ECOSYSTEM CONSULTING SERVICE, INC.

Robert W. Kortmann, Ph.D.
Ecosystem Consulting Service, Inc.
430 Talcott Hill Road
Coventry, CT 06238

December 8,1993

LAKE MOHEGAN 1993 DIAGNOSTIC REPORT

Mohegan Lake Improvement District
c/o James V. O'Gara, Jr.
RR 1 Box 355
Mohegan Lake, New York 10547

Introduction/Purpose

A limnological assessment of Mohegan Lake was initiated in 1993 to identify the physical, chemical, and biological nature of the ecosystem. This study was intended to begin to evaluate cause-effect relationships which result in poor water quality, and to identify approaches which appear to be most appropriate for cost-effective management of Mohegan Lake. Although the 1993 study has been "focused" to cost-effectively obtain basic information about the lake, much diagnostic information has been gained. The intent is to utilize the diagnostic information from this study to focus future study on lake aspects which offer the greatest management potential -- maximizing useful diagnostic information while minimizing cost. Ultimately, the goal is to prescribe a management/treatment approach to improve and protect the Mohegan Lake Ecosystem.

The specific objectives of the 1993 diagnostic study were:

1) to define and quantify the physical, chemical, and biological interactions which most directly affect resource quality,
2) to evaluate past and present lake management techniques used at Mohegan Lake, and
3) to identify fundamental lake management approaches which appear to have the greatest chance for success at Mohegan Lake.

DIAGNOSTIC EXECUTIVE SUMMARY

Mohegan Lake exhibits moderately strong (episodic) stratification, an anoxic sediment-water interface, substantial internal nutrient loading, lack of cool water habitat, poor zooplankton community composition, and poor transparency. These observations were made despite the operation of an artificial circulation aeration system (some were, perhaps, due to aeration). However, the aeration approach did result in some benefits. Zooplankton abundance and phytoplankton species composition suggested direct benefits of aeration. Modification of the aeration approach, maximizing benefits while minimizing impacts, offers substantial improvement potential.

Sediment-water exchanges and an "available iron deficiency" appear to be major causes of algal bloom problems. Incubation of experimental sediment-water systems is recommended to test the feasibility of several treatment techniques.

Although eutrophic, with poor summer transparency, several observed features were very encouraging regarding the potential improvement of Mohegan Lake including:

Nitrogen Cycle Dynamics

Iron deficiency (which can be cost-effectively corrected)

Zooplankton abundance (though not species composition)

Phytoplankton composition (though not abundance).

Although watershed management is critical to the long-term quality of the lake and should be pursued, it is unlikely that any degree of watershed management will result in significant improvement in the short-term.

RECOMMENDATIONS:

December1993 - February 1994:

- Perform Microcosm Incubation Tests on Lake Mohegan sediment-water systems
  - Oxygen Deficit Rate; Sediment Demand
  - Anaerobic Composition Fe, Mn, H_2S
  - Dose Treatment Testing - Alum Surrogates
  - Sediment Mechanical Analysis - % Organic

- Evaluate Current Aeration System Design
  - Design/Propose Modifications

- Winter through-the-ice sampling.

March-October 1994:

- Implement Aeration System Modifications with Chemical Injection Capability

- Lake Monitoring Program - Focused (based on 1993 results)

- Watershed Assessment including specific, high potential improvement locations (e.g. drainage system).

Winter 1994-95

- Treatment based on Microcosm Results and Additional Monitoring.

