conditions suitable for water contact recreation. As discussed in the DEIS, there are additional issues unrelated to Onondaga County's municipal wastewater issues which limit attainment of the lake's best use.

Consistent with the directives of the Onondaga County Legislature, the County proposes to undertake implementation of the proposed plan in phases. The phased actions (called interim phase and intermediate phase) are planned for both METRO and CSOs. The interim phase is scheduled from 1996 - 2000. The intermediate phase is currently scheduled to continue to the year 2020. At critical points during each phase of implementation, the County will assess progress towards compliance with applicable state and federal requirements. Onondaga Lake, the streams flowing into the lake (the lake tributaries), and the Seneca River will be closely monitored each year to assess the effectiveness of these phased actions. The impact on user fees of financing the completed projects and the overall financial and economic health of the community will also be evaluated. The outcome of this evaluative process will guide the scope and schedule for implementation of subsequent projects.

The potential adverse financial and economic impacts associated with implementing these phased actions dictate that the County, on behalf of its rate payers, insist on all reasonable cost containment measures. Assurances are necessary that these significant investments will actually promote attainment of the lake's designated uses. The County must also aggressively pursue outside funding from state and federal agencies. Financial participation will also be pursued with private entities whose operations and/or site management have caused or contributed substantially to current conditions.

If it becomes apparent from the evaluation process that the designated uses for Onondaga Lake cannot be attained and/or that economic and financial conditions dictate a reformulation of one or more of the remaining projects, the scope, and/or compliance schedule would be adjusted accordingly. Implementation would then focus on attaining the highest level of benefit achievable at that time.

Likewise, to the extent that other remedial activities result in removing barriers to use attainment and/or additional funding in the form of financial assistance becomes available, the scope of proposed projects as well as the compliance schedule could be adjusted to reflect the more favorable financial, economic, and environmental conditions.

Interim Phase METRO Projects (Total Cost, $20.9 Million)

All costs presented in the Executive Summary are indexed to mid-interim phase, based on an ENR of 5870.

1. Operational changes and physical plant improvements in order to operate METRO for seasonal ammonia removal once Bristol-Myers Squibb pretreatment is on line in 1996 ($1.4 million).

2. Improvements to the digital operating system in order to optimize plant performance for ammonia removal ($2.9 million).

3. Installation of permanent phosphorus removal facilities in order to improve reliability for phosphorus removal and comply with New York State chemical bulk storage regulations ($2.4 million).

4. Construct residuals handling and odor control facilities in order to reduce odors, improve solids handling, improve sludge handling capabilities, and expand anaerobic digester capacity ($7.5 million).

5. Improve sludge handling capabilities and expand anaerobic digester capacity ($6.7 million).

6. Design and implement a large-scale test of hypolimnetic oxygenation in order to add oxygen to the lake's lower waters. From the pilot testing, analyze environmental benefits and design criteria associated with full-scale implementation of hypolimnetic oxygenation (cost to be developed).

Interim Phase CSO Projects (Total Cost, $23.4 Million)

1. Hiawatha regional treatment facility (RTF) to treat overflows to Ley Creek, floatables control, remove settleable solids, disinfect, and demonstrate vortex technology ($8.0 million).

2. Newell RTF to treat overflows to Onondaga Creek, control floatables and demonstrate disinfection technology ($1.3 million).

3. Harbor Brook EquiFlow™ and wetlands demonstration facility to treat overflows to Harbor Brook, control floatables, and demonstrate alternative technology ($5.4 million).

4. Upgrade the Erie Boulevard storm sewer storage system in order to maximize storage within the collection system as a means to reduce overflows ($2.3 million).

5. Upgrade the Kirkpatrick Street pump station to reduce overflows and maximize the wet-weather flow to METRO ($5.6 million).

6. Evaluate the integrity of siphons crossing the tributaries, to identify and correct any breaks ($0.3 million).

7. Evaluate CSO toxicity to identify discharges to the combined sewer system that may be toxic to aquatic life ($0.3 million).

8. Implement floatables entrapment measures in order to comply with state and federal CSO policies ($0.2 million).

Monitoring and Assessment

The phased TMDL process requires Onondaga County to conduct a program of water quality monitoring and assessment. Monitoring of the lake and its tributaries and the Seneca River throughout the interim and intermediate phases of METRO improvements and CSO remediation is therefore proposed as an integral part of the County's MCP. The County's existing lake and tributary monitoring program, in place since 1970, will be re-focused to evaluate water chemistry, biology, and physical factors.

The tributary monitoring program will be expanded to capture more high flow events, thus improving the annual load estimates. Measured partitioning between point and non-point sources of phosphorus, specifically required as part of the phased TMDL process, will be a focus of the tributary monitoring effort. Bacteria in the streams will be monitored during and after storms to record improvements and determine the extent of CSO remediation required to meet state and federal policy objectives. Benthic (bottom-dwelling) organisms in the tributaries will be surveyed to measure improvements through the CSO program.

The in-lake chemical monitoring program will be expanded to include measurement of fish reproductive success. Zooplankton monitoring will also be expanded, as the numbers and species composition of these animals provide an important index of lake trophic structure. Fish contaminant burden, measured by the NYSDOH, will be tracked each year to evaluate progress towards remediating the complex industrial contaminant issues. Bacteria will be measured in near-shore areas and lake-wide following storms to assess progress towards meeting the public health standards for water contact recreation.

Following completion of the first phase, additional remedial actions will be implemented at METRO and abatement facilities constructed for the CSOs, as outlined below.

Intermediate Phase METRO Projects (Total Cost, $132.6 Million)

1. Acqure the Niagara Mohawk property within the METRO site and relocate the sewer maintenance group in order to maximize re-use of existing facilities and obtain space needed for process tankage required for nitrification ($5.8 million plus unknown land acquisition costs).

2. Implement a plant demonstration of year-round ammonia removal at METRO by upgrading one-quarter of the plant to treat ammonia. Testing of both conventional activated sludge technology and the advanced integrated fixed-film activated sludge in order to define

design criteria and performance characteristics for the full-scale plant upgrade ($32.7 million for one-quarter plant upgrade plus $0.3 million for ammonia removal demonstration).

3. Implement a full-scale hypolimnetic oxygenation to maintain aerobic conditions in the lake's lower waters (cost to be estimated during test phase; allowance of $20 million included).

4. Implement a full-scale plant upgrade for year-round ammonia removal ($73.8 million).

Intermediate Phase CSO Projects (Total Cost, $119.1 Million)

1. Construct the Midland RTF in order to reduce floatable and settleable solids and bacteria in Onondaga Creek, the Inner Harbor, and Onondaga Lake ($74.5 million).

2. Construct the Clinton RTF in order to reduce floatable and settleable solids and bacteria in Onondaga Creek, the Inner Harbor, and Onondaga Lake ($30.2 million).

3. Construct the Franklin floatables control facility (FCF) in order to reduce floatables in Onondaga Creek , the Inner Harbor, and Onondaga Lake ($3.2 million).

4. Construct the Maltbie St. (FCF) in order to reduce floatables in Onondaga Creek, the Inner Harbor, and Onondaga Lake ($2.5 million).

5. Separate selected combined sewer areas in the Onondaga Creek corridor ($8.7 million).

Continued Monitoring and Assessment of the Need for Additional Reductions (Total Cost, $10.6 Million)

Monitoring and assessment will continue to be an integral part of the County plan throughout the intermediate phase. Following completion of the intermediate phase, water quality conditions will be evaluated, and the need for additional reductions in pollutant loads will be assessed using the TMDL strategy. Criteria to be used in making the decision to proceed include compliance with standards, progress towards remediation of the significant industrial contamination issues that have led to the lake's listing on the National Priorities List, current technologies, availability of non-County funding, and analysis of potential future costs in relation to environmental benefits achieved.

The MCP and DEIS present several conceptual long-term alternatives for actions at METRO and the CSOs to reduce pollutant inputs to Onondaga Lake. Examples include effluent filtration, diversion of METRO effluent to the hypolimnion, diversion of METRO effluent to the Seneca River, and additional capture of CSO flows. None of the conceptual long-term alternatives are precluded by the interim and intermediate actions.

SIGNIFICANT BENEFICIAL AND ADVERSE IMPACTS (INCLUDING ISSUES OF CONTROVERSY)

General

The MCP was developed to bring discharges from METRO and the CSOs into compliance with the anticipated state effluent limits and state and federal CSO control strategies. Initial limits have been established in a draft permit for the interim phase. The need to improve water quality and the aquatic environment has been the driving force behind these proposed actions. Therefore, environmental impacts on natural resources from implementation of the MCP are largely positive. However, without significant non-County funding, impacts on human resources will be negative due to the high costs of the METRO and CSO projects, the additional tax burden associated with increased sewer use fees, and the depressed local economy relative to the state as a whole. The public may not perceive significant environmental benefits from implementation of the MCP without successful remediation of the industrial contamination, such as mercury in fish.

Significant Beneficial Impacts

1. **CSO-Related Water Quality Parameters.** Impairment of the lake and its tributaries by CSO floatables, solids, and bacteria is addressed by the MCP. The County's proposed plan is designed to bring Onondaga County CSO discharges into compliance with both state and federal control policies by separating some sewers, controlling floatables, consolidating remaining CSO's and providing regional treatment and disinfection. On an annual cycle, at least 85 percent of the wet weather flow in the combined sewer system will be captured and treated at METRO. The remaining flow will be subjected to floatables control, solids removal, and disinfection before discharge to the tributaries. Water quality improvements in the tributaries and the lake will be realized.

By the end of the interim phase CSO projects (year 2000), substantial compliance with the state's narrative ambient water quality standard and state and federal CSO policy for floatables will be met in Onondaga Lake.

The one exception is the covered portion of Harbor Brook, where no access is possible. Improvements to the bacterial quality of the Lake will be evidenced as well. A bacteria model of the lake developed by Upstate Freshwater Institute (UFI) has been coupled with the USEPA's SWMM model to project improvements in lake water quality in response to CSO actions. The models project that bacterial events in the lake will be reduced in frequency and magnitude as a result of the interim projects.

By the end of the intermediate phase CSO projects (year 2020 or earlier), the model predicts that bacterial compliance (defined as instantaneous concentrations of indicator bacteria greater than 200 cells per 100 ml) will be essentially met lake-wide. Occasional bacterial events may occur in the extreme southern end of the lake following intense storm events in excess of the design basis of the selected CSO remedial measures.

2. **Metro-Related Water Quality Parameters.**

a. **General**. Municipal wastewater discharges from METRO deliver ammonia and nitrite to the lake, along with phosphorus, which contribute to eutrophication, and oxygen-demanding materials. The MCP proposes to reduce the impacts of METRO's discharge on the lake by biologically converting ammonia and nitrite into nitrate prior to discharge, optimizing phosphorus removal, and adding oxygen to the lake's lower waters. Compliance with water quality standards will result from these actions.

b. **Ammonia and Nitrite.** METRO is the largest source of ammonia and nitrite to the lake, contributing more than 90 percent of the annual load of these substances. Concentrations of ammonia and nitrite exceed ambient water quality standards established to protect aquatic organisms particularly during reproduction and early life stages. The current concentrations of ammonia and nitrite in Onondaga Lake may represent an impairment of the designated use for fish propagation, although recent fishery data document the presence and successful reproduction of a number of species.

Onondaga Lake and the Seneca River are an open system, and fish are able to migrate in and out of the lake. This connection with the river appears to provide important habitat and refuge for the fishery.

The most significant proposed modification to METRO is biological conversion of ammonia to nitrate (nitrification). This is a costly modification to make, but one that is necessary to reduce the concentrations of ammonia in Onondaga Lake. The MCP proposes an innovative technology for ammonia conversion, integrated fixed-film activated sludge (IFAS). This technology requires less aeration tankage than conventional biological nitrification, and is recommended because of the limited land area available for expansion of the METRO site and because of the lower cost.

Provision of year-round nitrification will alleviate the high concentrations of both ammonia and nitrite in the effluent and the lake. The environment for aquatic organisms will improve. As the nitrification facilities are tested and built, the County will measure the effectiveness of the improved effluent quality in reducing in-lake concentrations of ammonia and nitrite. The "build and measure" approach is necessary to assess the impact of nitrification at METRO on the lake. The County's proposal to add oxygen to the lake's lower waters will affect how ammonia and nitrite cycle in the lake, and existing lake models do not take this action into account. Continued monitoring of the lake's chemistry and fishery is essential to measure response.

c. **Dissolved Oxygen.** Under current conditions, dissolved oxygen (DO) is rapidly depleted from Onondaga Lake's hypolimnion with the onset of thermal stratification. Consequently, fish and other organisms are restricted to the epilimnion. During fall mixing, reduced species such as hydrogen sulfide and methane that have accumulated in the oxygen-deficient lower waters mix throughout the water column, reducing oxygen lake-wide. Fish apparently seek refuge in the Seneca River and at the mouths of tributary streams during fall mixing, which can persist for a period of several days to several weeks.

The MCP addresses the complex use impairment associated with oxygen depletion in the lower waters. Hypolimnetic oxygenation, which injects oxygen into the lake's lower waters, has been proposed in light of the results of research and modeling indicating that the lower waters of Onondaga Lake would remain anoxic under any management alternative, including complete diversion of METRO from the lake.

The goal of hypolimnetic oxygenation would be to maintain aerobic conditions in the hypolimnion throughout summer stratification, thus avoiding the accumulation of hydrogen sulfide and methane and the associated lake-wide DO sag at fall mixing. Habitat for aquatic organisms would be expanded with provision of aerobic conditions. Additional investigation and testing is required to determine the extent to which mercury methylation and the subsequent bioaccumulation into fish flesh would be reduced. The extent to which DO would increase throughout the lower waters also requires additional investigation and testing.

d. **Phosphorus**. Phosphorus enters the lake from point (METRO and CSO) and non-point sources (stormwater and agricultural runoff) within the watershed. Although point sources have been relatively well defined, inputs from non-point sources have not. There is interannual variability based on the amount of rainfall in a given year (wet years have larger inputs from nonpoint sources), and performance of phosphorus removal at METRO.

Phosphorus has an impact on water clarity or transparency by stimulating the growth of aquatic plants. The current NYSDEC standard for phosphorus in surface waters is a narrative standard that limits phosphorus to "none in amounts that will result in growths of algae, weeds, and slime that will impair the waters for their best use". In October 1993, NYSDEC adopted a phosphorus guidance value of 20 parts per billion for ponded waters with recreational use. This guidance value was based on a survey of public perception of the fitness of lakes for recreational use based on water clarity and levels of aquatic weeds.

Based on the Onondaga Lake monitoring and modeling efforts, the guidance value of 20 parts per billion is not attainable in the lake, even with complete diversion of METRO and aggressive controls on nonpoint sources of pollution. The urban setting and large drainage basin preclude Onondaga Lake from meeting this low level of phosphorus.

Guidance values are not enforceable standards, so the approach towards addressing lake phosphorus uses the TMDL paradigm of freezing current inputs and monitoring progress towards meeting the state's water quality objectives.

New York State has a water transparency safety guideline of 4 feet for bathing beaches. In recent summers, Onondaga Lake has met this transparency guideline on the average, with lake transparency generally remaining over 4 feet during the recreational period. Occasional low transparency conditions are associated with algae blooms. The average summer concentration of phosphorus measured in the upper waters of Onondaga Lake varies between 60-80 parts per billion. This concentration does not represent an impairment of the designated use for water contact recreation based on safety considerations, although it potentially contributes to a local perception that Onondaga Lake is less desirable than other local water resources for this use.

Construction of permanent chemical storage and feed facilities is planned to optimize the removal of phosphorus from the wastewater effluent stream. With the proposed improvements to the phosphorus removal facilities, METRO will be able to consistently meet the state's mass load-based effluent phosphorus limit. Additional reductions in the lake's phosphorus concentration are anticipated, since hypolimnetic oxygenation will reduce or eliminate the release of phosphorus from the sediments.

3. **Effects of Other Use-limiting Conditions on the MCP.** Industrial residuals, including mercury and other organic compounds, are present in Onondaga Lake's sediment, water column, and aquatic biota. The New York State Health Department concluded that the lake poses a threat to human health (NYSDOH, July 1995). The lake bottom is classified by New York State as an inactive hazardous waste site, and has been placed on the National Priority List as a federal Superfund site. The contaminant burden in Onondaga Lake fish is of concern due to the open nature of the aquatic system; the interconnection between Onondaga Lake and the Seneca River allows contaminated fish to migrate to unaffected aquatic systems. The mercury in Onondaga Lake represents an impairment of the designated fishery use.

Other industrial residuals impact the habitat and food web of Onondaga Lake and the Seneca River. For example, the concentration of chlorides is elevated over natural background in

Onondaga Lake. The salinity has historically altered the stratification regime, and affected the environment for plants and animals. Petrochemical products have been detected in the lake sediments and fish.

Several issues affect the structure and productivity of the lake and river fisheries. Near-shore lake sediments contain calcium carbonate precipitates from the Solvay Process, and are a poor habitat for aquatic plants. Without aquatic plants, the spawning and nursery habitat for fish is reduced. Sediment enters the lake from the "mud boils" in the Onondaga Creek watershed, about 15 miles south of Syracuse. Mud boils discharge large amounts of sediments, and sometimes salts, with upwelling groundwater. The sediment from the mud boils reduces water clarity and habitat for fish spawning. The lake shoreline does not provide protected inlets and refuges for spawning and nursery areas for fish. Hydroelectric dams on the Seneca and Oswego Rivers have eliminated any annual spawning migration to Lake Ontario.

The MCP does not directly address these use-limiting conditions. The scope of Onondaga County's responsibilities is limited to municipal wastewater issues. However, the MCP may interact with remedial measures negotiated for these industrial issues. In particular, the proposal to provide oxygen to the hypolimnion is likely to alter the chemical speciation and transformation of mercury.

Significant Adverse Impacts

Without substantial non-County funding, the significant adverse impacts of the MCP relate to the economic and social impacts of the increase in wastewater user fees associated with increased debt service. Environmental benefits of the proposed MCP must be balanced against the potential for significant costs and social, fiscal and economic dislocation for Syracuse and Onondaga County residents.

The 1996 total project cost for the MCP is $307 million (indexed to mid-interim phase, ENR 5870). This total includes $21 million for METRO and $23 million for CSOs in the interim phase; $133 million for METRO and $119 million for CSO in the intermediate phase; and $11 million for long-term monitoring and assessment.

If these capital costs are projected using an annual inflation rate of approximately 5 percent (which reflects the average rate of growth in the ENR index over the past 20 years) the total funding required over the length of the implementation schedule is $536 million. Including interest costs, the total projects will exceed $1.1 billion.

If the County is required to fund all MCP costs, implementation will mean rapid increases in user fees for services. Projected household bills are constructed by adding charges for service under the existing system, any local retail charges for the local collection system, and the MCP increment, which is the estimated household charge to implement the proposed actions. The total cost of sewer service is projected to increase from approximately $277 in 1995 ($216 for existing County service and $61 in local retail) to approximately $671 in the year 2005, an average annual increase of approximately 9 percent. The total year 2005 bill would represent $412 for existing County service, $106 in local retail, and an MCP increment of $153, or 23 percent of the total bill.

In the year 2015, estimated fees under the existing system rise to $777, while local charges rise to $182. The MCP increment becomes a larger share of the bill, rising to $434, or 31 percent of the $1,313 total charge.

The affordability of these rates is a significant factor in implementing the proposed plan. If customers cannot afford to pay the resulting bills, the revenues needed to support the program will not be available, or will only be received at the cost of severe economic and financial hardship. The County has determined that for purposes of long-term facility planning it will use a 1 to 1.5 percent rate as an indicator of affordability and will strive to maintain long-term rates consistent with this standard. This standard is consistent with rating agency standards concerning affordability of user rates and the USEPA Draft Guidance Document. However, it is noted that residents of the City of Syracuse, representing almost 35 percent of the County's population, have income levels that average 35 percent below the County as a whole. Consequently, a sewer rate equal to 1.5 percent of the median County household income would equal 2.25 percent of the median City household income.

The rapid rise in sewer use charges between 1995 and the year 2015 represents an average annual increase of 7.5 percent, and a cumulative increase of 510 percent. This projected rate of increase far exceeds the projected growth in wages over this period. Sewer bills are projected to increase from

0.8 percent of County median household income in 1995 to 1.63 percent in 2015, more than doubling the burden of the fee. The situation is even more troubling for residents of the City of Syracuse, where the rate is projected to increase from 1.15 percent of median household income to 2.5 percent in 2015.

Although implementation of the MCP will result in temporary construction jobs, leakage of such employment benefits to other regions is expected to be high. In Boston, the MWRA treatment plant upgrades lost over 50 percent of the economic spinoff benefits to other regions because of the need to acquire specialized skills, equipment, and services which were unavailable in the local market. Commuting patterns for construction employees are also broader than for other types of labor, so job creation within the County may not reflect the size of the project. Phasing of construction will provide the maximum opportunity for the local labor force by spreading out the demand for labor over time, thus reducing the need to import labor form other regions.

Per capita disposable income will decrease as a result of the MCP, due to the significant increase in sewer use fees. The impact will be disproportionately felt by low and moderate income households. Since no permanent job creation is anticipated, there will be no offsetting rise in total community disposable income.

Negative economic impacts include a loss of 1,700 full time jobs and 3,700 residents by the year 2020 due to the economic impact of debt service. Increased user fees will shift consumer expenditures with local benefits to debt service with benefits to bond holders across the country. Federal or state aid, if available, would mitigate the losses to the local economy.

Issues of Controversy

Through a series of technical meetings, NYSDEC and Onondaga County staff and consultants have worked towards developing consensus regarding the MCP projects, and the supporting documents. Preliminary versions of text have been submitted to NYSDEC for review prior to formal submittal of the document to meet the consent order deadline. Unfortunately, the 90 day time period allowed between declaration of model completion and the filing deadline did not allow sufficient time for NYSDEC to review all chapters of both the MCP and the DEIS. There was also insufficient time to incorporate all of the thoughtful review comments made. These efforts at consensus were made to reduce or eliminate issues of controversy.

The TMDL "build and measure" approach calls for implementing corrective actions, then measuring the receiving water's response. With this approach, issues of controversy related to technical feasibility and projected environmental impact are resolved directly.

MITIGATION MEASURES PROPOSED

The MCP has been developed to improve environmental conditions in and around Onondaga Lake and its tributaries. The County will make every effort to minimize environmental impacts and mitigate adverse effects to sensitive natural and cultural resources. When it is not possible to avoid these impacts, the County will take every measure to minimize these impacts and to integrate resource improvements into the surrounding environment. Plans, specifications, and contract documents will include requirements intended to mitigate the potential negative effects of the short- and long-term impacts. Mitigation measures for the specific areas of concern mentioned previously are as follows.

The optimization plans for METRO are being accomplished by the maximum reuse of existing facilities to the extent possible. The only land acquisition planned is addition of the Niagara Mohawk property, which is a former manufactured gas plant site. The short- and long-term impacts of improvements to METRO have therefore been minimized. Particular emphasis will be place on mitigation of Construction Phase issues. Each project will have an approved public health and safety plan prior to the start of construction.

The contractor will be required to utilize flagmen, traffic signals, and lighted barricades as required to maintain safe and efficient flow of traffic. Although traffic related construction activities for individual projects will require a temporary shoulder closure, the contractor will be required to maintain the flow of traffic so that impacts on traffic will be minimal.

Noise impacts from construction activities, including blasting, will generally be confined to daylight, normal working hours in order to minimize noise disturbances. The contractor will be required to minimize excessive noise caused by work activities and to observe all local noise ordinances.

To mitigate dust production, contractors will be required to minimize dust generation as much as practical through control measures such as frequent sprinkling and sweeping of paved areas and sprinkling and mulching of unpaved areas.

Erosion and sediment control plans will be prepared to mitigate impacts on soil resources, along with stormwater management plans designed to ensure erosion control and mitigate nutrient and sediment runoff.

Impacts of construction activities on environmentally sensitive areas such as floodplains and wetlands will be minimized through strict adherence to the approved erosion and sediment control plan, complete re-vegetation of all disturbed areas, and complete restoration of natural, preconstruction drainage patterns.

A number of mitigative measures are available to address odor problems, if they occur. These measures include shortening the holding time of retained discharges (faster pump-back), use of masking agents, and odor control systems. It is believed that the maintenance of CSO facilities after storms, combined with adequate facility ventilation, will prevent odor problems.

ALTERNATIVES CONSIDERED

A technical effort to identify alternatives for reducing pollutant loadings from METRO and the CSOs to Onondaga Lake and its tributaries has been underway since 1988. The engineering effort to identify alternatives has been conducted in parallel with a water quality modeling effort designed to develop tools for use in predicting the effectiveness of each alternative on improving water quality. This parallel schedule of developing models and screening engineering alternatives was established in the Judgement on Consent (the consent decree) executed by Onondaga County, NYSDEC, and the Atlantic States Legal Foundation in January 1989.

Alternatives for modification and expansion of METRO to reduce pollutant loadings to Onondaga Lake have focused on four issues: (1) expanding hydraulic capacity, so that a greater volume of wastewater can receive full treatment; (2) optimizing performance of existing treatment processes for phosphorus, solids, and BOD; (3) adding new treatment processes to remove additional chemicals such as ammonia and residual chlorine from the waste stream; and (4) relocating some or all of the treated effluent to the lake's lower waters or to the Seneca River. The need to focus on all four issues was identified through changes in regulations, exceedances of the existing METRO SPDES permit, model predictions, and measured exceedances of ambient water quality standards in Onondaga Lake and the Seneca River.

An additional alternative, in-lake treatment of the symptoms of eutrophication through hypolimnetic oxygenation, was recently added on the recommendation of the USEPA.

Alternatives for improvements to the CSO network have also focused on three specific water quality or use impairment issues: (1) controlling floatables, to improve aesthetic conditions; (2) limiting the input of settleable solids to streams, to protect water quality and benthic habitat; and (3) reducing the concentrations of bacteria associated with human waste in the streams and the lake, to protect public health.

Since May 1995, biweekly technical meetings have been held between Onondaga County and their technical consultants and representatives of the NYSDEC to define the specific engineering alternatives for METRO and the CSOs to be included in the MCP, and their sequencing. As agreed to with the lead agency (NYSDEC), this draft environmental impact statement contrasts the County plan with the no-action alternative. The April 18, 1994 submittal of an MCP/DEIS presented additional evaluation of alternatives.

APPROVALS NEEDED

It will be necessary to obtain site-specific approvals relating to environmental impacts, funding, and building and transportation elements of the project. All CSO abatement facility sites will be subject to New York State SPDES permit requirements, and some sites will also be subject to wetland and streambed regulations at the state and federal level. Implementation of hypolimnetic oxygenation will require permits for navigational buoys, and easements for placement of structures on the lake bottom.

Project funding will come through Onondaga County's Capital Improvement Program and Annual Capital Budget, and must be approved through a process involving the Drainage and Sanitation Department Commissioner, County Executive, and County Legislature. The County has considered the possibility of creating an authority to fund implementation of the MCP, pending approval by the County and New York State Legislatures.

Transportation permits will be required through local, state, and federal agencies for highway and canal construction and rights-of-way. In addition, the project will be required to conform to certain zoning and building regulations at the local and state level.

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CHAPTER 1

DESCRIPTION OF THE PROPOSED ACTION

1.0 INTRODUCTION

In January 1989, Onondaga County executed a Judgment on Consent with the State of New York and the Atlantic States Legal Foundation (ASLF) in settlement of litigation initiated in connection with alleged violations of state and federal water pollution control laws. The conditions of the Judgment on Consent obligated the County to perform a series of engineering and scientific studies to evaluate the need for upgrading of the Metropolitan Syracuse Sewage Treatment Plant (METRO) and for providing treatment of combined sewer overflows (CSOs) that occur within the METRO Service Area. This study has resulted in a Municipal Compliance Plan (MCP), which presents a proposal for the upgrade and expansion of the County's METRO plant and for a combination of remedial actions in the combined sewer area (including regional treatment facilities, which include disinfection, floatables control, and sewer separation).

This Draft Environmental Impact Statement (DEIS) has been prepared as a companion document to the Onondaga County MCP. The MCP presents the County's proposal for improvements to the wastewater collection and treatment infrastructure. These improvements are necessary to bring discharges from the Metropolitan Syracuse Wastewater Treatment Plant (METRO) and the combined sewers into compliance with state and federal regulations. The DEIS document presents the environmental and economic impacts associated with the proposed actions.

Onondaga County is located in central New York on the eastern edge of the Finger Lakes region (Figure 1-1). The METRO service area of Onondaga County includes the City of Syracuse and surrounding suburban areas (Figure 1-2). METRO discharges to Onondaga Lake, a small urban lake that flows into the Seneca River and ultimately to Lake Ontario. Combined sewer overflows (CSOs) generated within the METRO Service Area are discharged into three tributaries to Onondaga Lake; the CSO locations and the tributaries into which they discharge are shown in Figure 1-3.

1.1 PROJECT PURPOSE, NEEDS, AND BENEFITS

1.1.1 Description of the Proposed Action

A. General Description of the Phased Total Maximum Daily Load (TMDL) Strategy for METRO and CSO

The Onondaga County MCP is structured to include both actions and processes. It proposes improvements to METRO and the CSOs (the actions), along with a long-term program of monitoring and assessment to evaluate the effectiveness of the planned actions in bringing the discharges into compliance with state and federal regulations (the process). This action/process or "build and measure" paradigm is consistent with the federal TMDL strategy, which was developed under Section 303(d) of the Clean Water Act to assist states with water-quality-based decisions. The strategy is used in cases such as that of Onondaga Lake, where technology-based limits on effluent discharges are insufficient to meet receiving water quality goals and standards. A TMDL is specified for each pollutant based on the assimilative capacity of the receiving water.

The objective of the TMDL strategy is to allocate allowable loads among different pollutant sources so that effective control measures can be taken. Consequently, the strategy is a valuable tool for dealing with water bodies that have multiple inputs of pollution from point, non-point and background sources (as is the case for Onondaga Lake). The United States Environmental Protection Agency (USEPA) notes that "TMDLs can and should be used, however, to consider the effect of all activities or processes that cause or contribute to the water-quality limited condition of a water body" (USEPA, April 1991 "Guidance for Water Quality-based Decisions: The TMDL Process" 440/4-91-001, pg. 19).

In cases where both point and non-point sources of pollution contribute to non-attainment of the designated use of a body of water (as determined by New York State's water quality classification system), the USEPA recommends a phased approach with additional receiving water quality monitoring. A phased TMDL strategy is therefore proposed for Onondaga County. The MCP reflects this phased approach; actions are implemented, and improvements to the physical, chemical, and biological quality of the receiving water are monitored. The impaired waters are assessed to determine whether water quality standards and associated designated uses have been attained. The need for additional reductions in daily loads is evaluated based on compliance with ambient water quality standards and progress toward attainment of designated uses. In this case, the phased approach provides a mechanism for reducing economic impact to the community as well. The impact of the proposed actions on the financial and economic status of the region will be evaluated throughout the process. The outcome of this evaluation will guide the scope and schedule of subsequent projects.

The MCP phased approach has been designed to include interim projects (years 1996-2000), intermediate projects (2000-2020), and commitment to a long-term conceptual re-evaluation of progress towards attainment of best use (year 2020). The MCP document describes a plan consisting of the phased implementation of a series of METRO and CSO interim and intermediate actions, as well as a process to evaluate future, conceptual level actions for additional reductions.

B. METRO Improvements (Interim, Intermediate, and Conceptual Long-term Alternatives)

The proposed plan to address the METRO plant's contribution to water quality impairment in Onondaga Lake involves the phased implementation of a series of actions, as follows:

1. Modification of the METRO State Pollutant Discharge Elimination System (SPDES) discharge permit to establish an immediate cap on phosphorus and ammonia mass loadings discharged to Onondaga Lake based upon current plant performance capabilities (which, in the case of phosphorus, are presently more stringent than permit limits).

2. Implementation of a series of interim actions, including capital projects and operational changes, to optimize treatment for ammonia removal. These actions will utilize existing process tankage, and will take advantage of wastewater pollutant loading reductions that result from industrial wastewater pretreatment by Bristol-Myers Squibb, Inc.

3. Monitoring and assessment of the impact of interim improvements on METRO's performance and adjustment of SPDES permit effluent limitations to capture the phosphorus and ammonia loading reductions that have been achieved.

4. Implementation of a one-quarter plant demonstration project to assess the performance capabilities and establish final design criteria for upgrading of the METRO plant for ammonia

removal. One quarter of the METRO plant will be modified (including the construction of a new secondary clarifier and replacement of mechanical aerators with a fine bubble diffused aeration system) to evaluate both conventional activated sludge and integrated fixed-film activated sludge technologies for their effectiveness on ammonia removal.

5. Implementation of a demonstration project to assess the technical feasibility, cost, and environmental impacts associated with hypolimnetic oxygenation in Onondaga Lake as proposed by USEPA.

6. Full-scale upgrading of the METRO plant for year-round removal of ammonia.

7. Continued monitoring and assessment (including biological and chemical measurements) by the County of the impacts of the above actions on METRO's performance and lake water quality with appropriate reductions of SPDES permit effluent limitations or phosphorus and ammonia as warranted.

8. Consistent with the policy of the Onondaga County Legislature, at critical junctures during each phase of implementation, the County will assess the impact of financing the completed projects on user fees and the overall financial and economic health of the community. The outcome of the evaluation will guide the future scope and schedule of implementation.

The following sections provide brief descriptions of these proposed actions. More detailed discussions of the proposed actions exist in Chapters 3 and 5 of the Municipal Compliance Plan.

B1. **Phosphorus and Ammonia Cap.** The New York State Department of Environmental Conservation (NYSDEC) has proposed modifications to the SPDES discharge permit for METRO. These modifications would establish an immediate cap on effluent phosphorus and ammonia mass loadings discharged to Onondaga Lake.

For phosphorus, a maximum 12-month rolling average limit of 400 lb per day was developed based on a statistical analysis of METRO effluent phosphorus loading data for the period of January 1990 through February 1995. This limit is consistent with the NYSDEC policy

(TOGS 1.3.6, dated December 8. 1988) pertaining to phosphorus removal requirements for wastewater discharges to lakes and lake watersheds. The NYSDEC policy, which is being implemented across New York State, requires that there be no increase in the annual mass loading of phosphorus discharged from existing wastewater treatment facilities that require expansion of flow capacity. Based on the permitted 12-month rolling average flow limit of 80 mgd, the phosphorus "cap" is equivalent to an effluent concentration of 0.6 mg/l. In comparison, the current SPDES permit specifies a maximum allowable 30-day average effluent concentration limit of 1.0 mg/l for phosphorus. In effect, the phosphorus "cap" will capture phosphorus reductions which METRO has accomplished above and beyond the requirements of the current SPDES permit.

For ammonia, a maximum 30-day average limit of 15,200 lb per day was established based on a statistical analysis of METRO effluent ammonia loadings recorded for the period of January 1990 through February 1995. The current SPDES discharge permit does not contain an effluent limit for ammonia. Establishment of a "cap" on ammonia will freeze the mass loading of ammonia permitted to be discharged by METRO and prevent further contravention of water quality standards for ammonia in Onondaga Lake.

B2. **Interim METRO Actions.** The goal of interim METRO improvements is to optimize performance for further reduction of phosphorus and ammonia loadings using existing process tankage. METRO plant performance will be optimized in two ways: (a) by taking advantage of influent wastewater loading reductions resulting from the court-ordered implementation of industrial wastewater pretreatment by Bristol-Myers Squibb, Inc.; and (b) by implementing a series of capital projects and operational changes at METRO. Phosphorus and ammonia loading reductions accomplished during this phase will be captured by modification of the SPDES discharge permit.

a) **METRO Operating Changes.** Onondaga County plans to alter METRO operating and maintenance strategies so as to maximize ammonia removal capabilities to the extent possible with existing aeration and secondary clarifier tankage. In addition to the operating and process control changes that were implemented as a result of the Comprehensive Plant Evaluation discussed in Chapter 1 of the MCP, the County proposes to implement several new strategies on or before the December 1996 deadline for startup of the Bristol pretreatment system:

1) Increase flow monitoring, sampling, and analysis efforts to include all sample locations and parameters necessary to develop a facility-wide mass balance for phosphorus and ammonia.

2) Increase activated sludge process monitoring to include parameters that impact ammonia removal performance (i.e., pH, alkalinity, dissolved oxygen, etc.).

3) Adjust operating logs to accommodate additional monitoring data required for ammonia removal and perform trend analysis of plant performance data.

4) Utilize results of the trend analysis to make appropriate adjustments in operating and process control strategies to maximize ammonia and phosphorus removal performance.

5) Develop operating and maintenance strategies to respond to anticipated changes in sludge settling and dewatering characteristics resulting from operation for ammonia removal.

6) Investigate the impact of phosphorus and ammonia loadings received at METRO from outside sources of County-hauled sludges and evaluate alternative disposal locations if impacts are significant.

b) **METRO Digital System Improvements.** Optimization of the METRO plant for ammonia removal will require additional process monitoring and the generation of additional operational data. The more readily available this information is, the better the plant staff will be able to make operating and process control decisions to produce the best effluent quality possible.

The existing METRO digital system is outdated and does not have capacity for expansion to monitor additional instrumentation. A new computer system is required to expand process monitoring and control capabilities. The County is in the initial stages of preparing a request for proposals to solicit and select a company to perform a turnkey operation associated with this project.

c) **Residuals Handling and Odor Control Improvements**. The County has retained O'Brien & Gere Engineers to provide professional engineering services in connection with the design, bidding, construction, and startup of residuals handling and odor control improvements. The scope of this project resulted from recommendations generated in the June 1992 report by Bowker & Associates, Inc., entitled "Survey of Odor Emissions and Evaluation of Sulfide and Odor Control Alternatives for the Metropolitan Syracuse WWTP" and the August 1994 follow-up report by Blasland, Bouck & Lee, Inc., entitled "Comprehensive Odor Control System for Metropolitan Syracuse Sewage Treatment Plant." Specific improvements are summarized as follows:

1) Modifications to grit collection and removal systems installed in both the "existing" and "new" screening and grit buildings.

2) Upgrading of the new screening and grit building for receiving and dewatering screenings generated at METRO as well as at other County wastewater treatment plants and pumping stations.

3) Construction of a new waste hauler receiving station designed to minimize odors.

4) Construction of a centralized odor treatment system to treat odorous air emissions generated at the primary clarifiers and the "existing" and "new" screening and grit buildings. Covers will be installed at the primary clarifier influent distribution structures, the primary clarifier effluent launders, and exposed wastewater channels in the "existing" and "new" screening and grit buildings. These areas will be ventilated to a fine mist scrubber system with sodium hypochlorite addition.

d) **Digester Modifications and Mechanical Sludge Thickening Improvements.** The intent of this project is to improve sludge stabilization and dewaterability as well as to provide flexibility in digester operation. The County has retained the services of O'Brien & Gere Engineers in connection with the preliminary design of modifications necessary to convert the existing secondary digester (Digester No. 4) to a primary digester. This work includes the installation of auxiliary equipment for heating and mixing of the digester.

In connection with this work, the County has requested that O'Brien & Gere evaluate the need for mechanical sludge thickening in anticipation of operation for ammonia removal. Operation for ammonia removal is expected to result in poorer sludge thickening characteristics, which may adversely impact gravity sludge thickening performance.

e) **Other Plant Improvements.** Onondaga County has retained the services of O'Brien & Gere Engineers in connection with the design, bidding, construction and startup of plant improvements necessary to correct design deficiencies, improve worker safety, and replace or repair deteriorated equipment. These plant improvements include the following:

1) The installation of perimeter handrails to the floating cover of Digester No. 4 and to the fixed covers of Digester Nos. 1 and 2. The installation of handrails is necessary to address worker safety concerns.

2) The replacement of three existing digester waste gas burners and the installation of a fourth waste gas burner. The new units will be equipped with automatic ignition systems for improved worker safety (existing units are ignited manually). An additional waste gas burner is necessary to handle increased digester gas production which has resulted from the improvements to digester mixing systems.

3) Upgrading of ventilation systems serving the digester control house to reduce excessive heat gain resulting from operating equipment.

4) Pipeline modifications to close off and abandon an unused section of tertiary force main which is of concern for potential rupture due to deterioration caused by hydrogen sulfide.

5) Remediation of groundwater infiltration into the main gallery, which is responsible for the deterioration of structural steel supports for gallery walkway grating and process piping. Structural steel supports will be replaced or repaired as necessary.

6) Replacement or repair of the existing screenings and grit building diversion gate and operator. The gate, which is presently inoperable, is used to isolate the existing screening and grit building for maintenance and operating flexibility.

7) Modifications to provide a means for isolating the tertiary pump station wet well for maintenance without requiring a complete bypass of secondary treatment facilities.

In addition to the improvements mentioned above, the County has requested that several modifications be incorporated into the project:

1) Modifications to the chlorination system to provide the ability to chlorinate the return activated sludge for control of filamentous microorganisms.

2) Addition of instrumentation to improve process monitoring and control.

3) Insulation and re-roofing of Primary Digesters Nos. 1 and 3.

4) Improvements to the cover structure for the influent diversion chamber.

5) Addition of fall protection for a ladder located on the roof of the digester control house.

6) Addition of variable frequency drive controls for the roof-mounted exhauster for the digester control house.

f) **Permanent Phosphorus Removal Facilities.** Phosphorus removal at METRO is presently accomplished by chemical precipitation using temporary chemical storage and feed equipment that was installed in the sludge recycle buildings in 1986 following the announced closure of the AlliedSignal Corporation. Replacement of these temporary facilities will be necessary for compliance with State bulk chemical storage regulations. These regulations require the installation of secondary containment systems for existing aboveground chemical storage tanks by December 22, 1999.

Permanent phosphorus removal facilities will provide flexibility for the use of alternate chemicals (ferric chloride, ferrous chloride, ferrous sulfate, and alum) and alternate chemical feed points (single or dual-point addition to primary settling, secondary treatment, or tertiary treatment facilities). This flexibility will provide the plant staff with the opportunity to minimize operating costs by using the most economical combination of chemicals and feedpoints that produce the desired environmental objective.

B3. **Hypolimnetic Oxygenation for Onondaga Lake.** Onondaga County proposes to undertake a demonstration project to assess the technical feasibility and determine the costs and environmental impacts associated with oxygenation of the hypolimnion of Onondaga Lake. Hypolimnetic oxygenation was suggested by USEPA as a means of attaining compliance with ambient water quality standards for dissolved oxygen in Onondaga Lake based upon the results of an evaluation performed by the U.S. Army Corps of Engineers (USACOE). The results of this evaluation suggested that hypolimnetic oxygenation could be accomplished by pure oxygen injection via a deep water diffuser system at relatively low cost. First-year project costs inclusive of capital, as well as annual operating and maintenance costs, were estimated by the USACOE at approximately $1.4 million. Subsequent annual operating and maintenance costs were estimated at $800,000 per year.

Review of the conceptual design and preliminary cost estimates developed by the U.S. Army Corps of Engineers for an in-lake oxygenation system has identified several concerns about the technical feasibility, costs, and potential environmental impacts of this alternative that require further investigation. These concerns will serve as the basis for the demonstration project, which will be performed by Onondaga County with monetary assistance and oversight by USEPA.

The results of the demonstration project will be used to determine full-scale design requirements. Onondaga County's participation in a full-scale hypolimnetic oxygenation system will be limited to the relative contribution of the METRO discharge to dissolved oxygen depletion in the hypolimnion. The results of the UFI water quality models approved by NYSDEC indicate that the County's responsibility for hypolimnetic oxygenation is relatively limited. Water quality model projections indicate that only slight improvement in dissolved oxygen concentrations can be expected, even with complete diversion of the METRO discharge.

B4. **Intermediate Phase Actions.** The goals and objectives of intermediate phase improvements proposed by Onondaga County for METRO address the issues of wastewater treatment capacity, ammonia removal and effluent dechlorination.

a) **Acquisition of Niagara Mohawk Property**. Onondaga County will pursue the acquisition of property (which the METRO plant site presently surrounds) presently owned by the Niagara Mohawk Power Corporation. Acquisition of this property will be necessary to provide space for the construction of additional process tankage necessary to upgrade the METRO plant.

b) **Relocation/Consolidation of Sewer Maintenance Group.** A portion of the sewer maintenance group presently operates out of the sewer maintenance building located on the METRO plant site. Relocation of this group to the Ley Creek pump station site, where the remainder of the Sewer Maintenance Group is located, will make additional land available for the construction of process tankage necessary for upgrading of the METRO plant.

To provide a central, consolidated headquarters for the Flow Control Division, the County proposes to renovate the former Ley Creek sewage treatment plant site in two phases. The first phase will involve demolition of process tankage and structures located at the site, except for the main building, which will be renovated for occupation by the Flow Control Division staff, and the new pump station complex. The process tankage and structures to be demolished have been out of service since 1980 and are in a state of disrepair and decay. The primary and secondary tanks, digester complex, pump houses, grit buildings, and galleries are crumbling, extensively weather-damaged, inoperable, and unsafe. With the exceptions of the main building and the new pump station complex, the site is unsecured, unsafe, unsightly, and infested with vermin.

The second phase of the project involves renovation of the fire protection system for the site with loop supply piping and an adequate number of hydrants. Fire protection for the existing site is inadequate because only one working hydrant presently exists. There are nine other non-working hydrants located near the components of the old treatment plant and no hydrants near the new pump station complex.

c) **One-Quarter Plant Upgrade/Ammonia Removal Demonstration.** The existing METRO sewage treatment plant was designed with four activated sludge treatment systems which are operated in parallel. Each system consists of two aeration tanks and one secondary clarifier and may be operated either as a conventional complete mix activated sludge system or as a contact stabilization activated sludge system. These facilities were designed based on an average daily sewage flow of 80 mgd. Peak sewage flows to the aeration tanks is restricted to 120 mgd by an overflow structure that is activated under wet weather conditions.

The County proposes to construct additions and modifications to one quarter of METRO which will provide for a side-by-side demonstration of the performance capabilities and process reliability for ammonia removal using conventional and advanced wastewater treatment technologies. Information obtained from the side-by-side demonstration will be used to select the appropriate technology and determine final design criteria for subsequent use in full-scale plant upgrading. The scope of the one-quarter plant upgrading includes the following:

1) The construction of one new 140-foot diameter secondary clarifier with associated sludge and scum removal equipment.

2) Structural modifications to two aeration tanks to convert from complete mix to plug flow with provisions for step feed capability.

3) The replacement of mechanical surface aerators with fine bubble diffused aeration equipment in all eight aeration tanks.

4) The installation of Ringlace fixed-film media in one of the two modified aeration tanks.

Following construction of the one-quarter plant upgrade described above, the facilities will be operated for a period of 36 months during which performance monitoring and testing will be performed. Testing will examine the impacts of wet weather conditions on nitrification performance in activated sludge treatment systems with and without fixed-film media. The 3 years of testing will result in 24 months of monitoring data, which will be used to determine appropriate modification of the SPDES discharge permit limit for ammonia.

The results of the performance testing will be used to determine the ammonia removal capabilities of conventional activated sludge treatment, as well as the extent of fixed-film media needed to enhance ammonia removal for consistent compliance with the proposed SPDES permit effluent ammonia limits of 4 mg/l (as NH_3) for November through May and 2 mg/l (as NH_3) for June through October. Based upon the information obtained from the one-quarter plant demonstration, final design criteria will be determined for subsequent full-scale upgrade of the METRO plant.

d) **Full-Scale Plant Upgrade.** At present, it is expected that full-scale upgrading of the METRO plant for ammonia removal will require the use of fixed-film media to enhance nitrification in the existing aeration tanks. Depending on the success of the one-quarter plant demonstration, the scope of the full-scale upgrade is expected to include the following:

1) The construction of four new 140-diameter circular secondary clarifiers with associated sludge and scum collection and removal equipment. As discussed previously, one of the units will be constructed as part of the one-quarter plant upgrade.

2) Structural modifications to the existing aeration tanks to convert from complete mix to plug flow with provisions for step feed.

3) The installation of fixed-film media and associated equipment in the existing aeration tanks.

4) The construction of additional process tankage and modification of existing tankage for chlorination and dechlorination.

Figure 1-4 provides a preliminary site plan for METRO identifying the proposed additions and modifications.

C. CSO Abatement (Interim, Intermediate, and Conceptual Long-Term Alternatives)

The TMDL strategy provides a basis for the development of a phased approach to achieving the objectives of CSO abatement: substantial compliance with the New York State CSO Control Strategy (Appendix C-6) and the National CSO Control Policy (Appendix C-7). These objectives include the abatement of floatables, settleable solids and bacteria. Floatables and settleable solids are an aesthetic concern whereas bacteria is a public-health concern. Settleable solids represent a potential sediment oxygen demand as well. Bacteria is a public health concern. This phased approach to CSO abatement achieves aesthetic improvement, settleable solids removal, and protection of the public health in the lake waters and aesthetic improvement to the creeks. Additionally, consideration has been given to the impacts of CSO abatement on the dissolved oxygen in the creeks and lake.

CSO discharges to Onondaga Lake and its tributaries will be abated through the construction of regional treatment facilities (RTFs), which include disinfection and floatables control facilities (FCFs). These facilities will be constructed in phases: interim and intermediate. At the completion of the interim and intermediate phases, the results of the effectiveness evaluation program will be used to assess any remaining impact of CSO discharges on lake water quality. The CSO projects reflect the need for some flexibility in the actual construction of the individual phases. This is required in part by the County's policy of coordinating County and industrial projects, and more importantly, by the need to seek and secure as-yet-uncertain state and federal aid. The actual construction schedule may be adjusted according to the extent to which remedial activities related to the NPL remove barriers to use attainment and the availability of outside aid.

The relative locations of the interim and intermediate projects with respect to the combined service area are illustrated on Figure 1-5. The corresponding service areas are shown on Figure 1-6. Projects included within these phases are briefly discussed below. A more detailed discussion of these projects can be found in Chapters 4 and 5 of the Municipal Compliance Plan.

C1. **Interim Phase.** The intent of the interim phase is to substantially entrap and remove floatables that would otherwise enter the lake. Projects proposed during this phase are intended to demonstrate new technologies (EquiFlow™ and disinfection) and operational and performance aspects of conventional technologies (Vortex™). The results will provide input to design considerations for facilities constructed during the intermediate phase.

a) **Hiawatha RTF Demonstration Project.** This will be a full-scale facility constructed to demonstrate vortex technology and storage of CSO discharges. The effectiveness of sodium hypochlorite as a high-rate disinfectant for CSOs will also be demonstrated. The pipelines serving this facility have already been designed, and the RTF has undergone preliminary design. The layout of the treatment facility has been included as Figure 1-7. This project will address the discharges from CSOs 074 and 075 in Ley Creek.

b) **Newell Street RTF.** The location of the Newell Street facility is shown on Figure 1-8. The existing Newell Street swirl concentrator will be reactivated with new pumps and controls. This project will provide treatment for CSO 067, which is the southernmost CSO discharge point. The importance of this interim project is linked to the chlorine dioxide and ultraviolet disinfection evaluation funded, in part, by New York

State Energy Research and Development Authority. The results of this evaluation will be applied to the other RTFs.

c) **Harbor Brook EquiFlow™ and Wetlands Demonstration.** The EquiFlow™ facility will be constructed at the mouth of Harbor Brook. This in-water facility will provide capture and temporary storage of CSO and urban stormwater from the Harbor Brook Basin for subsequent pump-back to METRO. The feasibility and effectiveness of wetlands treatment of stored flow will be demonstrated at this site via a USEPA-approved Environmental Technology Initiative (ETI) grant. A general layout of the Harbor Brook EquiFlow™ facility has been included as Figure 1-9. CSOs to be controlled by this project include: 003, 004, 005, 006, 006A, 007, 008, 009, 010, 011, 013, 014, 015, 016, 017, 018, 063A and B, 078, and 079 in Harbor Brook.

d) **EBSS Storage Upgrade.** The Erie Boulevard Storm Sewer (EBSS) storage system was designed and constructed as a Best Management Practice (BMP) implemented by Onondaga County in the 1980s. Persistent operation and control malfunctions plagued this facility and it was never made fully operational. An interim phase improvement to redesign and reconstruct the storage system will allow its use as a 5 mg CSO storage vessel. This improvement includes construction of aboveground control vaults for the hydraulic systems that operate as segmentation sluice gates and the design and installation of a state-of-the-art remote SCADA program to supervise its use. A plan and profile of this facility has been included as Figure 1-10. Redesign of this facility also includes installation of an inflatable dam on the Burnet Avenue trunk sewer to allow diversion of flows from this trunk via the James Street relief sewer. The principal overflows to be abated through this project are 080, including flow from Overflows 080A through 080I and a component of 021.

e) **Kirkpatrick Street Pump Station Upgrade.** The Kirkpatrick Street Pump Station is the only large pump station in the combined sewer system. Proposed improvements call for the redirection of the force main from this facility separately to METRO, and selected electrical and mechanical upgrades within the facility. This project will significantly reduce the frequency and volume of discharge from the Hiawatha Boulevard area and addresses CSOs 074 and 075 in conjunction with the Hiawatha RTF. Discharges from CSO will be limited to only events larger than a one-year storm.

f) **Floatables Control.** The federal CSO Control Policy established an implementation target of January 1, 1997 for control of floatables and solid materials in CSO discharges. Control of floatables discharges to Onondaga Lake will be achieved via the following efforts:

Onondaga Creek	Construction of a boom across the creek immediately south of the Inner Harbor (action by the City of Syracuse). Figure 1-11 illustrates the principal features of this facility.
Harbor Brook	Construction of a netting device for Harbor Brook will be located in the downstream reach of the brook between Hiawatha Boulevard and the outlet to Onondaga Lake. The basic components of a typical netting device are illustrated on Figure 1-12.
Ley Creek	Construction of the Hiawatha RTF and a netting device at the outfall of CSO 073 at Teall Avenue near Grant Boulevard.

g) **Non-Point Source Identification.** The identification of non-point source loadings can be accomplished through a watershed approach involving three components: (1) development of a geospatial database; (2) construction of a mathematical model capable of predicting pollution loads from all areas of the watershed; and (3) implementation of a comprehensive monitoring program of at least two full years to validate the watershed model and to measure the effectiveness of any abatement schemes.

The estimation of pollutant loads from the watershed would make use of all three sources of information. The calculation of long-term loads and event-specific pollutographs will be possible for a variety of important pollutant loads, including suspended solids, phosphorus, and nitrogen. Future land use scenarios and population growth trends may then be considered.

C2. **Intermediate Phase.**

a) **Midland RTF.** This is the single largest RTF to be constructed as part of the Onondaga County CSO Abatement Program. It will be comprised of a CSO interceptor sewer network and high rate treatment facilities. The CSO interceptor pipelines will provide regional treatment of the following CSOs: 039, 040, 042, 043, 044, 053, 060, 062, 076 and 077. A site plan for the facility has been included as Figure 1-13. Solids separation will be provided via vortex treatment, and disinfection will be provided via a method selected from the interim phase disinfection evaluations. The vortex underflow will be returned to the Main Interceptor Sewer (MIS) for treatment at METRO, as will any flow retained by the CSO interceptor sewers and high-rate treatment facilities.

b) **Clinton RTF.** The RTF for this area will be similar to that provided in the Midland Service Area; however, construction of the pipeline and treatment facilities will be completed sequentially in two separate phases, as illustrated in Figure 1-14. The first phase will include the construction of the CSO interceptor pipelines, pumping station wet well, and outfall pipeline. A floatables entrapment device will be installed in the pump well to allow regionalized floatables control prior to construction of the remainder of the RTF. The pump well will be connected to the existing MIS and will be controlled via a sluice gate. This will allow the capture, storage, and reintroduction of some fraction of CSO discharge back to the interceptor sewer, thus maximizing flow to the POTW and the use of the collection system for storage (pursuant to the NYSDEC CSO Control Strategy). A layout of the Clinton RTF site is included as Figure 1-15. CSO discharges that will be intercepted by this facility include 027, 028, 030, 031, 032, 033, 034, 035, and 036.

c) **Franklin FCF.** The Franklin FCF will serve to remove floatables emanating from CSO discharges of the Butternut Street and Burnet Avenue trunk sewers (CSOs 020 and 021). A site plan for this facility is included as Figure 1-16.

d) **Maltbie FCF.** The Maltbie RTF site plan has been included as Figure 1-17. This facility will be constructed using the infrastructure of a USEPA demonstration project in the early 1970s. A floatables netting device will be installed to entrap floatables. A

CSO interceptor pipeline to consolidate CSOs 065 and 066 was constructed as part of an emergency repair in 1994.

e) **Sewer Separation.** Some CSO basins within the Onondaga Creek corridor will be separated into sanitary and storm sewer collection systems as part of the intermediate phase improvement. These basins are generally small and remote from the CSO interceptor pipelines to be constructed as part of the RTFs or FCFs. Areas scheduled for separation have been illustrated in Figure 1-18 of this document.

C3. **Conceptual Long-Term Phase.** The programs implemented within the interim and intermediate phases are intended to achieve compliance with existing water quality objectives and meet requirements of the consent order. Onondaga County will evaluate the effectiveness of the elements of this MCP in bringing the CSOs into compliance with the state and federal CSO policies, including the impact of financing completed projects on user fees and the overall financial and economic health of the community. Following completion of the intermediate phase, the County will continue on a conceptual long-term process to evaluate the need for additional measures. Ambient water quality, progress towards use attainment, and changes in regulations and policies will be evaluated in a context that is consistent with the TMDL process. If additional controls or treatment are required, a program will be structured to address identified needs.

D. Water Quality Assessment Program

A key component of the phased TMDL strategy is monitoring of the receiving water to assess compliance with ambient water quality standards and progress towards attainment of designated uses. The County has conducted a monitoring program of Onondaga Lake and its tributaries each year since completion of a baseline survey in 1970. Changes in the scope and organization of the County's annual monitoring program are proposed to reflect the needs of the phased TMDL strategy. This section of the DEIS summarizes the objectives of the annual monitoring program proposed for the duration of implementation of the MCP. Management and technical strategies to implement the objectives are presented, along with summary tables of the rationale for program design. Tables detailing the proposed program (specific sites, monitoring frequencies, chemical and biological parameters to be monitored, analytical procedures and limits of detection) are included as Appendix C-4 to the MCP and DEIS documents.

The focus of the long-term monitoring program is twofold: (1) measurement of compliance with ambient water quality standards in the lake and tributaries (Table 1-1): and (2) assessment of progress toward resolution of the habitat and contamination issues affecting restoration of the biotic community (Tables 1-2 and 1-3). The proposed monitoring program includes physical and habitat issues, chemical water quality, and biological parameters. The USEPA notes that measuring environmental progress is a "critical need and has become a key element of the Agency's strategic planning process" (USEPA, April 1991 "Guidance for Water Quality-based Decisions: The TMDL Process" 440/4-91-001, pg. 3). The effectiveness of METRO and CSO improvements and the need for additional controls beyond the interim and intermediate projects will be assessed through the long-term monitoring of "ecological integrity," as depicted in Figure 1-19.

D1. Strategy to Implement Tributary, Lake and River Monitoring Programs

a) Structure monitoring programs to collect data at the temporal and spatial scale required to assess compliance.

b) Expand long-term monitoring programs to include elements of ecological integrity (biomonitoring and habitat issues).

c) Incorporate sufficient flexibility so that monitoring and assessment of additional chemicals or potential sources can be conducted as needed.

d) Define monitoring as an internal priority at Department of Drainage and Sanitation; dedicate sufficient resources to enable necessary flexibility, responsiveness, and reporting requirements.

e) Increase participation of independent technical experts, such as the Lake Advisory group, in the design and implementation of the monitoring program and the interpretation of results.

f) Utilize quality assurance/quality control procedures in the field and laboratory programs. Draw on guidance developed by NYSDEC and USEPA for use in documenting quality of data collected under state and federal hazardous waste programs.

g) Share findings with regulatory agencies on a regular (quarterly) basis.

D2. **Objectives of the Tributary Monitoring Program.**

a) Quantify external loading of phosphorus, nitrogen, suspended solids, indicator bacteria, heavy metals, and salts. Utilize the software program FLUX to quantify external loads, calculate standard error of loading estimates, and continually refine the allocation of sampling resources to best estimate loads. Shift monitoring from a scheduled to an event-based program as needed to minimize standard error of external load calculations.

b) Collect storm event data both upstream and downstream of the CSO tributary area to Onondaga Creek and Harbor Brook.

c) Gather data on an adequate temporal and spatial scale to assess compliance with ambient water quality standards.

d) Assess biological habitat in tributaries and measure improvements in response to CSO remedial measures. Measure and map sludge deposits in tributaries downstream of CSOs. Use the rapid field biotic index to assess changes to tributary macroinvertebrates.

e) Continue cooperative arrangements with USGS to gauge flows in major lake tributaries. Work with USGS and Crucible Specialty Metals to improve flow estimates (and therefore loading estimates) of Tributary 5A.

D3. **Objectives of the Onondaga Lake Monitoring Program.**

a) Gather data on an adequate temporal and spatial scale to assess compliance with ambient water quality standards, including bacteria concentrations in near-shore areas following storm events.

b) Assess the trophic status of the lake.

c) Evaluate trends in lake water quality over time and in response to remedial actions.

d) Complement the chemical monitoring program with biomonitoring to assess the densities and species composition of phytoplankton, zooplankton, macrophytes, macrobenthos, and fish.

e) Evaluate success of fish propagation (quantitative lakewide nest surveys, recruitment estimates, and juvenile community structure) in the lake on an annual basis.

f) Establish data sharing protocols with the NYSDOH to enable the County to track contaminant burden in fish flesh.

g) Assess biological habitat in the lake and monitor improvements in response to remedial measures.

h) Incorporate additional monitoring to test temporal and spatial variability in water quality. Estimate input loads from each tributary.

D4. **Objectives of the Seneca River Monitoring Program.**

a) Evaluate current water quality of the Seneca River and compliance with ambient water quality standards upstream and downstream of the Onondaga Lake outlet.

b) Evaluate the assimilative capacity of the Seneca River and quantify effects of the zebra mussels.

c) Concentrate river monitoring during critical conditions of warm weather and low stream flows.

d) Design monitoring to test temporal and spatial variability (for example, diurnal variations in river water quality, presence, and extent of chemical stratification).

1.1.2 Goals and Objectives of the Proposed Action

A. Continued Water Quality Improvement of Lake and Tributaries

The County's MCP has been developed in response to the need for improvements to ambient water quality in Onondaga Lake, Onondaga Lake tributaries, and the Seneca River. Existing water quality violates state standards for a number of parameters directly linked to discharges from METRO and the CSOs. The MCP focuses on bringing water quality into substantial compliance with applicable water quality standards. Consequently, a major objective of the MCP is water quality improvement.

Exceedances of ammonia and nitrite concentrations in Onondaga Lake's upper and lower waters will be addressed by provision of year-round nitrification at METRO. Currently, METRO supplies more than 90 percent of the external loading of ammonia and nitrite-nitrogen to the lake; significant reductions in loading associated with year-around nitrification will result in greatly diminished in-lake concentrations. Progress towards compliance in meeting the state ambient water quality standards will be monitored as part of the chemical component of the County's annual lake monitoring program. Impacts of ammonia and nitrite reductions on the lake's biota (especially zooplankton and fish) will be monitored as part of the biological component of the County's annual lake monitoring program.

The hypolimnetic oxygenation proposed to treat the symptoms of eutrophication is likely to alter the current processes and rates of nitrogen cycling in Onondaga Lake. The quality of the lake's outflow to the Seneca River is likely to change as well. Data gathered during the large-scale pilot study will be used to refine engineering and scientific estimates of potential changes in nitrogen dynamics. Impacts on the lake and Seneca River can be evaluated with greater certainty once the feasibility and benefits of hypolimnetic oxygenation are tested. Under the TMDL process, the state and County will continue to evaluate appropriate effluent limits for METRO as the MCP elements are implemented and receiving water quality is monitored.

The existing hypolimnetic anoxia and lake-wide violations of DO throughout the water column during fall mixing will be addressed by hypolimnetic oxygenation, which injects oxygen into the lake's lower waters. This alternative was introduced by the Army Corps of Engineers and has recently been endorsed by USEPA.

The goal of hypolimnetic oxygenation would be to maintain aerobic conditions in the lake's lower waters throughout summer stratification. Anoxic conditions would exist in the lower waters even in the absence of METRO loading. If it is possible to keep the lower waters aerobic, accumulation of reduced species, such as hydrogen sulfide and methane, and the associated lake-wide DO sag at fall mixing would be avoided. Habitat for aerobic organisms such as zooplankton and fish would presumably be expanded with provision of oxygen. Additional testing is required to demonstrate impacts on metals cycling, phosphorus release from the sediments, and in-lake nitrogen cycling. The potential impacts on mercury cycling will be of significance as well. The participation of other involved parties in assessing mercury impacts will be required.

CSO remedial alternatives are designed to address the violations of bacteria and floatables in the tributaries and lake. The intent of the intermediate phase is to eliminate the entry of floatables to the lake through Onondaga Creek and Harbor Brook, and reduce the in-lake concentration of bacteria. Floatables will be collected in Onondaga Creek starting with the largest regional site, each regional site representing a consolidation of existing CSO discharges, and progressing to the smaller regional sites. The regional sites will include floatables abatement progressing from the furthest upstream location to downstream locations. Settleable solids removal, coupled with disinfection, will be implemented generally in the same order, once floatables abatement is achieved. One exception is Midland Avenue, where floatables, settleable solids, and bacteria will be controlled in a single action. Midland will be the first and largest facility constructed during the intermediate phase. As a result, Onondaga Creek will realize early measurable improvement, as shown in Figure 1-20. Similarly, Onondaga Lake will experience step-wise improvements until substantial compliance with requirements is achieved at the end of the intermediate phase.

B. Protection of the Seneca River Water Quality and Assimilative Capacity for Economic Development

Diversion of some or all of the METRO effluent to the Seneca River has long been considered as a management alternative for improving Onondaga Lake's water quality. However, the large population of zebra mussels in the segment downstream of the outlet of Cross Lake at Jack's Reef has adversely affected the assimilative capacity of the river, and thus its viability as an alternative receiving water for METRO effluent. Seneca River water quality upstream of the Onondaga Lake outlet currently violates New York State ambient water quality standards for DO as a direct result of the zebra mussels. Diversion of METRO effluent to the river does not appear to be a cost-effective or environmentally viable option under these conditions. The plan to continue discharging to Onondaga Lake, with hypolimnetic oxygenation, will affect the Seneca River in two ways. First, water quality of the river will improve with the significant reduction in ammonia N achieved by year-round nitrification at METRO. Assimilative capacity of the river will be increased with this reduction in ammonia N input, which may ultimately benefit downstream industrial and municipal users. Second, the plan avoids the significant reduction in river assimilative capacity that would have resulted from relocation of the METRO effluent.

C. Cost/Environmental Benefit Analysis

The County's proposed MCP for improvements to METRO and the CSOs is based on the federal TMDL strategy and the Onondaga County Legislature policy, where actions are implemented and water quality response is evaluated. Under this approach, environmental benefits and cost effectiveness of actions are readily apparent. The effectiveness of actions in achieving compliance with water quality goals is continually evaluated through the County's environmental monitoring program. As impediments to achieving designated uses are removed, the need for any additional controls becomes clear.

METRO improvements are designed to take immediate advantage of influent load reductions anticipated with startup of pretreatment at Bristol-Myers Squibb. Operations will be engineered to achieve seasonal nitrification at METRO. Full-scale testing of one quarter of the plant will be implemented to assess technologies for nitrification using the existing plant site.

Oxygenation of the lake's lower waters may be a cost-effective means of addressing the low dissolved oxygen impairment to attainment of water quality goals. Pilot testing is proposed to determine design parameters and evaluate the impact on nutrient and metals cycling.

A consideration in the development of the proposed action is that regional CSO facilities be constructed in a manner that places the projects with the highest benefit-to-cost ratio earlier in the schedule. The principal water quality violations related to CSOs are floatables and bacteria; consequently, projects are sequenced based on their efficacy in remediating these parameters. A cost-benefit comparison of the volumetric discharge reduction associated with the Midland and Clinton RTF is included as well.

The ranking and scheduling of potential projects will be limited to the list of projects within the intermediate project listing. Projects within the interim phase are specifically not included since they either serve as demonstration projects, have high benefit to cost ratios, or are BMP-related projects undertaken to achieve early compliance with the state and federal policies.

C1. **CSO Volume Reduction.** The RTFs and CSO interceptor pipelines will provide significant storage potential that will optimize flow to the POTW and will reduce the volume of CSO discharged to the receiving waters. SWMM projections have been made for this impact for the Midland and Clinton RTFs and are included in Table 1-4, along with associated facility costs and calculated "unit costs." The cost information presented represents the total project cost for both the CSO interceptor sewer and the high rate treatment facilities. Lower unit costs imply more cost-effective projects (higher benefit-to-cost ratio).

Table 1-4 illustrates that Midland has the highest benefit-to-cost ratio of the two RTFs to be constructed in the intermediate phase, based on CSO volume reduction.

C2. **Floatable Control.** Inasmuch as floatables have not been specifically measured within any Onondaga County CSO sampling program, flow will be used as a surrogate parameter to evaluate the relative importance of the different intermediate projects with respect to each other. It should be noted that the flow represents treated flow and is not the same as the noted volume reductions that were discussed in the previous subsection. Table 1-5 develops the fundamental "unit cost" information from which the different RTFs can be compared. The table indicates that there is relatively little difference between the intermediate projects with respect to cost effectiveness of floatables control since the "unit cost" only varies between 0.213 and 0.276. Consequently, factors other than floatables will dictate the logical sequence of intermediate facility construction.

C3. **Bacteria.** Average bacteria concentrations have been calculated for all of the intermediate facilities and an annual "load" has been calculated for bacteria. As with floatables, the cost of each facility has been divided by the corresponding load to determine a "unit cost" (Table 1-6).

Although Clinton RTF has the higher benefit-to-cost ratio of the two intermediate phase RTFs based on the consideration of bacteria reduction, the Midland RTF area contributes approximately 46 percent of the total bacterial load in the creek, while Clinton contributes 37 percent. The remaining 17 percent of the bacteria load is associated with discharges from the EBSS system, Franklin FCF, and the Maltbie FCF, all of which discharge to the section of the Creek classified as "C". Bacteria modeling has shown that substantial compliance with bacteria standards in the lake can be achieved with the disinfection of CSO discharges from the Midland and Clinton service areas.

C4. **Cost/Environmental Benefit Summary.** Table 1-7 summarizes the priority ranking of the different intermediate projects on the basis of CSO volume reduction, floatables control, and bacteria control.

D. Affordable Phasing

One of the primary goals of the proposed action is to implement the MCP without severe adverse economic effects to the community. Project costs of the magnitude contained in the MCP require prudent phasing in order to minimize the negative effects of unit charge increases. User fees that are high and/or increase rapidly must be avoided because they place the community in jeopardy of losing jobs, population, and tax revenues. Phasing allows the increase in user fees to be more affordable to the rate payer. Beyond the economic effects, MCP project costs of this magnitude threaten to crowd out other practical borrowing limits and must forego additional borrowing. Prudent phasing is also required to preserve the County's credit quality [currently, a double A (Aa) rating]. As can be deduced from the proposed schedules of project implementation in the MCP, the County believes that the various project improvements should reasonably span 25 years. This implementation schedule is, in turn, built upon what the County believes are reasonable expectations of federal and state funding, and to a lesser extent, other variables, principally "real world" water quality conditions as compared to model predictions and projected use attainability goals. (For a more detailed explanation of affordable phasing, see Appendix E.)

E. Continued Assessment of Effectiveness of Actions and Need for Additional Reductions in TMDL Based on Response of Receiving Water(s)

As discussed above, the TMDL strategy for phased implementation of load reductions includes receiving water monitoring. The County's long-term monitoring program will be specifically tailored to assess the effectiveness of remedial actions planned for METRO and the CSOs to achieve compliance with water quality standards and remove impediments to best use. At the end of the interim and intermediate phases of remediation, the need for additional action will be evaluated. Criteria guiding the decision to make additional improvements to the County's wastewater collection and treatment infrastructure include the following:

1. Status of compliance with ambient water quality standards associated with designated use of the lake and its tributaries.

2. Progress towards resolution of the NPL issues of lake sediment contamination.

3. Assessment of the sources of pollution, including an improved estimate of the relative magnitude of non-point source phosphorus loads.

4. Assessment of the "ecological integrity" of the lake and its tributaries, including physical habitat, numbers and diversity of fish, zooplankton, benthic macroinvertebrates and phytoplankton, and water quality.

5. Advances in treatment technology.

6. Affordability and cost/benefit of additional controls.

7. Legal and regulatory requirements.

8. Assimilative capacity of alternative receiving waters (e.g., status of zebra mussel impacts on the Seneca River).

1.1.3 Public Need for the Project

A. SPDES Permit Violations for Capacity and Effluent Limits

As presented in Chapter 1 of the MCP, occasional exceedances of METRO's permitted flow capacity and SPDES limits have occurred over the six-year period that began on January 31, 1989 with signing of a consent agreement between the County, NYSDEC, and ASLF. Monthly average sewage flows have exceeded the maximum 30-day average flow limit of 80 mgd 15 times (21 percent). Re-rating the flow capacity as defined in the SPDES permit to a 12-month rolling average will be necessary to reflect actual design flows.

Monthly average BOD concentrations in the METRO effluent have ranged from 12.1 mg/l to 25.4 mg/l over the six-year period. Exceedances of the current interim limit of 21 mg/l have been reported 8 of the 72 months (11 percent). Monthly average effluent BOD concentrations have been in full compliance with the federally defined minimum level of secondary treatment for municipal sewage (30 mg/l).

Suspended solids concentrations in METRO effluent have ranged from 5.1 mg/l to 16.3 mg/l over the six-year period. No exceedances of the 30 mg/l permit limit have been recorded.

The monthly average METRO effluent phosphorus concentration has ranged from 0.16 mg/l to 1.31 mg/l over this time period. Seven months (10 percent) averaged higher than the permit limit of 1 mg/l. All of these exceedances were recorded in 1987 and 1988. No violations of the effluent phosphorus limit have occurred since completion of the full-scale phosphorus testing program in March 1991. Other minor SPDES permit violations are described in Chapter 1 of the MCP.

B. Requirements of the Consent Order

In January 1989, Onondaga County executed a consent order settlement with the NYSDEC which obligated the County to make improvements at the Ley Creek and Liverpool pump stations, to undertake a full-scale phosphorus removal testing program at METRO, to conduct a series of studies to determine a list of management alternatives for METRO and CSOs that would alleviate the impact on Onondaga Lake, and to undertake a program for abating extraneous flow into METRO via improper connections to the sanitary sewer system. These programs have been completed. and a brief summary of the results is presented in Appendix C-1.

C. Goals of the Clean Water Act

Passage of the Federal Water Pollution Control Act Amendments of 1972 (the Clean Water Act) established minimum treatment requirements for wastewater discharges. Also, the 1972 Amendments were notable in that for the first time the significance of CSO pollution was acknowledged on a national scale. An important provision of the Clean Water Act, as further amended in 1987, was the establishment of a national goal that all navigable waters should be suitable for recreation in and on the water, and survival and propagation of fish, shellfish and wildlife (commonly stated as fishable and swimmable).

Consistent with the provisions of the Clean Water Act, the NYSDEC issues permits to significant dischargers of wastes to lakes and streams, and in that role determines how much waste can be discharged to receiving waters. As an intermediate step, New York and the other states adopted ambient water quality standards. Standards are numerical, enforceable concentrations of contaminants designed to protect a water body's best use.

D. Role of the Onondaga Lake Management Conference

The local community has recognized "pollution" in Onondaga Lake as a problem since the early 1900s. Over the years, the poor condition of the lake and the hope that something could be done about it led to the establishment of a number of local, state and federal groups and/or organizations to promote change. More prominent among these are The Friends of Historic Onondaga Lake, the State Onondaga Lake Advisory Committee, and the OLMC.

The State Onondaga Lake Advisory Committee was created in November 1986. It has played a major educational role, sponsoring such activities as a public education curriculum describing the history and water quality of Onondaga Lake, the idea of an annual "Onondaga Lake Extravaganza," a speakers' bureau, and an educational video presentation. The challenge "Salmon 2000" can also be credited to the Advisory Committee. Salmon 2000 represents a vision for the lake which restores water quality characteristics suitable for the reintroduction of the Atlantic Salmon which once inhabited the lake.

The most recent, and perhaps most notable among the lake restoration organizations is the Onondaga Lake Management Conference, which was created by an act of Congress in 1990 (Public Law 101-596, Section 401). With the hope of the local community that the Lake Management Conference would be able to develop and pursue a lake restoration effort beyond the means of this community to pursue alone, Congress charged the Conference with the responsibility for:

> "... the development, in the two-year period beginning on the date of the enactment of this Act, of a comprehensive restoration, conservation and management plan for Onondaga Lake that recommends priority corrective actions and compliance schedules for the cleanup of such Lake ..."

The Lake Management Conference is comprised of six voting members, including: (1) the Onondaga County Executive; (2) the Mayor of the City of Syracuse; (3) the Governor of the State of New York; (4) the Administrator of the Environmental Protection Agency; (5) the Assistant Secretary of the Army for Civil Works (Army Corps of Engineers); and (6) the New York State Attorney General. Ex-Officio members of the Lake Management Conference include Senator Daniel Patrick Moynihan, Senator Alfonse D'Amato, and Representative James T. Walsh.

During the past several years, a number of key studies have been funded by the OLMC. These have provided important insights on a range of relevant issues, including mud boils, non-point sources of pollution, habitat for fish and wildlife, oxygenation of the lower waters of the lake, the impact of zebra mussels on the Seneca River, and organic contaminants in the lake sediments and water column. Additional study proposals before the OLMC include the hydrodynamic relationship between the lake and river, an expanded study of organic contaminants in the lake (which may be toxic to zooplankton), and alternative means to manage zebra mussels in the Seneca River system.

On May 27, 1993 the Management Conference released a draft plan for Onondaga Lake for public review and comment. The draft plan for Onondaga Lake, which was not a consensus document, recommends an out-of-lake discharge for the METRO effluent. The plan also recommends a pilot regional collection and storage project for CSO remediation, and that the remediation of mercury and other Allied-related toxic pollutants "be pursued as a priority." At the time of this writing, no final Conference Plan has been voted on or approved by all of the members.

Despite the County's serious reservations with fundamental recommendations contained in the draft Lake Management Plan, the County continues to support and participate on the Onondaga Lake Management Conference with the firm conviction that: (1) its members must be partners in whatever approach is taken to restore the lake; (2) the federal legislation creating the Management Conference provides a useful vehicle through which federal financial support for various lake restoration initiatives can be conveyed; and (3) additional important studies can be funded and carried out under the OLMC framework.

1.1.4 Benefits of the Proposed Action

A. Environmental

The objective of the planned improvements to Onondaga County's wastewater collection and treatment infrastructure is to bring the discharges into compliance with applicable state and federal requirements. Onondaga Lake, its tributaries, and the Seneca River will realize water quality enhancement from implementation of the proposed actions. As such, the MCP is an environmentally beneficial program. In this section, a brief summary of water quality issues and projected improvements is presented.

A1. **Municipal Wastewater Issues: Impact on Water Contact Recreation.**

a) **Bacteria**. Under existing conditions, bacteria concentrations in the lake and its tributaries exceed public health standards during or following wet weather events. The concentrations of bacteria in the lake and its tributaries represent an impairment of the resource for water contact recreation.

The sewers in many older cities like Syracuse were designed to convey both stormwater and sanitary sewage to a central treatment facility. During wet weather and snowmelt conditions, the hydraulic capacity of the interceptor sewer network is exceeded, and a mixture of stormwater and untreated sewage is discharged at overflow points. Bacteria contamination of Onondaga Lake and its tributary streams is a direct result of the 66 existing overflows from the combined sewerage system. Through the CSO abatement component, this plan addresses this impairment and brings the CSO discharges into compliance with the goals of the Clean Water Act.

The primary benefit of CSO abatement will be to treat discharges of sewage that presently enter the creeks and ultimately the lake during or following rainfall events. These events presently occur about 50 times per year. Treatment will consist of removal of the floatable solids and settleable solids followed by disinfection. The removal of floatables will prevent the unsightly appearance of materials in the creeks and lake during and after storm events. The removal of solids will prevent accumulations of material that can result in localized odors and may exert a sediment oxygen demand. Disinfection will result in achieving swimmability in the Lake, thus allowing primary and secondary contact recreation. The location of a bathing beach in Onondaga Lake will be possible providing it is consistent with the overall parks and recreation desires of the County. Secondary contact recreation will enhance the useability of the lake for such activities as day sailing and wind surfing.

b) **Phosphorus**. Phosphorus enters the lake from point sources (METRO and CSO) and from non-point sources (stormwater and agricultural runoff) within the watershed. While there is some interannual variability based on the performance of phosphorus removal at METRO and the amount of rainfall in a given year, total phosphorus inputs from point and non-point sources have not been adequately identified or apportioned.

However, the relative contribution of biologically available phosphorus (phosphorus that can be readily taken up by plants) from point and non-point sources is likely to be quite different. Most phosphorus discharged from sewage treatment plants is typically biologically available. Young, et al. (1982) reported that 83 percent of the total P in wastewater will be ultimately available for algae growth. In contrast, only 30 percent of total phosphorus from urban runoff, lake bottom sediments, and eroding soils may be biologically available (Cowen and Lee, 1976; Williams et al., 1980 as reported in Young et al., 1982). Given this relationship, METRO and the CSOs are likely to contribute a disproportionate amount of biologically available phosphorus.

Phosphorus has an impact on water clarity or transparency by stimulating the growth of aquatic plants. The current NYSDEC standard for phosphorus in surface waters is a narrative standard that limits phosphorus to "none in amounts that will result in growths of algae, weeds, and slime that will impair the waters for their best use." In October 1993, NYSDEC adopted a phosphorus guidance value of 20 parts per billion for ponded waters with recreational use. This guidance value was based on a survey of public perception of the fitness of lakes for recreational use based on water clarity and levels of aquatic weeds.

Based on the Onondaga Lake monitoring and modeling efforts, the guidance value of 20 parts per billion total P is not attainable in the lake, even with complete diversion of METRO and aggressive controls on non-point sources of pollution. The urban setting and large drainage basin preclude Onondaga Lake from meeting this low level of phosphorus. Guidance values are not enforceable standards, so the approach towards addressing lake phosphorus uses the TMDL paradigm of freezing current inputs and monitoring progress towards meeting the goals of the CWA.

New York State has a water transparency safety guideline of 4 feet for bathing beaches. In recent summers, Onondaga Lake has met this transparency guideline on the average, with lake transparency generally remaining over 4 feet during the recreational period. Occasional low transparency conditions are associated with algae blooms. The average summer concentration of phosphorus measured in the upper waters of Onondaga Lake varies between 60-80 parts per billion. This concentration does not represent an impairment of the designated use for water contact recreation based on safety considerations, although it potentially contributes to a local perception that Onondaga Lake is less desirable than other local water resources for this use.

The proposed actions will reduce the phosphorus content in the lake by improving the reliability of phosphorus removal at METRO, and by reducing the internal cycling of phosphorus from sediment release. Provision of oxic conditions in the lower waters will alter the sediment P exchange, and ultimately reduce the P content of the water column.

A2. **Municipal Wastewater Issues: Impact on Aquatic Life.**

a) **Ammonia and Nitrite.** The METRO facility is the largest source of ammonia and nitrite to the lake. Concentrations of these forms of nitrogen exceed ambient water quality standards established to protect propagation of aquatic organisms. The current concentrations of ammonia in Onondaga Lake may represent an impairment of the designated use for fish propagation, although recent fishery data document the presence and successful reproduction of a number of species. The hydraulic connection with the Seneca River apparently provides an important refuge for the lake fishery. The Municipal Compliance Plan to modify METRO to enable biological conversion of ammonia to nitrate will address the nitrite concentrations as well, and will bring the METRO discharge into compliance with the goals of the Clean Water Act.

Because of the complex issues associated with the contamination of the Onondaga Lake fishery by mercury and PCBs, the MCP phases the community investment in nitrification facilities with defined milestones to verify improvement in the habitat and public health status of the fishery. The County has questioned the advisability of proceeding with ammonia treatment facilities to improve reproductive success of a highly contaminated fishery, since the lake is an open system and contaminated fish migrate downriver to Lake Ontario. The TMDL process is a valuable tool in this regard, as it allows for staged improvements and a process for monitoring progress.

b) **Dissolved Oxygen.** The lower waters of Onondaga Lake are devoid of dissolved oxygen during most of the summer period, thus limiting fish habitat to the warmer upper waters. The lake fishery is consequently composed of warm water species. In the fall, when the upper and lower waters mix, dissolved oxygen concentrations in the upper waters decline as well, causing fish to seek refuge at the tributary streams or in the Seneca River. Historical evidence and the NYSDEC models suggest that dissolved oxygen depletion of the bottom waters of Onondaga Lake has been typical since the area was cleared for agriculture early in the last century.

The MCP directly addresses the DO depletion limitation to attainment of the lake's best use. Hypolimnetic oxygenation is proposed as a means to maintain aerobic conditions in the lake's lower waters throughout summer stratification by supplying sufficient oxygen for aerobic decomposition of the organic material (such as phytoplankton) settling into the hypolimnion. If it is possible to keep the lower waters aerobic, accumulation of reduced species such as hydrogen sulfide and methane and the associated lake-wide DO sag at fall mixing would be avoided. Habitat for aquatic organisms would presumably be expanded with provision of aerobic conditions. Additional investigation and testing is required to determine the extent to which mercury methylation and the subsequent bioaccumulation into fish flesh would be reduced. The extent to which ambient water quality standards for DO would be met throughout the lower waters also needs additional investigation and testing.

Provision of year-round nitrification at METRO will also have a beneficial impact on the oxygen resources of Onondaga Lake. Nitrification will occur at METRO, not in the receiving water. Thus, rare events, such as the late summer 1995 DO depletion in the lake that may have been the result of in-lake nitrification, will be avoided.

A3. **Habitat Enhancement**. Industrial residuals, including mercury and other organic compounds, are present in the lake's sediment, water column, and aquatic biota. In fact, the lake bottom is classified by New York State as an inactive hazardous waste site, and has been placed on the National Priority List as a federal Superfund site. The contaminant burden in Onondaga Lake fish is of concern due to the open nature of the aquatic system; the interconnection between Onondaga Lake and the Seneca River allows contaminated fish to migrate to unaffected aquatic systems. The concentration of mercury in Onondaga Lake represents an impairment of the designated fishery use. As noted above, the impact of the MCP (particularly the proposed hypolimnetic oxygenation) on mercury cycling will require additional investigation.

Other industrial residuals impact the habitat and food web of Onondaga Lake and the Seneca River. For example, the concentration of chlorides is elevated over natural background in Onondaga Lake. The salinity has historically altered the stratification regime, and affected the environment for plants and animals. Petrochemical products have been detected in the lake sediments and fish.

Several issues affect the structure and productivity of the lake and river fisheries. Near-shore lake sediments contain calcium carbonate precipitates from the Solvay Process and are a poor habitat for aquatic plants. Without aquatic plants, the spawning and nursery habitat for fish is reduced. Sediment enters the lake from the "mud boils" in the Onondaga Creek watershed, about 15 miles south of Syracuse. Mud boils discharge large amounts of sediments, and sometimes salts, with upwelling groundwater. The sediment from the mud boils reduces water clarity and habitat for fish spawning. The lake shoreline does not provide protected inlets and refuges for spawning and nursery areas for fish. Hydroelectric dams on the Seneca and Oswego Rivers have eliminated any annual spawning migration to Lake Ontario. These habitat issues, which are potential impediments to attaining designated use objectives, are not addressed as part of the County's MCP.

The CSO remedial alternatives will potentially improve the tributary habitat for aquatic biota. Elimination of overflows through sewer separation, and provision of regional treatment facilities will reduce the amount of solids delivered to the streams. Benthic habitat will be improved.

B. Social and Economic Benefits

The costs of the MCP will have social, economic, and fiscal impacts on this community. Potential benefits of the project are mixed with the probability of less positive economic and fiscal impacts. Most benefits of the MCP are tied to the potential for improved water quality on Onondaga Creek, Harbor Brook, Ley Creek, and Onondaga Lake, but such benefits are dependent on concurrent elimination of industrial pollution on water quality, bottom sediments, and the shoreline. All County residents will benefit to some degree from potential improvements in water quality, fishery, recreation, and development opportunities.

B1. **Economic Impacts.** Economic benefits include short-term increases in construction-related employment and local purchases. The refinement of technology with the EquiFlow™ Demonstration Project may result in development of an exportable product. A cleaner lake may draw tourist trade by boat from the Barge Canal system.

An abundant supply of very inexpensive water from Lake Ontario, Skaneateles, and Otisco Lakes has long been a marketing asset for this community. Industry attracted by this advantage will be affected by sharply rising wastewater treatment costs. A number of the County's largest employers (including Bristol-Myers Squibb, Crouse-Hinds), several commercial laundries, and food and beverage industries are large water users already required to undertake pretreatment programs. Increased user fees will exacerbate the economic impact of these efforts.

B2. **Quality of Life.** The potential for additional recreational use of Onondaga Lake will represent a marginal increase in leisure benefits. Onondaga Lake Parka logs some 500,000 visitors annually, not counting informal visits and car-top boat launches. The park includes a marine which is slated for expansion regardless of water cleanup activities. There is also an abundance in boating, fishing, and swimming opportunities on other large lakes with public beaches, excellent trout streams, and more than 24 public swimming pools.

Residents bordering Onondaga Creek and Harbor Brook will receive aesthetic benefits from improved water quality; decrease in storm-related odor problems along these streams will improve the quality of life in several neighborhoods. Both streams have been channelized for flood control by the Army Corps of Engineers, fenced for safety, and either flow far below ground level elevations or are covered for substantial distances. There is no potential to enhance recreation value of the streams without very large expenditures; none are contemplated.

B3. **Disparate Social Impacts.** Sewer separation projects and new transmission sewers, by opening large cuts in many city streets, will create the opportunity to replace other very old underground infrastructure which is well past its design life, albiet at additional cost in tax dollars or utility rates.

Syracuse accounts for 65 percent of the METRO Service Area residential customers and 43 percent of the County Sanitary District's customers. The impact of increased user fees will be particularly harsh on low income and poverty level households which are concentrated in Syracuse. The City houses 74 percent of County residents living I poverty who account for over 27 percent of all City residents. Another large proportion have low or moderate income.

City residents are also more apt to be elderly, minority, and tenants than town residents (see Table 1-8). Thus, any significant increase in user fees can be expected to have a disparate impact on household budgets in the City.

The cost of the program will be spread across all district customers. Despite this effective cost subsidy of METRO Service Area customers, increased user fees to residential customers will impact lower income residents in Syracuse most severely.

1.2 RELATIONSHIP OF THE PROJECT TO OTHER ONONDAGA LAKE CLEANUP ACTIVITIES

1.2.1 Superfund Sites (State and Federal) with the Onondaga Lake Drainage Basin

NYSDEC publishes an annual and quarterly status reports of inactive hazardous waste disposal sites in New York State. The latest quarterly report published in July 1995 lists 37 inactive hazardous waste sites in Onondaga County, 24 of which are located within the Onondaga Lake watershed basin. A list of these sites is presented in Table 1-9.

NYSDEC has assigned a priority classification for each of the listed inactive hazardous waste sites indicating the site's status with regard to remediation and closure. Class 2 sites indicate those sites which pose a "Significant threat to public health and the environment - Action required". Fifteen of the 24 sites are listed as Class 2 sites. Class 2a (4 of 24) are described as "Temporary classification assigned to sites that have inadequate and/or insufficient data for inclusion in any other classification." Class 3 sites (3 of 24) are those that "Do not present a significant threat to the public health or the environment - Action may be deferred." Class 4 sites (2 of 24) indicate situations where the "Site is properly closed - Requires continued management."

These sites may be significant sources of priority pollutant metals and organics. Priority pollutant metals, including cadmium, chromium, copper, lead and zinc have been documented from Crucible Steel discharges on the west side of Onondaga Lake (Onondaga County, 1990). AlliedSignal Corporation has been identified as the responsible party (along with LCP Chemicals) for three of the Class 2 sites adjacent to Onondaga Lake. AlliedSignal operated two chlor-alkali facilities (Willis Avenue and Bridge Street, now known as LCP Chemical), which have been found to be significant sources of mercury to Onondaga Lake. The AlliedSignal tar beds have been found to be a source of chlorinated benzene, benzene, toluene, ethylbenzene, xylene, and polycyclic aromatic hydrocarbons. AlliedSignal and LCP Chemical are currently performing remedial investigations and feasibility studies to determine the nature and extent of this contamination associated with the lake and to evaluate various cleanup technologies (Onondaga Lake Management Conference, 1993).

Spills and discharges from the area known as Oil City (including the McKesson Environmental Site), located on the east side of the lake, may have been a significant source of petroleum groundwater contamination. New York State is actively pursuing this matter and is discussing the terms of a consent decree with various oil companies to address this problem.

Finally, a number of inactive hazardous waste sites and sources of PCBs are present in the Onondaga watershed, including the Ley Creek PCB sediment site, Syracuse Fire Training School site, Val's Dodge site, Quanta Resources site, Salina town landfill, and the G.E. Farrell Road site (NYSDEC, July 1995).

1.2.2 National Priorities List (NPL) Sites Within the Watershed

On December 16, 1994, Onondaga Lake was listed on the NPL, Final Rule (59 FR 65206). USEPA is to more fully characterize all sources of mercury contamination during the RI/FS, including groundwater contamination beneath the Willis Avenue facility, the former Benzol plant; and investigate soil and groundwater contamination resulting from leakage of pipeline used to transport chlorobenzene residual wastes from the Willis Avenue facility to the main Allied plant in Solvay.

1.3 IMPLEMENTATION SCHEDULE AND REQUIREMENTS

1.3.1 Implementation Schedule and Requirements

Consistent with County policy, the proposed METRO and CSO project implementation plan reflects a phased approach allowing for any mid-course adjustments indicated by the proposed long-term water quality monitoring and assessment program. Not only is phasing a necessary cost containment measure for the County, it is consistent with the USEPA's phased TMDL approach (build and measure) to water quality improvement.

The plan's interim and intermediate actions correspond to Phase I of County Legislative Policy. These projects address the impacts of METRO and CSO discharges on water quality conditions in Onondaga Lake and its tributaries. Implementation will be performed in parallel with removal of other barriers to use attainment associated with the NPL listing of Onondaga Lake as a Superfund Site under CERCLA.

A. CSO Improvements

A1. **Interim Phase.** Figure 1-21 presents a proposed implementation schedule for interim CSO improvements. The interim improvements include best management practices (BMPs), capital improvements, and demonstration technologies which will reduce the discharge of floatable solids to Onondaga Lake and establish the basis for design, construction, and operation of subsequent intermediate phase improvements.

The demonstration projects include vortex treatment in combination with storage, a unique in-water treatment application, and alternative disinfection evaluations. The outcome of these full-scale demonstrations will establish the basis of design for much of the intermediate program implementation projects.

The interim projects, scheduled to be complete by the year 2000, will result in substantial compliance with the ambient water quality requirements for floatable solids in Onondaga Lake and Ley Creek. Substantial compliance with the water quality standard will be accomplished through control of floatable solids at the mouths of Harbor Brook and Onondaga Creek as well as at the two individual CSO discharges to Ley Creek. The foregoing projects, which will be undertaken at an estimated cost of $23.4 million (indexed to mid-interim phase, ENR 5870, excluding interest expense), will demonstrate the County's commitment to water quality improvements, while detailed design and phasing issues of additional CSO abatement projects are resolved.

A2. **Intermediate Phase.** Figure 1-22 presents a proposed implementation schedule for intermediate phase CSO improvements. These projects include design and construction of large consolidation pipe networks linking the many existing CSOs discharges with existing and proposed regional treatment facilities for control of floatable solids, settleable solids, and bacteria.

Full CSO treatment, consisting of settleable and floatable solids removal and disinfection, will be provided at the two largest regional CSO treatment facilities (Midland and Clinton). These facilities will treat 80 percent of the total CSO volume remaining after the interim actions. Additionally, floatables control facilities will be constructed at the two remaining regional locations. Fifteen small or remote CSO basins will be separated. The intermediate facility sites do not preclude future additional treatment or storage improvements if deemed necessary at the end of the intermediate phase.

The intermediate projects (Maltbie, Midland, Franklin, and Clinton) will result in substantial compliance with water quality standards for floatable solids in Onondaga Creek. Substantial compliance with ambient water quality standards for bacteria in Onondaga Lake will be achieved upon completion of the Clinton RTF.

The implementation schedule for interim and intermediate CSO projects provides for flexibility in the design and construction of the individual facilities. This is required, in part, by the County's policy of coordinating County and industrial projects, and more importantly, by the need to seek and secure as yet uncertain state and federal aid. The implementation schedule may be adjusted according to the availability of outside aid.

B. Metropolitan Sewage Treatment Plant Improvements

B1. **Interim Phase.** Figure 1-23 presents a proposed implementation schedule for interim METRO improvements. The interim improvements include capital projects, as well as changes in METRO operating strategies, which will focus on maximizing the phosphorus and ammonia removal capabilities of the existing facilities following the anticipated startup of industrial wastewater pretreatment facilities. It is anticipated that the pollutant loading reductions, resulting from industrial wastewater pretreatment by Bristol-Myers Squibb, Inc., will make it possible to increase the magnitude and extend the duration of seasonal ammonia removal at METRO.

In addition, the METRO interim improvements will include a demonstration project to assess the technical feasibility and determine the costs and environmental impacts of hypolimnetic oxygenation of Onondaga Lake. Consideration of hypolimnetic oxygenation has been suggested by the USEPA as a potential low-cost means for improving dissolved oxygen concentrations in Onondaga Lake based upon the results of a preliminary evaluation performed by the U.S. Army Corps of Engineers.

The interim METRO projects, which will be undertaken at an estimated cost of $20.9 million (indexed to mid-interim, ENR 5870, excluding interest expense) will demonstrate the County's demonstrate the County's commitment to progress, and water quality improvements while detailed design and phasing issues of additional CSO abatement and METRO improvement projects are resolved.

B2. **Intermediate Phase.** The implementation schedule for intermediate METRO improvements is presented in Figure 1-24. Intermediate improvements include a one-quarter plant demonstration project to assess the ammonia removal capabilities of the existing conventional activated sludge system with the elimination of secondary clarifier hydraulic loading limitations and to determine the need and design criteria for fixed-film media to enhance ammonia removal performance. Based upon the results of the ammonia removal demonstration project, final design criteria will be developed for the full-scale upgrade of METRO for year-round ammonia removal. The implementation schedule for final design and construction of the full-scale upgrade may be affected by the availability of outside aid and the extent to which remedial activities related to the NPL remove barriers to use attainment

Intermediate METRO improvements also include the full-scale implementation of hypolimnetic oxygenation for Onondaga Lake based upon the results of the demonstration project conducted during the interim phase. The County's responsibility for full-scale implementation of hypolimnetic oxygenation is limited to the extent to which the METRO and CSO discharges contribute to the cause for dissolved oxygen depletion.

C. Monitoring and Assessment

Monitoring (including biological and chemical measurements) and assessments of waer quality improvements will be conducted throughout the interim and intermediate actions to determine the degree of compliance. At the end of the intermediate phase, it is anticipated that compliance with applicable water quality standards will have been achieved. In the event that these actions fall short of compliance, then implementation of conceptual long-term alternatives will be considered.

1.3.2 Financial Requirements (Economic Impact and Affordability)

A. Project Costs

The project is divided into the interim and intermediate phases, requiring total funding over the life of the project of $536 million, excluding interest costs. With interest costs, the total project costs will exceed $1.1 billion.

The interim CSO projects scheduled to be complete by 2000 will be undertaken at an estimated cost of $23.4 million (indexed to mid-interim phase, ENR 5870, excluding interest expense). The interim METRO projects will be undertaken at an estimated cost of $20.9 million (indexed to mid-interim, ENR 5870, excluding interest expense). The interim projects serve, in the words of the Legislature's governing resolution, as a way the County can demonstrate its commitment, show progress, and achieve actual water quality improvements while detailed design and phasing issues of additional CSO abatement and METRO improvement projects are resolved.

B. Phasing

Phasing of the project serves several related purposes. First, consistent with the TMDL process, it provides an opportunity to assess the effectiveness of the County's program in tandem with other actions required to attain designated uses of the lake. Second, phasing seeks to reduce, in part, user fees that are high and/or increasing rapidly. Third, phasing provides equity; one generation should not be asked to pay for the entire remediation when decisions and actions over 100 years have contributed to water quality issues.

The MCP threatens to adversely impact the County's other capital borrowing needs. This occurs when the community approaches its practical credit limits and is precluded from borrowing for certain purposes. Prudent phasing is less likely to cause the County's double A (AA) credit rating to be reduced, which typically increases debt service costs, reduces market access, and hinders the County's ability to address future needs.

Phasing will improve the of administration of this large capital construction program. The Department of Drainage and Sanitation (D&S) currently manages capital construction projects that amount to approximately $15 million annually. The proposed 25-year implementation schedule would, in many cases, double the annual capital dollars that need to be managed. Accelerating the construction schedule would heighten the concern of the bond markets over the County's ability to fund, construct, and manage the MCP projects. D&S lacks a track record of managing a project the size and scope of the MCP. This heightened concern could limit market access to capital funds and/or increase interest costs.

C. Funding Sources

The County strongly believes that outside funding assistance is imperative, in addition to optimizing local fiscal resource use.

C1. **County Options.** The County will finance its share of the MCP costs by issuing general obligation bonds, the only legal means to issue debt. At a later date, if an authority is created, the County could issue revenue bonds. It is possible that obtaining County Legislative consensus for an authority could take as many as 7 to 10 years.

C2. **Outside Financial Assistance.** Outside financial assistance for the MCP could take at least three forms: direct federal grants, direct state assistance, and SRF interest subsidy.

Direct federal grants have been provided to the Massachusetts Water Resources Authority, San Diego, CA, and others. These grants are similar to the old Construction Grant Program, where the federal funding is available for some or all of the costs associated with a mandated wastewater project. Hiawatha RTF and Harbor Brook demonstration wetlands, and potentially the EquiFlow™ project, are initial project examples. The Hiawatha and Harbor Brook projects are scheduled to receive a small amount of grant money; substantially more aid will be required for the balance of the MCP.

Direct state assistance such as that presently provided by a number of states is another option. As an example, the Commonwealth of Massachusetts presently pays 20 percent of the debt service incurred by local wastewater projects to mitigate the affordability and financing difficulties for mandated projects.

State Revolving Loan Fund (SRF) assistance, administered by the NYSEFC, could permit the County to borrow significant portions of the MCP with no interest loans. Small communities experiencing hardship are the typical recipients of these loans; however, the NYSEFC has the ability to modify the guidelines. Use of no interest loans could dramatically reduce the cost to the sanitary district ratepayers. The SRF also provides subsidized financing, with interest costs approximately equal to two-thirds of the market rate. Use of this mechanism will marginally reduce the user fees.

Given the present budgetary upheaval at the federal level, it is difficult to project what types of federal assistance may be available for MCP projects or the SRF capitalization fund. Fund availability depends on reauthorization of the Clean Water Act and subsequent appropriations. Under the most optimistic circumstances, given full reauthorization and limited demand for funding within New York State, the County is unlikely to be able to finance more than 50 percent of its project costs through the SRF. A more likely case is SRF funding will be limited to approximately 10 to 20 percent of financing requirements. State grants are also viewed as unlikely at this time. However, they remain a key ingredient in the County's ability to implement the MCP without causing significant financial and economic damage.

D. Impact on User Fees

Without significant outside financial assistance, MCP implementation will mean rapid increases in user fees for services. User fees in the County Sanitary District will increase from approximately $282 in 1996 to over $1,700 by the year 2020. This represents an average annual increase of over 7.6 percent, or a cumulative increase of approximately 490 percent. During the same time period, the County is projecting that household income will increase at a 4.5 percent annual rate, or a cumulative increase of 187 percent. *Thus, the real cost of sewer service is projected to more than double* (see Appendix E for household bill projection details).

During the period 1995 to 2005, rate increases are expected to be especially sharp, with average annual increases exceeding 9 percent per year. This rate of increase is likely to cause significant financial and economic hardships undermining general support for the MCP. It is important to understand that the County is already paying sewer bills which are 30 percent more than those of the typical community across the country. The relationship of user fees to household income further underscores the County's concerns regarding affordability. Typical household bills are projected to increase from 0.8 percent of median household income in 1995 to over 1.63 percent in 2015. The USEPA affordability guidance document indicates that affordability becomes a concern when sewer user fees exceed 1.0 percent of median household income. This problem is especially acute for the typical city resident, where the bill is projected to peak at nearly 2.5 percent of median household income (Figure 1-25).

These bills are believed to be beyond the capacity of district ratepayers and will result in economic and financial dislocations. Other entities faced with increases of similar magnitude have only been able to sustain public support and continue their program with the addition of significant outside financial assistance.

E. Access to Credit

The financial markets will play a significant role in the County's ability to implement the MCP. The County will be required to finance significant amounts to implement the MCP, potentially borrowing over $535 million in future dollars. This would double the County's total outstanding debt and reflects the needs of just one municipal function, wastewater. The County anticipates that it would be difficult to borrow the funding necessary without experiencing significant penalties, such as a downgrade in credit rating.

The County has a double A (AA) rating from the major rating agencies. However, credit reports regarding the County all have expressed concerns regarding the County's high debt levels per capita and debt relative to equalized full valuations. If the County is required to finance the MCP without outside financial assistance, debt per capita will exceed $850 per capita, compared to the Moody's median of $312. Direct net debt relative to equalized value will exceed 0.9 percent, which is 20 percent higher than the Moody's median. Consequently, the County believes that financing the MCP will cause a rating downgrade which will result in significantly higher interest rates for all debt and severely constrain market access. This would inhibit the County's ability to fulfill its responsibilities.

F. Economic Impacts

Implementation of the MCP without significant outside financial assistance will cause increases in fees. These higher fees will have a direct adverse economic impact on employment, population, and income within the County, exacerbating the County's concerns regarding implementation. Onondaga County has not followed the national economy into recovery from the 1991 recession, and the rate of increase in wages over the last 10 years ranks the County 39 among New York State counties. Implementation of the MCP is likely to worsen these trends. The County has evaluated the potential economic impacts of the MCP without significant outside financial assistance. That analysis concluded that, all other things being equal, implementation of the MCP will cause employment levels to drop by more than 1,700. Employment loss of this magnitude would be similar to the County losing a company the size of Welch Allyn or Lockheed-Martin; such a loss would be very difficult for the community. It is also estimated that population will drop by over 3,700 people due to MCP economic impacts (see Appendix E). It must be emphasized that these figures are in addition to the recent decline in population and employment independent of the MCP and assume no further shocks to the local economy or any additional increases in local tax burden.

G. Local Government Fiscal Pressures

Federal government efforts to eliminate the national deficit will likely leave local governments with increased responsibilities, but with reduced financial support. Proposed changes in federal and state budgets are expected to shift more of the burden for human services to counties. Over 87 percent of the 1995 County expenditures go to human services, most mandated by higher levels of government.

The net effect is that local taxes and revenues will need to be increased to maintain levels of public service presently provided. County revenues are already stressed. Sales tax revenues have not kept pace with inflation, and declining real estate markets have severely reduced mortgage tax receipts. Concern also exists about the property tax base; distress in the real estate market will not be reflected in the County's full value assessment for two years due to lags in the state equalization rate process.

H. Outmigration

Without significant outside financial assistance, the costs for implementing the MCP would need to be paid by customers of the Onondaga County Sanitary District. The number of residents in the district and their income levels are key factors in accessing affordability. Reductions in the County's population means that the costs associated with the MCP will be allocated to fewer and fewer persons, increasing the per capita burden. If the disparity in cost of living between Onondaga County and other parts of the metropolitan area increases, outmigration will accelerate, exacerbating affordability concerns. There is a high potential for relocation by the 11,700 County residents who work in surrounding counties, should the cost of living here rise sharply. Within Onondaga County, over 87 percent of the acreage is not subject to sewer user fees, providing ample opportunity to relocate within the County. Given the current oversupply in housing market, MCP user fee impacts will lead to a relative decrease in the value of housing subject to sewer fees. These potential impacts would exacerbate sprawl and be counter to the County's 2010 Plan.

I. Dissolution of the District

The METRO Service Area (Figure 1-26) is the only area of the Onondaga County Sanitary District that is affected by the MCP. The Onondaga County Sanitary District was created by an act of the County Legislature and may be dissolved by the County Legislature. The County believes that significant pressure will arise to dissolve the sanitary district. If this were to occur, the financial feasibility of implementing the MCP will become significantly more difficult.

The METRO Service Area population is 60 percent of the sanitary district, and its household income averages 13 percent less than in the district. The user fee burden on the residents of a METRO Service area would be approximately 2.5 percent of median household income, two thirds above the USEPA affordability criterion. The economic prospects for the METRO Service Area are significantly weaker than for the County as a whole. The City of Syracuse, the major location of poverty in the County, is within the METRO Service Area. A METRO Service Area alone would face huge, possibly unsurmountable, barriers in obtaining the capital financing necessary to implement the MCP. The district would have a smaller, less well off population base, undertaking a huge capital program for the first time. Access to the capital markets would be extremely limited and would likely constrain the portion of the MCP that could be financed.

1.3.3 Permits and Approvals Needed

Upon completion of the SEQR process and the issuance of permits, the County of Onondaga will commence implementation of the first phase of the project. It will be necessary to obtain site-specific project construction-related approvals for funding, environmental impact, and mitigation and work within street and highway rights-of-way. It may be necessary to complete site-specific supplemental EIS documents prior to particular project implementation. Environmental information documents have already been prepared for the Hiawatha RTF pipeline project and the Harbor Brook EquiFlow™ project. An Environmental Assessment form (EAF) has additionally been prepared for the proposed Newell Street RTF facility upgrade project.

The following discussion of permits and approvals required is summarized in Table 1-27.

A. Environmental Permits - City of Syracuse

A1. **Floodprone Area Permit.** City of Syracuse; required under National Flood Insurance Act of 1968; Federal Flood Disaster Protection Act of 1978; New York State Environmental Conservation Article 36; Flood Protection Code, City of Syracuse.

B. Environmental Permits - State of New York

B1. **SPDES (NYSDEC).** Pollutant Discharge Elimination System Permit, New York State Environmental Conservation Law, Article 17, Titles 7 and 8; NYCRR Title 6 Parts 621 and 750-757.

B2. **Freshwater Wetland Permits (NYSDEC).** New York State Environmental Conservation Law Article 24, NYCRR Title 6 Parts 662-665 for state-regulated wetlands.

B3. **Stream Bed or Bank Disturbance Permit (NYSDEC).** New York State Environmental Conservation Law S15-1505, NYSDEC Protected Waters Program.

B4. **Dredging and Filling of Waterways (NYSDEC).** New York State Environmental Conservation Law S15-1505, New York State Protected Waters Program.

B5. **Water Quality Certification (NYSDEC).** U.S. Public Law 92-500 §401, New York State Codes, Rules, and Regulations Title 6 Part 608.7.

B6. **Stream Crossing Permit (NYSDEC).**

B7. **Grant for Land** along lake bottom. Office of General Services.

B8. **Permit for Buoys Associated with Hypolimnetic Oxygenation Work.** U. S. Coast Guard; New York State Office of Parks, Recreation, Historic Preservation; USACOE; and Thruway Authority are involved agencies.

C. Environmental Permits - Federal

C1. **Discharge of Fill Into Water Bodies (Wetlands).** U.S. Army Corps of Engineers, U.S. Clean Water Act §404a, 301a, and 309c, d, and e; River and Harbor Act of 1989 §10; Marine Protection, Research, and Sanctuaries Act of 1972 §1031.

C2. **Endangered Species Act (U.S. Fish and Wildlife Services).** Biologic assessment if endangered species present; no permit required.

D. Transportation Permits

D1. Highway Right-if-Way Construction Permit (City of Syracuse, Bureau of Traffic Engineering).

D2. Right-of-Way Occupation and Construction Permit (Onondaga County Department of Transportation).

D3. Highway Work Permit: Utility Work (NYSDOT) (Thruway Authority).

E. Canal

E1. **Construction in Navigable Waters.** Navigation Aids (33 CFR Part 66) (U.S. Coast Guard) (U.S. Army Corps of Engineers) - U.S. Rivers and Harbors Act of 1989, Section 10.

E2. Canal Access and Right-of-Way, New York State Barge Canal (Thruway Authority).

F. Zoning and Building Permits

Public permits are exempt from regulation under City of Syracuse zoning ordinance; however, historic districts and protected sites regulations may be relevant to CSO project areas. Building permits are not issued by the City of Syracuse for public projects; however, the project must conform to the New York State Fire Protection and Building Code of 1984 and a permit must be issued by the Onondaga County Department of Facilities Management.

G. Funding Approvals

The process of obtaining County approval for funding includes:

G1. Capital Improvement Program and Annual Capital Budget.

G2. Commissioner's Hearing, County Executive approval, legislative public hearing, and legislative approval of project design and authorization to incur debt.

H. Creation of an Authority

If an authority is required to fund implementation of the MCP, approval by the New York State legislature would be required.

TABLE 1-1

RATIONALE FOR ENVIRONMENTAL MONITORING PROGRAM DESIGN: COMPLIANCE ISSUES
Draft Environmental Impact Statement
Onondaga County, New York

ISSUE	TRIBUTARIES	LAKE	RIVER
Compliance with ammonia and nitrite standards	Annual loads (METRO and natural tributaries) monitor concentration, flow, pH, and temperature.	Monitor concentrations biweekly (Mar-December) in upper and lower waters (also pH and temperature). Collect winter data.	Monitor concentrations upstream and downstream of Jacks Reef, Onondaga Lake outlet. Upper and lower waters. Summer low flow conditions (also pH and temperature)
Compliance with bacteria standards	Storm-event sampling upstream and downstream of CSOs to complement routine biweekly program.	Monitor near-shore areas for indicator bacteria following storms (six storms annually, May-September)	Not included
Compliance with oxygen standards	Low-flow conditions in CSO tributaries to complement routine biweekly program.	Biweekly profiles (March-December). Intense monitoring at fall mixing. Additional profiles as needed to support design and implementation of hypolimnetic oxygenation	Monitor concentrations upstream and downstream of Jacks Reef, Onondaga Lake outlet. Upper and lower waters. Summer low flow conditions. Two diurnal profiles annually during low flow
Compliance with total dissolved solids standards	Monitored during routine biweekly program	Biweekly profiles	Monitor concentrations upstream and downstream of Jacks Reef, Onondaga Lake outlet. Upper and lower waters. Summer low flow conditions.

TABLE 1-2

RATIONALE FOR ENVIRONMENTAL MONITORING PROGRAM DESIGN:
ECOLOGICAL INTEGRITY
Draft Environmental Impact Statement
Onondaga County, New York

ISSUE	PROGRAM
Fish habitat (lake)	Map macrophytes in Lake
	Monitor zooplankton numbers and size class
	Monitor zoobenthos (number and diversity)
Fish reproductive success	Nest surveys
	Larval counts
	Juvenile and adult population structure
Biotic habitat (tributaries)	Measure and map sludge deposits
	Rapid field biotic index
Fish contaminant burden	Cooperate with NYSDOH to obtain annual measurements of mercury, PCB and other organic contaminants in fish flesh

TABLE 1-3

RATIONALE FOR ENVIRONMENTAL MONITORING PROGRAM:
LAKE TROPHIC STATE ASSESSMENT
Draft Environmental Impact Statement
Onondaga County, New York

PARAMETER	SIGNIFICANCE	MONITORING STRATEGY
Total P (TP)	Limiting nutrient for phytoplankton growth	Biweekly profiles April-November
Chlorophyll a	Indicator of primary production	Composite samples through photic zone, biweekly April - October
Soluble reactive P (SRP)	Limiting nutrient for phytoplankton growth.	Biweekly profiles April-November. Track SRP/TP ratio in response to hypolimnetic oxygenation
Dissolved oxygen profiles	Calculate areal hypolimnetic oxygen demand, support design of hypolimnetic oxygenation system	Weekly profiles April-November. Intense monitoring during fall mixing (see compliance table). Profile under ice.
Phytoplankton : abundance of major taxa	Continue long-term data set, track changes in response to remedial actions	Same as chlorophyll a
Zooplankton : abundance of major taxa	Size and abundance of zooplankton have major impact on food web, fishery management	Biweekly net tows through epilimnion (April-November), and entire water column as part of evaluation of hypolimnetic oxygenation
Fish species and abundance, fish propagation	Use attainability, success of fishery management plan	Gill netting (possible electroshocking), angler surveys, nest counts, larval sampling

TABLE 1-4

COST/BENEFIT RANKING OF INTERMEDIATE CSO FACILITIES
BY CSO VOLUME REDUCTION
Draft Environmental Impact Statement
Onondaga County, New York

Facility Name	Flow Volume Reduction (MGY)	Facility Cost $Millions	Unit Cost	Cost/Benefit Ranking
Midland RTF	178.4	72.67	0.407	1
Clinton RTF	49.82	30.18	0.606	2

TABLE 1-5

COST/BENEFIT RANKING OF INTERMEDIATE CSO FACILITIES
BY FLOATABLES CONTROL
Draft Environmental Impact Statement
Onondaga County, New York

Facility Name	"Floatables" (Flow) Treated (MGY)	Facility Cost $Millions	Unit Cost	Cost/Benefit Ranking
Midland RTF	299.2	72.67	0.242	3
Clinton RTF	141.9	30.18	0.213	1
Franklin FCF	83.3	19.92	0.239	2
Maltbie FCF	26.9	7.43	0.276	4

TABLE 1-6

COST/BENEFIT RANKING OF INTERMEDIATE CSO FACILITIES
BY BACTERIA CONTROL
Draft Environmental Impact Statement
Onondaga County, New York

Facility Name	Flow MGY	F. Coli Conc.	Load	% of Total	Facility Cost $M	Unit Cost	Cost/Benefit Ranking
Midland RTF	299.2	1.34E6	4.0E8	45.8	72.67	0.18	2
Clinton RTF	141.9	2.25E6	3.2E8	36.6	30.18	0.09	1

TABLE 1-7

COST/BENEFIT RANKING SUMMARY OF
INTERMEDIATE CSO FACILITIES
Draft Environmental Impact Statement
Onondaga County, New York

Facility Name	CSO Volume Reduction	Floatables Control	Bacteria Control
Midland RTF	1	3	2
Clinton RTF	2	1	1
Franklin FCF		2	
Maltbie FCF		4	

TABLE 1-8

CITY/SUBURBAN DEMOGRAPHIC COMPARISON
Draft Environmental Impact Statement
Onondaga County, New York

Poverty status	23% of City residents 4% of suburban residents
Median income	$21,242 City of Syracuse $31,783 Onondaga County
Minority residents	26.3% City population 3.5% suburban population
Elderly residents	17.4% of City residents 14.0% of suburban residents
Home ownership	41% of City residents 59% of suburban residents

Prepared by SOCPA. Source: 1990 Census.

TABLE 1-9

INACTIVE HAZARDOUS WASTE SITES LOCATED IN ONONDAGA LAKE WATERSHED (NYSDEC, 1993)
Draft Environmental Impact Statement
Onondaga County, New York

SITE NAME	CITY/TOWN/VILLAGE	CLASSIFICATION
AlliedSignal tar beds	Solvay	2
Crucible Steel	Solvay	3
Maestri site	Geddes	2
AlliedSignal Willis Avenue	Solvay	2
Onondaga Lake sediments	Syracuse/Geddes/Salina	2
Syracuse Fire Training School	Syracuse	2
Val's Dodge	Solvay	2a
LCP Chemical	Solvay	2
McKesson Environmental	Syracuse	2
Clark property	Syracuse	4
Quanta Resources	Syracuse	2
Crouse-Hinds	Syracuse	3
Salina town landfill	Syracuse	2a
Ley Creek PCB	Salina	2
Syracuse China	Syracuse	2
G.M/Fisher Guide	Dewitt	2
G.E. Farrel Road	Geddes	2
Bristol Labs	Dewitt	3
Tripoli landfill	Onondaga	4
Valenite	Dewitt	2a
Onondaga Nation Site B	Nedrow	2
UTC/Carrier	Dewitt	2
Peter Winkleman Company	Syracuse	2
American Bag and Metal	Syracuse	2a

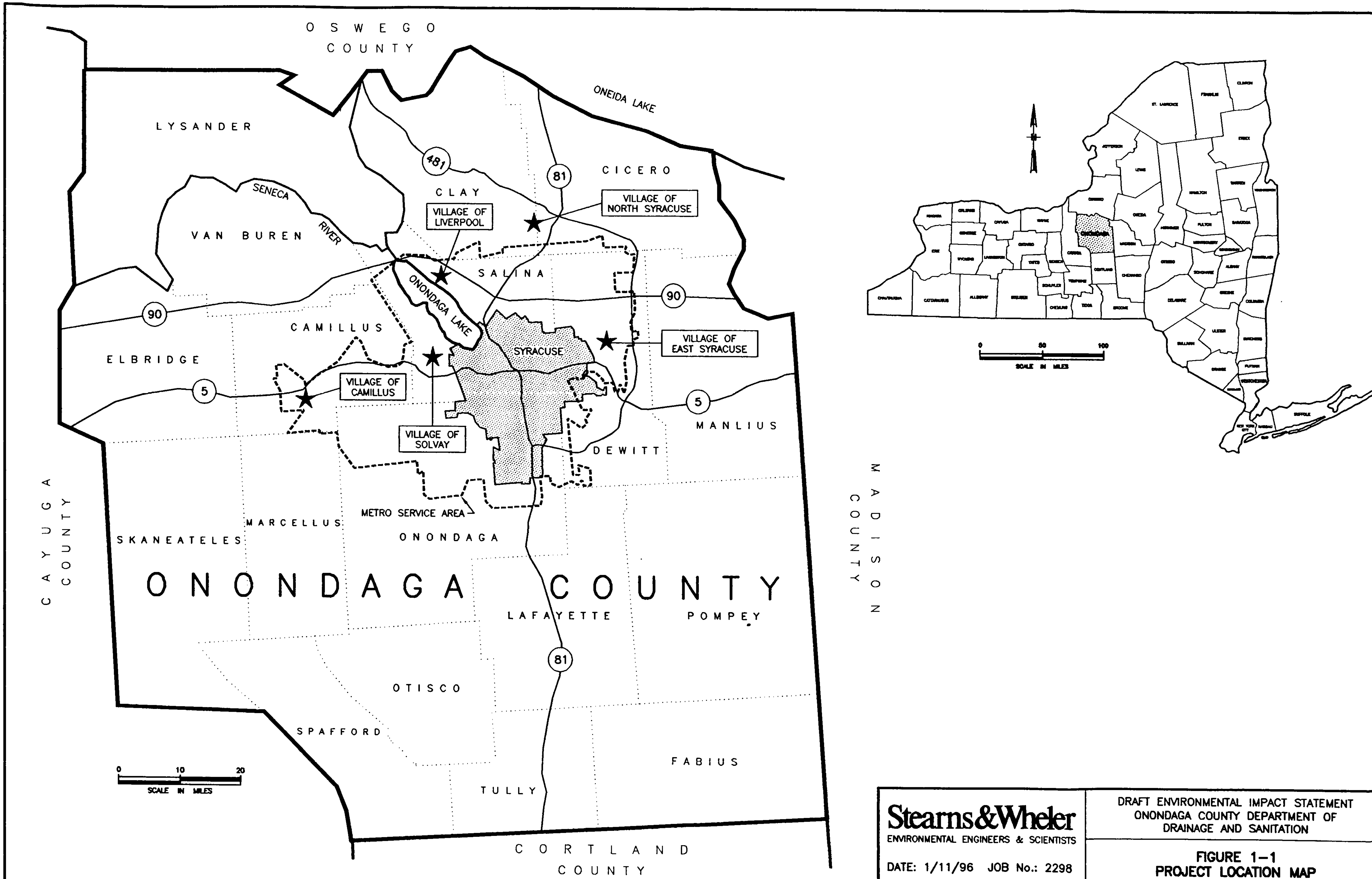
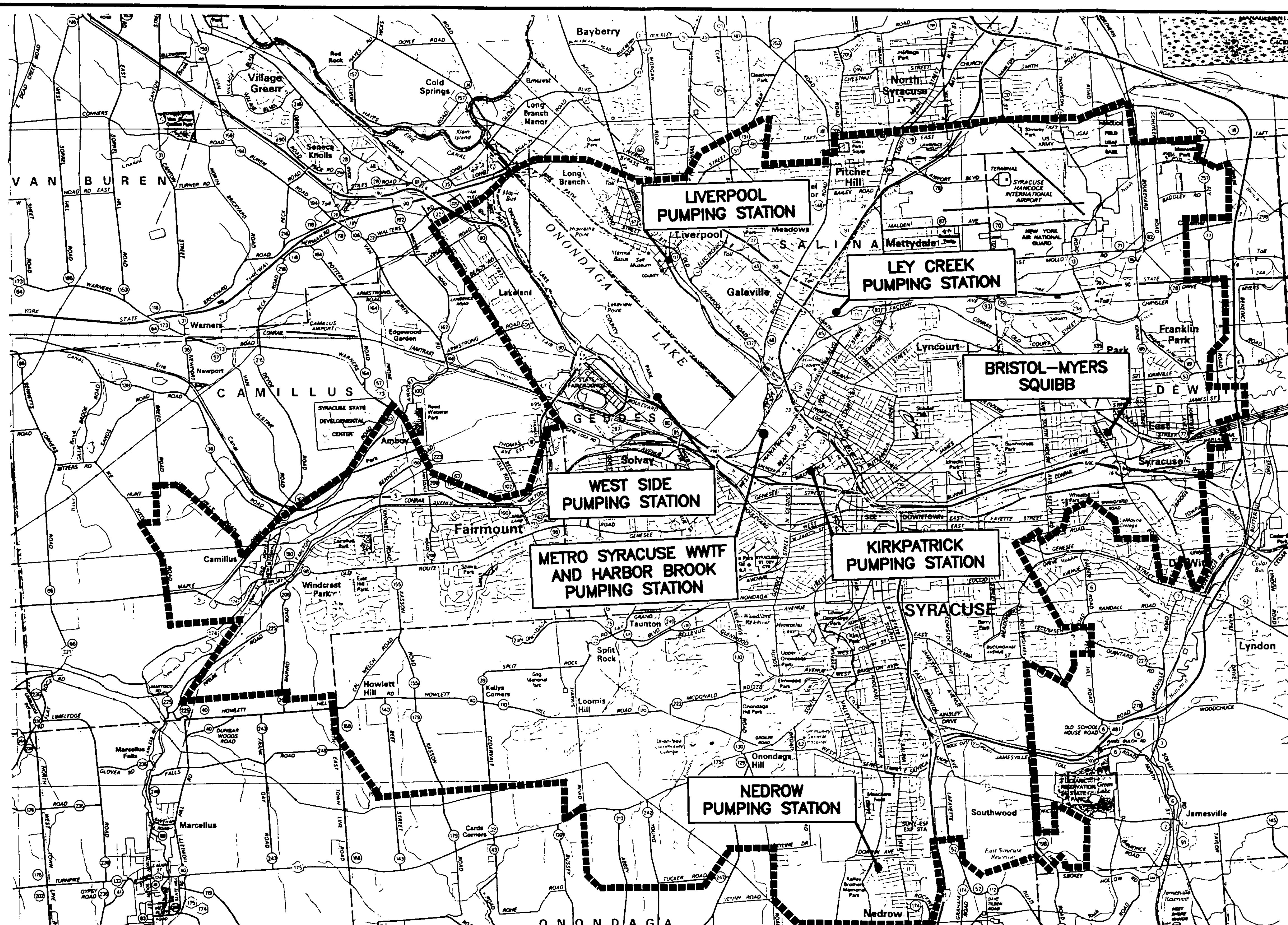


FIGURE 1-1
PROJECT LOCATION MAP



0 1 2 3 4 5 MILES

5,000 0 5,000 10,000 15,000 20,000 25,000 FEET

Adopted from: OCDD&S, August 1967

Map adapted from: NYS DEPARTMENT OF TRANSPORTATION (COUNTY BASE MAP SERIES)

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ONONDAGA COUNTY DEPARTMENT OF DRAINAGE AND SANITATION

FIGURE 1-2
METRO SERVICE AREA

SEE DRAINAGE AREAS FIGURE 1-3

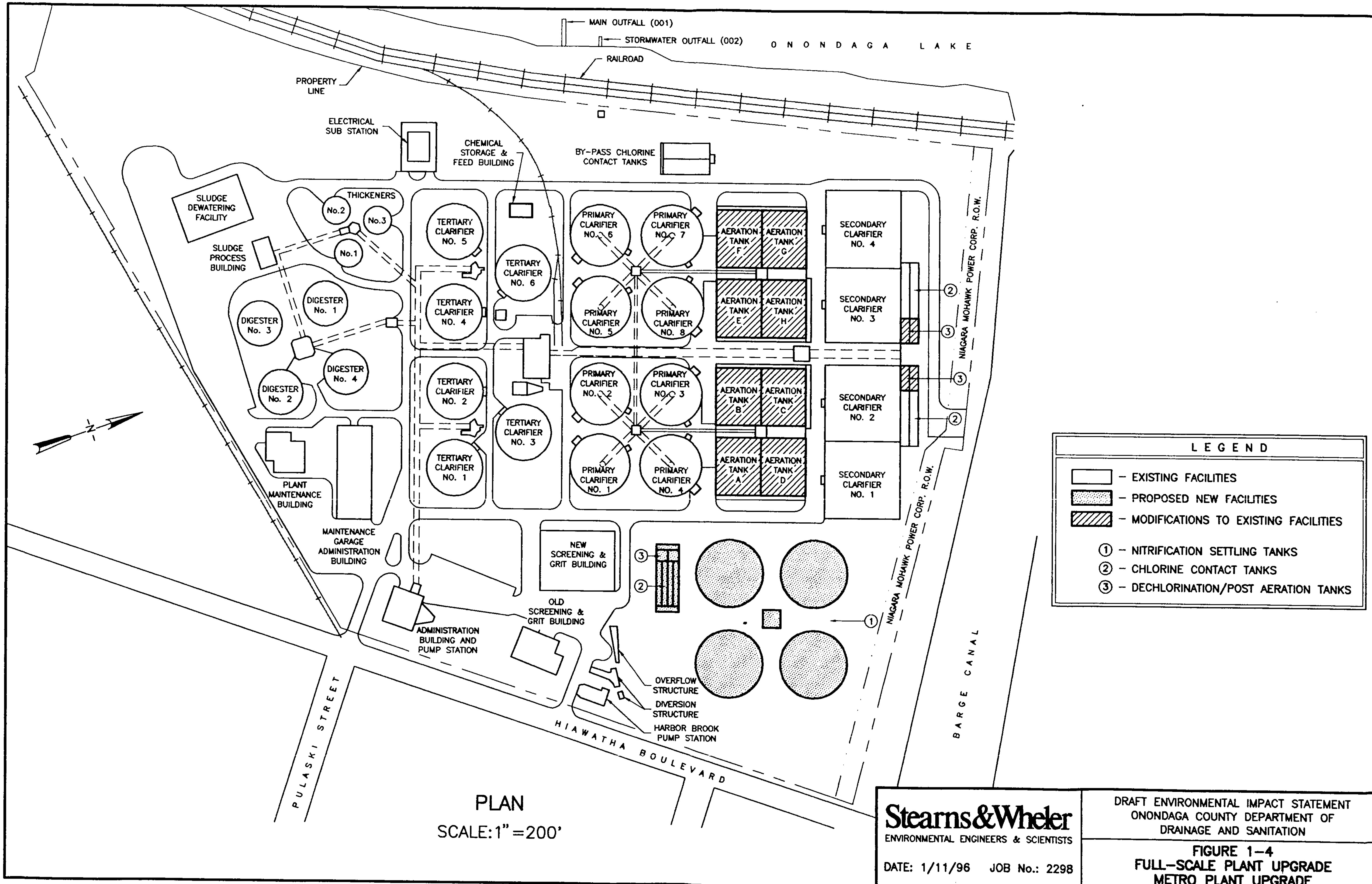

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FIGURE 1-4
FULL-SCALE PLANT UPGRADE
METRO PLANT UPGRADE

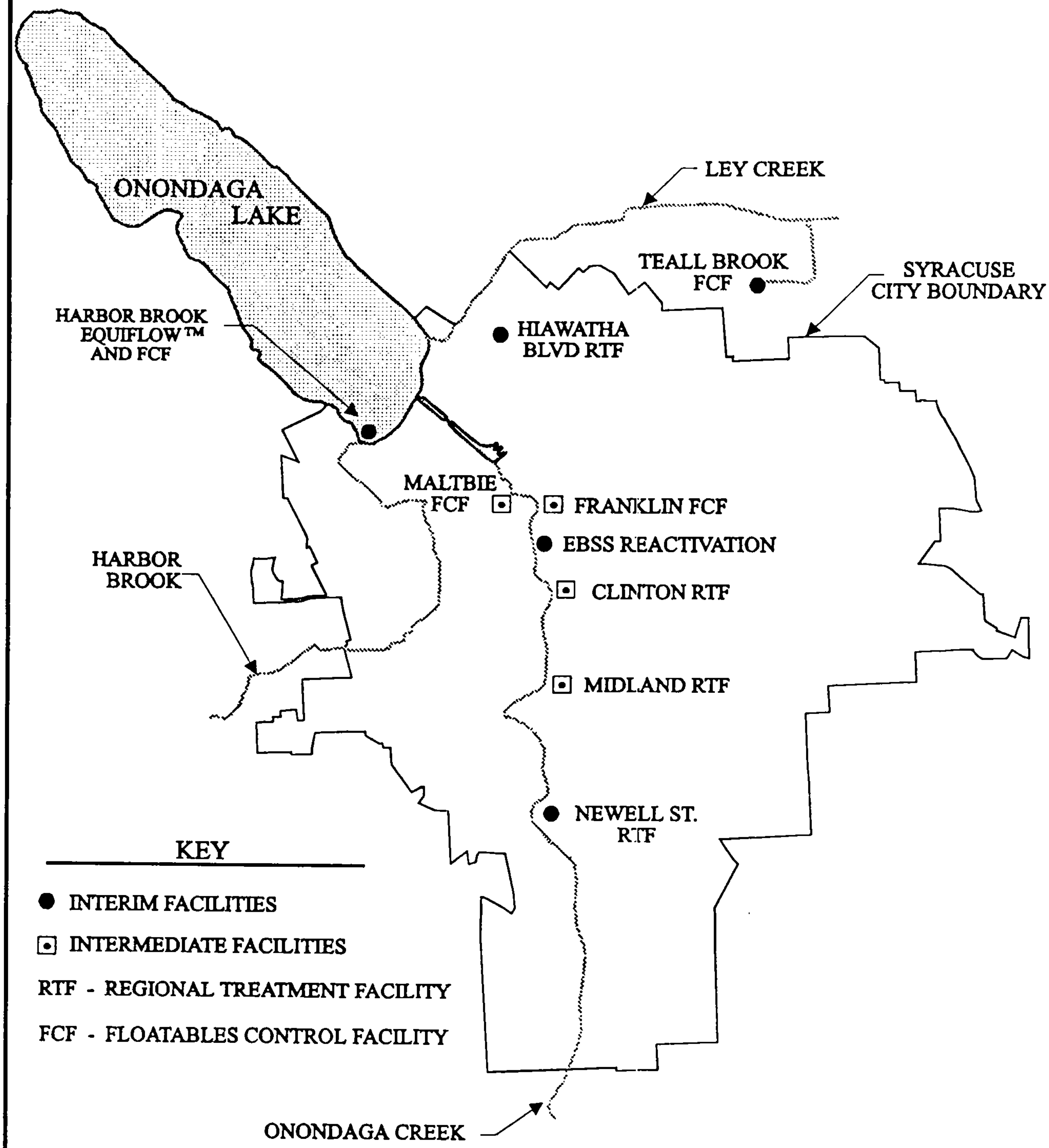

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FIGURE 1-5
INTERIM AND INTERIMEDIATE
CSO FACILITIES

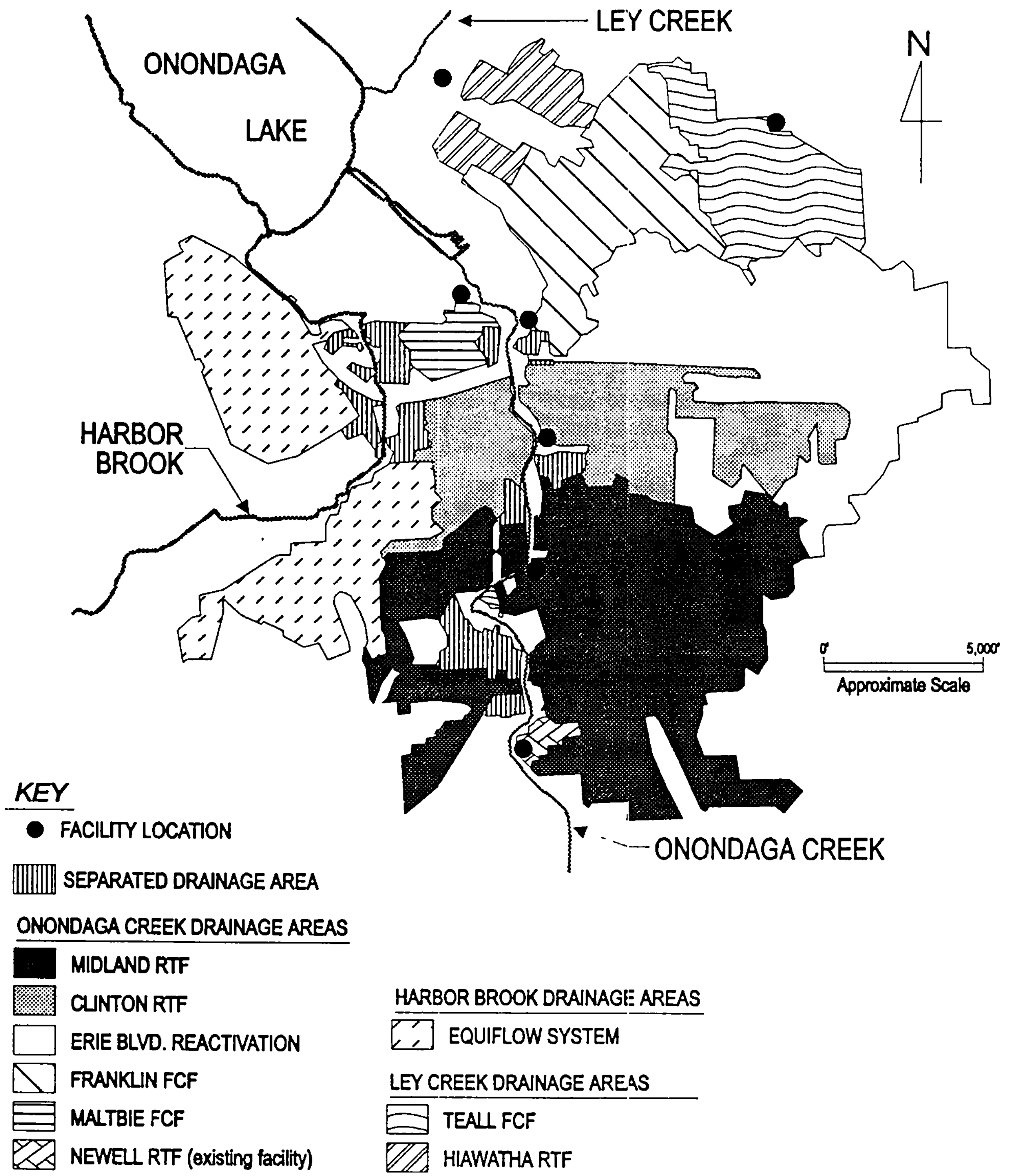

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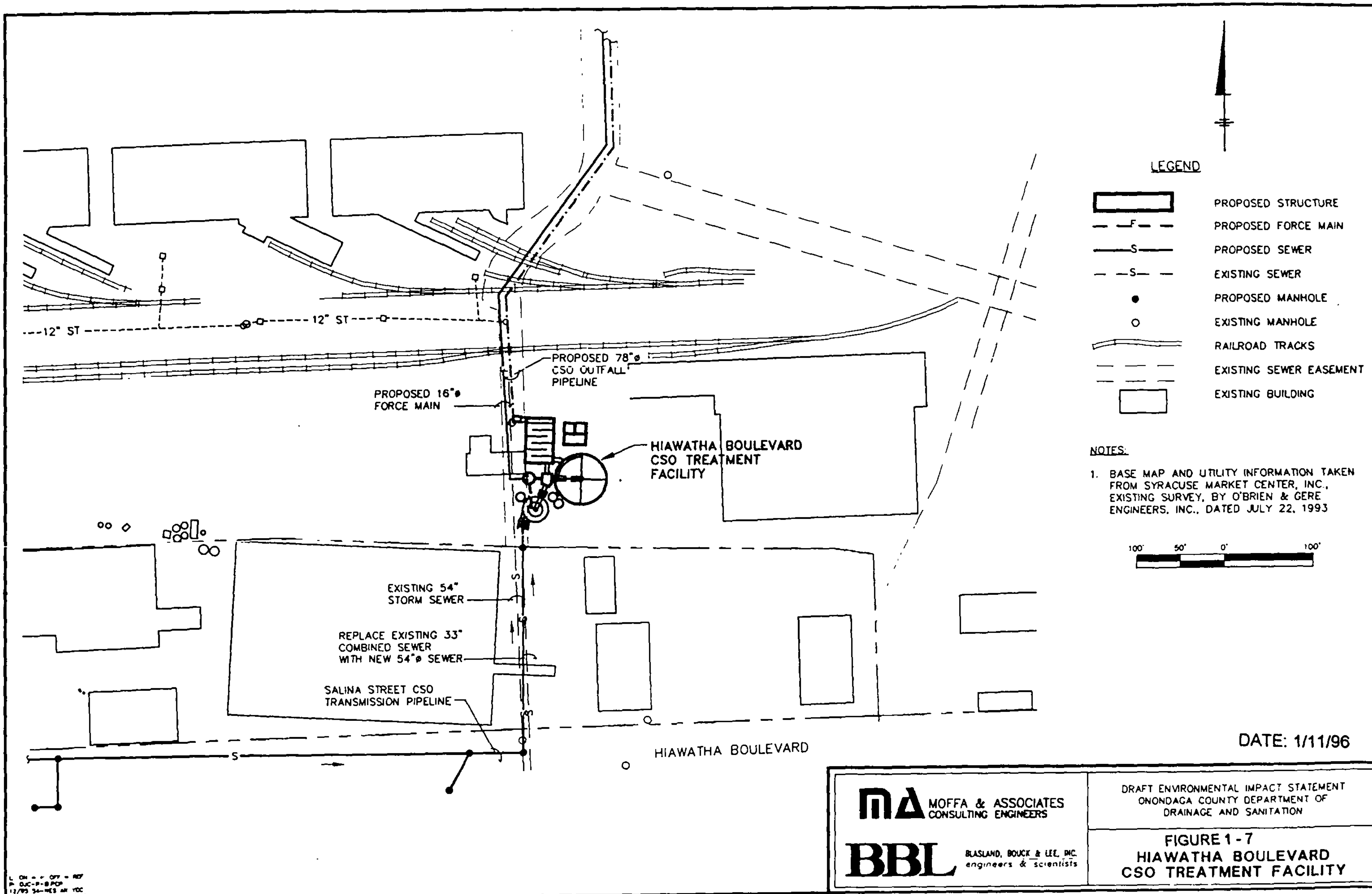
FIGURE 1-6
CSO REGIONAL TREATMENT
FACILITY DRAINAGE BASINS


LEGEND
PROPOSED STRUCTURE
PROPOSED FORCE MAIN
PROPOSED SEWER
EXISTING SEWER
PROPOSED MANHOLE
EXISTING MANHOLE
RAILROAD TRACKS
EXISTING SEWER EASEMENT
EXISTING BUILDING
NOTES:
1. BASE MAP AND UTILITY INFORMATION TAKEN FROM SYRACUSE MARKET CENTER, INC., EXISTING SURVEY, BY O'BRIEN & GERE ENGINEERS, INC., DATED JULY 22, 1993
100' 50' 0' 100'
12" ST
12" ST
PROPOSED 78"ø CSO OUTFALL PIPELINE
PROPOSED 16"ø FORCE MAIN
HIAWATHA BOULEVARD CSO TREATMENT FACILITY
EXISTING 54" STORM SEWER
REPLACE EXISTING 33" COMBINED SEWER WITH NEW 54"ø SEWER
SALINA STREET CSO TRANSMISSION PIPELINE
HIAWATHA BOULEVARD
DATE: 1/11/96
MOFFA & ASSOCIATES CONSULTING ENGINEERS
BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists
DRAFT ENVIRONMENTAL IMPACT STATEMENT
ONONDAGA COUNTY DEPARTMENT OF DRAINAGE AND SANITATION
FIGURE 1-7
HIAWATHA BOULEVARD CSO TREATMENT FACILITY

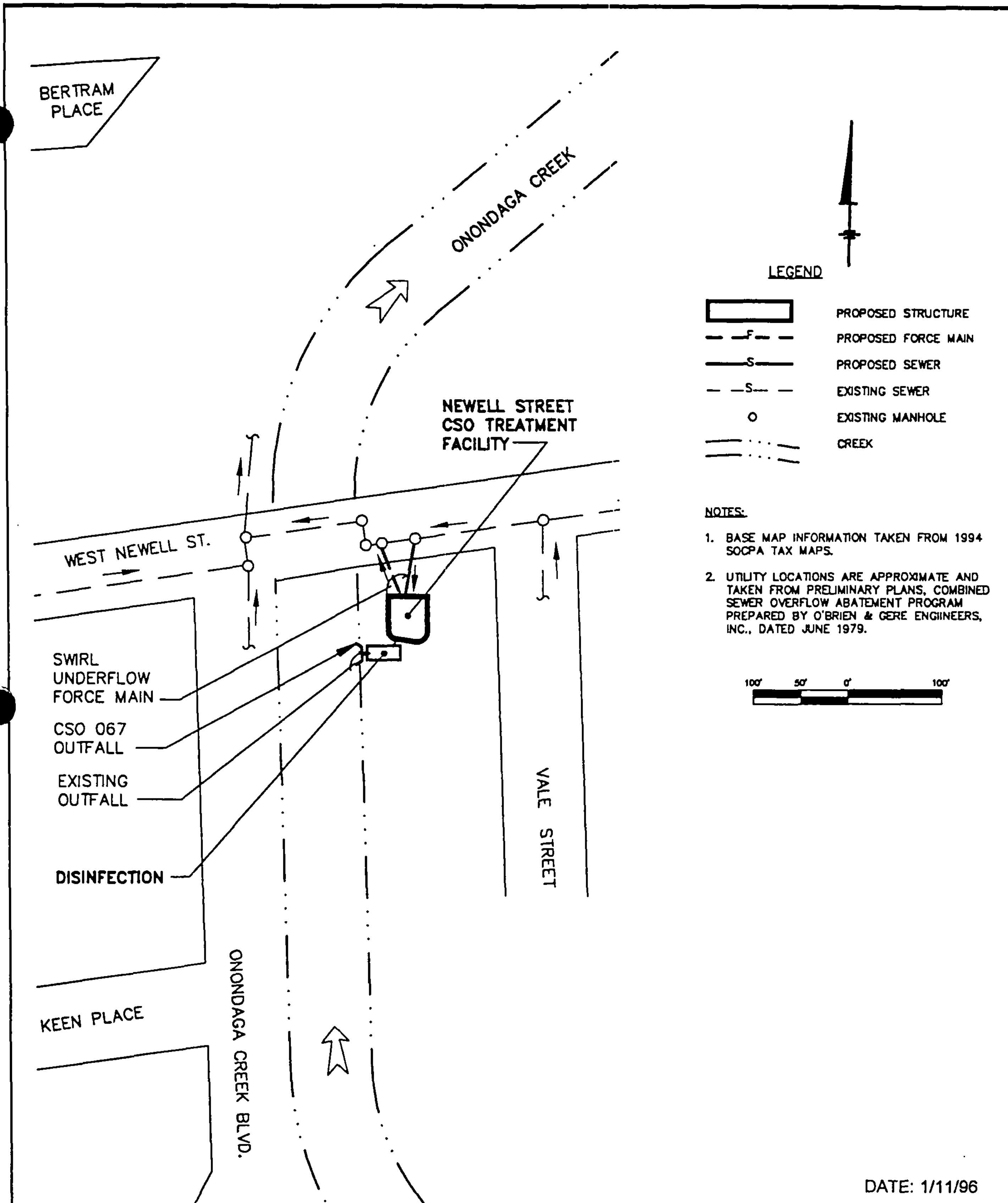


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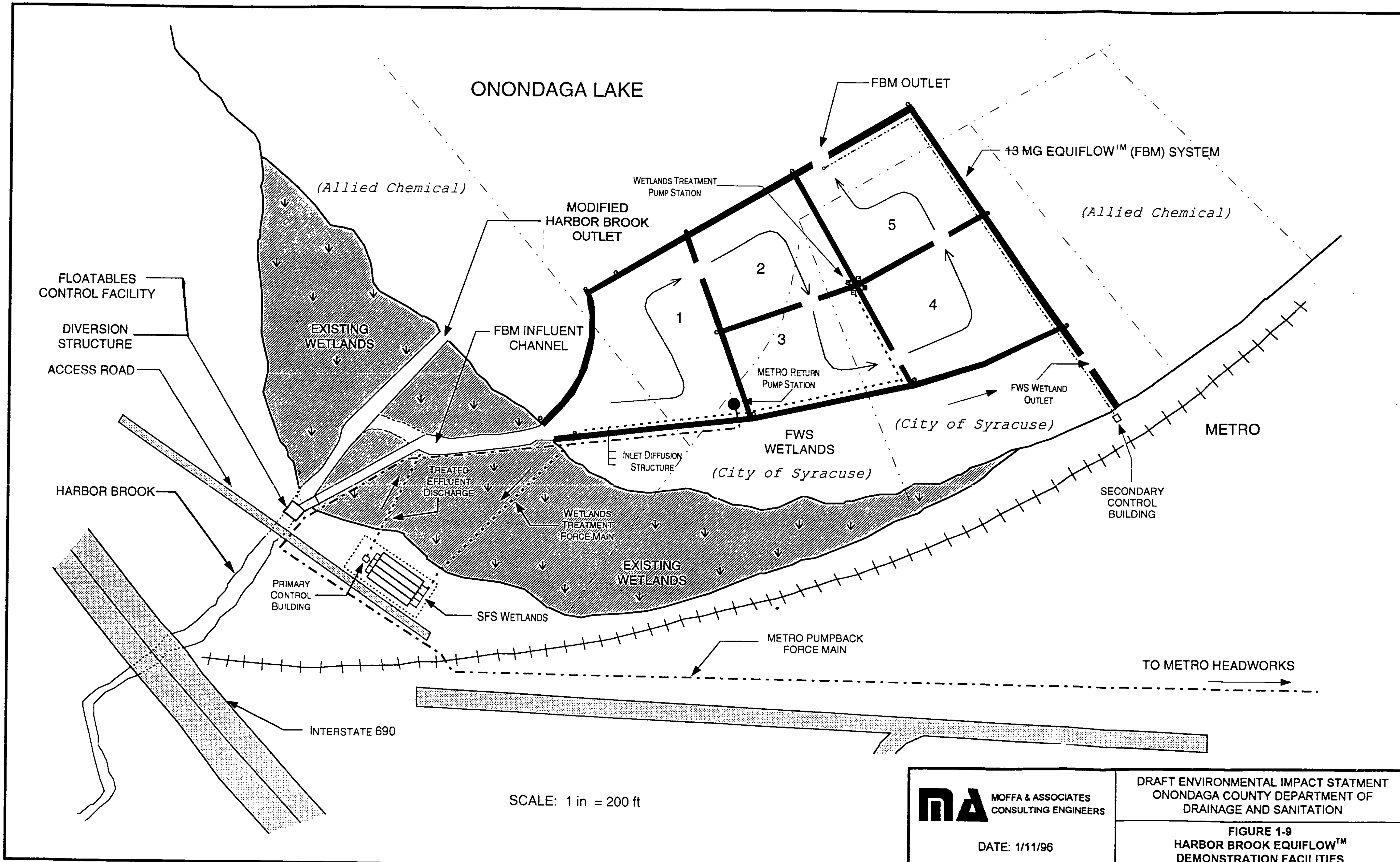
FIGURE 1-8
NEWELL STREET
CSO TREATMENT FACILITY

L: ON = *; OFF = REF
P: DJC-P-8.PCP
1/96 54-NES AK NES
18807036/18807G04.DWG



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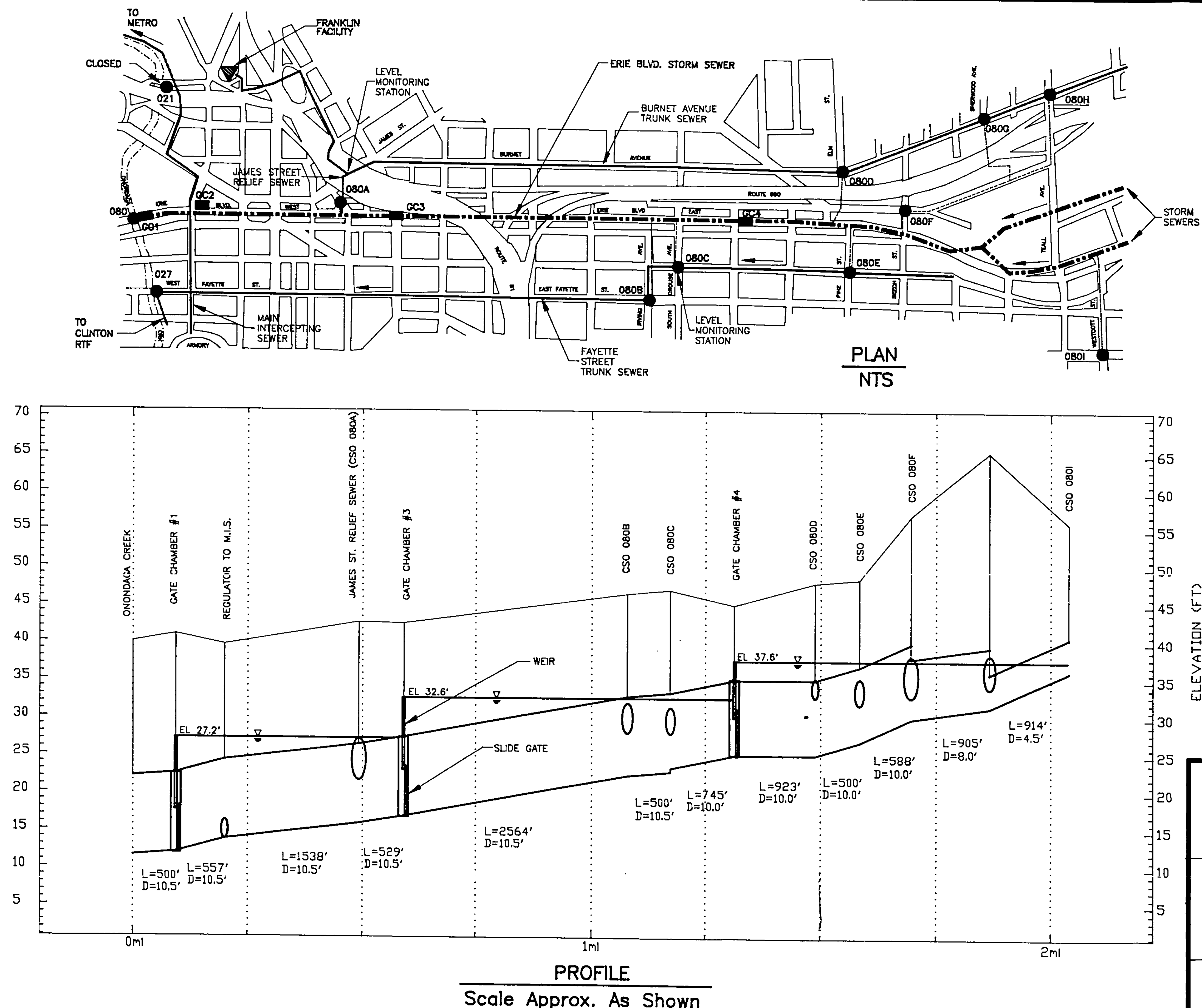
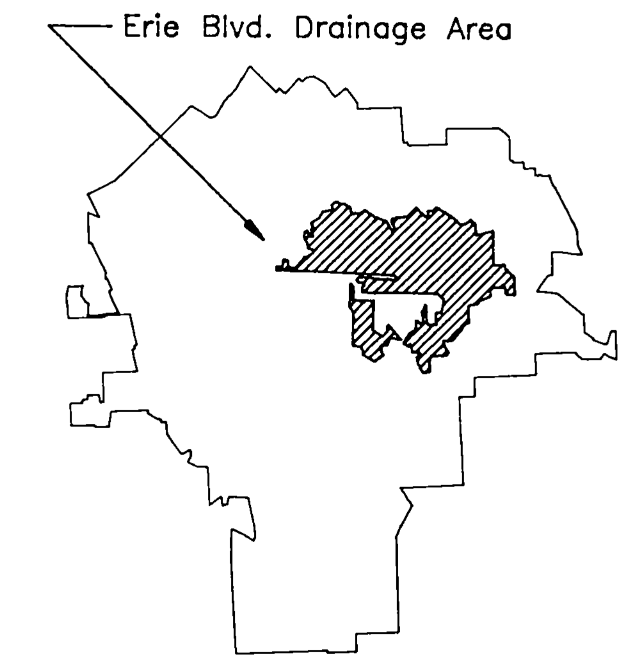
ONONDAGA COUNTY DEPARTMENT OF DRAINAGE AND SANITATION

FIGURE 1-9
HARBOR BROOK EQUIFLOW™ DEMONSTRATION FACILITIES





CITY OF SYRACUSE, NEW YORK

DATE: 1/11/96

DRAFT ENVIRONMENTAL IMPACT STATEMENT
ONONDAGA COUNTY DEPARTMENT OF DRAINAGE AND SANITATION

FIGURE 1-10
ERIE BLVD. STORM SEWER SYSTEM OPERATION (SLUICE GATES CLOSED)

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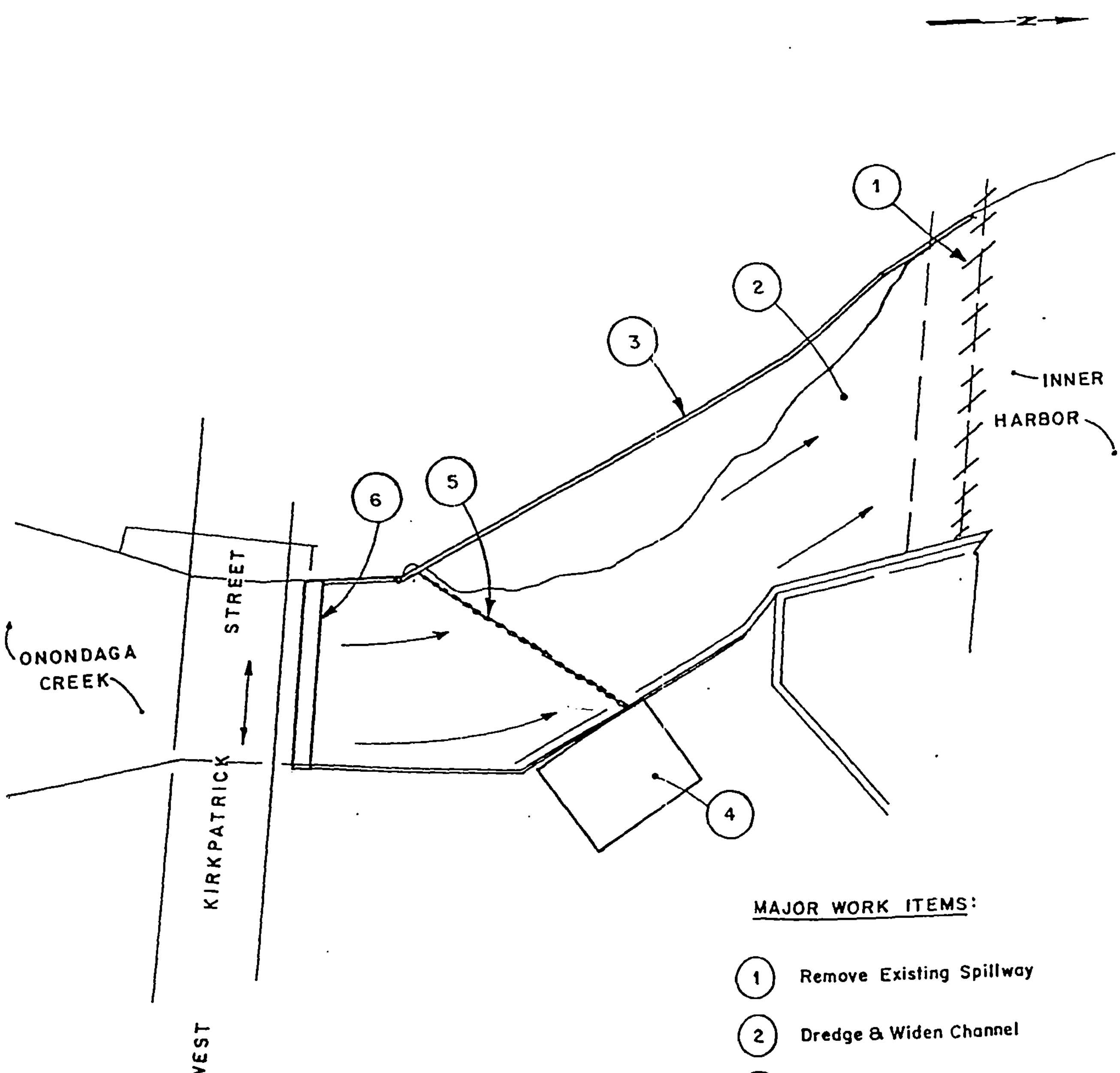
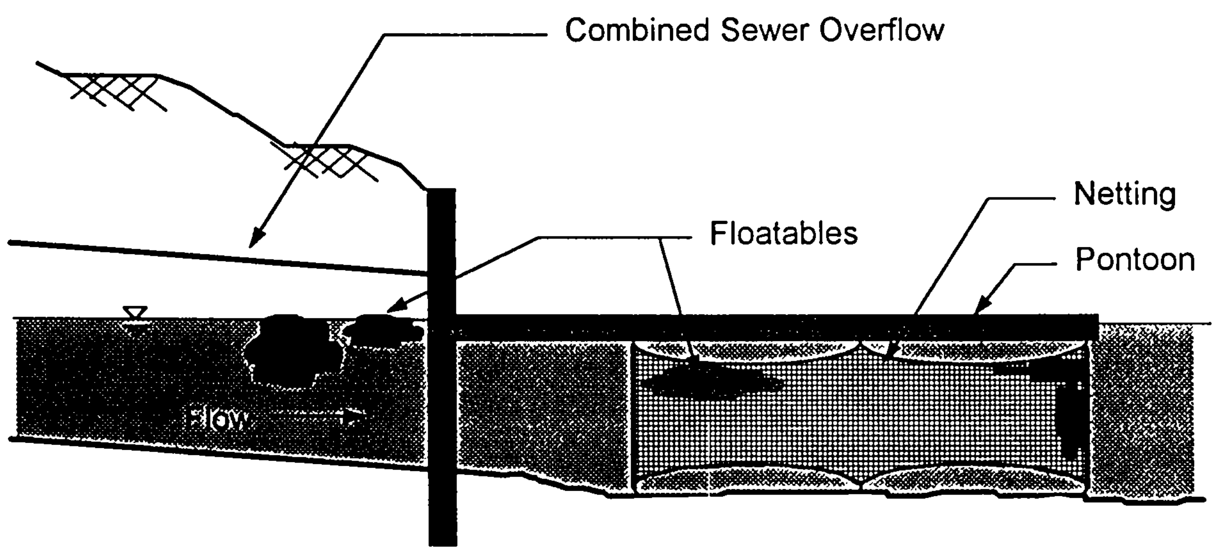


MAJOR WORK ITEMS:

1. Remove Existing Spillway
2. Dredge & Widen Channel
3. Sheet Both Sides Of Channel
4. Construct Floatables Collection Structure
5. Construct Boom System
6. Construct New Spillway

Source: C&S Engineers, Inc. (December, 1994)

MOFFA & ASSOCIATES CONSULTING ENGINEERS	DRAFT ENVIRONMENTAL IMPACT STATMENT ONONDAGA COUNTY DEPARTMENT OF DRAINAGE AND SANITATION
DATE: 1/11/96	FIGURE 1-11 ONONDAGA CREEK FLOATABLES ENTRAPMENT FACILITY



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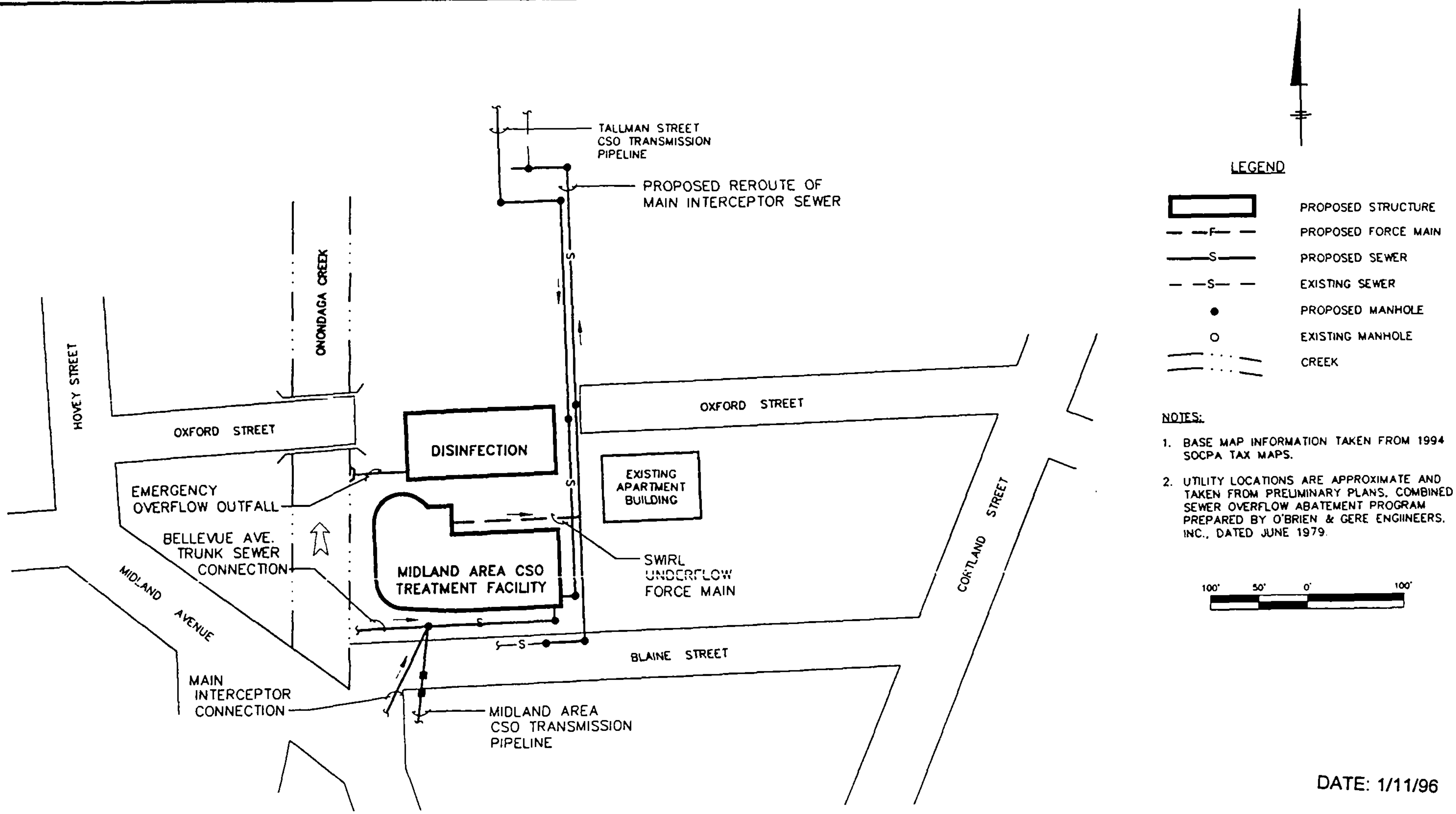
ONONDAGA COUNTY DEPARTMENT OF
DRAINAGE AND SANITATION

FIGURE 1 - 12
TYPICAL NETTING DEVICE



DATE: 1/11/96

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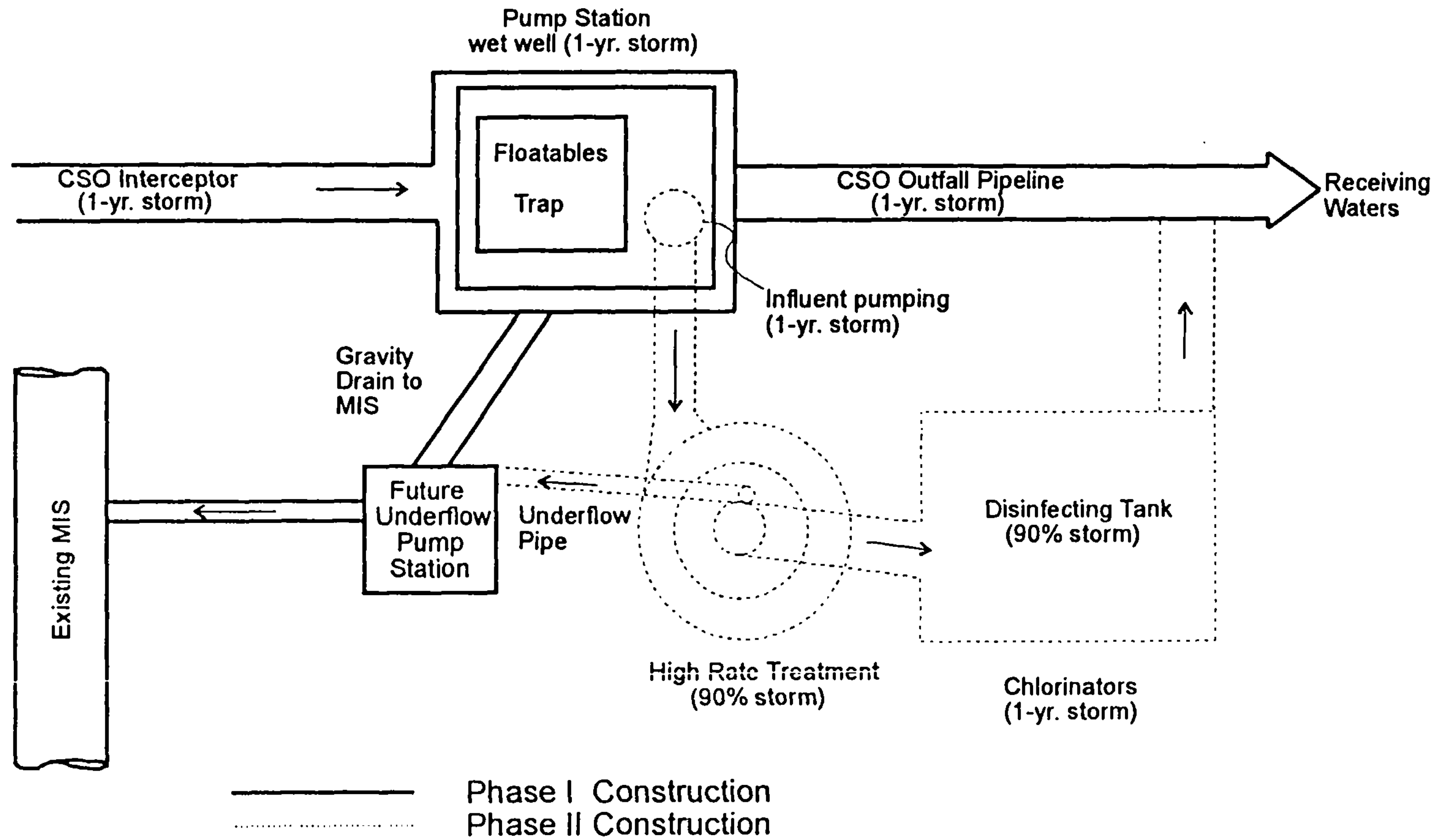
ONONDAGA COUNTY DEPARTMENT OF
DRAINAGE AND SANITATION

FIGURE 1 - 13
MIDLAND AREA
CSO TREATMENT FACILITY



NOTES: 1. Floatables trap will be removed during Phase II Construction
2. Underflow pumps and sluce gates will be added to underflow pump station in Phase II

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FIGURE 1-14
PHASED CONSTRUCTION OF
REGIONAL TREATMENT FACILITIES

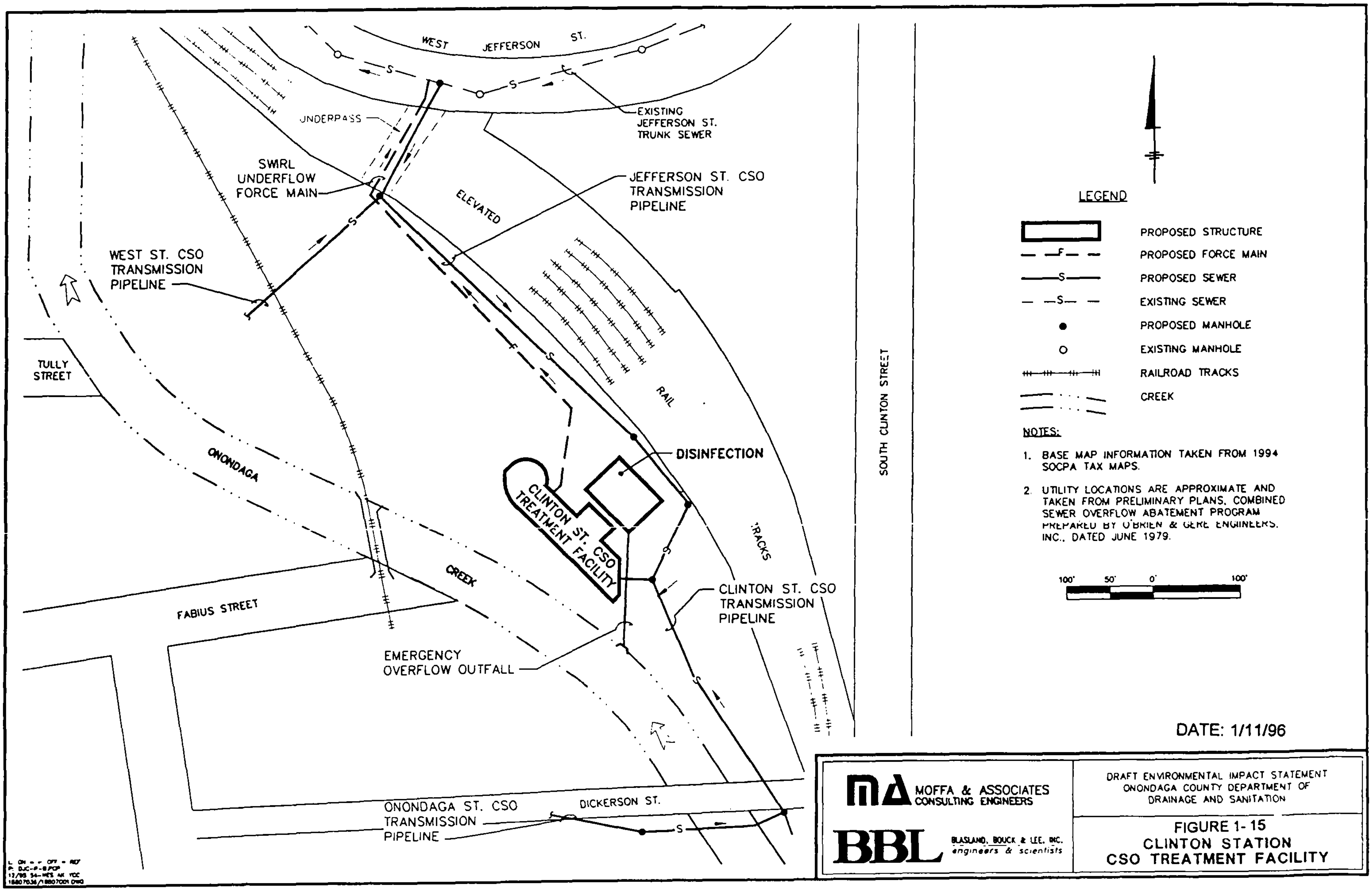
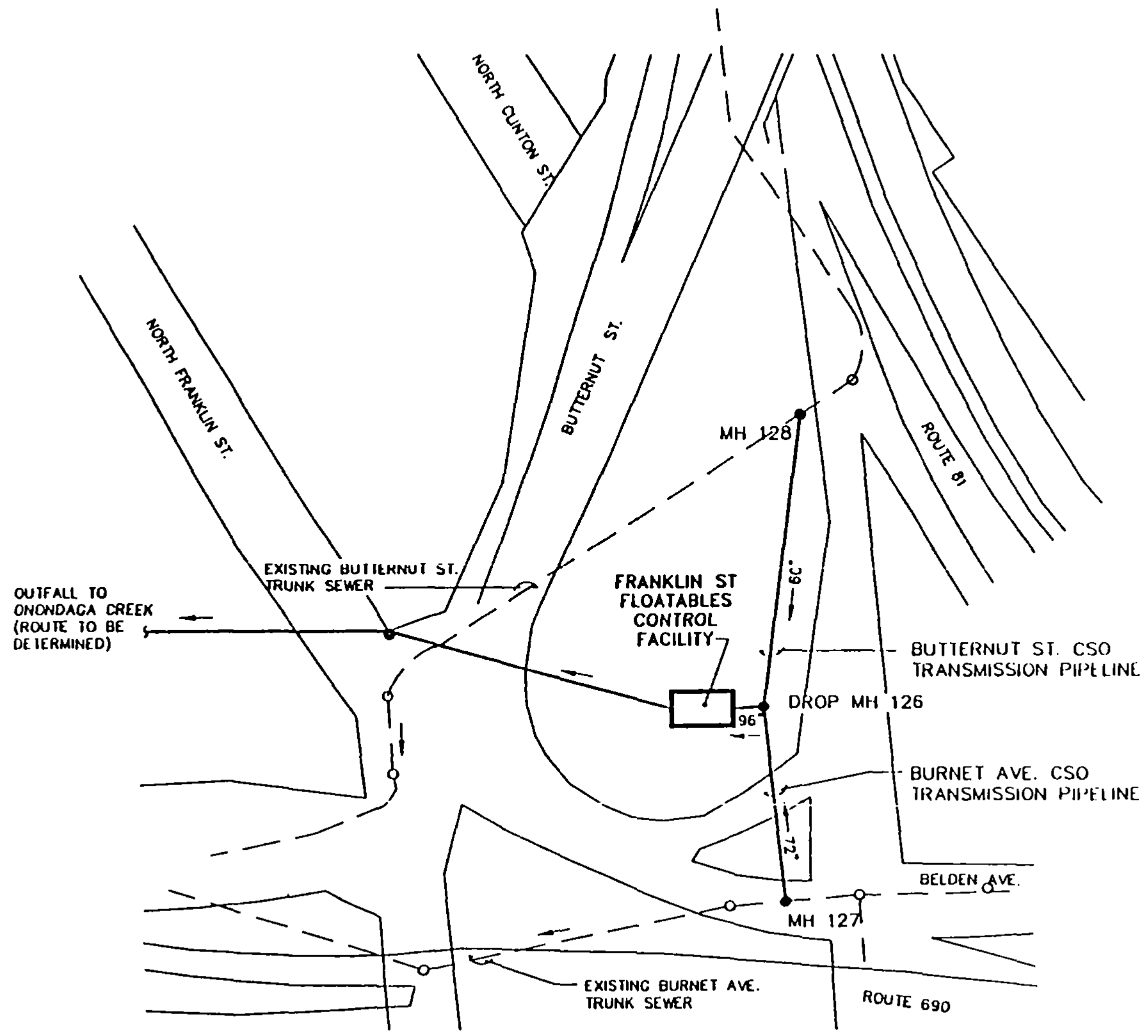
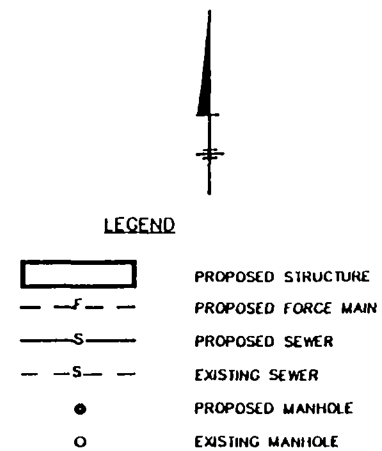


FIGURE 1-15
CLINTON STATION
CSO TREATMENT FACILITY





NOTES:

1. BASE MAP INFORMATION TAKEN FROM PRELIMINARY PLAN, COMBINED SEWER OVERFLOW ABATEMENT PROGRAM PREPARED BY O'BRIEN & GERE ENGINEERS, INC., DATED JUNE 1979.
2. UTILITY LOCATIONS ARE APPROXIMATE AND TAKEN FROM PRELIMINARY PLANS, COMBINED SEWER OVERFLOW ABATEMENT PROGRAM PREPARED BY O'BRIEN & GERE ENGINEERS, INC., DATED JUNE 1979.

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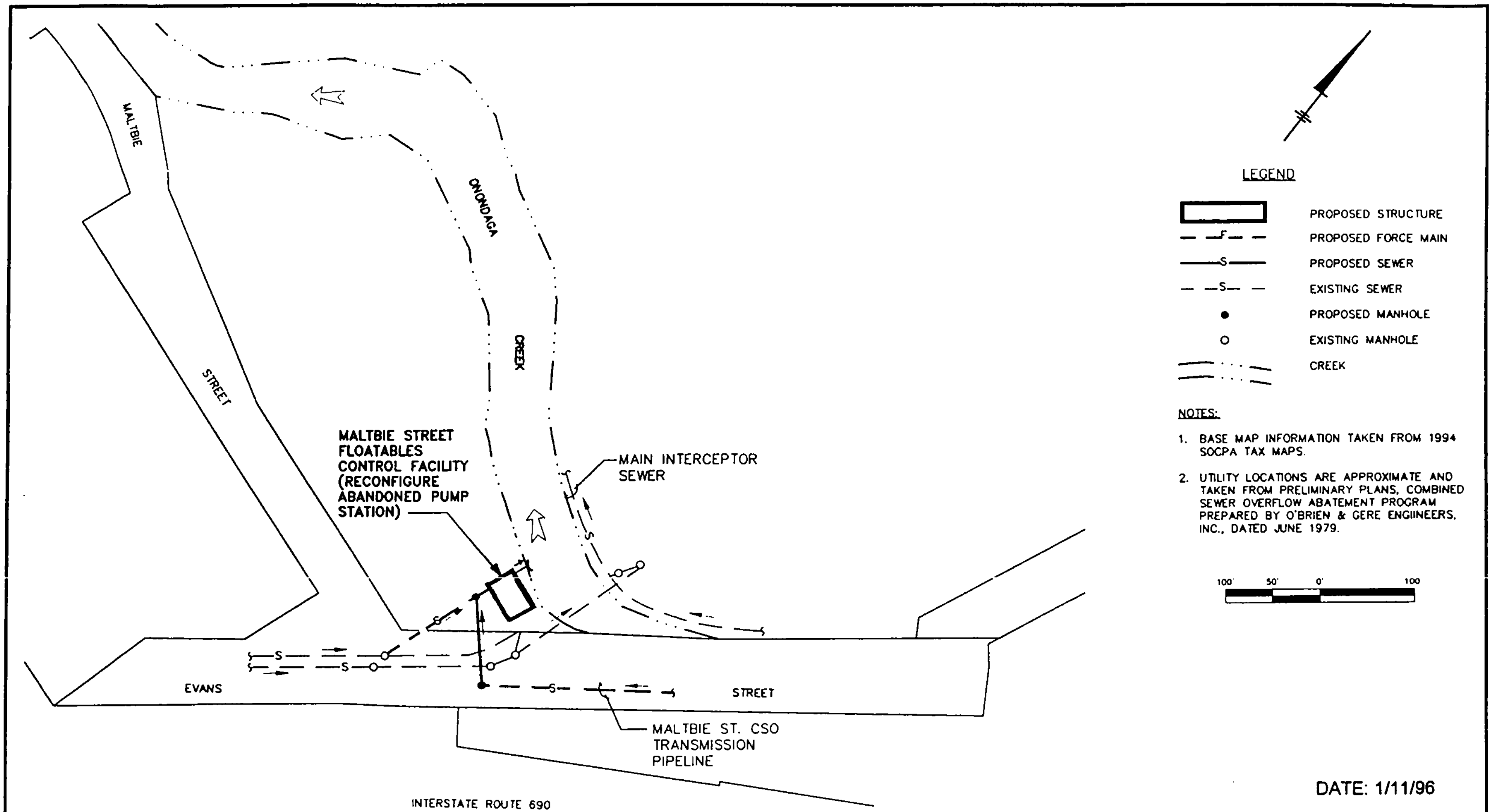
ONONDAGA COUNTY DEPARTMENT OF
DRAINAGE AND SANITATION

FIGURE 1-16
FRANKLIN STREET
FLOATABLES CONTROL FACILITY



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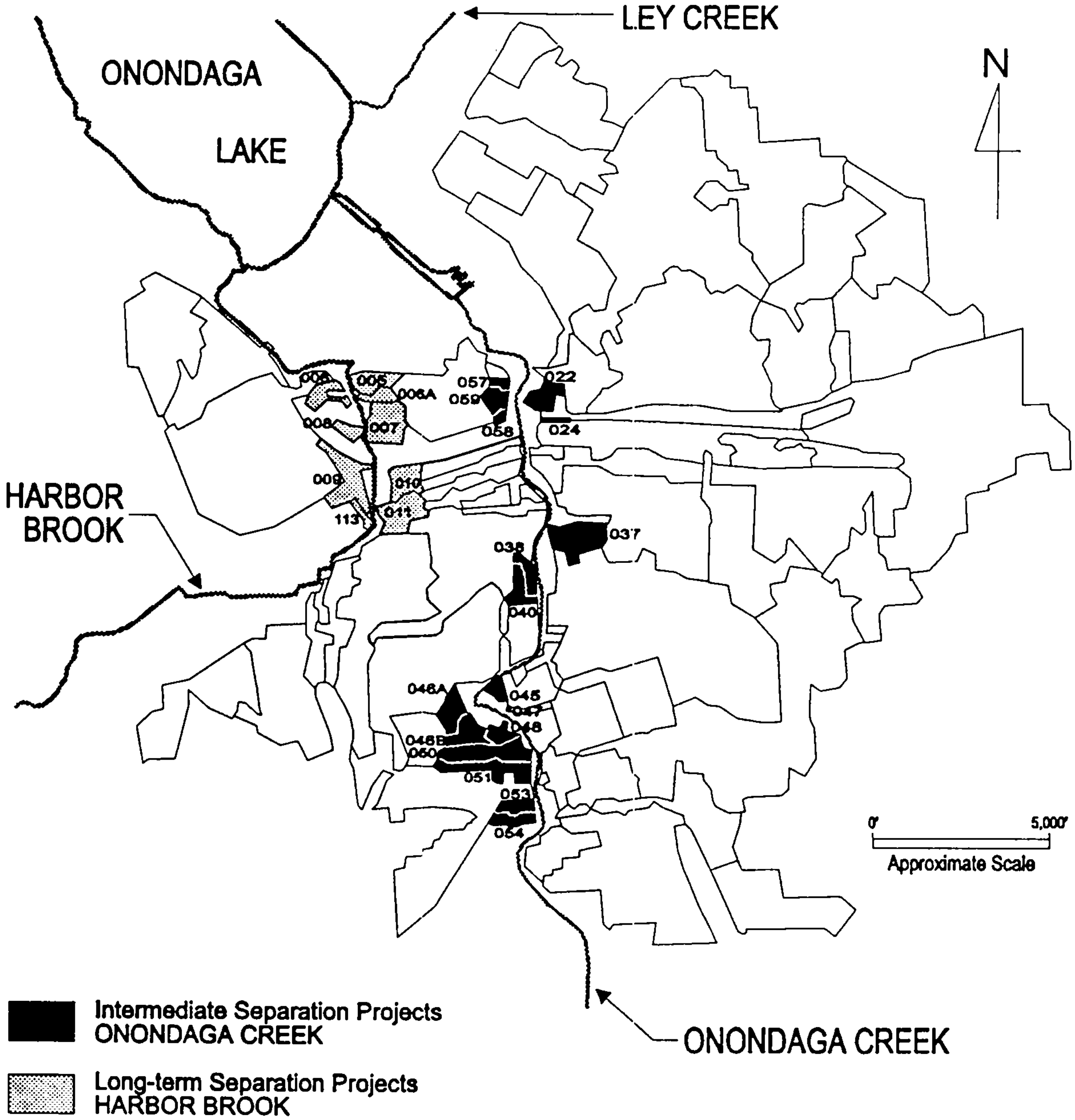
ONONDAGA COUNTY DEPARTMENT OF DRAINAGE AND SANITATION

FIGURE 1-17
MALTBIE STREET FLOATABLES CONTROL FACILITY



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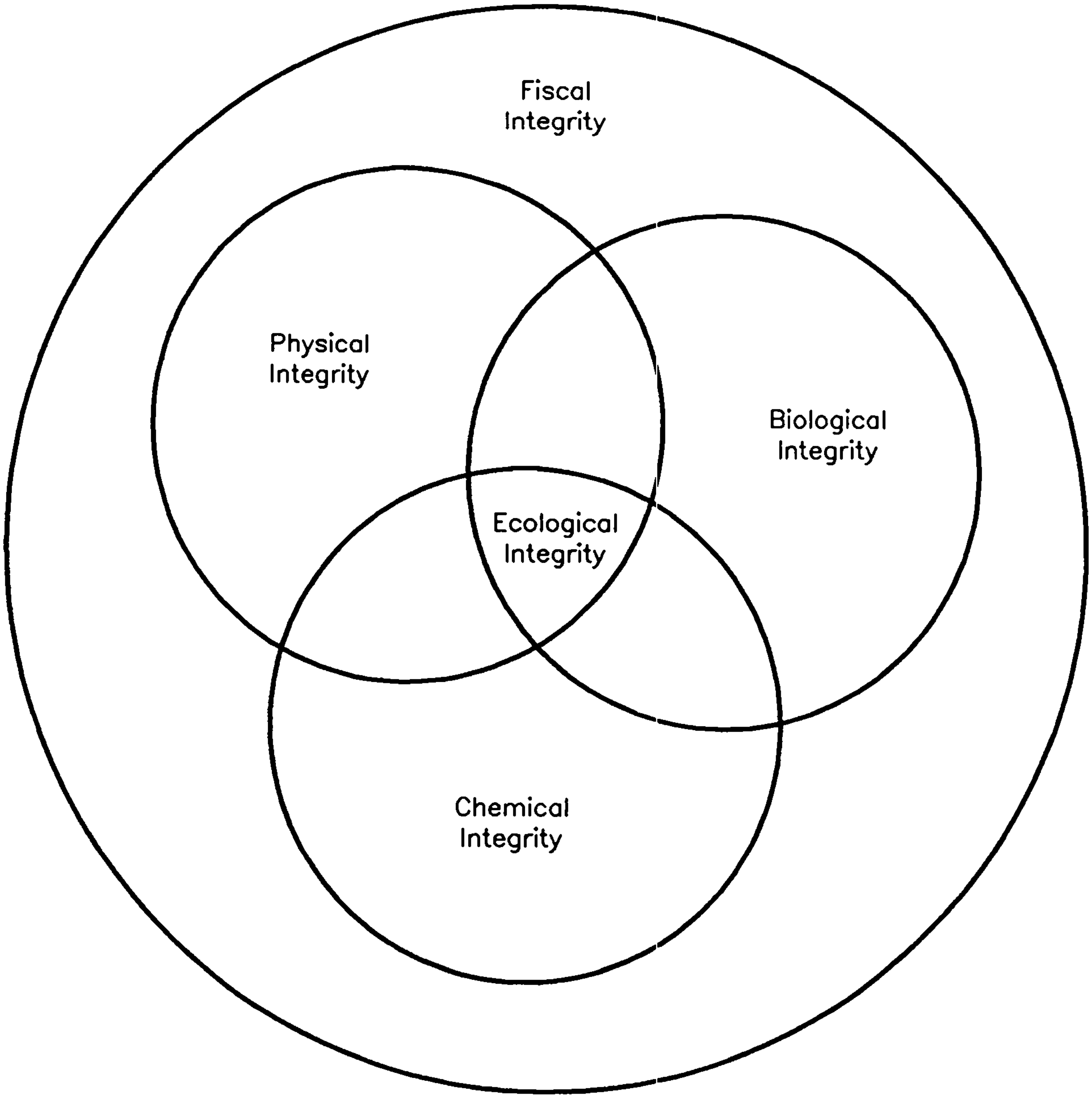
DRAINAGE AND SANITATION

FIGURE 1-18
AREAS RECOMMENDED FOR SEWER SEPARATION



Adapted from: EPA. April 1990. Biological Criteria

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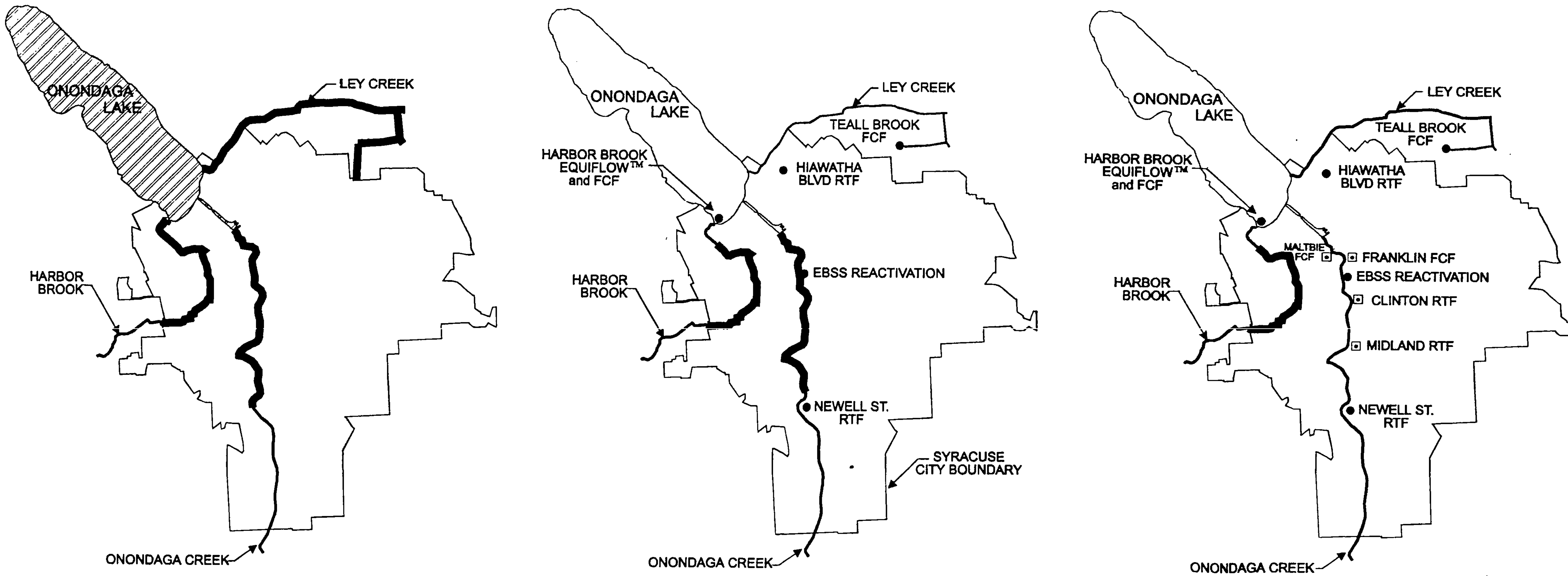
DATE: 1/11/96 JOB No.: 2298	FIGURE 1-19 THE ELEMENTS OF ECOLOGICAL INTEGRITY

CSO FLOATABLES ABATEMENT

EXISTING CONDITIONS 1996 | COMPLETION OF INTERIM PHASE 2000 | COMPLETION OF INTERMEDIATE PHASE 2020



KEY

- ● INTERIM FACILITIES
- ⊡ INTERMEDIATE FACILITIES
- RTF - REGIONAL TREATMENT FACILITY
- FCF - FLOATABLES CONTROL FACILITY
- ▬ CSO FLOATABLES IMPACTED WATERS

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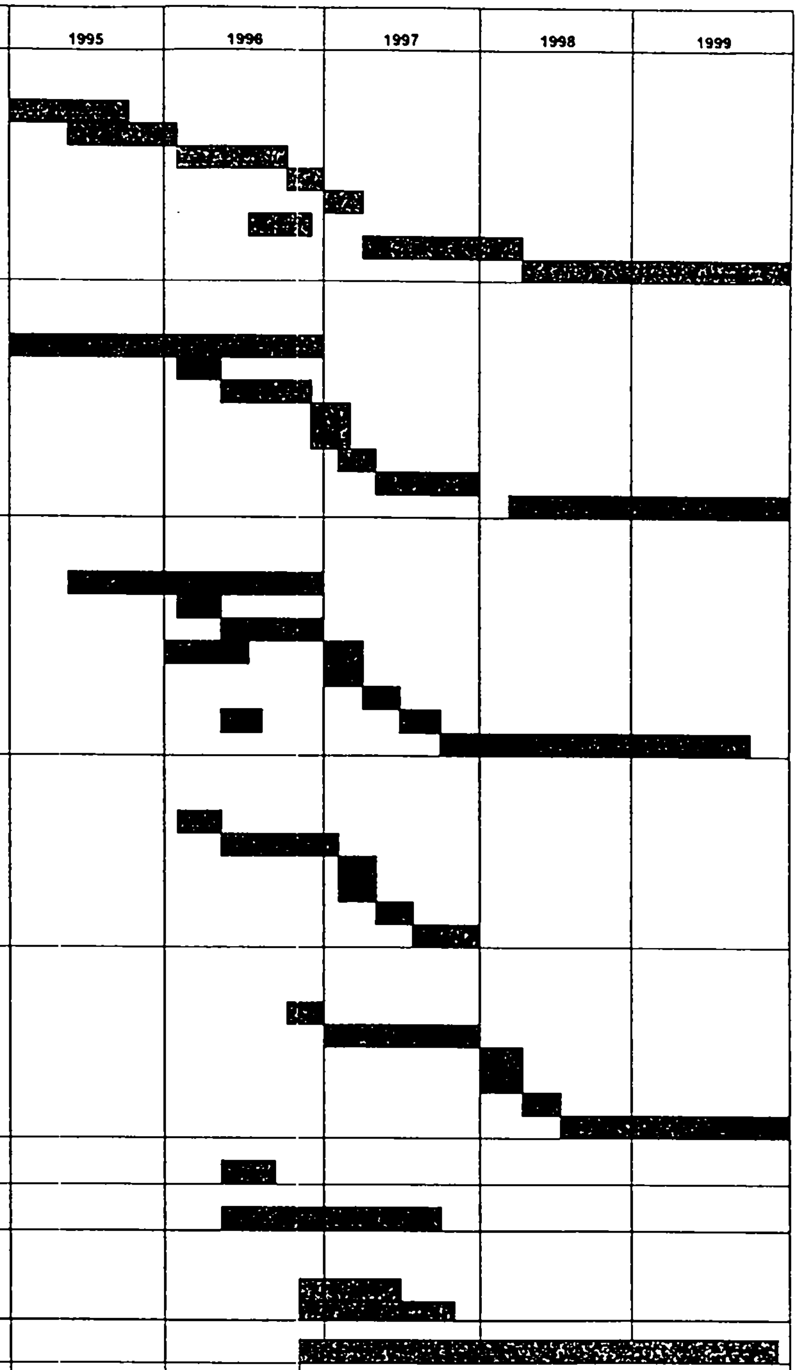
DRAFT ENVIRONMENTAL IMPACT STATEMENT
ONONDAGA COUNTY DEPARTMENT OF DRAINAGE AND SANITATION

FIGURE 1 - 20
ONONDAGA LAKE FLOATABLES CONTROL PLAN

PROJECT NAME	Project Cost (ENR 5870)
1. Hiawatha RTF Demonstration	7,980,000
Design Pipelines	
ACOE Contractural Arrangements	
Facility Design	
Regulatory & Environmental Reviews	
Bidding & Execution of Construction Contrac	
Pipeline Construction	
RTF Construction	
Demonstration Testing	
2. Newell Street	1,310,000
NYSERDA Grant Administration	
Contractural Arrangements	
Facility Design	
Regulatory & Environmental Reviews	
Project Funding Arrangements	
Bidding & Execution of Construction Contrac	
Construction	
Demonstration Testing	
3. Harbor Brook EquiFlow & Wetlands	5,440,000
EPA Grant Administration	
Contractural Arrangements	
Facility Design	
Regulatory & Environmental Reviews	
Project Funding Arrangements	
Bidding & Execution of Construction Contrac	
Construction	
Demonstration Testing	
4. EBSS Storage Upgrade	2,250,000
Contractural Arrangements	
Facility Design	
Regulatory & Environmental Reviews	
Project Funding Arrangements	
Bidding & Execution of Construction Contrac	
Construction	
5. Kirkpatrick Street PS Upgrade	5,640,000
Contractural Arrangements	
Facility Design	
Regulatory & Environmental Reviews	
Project Funding Arrangements	
Bidding & Execution of Construction Contrac	
Construction	
6. Siphon Evaluation	330,000
7. CSO Toxic Evaluation	300,000
8. Floatables Entrapment	
A. Teall Ave Trashtrap	180,000
B. Onondaga Cr. Floatables Boom	(by others)
9. Non-Point Data Collection	(by others)
TOTAL COST**	$23,430,000



** Includes some currently authorized projects

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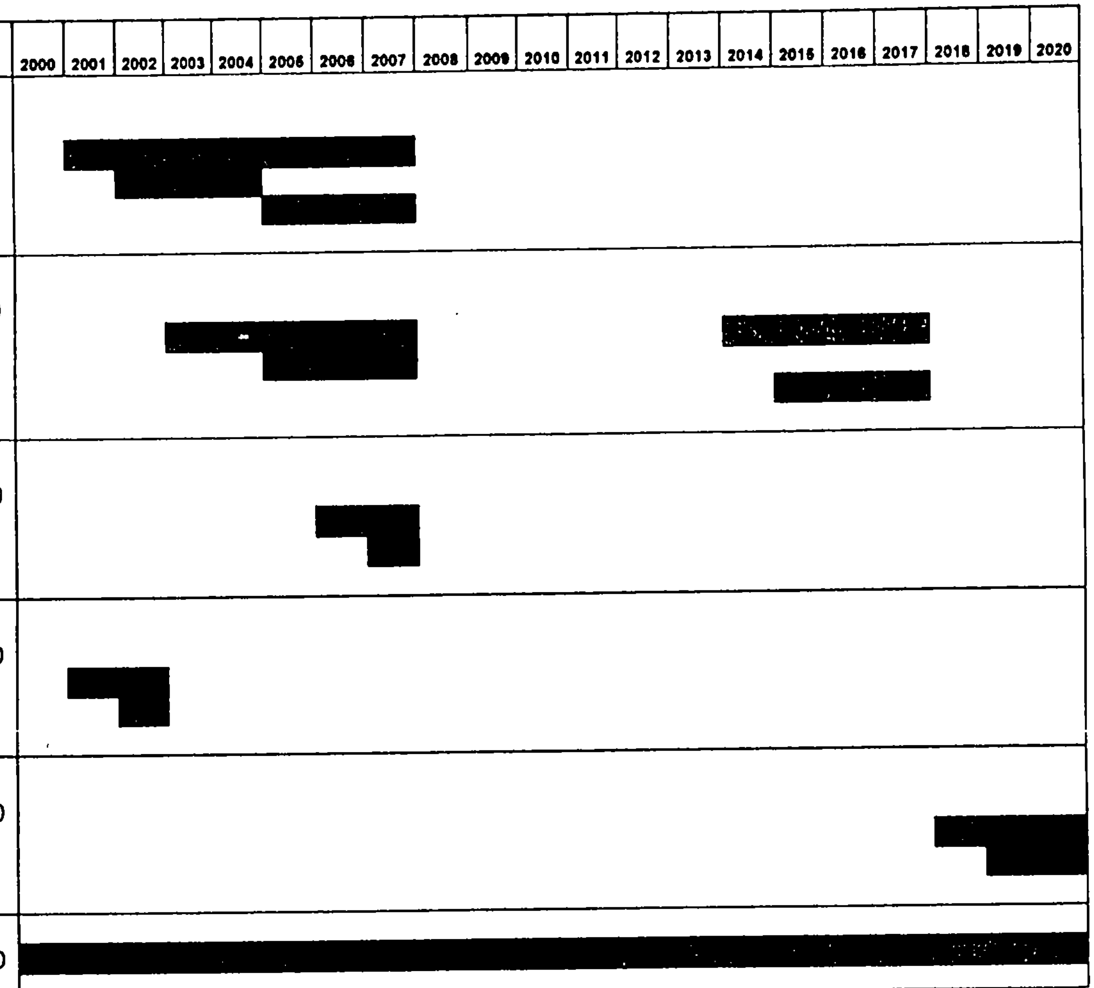
ONONDAGA COUNTY DEPARTMENT OF
DRAINAGE AND SANITATION

FIGURE 1-21
CSO INTERIM PROJECTS
IMPLEMENTATION SCHEDULE

PROJECT NAME	Project Cost (ENR 5870)
1. Midland RTF	74,530,000
Administration / Engineering	
Pipeline / Floatables Construction	
Regional Treatment Facility Construction	
2. Clinton Station RTF	30,190,000
Administration / Engineering	
Pipeline / Floatables Construction	
Regional Treatment Facility Construction	
3. Franklin Street FCF	3,200,000
Administration / Engineering	
Pipeline / Floatables Construction	
4. Maltbie Street FCF	2,550,000
Administration / Engineering	
Pipeline / Floatables Construction	
5. Sewer Sepatation	8,700,000
Administration / Engineering	
Sewer Separation Projects	
6. Effectiveness Evaluation Monitoring	1,500,000
TOTAL COST	**$120,670,000**



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ONONDAGA COUNTY DEPARTMENT OF DRAINAGE AND SANITATION

FIGURE 1-22
CSO INTERMEDIATE PROJECTS IMPLEMENTATION SCHEDULE

	Project Cost (July 1995)	1995	1996	1997	1998	1999
1. SPDES Permit Modification (Phosphorus and Ammonia Cap)						
2. BMS Industrial Wastewater Pretreatment System						
3. METRO Operating Changes						
4. METRO Digital System Improvements	$2,900,000					
Contractual Arrangements						
Design						
Regulatory and Environmental Reviews						
Project Funding Arrangements						
Bidding and Execution of Construction Contracts						
Construction						
5. Residuals Handling and Odor Control Improvements	$7,500,000					
Design						
Regulatory and Environmental Reviews						
Project Funding Arrangements						
Bidding and Execution of Construction Contracts						
Construction and Startup						
6. Digester Modifications/Mechanical Sludge Thickening	$6,700,000					
Preliminary Design - Modifications to Digester No. 4						
Evaluation of Sludge Thickening System Improvements						
Contractual/Project Funding Arrangements						
Final Design						
Regulatory and Environmental Reviews						
Bidding and Execution of Construction Contracts						
Construction and Startup						
7. Other Plant Improvements	$1,400,000					
Design						
Regulatory and Environmental Reviews						
Project Funding Arrangements						
Bidding and Execution of Construction Contracts						
Construction and Startup						
8. Permanent Phosphorus Removal Facilities	$2,400,000					
Contractual/Project Funding Arrangements						
Design						
Regulatory and Environmental Reviews						
Bidding						
Construction and Startup						
9. Monitoring and Assessment of METRO Plant Performance						
Monitoring and Assessment of METRO Performance						
Interim/Final Reports						
10. SPDES Permit Modification (Phase 1 Reductions)						
11. Demonstration Project - Hypolimnetic Oxygenation	not available					
12. Water Quality Monitoring and Assessment Program						
Total Project Cost =	$20,900,000	**				

** Includes some currently authorized projects.

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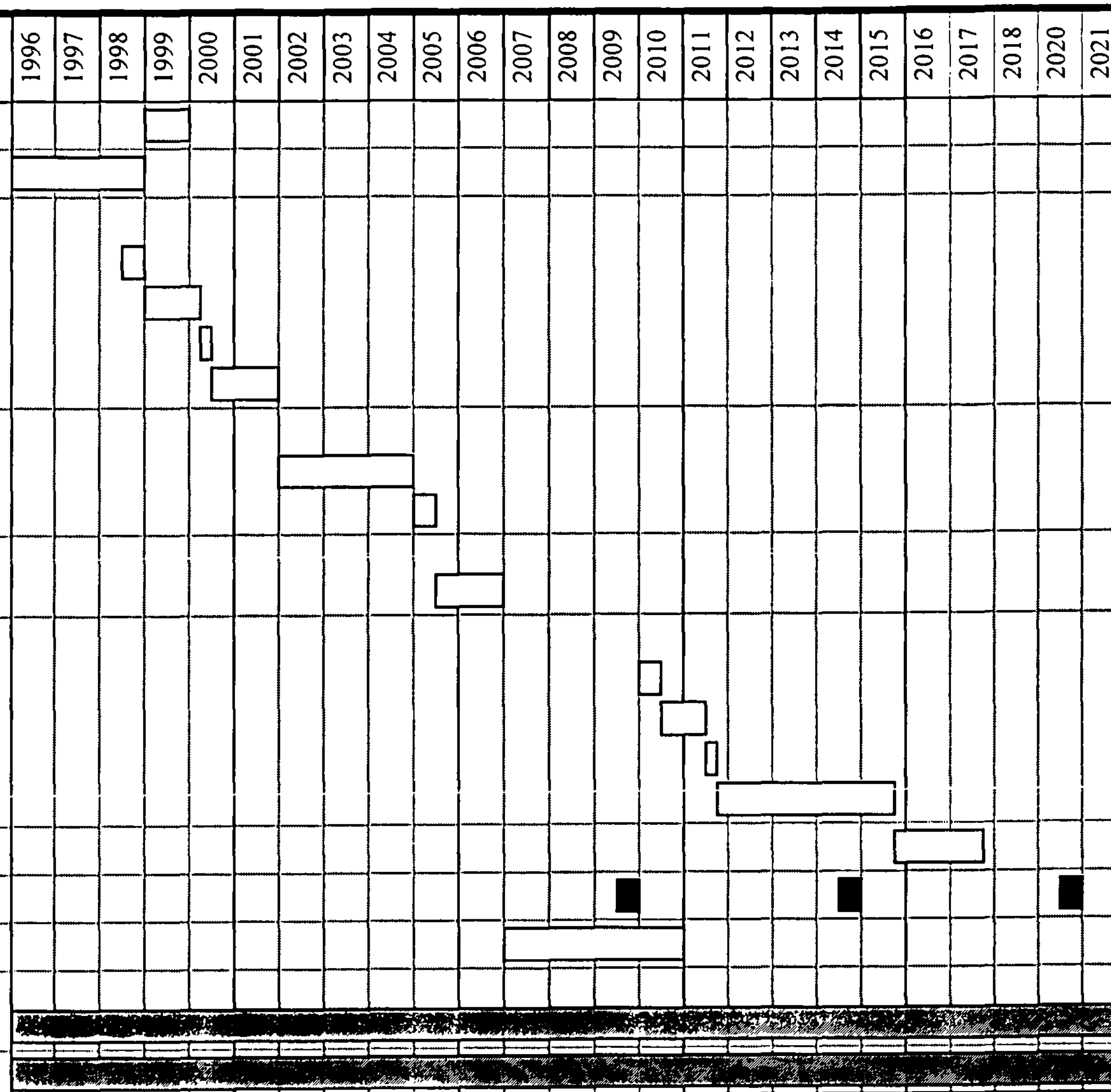
	Project Cost (July 1995)
1. Acquisition of NIMO Property	Unknown
2. Relocation of Sewer Maintenance Group	$5,800,000
3. 1/4-Scale Plant Upgrade	$32,700,000
Contractual/Project Funding Arrangements	
Preliminary and Final Design	
Bidding and Execution of Construction Contracts	
Construction and Startup	
4. Ammonia Removal Demonstration	
Operation and Performance Assessment	
SPDES Permit Modification	
5. Process Selection and Development of Final Design Criteria	
6. Full-Scale Plant Upgrade	$73,800,000
Contractual/Project Funding Arrangements	
Preliminary and Final Design	
Bidding and Execution of Construction Contracts	
Construction and Startup	
7. Monitoring and Assessment of METRO Performance	
8. SPDES Permit Modification	
9. Full-Scale Hypolimnetic Oxygenation Project	
10. Monitoring of Progress of Industry-Related Lake Remediation	
11. Water Quality Monitoring and Assessment Program	
Total Project Cost =	$112,300,000



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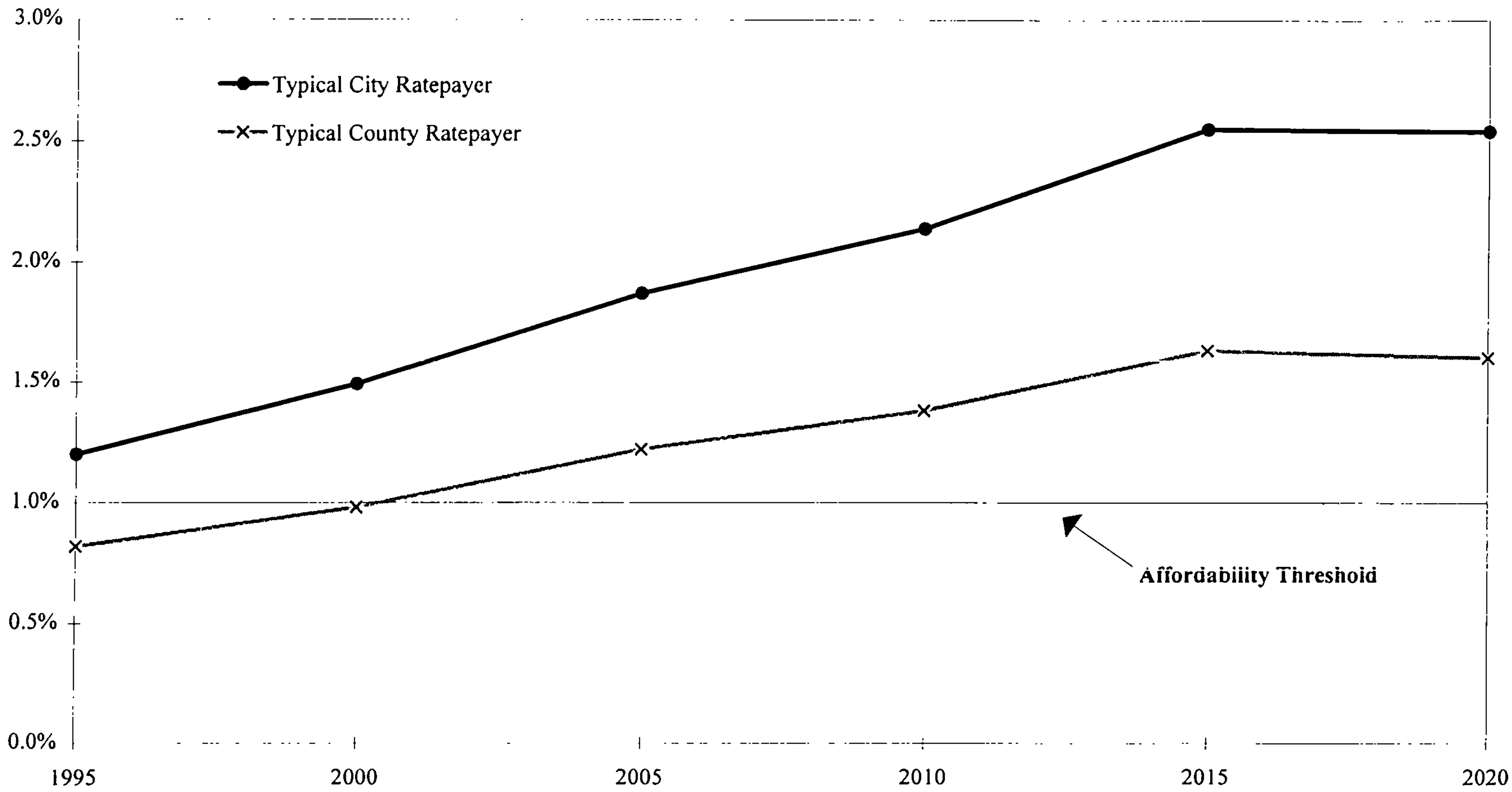
ONONDAGA COUNTY DEPARTMENT OF DRAINAGE AND SANITATION

FIGURE 1-24
INTERMEDIATE ACTIONS: METRO IMPROVEMENTS

Projected Household Bills as a Percentage of Median Household Income



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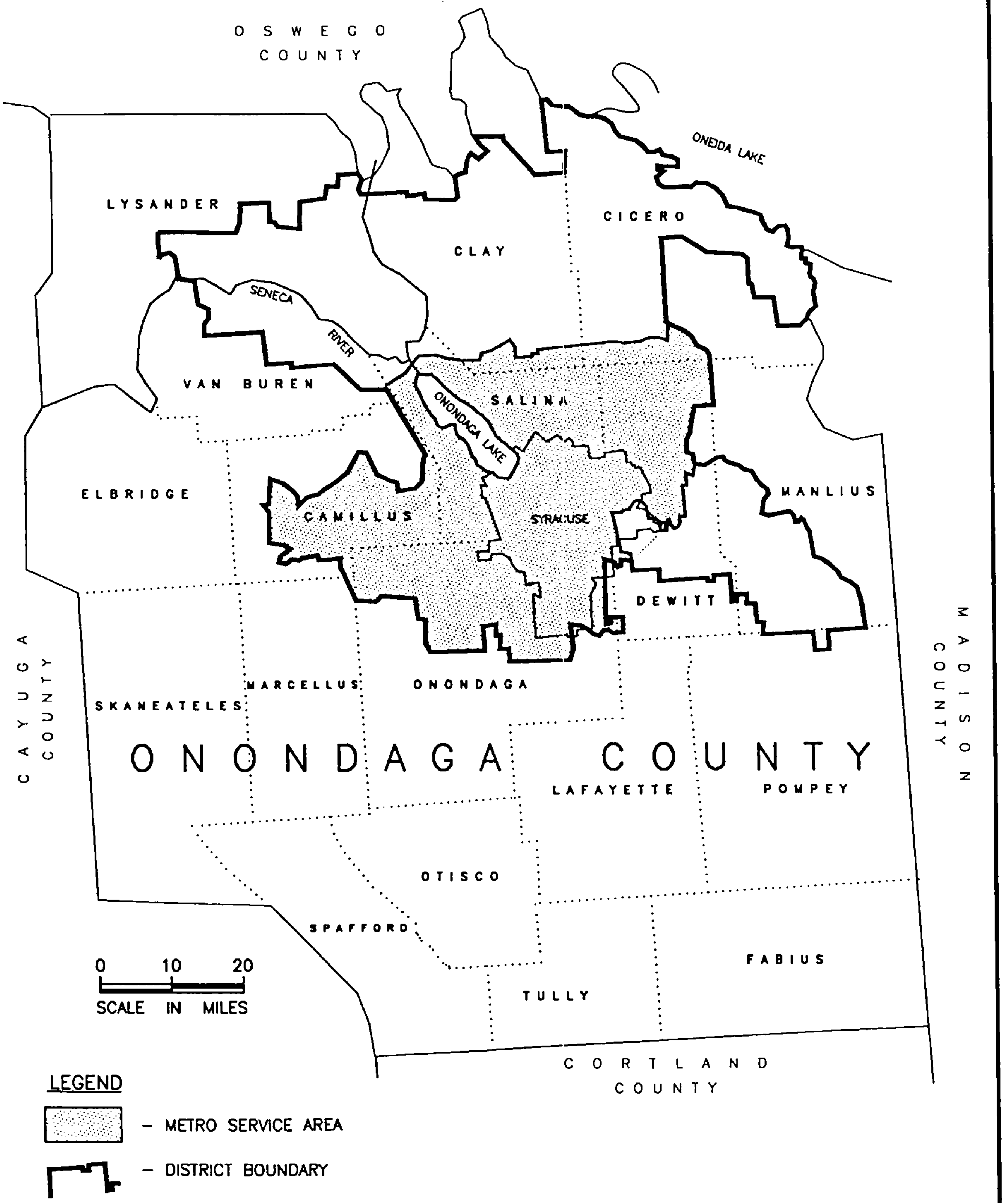
DATE: 1/11/96 JOB No.: 2298

DRAFT ENVIRONMENTAL IMPACT STATEMENT
ONONDAGA COUNTY DEPARTMENT
OF DRAINAGE AND SANITATION

FIGURE 1-25
AFFORDABILITY OF MCP ACTION



Stearns&Wheler
ENVIRONMENTAL ENGINEERS & SCIENTISTS

DATE: 1/11/96 JOB No.: 2298

DRAFT ENVIRONMENTAL IMPACT STATEMENT
ONONDAGA COUNTY DEPARTMENT OF DRAINAGE AND SANITATION

FIGURE 1-26
ONONDAGA COUNTY SANITARY DISTRICT

	Harbor Brook		Ley Creek		Onondaga Creek							METRO
	Equiflow™	FCF	Hiawatha RTF	Teall FCF	Onondaga Cree FCF	EBSS	Newell RTF	Midland RTF	Clinton Sta. RTF	Franklin FCF	Maltbie FCF	Improvements
ENVIRONMENTAL PERMITS												
City of Syracuse												
Floodprone Area Permit	✓						✓	✓				✓
State of New York												
SPDES			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Freshwater Wetland Permits	✓		✓									
Streambed or Bank Disturbance	✓	✓		✓	✓		✓	✓	✓	✓	✓	
Stream Crossing								✓	✓			
Dredging & Filling of Waterways	✓	✓			✓							
Water Quality Certification												
Grant for Land												
Buoys for Hypolimnetic Oxygenation												
Federal												
Discharge of Fill (Wetlands)	✓											✓
Endangered Species Act												
TRANSPORTATION PERMITS												
Highway ROW Construction *(City)*						✓		✓	✓			
Street Abandonment *(City)*								✓				
ROW Purchase *(City)*								✓				
CANAL												
Canal Access and ROW *(State)*					✓							
Construction in Navigable Waters *(Fed)*	✓				✓							
ZONING & BUILDING PERMITS												
Facilities Management Permit *(Cty)*	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
FUNDING APPROVALS *(County)*												
Capital Improvement Program	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Annual Capital Budget	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Commissioner's Hearing	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
County Executive Approval	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Legislative Approval	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

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DRAFT ENVIRONMENTAL IMPACT STATEMENT
ONONDAGA COUNTY DEPARTMENT
OF DRAINAGE AND SANITATION

FIGURE 1-27
PERMITS AND APPROVALS NEEDED

CHAPTER 2 - ENVIRONMENTAL SETTING
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CHAPTER 2

ENVIRONMENTAL SETTING

2.0 GENERAL

The environmental setting for the Municipal Compliance Plan (MCP) includes both natural resources and human resources. Water quality and fishery issues in Onondaga Lake are central to design parameters and to the environmental benefits to be derived from the project. Human resources, particularly demographics and the economy, are essential considerations in terms of financing and phasing the project and predicting its economic impacts. Other elements of the environmental setting (e.g., geology, soils, air quality) are less central to the wastewater issues facing Onondaga County. The organization of this chapter reflects the central nature of the water resource issues.

2.1 NATURAL RESOURCES

2.1.1 Hydrology

A. Seneca-Oswego River

The Seneca-Oswego River system is part of the Oswego River Basin, which encompasses an area of 5,100 square miles, 17 counties, and three physiographic regions of New York State. The southern boundary and central portion of the basin are within the Appalachian Uplands and include the Finger Lakes region (Figure 2-1). Land use is rural agricultural, with several small metropolitan areas. The Tug Hill uplands bounds the watershed on the northeast and is characterized by relatively steep and rural areas. The northwestern and east-central portion of the basin lies within the Erie-Ontario Lowlands. This area is characterized by relatively low relief and productive farmlands which provide numerous wetlands and row crop farms. The City of Syracuse is located at the boundary of the Appalachian Uplands and the Erie-Ontario Lowlands regions.

Flows of water in the Seneca Oswego River system are highly regulated as part of the 285-mile Erie Barge Canal system. The flow pattern is further altered from natural conditions to support hydroelectric power generation.

The Seneca-Oswego River is a part of the New York State Barge Canal system (Figure 2-2). The outlet of Onondaga Lake, is located at the northwest end of Onondaga Lake and flows into the Seneca River (New York State Barge Canal System) (Figure 2-3). There are no control structures on Onondaga Lake; however, lake levels are affected by Lock 0-1 at Phoenix on the Oswego Canal. The Seneca River flows east from Seneca Lake through Cross Lake to its junction with the Oswego Canal (consisting of the Oneida River which joins to the Oswego River and flows north to Lake Ontario). Construction of the Erie Canal has diverted many parts of the Seneca River. Water levels on the Seneca River are controlled by the canal and (to a greater extent) by storing water in pools during off-peak hours for hydroelectric power generation. There is an agreement in place between NYSDOT, New York State Electric & Gas, and Evans Chemetics to provide a minimum flow of the Seneca River from the Waterloo dam and lock. The agreement provides for a minimum seven-day average flow of 50 cfs from December through March, 60 cfs during April and November, 70 cfs during May and October, and 100 cfs during the June through September period. There is a U.S. Geologic Survey (USGS) gage on the Seneca River at Baldwinsville, New York (Lock 24).

Recorded peak discharges range from 5960 cfs to 17,200 cfs. The normal pool elevation of the reach between Baldwinsville and the Oswego Canal junction is 363.0 feet (Barge Canal Survey Datum of the New York State Engineers Survey of 1901). In this reach, boats from the Barge Canal system have free access (no locks) to Onondaga Lake. There is currently a New York State Barge Canal terminal, used for state maintenance purposes, located at the outlet of Onondaga Creek to Onondaga Lake.

B. Onondaga Lake

The Onondaga Lake drainage basin encompasses approximately 248 mi^2, and with the exception of 0.8 mi^2 in Cortland County, it lies almost entirely in Onondaga County. The drainage basin includes six natural subbasins: Nine Mile Creek, Harbor Brook, Onondaga Creek, Ley Creek, Bloody Brook, and Saw Mill Creek (Figure 2-4). In addition to the natural drainage, Onondaga

Lake receives hydraulic input from the effluent of the METRO sewage treatment plant. Water from Skaneateles Lake, Otisco Lake, and Lake Ontario is supplied to residences and industries within the METRO service area. Skaneateles Lake and Lake Ontario are outside of the Onondaga Lake drainage basin; consequently, most of the flow to Onondaga Lake from METRO represents an interbasin transfer. The total hydraulic input to the lake is large and is reflected in the long-term average three to four flushes per year (Figure 2-5). Note that the impact of METRO is calculated separately to reflect the interbasin transfer of water from Skaneateles Lake and Lake Ontario.

Onondaga Lake has a length of about 4.6 miles with a width of about 1 mile and a total surface area of 4.6 square miles. There are 12.2 miles of shoreline; approximately 9.5 miles is publicly owned by Onondaga County. The lake has a maximum depth of about 64 feet (19.5 meters) in the south basin and about 62 feet (18.9 meters) in the north basin. Prior to 1822, Onondaga Lake was larger and deeper than it is now. The land area at the southeastern end of the lake, Oil City and the downtown Syracuse Central Business District, were swamps and marshlands. In 1822, the level of Onondaga Lake was lowered about 2 feet when the State dredged the lake's outlet, making it wider and deeper. Overall, the surface area of the lake was reduced by 20 percent. This action drained the swampy areas at the south end of the lake and allowed development in this area.

The surface elevation of Onondaga Lake has been monitored since 1970. Lake level averages between 1971 and 1989 have differed by approximately 1 foot. Variations are attributed to annual total tributary inflow to the lake.

Onondaga Lake is surrounded by commercial, industrial and residential land use. However, a unique feature of this lake is that 80 percent of the shoreline is owned and maintained by Onondaga County as parkland; a small portion is owned by the City of Syracuse. The private ownership is entirely industrial/commercial; owners include Conrail, AlliedSignal Corporation, Crucible Steel, and Niagara Mohawk Power Corporation. There is no residential development along the shoreline (U.S. Army Corps of Engineers, 1992).

Three flow conditions occur at the outlet of Onondaga Lake:

"(1) Flow out of the lake (to the northwest) over the entire cross-section;

(2) Flow out of the lake in the lower (deeper) portion together with flow in the opposite direction (toward the lake) in the upper (surface) portion of the cross-section; and

(3) Flow toward the lake over the entire cross section." (UFI, 1994, p. 4-13).

Flow from the Seneca River to Onondaga Lake can be significant. About 29 percent of the surface inflow to the lake over the June to September interval of 1991 (a dry period) was from the Seneca River. This value may represent an upper-bound on the amount of flow from the river to the lake. The Onondaga Lake Management Conference is reviewing technical proposals to refine the estimated annual hydrologic exchange between the river and lake.

C. Onondaga Lake Tributaries

Long-term flow records of the major tributaries to Onondaga Lake are summarized in Table 2-1. Nine Mile Creek and Onondaga Creek are the largest natural tributaries (Figure 2-6), contributing 70 percent of the long-term hydraulic input to the lake. Effluent from METRO represents the third largest hydraulic input (long-term average contribution is close to 20 percent). The majority of this flow originates outside the watershed.

There is distinct seasonal variation in the percent contribution of natural tributaries and METRO (Figure 2-7) based on the steady inflow from METRO and variable inflows from the tributaries. The natural tributaries dominate hydraulic loading during spring runoff conditions. During dry periods such as summer, METRO effluent comprises a larger proportion of lake inflow.

C1. **Nine Mile Creek.** Nine Mile Creek originates at the outlet of Otisco Lake and flows through the Towns of Marcellus, Camillus, and Geddes in Onondaga County. The Nine Mile Creek watershed has a drainage area of 124.7 square miles. Forty-four square miles of the Nine Mile Creek drainage area lie upstream of the Otisco Lake outlet. Geddes Brook, a tributary of Nine Mile Creek with a total drainage area of 3 square miles, joins Nine Mile Creek 1.2 miles upstream from Onondaga Lake. Another small tributary flows into Nine Mile Creek in the Town of Camillus. The creek flows through the AlliedSignal waste beds in the lowest two miles of the stream.

Nine Mile Creek represents the second largest source of water to Onondaga Lake. Flow is regulated in Nine Mile Creek at Otisco Lake by an earthen and concrete dam. Water is also diverted from Otisco Lake for the water supply purposes of the regional Water Authority. The maximum recorded discharge of 2,760 cfs at the Camillus gaging station occurred on March 30, 1960. The narrow floodplain of Nine Mile Creek is developed with scattered residential communities and some small industries (about 10 percent urban land use). The remainder of the watershed area is made up of forest land use (25 percent) and agricultural or idle land.

C2. **Onondaga Creek.** Onondaga Creek is formed by the junction of the west and south branches about 1,700 feet upstream of the Corps of Engineer's dam located in the Town of Onondaga. The main stream then flows north through the City of Syracuse and empties into Onondaga Lake at the northwestern edge of the city, 13.2 miles downstream from the dam. The length of Onondaga Creek including its south branch is 27.2 miles. The total drainage area of the creek is 115.1 square miles, of which 68.1 square miles lies above the dam. The watershed is a mix of agricultural land use in the Tully Valley, with urban and industrial land use in the City of Syracuse. The Tully Valley is also the site of the mud boils, a phenomenon generating approximately 30 tons per day of sediment to Onondaga Creek and eventually to Onondaga Lake.

There are no lakes or permanent reservoirs in the Onondaga Creek watershed, although a pool will form behind the Corps of Engineers dam during flood stages. This dam, completed in 1949, is located about four miles south of the City of Syracuse on the Onondaga Nation Reservation. The reservoir has a capacity of 18,200 acre-feet at spillway crest. In addition, a flood control project was completed by the Corps of Engineers in 1963. This channelization project constructed dikes and realigned the creek from Dorwin Avenue to the northern boundary of the Onondaga Nation Territory. The largest recorded flood occurred in March 1920 with a flow of 6,000 cfs.

C3. **Ley Creek.** Ley Creek flows in a westerly direction from the junction of North and South Branch to its mouth at the western portion of Onondaga Lake near the Syracuse city line. Ley Creek with its five major tributaries (Bear Trap Creek, North Branch, South Branch, Sanders Creek and Teall Brook) drain an area of 29.9 square miles. Seventy percent of the watershed has been developed for industrial, commercial and residential uses. The remainder, in the upstream reaches, is primarily undeveloped land, with only 5 percent agricultural.

The topography of the basin is generally flat with some gently rolling hills. Surface elevations vary from about 410 feet at the headquarters of the basin to about 363 feet at Onondaga Lake. The stream bed gradients are low, varying from about 5 feet per mile to about 1 foot per mile. The USGS gaging station is rated poor due to the backwater effect from the lake. It is estimated that a 100-year flood would have a discharge of 2,000 cfs.

C4. **Harbor Brook.** Harbor Brook, which enters Onondaga Lake at the southernmost point of the lake, drains a long and narrow watershed of about 11.3 square miles. The upstream watershed is primarily rural, while the lower reaches run through the urban areas of Syracuse. The brook receives urban runoff and discharge from 19 CSOs and, on rare occasions, sanitary overflows from Hillcrest and Brookside Pump Stations.

C5. **Sawmill Creek.** Sawmill Creek is a small tributary that drains a wooded marshland located in the Onondaga County park at the north end of Onondaga Lake. The outfall for Sawmill Creek is located approximately one mile to the east of the Onondaga Lake Outlet. The watershed is small and has only a slight slope. The watershed drains a primarily low density residential, recreational, and natural wetland areas.

C6. **Bloody Brook.** Bloody Brook is a small tributary that drains an urban area of the Town of Liverpool. The Brook flows into Onondaga Lake at the north-central portion of the Lake, less than a mile southeast of the Yacht Club marina basin, or about 2.25 miles southeast of the lake's outlet. Bloody Brook has a watershed area of 4.5 square miles.

C7. **Tributary 5A.** Tributary 5A enters Onondaga Lake about 0.8 miles northwest of the City of Syracuse line on the west shore of the lake. This tributary receives treated waste water from Crucible Specialty Metals. The total flow to Onondaga Lake from this source is low.

C8. **East Flume.** This tributary channels the industrial process water, industrial cooling water, and site drainage from the former Allied Signal Chemical Corporation industrial complex to the site. The East Flume flow is difficult to gauge because there is no permanent fixed channel. The daily withdrawal reported in the SPDES permit is used to estimate flow.

2.1.2 Water Quality Issues

A. Seneca/Oswego River

A1. **Classification and Designated Uses.** Pursuant to Article 17 of the Environmental Conservation Law, the NYSDEC has adopted water quality classifications and standards for all surface waters in New York State. The classification is based on variables such as tributary flow, existing water quality, and past, present and anticipated uses of the water and surrounding land.

All of the Oswego River and Lower Seneca River drainage basins fall into either the B or C classification. The defined "best usage" of Class B waters is for primary and secondary water contact recreation and fishing. Class B waters must be suitable for the propagation and survival of fish. The defined "best usage" of Class C waters is for fishing. Water quality must be suitable for the survival of fish and propagation of fish. In addition, water quality must be suitable for primary and secondary contact recreation, although other factors may limit the use of the waters for these purposes.

At the point of entry into Lake Ontario, the Oswego River is designated as Class C. The area from this point, up-river to the confluence of the Seneca and Oneida Rivers at the Three Rivers junction, has all been designated as Class B. The tributaries of the Oswego River, including Black Creek, Mud Pond, Tannery Creek, Waterhouse Creek, Ox Creek, and Mud Lake, are designated as Class C.

The Seneca River and the Onondaga Lake outlet are classified as Class B. The tributaries of the Seneca River, including Crooked Brook, Dead Creek, White Bottom Creek, Gilly Brook, and Clay Pond (No.1 and No.2), are designated as Class C. Carpenters Brook, which enters the Seneca River 3.0 miles northeast of the Village of Jordan, is classified as C, with a water quality standard of C(T). The standard (T) designation reflects the designated use for trout spawning, and must therefore meet more stringent dissolved oxygen specifications and thermal discharge criteria. The majority of Carpenters Brook tributaries have been categorize as Class C. While Cross Lake is Class B, its tributaries are designated as Class C.

A2. **Current Water Quality Conditions.** The Seneca River combines with the Oneida River to form the Oswego River, which enters Lake Ontario at the City of Oswego. This three-river system receives outflow from Onondaga Lake and, under varying conditions, also serves as a source of water and materials loading to the lake.

Conditions of vertical stratification in water quality persist in the Seneca River. Significant conductivity differences are noted between the top and bottom layers during low flow conditions as a result of the interaction between the Seneca River and water originating from Onondaga Lake. Elevated salinity levels can be attributed to ionic waste loading from soda ash production in the lake. Chemical stratification in the river was less pronounced following the closure of the soda ash/chlor-alkali facility (UFI, 1994).

Dissolved oxygen depletion in the lower levels of the river prevails as a result of this chemical stratification. Decreased or depleted oxygen concentrations in the lower waters result from the lack of surface aeration and photosynthetic activity, and the high rate of oxygen consuming processes. The presence of large numbers of zebra mussels contributes to oxygen depletion in the lower waters (Effler and Siegfried, 1994). Elevated T-NH_3 concentrations also exist in the lower layer of the river in the vicinity of the lake inflow, causing violation of the state's NH3 standard (UFI, 1994).

Stratified conditions persist during low flow conditions between the lake outlet and the Three Rivers junction. Dense water with higher conductivity and lower dissolved oxygen concentrations is noted on the lower layer. Dissolved oxygen profiles exhibit greater variability near the surface due to the influence of algal photosynthesis (Calocerinos and Spina, 1984). Increased river flow rates cause vertical mixing and effectively eliminate stratified conditions.

Three investigations are summarized below to provide an historical review and current update on water quality in the river system.

a) **The Three Rivers Study, Calocerinos & Spina, 1984.** A monitoring and modeling program of the Seneca, Oneida, and Oswego Rivers was initiated in 1982 by Calocerinos and Spina Consulting Engineers. The Three Rivers Study was designed to document overall water quality characteristics, identify causes of degradation, and design a mathematical water quality model for waste load allocations of the municipal and industrial discharges to the three-river system.

Six water quality surveys were performed between May and August 1982, during which pronounced chemical stratification was detected in the Seneca River as a result of the outflow from Onondaga Lake. This outflow contained high concentrations of dissolved solids, primarily attributed to the AlliedSignal chlor-alkali facility. During high river flow conditions, the stratification was restricted to the region in the Onondaga Lake outlet. Under low flow conditions, however, stratification extended from the vicinity of the Baldwinsville Dam, and occasionally downstream as far as the Oneida River. Dissolved oxygen concentrations in the upper and lower waters of the Seneca River during low flow conditions are displayed in Figure 2-8. Elevated dissolved oxygen concentrations (>10 mg/l) at the surface were common throughout the summer months due to photosynthetic activity. Dissolved oxygen concentrations at the bottom waters, however, were significantly lower during the same time period.

Chemical stratification under low flow conditions resulted in occasional reductions of dissolved oxygen (DO) concentrations in the lower layer of the Phoenix Pool area of the Seneca River. According to the Three Rivers Study findings, supersaturated DO values and diurnal variations were recorded, especially in the upper regions of the waters. The oxidation rate of carbonaceous material in the Three Rivers system was relatively low, and nitrification in the water column was negligible.

b) **Upstate Freshwater Institute, 1994.** An investigation of the Seneca, Oswego and Oneida River system documented changes in river water quality caused by Onondaga Lake (UFI, 1994). Recent water quality changes are partially attributed to the 1993 detection of zebra mussels and to the 1986 closure of the soda ash/chlor-alkali facility on Onondaga Lake. The degree of chemical stratification and related impacts on oxygen resources during periods of low river flow were less pronounced after the closure of the chemical facility. Adequate DO concentrations were detected deeper in the water column following the plant closure, but concentrations remained low in the lower layer, upstream as well as downstream of the point of entry of the lake, resulting in continued violations of the DO standards (Figure 2-9, a-b). New York State standards continue to be exceeded for NH_3; T-NH_3 concentration remain high in the lower layers of the lake. Chemical stratification in the Seneca River is eventually broken up prior to merging with the Oneida River.

c) **Onondaga County Department of Drainage and Sanitation, 1994.** A monitoring program was conducted by Onondaga County Department of Drainage and Sanitation on the Seneca/Oneida River system from June 30, 1994 to October 11, 1994 to document water quality changes from the outlet of Cross Lake to a 30-mile stretch down river. Water chemistry and density stratification data were collected to evaluate the impacts to the river from key areas of potential contaminant loading, including the Onondaga Lake outlet and the County's Baldwinsville, Oak Orchard and Wetzel Road wastewater treatment plant facilities. Weekly samples were collected from 11 Seneca/Oneida River sampling sites (Figure 2-10). Samples were collected at 1 meter below the water surface and 1 meter above the channel bottom in order to evaluate density stratification effects on water quality. Figure 2-11 presents Seneca River flow recorded at the gauging station at Baldwinsville and depicts the measured flows on each sampling day.

DO, ammonia, total phosphorus, soluble reactive phosphorus, and nitrite were measured as indicator parameters of loading impacts to the river. Water quality impacts of the zebra mussels, the Onondaga Lake outflow, and (to a lesser extent) the wastewater treatment facilities are evident in the 1994 results. The 1994 data are graphically summarized.

1) **Dissolved Oxygen.** DO concentrations were measured during the 1994 program. Profiles showing surface and bottom dissolved oxygen concentrations

for July 14 and 19 are presented in Figure 2-12. When the river was stratified, surface concentrations tended to reach a minimum downstream of the Baldwinsville treatment plant and began to increase thereafter. Under well-mixed conditions, the surface minimum typically occurred in the stream segment adjacent to the Wetzel Road facility. Dissolved oxygen concentrations in the lower waters were comparable to concentrations in the upper waters, although the minimum concentration was seen further downstream. Minimum concentrations were measured at the Wetzel Road facility or at some point between the Onondaga Lake outlet and Wetzel Road. The minimum DO concentration at Wetzel Road usually occurred as a pronounced spike that was not reflected in the upper waters. Anoxic conditions in the river's lower waters downstream of Wetzel Road were recorded on July 26, 1994 (Figure 2-13a).

Dissolved oxygen concentrations in the upper waters fell below the daily average standard of 5 mg/l on four dates during July and August. On each of these dates, the lowest DO concentration was measured between the Baldwinsville treatment plant and the Onondaga Lake outlet. The DO concentrations in the lower waters fell below New York State ambient standards during seven of 13 weekly events. These occurred at the outlets of Cross Lake and Onondaga Lake.

Although concentrations at one meter above the channel bottom usually decreased downstream during periods of density stratification, they typically recovered to background concentrations (equivalent to those measured at the outlet of Cross Lake) downstream of Wetzel Road. Dissolved oxygen concentrations in surface waters declined through this stream segment during the summer low flow period.

The results depicted are from a daytime survey. A diurnal survey of this stream segment was conducted in August 1995 (Figure 2-13). Note that the diurnal DO fluctuation in these stream segments was low, the zebra mussel infestation has apparently reduced the standing crop of phytoplankon, and consequently, their DO production and consumption.

2) **Ammonia.** Ammonia concentrations were measured within the river monitoring network from July 14 to October 11, 1994. Elevated concentrations of ammonia in the Seneca River are associated with the Onondaga Lake outlet, where ammonia in the epilimnion is higher than ambient background concentrations in the Seneca River (Figure 2-13b). Ammonia concentrations in the surface waters consistently complied with the New York State Class A, B, and C standards except for occasional peaks in the stream segment between the Onondaga Lake outlet and the Wetzel Road plant. The bottom waters frequently approached or exceeded the New York State ambient water quality standard when the river exhibited density stratification.

3) **Total Phosphorus/Soluble Reactive Phosphorus.** Phosphorus is a critical nutrient that affects primary plant production in Onondaga Lake and the Seneca River. Elevated concentrations in the Onondaga Lake basin are primarily influenced by the performance of METRO, CSO inputs, and tributary loading from stormwater and agricultural sources. Seneca River total phosphorus (TP) concentrations are consequently influenced by excess nutrient levels from the lake and by additional non-point contributions from tributaries. Phosphorus promotes algal growth, thus decreasing water transparency and contributing to fluctuations in dissolved oxygen levels. Elevated soluble reactive phosphorus (SRP) concentrations during the summer may also be associated with zebra mussel grazing of phytoplankton.

TP and SRP concentrations in the study area are characteristic of highly productive waters (Figures 2-13c and 2-13d). Distinct peaks between the Onondaga Lake outlet and the Wetzel Road plant, or directly at the Wetzel Road plant, indicate a source of water with higher phosphorus concentrations in this area.

4) **Nitrite.** Nitrite concentrations were measured between June 30 and October 11, 1994. Concentrations at one meter below surface generally met the New York State ambient water quality standard of 0.1 mg/l for protection of a warm water fishery during the entire 1994 sampling period. Bottom

concentrations exceeded the standard on six of the monitoring dates. The elevated nitrite is associated with high concentrations in the Onondaga Lake outlet flowing into the river's lower waters (Figure 2-13e).

A3. Seneca-Oswego River Fishery and Aquatic Community

a) **Regional Perspective.** The structure of the fishery present in the Seneca-Oswego River system and Onondaga Lake is the result of human impacts, coupled with ecological succession that was itself greatly accelerated by human activities. The establishment of European settlements and the development of farms, cities, and industries close to rivers and lakes has accelerated eutrophication in most waters (Magnuson and Lathrop, 1992). Habitat changes, such as the construction of impoundments on the river to generate electricity, profoundly affected salmonid species. Introduction of industrial contaminants has affected the entire fishery.

The negative effects of the dam in Baldwinsville on salmon migrations was documented as early as 1815 (Ringler et al., 1994) and probably continued and increased until the end of the 19th Century. Salmon were eliminated from fisheries throughout the region by mill dams that interrupted migrations to spawning grounds; by lumbering and farming practices, which degraded spawning streams; and by overfishing (Smith, 1985).

The fishery of the Seneca River has been affected by the river connection with the Barge Canal and the Erie Canal. These canals were the routes of distribution of sea lamprey, alewife, white perch, and gizzard shad through New York State. The latter two are dominant in Onondaga Lake at present. The latest arrival to the river is the zebra mussel.

b) **Recent Findings.** A total of 48 fish species have been reported for the Seneca River (Table 2-2). A survey in waters adjacent to the lake outflow conducted in 1992 yielded 23 species, all of them also in the lake (Ringler et al., 1994).

Community and trophic assemblages are very similar to those found in the lake. In particular, the fish community in the outlet and around Klein Island appear to be an extension of the lake.

The relative abundance of the dominant species fluctuated widely from June to October. The fluctuations are probably the consequence of fish migrations. Mark and recapture data revealed that fish move out of the lake as far upriver as Baldwinsville (6 miles), and as far downriver as Fulton (15 miles). Channel catfish migrate to spawn in the river in June and migrate into the lake later in the summer. Walleye, smallmouth bass, and tiger muskellunge moved out of the lake during the fall turnover period, probably to avoid low oxygen conditions. Gizzard shad and white perch move downstream in September.

The rate of deformities measured in fish caught in 1989 was relatively low. In the Seneca River, 5 percent of the channel catfish had barbel deformities, 3 percent had skin lesions, and 1.5 percent had raised skin growth. In the highly contaminated Buffalo River, for comparison, more than 30 percent of the bullheads had barbel deformities. Additional discussion of the Seneca River fishery is presented in subsequent sections detailing the Onondaga Lake fishery, since the lake and river are essentially an open system Fish move freely between the lake and river, and any anthropogenic effect on one has an effect on the other.

The dynamic hydraulic exchange between lake and river discussed earlier is also evident in the fish fauna. Some fish from both the lake and river probably benefit from the expanded habitat, but the riverine fauna may be affected by the outflow from the lake. In 1992, fish species richness downstream from the lake was lower than upstream (Ringler et al., 1994).

Discussion in the subsequent sections of this DEIS chapter document that the connection with the Seneca River is the single most important factor providing resilience to the Onondaga Lake fishery. The migration in and out the lake is evident in the seasonal changes observed in the fish assemblages. The Seneca River and other tributaries provide refuge from adverse environmental conditions and serve as nurseries for some species that require flowing water to spawn.

A4. **Factors Contributing to Water Quality Impairment.** The Seneca River has been characterized as hypereutrophic due to upstream point source discharges and non-point source watershed runoff containing nutrients and organic matter, particularly from agricultural sources. Flows of water in the Seneca-Oswego River system are regulated as part of the 285-mile Erie Barge Canal system. The flow pattern is further altered from natural conditions to support hydroelectric power generation. According to NYSDEC records, there are 103 permitted industrial and municipal discharges in the Seneca Oswego River Basin.

Recent changes in Seneca River water quality are attributed to the 1986 closure of the soda ash/chlor-alkali facility. The chemical plant had been associated with elevated salinity levels in Onondaga Lake which contributed to the chemical stratification found in the river. The continued depletion of oxygen in the lower waters following the closure was attributed to limited vertical exchange with the well-aerated surface layer in addition to the oxygen-consuming processes in the river's lower waters.

Zebra mussels (*Dreissena polymorpha*) were detected in the Seneca River in 1993 in the area from Cross Lake to Baldwinsville. Their range is currently thought to extend throughout the Barge Canal and the Three River system. Elevated population densities were detected in a 1.4-km rock substrate channel known as the CUT during the summer of 1993, when densities as high as 61,000 individuals per square meter of river bottom were documented (Effler and Siegfried, 1994). Research has confirmed that metabolic activity of the zebra mussels has caused profound changes in Seneca River water quality (UFI, 1994). Due to zebra mussel influences, the Seneca River currently exhibits decreased phytoplankton biomass and higher water transparency (attributed to their filter feeding characteristics), enriched SRP and ammonia, and a significant depletion in DO (attributed to their respiratory processes). Oxygen reductions have eliminated the assimilative capacity for oxygen-demanding wastes in certain areas of the Seneca River, and remedial alternatives for Onondaga Lake have consequently been significantly altered. Zebra mussels are likely to continue to be a significant element in the Seneca River food web.

There are abundant foods sources provided by Cross and Onondaga Lakes, and ideal substrate conditions.

The Seneca-Oswego River fishery is dominated by warm water species. Profound habitat changes engendered by dams and locks have eliminated spawning and migration passage for salmonid species. Current species assemblages are tolerant of the highly productive water quality. In recent years, macrophyte biomass in the river has begun to increase (Onondaga County sampling team, personal communication based on visual reconnaissance). Increases in macrophytes are likely associated with the improved water clarity from zebra mussels.

B. Onondaga Lake

B1. **Classification and Designated Use.** The first recorded evidence of European settlement on Onondaga Lake was in 1665. Further development along the lakeshores occurred throughout the late 1700s following the discovery of salt springs near the mouth of Onondaga Creek. The first large-scale salt manufacturing operation was established near Harbor Brook. Much of the southern portion of the lake shoreline was eventually involved in the flourishing salt industry, which peaked in 1862.

In the early 1800s, Onondaga Lake was made part of the state-wide canal system. A channel was cut at the lake's outlet in the early 1820s to facilitate the flow of water to the Seneca River. As a result of this modification, wetlands along the lake shoreline were eliminated, a decrease in water depth of 2 feet occurred, and approximately 20 percent of the surface area was lost.

Throughout the 1800s, local salt and limestone deposits provided an impetus for industrial development along the lake, a process that was enhanced by the railroads, which arrived in the region in 1838 and 1839. As industry grew along the southern lake region, resorts were built along the northwest shore.

Onondaga Lake was primarily used for recreational and industrial purposes during this period. Since the arrival of the first Europeans, domestic and industrial wastes have been discharged to the lake and its shoreline. The lake has also been used as a source of cooling water for the soda ash process.

Lake degradation due to excessive sewage and industrial pollution was apparent by the turn of the century, leading to a dramatic decrease in the recreational uses of Onondaga Lake and surrounding regions. Commercial fishing and swimming were subsequently banned due to poor water quality and threats to public health.

Currently, Onondaga Lake is surrounded by developed areas. More than 75 percent of the shoreline is owned by Onondaga County and is classified as parkland; the majority of lakefront property is undeveloped. Despite the continuation of significant water quality problems, Onondaga Lake continues to serve as a focus for commercial development and outdoor recreation efforts along the urban waterfront. This includes plans to develop the Onondaga Lake Inner Harbor area and the redevelopment of the New York State Barge Canal facility, thereby enhancing the recreational and cultural uses of the lake.

Onondaga Lake is classified "B" in the northern basin and "C" in the southern basin (Figure 2-14). Best usage of Class B water is for primary and secondary water contact recreation. Water quality must be suitable for fish survival and propagation. Best usage of Class C water is for fishing and fish propagation. The water quality of Class C water is to be suitable for primary and secondary contact recreation, even through other factors may limit the use for that purpose.

B2. **Current Water Quality Conditions.**

a) **General.** Degraded water quality of Onondaga Lake is the major issue that has led to the need for a Municipal Compliance Plan for METRO and the CSOs. Exceedances of New York State's ambient water quality standards associated with the lake's best usage classifications have triggered investigations of the sources of contamination and alternatives for remediation. As described in the MCP, imposition of water quality based effluent limits for discharges to Onondaga Lake (and the Seneca River) is required once monitoring and waste load allocation modeling indicate that technology-based standards will not result in water quality that meets ambient standards.

Onondaga Lake water quality has been analyzed by a number of investigators (for example, Murphy, 1978; Onondaga County, 1970-1995; UFI, 1994). Extensive monitoring efforts have focused on quantifying loading of substances such as nitrogen, phosphorus, salts, sediment, bacteria, and mercury to the lake. Process-oriented research has focused on quantifying the fate and transformation of substances once in the lake. Results of these efforts will be used in formulating the TMDL process of phased reductions in external loads.

Current water quality conditions reflect impairment of the designated uses (and national goals) for water quality that supports aquatic life and human recreational use. Onondaga Lake has been closed for public swimming since the 1920s due to exceedances of public health standards for bacteria. Profound changes in the fish community were documented on the first half of the 20th Century, although investigations in the late 1980s-early 1990s indicate substantial improvement. A significant fishery impact remains. Contamination of the Onondaga Lake fishery by mercury and PCBs has led to designation of the lake as "public health hazard" (NYSDOH, 1995). Mercury contamination of Onondaga Lake fish was first documented in 1970, when the lake fishery was closed after Hg concentrations in fish tissue were found to exceed the interim Food and Drug Administration (FDA) limit of 0.5 ppm total mercury (wet weight). In 1986, the Onondaga Lake fishery was reopened for recreational fishing on a catch-and-release basis. The FDA standard (now at 1.0 ppm total mercury, wet weight) continues to be exceeded. Onondaga Lake has the most stringent mercury-related fish consumption advisory within New York (Figure 2-15).

Onondaga County Department of Drainage and Sanitation has conducted an annual lake monitoring program since completion in 1970 of a baseline environmental assessment (USEPA, 1971). The Department samples the lake and its tributaries and performs analyses in their environmental laboratory [which is certified in the New York Environmental Laboratory Accreditation Program (ELAP)]. Additional biological monitoring is conducted by specialty subcontractors; Dr. Philip Sze of Georgetown University has analyzed phytoplankton biomass and species composition since 1970, and Dr. Neil Ringler of SUNY College of Environmental Science and Forestry completed fish biomonitoring for the County in 1993 and 1994.

The results of the Onondaga County annual monitoring program document current water quality conditions of Onondaga Lake. The lake is highly eutrophic, enriched in dissolved salts, and subject to high levels of bacteria of human origin following storm events. Dissolved oxygen in the lower waters is depleted rapidly following the onset of thermal stratification. Elevated concentrations of ammonia and nitrite nitrogen, both considered toxic to aquatic life, are measured in the lake's upper waters. Mercury concentrations in the lake's sediments, water column, and biota are high. Table 2-3 summarizes 1994 lake water quality compared to New York State standards. Subsequent sections describe existing concentrations and major sources of the following water quality parameters: phosphorus, ammonia and nitrite-N, dissolved oxygen, mercury, salinity, and bacteria.

b) **Phosphorus and Productivity.** Recent (1990-1994) results of the County's annual lake monitoring program indicate that Onondaga Lake continues to exhibit characteristics consistent with eutrophication, or enrichment of lakes with nutrients. Concentrations of phosphorus measured in the upper waters during the summer typically vary between 60 to 80 μg/l. Differences between years are related to performance of METRO and the non-point source contributions from tributaries. High TP concentrations in 1993 were associated with construction-related scheduled bypass of a portion of plant flows after primary treatment and disinfection. The lake's trophic response is indicated by chlorophyll-a concentration and secchi disk transparency over the five-year period (Figure 2-16). Phytoplankton data collected over this period are generally consistent; fluctuations in blue-green algae concentrations have been noted (Figure 2-17). Figure 2-18 presents zooplankton results from recent years.

Phosphorus enters Onondaga Lake from point sources (METRO and CSOs) and from non-point sources (stormwater and agricultural runoff) within the watershed. Inputs from these point sources represent approximately one-half of the total phosphorus load, with some variability based on the amount of rainfall in a given year (wet years have larger inputs from non-point sources). Figure 2-19 depicts the partitioning of external phosphorus loading to the lake between 1990 and 1994. The TP loads presented in Figure 2-19 have been calculated from the Onondaga County annual monitoring program using the calculation procedures in the program "FLUX." FLUX was developed by Dr. William Walker, Jr. of Concord, MA, and is a widely accepted method for estimating nutrient and sediment loads to lakes. Dr. Walker is one of the County's lake advisors. The program incorporates several calculation procedures to estimate annual loading based on the frequency and results of monitoring efforts. The record presented in Figure 2-19 was calculated using Method 2 of FLUX, which stratifies the results of the monitoring program into flow regimes (low flow and high flow). The relationship based on the stratified data set is applied to the entire annual flow regime. Standard error in estimated loads are lower using this technique than the method historically used by Onondaga County in their loading calculations. In recent years (since 1993), Onondaga County's annual program has included additional wet weather monitoring events designed to capture high runoff periods when contribution of non-point source phosphorus from tributaries would be greatest. Efforts to improve the estimates of relative phosphorus loadings from METRO and non-point sources are a key component of the phased TMDL process. Additional discussion of the County's long-term monitoring strategy to measure external phosphorus load is presented both in the MCP and the DEIS.

In most northeastern lakes, phosphorus directly affects water clarity or transparency by stimulating the growth of aquatic plants. The current NYSDEC standard for phosphorus in surface waters is a narrative standard. The narrative standard limits phosphorus to "... none in amounts that will result in growths of algae, weeds, and slime that will impair the waters for their best use."

From 1990 to 1994, the summer concentrations of phosphorus measured in the upper waters of Onondaga Lake averaged 92 μg/l. However, the range (57 to 155 μg/l) includes the METRO construction period in 1993. Long-term averages are in the 60 to 80 μg/l range. At this concentration, the lake generally complies with NYSDOH safety guidelines for bathing beaches (4 feet transparency). Low transparency is associated with algae blooms.

In October 1993, NYSDEC adopted a state-wide phosphorus guidance of 20 μg/l for ponded waters classed AA, A, and B. This guidance value was based on a survey of public perception of the suitability of a lake for recreational use. Lakes in the survey were largely rural; none reflected Onondaga Lake's complex urban setting. Perceived suitability was then correlated to phosphorus concentration and a target phosphorus value selected based on perception. We note that other states have adopted a range of phosphorus guidance values for lakes based on perceived suitability for recreational use. Minnesota, for example, has adopted a range of target TP values (up to 90 μg/l) based on the nature of the watershed (remote to urban) and the attainability of recreational use (Heiskary and Walker, 1988).

In conclusion, Onondaga Lake contains elevated concentrations of phosphorus, the nutrient limiting algae production. High phosphorus concentrations support high algae populations. The phosphorus guidance value adopted by New York State to correlate with public perception of acceptable recreational waters (20 μg/l) is exceeded by existing conditions (60 to 80 μg/l). Phosphorus flows into Onondaga Lake from both point and non-point sources. The TMDL process provides a framework to phase reductions in point and non-point loads and evaluate attainability with designated uses. The County's long-term monitoring program and calculation procedures have recently been expanded to better quantify and partition external phosphorus loading.

c) **Ammonia and Nitrite-Nitrogen.** Onondaga Lake water contains concentrations of ammonia nitrogen in excess of New York ambient water quality standards (Figure 2-20a). The standard in effect for Onondaga Lake reflects protection of the designated Class B and C use: primary and secondary recreation and fish propagation. The Class D standard compares current conditions to the Class D standard, designed to protect against acute toxicity (fish survival). Figure 2-20b presents the ammonia-nitrogen concentrations in the lower waters. Exceedances of ambient water quality standards are measured at this depth as well. Because dissolved oxygen is depleted from the lake's hypolimnion, fish will avoid these depths.

Nitrite-nitrogen concentrations in the lake exceed the New York State ambient water quality standard of 100 μg/l for protection of a warm water fishery (Figure 2-21a and 2-21b). There is a typical seasonal pattern in nitrite concentration in the lake's upper waters that is associated with incidental nitrification of the METRO effluent.

Effluent from METRO is the single largest source of ammonia and nitrite-nitrogen loading to Onondaga Lake. Figure 2-22 plots the partitioning of ammonia-N to the lake in recent years. METRO effluent accounts for more than 90 percent of the loading. The load partitioning for nitrite-nitrogen (Figure 2-23) leads to a similar conclusion. As described in the MCP, the METRO facility is advanced secondary with phosphorus removal and is not designed to remove or convert ammonia into nitrate. Alternatives for biological ammonia treatment at METRO are consequently a focus of the MCP.

d) **Dissolved Oxygen.** Numerical limits on minimum DO concentrations are in effect for New York's surface waters. Onondaga Lake is classified both B and C and is not a designated trout water. Dissolved oxygen standards for Classes B and C waters are expressed as both daily average values (5 mg/l) and daily minima (4 mg/l).

The lower waters (hyplimnion) of Onondaga Lake are depleted of DO during summer stratification. DO concentrations fall below 4 mg/l by early June of a typical year; hypolimnetic anoxin persists through fall mixing (Figure 2-24). Many lakes of moderate productivity exhibit some DO depletion in the lower waters during stratification.

The upper waters of Onondaga Lake generally meet the dissolved oxygen standard for Class B and C waters. However, during fall mixing, reduced substances such as methane and hydrogen sulfide that have accumulated in the lower waters during summer stratification mix throughout the water column. Dissolved oxygen concentrations in the upper waters typically fall below the minimum 4 mg/l at this time (Figure 2-25). Duration of low DO can be from several days to as long as two weeks.

Onondaga Lake failed to undergo full mixing in the spring of 1993 and 1994. These conditions were likely related to extensive spring runoff. Wind velocity in the spring was not sufficient to overcome the thermal and chemical stratification gradient created by the fresher layer of rain and snowmelt on top of ionically-enriched hypolimnetic waters, resulting from the AlliedSignal waste bed discharges. By not mixing, the bottom waters were not replenished with atmospheric oxygen. Contraventions of the dissolved oxygen standard in the bottom waters were consequently evidenced earlier in the summer of these years.

The extent and duration of dissolved oxygen depletion in the fall is also related to atmospheric conditions. Wind speed impacts the rate of oxygen transfer between the atmosphere and the water surface. When wind speed is high during the fall mixing period (late October), dissolved oxygen is replenished at a faster rate, and the duration of potential standard contravention is minimized.

The major source of oxygen-demanding wastes (as measured by 5-day biochemical oxygen demand) is the METRO effluent. Figure 2-26 displays the relative BOD_5 load from METRO and the tributaries. Additional oxygen demand is executed by decomposing algae, which are generated within the lake itself. This is parameterized in the lake as sediment oxygen demand (SOD). In Onondaga Lake, SOD is caused primarily by the annual deposition of phytoplankton to the lake bottom. When algae cells decompose in the lower waters, oxygen is used by the decomposing organisms. Oxygen concentrations in the lower waters decline, and the habitat for fish is reduced.

Mathematical models of Onondaga Lake have attempted to quantify the factors controlling SOD so that predictions of lake DO response to remedial alternatives could be made. For example, the relationship between the amount of phytoplankton in the overlying water and the SOD rate is critical to predicting changes in lake DO in response to changes in trophic state. The Onondaga Lake models developed by UFI for NYSDEC addressed SOD. Over the period of their intensive lake water quality monitoring program (mid-1987 to 1991), UFI measured the exchange of various chemicals and the consumption of oxygen at the sediment-water interface. Based on predictions using the UFI Model Version 1.11 (approved by NYSDEC October 13, 1995), Onondaga Lake would continue to exhibit hypolimnetic anoxia and depressed concentrations of DO at fall mixing, even if METRO effluent were completely removed from the lake.

However, these model predictions are based on measurements of existing conditions. It is reasonable to expect that chemical exchanges between the sediment and the water would be altered as water quality conditions improve. UFI has recently (November 1995, poster presentation at the North American Lake Management Society meeting in Toronto Canada) reported predictions of Onondaga Lake DO based on functional relationships (mathematical summaries of how the chemical exchanges would alter as the lake water quality changes) between lake water quality and SOD. This information was presented after NYSDEC formal model approval and the initiation of the 90-day period for preparation of this document. In the future, this information may be incorporated into revised models of Onondaga Lake. The TMDL process (described in Chapters 1 and 3) provides a mechanism for monitoring, research, evaluation, and feedback as well as enough flexibility in the management system to respond to new information about environmental quality and the performance of existing controls.

In the late summer of 1995, Onondaga Lake DO declined to low concentrations (less than 2 mg/l) throughout the water column. This DO decline occurred prior to the onset of fall mixing. Dr. Steven Effler of UFI hypothesized that in-lake nitrification might have been responsible for this unprecedented decline in the lake's oxygen resources. We note that UFI's approved lake models do not predict that in-lake nitrification would occur to such an extent. The summer of 1995 exhibited highly unusual weather conditions (record low rainfall coupled with warm, sunny conditions). The statistical return frequency of these unusual conditions is unknown, since the hydrologic calculations of stream flow will not be final until early 1996.

If the low DO conditions were caused by in-lake nitrification, the proposed actions will address this water quality problem. The MCP actions to provide year-round nitrification at METRO will reduce the ammonia concentrations in the water column and prevent the reoccurrence of this phenomenon.

e) **Mercury.** Onondaga Lake has elevated concentrations of total mercury (HgT) and methyl mercury (CH_3Hg). In that respect, it is similar to other lakes that have received discharges from chlor-alkali facilities or other mining activities. Concentrations of mercury in the water column increase with depth, up to 35 ng/l in the hypolimnion during anoxic conditions.

Elemental mercury is innocuous; however, it is oxidized to mercury II and then methylated by both aerobic and anaerobic bacteria. Methyl mercury is the species of concern because it is toxic and accumulates in the food chain.

The rate of methylation and accumulation by fish are affected by concentration of total mercury and other local environmental factors. Concentration of Hg in fresh water fish was found to be negatively correlated with pH, water hardness, dissolved organic carbon, and dissolved oxygen, and positively correlated with concentrations of sulfate and hydrogen sulfide (Parsons and Bigham, 1993). Additionally, rates of accumulation of environmental CH_3Hg in tissue (slime coat, liver and intestine) are species specific for each organism (USEPA, 1985).

In Onondaga Lake, the concentrations of CH_3Hg in 1989 were about 10 percent and 20 percent of mercury in the upper and lower waters, respectively. Tributaries to Onondaga Lake had variable concentrations of HgT; there is an apparent positive relation between drainage size and concentration (Driscoll and Wang, 1994).

External loading of mercury to Onondaga Lake is under investigation as part of the AlliedSignal RI/FS. Loading and mass balance calculations from this effort are currently under review by New York State. We note that a representative of Onondaga County's Water Quality Management Agency has only recently begun to participate in the review. Drainage and Sanitation staff involvement has been minimal. A limited monitoring effort identified Nine Mile Creek (downstream of the AlliedSignal waste beds) and the METRO discharge as significant external sources of mercury to the lake. Driscoll and Wang (1994) attributed 48 percent of the external load to Nine Mile Creek and 25 percent to METRO.

In 1994, Onondaga County Department of Drainage and Sanitation contracted with Brooks Rand, Ltd., a specialty analytical laboratory, for low level mercury analyses of METRO influent and effluent and turbidity concentrations. These results (Table 2-4) indicate that the concentration of mercury in Nine Mile Creek significantly increases between Amboy (upstream of the AlliedSignal waste beds) and Lakeland (near the mouth of the tributary). On August 4, the total mercury concentration was measured at 2.19 ng/l upstream, and 22.3 ng/l downstream. The November 22 results were similar: total mercury increased from 7.64 ng/l to 14.6 ng/l. Brooks-Rand Ltd. measured methyl mercury in the November samples as well; the concentration of methyl mercury increased slightly from upstream to downstream.

The special mercury sampling also detected elevated concentrations of mercury in METRO's influent. During both sampling events, total mercury concentrations were reported to decrease an order of magnitude between the influent and effluent indicating removal or precipitation to sludge within the wastewater treatment process.

Coupling the low level mercury data with measured flows provides a snapshot of loadings from the sampling points during the August and November sampling events. METRO effluent and Nine Mile Creek delivered essentially comparable loads of both total and methyl mercury when both events are considered. In August, the METRO load was 1.8 x 10^{-2} lb/day, compared to 8.5 x 10^{3} lb/day. In November, Nine Mile Creek's load of 1 x 10^{-2} lb/day was higher than METRO's 7 x 10^{3} lb/day. Methyl mercury loads between the two sites were calculated to be of the same order of magnitude (2.1 x 10^{-4} lb/day in Nine Mile Creek, 4.3 x 10^{4} lb/day from METRO). The relative contribution of the two sites on an annual basis cannot be inferred from these limited data. Sampling and analyses over the entire flow regime (dry weather and wet weather) in Nine Mile Creek would be required to accurately estimate the annual load. The variability of METRO's mercury concentrations is an important consideration in calculating the annual lake loading and in identifying potential sources within the collection system.

The contribution of mercury deposits in the lake sediments to the overlying water, and consequently to the fishery, is under investigation as part of the AlliedSignal RI/FS. A mercury model has been developed and is under technical review by New York State (PTI, 1994).

f) **Salinity.** The salinity of Onondaga Lake may be regarded as the sum of all dissolved ions. Salinity in Onondaga Lake is relatively high (3.25 per thousand in 1981, 1.23 in 1989) as a result of industrial inputs of chlorides, calcium, and (to a lesser extent), sodium. The impact of the closure of the AlliedSignal facility in 1986 is reflected in the change between 1981 and 1989. Figure 2-27a plots the changes in major ions in Onondaga Lake.

Onondaga Lake, like other regional lakes, has natural geochemical sources of calcium. However, the concentrations of calcium in the water column reflect industrial inputs from the soda ash plant. Since closure of the facility, calcium concentrations have declined by 75 percent. Current concentrations (1990-1994) continue to be evaluated compared to area lakes of similar geochemical composition. Two tributaries, Nine Mile Creek and Onondaga Creek, are significant sources of ionic materials sodium, calcium, and chloride. Elevated salinity contributes to chemical stratification and consequent depletion of dissolved oxygen. Concentrations of anions and cations in the tributaries reflect natural geochemical conditions and the industrial waste materials deposited in the tributary watersheds. Figure 2-27b summarizes the partitioning of ionic inputs to Onondaga Lake.

g) **Bacteria.** Elevated concentrations of fecal coliform bacteria, an indicator of recent contamination with human waste, are detected in Onondaga Lake following storm events. As there is no public bathing beach in the lake, bacteria data are not collected at a frequency to evaluate compliance with swimming standards. The bacteria standard for Class B and C waters require a minimum of five tests each month to evaluate compliance:

> The monthly median total coliform value for 100 ml of sample shall not exceed 2,400 from a minimum of five examinations, and provided that not more than 20 percent of the samples shall exceed a coliform value of 5,000 for 100 ml of sample and the monthly geometric mean fecal coliform value for 100 ml of sample shall not exceed 200 from a minimum of five examinations. This standard shall be met during all periods when disinfection is practiced. (Source: NYCRR Part 704.2)

New York State Sanitary Code specifies bacteria quality required for a bathing beach:

> The fecal coliform density from the five successive sets of samples collected daily on five different days shall not exceed a logarithmic mean of 200 per 100 ml. When fecal coliform density of any sample exceeds 1,000 per 100 ml, consideration shall be given to closing the beach daily samples shall immediately be collected and analyzed for fecal coliform for at least two consecutive days. [Source: Chapter I, State Sanitary Code, Part 6, Sub-part 6-2, bathing beaches (1988).]

The combined sewer system serving the City of Syracuse is the most significant source of bacteria to Onondaga Lake. A mixture of stormwater and untreated wastewater from industries and residences overflows to Onondaga Lake tributaries under the hydraulic capacity of the sewerage system is exceeded. Indicator bacteria fecal coliform and streptoccal bacteria have been monitored since 1974. Levels of bacteria have declined since the mid-1970s, but still are present at concentrations which occasionally exceed the NYSDOH standards for bathing beaches (NYSDOH, 1995).

B3. **Onondaga Lake Fishery and Aquatic Community.**

a) **Fishery.** Analyses of historical changes in the Onondaga Lake community are difficult to identify, since the early records are limited. Evidence for the causes of particular changes in fish populations is even more limited. However, the degradation of water quality resulting from discharge of municipal and industrial wastes undoubtedly influenced the lake's fish community over the years. Other factors, including overfishing and high sedimentation results, have also contributed to the dynamics of the fish population.

From the arrival of European settlers and until the late 1800s, Onondaga Lake had an apparently productive cold water fishery dominated by Atlantic salmon and cisco.

Salmon were reduced in lakes and rivers through the region by mill dams that interrupted migrations to spawning grounds; by lumbering and farming practices, which degraded spawning streams; and by overfishing (Smith, 1985).

By 1927, few fish species were present in Onondaga Lake. A survey yielded only 10 species of fish, and no Atlantic salmon or ciscoes. The increasing loads of industrial and domestic wastes going in the lake during the first half of this century, coupled with the habitat changes evidenced throughout the Seneca River basin, had negatively impacted the Onondaga Lake fishery.

In 1946, Onondaga Lake was reported to have 14 species, four more than in 1927. Ninety-three percent of the individuals caught were carp. The fish community was one capable of surviving in a severely degraded environment.

In 1969, it was reported that the species composition had not changed appreciably since 1946, except for a large population of white perch (USEPA, 1971). It was found that Onondaga Lake supported a fairly diverse fish fauna, typical of many warm water lakes in central New York State.

The main change between 1946 and 1969 was the construction of METRO in 1960. By the end of this period, carp had become less prevalent, and more species were recorded living in the lake. Apparently, the lake fishery began to recover. During the next 12 years, AlliedSignal reduced its loading of mercury; phosphorus was banned from detergents, and METRO upgraded to secondary and tertiary treatment. These reductions of pollutants are probably related with the further improvement of the fish community. In 1968-1969, the lake had 22 species. The fish community was dominated by white perch (63 percent) and alewife (14 percent). Carp had become scarce and gizzard shad represented less than 2 percent of individuals.

There were further improvements in the water quality, particularly after the closure of the AlliedSignal plant in 1986. By 1993, the number of species in the lake had more than doubled. Intensive fish surveys between 1989 and 1993 revealed the presence of 51 species (Table 2-5). Diversity as measured with the Shannon Index is comparable with lakes in the Adirondack region. Species richness for the same period is comparable with other regional lakes as well. However, the open nature of the aquatic system apparently provides a great deal of resilience to the lake fishery. The connection to the Seneca River provides refuges and a source of recruits.

In summary, the Onondaga Lake fishery changed from a cold water assemblage to a warm water one by the beginning of the century. Profound changes in species composition continued through the mid-1900s. In the later part of this century, the fishery began recovering to the point that in 1993, Onondaga Lake supported a relatively diverse warm water community. Apparently, substantial improvements in water quality are leading to improvements in the fish community.

Onondaga Lake currently supports a warm water fishery. The open epilimnetic waters are dominated by pelagic, planktivorous gizzard shad and white perch. The littoral zone is dominated by planktivorous/insectivorous bluegill and pumpkinseed. The fish community in Onondaga Lake depends on the Seneca River as refuge at times of the year when water conditions are adverse and as a source of recruits for lake populations. The dynamics of this relationship between lake and river are evident in the seasonal changes in the lake community observed in 1990. In June, the dominant species was white perch. By late August and early September, the catch was dominated by gizzard shad and bluegill. White perch became dominant again in October. Some species are absent from the catch during the fall; presumably, fish seek refuge in the Seneca River or the mouths of lake tributaries to avoid low concentrations of oxygen and return when conditions improve.

In 1990, more than 65 percent of fish caught were the pelagic planktivores, gizzard shad and white perch. Gizzard shad is an opportunistic filter feeder whose diet includes zooplankton, phytoplankton, and detritus. White perch in Onondaga Lake consumed amphipods, cladocerans, copepods, and chironomids; fish were rare in their diet. The second most abundant group (24 percent) are the littoral planktivore/insectivores like golden shiner, yellow perch, bluegill and pumpkinseed. These fish were consuming mostly chironomids and cladocerans. The absence of molluscs in sunfish diets is noteworthy, for this is an important item for this fish group in most northeastern lakes. The benthic piscivore/insectivore group included channel catfish, brown bullhead and freshwater drum.

Omnivores in the lake were shorthead redhorse, common carp, and white sucker and represented less than 5 percent of the total. The piscivores were walleye, smallmouth bass, largemouth bass, and crappies. Small numbers of tiger muskellunge and northern pike have also been reported. At present, Onondaga Lake supports a non-consumptive fishery, and the fishing pressure particularly on the piscivores is very light.

Diet composition data for Onondaga Lake suggests high spatial and temporal variability, and an apparent trend since 1980 towards increase of littoral planktivore/insectivores, possibly due to increased macrophyte growth in response to improved water quality. Growth rates, age distribution, and mortality rates of several species are comparable to those in other northeastern lakes.

b) **Phytoplankton and Rooted Macrophytes.** Phytoplankton communities have been monitored since 1968. In the early years of monitoring, bloom conditions were common from spring to fall. Nuisance filamentous blue-green algae (cyanobacteria) disappeared from the phytoplankton community by 1972 as a response to reductions in phosphorus due to a ban on high phosphorus detergents. Several species of green algae were dominant between the early 1970s and late 1980s. A recurrence of cyanobacteria in the late 1980s is attributed to the presence of efficient zooplankton grazers (Auer et al., 1990). The larger zooplankton prefer to graze on green algae, but do not consume the cyanobacteria (Lathrop and Carpenter, 1992).

In spite of high concentrations of nutrients, only five species of rooted aquatic macrophytes were found in a recent survey. This number is very low when compared with 18 found in a "typical lake" in New York State. Diversity and biomass production is probably limited by the presence of calcite stones in the littoral substrate, elevated salinity precipitated $CaCO_3$ and turbidity and possibly bioturbation by carp (Madsen, et al., 1994). Fish are negatively affected by the absence of littoral macrophytes because plants are sources of invertebrate food, provide spawning sites and refuges from predators.

c) **Zooplankton.** The energy captured as algae biomass is consumed by zooplankton. Zooplankton filter the water and, as a consequence, may help to control water clarity (Lathrop and Carpenter, 1992). Development of maximum clarity events in 1987 to 1989 had been associated with increases in herbivorous zooplankton biomass in Onondaga Lake (Siegfried et al., 1995).