Diagnostic Observations

Physical Structure and Function

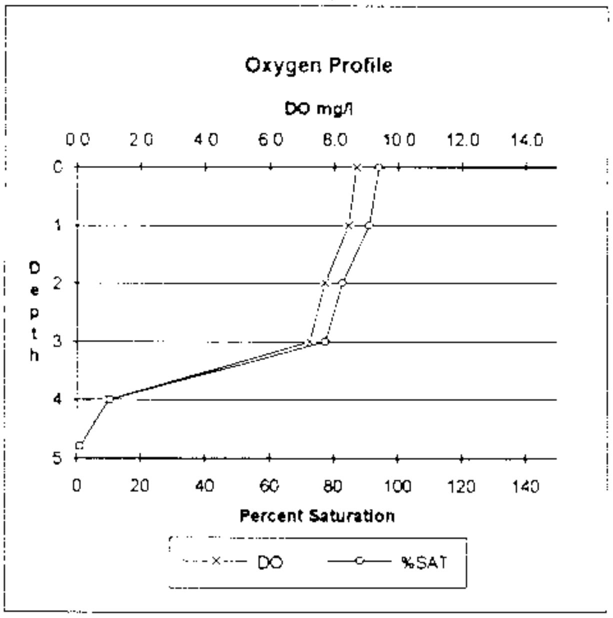
Temperature, Secchi disk transparency, and dissolved oxygen were measured on several dates. These data were entered into a program which computes % saturation as a function of temperature, relative thermal resistance to mixing (density gradient as a function of temperature), relative viscosity gradient, and anoxic boundary. Data printouts and plots follow the diagnostic observations.

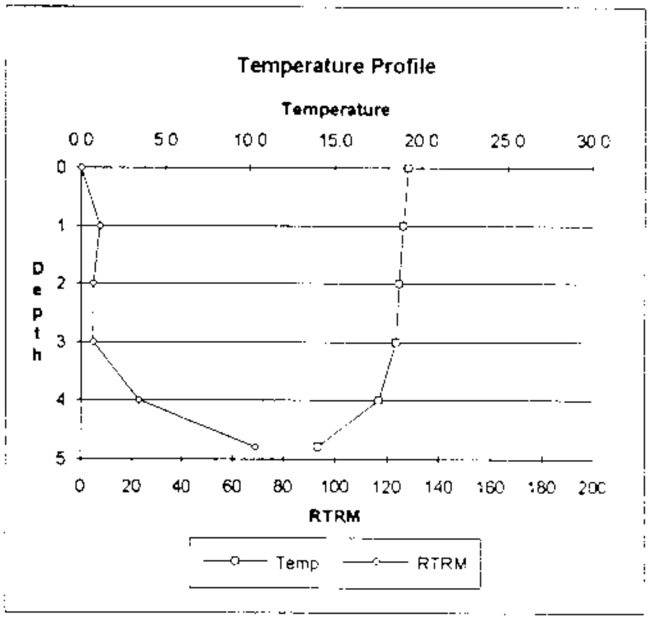
* Mohegan Lake exhibits moderately strong and somewhat episodic thermal stratification structure.
* Most of the sediment-water interface remains anoxic, even when most open water depths contain dissolved oxygen. Sediment oxygen demand appears to be very high. (Measurement of sediment-water interactions via microcosm incubation is recommended for future work.)
* Moderate thermal stratification persisted despite operation of the artificial circulation aeration system. Although the aeration system clearly exhibited several beneficial effects, it appears to be undersized and creates a "continuous algal culture" behavior in the lake. Modification of the aeration approach is likely to result in significant lake improvement.
* Secchi disk transparency declined through the summer, supporting previous conclusions about internal nutrient loading and "continuous algal culture" aspects of sediment-water interactions.
* No suitable Temp/DO conditions existed for brown trout during the summer. However, this may be remedied by modification of the aeration approach.
* Mohegan Lake is a steep-sided basin with a flat muck bottom. It exhibits moderately strong thermal stratification and anoxic coverage over most of the bottom (despite aeration). These physical features indicate a need for improved in-lake management techniques.

Mohegan Lake

Station	*1*	
Date	6/2/93	
SECCHI	1.6	*meters*
Anoxic Boundry	4.00	*meters*

Depth	*Temp*	*DO*	*%SAT*	*RTRM*	*RVG*
0	19.2	8.7	94	0	0
1	18.9	8.4	91	7	12
2	18.7	7.7	83	5	8
3	18.5	7.3	77	5	8
4	17.5	1.0	10	23	40
4.8	14.0	0.1	1	69	186