The community structure of zooplankton is controlled from the "bottom up" by the quality and quantity of food and from "top down" by fish. In Onondaga Lake, monitoring from 1969 to 1989 reveals that the zooplankton assemblage in Onondaga Lake is relatively poor when compared with neighboring lakes. However, species richness over this period increased, particularly after the closure of the AlliedSignal soda ash facility. There has been a shift towards larger size cladoceran zooplankters and higher number of species. The changes may be related to decreasing concentrations of $CaCO_3$ and lower salinities. An apparent "top down" effect of fish on zooplankton communities was observed in the late 1980s when high densities of alewife in the open waters coincided with low densities of daphnids. Gizzard shad and white perch are unlikely to impact the mid-lake zooplankton in the same manner as the alewife, because only the juveniles of these species feed heavily on zooplankton and they inhabit on the littoral zone (Siegfried et al., 1995).

The Onondaga Lake Management Conference has funded a study of an organic contaminant in the lake, which appears to be a byproduct of coal tar wastes. Researchers involved in the study raise the possibility of this compound having a toxic effect on zooplankton (Hassett, 1994).

Improvements in water quality are leading towards an improved zooplankton assemblage. This will directly benefit sunfish, largemouth bass, yellow perch, and other fishes whose early life stages depend on zooplankton (Smith, 1985).

d) **Benthic Macroinvertebrates.** A single survey conducted in 1989 revealed that the benthic invertebrate fauna was severely impacted, especially along the waste bed shore. Diversity on two sites along the eastern shore of Onondaga Lake was similar to that of the outflow of Cayuga Lake, but diversity along the waste bed shore was about one-sixth of that of a reference site in Cayuga Lake (Wagner et al., 1994). The impairment of the benthic fauna probably limits food supply of most pan fish and the young of larger sport fishes, such as bass.

e) **Zebra Mussels.** Adult zebra mussels (*Dreissena polymorpha*) were first observed in the lake in 1992. High concentrations of zebra mussels were reported from the Seneca River, upstream from the Onondaga Lake outlet, but to date, the zebra mussels appear to be less successful in colonizing the lake.

Zebra mussels prefer habitats characterized by Ca^{+2} above 12 mg/l and pH above 7.2. They will tolerate DO concentrations as low as 2 mg/l at 25°C, but they die in anoxic water. Water bodies with prolonged periods above 54°F and with maximum temperatures of 64-74°F provide optimum conditions for growth and reproduction (Heath, 1993). They prefer to settle over hard substrate, but many populations are developing on aquatic macrophytes and even over soft substrates (Sparks, 1994, Personal Communication). Zebra mussels adapt rapidly to a wide range of conditions and successfully invade some regions that offer only marginal environment to other molluscs (Heath, 1993).

Zebra mussels graze on particles greater than 0.00004 in. (1 μm) in size. They thrive in waters with large populations of diatoms and green algae. They indiscriminately consume algae, protozoans, and rotifers, but seem to avoid filamentous blue-green algae. Some portion of the filtrate is digested and excreted as feces. The inedible particles are collected, coated with mucus, and excreted as pseudofeces. As a result, large quantities of organic material are "pulled down" from the water column and deposited on the benthos; consequently, dramatic increases in water clarity have been observed (Heath, 1994; Makarewicz, 1993).

Long-term effects of zebra mussels on lakes include increased water clarity and an enriched benthos that promotes remarkable increases in the diversity and production of all groups of benthic organisms. Periphyton and macrophytes benefit from the improved water clarity and, like zoobenthos, benefit from increased levels of nutrients present on feces and pseudofeces. Many benthic invertebrates benefit from increased surfaces created by the mussel shells. Native molluscs like clams and snails are outcompeted. When zebra mussels use the shells of other molluscs as substrate, they compete for food and create a weight burden that is energetically costly to move around (Schnieder, 1994). The production of benthic feeding fish increases in response to the added food sources (Karatayev, 1994).

In general, zebra mussels can cause an accelerated transfer of energy in the benthic region. The remineralization and recycling of nitrogen and phosphorus, plus additional oxygen produced by aquatic plants set the ideal conditions for a highly productive benthos (Karatayev, 1994; Culver and Pontius, 1994; Lowe, 1993).

Another effect of zebra mussel colonization is mobilization of toxicants from the sediments into the food chain. The mussels accumulate PAHs and PCBs in their fatty tissues in concentrations 50,000 greater than that of the surrounding water and 10 times more than other molluscs. They also concentrate toxicants in the pseudofeces and make them available to other invertebrates that feed on them. They are likely to concentrate contaminants at a level 100 times greater than would be expected in fish. Bioconcentration depends on environmental temperature and the contaminant's affinity for water (Fisher, 1993). Zebra mussels and contaminated invertebrates are then consumed by fish, which in turn may be consumed by humans (Heath, 1994).

Potentially, zebra mussels could outcompete pelagic zooplankton for phytoplankton resources (Idrisi and Stewart, 1994; Beeton, 1993). Yields of fish like walleye or other pelagic cold water fish could decrease as pelagic zooplankton are reduced. On the other hand, yields of sunfish and pikes that prefer vegetated littoral habitats would increase.

There is great uncertainty regarding the effects of zebra mussels on aquatic systems. The short history of zebra mussels on this continent does not provide adequate data to use in predictive models applicable to all situations. Zebra mussels are a nuisance to managers of water intake of drinking or cooling water because they clog the intakes. However, there are certain fish species that could benefit from zebra mussels (Culver and Pontius, 1994; Dabrowski, 1994; Karatayev, 1994).

The short- and long-term effects of zebra mussel colonization in the Onondaga Lake-Seneca River system are difficult to predict. Experiments of zebra mussel filtration of municipal sewage (Selegean and Heidtke, 1994) suggest that they could survive in the ammonia concentrations present in Onondaga Lake. Moreover, calcium is abundant. However, anoxia in the hypolimnion limits zebra mussel to the epilimnion. In the immediate future, it is uncertain if zebra mussels would attach to oncolites and how would they react to the unique chemical characteristics of Onondaga Lake. It is also uncertain how improvements in the lake quality would affect zebra mussel dispersion.

B4. **Factors Contributing to Water Quality and Use Impairment.** As described above, Onondaga Lake is classified B and C water, with designated uses for water contact recreation and fish propagation. Discussion in the preceding sections regarding current water quality conditions and status of the biotic community is summarized in Table 2-6.

The fish community in the Onondaga Lake-Seneca River system is one piece in the complex web of abiotic and biotic factors that make up this ecological entity. Geographic and climatological conditions define water bodies at a base level. Water chemistry and organic energy transfer establish potential productivity, and food web processes determine the allocation of productivity.

Interactions among these factors occur at different temporal and spatial scales and produce an ever-evolving system. The following is a brief summary of the physical, chemical, and biological factors that appear to limit the fish community in Onondaga Lake and the Seneca River.

a) **Physical.**

1) **Connection Between Lake and River.** Onondaga Lake and the Seneca River are intimately related systems. The river is relatively large, and the lake is relatively small with a high flushing rate. These features favor movement of fish between these systems. Any anthropogenic effect on one will have some effect on the other.

One such effect was the construction of river dams that restricted Atlantic salmon migrations to the lake. At present, the outlet of Onondaga Lake to the Seneca River has unusual flow conditions due to the elevated ionic density of lake waters and the nearly equal elevations of lake and river. The entire water column at times moves from the lake to the river, and other times from the river to the lake. Frequently in the summer, the outlet channel stratifies and sometimes the epilimnion of this channel flows into the lake. This dynamic exchange between lake and river is also evident in the fish fauna. Some fish from both the lake and river probably benefit from the expanded habitat, but the riverine fauna may be affected by the outflow from the lake. In 1992, fish species richness downstream from the lake was lower than upstream (Ringler et al., 1994).

2) **Spawning and Nursery Habitats.** Most of the substrate of the littoral zone in Onondaga Lake is not hospitable for fish. The eastern and northwestern shores are covered with oncolites resulting from AlliedSignal operations. Because oncolites are susceptible to resuspension by waves, they limit fish populations directly by not providing stable spawning substrate to some species and indirectly by limiting growth of rooted aquatic plants, where some fish could feed and spawn. Overall, the substrate in Onondaga Lake supports a severely impacted macroinvertebrate fauna. That translates to food limitations for some species of fish like yellow perch (Lathrop, 1992).

The littoral zone in Onondaga Lake presents very low microhabitat diversity. The absence of in-lake cover structures like fallen trees, clean rocky outcrops, or healthy adjacent wetlands results in limited spawning and feeding habitats for perch, largemouth bass, and northern pike.

Analysis of spawning requirements and reproductive status of Onondaga Lake fishes (Table 2-7) suggests that the physical characteristics of the littoral zone in the lake are important factors to be considered in plans to improve the fishery. Manipulation of littoral habitat to enhance spawning and recruitment of largemouth bass and pumpkinseed sunfish in 1993 produced dramatic result. The placement of gravel beds, half logs, and aquatic macrophytes promoted a 17 times increase of nesting, mostly by sunfish (51 percent of the nests), but also of largemouth bass (2 percent) and bluegill (2 percent); some 35 percent of the nest builders were not identified. Pumpkinseeds spawned near the half logs and largemouth bass on the gravel beds. Yearling bass and sunfish were, respectively, five times and nine times more abundant in the macrophyte enclosures than in reference non-manipulated sites (Arrigo and Ringler, 1994).

b) **Chemical.**

1) **Dissolved Oxygen.** Fish require well-oxygenated waters. Prolonged exposure to low concentrations of dissolved oxygen create physiological stress in most temperate fish species. Responses to low dissolved oxygen conditions are: (a) avoidance of the anoxic waters; (b) increased breathing rate; © gulping for air at the surface; (d) loss of coloration; and (e) loss of equilibrium and death.

Dissolved oxygen affects the Onondaga Lake fishery in two ways: first, the depletion of dissolved oxygen in the hypolimnion during the summer months precludes the establishment of a resident cold water fishery, which requires DO concentrations greater than 5 mg/l. Second, the low concentrations of dissolved oxygen during fall turnover force some species to seek refuge in the river or the mouths of the tributaries (Ringler et al., 1994).

2) **Ammonia.** Total ammonia in water equilibrates between two forms: unionized ammonia (NH_3) and ionized ammonia (NH_4+). The concentration of unionized ammonia depends on total quantity of ammonia present, pH, and temperature. The relative concentration of unionized ammonia increases with increases in water temperature and pH. Unionized ammonia is highly soluble in waters and is primarily responsible for the toxic effects to aquatic life.

Biochemical oxidation of ammonia to nitrite and later to nitrate lowers the dissolved oxygen concentration of the water. The toxicity of ammonia increases with simultaneous exposure to other pollutants, low levels of oxygen, and sudden fluctuations in ammonia concentrations. Toxicity of ammonia decreases with increasing ionic strength, particularly by the competitive inhibition of sodium and calcium. Some fishes tolerate levels of ammonia that would be toxic to non-acclimated individuals as a consequence of previous exposure to lower levels (Russo and Thurston, 1991). Elevated levels of ammonia do not always limit biotic integrity (Karr and Heidinger, 1985).

Acclimation, predominance of tolerant species, and the availability of refuges can enable survival of diverse fisheries in lakes receiving treated wastewater. For example, in Hamilton Harbor, Lake Ontario concentrations of unionized ammonia frequently exceeded toxicity thresholds of 300 μg/l; however, short duration and spatial patchiness of the ammonia distribution, coupled with availability of refugia, allowed survival of warm water fish populations (Barica, 1990). Warm water fish are, in general, more tolerant of ammonia than are cold water fish.

The Onondaga Lake fishery appears to have developed adaptive mechanisms to compensate for ammonia concentrations that exceed guidelines for chronic toxicity. Measured concentrations exceed the ambient water quality standards for ammonia, yet a number of species do successfully reproduce.

In 1994, Professor Neil Ringler from the State University of New York's College of Environmental Sciences and Forestry led a research effort focused on the fish communities of Onondaga Lake. The objectives of the analysis were to conduct a quantitative lakewide nest survey, estimate recruitment and juvenile community structure, and evaluate the role of environmental factors in limiting reproductive success. Species composition and relative catch rates were investigated as well.

Thirty-nine fish species were identified in Onondaga Lake in 1994. White perch remained the dominant species. The number of fish species caught in the lake appears to increase each year at a steady rate, and in most years, at least a few individuals representing "new" species are caught. In 1994, new species included the fallfish, northern hogsucker, and troutperch.

The connection of the lake with the Seneca River appears to be a major factor affecting population dynamics. Some species that are common in the lake as adults have rarely been captured as young-of-year, and apparently travel from the Seneca River. Dr. Ringler's investigations found evidence of only eight species that successfully reproduce in the lake in 1994.

Analysis of the role of environmental factors on recruitment is a complex task. The data are scarce, and the interrelationships are not well understood, even in unperturbed systems. In Onondaga Lake, lack of appropriate reproductive and nursery habitats, refuges from predation and extreme weather conditions may directly affect recruitment dynamics. These factors presumably interact with the lake's water quality issues such as ammonia nitrogen, dissolved oxygen, suspended solids and perhaps mercury. Onondaga County plans to continue an annual monitoring program that will examine the interaction of physical and chemical factors on the success of fish reproduction in the lake.

3) **Contaminant Burden.** Monitoring fish tissue contamination from 1970 to present indicates that sport fish in Onondaga Lake, particularly smallmouth bass, have mercury concentrations that exceed the Food and Drug Administration Standards of 1.0 ppm. For this reason, the fish are not fit for human consumption. The extent of mercury contamination of fish extends

beyond Onondaga Lake because sport fish, in particular, migrate to the Seneca River, and because the outflow from the lake carries mercury downstream.

Methyl-mercury accumulates higher in the food chain, thus carnivorous fish, especially those of big size, are a source of contaminants for humans.

Limited monitoring also documents that some fish are contaminated with benzene, various chloro-benzenes, chlordane, and PCB. NYSDOH has concluded that fish from Onondaga Lake are contaminated with mercury and PCBs at levels which could cause a high risk of adverse human health effects (NYSDOH, 1995).

Contaminants in the Onondaga Lake fishery is a factor impairing the best use of the resource. Mercury concentrations in the fish exceed the FDA standard of 1.0 ppm. Fish are consequently not fit for human consumption. The extent of mercury contamination of fish extends beyond Onondaga Lake because sport fish, such as smallmouth bass, migrate to the Seneca River. The outlet of Onondaga Lake carries mercury to downstream aquatic systems, ultimately to Lake Ontario.

A recent public health assessment of Onondaga Lake was prepared by New York State Department of Health under cooperative agreement with the federal agency for Toxic Substances and Disease Registry. The report concludes that Onondaga Lake is a public health hazard. Fish are contaminated with mercury and PCBs at levels which pose a high risk of adverse human health effects (NYSDOH, 1995).

In order for the designated best use of Onondaga Lake to be met, the toxic contaminants must be addressed. Industrial residuals indirectly affect the fishery as well by altering the habitat available for spawning and sheltering young-of-the-year fishes. High concentrations of calcium in the lake affect the macrophyte and fish communities. Increased turbidity from $CaCO_3$ precipitates limit light penetration. Macrophytes (rooted aquatic plants) photosynthetic activity is decreased. Excessive calcium has promoted the formation of oncolites, which are low density precipitates consisting of more than 90 percent $CaCO_3$. Oncolites cover much of the littoral zone of the lake. Because of their relatively low density, oncolites are subject to movement by wave action and provide an unstable substrate for establishment of diverse communities of rooted macrophytes and benthic macroinvertebrates. Spawning habitat for fish is reduced.

New York incorporates chemicals limits into their ambient water quality standards for protection of human health and the aquatic biota. Water quality that meet these standards is assumed to be acceptable. However, water chemistry data alone does not provide a complete assessment of whether a water body is suitable for the aquatic biota. Other factors, especially related to habitat, must be considered in assessing whether a water body does in fact provide for the protection and propagation of fish, shellfish, and wildlife.

The USEPA has recognized the need to consider factors beyond chemically-based standards in addressing water quality issues. The National Program Guidance for Surface Waters (USEPA, 1990) defines consideration of biological integrity as a new priority for water quality standards. The latest revision of the USEPA's Water Quality Standards Handbook (August 1994) incorporates biological criteria such as the numbers and diversity of plants and animals into the assessment of aquatic systems.

Selection of an appropriate remedial alternative for Onondaga Lake must consider the full matrix of biotic and abiotic factors which influence the diversity and health of the aquatic ecosystem. To be successful, any comprehensive restoration effort will integrate chemical, physical and biological factors into a assessment of ecological integrity. Focusing on just one facet of the aquatic environment could prevent a restoration effort from meeting its objectives.

C. Onondaga Lake Tributaries

C1. **Classification and Designated Use.** Onondaga Creek is designated as a Class C water (suitable for fishing) from the point at which it enters the lake to Temple Street in the City of Syracuse. From Temple Street to the point at which an unnamed tributary enters from the west approximately 1.0 mile south of Cold Brook, the waters are designated as Class B (suitable for primary and secondary contact recreation and fishing). From the unnamed tributary to its source, the water quality classification returns to Class C (suitable for fishing). Current CSO discharges to Onondaga Creek are tributary to the Class B and C sections located downstream of the unnamed tributary. These sections have not been designated as a cold water fishery.

Harbor Brook is designated as Class C (suitable for fishing) waters from the point at which it enters the lake to the upper end of an underground section at Gifford Street in the City of Syracuse. From Gifford Street to the City of Syracuse line, the water quality classification is designated as Class B (suitable for primary and secondary contact recreation and fishing). From the City of Syracuse border to the source, the stream classification reverts to Class C. Only the section of Harbor Brook located upstream of the City of Syracuse border has been designated as a cold water fishery. Current CSO discharges to Harbor Brook are tributary to the Class B and C sections located downstream of the City limits. These sections have not been designated as a cold water fishery.

Ley Creek, which receives the discharges from two active CSOs, is designated as Class C waters (best usage for fishing) from the point at which it enters the lake to the location of the abandoned Ley Creek sewage treatment. From the abandoned Ley Creek sewage treatment plant site to the confluence of the North and South Branches approximately 3.0 miles upstream of the mouth, the water quality classification is designated as Class B (suitable for primary and secondary contact recreation and fishing). Upstream of the confluence of the North and South Branches, the water quality classification reverts to Class C (suitable for fishing). The current CSO discharges to Ley Creek are tributary to the Class B and C sections downstream of the confluence of the north and South Branches. These sections have not been designated as cold water fisheries.

C2. **Current Water Quality Conditions.** Onondaga County Department of Drainage and Sanitation has conducted an annual tributary monitoring program since completion of a baseline study in 1970. Tributary monitoring sites of Onondaga Creek, Ley Creek, Nine Mile Creek, Harbor Brook, the East Flume, and Tributary 5A (receiving treated effluent from Crucible Specialty Metals) are shown on Figure 2-28.

The most recent monitoring data compiled for the tributaries (1994 results) are summarized in Table 2-8, and compliance with New York ambient water quality standards is noted.

Tributaries provide the pathways for external loading from watershed runoff and point source industrial discharges. The CSOs are point source discharges to Onondaga Lake and are situated on Onondaga Creek, Ley Creek, and Harbor Brook. The capacity of the sewer network is frequently exceeded during precipitation events, at which time stormwater and untreated sewage is discharged to Onondaga Lake through the CSOs. High levels of bacteria from these discharges represent an impairment of Onondaga Lake for water contact recreation. The CSOs transport floating waste and solids to the lake, which negatively impact aesthetic qualities and degrade benthic habitat.

The following excerpt from New York State Water Inventory, 1992 (NYSDEC, August 1992) describes the status of the macroinvertebrate fauna in the Onondaga Lake subbasins.

> "Five sites in this subbasin were monitored during the Rotating Intensive Basin Studies." They were Onondaga Creek in the Town of Lafayette and City of Syracuse, Ley Creek in the Syracuse, Ninemile Creek at Lakeland, and Onondaga Lake Outlet at Long Branch Road in the Town of Salina. Ley Creek, Ninemile Creek, and Onondaga Creek in Syracuse were given ratings of very poor as overall water quality assessments. PCB tissue levels above background were also found in macroinvertebrates collected at these three sites. Onondaga Creek in Lafayette and Onondaga Outlet were assessed as poor. In addition to the sites above, macroinvertebrate communities in several Onondaga Lake tributaries including Ninemile Creek, Geddes Brook, Harbor Brook, Ley Creek, Bloody Brook, and Sawmill Creek were also studied as auxiliary sites in 1989-1990. The macroinvertebrate populations in each of these tributary streams were found to be moderately or severely impacted. Elevated levels of metals were found in the tissues of organisms collected from Bloody Brook, Ninemile Creek, Harbor Brook, and Geddes Brook. Tissue PCB levels above background were noted in Ley Creek."

Additional discussion of three tributaries is presented below.

a) **Onondaga Creek.** The section of Onondaga Creek within the City of Syracuse is characterized as highly urbanized with little undeveloped land. Prior to its channelization in the 1920s, the creek meandered considerably throughout its course within the City. The rechannelization effectively reduced the length of the creek and increased its slope. The resulting higher stream velocities necessitated lining the creek with stone paving blocks to prevent erosion. The lined section of the creek extends from Dorwin Avenue northward to approximately Spencer Street. Velocities of 3 to 5 fps are common within the channel throughout much of the City. The rechannelization effort and other subsequent flood control projects have significantly reduced the flooding potential along the creek. Maintenance of the stream channel, however, has been sporadic and largely inadequate over the last 60 years to maintain its carrying capacity. Mature trees exist in many areas along the overbank, and several feet of sediment have accumulated within the channel. South of the Route 690 bridges, there is no public access to the creek nor any focus on it.

Sediment within the paved section of the channel originates from upstream non-point sources, CSOs, and urban stormwater discharges. Some of the larger, recognizable objects (shopping carts, bottles, cans, and tires) are caused by littering. Sediment within the lower creek (Barge Canal Terminal) includes the above sources in addition to a high percentage of finer material (including sediments associated with the mud boils that originate in the upper Onondaga Creek basin). An analysis was made of the relative impact of CSO discharges on the fate and transport of solids within the Onondaga Creek corridor within the City of Syracuse (Appendix C-8). Under existing conditions, the existing 45 CSOs generate approximately 1.7 acre-feet of sediment annually, or approximately 20 percent of the total basin load. Approximately 37 percent of the CSO associated solids is retained within the paved stream channel and another 37 percent is captured in the Inner Harbor area. The remaining 26 percent is discharged to the lake. Most non-CSO solids settle in the Inner Harbor (approximately 70 percent) and the stream channel (approximately 20 percent). Only 10 percent of the non-CSO solids are discharged to the lake.

The high solids loading to the paved section of the creek and the Inner Harbor area is one of the principal stressors of macroinvertebrates. Other factors include high flow velocities (especially during CSO events) and pollutants attached to CSO, urban stormwater, and non-point solids.

Recent studies of Onondaga Creek, up and downstream from the mud boils concluded that the macroinvertebrate fauna was significantly altered. In June 1991, one site upstream and one downstream were surveyed for macroinvertebrates. The site upstream from the mud boils yielded 768 individuals, 16 families of invertebrates, a Shannon-Wiener diversity of 1.5, evenness of 0.55, and an estimated density of 2,750 individuals/m^2. In a site downstream from the mud boils, the same survey team found 39 individuals, 9 families, diversity of 0.9, evenness of 0.54, and estimated density of 140 individuals/m^2 (Wagner et al., 1994).

This research concluded that the benthic macroinvertebrate community at the downstream site was greatly modified by high levels of suspended sediment originating from the mud boils. Suspended sediment causes reduced light penetration, thereby limiting primary productivity and altering the composition and structure of feeding groups. Excessive silt interferes with the feeding habits of visual predators and fouls the filtered food nets of collectors. The impact from the mud boils, as reported in this 1991 study, exceeded results from previous studies that had been conducted in 1982 and 1989.

CSOs exert an oxygen demand during and shortly after a discharge due to biodegradation of organic solids within the CSO discharge and, over time, due to accumulation of solids within slower moving water, such as the Inner Harbor, at the downstream terminus of Onondaga Creek. Non-point source pollution is also a contributing element to the SOD in the Inner Harbor; however, its relative impact is unknown since the organic loading associated with non-point is not quantified at this time. A sediment load, both organic and inorganic, is also contributed from sources other than the CSOs as discussed below.

A memorandum completed by Moffa & Associates included monitoring and modeling results of existing DO conditions in Onondaga Creek (Appendix C-9). Onondaga Creek was selected for the DO analysis because of a suspected DO sag due to large CSO contributions (in relation to stream flow) and SOD conditions (due to sediments that accumulate within the Inner Harbor and the Barge Canal. A desktop model was developed using the Streeter-Phelps equation to predict the dissolved oxygen in Onondaga Creek under existing dry weather and design storm conditions. The modeling indicates CSO discharges do not cause DO violations in Onondaga Creek. CSO abatement will provide a significant reduction in solids and BOD, thereby theoretically improving the DO conditions within the tributaries.

Floatables are waterborne waste materials and debris that are relatively buoyant and float at or below the water surface. Floatables are discharged to surface waters from CSOs and stormwater outfalls during and following most storm events. Floatable material can be an aesthetic nuisance and a public health threat. The debris typically consists of man-made materials, such as plastics, polystyrene, paper, and other constituents. These pollutants are not only aesthetically undesirable, but can be detrimental to both man and aquatic organisms. Floating debris can interfere with navigation by fouling propellers and water intake systems. Aquatic life can be impacted by floating material through entanglement and ingestion. Floatable "slicks" have been observed in the Inner Harbor and Barge Canal Terminal. The presence of these floatables has a direct influence on the use of these resources. The State CSO Strategy and National CSO Policy have designated floatables control as an immediate priority.

b) **Harbor Brook.** The lower Harbor Brook watershed, like that of Onondaga Creek, is highly urbanized. Drainage is provided by a mix of combined sewers and separate storm sewers. The brook, unlike Onondaga Creek, is enclosed (covered) for approximately half of its length throughout the City of Syracuse. There are 19 CSO discharges to Harbor Brook. Five of the discharge points are upstream from the covered section, 12 in the covered section, and 2 downstream from it. The fact that the brook is enclosed and/or fenced off for a significant portion of its length effectively limits the potential for contact with residents in the lower drainage basin.

The section of the brook between State Fair Boulevard at Waite Avenue and Onondaga Lake is uncovered, but there are no adjacent residential neighborhoods. The covered section of the brook may also represent a significant obstacle for fish migration from Onondaga Lake.

c) **Ley Creek.** There are two CSO discharge points to Ley Creek, one at Hiawatha Boulevard adjacent to the Central New York Regional Market Authority (Regional Market) and the other at Teall Avenue. The CSO drainage area within the Ley Creek basin is a relatively small percentage of the total. A high percentage of this basin is urbanized, resulting in impact on water quality. The lower reaches of Ley Creek have a number of wetland areas; one wetland area near the Regional Market is unique due to the presence of salt-tolerant species.

Public access to the creek is minimal due in part to the wetlands and the general commercial and industrial nature of the majority of the basin. The only residential area that is adjacent to the creek is in Mattydale between Route 11 and Gordon Avenue, a distance of approximately ½ mile. Floatable material has been observed on the stream banks of Ley Creek.

C3. **Factors Contributing to Water Quality Impairment.** Onondaga Lake has served as the primary receptacle for domestic and industrial wastes ever since the early development of the region, over 100 years ago. Point source pollutant inputs to Onondaga Lake include treated effluent from METRO and Crucible, the AlliedSignal complex, and the CSOs. Non-point source inputs include nutrients, sediment, and bacteria. The lake tributaries are naturally enriched with alkalinity, calcium, and sulfate. The two largest tributaries, however, have also had high ionic concentrations as a result of industrial discharges. Industrial residuals in the watersheds of individual tributaries, such as PCBs in the Ley Creek basin and Hg in the AlliedSignal waste beds in the Nine Mile Creek basin, continue to enter the lake water through runoff and infiltration. Tributary contributions of road deicing chemicals to the lake are elevated during periods of spring runoff.

D. Uses of Surface Water (Public and Private)

Following initial development along the shoreline in the 1700s, Onondaga Lake water had been withdrawn for industrial purposes. At one time, for example, the lake had been used as a source of cooling water for the soda ash process, during which cold water was withdrawn from the hypolimnion and warm water was returned to the lake's surface. Current water use from Onondaga Lake, however, is primarily limited to recreational purposes. Despite water quality problems, Onondaga Lake continues to serve as a focus for outdoor recreation and aesthetic appeal for commercial development. Although fisheries and swimming activities have been banned due to poor water quality and threats to public health, the lake is used during the summer months for boating and limited catch and release fishing.

Since the early 1800s, Onondaga Lake has been a part of the state-wide canal system. Plans currently exist for the development of the Onondaga Lake Inner Harbor area and the redevelopment of the New York State Barge Canal facility. This would further enhance the recreational and cultural uses of the lake.

Water from the Seneca River is currently used for recreational and agricultural purposes (Central New York Regional Planning and Development Board, personal communication, 1995). Information regarding industrial uses of the Seneca River is limited. The New York State Great Lakes Water Withdrawal Registration is a voluntary registration program maintained by the Department of Environmental Conservation. Through this program, users of water in excess of 100,000 gal/day are asked to register with the State. The Hampshire Chemical Corporation, the only facility that is registered in the region of Onondaga Lake, uses up to 3 million gallons per day from the Seneca River for cooling purposes. This water is then returned to the river. This facility is located up-river from Onondaga Lake (NYSDEC, personal communication, 1996).

2.1.3 Geology

Nearly all of the parent materials of the soils of Onondaga County were deposited either directly or indirectly through glacial action. Only the recent alluvium of the floodplains is post-glacial.

Bedrock from which the soil material in Onondaga County is derived is mostly limestone, siltstone, and shale that formed from materials deposited at the bottom of the sea during Silurian and Devonian geologic periods. These sedimentary strata are about 8,000 feet thick and overlay older crystalline rocks. The northern portion of Onondaga County is underlain primarily by softer, less resistant shale and limestone of Silurian age. The southern portion of the County is underlain by mostly interbedded shale and thin limestone of Devonian age, with thicker beds of Onondaga limestone found along an escarpment that bisects the County from east to west across its center. Overall, bedrock strata occur in east-west bands having a regional southward dip of about 1 degree. This orientation results in outcrops becoming older from south to north.

The east-west escarpment of Onondaga limestone divides the County into two different regions of both soil and topography -- the Erie-Ontario Lowlands in the north, and the Appalachian Uplands in the south. Onondaga Lake is situated at the boundary of these two regions. A brief geologic history is provided below and is summarized from a previous site investigation report (O'Brien & Gere Engineers, 1971).

Central New York State was highly scoured during the most recent glacial episode, which ended roughly 10,000 years ago. As glaciers retreated northward from the uplands border between Syracuse and Oneida, free drainage was permitted eastward, and proglacial Lake Iroquois formed in the area from Syracuse to the glacial margins to the north. As the area continued to drain, levels of Lake Iroquois lowered until several distinct basin lakes formed, one of which is the present Onondaga Lake. Post-glacial lake sediments across the region are quite thick and consist of silts, sands, and valved clays overlain by marl and organic-rich soils (O'Brien & Gere, 1971).

The previous investigation referenced above was based on numerous soil borings advanced at the METRO plant site to depths in excess of 300 feet. Soil borings revealed a surface layer of miscellaneous trash and debris, ash cinders, and Allied Chemical waste materials to a depth of 20 to 40 feet below the ground surface. Natural soils consisting of fine sand, clay, and silt are found to depths of 40 to 250 feet. A layer of fine silty sand is located at 250 to 280 feet, while a denser sand layer is located around 280 to 300 feet below ground level. The footings of the Syracuse METRO sewage treatment plant are lain in this denser sand layer. Bedrock is located at a depth of approximately 600 feet below the south end of Onondaga Lake (O'Brien & Gere Engineers, 1971; Ken Kaufman, 1994, Personal Communication).

Other historical accounts of geology beneath Onondaga Lake are provided by Clark (1849) and Clayton (1878), as described in the Upstate Freshwater Institute's "The State of Onondaga Lake" 1994). According to Clark, a red sandstone base is overlain by clay, which is in turn overlain by alluvium composed of gravel, sand, clay, marl, and black swamp muck. Many areas in the lake's proximity are covered with various artificial fills and interbedded with marl, clay, silt, sand, and gravel. A generalized cross section of the southeastern end of Onondaga Lake was presented by Clark, and is reproduced as Figure 2-29.

A. Physiography and Topography

The major physical features of central New York State are attributed to erosional forces of the Cenozoic era, although landforms have been modified more recently by glaciation. Despite glacial influences, the broad outlines of major topographic features and the distinction between physiographic provinces have resulted from the varying ways in which different rock types resisted erosional forces of the Cenozoic.

Onondaga County is situated at the convergence of two distinct physiographic provinces: the Ontario Lowlands and the Appalachian Uplands. The boundary between these two provinces bisects the County along an east-to-west escarpment that rises abruptly southward. Devonian sandstones, limestones, and dolostones form the erosion-resistant cap that covers the highest elevations of the Appalachian Uplands region of southern Onondaga County. In the southernmost portion of the County, elevations exceed 2,000 feet. Dissection of this region has subsequently resulted in topographic relief that exceeds 1,000 feet in some areas.

Glacial cover over the Uplands province is generally thin, although within some north-south valleys glacial deposits can extend hundreds of feet deep, which tends to flatten the topography somewhat in relation to the eroded bedrock surface. Nonetheless, the Appalachian Uplands province of Onondaga County has maintained a high elevation, high relief character.

The escarpment that bisects these two provinces marks the base (northernmost edge) of the uplands and slopes downward to the north. This slope is comprised of less resistant Silurian shales, dolostones, and evaporites of the Salina group. The Vernon shale, which is the oldest member of the Salina group, marks the southernmost extent of the Ontario Lowlands, which is the low-lying, low relief region in the northern portion of the County. From an elevation of 244 feet at Lake Ontario to the north, elevation increases only gradually to the south. The flat-lying bedrock of this region is overlain by glaciolacustrine sediments, with some moderate relief resulting from scattered drumlin fields.

B. Distribution of Soil Types and Vegetation

Extensive industrial and urban development in Onondaga Lake's immediate vicinity has obscured the natural soil cover around the majority of the lake. The Soil Survey of Onondaga County prepared by the U.S. Soil Conservation Service describes surficial soils around the lake as primarily "urban" or "made" land. Approximately 2,000 acres of what is known as "Solvay waste" surround roughly 30 percent of Onondaga Lake, as shown on Figure 2-30. This material is prevalent surrounding the southeast portion of the lake, and is a byproduct of the "Solvay Process," which was used to manufacture soda ash from the mid-1800s until 1986 (Upstate Freshwater Institute, 1994). It has been reported that the chemical composition of Solvay waste deposited around the lake is 20 percent $CaCO_3$, 17 percent Ca-silicate, 10 percent MgOH, 8 percent $CaO \cdot CaCl_2$, 7 percent SiO_2, 6 percent alkalinity and iron oxides, 4 percent $Ca(OH)_2$, 4 percent $CaSO_4$, and 12 percent water of hydration (Upstate Freshwater Institute, 1994). Other materials deposited along with the Solvay waste include fly ash and cinder from the Solvay Process facility coal burning plant, as well as small quantities of mercury, lead, and asbestos from the later Allied sodium hydroxide and chlorine production facilities (Blasland & Bouck Engineers, 1989).

The above materials have a silt-like texture with little structural development. They are moderately to somewhat poorly drained on higher terraces, and become more poorly drained at lower levels closer to the lake. These physical conditions are suitable for lime-tolerant plants that can also tolerate the generally poor drainage. The soil materials are practically devoid of nitrogen, phosphorous, and potassium (U.S. Soil Conservation Service, 1977).

Vegetative cover begins to establish itself roughly 20 to 25 years following the deposition of the wastes, owing to the time needed to leach toxic salts from the uppermost 1 to 2 feet of the beds. Vegetation on the older beds consists of cottonwood and natural and European black alder trees and wild carrot and sweetclover forbs. All of these have a root depth of greater than 1 foot.

Other species of tree-like aspen and white birch have root depths of less than 1 foot (U.S. Soil Conservation Service, 1977).

Towards the northwest portion of the lake, a variety of natural soils are intact and include silty loams and muck. Overall, these soils are typical of the flat-lying, low elevation, and poorly drained areas in which they occur.

2.1.4 Lake Bottom Sediments

A. Introduction

Onondaga Lake bottom sediments are composed of a mixture of material that flows to the lake through the tributaries and municipal outfalls, and material generated within the lake itself, such as decaying plants, animals, and inorganic precipitates such as $CaCO_3$. Lake sediment is typically composed of particles of different size, shape, chemical composition, and origin.

The natural processes involved in the formation of Onondaga Lake sediment have been altered by human activities within the watershed. Analysis of Onondaga Lake sediment has therefore been the focus of several investigations designed to document contaminant types, quantity and attributes, and to determine their distribution and depth, resuspension and transportation characteristics. On December 16, 1994, the Onondaga Lake sediments were listed on the federal National Priorities List (NPL) due to mercury contamination. Sediment contaminants can accumulate in the aquatic food chain and can significantly influence water chemistry and the health of lake biota.

Mercury was discharged to Onondaga Lake by the adjacent chlor-alkali plant. Mercury cells were used in the production of chlorine. Between 1946 and 1970, an estimated 75,000 kg of mercury was discharged from the facility into the lake (USEPA, 1973). In 1970, the daily mercury load from the facility was reduced from 10 kg/day to 0.5 kg/day. Higher loadings may have recurred between 1986 and the plant's closure in 1989 (NYSDEC, 1989). A remedial investigation/feasibility study, discussed below, has identified the areal and depth distribution of mercury contamination in the lake sediments.

B. Geologic Influences

Bedrock geology plays a major role in sediment characteristics. Well logs from land adjacent to the lake show many areas covered with varying depths of artificial fill, interbedded layers of marl, sands, gravels, blue, brown and reddish brown clay, and silt. From 1.8 to 6.1 meters (6 to 20 ft.) of marl can be found in areas bordering the lake. As indicated in the 1994 UFI report, marl forms in open waters which are supersaturated with calcite. Geological research conducted by Winkley in 1989 revealed that significant accumulations of marl have been deposited in many of Onondaga County lakes (Winkley, 1989, as cited in UFI, 1994). Winkley's research also revealed that surficial sediments surrounding the lake consist of peat and or marl, lodgement till, and glaciolacustrine silt and clay. These sediments are believed to have originally formed under glacial ice.

Onondaga Lake is divided into two basins that have a maximum depth of 20 meters (Figure 2-31). A dividing ridge, thought to be a glacial moraine, separates the basins and has a maximum depth of 16 meters. A large number of lake bottom depressions were mapped in the northwest and southeast sections of the lake by PTI. Some of these depressions vent fluids, believed to be composed of biogenic gas or water (PTI, 1992). A large mound of material, thought to be composed of sedimentary material, has been detected on the southwest region of the lake, but the nature and source of this material are unknown.

The surface sediments in the lake are primarily fine-grained. The PTI 1993 Pilot Study revealed that Onondaga Lake sediments consisted of course sand, mud, and marl. The calcium carbonate content ($CaCO_3$) ranged from 36 to 82 percent and the total volatile solids content ranged from 2.6 to 8.4 percent (PTI, 1993).

Acoustical data (PTI, 1992) indicated that the sediment appeared to contain biogenic gas. Subsediment characteristics could not be confirmed during the 1992 research due to the difficulty of sonar signals penetration to the bottom sediments. Based on the geologic history of Onondaga Lake, however, the bottom sediments are thought to be clays, silts and fine-grained sands. The deepest acoustic boundary at 40 to 60 feet in depth is believed to be a glacial clay or till.

Course-grained sediments, thought to be calcite concretions or oncolites, were reported by PTI in patches around the lake's perimeter. This finding was also supported by 1994 Upstate Freshwater Institute (UFI) research. Oncolites are algal pisoliths (cryptalgal structures) composed mostly of $CaCO_3$ (92 percent) and ranging up to 15 cm in diameter. In 1994, UFI reported the presence of oncolites in the near-shore deposits along most of the eastern, northern, and northwest shores of the lake (UFI, 1994). Oncolites are thought to have been formed as a result of the Ca^{+2} enriched ionic waste discharged by the soda ash/chlor-alkali facility.

The shallow water sediments are composed of large particles, composed of up to 90 percent $CaCO_3$. This narrow band of sediment extends around most of the lake except for the southern shore. Deep water sediment has greater water content and organic concentrations. The deepest portions of the lake contain sediment enriched in phosphorus and COD. Sediment composition in the southern portion of the lake is greatly influenced by METRO discharges and Onondaga Creek flows (UFI, 1994). Figure 2-32 summarizes these findings.

C. Sediment Quality Investigations

Through the 1994 surface sediment studies, UFI documented points of entry of several forms of chemical loading to the lake. These study areas focused on Nine Mile and Onondaga Creeks. Organic carbon and nutrient concentrations in the surface sediments of the low energy environment (the depositional lake basin, corresponding to depths greater than 8 meters) were reported to be unusually low by comparison to other lakes. $CaCO_3$ and organic carbon are primarily autochthonous (produced within the lake). The remaining portion of the surface sediments are composed primarily of material of allochthonous (produced in the lake watershed) origin. UFI reports that concentrations of organic carbon, nitrogen and phosphorus are negatively correlated with $CaCO_3$ (UFI, 1994).

In June 1993, PTI Environmental Services submitted a report summarizing a remedial investigation and feasibility study on Onondaga Lake (PTI, 1993). This study included sediment chemistry analyses as one portion of five major field investigations. The primary objectives of the sediment research were to determine the horizontal and vertical distributions of substances in lake sediments, and to measure the concentrations of mercury in surface sediments of the West Flume. This study also included a determination of petroleum hydrocarbons in surface sediments at the south end of the lake. Elevated concentrations of mercury and other heavy metals in Onondaga Lake sediments have been reported for the past 25 years (UFI, 1994). High concentrations of these contaminants are attributed to long-term industrial loading, especially from the chlor-alkali process at AlliedSignal. Reductions in the uppermost sediments reflect gradual decreased loading from industrial facilities and subsequent burial from continued sediment deposition. Areal isopleths of total mercury concentrations, compiled in 1972 by USEPA and in 1986 by NYSDEC, are presented in Figure 2-33a. The 1992 data collected by PTI as part of the Allied RI/FS are presented in Figure 2-33b (Klein and Jacobs, 1995).

The report provided the following chemistry summary:

> Metals detected in sediments, lake water and biota include mercury, cadmium, chromium (III), chromium (VI), copper, lead, nickel, and zinc. Organic compounds detected in sediments, lake water, and biota include chlorinated benzenes, polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), and pesticides (e.g., 4.4'-DDD, 4,4'-DDT, and aldrin). Other substances of concern include ammonia, calcite, and bacteria (including *E. coli* and *enterococci*). (PTI, 1993).

D. Sediment Stratigraphy

Several stratigraphy analyses of Onondaga Lake sediments have been performed (Table 2-9). Two definitive stratigraphic units were identified during the UFI 1994 research studies in the northern and southern basins. A dark gray clay (gyttja) with fine laminations and relatively low organic content is found on the bottom strata. A gaseous black clay (sapropel), with macrolaminations and microlamination and a higher concentrations of organic matter, is found on the top strata. Strata characteristics indicate minimal sediment mixing has occurred in the centers of the two lake basins.

Historical trends can be identified through an evaluation of sediment profiles. The presence of sediment diatom frustules and chrysophyte cysts in Onondaga Lake sediment profiles, for example, is an indication that the lake was mesotrophic prior to shoreline habitation and contaminant loading. UFI research reported accelerated eutrophication rates, increased salinity levels, as well as Hg and heavy metal loading to the lake as a direct response to shoreline industrial influences. Sediment characteristics of the uppermost layers have improved in response to reductions in nutrient and pollutant loadings. A description of sedimentary stratigraphic horizons in the southern basin is found in Table 2-10.

2.1.5 Groundwater Resources

Approximately 12,000 years ago, as the elevation of glacial Lake Iroquois continued to decline, a number of lakes formed within depressions left behind by the ice. Onondaga Lake formed in the northern terminus of one such depression known as the Onondaga Trough. The Onondaga Trough is the deepest of a series of northward-draining troughs in Onondaga County, and contains greater than 400 feet of glacial drift.

The northward-draining troughs in Onondaga County typically contain aquifers confined by layers of glaciolacustrine silt and clay. The residence time of groundwater within these deep confined systems is believed to be quite long, possibly on the order of tens to hundreds of thousands of years (Winkley, 1989). Salt wells pumped for salt production were abandoned after the salinities decreased; apparently the recharge of saline water from the south could not keep pace with the removal of water from the wells. This provides indirect evidence of a poor recharge capacity (Winkley, 1989).

The most extensive water-bearing sediments in proximity to Onondaga Lake are shallow glacial outwash deposits of sand and gravel that underlie the lake and its tributaries (Figure 2-34). Generally, the sand and gravel deposits are thickest in places along the Seneca River and in meltwater channels leading to Onondaga Lake (Upstate Freshwater Institute, 1994). The groundwater gradient is believed to be fairly flat in most places near the lake. Water flows directly into the outwash deposits from the uplands by both surface and groundwater flow. Additionally, rainfall and stream bank storage during periods of high flow can recharge the groundwater system. Groundwater leaves the system as discharge into the overlying surface water tributaries. Onondaga Lake is the ultimate discharge point for the surrounding watershed.

Although there are known to be adequate yields to support groundwater use, water quality issues exclude widespread development of groundwater resources in Onondaga County. These water quality issues are a direct consequence of the natural lithology of the area. An early study entitled "Ground-Water Resources in the Eastern Oswego River Basin, New York" was published in 1970 by Kantrowitz for the State of New York Conservation Department. According to the report:

> Groundwater in much of the Eastern Oswego River basin is of poor quality. Wells tapping either limestone and middle shale units or the unconsolidated deposits overlying these units are likely to yield very hard water. Water from the middle shale unit may be so hard as to make treatment uneconomical. Large parts of the basin are underlain by relatively shallow salty groundwater. The salt water is derived in part from layers of rock salt within the middle shale unit and in part from the upward movement of salt water from deeper parts of the bedrock.

Indeed, groundwater underlying Onondaga County can typically contain a variety of naturally derived solutes that render it unsuitable for potable use. Chloride concentrations greater than the drinking water standard of 250 mg/l, for example, have been measured in groundwater monitoring wells located in regional discharge areas along the north-facing escarpment front (Kantrowicz, 1970; Winkley, 1989). Hardness is perhaps the most common natural water quality problem in Onondaga County (Winkley, 1989). The local distribution of hardness is controlled by area lithology, with limestone, dolostone, and gypsiferrous formations producing hard water. Locally, the Vernon and post-Vernon hydrostratigraphic units produce the most iron-related problems in Onondaga County (Kantrowitz, 1970). The red and green shales of these two units produce iron from the minerals hematite and glauconite (Winkley, 1989). In addition, iron is derived from pyrite deposits found in Devonian shales. Hydrogen sulfide gas can produce a rotten egg odor in water even if present in low concentrations. Hydrogen sulfide in Onondaga County groundwater is derived from the reduction of sulfate in the absence of oxygen and in the presence of organic matter. Sulfate originates from dissolution of gypsum, or from the oxidation of pyrite. Hydrogen sulfide generation has been reported in the Lockport carbonate unit, and the carbonate and Devonian shale units, which are known to contain organic material.

The presence of salty water around Onondaga Lake was a major economic benefit to the Syracuse region in the 19th and early 20th centuries, but it has also been a source of considerable debate over whether the high salinity levels measured in the lake are due to natural upwelling from underground salt formations, or whether they result from past salt mining and industrial discharges. Recent observations of substantial and rapid declines in salinity levels in Onondaga Lake since closure of the Allied Signal manufacturing operations in 1986 provide strong evidence that industrial discharges were the principal source of chloride inputs to Onondaga Lake in recent decades (NYSDL and NYSDEC, 1990).

Overall, the poor quality of groundwater in the central portion of Onondaga County has precluded the development of groundwater into a resource. Groundwater is therefore not a significant issue in relation to the topic of this DEIS. Site-specific impacts on groundwater during construction at METRO and in support of the CSO abatement facilities will be addressed by supplemental EIS as the phased implementation proceeds.

Investigations and remedial actions at industrial facilities in the Onondaga Lake watershed have provided additional data regarding the presence and concentrations of priority pollutant metals and organic compounds in groundwater. Priority pollutant metals, including cadmium, chromium, copper, lead, and zinc have been documented from Crucible Street discharges on the west side of Onondaga Lake (Onondaga County, 1990b). AlliedSignal operated two chlor-alkali facilities in Solvay (Solvay facility and Willis Avenue facility), which used mercury cells in the production of chlorine, caustic soda, and caustic potash. These facilities have been identified as sources of mercury to Onondaga Lake (USEPA, 1973), as well as of chlorinated benzene, benzene, toluene, ethylbenzene, xylene, and polycyclic aromatic hydrocarbons. Spills and discharges from the area known as Oil City, located on the east side of the lake, have also been a significant source of benzene, toluene, ethylbenzene, xylene, and polycyclic aromatic hydrocarbons. A number of inactive hazardous waste sites and sources of PCBs are present in the Onondaga watershed, including the Ley Creek PCB sediment site, Syracuse Fire Training School site, Val's Dodge site, Quanta Resources site, Salina town landfill, and the G.E. Farrell Road site (NYSDEC, July 1995).

2.1.6 Terrestrial Ecology

A. Habitats and Species in Project Area.

A1) **Vegetation.** Two reports of natural communities in the County are Dr. Maurice Alexander's 1973 report on "The Ecology of Onondaga County and Vicinity: The Past, Present and Future of its Ecosystems" and a more recent report by Van Druff and Pike on

"Wildlife and Habitats of the Onondaga Lake Area: A Review" prepared for the Wildlife Habitat Working Group of the Onondaga Lake Management Conference in 1992.

The following overview of general habitat types in Onondaga County and terrestrial communities in the vicinity of Onondaga Lake is provided from the introduction to the 1992 report (sources referred to in the following summary are cited in the 1992 report by VanDruff and Pike).

Davis (1977) described 13 primary ecosystems in New York State, based on land form and biota, useful for better managing natural resources. The Onondaga Lake basin is included in Davis's Erie-Ontario lowlands physiographic ecosystem which extends from Lake Erie in the west to the Mohawk Valley, and north to the St. Lawrence River.

Onondaga County contains two vegetational zones that appear to correspond to two of its physiographic regions. To the south, the Appalachian plateau is predominated by a northern deciduous forest that is characterized by sugar maple (*Acer saccharum*), beech (*Fagus grandifolia*), yellow birch (*Betula alleghaniensis*), and hemlock (*Tsuga canadensis*). The Ontario plains region is predominated by a southern deciduous forest that includes oaks (*Quercus* spp.), hickories (*Carya* spp.), tulip tree (*Liriodendron tulipifera*), sassafras (*Sassafras albidum*), and American Sycamore (*Platanus occidentalis*) (Bye and Oettinger, 1969; Bull, 1974; Rowse, 1980).

Presently, there are no virgin wooded areas in Onondaga County (Harding 1973). What natural areas are left are being developed at a rapid pace. Industrial expansion and pollution have degraded or destroyed many of the unusual natural areas in the county, such as the Tamarack (Lodi) Swamp, Nine Mile Creek, Onondaga Creek, the Seneca River and Onondaga Lake itself (Harding, 1973; Van Druff and Pike, 1992).

The Onondaga Lake shoreline historically consisted of extensive marshlands and woodlands interspersed with salt springs, particularly along the lake's southern and eastern shores. These marshes were gradually drained and filled, beginning in 1822 when the lake level was lowered for improved navigation. Syracuse's salt industry altered the shoreline vegetation, but also served to encourage the proliferation of salt tolerant plants along the shorelines in the City of Syracuse and in the Town of Salina, along what is presently the Onondaga Lake Parkway.

In their 1983 report on "The 11 Salt Plants of Onondaga Lake, Onondaga County, New York," Dr. Mildred Faust and Nancy Roberts noted that salt tolerant plants were widely dispersed around the southeastern part of the lake during the 1920s and 1930s, including the lands on which the present Regional market is located. The most abundant salt marsh plant was *Salicornia europaea*, commonly known as samphire or glasswort, which was found along the lakeshores from the Village of Liverpool southward into the City of Syracuse, and was also present along the west shore of the lake in the vicinity of Nine Mile Creek.

Other salt tolerant (halophyte) plants were identified in the higher drier areas where solar salt sheds were built between 1988 and 1925 by the salt manufacturers. According to Faust and Roberts, several of the upland salt tolerant plants that were still present in limited numbers in 1983 had not been recorded by early botanists until after the development of salt manufacturing using the solar evaporation process.

Increasing urban and industrial development along the lake shores, and especially the disposal of vast amounts of waste materials from the manufacturing of soda ash by the Solvay Process (Allied waste beds), led to the gradual filling and covering of the natural vegetation along the western and southern shores of the lake. Additional salt marsh areas were eliminated by the construction of Interstate 690 along the west shore of Onondaga Lake, the Onondaga Lake Parkway along the east shore, as well as the construction of MacArthur Stadium.

Another adverse factor was the establishment of *Phragmites*, a large introduced reed plant which grows in dense clusters on disturbed soils such as roadsides and on the Allied wastebeds. Although *Phragmites* was not widely found along the Onondaga Lake shore prior to the 1940s, Faust and Roberts report that these plants spread rapidly during the 1960s and 1970s, completely covering the remaining salt marsh plants along the west shore and much of the southeastern shoreline of Onondaga Lake (Faust and Roberts, 1983).

By 1983, the population of glasswort, or *Salicornia*, had been reduced to a small collection of plants between Route 370 and Onondaga Lake on the southeast side of the lake near Danforth Pool (also known as the Salt Pond or Pool). A small number of other salt tolerant plants such as *Spergularia media* (sand spurry) and *Puccinellia distans* (European alkali grass) were also reported by Faust and Roberts to have survived in the drier areas on both sides of New York State Route 370 near Danforth Pool, but the authors noted that the remaining salt marsh plants were "few and decreasing in numbers."

Most of the field investigations of plant communities in the Onondaga Lake vicinity were conducted prior to 1983, when Faust and Roberts published their report on the area's salt plants. The most recent update on the botanical literature from the Onondaga Lake vicinity was prepared by Joseph M. McMullen of Terrestrial Environmental Specialists, Inc. in 1993. McMullen's literature review and annotated list of plant species includes aquatic wetland and upland species.

McMullen prepared an annotated list consisting of 271 species entries in 68 families. He notes that this list is a collection of plant species and annotations from the literature, not a list of what is presently known from in and around the lake. McMullen also made an effort to resolve the question of what plants are only of historical record in the area and no longer occur in Onondaga County based on more recent botanical studies (1961 to 1990) (McMullen, 1993).

Since about 1980, the Onondaga County Parks Department has attempted to preserve the remaining salt marsh plants in the Danforth Pool vicinity by not mowing the grass in this area. Dennis Connors, former director of Onondaga County's Salt Museum said that parks maintenance crews were requested not to mow in the wet areas adjacent to the salt ponds, which appear to be the last remnants of the salt springs which were historically much more common along the Onondaga Lake shores.

Both McMullen and Connors report that their recent observations (since 1990) seem to indicate a significant decline in the last known population of samphire (*Salicornia europaea*) around Onondaga Lake. The decline may be related to a reduction in the flow of saline ground water into the Danforth Pool.

A2) **Wildlife.** Dr. Maurice Alexander's 1974 report on "Vertebrates of Onondaga County" listed 20 species of amphibians, 19 species of reptiles, 264 species of birds and 52 species of mammals (Alexander, 1974). Six rare and endangered species were described in the 1975 "Onondaga County Environmental Plan" although some of these may no longer exist in the County. The six species are as follows:

Lake Sturgeon	Was in Seneca River-Oneida Lake complex.	May be gone from County.
Bog Turtle	Reported to exist in Cicero swamp.	No known recent records.
Peregrine Falcon	Migratory.	Two individuals nest on MONY tower.
Pine Grosbeak	Officially listed as marginal.	
Osprey	Official status undetermined.	Frequently seen in County.
Pigeon Hawk	Official status undetermined.	Uncertain of its presence in County (OCEMC, 1975)

Various researchers at the SUNY College of Environmental Science and Forestry, including Dr. Larry Van Druff, have investigated wildlife communities in central New York's urbanized landscapes, but until recently there was virtually no attention paid to wildlife communities associated with Onondaga Lake.

It was with the intention of filling this gap that the Onondaga Lake Management Conference's Wildlife Habitat Working Group developed the recommendations which led to funding of Van Druff and Pike's 1992 study on "Wildlife and Habitats of the Onondaga Lake Area." The report provides an inventory of wildlife habitat areas and associated wildlife communities in the Onondaga Lake vicinity, and also suggests management guidelines for the protection, maintenance and possible restoration of certain plant and wildlife communities.

B. Freshwater Wetlands and Designated Floodplains in Project Area

Wetland resources located in the vicinity of METRO and the CSO facilities described in the Municipal Compliance Plan are described for three general locations. Additional site-specific wetland inventories will be done as each phase of the CSO and METRO projects proceed.

- Syracuse METRO wastewater treatment plant site
- Ley Creek/Hiawatha Boulevard corridor
- Onondaga Creek and Harbor Brook corridor

B1) **METRO.** The METRO Plant site is bounded by Onondaga Lake, the Barge Canal, Hiawatha Boulevard and the Roth Steel property. There is very little natural vegetation on the site.

There are no New York State or federal designated wetlands on the METRO Plant site. The National Wetlands Inventory (Syracuse West Quadrangle) indicates that there is a small artificial open water wetland (POWRZh) located in the northwest corner of the METRO Plant property, away from any existing or proposed plant facilities. To the east of the plant, the Barge Canal Terminal is listed as an open water site. Also, the south shore of Onondaga Lake, offshore from the METRO Plant, is listed as a littoral open water wetland (L20WH) on the National Wetlands Inventory.

Part of the METRO plant site is within the 100-year floodplain for Onondaga Creek, as denoted on FEMA Map 360595, Panel 0001D for the City of Syracuse dated May 1992. Supplemental analysis of the potential impact of the new METRO facilities on the floodplain will be completed in the design phase of new METRO facilities.

B2) **Hiawatha RTF.** There are federal wetlands at either the proposed RTF site or along the routes of the underflow force main or outfall extension. However, a narrow linear section of NYSDEC-designated wetland SYW-11 may be affected by a proposed underflow force main connection with the existing Ley Creek force main. The outfall extension pipeline will be constructed through the same wetland area to the point where the pipeline will be connected to existing culverts under the ConRail tracks.

The wetland affected by the proposed CSO outfall extension pipeline is identified as SYW-11 on the NYSDEC freshwater wetland maps, and at one time covered 41 acres according to the "Onondaga County Wetlands Inventory." A recent update of the wetland boundaries using the 1987 U.S. Army Corps of Engineers Wetlands Delineation Manual indicates that there are only 9.5 acres of wetlands remaining on this site, consisting of 9.0 acres of reed grass/purple loosestrife marsh and 0.5 acres of shrub/wooded swamp (O'Brien & Gere, May 1994).

SYW-11 is designated as a Class II wetland by NYSDEC. It is described as having a very low diversity, consisting mostly of Phragmites, and is given a Habitat Diversity Index of 0.00 in the "Onondaga County Wetlands Inventory" report.

B3) **Onondaga Creek and Harbor Brook RTF Sites.** Along Onondaga Creek, the proposed CSO facilities include six projects extending from Kirkpatrick Street southerly to West Newell Street with associated CSO transmission pipelines. At the mouth of Harbor Brook, the proposed facilities include demonstration wetlands and the EquiFlow™ facility in Onondaga Lake, and the FCF in the stream north of Hiawatha Boulevard.

Wetlands in the vicinity of the proposed facilities are limited in number, and are mainly those located near the shoreline of Onondaga Lake. The only state-designated wetland is SYW-19, covering approximately 30 acres along the southwest shore of Onondaga Lake. This wetland was not mapped for the "Onondaga County Wetlands Inventory" since it consists primarily of dense stands of Phragmites located on former industrial waste beds. The NYSDEC has designated SYW-19 as a Class II wetland. Its primary significance is its lakeshore location and proximity to the mouth of Harbor Brook.

Federal wetlands in the Onondaga Creek/Harbor Brook vicinity are identified on the Syracuse West Quadrangle of the 1978 National Wetlands Inventory. The only federal wetland shown along Onondaga Creek is located at the northwest corner of the METRO site. The wetland is a small intermittent open water site, artificially created. It has no direct linkage to Onondaga Creek or Onondaga Lake.

2.1.7 Air Resources

A. Climate

Onondaga County has a climate classified as humid-continental. Lake Ontario exerts an important influence on the climate by moderating temperature extremes. Topography and elevation contribute to climatic variation within Onondaga County. The hilly terrain and higher elevations in the southern half of the County can cause significant differences in local temperature and weather within relatively short distances.

Maximum daytime temperatures generally range from the upper 70s to the middle 80s Temperatures of 90°F or higher occur on an average of three to seven days per year. The winters are long and cold with occasional periods of severe weather. The occurrence of below-zero temperatures varies from about six days per year in the northwestern part of Onondaga County to about 12 days in the southeastern part. In most winters, the coldest temperature is between -5° and -20°F. The frost-free growing season averages between 160 and 165 days in the vicinity of Syracuse. It generally is about 175 days in the extreme northwestern part of the county and about 150 days in the southeastern highlands.

Average annual precipitation ranges from 36 inches in the lake plain to 39 to 40 inches in the southern and southeastern border areas of the county. About 45 percent of the annual precipitation occurs during the growing season, from May through September. Precipitation is rather evenly distributed throughout the year at about 3 inches per month. It is generally adequate for farming needs and water supplies. Snowfall is heavy throughout the county. Average annual snowfall ranges from 100 to 120 inches in the northern and eastern sections to about 90 inches in southwestern Onondaga County. Total snowfall of 50 inches or more is not uncommon in two successive months (Army Corps of Engineers, 1992).

B. Air Quality

Air quality monitoring data collected for the Syracuse area in the early to mid-1970s indicate that the main problem 20 years ago was violation of 1970 Clean Air Act standards for total suspended particulates, as several stations in the Village of Solvay and the City of Syracuse exceeded the suspended particulates standard of 60 micrograms per cubic meter.

Between 1970-1974, Onondaga County and the NYSDEC operated seven air monitoring stations located in the Village of Solvay, at Hiawatha Boulevard and Townsend Street in the City of Syracuse and in the Village of East Syracuse. According to the 1975 "Onondaga County Environmental Plan" prepared by the Onondaga County Environmental Management Council, the Syracuse-area monitoring stations were in compliance with federal primary and secondary standards for sulfur dioxide, carbon monoxide, and nitrogen dioxides, but exceeded the standards for total suspended particulates.

Concentrations of several of the principal air quality parameters have improved in the Syracuse area since the early 1970s. Total suspended particulates last exceeded the New York State Ambient Air Quality Standard (AAQS) of 65 micrograms per cubic at the Solvay air monitoring station in 1984. Levels of sulfur dioxide are below the annual primary standard of 0.03 ppm, but have occasionally exceeded the New York State AAQS for 3-hour and 24-hour average readings at the Solvay monitoring station.

The exceedance of sulfur dioxide and particulate standards measured at the Solvay station resulted in part from industrial emissions by the AlliedSignal manufacturing operations. Until their closure in 1986, the AlliedSignal plant operations produced emissions of sulfur dioxide, nitrogen oxide and particulates which also contributed to the pollution of Onondaga Lake.

2.1.8 Cultural Resources

A. Agriculture in the Watershed

Close to 30 percent of the Onondaga Lake watershed is in agricultural use. Agricultural activity has the potential to contribute non-point agricultural pollution, including sediments, nutrients, pesticides, organic matter, and pathogens, especially in the Onondaga Creek and Nine Mile Creek watersheds. The Onondaga Lake Management Conference funded development of a multi-phased Non-Point Source Management Plan. A survey completed under this project determined that:

1. 11,662 dairy cattle, over one-half of the dairy cattle in Onondaga County, are within the Onondaga Lake watershed.

2. The dairy cattle in the watershed produce an average of 417 tons of manure per day, which translates into 32 pounds per acre of excess phosphorus, or two times the needed phosphorus.

3. Sixty-five percent of the dairy cattle have direct access to tributaries in the watershed.

In response to these findings, the Onondaga Lake Management Conference has sponsored an information and education program to encourage the adoption of non-point source best management practices on farms on the watershed.

B. Farm Operation and Project Sites

There are no farm operations on or adjacent to either CSO or METRO project sites.

C. Agricultural Districts

There are no agricultural districts covering or adjacent to either CSO or METRO project sites.

2.1.9 Solid Waste (Biosolids) Management

Management of biosolids is an important component in the operation of wastewater treatment facilities. The success of how well biosolids are managed has a direct impact on the quality of the treatment plant effluent. The Onondaga County Department of Drainage and Sanitation (OCDDS) is a resource for managing biosolids for much of the County, including areas that are not within the Onondaga County Sanitary District and areas not serviced by public sewers. The OCDDS operates nine wastewater treatment plants, including METRO. Collectively, they produce approximately 70,000 wet tons/year (five-year average) of biosolids. Table 2-11 shows the production and distribution of biosolids from 1991 to October of 1995.

In addition to the biosolids generated by the County's facilities, liquid sludge hauled to METRO by haulers from other publicly owned treatment works (POTWs) within Onondaga County and from septage haulers serving residential septic systems, portable toilet waste, and other sources.

During 1994, a total of 8,289,838 gallons of liquid sludge was accepted at the waste hauler control facility located at METRO. Table 2-12 indicates the type of waste and gallons delivered to METRO for further treatment and processing.

METRO and the Baldwinsville-Seneca Knolls wastewater treatment plant are the two County operated facilities which have biosolids dewatering facilities. Liquid sludge from the other seven County operated plants is hauled to these two facilities for further treatment and dewatering. The dewatered sludge is then transported to a private company (located on site at METRO) for processing and beneficial use.

In June 1994, the County began full-scale operation of a 240 ton per day beneficial use processing facility located on the METRO plant site under a 10-year contract with Waste Stream Environmental, Inc. (WSE). The startup of the $2.5 million N-Viro soil processing facility culminated a five-year process that began in 1989 to select a private contractor to permit, design, construct, and operate a biosolids processing facility and market the product produced from the biosolids generated from nine wastewater treatment facilities operated by the County.

The County used the procurement process provided in the New York State General Municipal Law, Section 120-W, to solicit proposals from qualified vendors and ultimately to select a company. The 10-year contract was awarded to WSE and an agreement between the County and WSE was executed on September 29, 1992. The 10-year agreement requires the contractor to process and/or dispose of 240 tons per day of biosolids; finance the design and construction; obtain all necessary permits; guarantee minimum payments; develop a marketing plan; maintain product liability insurance; and agree to provide the County 40 percent of the net revenue from the sale of the biosolids product.

The N-Viro process uses alkaline admixtures to pasteurize and stabilize wastewater treatment plant biosolids by high temperature and high pH, meeting the highest level of disinfection required by the USEPA. Alkaline admixtures include kiln dusts, quicklime, and pulverized limestone from cement and lime processing plants. The end product is called N-Viro soil, a low odor, pasteurized product that is useful as a soil amendment. The N-Viro process turns biosolids into a product that can be beneficially used by the public for agricultural uses as an Aglime/fertilizer additive.

The facility was permitted by New York State under the Part 360 regulations as a solid waste facility. The product qualifies under the USEPA 503 regulations as an exceptional quality biosolid and also complies with the more stringent NYSDEC Part 360 regulations. The product is permitted for unrestricted distribution under a product-specific Beneficial Use Determination. The quality control and quality assurance procedures at WSE ensure strict compliance with the regulations and permits.

Since initial operation, which began with temporary facilities in November 1990, over 160,000 tons of biosolids have been processed into a soil product. N-Viro soil has primarily been used as an aglime on more than 35,000 agricultural acres in 10 central New York counties. The 260,000 tons of product produced by WSE have been marketed by their affiliate company, Earthblends, Inc., which is registered as an agricultural lime with the New York State Department of Agriculture and Markets. Over 300 farms have successfully used this biosolid product to enrich their soil to grow crops such as alfalfa, corn, hay, oats, and winter wheat.

2.2 HUMAN RESOURCES

2.2.1 Transportation

Transportation services for the METRO plant, the regional CSO sites, and sewer improvement and separation projects involve City of Syracuse streets. The transportation services related to proposed projects are outlined below. The DEIS will be expanded with project-specific supplemental transportation studies at the appropriate stage in the implementation of each project.

A. METRO

The METRO plant is located on Hiawatha Boulevard at the intersection of Pulaski Street; the plant entrance is the northern leg of the signalized intersection. Hiawatha Boulevard, a minor arterial on the Federal Aid system, was reconstructed in 1991 to provide two through lanes in each direction and a center turning lane. Traffic volumes for weekdays are 28,840 annualized average daily traffic (AADT) and 2,310 for the p.m. peak hour. Saturday counts are 26,990 AADT, with a peak hour of 1.930. Level of service (LOS) analysis indicates a weekday LOS of A for the p.m. peak and LOS B for the Saturday peak hour. Exiting traffic generators in addition to METRO plant include Carousel Center, the Regional Market, MacArthur Stadium, and numerous industrial and commercial sites along Hiawatha Boulevard. Hiawatha Boulevard links eastbound traffic on Route 690 to Interstate 81 northbound entrance ramps, although Bear Street is the state designated link. Sidewalks exist along Hiawatha Boulevard; the type and scale of the land uses do not draw many pedestrians, nor do the speed and volume of vehicular traffic create an environment conducive to pedestrians.

Hiawatha Boulevard is the subject of two current traffic studies. The DEIS for Carousel Landing, a discount retail center, was completed in November 1995, and the Lakefront Development District Transportation Study is scheduled to be completed by Syracuse Metropolitan Transportation Council in January 1996. The Lakefront study will include analysis of the proposed transportation center, Regional Market, and Onondaga County's multi-purpose stadium recently under construction, as well as area commercial growth.

The METRO plant site is bounded on the northwest by the Conrail mainline, which is also used by Amtrack and Syracuse ONTrack, a passenger shuttle between Jamesville and Carousel Center. The site is bounded on the northwest by the Barge Canal terminal, on Onondaga Creek, which the Thruway Authority is transferring to the City of Syracuse.

B. CSO Project Areas

The CSO regional treatment facilities, the Erie Boulevard storm sewer project, and the sewer separation projects in drainage basins along Onondaga Creek are all located in the right-of-way or adjacent to city streets. The only exception is the floatables removal project on Teall Brook, near Teall Avenue and Lorenzo Drive, in the Town of Salina. Functional class is detailed in Table 2-13. Access to all sites is from city streets, except the Harbor Brook EquiFlow™ Demonstration Project, which can only be accessed from Onondaga Lake or a private road owned by AlliedSignal. The streets involved are classed as principal arterial, minor arterial, collector, or local streets. Most have sidewalks and carry pedestrian traffic. CSO project which affect sites access to major traffic-generating land uses are noted in Appendix C-5. Public bus service is generally available throughout the city.

Several transportation facilities will become part of the sites for CSO projects. These include a portion of Oxford Street between Midland Avenue and Tremont Street, east of the bridge over Onondaga Creek, which will be incorporated into the site of the Midland RTF. Parking lots owned by the City of Syracuse and New York State Department of Transportation will become sites for regional treatment facilities at the Clinton RTF and Franklin FCF sites, respectively.

Major streets and bridges involved in CSO and sewer separation projects are noted in Table 2-14.

2.2.2 Existing Land Use and Zoning

A. Land Use in Onondaga County

Development in Onondaga County has grown from the City of Syracuse to the northern, eastern, and western suburbs. The northern towns have had the greatest growth, with the eastern and western towns having considerably less; the southern towns have had relatively little development. The variability is due to topography; flat land in Syracuse and the northern towns was less expensive to develop than the steeper slopes, ridges, and valleys south of the city. There is considerable vacant developable land in suburban towns, and considerable redevelopment potential in Syracuse, Geddes, Salina, and Dewitt. Some suburban growth has been the result of relocation of land uses from Syracuse and these towns.

Distribution of land uses in the County indicates that vacant land and agriculture are the largest uses in terms of acreage; residential use is the largest in terms of developed areas (see Table 2-15). Retail and industrial uses comprise about 6 percent of the County's area. The relative distributions of these land uses is not expected to change dramatically in the future although residential usage should slowly increase while agricultural usage will decrease, especially in areas near the urban fringe.

The ongoing shift of residential uses away from the center is illustrated by the distribution of residential buildings permits between 1990 and 1994. Table 2-15 shows gain or loss by traffic analysis zone for single- and multi-family dwelling units. Syracuse suffered a net loss of 298 dwelling units over this time period, as demolitions outpaced new construction or conversions.

In Syracuse, loss of population during the 1970s led to disinvestment and a modest decline in the housing stock; during the 1980s and early 1990s, demolitions outpaced new building permits by over 1,280 units. Demolitions tended to concentrate in the south side and near west sides. Many neighborhoods are very stable, and others have grown through new construction or redevelopment. Manufacturing has declined while office, institutional, and government uses have increased. Retailing has declined downtown while thriving at Carousel Center. Syracuse remains the largest employment center in the County.

B. Existing Land Use and Zoning for Project Sites

B1. **METRO.** METRO is located in an industrial area at the south end of Onondaga Lake. Adjacent uses include a utility transmission substation and natural gas vehicle fueling station, scrap metal salvage yard, the Conrail mainline, and Barge Canal terminal. Across Hiawatha Boulevard, uses include a gas station, contractors yards, and manufacturing. The METRO site is zoned Industrial A for a depth of 300 feet from Hiawatha Boulevard and Industrial B for the balance of the site according to the Zoning Atlas. Permitted uses are governed by the "Zoning Rules and Regulations of the City of Syracuse." In Industrial A zones, all uses (except bulk oil storage) allowed in any City zone district are permitted, although residential uses require a special permit. In Industrial B zones, bulk oil storage and all other uses, except residential, are permitted.

There is no New York State Equalization and Assessment Agricultural District or farmland retention program near the site.

B2. **CSO Project Sites.** All CSO regional facilities, CSO transmission pipelines, and sewer separation areas are located in older city neighborhoods along Onondaga Creek and Harbor Brook. These neighborhoods include mixed residential, retail, service, institutional and industrial uses, and vacant lots. Many neighborhoods include schools and city parks. Lot sizes are small; lot coverage is high in most areas. Recent investments to schools and parks have been made within the project areas. City and private sector programs to replace deteriorated housing with new single-family homes is occurring in several project areas. Zoning in these neighborhoods is also mixed, including residential, business, commercial, industrial, and CBD (Central Business District) districts, according to the Syracuse Zoning Atlas.

Detailed descriptions of land use and zoning for specific project sites and sewer drainage districts where sewer separation is proposed can be found in Appendix C-5. Supplemental land use and zoning studies may be desirable prior to implementation of specific projects, as land use in many of the project areas is subject to change over time.

C. Land Use Plans

C1. **"Onondaga County 2010 Development Guide."** Adopted by the Legislature in 1991 and used by the County to guide infrastructure decisions, this plan stresses the maintenance of roads, water, and wastewater facilities and managing other fiscal priorities. The plan highlights the need to support the community growth and to provide a sound fiscal approach to infrastructure. Major goals call for economic growth and job creation, compact urban land use pattern, redevelopment and in-fill development of vacant sites which have urban services. Downtown and the Onondaga Lakefront are expected to be centers of economic growth. Residential growth is encouraged in areas with existing infrastructure. The plan recognizes that "Significant community resources will be focused on Onondaga Lake, its tributaries, and environs through efforts to improve water quality, enhance Onondaga Lake Park, and develop opportunities for economic growth."

C2. **City of Syracuse General Plan, Plans and Policies (1967).** This plan is the most recent citywide plan and has four objectives: economic and social mobility for all individuals; optimum use of natural resources, improved air and water quality, and slowing of urban sprawl; economic development and efficient government services; and the creation of an attractive environment. Most of the city retains the neighborhood character described in the plan. The Oil City industrial area has changed markedly, however, as expressed in the following plans related to the Syracuse Harbor, Lakefront Development District, and Franklin Square.

C3. **"2020 Long-Range Transportation Plan," January 1995, Syracuse Metropolitan Transportation Council.** This comprehensive long-range transportation plan, prepared in response to ISTEA, will guide federal transportation funding in Onondaga County. Based on the growth concepts of the County's 2010 Development Guide, the plan recommends funding for maintenance and strategic improvements in congested areas.

Follow-up studies, including the "Lakefront District Transportation Study," which will address transportation impacts and needs related to the new multi-purpose stadium, redeveloped the Harborfront and Regional Market, the proposed transportation center (regional bus and rail), and the proposed Carousel Landing (discount retail center), all of which will impact traffic on Hiawatha Boulevard. This study is in progress.

C4. **Studies and Plans Which Include the Project Sites And Surrounding Areas.**

a) **"Design and Land Use Feasibility Study: Syracuse Harbor," June 1990, O'Brien and Gere.** This study evaluates the potential and provides a redevelopment strategy for the Barge Canal Harbor. The strategy includes a mix of uses (a marina complex, restaurants and retail, waterfront housing, and a major public park) and creation of opportunity by assembling sites and initiating various improvements in amenities and infrastructure.

b) **"Action Plan For the Syracuse Lakefront," October 1991**. This plan was prepared by the Syracuse Office of Lakefront Development by O'Brien & Gere, Halcyon Ltd., and Childs, Bertman, Tseckares, and Casendina. It focuses on a redevelopment strategy for the harbor and the surrounding lakefront, including a variety of short-term, market-supportable initiatives to leverage more substantial ongoing development. The first phase includes a marina, restaurants and retail facilities, a consolidated state canal terminal, and strengthened ties between Franklin Square, the Harbor and the Carousel Center.

c) **"Syracuse Lakefront Zoning and Design Guidelines," December 1991**. This document was prepared by Childs, Bertman, Tseckares, Inc. to create a design framework to ensure the quality and coherence of the redevelopment of the Syracuse Lakefront Area. It provides clear descriptions of desirable design principles for new projects or renovations in the Lakefront area; establishes guidelines for public improvements and criteria for the review of development applications presented to the Lakefront Design Review Board.

d) **"1991 Onondaga Lake Development Plan," October 1991**. This plan was sponsored by the MDA Foundation of CNY, NYS UDC, OCIDA, City of Syracuse with the Reimann Buechner Partnership. It calls for a cohesive set of land uses, including recreation and transportation. Intended to guide development, the recreation element focuses on educational opportunities, shoreline access and sports facilities; the transportation element is concerned with pedestrian movement and mass transit.

e) **"Franklin Square Urban Renewal Plan," May 1989, City of Syracuse.** This plan covers the 100-acre Franklin Square area and is focused on ensuring quality rehabilitation of this formerly neglected manufacturing district for office and residential uses. Recommendations are made in the plan for public improvements, rehabilitation of buildings, design guidelines, properties for acquisition, and zoning amendments. Specific implementation and construction has occurred.

f) **"City of Syracuse, Economic Development Zone Final Application," March 1987, Syracuse Department of Community Development.** The goals of the City in establishing the Economic Development Zone are to improve the business climate, expand employment opportunities, enhance the quality of life for both business and residents within the Zone, and broaden the economic base of the city as a whole. Business development goals focus on small businesses, startups, retention and expansion of existing zone manufacturing and commercial industries, as well as the businesses evolving out of the current incubator programs. The human resource goal is to enhance the employability of zone residents through education, skill training, and job search and placement, as well as special services to overcome language and cultural barriers.

g) **"Central New York Canal Plan," 1993, Central New York Regional Planning and Development Board.** The goal of this plan is to preserve and enhance the natural environment of the canals, the historic heritage associated with the canals, the recreational use and enjoyment of the canals, and the canalling experience, while stimulating economic activity in cities, villages and hamlets along the Central New York Canal System. When the recommendations are implemented, full utilization of the canals can be achieved as a community economic opportunity and a tourism and recreational resource.

h) **"New York State Canal Recreational Way Plan," Beyer Blinder Belle Consortium.** This plan focuses on economic development related to tourism and historic preservation, recreation, and environmental protection along the canal.

i) **Strategic Neighborhood Action Plan.** This plan is a locally based program, directed by the County of Onondaga in the City of Syracuse, in cooperation with New York State Departments of Health and Social Services. The plan targets two westside neighborhoods (centered around Tallman Street and Seymour and Shonnard Streets) to direct resources to several social and economic needs, and address housing and other acute land use issues. Both neighborhoods are affected by CSO facilities and combined sewer separation projects.

D. Demographic and Economic Trends

Demographic and economic trends are relevant to waste water treatment in several respects. Population and poverty, household composition, geographic distribution, and income are indicative of the need for waste water treatment capacity and the ability to fund future capital projects for waste water treatment. Population density relates to the potential benefits as well as to the potential impacts during construction of the CSO regional treatment facilities and sewer separation projects.

Population growth is dependent on creation of new jobs in the county economy. Therefore, the strength and diversity of the County economy, structural changes in employment, and wage structure are relevant of the area's wealth and ability to support the MCP Capital Program.

Onondaga County's population has grown very little over the last 20 years and Syracuse's population has declined markedly (see Table 2-17). The number of households has increased steadily in the County, in contrast to an ongoing decrease in households in Syracuse. Growth in population and households is likely relatively flat, dependent on job growth. Modest economic and demographic growth, an aging population, and increasing poverty can be expected to make major financial undertakings more difficult. However, these trends could be adversely impacted by the high sewer use fees that would result from implementing the MCP.

A concurrent structural shift in the regional and County economy has resulted in the loss of high paying manufacturing jobs and a gain in service and part-time retail jobs which usually carry no benefits. Since 1990, a decline in total employment of residents, a loss of jobs in Onondaga County, and continued out-migration of residents suggests significant economic problems in the County if not New York State.

Syracuse and Onondaga County have suffered significant drops in income relative to New York State. Incomes in Syracuse are more heavily skewed towards lower levels and median household income is lower than in the County as a whole, based on the 1990 Census. Persons in households with incomes below poverty exceeded 22 percent in Syracuse, while an increase in minority population, recent immigrants, single person and female headed households in the city suggests that city residents are likely to continue to lose income relative to the county and the state.

Both economic and demographic data have shown declines since 1990. Onondaga County has not followed the nation out of the 1991 recession; employment has not yet returned to 1990 levels. Losses in manufacturing, financial, insurance and residential construction are more than triple gains in services, including health care, since 1992. Residential building permits have fallen steadily from a high of 2,600 in 1987 to a projected 700 for 1995. Demolition of dwelling units in Syracuse now outpaces new construction of dwellings by two to one. Net outmigration from Onondaga County continues at close to the 1980's rate of over 25,000 per decade. County population grew at 0.4 percent per year until 1993 then declined by 0.34 percent in 1994, while city population has continued to decline at nearly 0.8 percent per year from 1970 through 1994, according to estimates by the Bureau of Census.

D1. **Population**. Population in Onondaga County declined by about 1 percent between 1970 and 1990 to 468,973; most recent census estimates indicate gain of under 1 percent through 1993, then a decline of 1,600 through July 1994. In contrast, population in Syracuse fell by almost 17 percent between 1970 and 1990, and estimates indicate an additional loss of 2.4 percent through 1994 to 159,895.

Moderate population growth totaling 5.6 percent was projected for the County over the next 20 years by the New York State Department of Commerce in 1989. However, Syracuse is likely to continue to lose population relative to the towns and Onondaga County will likely grow more slowly than the rest of the MSA. Population growth will be highly dependent on migration trends and the strength of the job creation in local economy. The community's ability to positively influence the factors that affect job creation, including a favorable tax climate for business, will significantly influence future growth.

a) **Distribution of Population**. The Onondaga County Sanitary District includes 87 percent of the County's population and 88 percent of its households. In 1990, 83 percent of the County's households indicated that they had public sewer service according to the Census; that number included those with service from five villages which are outside the sanitary district.

The METRO Service Area includes 100,254 households, or about 65 percent of the district's residential customers. The service area covers Syracuse, Geddes, and most of Dewitt, Salina, the developed portions of Camillus and Onondaga, and a very small area of Clay. There are five other service areas in the district serving suburban areas of Van Buren, Lysander, Clay, Cicero, Manlius, and Pompey (Table 2-18). The Village of Minoa maintains its own wastewater system. Rural towns, south and west of Syracuse, home to 12 percent of the County's households, lack public wastewater systems, except in the Villages of Tully, Skaneateles, Marcellus, and Jordan.

Since 1970, redistribution of population has led to a loss of population in Syracuse and a relative concentration of elderly, poor, and minority residents, smaller households and single-person households in the city. At the same time, residential construction in suburban towns led to an increase in young families and overall growth in the most suburban towns. The towns closest to Syracuse -- Salina, Geddes, and DeWitt -- have also seen population declines and aging households despite substantial residential construction over the same period. Within the METRO service area, the Town of Onondaga is the only municipality to grow in both population and housing during this time period.

b) **Growth Areas.** Despite a lack of growth in County population, the towns of Clay, Lysander, and Cicero to the north of Syracuse, and Manlius to the east have been the major residential growth centers. Average annual residential construction has declined from 1,950 units during the 1980s to 1,126 units in the 1990s. Since 1990, Cicero has replaced Clay and Manlius as the prominent growth area; Cicero gained 1,015 building permits to 881 units in Clay and 627 in Manlius. Cicero also grew by an estimated 22.5 percent in population compared to a 1 percent loss in Clay and a 1.51 percent gain in Manlius. Lysander and Onondaga also experienced continued residential growth (Table 2-19). Several rural towns had a high percentage growth, on a relatively low population base. About 14 percent of residential building permits have been issued in areas beyond the sanitary district. Since 1990, the net effect is a continuing relocation of dwellings and tax base from the METRO service area to other service areas and areas beyond the sanitary district.

METRO service area includes many major employment centers (Downtown; Carousel Center; University Hill-Syracuse University and Upstate Medical Center and the Hutchings Psychiatric Center; St. Joseph's Hospital; and major industries, including Bristol-Myers Squibb, Crucible Specialty Metals, United Technologies-Carrier, Syracuse China, Lockheed-Martin, Crouse-Hinds, New Process Gear, Will & Baumer, several major industrial laundries, metal plating plants, and office parks).

Although suburban industrial and office parks continue to attract employment growth, the METRO service area still includes the majority of County employment. Ongoing redevelopment efforts in the expanded City Economic Development Zone and new centers such as Syracuse Research Park suggest continued dominance of the METRO area for economic activity.

Population, however, continues to leave the urban core, which comprises most of the METRO Service Area. The population remaining in the service area tends to be less well off financially.

Census estimates of growth since 1990 are available only on a municipal level; thus, it is not possible to produce a current estimate for the precise METRO service area. Table 2-20 summarizes the most recent shifts in population for towns in the service area, but includes areas which lie beyond the service area. These estimates indicate a continued shift of population to suburban and rural areas. Population in Syracuse declined by 2.4 percent; in Salina by 3 percent; and all the municipalities in the METRO Service Area by 1.5 percent, while the County as a whole had growth of almost 1 percent according to 1994 estimates.

Table 2-21 indicates greater growth in Cayuga, Madison, and Oswego Counties (3.31 percent) than in Onondaga County, suggesting a movement to areas beyond Onondaga County as well.

Recent growth of under 1 percent in Onondaga County has not matched growth of over 3 percent in Oswego County and Madison County, reflecting lower cost of living beyond Onondaga County. Thus, Onondaga County continues to lose relative to other counties in the Syracuse MSA.

c) **Household Trends**. Change in the number, size, and composition of households is relevant to the ability to pay for wastewater treatment. Although the unit charge is assessed against dwelling units, households ultimately pay the bill. According to the census, the number of households in Onondaga County increased by

7.5 percent between 1980 and 1990, despite a stable population. In Syracuse, the number of households fell by two percent.

Household formation by the baby boom generation and decreasing household size due to a number of social trends are factors in the change in households; these trends have largely played out and the smaller Generation X will create a much lower level of household formation.

At the same time, average household size has declined due to more single- person households and increasing rates of family dissolution. Decline in household size is expected to continue, from an average 2.64 persons per household in 1990 to 2.55 by 2020. Syracuse will experience a greater decline in household size than the County as a whole. Declining average household size reflects more single-person households, more elderly households, and more single-parent households. These types of households typically have lower incomes than two-parent family households.

The composition of households is a key indicator of potential income growth. Married couple family households have higher incomes than do single-parent, female-headed households, or single-person households. An increase in the number of female headed households is likely to be accompanied by a slower rate of growth in median household income. In the county, households increased by 8.1 percent from 1980 to 1990, while married couple households decreased by 2.5 percent and female headed households increased by over 17 percent. In Syracuse, a decline in the number of households, a decrease of 19 percent in married couple households, and a 12 percent increase in the number of female-headed households are trends which together lead to relative decline in median household income in the City and the METRO Service Area.

d) **Household Income.** Median household income in the County has increased from $8,456 in 1970 to $31,783 in 1990, an average annual rate of increase of 6.8 percent. (Table 2-22). The median household income in the City increased from $6,023 to over $23,082 over the same period. The distribution of incomes shows that over one-third of all city households have incomes below $15,000, while less than one-quarter of Onondaga County households do; one-quarter of city families have incomes below $15,000, while one-eighth of Onondaga County families do (Table 2-23). The median household income in the County is $8,701, 7.7 percent higher than the median in the city.

The city and the County are becoming less well off relative to the state. In 1970, the County and the state had virtually the same median household income, with the City approximately 70 percent of the state median. Between 1970 and 1980, income in the City and the County grew at a more rapid rate than the state, with the County median surpassing the state by more than 5 percent. However, since 1980, the County fell to less than 90 percent and the City to less than 65 percent of the state level. A similar pattern exists for per capita income and median family income. The precipitous drop in relative income growth shows that the County has been experiencing economic difficulties relative to the state.

While Onondaga County ranks 10th in population size among all New York State counties, 15th in median family income, 16th in per capita income, and 18th in median household income. In comparison with the other 62 counties, Onondaga County ranks 34th in growth in total personal income from 1980 to 1990, and 28th in growth in per capita personal income for the same period. Similarly, the County ranked 27th in growth in wages and salaries from 1980 to 1990.

e) **Poverty**. Persons living in poverty increased to 10 percent of County population by 1990. In Syracuse, persons in poverty increased from 14 percent to 22.7 percent of the population between 1970 and 1990. Poverty level income for a family is $15,152 per year, in Onondaga County for 1995, as defined by the U.S. Office of Management and Budget.

D2. **Economy.** Future income growth in Onondaga County will be highly dependent on employment trends in the County and the region. If the economy is strong and employment increases, the proportion of MCP costs borne by residential customers will be proportionately less and household incomes will be higher. Employment in the County and the State are reviewed to assess trends and structural shifts in the economy that are relevant to the County's ability to proceed with the project.

The economy in Onondaga County has suffered significant decline since 1990. The number of employed residents decreased by 10,500, or 4.4 percent, since 1990 (Table 2-24). The unemployment rate increased from 3.9 percent to 5.1 percent. Unemployment peaked in 1992 at 6.5 percent, but while the number of unemployed decreased by 3,200 by 1994, the number of employed only grew by 200. This suggests that substantial numbers have either dropped out of the labor force or left the area in search of work.

Jobs located in Onondaga County decreased by 12,000 between 1990 and 1994. Manufacturing suffered the greatest loss - over 5,700 jobs, or a decline of 13.1 percent in four years. Manufacturing firms leaving the area since 1990 include General Motors, Inland Fisher Guide Division, and Pass and Seymour; the GTE data processing facility will close by the end of 1995. Retail and wholesale trade, construction, transportation, finance, insurance and real estate all suffered major losses measured by either absolute and percentage change. The service sector was the only one to show significant gain. Over half the gain in service employment was in health care - a sector which is in flux due to proposed the shift in Medicaid managed care, changing federal Medicare policy. Comparison of first quarter data for 1994 and 1995, shows a continued downward trend in total employment despite small gains in trade, services and government.

Declines in employment have continued into 1995. First quarter comparisons show a loss of 1,522 jobs from 1994. Losses occurred in every sector except government, trade, and services. Most recent data for October 1995 shows losses every year except 1994, with a drop of 13,400 for that month over five years. Data for August, the usual employment peak, show a loss of 14,300 between 1990 and 1995.

Within the region, Onondaga County is the predominant center of employment, but that relative share has declined by almost 1 percent since 1990 (Table 2-25). Onondaga County suffered a 4.67 percent decline in employment compared to a .25 percent loss in Cayuga County, a 2.62 percent loss in Oswego County, and a 4.4 percent gain in Madison County.

Onondaga County accounts for all but 160 of the region's 11,900 employment decline since 1990.

The average wage in Onondaga County is below that of the state. According to State Department of Labor data, a 64 percent increase has occurred in Onondaga County from 1980 to 1990, compared with an 84 percent increase for the state. The average worker in Onondaga County earned 17 percent less than the state average in 1990. Onondaga County was ranked 39th among New York counties in terms of change in average wage per worker between 1980 and 1990.

Forecasts of future economic conditions are speculative. Clearly Onondaga County has not responded in line with the national post recession growth. Pointing to a net outmigration for New York State of over 775,000 people since 1990 (despite foreign immigration of 450,000), *Fortune* magazine suggests that "residents trekking out of a state are a symptom for existing economical problems and a harbinger of future ones" (Spiers, 1995). It is noted that outmigrants tend to be young families in search of employment; this is consistent with New York State population projections for Onondaga County which forecast decline in all age groups under 44 and growth for those 45 and over.

Projections for New York State population and employment based on current data and recent trends do not exist as of this writing. However, Cornell Institute of Social and Economic Research (CISER), Cornell University and consultants under contract to NYSDOT, are proposing to complete projections in the coming year. Because both population and employment are responsive to state business climate, regional and national trends, it is not reasonable for Onondaga County to prepare independent projections. However, it is reasonable to take note of a five-year decline in indicators of economic strength when assessing the ability of the County to fund substantial capital projects. Syracuse University's Maxwell School is currently refining the REMI, Inc. economic forecasting model for Onondaga County as a tool to evaluate the economic and fiscal impact of various policy alternatives on financing improvements to wastewater infrastructure projects. The Maxwell School effort was funded by the Onondaga Lake Management Conference; results are anticipated in 1996.

E. Cultural Resources

E1. **Visual Resources.**

a) **City of Syracuse Impact Area.** The most intensively developed areas in Syracuse, settled early in the City's history, include downtown and University Hill. These predominantly commercial areas are surrounded by residential neighborhoods with commercial ribbons radiating out from downtown along existing or former transportation corridors.

Most of the streams that originally existed in Syracuse have been eliminated over time either through various dewatering projects or enclosed culverts. Onondaga Creek and Harbor Brook have been channelized to reduce flooding. Channelization (placing the creek beds well below ground level) and fencing (to protect residents from high-volume, high-velocity flows) have eliminated the natural character, fishery, and recreation potential of Onondaga Creek and Harbor Brook in the project area. Sections of both streams have also been covered to provide additional space for urban land uses.

Approximately 55 percent of the City is categorized as greenspace although it is not evenly distributed throughout the City. There are 176 parks containing 900 acres of land. Additional greenspace resources include institutional lands (e.g., cemeteries, universities, and school properties) and streetside spaces (Syracuse Conservation Advisory Council, 1979.)

With exception of Onondaga Valley, the Erie Boulevard corridor, downtown and the lands along the southern shore of Onondaga Lake, most of Syracuse is moderately to steeply sloping which provides for many scenic vistas and views.

b) **Population Density.** The southern end of Onondaga Lake is near the geographic center of the County's population. Density for Onondaga County was 601 people per square mile in 1990. Density decreases from the city, through suburban towns to rural areas; newest suburban developments tend toward two or fewer dwellings per acre in accordance with half-acre zoning which predominates at the suburban fringe. Density in MCP project areas varies from 11,161 to 16,447 people per square mile in the most dense census tracts in Syracuse (the CSO drainage basins which are to undergo sewer separation) to 140 people per square mile in the census tracts nearest the METRO plant site on Hiawatha Boulevard.

c) **Natural and Scenic Areas.**

1) **General.** There are numerous natural and scenic areas of high value in Onondaga County in rural, unspoiled portions of the County and in more intensely developed areas. Scenic areas frequently take advantage of promontories and open areas which offer expansive views over the landscape. More than 50 large state, county, town and city parks and numerous smaller neighborhood parks. Many of the larger parks offer water-related activities, especially the state, county and city parks. The Barge Canal bisects the county and provides boating, fishing and informal swimming plus a connection with other inland waterways and the Atlantic Ocean. Sports activities include minor league baseball, Carrier Dome and related Syracuse University athletics, numerous softball fields, 40 golf courses, spring facilities, snowmobiling trails, skating rinks and so forth.

2) **Onondaga Lake.** Onondaga Lake and its shoreline represents a major resource for natural habitat, recreation and natural beauty. The north, west and portions of southwest, south and southeast shorelines have a somewhat natural appearance although none of the shoreline is natural in the true sense. Several areas on the Lake support wildlife of various kinds. These areas include the west shore between Nine Mile Creek and the Lake outlet, the mouth of Nine Mile Creek, the lakeside wastebeds on the west shore, the mouth of Harbor Brook, the former Murphy property at the southeast shore and the mouth of Ley Creek.

3) **City of Syracuse.** Several parks occur along Onondaga Creek providing green space opportunities in predominately dense residential neighborhoods.

These include Kirk Park, Onondaga Park and a mostly undeveloped section of the park following the Creek from Dorwin Avenue at the southern boundary of the City to Van Duyn School. The City is in the process of developing a creekwalk park from downtown to the Inner Harbor (formerly the Barge Canal Terminal).

These natural/recreation areas do not have significant views or vistas because of their topographic character, but they do afford residents an opportunity for recreation and views of Onondaga Creek. The City of Syracuse has recently embarked on a program of cleaning out overgrown areas flanking the Creek which will help preserve and enhance the scenic and recreational values of these areas.

E2. **Historic and Archaeological Resources.** A bibliography of archaeologically significant sites throughout New York State is kept by the New York State Office of Parks, Recreation and Historic Preservation. In 1982, the State Historic Preservation Office prepared a Statewide Archaeological Inventory Map, which was subsequently incorporated by the Onondaga County Environmental Management Council in a series of environmental inventory maps covering the 19 towns plus the City of Syracuse in Onondaga County.

The Environmental Management Council inventory maps indicate generalized areas of known prehistoric, proto-historic and historic Indian occupation in Onondaga County. Two archaeological sites of particular significance in the vicinity of Onondaga Lake are the French Fort, also known as the site of Ste. Marie de Gah-nah-ta-ha, believed to be located in the Town of Salina near the present Saint Marie Among the Iroquois Living History Site; and a former Onondaga fishing camp known as "Kaneenda," which is believed to have been located at or near the present site of the Carousel Center on Hiawatha Boulevard.

Among the historical resources of the past two centuries, perhaps the most significant was the construction of the Erie Canal. A brief history of the Erie Canal and associated development in the Onondaga Lake vicinity is contained in the Draft Environmental Impact Statement prepared for the Carousel Center:

impact of the rapidly increasing user fees. However, due to the high project costs, even a 25-year implementation schedule only marginally reduces the sewer use charge. If the current MCP project schedule is to be affordable, State and federal assistance is necessary. Absent significant federal and state assistance, whenever appropriate, the project schedule should be extended in order to reduce the impact of rapidly rising sewer use fees.

5.3.3 District Hardship Assistance

The County is very concerned that many residents and businesses will be adversely impacted during implementation of the MCP. The affordability guidance document focuses on the impact of the proposed project on a household at the median income. That, by definition, means that half of the households in the County will be paying more than the rate deemed "affordable" by federal guidance. This problem is especially acute in Onondaga County, where over 11 percent of the households are at or below the poverty level, and in the City of Syracuse where 22 percent of the households are at or below the poverty level. These households have incomes that are less than half of the County median. These households face sewer bills in the year 2000 exceeding 1.8 percent of household income and peaking at approximately 3.3 percent of household income.

There are several options potentially available for the County to address these hardship concerns:

1. Modify the County's present user fee structure to one based on actual flows.

2. Develop a lifeline fee to insulate certain portions of the population from the impact of increasing sewer user fees.

3. Obtain outside financial assistance or scale back the elements of the project to reduce the County's costs and improve the affordability of the project to all households.

The County has practical reservations regarding modifying the present user fee system, given its lack of control over and the lack of uniformity of water billing data. Despite those concerns, it does not appear that this type of fee structure modification would materially change the affordability of the program for hardship households. Apogee Research, in work performed for the Onondaga Lake Management Conference, estimated that flow-based rates would reduce the average household bill

Near to the Hiawatha RTF is the Regional Market site. The New York State Office of Parks, Recreation and Historic Preservation (NYSOPRHP) has determined the general Central New York Regional Market site is eligible as a "State and National Register of Historic Places" site and, based on reported sources, that the site contains an archaeological site. The DGEIS/FGEIS identifies evidence of past land condition and disturbances which would suggest that no archeological resources of value previously existed and/or now exist at the Stadium Market Center site. In the pre-European settlement period, this site was a wetland and probably not suitable for any permanent habitation. The site was initially drained in 1822 when Onondaga Lake was lowered. Since then, substantial filling activities and foundation development have occurred, including the railroad embankment, City of Syracuse landfill, miscellaneous general fill (commercial and hard fill), deep foundation (piles), and spread footing for the Regional Market. The METRO and other facilities are far enough away that they will not interfere with any of these facilities. Based on this information, there will be no significant impact on historic or archeological resources.

The following subsections present additional detail in project areas.

a) **Location and Description of Historic Areas.**

1) **METRO Project Area.** The shoreline of Onondaga Lake is one of the most important resources in the County with regard to early (pre-historic and historic) development of this area. Indian sites and early European settlement sites exist in the general east and southeast shore.

Following the early settlement period, settlement consisted of residential and commercial and industrial users. The salt industry is well documented in terms of locations and overall impact on Syracuse and the nation. With salt came a demand for easy, inexpensive travel and distribution. The development of the Erie Canal, Oswego Canal, and eventually the Barge Canal, all had significant historical significance to Onondaga County and the nation.

Industrial development occurred simultaneously with discovery of salt and development of the canals. Remnants of residential, commercial, and industrial development throughout the early 1900s still exist surrounding the entire lake.

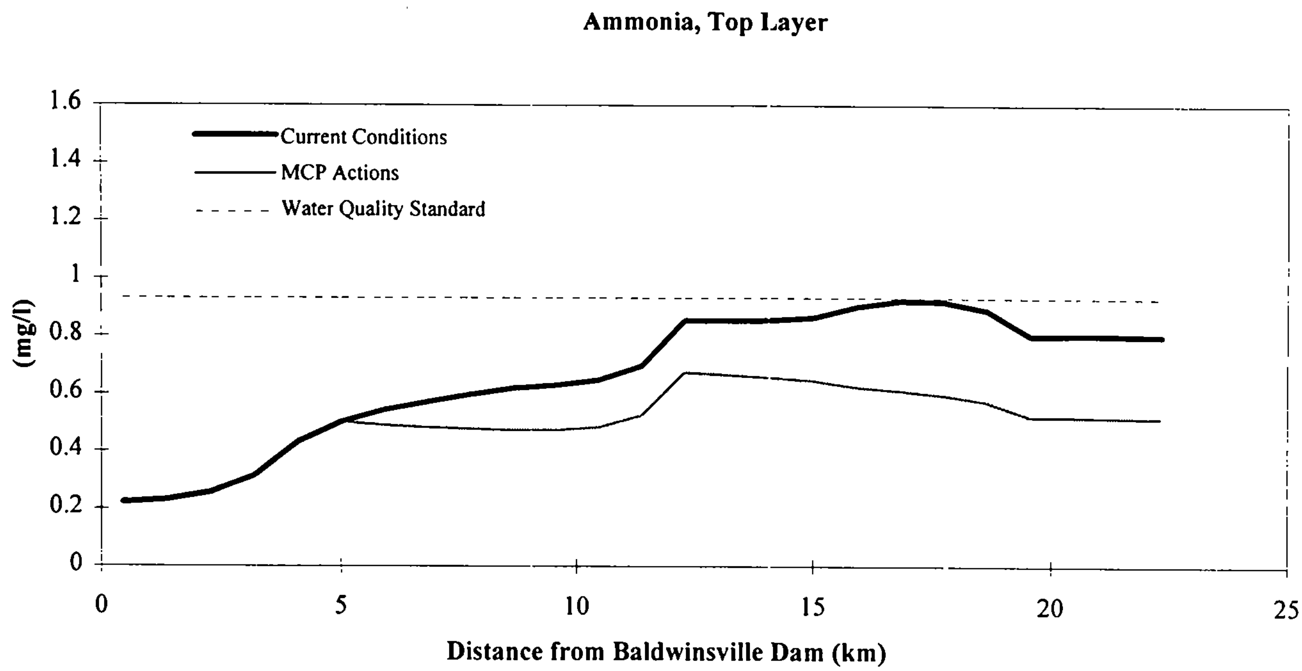
2) **CSO Impact Overview.** This is a generic review of archaeological/historical significance of proposed sites based upon existing and available information as cited below and listed in the bibliography. It should be recognized that any findings from this review could be altered significantly by subsurface digging.

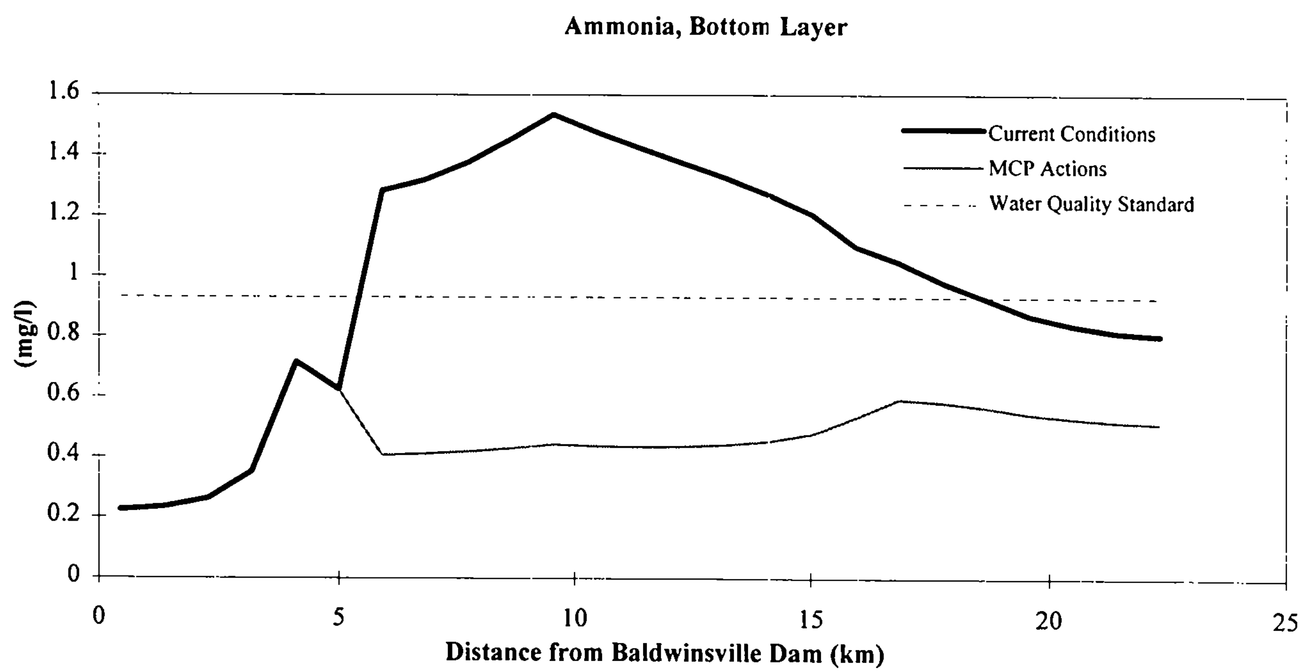
When specific footprints are determined, detailed historical and archaeological surveys will be required. To date, staff to the Syracuse Landmarks Preservation Board and archaeological experts have been consulted to do preliminary resource screening.

The potential locations for CSO facilities generally fall within the corridor following Onondaga Creek and Harbor Brook and occur in two isolated sites in the Ley Creek drainage basin. Specific resources have not been identified at this stage, but resource sensitivity has been identified within the affected corridors/sites. Additionally, NYSDOT and others have been consulted regarding knowledge obtained relative to street/highway construction projects. They have offered opinions on the existence of resources in proximity to their projects, based on cultural/historic surveys (if conducted) and construction experience.

a. **Newell Street RTF.** NYSDOT reconstructed a bridge at this site two years ago. There was no reason to take right-of-way, so no cultural or historical survey was done. The site is located at Yale Street and West Newell Street.

b. **Midland RTF.** The Midland site is located along Onondaga Creek north of the intersection of Blaine Street and Midland Avenue. NYSDOT stated that this site has no historical significance.





Projections of the impact of potential future MCP actions on ammonia levels in current (stratified) conditions in the Seneca River using the UFI Seneca River Water Quality Model. Projections are run for 7q10 flow conditions since model flows are invariable in the stratified river scenario.

Stearns & Wheler ENVIRONMENTAL ENGINEERS & SCIENTISTS DATE: 1/11/96 JOB No.: 2298	DRAFT ENVIRONMENTAL IMPACT STATEMENT ONONDAGA COUNTY DEPARTMENT OF DRAINAGE AND SANITATION
	FIGURE 4-1 D SENECA RIVER MODEL PROJECTIONS FOR IMPACTS OF MCP ACTIONS ON AMMONIA

notes that the lake and its tributaries were used as temporary living areas and may not be of any specific archaeological significance.

The following is a typical example of the problems with the sites reviewed. The Cultural Resources Survey Report that focused on the area where Spencer Street was continued over Onondaga Creek stated that this was an area of low prehistoric interest and had been altered so often that no subsurface testing was thought necessary to ascertain any historic significance. This type of site improvement in all locations has made it difficult to ascertain with certainty the importance of the sites selected. The comments by NYSDOT are those of Geoffrey Christoff, Regional Cultural Coordinator, Region 3, NYSDOT.

1) **Clinton RTF.** This site is located in the downtown Syracuse area and has been a focus of development for 150 years. In the mid-19th century, this land was adjacent to a large body of water called the Mill Pond. The Mill Pond was a wide section of Onondaga Creek that made development impossible. Developers saw this location as one of great potential, and in 1849, they drained this marshy, unhealthy area, making the Clinton Street site attractive to investors. Historically, railroads dominated this area, resulting in the erection of machine shops, engine houses, office buildings, and repair facilities. Over the years, the influence of the railroads declined and the railroads relocated their operations.

Presently, this site is a parking lot separated from the Jefferson Street Armory by elevated railroad tracks. The parking lot is a stop on the downtown trolley route and is heavily used by employees of downtown businesses. The NYSDOT would use the existing elevated railroad tracks if the proposed intracity railroad becomes operational. Laurie Reed of the Downtown Committee and Joanne Araney of EMC stated that this site is just outside the Army Square Historic District.

2) **Erie Boulevard SS.** The Erie Boulevard site seems to have been the area of interest for power companies and breweries. In 1882, Sanborn atlas shows on

Plate 15 that the Germanie Brewery Company stored empty barrels in a building over Onondaga Creek. To the east of this was the bottling works, and further east was Gass Company's coalhouse.

The 1938 Hopkins Atlas on Plate 7 shows Onondaga Creek running under the Bantel Brewing Company and the property adjoining just to the east, owned by the brewery. This area is surrounded on the north and east by the property of the property of the CNY Power Corporation. In 1953, the area between the brewery and the CNY Power Corporation was empty. With the building of the West Street arterial, the surface and subsurface soils in that area were deeply disturbed. The area in question is undeveloped. The NYSDOT and Gordon DeAngelo knew of no definite historic or cultural significance on this site.

3) **Franklin FCF.** This site is located along the north side of a street designated as Webster's Landing, formerly named West Belden Street. The 1892 Vose Atlas, Section 3, shows several brick buildings along Belden Street and a brick freighthouse along Fulton Street. By 1908, there were a number of brick and frame buildings there with railroad tracks running north and south throughout the area. More buildings, some being of stone and stucco, were constructed; the 1911-1952 atlases show a diversified array of businesses such as restaurants, parking lots, wholesale beer companies, and the Hotel Belden. However, in 1953, the area was empty. The construction of Route 81 and Butternut Street in the early 1960s resulted in extensive changes in surface and subsurface soils. No cultural report was done at the time, according to the NYSDOT. This site is presently a parking lot.

Gordon DeAngelo believed that the foundation of previous businesses located there might be unearthed if any digging is done.

4) **Hiawatha Boulevard CSO Treatment Facility.** The Hiawatha Boulevard site is located on the northwest side of Hiawatha Boulevard across from the Spring Street intersection. The NYSDOT has plans for a new road to

loop around the Regional Market and/or a railroad line to service the area as part of the Jamesville-Carousel Mall line, so this site should be investigated further.

5) **Maltbie FCF.** The Maltbie site is located north of Route 690 near Leavenworth Avenue. In 1892, there were several buildings on the site. These same buildings existed in 1938. In 1969, the Allen Tool Company was given demolition permits to take down nine unoccupied buildings on that site. The location was not redeveloped and is presently a parking lot. The NYSDOT is not aware of any known Indian sites of historical significance at this location.

The Maltbie site is located just south of Leavenworth Avenue. Remnants of the foundation of an old pumphouse can be seen along the base of the road. More structures may be unearthed if digging occurs in the immediate area.

6) **Midland RTF.** This site is located in Ward 18 on Syracuse's west side as part of the Tallman Park tract, along Onondaga Creek north of the intersection of Blaine Street and Midland Avenue. In the 1892 Vose Atlas of the City of Syracuse, NY, buildings are present on five lots on Oxford Street. By 1908, the site was listed in the newly assigned Ward #14 and the area was covered with buildings. In 1971, the Syracuse Urban Renewal Agency removed several of the existing structures. The next year, an apartment building was built next to the site, which has remained undeveloped.

7) **Newell Street RTF.** The 1892 Vose Atlas shows this site as pat of the Saunders tract, where lots were laid out but were undeveloped at that time. This continues to be the case, as seen in the 1908, 1924, and 1938 Hopkins Atlases. This site is located at Yale Street and West Newell Street and is presently the site of the Onondaga Count Newell Street CSO treatment facility.

The NYSDOT rehabilitated the nearby bridge two years ago. There was no need for additional right-of-way, so no cultural or historical surveys were done.

8) **Teall Brook FCF.**

9) **EquiFlow™ Site at Harbor Brook.** Based on a literature search conducted by Hartgen Archaeological Associates of Troy, NY (1984), no evidence of any archaeologic or historic significance for the proposed location of facilities at the Harbor Brook EquiFlow™ system. This will be confirmed once the facilities have been designed and submitted for final review.

E3. **Noise.** The major source of noise at the METRO plant and the CSO regional treatment facility sites is background traffic noise, which varies from low levels typical of parks and residential neighborhoods to high levels of traffic noise generated by traffic on interstate highways. The METRO plant, Maltbie Street, Erie Boulevard, Franklin Street, and Hiawatha Boulevard are particularly affected by traffic noise from Route 690 and Interstate 81. Sites at Newell Street and Midland Avenue are relatively isolated from traffic noise.

Periodic noise from freight and passenger trains affects Clinton Street, Erie Boulevard, and METRO plant sites.

Sensitive noise receptors at specific sites that are in drainage basins slated for sewer separation include residential uses, parks, and schools, as noted in Appendix C-5.

TABLE 2-1

LONG-TERM AVERAGE TRIBUTARY FLOWS AND MONTHLY VARIATIONS,
ONONDAGA LAKE TRIBUTARIES
Draft Environmental Impact Statement
Onondaga County, New York

	JAN	FEB	MAR	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
HARBOR BROOK AT HIAWATHA												
Max.	31.0	38.4	68.8	68.8	27.9	51.9	24.6	12.0	28.7	34.0	26.6	35.8
Min.	4.4	6.3	6.0	6.1	4.8	4.6	4.3	3.5	4.2	3.8	3.8	5.1
Median	10.2	11.1	21.3	23.7	10.8	8.4	7.4	6.8	7.2	7.1	7.5	9.6
Mean	11.1	13.1	25.9	24.9	13.1	11.5	9.3	7.1	8.8	9.1	9.3	12.0
Std Dev	6.2	7.4	14.6	13.9	6.3	10.2	5.5	2.3	5.4	7.1	5.7	8.4
LEY CREEK AT PARK STREET												
Max.	70.9	125.0	154.0	334.0	88.7	71.4	61.6	46.7	99.1	129.0	102.0	145.0
Min.	11.0	16.1	25.0	22.5	12.7	13.0	10.9	8.2	9.1	7.0	17.3	18.9
Median	35.8	44.0	76.4	62.2	28.2	31.6	21.9	22.9	26.4	25.1	43.1	41.8
Mean	38.0	50.1	77.6	83.0	36.5	33.1	27.0	22.7	32.4	38.8	46.1	58.0
Std Dev	18.8	30.1	29.7	71.2	19.8	14.3	15.6	9.9	22.0	34.1	20.1	36.1
NINE MILE CREEK AT LAKELAND												
Max.	492.0	408.0	669.0	807.0	385.0	676.0	289.0	216.0	308.0	529.0	439.0	623.0
Min.	81.8	114.0	112.0	150.0	88.6	52.6	44.2	28.6	33.0	43.6	56.0	97.3
Median	184.0	193.0	309.0	356.0	183.0	124.0	101.1	103.5	90.0	124.6	146.0	183.0
Mean	221.7	231.1	350.1	388.2	206.5	159.5	113.6	102.4	107.2	143.1	180.5	234.1
Std Dev	111.5	90.0	140.6	159.1	95.3	135.6	63.3	50.8	64.3	115.6	104.9	130.4
ONONDAGA CREEK AT SPENCER STREET												
Max.	381.0	457.0	653.0	935.0	379.0	617.0	225.0	171.0	275.0	424.0	324.0	452.0
Min.	73.6	70.4	123.0	166.0	89.1	70.4	46.2	37.0	38.7	39.2	60.3	103.0
Median	163.0	201.0	315.0	339.0	168.0	112.0	93.4	77.4	84.1	81.4	158.0	164.0
Mean	176.7	210.1	348.7	377.6	199.9	156.0	103.4	81.7	94.8	121.4	163.5	205.8
Std Dev	84.3	98.1	134.9	163.6	84.0	118.0	52.9	38.5	57.8	97.7	78.9	95.8

TABLE 2-2

SENECA RIVER FISH SURVEY SUMMARY
Draft Environmental Impact Statement
Onondaga County, New York

Species	**1927**	**1978**	**1989**	**1991**
Lake sturgeon	•			
Longnose gar	•			
Bowfin	•			
American eel	•			
Alewife	•			•
Gizzard shad			•	•
Channel catfiish	•		•	•
Brown bullhead	•	•	•	•
Yellow bullhead	•			
Lake chubsucker	•			
Whitenosed redfin sucker	•			
White sucker	•			•
Shorthead redhorse	•			•
Carp		•	•	•
Goldfish		•		
Hornyhead chub	•			
Bridle shiner	•			
Blacknose shiner	•			
Mimic shiner	•			
Satinfin shiner	•			
Spottail shiner	•			
Spotfin shiner				•
Common shiner	•		•	
Golden shiner			•	•
Rosyface shiner	•			
Cutlips minnow	•			
Silvery minnow	•			
Slender minnow	•			
Chain pickerel	•	•		
Northern pike	•		•	•
Tiger muskellunge (hybrid)	•		•	
Banded killifish	•			
Brook silverside				•
Brook stickleback	•			
White perch		•	•	•
White bass	•			•
Smallmouth bass	•		•	•
Largemouth bass	•		•	•
White crappie			•	•
Black crappie	•		•	•
Rock bass	•		•	•
Bluegill	•		•	•
Pumpkinseed	•	•	•	•
Tesselated darter	•			
Logperch	•			
Yellow perch	•		•	•
Walleye	•			•
Freshwater drum			•	•

Total Number of Species = 48

Ringler et. al., 1994 copied with permission

TABLE 2-3

REGULATORY COMPLIANCE IN ONONDAGA LAKE WATERS, 1994.
UW = UPPER WATERS, LW = LOWER WATERS.
Draft Environmental Impact Statement
Onondaga County, New York

PARAMETER (UNITS)	NYSDEC STANDARD (CLASS B,C)	AVERAGE OF 1994 MEASURED CONCENTRATIONS		OBSERVATIONS IN COMPLIANCE
pH (standard units)	Shall not be less than 6.5 nor more than 8.5	UW : LW :	7.6 - 8.3 7.2 - 7.8	100% 100%
Dissolved Oxygen (mg/l)	Minimum daily average 5.0 mg/l, at no time shall DO be < 4.0 mg/l	UW : LW :	7.6 * 2.4 *	100% 27%
Dissolved Solids (mg/l)	Shall be kept as low as practicable to maintain the best usage of waters but in no case shall it exceed 500 mg/l.	UW : LW :	1268 1457	0% 0%
Fecal Coliform (cells/100 ml)	The monthly geometric mean, from a minimum of five examinations, shall not exceed 200 cells/100ml.	UW : LW :	35.9 * 27.5 *	
Ammonia (mg/l)	Varies with pH and temperature.	UW : LW :	2 3.14	12% 12%
Arsenic (mg/l)	190 mg/l	UW : LW :	<2 <2	100% 100%
Cyanide (mg/l)	5.2 mg/l (Free CN)	UW : LW :	1.5 * 1.5 *	100% 100%
Nitrite (mg/l)	100 mg/l (Warm water fishery)	UW : LW :	107.4 65.0	32% 78%
Copper (μg/l)	exp (0.8545 [ln (ppm hardness)] - 1.465) Standard - 34.5 μg/l	UW : LW :	7.2 7.2	100% 100%
Mercury (μg/l)	0.2 μg/l	UW : LW :	0.15 * 0.13 *	100% 100%

TABLE 2-3 (CONTINUED)

REGULATORY COMPLIANCE IN ONONDAGA LAKE WATERS, 1994.
UW = UPPER WATERS, LW = LOWER WATERS.
Draft Environmental Impact Statement
Onondaga County, New York

PARAMETER (UNITS)	NYSDEC STANDARD (CLASS B,C)	AVERAGE OF 1994 MEASURED CONCENTRATIONS		OBSERVATIONS IN COMPLIANCE
Lead (µg/l)	exp (1.266 [ln (ppm hardness)] - 4.661) Standard - 15.7 µg/l	UW : LW :	2.4 * 1.5 *	100% 100%
Cadmium (µg/l)	exp (0.7852 [ln (ppm hardness)] - 3.490) Standard - 3.0 µg/l	UW : LW :	0.95 * 1.2	100% 100%
Zinc (µg/l)	exp (0.85 [ln(ppm hardness)] + 0.50) Standard - 240	UW : LW :	37.5 20.4	100% 100%
Chromium (µg/l)	exp (0.819 [ln (ppm hardness)] + 1.561) Standard - 577 µg/l	UW : LW :	2.6 2.2	100% 100%
Nickel (µg/l)	exp (0.76 [ln (ppm hardness)] + 1.06) Standard - 247 µg/l	UW : LW :	21.9 22.4	100% 100%
Iron (µg/l)	300 µg/l	UW : LW :	137 144	94% 100%
Total Phosphorus (µg/l)	None in amounts that will result in growths of algae, weeds, and slimes that will impair the waters for their best usages. Guidance value of 20 µg/l, *upper waters summer average.*	UW :	99.5	0%

Regulatory compliance in Onondaga Lake waters, 1994. Standard values derived from NYSDEC Ambient Water Quality Standards and Guidance Values, 1993, and 6NYCRR Part 703. Averages include observations from April 13 to December 21. Bacteria sampling is not conducted at the required frequency to assess compliance.

Range of water hardness on sampling dates: 360.4 - 560.7 ppm. Compliance calculations were made using a hardness value of 350 mg/l, which is the maximum value allowed by NYSDEC for these calculations.

* Data may consist of observations both above and below detection limits. Observations below detection limits are replaced by one half the limit's value so that a mean may be computed.

TABLE 2-4

BROOKS RAND LTD. MERCURY TESTING RESULTS - AUGUST 4 TO NOVEMBER 22, 1994
ONONDAGA LAKE, NATURAL TRIBUTARIES, MUNICIPAL TREATMENT PLANT, AND INDUSTRIAL INFLOWS
Draft Environmental Impact Statement
Onondaga County, New York

SAMPLE DATE	SAMPLE LOCATION	CONCENTRATION (NG/L)			LOAD (POUNDS/DAY)	
		TOTAL HG	METHYL HG	FLOW (MGD)	TOTAL HG	METHYL HG
08/04/94	Nine Mile Creek - Amboy	2.19	-	N/A	N/A	-
08/04/94	Nine Mile Creek - Lakeland	22.3	-	45.8	8.5×10^{-3}	-
08/04/94	METRO Influent	428	-	62	0.22	-
08/04/94	METRO Effluent	35.7	-	60.4	1.8×10^{-2}	-
08/04/94	Allied - Sewer 1	57.9	-	0.029	1.4×10^{-5}	-
08/04/94	Allied - Sewer 2	16.2	-	0.04	5.4×10^{-6}	-
09/21/94	Allied - Sewer 3	5.79	-	0.0008	3.9×10^{-8}	-
09/26/94	Allied Overflow	0.834	-	0.0009	6.3×10^{-9}	-
11/22/94	Nine Mile Creek - Amboy	7.64	0.206	N/A	N/A	N/A
11/22/94	Nine Mile Creek - Lakeland	14.6	0.318	80.9	1×10^{-2}	2.1×10^{-4}
11/22/94	METRO Influent	254	1.32	60.1	0.127	1×10^{-3}
11/22/94	METRO Effluent	14.9	0.898	57	7×10^{-3}	4.3×10^{-4}
11/22/94	Allied - Sewer 1	199	2.59	0.04	6.6×10^{-5}	8.6×10^{-7}
11/22/94	Allied - Sewer 2	339	1.64	0.026	7.4×10^{-5}	3.6×10^{-7}
11/22/94	Allied - Sewer 3	48.3	2.96	0.0006	2.4×10^{-7}	1.5×10^{-8}
11/22/94	Allied Overflow	57.5	32.5	0.0014	6.7×10^{-7}	3.8×10^{-7}

TABLE 2-5

ONONDAGA LAKE FISH SURVEY SUMMARY
Draft Environmental Impact Statement
Onondaga County, New York

Species	h	1927	1946	1969	1980	1989	1990	1991	1993
Sea lamprey								•	
longnose gar					•		•	•	•
bowfin					•	•	•	•	•
American eel								•	•
alewife			•		•	•	•	•	
gizzard shad					•	•	•	•	•
channel catfish			•	•	•	•	•	•	•
brown bullhead				•	•	•	•	•	•
yellow bullhead						•	•	•	•
white sucker		•		•	•	•	•	•	•
shorthead redhorse		•	•	•	•	•	•	•	•
carp		•	•	•	•	•	•	•	•
creek chub								•	
spottail shiner								•	•
spotfin shiner								•	
golden shiner		•	•			•	•	•	•
emerald shiner		•	•			•	•		•
redfin shiner								•	•
bluntnose minnow		•					•	•	
fathead minnow								•	•
rudd								•	
cisco	h								
Atlantic salmon	h								
brown trout						•	•	•	•
rainbow trout								•	
tiger trout						•			
brook trout								•	
lake trout									
rainbow smelt								•	
central mudminnow								•	
grass pickerel		•							
chain pickerel							•	•	
Northern pike			•			•	•	•	•
tiger muskellunge						•		•	•
burbot						•			
banded killifish		•	•			•	•	•	•
brook silverside						•	•	•	
brook sticleback				•	•	•	•	•	
white perch				•	•	•	•	•	•
white bass			•			•	•	•	•
smallmouth bass				•	•	•	•	•	•
largemouth bass		•				•	•	•	•
white crappie						•	•	•	
black crappie						•	•	•	•
rock bass						•	•	•	•
bluegill				•	•	•	•	•	•
green sunfish								•	
pumpkinseed		•	•	•	•	•	•	•	•
tesselated darter								•	
logperch			•			•	•	•	
yellow perch		•	•	•	•	•	•	•	•
walleye			•	•	•	•	•	•	•
freshwater drum				•	•	•	•	•	•

Total Number of Species = 53
* h = historical accounts pre-1900

Ringler et. al., 1994, copied with permission

TABLE 2-6

SUMMARY OF USE LIMITING CONDITIONS
AND CONTRIBUTING FACTORS
Draft Environmental Impact Statement
Onondaga County, New York

DESIGNATED USE	IMPAIRED BY	CONTRIBUTING FACTORS
Water contact recreation	Bacteria	CSO, stormwater
	Turbidity	Phytoplankton (phosphorus) Inorganic turbidity (mud boils)
	Aesthetics	Floatables (CSO)
Fish propagation	Habitat	Oncolites-reduced macrophytes
	Turbidity	Phytoplankton (phosphorus) Inorganic turbidity
	Ammonia and nitrite	METRO effluent
	Dissolved oxygen	Algal biomass (phosphorus)
Consumptive fishery	Mercury	Sediments (historical inputs)
	PCB	Industrial (historical and current?)
	Other contaminants	Petroleum and other industrial contaminants

<u>TABLE 2-7</u>

ONONDAGA LAKE FISHES: SPAWNING REQUIREMENTS AND REPRODUCTIVE SUCCESS
Draft Environmental Impact Statement
Onondaga County, New York

FISH SPECIES	SPAWNING HABITAT	HABITAT AVAILABLE?	REPRODUCTIVE SUCCESS
white perch	shallow, various substrates	yes	High (> 1000 juveniles)
gizzard shad	shallow, various substrates, also streams	yes	High
banded killifish	weedy shallows	reduced areas	High
golden shinner	weedy shallows	reduced areas	High?
brook silverside	washed gravel or vegetation	reduced areas	High
bluegill	shallow, firm sand or gravel	some areas	High
pumpkinseed	shallow sand, gravel, some vegetation	reduced areas	High
carp	weedy shallows	reduced areas	Moderate (100 -1000 juveniles)
emerald shiner	2-6 m depth, hard substrate	yes	Moderate
largemouth bass	sand or gravel among vegetation	reduced areas	Moderate
yellow perch	gravel, rock, vegetation	reduced areas	Moderate
brown bullhead	sand or gravel near structure	almost absent	Low (1 -100 juveniles)
spotfin shiner	rocks, logs, other structure	almost absent	Low
northern pike	weedy shallows	reduced areas	Low
smallmouth bass	gravely shores, near structure	reduced areas	Low
black crappie	various sediments, near vegetation	reduced areas	Low
alewife	shallows, different substrates	yes	No juveniles
white bass	windswept hard substrate, also streams	yes	No juveniles
redfin shinner	benthic, sand or gravel	reduced areas	No juveniles
freshwater drum	pelagic, ofshore	yes	No juveniles
bowfin	weedy shallows	reduced areas	No juveniles
rudd	weedy shallows	reduced areas	No juveniles
grass pickerel	weedy shallows	reduced areas	No juveniles
chain pickerel	weedy shallows	reduced areas	No juveniles
brook stickleback	weedy shallows	reduced areas	No juveniles
yellow bullhead	weedy shallows, also in streams	reduced areas	No juveniles
white crappie	weedy shalows	reduced areas	No juveniles
channel catfish	rivers, near rocks or other structure	almost absent	No juveniles
spottail shiner	sandy shoals of lakes, also in streams	almost absent	No juveniles
bluntnose minnow	over sand and gravel, underside of structure	almost absent	No juveniles
fathead minnow	over sand, underside of structure	almost absent	No juveniles
rock bass	sandy, gravely shallows	almost absent	No juveniles
green sunfish	very shallow sand or gravel, near structure	almost absent	No juveniles
tasselated darter	shallow, under structure, also in streams	almost absent	No juveniles
longnose gar	weedy shallows with gravel	almost absent	No juveniles
creeck chub	streams or clean gravel of lakes	absent	No juveniles
lake trout	streams or clean rock-rubble of lakes	absent	No juveniles
brown trout	streams or clean rock-rubble of lakes	absent	No juveniles
rainbow smelt	streams or clean gravel of lakes	absent	No juveniles
walleye	wave-washed rock and gravel, also in streams	absent	No juveniles
burbot	benthic, clean sand or gravel	absent	No juveniles
logperch	clean sand and gravel shoals, also streams	absent?	No juveniles

TABLE 2-8

REGULATORY COMPLIANCE IN ONONDAGA LAKE TRIBUTARIES, 1994.
NM=NINE MILE CREEK, OC=ONONDAGA CREEK, LC=LEY CREEK,
HB=HARBOR BROOK, AND 5A=TRIB 5A.
Draft Environmental Impact Statement
Onondaga County, New York

PARAMETER (UNITS)	NYSDEC STANDARD (CLASS B,C)	AVERAGE OF 1994 MEASURED CONCENTRATIONS		OBSERVATIONS IN COMPLIANCE
pH (standard units)	Shall not be less than 6.5 nor more than 8.5	NM :	7.5 - 8.1	100%
		OC :	7.6 - 8.1	100%
		LC :	7.0 - 7.8	100%
		HB :	7.3 - 8.1	100%
		5A :	7.4 - 8.7	100%
Dissolved Oxygen (mg/l)	Daily Average <5.0 Daily Minimum <4.0	NM :	9.99	100%
		OC :	10.13	100%
		LC :	8.36	100%
		HB :	9.49	100%
		5A :	6.64	96%
Fecal Coliform (cells/100 ml)	The monthly geometric mean, from a minimum of five examinations, shall not exceed 200 cells/100ml.	NM :	1159	*
		OC :	2827	*
		LC :	924	*
		HB :	3779	*
		5A :	41	*
Ammonia * (mg/l)	Varies with pH and temperature.	NM :	0.42	100%
		OC :	0.07	100%
		LC :	0.39	100%
		HB :	0.11	100%
		5A :	0.12	100%
Arsenic * (µg/l)	190 µg/l	NM :	1.4	100%
		OC :	1.9	100%
		LC :	1.4	100%
		HB :	<2	100%
		5A :	1.6	100%
Cyanide * (µg/l)	5.2 µg/l (Free CN)	NM :	1.8	100%
		OC :	<2	100%
		LC :	6.3	50%
		HB :	1.7	100%
		5A :	3.8	75%

TABLE 2-8 (CONTINUED)

REGULATORY COMPLIANCE IN ONONDAGA LAKE TRIBUTARIES, 1994.
Draft Environmental Impact Statement
Onondaga County, New York

PARAMETER (UNITS)	NYSDEC STANDARD (CLASS B,C)	AVERAGE OF 1994 MEASURED CONCENTRATIONS		OBSERVATIONS IN COMPLIANCE
Copper (μg/l)	exp (0.8545 [ln (ppm hardness)] - 1.465)			
	NM Range: 33.0 - 34.5 μg/l	NM :	16.1	100%
	OC Range: 23.1 - 34.5 μg/l	OC :	10.5	100%
	LC Range: 16.6 - 34.5 μg/l	LC :	11.2	75%
	HB Range: 27.5 - 34.5 μg/l	HB :	10.1	100%
	5A Range: 26.7 - 34.5 μg/l	5A :	17.5	100%
Mercury * (μg/l)	0.2 μg/l (Guidance Value)	NM :	0.13	100%
		OC :	**	75%
		LC :	0.13	100%
		HB :	<0.2	100%
		5A :	<0.2	100%
Lead (μg/l)	exp (1.266 [ln (ppm hardness)] - 4.661)			
	NM Range: 14.7 - 15.7 μg/l	NM :	3.8	100%
	OC Range: 8.7 - 15.7 μg/l	OC :	3.8	100%
	LC Range: 5.3 - 15.7 μg/l	LC :	10.1	100%
	HB Range: 11.2 - 15.7 μg/l	HB :	4.1	100%
	5A Range: 10.8 - 15.7 μg/l	5A :	3.9	100%
Cadmium (μg/l)	exp (0.7852 [ln (ppm hardness)] - 3.490)			
	NM Range: 2.9 - 3.0 μg/l	NM :	0.63	100%
	OC Range: 2.1 - 3.0 μg/l	OC :	0.71	100%
	LC Range: 1.6 - 3.0 μg/l	LC :	1.00	100%
	HB Range: 2.5 - 3.0 μg/l	HB :	0.76	100%
	5A Range: 2.4 - 3.0 μg/l	5A :	0.50	100%
Zinc (μg/l)	exp (0.85 [ln (ppm hardness)] + 0.5)			
	NM Range: 229 - 240 μg/l	NM :	23.7	100%
	OC Range: 161 - 240 μg/l	OC :	35.7	100%
	LC Range: 116 - 240 μg/l	LC :	33.5	100%
	HB Range: 191 - 240 μg/l	HB :	32.8	100%
	5A Range: 461 - 240 μg/l	5A :	31.8	100%

TABLE 2-9

SUMMARY OF PREVIOUS SEDIMENT STRATIGRAPHY
ANALYSES OF ONONDAGA LAKE
Draft Environmental Impact Statement
Onondaga County, New York

SOURCE	SAMPLE SITES	VERTICAL RESOLUTION	MEASURED PARAMETERS
Onondaga County (1971) and Murphy (1978)	8 cores lake-wide		Visual description
	20 cores lake-wide	≥0.3 meters	Chloride in pore water
USEPA (1973)	43 cores lake-wide	≥6 inches	Visual description, Hg, volatile solids, percent solids
Effler* (1975) and Effler, et. al. (1979)	3 cores	≥5 cm	Ca, K, Mg, Fe, Mn, P, Cd, Cr, Cu, Ni, Pb, Zn, volatile solids, particle size, X-radiography, percent solids, specific gravity, Cs-137, Pb-210
NYSDEC (1990)	43 cores lake-wide	≥3 inches	Hg, percent solids
	3 cores	≥3 inches	Organic compounds Al, Sb, As, Ba, Cd, Ca, Cr, Co,Cu, Pb, Fe, Mg, Mn Ni, K, Ag, Na, V, Zn, cyanide
Effler, et. al. (1990)	2 cores	1 cm	Chloride in pore water

Source: UFI, 1994.

TABLE 2-10

SEDIMENTARY STRATIGRAPHIC HORIZONS, ASSOCIATED DATES,
AND INTERVAL AVERGE SEDIMENT ACCUMULATION RATES
AT THE SOUTH DEEP STATION OF ONONDAGA LAKE*
Draft Environmental Impact Statement
Onondaga County, New York

SEDIMENTARY DEPTH (CM)	HORIZON/EVENT	INTERVAL	ACCUMULATION (CM/YR)
0	Core sample collected (1988)	1964-1968	0.6
21	C_s-137 peak fallout from bomb testing	1884-1964	0.46
60	Abrupt increase in $CaCO_3$ conc./soda ash production starts in 1884	1822-1881	0.32
80	Abrupt decrease in ratio of benthic-epiphytic to planktonic diatoms/lowering of lake level in 1822	5490YBP-1822	0.08
5000	5490 year before present (YBP) by C-14 dating	--	--

*Adjusted to account for sediment compaction.

Source: UFI, 1994.

TABLE 2-11

PRODUCTION AND DISTRIBUTION OF BIOSOLIDS (WET TONS)
ONONDAGA COUNTY
Draft Environmental Impact Statement
Onondaga County, New York

	1991	1992	1993*	1994	JANUARY-OCTOBER 1995	TOTAL
N-Viro	18,159	34,621	9,123	49,799	37,425	159,127
Land reclamation (out of state)	9,416	12,353	6,098	29	0	27,896
Landfill	42,793	30,314	37,017	19,312	15,268	144,704
TOTAL	80,368	77,288	52,238	69,140	52,693	331,727

*Production of biosolids decreased for 1993 due to the temporary shutdown of a portion of METRO's secondary unit process to make consent order required improvements.

TABLE 2-12

1994 WASTE HAULER SUMMARY
Draft Environmental Impact Statement
Onondaga County, New York

WASTE TYPE	1994 GALLONS
Miscellaneous non-industrial (e.g, recreational vehicles)	1,892
Camillus landfill leachate	1,655,197
Jordan WWTP sludge	147,460
Marcellus WWTP sludge	579,000
Animal waste	5,427
Holding tank waste	758,036
Out-of-County holding tank waste	18,272
Imhoff tank waste	8,500
Portable toilet waste	517,506
Septage	3,429,137
Out-of-county septage	267,158
Sewage treatment plant sludge	3,815
Other miscellaneous non-industrial	11,170
Grease trap waste	266,282
Skaneateles WWTP sludge	363,853
Welch-Allyn WWTP sludge	257,133
TOTAL	8,289,838

<u>TABLE 2-13</u>

TRAFFIC FACILITIES
CSO PROJECT AREAS
Draft Environmental Impact Statement
Onondaga County, New York

PROJECT LOCATION	TRANSPORTATION FACILITY	FUNCTIONAL CLASS
MCP Interim Projects		
Hiawatha RTF	Hiawatha Boulevard Spring Street	Minor arterial Local street
Newell RTF	West Newell Street and bridge over Onondaga Creek Vale Street	Local street Local street
Harbor Brook EquiFlow	Access via Onondaga Lake, private road owned by AlliedSignal	Barge Canal Local road
Erie Boulevard Storm Sewer	Erie Boulevard @ North Franklin Street State Street University Avenue James Street @ North State Street	Principal arterial Local street Principal arterial Local street Principal arterial Principal arterial
Kirkpatrick Street FCF	Kirkpatrick Street @ Onondaga Creek	Minor arterial
Teall Brook FCF	Lorenzo Avenue near Teall Avenue (County jurisdiction)	Local street Principal arterial
Harbor Brook FCF	Hiawatha Boulevard @ Harbor Brook west of I-690	Minor arterial Principal arterial
Intermediate Projects		
Clinton Station RTF	Gifford Street @ Onondaga Creek, railroad South Clinton Street North Franklin Street Jefferson Street Tully Street West Street Fabius Street Dickerson Street Gifford Street Granger Street West Onondaga Street City parking lot	Local street Major north/south line Minor arterial Local street Local street Local street Principal arterial Local street Local street Local street Local street Minor arterial Public parking

TABLE 2-13 (continued)

PROJECT LOCATION	TRANSPORTATION FACILITY	FUNCTIONAL CLASS
Midland RTF	Oxford Street Blaine Street Midland Avenue West Castle Street South Avenue Kirk Park Drive West Colvin Street Crehange Street Elmhurst Avenue West Brighton Street Tallman Street CENTRO Parking Lot	Local street and pedestrian bridge Local street Minor arterial Local street Minor arterial Local street Minor arterial Local street Local street Minor arterial Collector Private parking
Franklin FCF	North Franklin Street Butternut Street North Clinton Street exit from I-81 West Belden Avenue	Local street Minor arterial bridge over I-81 Minor arterial Local street
Maltbie FCF	Maltbie Street Evans Street	Local street Local street
Sewer Separation Drainage Basins		
022	Herald Place South Clinton Street Erie Boulevard West	Local street Minor arterial
024	Erie Boulevard West South Salina Street Washington Street North Franklin Street	Principal arterial Minor arterial Collector Local street
037	Adams Street South State Street Taylor Street	Principal arterial Principal arterial Local street
057, 058, 059	West Genesee Street West Street Erie Boulevard West Barker Avenue	Principal arterial Principal arterial Principal arterial Local street

TABLE 2-13 (continued)

PROJECT LOCATION	TRANSPORTATION FACILITY	FUNCTIONAL CLASS
038, 040	Temple Street Midland Avenue Daisey Street Tallman Street Rich Street	Local street Minor arterial Local street Collector Local street
045	South Avenue Chestnut Street	Minor arterial Local street
046A, 046B, 048, 050, 051	Onondaga Avenue Bissell Street May Avenue West Colvin Street	Minor arterial Local street Local street Minor arterial
053, 054	Elmhurst Avenue Hunt Place LaFayette Avenue South Avenue	Local street Local street Local street Minor arterial

TABLE 2-14

FUNCTIONAL CLASSIFICATION OF STREETS
INVOLVED IN CSO PROJECTS
Draft Environmental Impact Statement
Onondaga County, New York

PRINCIPAL ARTERIALS	MINOR ARTERIALS	COLLECTORS
Adams Street	Bear Street	Bellevue Avenue
Erie Boulevard (Route 5)	Brighton Avenue	State Fair Boulevard
North Geddes Street	Butternut Street	Tallman Street
West Genesee Street (Route 5)	Clinton Street	
Shonnard Street	Cortland Avenue	
Teall Avenue	South Geddes Street	
West Street Arterial	Grand Avenue	
	Grant Boulevard	
	Hiawatha Boulevard	
	Kirkpatrick Street	
	West Onondaga Street	
	Spencer Street	
	Van Rensselaer Street	

Source: SMTC, 2020 Long Range Transportation Plan for Syracuse and Onondaga County, January 1995.

BRIDGES OVER ONONDAGA CREEK
IN THE CSO PROJECT AREAS
Draft Environmental Impact Statement
Onondaga County, New York

Adams Street	LaFayette Avenue
Brighton Street	Midland Avenue
Colvin Street	Newell Street
Dickerson Street	Onondaga Street
Elmhurst Avenue	Oxford Street
Fayette Street	South Avenue
Gifford Street	Tallman Street

Source: SOCPA, City of Syracuse Base Map.

TABLE 2-15

1990 LAND USE - ONONDAGA COUNTY
Draft Environmental Impact Statement
Onondaga County, New York

CATEGORY	PERCENT OF TOTAL COUNTY
Residential	9.0%
Retail/office/other commercial	2.5%
Industrial	3.5%
Educational	.5%
Transportation	1.0%
Parks and recreation	5.0%
Agricultural	31.0%
Vacant	43.5%
Water bodies	2.8%
Onondaga Nation	1.2%

Source: SOCPA 1990 Land Use Plan Map.

TABLE 2-16

LOCATION OF RESIDENTIAL BUILDING AND DEMOLITION PERMITS
ONONDAGA COUNTY
Draft Environmental Impact Statement
Onondaga County, New York

	1980-1989			
	TOTAL PERMITS	DEMOLITION PERMITS	NET PERMITS	ANNUAL AVERAGE
Syracuse	1,783	2,768	985	-99
Total County	18,812	2,917	15,895	1,590

	1990-1994			
	TOTAL PERMITS	DEMOLITION PERMITS	NET PERMITS	ANNUAL AVERAGE
Syracuse	562	860	-298	-60
Total County	6,537	904	5,633	1,127

TABLE 2-17

DEMOGRAPHIC CHARACTERISTICS
Draft Environmental Impact Statement
Onondaga County, New York

CHARACTERISTIC	1970	1980	1990
Population			
City of Syracuse	197,297	170,105	163,860
Onondaga County	472,835	463,920	468,973
Households			
City of Syracuse	71,844	66,280	64,945
Onondaga County	153,609	164,557	177,898
Percent below poverty level			
City of Syracuse	14.1%	18.4%	22.7%
Onondaga County	9.0%	6.6%	10.3%
New York State	11.0%	13.4%	13.0%
Median household income			
City of Syracuse	$6,033	$12,321	$23,082
Onondaga County	8,456	7,574	31,783
New York State	8,550	16,647	35,811

TABLE 2-18

GEOGRAPHIC DISTRIBUTION OF POPULATION
IN ONONDAGA COUNTY, 1990
Draft Environmental Impact Statement
Onondaga County, New York

	POPULATION	HOUSEHOLDS
Onondaga County	468,973	177,898
Towns	323,113	112,953
Sanitary District	408,609	156,592
METRO service area	254,339	100,254
Syracuse	163,860	64,945

Source: 1990 Census, block group data; compiled by the Central New York Regional Planning and Development Board.

TABLE 2-19

RESIDENTIAL BUILDING PERMITS IN ONONDAGA
FOR TOWNS AND THE CITY OF SYRACUSE
1990 TO 1994
Draft Environmental Impact Statement
Onondaga County, New York

TOWN	1990	1991	1992	1993	1994	TOTAL
Camillus	52	47	46	87	83	315
Cicero	214	204	224	215	158	1,015
Clay	233	161	201	125	161	881
DeWitt	55	39	38	34	56	222
Elbridge	16	14	19	40	10	99
Fabius	11	11	17	11	8	58
Geddes	42	77	39	42	29	229
LaFayette	17	11	21	14	17	80
Lysander	175	158	195	174	125	827
Manlius	133	93	125	184	92	627
Marcellus	11	8	17	14	37	87
Onondaga	127	105	130	108	98	568
Otisco	26	22	20	19	13	100
Pompey	22	34	51	23	31	161
Salina	43	143	42	28	99	355
Skaneateles	23	22	20	14	18	97
Spafford	11	6	12	7	10	46
Tully	20	19	22	48	5	114

TABLE 2-19 (continued)

TOWN	1990	1991	1992	1993	1994	TOTAL
Van Buren	34	23	7	14	16	94
Town Total	1,265	1,197	1,246	1,201	1,066	5,975
City of Syracuse*	164	105	76	101	116	562
Total County	1,429	1,302	1,322	1,302	1,182	6,537

*There were 860 residential dwelling units demolished in Syracuse during this period, resulting in a net loss of 298 dwellings in the city.

Source: Syracuse-Onondaga County Planning Agency, 1994.

TABLE 2-20

POPULATION CHANGE: 1990 TO 1994
MUNICIPALITIES IN METRO SERVICE AREA
Draft Environmental Impact Statement
Onondaga County, New York

	1990	1994	% CHANGE
Onondaga County	468,973	473,366	+0.93
Syracuse	163,860	159,895	-2.4
Camillus	23,625	23,711	+0.36
Dewitt	25,148	25,237	+0.35
Geddes	17,677	17,418	-1.47
Onondaga	18,396	19,256	+5.22
Salina	35,145	34,091	-3.00
TOTAL	283,851	279,604	-1.5

Source: U.S. Census Estimates, 1994.

TABLE 2-21

POPULATION CHANGE: 1990 TO 1994
SYRACUSE, MSA
Draft Environmental Impact Statement
Onondaga County, New York

COUNTY	1990	1994	% CHANGE
Onondaga	468,973	473,336	0.93
Cayuga	82,313	83,115	0.97
Madison	69,166	71,711	3.68
Oswego	121,785	125,818	3.31

Source: U.S. Census Estimates, 1994.

TABLE 2-22

DISTRIBUTION OF INCOME AND POVERTY
IN ONONDAGA COUNTY
1970, 1979, 1989
Draft Environmental Impact Statement
Onondaga County, New York

	SYRACUSE		ONONDAGA COUNTY		RANK*
	1970	1989	1979	1989	1989
Median household income	$12,321	$21,242	$17,574	$31,783	18
Median family income	16,591	28,012	21,222	38,816	15
Per capita personal income	6,232	11,882	17,286	14,703	16
Persons below poverty	29,281	34,402	43,060	46,462	35
Persons below poverty	18.4%	22.7%	9.6%	10.3%	N/A

*Rank among New York State counties.
Source: U.S. Census Bureau.

TABLE 2-23

PERCENT OF HOUSEHOLDS AND FAMILIES
BY INCOME LEVEL 1989
Draft Environmental Impact Statement
Onondaga County, New York

	HOUSEHOLDS			FAMILIES		
	SYRACUSE	TOWNS	ONONDAGA COUNTY	SYRACUSE	TOWNS	ONONDAGA COUNTY
$0-$4,999	9.5%	2.0%	4.7%	7.5%	.9%	2.8%
$5,000-9,999	16.2%	5.6%	9.5%	9.2%	2.2%	4.2%
$10,000-14,999	11.6%	5.8%	7.9%	9.1%	3.7%	5.3%
$15,000-19,999	10.4%	7.4%	8.5%	9.7%	5.7%	6.9%
$20,000-24,999	9.0%	7.6%	8.1%	9.4%	6.9%	7.7%
$25,000-29,999	7.9%	8.5%	8.3%	8.1%	8.3%	8.3%
$30,000-34,999	7.3%	8.3%	7.9%	8.5%	8.3%	8.4%
$35,000-39,999	5.9%	7.9%	7.2%	7.5%	8.4%	8.1%
$40,000-49,999	8.8%	14.0%	12.1%	11.8%	15.8%	14.6%
$50,000-74,999	9.4%	21.5%	17.1%	13.1%	25.6%	21.9%
$75,000+	4.0%	11.4%	8.7%	6.0%	14.2%	11.8%

TABLE 2-24

EMPLOYMENT IN ONONDAGA COUNTY
1990-1994
Draft Environmental Impact Statement
Onondaga County, New York

	1990	1994	CHANGE 1990 TO 1994	
Employed Residents	235,600	225,100	(4.4%)	(10,500)
Jobs in Onondaga County	254,621	242,729	(4.6%)	(11,892)
Manufacturing	41,417	35,706	(13.8%)	(5,711)
Mining	163	168	3.1%	5
Construction	12,792	10,545	(17.5)	(2,247)
Transportation	15,805	14,710	(6.9%)	(1,095)
Finance, insurance, and real estate	18,994	16,962	(10.7%)	(2,032)
Retail trade	45,908	42,284	(7.9%)	(3,624)
Wholesale trade	16,776	15,179	(9.5%)	(1,597)
Services	64,042	68,520	6.9%	4,478
Government	37,397	37,208	(0.5%)	(189)
Other	1,327	1,375	3.6%	48

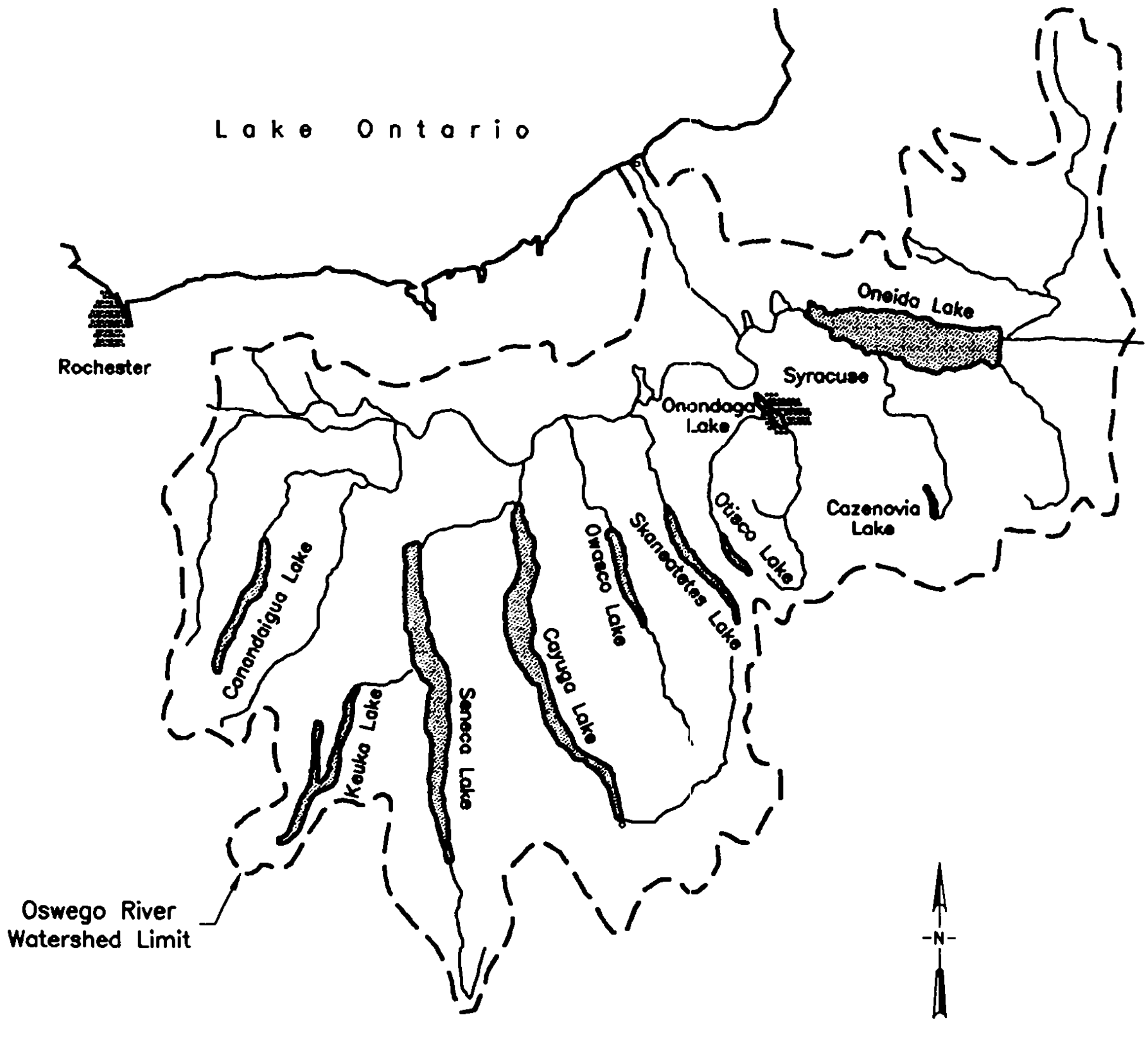
Source: New York State Department of Labor, November 1995.

TABLE 2-25

SYRACUSE MSA EMPLOYMENT
Draft Environmental Impact Statement
Onondaga County, New York

COUNTY	1990	1994	CHANGE 1990 TO 1994	
Onondaga	254,621	242,729	-4.67%	(11,892)
Cayuga	23,982	23,921	-.25%	(61)
Madison	18,065	18,859	+4.40%	794
Oswego	34,196	33,299	-2.62%	(897)
MSA Total	330,864	318,808	-3.64%	(12,056)
Onondaga County as % of MSA	76.96%	76.14%		

Source: New York State Department of Labor, November 1995.



Adapted from: Army Corps of Engineers, 1992

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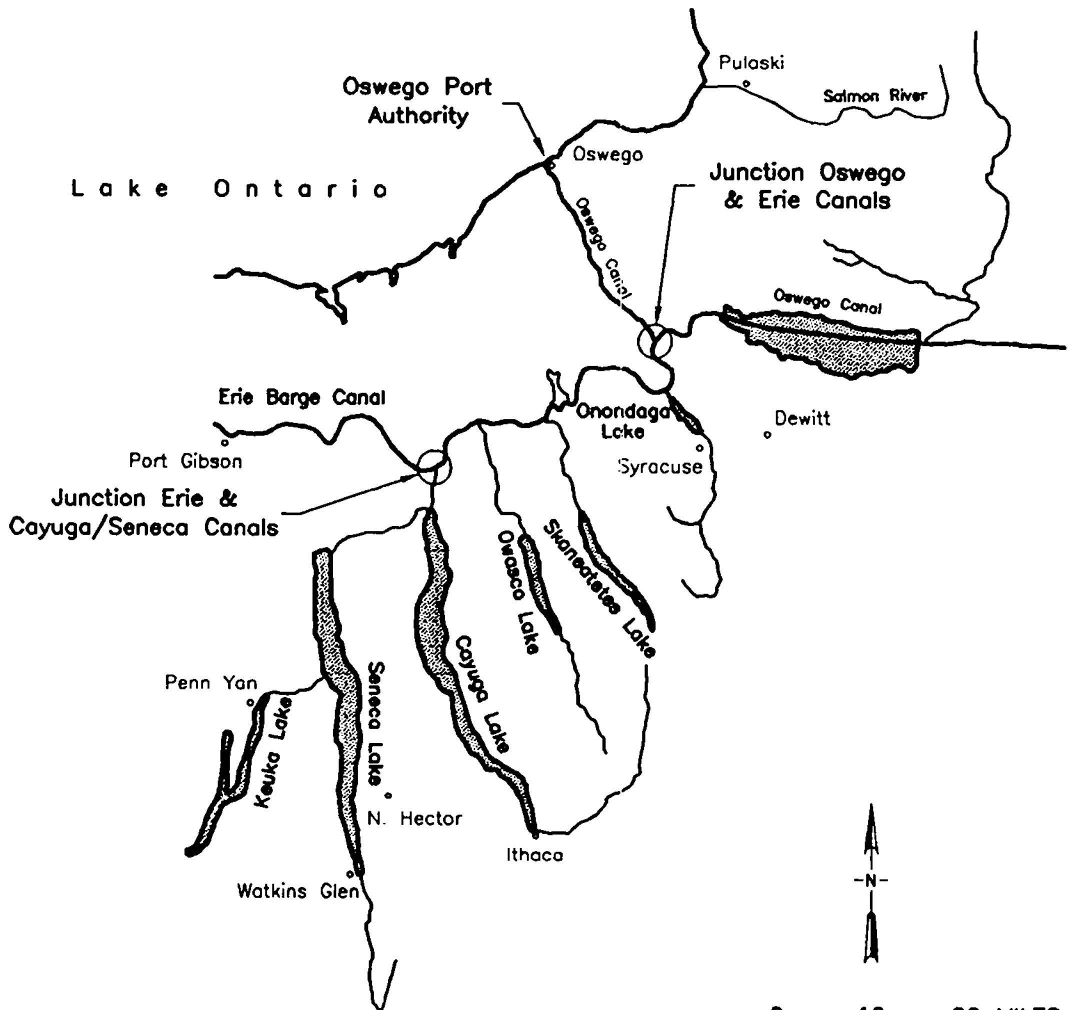
FIGURE 2-1
SENECA-OSWEGO
RIVER SYSTEM



Adapted from: Army Corps of Engineers, 1992

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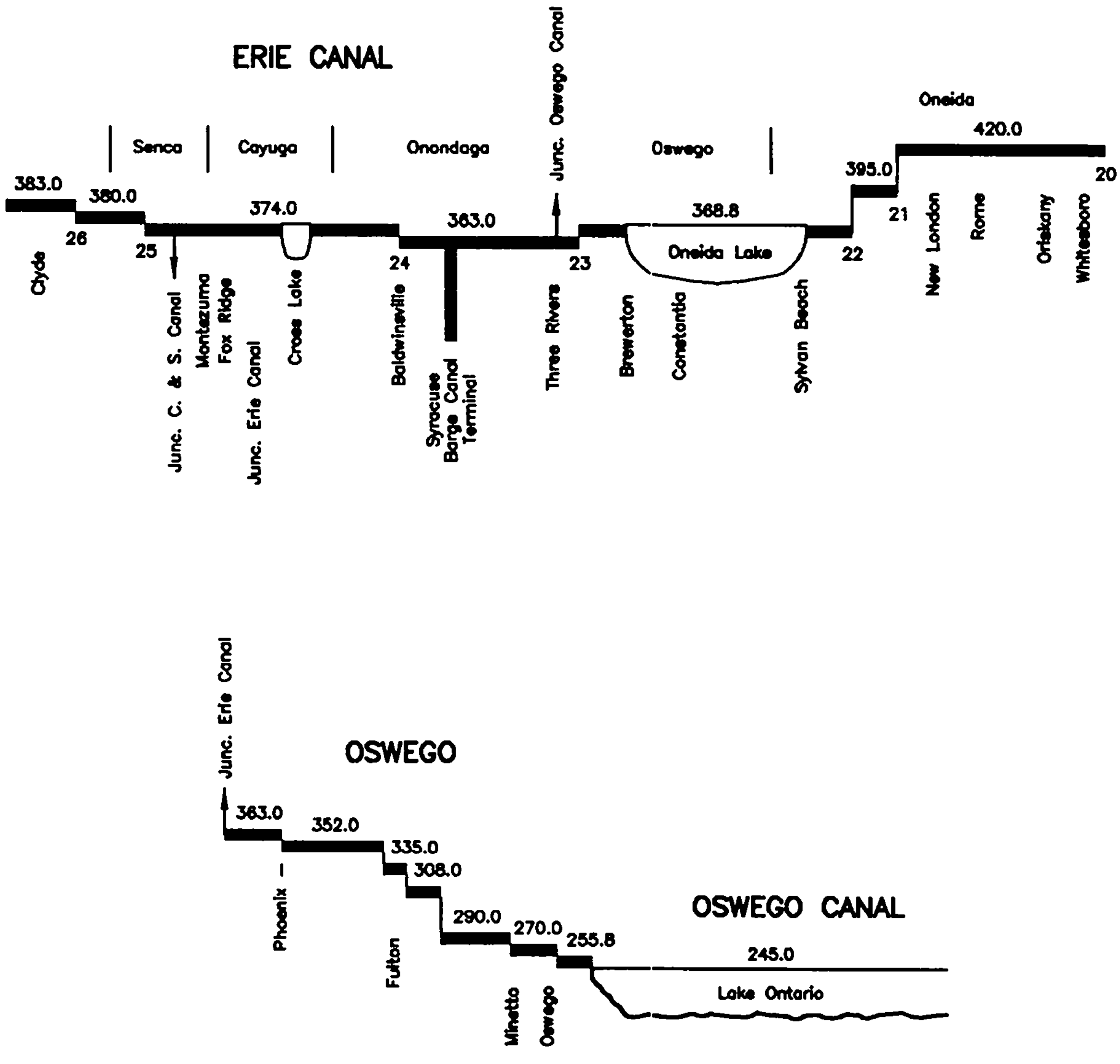
FIGURE 2–2
NEW YORK BARGE CANAL SYSTEM
– ONONDAGA LAKE



Adapted from: Army Corps of Engineers, 1992

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ONONDAGA COUNTY DEPARTMENT OF
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FIGURE 2-3
ONONDAGA LAKE AND THE NEW YORK STATE BARGE CANAL SYSTEM

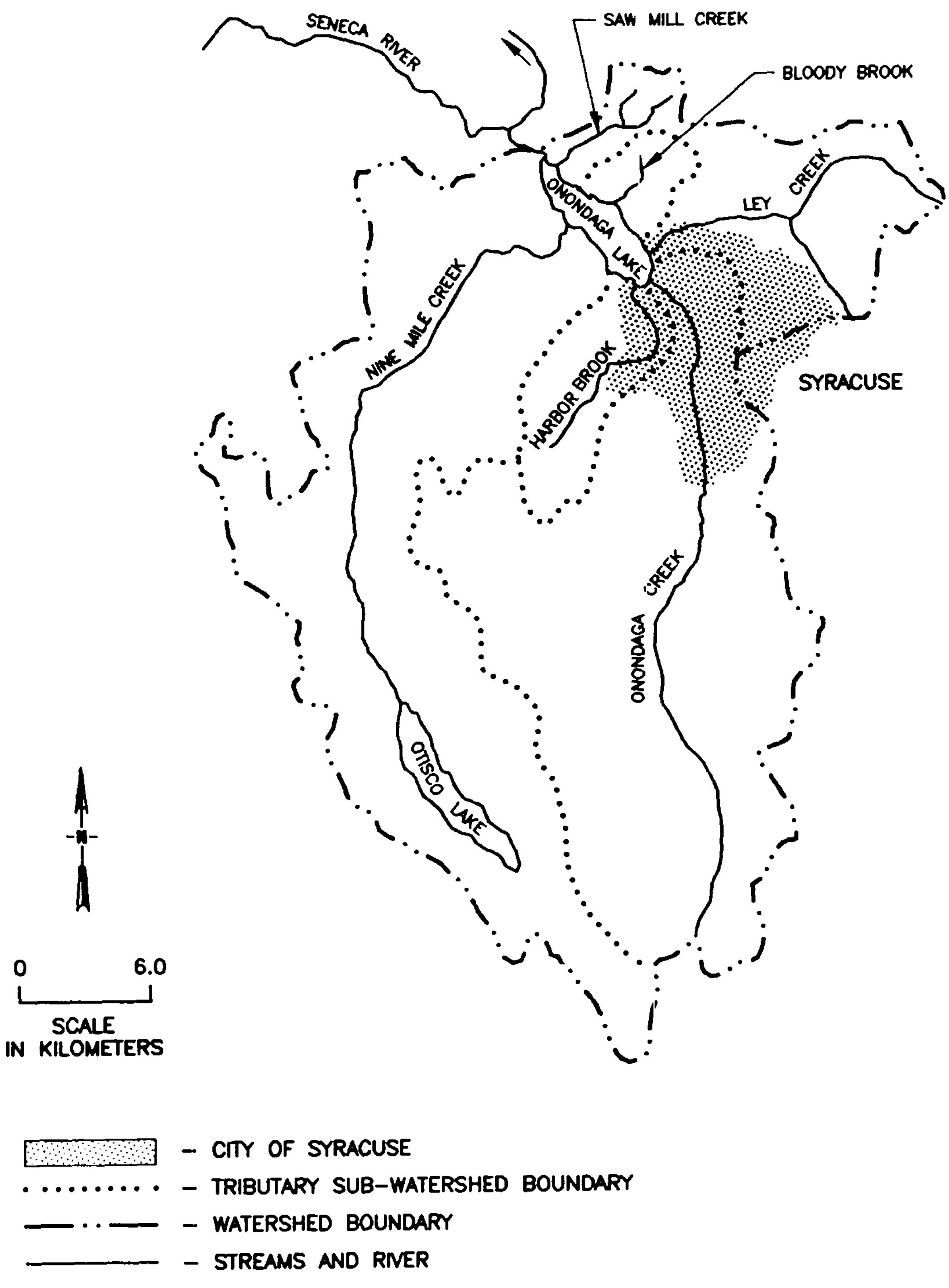

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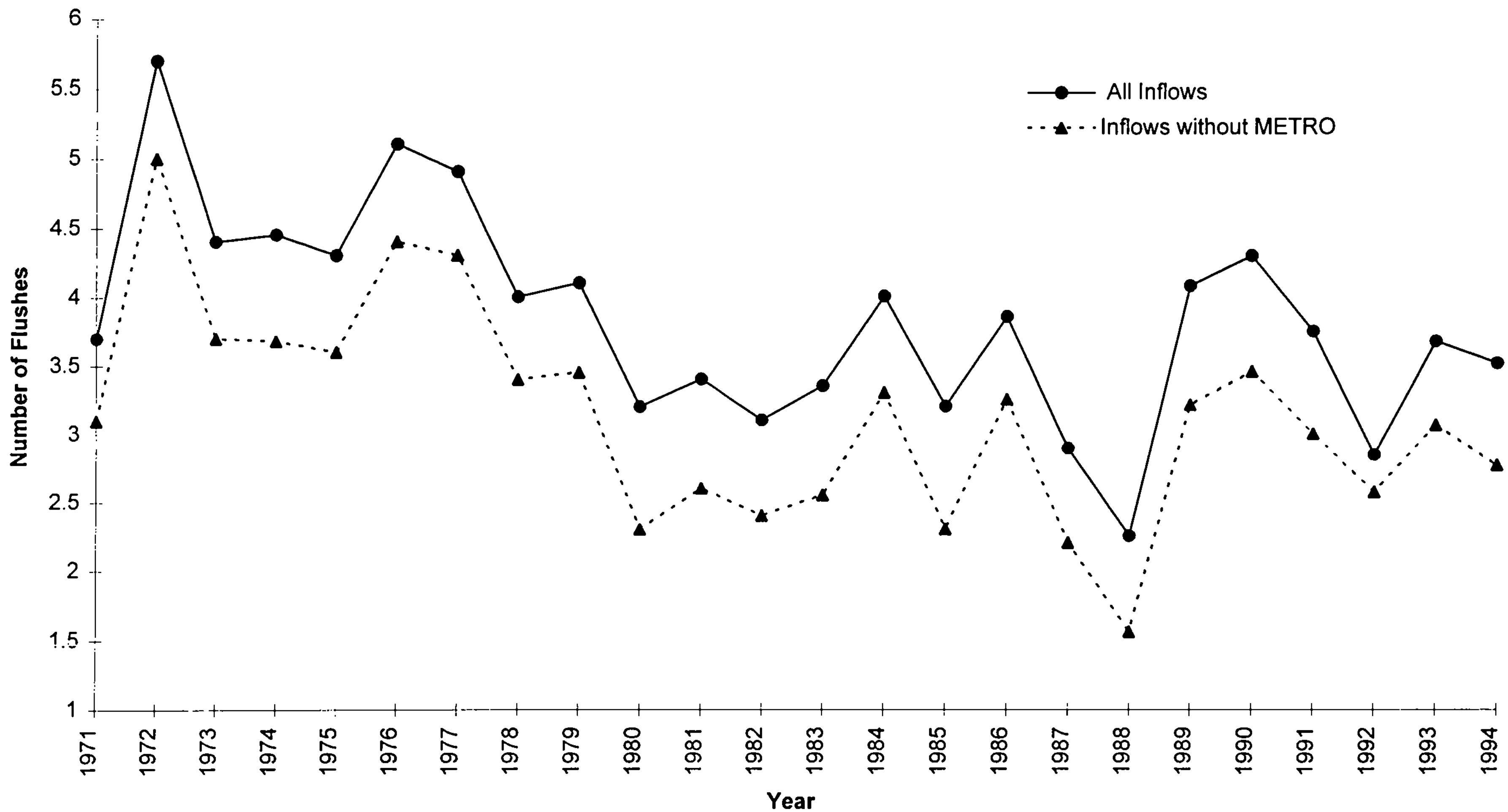
FIGURE 2–4
ONONDAGA LAKE DRAINAGE BASIN
AND 6 SUBBASINS



1971-1987 data source: Upstate Freshwater Institute, 1994, The State of Onondaga Lake.

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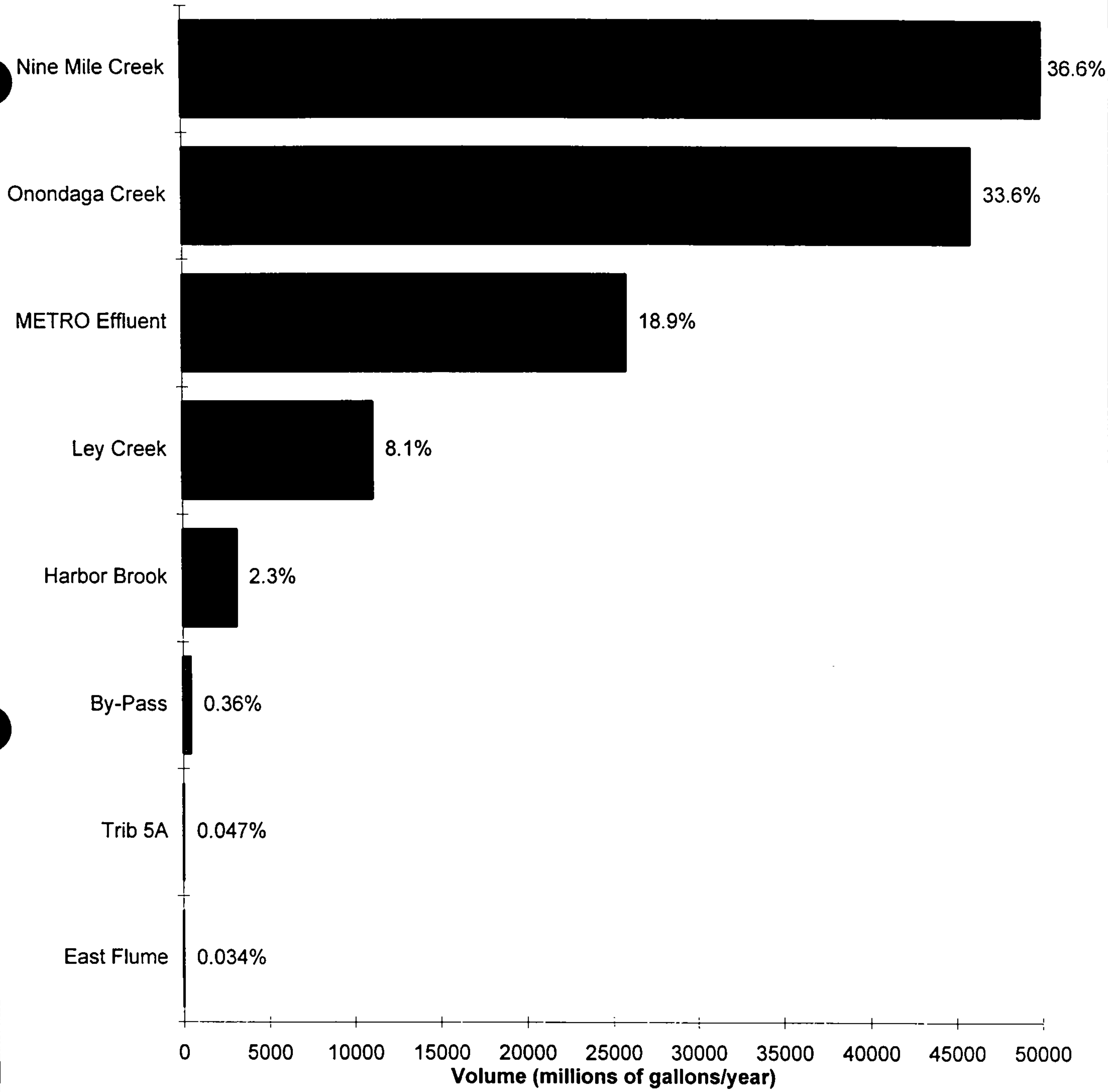
FIGURE 2-5
ANNUAL COMPLETE-MIXED FLUSHING RATES WITH AND WITHOUT METRO CONTRIBUTION



METRO fully treated effluent and by-pass data are taken directly from SPDES permits for 1987-1994. METRO data from 11/92 to 9/93 are not used due to unusual conditions from construction activities during that period. Flow records for Onondaga Creek and Harbor Brook are from Oct. 1961 - Dec. 1994, records for Nine Mile Creek are from Jan 1971 - Dec. 1994, and records for Ley Creek are from Jan. 1973 - Dec. 1994. Flows of Tributary 5A and East Flume are estimated from SPDES Permits.

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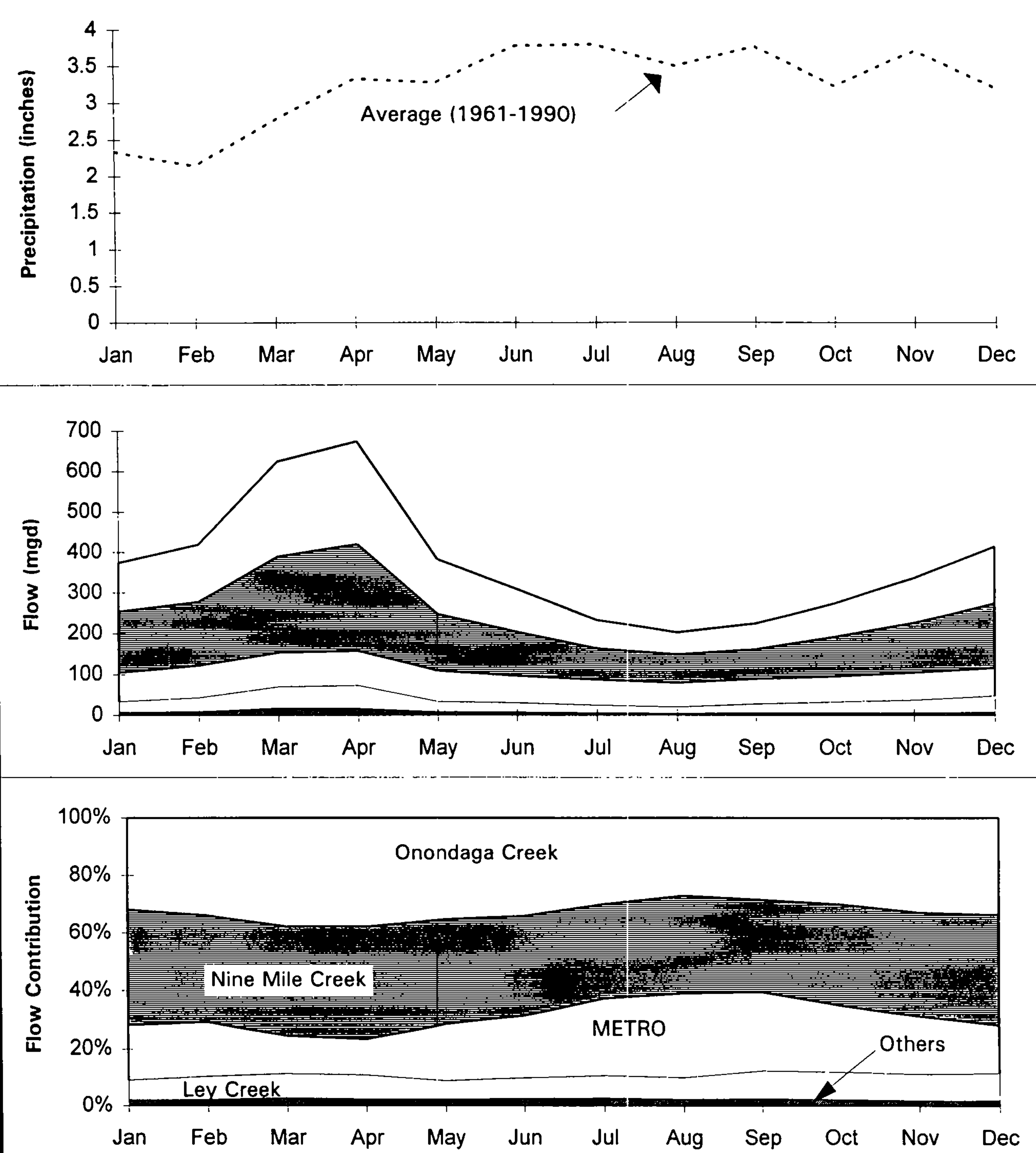
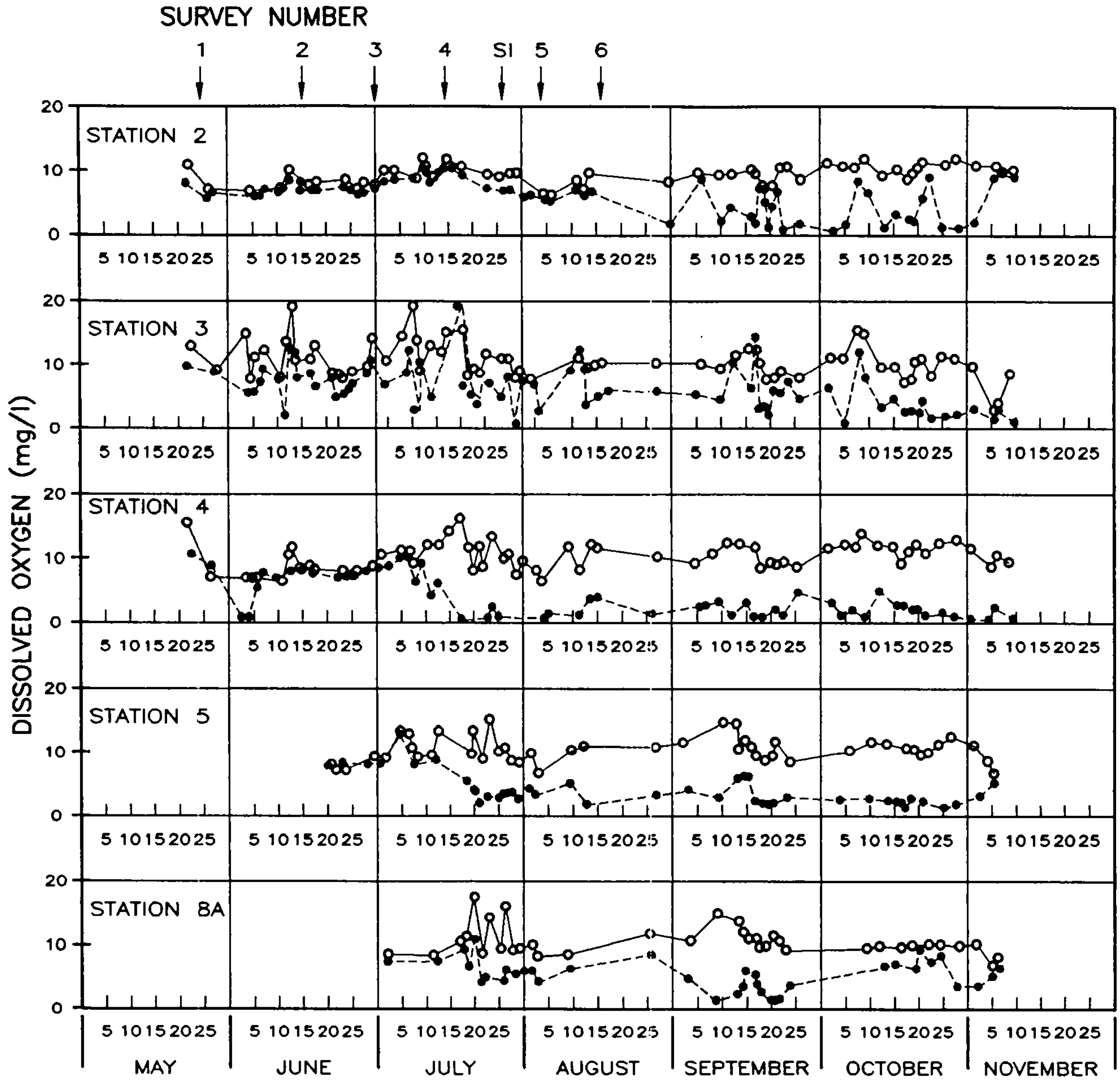
	FIGURE 2-6 **LONG-TERM HYDROLOGICAL CONTRIBUTIONS OF TRIBUTARIES TO ONONDAGA LAKE**



METRO fully treated effluent and by-pass data are taken directly from SPDES permits for 1987-1994. METRO data from 11/92 - 9/93 are not used due to unusual conditions from construction activities during that period. Tributary 5A and East Flume flows are estimated from SPDES permits. Bloody Brook and Sawmill Creek are not included. See Table 2-5 for information on the tributary records used.

Stearns & Wheler ENVIRONMENTAL ENGINEERS & SCIENTISTS DATE: 1/11/96 JOB No.: 2298	DRAFT ENVIRONMENTAL IMPACT STATEMENT ONONDAGA COUNTY DEPARTMENT OF DRAINAGE AND SANITATION **FIGURE 2-7** **SEASONAL CHANGES IN THE ONONDAGA LAKE HYDROLOGIC REGIME**



DATA WERE OBTAINED WITH IN-SITU PROBE

Source: MODIFIED FROM CALOCERINOS AND SPINA, 1984

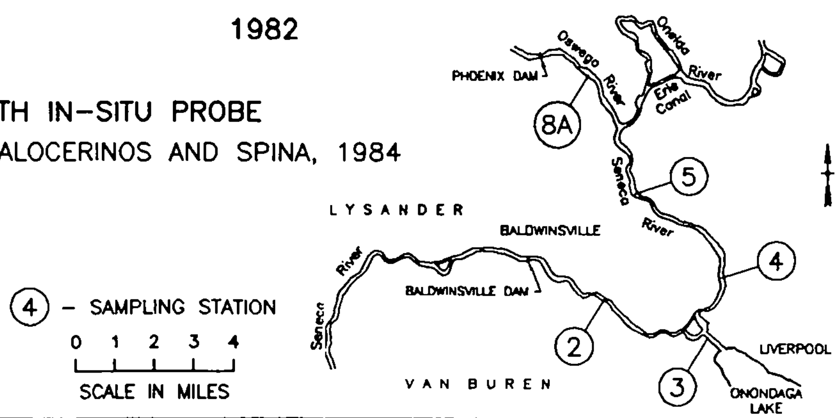


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FIGURE 2-8
DISSOLVED OXYGEN IN THE SENECA RIVER DURING LOW FLOW CONDITIONS, 1982

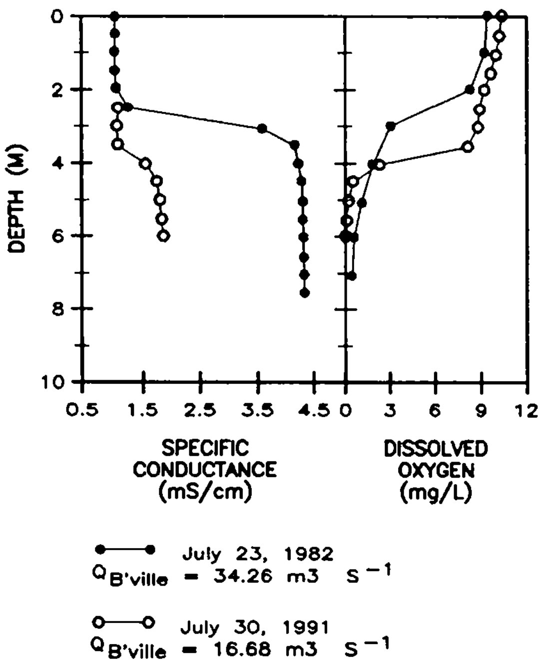

DIAGRAM A
VERTICAL CHARACTER, SPECIFIC CONDUCTANCE AND DISSOLVED OXYGEN, JULY 30, 1991 AND JULY 23, 1982

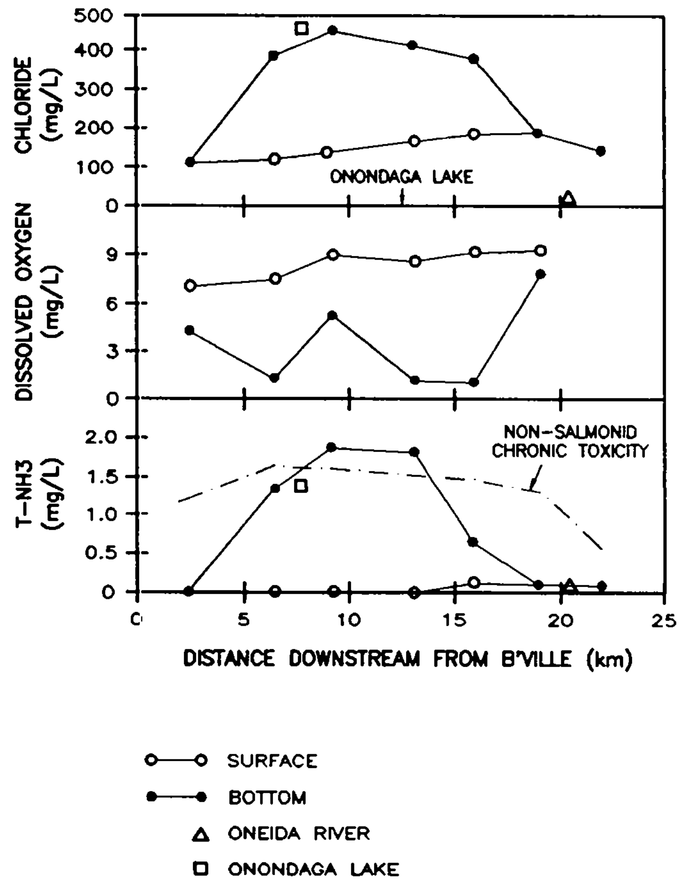

DIAGRAM B
LONGITUDINAL EXTENT OF STRATIFICATION AND VIOLATIONS OF D.O. AND NH3 STANDARDS, JULY 30, 1991

Source: UFI, 1994

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FIGURE 2-9
STRATIFICATION AND WATER QUALITY IN THE SENECA RIVER

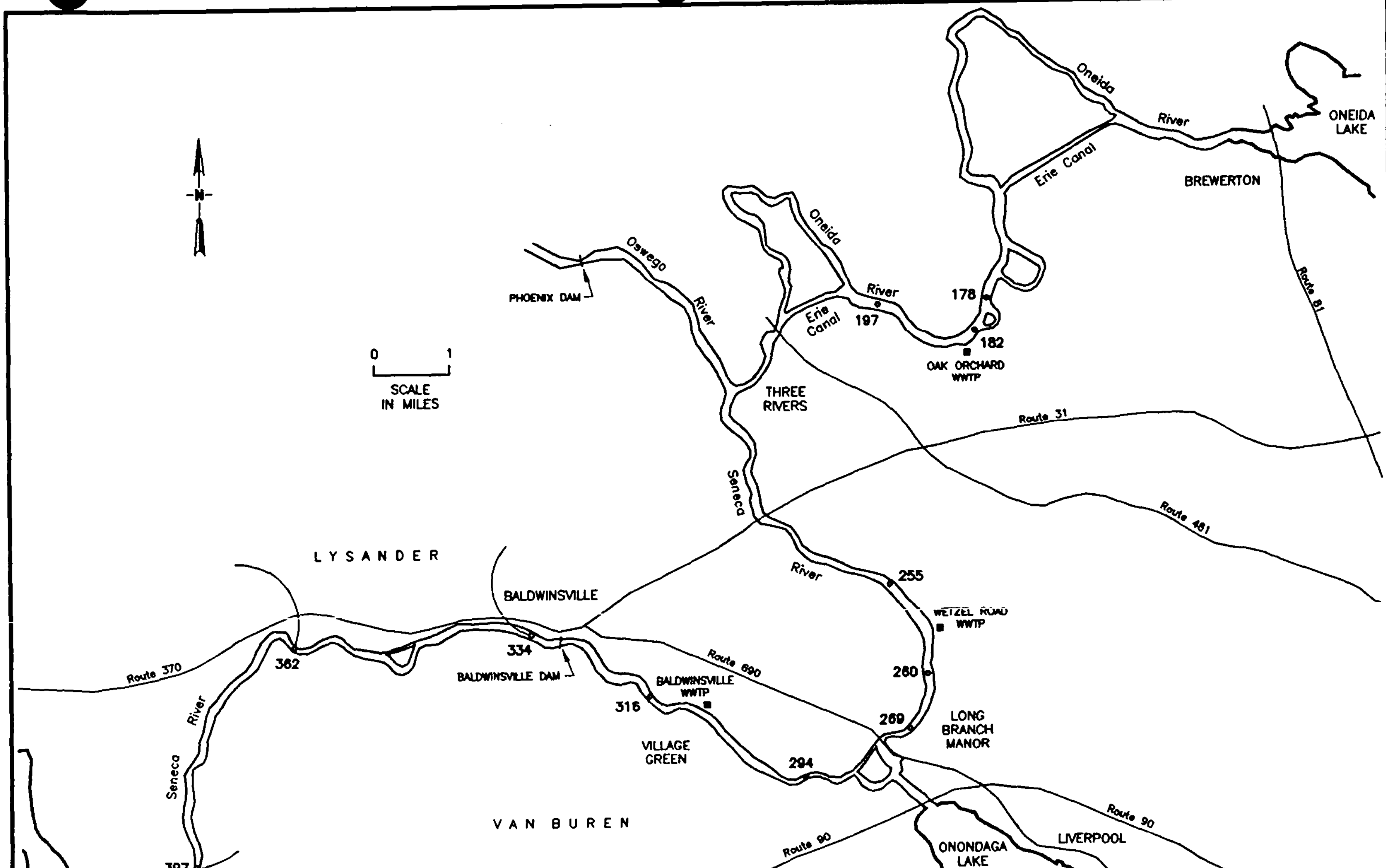

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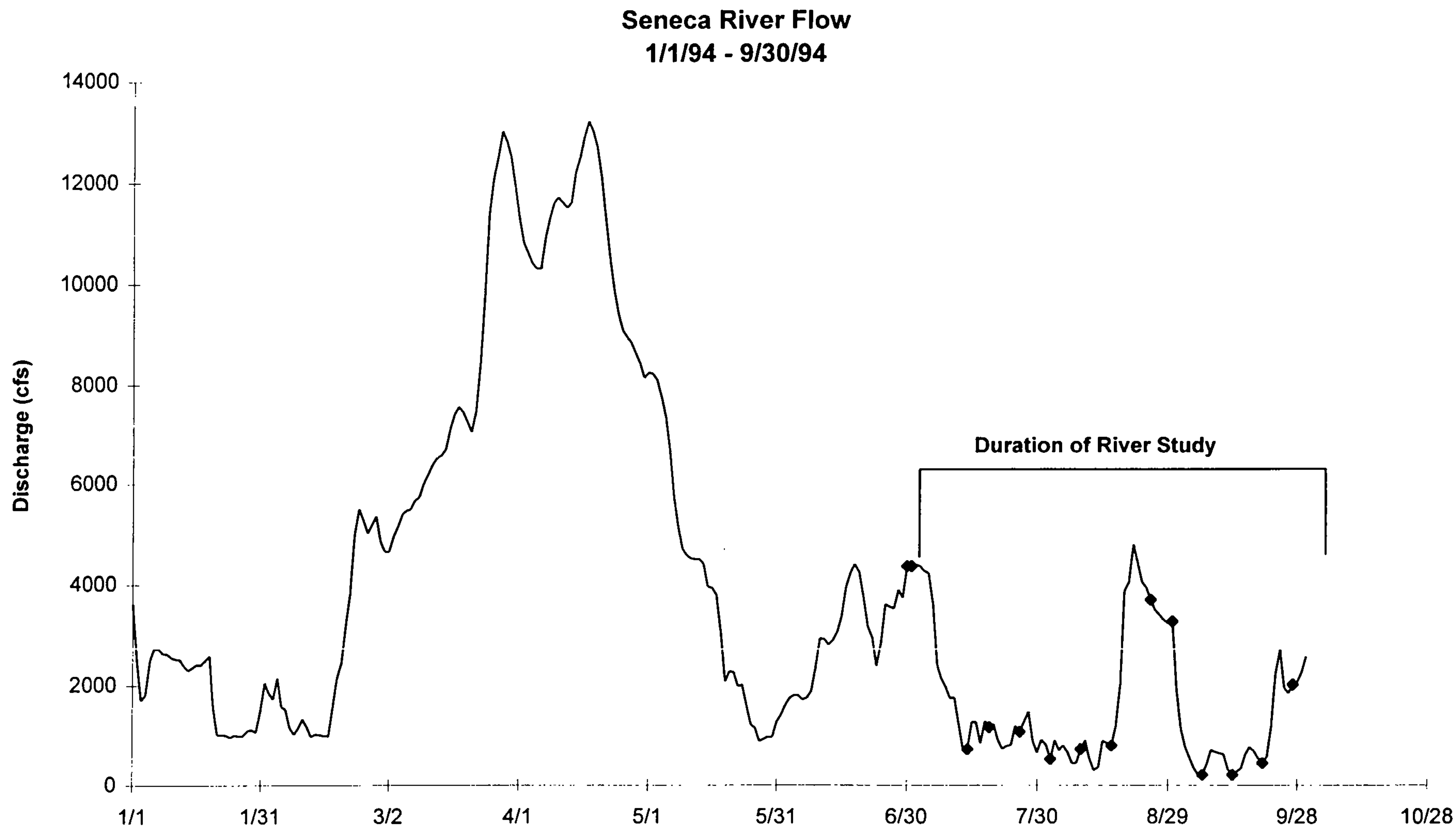
FIGURE 2-10
SAMPLING STATIONS ALONG
THE SENECA/ONEIDA RIVER



Data used is provisional (has not yet been finalized by the USGS). Dots indicate flows occurring on sampling days.

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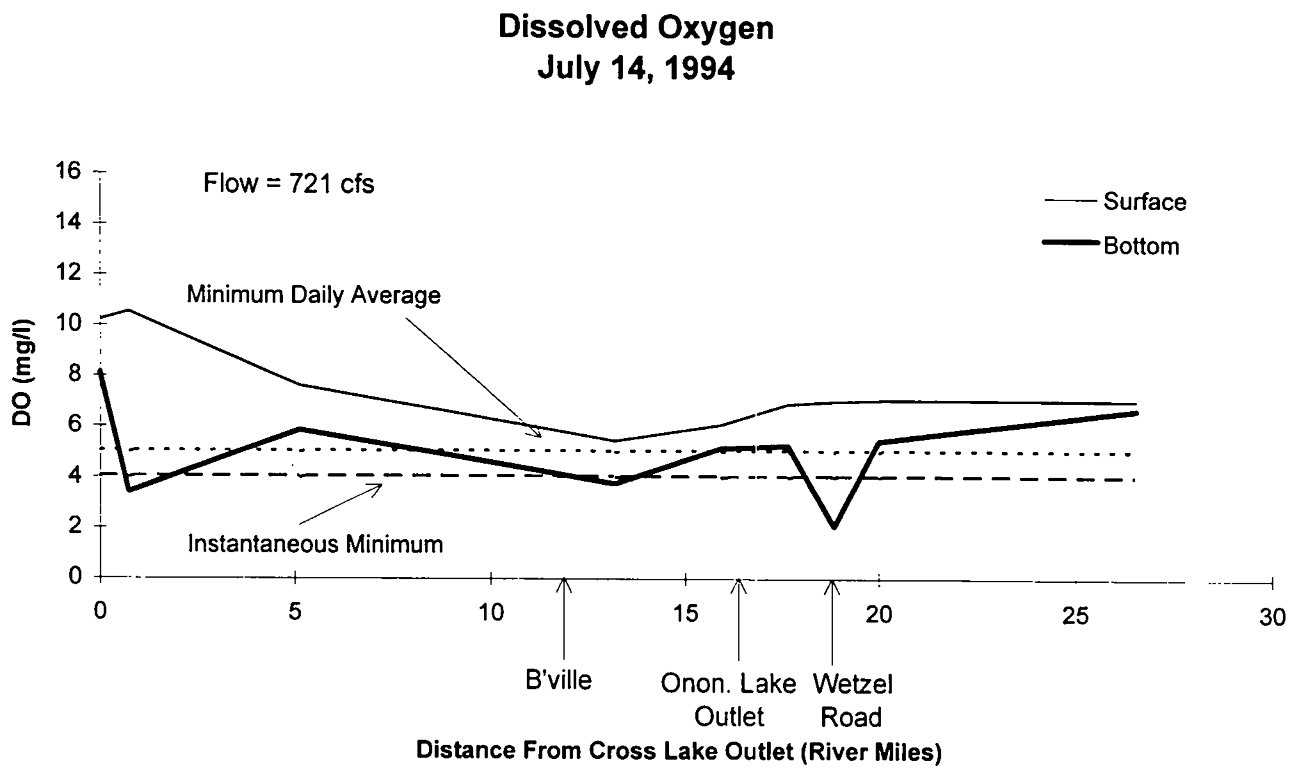
FIGURE 2-11
SENECA RIVER FLOWS RECORDED AT
BALDWINSVILLE, 1994



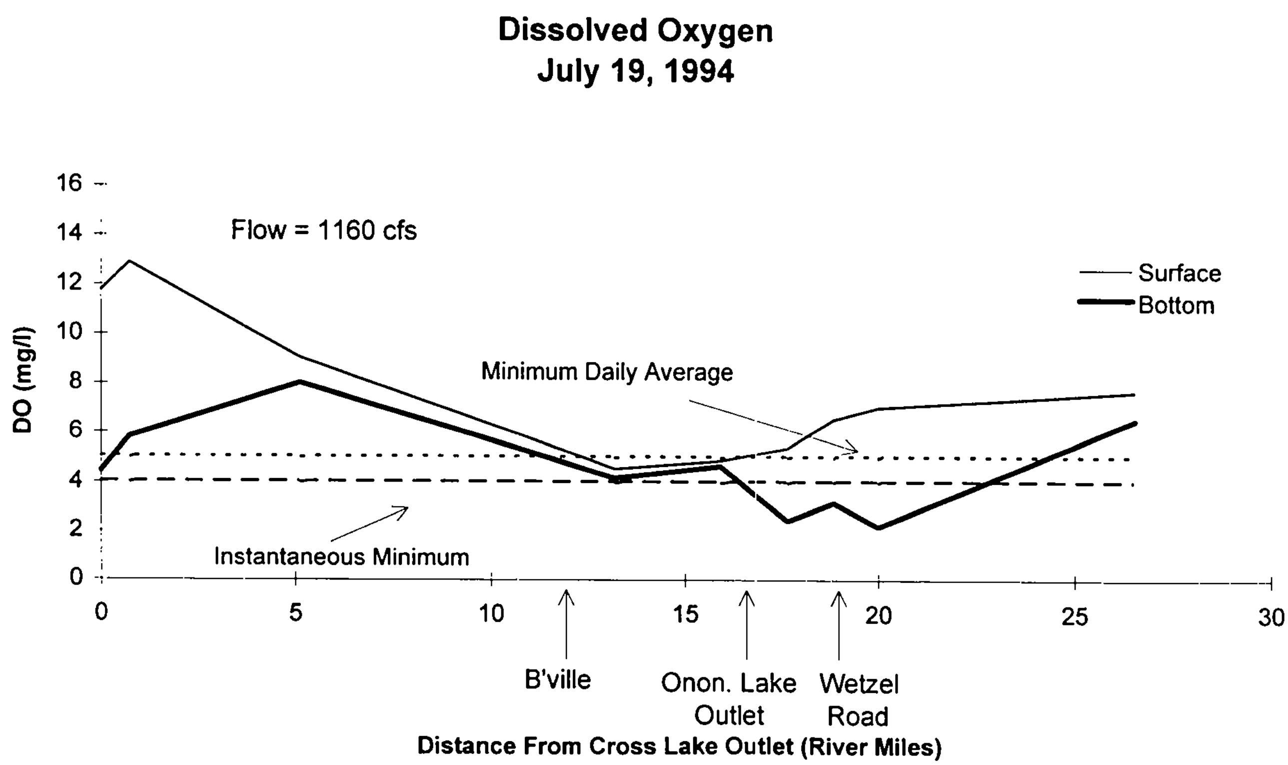


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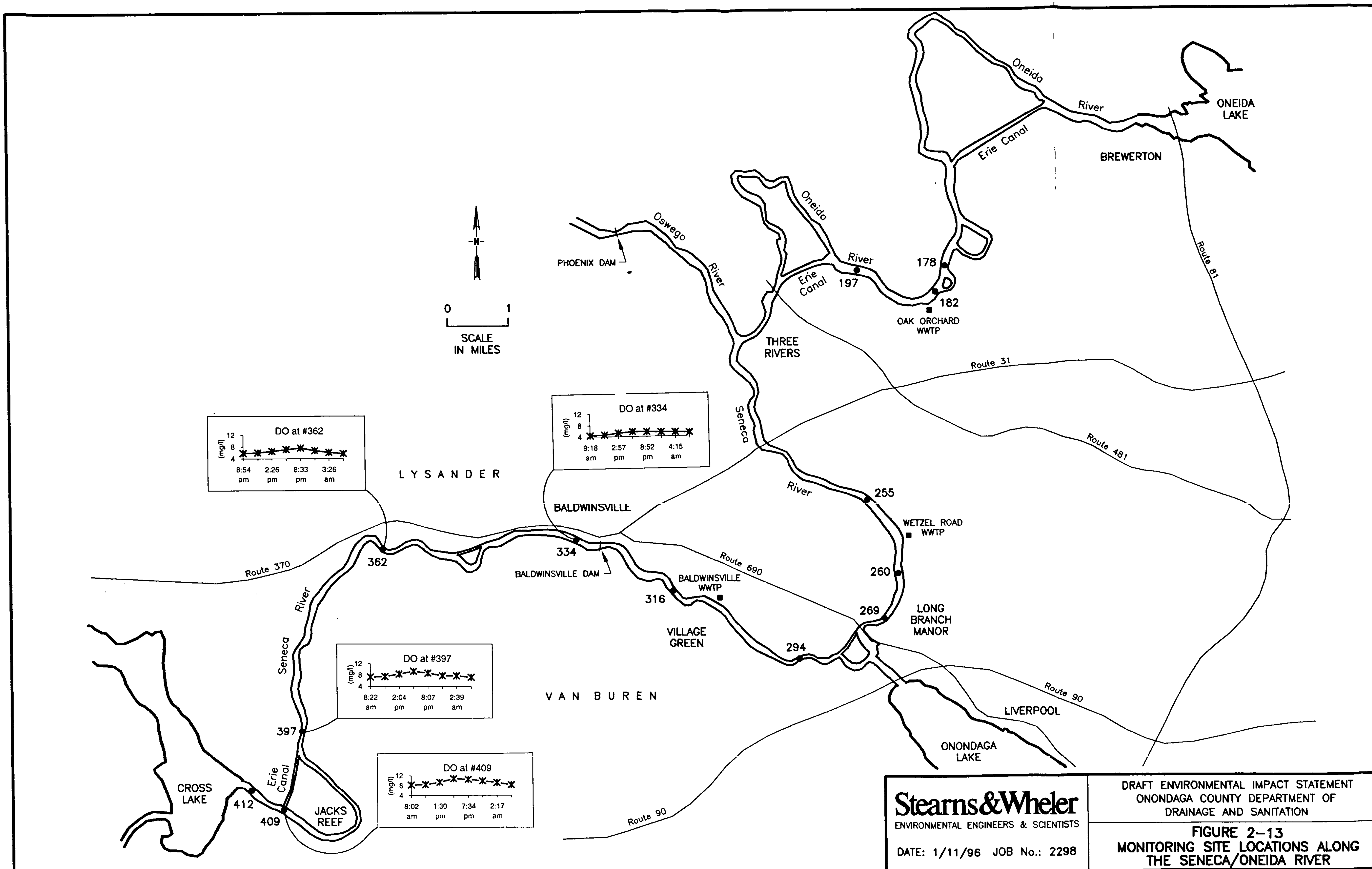
FIGURE 2-12
DISSOLVED OXYGEN IN THE SENECA RIVER,
JULY 14 AND 19, 1994



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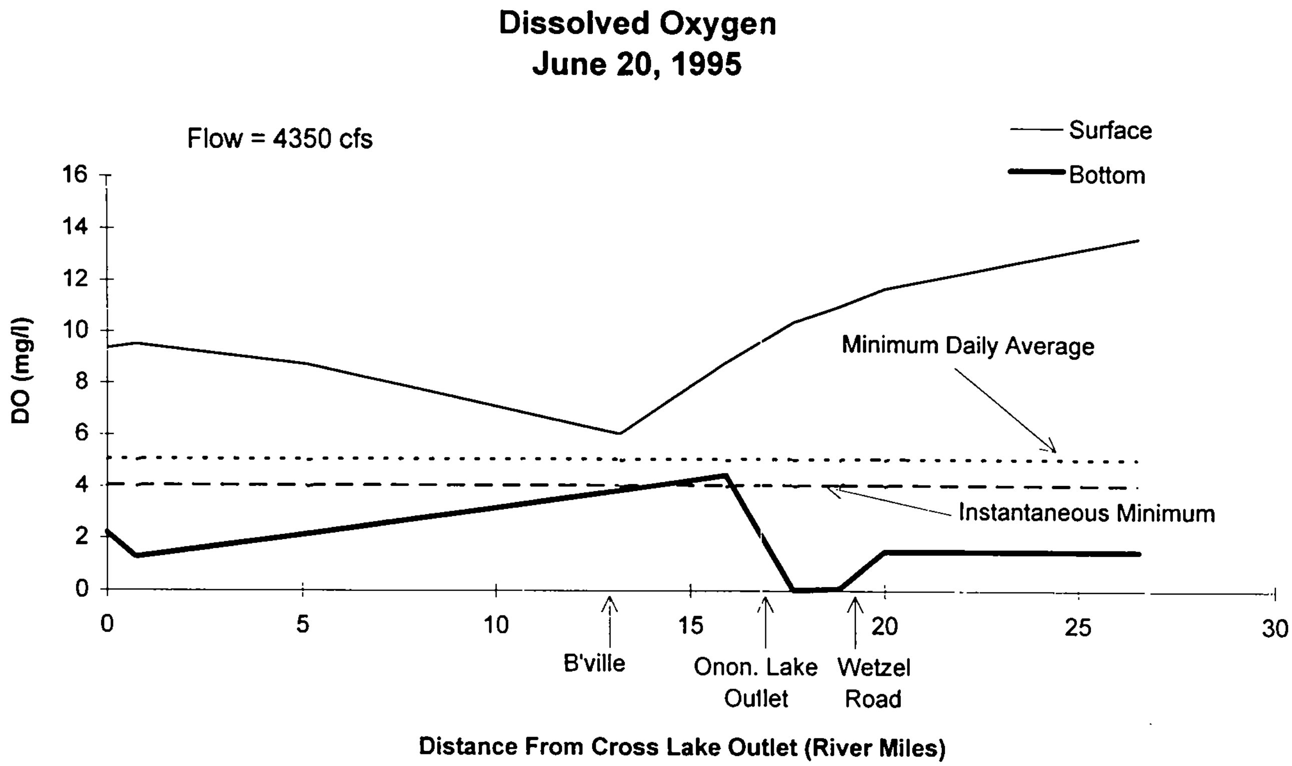
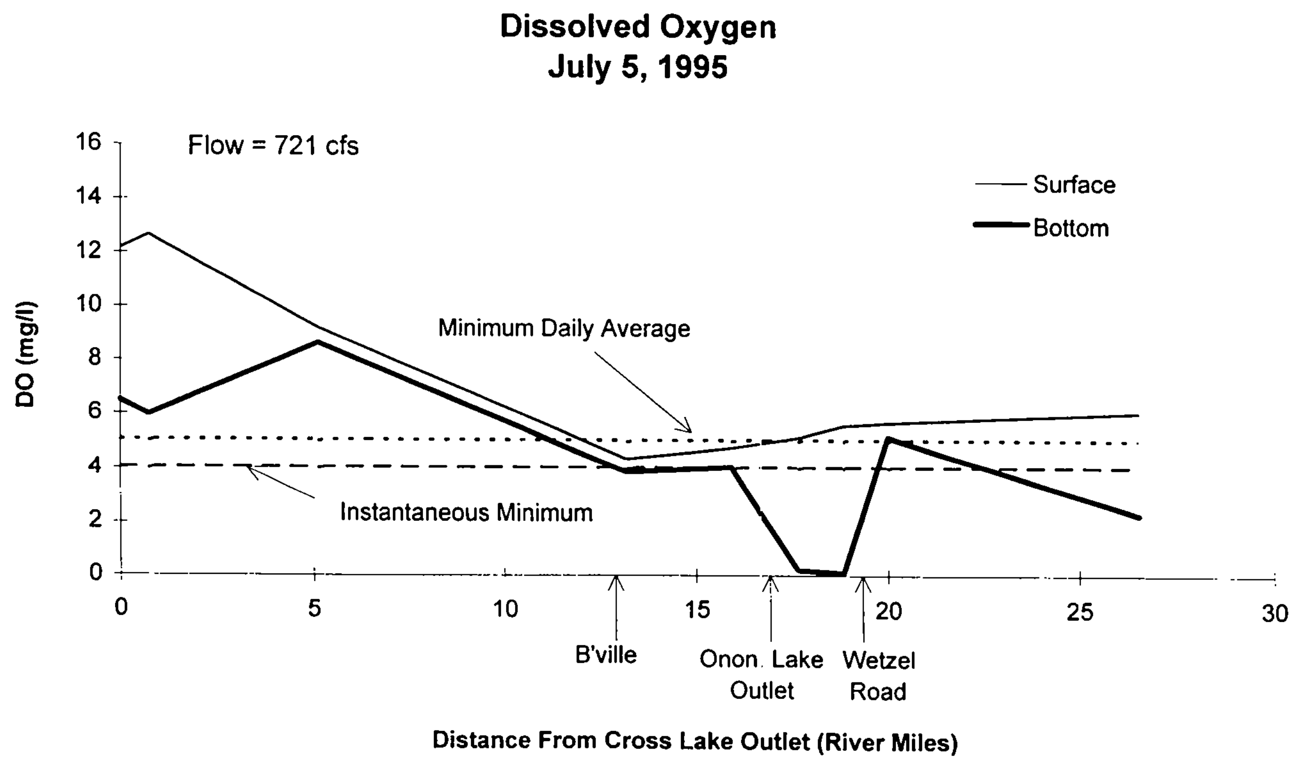
ONONDAGA COUNTY DEPARTMENT OF DRAINAGE AND SANITATION

FIGURE 2–13
MONITORING SITE LOCATIONS ALONG THE SENECA/ONEIDA RIVER





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ONONDAGA COUNTY DEPARTMENT
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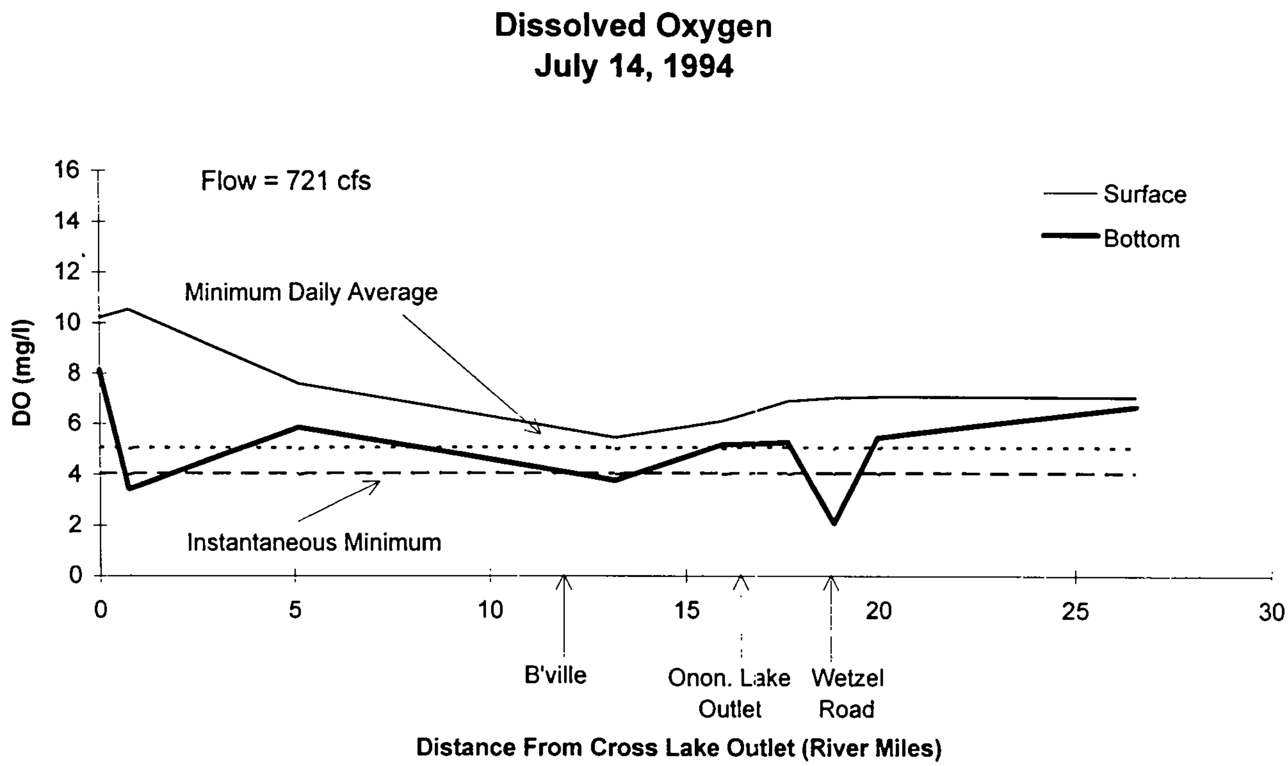
FIGURE 2-13 A
DISSOLVED OXYGEN IN THE SENECA RIVER DURING THE 1994 SAMPLING PROGRAM



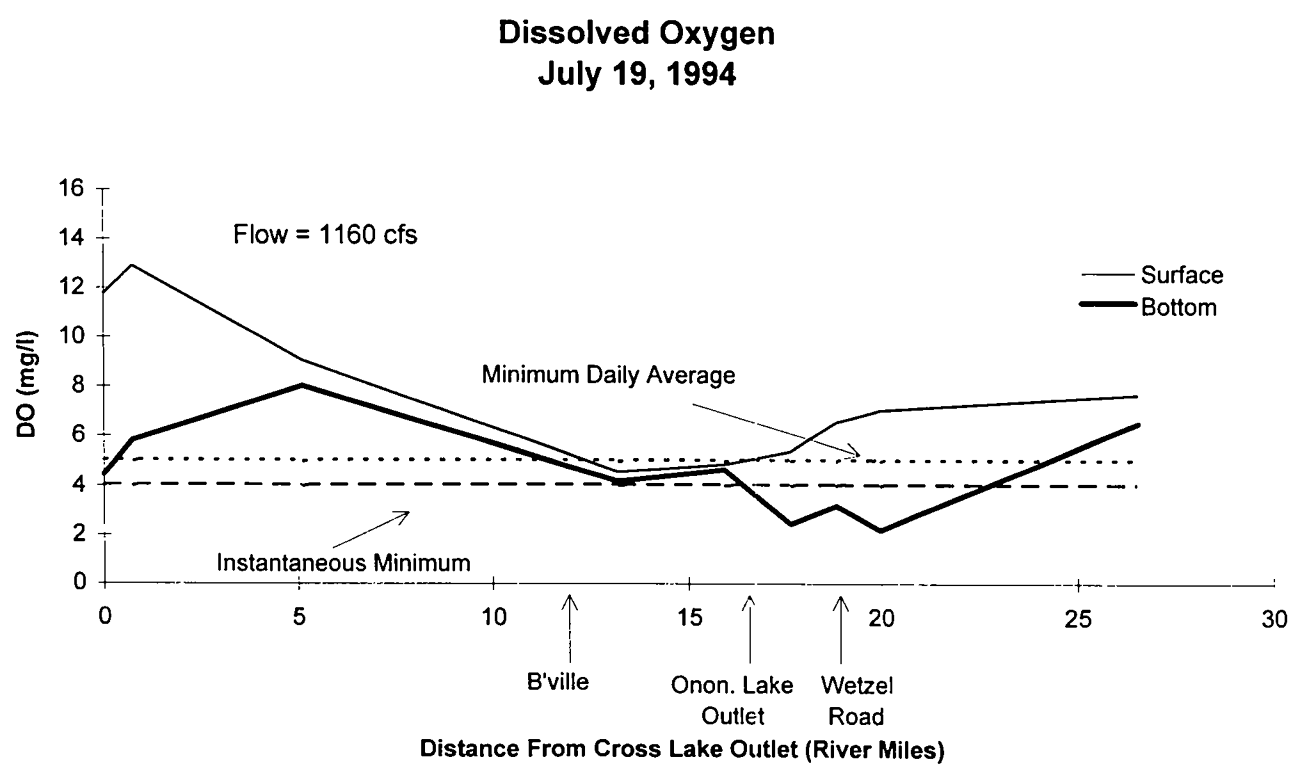


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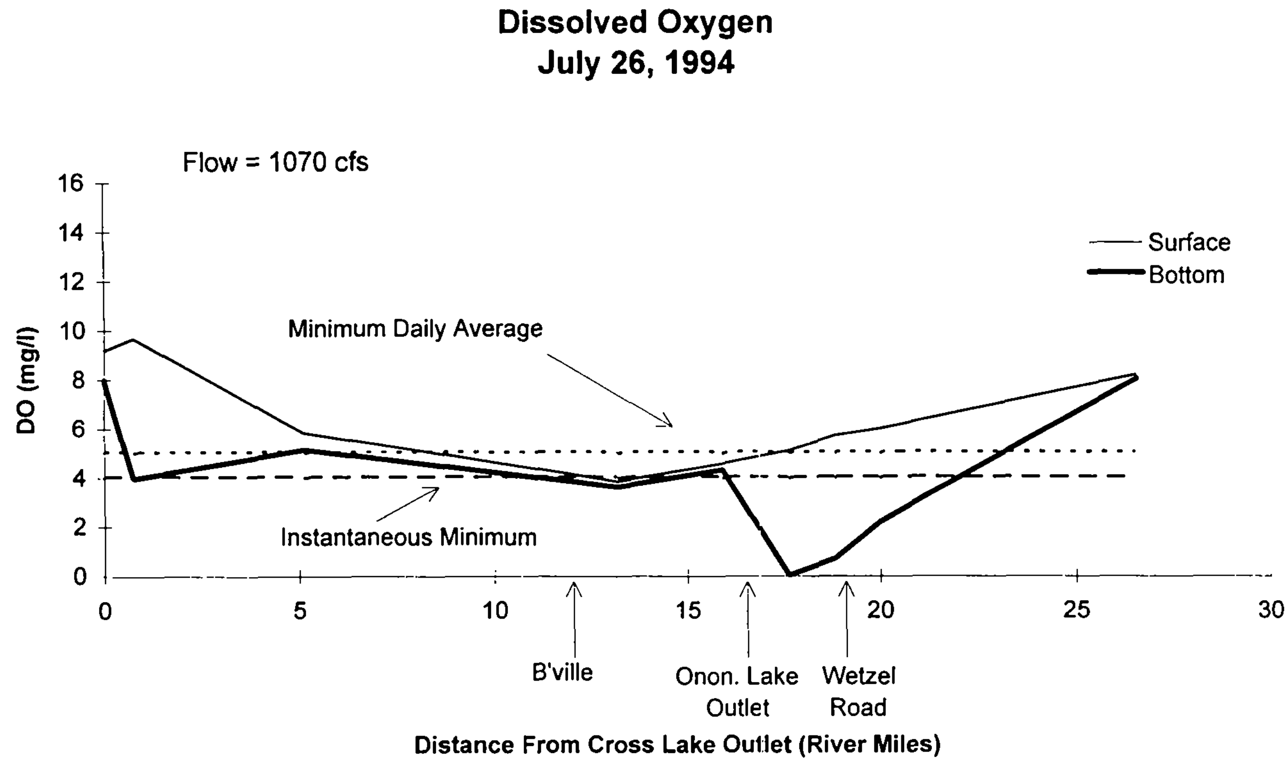
	FIGURE 2-13 A (CONTINUED) DISSOLVED OXYGEN IN THE SENECA RIVER DURING THE 1994 SAMPLING PROGRAM



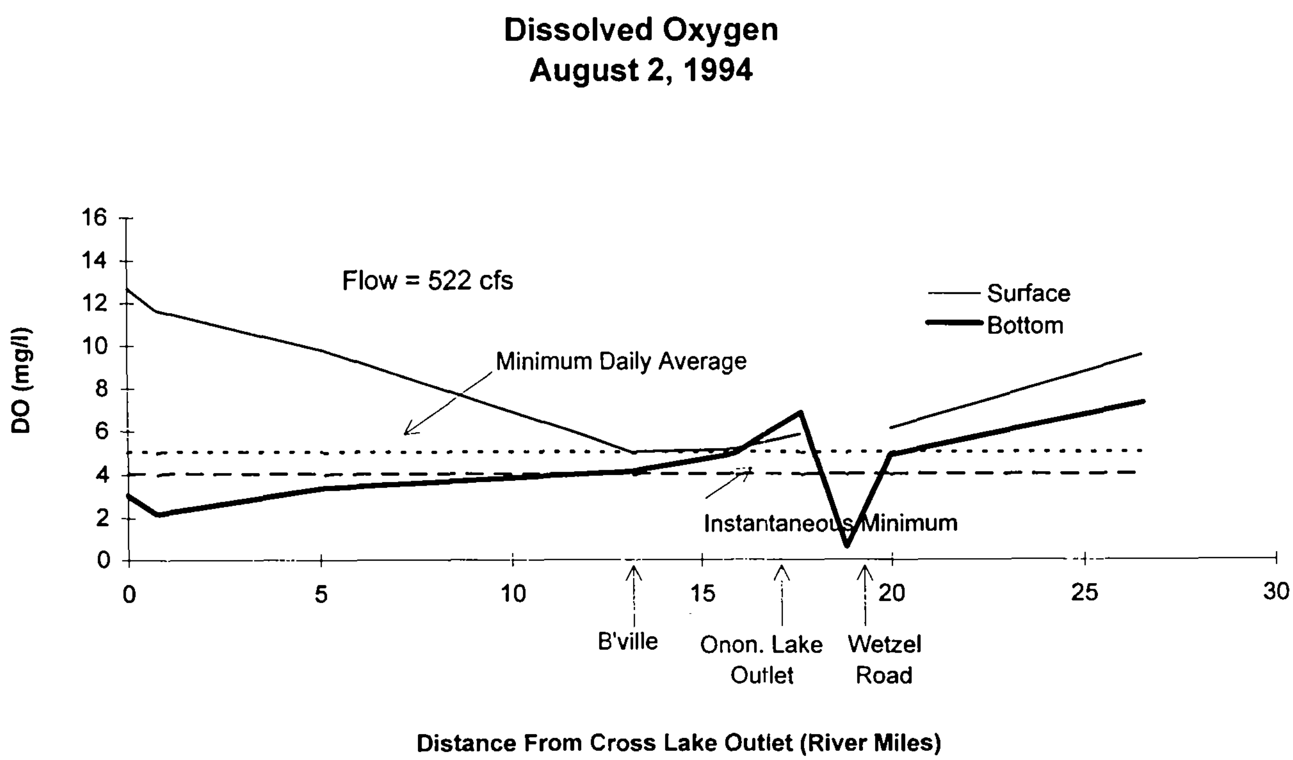


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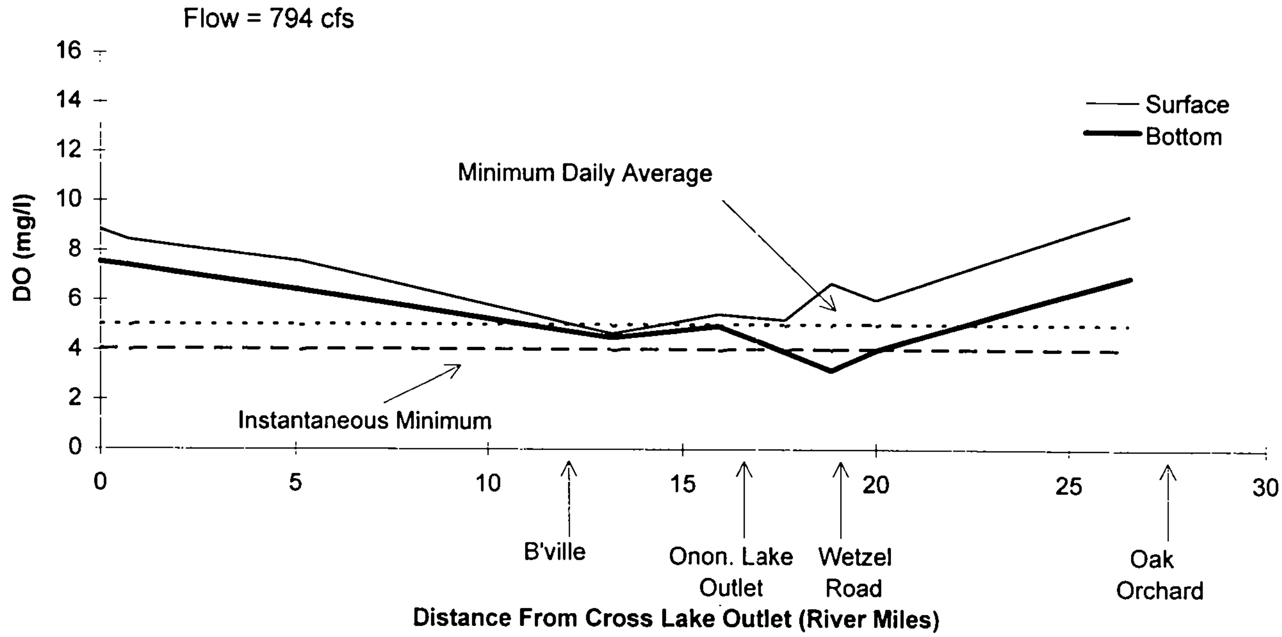
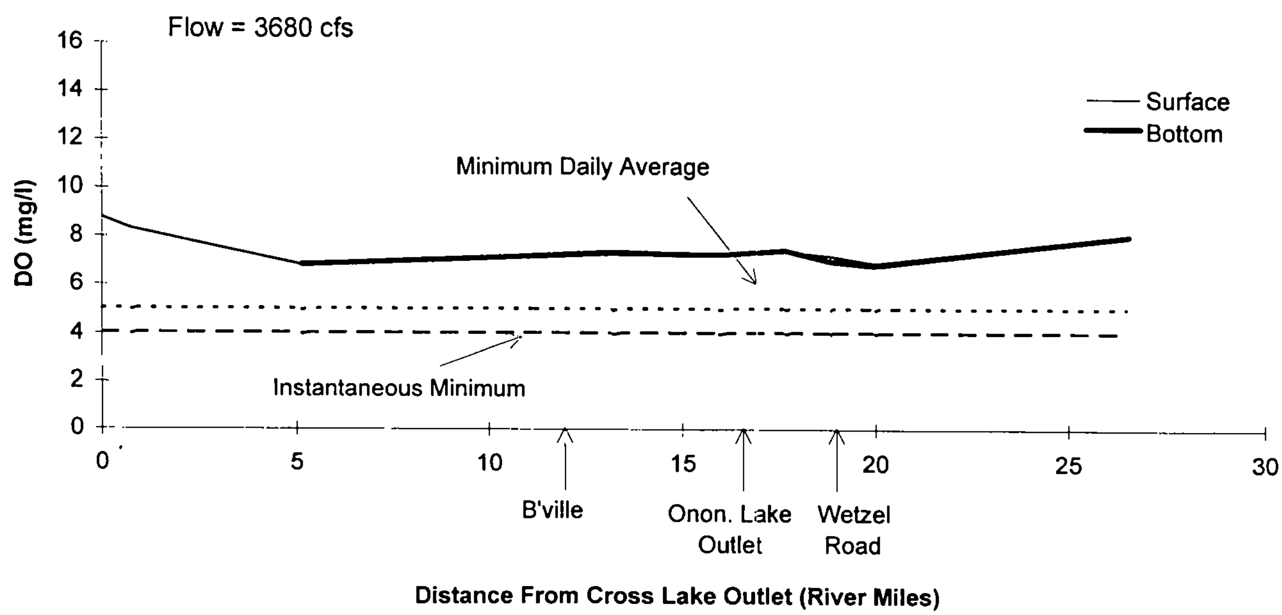
FIGURE 2-13 A (CONTINUED)
DISSOLVED OXYGEN IN THE SENECA RIVER DURING THE 1994 SAMPLING PROGRAM

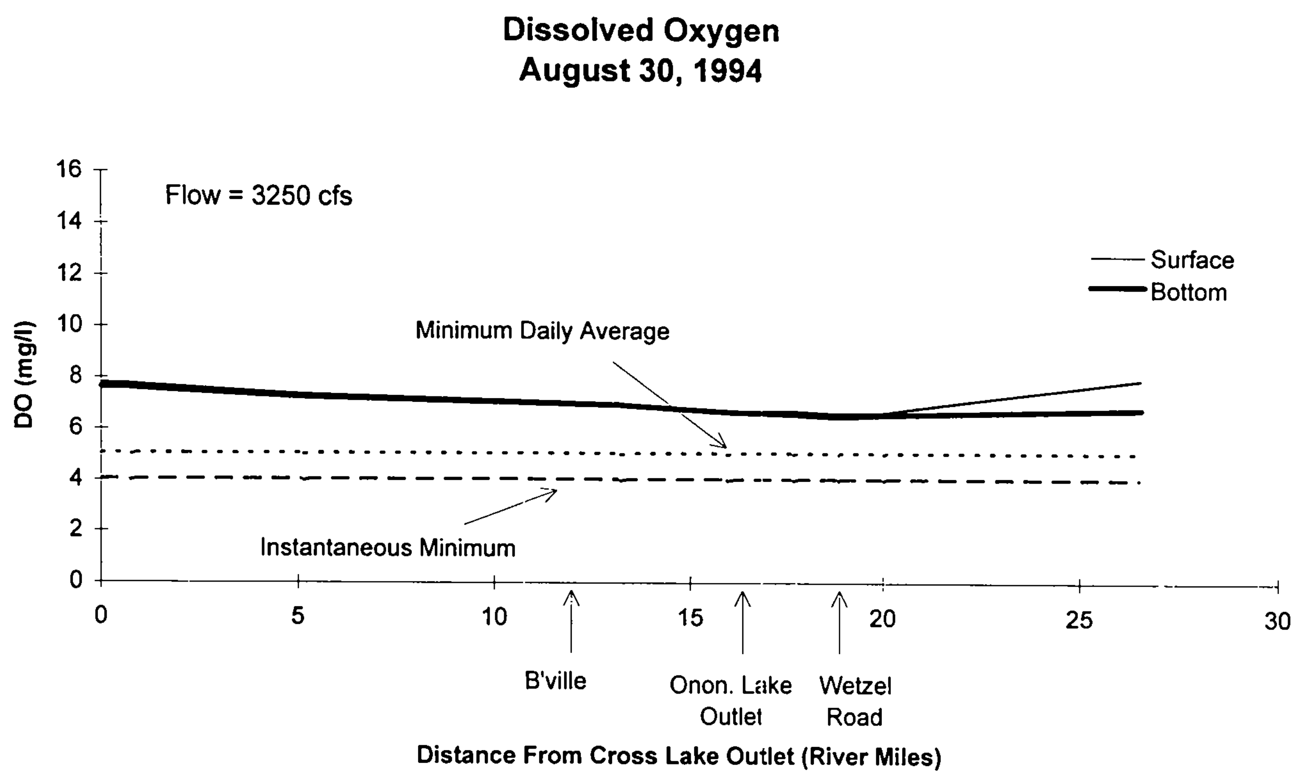
Dissolved Oxygen
August 16, 1994



Dissolved Oxygen
August 25, 1994



Stearns & Wheler ENVIRONMENTAL ENGINEERS & SCIENTISTS DATE: 1/11/96 JOB No.: 2298	DRAFT ENVIRONMENTAL IMPACT STATEMENT ONONDAGA COUNTY DEPARTMENT OF DRAINAGE AND SANITATION **FIGURE 2-13 A (CONTINUED)** **DISSOLVED OXYGEN IN THE SENECA RIVER DURING THE 1994 SAMPLING PROGRAM**



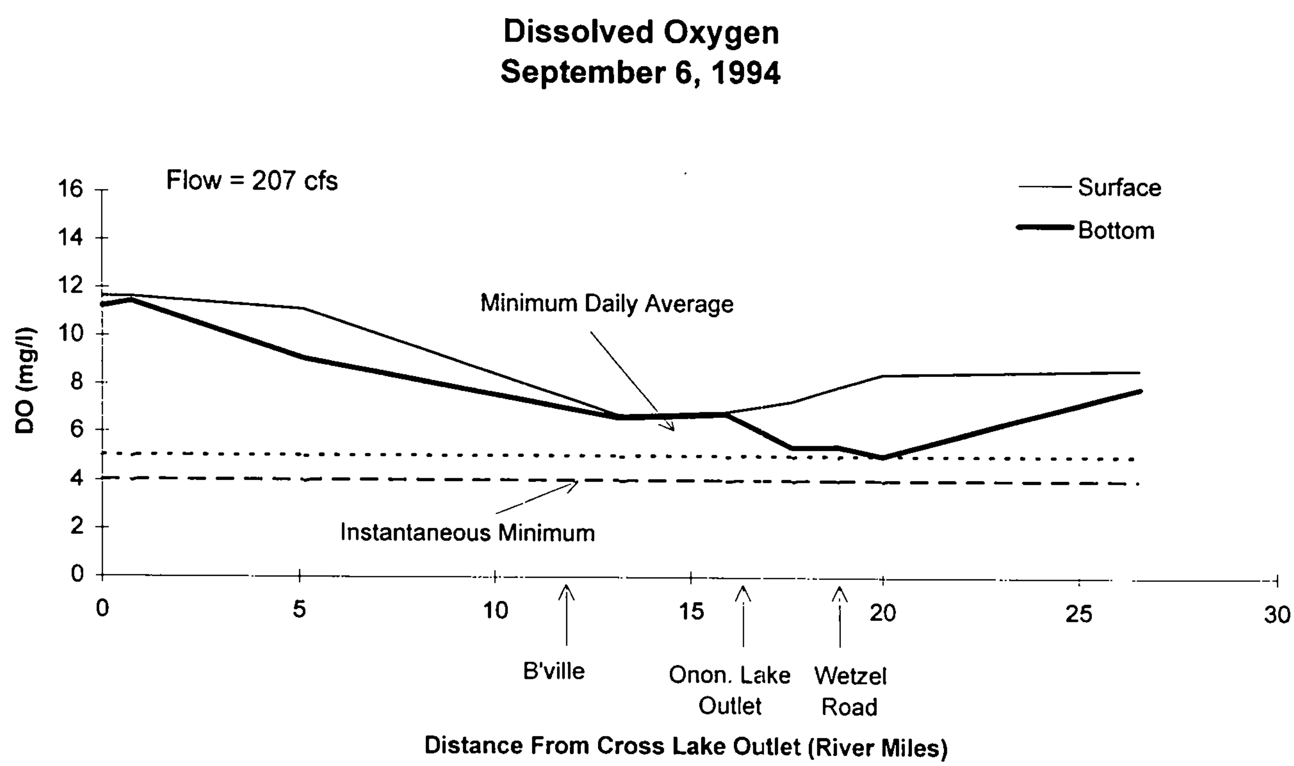


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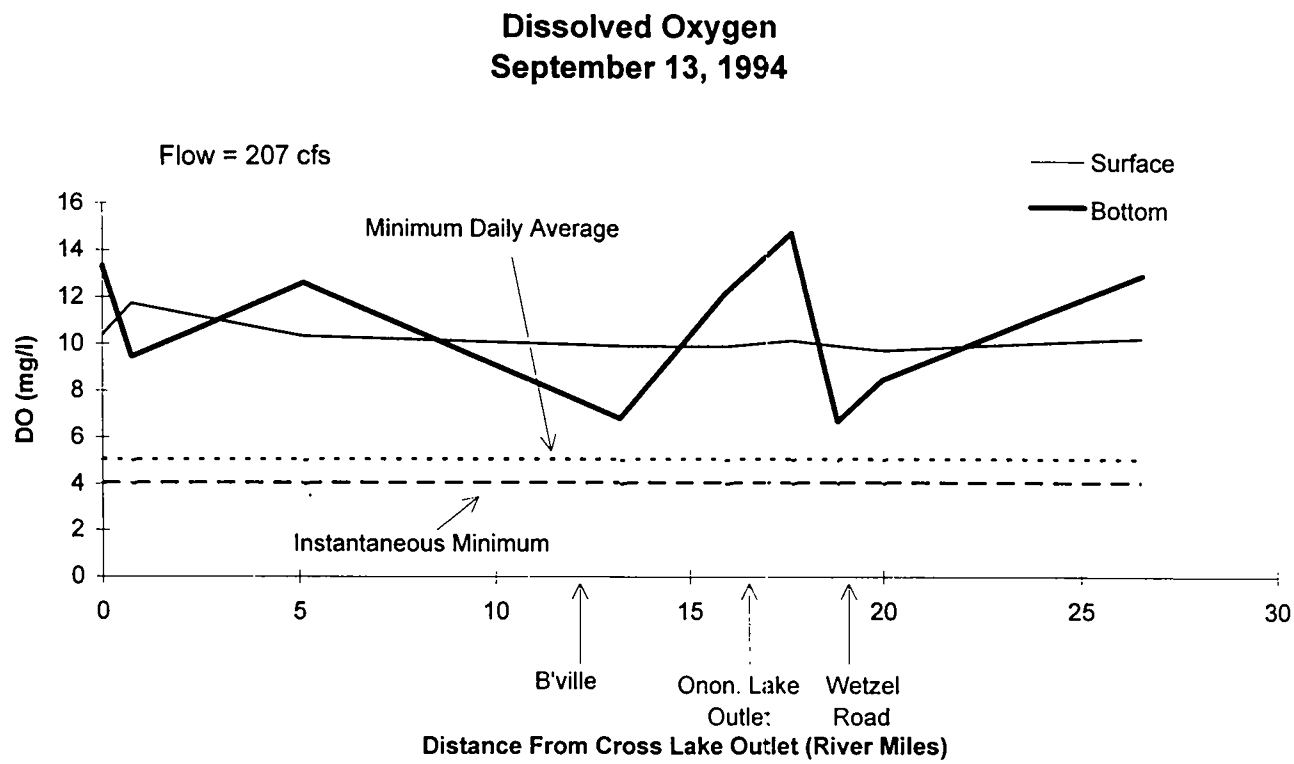
FIGURE 2-13 A (CONTINUED)
DISSOLVED OXYGEN IN THE SENECA RIVER DURING THE 1994 SAMPLING PROGRAM



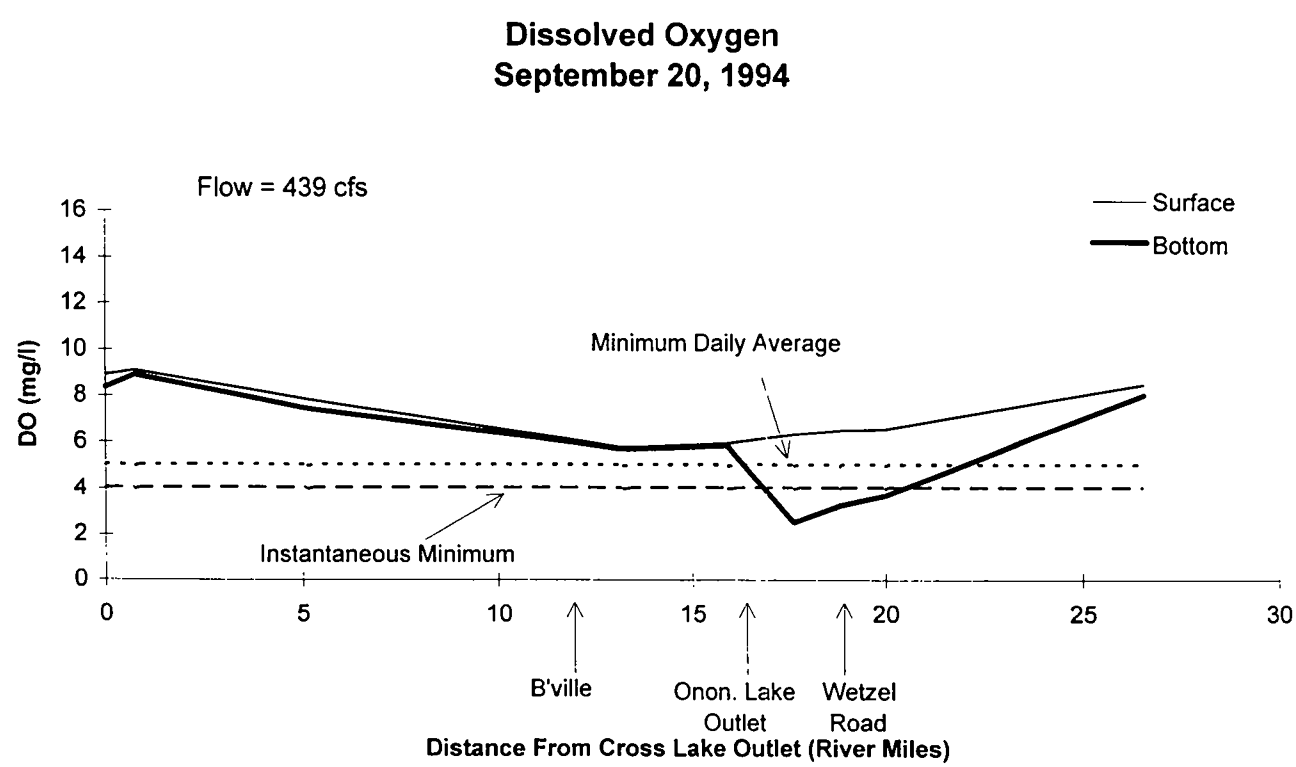


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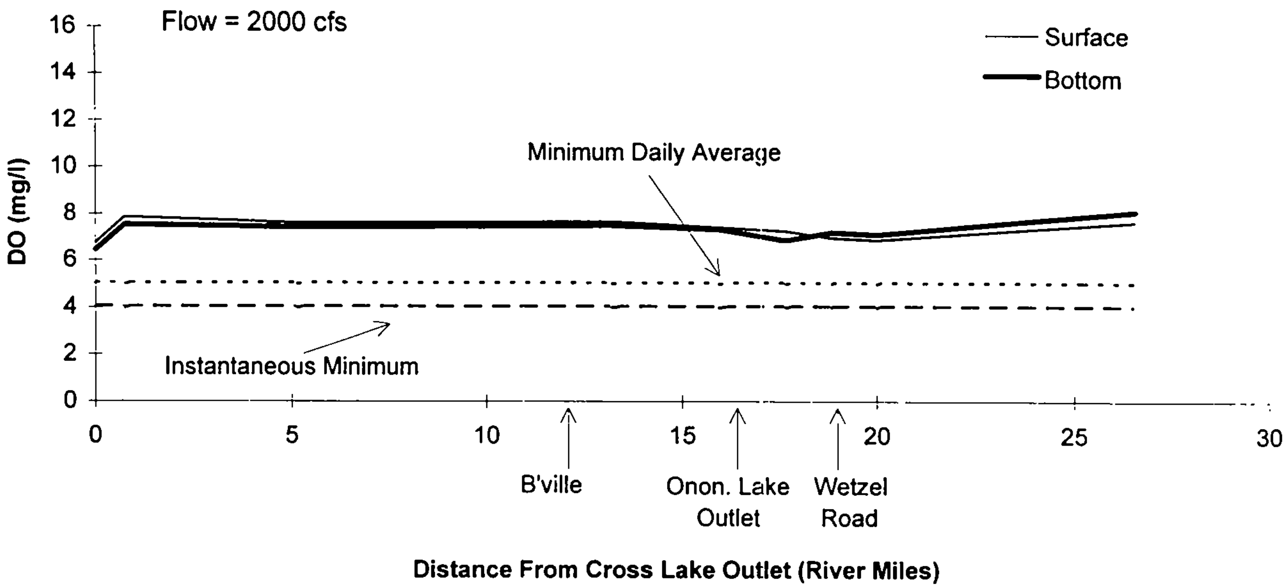
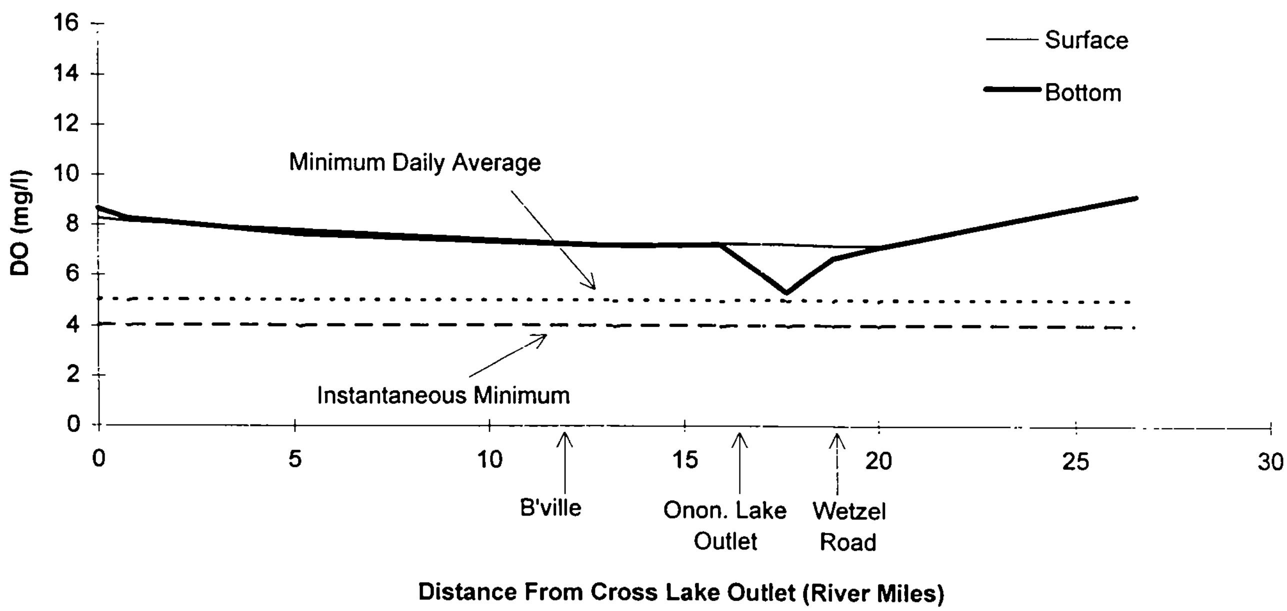
FIGURE 2-13 A (CONTINUED)
DISSOLVED OXYGEN IN THE SENECA RIVER
DURING THE 1994 SAMPLING PROGRAM

Dissolved Oxygen
September 27, 1994



Dissolved Oxygen
October 4, 1994



Stearns & Wheler ENVIRONMENTAL ENGINEERS & SCIENTISTS DATE: 1/11/96 JOB No.: 2298	DRAFT ENVIRONMENTAL IMPACT STATEMENT ONONDAGA COUNTY DEPARTMENT OF DRAINAGE AND SANITATION **FIGURE 2-13 A (CONTINUED)** **DISSOLVED OXYGEN IN THE SENECA RIVER DURING THE 1994 SAMPLING PROGRAM**

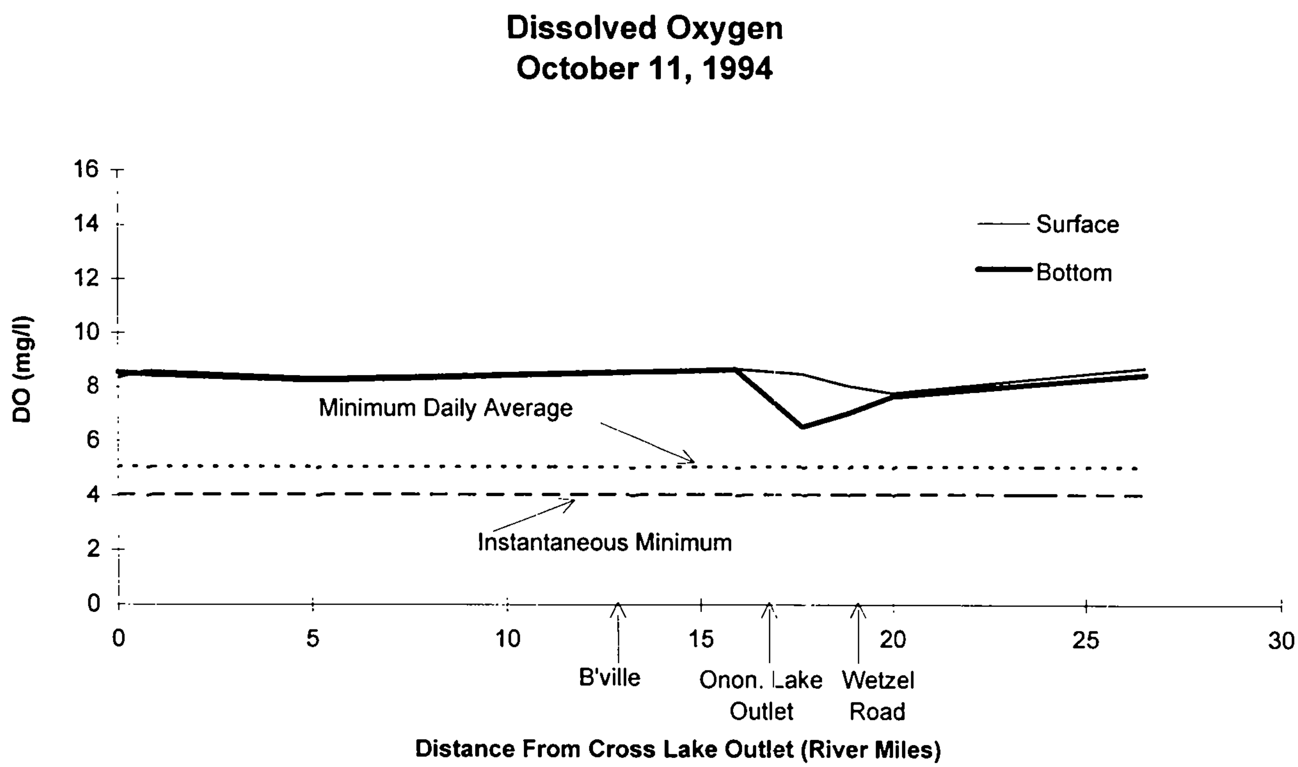


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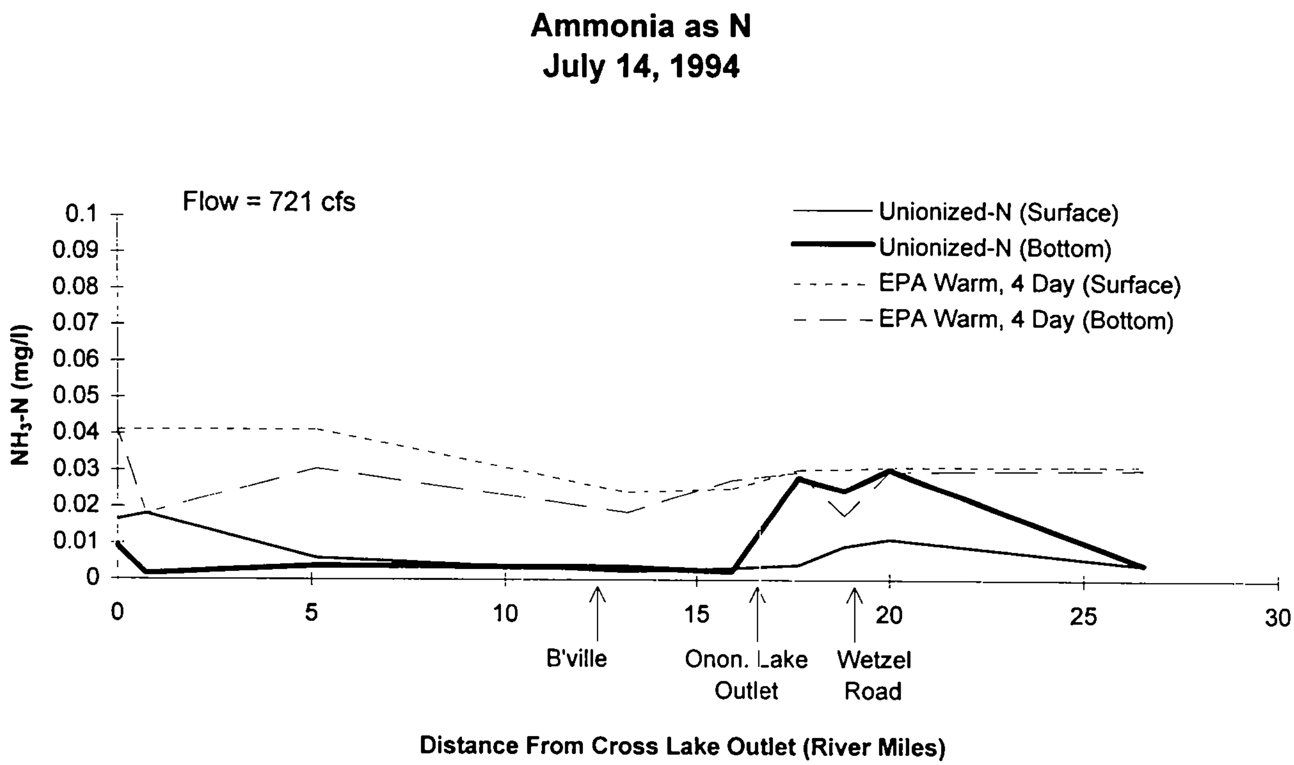
FIGURE 2-13 A (CONTINUED)
DISSOLVED OXYGEN IN THE SENECA RIVER
DURING THE 1994 SAMPLING PROGRAM



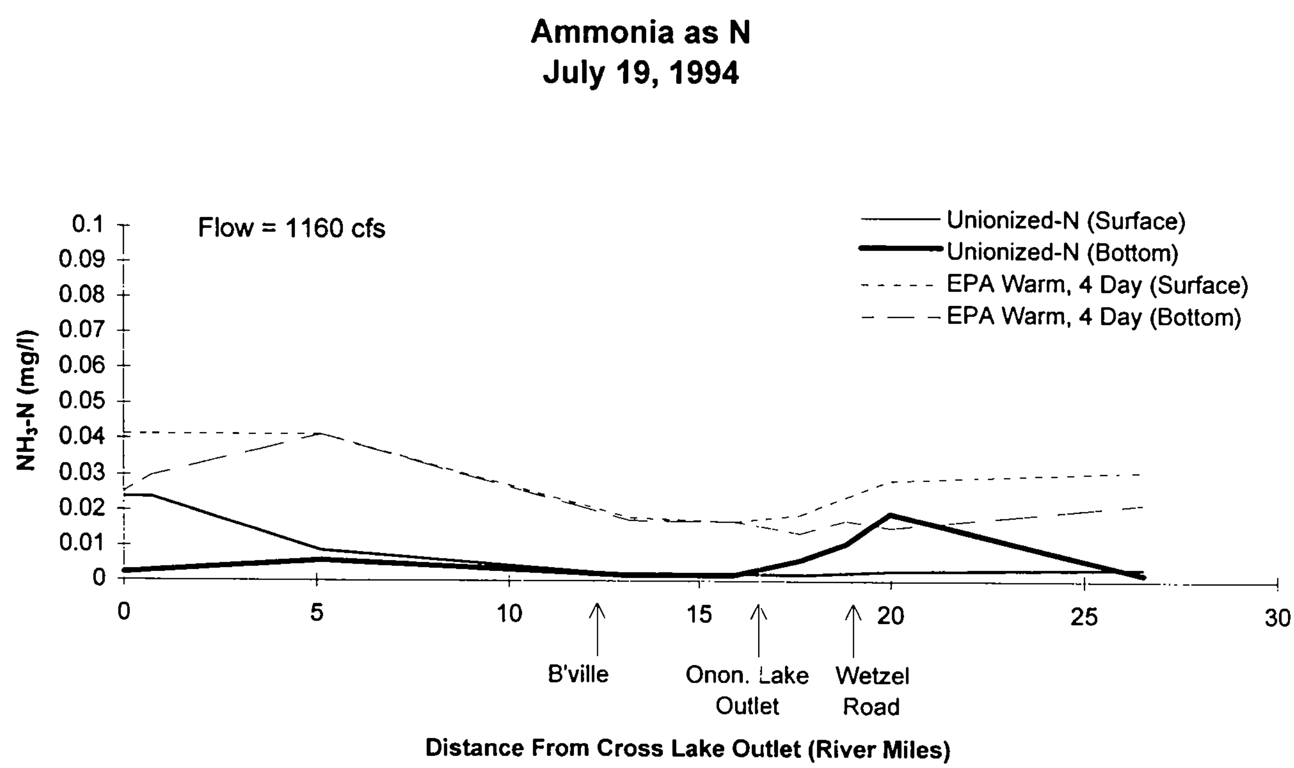


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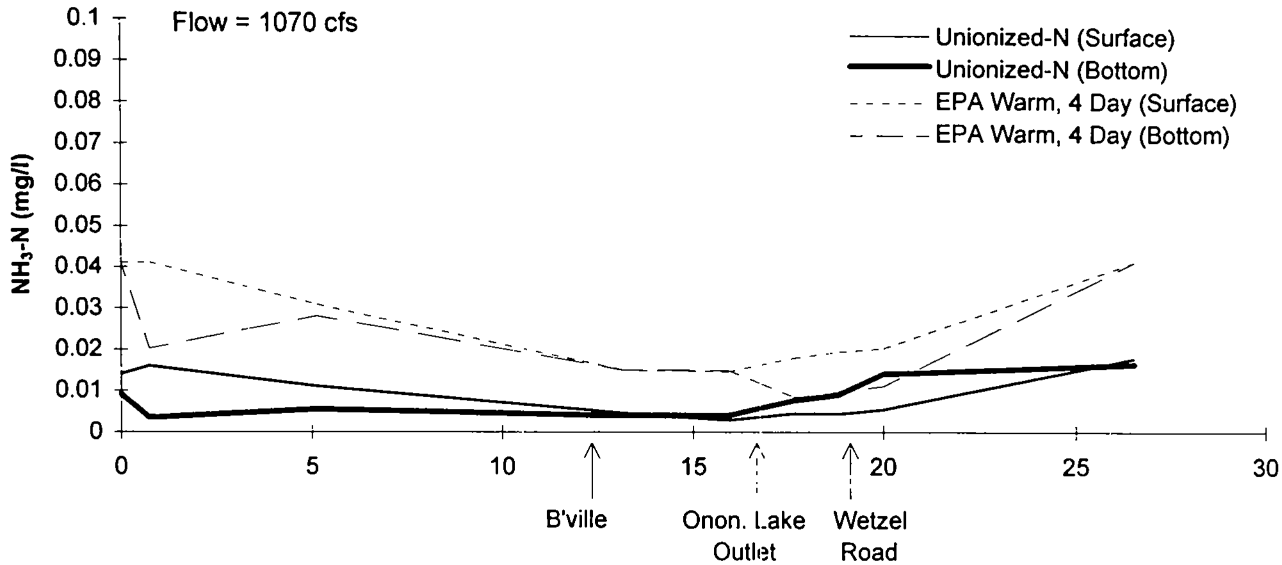
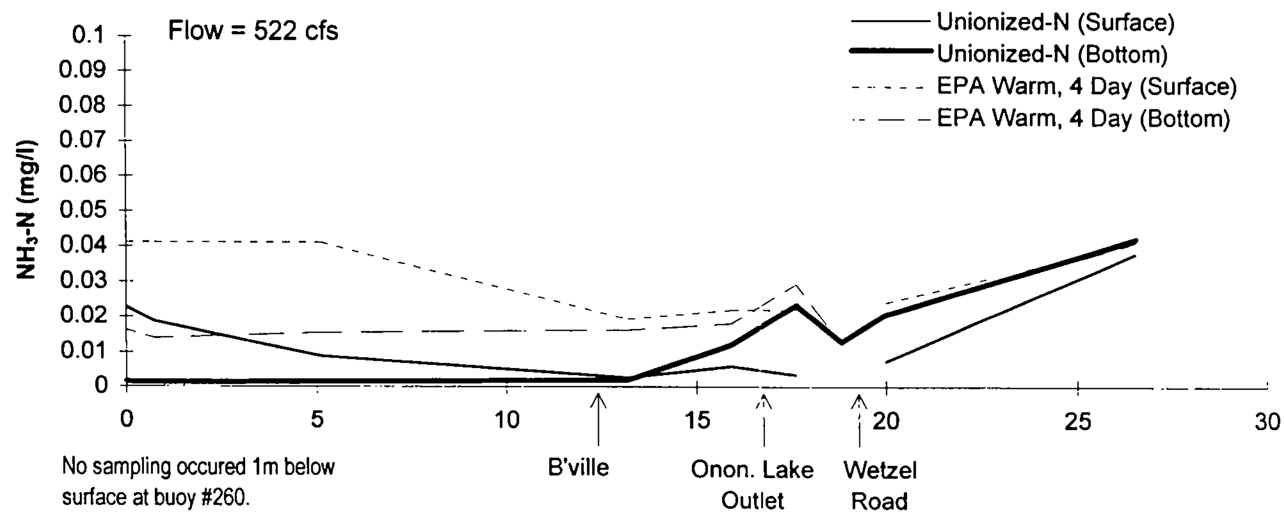
FIGURE 2-13 B
AMMONIA IN THE SENECA RIVER DURING THE 1994 SAMPLING PROGRAM

Ammonia as N
July 26, 1994



Ammonia as N
August 2, 1994



No sampling occured 1m below surface at buoy #260.

Distance From Cross Lake Outlet (River Miles)

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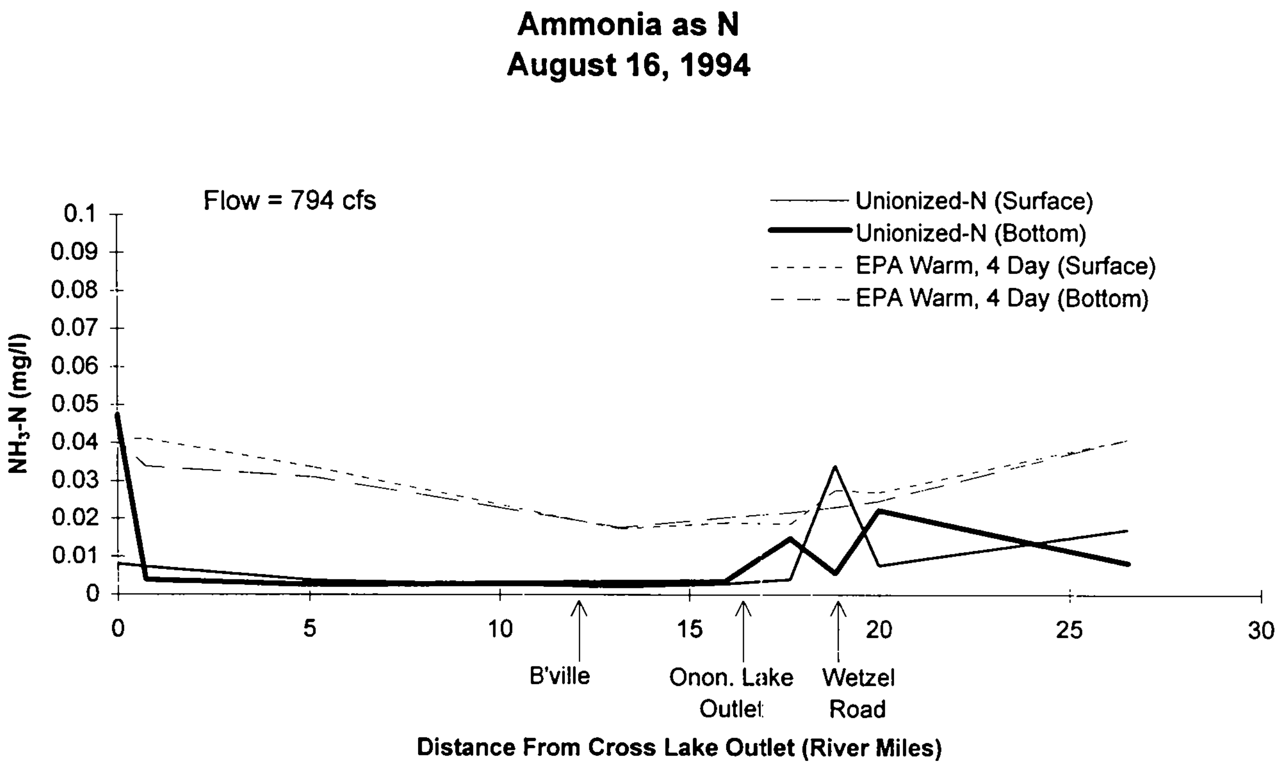

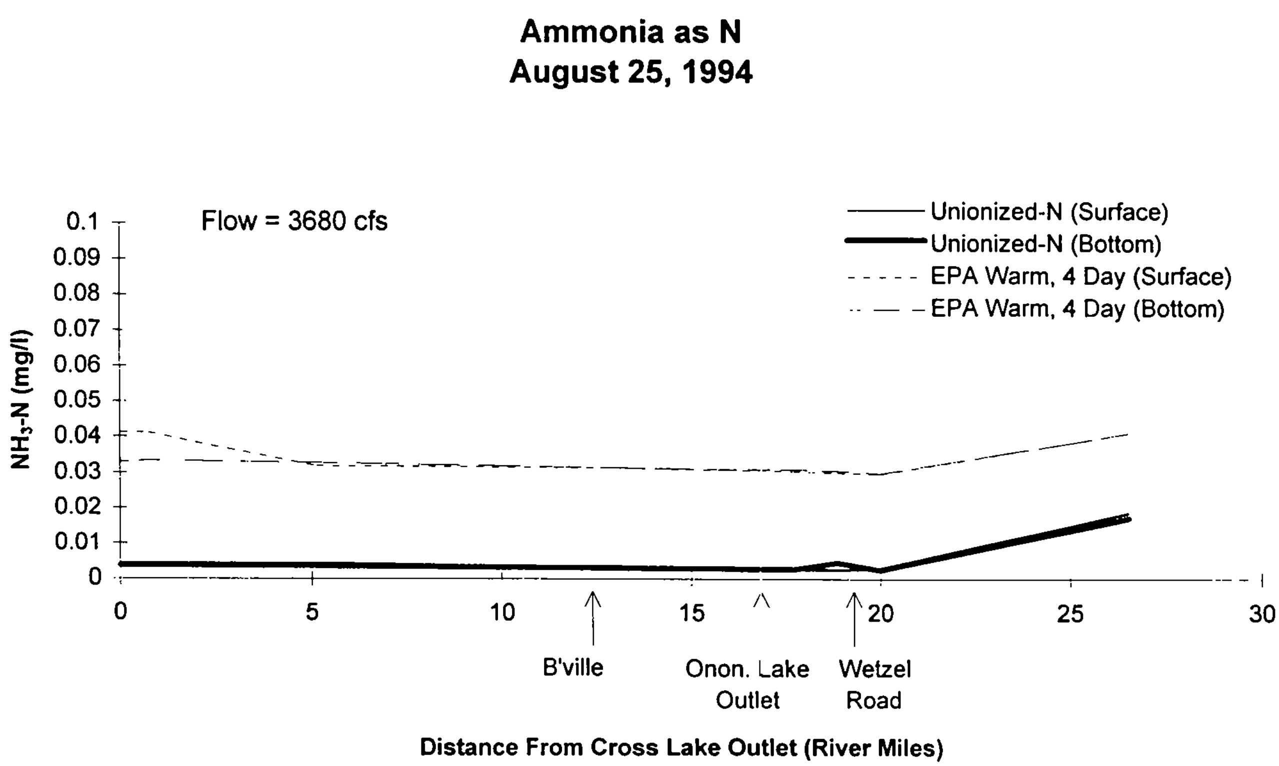

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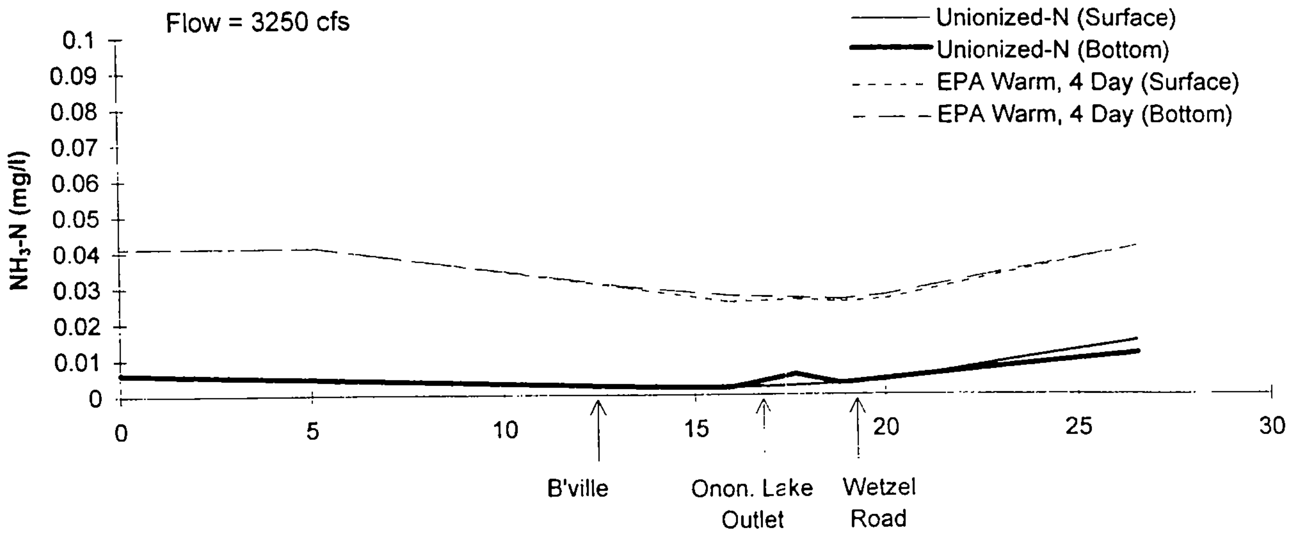
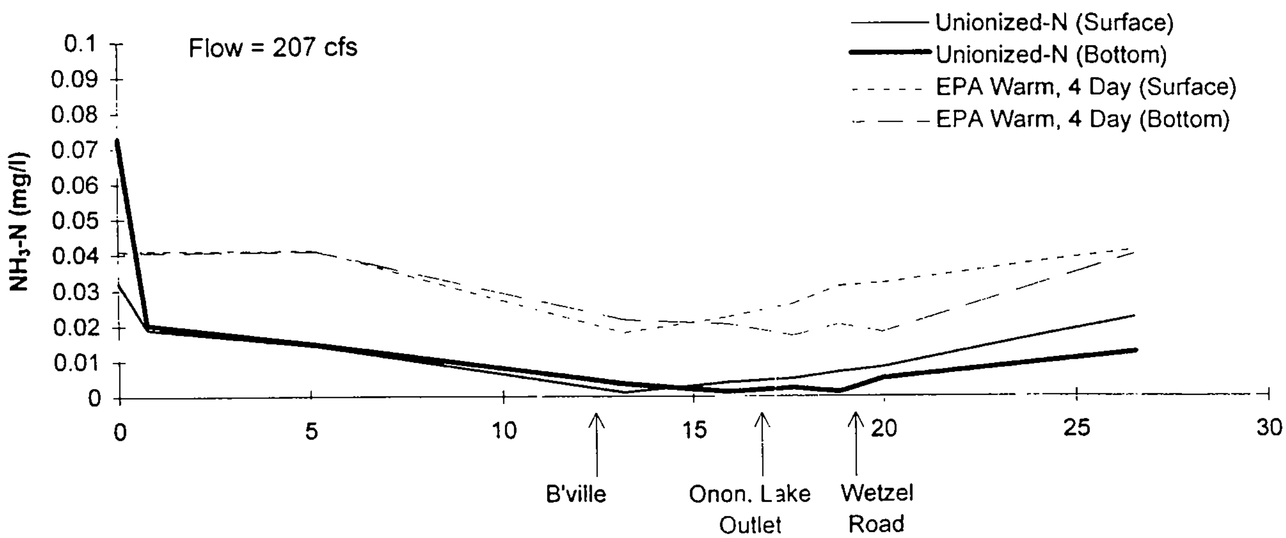
FIGURE 2-13 B (CONTINUED)
AMMONIA IN THE SENECA RIVER DURING THE 1994 SAMPLING PROGRAM

Ammonia as N
August 30, 1994



Distance From Cross Lake Outlet (River Miles)

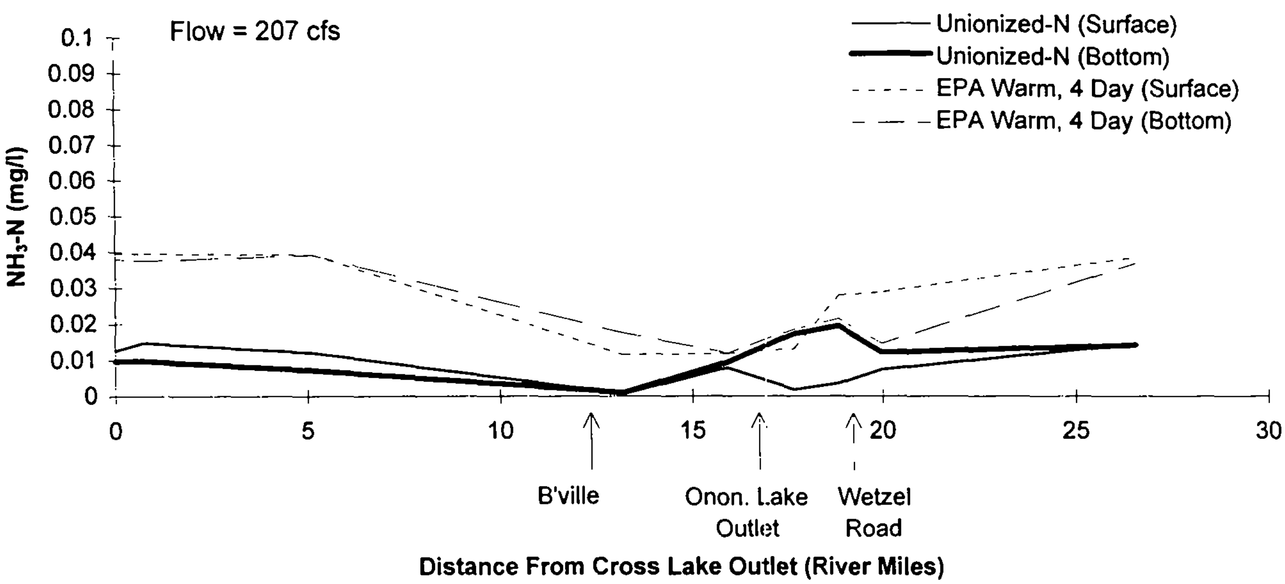
Ammonia as N
September 6, 1994



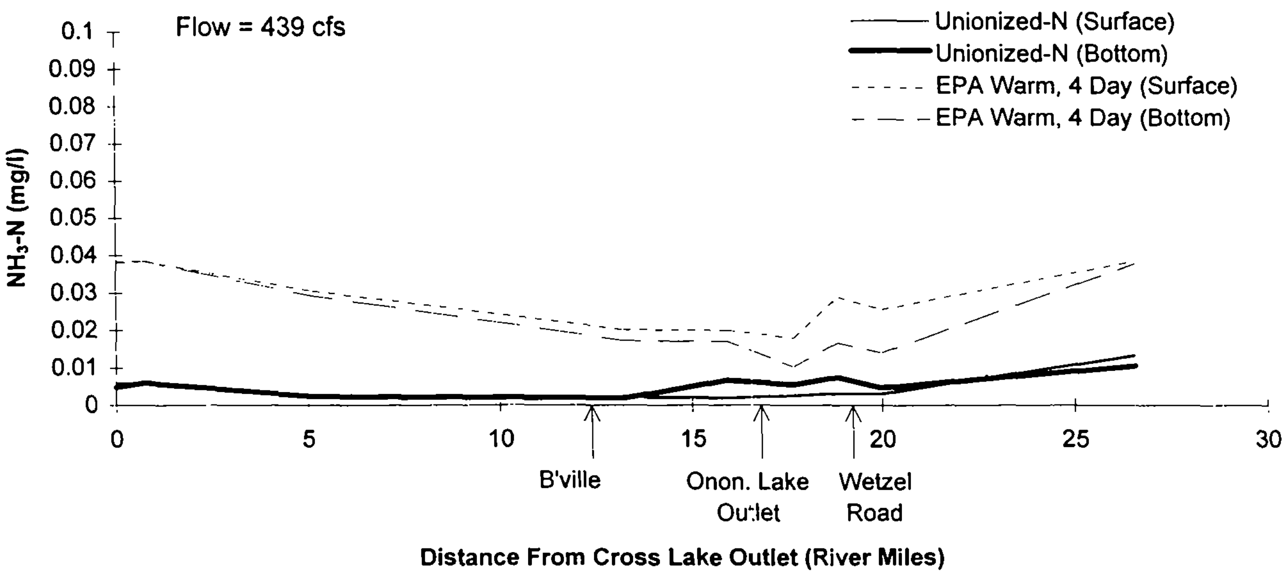
Distance From Cross Lake Outlet (River Miles)

Stearns & Wheler ENVIRONMENTAL ENGINEERS & SCIENTISTS DATE: 1/11/96 JOB No.: 2298	DRAFT ENVIRONMENTAL IMPACT STATEMENT ONONDAGA COUNTY DEPARTMENT OF DRAINAGE AND SANITATION **FIGURE 2-13 B (CONTINUED)** **AMMONIA IN THE SENECA RIVER DURING THE 1994 SAMPLING PROGRAM**

Ammonia as N
September 13, 1994



Ammonia as N
September 20, 1994



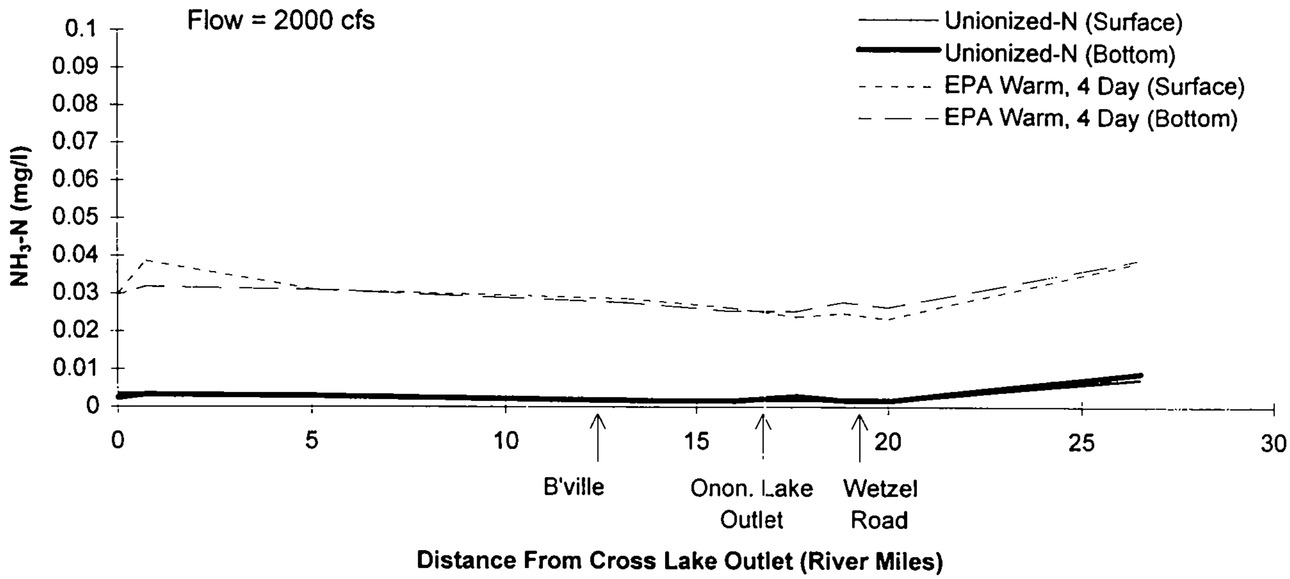
Stearns & Wheler
ENVIRONMENTAL ENGINEERS & SCIENTISTS

DATE: 1/11/96 JOB No.: 2298

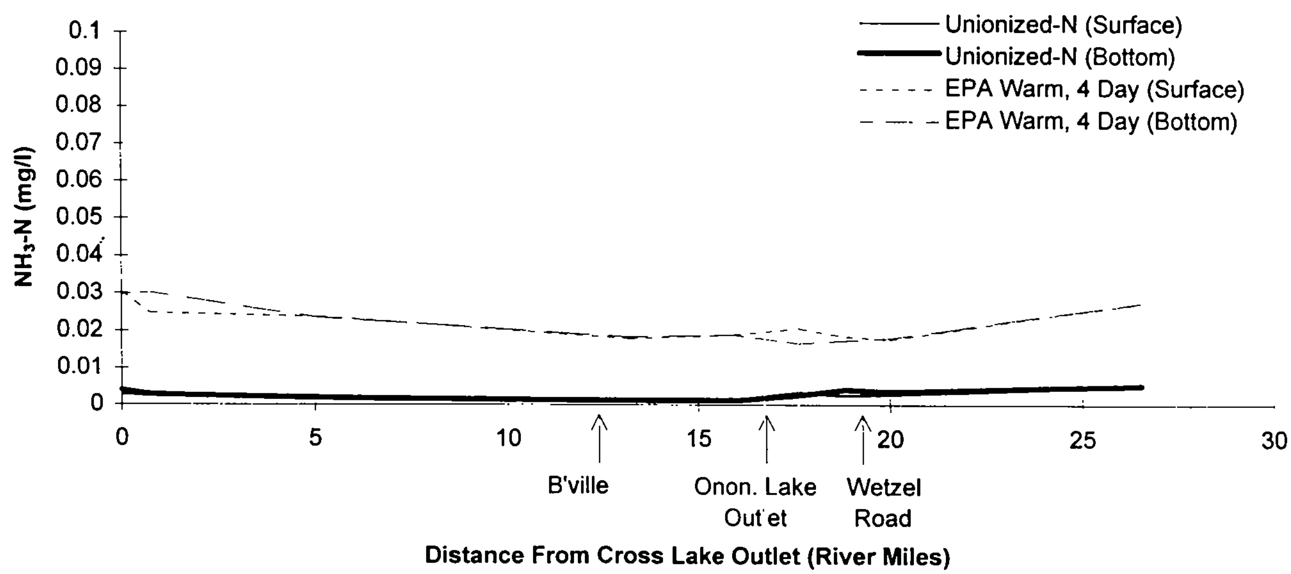
DRAFT ENVIRONMENTAL IMPACT STATEMENT
ONONDAGA COUNTY DEPARTMENT
OF DRAINAGE AND SANITATION

FIGURE 2-13 B (CONTINUED)
AMMONIA IN THE SENECA RIVER DURING THE 1994 SAMPLING PROGRAM

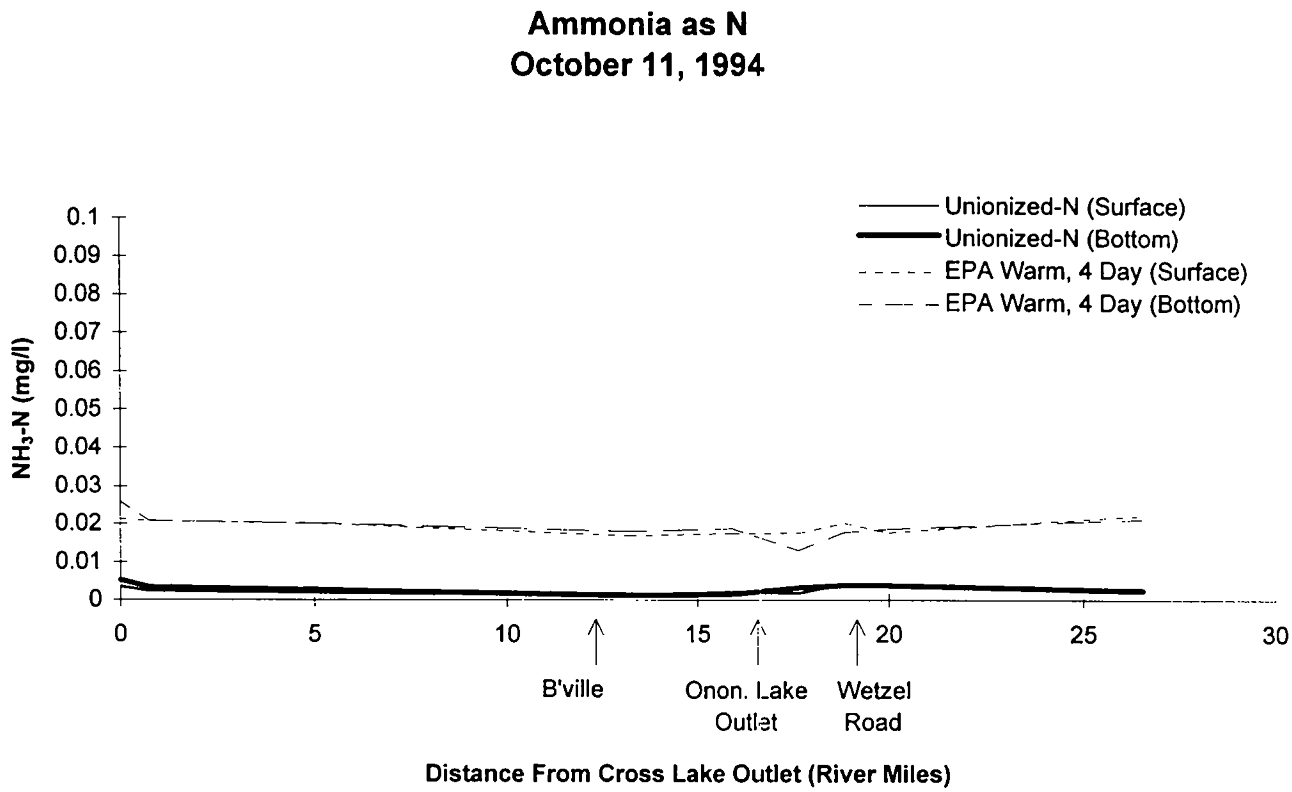
Ammonia as N
September 27, 1994



Ammonia as N
October 4, 1994



Stearns & Wheler ENVIRONMENTAL ENGINEERS & SCIENTISTS DATE: 1/11/96 JOB No.: 2298	DRAFT ENVIRONMENTAL IMPACT STATEMENT ONONDAGA COUNTY DEPARTMENT OF DRAINAGE AND SANITATION **FIGURE 2-13 B (CONTINUED) AMMONIA IN THE SENECA RIVER DURING THE 1994 SAMPLING PROGRAM**



Stearns & Wheler

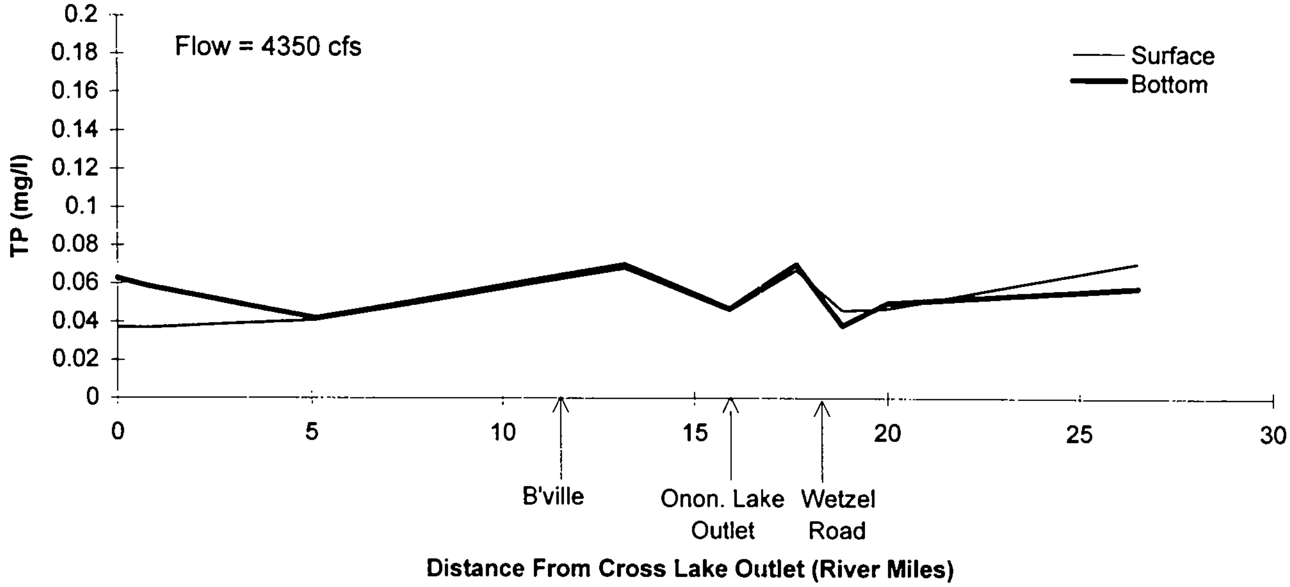
ENVIRONMENTAL ENGINEERS & SCIENTISTS

DATE: 1/11/96 JOB No.: 2298

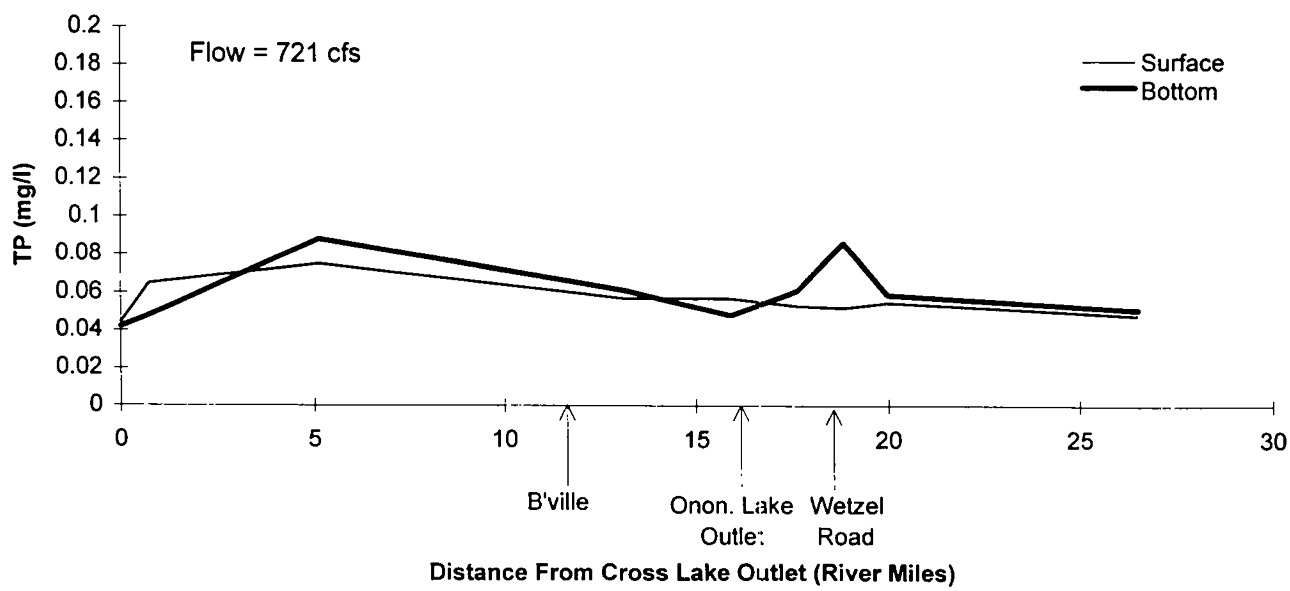
DRAFT ENVIRONMENTAL IMPACT STATEMENT
ONONDAGA COUNTY DEPARTMENT
OF DRAINAGE AND SANITATION

FIGURE 2-13 B (CONTINUED)
AMMONIA IN THE SENECA RIVER DURING
THE 1994 SAMPLING PROGRAM

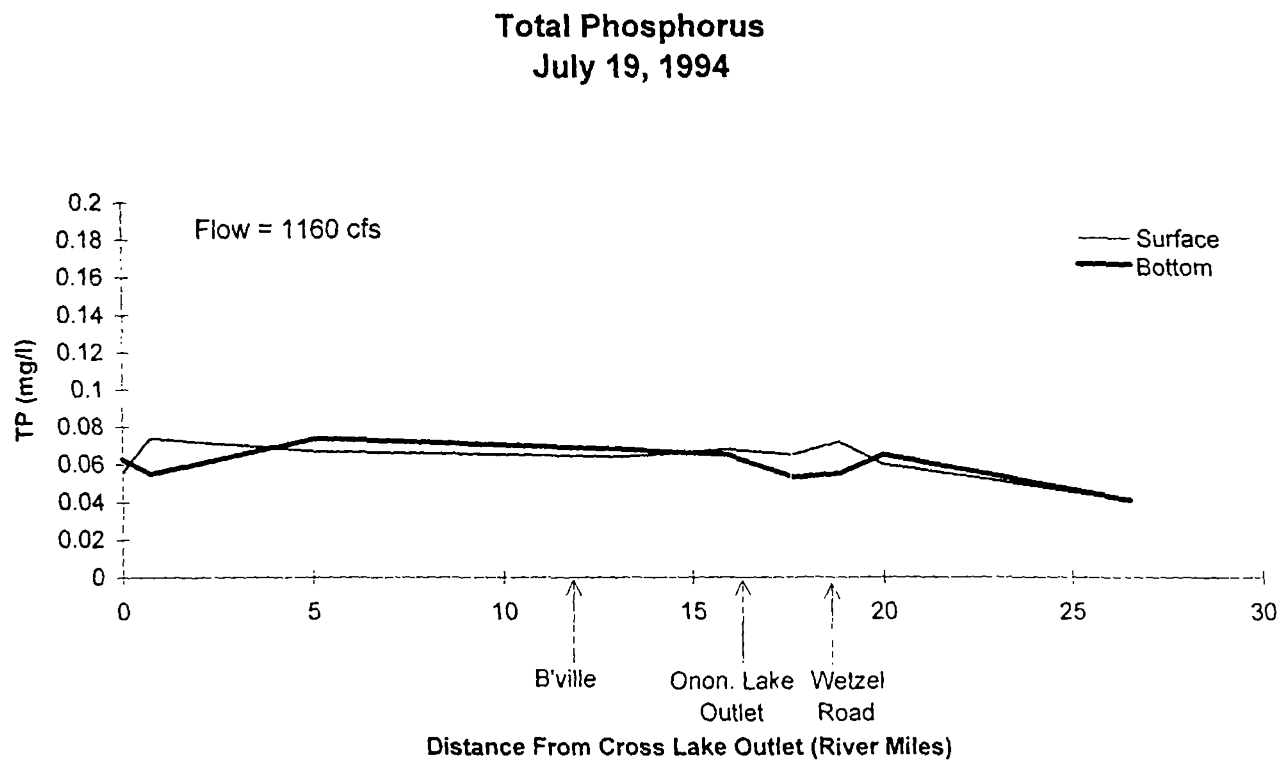
Total Phosphorus
June 30, 1994

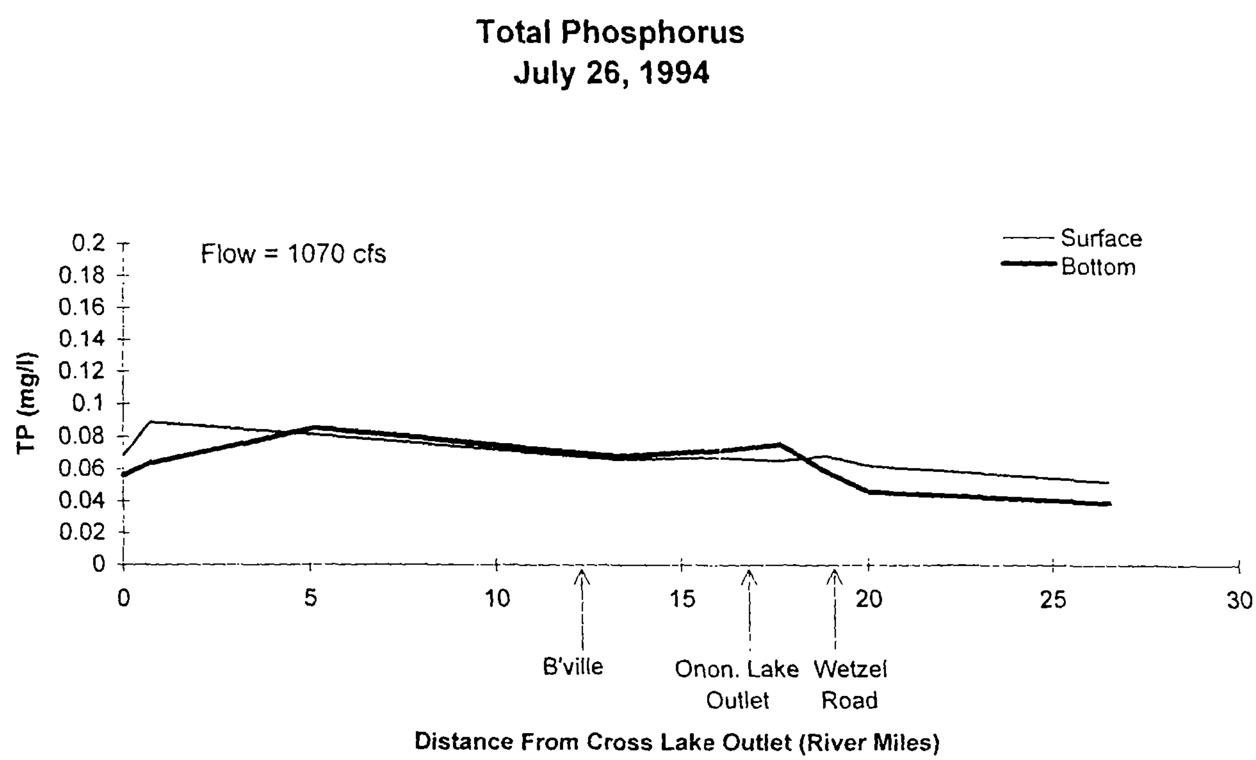


Total Phosphorus
July 14, 1994



Stearns & Wheler ENVIRONMENTAL ENGINEERS & SCIENTISTS	DRAFT ENVIRONMENTAL IMPACT STATEMENT ONONDAGA COUNTY DEPARTMENT OF DRAINAGE AND SANITATION
DATE: 1/11/96 JOB No.: 2298	FIGURE 2-13 C TOTAL PHOSPHORUS IN THE SENECA RIVER DURING THE 1994 SAMPLING PROGRAM





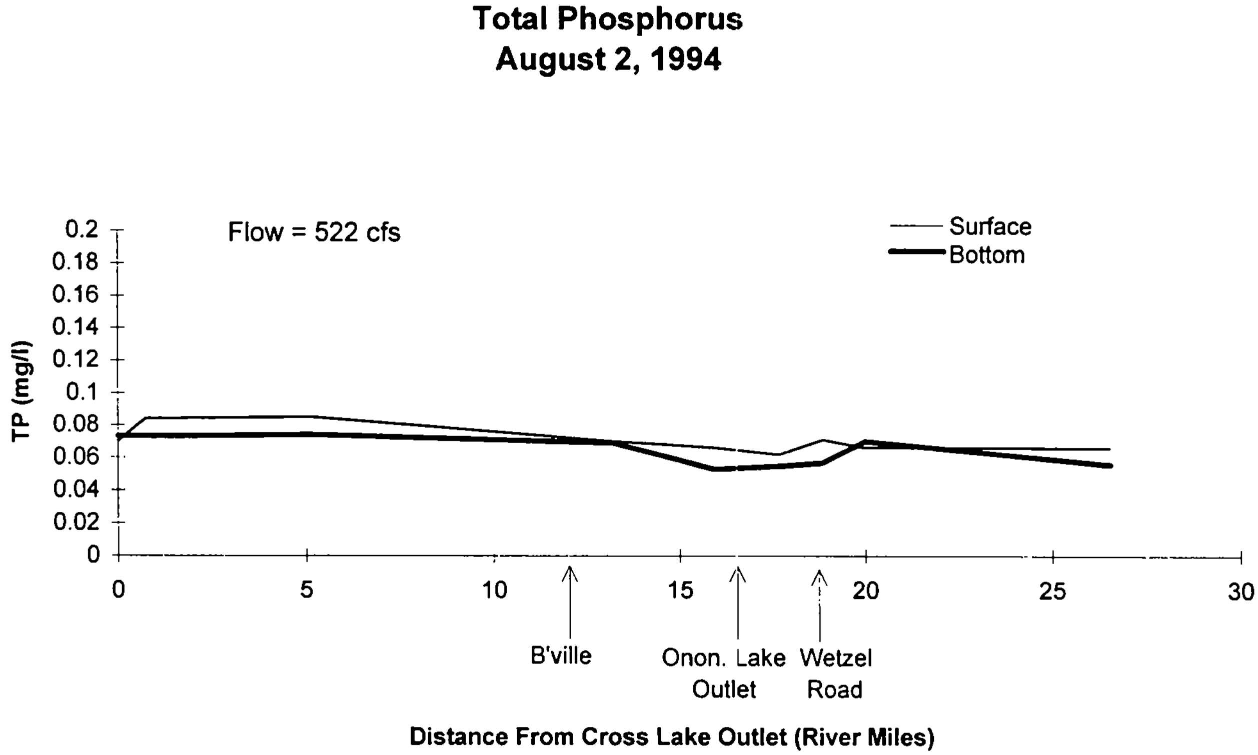
Stearns & Wheler

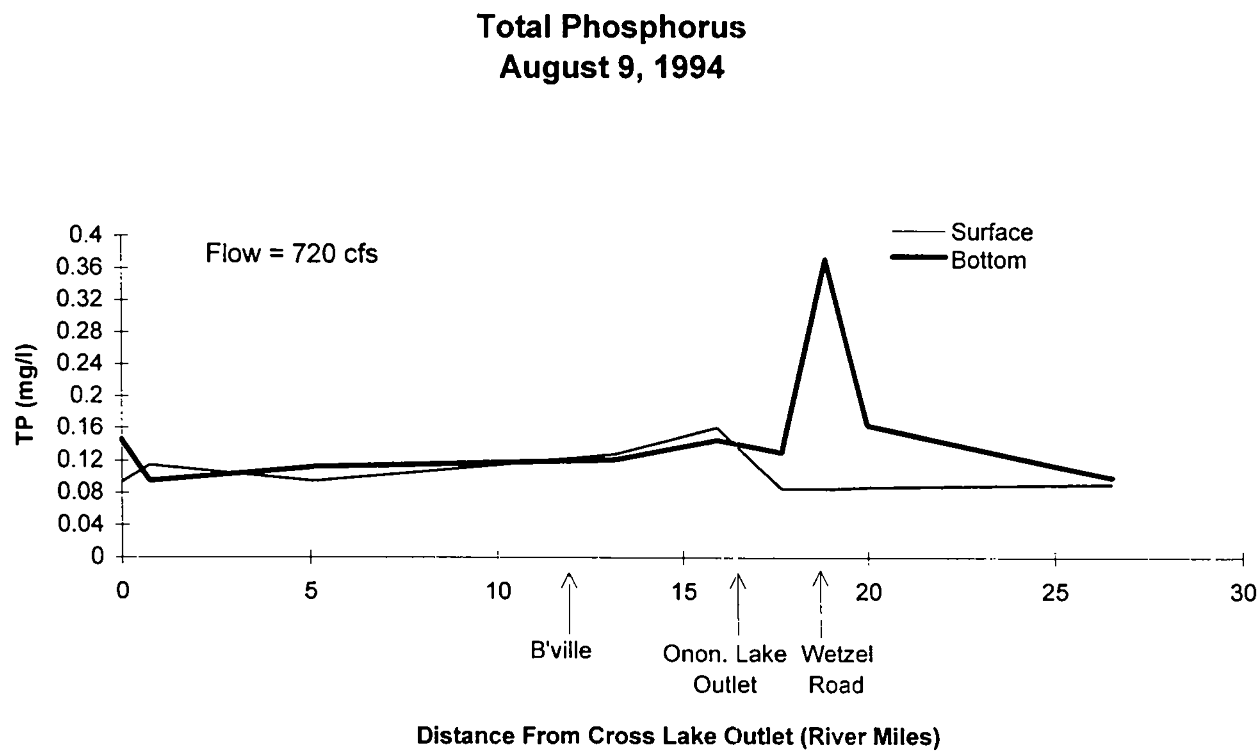
ENVIRONMENTAL ENGINEERS & SCIENTISTS

DATE: 1/11/96 JOB No.: 2298

DRAFT ENVIRONMENTAL IMPACT STATEMENT
ONONDAGA COUNTY DEPARTMENT
OF DRAINAGE AND SANITATION

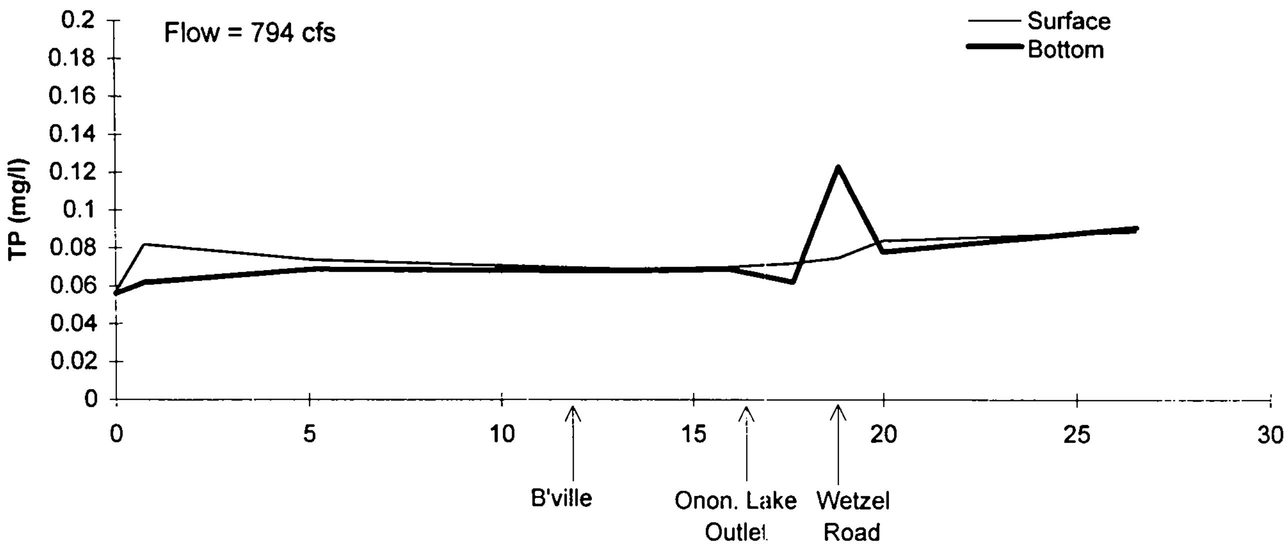
FIGURE 2-13 C (CONTINUED)
TOTAL PHOSPHORUS IN THE SENECA RIVER
DURING THE 1994 SAMPLING PROGRAM





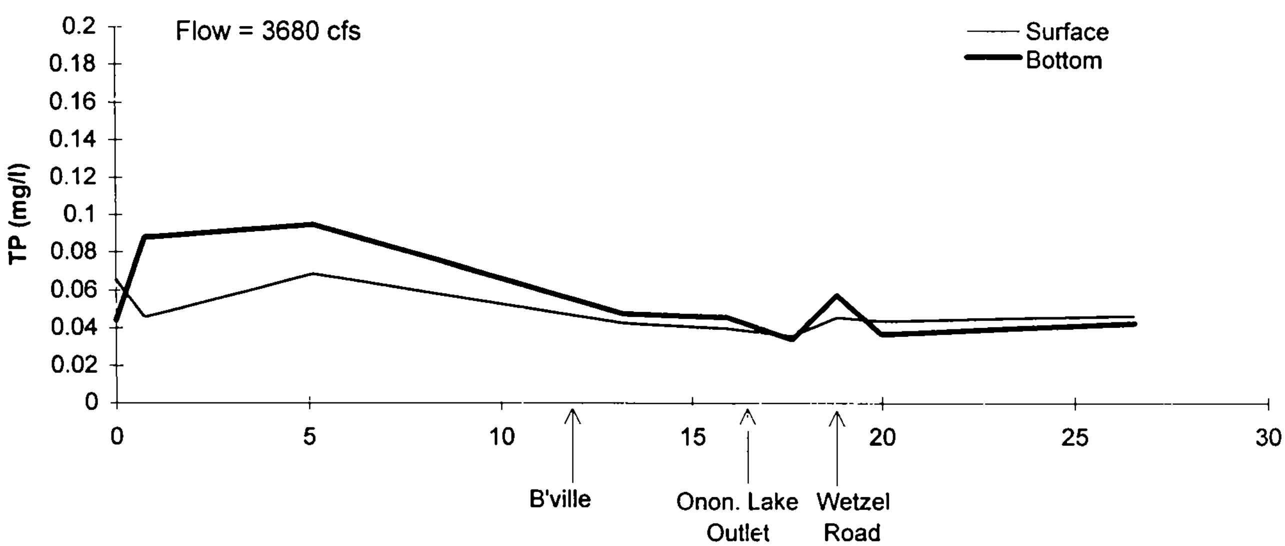
Stearns & Wheler ENVIRONMENTAL ENGINEERS & SCIENTISTS	DRAFT ENVIRONMENTAL IMPACT STATEMENT ONONDAGA COUNTY DEPARTMENT OF DRAINAGE AND SANITATION
DATE: 1/11/96 JOB No.: 2298	**FIGURE 2-13 C (CONTINUED)** **TOTAL PHOSPHORUS IN THE SENECA RIVER DURING THE 1994 SAMPLING PROGRAM**

Total Phosphorus
August 16, 1994



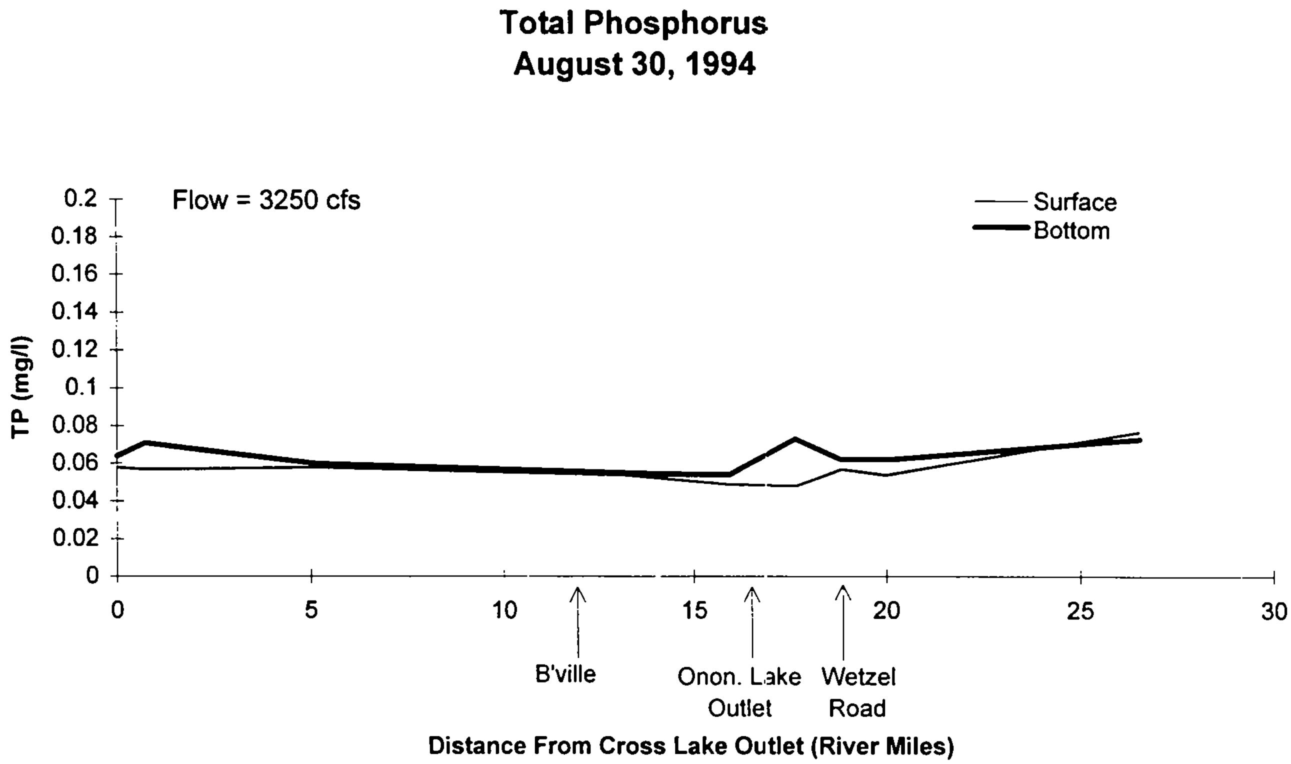
Distance From Cross Lake Outlet (River Miles)

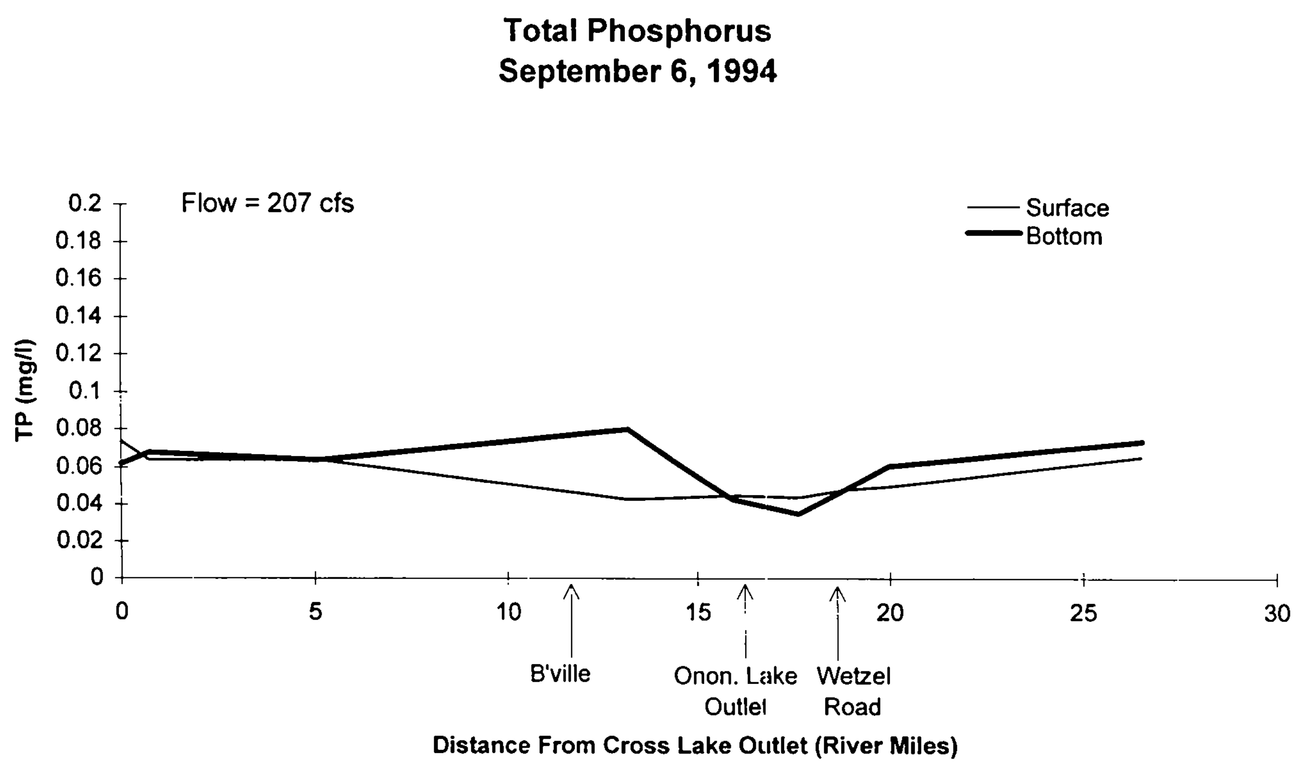
Total Phosphorus
August 25, 1994



Distance From Cross Lake Outlet (River Miles)

Stearns & Wheler ENVIRONMENTAL ENGINEERS & SCIENTISTS DATE: 1/11/96 JOB No.: 2298	DRAFT ENVIRONMENTAL IMPACT STATEMENT ONONDAGA COUNTY DEPARTMENT OF DRAINAGE AND SANITATION FIGURE 2-13 C (CONTINUED) TOTAL PHOSPHORUS IN THE SENECA RIVER DURING THE 1994 SAMPLING PROGRAM





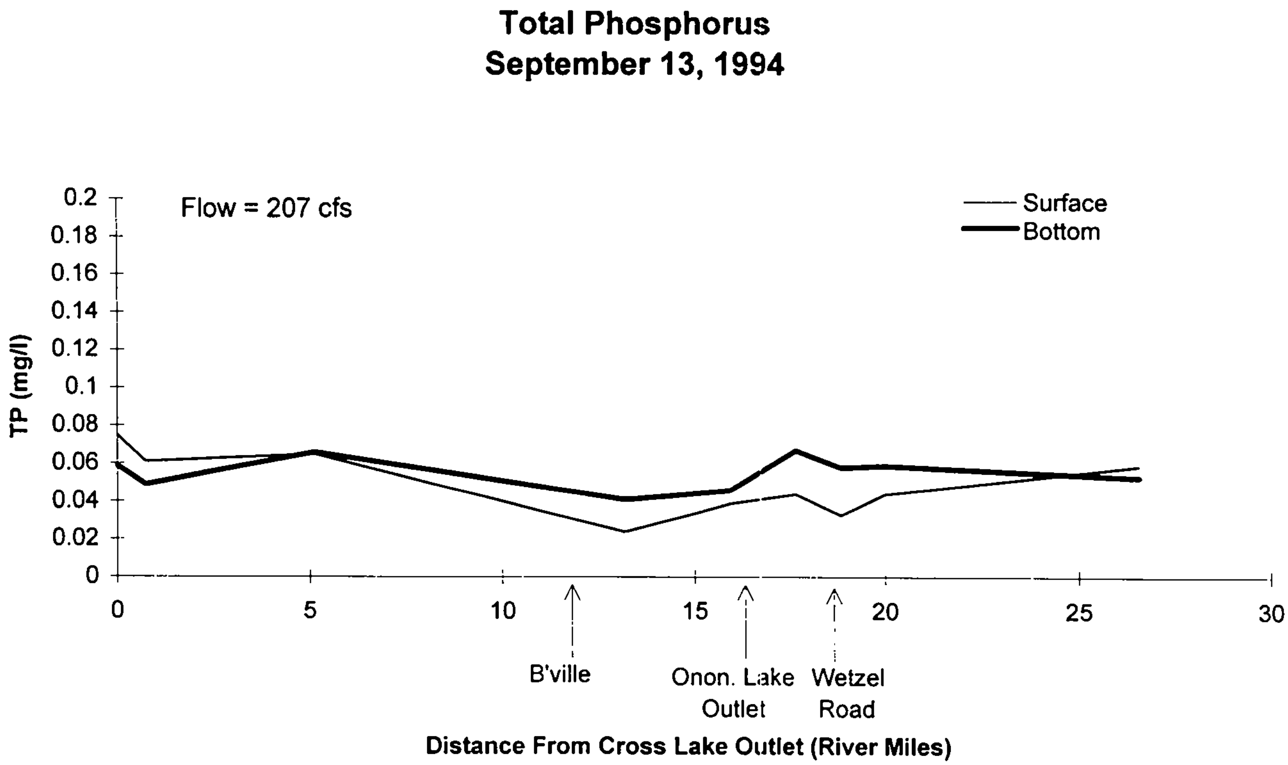
Stearns & Wheler

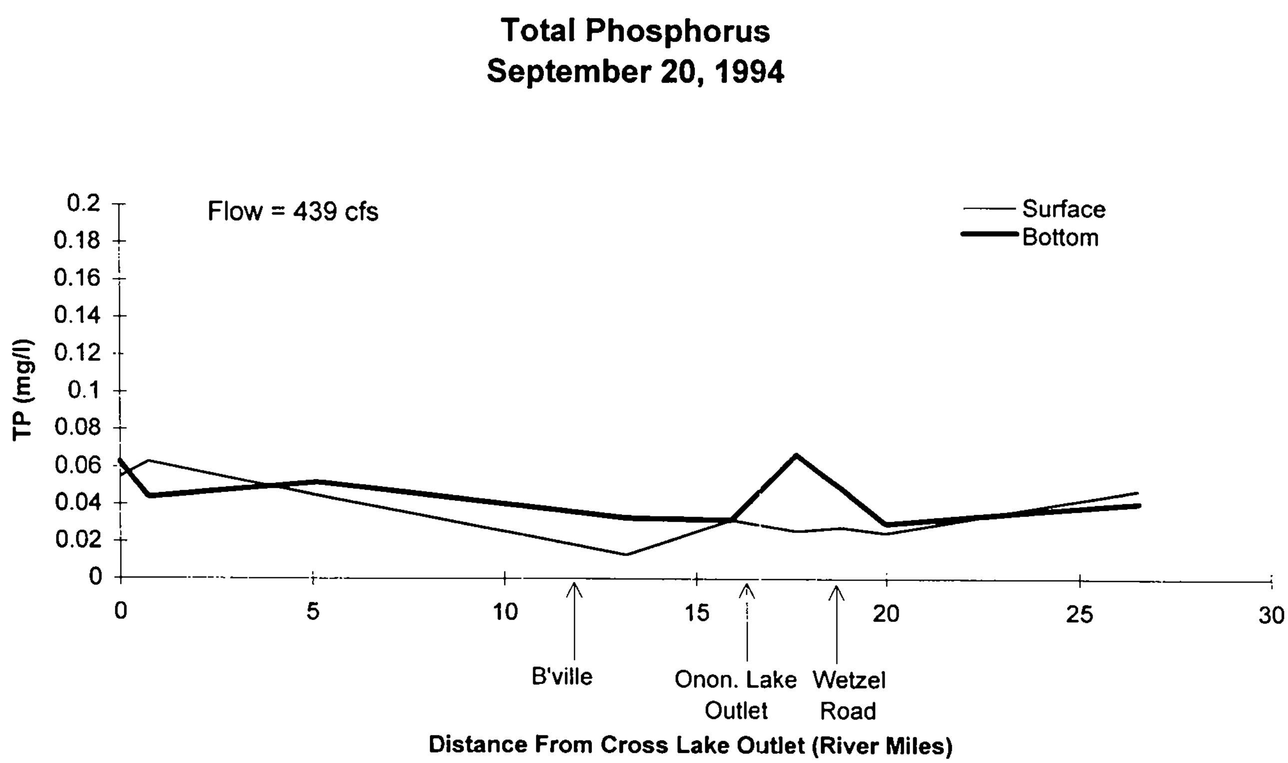
ENVIRONMENTAL ENGINEERS & SCIENTISTS

DATE: 1/11/96 JOB No.: 2298

DRAFT ENVIRONMENTAL IMPACT STATEMENT
ONONDAGA COUNTY DEPARTMENT
OF DRAINAGE AND SANITATION

FIGURE 2-13 C (CONTINUED)
TOTAL PHOSPHORUS IN THE SENECA RIVER DURING THE 1994 SAMPLING PROGRAM





Stearns & Wheler

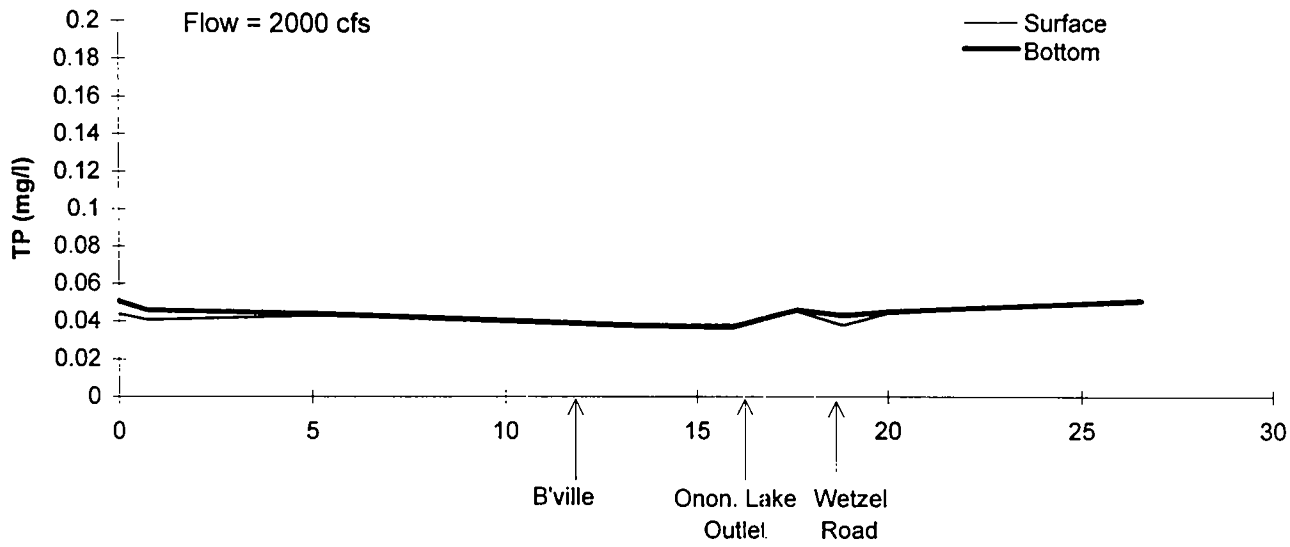
ENVIRONMENTAL ENGINEERS & SCIENTISTS

DATE: 1/11/96 JOB No.: 2298

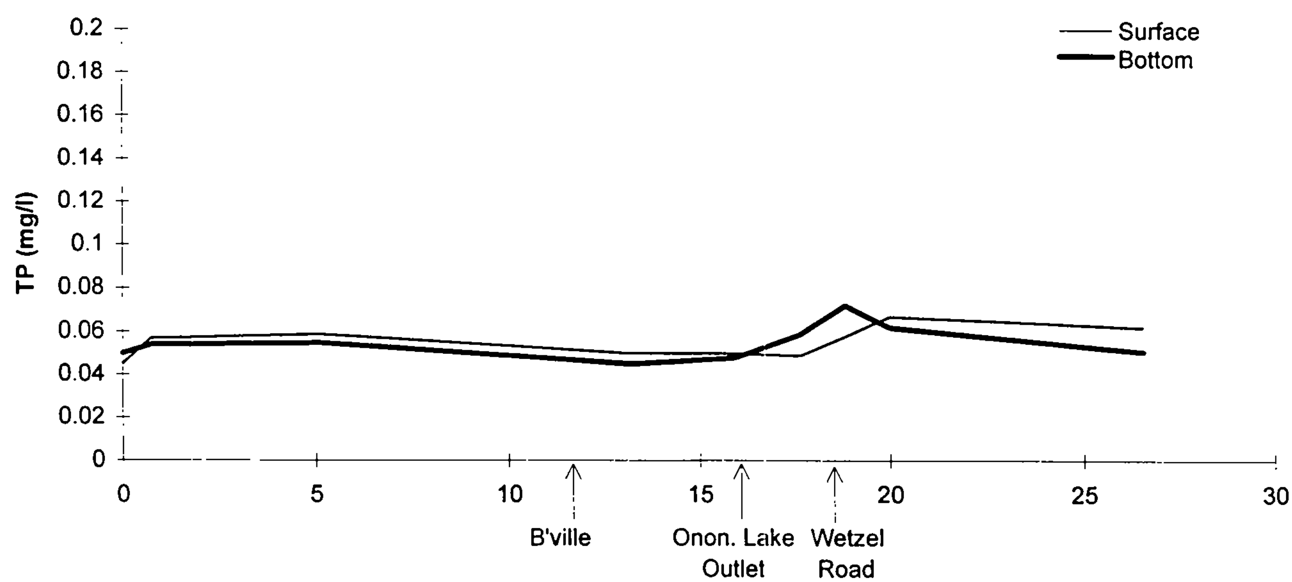
DRAFT ENVIRONMENTAL IMPACT STATEMENT
ONONDAGA COUNTY DEPARTMENT
OF DRAINAGE AND SANITATION

FIGURE 2-13 C (CONTINUED)
TOTAL PHOSPHORUS IN THE SENECA RIVER
DURING THE 1994 SAMPLING PROGRAM

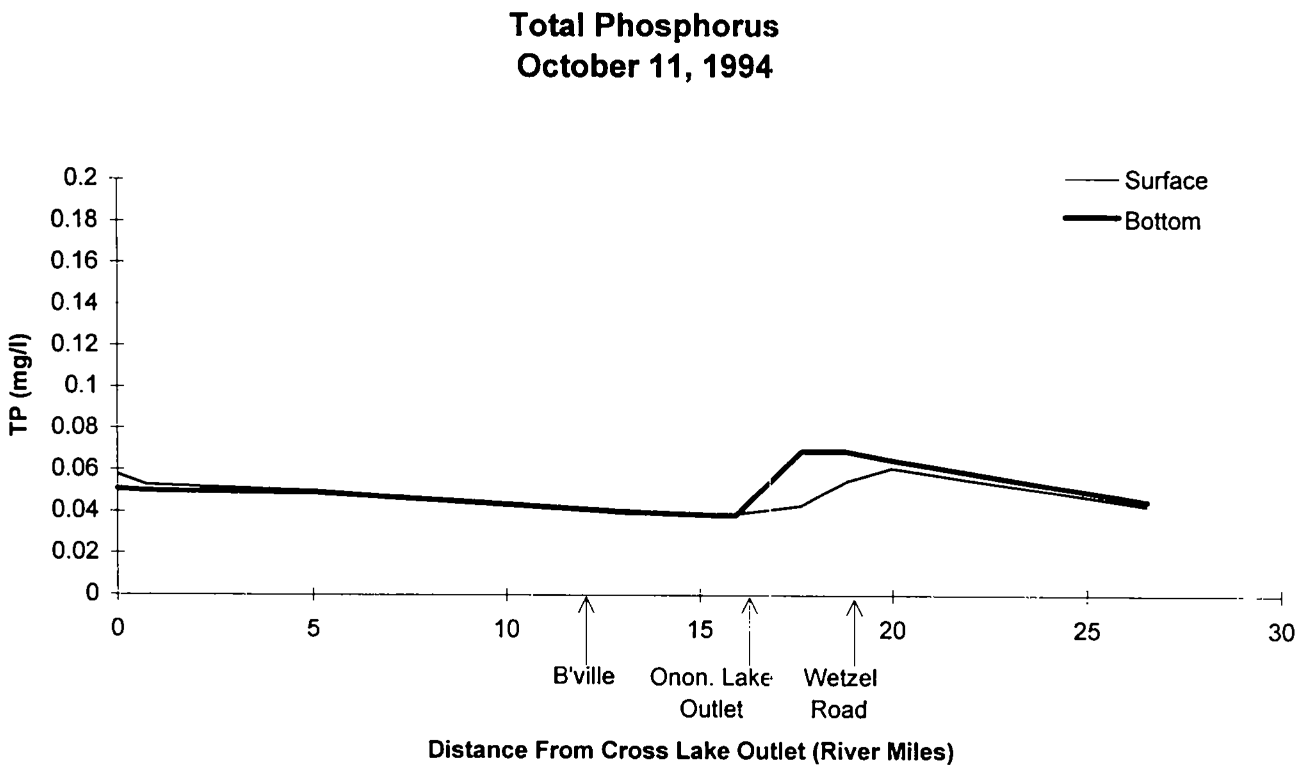
Total Phosphorus
September 27, 1994



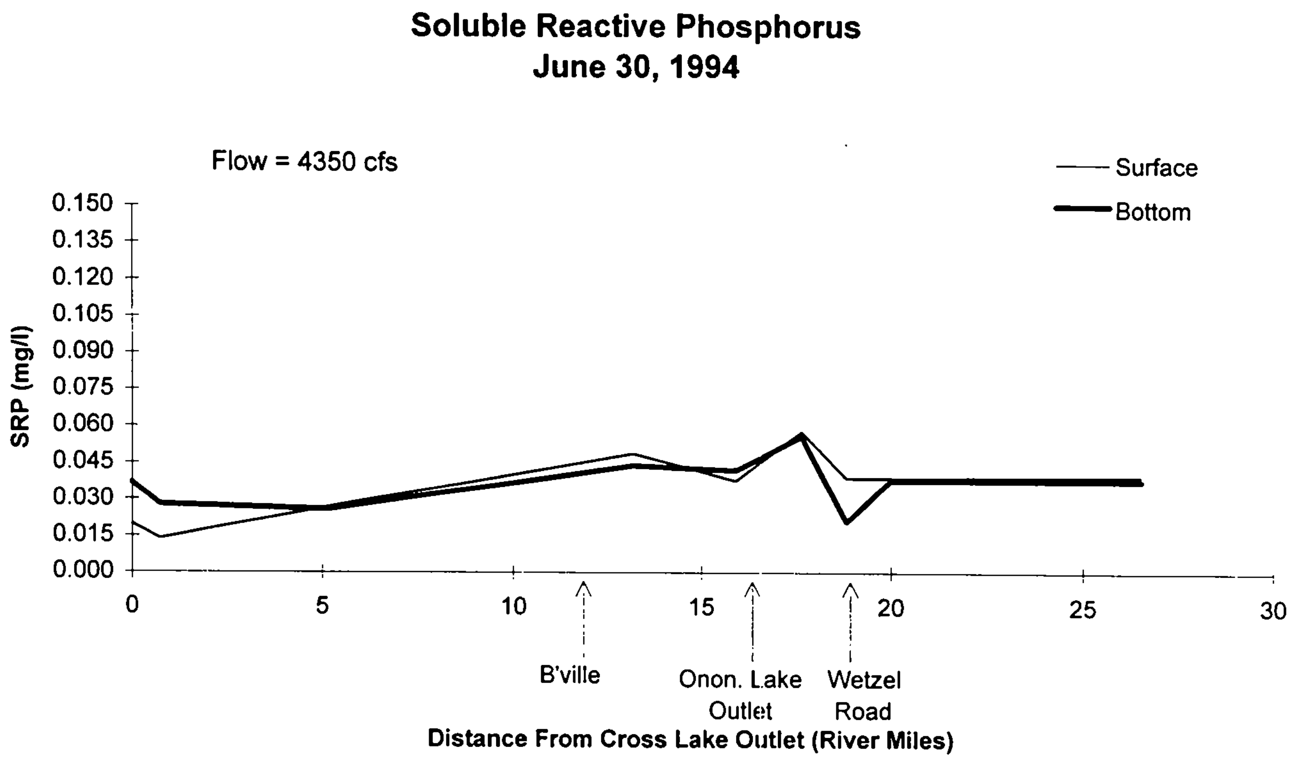
Total Phosphorus
October 4, 1994

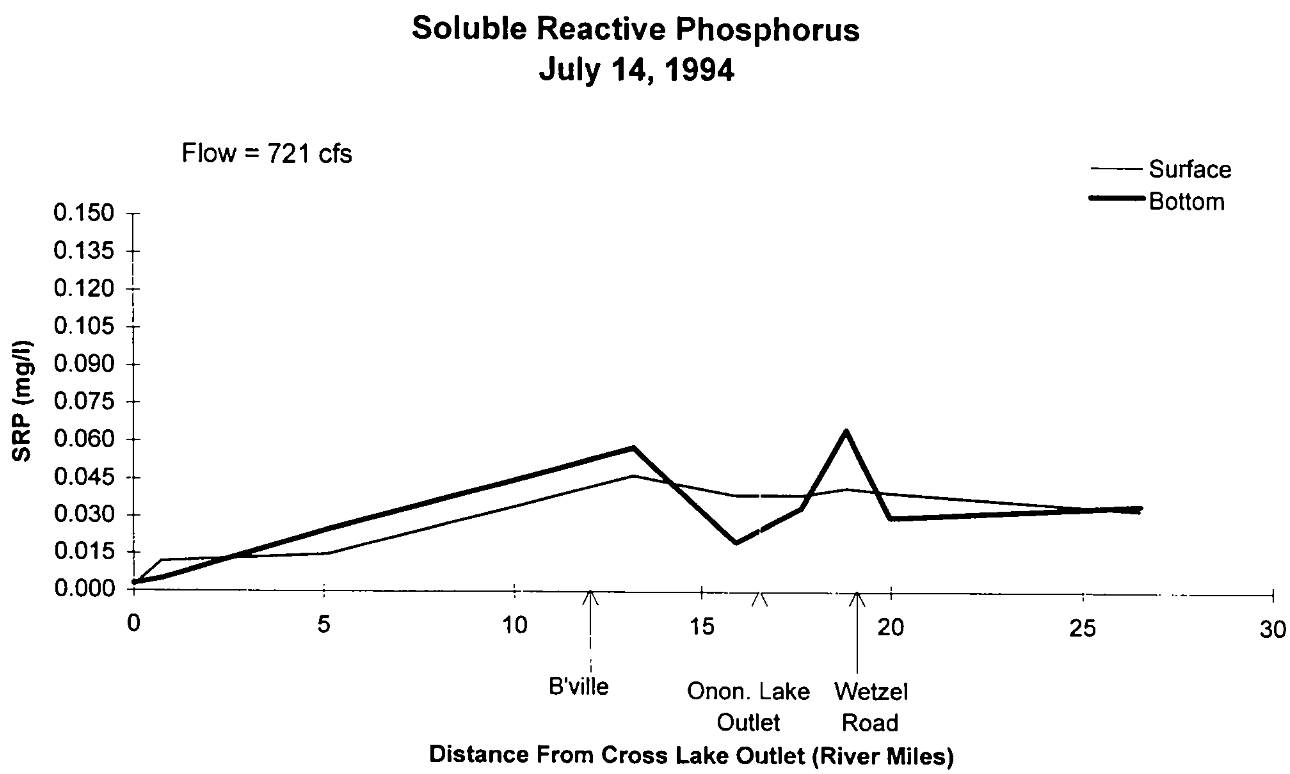


Stearns & Wheler ENVIRONMENTAL ENGINEERS & SCIENTISTS DATE: 1/11/96 JOB No.: 2298	DRAFT ENVIRONMENTAL IMPACT STATEMENT ONONDAGA COUNTY DEPARTMENT OF DRAINAGE AND SANITATION **FIGURE 2-13 C (CONTINUED)** **TOTAL PHOSPHORUS IN THE SENECA RIVER DURING THE 1994 SAMPLING PROGRAM**

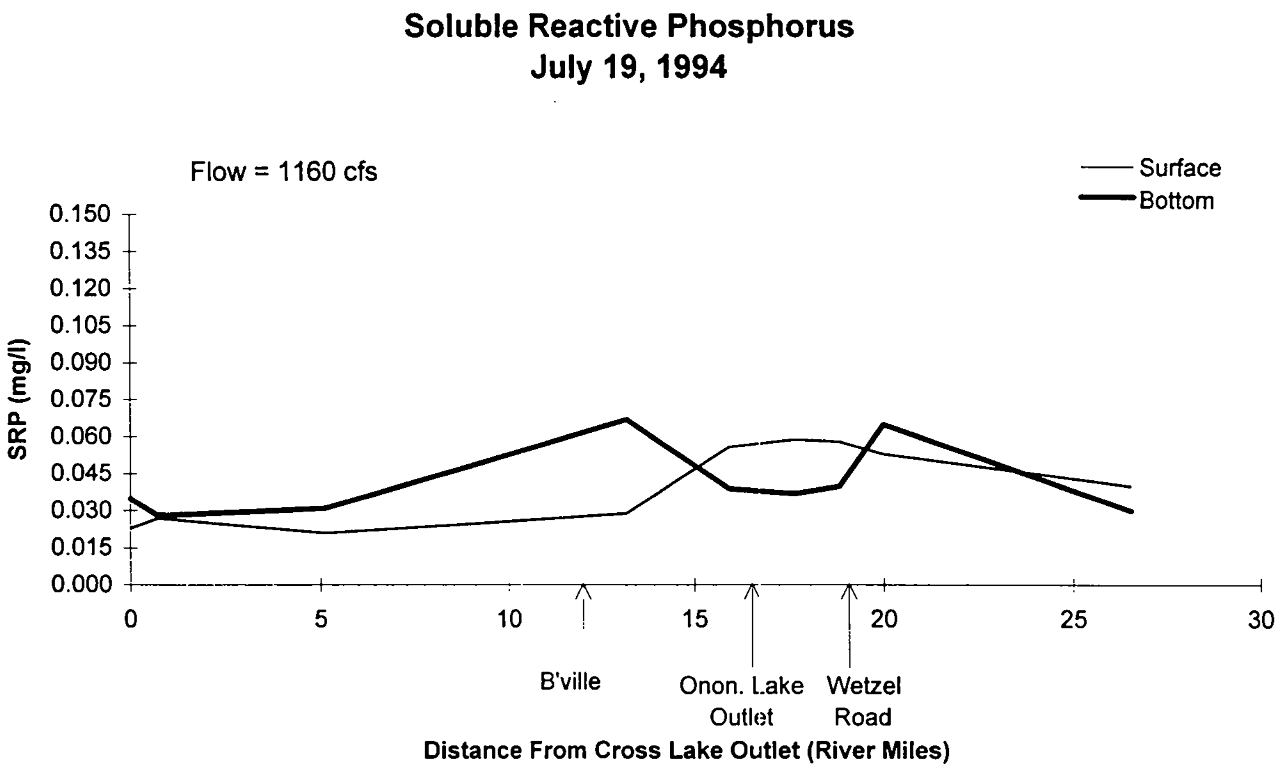


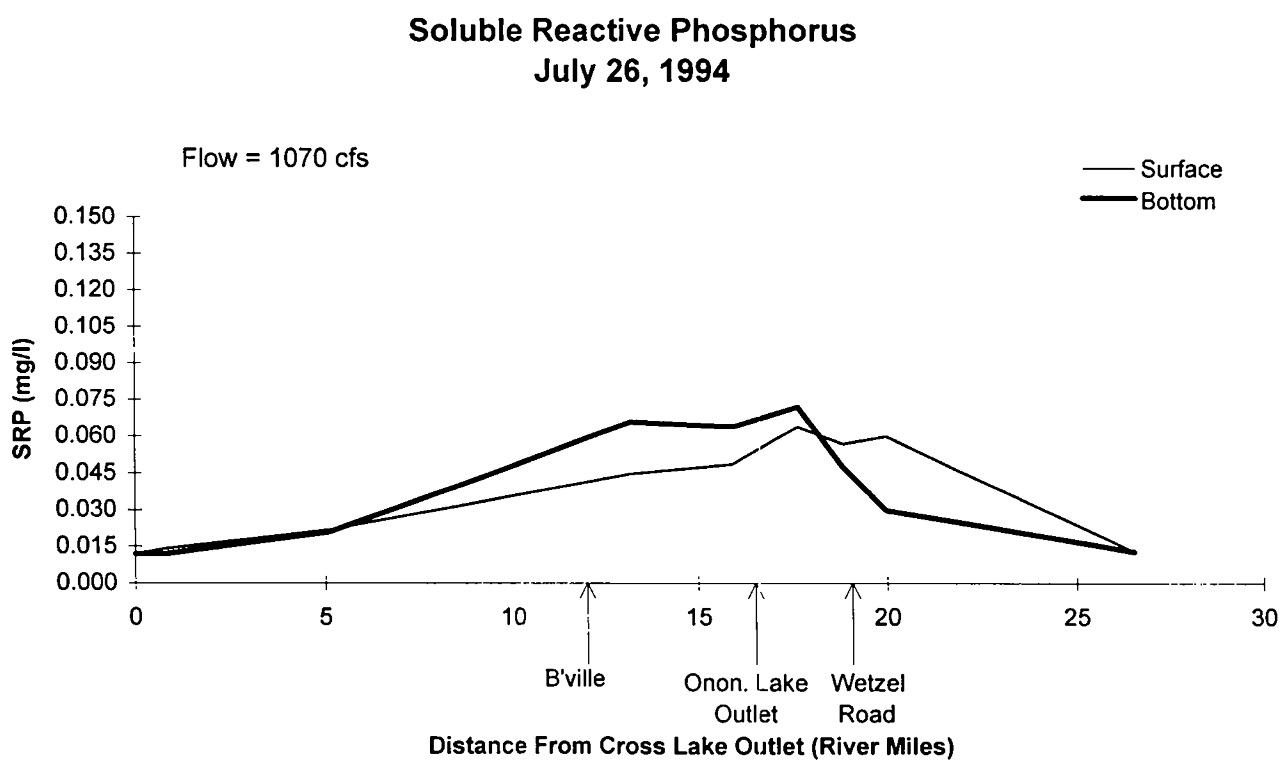
Stearns & Wheler ENVIRONMENTAL ENGINEERS & SCIENTISTS DATE: 1/11/96 JOB No.: 2298	DRAFT ENVIRONMENTAL IMPACT STATEMENT ONONDAGA COUNTY DEPARTMENT OF DRAINAGE AND SANITATION **FIGURE 2-13 C (CONTINUED)** **TOTAL PHOSPHORUS IN THE SENECA RIVER DURING THE 1994 SAMPLING PROGRAM**





Stearns & Wheler ENVIRONMENTAL ENGINEERS & SCIENTISTS	DRAFT ENVIRONMENTAL IMPACT STATEMENT ONONDAGA COUNTY DEPARTMENT OF DRAINAGE AND SANITATION
DATE: 1/11/96 JOB No.: 2298	FIGURE 2-13 D SRP IN THE SENECA RIVER DURING THE 1994 SAMPLING PROGRAM





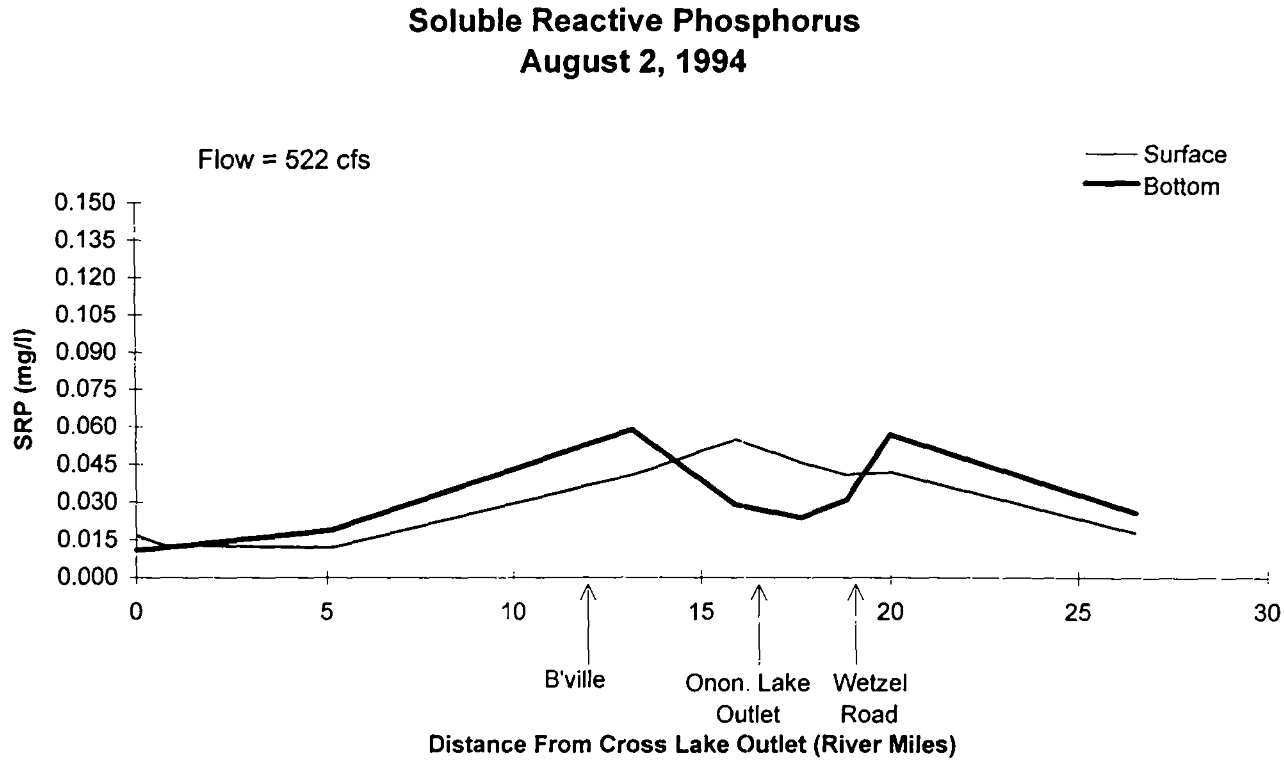
Stearns & Wheler

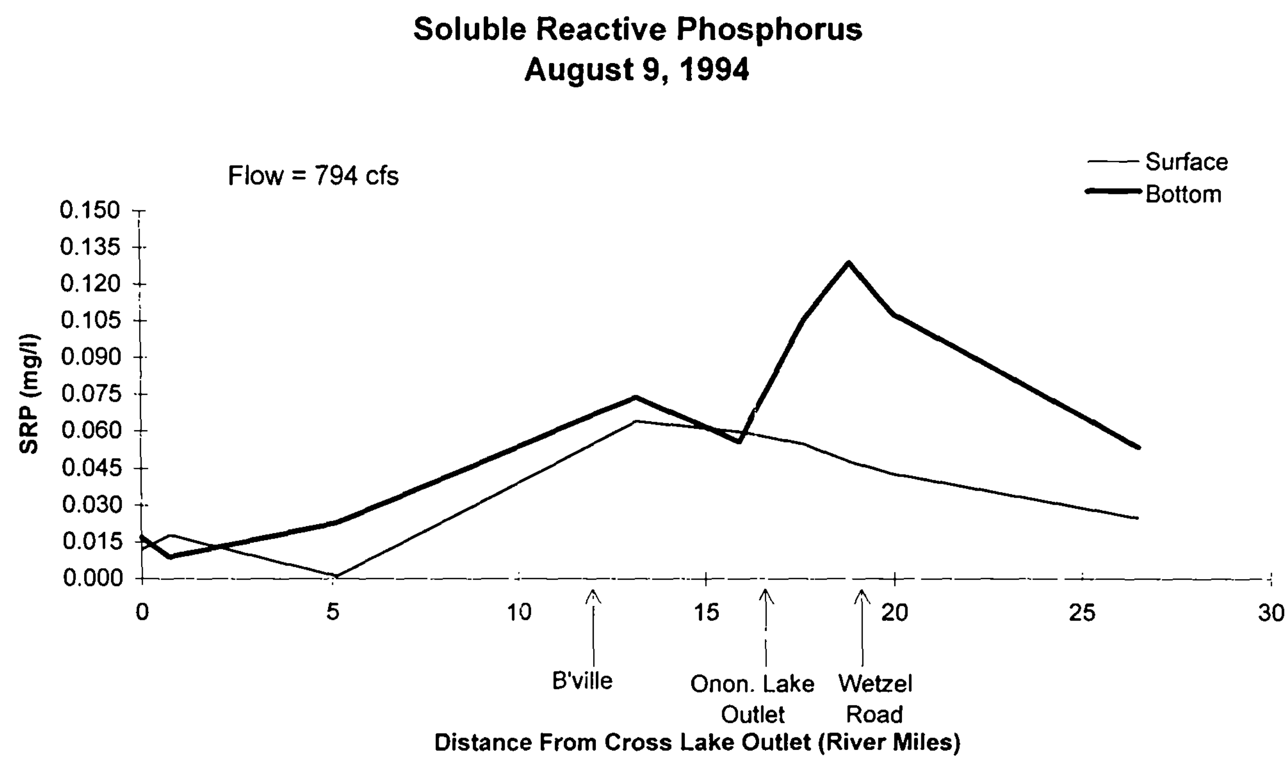
ENVIRONMENTAL ENGINEERS & SCIENTISTS

DATE: 1/11/96 JOB No.: 2298

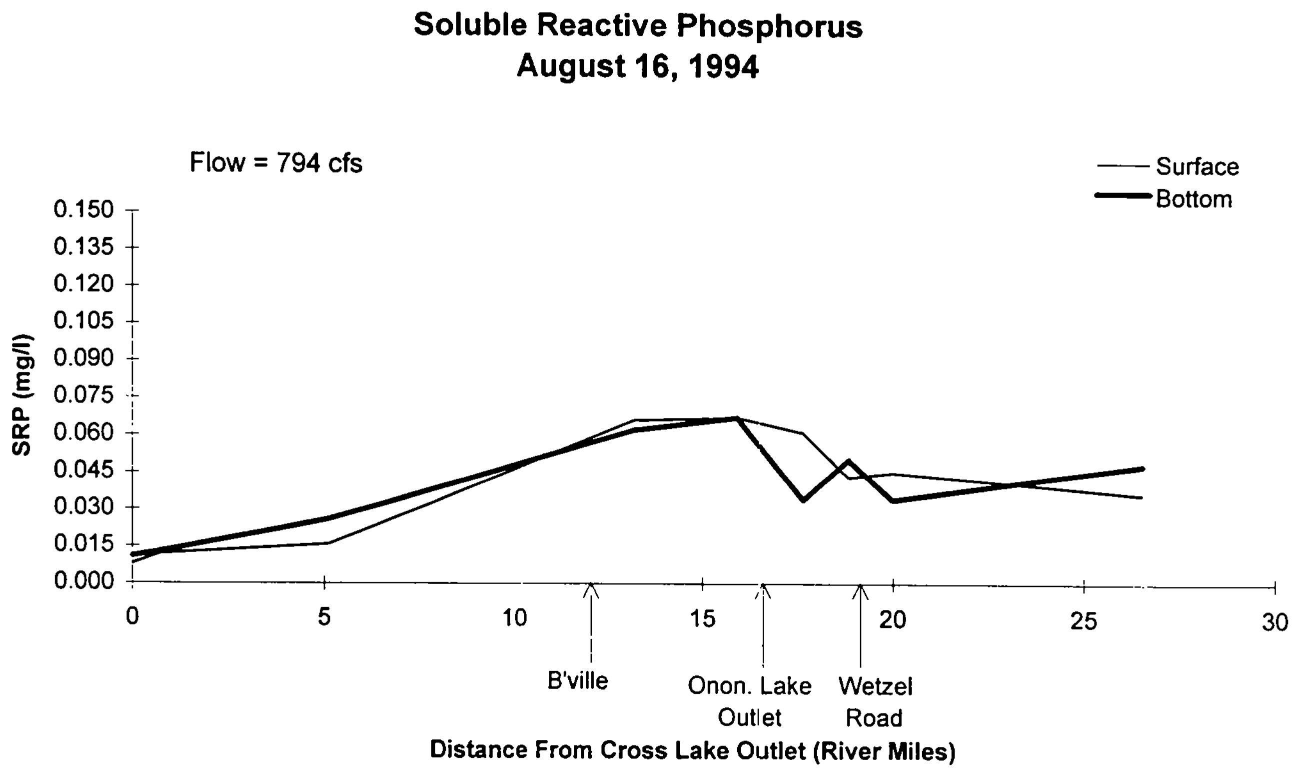
DRAFT ENVIRONMENTAL IMPACT STATEMENT
ONONDAGA COUNTY DEPARTMENT
OF DRAINAGE AND SANITATION

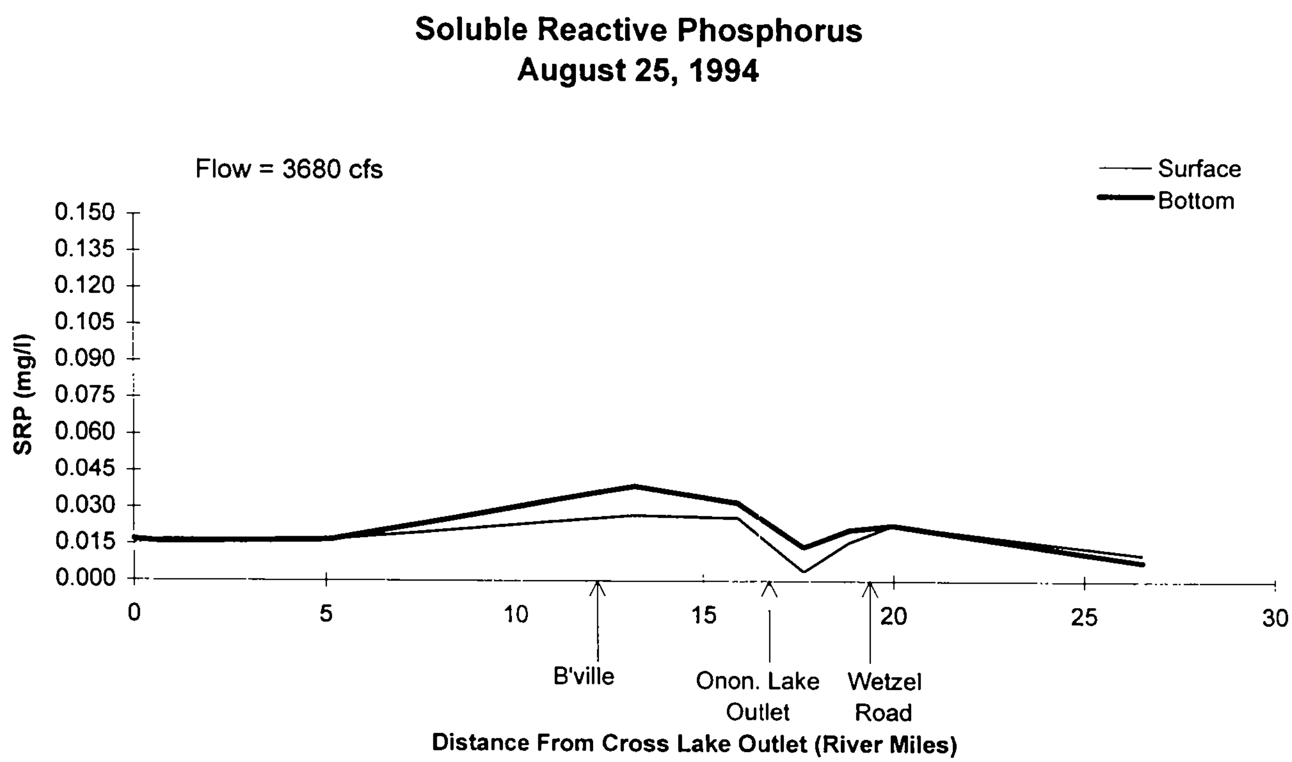
FIGURE 2-13 D (CONTINUED)
SRP IN THE SENECA RIVER DURING
THE 1994 SAMPLING PROGRAM





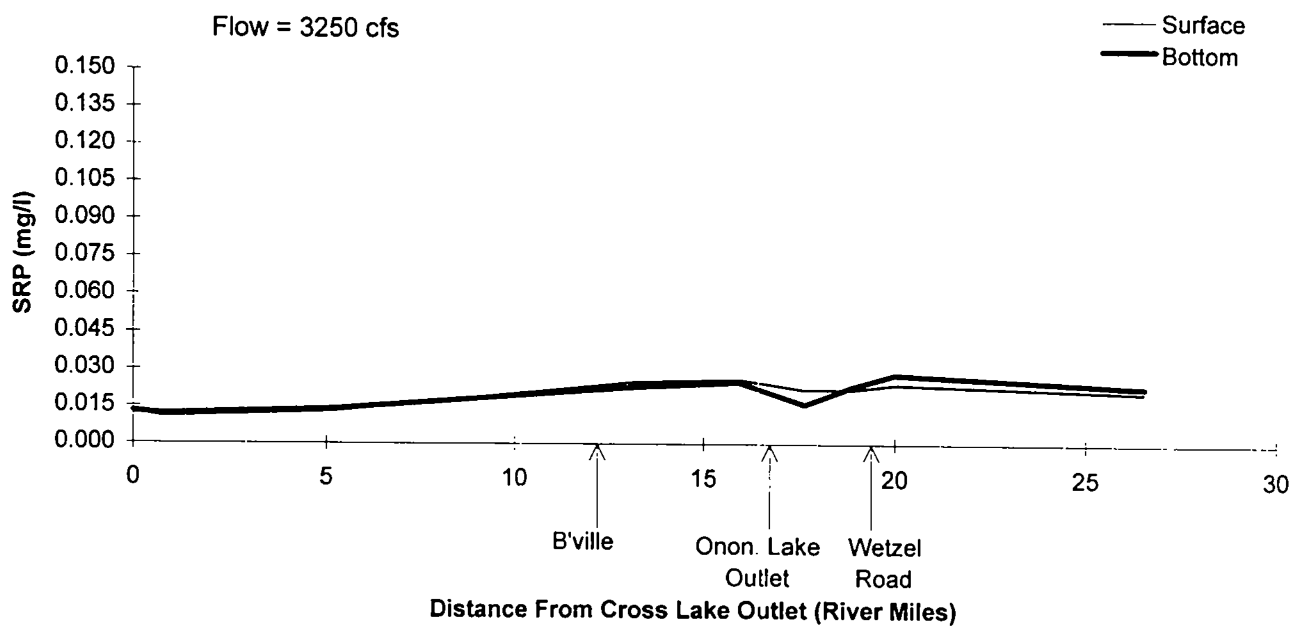
Stearns & Wheler ENVIRONMENTAL ENGINEERS & SCIENTISTS DATE: 1/11/96 JOB No.: 2298	DRAFT ENVIRONMENTAL IMPACT STATEMENT ONONDAGA COUNTY DEPARTMENT OF DRAINAGE AND SANITATION **FIGURE 2-13 D (CONTINUED)** **SRP IN THE SENECA RIVER DURING THE 1994 SAMPLING PROGRAM**



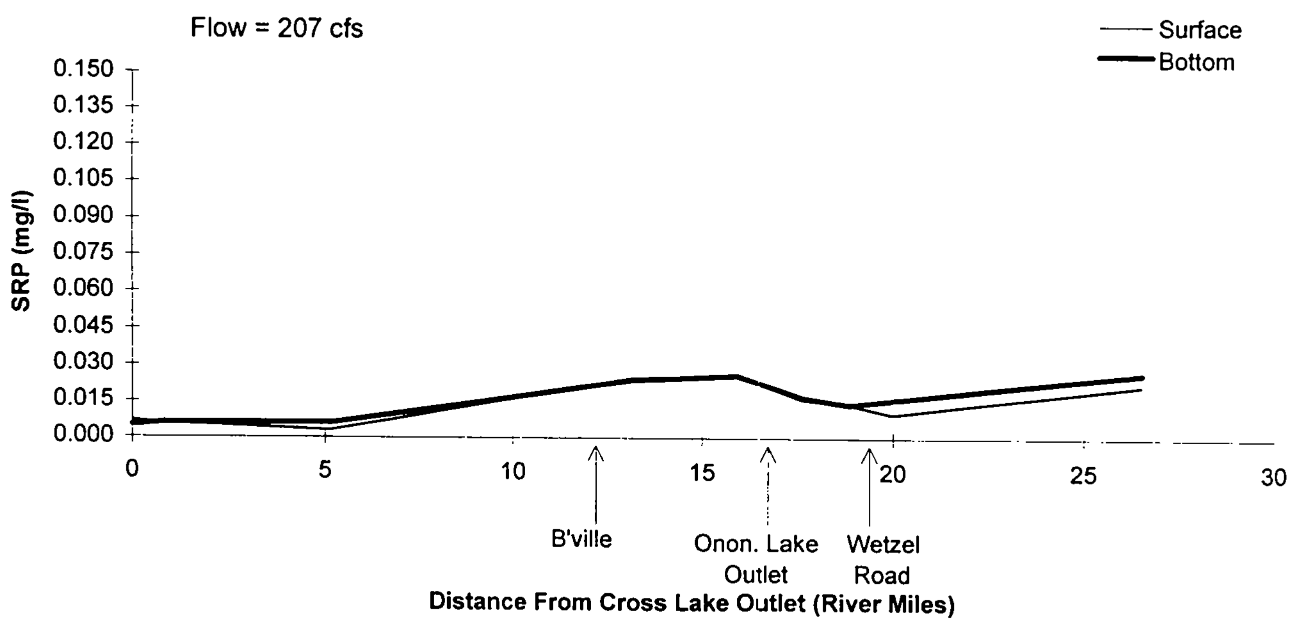


Stearns & Wheler ENVIRONMENTAL ENGINEERS & SCIENTISTS DATE: 1/11/96 JOB No.: 2298	DRAFT ENVIRONMENTAL IMPACT STATEMENT ONONDAGA COUNTY DEPARTMENT OF DRAINAGE AND SANITATION
	FIGURE 2-13 D (CONTINUED) **SRP IN THE SENECA RIVER DURING THE 1994 SAMPLING PROGRAM**

Soluble Reactive Phosphorus
August 30, 1994



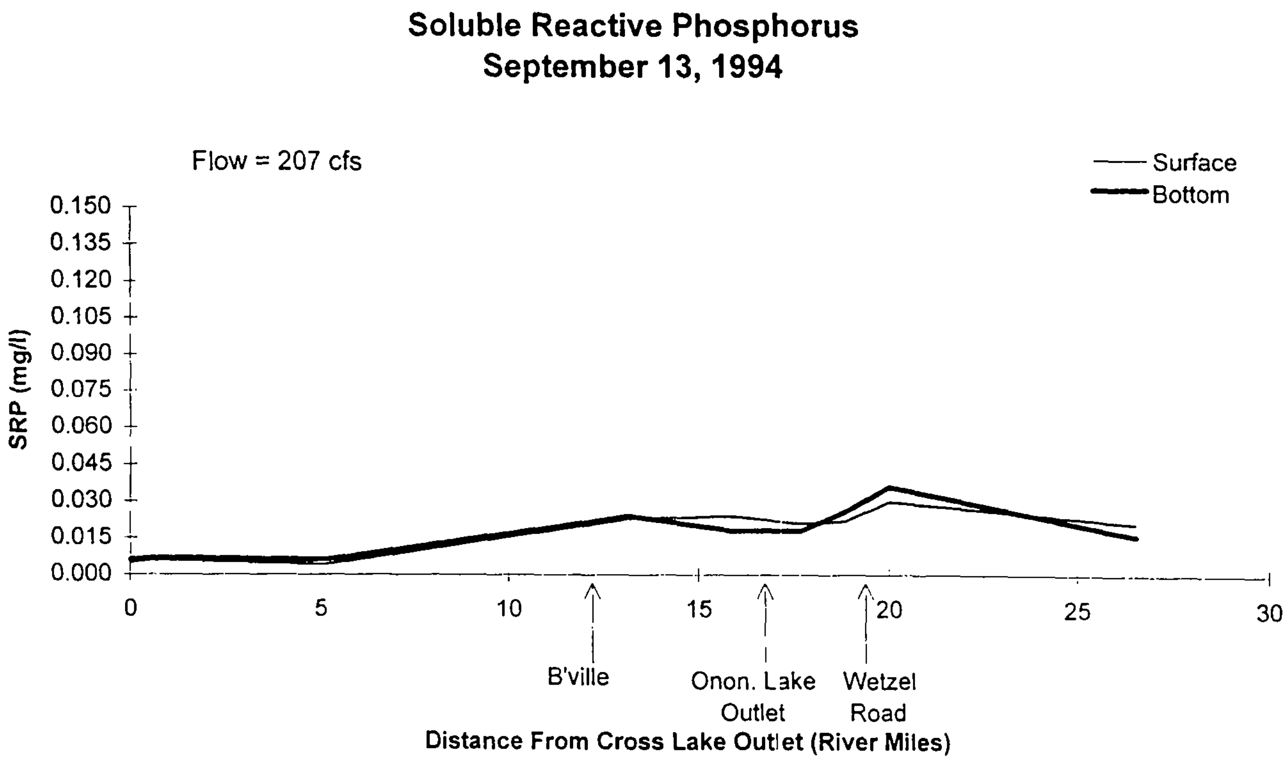
Soluble Reactive Phosphorus
September 6, 1994

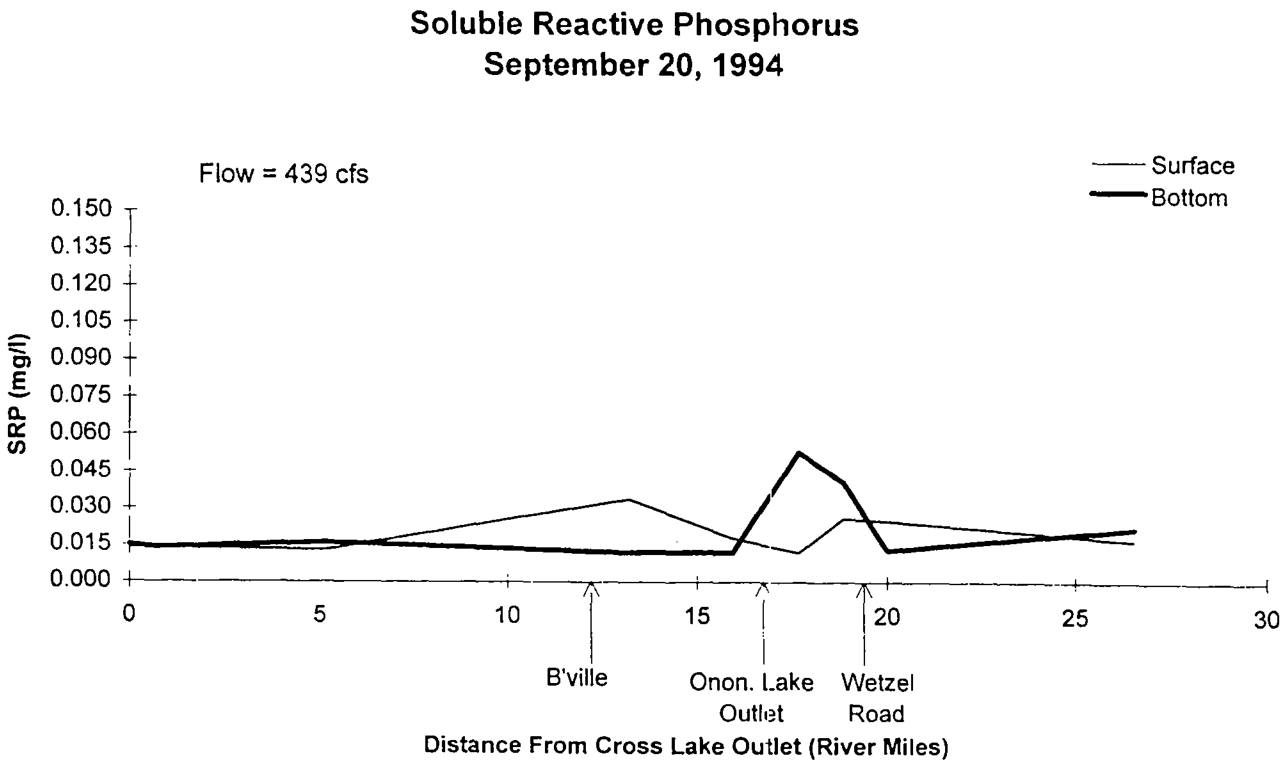


Stearns & Wheler
ENVIRONMENTAL ENGINEERS & SCIENTISTS
DATE: 1/11/96 JOB No.: 2298

DRAFT ENVIRONMENTAL IMPACT STATEMENT
ONONDAGA COUNTY DEPARTMENT
OF DRAINAGE AND SANITATION

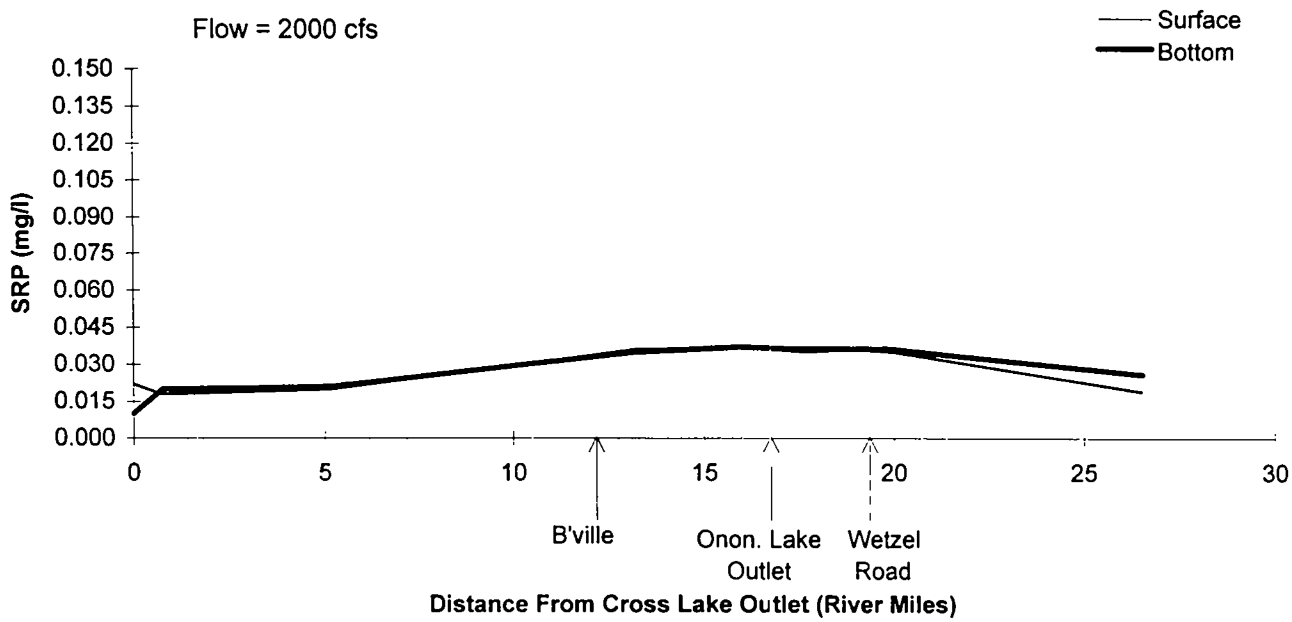
FIGURE 2-13 D (CONTINUED)
SRP IN THE SENECA RIVER DURING
THE 1994 SAMPLING PROGRAM



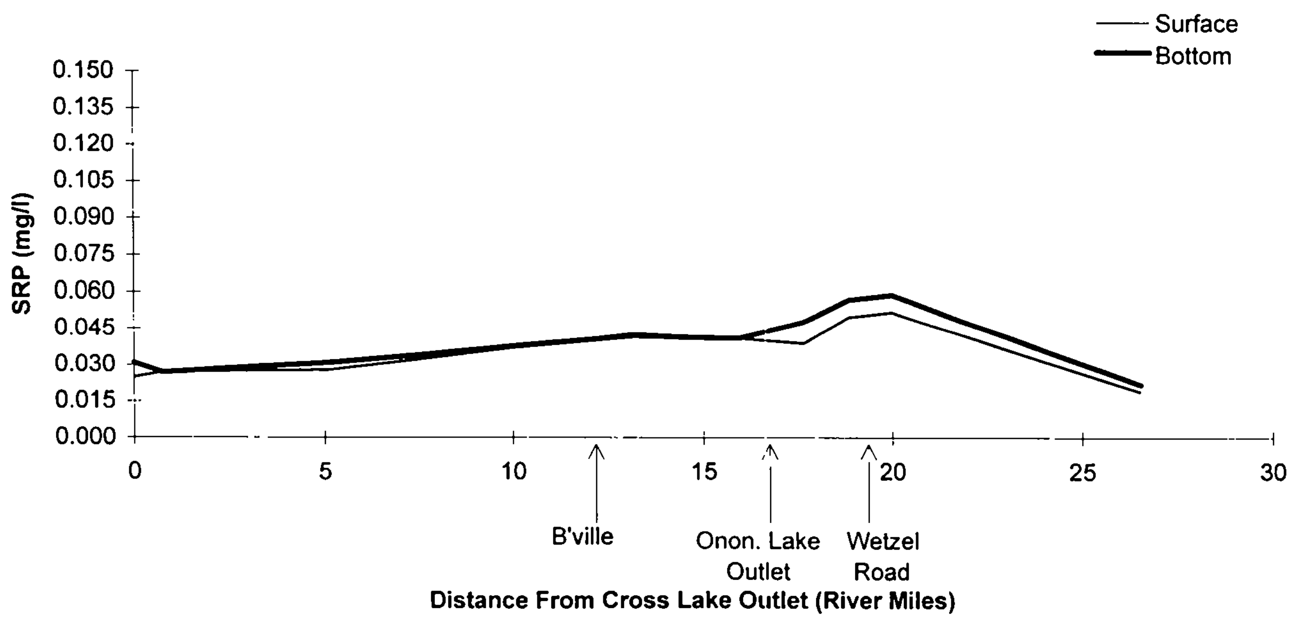


Stearns & Wheler ENVIRONMENTAL ENGINEERS & SCIENTISTS DATE: 1/11/96 JOB No.: 2298	DRAFT ENVIRONMENTAL IMPACT STATEMENT ONONDAGA COUNTY DEPARTMENT OF DRAINAGE AND SANITATION **FIGURE 2-13 D (CONTINUED)** **SRP IN THE SENECA RIVER DURING THE 1994 SAMPLING PROGRAM**

Soluble Reactive Phosphorus
September 27, 1994



Soluble Reactive Phosphorus
October 4, 1994



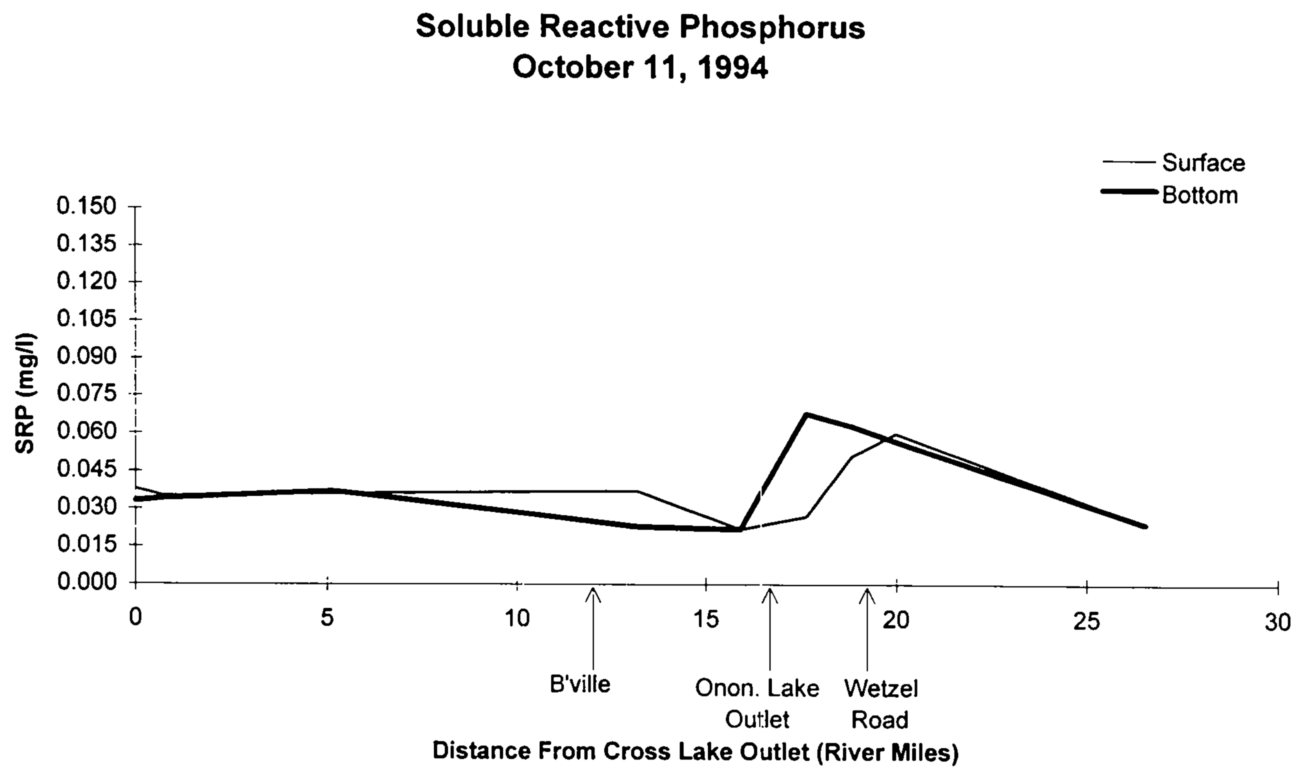
Stearns & Wheler

ENVIRONMENTAL ENGINEERS & SCIENTISTS

DATE: 1/11/96 JOB No.: 2298

DRAFT ENVIRONMENTAL IMPACT STATEMENT
ONONDAGA COUNTY DEPARTMENT
OF DRAINAGE AND SANITATION

FIGURE 2-13 D (CONTINUED)
SRP IN THE SENECA RIVER DURING THE 1994 SAMPLING PROGRAM



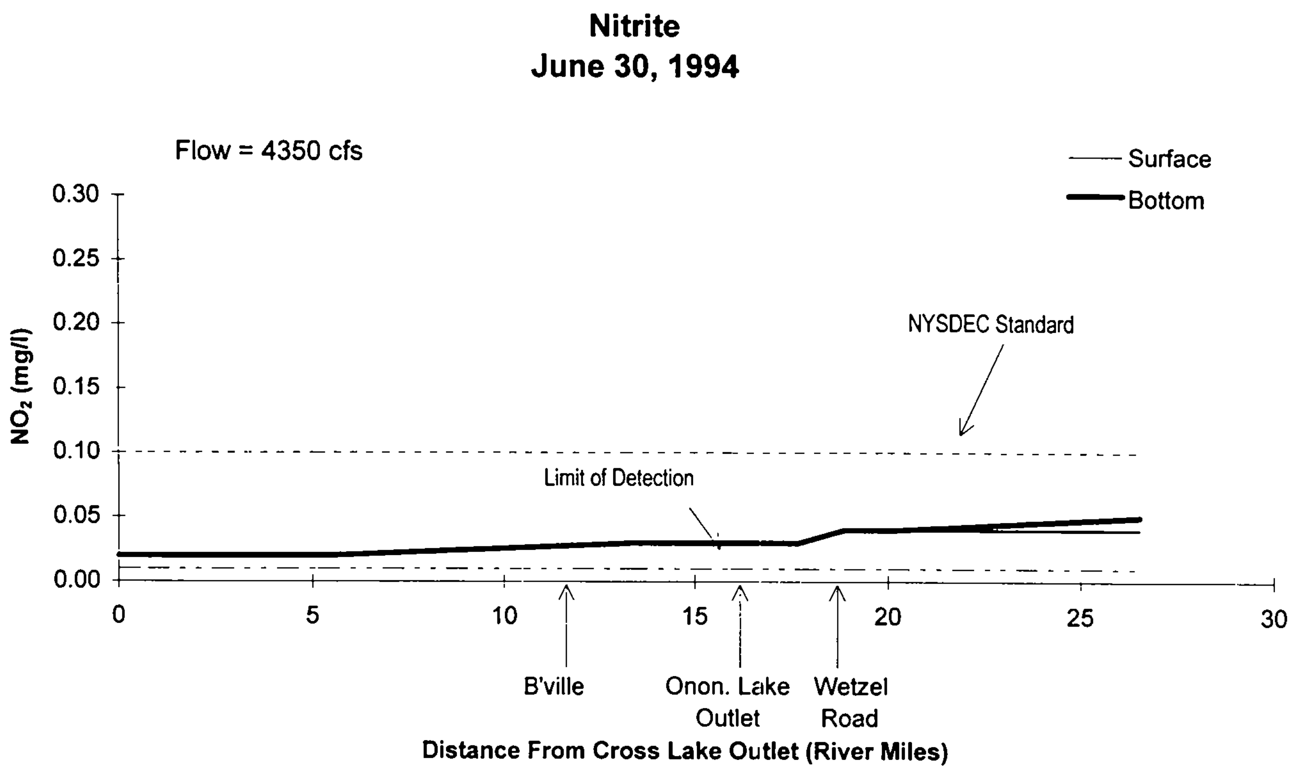
Stearns & Wheler

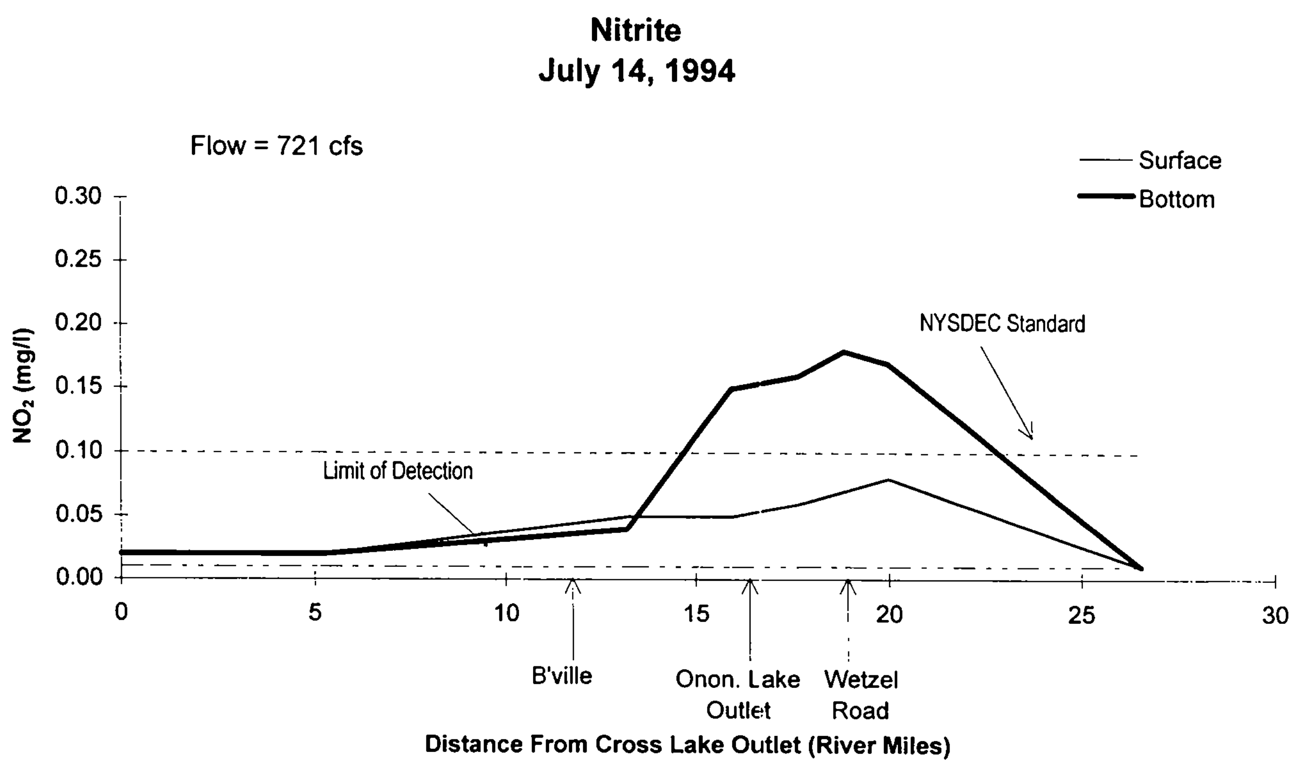
ENVIRONMENTAL ENGINEERS & SCIENTISTS

DATE: 1/11/96 JOB No.: 2298

DRAFT ENVIRONMENTAL IMPACT STATEMENT
ONONDAGA COUNTY DEPARTMENT
OF DRAINAGE AND SANITATION

FIGURE 2-13 D (CONTINUED)
SRP IN THE SENECA RIVER DURING THE 1994 SAMPLING PROGRAM





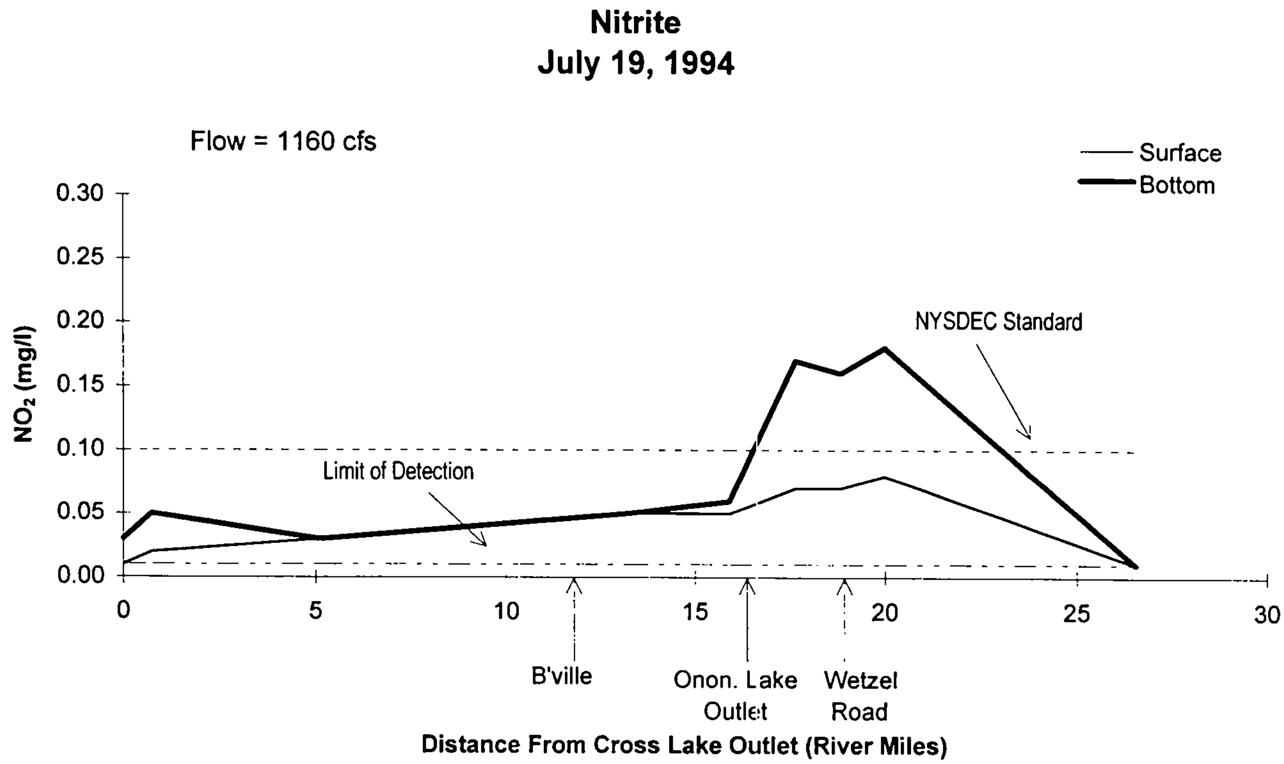
Stearns & Wheler

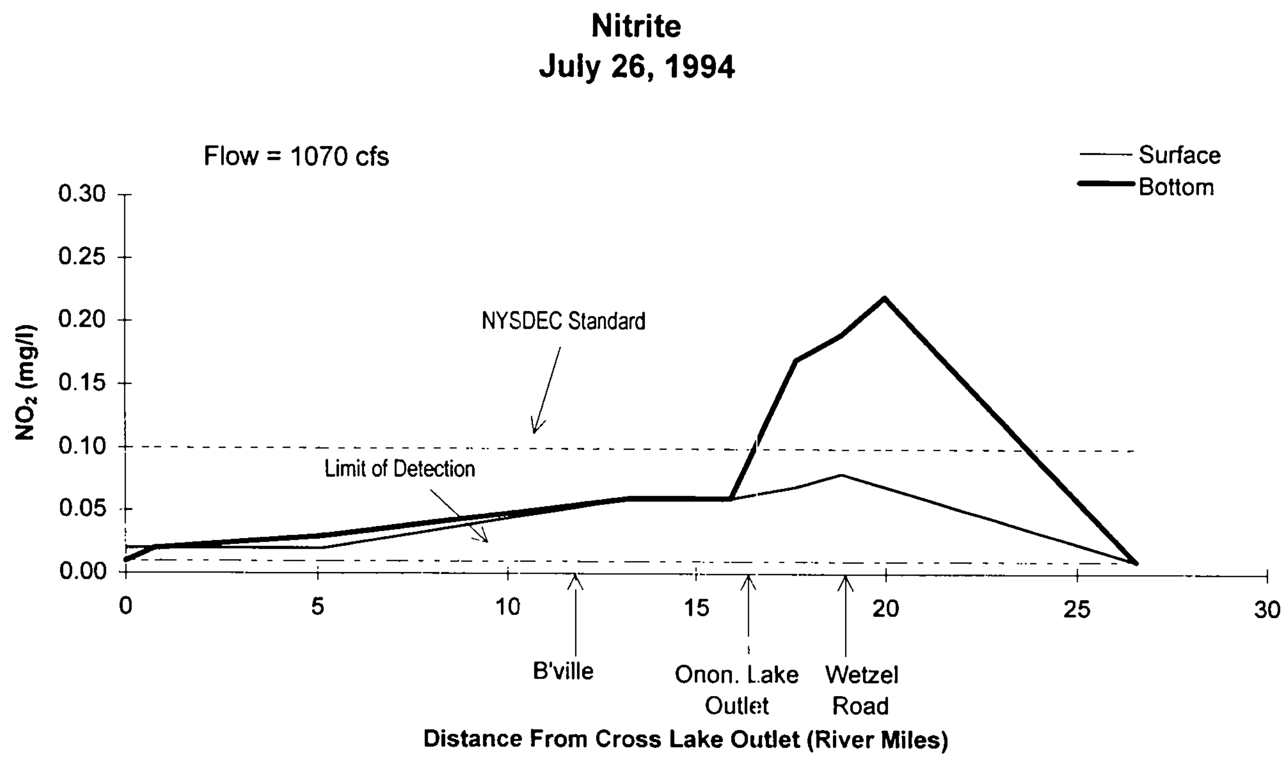
ENVIRONMENTAL ENGINEERS & SCIENTISTS

DATE: 1/11/96 JOB No.: 2298

DRAFT ENVIRONMENTAL IMPACT STATEMENT
ONONDAGA COUNTY DEPARTMENT
OF DRAINAGE AND SANITATION

FIGURE 2-13 E
NITRITE IN THE SENECA RIVER DURING THE 1994 SAMPLING PROGRAM





Stearns & Wheler

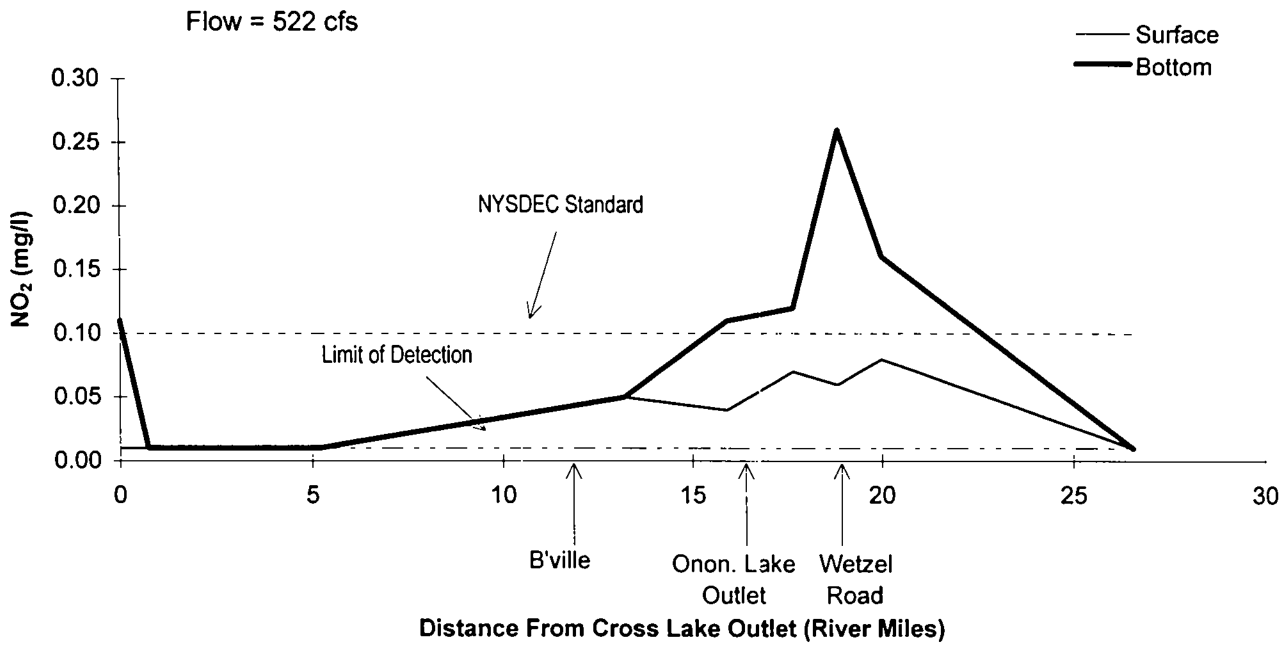
ENVIRONMENTAL ENGINEERS & SCIENTISTS

DATE: 1/11/96 JOB No.: 2298

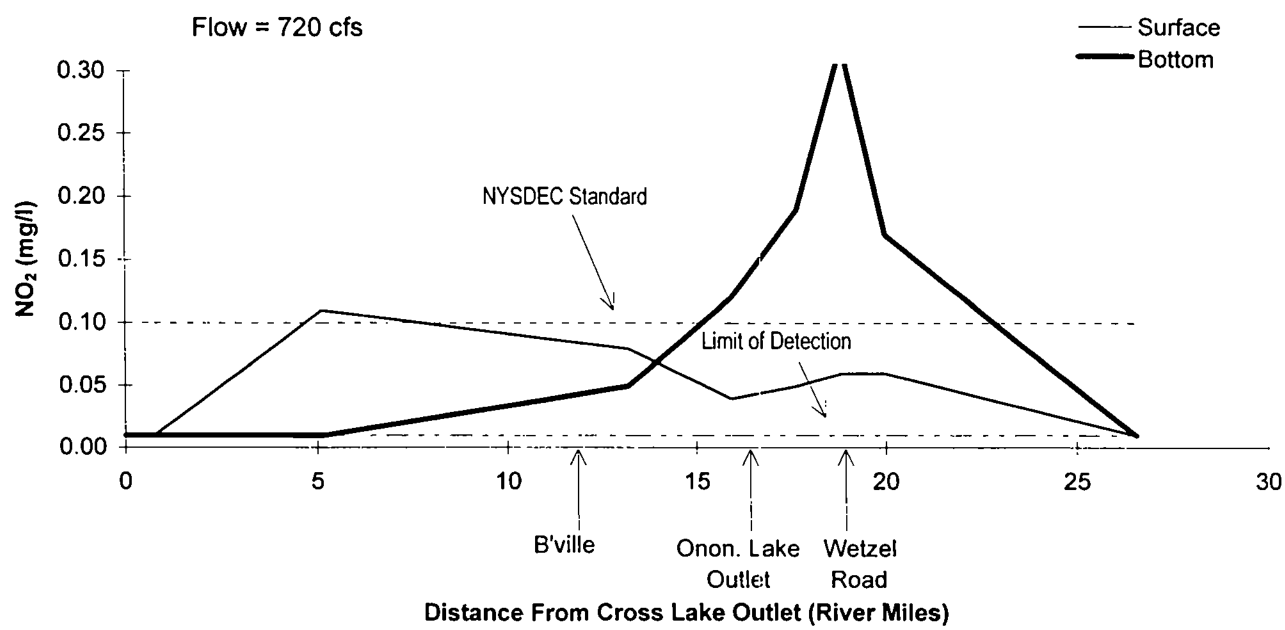
DRAFT ENVIRONMENTAL IMPACT STATEMENT
ONONDAGA COUNTY DEPARTMENT
OF DRAINAGE AND SANITATION

FIGURE 2-13 E (CONTINUED)
NITRITE IN THE SENECA RIVER DURING THE 1994 SAMPLING PROGRAM

Nitrite
August 2, 1994



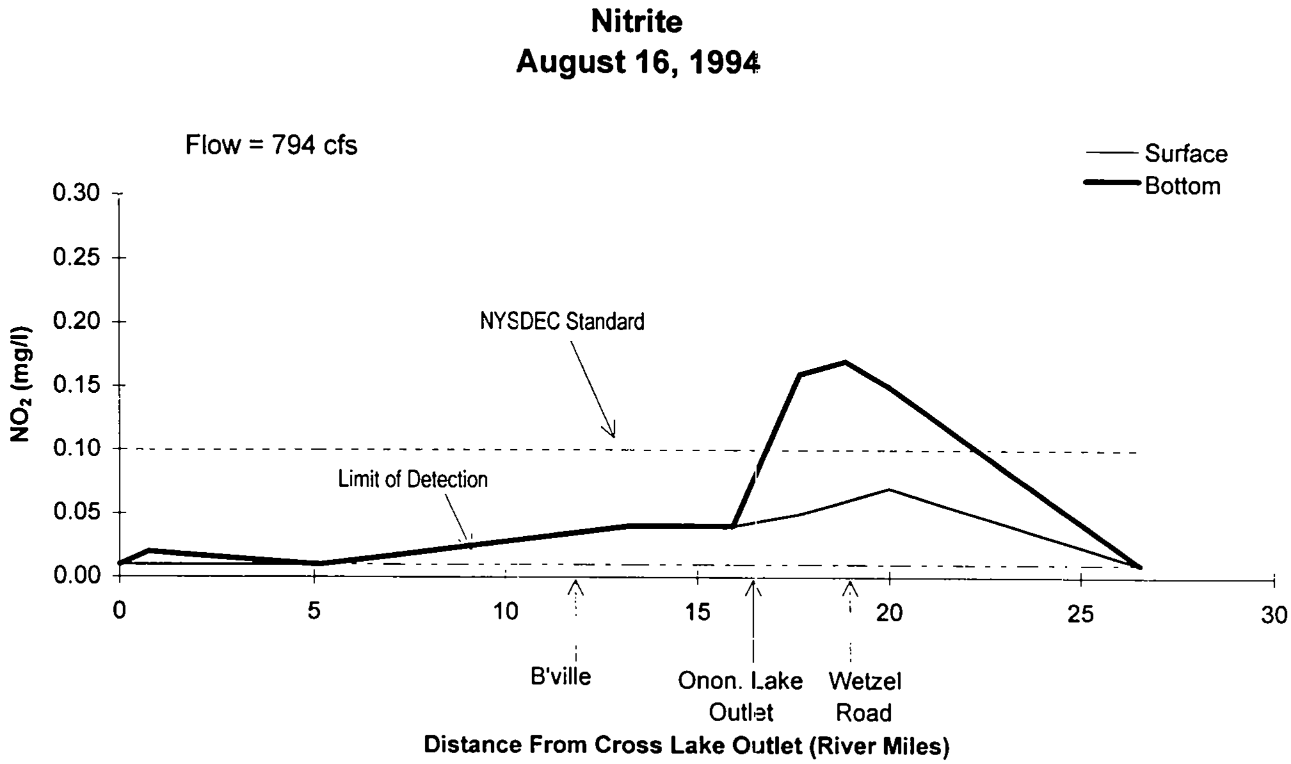
Nitrite
August 9, 1994

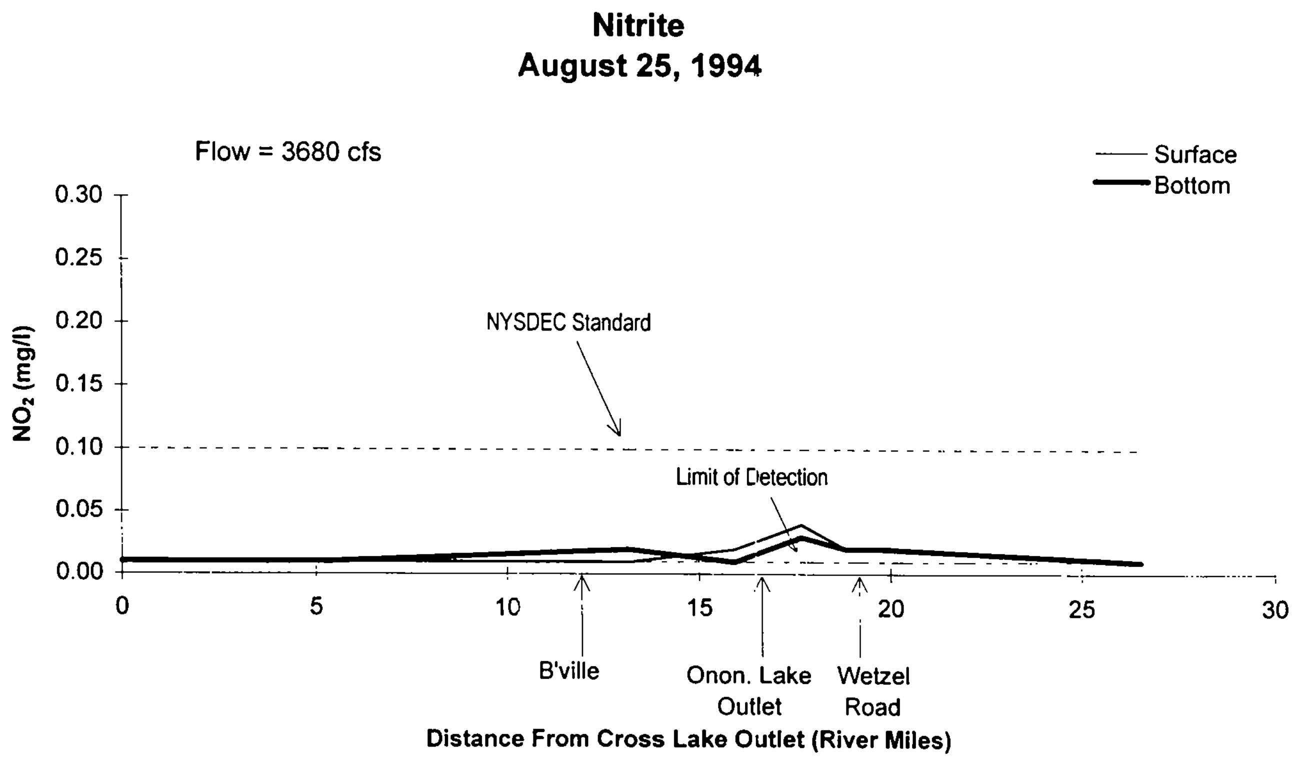


Stearns & Wheler
ENVIRONMENTAL ENGINEERS & SCIENTISTS
DATE: 1/11/96 JOB No.: 2298

DRAFT ENVIRONMENTAL IMPACT STATEMENT
ONONDAGA COUNTY DEPARTMENT
OF DRAINAGE AND SANITATION

FIGURE 2-13 E (CONTINUED)
NITRITE IN THE SENECA RIVER DURING THE 1994 SAMPLING PROGRAM





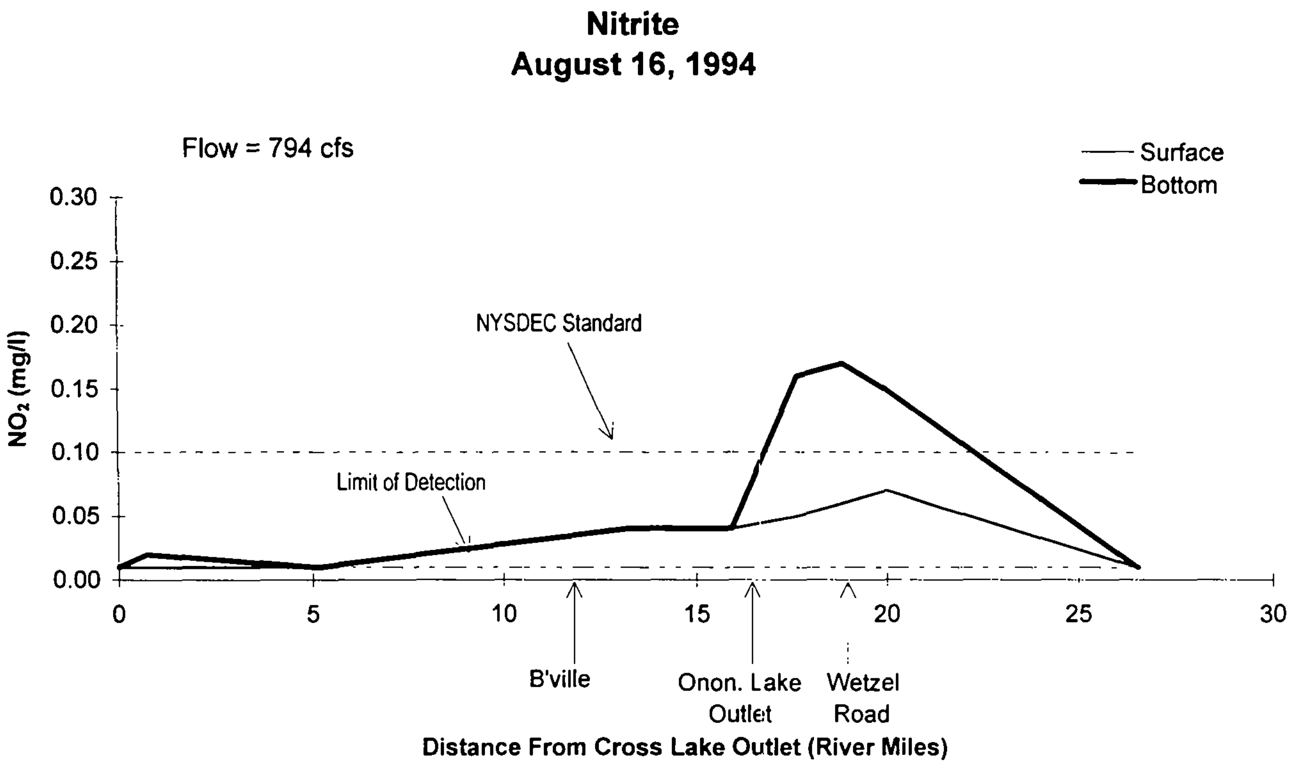
Stearns & Wheler

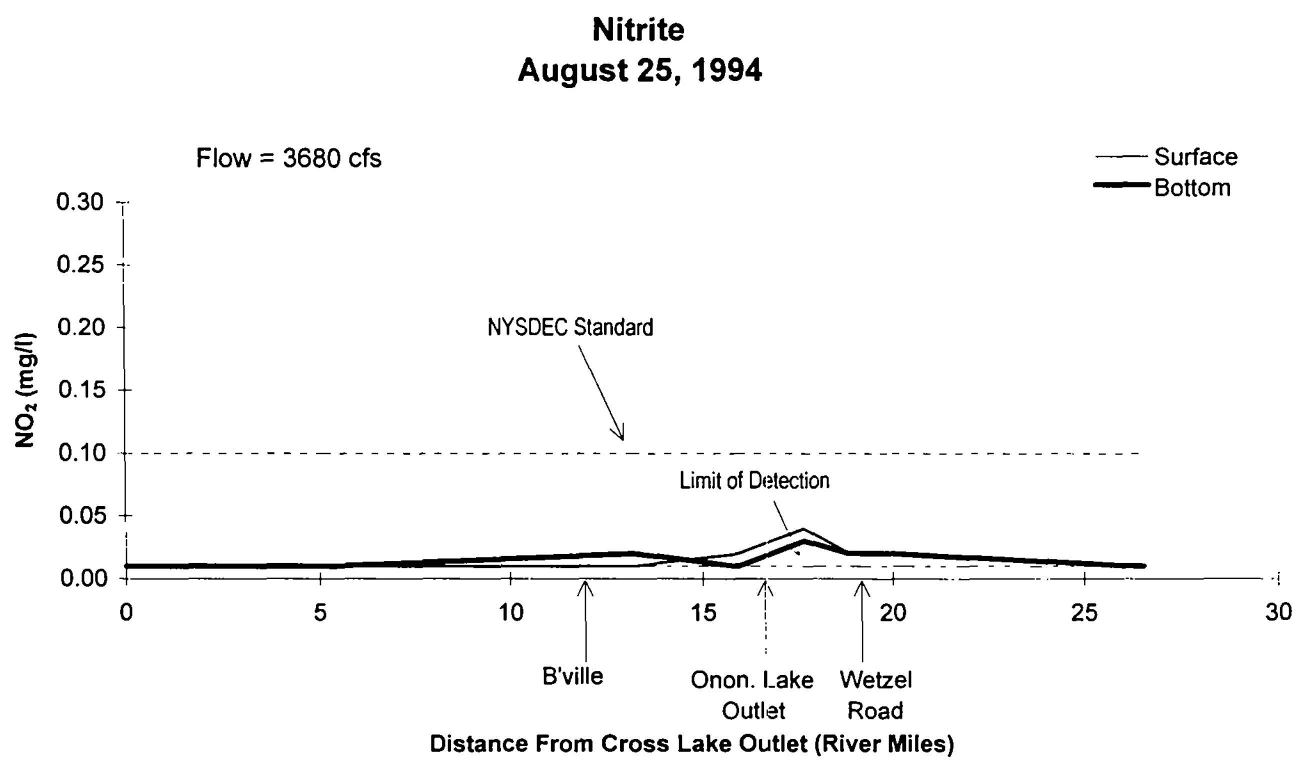
ENVIRONMENTAL ENGINEERS & SCIENTISTS

DATE: 1/11/96 JOB No.: 2298

DRAFT ENVIRONMENTAL IMPACT STATEMENT
ONONDAGA COUNTY DEPARTMENT
OF DRAINAGE AND SANITATION

FIGURE 2-13 E (CONTINUED)
NITRITE IN THE SENECA RIVER DURING THE 1994 SAMPLING PROGRAM





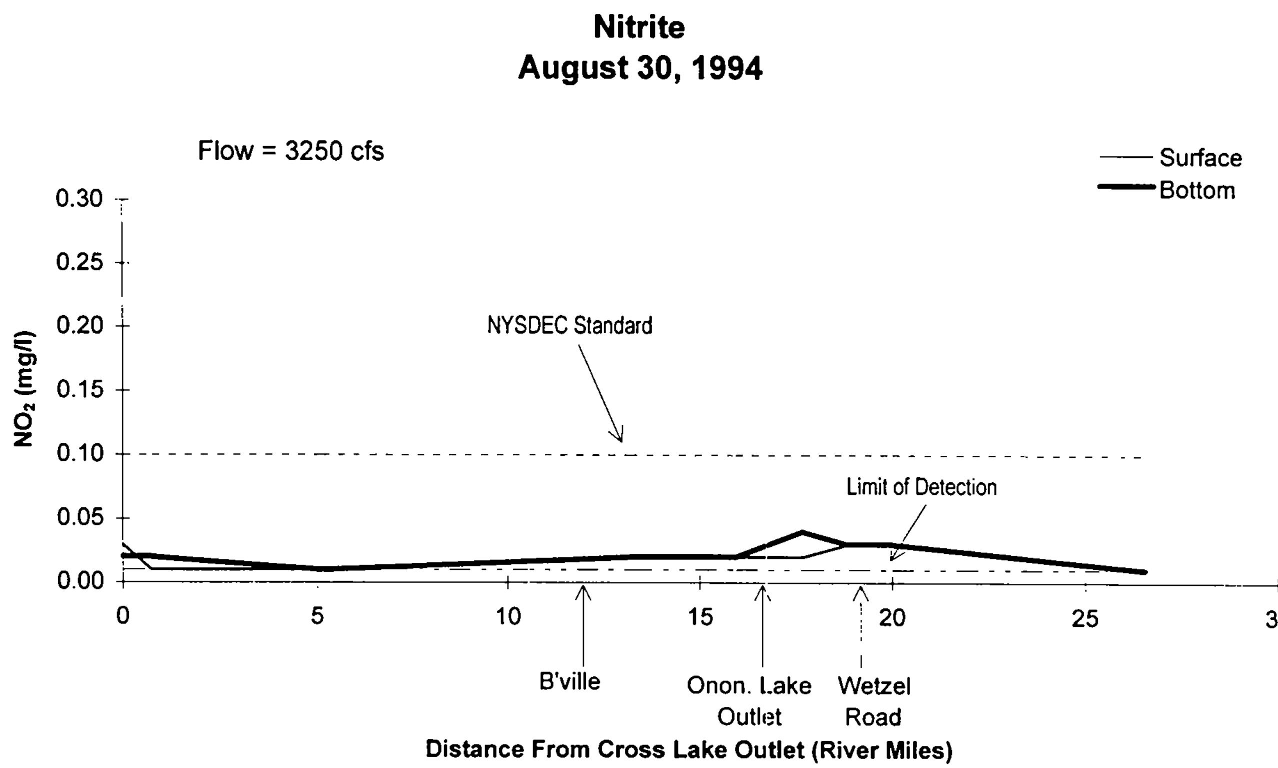
Stearns & Wheler

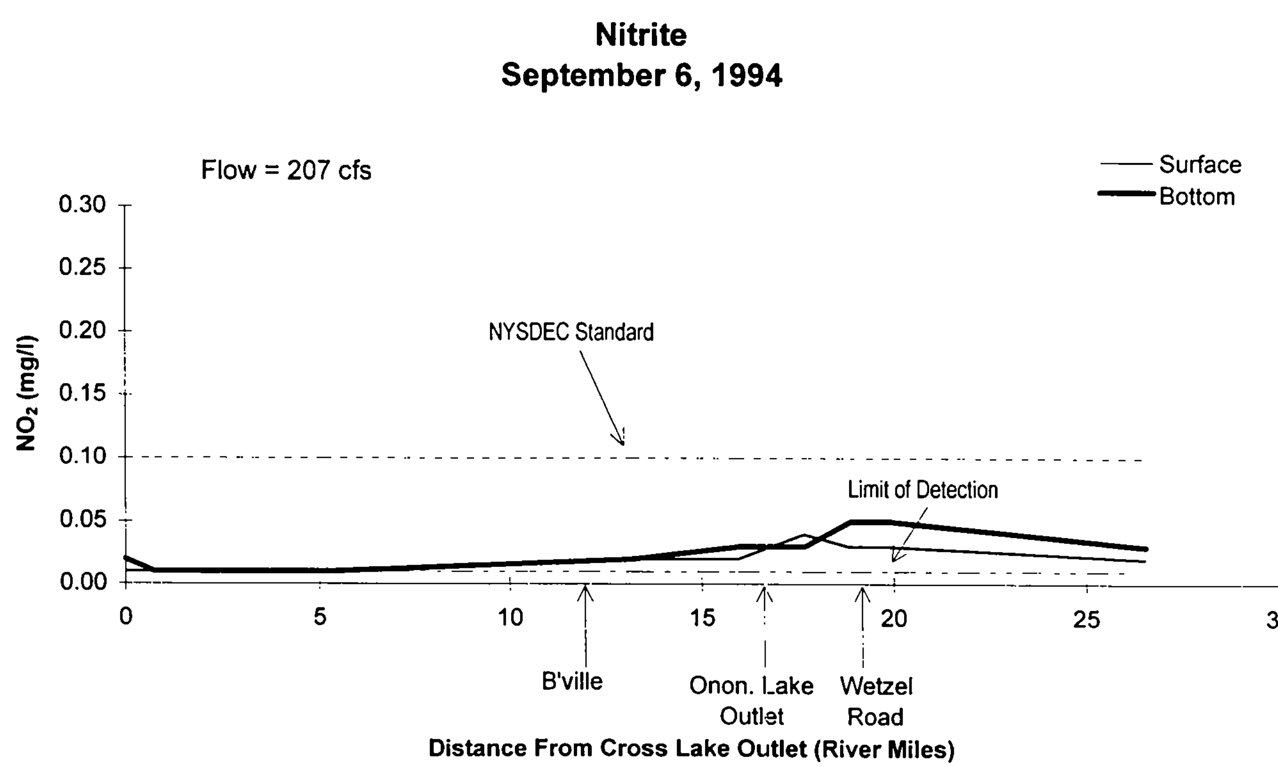
ENVIRONMENTAL ENGINEERS & SCIENTISTS

DATE: 1/11/96 JOB No.: 2298

DRAFT ENVIRONMENTAL IMPACT STATEMENT
ONONDAGA COUNTY DEPARTMENT
OF DRAINAGE AND SANITATION

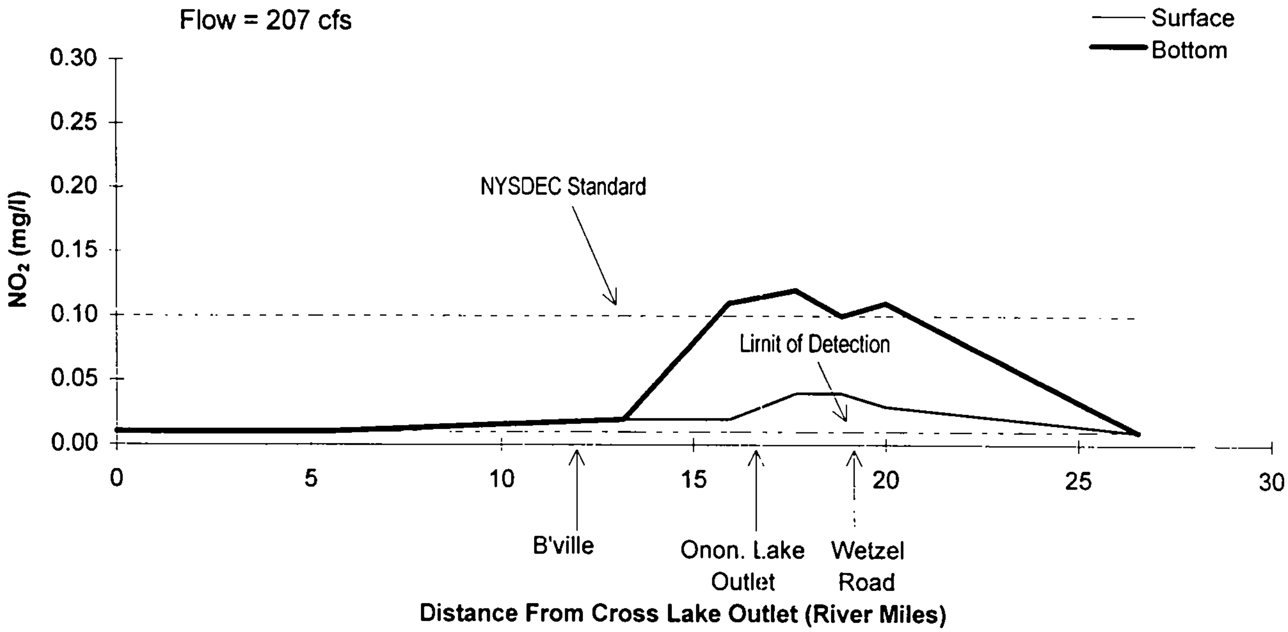
FIGURE 2-13 E (CONTINUED)
NITRITE IN THE SENECA RIVER DURING THE 1994 SAMPLING PROGRAM





Stearns & Wheler ENVIRONMENTAL ENGINEERS & SCIENTISTS DATE: 1/11/96 JOB No.: 2298	DRAFT ENVIRONMENTAL IMPACT STATEMENT ONONDAGA COUNTY DEPARTMENT OF DRAINAGE AND SANITATION
	FIGURE 2-13 E (CONTINUED) **NITRITE IN THE SENECA RIVER DURING THE 1994 SAMPLING PROGRAM**

Nitrite
September 13, 1994



Nitrite
September 20, 1994

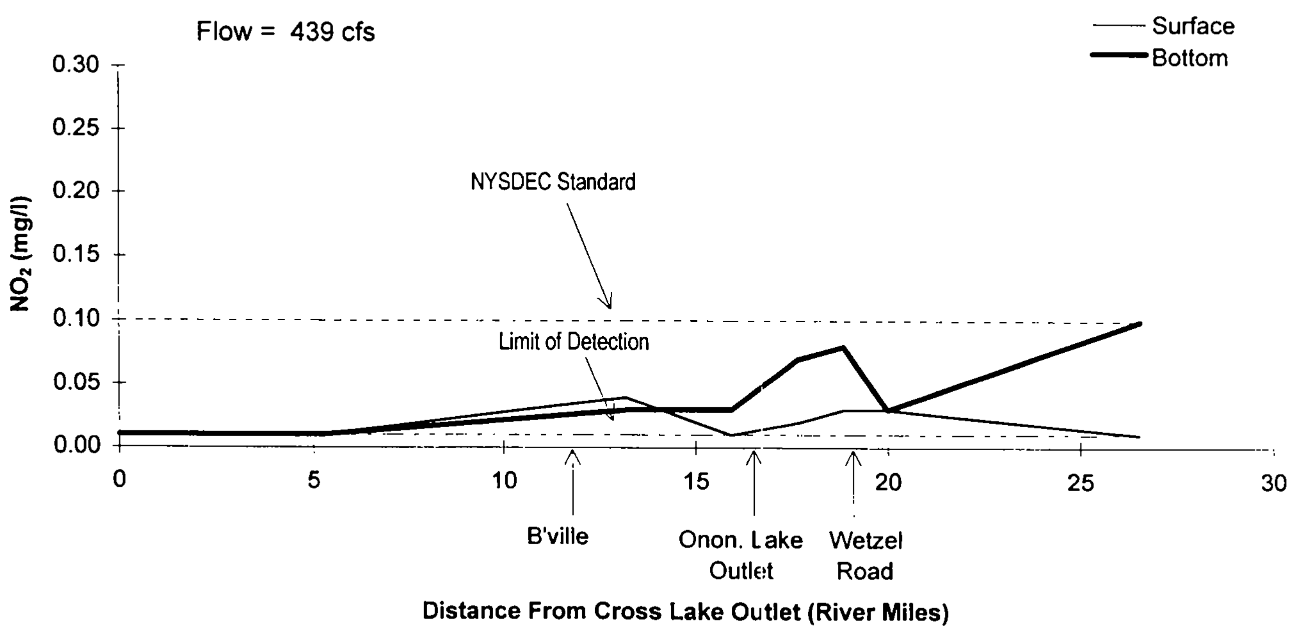


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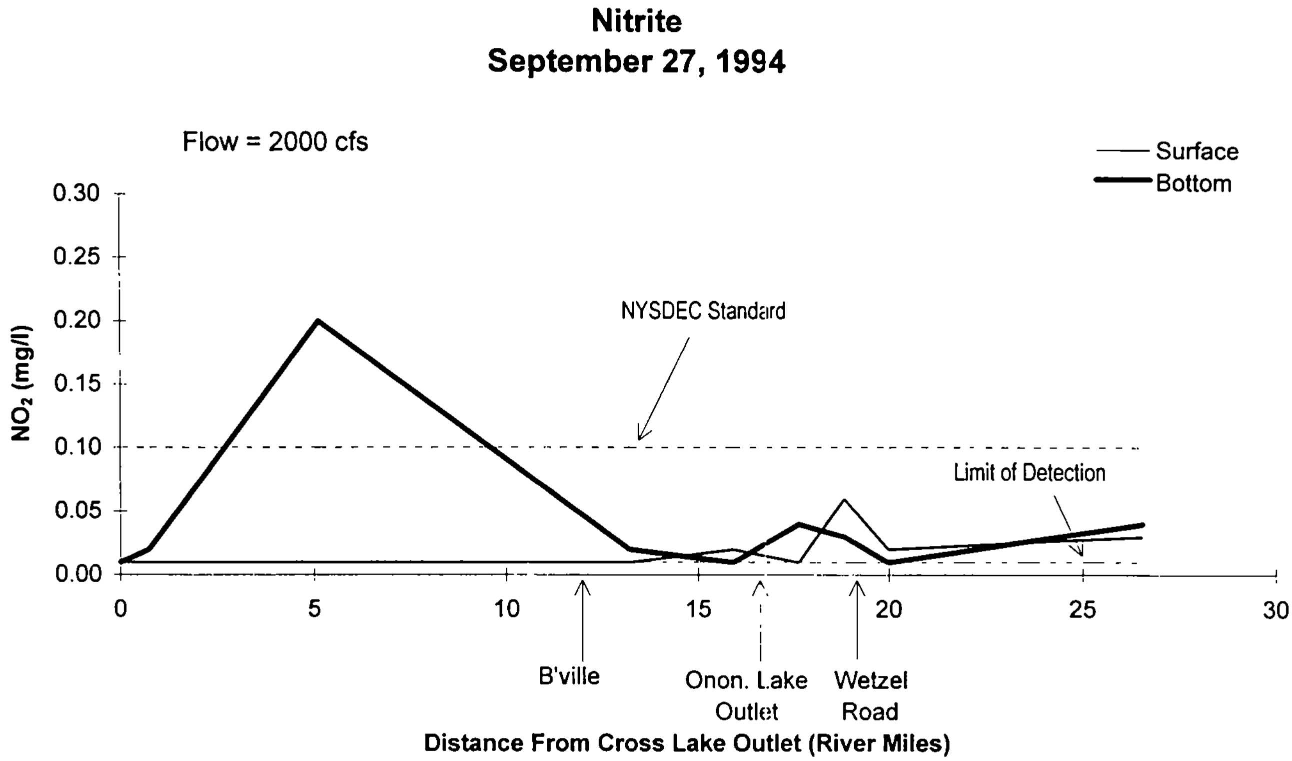
FIGURE 2-13 E (CONTINUED)
NITRITE IN THE SENECA RIVER DURING THE 1994 SAMPLING PROGRAM



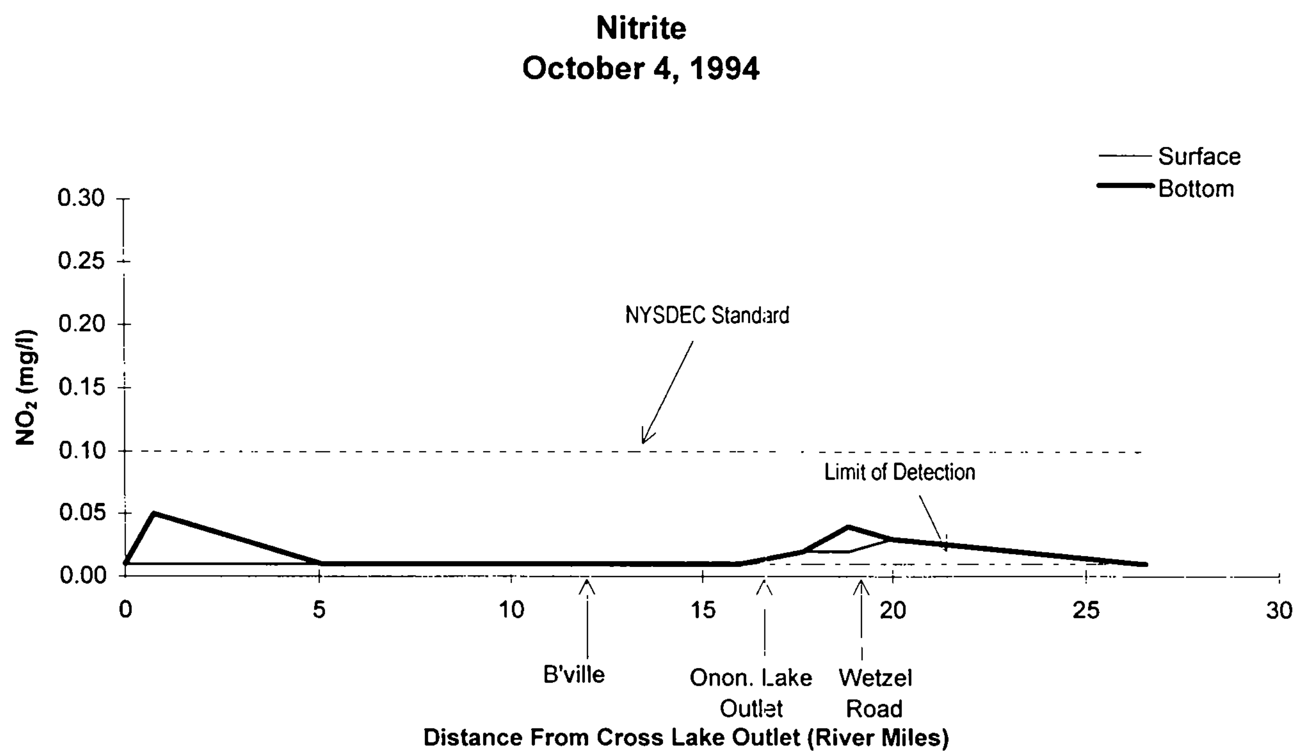


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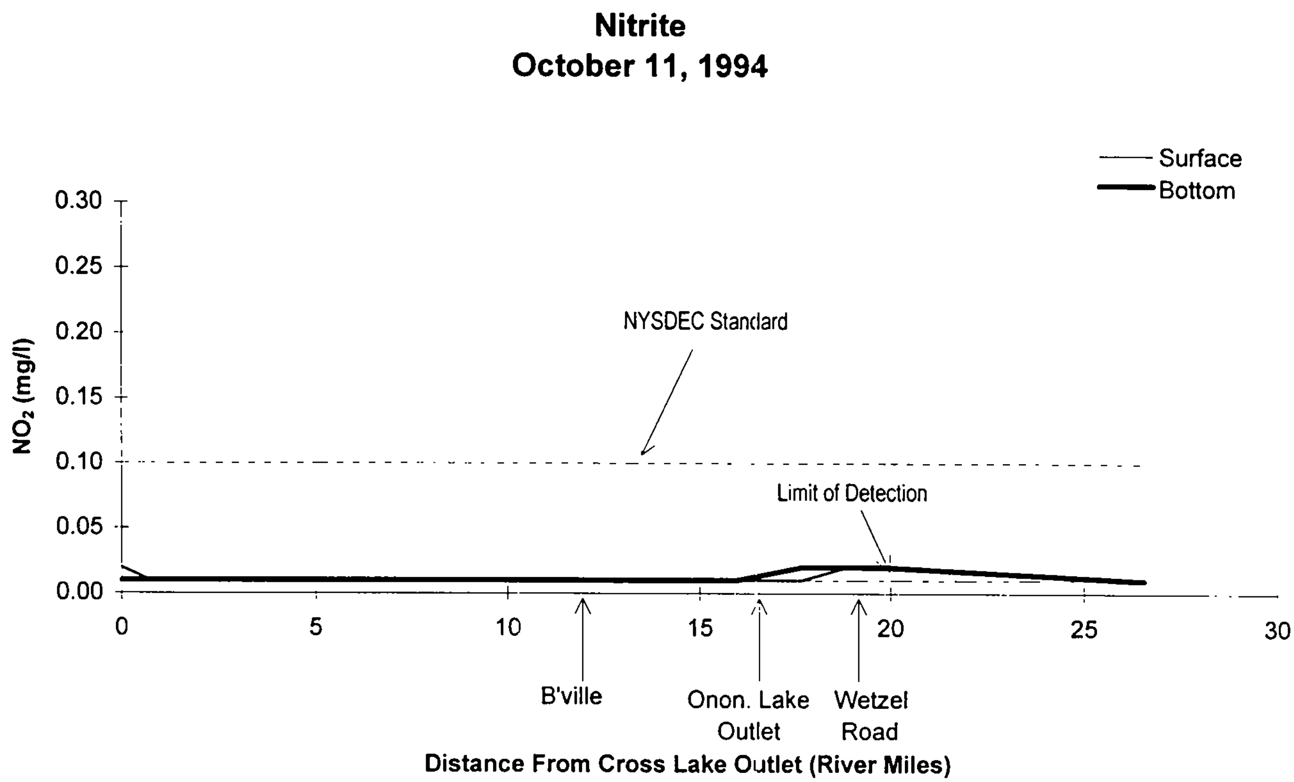
FIGURE 2-13 E (CONTINUED)
NITRITE IN THE SENECA RIVER DURING THE 1994 SAMPLING PROGRAM



Stearns & Wheler ENVIRONMENTAL ENGINEERS & SCIENTISTS DATE: 1/11/96 JOB No.: 2298	DRAFT ENVIRONMENTAL IMPACT STATEMENT ONONDAGA COUNTY DEPARTMENT OF DRAINAGE AND SANITATION **FIGURE 2-13 E (CONTINUED)** **NITRITE IN THE SENECA RIVER DURING THE 1994 SAMPLING PROGRAM**

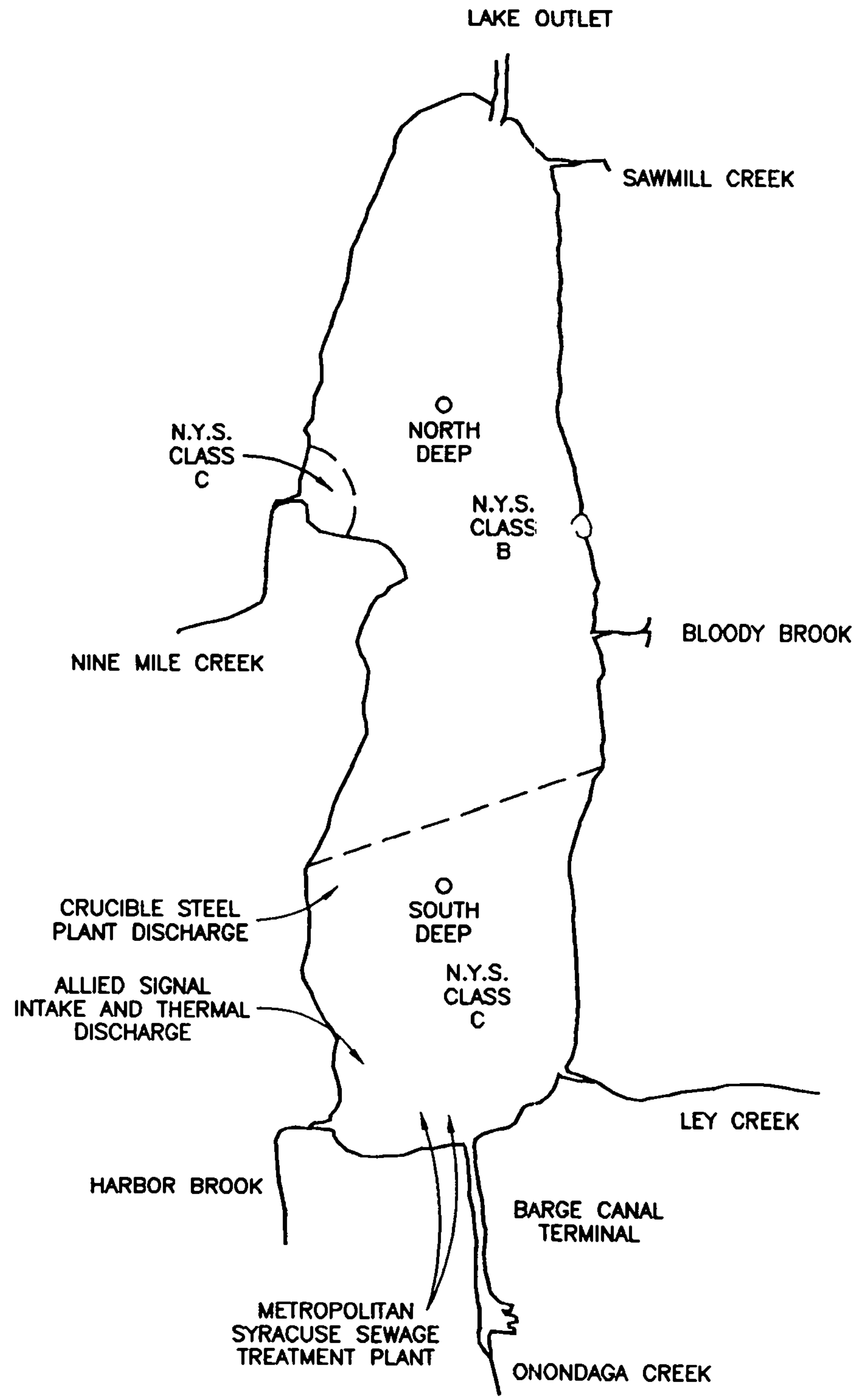


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FIGURE 2-14
WATER QUALITY CLASSIFICATIONS FOR ONONDAGA LAKE

Mercury Advisory **Fact Sheet**

New York

Summary Information:

1.	**Number of Waterbodies with Advisories**	14
2.	**Basis of Advisory**	FDA action level
3.	**Date Advisory Issued**	1st issued in 1970; advisories are updated annually

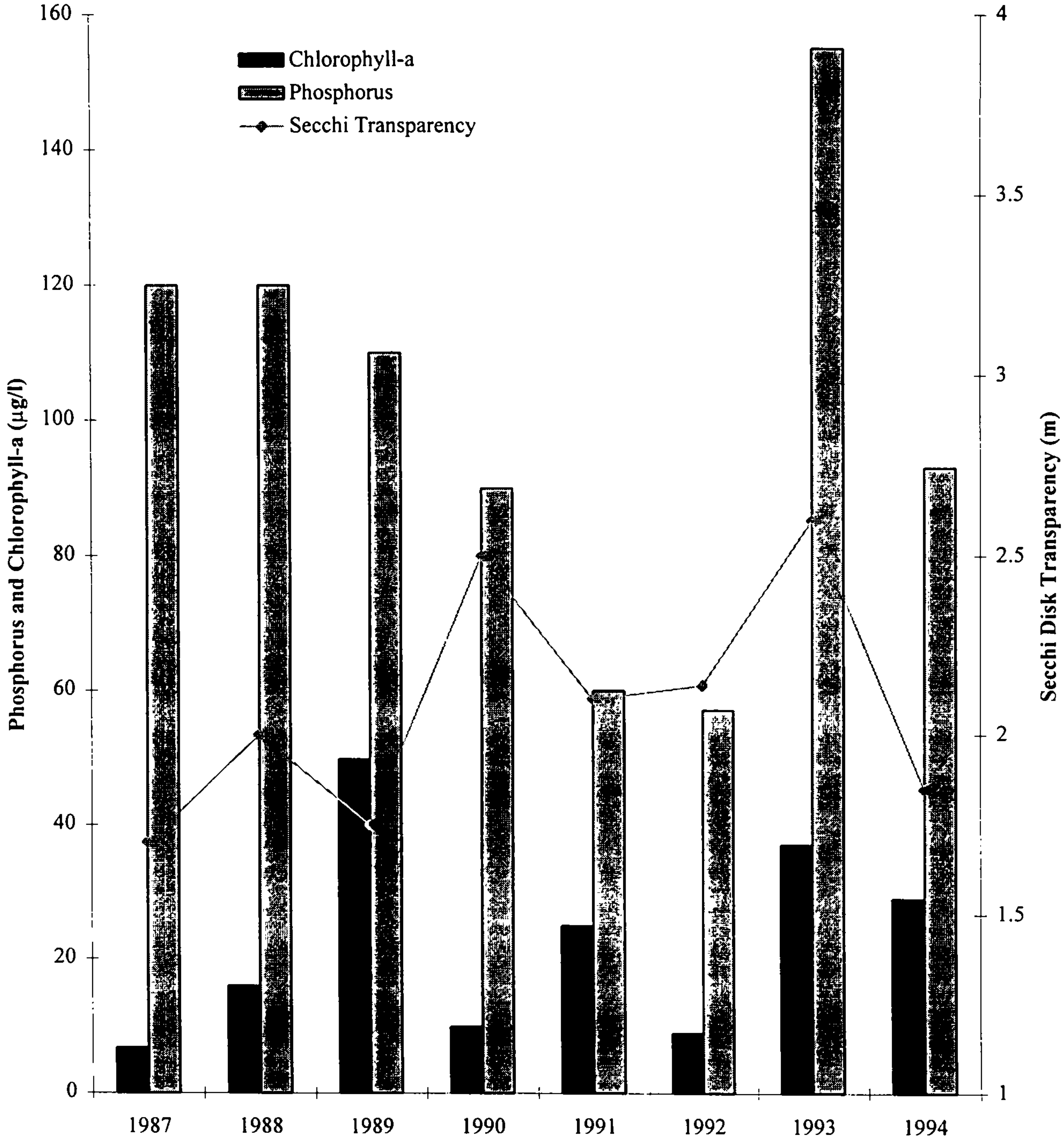
Advisory Specifics:

General Recommendation: For all waterbodies listed below, the advisory recommends that "women of childbearing age, infants and children under 15 should not eat any fish species".

Location	Waterbody Type	Restrictions	Possible Sources
Big Moose Lake	Lake	yellow perch - no more than one meal/month (1 meal = 8ounces)	Combination: atmospheric deposition and point source contributions
Carry Falls Reservoir	Reservoir	walleye - no more than one meal/ month	
Ferris Lake	Lake	yellow perch >12" - do not consume; <12" no more than one meal/month	
Francis Lake	Lake	yellow perch - no more than one meal/month	
Halfmoon Lake	Lake	yellow perch - no more than one meal/month	
Indian Lake	Lake	All species - no more than one meal/month	
Lake Champlain (Whole Lake)	Lake	lake trout >25", walleye >19" - no more than one meal/month	
Long Pond	Pond	splake >12" - do not consume	
Meacham Lake	Lake	yellow perch >12" - do not consume; <12" - no more than one meal/month	
Moshier Reservoir	Reservoir	yellow perch - no more than one meal/month	
Onondaga Lake	Lake	All species - do not consume	
Round Pond	Pond	yellow perch >12" - no more than one meal/month	
Stillwater Reservoir	Reservoir	splake - no more than one meal/month	
Sunday Lake	Lake	yellow perch - no more than one meal/month	

Source: Environmental Protection Agency. National Forum on Mercury in Fish. June 1995. EPA 823-R-95.002.

FIGURE 2-15
NEW YORK STATE MERCURY ADVISORY SUMMARY SHEET



Total phosphorus, chlorophyll a and secchi disk transparency, 1987 - 1994. Values are averages of observations during the growing season (May-September) in the upper waters (0-9 m) of Onondaga Lake, NY.

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DATE: 1/11/96 JOB No.: 2298	**FIGURE 2-16** **TROPHIC INDICATORS IN THE UPPER WATERS DURING THE GROWING SEASON, 1987 - 1994**

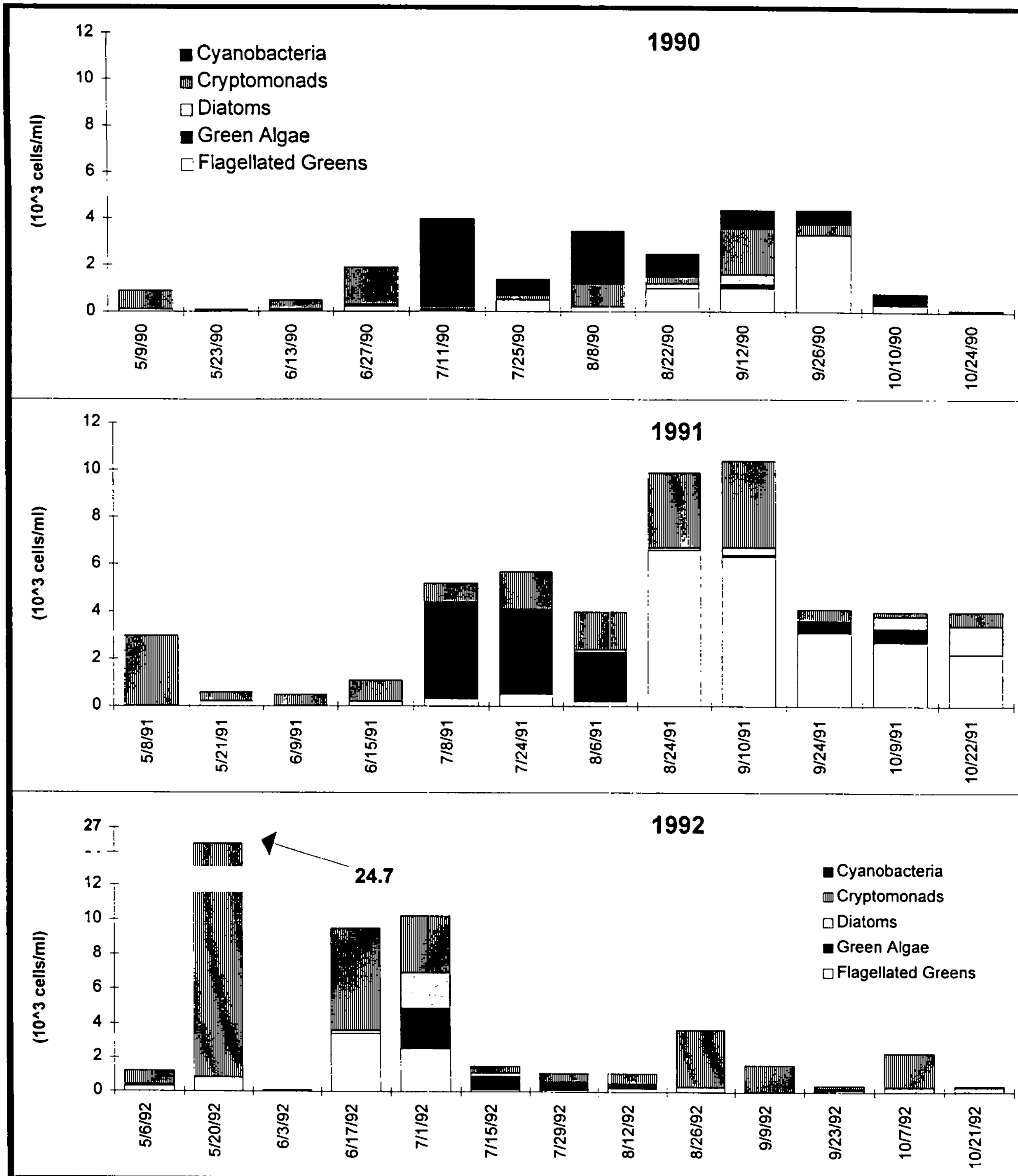

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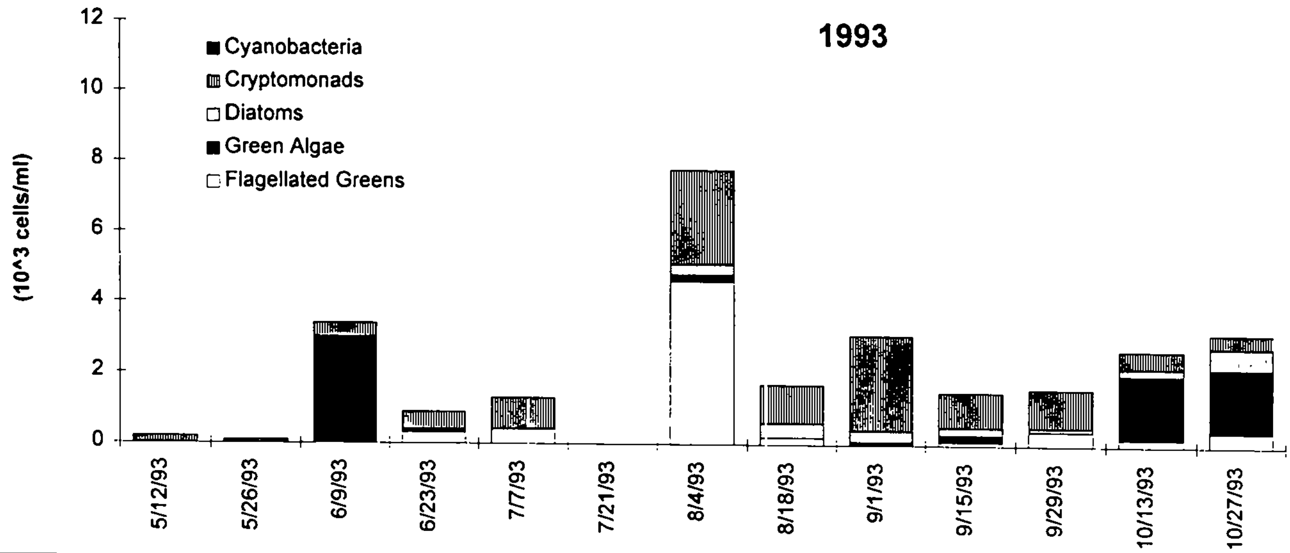
FIGURE 2-17
PHYTOPLANKTON TRENDS IN ONONDAGA LAKE, MAY 1990 - OCTOBER 1994



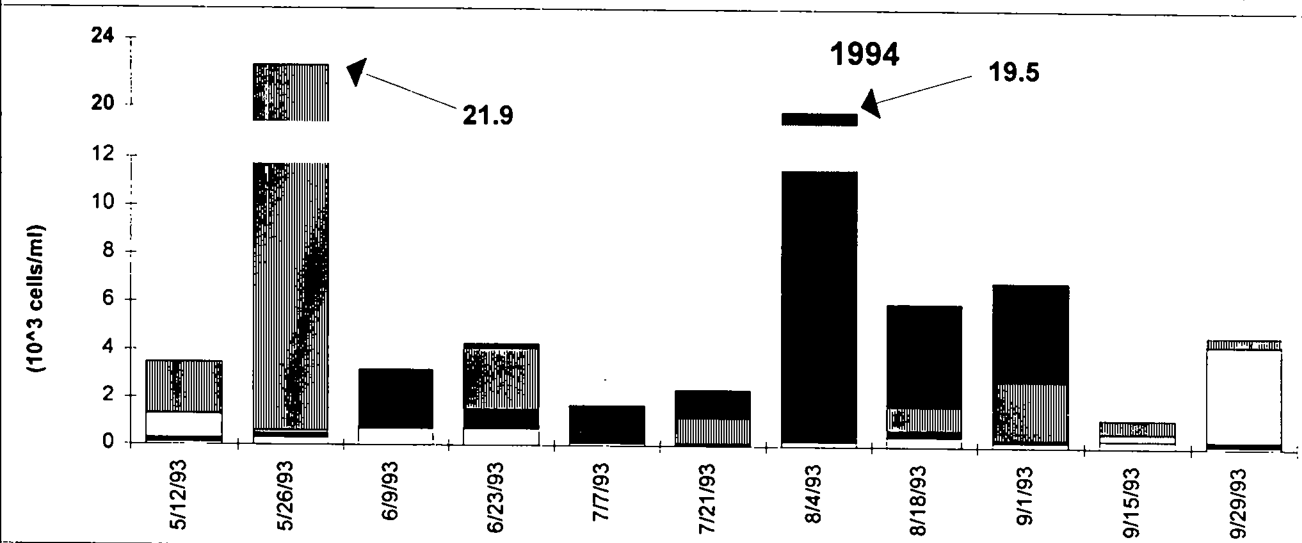


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FIGURE 2-17 (CONTINUED)
PHYTOPLANKTON TRENDS IN ONONDAGA LAKE, MAY 1990 - OCTOBER 1994

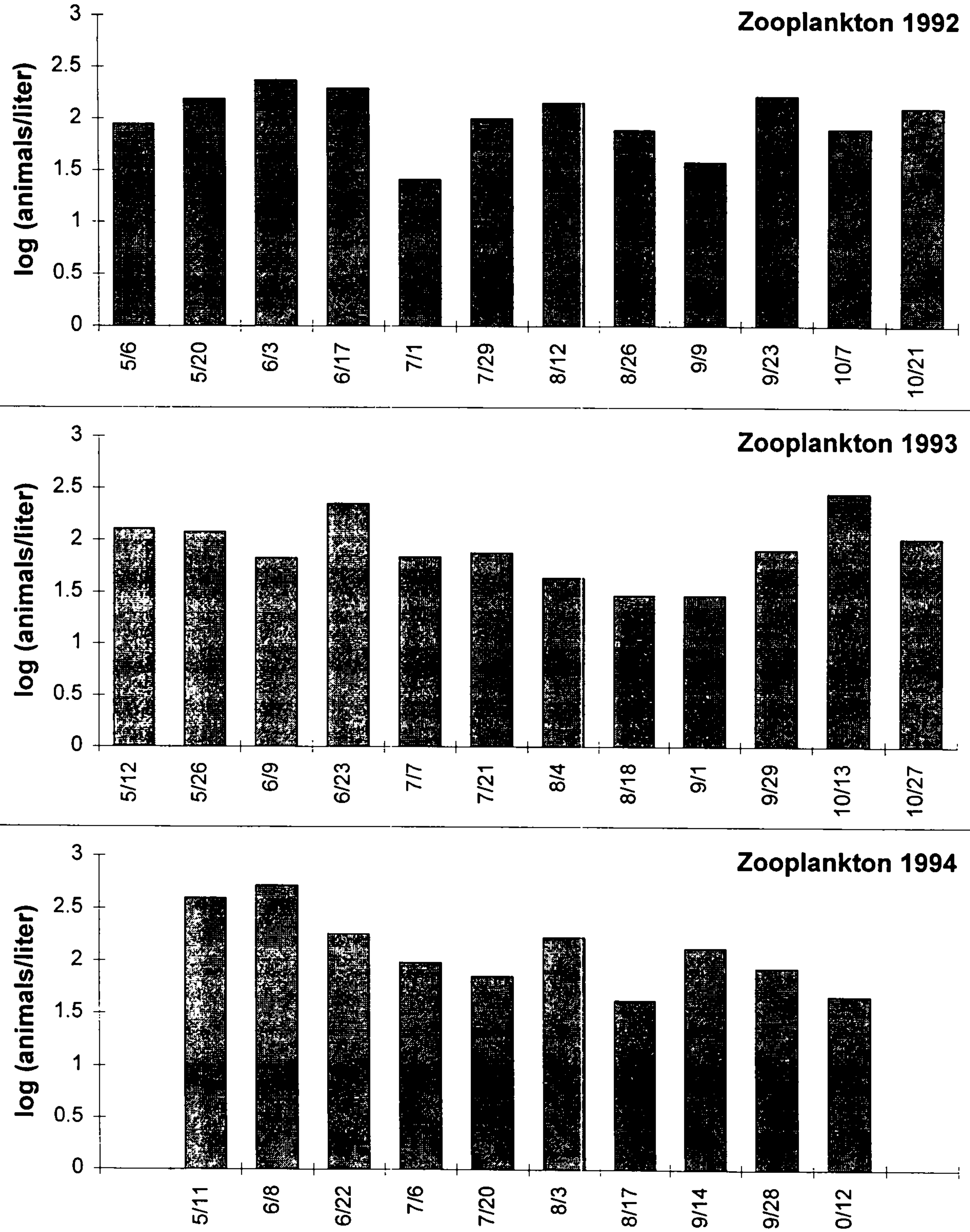

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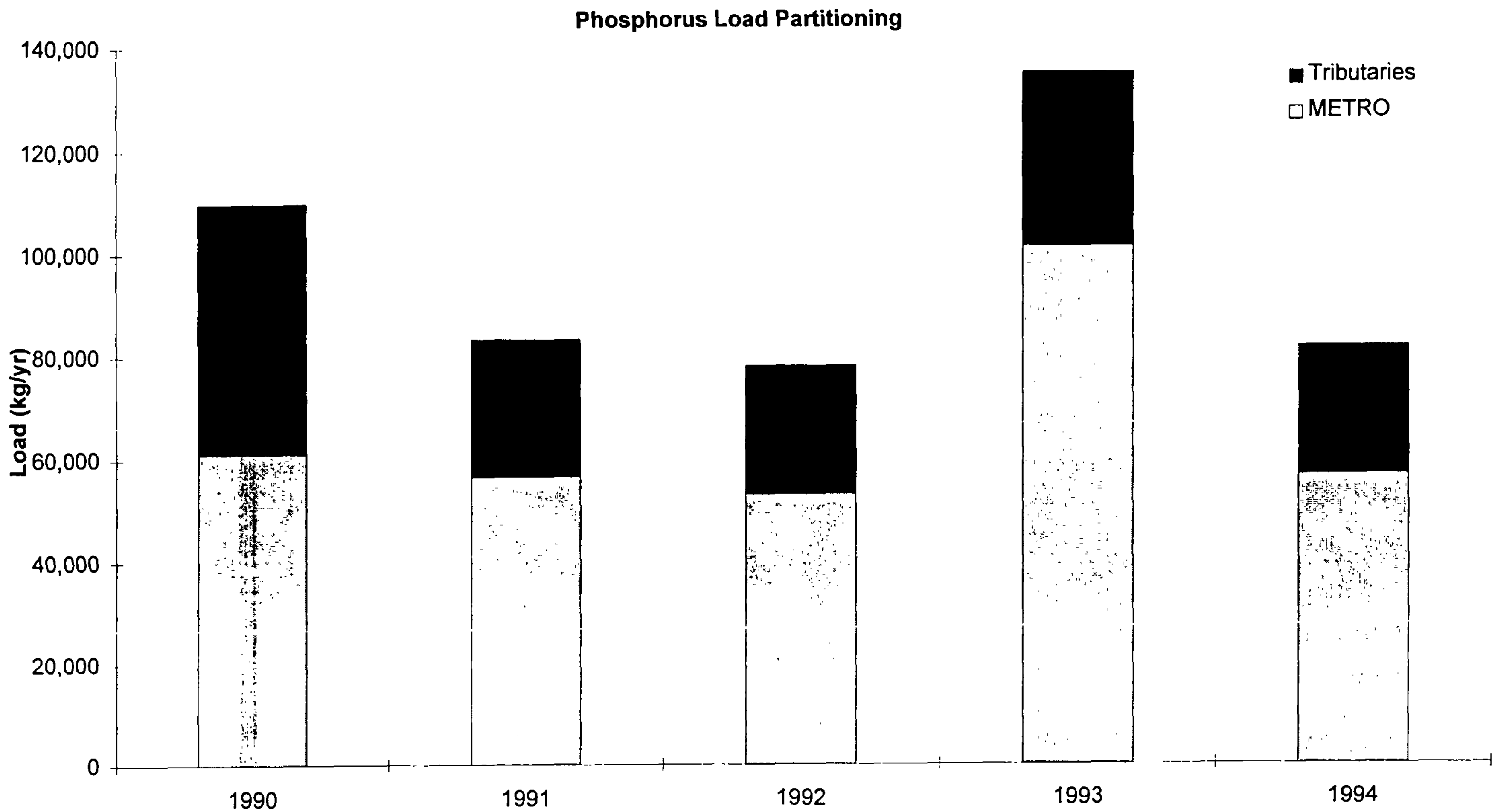
FIGURE 2-18
TOTAL ZOOPLANKTON TRENDS IN ONONDAGA LAKE, MAY 1992 - OCTOBER 1994



METRO includes by-pass and fully-treated effluent.

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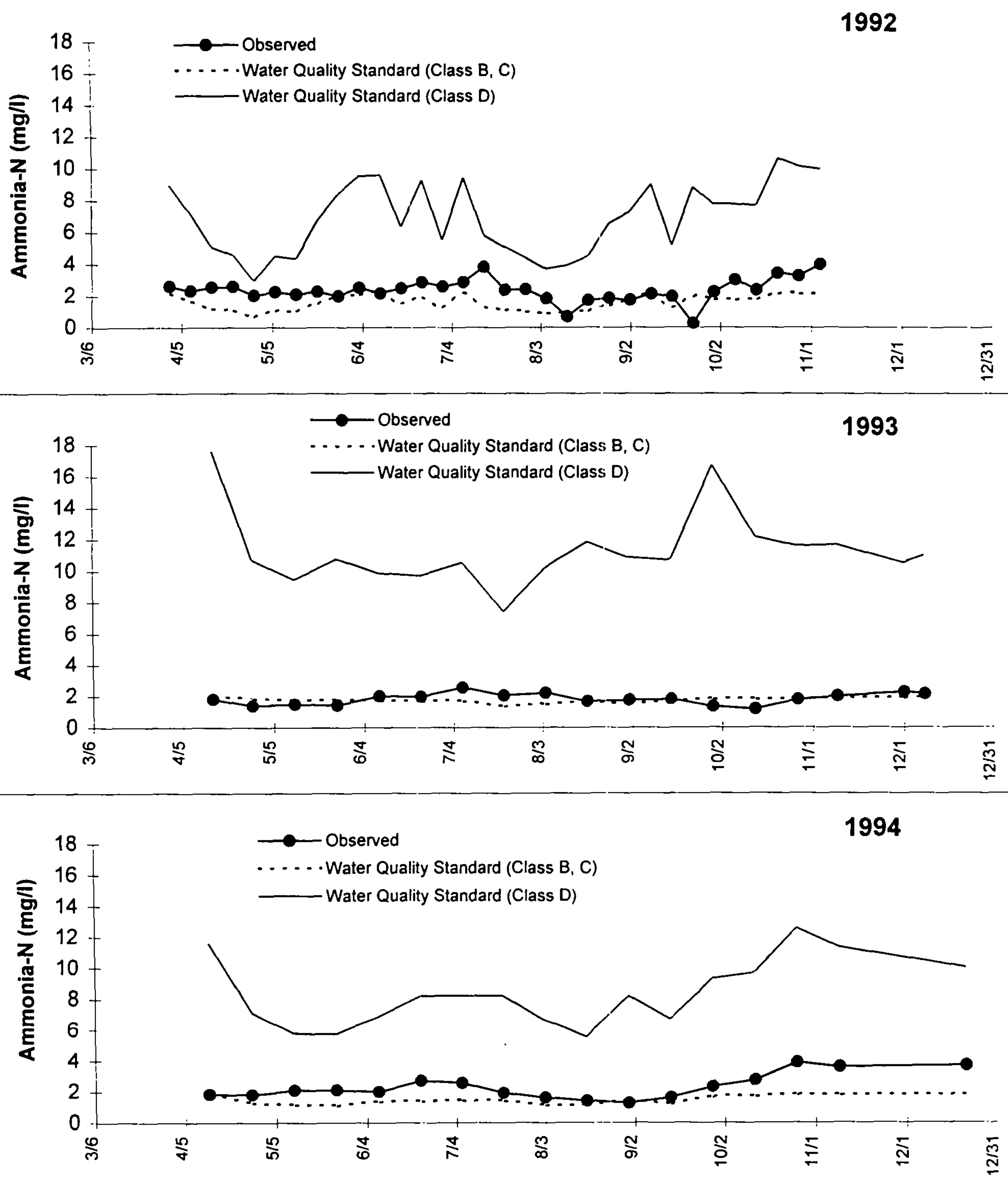
FIGURE 2-19
PHOSPHORUS LOAD PARTITIONING, 1990 - 1994



Standards are published in New York Ambient Water Quality Standards and Guidance Values, classes AA, A, B, C and class D waters (NYSDEC, 1993).

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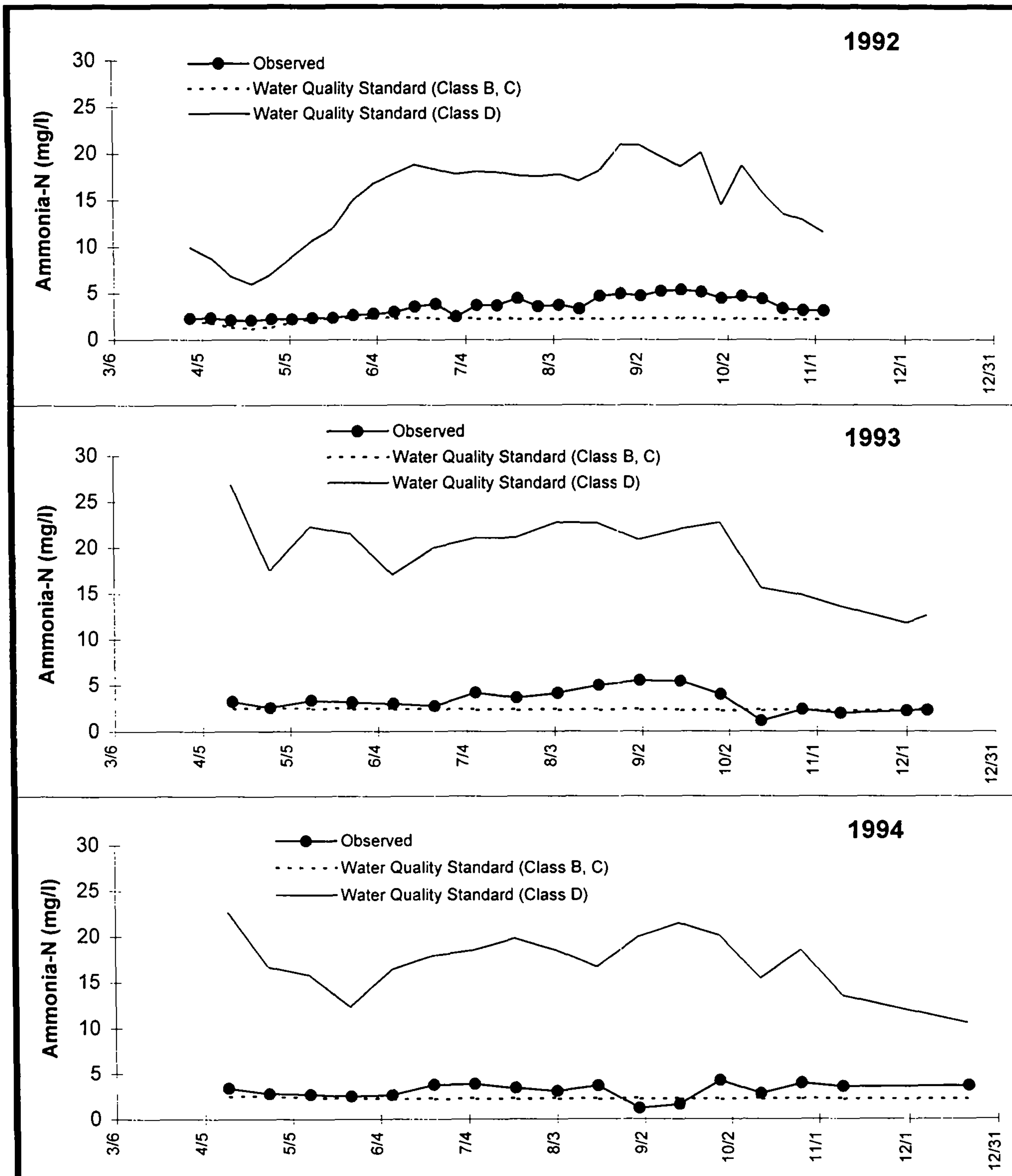
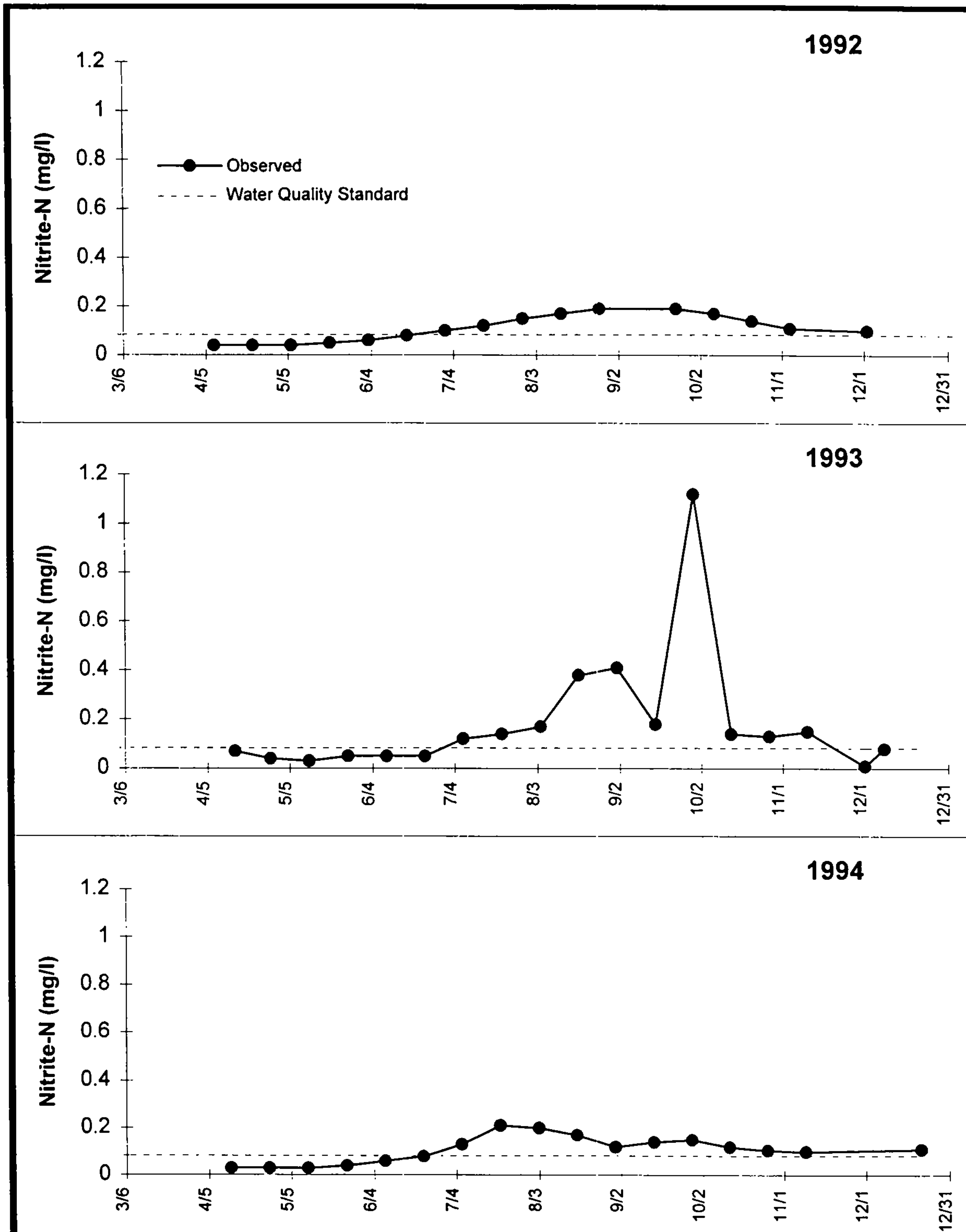
ENVIRONMENTAL ENGINEERS & SCIENTISTS DATE: 1/11/96 JOB No.: 2298	FIGURE 2-20 A TOTAL AMMONIA-N IN THE UPPER WATERS (0-9 M) OF ONONDAGA LAKE, 1992-1994



Standards are published in New York Ambient Water Quality Standards and Guidance Values, classes AA, A, B, C and class D waters (NYSDEC, 1993).

Stearns & Wheler ENVIRONMENTAL ENGINEERS & SCIENTISTS DATE: 1/11/96 JOB No.: 2298	DRAFT ENVIRONMENTAL IMPACT STATEMENT ONONDAGA COUNTY DEPARTMENT OF DRAINAGE AND SANITATION
	FIGURE 2-20 B TOTAL AMMONIA-N IN THE LOWER WATERS (12-18 M) OF ONONDAGA LAKE, 1992-1994



Standards are published in New York Ambient Water Quality Standards and Guidance Values, classes AA, A, B, C waters (NYSDEC, 1993).

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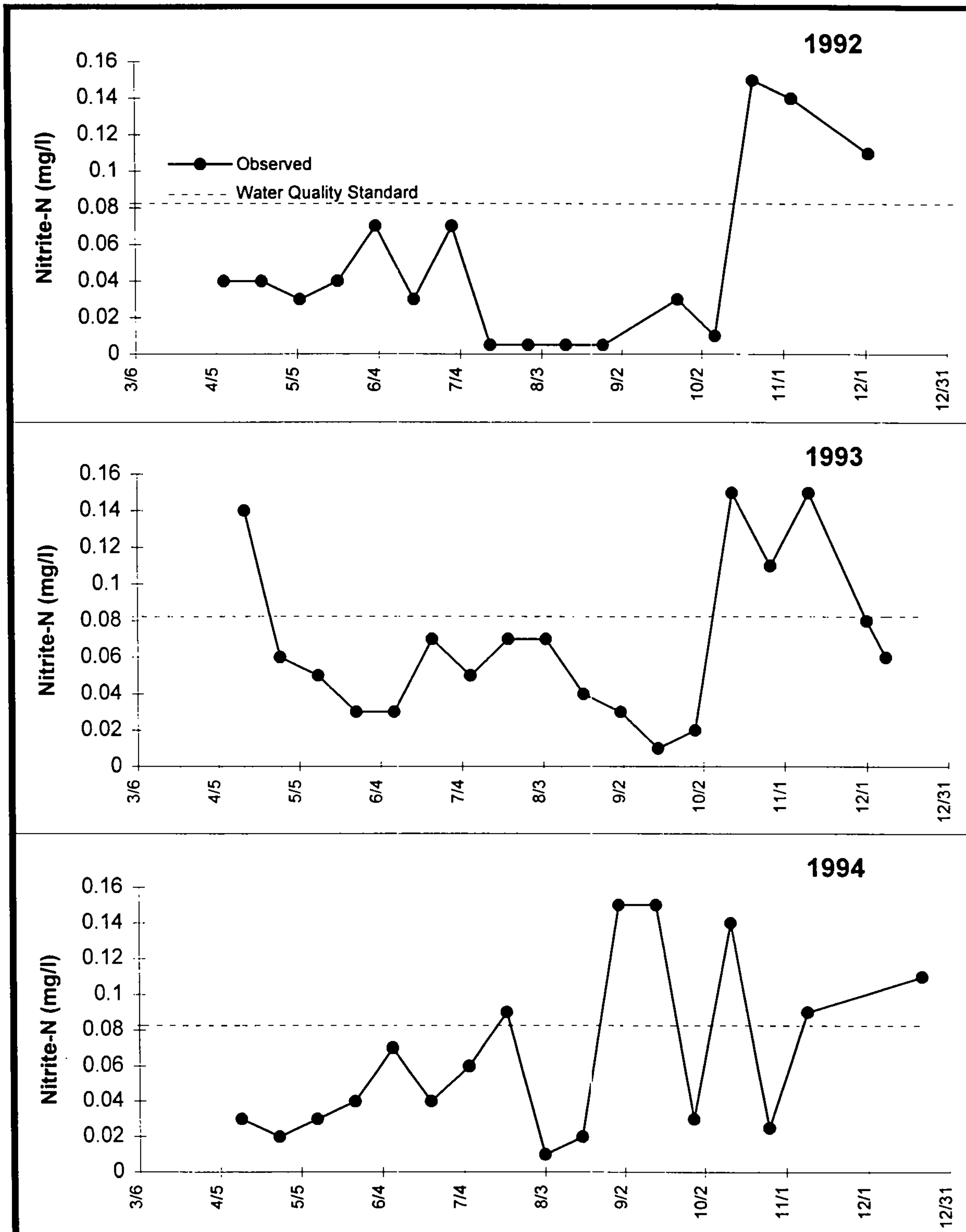
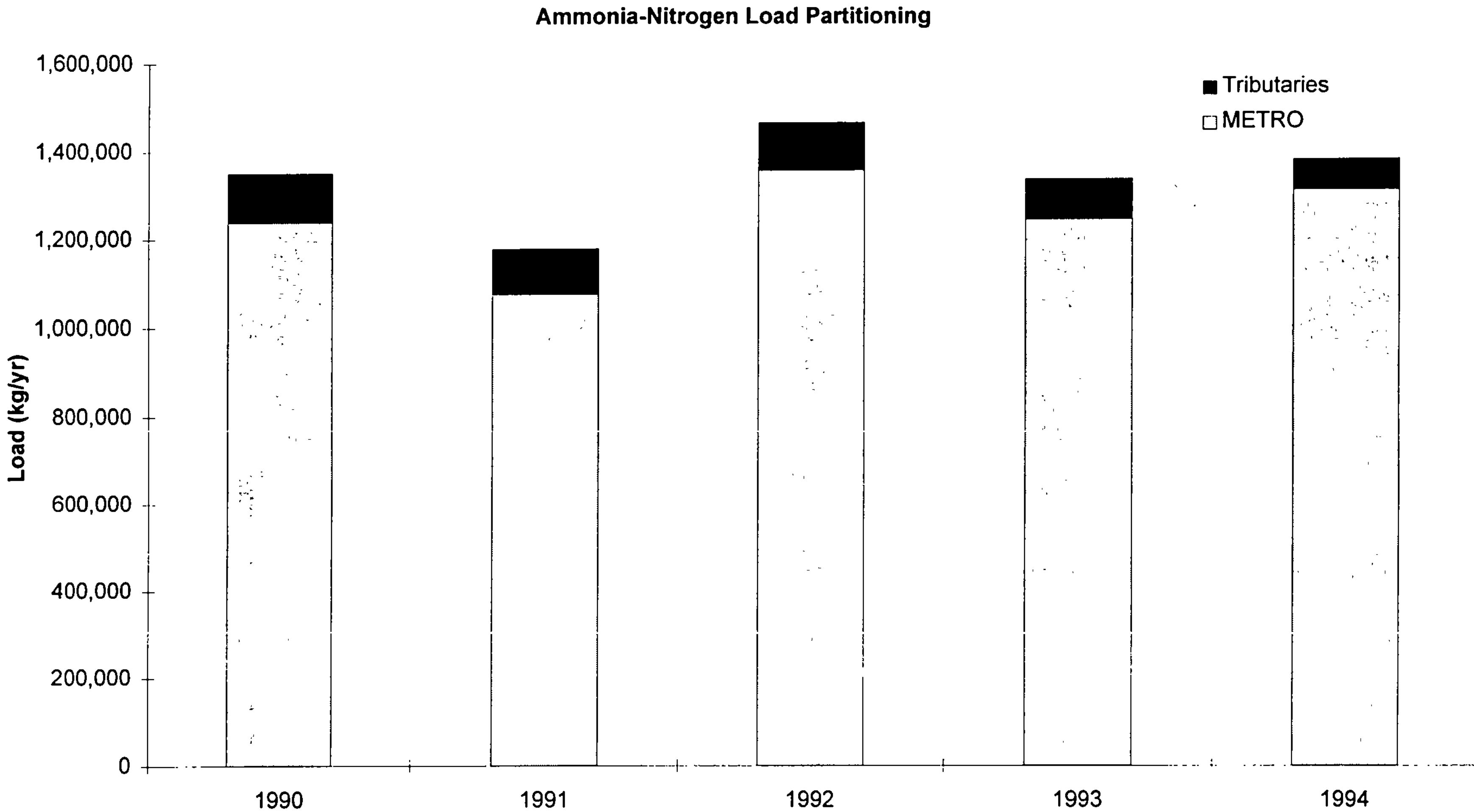
DATE: 1/11/96 JOB No.: 2298	**FIGURE 2-21 A** **NITRITE IN THE UPPER WATERS (0-9 M) OF ONONDAGA LAKE, 1992-1994**



Standards are published in New York Ambient Water Quality Standards and Guidance Values, classes AA, A, B, C waters (NYSDEC, 1993).

Stearns & Wheler ENVIRONMENTAL ENGINEERS & SCIENTISTS	DRAFT ENVIRONMENTAL IMPACT STATEMENT ONONDAGA COUNTY DEPARTMENT OF DRAINAGE AND SANITATION
DATE: 1/11/96 JOB No.: 2298	FIGURE 2-21 B NITRITE IN THE LOWER WATERS (12-18 M) OF ONONDAGA LAKE, 1992-1994



METRO includes by-pass and fully-treated effluent.

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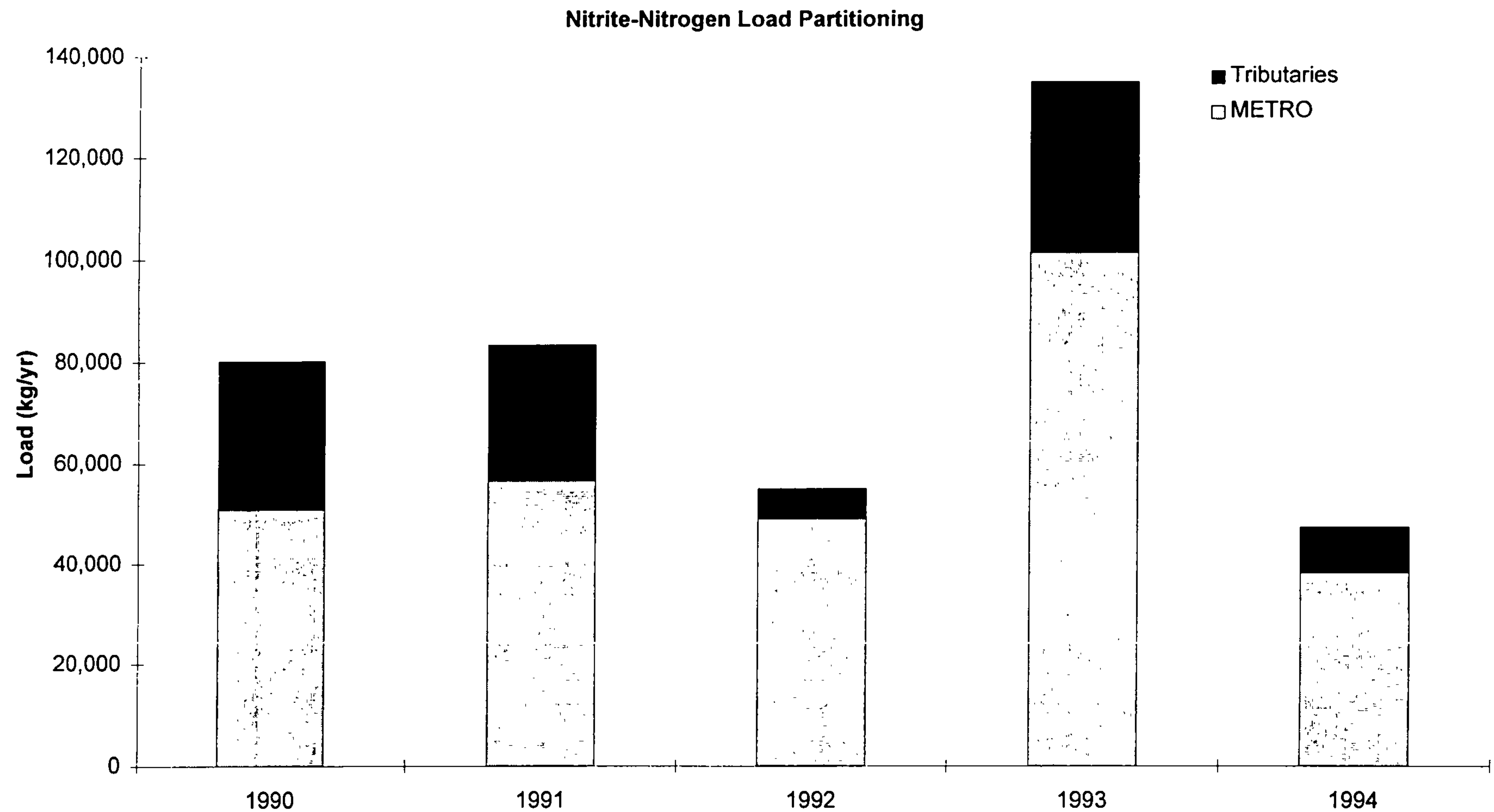
FIGURE 2-22
AMMONIA NITROGEN LOAD PARTITIONING,
1990 - 1994



METRO includes by-pass and fully-treated effluent.

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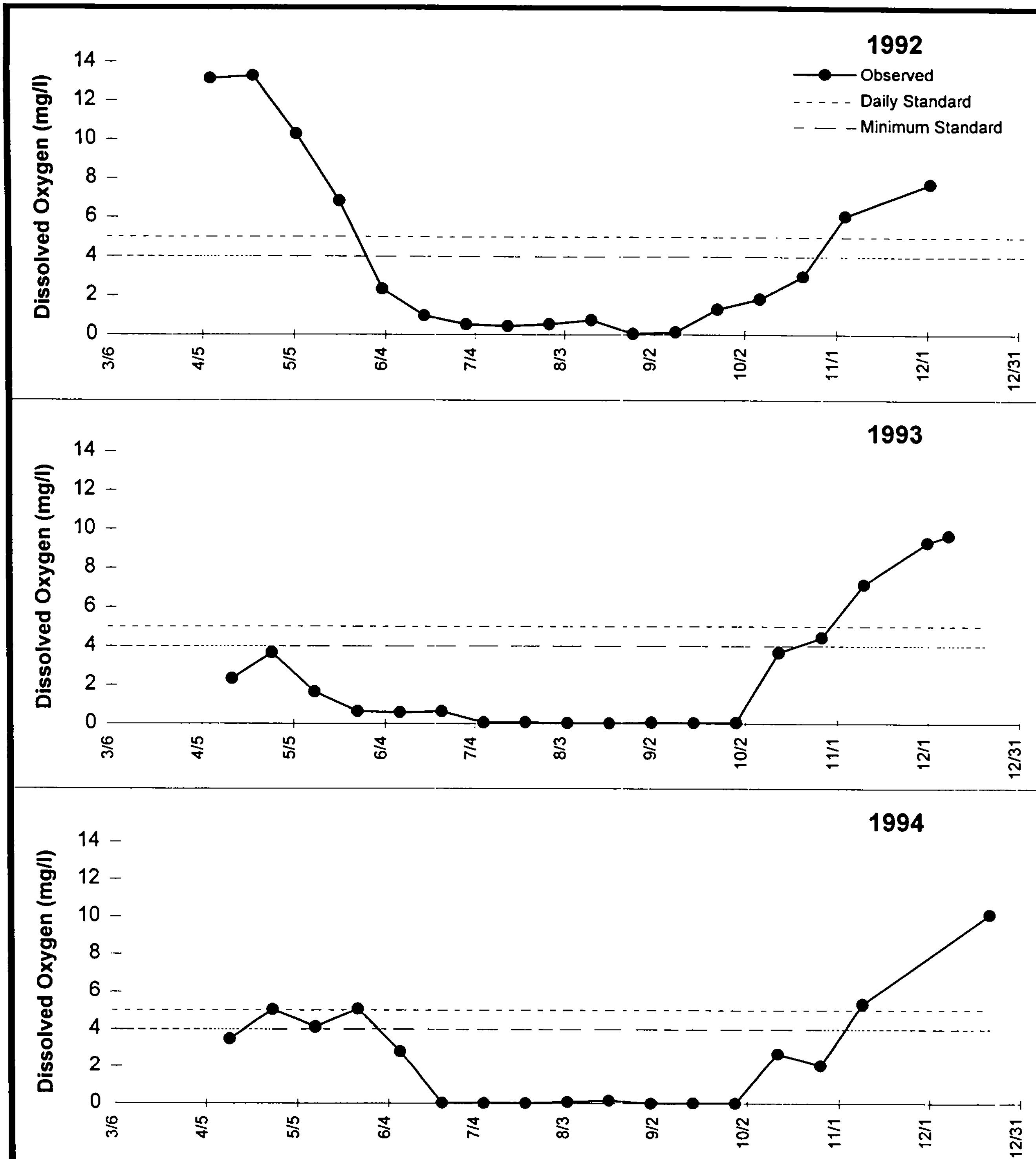
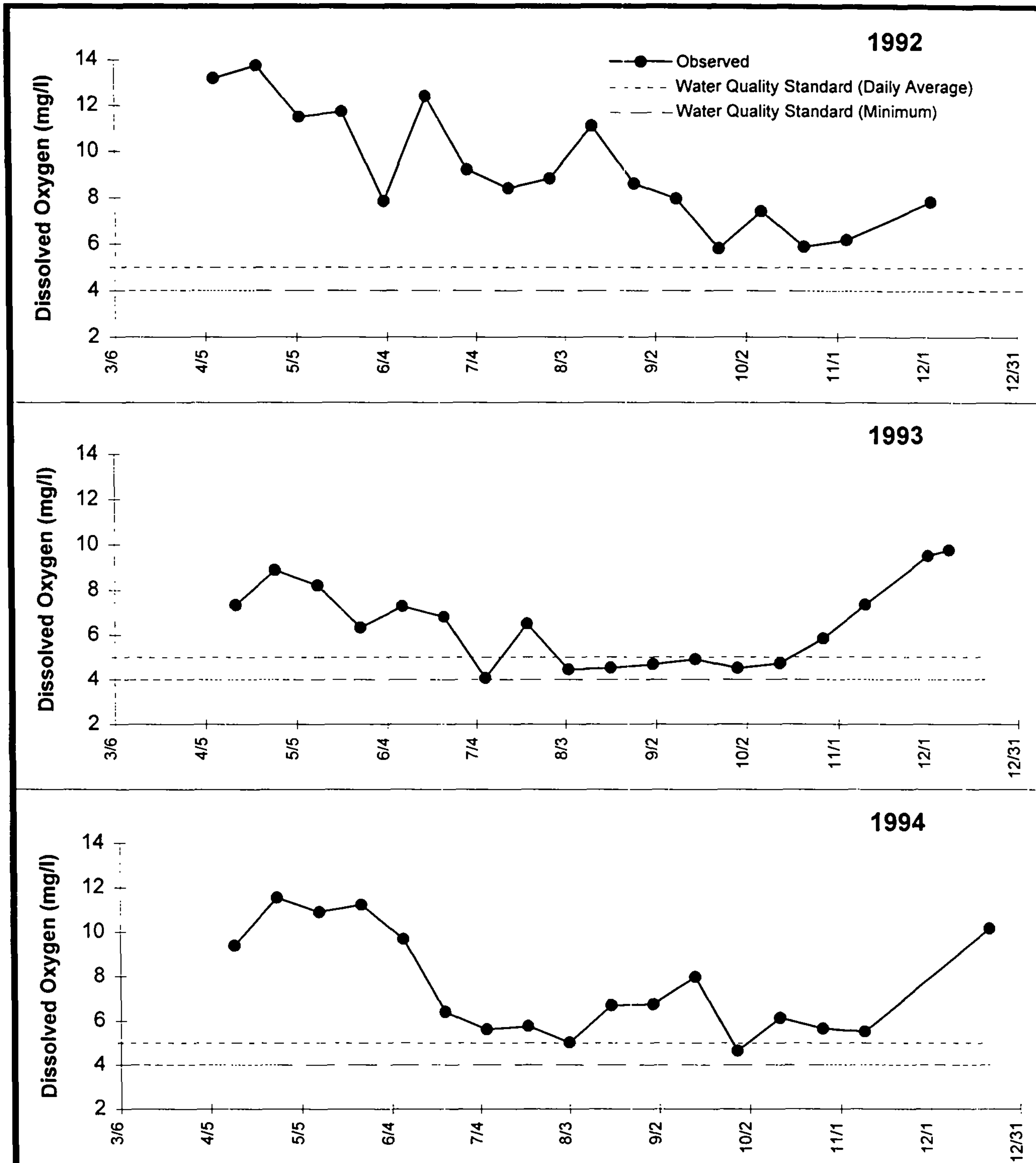
OF DRAINAGE AND SANITATION

FIGURE 2-23
NITRITE NITROGEN LOAD PARTITIONING, 1990 - 1994



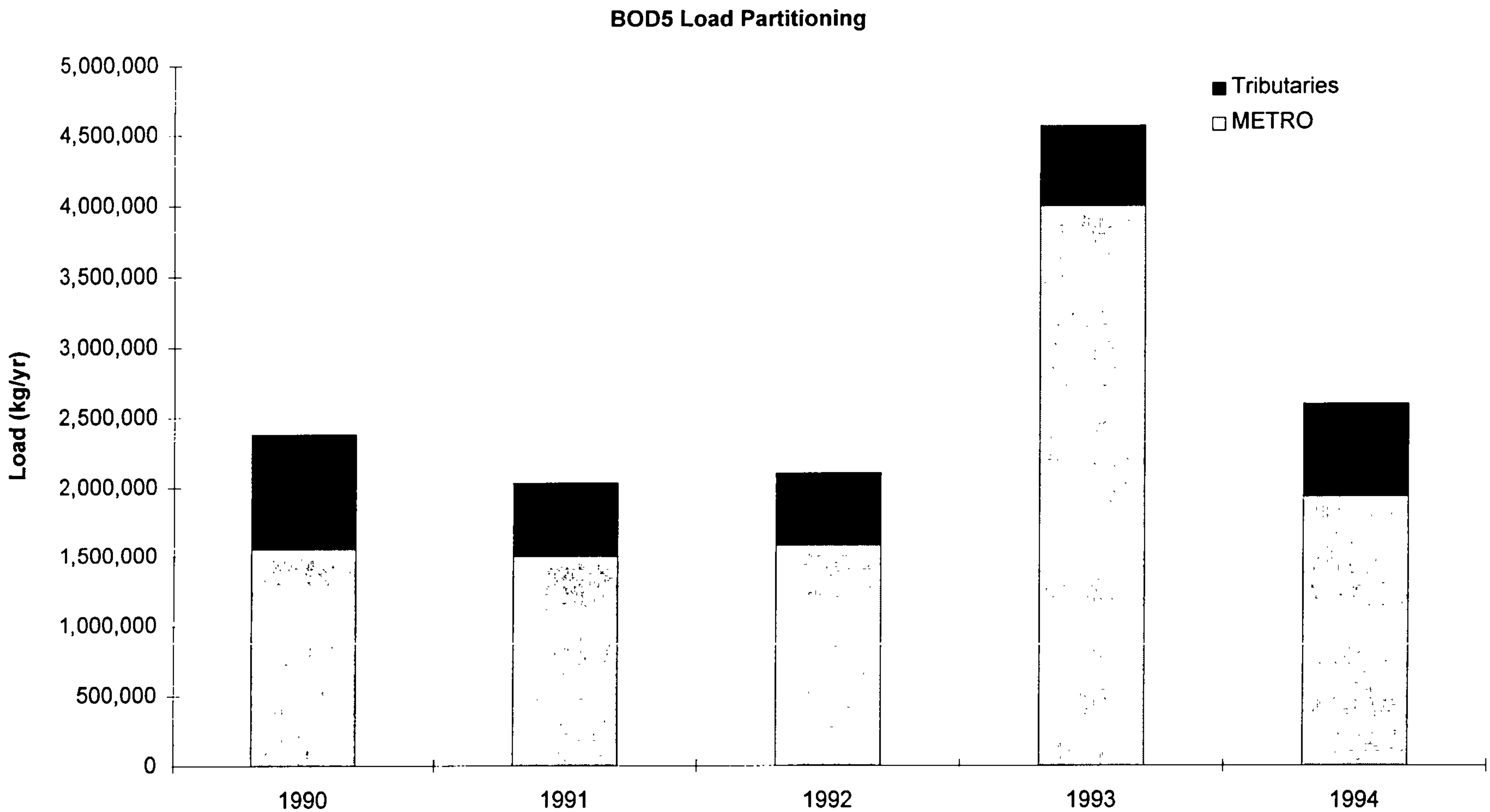
Standards are published in New York Ambient Water Quality Standards and Guidance Values, classes AA, A, B, C waters (NYSDEC, 1993).

Stearns & Wheler ENVIRONMENTAL ENGINEERS & SCIENTISTS DATE: 1/11/96 JOB No.: 2298	DRAFT ENVIRONMENTAL IMPACT STATEMENT ONONDAGA COUNTY DEPARTMENT OF DRAINAGE AND SANITATION
	FIGURE 2-24 **DISSOLVED OXYGEN IN THE LOWER WATERS (12-18 M) OF ONONDAGA LAKE, 1992-1994**



Standards are published in New York Ambient Water Quality Standards and Guidance Values, classes AA, A, B, C waters (NYSDEC, 1993).

Stearns & Wheler	DRAFT ENVIRONMENTAL IMPACT STATEMENT ONONDAGA COUNTY DEPARTMENT OF DRAINAGE AND SANITATION
ENVIRONMENTAL ENGINEERS & SCIENTISTS DATE: 1/11/96 JOB No.: 2298	FIGURE 2-25 DISSOLVED OXYGEN IN THE UPPER WATERS (0-9 M) OF ONONDAGA LAKE, 1992-1994



METRO includes by-pass and fully-treated effluent.

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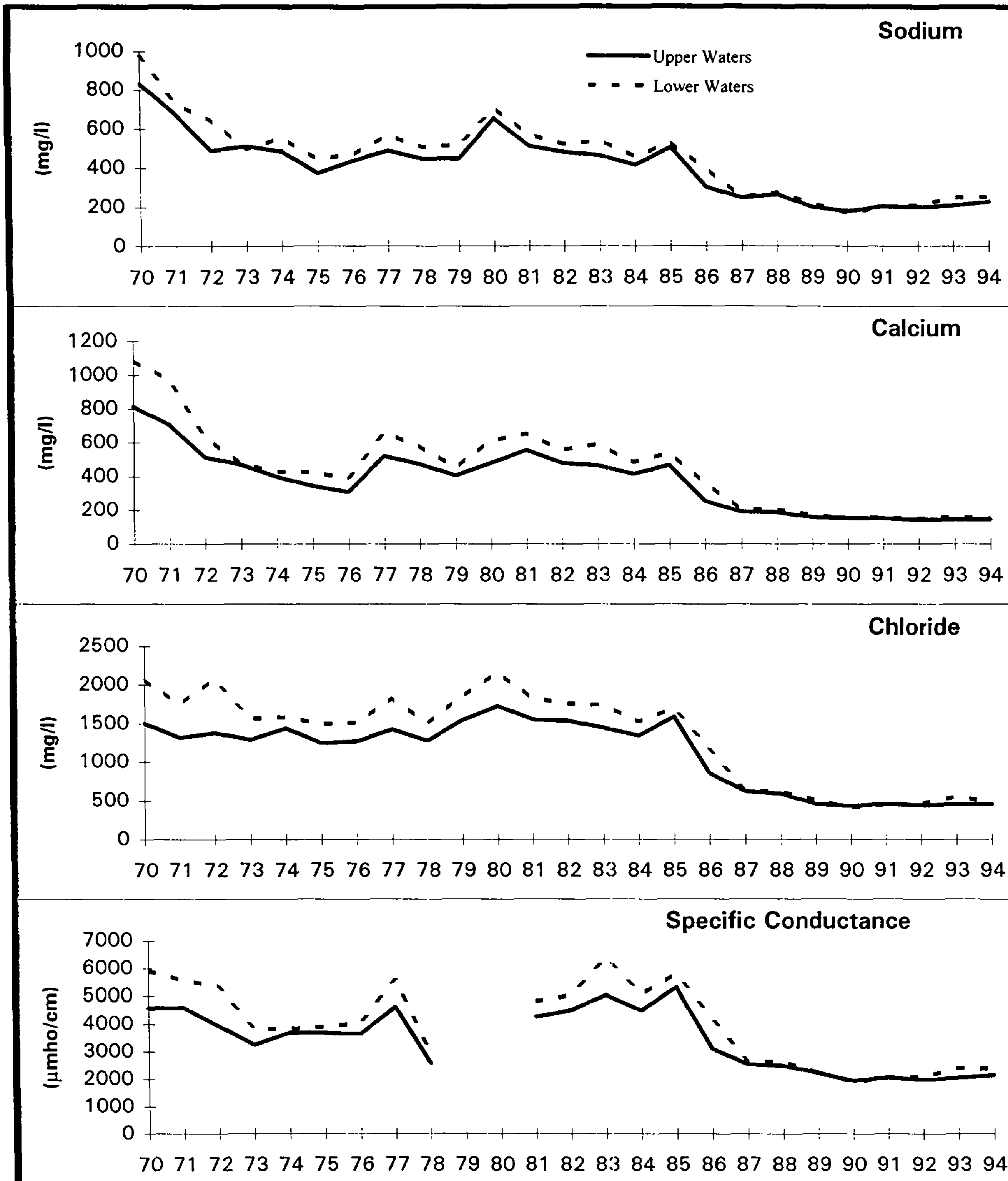
FIGURE 2-26
BOD5 LOAD PARTITIONING,
1990 - 1994



Yearly points are means calculated from the ice-free season data (mid-April to mid-December). Specific conductance was not measured in 1979 and 1980.

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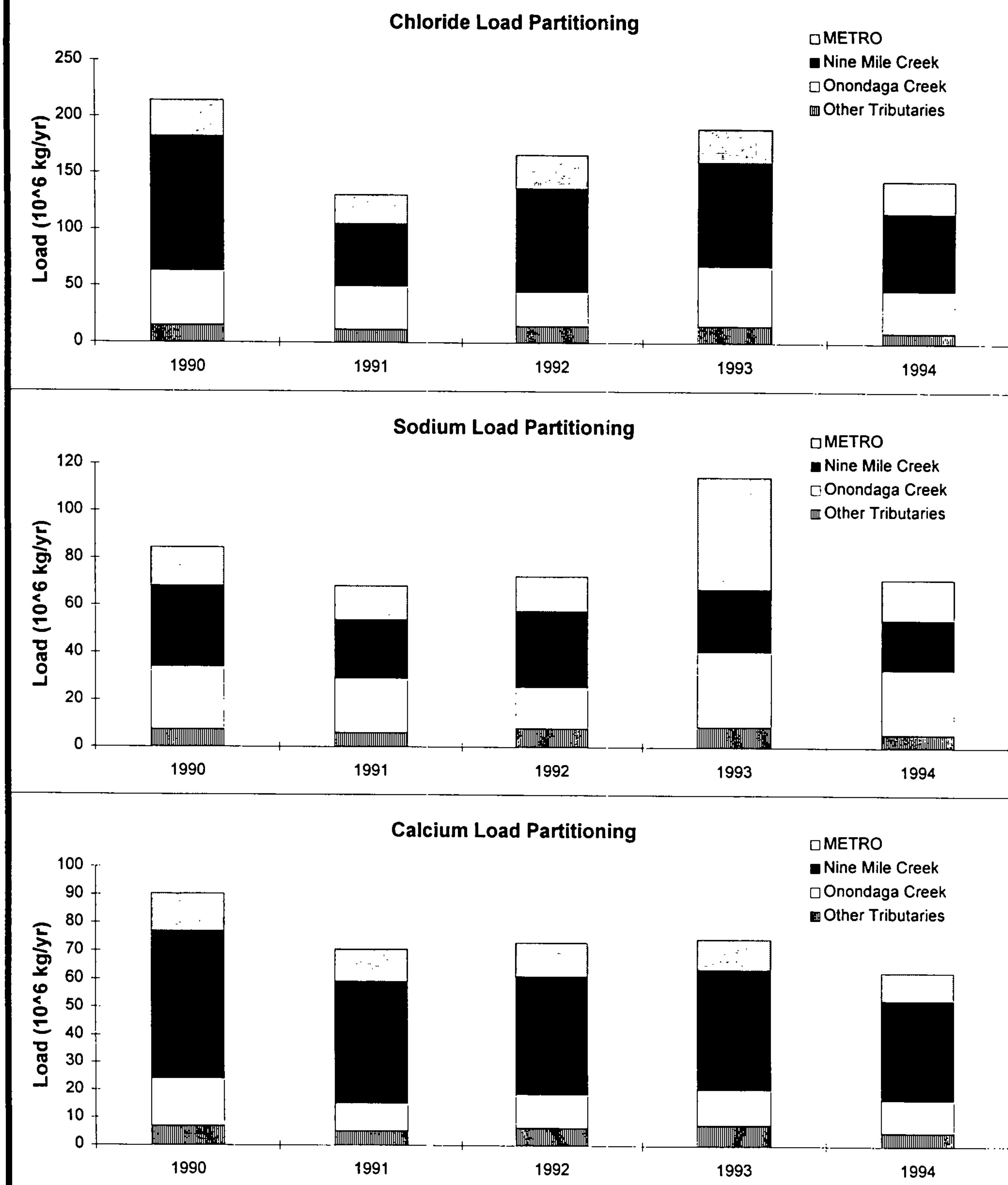
FIGURE 2-27 A
CHANGES IN MAJOR IONS OVER TIME
(1970 - 1994)



METRO includes by-pass and fully-treated effluent.

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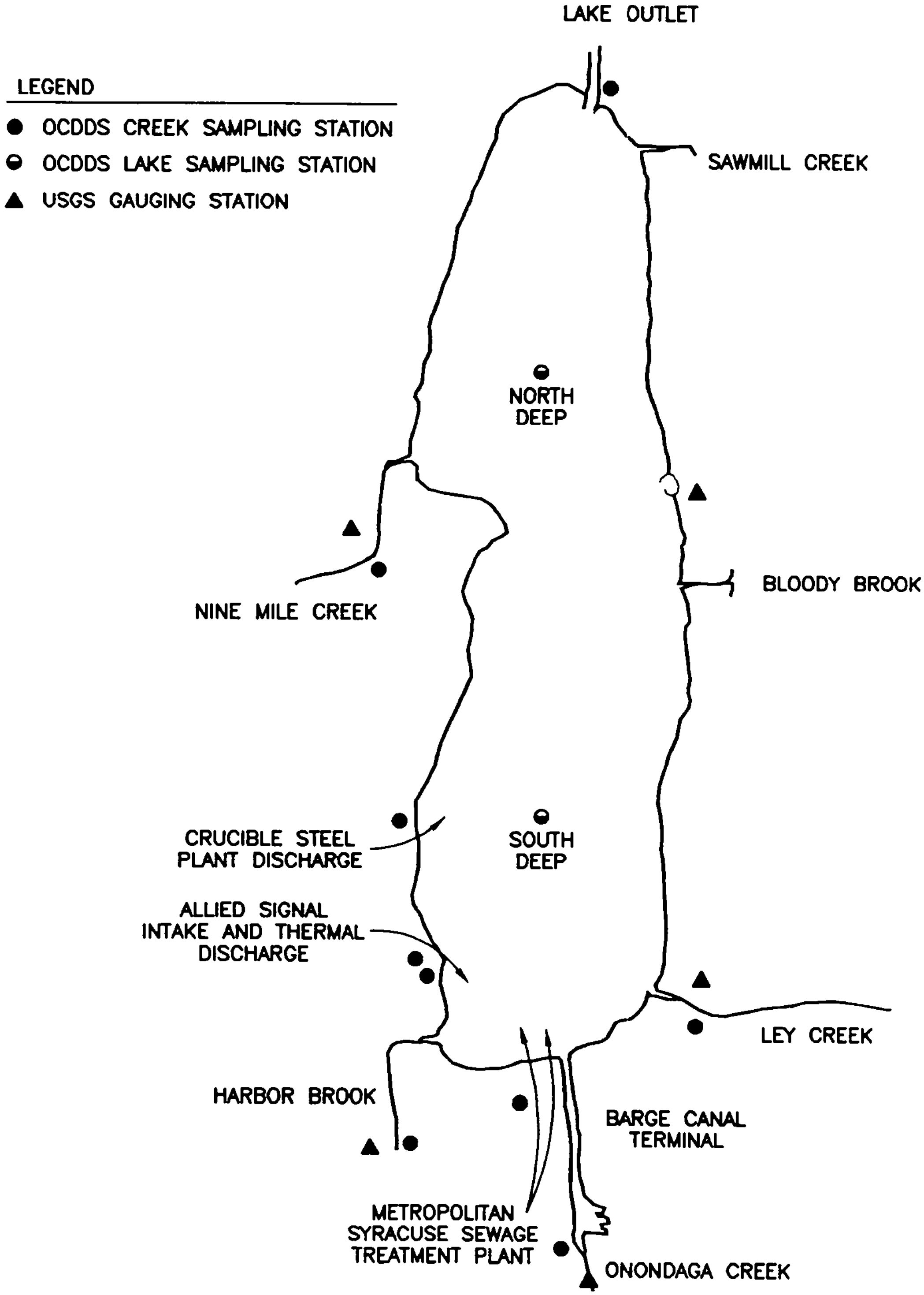
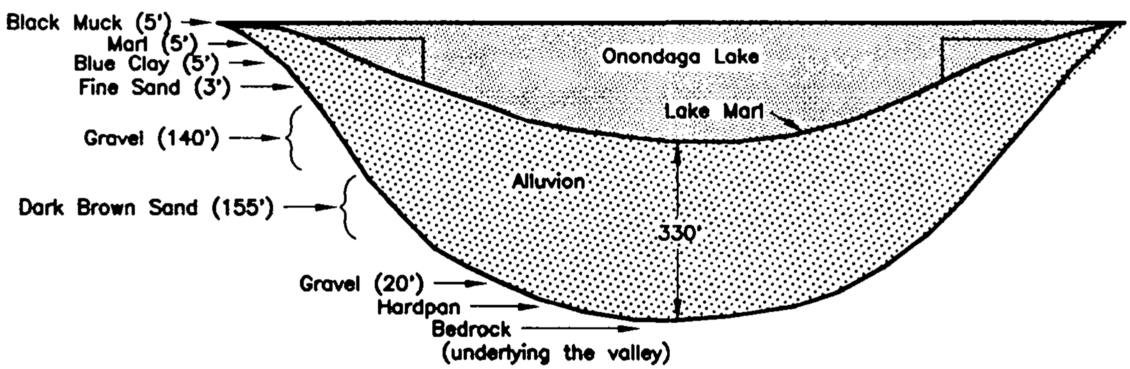
FIGURE 2-27 B
CHLORIDE, SODIUM AND CALCIUM LOAD PARTITIONING, 1990-1994



Stearns&Wheler ENVIRONMENTAL ENGINEERS & SCIENTISTS	DRAFT ENVIRONMENTAL IMPACT STATEMENT ONONDAGA COUNTY DEPARTMENT OF DRAINAGE AND SANITATION
DATE: 1/11/96 JOB No.: 2298	FIGURE 2-28 TRIBUTARY MONITORING STATIONS FOR ONONDAGA LAKE



DRAWING NOT TO SCALE

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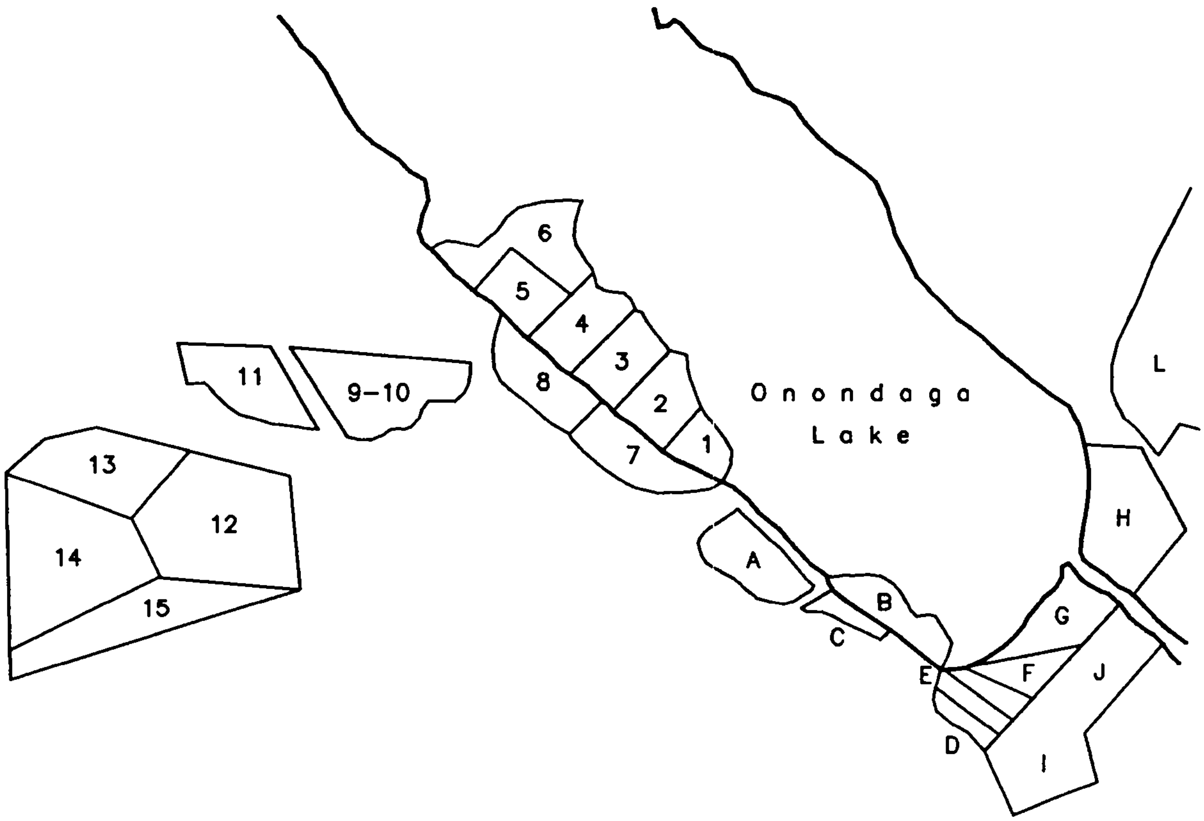
DATE: 1/11/96 JOB No.: 2298	**FIGURE 2–29** **CROSS SECTION OF SEDIMENT UNDERLYING THE SOUTHEASTERN END OF ONONDAGA LAKE**



Adapted from: Blasland and Bouck, 1989

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FIGURE 2-30
AREAL DISTRIBUTION OF SOLVAY
WASTE DEPOSITS

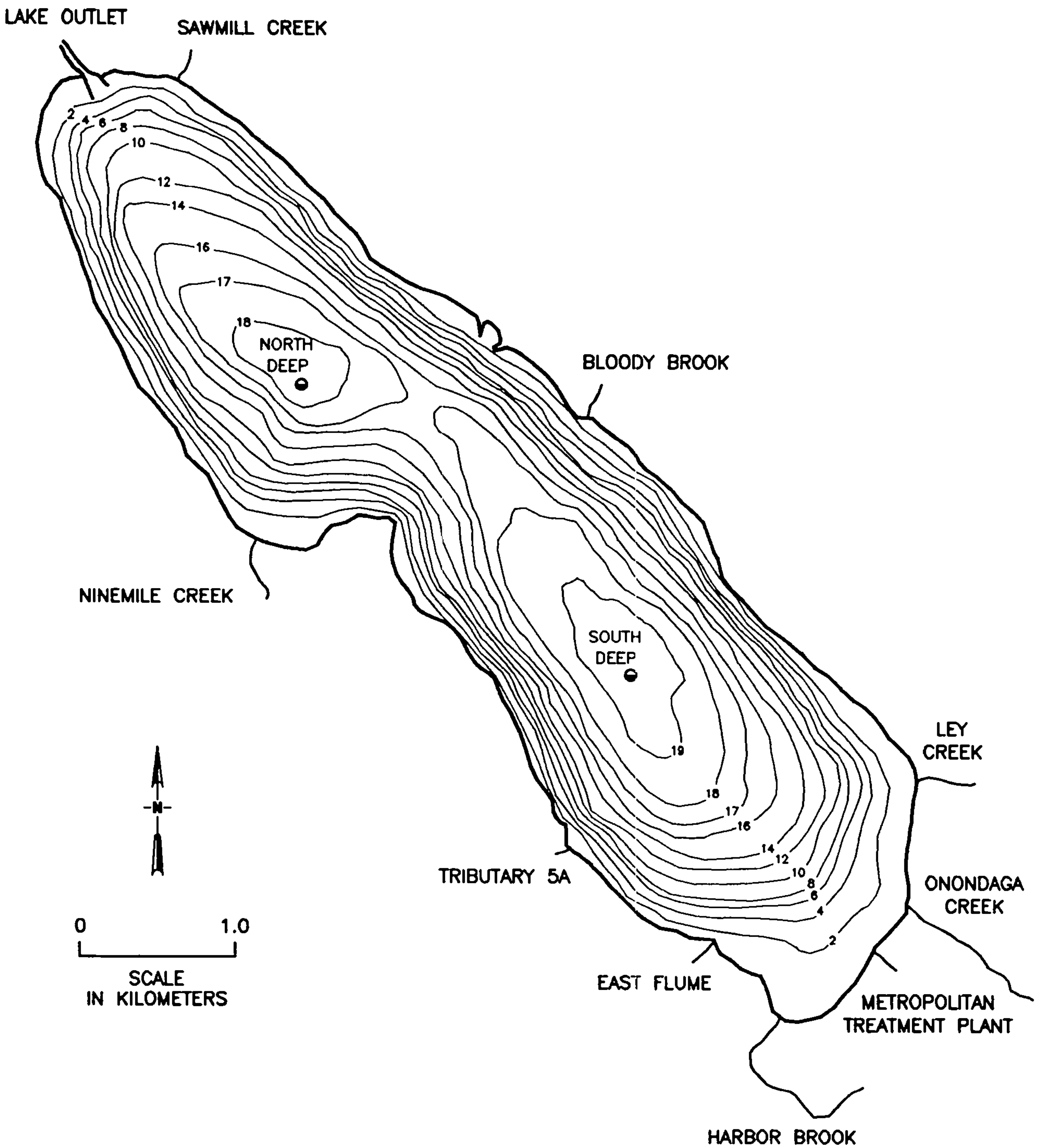

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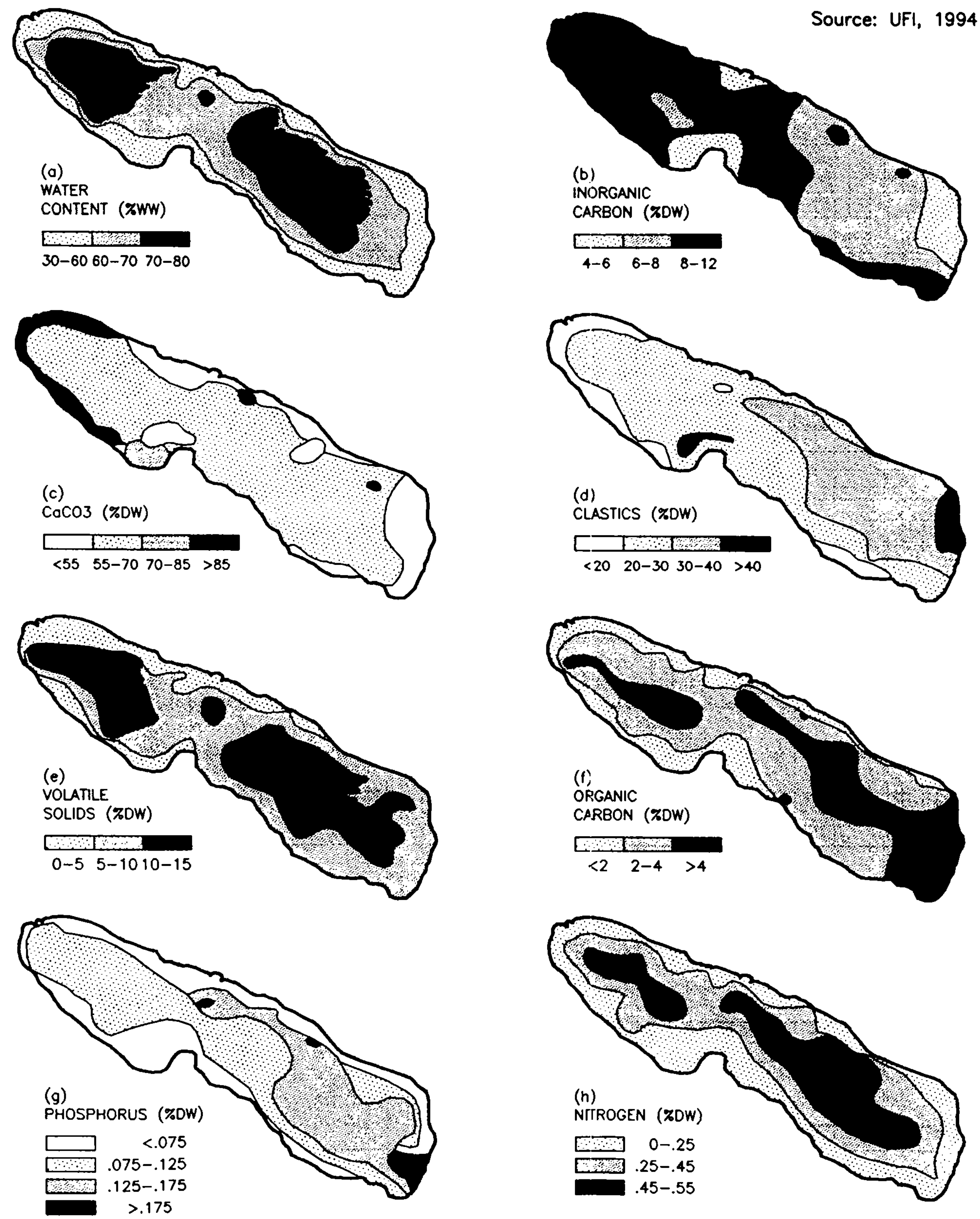
FIGURE 2-31
BATHYMETRIC MAP OF ONONDAGA LAKE



(%DW) - DRY WEIGHT
(%WW) - WET WEIGHT

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FIGURE 2-32
ONONDAGA LAKE BOTTOM SEDIMENT COMPOSITION

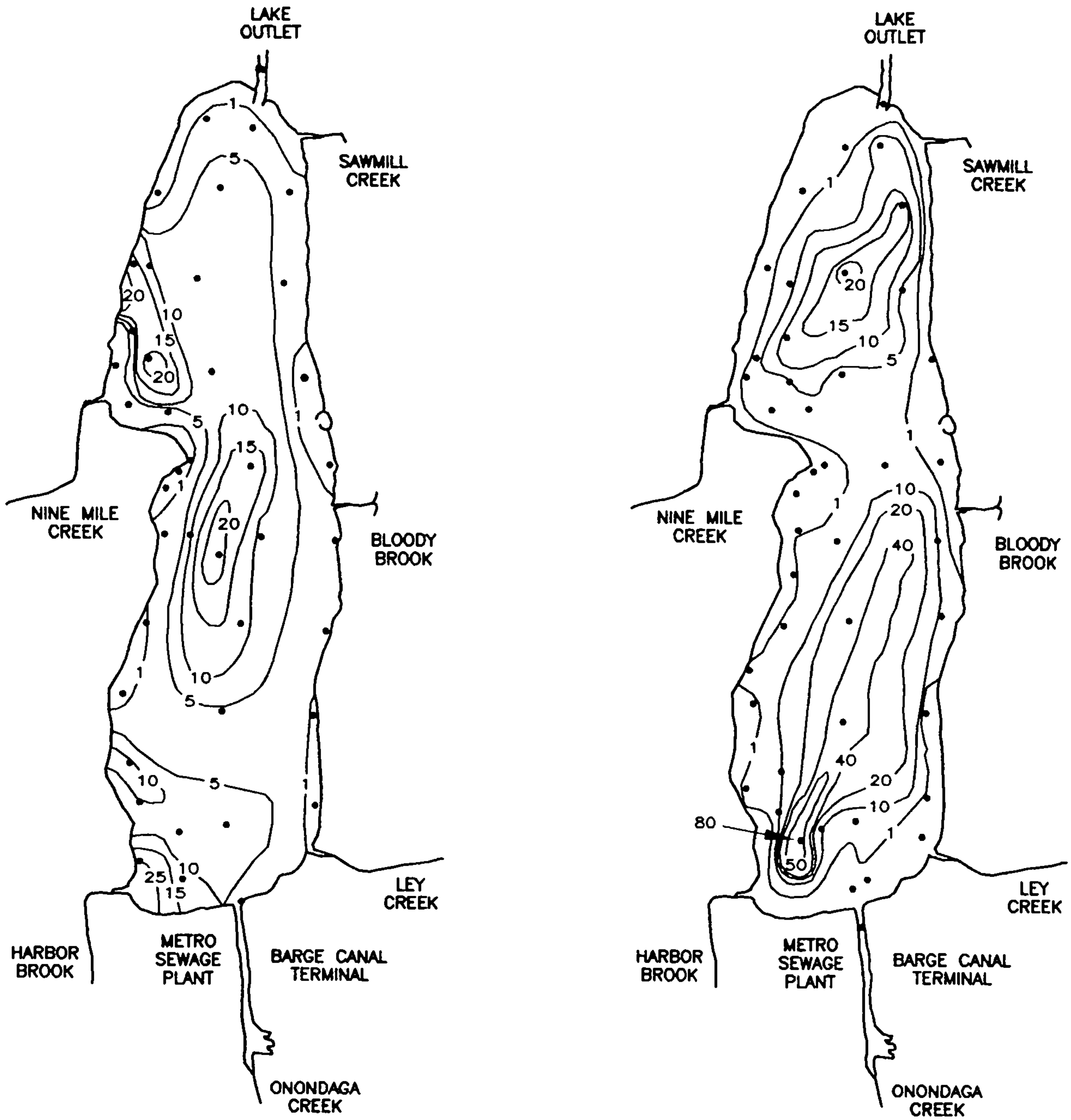

DIAGRAM A
3 INCHES BELOW SURFACE IN 1972
(Source: USEPA, 1973)

DIAGRAM B
0–3 INCHES DEPTH INTERVAL IN 1986
(Source: NYSDEC, 1989)

• – SAMPLING STATIONS

0 1,000 2,000
SCALE (M)

Figure Adapted From: UFI, 1994

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DATE: 1/11/96 JOB No.: 2298	**FIGURE 2–33a TOTAL Hg CONCENTRATIONS (mg/kg DRY WEIGHT), ONONDAGA LAKE SEDIMENTS**

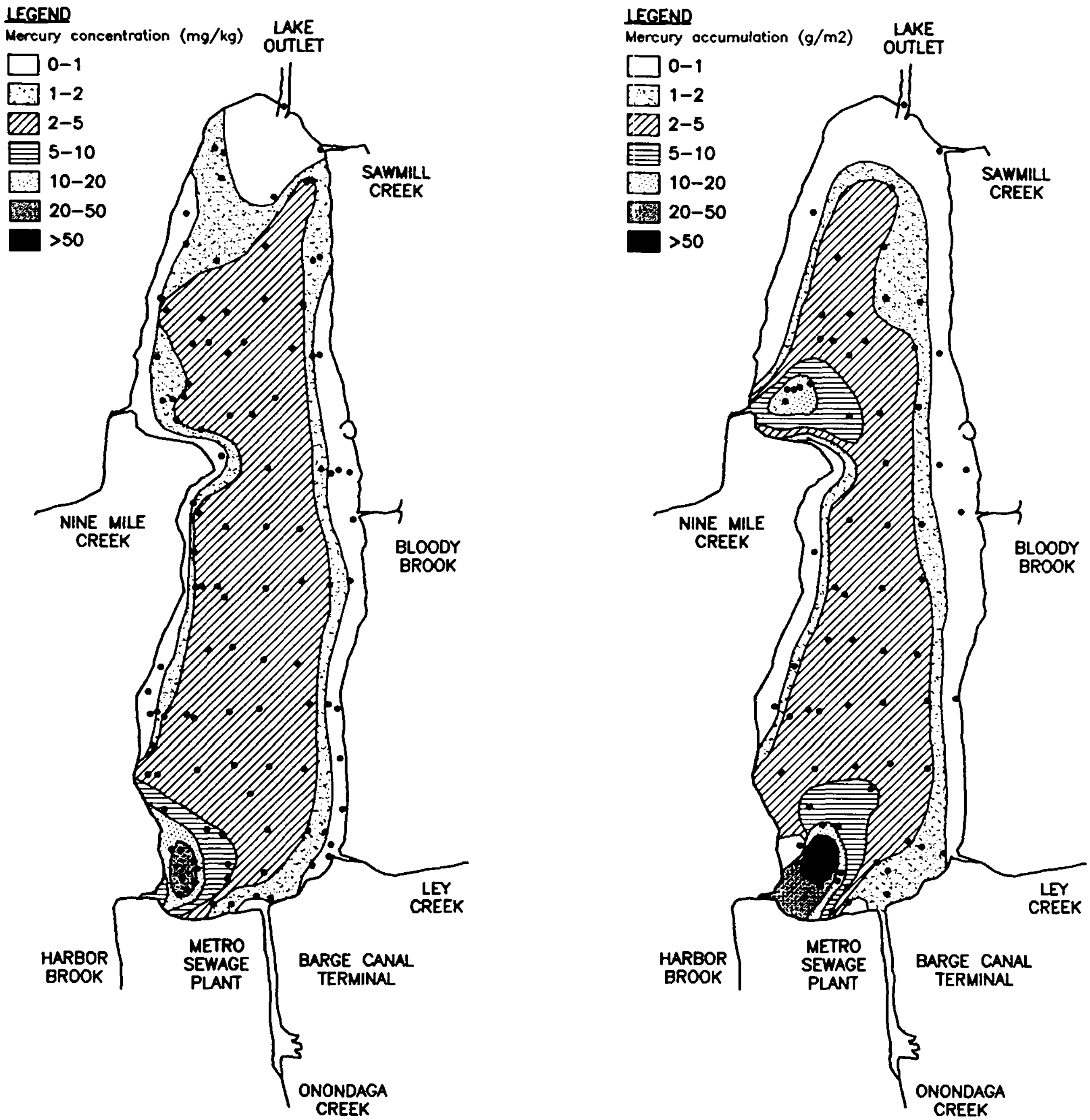

DIAGRAM A
MECURY CONCENTRATIONS IN SURFACE SEDIMENT, 0-2 CM DEPTH

DIAGRAM B
TOTAL ANTHROPOGENIC MERCURY ACCUMULATION

• – SAMPLING STATIONS

0 1,000 2,000
SCALE (M)

Source: Klein and Jacobs 1995

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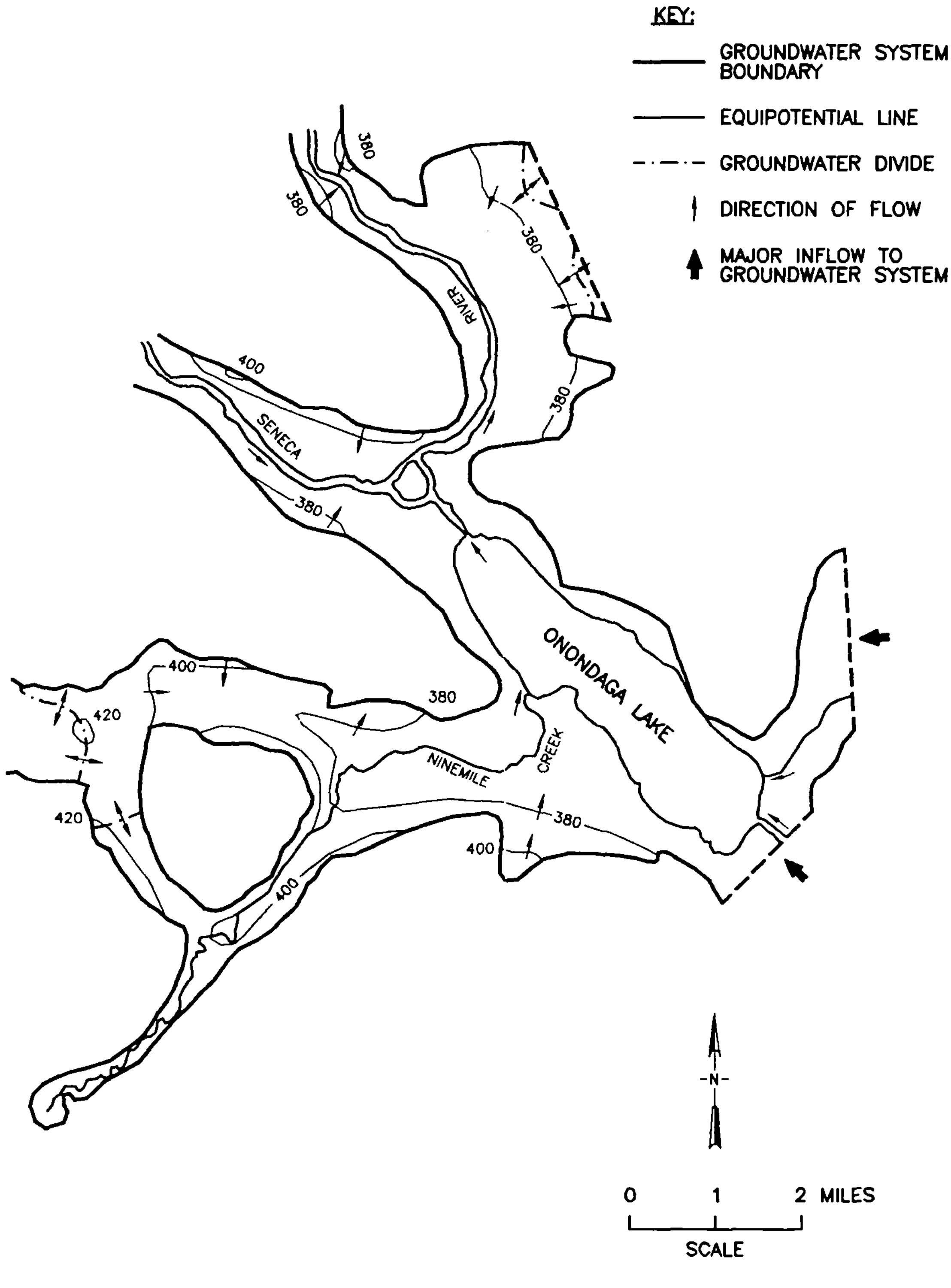
FIGURE 2-33b
RESULTS OF 1992 SEDIMENT MERCURY ANALYSIS BY PTI



Adapted from: Cosner, 1984

Stearns&Wheler ENVIRONMENTAL ENGINEERS & SCIENTISTS	DRAFT ENVIRONEMTAL IMPACT STATEMENT ONONDAGA COUNTY DEPARTMENT OF DRAINAGE AND SANITATION
DATE: 1/11/96 JOB No.: 2298	FIGURE 2-34 POTENTIOMETRIC SURFACE AND DIRECTION OF FLOW OF GROUNDWATER IN THE BALDWINSVILLE AQUIFER

CHAPTER 3 - ALTERNATIVES CONSIDERED
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CHAPTER 3

ALTERNATIVES CONSIDERED

3.0 GENERAL

The development and screening of METRO and CSO engineering alternatives has occurred over the past seven years in parallel with the development and refinement of water quality models for Onondaga Lake and the Seneca River. The alternatives were evaluated for their effectiveness in addressing the contribution of METRO and CSO discharges to contravention of ambient water quality standards. This parallel schedule was established in the Judgement on Consent jointly executed by Onondaga County, NYSDEC and the Atlantic States Legal Foundation in January 1989.

Appendix C-2 provides a detailed discussion of the history of the development and screening of alternatives which preceded the preparation of this Municipal Compliance Plan. In brief, these prior efforts have focused on comparative evaluation of continued discharge of METRO effluent to Onondaga Lake and complete (or partial) diversion of the METRO discharge to the Seneca River. Analysis of these alternatives was performed using the water quality models developed by UFI as well as water quality models developed by HydroQual, Inc. in connection with the AlliedSignal RI/FS.

As discussed in Chapter 2, the water quality models have identified the METRO discharge as the primary factor contributing to the exceedance of ambient water quality standards for ammonia in Onondaga Lake. Exceedance of the water quality standard for ammonia is a contributing factor to impairment of the use of the lake for fishing, in particular, protection of water quality suitable for fish propagation. Monitoring data indicate that the METRO discharge is responsible for approximately 90 percent of the total mass loading of ammonia influent to the lake. For this reason upgrading of the METRO plant for year-round ammonia removal is required.

To a much lesser extent, the METRO discharge has also been identified as a contributing factor to the violation of ambient water quality standards for dissolved oxygen (DO). Water quality model results indicate that DO concentrations in Onondaga Lake can be expected to improve only slightly even with complete removal of the METRO discharge. Sediment oxygen demand, as impacted by background water chemistry, urban and rural non-point source pollution, and residuals from past municipal and industrial waste disposal practices, appears to be the most significant factor impacting DO conditions in the lake.

In recognition of the complexity of the water quality issues facing Onondaga Lake and the importance of other non-County related water quality remediation efforts, a strategy involving the phased implementation of METRO and CSO improvements has been developed. The strategy is based on the phased TMDL approach to water quality improvements which is used by USEPA in those cases where immediate compliance with water quality standards cannot be attained. The phased strategy for Onondaga Lake provides for the remediation of water quality impacts associated with the METRO and CSO discharges in parallel with other non-County related lake remediation efforts. This strategy also takes into consideration the principles set forth in the policy adopted by the Onondaga County Legislature on August 7, 1995. Elements of the phased approach include the following:

1. Modification of the METRO SPDES discharge permit to establish an immediate "cap" on phosphorus and ammonia mass loadings discharged to Onondaga Lake. The "caps" will freeze ammonia mass loadings discharged to Onondaga Lake and capture phosphorus reductions accomplished by METRO above and beyond current SPDES permit requirements.

2. Implementation of a series of interim and intermediate projects to address the impacts of CSO discharges and compliance with water quality standards for bacteria and floatable solids in Onondaga Lake and the tributaries. Evaluations will be performed for CSO facilities to determine their effectiveness and adequacy with respect to compliance at the end of the intermediate phase.

3. Implementation of a series of interim and intermediate projects involving improvements to METRO which include expansion of flow capacity, upgrade for year-round ammonia removal, permanent chemical storage and feed facilities for phosphorus removal and effluent dechlorination.

4. A long-term water quality monitoring and assessment program (including biological and chemical measurements) designed to collect information necessary to resolve issues relating to conceptual long-term alternatives which involve further reduction of phosphorus or relocation of the METRO discharge.

5. Implementation of a demonstration project to assess the technical feasibility and determine the costs and environmental impacts of hypolimnetic oxygenation, suggested by USEPA as a means of improving in-lake dissolved oxygen conditions until such time as decisions on long-term alternatives can be made.

The decision to defer complete or partial diversion of the METRO discharge to the Seneca River has been made due to the minimal environmental benefit expected in relation to the significant cost involved, as well as due to concern for potential adverse environmental impacts on the Seneca River where wastewater assimilation capacity has been significantly impacted by zebra mussels.

Water quality projections made using the approved UFI water quality models for Onondaga Lake indicate that only slight improvement in dissolved oxygen concentrations and water clarity can be expected even with complete diversion of the METRO discharge. Continued violation of the minimum water quality standard for dissolved oxygen can be expected in the lower waters of the lake during the period of summer stratification. Lake-wide oxygen depletion during fall mixing is projected as well, with violations of minimum DO standards in at least some years in the upper waters during fall turnover conditions. Exceedances of the ambient water quality guidance value for phosphorus are also anticipated even with complete diversion. Although the water quality model results indicate that summer average phosphorus concentration in the epilimnion may be reduced from 70 μg/l (current conditions) to between 25-30 μg/l with complete diversion, only slight improvement in water clarity is projected. The water quality models indicate that eutrophic conditions will continue in the lake whether the METRO discharge remains in the lake or is diverted to the Seneca River.

3.1 NO ACTION ALTERNATIVE

3.1.1 Effect on Public Need

Under the "no action" alternative, the existing conditions for collection and treatment of the County's municipal wastewater would continue. METRO effluent would continue to be discharged to the lake's upper waters at current levels of treatment for phosphorus, ammonia, BOD, solids, and the other permitted parameters. However, actions by others could result in changes to METRO performance and mass loading even under the "no action" alternative. Industrial pretreatment at Bristol-Myers Squibb, for example, will result in lower mass loading of ammonia to the treatment plant, which will in turn reduce loading to the lake. With no action, the existing 66 CSOs would continue to discharge to Onondaga Creek, Harbor Brook, and Ley Creek during and immediately following wet weather. Impairment of waters for their designated use would continue.

The 1989 consent order effectively precludes consideration of a "no action" alternative. Fines could be imposed by the court for failure to produce a viable plan to bring the County's wastewater treatment and collection system into compliance with state and federal requirements.

In addition, METRO is currently operating at or near its design capacity. Therefore, a "no action" alternative would not provide treatment capacity for future residential or industrial growth within the service area. For these reasons, the "no action" alternative is not considered to be a viable option to meet the wastewater collection and treatment needs of Onondaga County.

3.1.2 Effect on the Community

Without implementation of a municipal compliance plan, the community would be subject to legal action and potential fines. This social impact may represent the most significant community-level impact of the "no action" alternative. The lake has been degraded for much of this century; community perceptions, activities, and investments have developed accordingly.

Water quality-related impacts of the "no action" alternative on the community are more likely to occur from continued CSO discharges than from continued METRO discharges to the lake. Public health and aesthetic impairment of use by continued CSOs would limit options for development of the Onondaga Lake waterfront. Continued impairment of the resource by ammonia would limit reproductive success of certain lake fishes. Without resolution of the mercury and PCB contamination of the fishery, the lake fishery will remain a non-consumptive "catch and release" fishery.

3.1.3 Effect on the Environment

The need for action regarding METRO and the CSOs is related to current water quality conditions in Onondaga Lake and its tributaries. As described in Section 2.1.2B.2 of Chapter 2, the water quality of Onondaga Lake is significantly degraded by industrial residuals and the discharges from METRO and the CSOs. The lake is not in compliance with state and federal requirements that support human water contact recreation and protection and propagation of fish, shellfish, and wildlife. Moreover, the lake is not in compliance with New York State ambient water quality standards for ammonia, nitrite, DO, and bacteria. In July 1995, the New York State Department of Health designated the lake as a public health hazard based on contamination of the lake fishery by mercury and PCBs and the elevated concentrations of bacteria following storms.

The "no action" alternative essentially preserves current water quality conditions. METRO would remain at its existing permitted flow capacity of 80 mgd (12-month rolling average flow). Reductions in influent loading projected from implementation of pretreatment at Bristol-Myers Squibb (detailed in Chapter 3, Section 3.1B of the MCP) will influence METRO performance and Onondaga Lake water quality. The UFI models have been run to project lake water quality impacts of a "no action" alternative. Model inputs for the no action alternative (with a range of assumptions regarding performance of Bristol-Myers Squibb pretreatment) are summarized in Table 3-1. Model results are graphed in Figure 3-1 (total P), Figure 3-2 (ammonia N), and Figure 3-3 (dissolved oxygen). Note that continued exceedances of the New York State ambient water quality standard for ammonia are predicted despite implementation of pretreatment at Bristol-Myers Squibb.

Moffa & Associates applied the USEPA stormwater management model (SWMM Version 4) to the County CSO system to predict the loading of bacteria and solids to the lake under simulated rainfall regimes. Once annual loads were simulated, the UFI bacteria model was applied to predict the in-lake response in units of bacteria cells per water volume. Under existing conditions (the "no action" alternative), the models predict an average of 21 bacteria events in the southern lake basin (defined as greater than 200 colony forming units per 100 ml of water) per recreational season. The "no action" alternative does not address this use impairment.

3.2 THE PHASED TMDL PROCESS

For the past seven years, Onondaga County and New York State have been in the process of evaluating current water quality conditions of the lake and the Seneca River, model predictions of the water quality impacts of implementation of management alternatives, project costs, and environmental benefits derived from public funds invested. Onondaga Lake presents a challenge to both the state and County. The water quality impairment issues are complex and interwoven with industrial waste remediation issue. The costs for improvements to the wastewater collection and treatment infrastructure are high. Water quality model projections indicate that no management alternative considered, even complete diversion of METRO to the Seneca River, would attain the lake's designated uses. Moreover, diversion to the Seneca River was made more complex and costly when the zebra mussels effectively eliminated the river's assimilative capacity for treated wastewater.

NYSDEC has adopted a phased approach to improvements of the County's wastewater collection and treatment system. The strategy is patterned after the phased Total Maximum Daily Load (TMDL) process developed by USEPA to guide water quality-based decisions such as those facing Onondaga County and New York State.

The phased TMDL process provides a conceptual basis and series of procedures for states to meet the requirements of the Clean Water Act, Section 303(b). The process is used to develop and implement maximum pollutant loadings to water bodies where water quality standards cannot be achieved by implementation of technology-based controls on inputs. Loads are reduced in an iterative manner, and progress towards meeting water quality goals and attaining uses is monitored. The strategy is a valuable management tool for dealing with water bodies with both point and non-point sources of pollution.

A series of actions (reductions in pollutant loadings) and evaluations (long-term monitoring focused on use attainment and compliance with ambient water quality standards) is planned for Onondaga County under this strategy. Interim and intermediate improvements to both METRO and the CSOs are proposed. The approach provides for the phased implementation of METRO and CSO improvements in parallel with timetables for remediation of the non-County issues, such as fish contamination and habitat degradation; allows for continual evaluation of progress towards attaining designated use in Onondaga Lake; and mitigates the economic impact to the community.

The proposed interim and intermediate actions are discussed in detail in the MCP. Chapter 3 presents detailed descriptions of METRO actions, and Chapter 4, CSO projects. Summary descriptions of the projects are presented in the following section.

3.3 INTERIM AND INTERMEDIATE PROJECTS FOR METRO AND CSOS

3.3.1 METRO Projects

A. Interim METRO Improvements

The goal of the interim METRO improvements proposed by Onondaga County is to optimize METRO performance for further reduction of phosphorus and ammonia loadings using existing process tankage. METRO plant performance will be optimized by implementing a series of capital projects and operational changes at METRO following the court-ordered implementation of industrial wastewater pretreatment by Bristol-Myers Squibb. Phosphorus and ammonia loading reductions accomplished during this phase will be captured by modification of the SPDES discharge permit.

The following provides a brief description of the projects which comprise the interim phase improvements proposed for METRO. More detailed descriptions of the proposed projects may be found in Chapter 3 of the MCP.

A1. **METRO Operating Changes.** Operation and maintenance strategies will be modified to maximize ammonia removal performance using existing facilities. Additional monitoring will be performed to prepare a complete plant mass balance for phosphorus and ammonia. The mass balances will be used to assess the relative importance of phosphorus and ammonia loadings received from outside sources and sludge return streams, as well as to guide decisions on operating changes.

A2. **METRO Digital System Improvements.** A new computer system will be provided to replace the existing digital system which is outdated and lacks capacity to accommodate the additional instrumentation required for ammonia removal process control.

A3. **Residuals Handling and Odor Control Improvements.** This capital project involves upgrading the wastewater screenings and grit removal systems at METRO, as well as installing an odor control system.

A4. **Digester Modifications and Mechanical Sludge Thickening Improvements.** This project involves conversion of the secondary digester for use as a primary digester to increase anaerobic sludge digestion capacity and improve sludge stabilization and dewaterability. In addition, the County will evaluate mechanical sludge thickening as an option for improving sludge thickening performance in anticipation of operation for ammonia removal.

A5. **Other Plant Improvements.** This project consists of plant improvements necessary to correct design deficiencies, improve worker safety, and replace or repair deteriorated equipment.

A6. **Permanent Phosphorus Removal Facilities.** Temporary chemical storage and feed facilities will be replaced with permanent facilities designed for compliance with New York State bulk chemical storage regulations.

B. Intermediate METRO Improvements

The intermediate METRO improvements are intended to address the issues of wastewater treatment capacity, ammonia removal and effluent dechlorination. The series of intermediate improvements is summarized below. Details of the intermediate projects, basis of design, and cost estimates are presented in Chapters 3 and 5 of the MCP.

B1. **Acquisition of Niagara Mohawk Property.** Acquisition of this property to provide necessary space required for the construction of additional process tankage.

B2. **Relocation/Consolidation of Sewer Maintenance Group.** Relocation of this group to the Ley Creek pump station site will make additional land available for the construction of process tankage necessary for upgrading METRO.

B3. **Plant Upgrade/Ammonia Removal Demonstration.** The County proposes to construct additions and modifications to one quarter of the METRO plant that will provide for a side-by-side demonstration of the performance capabilities and process reliability of conventional and advanced ammonia removal technologies. Information obtained from the side-by-side demonstration will be used to select the appropriate technology and determine final design criteria for subsequent use in full-scale plant upgrading. In conjunction with the one-quarter plant upgrade, the existing mechanical surface aerators at METRO will be replaced with a new cost-efficient fine bubble diffused aeration system. The mechanical aerators which have been in operation for 17 years and are near the end of their useful life.

B4. **Ammonia Removal Demonstration.** Following construction of the one-quarter plant upgrade, the facilities will be operated for a period of three years, during which time performance monitoring and testing will be performed. Testing will be performed to examine the impacts of wet weather conditions on nitrification performance in activated sludge treatment systems with and without fixed-film media. The three years of testing will result in 24 months of monitoring data that will be used to determine appropriate modification of the SPDES discharge permit limit for ammonia.

B5. **Process Selection and Development of Final Design Criteria**. The results of the performance testing will be used to determine the ammonia removal capabilities of conventional activated sludge treatment, as well as the extent of fixed-film media needed to enhance ammonia removal for consistent compliance with the proposed SPDES permit effluent ammonia limits of 4 mg/l (as NH_3) for November through May and 2 mg/l (as NH_3) for June through October. Based upon the information obtained from the ammonia removal demonstration project, final design criteria will be determined for subsequent full-scale upgrade of the METRO plant.

B6. **Full-Scale Plant Upgrade.** A full-scale upgrade of the METRO plant for year-round ammonia removal will be required to ensure compliance with ambient water quality standards in the receiving water. Progress towards remediation of other non-County issues impacting restoration of the fishery will be assessed prior to moving ahead with the full-scale plant upgrade. The full-scale upgrade is anticipated to utilize fixed-film media to enhance nitrification in the existing aeration tanks.

C. Hypolimnetic Oxygenation

The County will perform a demonstration project with monetary assistance and oversight by USEPA to assess the technical feasibility and determine the costs and environmental impacts associated with hypolimnetic oxygenation for Onondaga Lake. Hypolimnetic oxygenation has been suggested by USEPA as a possible means of improving dissolved oxygen concentrations in Onondaga Lake until such time as further information is available to resolve uncertainties regarding the need for additional phosphorus removal and/or relocation of the METRO discharge. The scope of the demonstration project, which is scheduled to be performed in parallel with METRO interim improvements, will focus on resolving concerns related to technical issues, cost estimates, and potential environmental impacts raised in connection with the conceptual design developed by the U.S. Army Corps of Engineers.

It is intended that the results of the demonstration project, if successful, will be used to establish the basis for full-scale implementation, which is anticipated to follow in parallel with intermediate METRO improvements. The County's responsibility to participate in full-scale hypolimnetic oxygenation will be limited to the relative contribution of the METRO discharge to dissolved oxygen depletion in the hypolimnion. At present, this responsibility appears to be relatively small based on the water quality model results which indicate only slight improvement in dissolved oxygen concentrations even with complete diversion of the METRO discharge.

A more detailed discussion of hypolimnetic oxygenation, as conceived by USEPA and the U.S. Army Corps of Engineers, is presented in Chapter 3 of the MCP.

3.3.2 CSO Projects

A. Interim Projects

Interim projects for CSO remediation focus on demonstration of abatement technologies and compliance with the BMP requirements of the SPDES permit recently publicly noticed by NYSDEC Region 7. Interim projects designed to meet these objectives are summarized below. Additional details regarding engineering design criteria, implementation timetables, and costs are presented in Chapters 5 and 6 of the MCP.

Demonstration projects at Hiawatha Boulevard and Newell Street are planned to test the efficacy of vortex separation, disinfection, and the incremental loading reductions achieved by storage. An innovative technology (EquiFlow™ System in conjunction with constructed wetland treatment) is proposed for Harbor Brook.

BMP efforts are designed to improve the operation of the combined sewer system and further reduce the frequency and duration (and consequently, volume) of overflow events. These BMP measures have been included in the interim phase (implementation within five years) because of the high benefit to cost ratios. Moreover, the measures are consistent with the state and federal CSO strategies.

BMP measures include the following:

A1. **Upgrade the Erie Boulevard Storm Sewer (EBSS).** The EBSS needs aboveground sluice gate controls and an updated SCADA system in order to function. Discharge from a 90 percent storm can be contained in the EBSS; flows will be routed to METRO when the treatment plant can receive and process the flow.

A2. **Upgrade the Kirkpatrick Street Pump Station.** Recent investigations have demonstrated that this pump station and associated force main constitute a significant obstruction for wet weather flows in the Hiawatha Boulevard CSO basin. Therefore, upgrade of this facility will provide a significant reduction in CSO discharges. The existing force main will be redirected from the main interceptor system to the METRO headworks, which will serve to maximize flows to the treatment plant.

A3. **Evaluate Integrity of Siphons.** Any defects in the many siphons crossing Onondaga Creek and Harbor Brook (some of which are 70 to 80 years old) may contribute to stream infiltration to the collection system or sewage exfiltration to the stream. An interim action is consequently proposed for the County to evaluate and make necessary repairs to siphons.

A4. **Evaluate Potential for Toxic Discharges from CSOs.** The County plans to design and implement a program to evaluate potential toxic discharges from CSOs. A limited number of points within the collection system will be sampled and assayed for biological toxicity, after dilution with the overlying water. If potentially toxic conditions are detected, source control measures (more aggressive pretreatment limits) or specific remedial measures will be evaluated.

A5. **Implement Control of Floatables.** Various technologies, including netting, (e.g., TrashTrap™), regional treatment facilities, and a floatables boom are proposed to control floatables. These actions will greatly reduce the aesthetic impacts of CSOs and provide additional fish and wildlife benefits.

B. Intermediate Projects.

Intermediate CSO projects are proposed based on their environmental benefit to cost ratio, geographical coverage, additional reduction in floatables, and ability to improve bacteria quality of Onondaga Lake. The major focus of the intermediate phase program is abatement of CSO discharges to Onondaga Creek. Regional treatment facilities at Midland Avenue and Clinton Station, and additional floatables control at Franklin Street and Maltbie Street are proposed. Sixteen smaller CSO drainage basins will be separated in this phase.

3.4 CONCEPTUAL LONG-TERM ALTERNATIVES

3.4.1 General

The actions planned for METRO and the CSOs during the interim and intermediate phases are designed to bring these discharges into compliance with state requirements. The County has incorporated a monitoring and assessment program (including biological and chemical measurements) into its MCP, along with the METRO and CSO improvements. Based on the results of the monitoring and assessment program, additional actions may be required. In this section, we introduce conceptual long-term alternatives that might be considered if additional actions are required. These conceptual long-term alternatives include actions at METRO and the CSOs. None of the conceptual long-term alternatives are precluded by the interim and intermediate actions.

The TMDL strategy will continue to provide the framework for assessing the need for additional actions. Criteria to evaluate the need for additional reductions in pollutant inputs to the lake will include consideration of the following:

1. Assessment of the classification and use of the lake and its tributaries, and changes to ambient water quality standards.

2. Progress towards resolution of the NPL (lake sediment contamination) issues.

3. Availability of monitoring data and predictive modeling tools.

4. Assessment of sources of pollution, including an improved estimate of the relative magnitude of non-point source phosphorus loads.

5. Biological monitoring results indicating the presence and magnitude of toxic substances within the lake's fishery.

6. Improvements in species composition and diversity in Onondaga Lake's phytoplankton, zooplankton, and fish.

7. Advances in treatment technologies.

8. Assessment of the condition of METRO

9. Affordability and cost/benefit of additional controls.

10. Assessment of legal and regulatory requirements.

11. Assimilative capacity of alternate receiving waters (e.g., status of zebra mussel impacts on the Seneca River).

3.4.2 METRO Long-Term Conceptual Alternatives

Several long-term alternatives for METRO have been developed conceptually and include the following:

1. Upgrading of METRO to incorporate effluent filtration for "state-of-the-art" phosphorus removal.

2. Relocation of the METRO plant outfall for oxygenated deepwater discharge to the lake or for discharge to the Seneca River.

3. Reduction of influent wastewater flows by diversion to other County-owned wastewater treatment facilities either alone or in combination with effluent diversion.

The following sections provide a brief description of these conceptual long-term alternatives. Implementation of interim and intermediate improvements will not preclude future implementation of any of the long-term alternatives.

A. Effluent Filtration for "State-of-the-Art" Phosphorus Removal

The current practice of chemical addition at METRO constitutes the "Best Treatment Technology" (BTT) for phosphorus removal as defined in Technical and Operational Guidance Series

(TOGS) 1.3.6, published by the NYSDEC Division of Water in reference to phosphorus removal requirements for wastewater discharges to lakes and lake watersheds. Treatment for phosphorus removal is presently accomplished at METRO by chemical precipitation using ferrous sulfate. Ferrous sulfate is added to the return activated sludge force mains for precipitation of phosphorus in the activated sludge treatment system. Ferrous chloride is also added at several points in the wastewater collection system for odor control. Based on the results of the phosphorus removal study, it appears that the addition of iron salts to the collection system for odor control also contributes to phosphorus removal at the METRO plant.

Monthly average METRO effluent phosphorus concentrations typically range from approximately 0.4 mg/l to 0.8 mg/l (Figure 1-11 of the MCP). Effluent phosphorus concentrations increase with increasing effluent suspended solids concentrations and increasing wastewater flows as presented in Figures 3-4 and 3-5, respectively. These relationships illustrate the importance of clarifier design on suspended solids capture and phosphorus removal.

The METRO phosphorus removal performance data are also consistent with data reported by USEPA for municipal wastewater treatment facilities located in the Chesapeake Bay drainage basin (USEPA, September 1987). The USEPA data indicate phosphorus removal performance capabilities for municipal wastewater treatment facilities utilizing activated sludge treatment systems as shown in Table 3-2.

Effluent phosphorus concentrations can be reduced to less than 0.2 mg/l with tertiary filtration. This represents the current "state-of-the-art" with respect to phosphorus removal for municipal wastewater treatment facilities. The cost of adding effluent filtration at METRO will be significant. Preliminary estimates indicate a project cost of approximately $70 million for tertiary filtration facilities. As discussed previously, current water quality model results indicate that compliance with NYSDEC's phosphorus guidance value cannot be attained even with complete diversion of the METRO discharge.

B. METRO Outfall Relocation

B1. **Hypolimnetic Discharge to Onondaga Lake.** Relocation of the METRO outfall for discharge to the hypolimnion of Onondaga Lake was presented as an alternative in the April

1994 Draft MCP/DEIS submittal by Onondaga County to NYSDEC. Interest in this alternative developed in response to the 1993 discovery of adverse water quality impacts in the Seneca River caused by zebra mussels. The zebra mussel infestation depleted the available waste assimilative capacity in the river, resulting in the requirement for tertiary effluent filtration, at significant cost, for a river discharge.

Discharge of oxygenated METRO effluent to the hypolimnion of Onondaga Lake represents a potential means of avoiding further adverse impact on water quality in the Seneca River while improving water quality conditions in the lake. The principal concept of the alternative involves addressing the depletion of dissolved oxygen concentrations in the upper waters during fall turnover by providing oxic conditions in the hypolimnion during the period of lake stratification. Oxygen demand resulting from the accumulation of reduced species, such as hydrogen sulfide and methane, during the period of lake stratification is the cause of dissolved oxygen depletion in the upper waters of Onondaga Lake during fall turnover conditions. Provision of oxic conditions would prevent this phenomenon from occurring. In addition, relocation of the METRO discharge to the hypolimnion would reduce phosphorus and ammonia concentrations in the epilimnion.

B2. **Discharge to the Seneca River.** Relocation of the METRO discharge from Onondaga Lake to the Seneca River is an alternative which was discussed in the draft MCP/DEIS document submitted to the NYSDEC by Onondaga County in April 1994. Diversion of the METRO discharge may be accomplished by conveyance of the METRO plant effluent to the Seneca River alone (i.e. "complete diversion") or in combination with the partial diversion of METRO influent to the Baldwinsville-Seneca Knolls wastewater treatment plant (i.e. "split total diversion").

The results of an evaluation performed by the NYSDEC indicated that the wastewater assimilative capacity of the Seneca River is adversely impacted by an infestation of zebra mussels located upstream of the Baldwinsville-Seneca Knolls sewage treatment plant. As a result, NYSDEC has determined that an "oxygen neutral" discharge would be required for METRO to discharge to the river.

The term "oxygen neutral" has been defined by NYSDEC as the most stringent level of treatment required for a municipal wastewater treatment facility. In terms of permit limits for METRO effluent BOD_5, ammonia and dissolved oxygen, concentrations would be 5 mg/l, 2 mg/l, and 7 mg/l, respectively. In accordance with current SPDES permitting practices, the effluent limits for BOD_5 and ammonia would be imposed as daily maximum concentration limits and the effluent limit for dissolved oxygen would be imposed as a daily minimum concentration limit. These limits represent the maximum level of treatment which the NYSDEC imposes on municipal wastewater treatment facilities and are more stringent than the effluent limits presently provided for continued discharge to Onondaga Lake. Compliance with these limits would require additional facilities (beyond those proposed for intermediate improvements) for ammonia removal as well as effluent filtration for BOD_5 removal and post aeration to maintain effluent dissolved oxygen concentrations in compliance with the proposed permit limit.

With respect to phosphorus and chlorine residual, NYSDEC has indicated that effluent limitations of 1 mg/l and 0.1 mg/l, respectively, would be acceptable for discharge to the Seneca River. The 1 mg/l limit for phosphorus is based on the Great Lakes Water Quality Agreement and would be imposed as a maximum 30-day average concentration limit in accordance with current SPDES permitting practices. The 0.1 mg/l limit for chlorine residual represents the analytical detection limit for chlorine residual in wastewater effluent and is consistent with current SPDES permitting practices for situations where inadequate effluent dilution is available to establish a measurable effluent limitation based on the current ambient water quality standard (0.005 mg/l). Unlike BOD_5 and ammonia, the effluent limits for phosphorus and chlorine residual would not require any additional facilities at METRO beyond those proposed as intermediate improvements.

Conveyance of the METRO effluent to the Seneca River for discharge would require the construction of an effluent pump station at the METRO plant site and a force main extending approximately 33,500 feet (6.3 miles) from the METRO site to the Seneca River. This length is estimated for a pipeline routing along the eastern shoreline of the lake. The size of the force main would be dependent on the amount of flow to be conveyed. Preliminary sizing indicates the need for a 96-inch diameter force main to convey the peak effluent flow handled at

METRO during wet weather. Reduced sizing may be possible if effluent flows above a certain base flow could be discharged to the lake.

Costs and environmental impacts of the effluent force main would be dependent on the routing chosen. Alternate routes which have been discussed include: (1) along the eastern shoreline of the lake; (2) along the western shoreline of the lake; and (3) through the lake via a pipeline installed on the lake bottom. A detailed evaluation of the costs and environmental impacts of these alternate pipeline routes should be performed if diversion of the METRO discharge to the Seneca River is required in the future.

C. *Influent Flow Diversion*

Diversion of a portion of the METRO influent sewage flow to another County-owned facility where site constraints for expansion were less severe was developed conceptually by Onondaga County as an alternative means of attaining compliance with water quality standards in Onondaga Lake. Based on preliminary water quality model results available in July 1992, the County developed the "partial diversion" alternative which entailed diversion of sewage flows from the Westside service area, along with a baseline flow of 28 mgd from METRO to the County's Baldwinsville-Seneca Knolls sewage treatment plant. This alternative reduced average daily flows influent to METRO by 38 mgd and peak flows by 56 mgd, thereby providing capacity for seasonal nitrification at the METRO plant without the need for expansion of process tankage. When subsequent model revisions indicated that year-round nitrification was required, the partial diversion alternative was modified to incorporate enhanced nitrification utilizing integrated fixed-film activated sludge technology at METRO. The alternative was further modified by the Director of the Onondaga Lake Management Conference, who suggested that the reduced effluent flow from METRO could be diverted to the Seneca River, resulting in "split total diversion."

The discovery of the adverse water quality impacts resulting from infestation of the Seneca River by zebra mussels in 1993 significantly impacted the technical and economic viability of these alternatives. Using the water quality model developed by UFI for the Seneca River, NYSDEC determined that tertiary effluent filtration would be necessary at both the Baldwinsville-Seneca Knolls and METRO facilities to produce an "oxygen-neutral" discharge to the river. As discussed previously with regard to "state-of-the-art" phosphorus removal, effluent filtration represents a significant additional cost impact of approximately $70 million. Remediation of the adverse water quality impact caused by the zebra mussels could avoid this potential expense.

3.4.3 CSO Long-Term Conceptual Alternatives

Long-term alternatives for CSO projects reflect the potential for additional treatment to be required for attainment of water quality goals in the lake and tributaries. The need for additional CSO projects will be evaluated at the end of the intermediate phase based on compliance with ambient water quality standards, changes in regulations on policy regarding CSOs, and cost-benefit considerations.

A. Expansion of Regional Treatment Facilities

The basis of design for the facilities at Clinton and Newell Street is the 90 percent storm. These facilities could be expanded to treat flow up to the one-year storm by construction of additional high-rate treatment devices and disinfection facilities.

B. Addition of Regional Facilities

Additional regional facilities may be constructed based upon either regulatory requirement or demonstrated need to comply with water quality objectives. The Harbor Brook EquiFlow™ facility has been characterized by NYSDEC as an acceptable long-term interim measure for the Harbor Brook Drainage Basin. CSO discharges within the Harbor Brook basin may, in the future, require the construction of conventional high-rate treatment facilities near State Fair Boulevard and Delaware Street. CSO transmission pipelines would be required to consolidate those overflows discharging to Harbor Brook and to route their flow to the aforementioned State Fair and Delaware RTFs. Limited sewer separation would also be required for small or remote CSO basins in the Harbor Brook area with this alternative.

CSO floatables and solids will remain present in the urban segment of Harbor Brook, which has no public access. Additional RFTs may ultimately be required to treat the discharge of the EBSS, Teall Avenue, Franklin, and Maltbie areas. All RTFs will be designed in a manner to allow for subsequent expansion. The extent to which supplemental storage can be provided is limited at a number of RTF sites.

TABLE 3-1

MODEL INPUT FOR RUN DESCRIPTION: NO ACTION WITH BRISTOL TREATMENT BASED ON TENTATIVE FINAL LIMITS
Draft Environmental Impact Statement
Onondaga County, New York

BEST CASE SCENARIO

MONTH	METRO Q (MGD)	METRO TP (MG/L)	METRO TKN-N (MG/L)	METRO NH_3-N (MG/L)	METRO NO_x-N	METRO DO (MG/L)	METRO BOD (MG/L)
January	80.1	0.6	15.7	15.4	6.0	4.0	25.0
February	86.7	0.6	14.0	13.4	8.7	4.0	25.0
March	95.6	0.6	13.3	12.5	7.2	4.0	25.0
April	98.1	0.6	12.8	11.9	6.9	4.0	25.0
May	86.6	0.6	14.2	13.6	7.4	4.0	25.0
June	75.9	0.6	15.3	14.9	9.7	4.0	25.0
July	71.5	0.6	*3.6*	*0.73*	*17.6*	4.0	25.0
August	68.5	0.6	*3.7*	*0.90*	*16.1*	4.0	25.0
September	70.3	0.6	*3.7*	*0.87*	*16.2*	4.0	25.0
October	72.6	0.6	13.1	12.3	12.0	4.0	25.0
November	77.1	0.6	15.9	15.7	9.4	4.0	25.0
December	78.8	0.6	14.8	14.3	9.1	4.0	25.0

(continued)

*Conditions specified are for METRO effluent.

TABLE 3-1 (continued)

WORST CASE SCENARIO

MONTH	METRO Q (MGD)	METRO TP (MG/L)	METRO TKN-N (MG/L)	METRO NH_3-N (MG/L)	METRO NO_X-N	METRO DO (MG/L)	METRO BOD (MG/L)
January	80.1	0.6	15.7	15.4	6.0	4.0	25.0
February	86.7	0.6	14.0	13.4	8.7	4.0	25.0
March	95.6	0.6	13.3	12.5	7.2	4.0	25.0
April	98.1	0.6	12.8	11.9	6.9	4.0	25.0
May	86.6	0.6	14.2	13.6	7.4	4.0	25.0
June	75.9	0.6	15.3	14.9	9.7	4.0	25.0
July	71.5	0.6	***12.4***	***11.4***	***10.2***	4.0	25.0
August	68.5	0.6	***11.1***	***9.8***	***10.5***	4.0	25.0
September	70.3	0.6	***10.6***	***9.2***	***11.8***	4.0	25.0
October	72.6	0.6	13.1	12.3	12.0	4.0	25.0
November	77.1	0.6	15.9	15.7	9.4	4.0	25.0
December	78.8	0.6	14.8	14.3	9.1	4.0	25.0

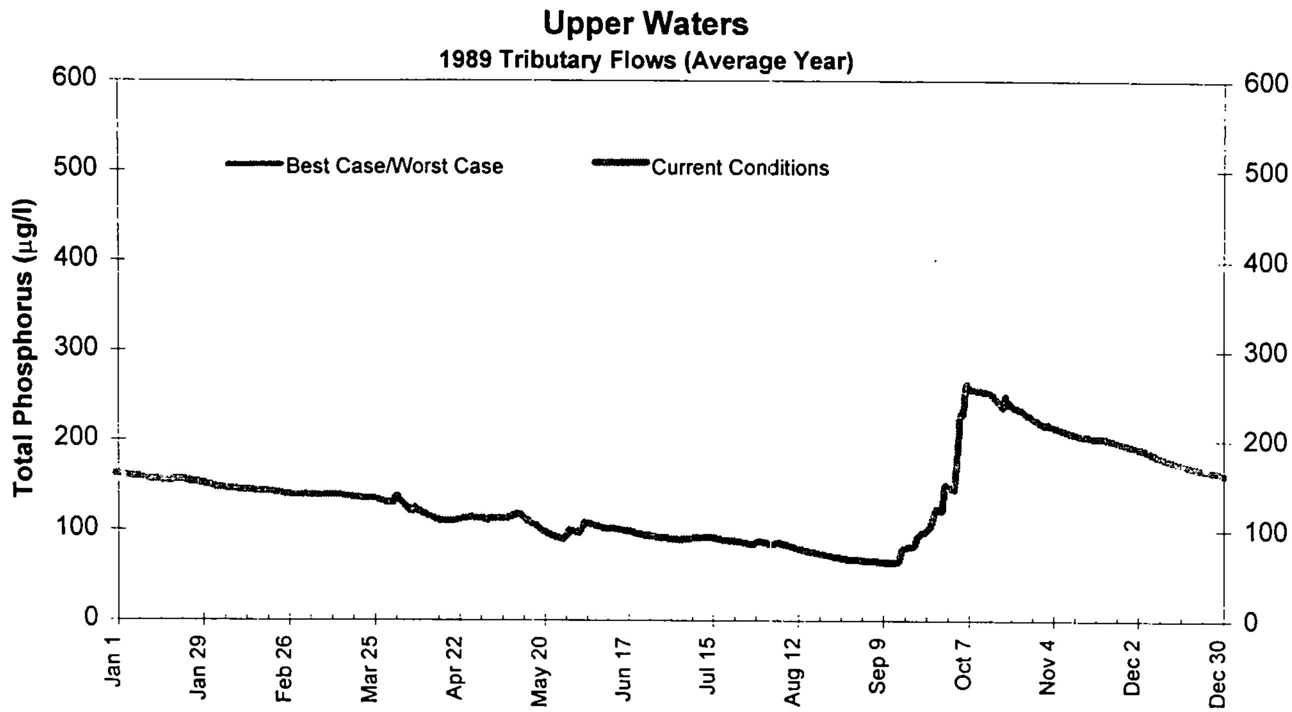
*Conditions specified are for METRO effluent.

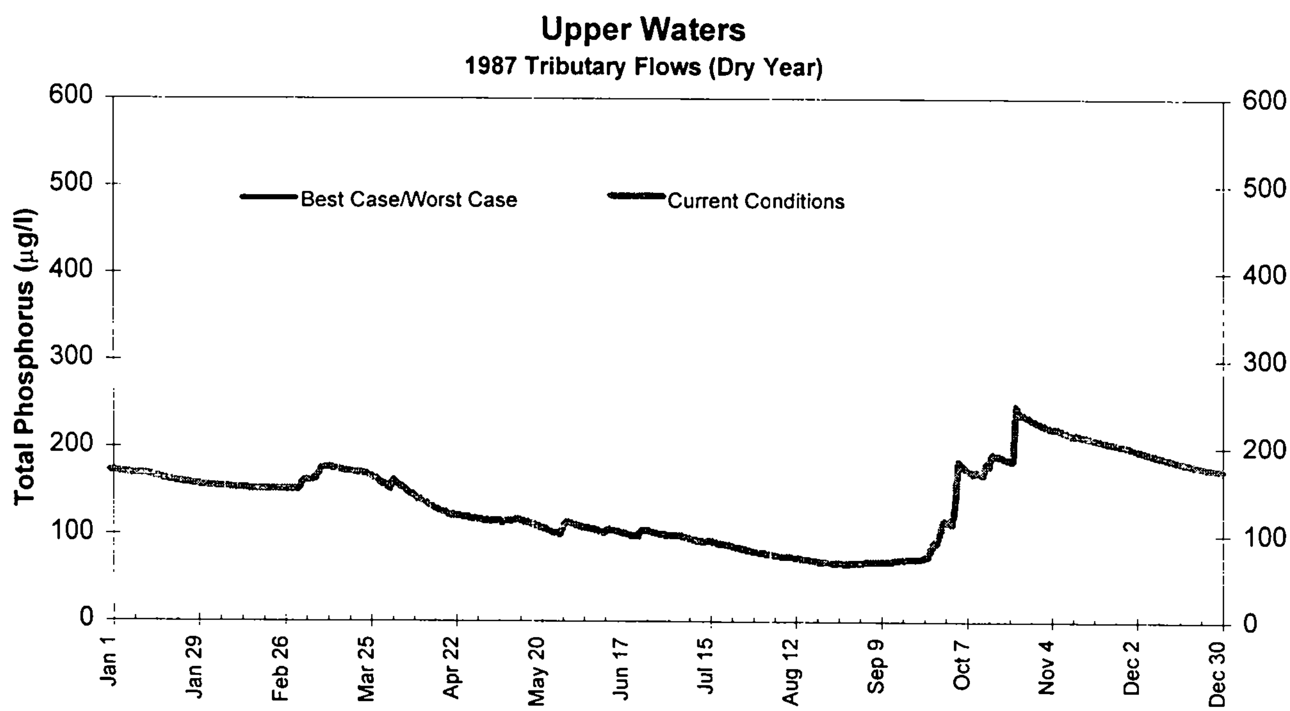
TABLE 3-2

TYPICAL PHOSPHORUS REMOVAL PERFORMANCE CAPABILITIES
CHEMICAL PRECIPITATION BY METAL SALT ADDITION*
Draft Environmental Impact Statement
Onondaga County, New York

EFFLUENT TP (MG/L)	CHEMICAL DOSAGE M^{3+}/INFLUENT TP (MOLAR RATIO)	POLYMER DOSAGE (MG/L)	PEAK CLARIFIER SURFACE OVERFLOW RATE (GPD/SF)	EFFLUENT FILTRATION REQUIRED?
2.0	1.0 - 1.2	0.1 - 0.2	800	No
1.0	1.2 - 1.5	0.1 - 0.2	600	No
0.5	1.5 - 2.0	0.1 - 0.2	500	Maybe
0.2	3.5 - 6.0	0.5 - 1.0	500	Yes

*Source: USEPA "Handbook - Retrofitting POTWs for Phosphorus Removal in the Chesapeake Bay Drainage Basin," USEPA Water Engineering Research Laboratory, Cincinnati, Ohio, EPA/625/6-87-017, September 1987.





Total phosphorus projections using the UFI Hydrothermal and Water Quality models (Version 1.11 approved by NYSDEC 10/13/95) for the no action alternative and average vs. dry year tributary flow. TP is unaffected by best and worst case changes in effluent nitrogen. Onondaga Lake, NY.

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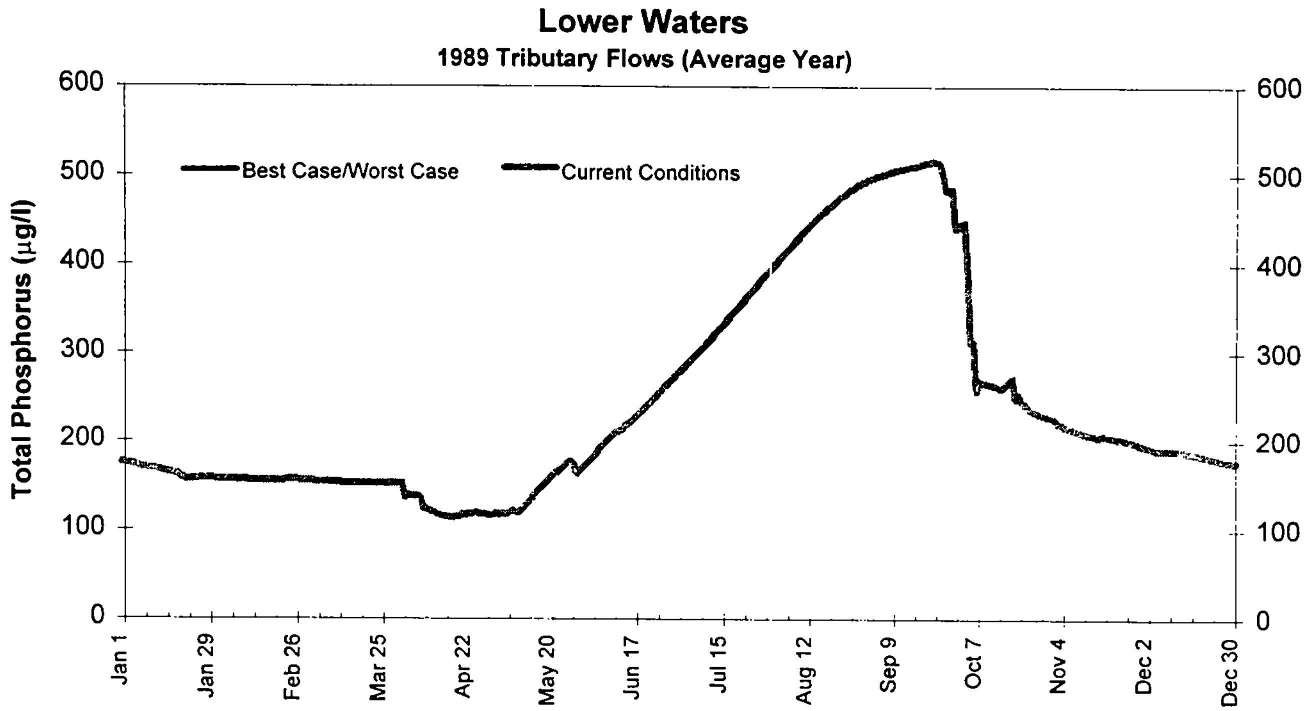
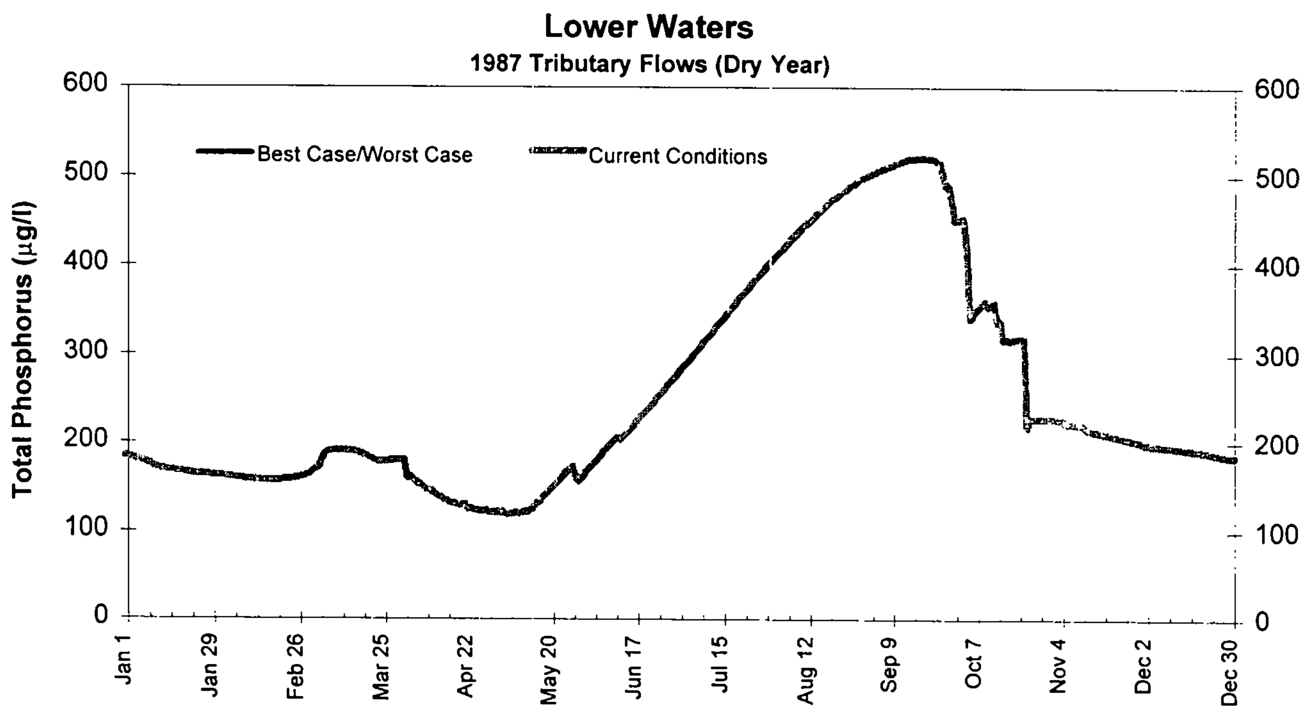
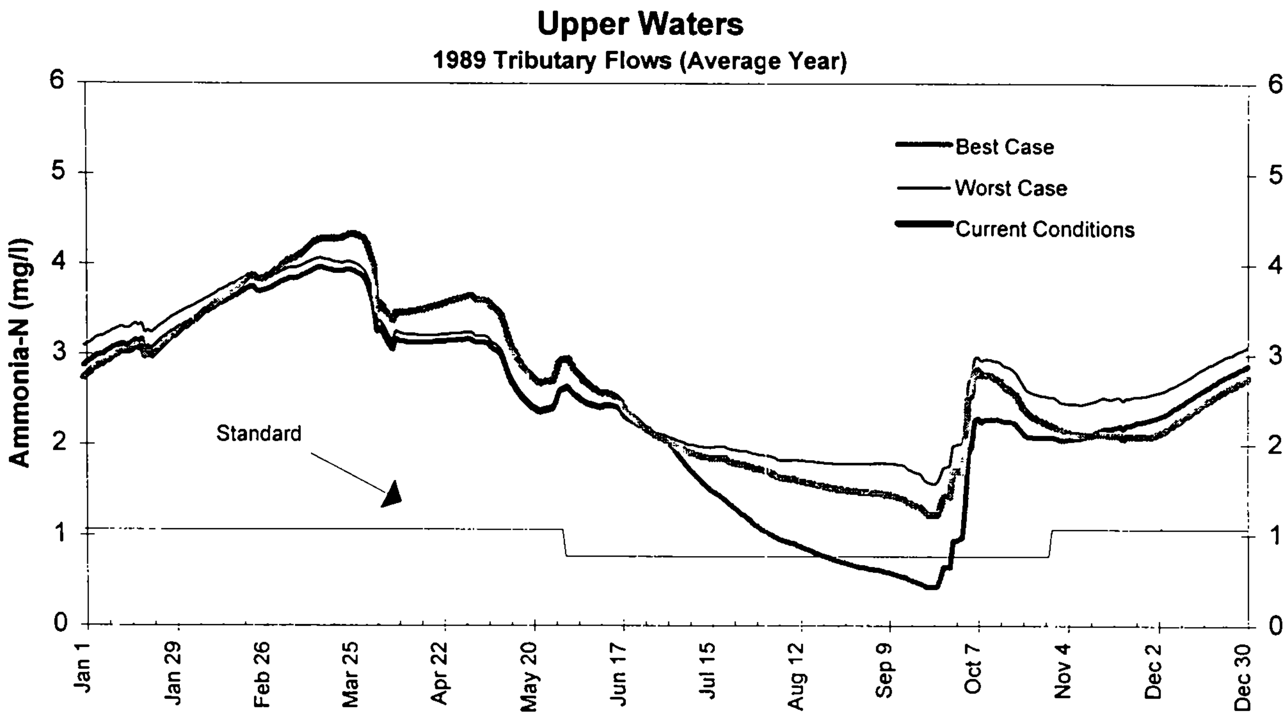
	FIGURE 3-1 TOTAL PHOSPHORUS PROJECTIONS-NO ACTION

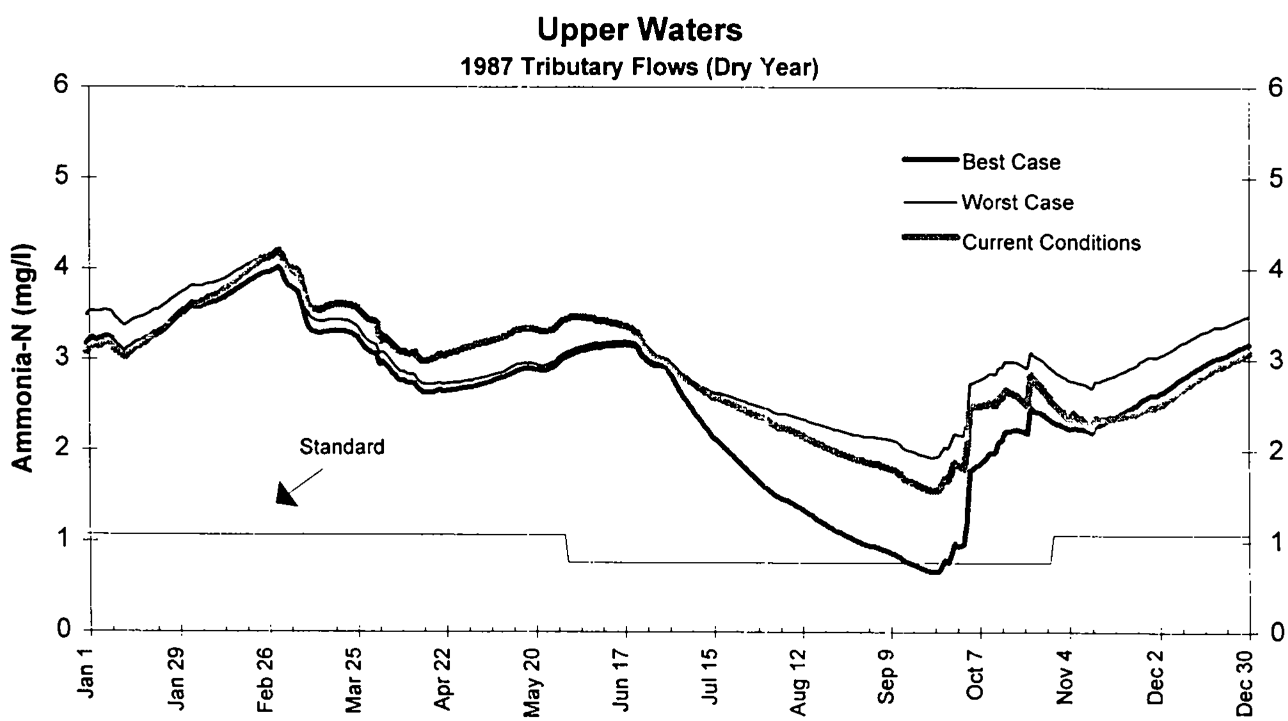




Total phosphorus projections using the UFI Hydrothermal and Water Quality models (Version 1.11 approved by NYSDEC 10/13/95) for the no action alternative and average vs. dry year tributary flow. TP is unaffected by best and worst case changes in effluent nitrogen. Onondaga Lake, NY.

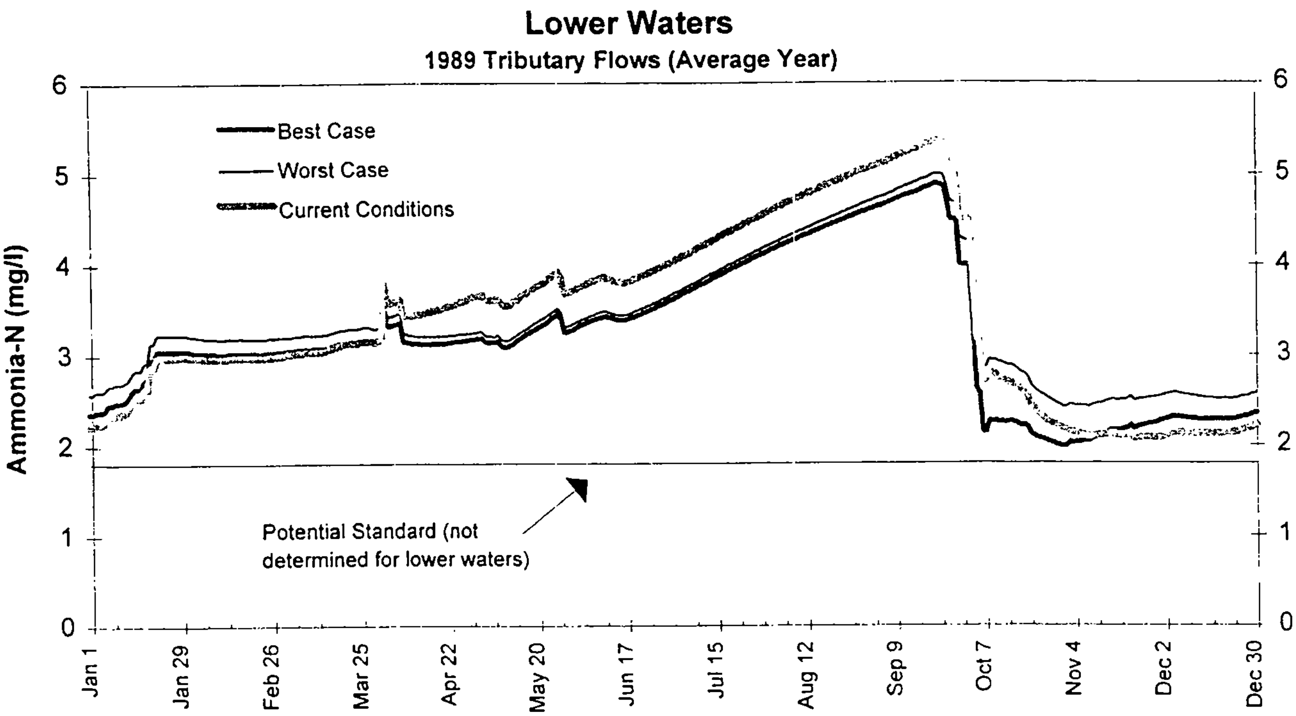
Stearns & Wheler ENVIRONMENTAL ENGINEERS & SCIENTISTS DATE: 1/11/96 JOB No.: 2298	DRAFT ENVIRONMENTAL IMPACT STATEMENT ONONDAGA COUNTY DEPARTMENT OF DRAINAGE AND SANITATION FIGURE 3-1 (CONTINUED) TOTAL PHOSPHORUS PROJECTIONS-NO ACTION

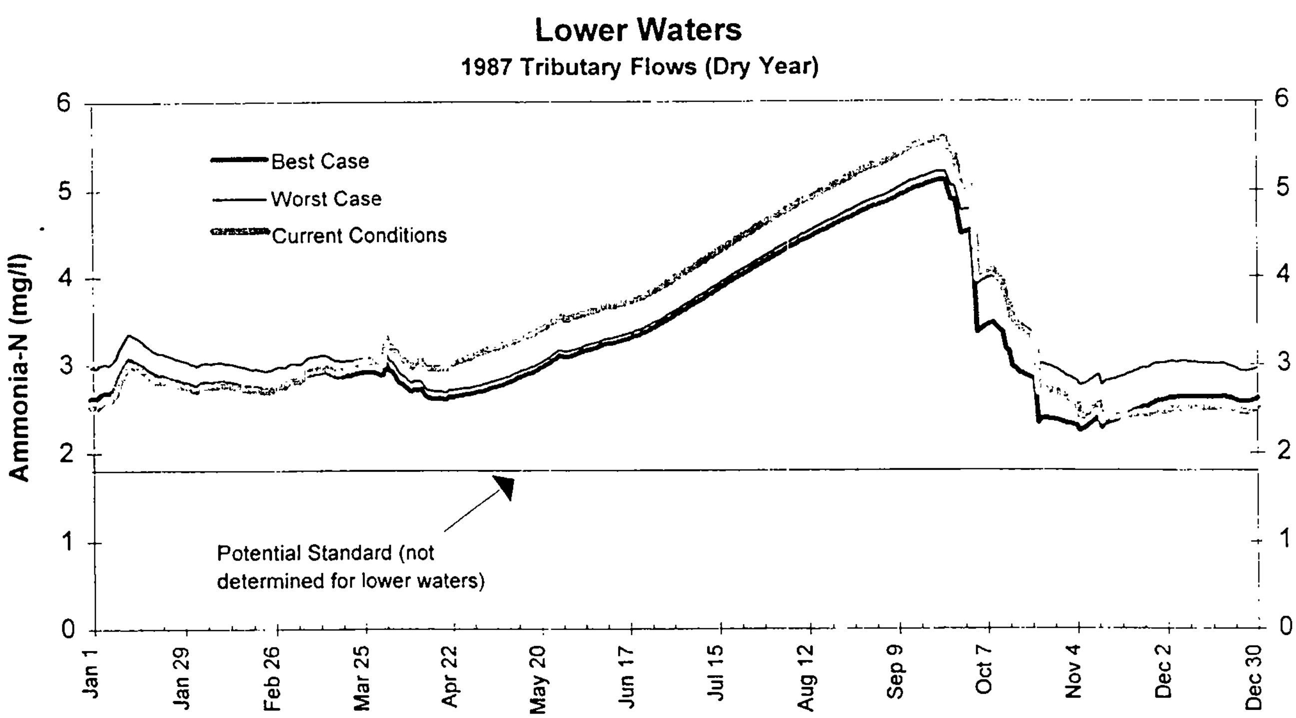




Ammonia-N projections using the UFI Hydrothermal and Water Quality models (Version 1.11 approved by NYSDEC 10/13/95) for the no action alternative and average vs. dry year tributary flow. Onondaga Lake, NY.

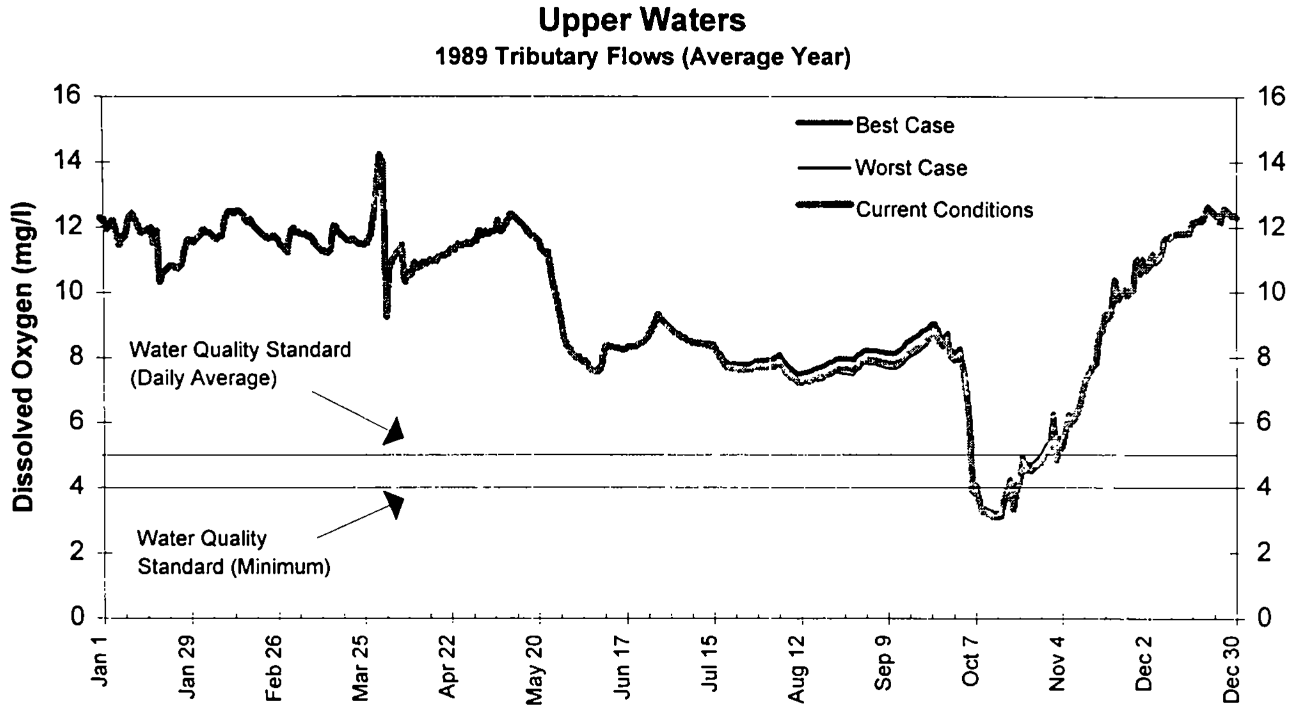
Stearns & Wheler ENVIRONMENTAL ENGINEERS & SCIENTISTS DATE: 1/11/96 JOB No.: 2298	DRAFT ENVIRONMENTAL IMPACT STATEMENT ONONDAGA COUNTY DEPARTMENT OF DRAINAGE AND SANITATION
	FIGURE 3-2 AMMONIA-N PROJECTIONS-NO ACTION

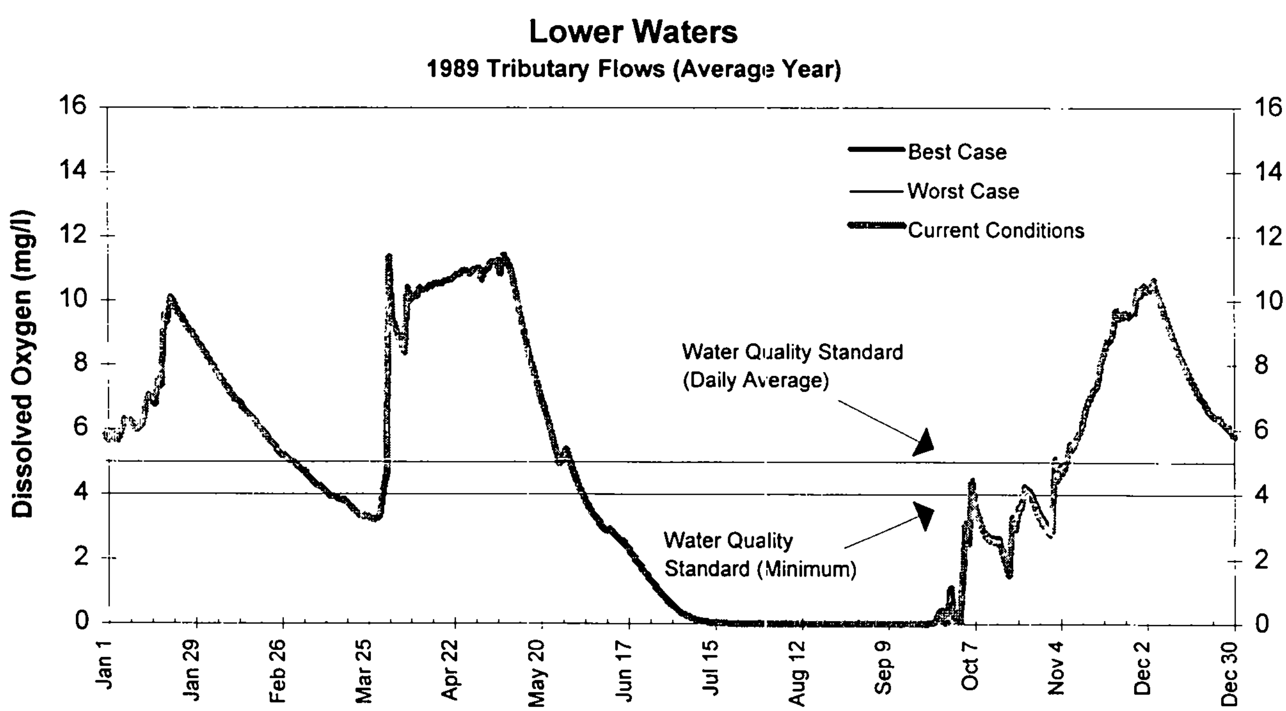




Ammonia-N projections using the UFI Hydrothermal and Water Quality models (Version 1.11 approved by NYSDEC 10/13/95) for the no action alternative and average vs. dry year tributary flow. Onondaga Lake, NY.

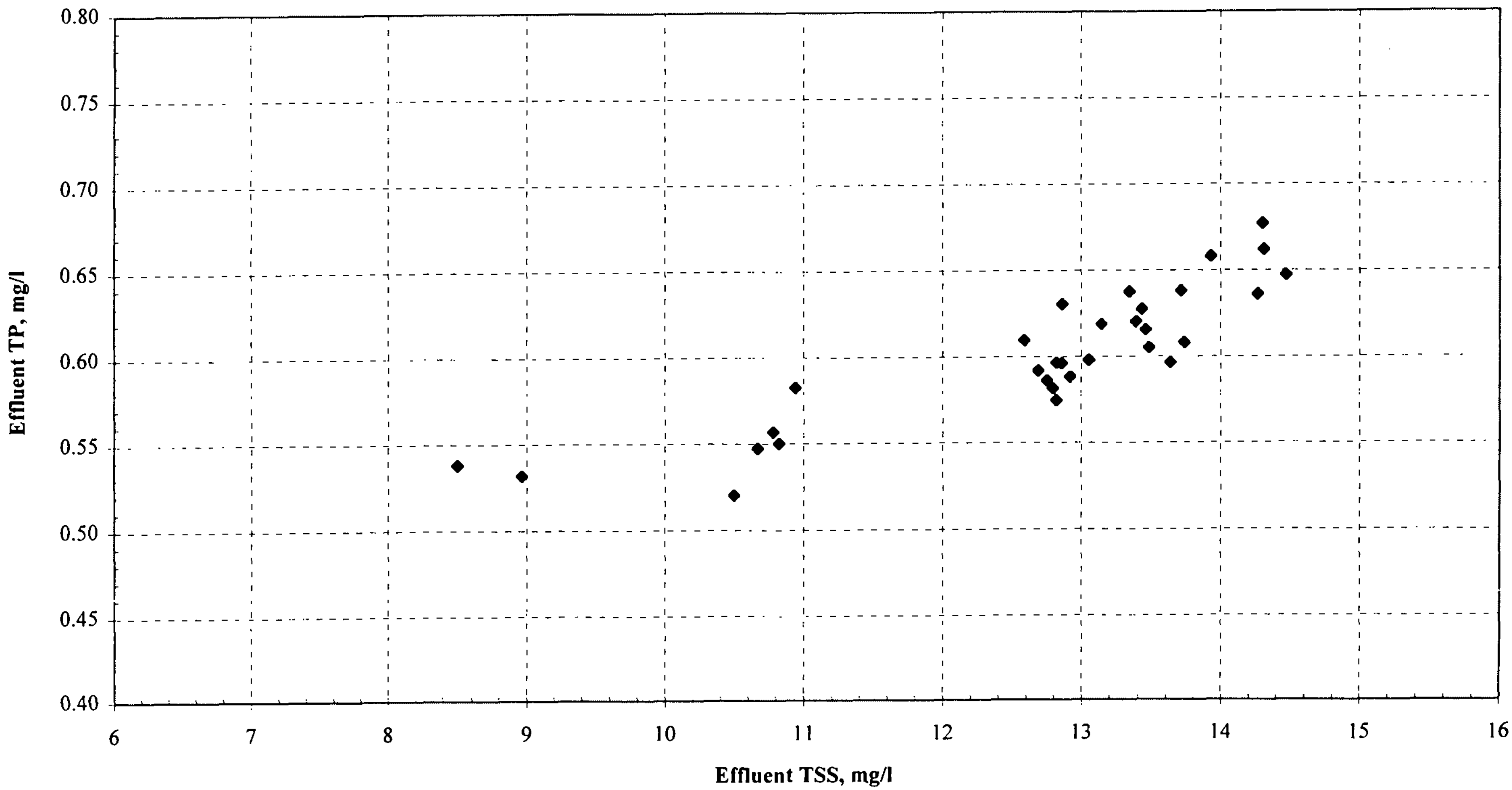
Stearns & Wheler ENVIRONMENTAL ENGINEERS & SCIENTISTS	DRAFT ENVIRONMENTAL IMPACT STATEMENT ONONDAGA COUNTY DEPARTMENT OF DRAINAGE AND SANITATION
DATE: 1/11/96 JOB No.: 2298	FIGURE 3-2 (CONTINUED) AMMONIA-N PROJECTIONS-NO ACTION





Dissolved oxygen projections using the UFI Hydrothermal and Water Quality models (Version 1.11 approved by NYSDEC 10/13/95) for the no action alternative and average vs. dry year tributary flow. The DO model produces no output for the dry year scenario. Onondaga Lake, NY.

Stearns & Wheler ENVIRONMENTAL ENGINEERS & SCIENTISTS DATE: 1/11/96 JOB No.: 2298	DRAFT ENVIRONMENTAL IMPACT STATEMENT ONONDAGA COUNTY DEPARTMENT OF DRAINAGE AND SANITATION FIGURE 3-3 DISSOLVED OXYGEN PROJECTIONS-NO ACTION



Correlation is for 12-Month Running Averages (November 1991 - April 1995)

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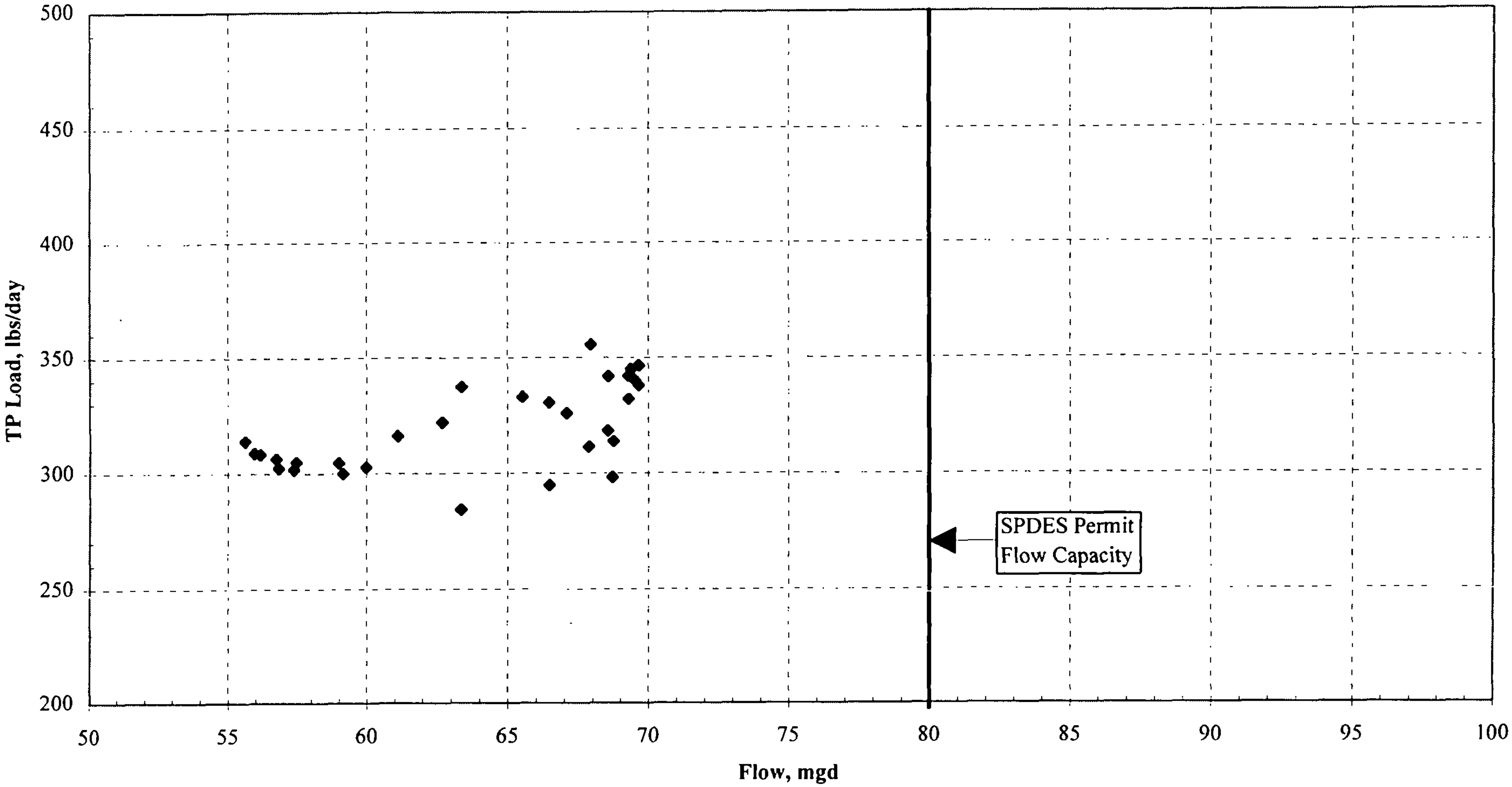
	FIGURE 3-4 **CORRELATION OF METRO EFFLUENT PHOSPHORUS AND TSS CONCENTRATIONS**



Correlation is for 12-Month Running Averages (November 1991 - April 1995)

Stearns & Wheler

ENVIRONMENTAL ENGINEERS & SCIENTISTS

DATE: 1/11/96 JOB No.: 2298

DRAFT ENVIRONMENTAL IMPACT STATEMENT
ONONDAGA COUNTY DEPARTMENT
OF DRAINAGE AND SANITATION

FIGURE 3-5
CORRELATION OF METRO EFFLUENT
PHOSPHORUS LOADING TO SEWAGE FLOW

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CHAPTER 4

SIGNIFICANT ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION

4.0 GENERAL

The Municipal Compliance Plan is designed to bring the wastewater discharges from METRO and the combined sewers into compliance with applicable state and federal requirements. Proposed actions are based on the need to improve the wastewater collection and treatment infrastructure serving the METRO Service Area. The need for proposed improvements is reflected in current water quality conditions in Onondaga Lake and the three tributary streams receiving CSO discharges (Onondaga Creek, Ley Creek, and Harbor Brook). As described in Chapter 2, the lake and tributaries contain elevated concentrations of municipal wastewater-related contaminants.

The focus of the MCP is defining cost-effective improvements to the wastewater collection and treatment system that will lead to improved water quality conditions. Compliance with the water quality standards related to municipal wastewater (ammonia and nitrite nitrogen, bacteria, floatables, and dissolved oxygen) is the projected outcome of the proposed MCP actions. Therefore, the long-term impacts of the proposed actions on water resources are positive.

The focus of this chapter is to evaluate the potential environmental impacts associated with the proposed MCP, many of which will be temporary, given the temporary nature of the construction and the long-term benefits of the MCP. The chapter also discusses, in a generic manner, the potential long-term impacts of plan implementation. Direct impacts of construction and operation of the MCP's recommendations will be limited to upgrading and expanding METRO and implementing remedial actions for the CSOs. The specific area impacts will depend on final location and designs in each case. Improvements to METRO will be accomplished with the maximum reuse of existing facilities and minimal additions of new facilities. The only land acquisition planned is the Niagara Mohawk property which is within the existing METRO boundaries. This property is the site of a former manufactured gas plant.

The environmental impacts of the MCP were evaluated with respect to the following areas of concern:

1. Impacts on natural resources, including effects on hydrology, water quality, aquatic ecology, geology, terrestrial ecology, air quality, and solid waste disposal.

2. Impacts on human resources, which include both short- and long-term impacts to the existing transportation network, land use in project area, land use plans, demography, and cultural resources which include visual resources, historical and archeological resources, and noise.

Short-term effects include immediate and temporary impacts, generally resulting from construction activities. Examples include increased erosion and sedimentation from earthmoving activities, removal of vegetation cover, construction noise, dust generation, and disruption of traffic. These impacts may be mitigated by the enforcement of appropriate conditions in the construction specifications during the actual work period. Long-term effects are the permanent impacts of the completed project which continue over time.

4.1 IMPACTS ON NATURAL RESOURCES

4.1.1 Effects on Hydrology

The proposed MCP actions do not include re-routing the discharge from METRO. The current discharge to the lake's upper waters will be maintained Consequently, changes to the hydrology of Onondaga Lake and its outflow to the Seneca river are not anticipated. Following completion of these MCP actions, an evaluation of the need for additional measures to improve water quality is planned. Part of that evaluation will examine the need for diversion of METRO effluent to the lake's hypolimnion or to the Seneca River . Hydrologic effects will be re-examined as part of a new DEIS prepared for any long-term alternatives considered once these MCP actions are complete.

There will be no significant adverse impacts on flooding resulting from the implementation of the MCP. However, anticipated construction on the METRO site may involve areas within the existing 100-year floodplain boundary; this cannot be determined with certainty until initiation of the design phase. If required, a supplemental DEIS will be prepared at that time. A number of the CSO facilities (Hiawatha, EBSS, Clinton, Midland, and Newell Street RTF) will collectively result in reduced volumetric discharge to receiving waters. Specific and detailed impacts will be developed as part of each individual facility design. Two of the proposed CSO treatment facilities are at a level of conceptual design, enabling evaluation of impacts on flooding and hydrology.

The lower sections of the underflow force main and outfall extension pipeline of the Hiawatha RTF will be located within the 100-year floodplain of Onondaga Lake and Ley Creek. Construction of these facilities will not lead to any filling within the designated floodplain. However, the construction of other improvements within the immediate area will require the placement of fill material. A stormwater management analysis conducted as part of the Stadium Market Center DGEIS/FGEIS concluded that stormwater detention facilities would be inappropriate for this site and might in fact exacerbate flooding. Therefore, mitigation of incremental flooding from the CSO projects will not be necessary.

The proposed abatement measure for CSOs on Harbor Brook, the EquiFlow™ system, will be located within Onondaga Lake. The facility will include a non-restrictive bypass channel to accommodate high flows. Therefore, no significant effect on the drainage basin or flooding is projected. The construction of this facility will not lead to filling within the designated floodplain, and consequently will not affect the floodplain.

The METRO facility is located within the Onondaga Creek floodplain. Construction is not anticipated to impact flooding.

4.1.2 Effects on Water Quality

A. Seneca/Oswego River

The proposed interim and intermediate phase actions for METRO and the CSOs will have only a minor effect on the current water quality conditions in the Seneca River. Improved water quality in Onondaga Lake will affect the river, as the lake outlet discharges to this aquatic system. However, the incremental differences in the river's water quality will be difficult to discern. Other factors, most notably the impact of benthic oxygen demand exerted by zebra mussels and the continuing density stratification from elevated chlorides, play a more significant role in determining the river's water quality.

A quantitative prediction of the potential impact of the MCP actions on Seneca River water quality has been made using the water quality models of the lake and river developed by UFI and approved by New York State on October 13, 1995. The projections reflect the MCP proposal of providing year-round nitrification at METRO to comply with NYSDEC's effluent limit, but do not incorporate any additional water quality improvements resulting from hypolimnetic oxygenation. The approved lake models are not sufficiently flexible to enable an evaluation of a surface discharge of treated wastewater coupled with addition of oxygen to the lower waters. Tables 4-1 and 4-2 summarize the input values used to make these model projections. Dissolved oxygen concentration in the river upstream of the lake outlet is estimated at 4.0 mg/l and pH at 8.0, reflecting continued zebra mussel impact. TKN levels were increased over the assigned defaults to reflect water quality impacts of zebra mussel respiration documented in recent years.

The projected improvements to Seneca River water quality are presented in Figure 4-1a through 4-1e, which contrasts projected river water quality under current METRO performance with river water quality following the MCP actions. River model projections are made using warm water, low flow conditions. The river model projects that under existing conditions (stratified flows, background levels impacted by zebra mussels), DO concentrations will fall below zero. Negative values are truncated to zero in Figure 4-1 and subsequent figures.

Note that under warm water, low flow conditions, the DO, chlorides, ammonia nitrogen, and carbonaceous biochemical oxygen demand (CBOD) will improve slightly from existing conditions. The impacts on the river of the projected improvements to epilimnetic DO and ammonia achieved by year-round nitrification at METRO are measurable, but not large (Figures 4-1a, b, and d).

Figures 4-2a through 4-2e demonstrate the potential improvement in river water quality achieved by eliminating density stratification. Note that marked improvement in DO conditions are realized in comparison to the stratified condition. The density stratification of the river downstream of Onondaga Lake is a remnant of the past industrial discharges of chlorides.

Further improvements to Seneca River water quality would be seen with elimination of the zebra mussel impact. Figures 4-3a through 4-3e contrast the projected improvements to the Seneca River (destratified conditions) with the MCP actions under existing conditions with remediation of the zebra mussel impacts.

The linkage of the zebra mussel invasion to a significant loss of wasteload assimilative capacity in the Seneca/Oswego River system (Effler and Siegfried, 1994) has focused regulatory and research attention on possible remedial measures. The options selected for improvements to METRO effluent and relocation of the discharge, as well as implications to downstream users, must be made in the context of the river's diminished assimilative capacity. Four factors must be considered in evaluating remedial measures: (1) the cost of implementation; (2) likelihood of success; (3) how often the implementation process would have to be repeated; and (4) who has responsibility for implementation.

A preliminary list of management options for zebra mussel control was developed by the Seneca/Oswego River Working Group (SORWG) of the Onondaga Lake Management Conference's Technical Review Committee. Two overall remedial strategies were evaluated: eliminate or reduce the zebra mussel populations within the State Cut to reduce their oxygen consumption, or mitigate the effects of the zebra mussels by adding oxygen to the Seneca River system to increase its wasteload assimilative capacity.

Preliminary cost estimates of several short-term and intermediate range management options were developed by the SORWG. Included are comments on the various option scenarios regarding their respective feasibility and/or drawbacks to implementation. Refinements as to engineering feasibility, likelihood of success of each option, and implementation costs need to be fully evaluated. Completion of these tasks has been proposed for completion as part of Onondaga Lake Management Conference's 1994 Seneca River zebra mussel monitoring program.

There may also be additional options. For example, discussions of river reoxygenation have focused on the possible installation of reaeration units upstream of the Baldwinsville Dam, despite the fact that the Cross Lake to Baldwinsville Dam reach would not be impacted by any of the wastewater management options under discussion for METRO.

In-stream oxygenation closer to a wastewater discharge location would be more beneficial than oxygenation upstream of Baldwinsville. Possible options to consider besides the installation of reaeration units or discharge point aeration include increasing reaeration at the Baldwinsville Dam either through artificial introduction, downstream substrate manipulation to increase reaeration, or dam structure modification to allow for surface spillage of flow to make use of the dam's reaeration capabilities.

In developing any strategies to address the zebra mussel issue, it is necessary to recognize that it is unlikely that the State Cut zebra mussel population will exhibit a typical pattern in population dynamics of exotic species introductions, where large expansions in population size are rather quickly followed by decreases in population until an equilibrium point is reached. In the State Cut situation, it appears likely that populations would remain high due to favorable bottom substrate conditions and a food source from the highly eutrophic Seneca River and Cross Lake.

Another factor that may keep the zebra mussel population elevated in this region is that bottom velocities that occur in the State Cut during higher flows may be of sufficient magnitude to remove shell debris buildup from dead zebra mussels. Shell accumulation to a depth of 10 to 15 cm has been reported to create an unsuitable substrate for live zebra mussels leading to reductions in population numbers (Reeders, et al., 1989). Bottom velocities within the Cut at higher flow discharges likely allow washout or scour of shell debris and smaller diameter material, thus eliminating this factor for self-limiting the population.

The SORWG recognized that long-term watershed management with resulting decreases in nutrient loadings to the upstream Seneca River system should be part of the zebra mussel management strategy. Permanent elimination or a significant reduction in the State Cut zebra mussel population would be the preferred zebra mussel management option. This could only be achieved by: (1) permanently altering the bottom substrate conditions in the State Cut to make them inhospitable to a large zebra mussel population; and/or (2) significantly reducing the Seneca River nutrient load which serves as the available food source.

B. Onondaga Lake and the Lake Tributaries

Water quality improvements in Onondaga Lake and three of its tributary streams (Onondaga Creek, Ley Creek, and Harbor Brook) are projected as a direct result of the County's proposed MCP actions. In general, METRO-related improvements affect Onondaga Lake, while CSO-related improvements affect the tributaries and the lake. Improvements in ambient water quality conditions will be realized through the interim and intermediate phase actions.

In the following sections, improvements in specific water quality conditions (phosphorus, dissolved oxygen, ammonia and nitrate, floatables, bacteria, settleable solids, toxic substances, and mercury) are discussed. Whenever possible, qualitative discussions are supplemented by quantitative predictions using the approved water quality models.

B1. **Phosphorus.** The current phosphorus concentrations in Onondaga Lake (discussed in DEIS Chapter 2) are projected to decrease with implementation of the MCP actions. The decrease will be brought about by a reduction in both external loading (from improvements to METRO's chemical phosphorus removal technology) and internal loading (from decreased phosphorus release from the lake's bottom sediments resulting from provision of aerobic conditions in the hypolimnion).

UFI completed a model of Onondaga Lake's phosphorus dynamics, which was approved by NYSDEC on October 13, 1995. The lake phosphorus model is not sufficiently flexible to enable evaluation of the benefit of a reduction in internal sediment phosphorus loading resulting from provision of aerobic conditions in the lake's hypolimnion. Therefore, the phosphorus model cannot predict MCP-related improvements to this water quality parameter. However, earlier work by UFI can be used to support a qualitative discussion regarding the potential percentage reduction in lake total phosphorus that might result from suppression of sediment phosphorus release. The April 1, 1993 report, "Total Phosphorus Model Report - Onondaga Lake, 1987-1990," by R.P. Canale, S.M. Doerr, and S.W. Effler, submitted to the Central New York Regional Planning and Development Board, presents a sensitivity analysis of the impact of changes in sediment phosphorus release on the prediction of summer average total P concentrations. Based on 1990 conditions of METRO performance and watershed hydrology, summer total P would be reduced less than 10 percent by eliminating sediment P release. Summer TP would decrease from 78 μg/l to between 72-75 μg/l, depending on assumptions made regarding partitioning between soluble and particulate phosphorus.

UFI also estimated the annual phosphorus mass balance to Onondaga Lake for the years 1988, 1989, and 1990 as part of the April 1, 1993 submittal. External phosphorus load averaged 114 metric tons during this period (range 104-116), and internal sediment P release averaged 21 metric tons. On an annual basis, total phosphorus content in the lake will likely be reduced in proportion to the relative percent contribution of sediment release to the total load. The summer average upper waters TP will continue to be dominated by the METRO discharge; therefore, reductions in summer total P are projected to be less.

The interim and intermediate phase MCP actions are designed to optimize phosphorus removal at METRO. NYSDEC will adjust METRO's discharge permit to require performance-based standards for effluent phosphorus levels, ensuring that the external TP input to the lake remains as low as possible. At the same time, the MCP "measure" actions will focus on defining the relative contributions of point and non-point source phosphorus to the lake. A watershed approach is necessary to put the METRO phosphorus loading in context with all the sources of phosphorus.

At the end of the intermediate phase projects, lake water quality will be assessed in light of compliance with standards, progress towards meeting designated uses, the status of remediation of industrial wastes, available technologies, and economic health of the community. The need for additional phosphorus removal at METRO (by effluent filtration or diversion of some or all of the treated effluent to the lake's lower waters or to the Seneca River) will be evaluated.

CSOs contain nutrients, including phosphorus and nitrogen, from both wastewater and stormwater. Phosphorus is the limiting nutrient for plant growth within the tributaries and the lake. The proposed interim projects will result in some reductions of nutrients discharged to Onondaga Lake and its tributaries. Regional treatment control facilities will provide some TP reduction by virtue of storage provided by the transmission pipelines, vortex devices, and disinfection tankage that is associated with these facilities. Additional reductions will occur simply by a mass removal of the solids that harbor nutrients.

The proposed interim projects will help reduce the amount of nutrients discharged to Onondaga Creek. The Hiawatha area improvements will reduce the amount of nutrients discharged primarily to Ley Creek with some benefits to the barge canal portion of Onondaga Creek (substantial reduction in discharge from CSO 075).

The Newell RTF reactivation will remove nutrients by providing solids removal through the vortex unit. The EBSS upgrade will remove solids and nutrients through detention in the existing pipelines, which will be diverted to METRO by gravity following storm events. These projects will reduce the above nutrients strictly by mass removal of solids. The projected nutrient removal of each facility is summarized in Table 4-3.

No improvements for Harbor Brook are scheduled under the interim projects. However, the EquiFlow™ system will be installed at the terminus of the brook and the lake. This facility will be discussed below regarding lake improvements.

Hiawatha Boulevard area improvements will provide several mechanisms for the removal of nutrients presently discharged to Ley Creek. The new consolidation pipeline entering the Hiawatha RTF will provide some storage of flows. The Hiawatha RTF (vortex device with storage) will remove solids, and thus nutrients. The Kirkpatrick Street Pump Station upgrade will increase the flow and resulting solids to METRO and decrease the amount of overflow to both Ley and Onondaga Creek (presently CSO 073 and CSO 075, respectively).

One proposed interim CSO project, the Harbor Brook EquiFlow™ system, helps reduce the amount of nutrients discharged to the lake. This facility will reduce nutrients by solids settling during detention. This facility will pump back stored flow to METRO for treatment. The projected nutrient removal for this facility is estimated at 92 percent (Table 4-3).

Additional nutrient (phosphorus and nitrogen) removal is projected following completion of the intermediate phase CSO actions. The Midland and Clinton RTFs along Onondaga Creek will further reduce nutrient inputs from CSOs by mass removal of solids from high-rate vortex units and from the inherent storage within the disinfection chambers at both locations. The projected nutrient removals for these facilities are summarized in Table 4-3. A significant quantity of nutrients are deposited annually in the Inner Harbor. Some of these nutrients are associated with CSO discharges and some are from urban stormwater or non-point sources. A preliminary assessment was made of this loss, which indicated an annual phosphorus load reduction of 30,000 to 35,000 lb per year.

B2. **Dissolved Oxygen.** The MCP actions will have a direct and positive impact on Onondaga Lake's DO concentrations. The proposed hypolimnetic oxygenation will increase DO concentrations in the lake's lower waters during summer stratification. The epilimnetic DO sag, characteristic of Onondaga Lake during fall mixing, will be eliminated as hydrogen sulfide, methane, and other reduced chemicals will not accumulate in the hypolimnion under oxic conditions. Provision of year-round nitrification at METRO will eliminate this potential oxygen demand on the lake system.

The UFI water quality models cannot be used to project the impacts of the MCP actions on Onondaga Lake DO concentrations. The final model version (Version 1.11, approved by NYSDEC October 13, 1995) is not sufficiently flexible to predict the water quality impacts associated with continued discharge of METRO to the upper waters, coupled with injection of oxygen into the lower waters. Consequently, the "build and measure" (TMDL) paradigm is proposed as the means to predict the environmental impacts of this action.

The proposed MCP actions call for a large-scale pilot test of hypolimnetic oxygenation, which will provide direct measurements of the efficacy of this alternative. The pilot test will be designed to provide design criteria for full-scale implementation of this proposed solution. Injecting oxygen into the hypolimnion as a means to improve the lake's lower waters was introduced by the ACOE in their 1992 reconnaissance report on the status of Onondaga Lake. Recently, the USEPA endorsed the concept of hypolimnetic oxygenation and encouraged Onondaga County to consider this action as part of the MCP.

According to the ACOE research, an oxygen injection system is a cost-effective, in-lake treatment alternative that could be utilized to increase lake water quality. Oxygen injection would maintain the lake's summer stratification, preserve hypolimnetic temperatures and volume, while reducing or eliminating nutrient recycling from the sediments.

The primary objective for installing an oxygen injection system would be to increase the usability of the lake and to prevent anoxic conditions in the hypolimnion. Onondaga Lake fishery would be enhanced with dissolved oxygen concentrations above 4 mg/l. Concentrations above 2 mg/l would eliminate the solution of most metals (iron and manganese) from the sediments. Although the effects on mercury concentrations are unknown, oxygen injection is expected to eliminate or reduce the formation of hydrogen sulfide, methane, and ammonia.

The ACOE report indicated that the oxygen deficit present in Onondaga Lake's hypolimnion would require oxygenation at a rate between 12 to 15 pounds of oxygen per minute. Injection at this rate would maintain the dissolved oxygen concentrations at the levels present at the onset of summer stratification. The use of pressurized liquid oxygen is the preferred treatment alternative. Oxygenation units are recommended for two basins of the lake, each delivering 7 to 7.5 pounds of oxygen per minute. Maximum efficiency would be reached if the system is used seven months of the year from April through October.

The preliminary capital and annual estimate for physical plant construction costs, with contingencies, totaled $1,378,000. This includes planning, engineering and design, construction management, setup costs, contingencies, and the cost of the liquid oxygen.

Additional discussion of the impact of this alternative on the aquatic biota is presented in Section 4.1.3, Effects on Aquatic Ecology.

Dissolved oxygen improvements in the three CSO-impacted tributaries may result from the MCP actions as well. Organic solids that are deposited in receiving waters can contribute to sediment oxygen demand. Water quality improvements will result from the removal of solids during interim and intermediate phase CSO projects.

B3. **Ammonia and Nitrite.** The MCP actions will have a direct and positive impact on the concentrations of ammonia and nitrite in Onondaga Lake. Provision of year-round nitrification will reduce the external loading of these nitrogen species; currently, METRO represents more than 90 percent of the total external loading of these nitrogen species to the lake.

The effectiveness of the significant reductions in METRO's ammonia levels on improving Onondaga Lake water quality will be measured throughout the MCP implementation schedule. Chemical measurements in the lake will be supplemented by monitoring of the biological community; in particular, the reproductive status of the lake fishery.

The UFI lake models have been used to confirm the need for year-round nitrification at METRO. Model inputs are summarized in Table 4-4. Figure 4-4 depicts the projected improvement in Onondaga Lake's upper and lower waters at completion of the interim and intermediate stages. Note that the impact of adding oxygen to the lake's lower waters is not included in this prediction. Additional reductions in ammonia nitrogen are anticipated in response to hypolimnetic oxygenation. The approved UFI models do not accommodate an evaluation of the impact of adding oxygen on the recycling and transformation of nitrogen species. The "build and measure" process adopted for the County's MCP will enable direct measurement of the efficacy of nitrification and hypolimnetic oxygenation.

The goal of the MCP is compliance with applicable state requirements. At the end of the intermediate phase, progress towards compliance will be assessed. The need for additional reductions in ammonia will be evaluated in light of the measured biological response, as well as chemical concentrations.

Reductions in tributary nitrogen concentrations and loading to Onondaga Lake are projected to result from the CSO actions. Discussion of nutrient impacts of CSO remediation presented in Section 4.1.2.B.B1 (phosphorus) is also relevant to nitrogen reductions.

B4. **Floatables**. Floatables are waterborne waste materials and debris that are relatively buoyant and float at or below the water surface. The debris typically consist of man-made materials, such as plastics, polystyrene, paper, and other constituents. These pollutants are not only aesthetically undesirable, but can be detrimental to both man and aquatic creatures. Certain types of floatables that wash up on shorelines can cause beach closings, which in turn impose economic losses within a community. Floating debris can interfere with navigation by fouling propellers and water intake systems. In the case of Syracuse, floatable materials are discharged into the tributaries, namely Onondaga Creek, Harbor Brook, and Ley Creek. They are then conveyed to Onondaga Lake.

The proposed interim projects include Hiawatha area improvements, Harbor Brook EquiFlow™ system, Newell Street RTF reactivation, EBSS upgrade, and Teall Brook FCF. These projects are summarized in Chapter 1 of the DEIS and presented in detail in Chapter 4 of the MCP. As shown in Figure 1-20 (floatables containment), the interim projects will provide floatables control for Onondaga and Ley Creek (via Teall Brook) and Onondaga Lake. Netting devices or booms will be utilized to capture floatables material at these locations. The proposed netting devices serve to remove floatables from the flow in excess of the total wet weather flow captured as listed in Table 4-3. While booms have been used historically in other locales, no data are available on their effectiveness. The removal efficiency of the boom will be evaluated following its installation.

Onondaga Creek will see a marked improvement in the removal of floatable material due to the interim projects. Projects that will reduce the presence of floatables in the creek include the Newell RTF reactivation and the EBSS upgrade. The RTF will remove floatables by the use of a vortex facility that contains floatables entrapment capability. The EBSS upgrade will provide storage for floatables which will be returned to METRO via the MIS for treatment.

No improvements for Harbor Brook are scheduled under the interim projects. However, the EquiFlow™ system will be installed at the terminus of the brook and the lake.

Floatables within Ley Creek will be reduced by the proposed construction of two separate facilities: the Hiawatha RTF (treating CSOs 074 and 075) and Teall Brook FCF (CSO 073). The Hiawatha RTF will remove floatables by the use of a vortex facility, which contains floatables entrapment capability, and is supplemented by storage. The Teall Brook FCF will employ a netting device to capture floatables. This facility will be located at the outfall of CSO 073, which is also the origin of Teall Brook.

Onondaga Creek will realize additional improvement as intermediate projects are constructed. The Midland and Clinton RTF will eliminate most floatables presently discharged from these drainage areas. Three types of vortex designs currently exist for treatment of wet weather flow. All three incorporate floatable traps within their design. These traps will collect and divert the floatables to METRO for ultimate treatment. The Midland and Clinton RTFs will provide floatables control for a large section of the City. The Franklin and Maltbie FCFs will also provide floatables control through netting devices that will be placed at these locations. The proposed netting devices will remove floatables from the flow in excess of the total wet weather flow captured as listed in Table 4-3.

A proposed floatables control facility (netting device) at the mouth of Harbor Brook will capture floatables prior to entering the lake. A boom device proposed for the end of Onondaga Creek (design by C&S engineers) will be located immediately upstream of the barge canal terminal to remove floatable material conveyed by the creek prior to discharge to the lake. The effectiveness of these facilities will be evaluated following installation.

B5. **CSO Bacteria.** Bacteria from CSOs is a significant water quality issue in Onondaga Lake and its tributaries. The proposed abatement plan utilizes regional treatment facilities to reduce the CSO discharge volume and to disinfect the discharge following high-rate treatment. Disinfection facilities associated with the regional CSO treatment facilities are sized to provide a minimum 3-log kill (99.9 percent efficiency of disinfection) at the peak flow rate for a one-year design storm.

Bacteria standards are derived from federal, state, and local interpretation. The federal CSO policy (Presumptive Approach) allows for four overflow events per year with a provision for the permitting agency (in this case, NYSDEC) to permit two more events per year. Overflow events can cause bacterial violations in the lake depending upon the severity of the rainfall event. Bacteria impacts are more pronounced in the southern basin since all CSO discharges are tributary to the southern end of the lake.

The public health standard for bathing beaches defines a fecal coliform bacteria violation when the logarithmic mean of colony forming units (cfu) exceeds 200 cfu/100 ml over a period of five consecutive days or 1000 cfu/100ml for any measurement. The difficulty with this standard is defining what represents a wet weather violation. Presently, the state does not have a wet weather standard associated with fecal coliform bacteria.

For the purposes of this evaluation, a violation is interpreted as any concentration exceeding 200 cfu/100ml. While not specified in the current standards, bathing beaches could not reopen until bacteria fall below this level.

In contrast to the lake, the tributaries into which the CSOs discharge are not currently useable or potentially useable for contact recreation. Nevertheless, significant reductions in tributary bacterial concentrations will result from the disinfection of CSOs targeted for achieving bacteria compliance in the lake. The primary use of Onondaga Creek and Harbor Brook, as they flow through the City, is for efficient conveyance of stormwater and flood protection. They are engineered channels; not well suited for fish migration, propagation, or water contact recreation. Higher disinfection dosages of CSOs to achieve compliance in the tributaries would pose an additional risk to the aquatic system and add unnecessary chemicals to these streams without providing a benefit for water contact recreation.

The Onondaga Lake bacteria model was used to project the existing average annual fecal coliform bacteria concentrations for the lake. The model was further used to develop in-lake fecal coliform bacteria concentrations associated with the interim and intermediate phase improvements.

The modeling results depict the reduction in fecal concentration throughout the lake following proposed MCP actions. The results of this analysis (Table 4-5) show the projected number of annual violations and peak fecal concentrations in each lake model cell for the existing condition and following interim and intermediate phase improvements.

This analysis shows a modest reduction in bacteria violations and peak concentrations following construction of the interim phase projects, especially for Cells 5 through 8, which represent the northern end of the lake. While these reductions are minimal, it should be noted that the goal of the interim phase improvements is to demonstrate CSO treatment and disinfection technologies to aid in the design, construction, and operation of much larger proposed treatment facilities in the intermediate phase.

At the end of intermediate phase CSO remedial actions, compliance with bacterial concentrations throughout the lake is projected. One possible exception is Cell 1, where exceedances of 200 cells per 100 ml may occur following large storms. Cell 1 is the southernmost cell of the lake and immediately proximate to Onondaga Creek, Ley Creek, Harbor Brook, and METRO. Because of inherent model uncertainties, the status of compliance will be verified through lake monitoring during and following intermediate phase improvements. Recall that "compliance" is conservatively defined as bacteria cells less than 200/100 ml, when the bathing beach standard allows for up to 1,000 cells/100 ml before closing a beach.

A compliance schedule is provided in Figure 4-5 to illustrate the beneficial nature of the interim and intermediate phase projects to the lake. This figure shows the CSO abatement time line, Onondaga Lake bacterial compliance projections, and Onondaga Lake bacteria model cells on the same horizontal time axis. A trend towards bacterial compliance is portrayed from the existing condition (1996) through interim phase (2000) and intermediate (2017) phase buildouts.

B6. **Total Settleable Solids (TSS)**. Solids are waterborne waste materials and debris that are suspended in the water column or have a tendency to settle out based on the density and shape of the particles. The solid material discharged by CSOs typically consist of gravel, sands, silts, clays, and organic matter. The discharge of solids not only causes a visual nuisance, but can affect turbidity, dissolved oxygen, and can carry pathogens in the receiving water. Furthermore, the accumulation of solids within sewers can cause decreased hydraulic capacity and increased frequency of overflows. High concentrations of accumulated solids can also be discharged from a CSO at the beginning of a storm event which is known as a "first-flush effect." Organic solids that are deposited in receiving waters can also cause a sediment oxygen demand. Sources of solids entering the CSO collection system can include domestic and industrial wastewater and debris washed from streets.

The settleable solids associated with CSO discharges represent solids that accumulate in downstream areas, and for the most part, are those representing heavier (grit) materials. The vortex facilities proposed for the interim and intermediate phases are designed to remove 90 percent or more of such settleable solids at their design flow (solids of specific gravity of 2.65 at a particle size of 0.4 to 1.0 millimeter or a specific gravity of 1.2 and a particle size of 1 to 3 millimeters).

Three facilities along Onondaga Creek will be constructed or upgraded as part of the interim phase to provide for TSS removal. These projects are discussed in detail in Chapter 4 of the MCP. Table 4-3 shows the TSS capture for subsequent treatment at METRO as a result of the interim phase projects. The capture resulting from the interim phase projects is 89 percent. The fate and transport of these solids have been identified for the Onondaga Creek corridor by the use of the HEC-6 model discussed in detail in the memorandum titled "Onondaga Creek Solids Transport" (Appendix C-8).

No improvements for Harbor Brook are scheduled under the interim projects. However, the EquiFlow™ system will be installed at the terminus of the brook and the lake. This facility will be discussed in the next section regarding lake improvements.

Solids contribution to Ley Creek will be decreased by the Hiawatha RTF. This facility will treat CSOs 074 and 075 and will remove a significant percentage of solids by the use of a vortex facility.

Facilities to be constructed for the intermediate CSO phase will provide additional environmental benefit from reduction in solids loadings. The RTFs include the consolidation pipelines and vortex facilities in combination with disinfection facilities. The FCFs include transmission pipelines and netting facilities. Although the netting facilities will provide negligible solids capture, the transmission pipelines for the FCFs can provide storage through gate structures which will capture some solids. These solids would then be diverted to METRO for treatment.

Onondaga Creek will see an added improvement once the intermediate projects are constructed. The Midland and Clinton RTF will eliminate a significant portion of solids presently discharged from these drainage areas. These devices will reduce solids discharged to the lower reach of Onondaga Creek.

No improvements for Harbor Brook are scheduled under the intermediate projects. Related improvements for Harbor Brook are included in the interim phase improvements described previously.

No improvements for Ley Creek are specifically scheduled under the intermediate projects. Related improvements for Ley Creek are included in the interim phase improvements described previously.

CSO solids which are discharged into the tributaries can be carried downstream to Onondaga Lake. Once in the lake, the bulk of solids will settle and contribute to the sediment layer. The organic fraction of the solids may contribute, in a minor sense, to the DO problem in the lake. Sediment resuspension may occur as a result of high influent velocities from the tributaries or as a result of wave action in the near-shore area induced by strong winds.

After intermediate phase projects, the RTFs and FCFs along the Onondaga Creek corridor will reduce solids entering this tributary. By reducing this load, these facilities will also limit the amount of solids discharged to the lake from the CSOs. It should be noted that there exists a significant solids load from non-point sources within the Onondaga Creek subwatershed. This non-point load will not be affected by the CSO abatement facilities along the creek. Teall Brook FCF will not provide significant solids capture for Teall Brook or Ley Creek.

B7. **Toxics.** A number of industries discharge to the combined sewer system; consequently, toxic chemicals may be present in combined sewer overflows. The concentration of toxics within the discharge at each CSO location is contingent upon a number of factors:

a) Whether an industry is discharging to the combined sewer system (CSS) during a rainfall event.

b) The quantity of "dilution" water afforded by background sewage flows, infiltration, and stormwater runoff that enters the CSS.

c) The ability of the interceptor sewer network to accept the wet weather flow.

The problem of toxicity can exist both on an acute and chronic basis. Acute toxicity occurs when an organism is either killed outright or severely stressed by the presence of a toxin or toxins. Chronic toxicity is the impact on an organism when it is exposed to toxins over a longer time period. A preliminary assessment was conducted by Moffa & Associates using available analytical data from the County's pretreatment monitoring coupled with projections of overflow rates from SWMM modeling. A limited number of overflows were identified as candidates for detailed study on the basis of potential toxicity. The recommended investigations have been incorporated into the list of interim projects for CSOs. This work is necessary to accurately quantify toxic pollutant loads, concentrations, and their potential impact on aquatic life. Toxicity testing will be incorporated into this interim program element.

It should be noted that the chlorination of CSO discharges at the RTFs will generate a limited amount of potentially toxic byproducts, some portion of which will eventually be discharged to the receiving waters. The risk to the aquatic ecosystems is significantly reduced however, via the dechlorination of discharges from the proposed RTFs.

Onondaga Creek may see a small to moderate reduction in the quantity of toxics discharged. This reduction will occur as a result of the reactivation of the EBSS, and to a lesser extent, through the upgrade of the Kirkpatrick Street Pump Station. The Newell Street RTF will have a comparatively small impact because there are no significant industries tributary to this facility.

No reduction of CSO discharges or potential toxicity impacts are anticipated in Harbor Brook as part of the interim or intermediate CSO projects.

Construction of the Hiawatha RTF will result in a significant reduction in the quantity of CSO discharge from this drainage basin and a corresponding reduction in any potential toxics contained in its discharge. There are no significant industrial users within the Hiawatha RTF service area. (The Teall Brook FCF service area also has no significant industrial users.) Inasmuch as the proposed FCF does not provide any treatment of toxics or CSO volumetric reduction, the discharge of toxics would remain unchanged within the upper Ley Creek basin as a result of both interim and intermediate projects. It is unlikely that there is a significant impact from this area since 91 percent of the wet weather flow generated within this basin is retained by the CSS.

All of the tributary toxics reductions for the intermediate phase will happen within the Onondaga Creek basin. A principal significant industrial users discharge will be addressed at

CSO 039 with the construction of the Midland RTF. Another CSO drainage basin with a significant industrial user will be separated as part of the intermediate project. Although basin separation has generally been slated for the latter end of the intermediate phase, selected basin separation may occur earlier if the CSO toxics investigation program, proposed as part of the interim phase, indicates significant impacts and if they cannot be addressed via industrial pretreatment activities (source control).

As is the case for many other parameters, the magnitude of pollutant loading to the lake from the Harbor Brook basin will be significantly reduced with the construction of the EquiFlow™ system (projected as 92 percent for the demonstration facilities). In a similar manner, the potential impact of toxics from the Ley Creek basin will be significantly reduced because of the Hiawatha RTF. The net CSO volumetric reduction in the Ley Creek basin is projected to be 75 percent of the existing CSO discharge. Based on a preliminary assessment, potential toxic discharges to the lake following the implementation of the interim projects will likely be associated with CSOs tributary to Onondaga Creek.

B8. **Mercury.** Mercury (Hg) in natural waters can be found primarily in the form of slightly soluble inorganic (unmethylated) species bound to particles of lake bottom sediment (Jackson, 1993). Bacteria and fungi in the sediment convert this to methyl mercury (CH_3Hg^+), a toxic form which biomagnifies in the food chain and accumulates in fish tissues (Jensen and Jernelov, 1969; Jackson, 1993). CH_3Hg^+ diffuses into the bottom waters and is consumed or absorbed by aquatic organisms.

Regnell and Tunlid (1991) conducted studies of mercury concentrations in lake sediment and water under aerobic and anaerobic conditions. They determined that the proportion of methylated Hg was significantly higher in the anaerobic water and sediment systems than in aerobic systems.

Microorganisms in the aquatic environment methylate inorganic mercury in sediment and water (Jackson, 1988). Methyl mercury production is determined by the methylation rate and the fraction of the total mercury which is available for methylation. Both of these factors are dependant on the level of microbial activity in the water or sediment (Regnell, et al. 1991). Algal blooms, a common characteristic of eutrophic lakes, stimulate nutrient substrate production. These organic nutrient substrates then increase the growth and productivity of Hg-methylating microbes (Jackson, 1993).

Several studies have indicated that methylation of mercury takes place primarily under anaerobic conditions (Jackson, 1988). Research conducted by Regnell and Tunlid (1991) support this theory and show that anoxic conditions in lake bottom water and sediment causes an increase in bioavailable mercury. Studies conducted in fresh water environments demonstrated that bacterial cells averaged 3.6 times higher in anaerobic conditions, whereas volatilization of Hg took place at the same rates in the aerobic and anaerobic conditions. Hg was incorporated into the sediment at a faster rate under aerobic than anaerobic conditions. While aeration in rapidly flushed environments enhances the availability of sediment bound inorganic Hg for methylation, this condition depresses the rate at which microbial activity is able to methylate the mercury (Jackson, 1988).

The effectiveness of hypolimnetic oxygenation in Onondaga Lake will depend on design factors including positioning of the apparatus. Research has indicated that mercury is concentrated within identifiable areas within the lake basin. Low Hg concentrations are generally found in the littoral zone sediments, higher concentrations have accumulated in the profundal sediments, and the highest concentrations are near known sources of Hg deposits. Sediment core analysis has indicated that Hg has low mobility in profundal sediments and that the largest concentrations of Hg is buried by lake bottom sediment (Henry, et al. 1995).

Based on these investigations, it appears that provision of aerobic conditions in the lower waters will reduce the rate at which mercury is methylated. A complicating issue lies in the role of sulfides in mobilizing mercury from the sediments and potential impacts of hypolimnetic oxygenation on altering these processes.

Wang and Driscoll (in review, 1996, and 1994) have investigated mercury and sulfide dynamics in Onondaga Lake. They reported that elevated mercury concentrations in the hypolimnion during summer stratification closely coincided with increased total hydrogen sulfide (H2ST) concentrations.

Sulfate naturally occurs in elevated concentrations throughout the Onondaga Lake drainage basin. During anoxic conditions, sulfate is reduced to sulfides in the lake's hypolimnion. In the anoxic hypolimnion, Hg is found primarily as HgS_2 2- and/or $Hg(HS)_2$ when concentrations of H_2S are in excess of HgT. According to Wang and Driscoll (1994 and 1996), formation of H_2S and mercuric sulfide complexes could mobilize Hg from solid phases to contribute to the summer accumulation of total Hg in the hypolimnion of Onondaga Lake.

Mercury polysulfide complexes are the primary form of mercury in the Onondaga Lake hypolimnion. An insoluble precipitate, HgS can form in water containing Hg and S during anoxic conditions. The formation of HgS appears to be dependent on pH values. Production of H_2S may scavenge Hg by precipitation of HgS under mildly reducing conditions and pH values below 7.0. Mason et al. (1993, as cited in Wang and Driscoll, 1995), also demonstrated the significance of other particulate substances (especially iron and manganese) in scavenging and transporting Hg in the water column.

The pilot test proposed as an interim phase MCP action will be designed to evaluate whether hypolimnetic oxygenation has a net positive impact on mercury cycling and methylation within Onondaga Lake. Chemical forms of mercury and sulfides will be closely monitored.

4.1.3 Effects on Aquatic Ecology

The projected water quality improvements discussed in Section 4.1.2 will result in an improved environment for the aquatic biota. Aquatic habitat in the tributaries will improve with control of the combined sewer overflows and associated reductions in solids deposition. Overlying water quality in the tributaries will improve as well as control of CSOs. The County's monitoring program will be expanded to include assessment of the field biotic index (a measurement of the presence of pollution-tolerant macroinvertebrates) as a means to quantify improvements to the aquatic habitat in the CSO-impacted tributaries throughout the implementation phase.

Water quality improvements to the Seneca River resulting from implementation of the MCP are less certain. As discussed earlier, the most significant impacts on the Seneca River result from zebra mussel respiration (decreased DO, increased TKN and ammonia, increased water clarity, increased soluble reactive phosphorus). Additional water quality impacts on the Seneca River result from the chloride-induced density stratification resulting from the inflow of Onondaga Lake water. Stratification isolates the lower portions of the river's water column from atmospheric exchange, thus exacerbating DO depletion. Neither zebra mussels nor chemical stratification in the Seneca River is addressed in the County's MCP.

However, the County's MCP is projected to measurably improve Seneca River water quality. As the epilimnetic lake water quality improves, the input to the river is improved. Lower ammonia concentrations and improved DO conditions are projected. These improvements may expand the habitat available for the river's existing warm water fishery.

Onondaga Lake will evidence improvements to aquatic ecology as the MCP actions are implemented. Reduction in ammonia loading will greatly reduce the in-lake concentrations. Habitat for aquatic biota (zooplankton and fish) will be improved in response to improvements at METRO as well as hypolimnetic oxygenation. The County's monitoring program will be expanded to include measurement of the response of these organisms to MCP actions.

Hypolimnetic oxygenation is projected to greatly improve the aquatic habitat in Onondaga Lake. The hypolimnetic oxygenation system is proposed as a means to recover aerobic conditions and to reduce nutrient input from the hypolimnion or the sediments. The impacts of hypolimnetic oxygenation vary according with the particular conditions of a water body and the features of the engineering design. Initial chemical budgets of the water column, hydrological features, and nature of the sediments will determine short- and long-term effects. Oxygenation will directly impact the chemical composition of the hypolimnion; it may change the nature of the thermocline and result in changes in the epilimnion.

Improvements in water quality are more likely to occur in lakes where the thermal stratification is maintained so that nutrients from the hypolimnion do not get cycled in the epilimnetic food web. Systems that are less eutrophic respond faster to oxygenation than those with higher amounts of nutrients (Lowell, et al., 1987).

Experimental hypolimnetic oxygenation of a naturally eutrophic lake where stratification was maintained produced the following changes after half a year:

1. Reduction of internal phosphorus loading and hypolimnetic orthophosphate concentrations, but aerobic phosphorus regeneration increased (Ashley, 1983).

2. Ammonia concentrations were reduced when sufficient oxygen was added for nitrification.

3. Oxygen concentration increased, as well as oxygen consumption due to oxidation of organic material in the water column and the sediments.

4. Calcium, magnesium, bicarbonate, and orthophosphate concentrations were reduced via carbonate phosphate coprecipitation.

5. Hypolimnetic turbidity increased, but did not affect epilimnetic transparency (Ashley, 1983).

A seven-year study in a eutrophic water supply produced the following ecological impacts:

1. Summer secchi disk increase from 1.8m to 4.6m due to elimination of blue-green (cyanobacteria) blooms.

2. Compensation depth increased into the hypolimnion, restoring habitat for salmonids and zooplankton.

3. By the end of the study, large clodocera was the dominant zooplankton.

4. Increase in aerobic respiration was detected in the hypolimnion (Kortmann, et al., 1994).

When thermal stratification was not maintained, inconsistent results were seen in some lakes after hypolimnetic aeration. In Lake Cachuma, CA, there was a weakening of the stratification, increased oxygen and temperature in the hypolimnion, and increased green algae (Bohemke, 1983). Hypolimnetic aeration increased diffusion of nutrients into the epilimnion in one case. This internal fertilization of the lake increased filamentous cyanophyte biomass (Steinberg, 1984).

The 1993 limnocorral experiments in Onondaga Lake suggest that hypolimnetic oxygenation would significantly reduce ammonia and phosphorus and eliminate anoxic conditions in the hypolimnion. The epilimnion would benefit from increased dissolved oxygen and reduced ammonia. It appears that at least initially, epilimnetic phosphorus will only decrease when the lake is not stratified. However, oxygenation of the lower waters would decrease the total phosphorus throughout the water column.

In summary, hypolimnetic oxygenation would potentially improve water quality and provide an expanded habitat for fish and zooplankton. Best results will be obtained if sufficient oxygen is added to bind nutrients and metals to the sediments to minimize internal loading. Over time, nutrient loss from the water column could potentially result in reduction of primary production, particularly of cyanobacteria blooms; increased diversity and biomass of large cladoceran zooplankton, and expansion of suitable habitat for the existing warm water fishery.

4.1.4 Effect on Geology

A. Potential Impacts to Surface and Subsurface Conditions

There will be no significant impact on the geology of the area. There is no expected deep drilling as part of the MCP. Pilings for structural facilities follow standard construction practices and have minimal impact on subsurface conditions. Any pile driving will follow standard construction procedures and will have no significant impact on subsurface conditions. There are no anticipated significant changes to internal earth stresses caused by any surface or subsurface loadings (e.g., blasting, heavy machinery operation, and installation of footings and foundations).

B. Potential Impacts to Topography

There are no earthslide-prone areas characterized by unstable slopes or land surfaces. There will be no significant exposure of soil or rock to wetting, drying, heating or cooling processes; there are no extremely steep slope gradients being cut. Any grading operations will attempt to return contours to their approximate original configuration.

C. Potential Impacts to Soil Conditions

The County and their engineering consultants will be working closely with the Onondaga County Soil and Water Conservation District, USDA Natural Resource Conservation Service, to ensure that final construction plans comply with all applicable state, city, and County soil and erosion control requirements and follow guidelines for urban and sediment control issues by the state. This will include erosion and sediment control plans and stormwater management plans designed to ensure erosion control and mitigate nutrient and sediment runoff into the draining tributaries. Soil and erosion control plans will include seeding temporary berms, levees, and topsoil piles. Also, Onondaga County personnel will inspect erosion-prone areas during construction on a regular basis.

D. Potential Impacts to Bottom Sediments

Potential impacts to Onondaga Lake bottom sediments are primarily associated with the provision of aerobic conditions at the sediment-water interface. The current biochemical and physical/chemical reactions releasing soluble phosphorus, ammonia, iron, and manganese to the lower waters would be altered. Provision of aerobic conditions would enable complete decomposition of organic material. The potential impact on mercury mobilization from the lake bottom sediments is unknown and will be investigated as part of a large-scale demonstration project.

The demonstration project will be organized by Onondaga County, with financial and technical support provided by USEPA. Results from the demonstration project will be used to formulate lake-wide design and implementation recommendations.

4.1.5 Terrestrial Ecology

A. Vegetation

The impact on vegetation will be limited to construction activities. Construction activities associated with the proposed MCP projects such as the Hiawatha RTF would affect vegetation communities in these project areas. Outside of these few CSO site facilities, most forested areas will be largely undisturbed during the implementation of the MCP.

Direct impacts of construction and operation of the MCP's recommendations will be limited to the METRO improvements; the proposed CSO site facilities; the expansion of paved surfaces and parking lots; and the routing of the proposed CSO transmission facilities. The specific area impacts will depend on the vegetation association disturbed in each case. Most of the adjacent land uses (see Appendix C-5) are urban and do not contain significant natural vegetation communities. Indirect impact of construction runoff to natural vegetation downslope from the site will be minimized by the implementation of an approved sedimentation and an erosion control plan.

According to the NYSDEC for areas that have been examined (such as the Hiawatha RTF), there are no records of federal or state endangered or threatened or significant plant species on or in the vicinity of the proposed project sites. Therefore, the proposed projects should have no significant impact on such species.

B. Wildlife

Two types of potential impacts to wildlife associated with construction and operation of the project sites were examined. The first is the direct loss of wildlife habitats to the expansion of the CSO site areas themselves and of the immediately adjacent portions of potential habitats. These areas could be used as foraging habitat for granivorous species such as morning dove, granivorous/insectivorous species such as blackbirds, and herbivores such as white-tailed deer. The second anticipated impact to wildlife will be the disruption of movement patterns for mammals with large home ranges such as white tailed deer and red fox. Because these species are more sensitive to human activity than the avian species mentioned under existing conditions, the "impact area" of the METRO and CSO abatement sites may extend several hundred meters from the site itself with regard to their behavioral patterns. However, it should be noted that the METRO site expansion and CSO facilities would, in the worse case, create impacts that would be considered extremely minor as well as temporary as a result of construction. In addition, habitats of wildlife species will remain on site in those portions of the project site not affected by construction activities. Furthermore, it is expected that wildlife will reinhabit restored areas and portions of the disturbed areas once construction and restoration activities have been completed.

For the areas examined by NYSDEC (such as the Hiawatha RTF), there are no records of federal or state endangered or threatened terrestrial wildlife on or in the vicinity of these projects. Therefore, the project should have not impact on such species. As each individual facility is developed, a thorough search for any rare or endangered wildlife will be conducted.

C. Freshwater Wetlands

Construction activities associated with the proposed Hiawatha RTF and Harbor Brook EquiFlow™ will impact freshwater wetlands in the project area.

The wetland affected by the proposed Hiawatha RTF outfall extension pipeline covers 9.5 acres and is designated as a Class II wetland by NYSDEC. Onondaga County has proposed to mitigate this impact as part of measures undertaken for the Stadium Market Center project. The permit application, EAF, negative declaration, and other supporting documentation of the wetland mitigation effort has been included in Appendix C-11 of the document.

The wetlands affected by the proposed Harbor Brook EquiFlow™ demonstration project are of poor quality and have been severely degraded due to past filling, dumping, and channeling activities. The proposed layout of the EquiFlow™ facility will minimize adverse impacts and, in fact, will provide for natural expansion of the wetland between the sheltered lake shoreline and the EquiFlow™ system. This project also includes a USEPA sponsored and funded pilot demonstration wetlands treatment component. Demonstration subsurface and freshwater surface wetlands will be constructed and tested as a unit process following EquiFlow™ CSO capture and treatment. Details may be found in Appendix C-12 of this document.

4.1.6 Air Quality Impacts

The proposed projects recommended as part of the MCP will involve site preparation, transportation of equipment and material to the site, construction, and operations of the METRO and CSO facilities.

The emissions of air pollutants will result from the following:

1. Fugitive emissions from construction activities, including land clearing, site grading, site restoration. Vehicular traffic exhaust, including trucks use to bring the CSO equipment in to each site, to haul wastes off site, and automobiles used by site workers during construction.

2. Fugitive emissions from paved and unpaved roads because of vehicular traffic during operations.

3. Fugitive emissions of volatile organic compounds in cleaning formulations and paints.

4. Fugitive emissions of volatile organic compounds as a result of the storage of CSO discharges.

Of these, most emission sources are expected to be short term and minor in mature. The potential odor from the storage of CSO discharges is expected to be the only potential significant source of atmospheric emissions. The expansion of METRO should have no increase in present fugitive emissions. Due to the added treatment program being implemented by Bristol-Myers Squibb, the concentration of wastewater being treated will be lower.

The potential for the proposed facilities to produce odors is a concern relating to impacts on adjacent neighborhoods. The land use section of this document addressed the location of sensitive receptors in the areas surrounding these facilities. Odors will be generated primarily as a result of storage of CSO discharges. The solids which are removed via the swirl concentrator devices will be largely inert material with a higher specific gravity. These solids will be returned to the interceptor sewer network via the underflow pumping facilities. It is important that this is done during high flow conditions since the higher flow velocities that exist in the interceptors will carry the solids removed at the regional treatment facilities down to METRO. The remaining solids that are stored during and immediately following a storm will have a higher organic content than what is discharged to the interceptors. Organic constituents contained in the stored water will continue to undergo biodegradation and remove available oxygen from the trapped flow. Once the supply of oxygen has been exhausted in the water, odors can be produced. These odors are generally caused by the production of hydrogen sulfide gas by microbial activity. The probability of odor development is increased with: (1) the length of time that material is stored; (2) higher temperatures; (3) higher solid concentrations; and (4) increased number of access points.

The MCP alternatives selected minimize the amount of storage, and as such, will minimize odors. There should be no appreciable increase in odors from either the proposed EquiFlow™ or floatables netting facilities. The netting facilities will be inspected on a routine basis and after each significant storm event and will be removed/replaced as required.

4.1.7 Potential Impacts on Solid Waste (Sludge) Disposal

There will be no significant adverse impacts to sludge disposal as a result of the METRO improvements. Conversion of the existing digester to an improved digester system will decrease the amount of sludge disposal needed.

4.2 IMPACTS ON HUMAN RESOURCES

4.2.1 Potential Impacts to Existing Transportation Network

A. Short-Term Impact on Traffic from Construction

The most significant land-based impact will be the impact on the maintenance and protection of traffic flow through the areas affected by the project. This will be a short-term impact that will no longer exist upon completion of construction. The generic impacts on traffic are presented below. Specific traffic protection plans will be developed for each capital project in its design phase and will be presented in project-specific Supplemental Draft Environmental Impact Statements or Environmental Assessment Forms. The following discussion is intended to point out significant areas of concern.

A1. **General.** It is intended that pedestrian and vehicular traffic operations will be maintained adjacent to construction locations and that lane closings or road narrowings rather than road closings will be employed wherever possible. The roadway facilities in the vicinity of each construction location were inspected and appropriate detours defined as found necessary.

The details of any rerouting of traffic for each construction site will be coordinated with the City of Syracuse at the planned time of construction as modifications to roadway geometry or traffic patterns may occur during the time interval between this writing and the start of construction. Additionally, other activities in the vicinity of and at the time of construction may warrant revisions to the currently envisioned maintenance and protection of traffic plans.

A2. **Site-Specific Traffic Considerations.** Work areas have been subdivided into segments of construction to minimize the overall impact to traffic operations. Segments of the construction that can be accomplished independently and in any order have been identified using separate paragraphs below. Stage numbers have been used to identify those segments of construction that cannot be permitted to occur simultaneously, that must be separated by a revision to the traffic flow pattern of the area, and that must be performed in sequence.

a) **Newell RTF.** Newell Street will be closed during modification of the Newell Demonstration Facility. A two-way detour will be established along Onondaga Creek Boulevard, Brighton Avenue, Onondaga Creek Park Drive, and Raymond Avenue.

b) **Midland RTF.** Construction must be completed in the order of the stages indicated.

Stage 1. Blaine Street will be closed to all but local traffic during the construction of Manholes #1, #2, #3, and #26.

Stage 2. Midland Avenue will be closed during the construction of Manholes #4, #24, #25, and #27, and their associated facilities, including the pipeline along Midland Avenue toward but not including any portion of Castle Street. A two-way detour will be established along Bellevue Avenue, South Avenue, and Cortland Avenue.

Stage 3. The Stage 2 detour for Midland Avenue traffic will be maintained and expanded during Stage 3 to accommodate Castle Street traffic. During the construction of Manhole #5, a two-way detour will be established along Ballard Avenue and Cortland Avenue.

Stage 4. Castle Street will be closed to all but local traffic between Midland Avenue and South Avenue during the construction of facilities between Manholes #5 and #8.

Stage 5. South Avenue will be closed to all but local traffic during the construction of Manholes #9, #10, and #11 and their associated facilities. A two-way detour will be established along Sterling Avenue and Onondaga Avenue.

Stage 6. During the construction of facilities between Manholes #11 and #16 across Kirk Avenue and through Kirk Park, Kirk Avenue, Kirk Park Drive, and Onondaga Creek Boulevard will be closed to all but local traffic.

Stage 7. Colvin Street will be closed at Onondaga Creek Boulevard during the construction of Manhole #30 and the pipeline between Manholes #16 and #17. During this time, Colvin Street traffic will be detoured south along Hatch Street to Elmhurst Avenue, then west across the creek to Onondaga Creek Boulevard, then north to Colvin Street.

Stage 8. Onondaga Creek Boulevard along the east side of Onondaga Creek will be closed to all but local traffic during the construction of facilities between Manholes #17, #18, #19, #31 and #32.

Stage 9. Elmhurst Avenue will be closed during the construction of Manholes #19, #20, #32, and #33. A two-way detour will be established along Onondaga Creek Boulevard, Brighton Avenue, and Hatch Street.

Stage 10. Onondaga Creek Boulevard along the east side of Onondaga Creek will be closed to all but local traffic during the construction of facilities between Manholes #20, #21, and #22. It is anticipated that the construction of Manhole #22 will not disrupt the movement of traffic along Brighton Avenue.

Tallman Street CSO. Tallman Street will be closed during the installation of facilities in the vicinity of Manholes #38 and #41. A two-way detour will be established along Midland Avenue, Taylor Street, and Oneida Street.

c) **Clinton RTF.**

West Street And Jefferson Street CSO.

1) It will be necessary to close the portion of Jefferson Street south of the Armory, including the passageway under the railroad during the construction of pipeline and Manholes #60 and #61. Traffic will be diverted along the northerly side of the Armory, and access/egress to City Parking Lot #26 will be provided via Dickerson Street during this construction.

2) The easterly end of Tully Street will be closed during the construction of Manholes #63 and #64. Pedestrian access/egress at the Hanford Pharmaceutical building and parking area will be maintained.

3) Construction within the service lanes of the West Street Arterial will require the closing of that facility, no disruption of the mainline roadway is envisioned. Access and egress to adjacent properties will be maintained.

4) Construction within the mainline of the West Street Arterial in the vicinity of the railroad overpass may require the narrowing of the roadway to one travel lane for northbound traffic. This narrowing will not affect operations at the Fayette Street traffic signal.

Onondaga and Clinton Streets CSO. Construction must be completed in the order of the sages indicated.

Stage 1. Dickerson Street will be closed during the construction of the pipeline between Manhole #43 and the CSO treatment facility. Access to City Parking Lot #26 will also be affected on Dickerson Street. Access to properties abutting

Dickerson Street will be maintained via Granger Street during construction. Vehicular access/egress at the City Parking Lot will be via the Jefferson Street entrance. This operation will not be permitted to coincide with the closing of the railroad underpass at Jefferson Street.

Stage 2. After the completion of Stage 1 and the reopening of Dickerson Street to the east of Onondaga Creek, Dickerson Street will be closed on the westerly side of the Creek. The parking lot on Dickerson Street adjacent to the building at street address #122 (Rescue Mission Recreation Center) will have to be closed during the construction of Manholes #49, #50 and #55.

Stage 3. Upon completion of Stage 2, Dickerson Street will be closed to all but local traffic between Onondaga Creek and Granger Street during the construction of Manholes #50 and #51.

Stage 4. During construction on Granger Street between Dickerson and Gifford Streets the roadway will be closed to all but local traffic. During construction at the intersection of Gifford and Granger Streets, Gifford Street will be closed to all but local traffic at Clinton Street. During construction on Granger Street between Gifford and Seymour Streets, Granger Street will be closed to all but local traffic.

Stage 5. Seymour Street will be closed between Onondaga and West Streets during construction at the intersection of Granger and Seymour Streets and across Seymour Street. Westbound traffic will be detoured from the intersection of Adams, Onondaga, Shonnard and Seymour Streets to the north along Onondaga Street to Gifford Street, then westerly along Gifford Street to West Street, then southerly along West Street to Seymour Street.

Stage 6. During construction within Shonnard Street the roadway will be closed. Eastbound traffic will be detoured to the south at the intersection of Shonnard and West Streets to Onondaga Street, then easterly along Onondaga Street to the intersection of Adams, Onondaga, Shonnard and Seymour Streets. The existing left turn prohibition facing southbound traffic on West Street at Onondaga Street will be temporarily removed.

Stage 7. During the construction of Manholes #54 and #58 the westbound lanes of Onondaga Street will be closed. Westbound traffic will be routed to the eastbound lanes, and no adjustment to the signal or the fire pre-emption at Adams, Onondaga, Shonnard, and Seymour Streets will be required.

Stage 8. The unnamed roadway linking Gifford and Dickerson Streets adjacent to and immediately west of the railroad will be closed during construction of the pipeline between Manholes #43 and #45. No traffic detours will be required.

During the construction of Manhole #45, Gifford street will remain open to traffic. A street width constriction and/or the prohibition of some on-street parking may be required.

d) **Franklin FCF.**

Butternut Street And Burnet Avenue. The right turn roadway from Clinton Street to Webster's Landing will be closed during construction of the pipeline between Manholes #77 and #78. Traffic from the I-81 southbound exit ramp (on Clinton Street) turning right onto Webster's Landing will be detoured around the turning roadway and into the intersection.

Webster's Landing will be closed to all but local traffic between the I-81 southbound off-ramp at Clinton Street and Franklin Street during the construction of Manhole #78. Westbound traffic approaching Clinton Street on Webster's Landing will be directed to the south along Clinton Street. During this time the Webster's Landing building will remain accessible from I-81 southbound.

e) **Maltbie FCF.** Access and egress at the parking garage of the Bridgewater Place office building will be affected. Two driveways exist at the garage and at no time will both driveways to the garage be obstructed. Garage users will be notified of construction scheduling to minimize any disruption of their activities.

f) **Teall Brook FCF.** There should be no significant increase in traffic for the Teall Avenue floatable control facility except for minor traffic disruptions.

g) **Hiawatha RTF.** During the construction period of the CSO transmission pipeline, traffic patterns and volumes at the various site driveways and intersections along Hiawatha Boulevard and Park Street will be affected. No long-term impacts of the proposed transmission pipelines on traffic or safety are expected. Potentially unsafe conditions to be managed during the construction of these pipelines include soils tracked by construction equipment onto public roads, open trenches, construction materials, and equipment left unattended during non-working hours. The CSO transmission facilities are not considered to be a significant hazard to the public.

h) **Erie Boulevard Storage System Reactivation.** Anticipated disruptions of traffic would be expected at the three affected intersections on Erie Boulevard and at the James and State Street intersection. Supplemental DEISs would need to be conducted for the time of facility implementation.

I) **Floatables Control Projects, Kirkpatrick Street Pump Station, and the Harbor EquiFlow™.** These projects will be located in Onondaga Lake, Onondaga Creek, Teall Brook, and Harbor Brook and are not expected to have an impact on traffic.

j) **Sewer Separation.** Sewer separation within Onondaga Creek sewer drainage areas will occur within local street right-of-ways. Site specific supplemental DEISs will be prepared in conjunction with project design.

k) **METRO** construction-related traffic will affect the signalized intersection of Hiawatha Boulevard and Pulaski Street with the temporary increase of truck traffic. Given the existing high traffic volumes and high percentage of truck traffic and existing Level of Service A (no delays) at the intersection, the impact on traffic is not expected to be significant.

both driveways to the garage be obstructed. Garage users will be notified of construction scheduling to minimize any disruption of their activities.

f) **Teall Brook FCF.** There should be no significant increase in traffic for the Teall Avenue floatable control facility except for minor traffic disruptions.

g) **Hiawatha RTF.** During the construction period of the CSO transmission pipeline, traffic patterns and volumes at the various site driveways and intersections along Hiawatha Boulevard and Park Street will be affected. No long-term impacts of the proposed transmission pipelines on traffic or safety are expected. Potentially unsafe conditions to be managed during the construction of these pipelines include soils tracked by construction equipment onto public roads, open trenches, construction materials, and equipment left unattended during non-working hours. The CSO transmission facilities are not considered to be a significant hazard to the public.

h) **Erie Boulevard Storage System Reactivation.** Anticipated disruptions of traffic would be expected at the three affected intersections on Erie Boulevard and at the James and State Street intersection. Supplemental DEISs would need to be conducted for the time of facility implementation.

i) **Floatables Control Projects, Kirkpatrick Street Pump Station, and the Harbor EquiFlow™.** These projects will be located in Onondaga Lake, Onondaga Creek, Teall Brook, and Harbor Brook and are not expected to have an impact on traffic.

j) **Sewer Separation.** Sewer separation within Onondaga Creek sewer drainage areas will occur within local street right-of-ways. Site specific supplemental DEISs will be prepared in conjunction with project design.

k) **METRO** construction-related traffic will affect the signalized intersection of Hiawatha Boulevard and Pulaski Street with the temporary increase of truck traffic. Given the existing high traffic volumes and high percentage of truck traffic and existing Level of Service A (no delays) at the intersection, the impact on traffic is not expected to be significant.

B. Long-Term Impacts on Transportation Facilities

a) **Midland RTF.** The Midland RTF will require abandonment of the Oxford Street bridge. The bridge carries only pedestrian traffic. The construction of the Midland facility may eliminate the Oxford Street bridge for use by pedestrian traffic across the creek. However, alternate routes exist one block north and one block south of the project site.

b) **Clinton RTF and Franklin FCF.** Both projects will result in the permanent loss of some surface parking spaces. However, alternate parking lots exist in the immediate area, and downtown generally has a surplus of parking spaces.

4.2.2 Potential Impacts to Land Use in Project Area, Including Multiple Use Opportunities

METRO plant improvements will have no significant impact on adjacent uses, including industrial uses and the automotive service station on Hiawatha Boulevard or mall parking across Onondaga Creek. The Niagara Mohawk site, which is to be acquired for expansion of METRO plant facilities is under remedial investigation. Current uses of the site, including an automotive natural gas filling station, will need to be relocated.

CSO regional treatment facilities will preclude alternate future commercial or residential use on all sites, cause the loss of open space, or surface parking spaces (Clinton Station, Franklin Street, Erie Boulevard) and associated revenue to the City of Syracuse and NYSDOT. Each site presents the opportunity for multiple use, including parking, public open space, and recreation, which will be evaluated at the design stage of each facility (Table 4-6).

Sewer improvement projects will occur within street rights-of-way or stream channels for Onondaga Creek, Harbor Brook, and Teall Brook. These projects will not result in permanent impacts to adjacent uses.

Sewer separation in the Onondaga Creek drainage basins will require excavation within City streets. Excavation will provide the opportunity to address maintenance or replacement needs of other infrastructure systems which are of comparable age to the sewer system.

4.2.3 Potential Impacts to Land Use Plans

A. *Consistency with Onondaga County 2010 Plan*

With outside financial assistance, the MCP is consistent with the County's 2010 Development Guide, which stresses fiscal management, the environment, and infrastructure efficiency (2010 Development Guide, Volume 3, Development Goals and Policies, 1991, page 3). The plan encourages infill and redevelopment on land already served by urban infrastructure ahead of extension of infrastructure to rural areas; the plan also recognizes that 'significant community resources will be focused on Onondaga Lake, its tributaries and environs through efforts to improve water quality, enhance Onondaga Lake Park, and develop opportunities for economic growth." (2010 Plan, Volume 3, page 3). By improving aesthetics along the lake and its tributaries and by increasing capacity for wastewater treatment at METRO by 5 mgd, the proposed MCP will support growth and redevelopment within the METRO Service Area in accordance with the 2010 Plan.

B. *Consistency with Waterfront Revitalization*

By improving water quality in Onondaga Creek, Harbor Brook, Ley Creek, and Onondaga Lake, and by improving processes at METRO aimed at odor control, the MCP is consistent with and supportive of redevelopment plans by the City of Syracuse for the harbor on Onondaga Creek and the lakefront; the New York State Thruway Authority for the barge canal revitalization; recent and planned private commercial and residential development along the creek and the lake; and the Transportation Center, New York State Regional Market Authority's planned redevelopment, and Onondaga County's multi-purpose community stadium along Ley Creek.

4.2.4 Potential Impacts to Demography

A. *Population and Residential Distribution*

The MCP is projected to cause an ongoing decline in population amounting to a loss of 3,700 people by 2020. The potential impact of the MCP on County population was analyzed using a REMI (Regional Economic Models, Inc.) Model. As explained in Appendix E, baseline demographic and economic forecasts were compared to forecasts prepared using project expenditures for capital construction and increased operation and maintenance, assuming no financial aid.

Despite the improvement in water quality and odor control from MCP projects and the increase in the wastewater capacity of the METRO Service Area, which are supportive of growth within the service area, particularly in City neighborhoods along the tributaries, lower costs of living outside the Onondaga County Sanitary District can be expected to increase the attractiveness of rural areas for low density residential development and exacerbate a trend toward growth outside the District, within, and beyond Onondaga County. Given a stable or declining population, this trend would decrease the residential property values of the oldest neighborhoods, particularly in the City. Economic incentives to abandon older City dwellings and build new housing beyond the District would intensify.

An increased unit charge will weigh most heavily on low and very low income households. Poverty is more prevalent in Syracuse than in suburban towns, thus the impact of increased user fees can be expected to weigh most heavily on Syracuse residents. A substantial increase in the unit charge will increase the cost of living in the district in comparison to rural areas in Onondaga County and surrounding counties.

B. Economic Impact

Initially, project construction can be expected to create a short-term boost in economic activity and employment; increased demand for construction workers and materials will provide minor gains in population, households, personal income, and employment. As user fees increase to cover debt service and operating costs associated with the MCP, business and residents will have to shift consumption expenditures. Debt service payments to bondholders will leave the local economy.

The regional economic projections done with the REMI model show that within a few years, the increased user fees will decrease disposal income and cause the County's economy to drag. During the initial construction phase, area employment is projected to remain stable, but from 2000 to 2015, employment is projected to decline from baseline projections. According to the REMI projections (see Appendix E), project implementation can be expected to result in the decline of employment in the County over the life of the program, totaling 1,700 by 2020.

If project construction is phased over a longer term, it will be possible to use more local labor and integrate these initial employment benefits into the local economy over a longer term. However, debt service is expected to remove spending from the local economy by way of increased user fees.

C. Regional Competitiveness

Higher costs of doing business in a region makes the region less competitive in relation to other regions. To the extent that MCP-related increases in sewer use fees increases the costliness of the business climate, it may have an impact on economic competitiveness of Onondaga County and the central New York region.

D. Tax Base

Given the large increases in sewer use rates, there is a high probability for relocation of a significant number of district sewer users. Current sewer users could relocate within portions of Onondaga County that are not part of the current sewer district. Over 87 percent of the County acreage is not served by the sewers or subject to user fees. This includes 69,517 acres within the district and 370,201 acres outside the district. Residential development in areas without sewers would greatly exacerbate urban sprawl contrary to the County's 2110 Development Guide.

An even greater impact would be felt if current district residents relocate outside of the County. Over 11,700 Onondaga County residents commute to jobs in surrounding counties. This group would be particularly vulnerable to permanent outmigration given increased cost of living due to sharp rises in wastewater fees. Other resident outmigration is also likely due to business relocation caused by the desire to avoid large sewer use rate increases. In these cases, the County would not only lose district sewer rate payers but general fund tax payers. A shrinking tax base, the likely outcome of large increases in the sewer use fees, would reduce the capacity of Onondaga County to maintain its other essential services.

E. Onondaga County Sanitary District Stability

The METRO plant provides 70 percent of the County's wastewater treatment capacity, serving 65 percent of the households and most of the major industrial and commercial areas. Direct benefits from the proposed MCP will occur within the City of Syracuse and the six towns with the METRO Service Area as a result of aesthetic improvements along Onondaga Creek and the harborfront and increased treatment capacity at the METRO plant. However, increased unit charges would be spread across the Onondaga County Sanitary District.

Pressure by suburban areas to reconsider the configuration of the district can be anticipated. Dissolution of the district either within the current administrative structure as a County department or in the process of creating an authority would create severe affordability issues given the relative concentration of poverty population in the City, and hence the METRO Service Area. Average household income in the METRO Service Area households is over $6,200 below the district average, according to 1990 Census data. An independent METRO Service Area would have a population base not only poorer, but 38 percent smaller; and a household base which is 36 percent smaller than the district's, from which to raise increased user fees. Dissolution of the district would also increase the project's negative economic impact on industry and employment because the costs would be spread over a smaller base, further increasing the unit charge, and hence the cost of doing business in the District.

4.2.5 Potential Impact to Cultural Resources

A. Visual Resources

Onondaga Creek has been proposed as a greenspace corridor in the draft Open Space Index (1976). This index is presently under revision by the Syracuse Conservation Advisory Council. There could be some impacts on the present visual character of this creek in the areas adjacent to the Midland RTF and Newell RTF, particularly lower Onondaga Park. The other areas further downstream (i.e., Clinton RTF, EBSS reactivation, Franklin FCF) could have an impact on future potential visual resources.

A1. **Potential Impacts to Physical Character of the Community.** The implementation of the MCP will have an adverse negative impact from the perspective of structures; however, it will also represent a positive impact by reducing existing levels of floatables from CSO discharges in the tributaries and lake. The swirl concentrator and other vortex devices that may be considered for floatables removal will provide high levels of floatable removal. In all instances, the structures envisioned for CSO abatement will be designed to be less obtrusive visually than a typical treatment plant and will be landscaped to minimize the impact.

A2. **Potential Impacts to Natural Areas of Significant Scenic Value.** The area flagged as a scenic and recreational resource in the Open Space Index (1976, currently under revision) is part of the Onondaga Creek corridor. Depending on the final location and appearance of the CSO facility proposed by the creek, there could be impacts to this corridor.

A3. **Potential Impacts to Structures of Significant Architectural Design.** The METRO site may be within distant view of any motorists on adjacent and nearby roads. Directional lighting will be used at night to light the area for security and 24-hour operation of the plant, as is now the case. Due to the distance of the METRO site from any homes and the existence of street trees between the METRO and the homes, this additional lighting is not expected to impact the residents. Efforts will be made to direct such lighting to the immediate area of operations and away from the homes. During the site construction and restoration, all activity will occur during daylight hours. Therefore lighting will not be necessary.

B. Historic and Archeological Resources

The impact of MCP projects on historical and archaeological resources will be investigated through supplemental DEIS process, once site-specific designs are completed. These resources are described in Chapter 2.

C. Noise

C1. **Short Term (Construction Phase).** Short-term impacts of the proposed CSO facilities, and particularly the CSO transmission facilities, include elevated noise levels due to construction, to sensitive receptors such as residential areas adjacent to these CSO facilities. The expected noise levels vary by type of construction equipment, ranging for 78 to 85 A-weighted decibels (dBA). These sound pressure levels are as measured 50 feet from the equipment.

C2. **Long Term.** Once constructed, there should be no significant increase in noise levels above ambient noise.

TABLE 4-1

INPUT TO THE UFI HYDROTHERMAL AND WATER
QUALITY MODELS TO GENERATE FILES FOR THE
UFI SENECA RIVER WATER QUALITY MODEL
Draft Environmental Impact Statement
Onondaga County, New York

METRO PERFORMANCE FOLLOWING
COMPLETION OF INTERMEDIATE PHASE ACTIONS

MONTH	METRO FLOW (MGD)	METRO TP (MG/L)	METRO TKN-N (MG/L)	METRO NH3-N (MG/L)	METRO NOx-N (MG/L)	METRO DO (MG/L)	METRO BOD (MG/L)
JANUARY	80.1	0.6	5.28	3.3	13.3	9.4	16.0
FEBRUARY	86.7	0.6	5.28	3.3	12.1	9.4	16.0
MARCH	95.6	0.6	5.28	3.3	12.7	9.4	16.0
APRIL	98.1	0.6	5.28	3.3	12.9	9.4	16.0
MAY	86.6	0.6	5.28	3.3	11.6	9.4	16.0
JUNE	75.9	0.6	2.64	1.65	13.7	9.4	16.0
JULY	71.5	0.6	2.64	1.65	16.7	9.4	16.0
AUGUST	68.5	0.6	2.64	1.65	16.5	9.4	16.0
SEPTEMBER	70.3	0.6	2.64	1.65	14.0	9.4	16.0
OCTOBER	72.6	0.6	2.64	1.65	13.4	9.4	16.0
NOVEMBER	77.1	0.6	5.28	3.3	11.5	9.4	16.0
DECEMBER	78.8	0.6	5.28	3.3	11.0	9.4	16.0

* Conditions specified are for METRO effluent.

TABLE 4-2

INPUT TO THE UFI SENECA RIVER MODEL TO PREDICT
IMPROVEMENTS FROM PROPOSED MCP
Draft Environmental Impact Statement
Onondaga County, New York

CURRENT CONDITIONS:
RIVER STRATIFIED, ZEBRA MUSSELS PRESENT

1. METRO Parameters

Flow to Lake	NA	mgd	Cl	NA	mg/l
Flow to B'ville	NA	mgd	CBODu	NA	mg/l
Flow to River	NA	mgd	TKN	NA	mg/l
			DO	NA	mg/l

2. Boundary Conditions

	Flow (mgd)	Cl (mg/l)	CBODu (mg/l)	TKN (mg/l)	DO (mg/l)
Seneca River	473	116.5	1.4	**0.35**	**4**
Onon. Lk. Outlet	61.2	450	0.84	**2.71** [1]	**6.22** [1]
Oneida River	121	27.1	2	2	7.2

3. Treatment Plant Loads

	Flow (mgd)	Cl (mg/l)	CBODu (mg/l)	TKN (mg/l)	DO (mg/l)
B'ville	9	144	38	16	10
Wetzel Rd.	3.5	128	68	32	5.1
Busch	6	208	84	4.4	4.9
Phoenix	0.6	75	45	20	2.3
Miller	5.2	107	230	3.5	4.4
Fulton	3.4	195	85	32	3.5
Armstrong	3.2	109	58	11	6.1
Minetto	0.1	109	45	32	7

4. Flow Conditions

River Flows = **7q10 conditions**
WWTP Flows = **defaults**
Stratified River Conditions

5. Kinetic Coefficients

CBODu Decay	=	**0.1**	1/day
Ammonia Decay	=	0.021	1/day
Ave. Reaeration	=	0.22	1/day

6. Environmental Conditions

Top Temp.	=	25	deg C
Bottom Temp.	=	25	deg C
Top pH	=	**8**	
Bottom pH	=	**8**	

NOTES: Bold numbers indicate a change from the model default value.
[1] averages of observations during August and September of the 1994 Lake monitoring program

TABLE 4-2 (CONTINUED)

INPUT TO THE UFI SENECA RIVER MODEL TO PREDICT
IMPROVEMENTS FROM PROPOSED MCP
Draft Environmental Impact Statement
Onondaga County, New York

FUTURE CONDITIONS WITH MCP ACTION:
RIVER STRATIFIED, ZEBRA MUSSELS PRESENT

1. METRO Parameters

Flow to Lake	NA	mgd	Cl	NA	mg/l
Flow to B'ville	NA	mgd	CBODu	NA	mg/l
Flow to River	NA	mgd	TKN	NA	mg/l
			DO	NA	mg/l

2. Boundary Conditions

	Flow (mgd)	Cl (mg/l)	CBODu (mg/l)	TKN (mg/l)	DO (mg/l)
Seneca River	473	116.5	1.4	**0.35**	**4**
Onon. Lk. Outlet	61.2	450	0.84	**0.74**	**9**
Oneida River	121	27.1	2	2	7.2

3. Treatment Plant Loads

	Flow (mgd)	Cl (mg/l)	CBODu (mg/l)	TKN (mg/l)	DO (mg/l)
B'ville	9	144	38	16	10
Wetzel Rd.	3.5	128	68	32	5.1
Busch	6	208	84	4.4	4.9
Phoenix	0.6	75	45	20	2.3
Miller	5.2	107	230	3.5	4.4
Fulton	3.4	195	85	32	3.5
Armstrong	3.2	109	58	11	6.1
Minetto	0.1	109	45	32	7

4. Flow Conditions

River Flows = **7q10 conditions**
WWTP Flows = **defaults**
Stratified River Conditions

5. Kinetic Coefficients

CBODu Decay	=	**0.1**	1/day
Ammonia Decay	=	0.021	1/day
Ave. Reaeration	=	0.22	1/day

6. Environmental Conditions

Top Temp.	=	25	deg C
Bottom Temp.	=	25	deg C
Top pH	=	**8**	
Bottom pH	=	**8**	

NOTES: Bold numbers indicate a change from the model default value.

TABLE 4-2 (CONTINUED)

INPUT TO THE UFI SENECA RIVER MODEL TO PREDICT
IMPROVEMENTS FROM PROPOSED MCP
Draft Environmental Impact Statement
Onondaga County, New York

FUTURE CONDITIONS WITH MCP ACTION:
RIVER DESTRATIFIED, ZEBRA MUSSELS PRESENT

1. METRO Parameters

Flow to Lake	**80**	mgd	Cl	80	mg/l
Flow to B'ville	**0**	mgd	CBODu	**16**	mg/l
Flow to River	**0**	mgd	TKN	**2.64**	mg/l
			DO	**9.4**	mg/l

2. Boundary Conditions

	Flow (mgd)	Cl (mg/l)	CBODu (mg/l)	TKN (mg/l)	DO (mg/l)
Seneca River	473	116.5	1.4	**0.35**	**4**
Onon. Lk. Outlet	61.2	450	0.84	**0.74**	**9**
Oneida River	121	27.1	2	2	7.2

3. Treatment Plant Loads

	Flow (mgd)	Cl (mg/l)	CBODu (mg/l)	TKN (mg/l)	DO (mg/l)
B'ville	9	144	38	16	10
Wetzel Rd.	3.5	128	68	32	5.1
Busch	6	208	84	4.4	4.9
Phoenix	0.6	75	45	20	2.3
Miller	5.2	107	230	3.5	4.4
Fulton	3.4	195	85	32	3.5
Armstrong	3.2	109	58	11	6.1
Minetto	0.1	109	45	32	7

4. Flow Conditions

River Flows = **7q10 conditions**
WWTP Flows = **defaults**
Non-Stratified River Conditions

5. Kinetic Coefficients

CBODu Decay	=	**0.1**	1/day
Ammonia Decay	=	0.021	1/day
Ave. Reaeration	=	0.22	1/day

6. Environmental Conditions

Top Temp.	=	25	deg C
Bottom Temp.	=	25	deg C
Top pH	=	**8**	
Bottom pH	=	**8**	

NOTES: Bold numbers indicate a change from the model default value.

TABLE 4-2 (CONTINUED)

INPUT TO THE UFI SENECA RIVER MODEL TO PREDICT
IMPROVEMENTS FROM PROPOSED MCP
Draft Environmental Impact Statement
Onondaga County, New York

FUTURE CONDITIONS WITH MCP ACTION:
RIVER DESTRATIFIED, ZEBRA MUSSELS ABSENT

1. METRO Parameters

Flow to Lake	**80**	mgd	Cl	80	mg/l
Flow to B'ville	**0**	mgd	CBODu	**16**	mg/l
Flow to River	**0**	mgd	TKN	**2.64**	mg/l
			DO	**9.4**	mg/l

2. Boundary Conditions

	Flow (mgd)	Cl (mg/l)	CBODu (mg/l)	TKN (mg/l)	DO (mg/l)
Seneca River	473	116.5	1.4	**0.96**	**8.06**
Onon. Lk. Outlet	61.2	450	0.84	**0.74**	**9**
Oneida River	121	27.1	2	2	7.2

3. Treatment Plant Loads

	Flow (mgd)	Cl (mg/l)	CBODu (mg/l)	TKN (mg/l)	DO (mg/l)
B'ville	9	144	38	16	10
Wetzel Rd.	3.5	128	68	32	5.1
Busch	6	208	84	4.4	4.9
Phoenix	0.6	75	45	20	2.3
Miller	5.2	107	230	3.5	4.4
Fulton	3.4	195	85	32	3.5
Armstrong	3.2	109	58	11	6.1
Minetto	0.1	109	45	32	7

4. Flow Conditions

River Flows = **7q10 conditions**
WWTP Flows = **defaults**
Non-Stratified River Conditions

5. Kinetic Coefficients

CBODu Decay	=	**0.1**	1/day
Ammonia Decay	=	0.021	1/day
Ave. Reaeration	=	0.22	1/day

6. Environmental Conditions

Top Temp.	=	25	deg C
Bottom Temp.	=	25	deg C
Top pH	=	**8.35**	
Bottom pH	=	**8.35**	

NOTES: Bold numbers indicate a change from the model default value.

TABLE 4-3

POLLUTANT LOADING REDUCTIONS, PERCENT CAPTURE FOR
INTERIM AND INTERMEDIATE PHASE IMPROVEMENTS
Draft Environmental Impact Statement
Onondaga County, New York

REGIONAL FACILITY	PERCENT OF TOTAL WET-WEATHER FLOW CAPTURED	PERCENT CAPTURED (DIRECTED TO METRO)			
		TSS	TKN	TP	NH_3
INTERIM PHASE PROJECTS					
Harbor Brook FBM	92	93	92	92	92
Hiawatha Blvd. RTF	99	99	99	99	99
Teall Avenue FCF	91	91	91	91	91
EBSS	80	80	80	80	80
Newell Street RTF	76	81	78	78	78
Subtotal	**88**	**89**	**90**	**90**	**90**
INTERMEDIATE PHASE PROJECTS					
Midland Avenue RTF	80	84	81	81	81
Clinton Station RTF	84	87	85	85	85
Franklin Street FCF	85	85	85	85	85
Maltbie Street FCF	68	68	68	68	68
Subtotal	**83**	**85**	**83**	**83**	**83**
TOTAL	**85**	**87**	**85**	**85**	**85**

TABLE 4-4

INPUT TO THE UFI HYDROTHERMAL AND WATER QUALITY MODELS FOR PROJECTING AMMONIA CONCENTRATIONS IN RESPONSE TO CURRENT CONDITIONS, INTERIM PHASE AND INTERMEDIATE PHASE ACTIONS
Draft Environmental Impact Statement
Onondaga County, New York

MONTH	METRO FLOW (MGD)	METRO TP (MG/L)	METRO TKN-N (MG/L)	METRO NH3-N (MG/L)	METRO NOx-N (MG/L)	METRO DO (MG/L)	METRO BOD (MG/L)
CURRENT CONDITIONS							
JANUARY	80.1	0.6	19.6	16.3	0.33	4.0	25.0
FEBRUARY	86.7	0.6	18.8	15.1	0.33	4.0	25.0
MARCH	95.6	0.6	19.6	15.7	0.33	4.0	25.0
APRIL	98.1	0.6	19.6	15.9	0.33	4.0	25.0
MAY	86.6	0.6	18.2	14.6	0.33	4.0	25.0
JUNE	75.9	0.6	15.3	12.1	3.28	4.0	25.0
JULY	71.5	0.6	12.0	9.03	9.3	4.0	25.0
AUGUST	68.5	0.6	9.14	6.5	11.6	4.0	25.0
SEPTEMBER	70.3	0.6	8.11	5.62	10	4.0	25.0
OCTOBER	72.6	0.6	9.48	6.97	8.1	4.0	25.0
NOVEMBER	77.1	0.6	13.1	10.3	4.46	4.0	25.0
DECEMBER	78.8	0.6	17.7	14.3	1.04	4.0	25.0
INTERIM PHASE ACTIONS							
JANUARY	80.1	0.6	15.7	15.4	6.0	4.0	25.0
FEBRUARY	86.7	0.6	14.0	13.4	8.7	4.0	25.0
MARCH	95.6	0.6	13.3	12.5	7.2	4.0	25.0
APRIL	98.1	0.6	12.8	11.9	6.9	4.0	25.0
MAY	86.6	0.6	14.2	13.6	7.4	4.0	25.0
JUNE	75.9	0.6	15.3	14.9	9.7	4.0	25.0
JULY	71.5	0.6	3.6	0.73	17.6	4.0	25.0
AUGUST	68.5	0.6	3.7	0.90	16.1	4.0	25.0
SEPTEMBER	70.3	0.6	3.7	0.87	16.2	4.0	25.0
OCTOBER	72.6	0.6	13.1	12.3	12.0	4.0	25.0
NOVEMBER	77.1	0.6	15.9	15.7	9.4	4.0	25.0
DECEMBER	78.8	0.6	14.8	14.3	9.1	4.0	25.0
INTERMEDIATE PHASE ACTIONS:							
JANUARY	80.1	0.6	5.28	3.3	13.3	9.4	16.0
FEBRUARY	86.7	0.6	5.28	3.3	12.1	9.4	16.0
MARCH	95.6	0.6	5.28	3.3	12.7	9.4	16.0
APRIL	98.1	0.6	5.28	3.3	12.9	9.4	16.0
MAY	86.6	0.6	5.28	3.3	11.6	9.4	16.0
JUNE	75.9	0.6	2.64	1.65	13.7	9.4	16.0
JULY	71.5	0.6	2.64	1.65	16.7	9.4	16.0
AUGUST	68.5	0.6	2.64	1.65	16.5	9.4	16.0
SEPTEMBER	70.3	0.6	2.64	1.65	14.0	9.4	16.0
OCTOBER	72.6	0.6	2.64	1.65	13.4	9.4	16.0
NOVEMBER	77.1	0.6	5.28	3.3	11.5	9.4	16.0
DECEMBER	78.8	0.6	5.28	3.3	11.0	9.4	16.0

* Conditions specified are for METRO effluent.

TABLE 4-5

ONONDAGA LAKE BACTERIA MODEL RESULTS FOR EXISTING CONDITIONS, INTERIM PHASE, AND INTERMEDIATE PHASE
Draft Environmental Impact Statement
Onondaga County, New York

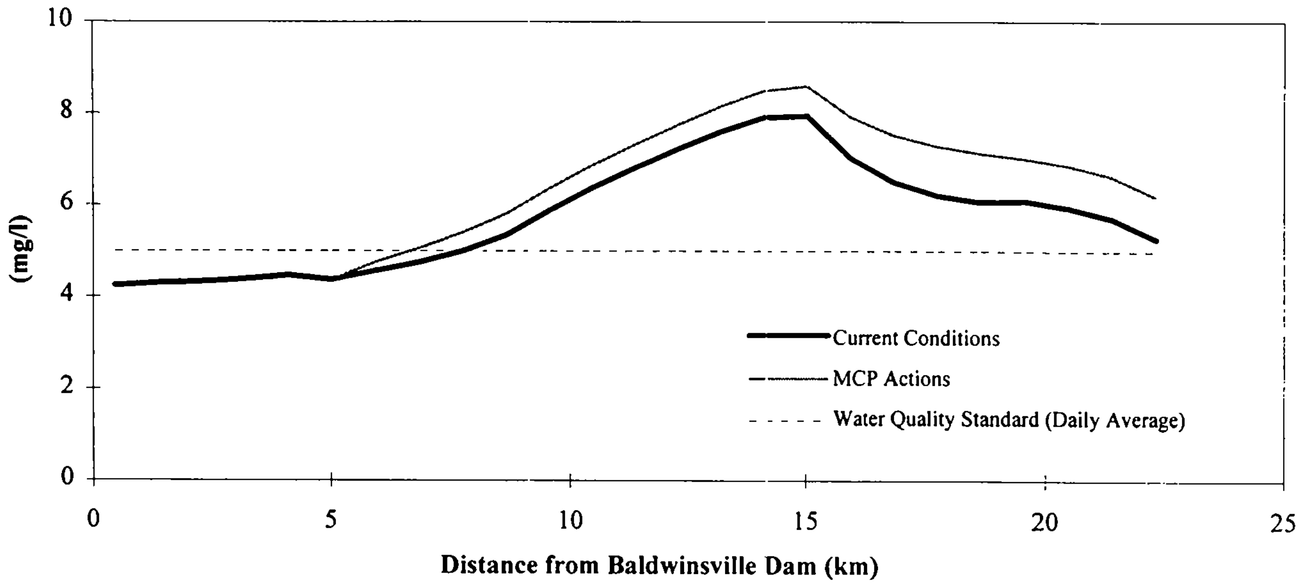
CELL NO.	EXISTING CONDITIONS		INTERIM PHASE		INTERMEDIATE PHASE	
	NUMBER OF VIOLATIONS	PEAK CONCENTRATION CFU/100 ML	NUMBER OF VIOLATIONS	PEAK CONCENTRATION CFU/100 ML	NUMBER OF VIOLATIONS	PEAK CONCENTRATION CFU/100 ML
1	21	2,515	21	1,860	7	500
2	13	1,420	11	1,040	0	<200
3	12	900	11	670	0	<200
4	8	610	7	440	0	<200
5	5	390	3	290	0	<200
6	2	320	1	240	0	<200
7	1	290	1	220	0	<200
8	1	280	1	210	0	<200

TABLE 4-6

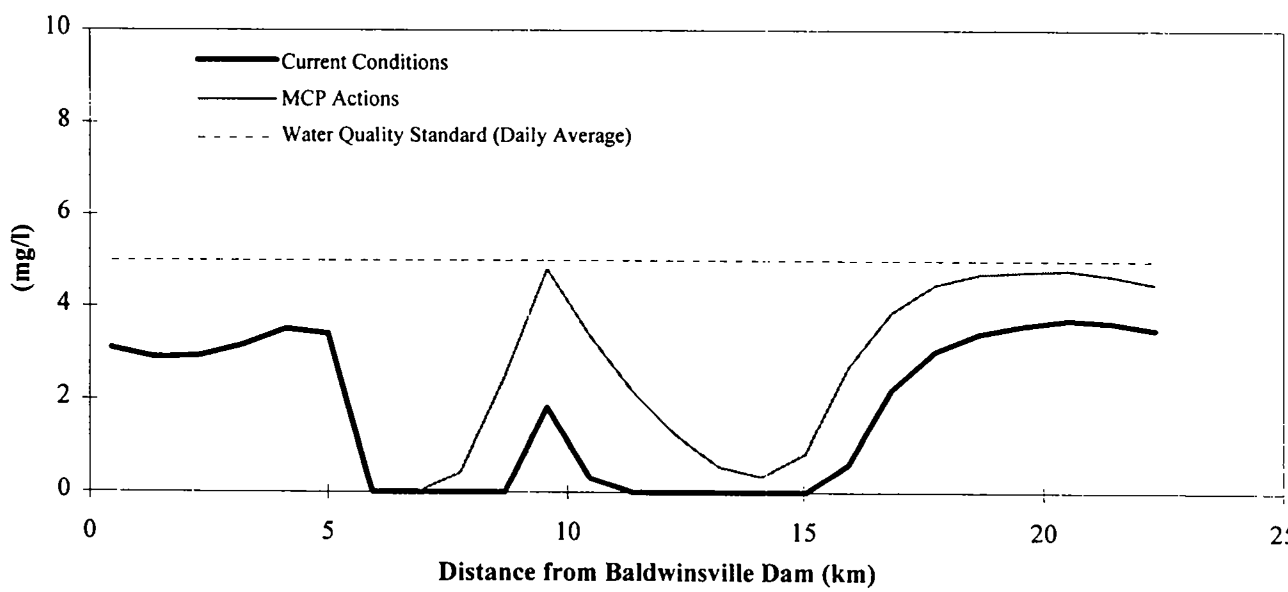
POTENTIAL LAND USE IMPACTS OF CSO PROJECTS
Draft Environmental Impact Statement
Onondaga County, New York

CSO SITE	IMMEDIATE SITE	ADJACENT SITES
Hiawatha RTF	Precludes future commercial use	No impact
Newell RTF	No impacts, use unchanged	No impact
Harbor Brook EquiFlow™	Precludes shoreline access from Onondaga Lake	No impact
Maltbie FCF	Precludes future commercial use	No impact
Clinton Station RTF	Loss of surface parking spaces Loss of revenue to City	No impact Parking surplus exists
Franklin FCF	Loss of surface parking spaces Loss of revenue to NYSDOT	No impact Parking surplus exists
Midland RTF	Precludes alternate use, may require permanent abandonment of a portion of Oxford Street and pedestrian use of bridge	May impact homeless shelter, apartment, townhouses, and playgrounds

Average Dissolved Oxygen, Top Layer

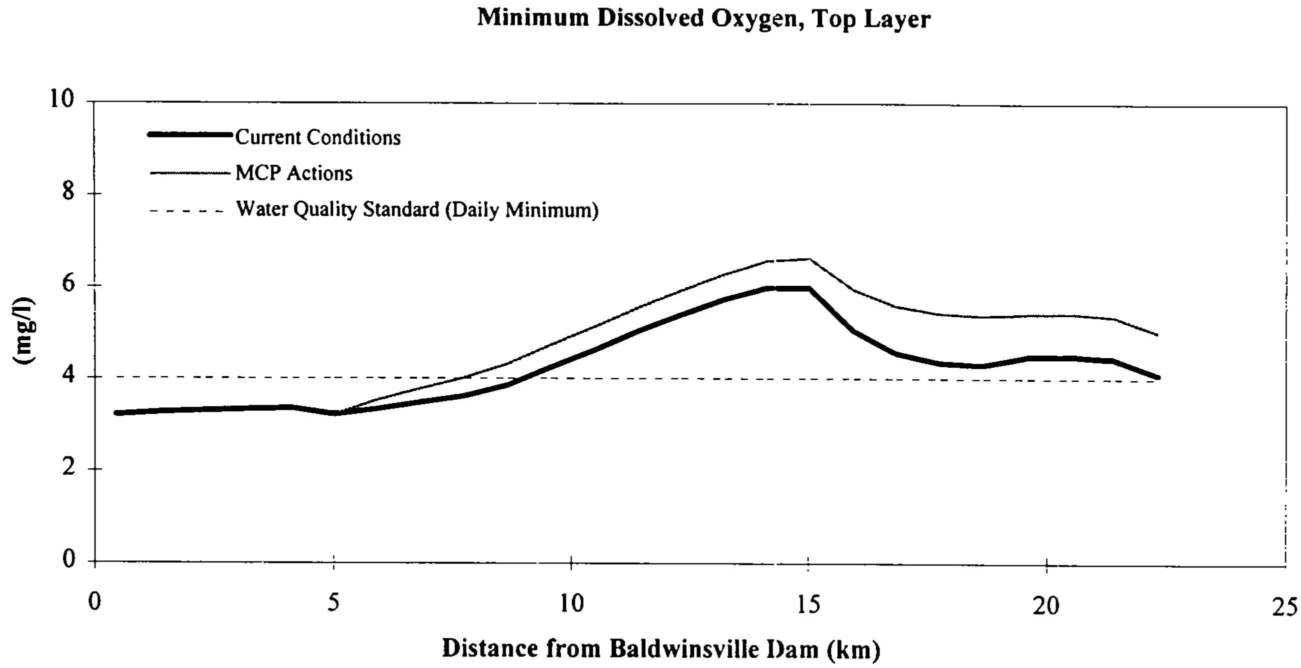


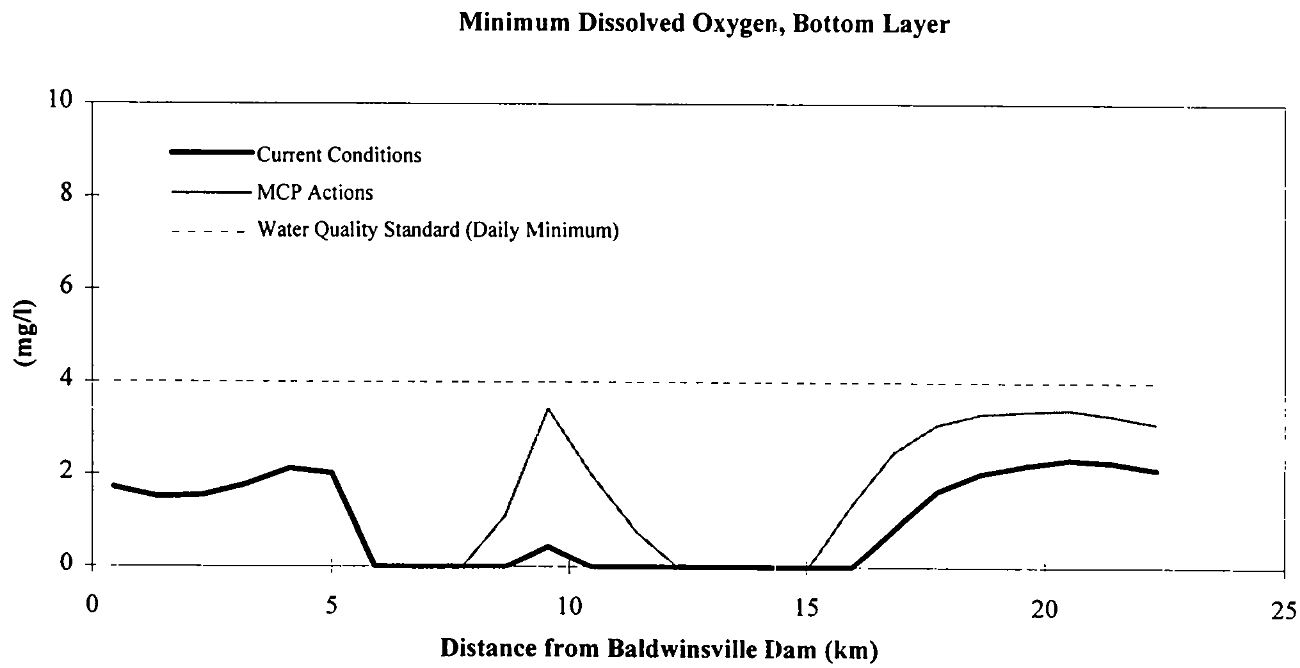
Average Dissolved Oxygen, Bottom Layer



Projections of the impact of potential future MCP actions on average dissolved oxygen levels in current (stratified) conditions in the Seneca River using the UFI Seneca River Water Quality Model. Note that negative values projected by the model are truncated to zero. Projections are run for 7q10 flow conditions.

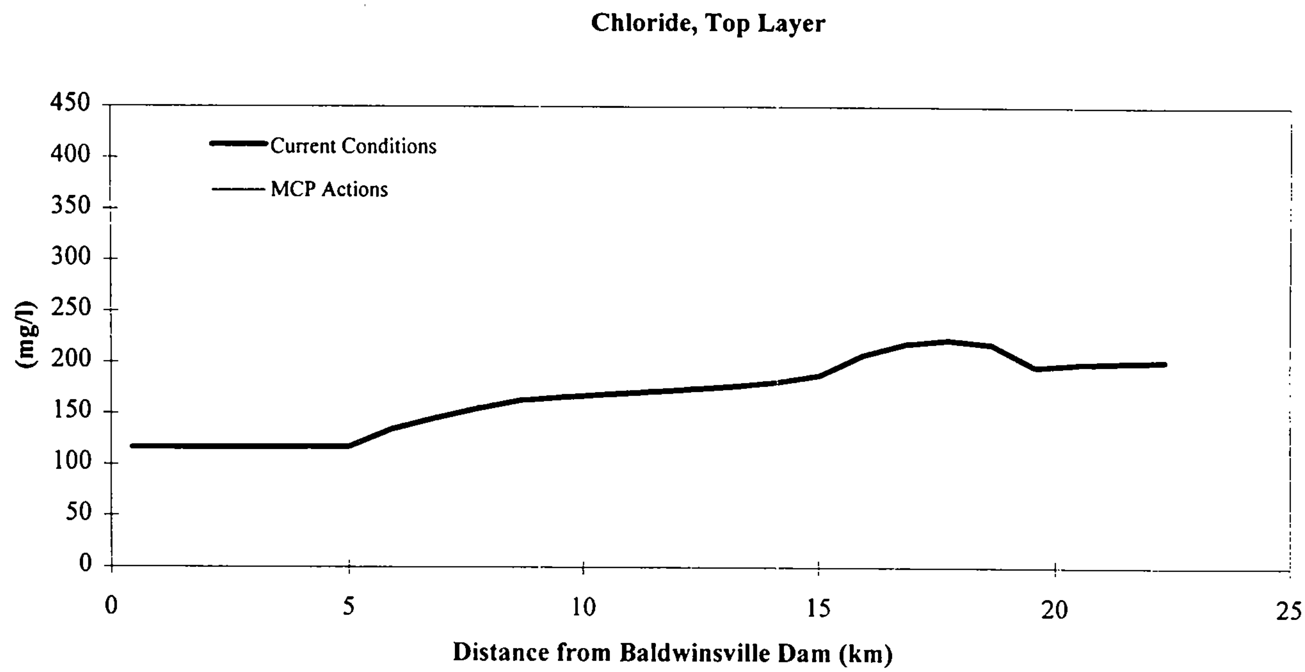
Stearns & Wheler ENVIRONMENTAL ENGINEERS & SCIENTISTS DATE: 1/11/96 JOB No.: 2298	DRAFT ENVIRONMENTAL IMPACT STATEMENT ONONDAGA COUNTY DEPARTMENT OF DRAINAGE AND SANITATION FIGURE 4-1 A SENECA RIVER MODEL PROJECTIONS FOR IMPACTS OF MCP ACTIONS ON AVERAGE D.O.

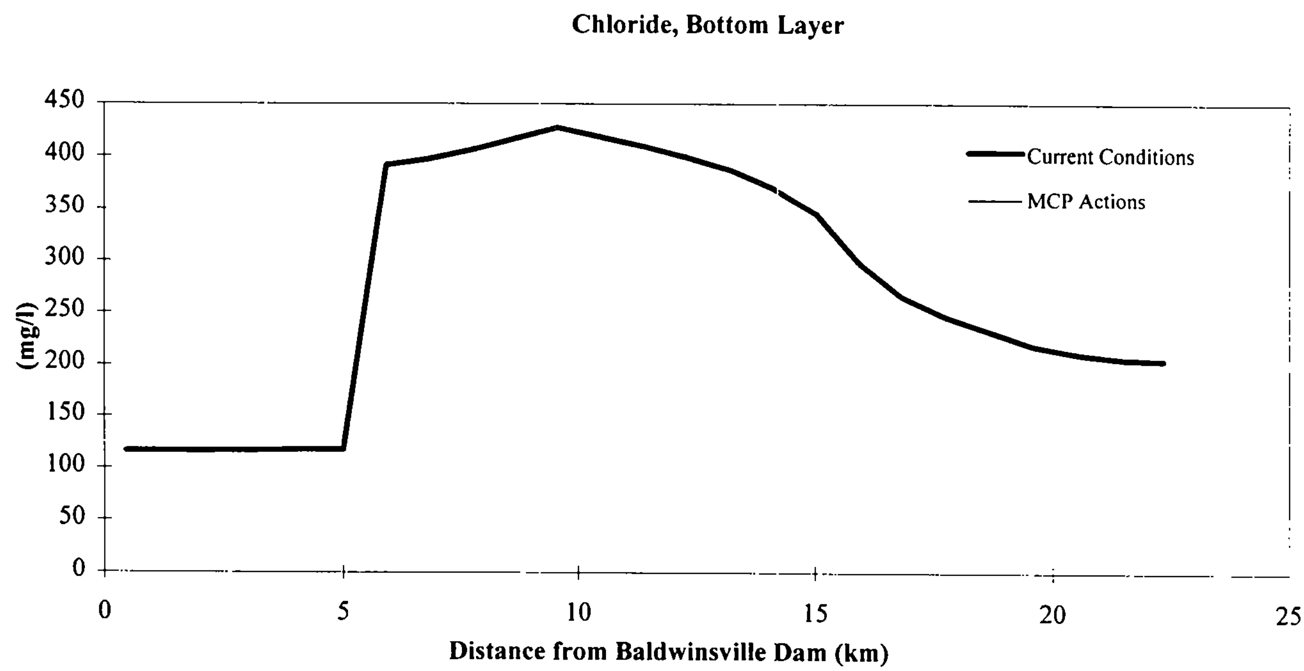




Projections of the impact of potential future MCP actions on minimum dissolved oxygen levels in current (stratified) conditions in the Seneca River using the UFI Seneca River Water Quality Model. Note that negative values projected by the model are truncated to zero. Projections are run for 7q10 flow conditions.

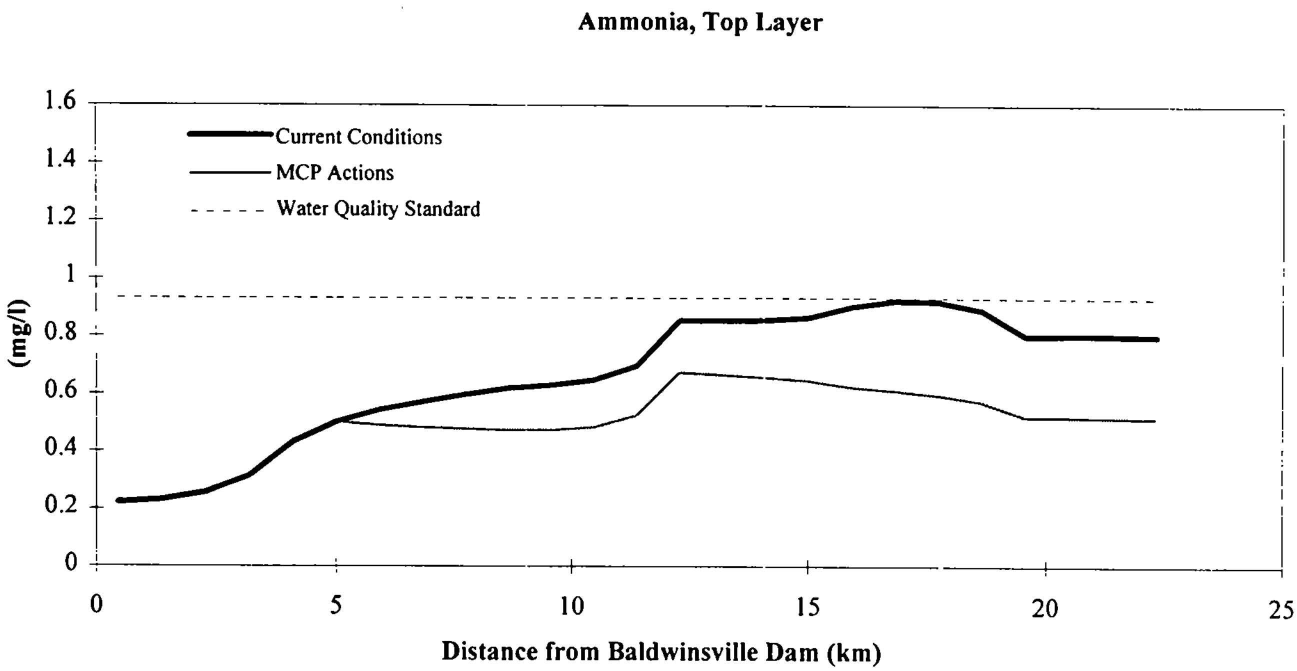
Stearns & Wheler ENVIRONMENTAL ENGINEERS & SCIENTISTS DATE: 1/11/96 JOB No.: 2298	DRAFT ENVIRONMENTAL IMPACT STATEMENT ONONDAGA COUNTY DEPARTMENT OF DRAINAGE AND SANITATION **FIGURE 4-1 B** **SENECA RIVER MODEL PROJECTIONS FOR IMPACTS OF MCP ACTIONS ON MINIMUM D.O.**

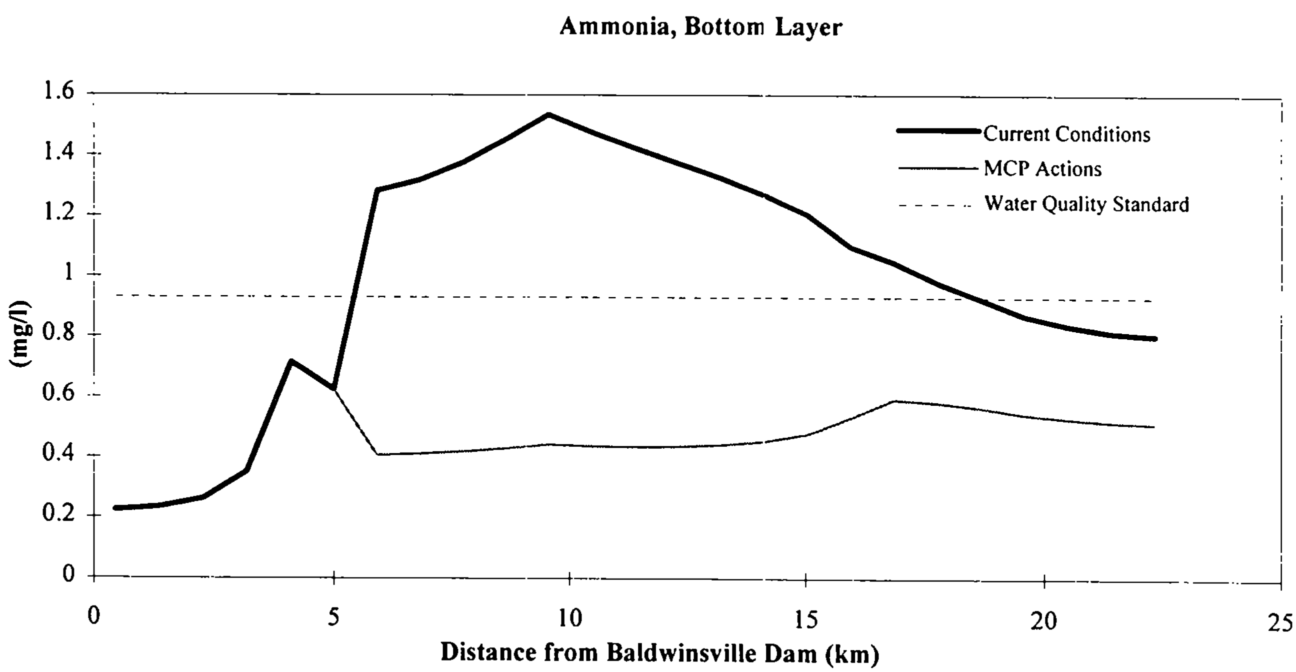




Projections of the impact of potential future MCP actions on chloride levels in current (stratified) conditions in the Seneca River using the UFI Seneca River Water Quality Model. Note that chloride is unaffected in this scenario. Projections are run for 7q10 flow conditions.

Stearns & Wheler ENVIRONMENTAL ENGINEERS & SCIENTISTS	DRAFT ENVIRONMENTAL IMPACT STATEMENT ONONDAGA COUNTY DEPARTMENT OF DRAINAGE AND SANITATION
DATE: 1/11/96 JOB No.: 2298	**FIGURE 4-1 C** **SENECA RIVER MODEL PROJECTIONS FOR IMPACTS OF MCP ACTIONS ON CHLORIDE**





Projections of the impact of potential future MCP actions on ammonia levels in current (stratified) conditions in the Seneca River using the UFI Seneca River Water Quality Model. Projections are run for 7q10 flow conditions since model flows are invariable in the stratified river scenario.

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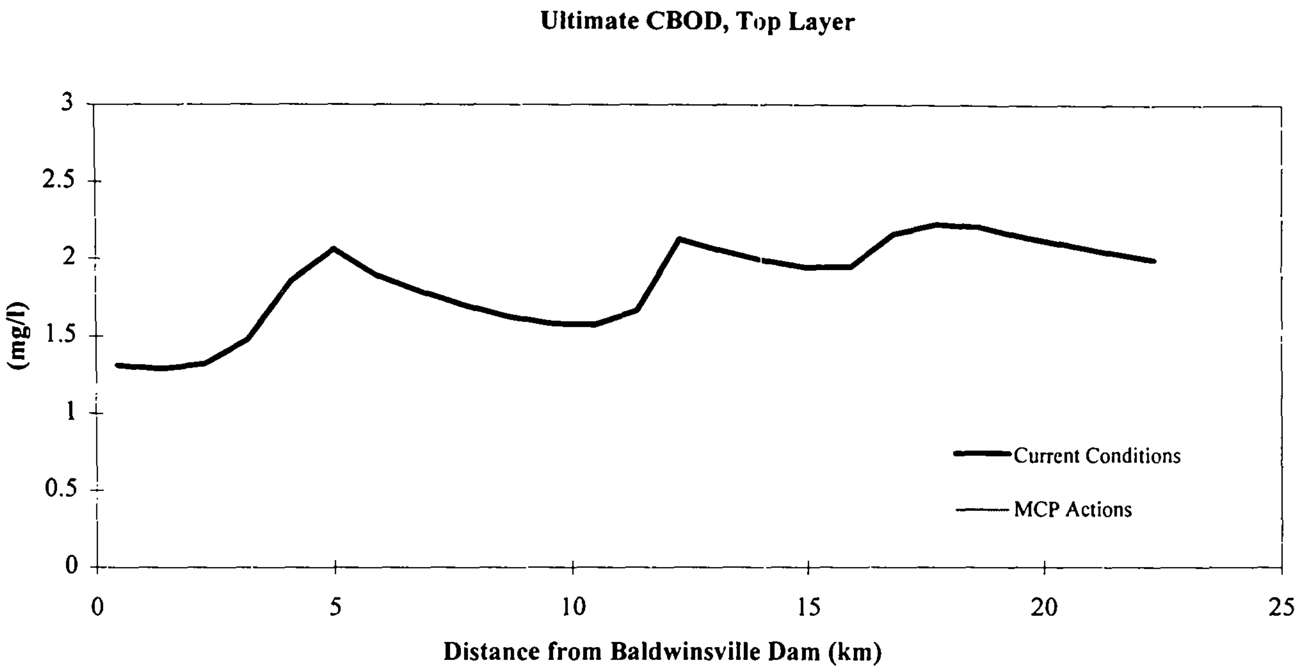
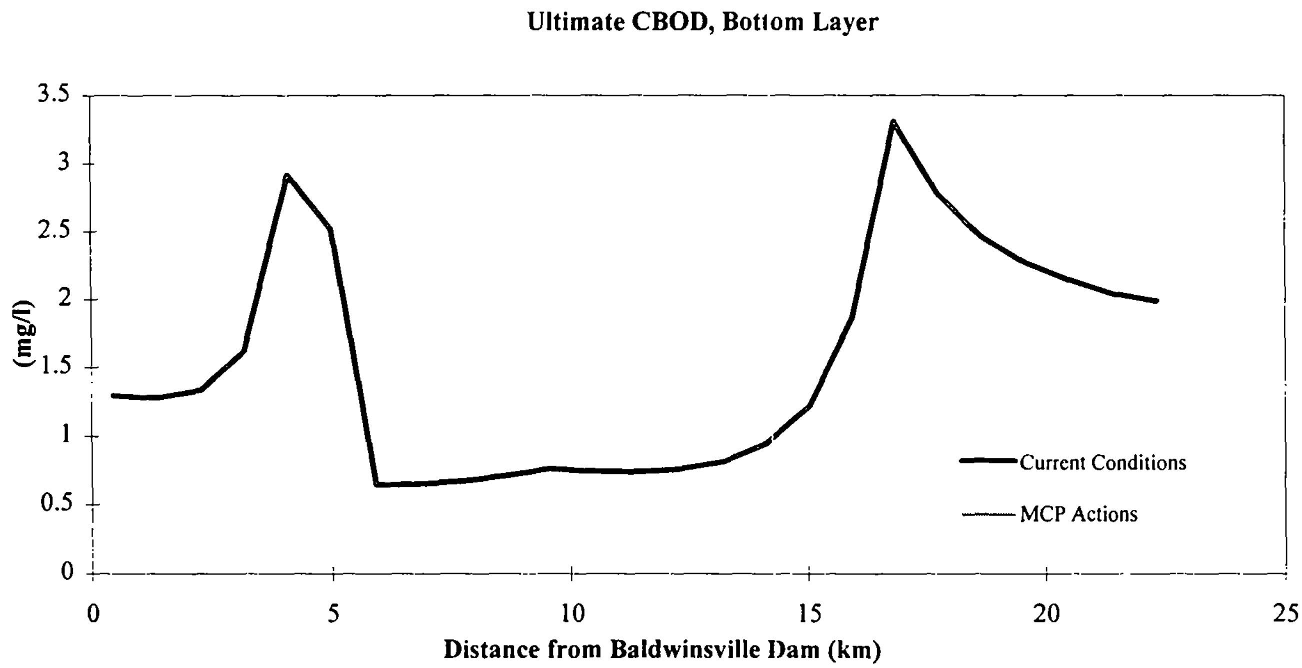
FIGURE 4-1 D
SENECA RIVER MODEL PROJECTIONS FOR IMPACTS OF MCP ACTIONS ON AMMONIA

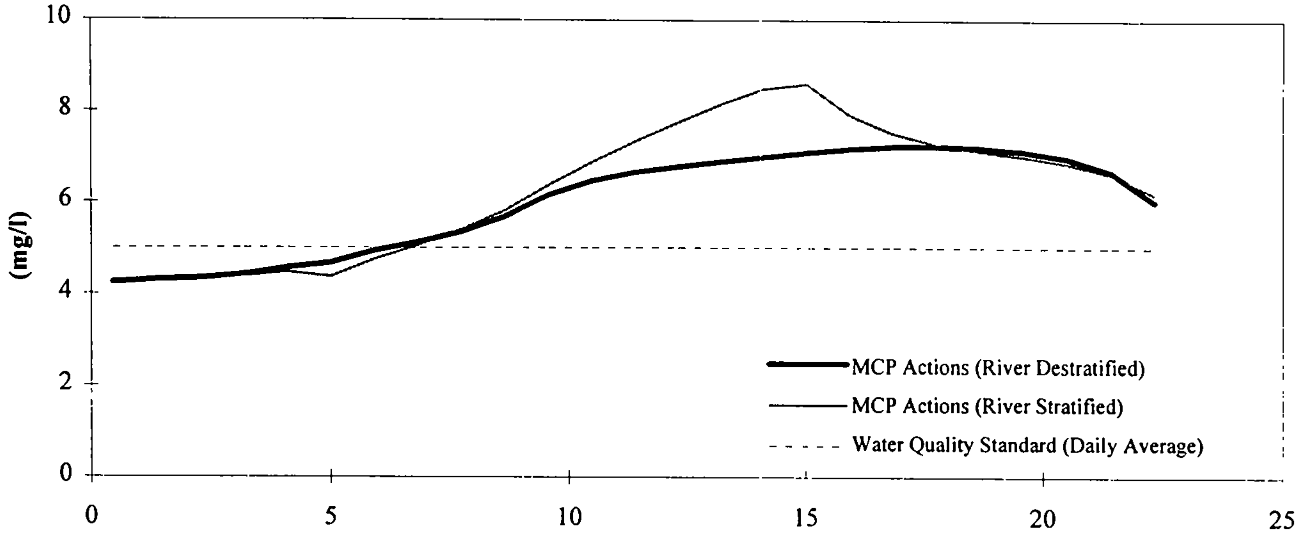




Projections of the impact of potential future MCP actions on ultimate CBOD levels in current (stratified) conditions in the Seneca River using the UFI Seneca River Water Quality Model. Note that CBOD is unaffected in this scenario. Projections are run for 7q10 flow conditions.

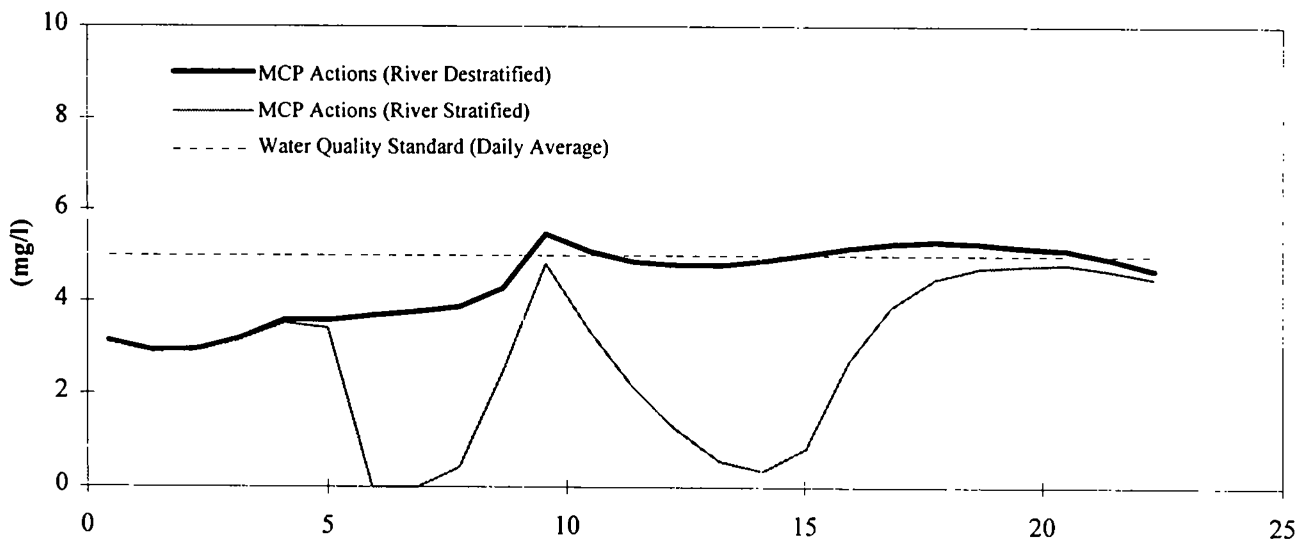
Stearns & Wheler ENVIRONMENTAL ENGINEERS & SCIENTISTS DATE: 1/11/96 JOB No.: 2298	DRAFT ENVIRONMENTAL IMPACT STATEMENT ONONDAGA COUNTY DEPARTMENT OF DRAINAGE AND SANITATION FIGURE 4-1 E SENECA RIVER MODEL PROJECTIONS FOR IMPACTS OF MCP ACTIONS ON CBOD

Average Dissolved Oxygen, Top Layer



Distance from Baldwinsville Dam (km)

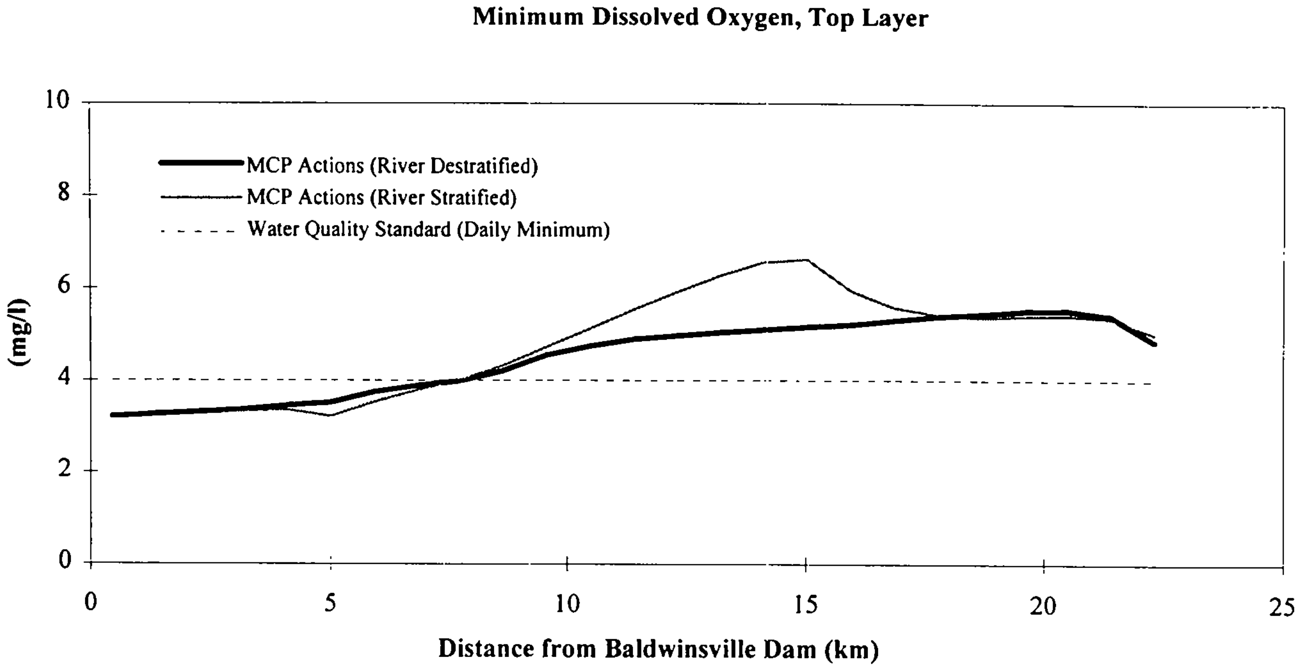
Average Dissolved Oxygen, Bottom Layer

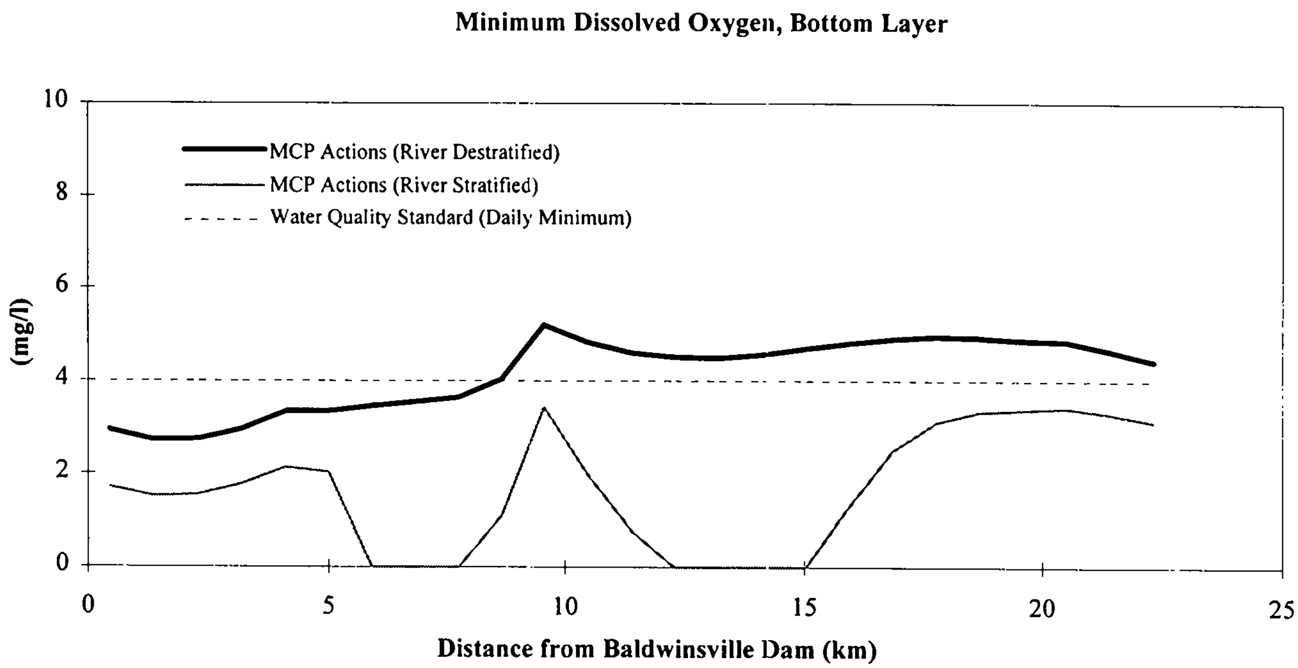


Distance from Baldwinsville Dam (km)

Projections of the impact of stratification in conjunction with potential future MCP actions on average dissolved oxygen levels in the Seneca River using the UFI Seneca River Water Quality Model. Note that negative values projected by the model are truncated to zero. Projections are run for 7q10 flow conditions.

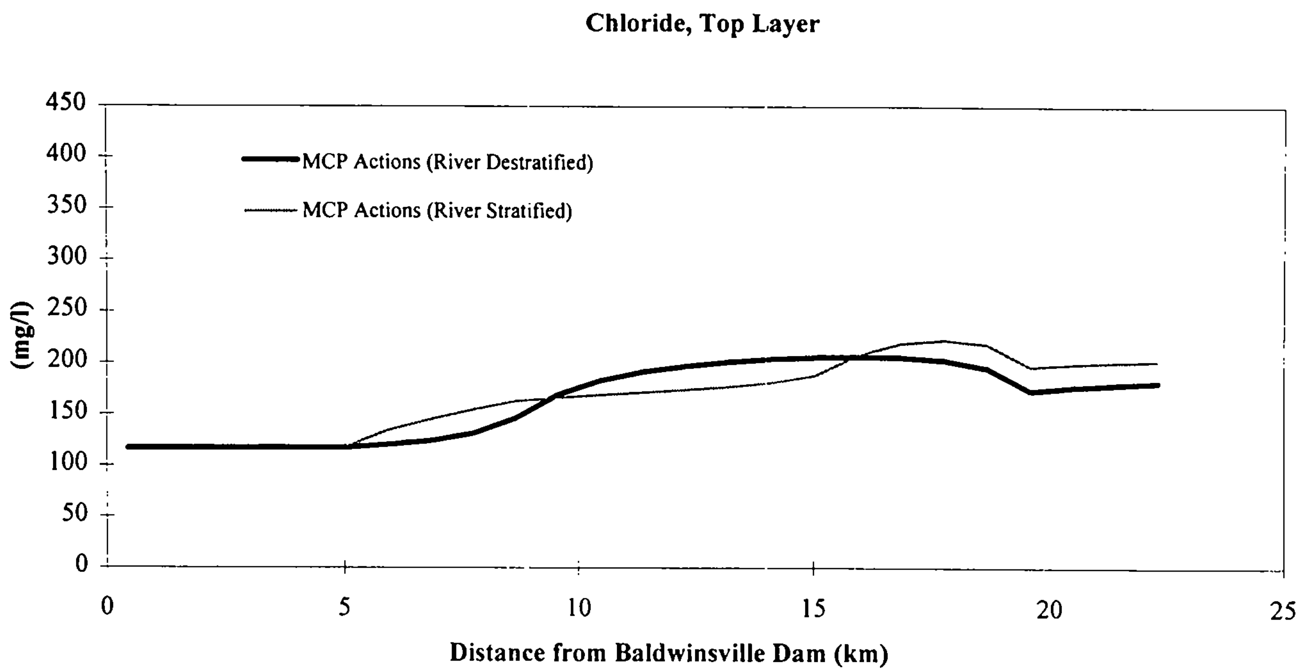
Stearns & Wheler ENVIRONMENTAL ENGINEERS & SCIENTISTS	DRAFT ENVIRONMENTAL IMPACT STATEMENT ONONDAGA COUNTY DEPARTMENT OF DRAINAGE AND SANITATION
DATE: 1/11/96 JOB No.: 2298	FIGURE 4-2 A SENECA RIVER MODEL PROJECTIONS FOR IMPACTS OF STRATIFICATION ON AVERAGE D.O.

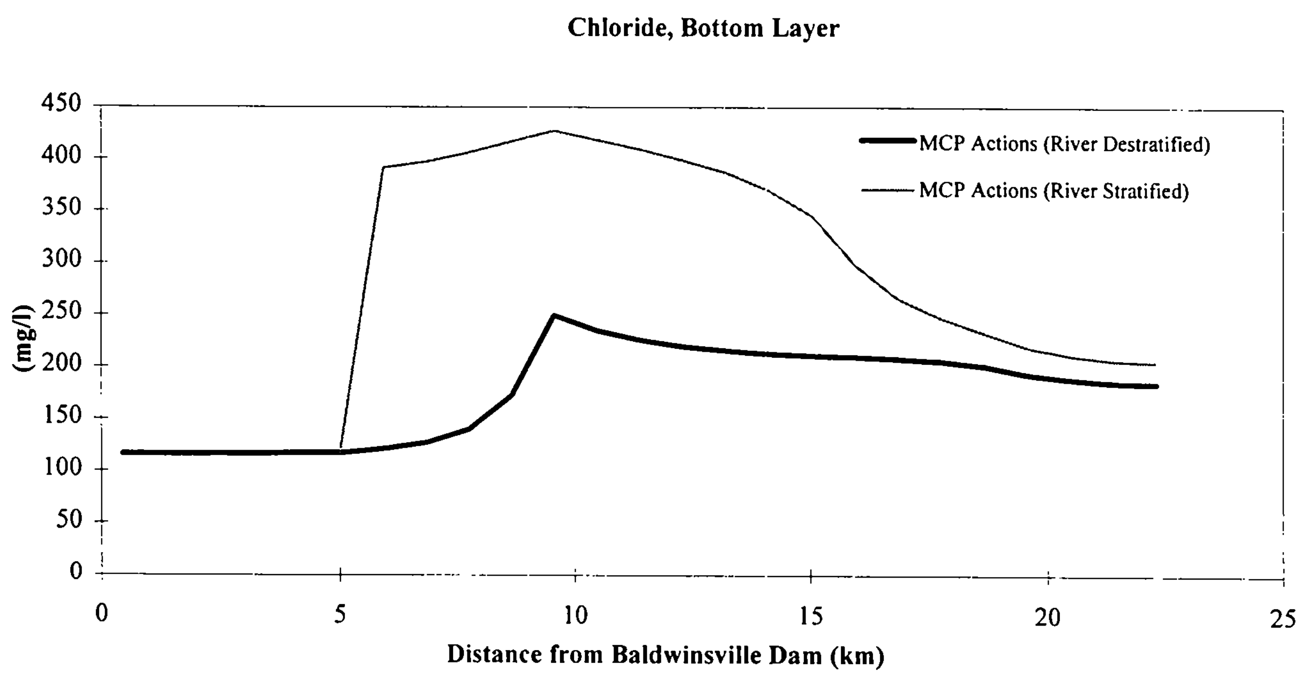




Projections of the impact of stratification in conjunction with potential future MCP actions on minimum dissolved oxygen levels in the Seneca River using the UFI Seneca River Water Quality Model. Note that negative values projected by the model are truncated to zero. Projections are run for 7q10 flow conditions.

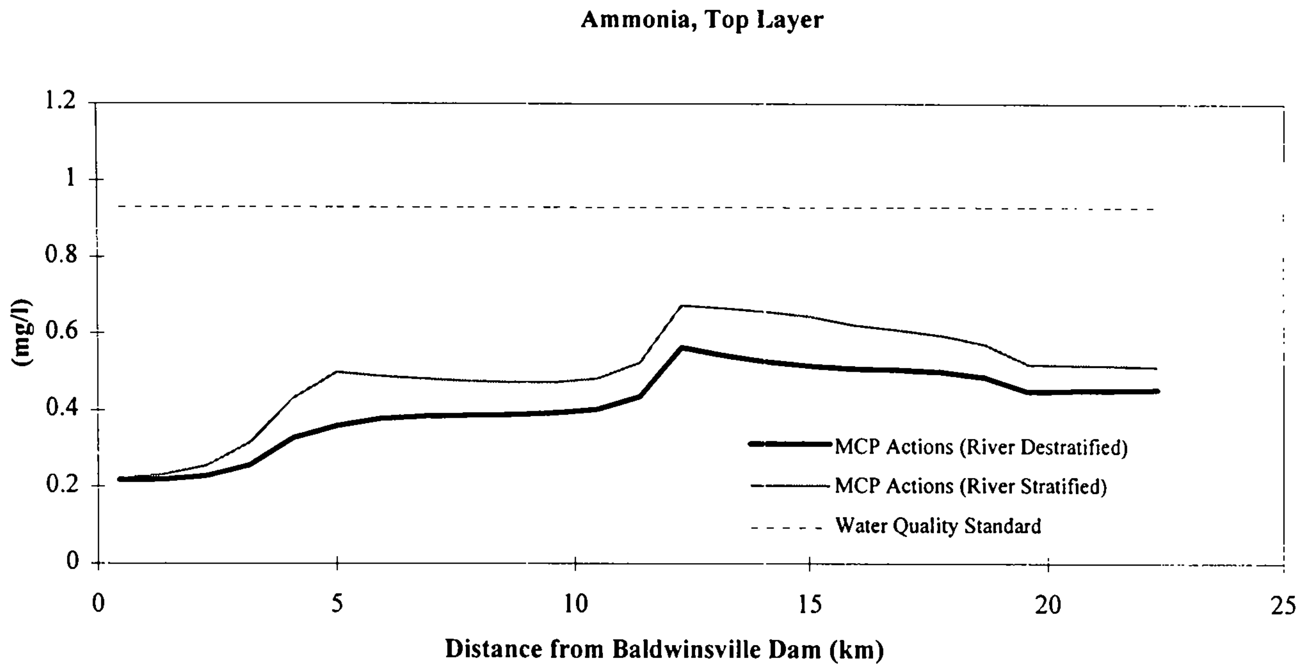
Stearns & Wheler ENVIRONMENTAL ENGINEERS & SCIENTISTS	DRAFT ENVIRONMENTAL IMPACT STATEMENT ONONDAGA COUNTY DEPARTMENT OF DRAINAGE AND SANITATION
DATE: 1/11/96 JOB No.: 2298	FIGURE 4-2 B SENECA RIVER MODEL PROJECTIONS FOR IMPACTS OF STRATIFICATION ON MINIMUM D.O.

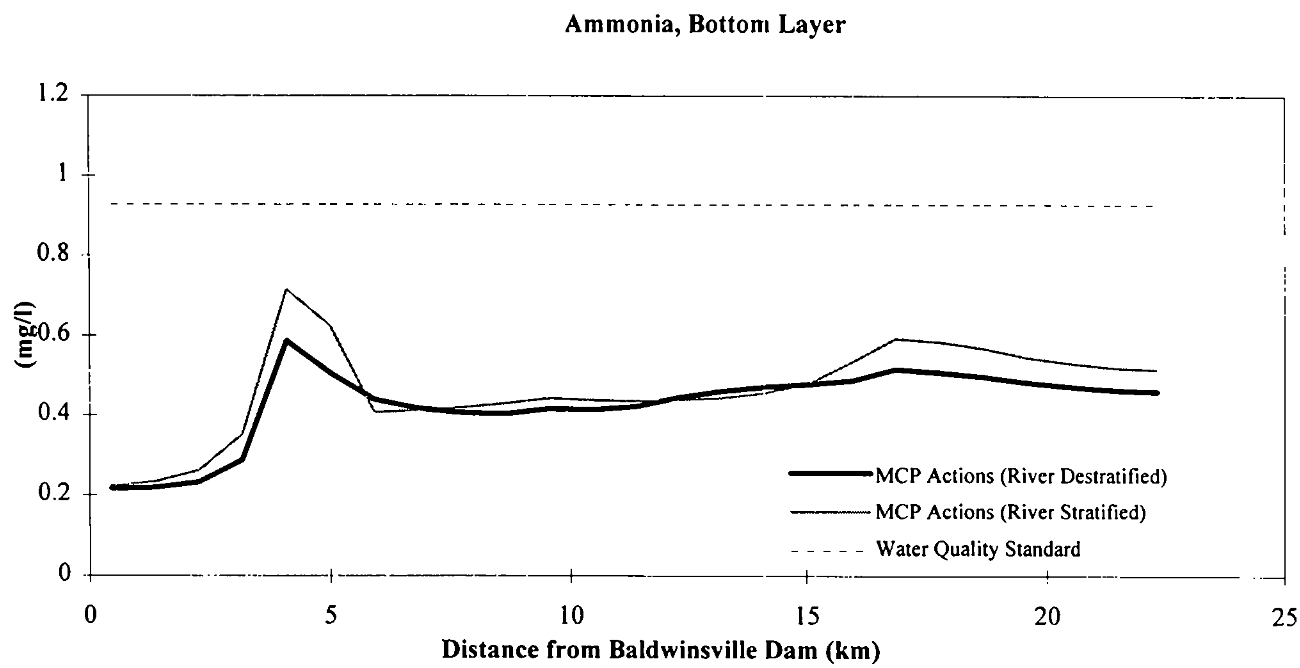




Projections of the impact of stratification in conjunction with potential future MCP actions on chloride concentrations in the Seneca River using the UFI Seneca River Water Quality Model. Projections are run for 7q10 flow conditions.

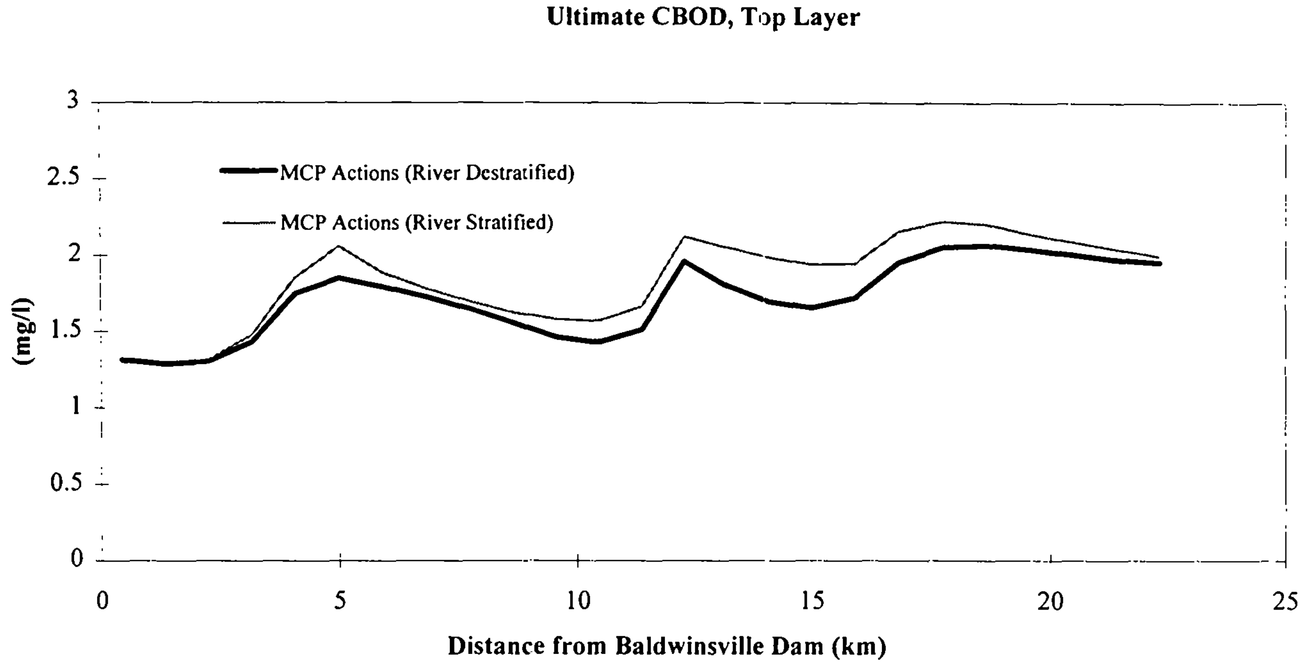
Stearns & Wheler ENVIRONMENTAL ENGINEERS & SCIENTISTS DATE: 1/11/96 JOB No.: 2298	DRAFT ENVIRONMENTAL IMPACT STATEMENT ONONDAGA COUNTY DEPARTMENT OF DRAINAGE AND SANITATION
	FIGURE 4-2 C SENECA RIVER MODEL PROJECTIONS FOR IMPACTS OF STRATIFICATION ON CHLORIDE

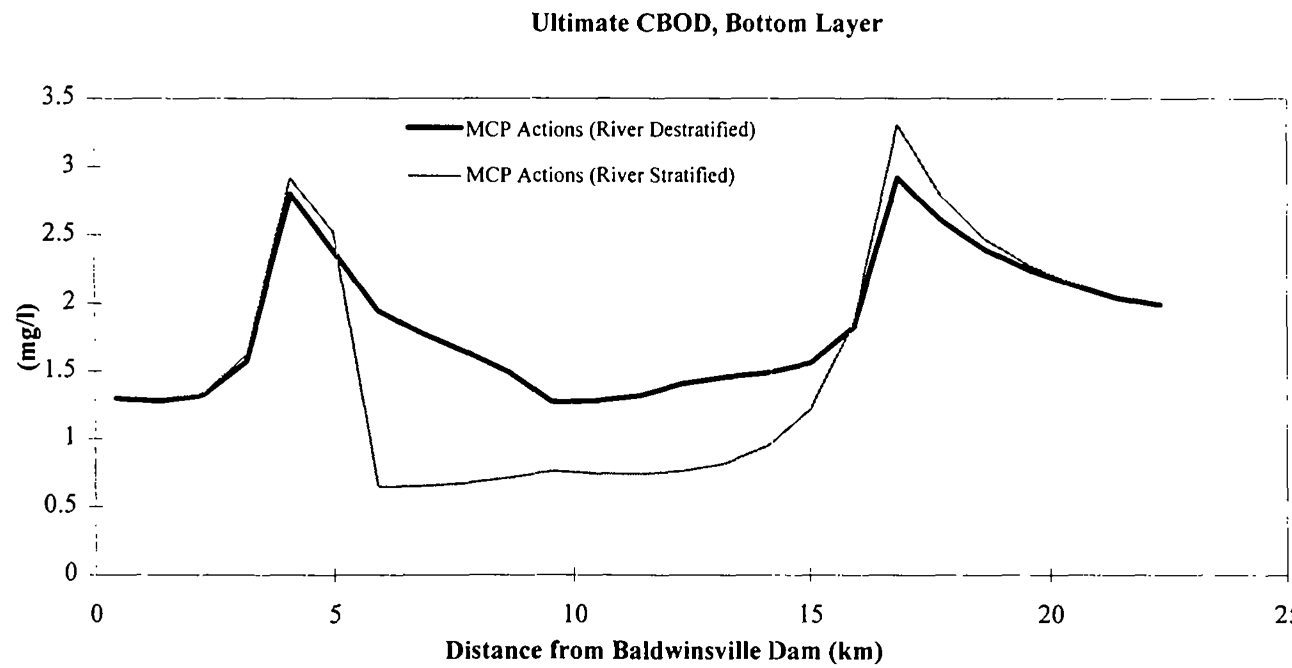




Projections of the impact of stratification in conjunction with potential future MCP actions on ammonia concentrations in the Seneca River using the UFI Seneca River Water Quality Model. Projections for the stratified scenario are run with the model default 7q10 flows since the model holds them invariable under these conditions. Projections for the destratified scenario are run with 30q10 flows for critical ammonia conditions.

Stearns & Wheler ENVIRONMENTAL ENGINEERS & SCIENTISTS DATE: 1/11/96 JOB No.: 2298	DRAFT ENVIRONMENTAL IMPACT STATEMENT ONONDAGA COUNTY DEPARTMENT OF DRAINAGE AND SANITATION FIGURE 4-2 D SENECA RIVER MODEL PROJECTIONS FOR IMPACTS OF STRATIFICATION ON AMMONIA





Projections of the impact of stratification in conjunction with potential future MCP actions on ultimate CBOD concentrations in the Seneca River using the UFI Seneca River Water Quality Model. Projections are run for 7q10 flow conditions.

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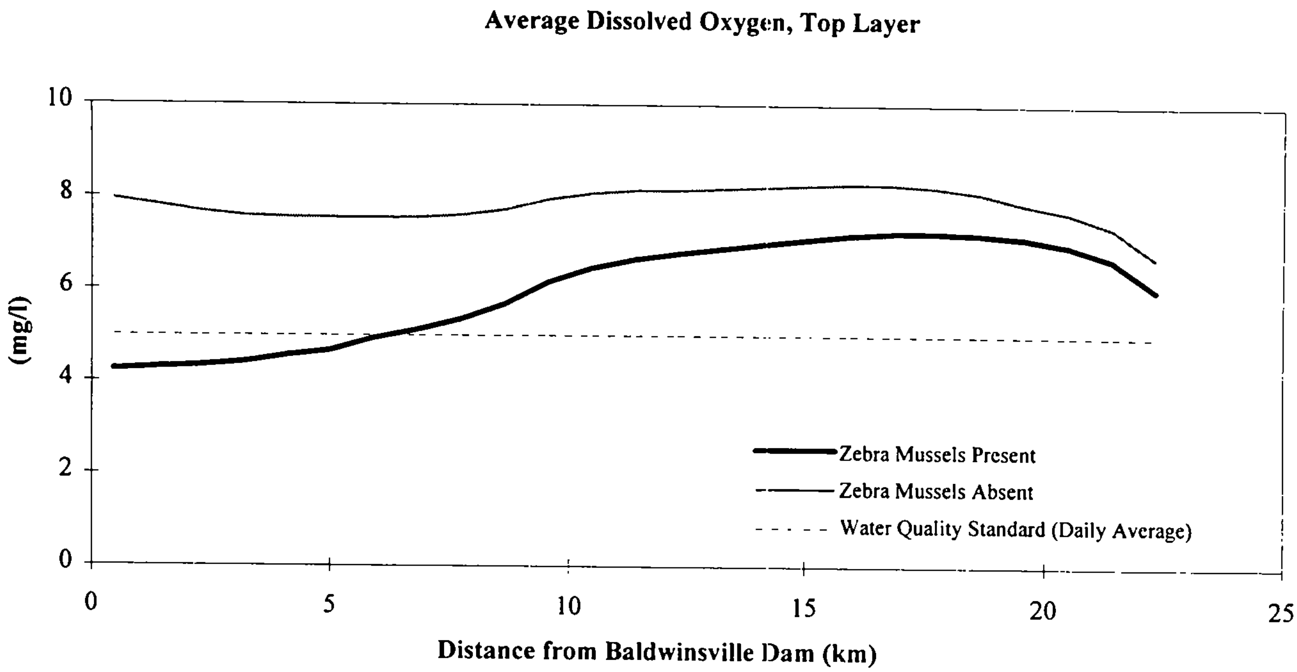
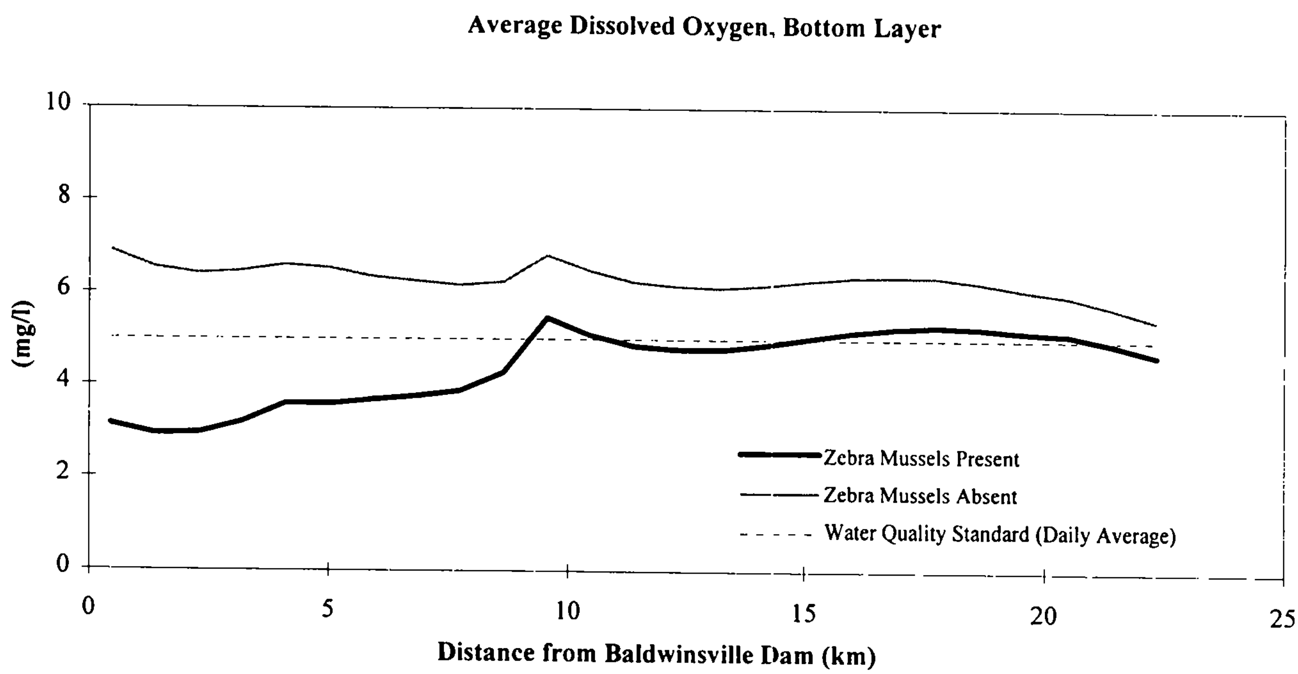
FIGURE 4-2 E

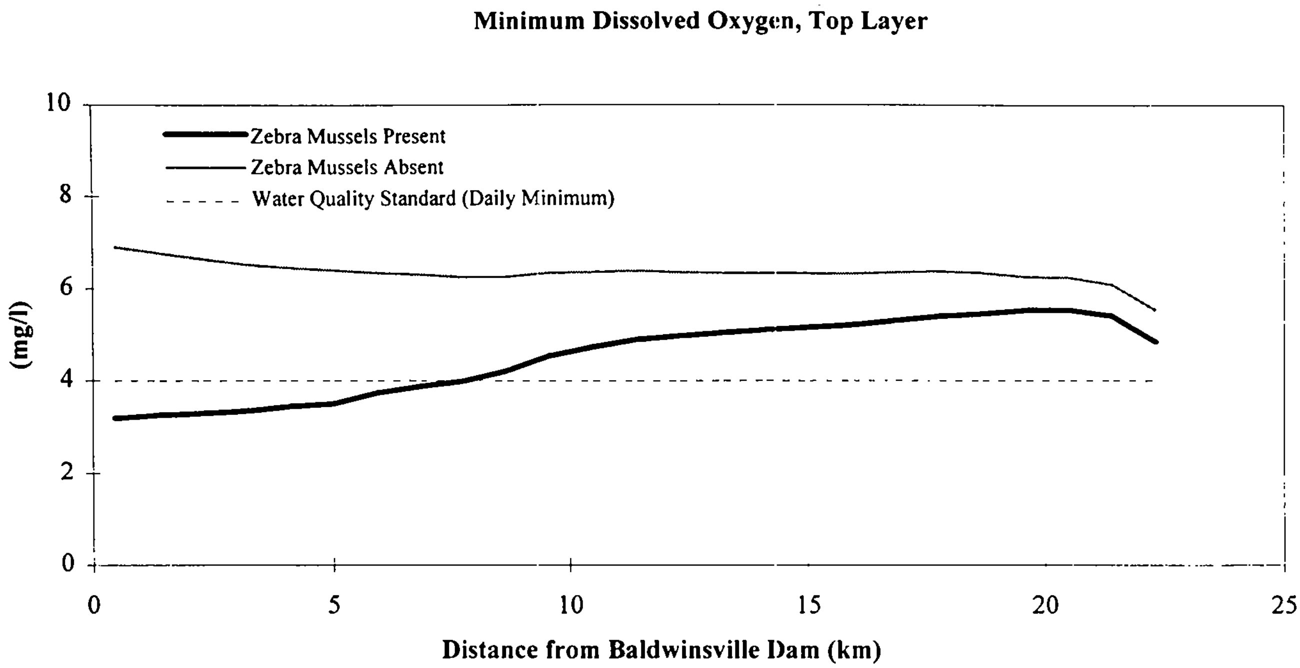
SENECA RIVER MODEL PROJECTIONS FOR IMPACTS OF STRATIFICATION ON CBOD

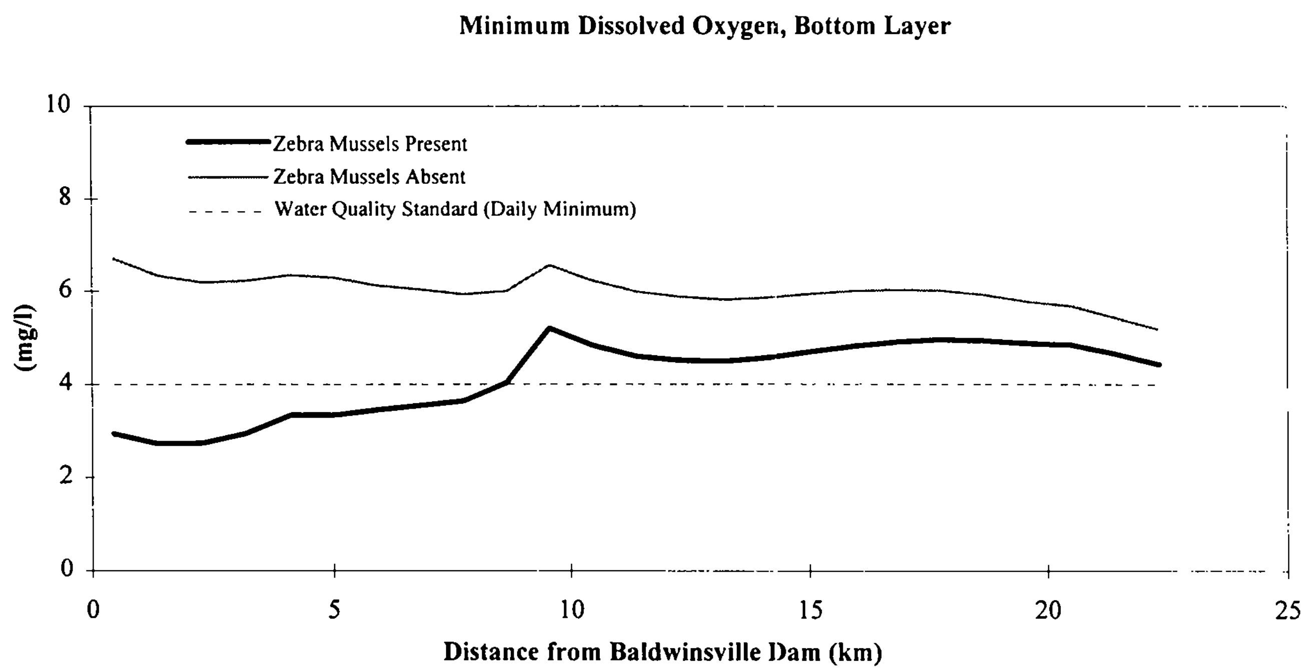




Projections of the impact of zebra mussels in conjunction with potential MCP actions on average dissolved oxygen levels in the Seneca River in a destratified state, using the UFI Seneca River Water Quality Model. Projections are run for 7q10 flow conditions.

Stearns & Wheler ENVIRONMENTAL ENGINEERS & SCIENTISTS DATE: 1/11/96 JOB No.: 2298	DRAFT ENVIRONMENTAL IMPACT STATEMENT ONONDAGA COUNTY DEPARTMENT OF DRAINAGE AND SANITATION
	FIGURE 4-3 A **SENECA RIVER MODEL PROJECTIONS FOR IMPACTS OF ZEBRA MUSSELS ON AVERAGE D.O.**

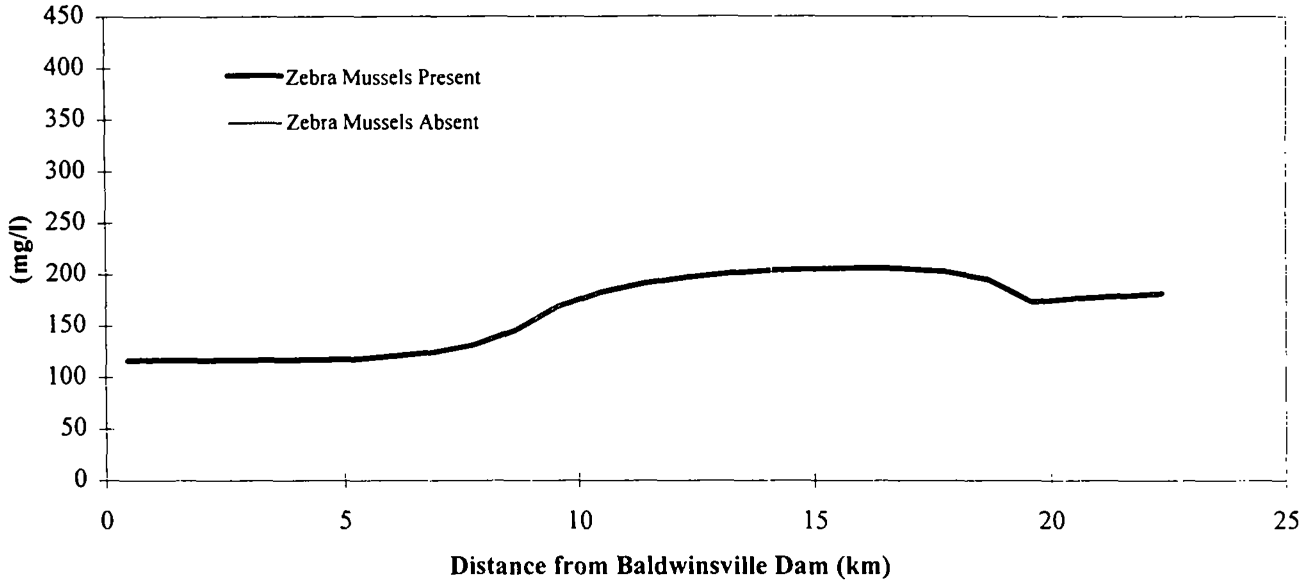




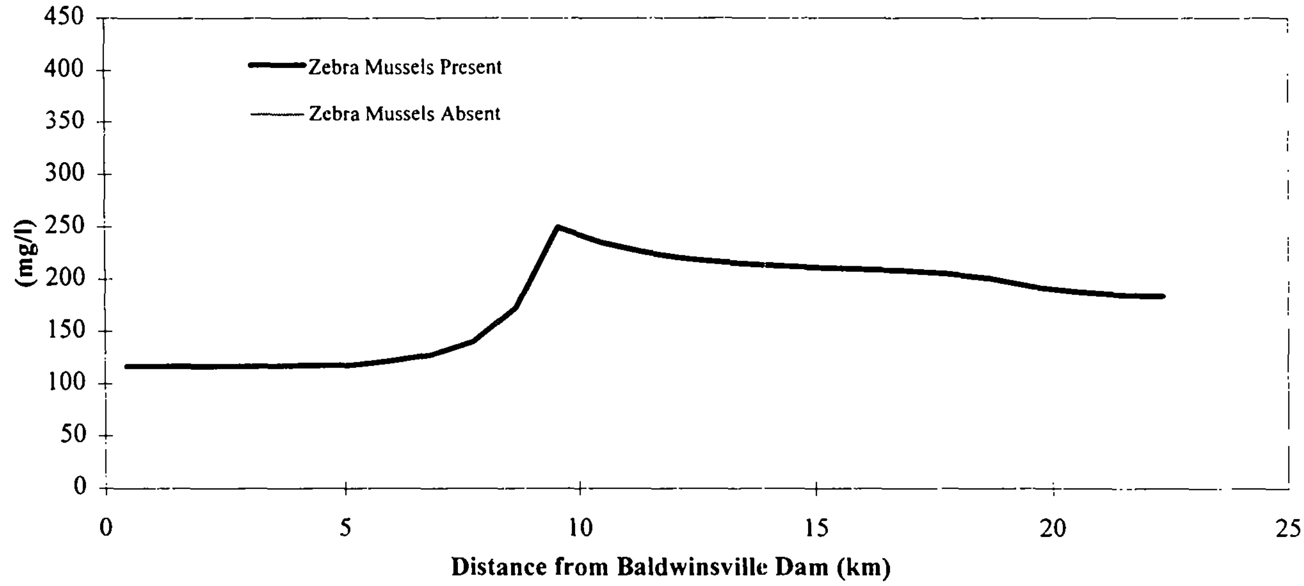
Projections of the impact of zebra mussels in conjunction with potential MCP actions on minimum dissolved oxygen levels in the Seneca River in a destratified state, using the UFI Seneca River Water Quality Model. Projections are run for 7q10 flow conditions.

Stearns & Wheler ENVIRONMENTAL ENGINEERS & SCIENTISTS DATE: 1/11/96 JOB No.: 2298	DRAFT ENVIRONMENTAL IMPACT STATEMENT ONONDAGA COUNTY DEPARTMENT OF DRAINAGE AND SANITATION FIGURE 4-3 B SENECA RIVER MODEL PROJECTIONS FOR IMPACTS OF ZEBRA MUSSELS ON MINIMUM D.O.

Chloride, Top Layer

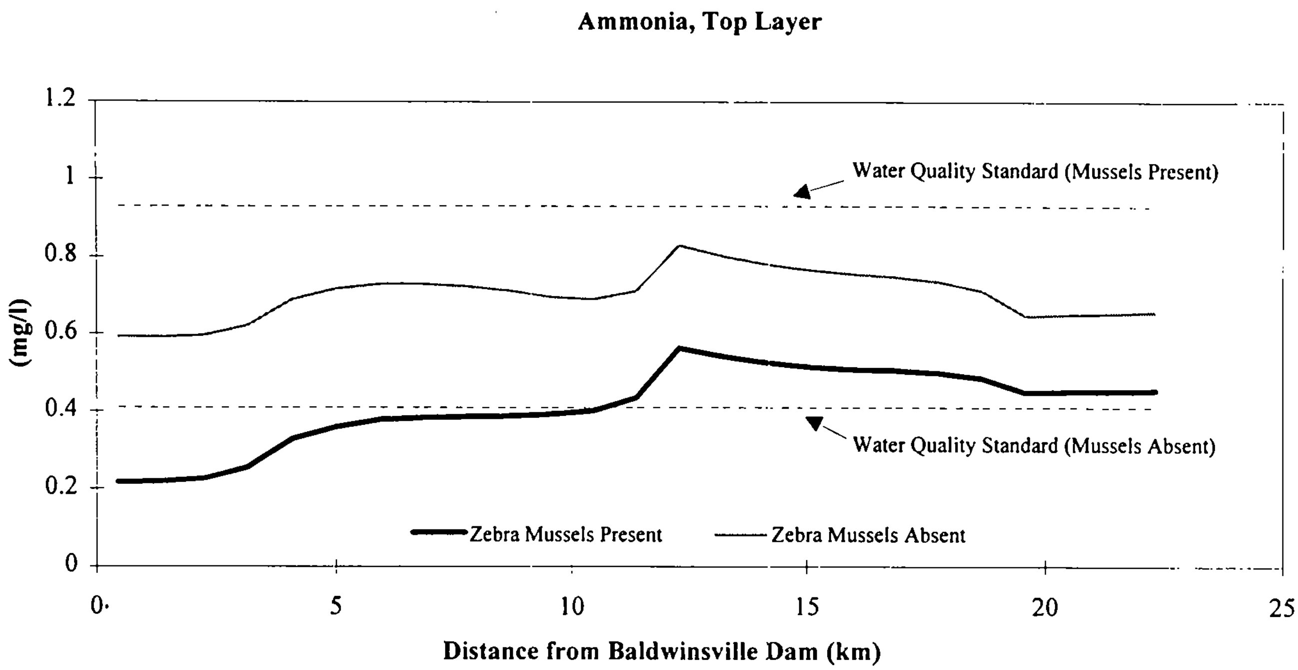


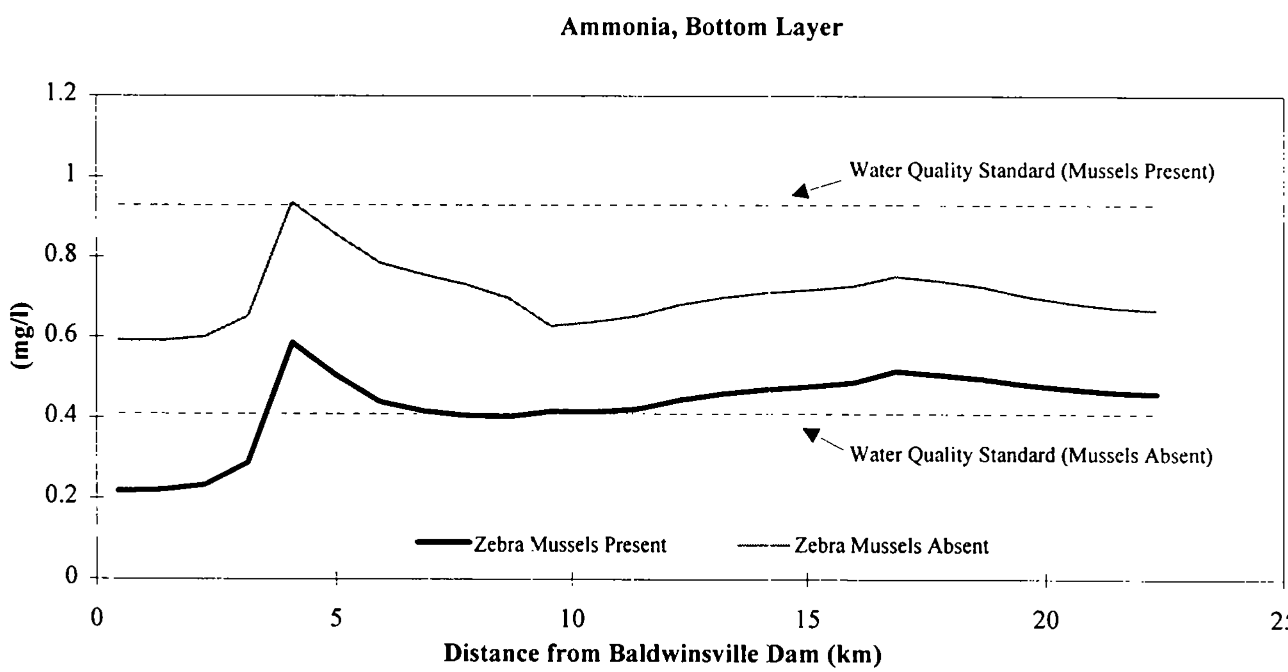
Chloride, Bottom Layer



Projections of the impact of zebra mussels in conjunction with potential MCP actions on chloride concentrations in the Seneca River in a destratified state, using the UFI Seneca River Water Quality Model. Notice that chloride is unaffected by this scenario. Projections are run for 7q10 flow conditions.

Stearns & Wheler ENVIRONMENTAL ENGINEERS & SCIENTISTS DATE: 1/11/96 JOB No.: 2298	DRAFT ENVIRONMENTAL IMPACT STATEMENT ONONDAGA COUNTY DEPARTMENT OF DRAINAGE AND SANITATION FIGURE 4-3 C SENECA RIVER MODEL PROJECTIONS FOR IMPACTS OF ZEBRA MUSSELS ON CHLORIDE





Projections of the impact of zebra mussels in conjunction with potential MCP actions on ammonia concentrations in the Seneca River in a destratified state, using the UFI Seneca River Water Quality Model. Projections are run with 30q10 flows for critical ammonia conditions.

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ENVIRONMENTAL ENGINEERS & SCIENTISTS

DATE: 1/11/96 JOB No.: 2298

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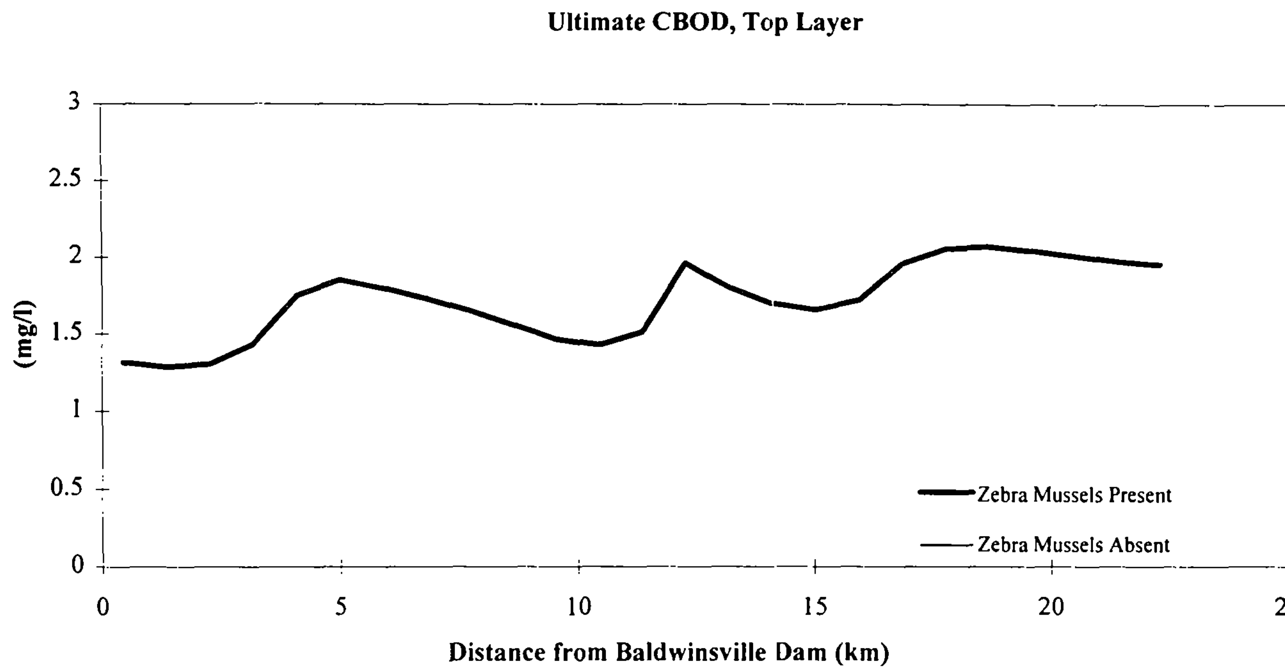
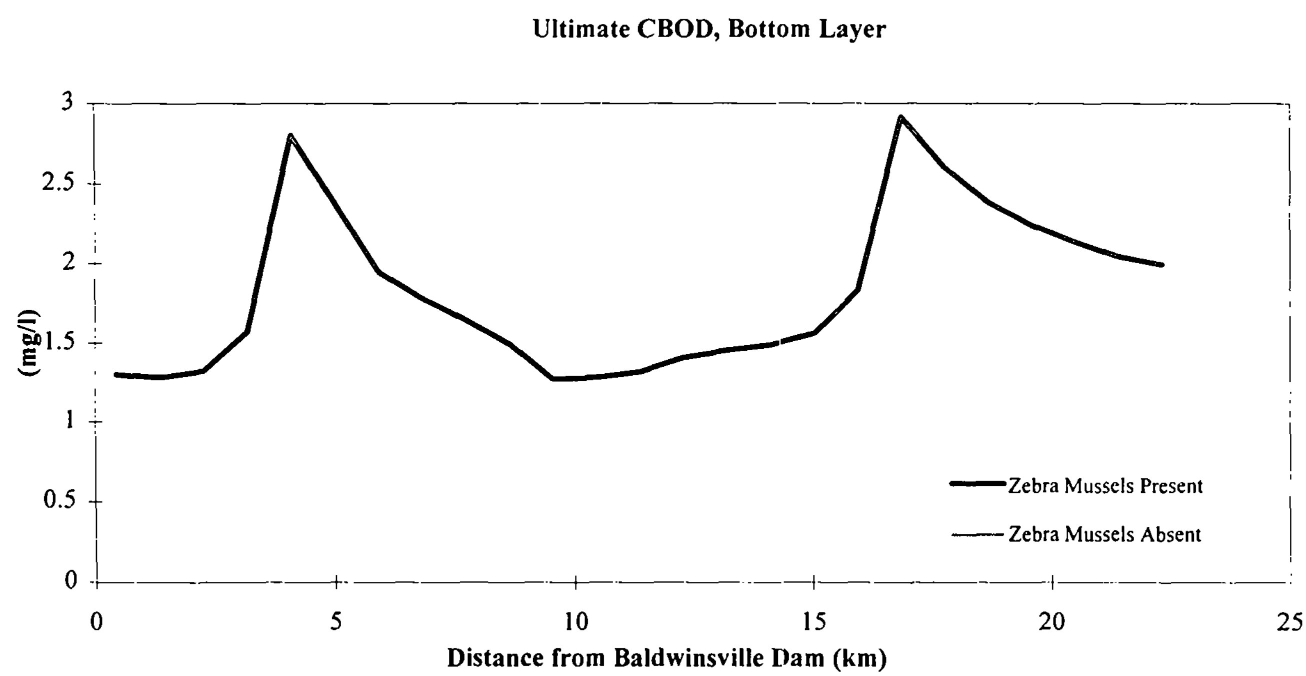
OF DRAINAGE AND SANITATION

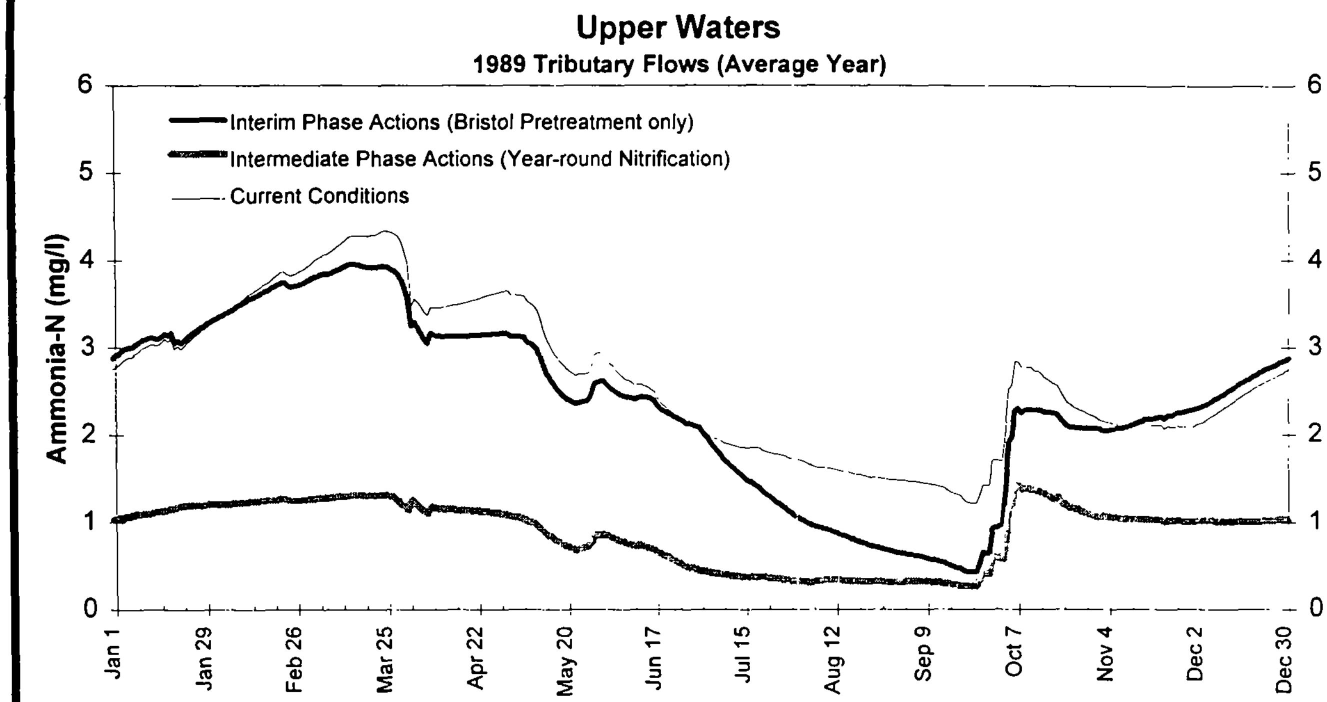
FIGURE 4-3 D
SENECA RIVER MODEL PROJECTIONS FOR IMPACTS OF ZEBRA MUSSELS ON AMMONIA

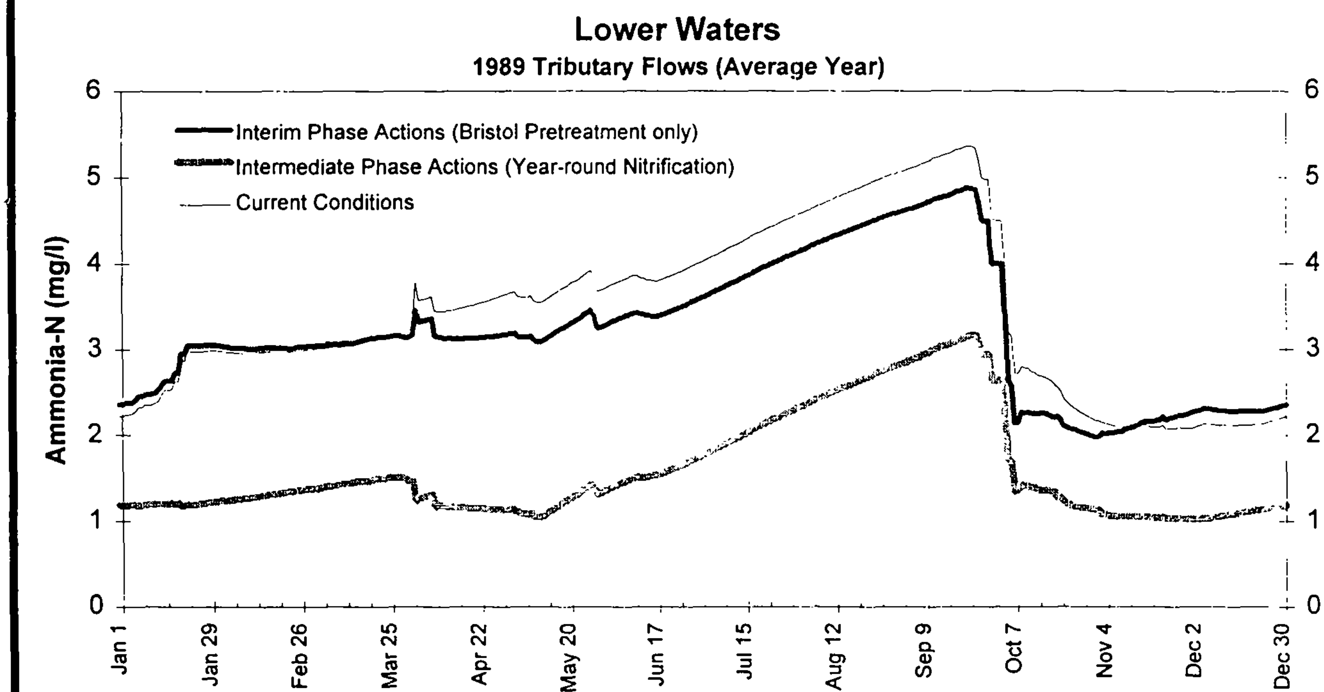




Projections of the impact of zebra mussels in conjunction with potential MCP actions on ultimate CBOD concentrations in the Seneca River in a destratified state, using the UFI Seneca River Water Quality Model. Note that ultimate CBOD is unaffected in this scenario. Projections are run for 7q10 flow conditions.

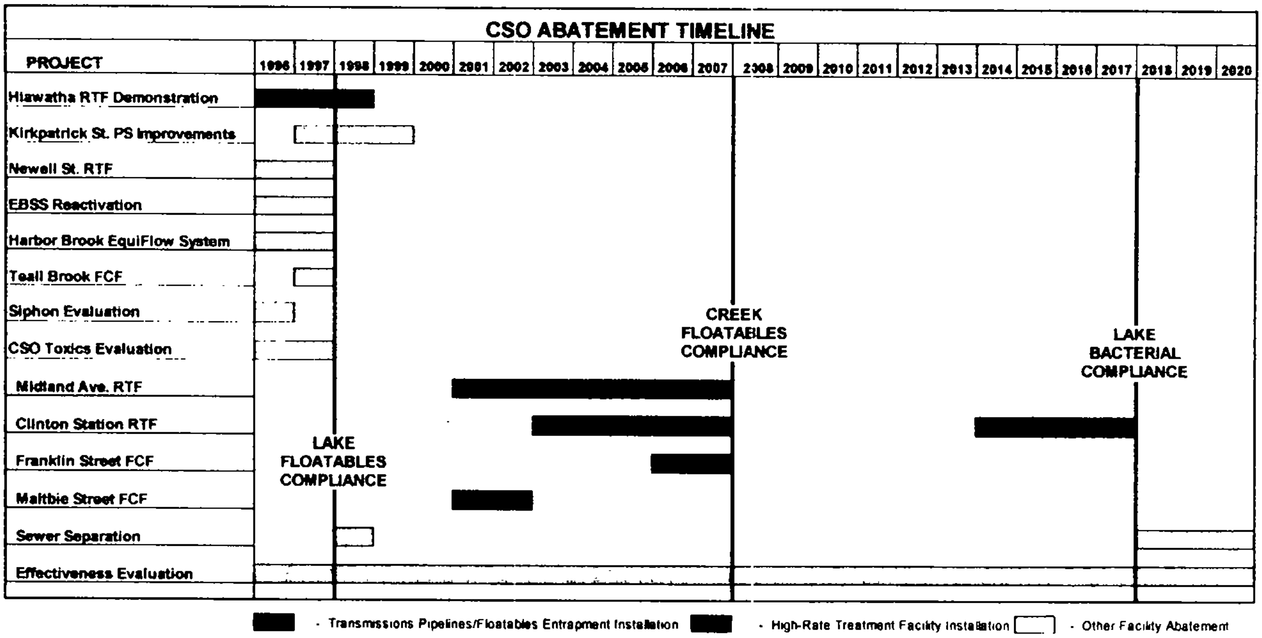
Stearns & Wheler ENVIRONMENTAL ENGINEERS & SCIENTISTS DATE: 1/11/96 JOB No.: 2298	DRAFT ENVIRONMENTAL IMPACT STATEMENT ONONDAGA COUNTY DEPARTMENT OF DRAINAGE AND SANITATION FIGURE 4-3 E SENECA RIVER MODEL PROJECTIONS FOR IMPACTS OF ZEBRA MUSSELS ON CBOD



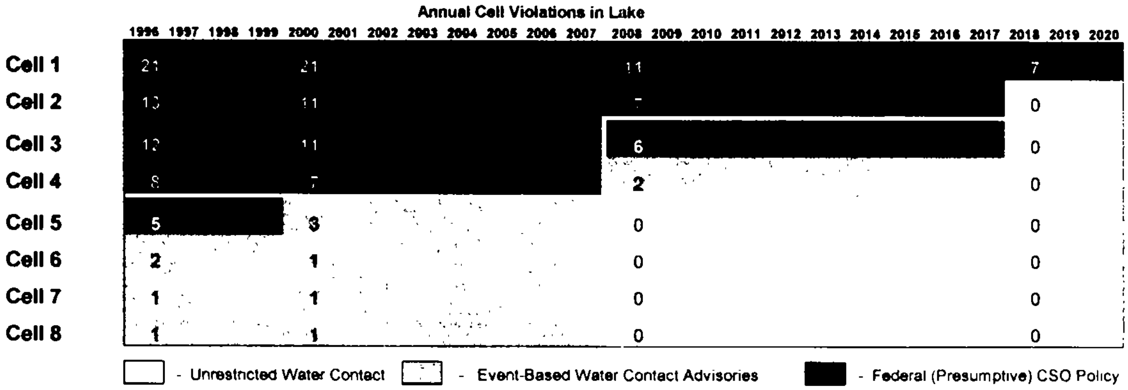


Ammonia-N projections using the UFI Hydrothermal and Water Quality models (Version 1.11 approved by NYSDEC 10/13/95) for the interim phase action of Bristol pretreatment only vs. the intermediate phase action of nitrification of METRO effluent to limits of 2 mg/l during the summer and 4 mg/l during the winter. Onondaga Lake, NY.
NOTE: Projections do not include the impact of hypolimnetic oxygenation on lake water quality.

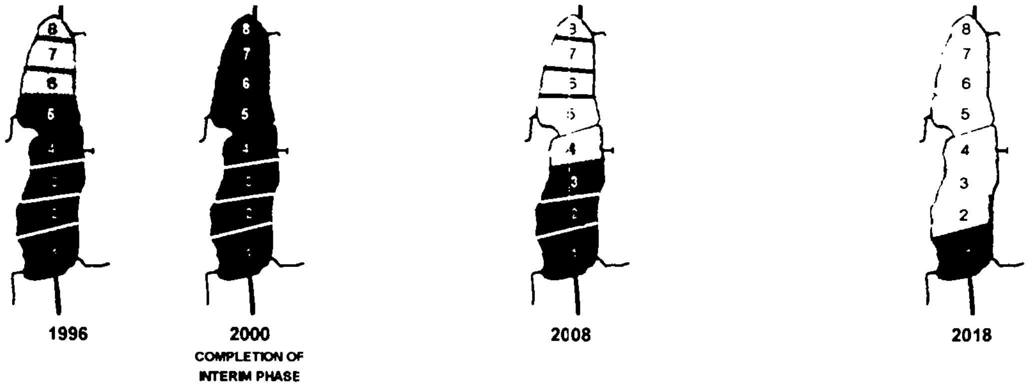
Stearns & Wheler	DRAFT ENVIRONMENTAL IMPACT STATEMENT ONONDAGA COUNTY DEPARTMENT OF DRAINAGE AND SANITATION
ENVIRONMENTAL ENGINEERS & SCIENTISTS DATE: 1/11/96 JOB No.: 2298	**FIGURE 4-4** **MODEL PROJECTIONS FOR AMMONIA: INTERIM VS. INTERMEDIATE ACTIONS**



ONONDAGA LAKE BACTERIAL COMPLIANCE PROJECTIONS



Onondaga Lake Bacteria Model Cells



MOFFA & ASSOCIATES
CONSULTING ENGINEERS

DATE: 1/11/96

DRAFT ENVIRONMENTAL IMPACT STATEMENT
ONONDAGA COUNTY DEPARTMENT OF
DRAINAGE AND SANITATION

FIGURE 4-5
INTERIM AND INTERMEDIATE PHASE BACTERIAL COMPLIANCE TIMELINE

CHAPTER 5 - MITIGATING MEASURES FOR ADVERSE ENVIRONMENTAL IMPACTS
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CHAPTER 5

MITIGATING MEASURES FOR ADVERSE ENVIRONMENTAL IMPACTS

5.0 GENERAL

The County, in implementing the MCP, will make every effort in the final location and siting of facilities to avoid sensitive natural and cultural resources. When this is infeasible, measures which minimize this impact and integrate the improvement into the surrounding physical environment must be examined.

Plans, specifications, and contract documents will include requirements intended to mitigate the potential negative effects of short- and long-term impacts. Mitigation measures for specific areas of concern are presented in subsequent sections of this chapter.

The MCP has been developed to improve environmental conditions in and around Onondaga Lake, and every effort has been made to minimize environmental impacts and mitigate adverse effects. For example, the improvements to METRO will maximize reuse of existing facilities within the existing plant footprint, with the only land acquisition a small parcel from Niagara Mohawk. Consequently, the short- and long-term impacts of this plant upgrade have been minimized.

Without significant outside financial assistance, the County will be required to finance approximately $535 million, excluding interest, over the life of the MCP. The County is concerned that the magnitude of the costs will adversely effect ratepayers of the District. Given this potential, the County is seeking to secure outside financial assistance. Extending implementation and assisting ratepayers experiencing difficulty in paying high use rates are also being considered.

This chapter presents a discussion of mitigating measures associated with METRO and CSO projects. As this DEIS is advanced through the SEQR process and the MCP document is approved, individual CSO and METRO projects will be further developed and require specific supplemental DEIS work. Some of the proposed CSO interim phase projects have advanced to the point where detailed EIDs have been drafted for preliminary consideration. Project specific environmental documents have been included as the following appendices:

- C-10 Newell Street CSO Disinfection Demonstration EAF
- C-11 Hiawatha Boulevard CSO Transmission Pipelines Facilities EID
- C-12 Harbor Brook TrashTrap™ and EquiFlow™ CSO Demonstration EID

The last two documents are separately bound.

5.1 CONSTRUCTION PHASE ISSUES

5.1.1 Subsurface Conditions

To mitigate impacts to subsurface conditions, engineering plans can be developed to: (1) reduce the area of exposed strata subject to unstable subsurface conditions, such as earthslide; (2) reduce the angle of cuts on exposed earth below what might otherwise be acceptable; (3) provide physical support for exposed soil or rock faces; (4) concentrate or distribute, as appropriate, the weight loadings of foundations to areas or strata better able to support that weight; (5) use small charges for blasting (if required); and (6) restrict the movement of heavy machinery during the construction phase.

5.1.2 Traffic

Although construction activities for individual projects will require temporary road, lane, or shoulder closure(s), the contractor will be required to maintain the flow of traffic via approved alternate routes to minimize impacts. Access for emergency vehicles will be maintained at all times. The contractor will be required to utilize flagmen, traffic signals, and lighted barricades as required to maintain safe and efficient flow of traffic. Stabilized construction entrances will be utilized to minimize the amounts of sediment material tracked off site and onto public roadways.

5.1.3 Noise

Construction activities, including blasting, will generally be confined to daylight, normal working hours, except in the case of an emergency, in order to minimize noise disturbances. The contractor will be required to control equipment noise by use of proper mufflers. The contractor will also be required to minimize excessive noise caused by work activities and to observe all local noise ordinances.

5.1.4 Dust

The contractor will be required to minimize dust generation as much as practical through control measures, such as frequent sprinkling and sweeping of paved areas and sprinkling and mulching of unpaved areas.

5.1.5 Public Health and Safety

Contractors will be required to have a public health and safety plan. To minimize the dangers of unattended open trenches, equipment, materials, or other unsafe conditions, the contractor will be required to employ flashing lights, temporary fencing or barricades, and/or heavy metal cover plates. Furthermore, the contractor will be required to properly secure unattended equipment and hazardous materials. Utilities and public safety agencies will be notified prior to the start of construction at all locations.

5.1.6 Erosion and Sedimentation Controls for Construction Near Streams and Lakes

Impacts of construction activities on streams and lakes will be minimized through strict adherence to the approved erosion and sediment control plan. Complete revegetation of all disturbed areas will be required in addition to complete restoration of natural preconstruction drainage patterns.

5.1.7 Freshwater Wetland and Floodplain Issues

Impacts of construction activities on environmentally sensitive areas, such as floodplains and wetlands, will be minimized through strict adherence to the approved erosion and sediment control plan, complete revegetation of all disturbed areas, and complete restoration of natural, preconstruction drainage patterns.

5.2 OPERATION PHASE(S) ISSUES

5.2.1 Air Quality Impacts

A number of mitigative measures are available to address odor problems if they occur. These include chlorination of flow into storage vessels, shortening the holding time of retained discharges (faster pumpback), use of masking agents, and odor control systems. It is believed that the maintenance of CSO facilities after storms, combined with adequate facility ventilation, will prevent odor problems.

The operation of the EquiFlow™ system will capture and store, for short periods of time, wet weather discharges from Harbor Brook. If the captured CSO and stormwater are left sufficiently long, oxygen may be depleted and odors produced from the reduction of organic matter contained in the facility. To avoid this impact, captured flow will be pumped back to METRO as soon following a CSO event as METRO has adequate flow capacity and accumulated solids will be removed as frequently as required to prevent the origination of odors.

5.2.2 Sludge Generation and Disposal

A. Sludge Generation and Disposal

There are several mitigative measures available to address sludge generation in this plan. The major components that will result in a decrease in the volume of sludge necessary for the County to manage are briefly described. The Bristol-Myers Squibb, Inc. industrial wastewater pretreatment facility will significantly reduce the influent loading of BOD_5 and TSS to METRO, which will result in a decrease in the amount of sludge generated. This volume of sludge will now be generated from the Bristol-Myers Squibb, Inc. industrial wastewater pretreatment facility and will become Bristol's responsibility to find disposal or beneficial use options.

Conversion of the secondary anaerobic digester to a heated completely mixed primary digester in the interim phase of this plan is anticipated to provide some additional primary digester capacity. This will result in further improvement to the anaerobically digested sludge produced at METRO.

These improvements should provide a reduction in sludge volume and improved dewaterability of the anaerobic digested sludge.

The implementation of year-round nitrification at METRO, as described in the intermediate phase, should also result in a small reduction in the amount of sludge generated. Operating the activated sludge process at higher MLSS and a longer sludge age will result in a reduction of sludge produced in the secondary clarifiers.

The implementation of the CSO control facilities are expected to improve the capture and treatment of CSO discharges. The increase in capture will result in additional solids and organic matter being conveyed to METRO for treatment and will result more sludge being generated.

A majority of the sludge that is currently being generated at METRO is being beneficially used rather than disposed. Any sludge generated in the future will continue to be beneficially used as the County is in the second year of a 10-year contract to produce N-VIRO soil for use as an aglime and fertilizer on agricultural land.

5.2.3 Energy Use

The implementation of the MCP will result in increased energy consumption over existing conditions as a result of both the METRO upgrade and the CSO control facilities. Energy will be used to operate pumps that lift collected discharges in the wet wells of the facilities to the level where they will undergo treatment. The discharge of the swirl underflows will be pumped back into the main interceptor sewer in all locations, resulting in additional energy usage.

5.3 FINANCIAL OPTIONS

Without significant outside financial assistance, the County will be required to finance approximately $535 million, excluding interest, over the life of the MCP. To put this in perspective, the County's existing wastewater debt is approximately $65 million. The County is concerned that the required magnitude of the costs will have an adverse impact on the County's present financial situation. The anticipated impacts include a reduction in the County's present AA bond rating, which will increase the interest cost of all borrowing, as well as precluding the County from financing other necessary, and in many cases, mandated projects. Given this potential, the County is investigating a number of options to reduce the MCP's adverse impacts, while at the same time insulating its existing general obligation bond rating.

These options include:

1. Obtain federal and state financial assistance in the form of grants. Secure low and no interest loans through the New York State Environmental Financing Corporation State Revolving Loan Program.

2. Establishment of an independent authority with the ability to issue revenue bonds, thus insulating the County's general obligation (GO) credit rating. This option will still require additional financial assistance to mitigate the impact of increased rates on the local user population.

3. Project phasing, with certain elements of the project delayed until such time as a use attainability analysis substantiates the environmental need to move forward *and* the County's ability to finance the needed improvements is determined.

4. Internal to the district, providing financial assistance for users who experience significant difficulty in paying high and rapidly increasing sewer use fees.

5.3.1 Creation of an Authority

As previously discussed, the County has two overriding concerns regarding its capacity to proceed with the MCP. The first is the affordability of the resulting program on the County's ratepayers. The second is the likely adverse impacts on the County's financing capacity, measured, in part, by its GO bond rating. The first issue will require reducing project capital costs and/or subsidizing the costs of required capital. The County is currently considering addressing the second issue through the creation of an independent sewer authority, with the ability to issue revenue bonds not secured by the County's general taxing powers.

Under New York State law, communities may only issue revenue bonds through the creation of a public benefit corporation or authority. Thus, it will be necessary for the County to assess the feasibility of establishing an authority to finance, as well as own and operate the County's wastewater system. A number of communities, including Buffalo and New York City, have recently undertaken this. The process has taken as long as seven to 10 years.

The first step will be to select or create a model suitable for Onondaga County. The proposed model would need to be approved by the County Legislature and then prepared and submitted to the State Legislature. The legislation would likely take the form of an amendment to the Public Authorities Law of New York State and would address the basic powers and responsibilities of the authority.

An authority would provide a number of key advantages relative to the MCP. One of the most important from the County's perspective is that its GO credit would be insulated. However, the rate impact on the County's residents and businesses may be higher under this situation than under GO financing. Higher interest costs and debt issuance costs could directly increase the annual user fees paid by residents and businesses. This is because revenue bond issuers normally are required to comply with a number of bond covenants designed to protect bondholders from the greater risk associated with revenue bonds. These include:

1. Debt service coverage of 125 percent such that the Authority generates an annual surplus after all expenses equal to at least 25 percent of annual debt service.

2. Operation and maintenance reserve funded at a level equal to and maintained at two or three months operating expenses.

3. Renewal and replacement reserves equal to at least one percent of the cost of the system.

These covenants are critical to an authority's ability to access the public debt markets.

5.3.2 Phasing

Phasing is a key strategy needed to reduce the significant affordability issues resulting from project costs of this magnitude. The current (25-year) implementation schedule does reduce, in part, the impact of the rapidly increasing user fees. However, due to the high project costs, even a 25-year implementation schedule only marginally reduces the sewer use charge. If the current MCP project schedule is to be affordable, State and federal assistance is necessary. Absent significant federal and state assistance, whenever appropriate, the project schedule should be extended in order to reduce the impact of rapidly rising sewer use fees.

5.3.3 District Hardship Assistance

The County is very concerned that many residents and businesses will be adversely impacted during implementation of the MCP. The affordability guidance document focuses on the impact of the proposed project on a household at the median income. That, by definition, means that half of the households in the County will be paying more than the rate deemed "affordable" by federal guidance. This problem is especially acute in Onondaga County, where over 11 percent of the households are at or below the poverty level, and in the City of Syracuse where 22 percent of the households are at or below the poverty level. These households have incomes that are less than half of the County median. These households face sewer bills in the year 2000 exceeding 1.8 percent of household income and peaking at approximately 3.3 percent of household income.

There are several options potentially available for the County to address these hardship concerns:

1. Modify the County's present user fee structure to one based on actual flows.

2. Develop a lifeline fee to insulate certain portions of the population from the impact of increasing sewer user fees.

3. Obtain outside financial assistance or scale back the elements of the project to reduce the County's costs and improve the affordability of the project to all households.

The County has practical reservations regarding modifying the present user fee system, given its lack of control over and the lack of uniformity of water billing data. Despite those concerns, it does not appear that this type of fee structure modification would materially change the affordability of the program for hardship households. Apogee Research, in work performed for the Onondaga Lake Management Conference, estimated that flow-based rates would reduce the average household bill by approximately 11 percent. The County believes that the Apogee analysis overstates the impact, but an 11 percent reduction in typical household bills would not appreciably alter the affordability of the MCP on hardship households.

The Clean Water Act of 1987 authorizes communities to use rate structures that limit the user fee charges to households with limited incomes, so-called lifeline rate structures. While the County believes this warrants further consideration, lifeline rate structures explicitly require higher income households to subsidize lower income households. Given the income structure of Onondaga County, this would require every residential customer above the poverty level to pay in 2005 approximately an additional $30 per year to keep the rate for all households at or below the poverty level to 1.5 percent of the poverty level income. By the year 2015, the transfer would increase to over $90 per year. Given the County's unique situation, with the real possibility that implementation of the MCP could cause the Onondaga County Sanitary District to dissolve to the METRO Service Area as a result of the implicit subsidization of one portion of the County by others, the County does not believe that lifeline rates are an appropriate mechanism to address the problems facing hardship households. It is also important to point out that a lifeline structure requires the development of a cumbersome and intrusive process to certify eligible households which effects all district households.

The final options available to address hardship households are obtaining capital assistance funding (grants or subsidized loans) or scaling back the size of the MCP to reduce the County's capital obligations and its revenue requirements. If such funding is available and obtained, it will reduce the burden on all of the County's customers and may improve the efficacy of these other mechanisms. Capital assistance could come in the form of capital grants, reductions in debt service obligations (through discounted loans or direct debt service assistance) or further extending the County's proposed implementation schedule.

5.3.4 Outside Financial Assistance

The County strongly believes the need for such assistance is imperative. The County's projected sewer use rates will be considerably higher when compared to other major metropolitan areas in the state, and the burden they will impose on the County's residents, especially within the City of Syracuse, will be substantial. The result may well be the dissolution of the Onondaga County

Sanitary District and the creation of a METRO Service Area District. If this were to occur, the costs on sewer users would be even more dramatic. If the METRO Service Area users were required to pay for all the project costs, already high sewer use fees would increase by approximately 30 percent. It should be noted that even with the proposed implementation period of 25 years, the projected sewer rates in the County will exceed USEPA's affordability standard, and those of residents in the City will be significantly above the affordability threshold.

Needed financial assistance for the MCP could take at least three forms:

1. State Revolving Loan Fund (SRF) assistance, whereby the County will borrow significant portions of the MCP cost through the SRF. The SRF provides subsidized financing through reducing the interest cost to a rate approximately equal to two-thirds of the market rate.

2. Direct federal assistance through grants, such as those that have been provided to the Massachusetts Water Resources Authority, San Diego, CA, and others. These grants are similar to the old Construction Grant Program, where the federal government directly pays for some or all of the costs associated with a mandated wastewater project.

3. Direct state assistance such as that presently provided by a number of states. As an example, the Commonwealth of Massachusetts presently pays 20 percent of the debt service incurred by local communities associated with wastewater projects to mitigate the affordability and financing difficulties facing many communities with mandated projects.

Given the present budgetary upheaval at the federal level, it is difficult to project what types of federal assistance may be available for projects such as the MCP. This also carries over to the SRF. The amounts potentially available for funding depend upon reauthorization of the Clean Water Act and the amount eventually appropriated to provide additional loan amounts. Under the most optimistic circumstances, given full reauthorization and limited demand for funding within New York State, the County is unlikely to be able to finance more than 50 percent of its project costs through the SRF. A more likely case is SRF funding will be limited to approximately 10 to 20 percent of financing requirements. State grants are also viewed as unlikely at this time.

However, they remain a key ingredient in the County's ability to implement the MCP without causing significant financial and economic damage.

Without state and federal assistance, extending the phasing of the project remains the only alternative that would allow the sewer use fees as a percentage of household income to fall within the affordability range advocated by USEPA. (To alleviate affordability concerns, sewer use fees as a percentage of median household income would need to be 1 percent or less as indicated by the USEPA's Financial Capability Guidebook issued in February 1993. See Appendix E for a more detailed explanation.)

CHAPTER 6 - ADVERSE IMPACTS THAT CANNOT BE AVOIDED
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CHAPTER 6

ADVERSE IMPACTS THAT CANNOT BE AVOIDED

6.0 GENERAL

This section summarizes any probable adverse environmental effects which cannot be avoided. This essentially summarizes in one place those effects discussed in Chapter 4 which cannot be reduced in severity or which can be reduced to an acceptable level but not eliminated. Included are any irreversible and irretrievable commitments of resources that would be involved in the proposed action should it be implemented.

6.1 CONSTRUCTION PHASE

6.1.1 Subsurface Conditions

There will be no significant impacts on subsurface conditions that cannot be avoided or mitigated.

6.1.2 Traffic

While every effort will be made to minimize traffic impacts, some impacts to traffic during construction will occur. Construction of the components of the MCP may potentially result in two types of traffic impacts: (1) traffic volume increases at various project sites due to trips made by construction personnel and the movement of construction equipment; and (2) potential disruption of existing traffic, primarily along the major roads and service roads, due to the pipeline construction activities, and the METRO construction.

The magnitude of the impact resulting from construction worker vehicle trips will be dependent on the number of such workers and time of day the construction activity occurs.

The Oxford Street bridge over Onondaga Creek, which is closed to all but pedestrian traffic, may be eliminated and a portion of Oxford Street will be abandoned for construction of the Midland RFT.

6.1.3 Noise

Construction site noise level is dependent on the phase of construction and the type and quantity of construction equipment used. While every effort will be made to mitigate noise levels, it is expected that the highest noise levels will occur during the excavation and foundation phase of construction. The noisiest equipment likely to be used is impact equipment such as rock drills, earthmoving equipment such as bulldozers and backhoes, and pile driving equipment. The construction activity with the highest noise emission is pile driving. Specific information on construction activities, schedule, type and quantity of equipment has not been developed to allow calculation of boundary line noise levels. As the MCP actions proceed through design phases, noise mitigation measures will be included in contact specifications.

6.1.4 Dust

Land clearing, excavation and related construction activities, including construction vehicle movements, can generate dust. Activities such as these are typical for any large project and fugitive emissions will be effectively mitigated using methods such as water sprays, wind screens, and debris enclosures. Since most of the work at sites such as METRO will be in areas with a high water table, dust will be minimized at Harbor Brook, much construction activity will be below water level, little dust would be expected from construction at any of the sites. Despite mitigative measures, a certain amount of dust will be generated, but the impact should be temporary and over a short period.

6.1.5 Public Health and Safety

All applicable OSHA regulations, including the development of a public health and safety plan, will be adhered to during construction and operation of the facilities proposed in the MCP. The enforcement files, monitoring reports, safety records, and other non-confidential data are available to the public upon request. In addition, the contractor will notify any person whose health and safety is in imminent danger due to non-compliance on the part of the permittee. Any construction activity may add some risk to public health or safety of workers. However, this should be minimal.

6.1.6 Erosion and Sedimentation Controls for Construction Near Streams and Lakes

Final construction plans for each facility will comply with all applicable local, state, and federal requirements. This will include erosion and sediment control and stormwater management plans designed to mitigate nutrient and sediment runoff into the draining tributaries. Therefore, there should be no significant impact on soil resources that will not be mitigated.

6.1.7 Disturbance or Destruction of Freshwater Wetlands, Floodplain Impacts

For each proposed project implemented as a result of the MCP, wetland resource and the quality of wetlands will be identified. These wetland resources will either be avoided or impacts mitigated as specified by the current wetland law. Consequently, there should be no significant impact on the wetland resources that have not be mitigated. Effects on filling in floodplains will be mitigated on a case-by-case basis.

6.1.8 Temporary Water Quality Impacts During METRO Construction

As discussed in the MCP, portions of the METRO treatment facility will be temporarily taken out of service in order to construct the planned improvements. The capacity of the plant to provide full treatment to the influent flows will be reduced during the construction period. An interim SPDES permit will be required from NYSDEC during the scheduled construction period.

6.2 OPERATIONS PHASE

6.2.1 Impacts on Aquatic Resources in Onondaga Lake, Onondaga Lake Tributaries, and the Seneca/Oswego River System

No adverse impacts are expected to affect aquatic resources in Onondaga Lake, its tributaries, or the Seneca/Oswego Rivers system as a result of actions proposed in the MCP, since these actions will be implemented to provide environmental benefits to these aquatic resources. Refer to Chapter 4 of this document for a discussion of environmental impacts to these water systems.

6.2.2 Impacts on Energy Resources

The construction of a large number of facilities for both the METRO upgrade and the CSO control facilities will require energy to operate equipment and heat facilities. In order to produce the desired environmental improvements to Onondaga Lake and its tributaries, the increased use of energy cannot be avoided.

The construction of the four CSO RTFs and the Harbor Brook EquiFlow™ system are all new facilities that will require energy to operate. It is anticipated that operating the activated sludge process at METRO for year-round nitrification will require approximately a 60 per cent increase in electrical energy over current operations.

6.2.3 Impacts on Solid Waste Disposal (Sludge)

The implementation of the MCP is expected to result in an overall decrease in the amount of sludge generated by the County. The reduction of wastewater loadings as a result of Bristol-Myers Squibb, Inc. industrial wastewater pretreatment ill more than offset the increase in sludge generated from capturing and treating more CSO flow.

Since the County is producing N-Viro soil from the sludge generated at METRO and the final product is being used in a beneficial way, this reduces any potential adverse environmental impacts. The use of N-Viro soil in accordance with NYSDEC 360 regulations results in a more positive environment effect as opposed to a more adverse environmental effect of landfilling or incinerating.

6.3 UNAVOIDABLE FINANCIAL AND ECONOMIC IMPACTS

6.3.1 Sewer Use Fee Increases and Affordability Concerns

Without significant outside financial assistance, MCP implementation will mean unacceptably rapid increases in user fees for services. Projected household bills are constructed by adding charges for service under the current system; any local retail charges (charges for the local collection system); and the MCP increment, an estimate of the cost per household for MCP improvements. In 1996, users pay $222 in annual fees per year to the County and an estimated $60 in local retail charges, resulting a total bill of $282. In 2005, assuming for illustrative purposes only no additional financing assistance, charges for service under the existing system are estimated to be $412 and local retail charges are estimated at $106. The MCP increment is estimated at $153, or 23 percent of the total bill of $671. In 2015, estimated fees under the existing system rise to $777, while local charges rise to $182. The MCP increment becomes a larger share of the bill, rising to $434, or 31 percent of the $1,393 total charge. The increasing household charges continue to rise to $1,708 in 2020 (Appendix E). These projected household bills represent a doubling of the real burden being imposed on local ratepayers. These bills are believed to be beyond the capacity of our ratepayers and will result in economic and financial dislocations.

The County's evaluation of the affordability of the MCP is guided by the USEPA's Combined Sewer Overflow Financial Capability Guidebook issued by the USEPA in February 1993. That Guidebook states that:

> If the CSO control costs are between 1 and 2 percent of the permittee's MHI [Median Household Income], and the controls meet the WQS [Water Quality Standards]; a review of the permittee's financial health is conducted to determine if there is a need to lengthen the completion schedule to ease the financial burden.

The County has determined that for purposes of long-term facility planning, it will use a 1 to 1.5 percent rate as an indicator of an affordability problem and will seek to maintain long-term rates consistent with this standard. This determination of hardship is based on the cost of wastewater service to a typical household, expressed as a percentage of median household income. The County continues to be concerned about the impact of this level of sewer rate on the City of Syracuse, since a sewer rate equal to 1.5 percent of the County's median household income results in a sewer rate equal to approximately 2.25 percent of the City's median household income, significantly above the USEPA's affordability threshold.

Sewer bills are projected to increase from approximately 0.8 percent of County median household income in FY 1995 to 1.63 percent in FY 2015, thus, the burden of sewer service is projected to more than double. The situation is even more troubling for residents in the City of Syracuse, where the projected rate is projected to increase from 1.15 percent of the City's median household income in FY 1995 to 2.5 percent in FY 2015.

From the perspective of the County as a whole, projected sewer rates in the years after FY 2005 will exceed the affordability standard by as much as 10 percent. However, the County believes a number of steps should be taken, including obtaining significant outside financial assistance and/or extending the implementation schedule, that would enable it to maintain rates within the 1.0 to 1.5 percent affordability standard. The magnitude of rates within the City of Syracuse relative to income preclude the County from being able to do anything that will cause these rates to meet the affordability guideline. This becomes an even larger issue if the County is unable to preserve the integrity of the present district and the district dissolves, creating a METRO service area. The dissolution of the district with the smaller customer base, lower incomes, and outmigration prospects would call into the question the financial ability of the service area to successfully implement the MCP.

The MCP, when implemented, will have a negative economic impact on the County. While the MCP will have a stimulus impact initially, as construction starts up, the County has concluded that once the rate payers begin to pay the costs associated with the MCP, the impact will be negative. The County has evaluated the potential economic impacts of the MCP without significant outside financial assistance. That analysis concluded that, all other things being equal, implementation of the MCP will cause employment levels to drop by more than 1,700. Employment loss of this magnitude would be similar to the County losing a company the size of Welch Allyn or Lockheed-Martin. It is also estimated that population will drop by over 3,700 people (see Table 6-1). It must be emphasized that these figures are in addition to the anticipated decline in population and employment within the County independent of the MCP and assume no further shocks to the local economy or any additional increase in local tax burden. Both these latter assumptions are likely to prove to be overly optimistic given continued and possibly accelerating worldwide restructuring, putting further pressure on the regional economy. For a more detailed description of the financial and economic impacts as well as the assumptions utilized in construction the projections, refer to Appendix E, Financial Capability Analysis.

6.3.2 Change in District Composition

In the current MCP, the costs will be borne by all users of the Onondaga County Sanitary District. However, the proposed improvements only affect one treatment service area within the sanitary district --"the METRO Service Area." Other geographical areas in the District are serviced by treatment plants and collection systems independent of the METRO Service Area. Given the underlying statutory structure for the Onondaga County Sanitary District, it would take a simple vote of the County Legislature to dissolve or realign district boundaries and create an independent district for the METRO Service Area, which would have at least a one-third smaller population base to raise sewer user fees. The potential change in the sewer district composition would make the current MCP projects and schedule severely unaffordable.

A dissolution of the current district would have a direct and severe adverse effect on the METRO Service Area's financial capacity and economic viability. The METRO Service Area would have a much smaller population base and, thus, fewer households to charge in order to pay for MCP project costs. This factor alone, assuming no outmigration, would result in an increase in the average household costs of approximately 30 percent. Given this situation, rapid and substantial outmigration from the METRO Service Area to other areas of the County is highly probable. Even more detrimental to the County is the likelihood that residents would leave the County entirely which would decrease the tax base used to support current general fund services.

Further exacerbating this issue is the fact that the income level of the METRO Service Area is significantly less than that of the County (87 percent) and the Onondaga County Sanitary District (86 percent). The result would be rates that are 50 percent higher relative to income for a METRO Service Area district as compared to the current Onondaga County Sanitary District. Therefore, without substantial reduction in the project costs or a greatly extended schedule, the potential change in the sewer district composition would make the current MCP projects and schedule unaffordable.

TABLE 6-1

PROJECTED CHANGES FROM BASELINE CONDITIONS
RESULTING FROM THE MCP

YEAR	POPULATION	EMPLOYMENT
1996	0	6
2000	(200)	(160)
2005	(750)	(425)
2010	(935)	(650)
2015	(3,100)	(1,400)
2020	(3,700)	(1,700)

Source: REMI Model, 1995.

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CHAPTER 7

GROWTH INDUCING IMPACTS

7.0 GENERAL

Growth inducing aspects of the MCP derive from an increase in wastewater treatment capacity and improved water quality in Onondaga Creek, Harbor Brook, Ley Creek, and Onondaga Lake. Disincentives to growth derive from the increased user fees associated with the MCP, which are expected to increase the cost of living and doing business in Onondaga County relative to surrounding areas and other states.

METRO currently operates at design capacity; proposed improvements will lead to a 4.2 mgd increase in design capacity. Permitted design capacity will increase from 80 mgd to 84.2 mgd, and peak design capacity will increase from 120 mgd to 126.3 mgd. Although METRO design flows will be greater than current flow conditions, decreases in treatment loads at METRO due to industrial pretreatment at Bristol-Myers Squibb and CSO abatement projects will yield a net increase in wastewater treatment capacity that will be used to provide a higher level of treatment (i.e., ammonia removal).

In accord with Onondaga County's 2010 Plan, this gain in treatment capacity will allow for additional residential growth and economic development in Syracuse, Salina, Geddes, Camillus, Onondaga, Dewitt, and Cicero. Significant areas within the METRO Service Area are undeveloped, particularly in the Town of Onondaga; increased capacity will permit but not induce growth to occur in this location. In Syracuse and the remaining towns in the service area, there is relatively little undeveloped land, but significant potential for redevelopment of industrial and commercial sites and the oldest residential neighborhoods; additional treatment capacity will allow redevelopment to occur. Improvements to water quality in the creeks and Onondaga Lake and reduction of odors associated with CSOs will eliminate a disincentive to redevelopment of adjacent neighborhoods.

However, increased sewer user fees associated with the proposal can be expected to decrease the desirability of redevelopment in these locations relative to sites outside the Sanitary District. Higher user fees will increase the cost of living, which is already higher in Onondaga County than in surrounding counties, and likewise the cost of doing business.

7.1 POPULATION

METRO improvements represent a 4.4 percent increase in the County's system-wide wastewater treatment capacity, and a 6.25 percent increase in treatment capacity in the METRO Service Area. Growth of population and jobs possible with increased treatment capacity can be apportioned according to a number of alternatives. For example, if the entire gain in treatment capacity were used by residential development, the service area could support a gain of 20,000 new dwelling units or 50,000 population at the current average household size, assuming average demand of 250 gallons per household per day for household wastewater and inflow and infiltration of groundwater and stormwater.

The County's 2010 Plan projected an increase of 11,200 dwellings during the 1990s, another 6,840 dwellings to 2010, and still fewer units in the following decade. Net residential building permits for the first half of this decade stand at 5,680, suggesting that these projections remain reasonable. However, this gain in dwelling units has not translated into commensurate population growth. According to Census estimates from 1990 to 1994, the County population grew by 4,363 people.

In addition to the proposed addition to capacity at METRO plant, there is currently unused capacity at several other County treatment plants totaling 12.9 mgd: Oak Orchard has 40 percent or 4 mgd unused capacity, pending scheduled improvements; Baldwinsville Seneca Knolls has 50 percent or 4.5 mgd excess capacity; Meadowbrook Limestone has 32 percent or 2.9 mgd excess capacity; Brewerton has 50 percent or 1.5 mgd excess capacity. Only the Wetzel Road plant is operating at capacity, pending reconstruction.

The proposed gain in treatment capacity at METRO means that almost 30 percent of the growth potential in the County can be accommodated within the METRO Service Area. In the last five years, about 21 percent of the County's net gain in dwellings was in Syracuse and the six towns in the METRO Service Area (although the service area does not cover all the area or permits in these towns). The proposed capacity is appropriate in the METRO Service Area where more compact development can make cost-effective use of existing water lines, sewers, roads, public transportation, and cultural and educational facilities.

Growth in the METRO Service Area would reverse the trend toward sprawl that has prevailed since 1950. However, treatment capacity will not necessarily lead directly to growth of either jobs or housing. Historically, both jobs and housing have moved from the METRO Service Area to newer suburban and rural locations. Costs associated with this project could add an economic incentive to relocate beyond the Sanitary District or the County. Project costs may further decrease the relative attractiveness of the area which faces severe competition from lower cost states. For example, the REMI economic model projects a loss of $213,700 people by 2020, over baseline projections, due to the impact of costs imposed on County residents by the project.

7.2 INDUSTRIAL AND MANUFACTURING BASE

Potential for job growth is possible with increased treatment capacity from the MCP is complementary to housing growth. For example, if 3,000 dwelling units were to be built in the METRO Service Area, they would use 0.75 mgd of the net addition to treatment capacity at 250 gallons per household per day. The additional treatment capacity would be left for commercial and industrial development. Water use and pollutant loads associated with employment vary widely by industry, making it very difficult to predict levels of employment possible with new wastewater treatment capacity.

However, the REMI economic model projects a loss of 1,700 jobs from baseline forecasts for the next 20 years, due to costs associated with the MCP. Because population growth in Onondaga County is dependent on employment growth, lower levels of employment can be expected to lead directly to less population growth if not a decline in the size of the population.

7.3 ECONOMIC DEVELOPMENT

The Metropolitan Development Association of Central New York has developed an Economic Development Plan for the creation of one percent annual growth in employment population over the next 20 years.

With construction of improvements to METRO and programmed improvements to the Oak Orchard and Wetzel Road treatment plants, the County will have wastewater treatment capacity to support growth of 18 percent and can accommodate the plan for growth for 18 years, appropriately located with the urbanized area.

The geographic distribution of unused wastewater treatment capacity, including the new capacity at METRO, is well located in relation to other infrastructure required to support growth, such as the highway network and the public transit system. Syracuse and nearby towns remain the major employment center in Onondaga County and the region. Proposals to continue this focus include the Syracuse Research Park, Hancock Redevelopment Park, Carousel Landing, Lockheed Martin Redevelopment Park, and the Syracuse Economic Development Zone, among others. Beyond the central core, potential economic growth areas include Radisson, Clay Industrial Park, Woodard Industrial Park, and new and redevelopable sites in Camillus, Geddes, Dewitt, Cicero, Manlius, Van Buren, and Onondaga, all of which have access to the interstate highway system and the water distribution system, as well as trunk sewers and wastewater treatment facilities.