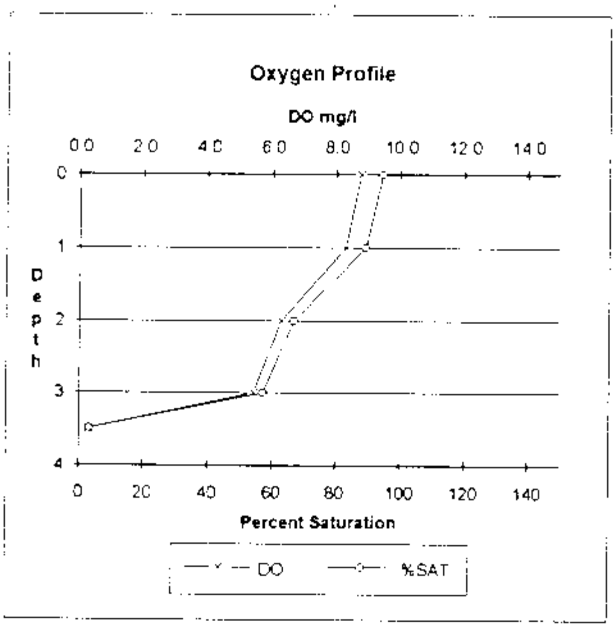


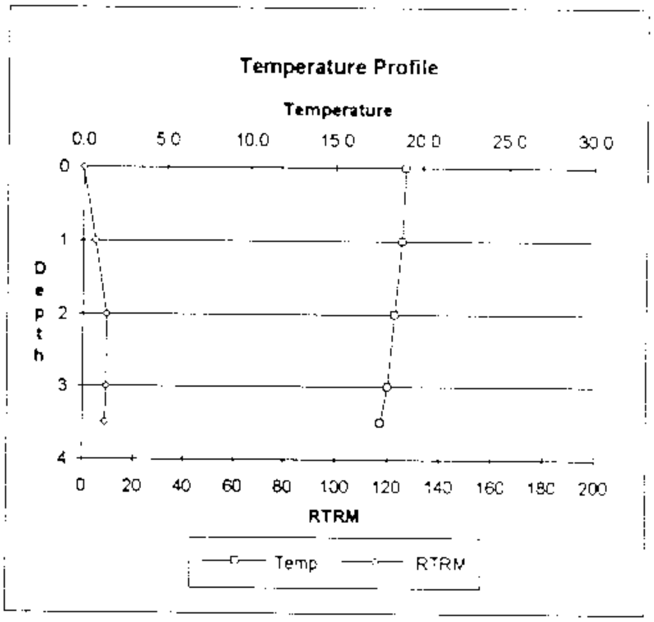
Lake Mohegan

Station	2	
Date	6/2/93	
SECCHI	1.7	*meters*
Anoxic Boundry	3.43	*meters*

4

Depth	*Temp*	*DO*	*%SAT*	*RTRM*	*RVG*
0	19.0	8.8	94	0	0
1	18.8	8.3	89	5	8
2	18.4	6.3	67	9	16
3	18.0	5.4	57	9	16
3.5	17.6	0.3	3	9	16



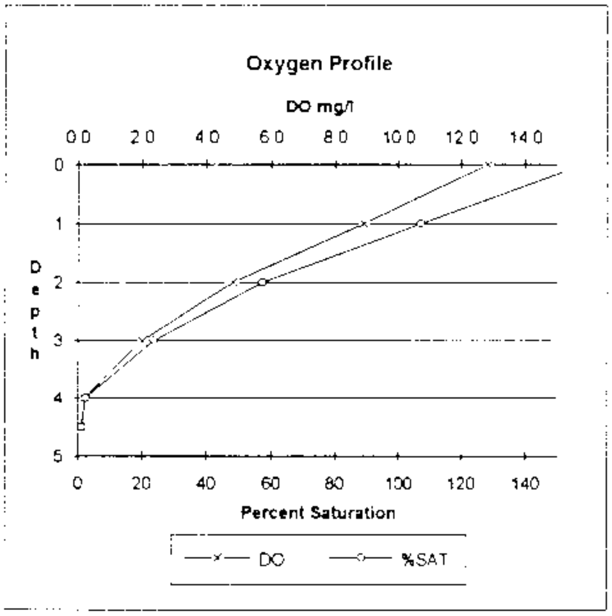


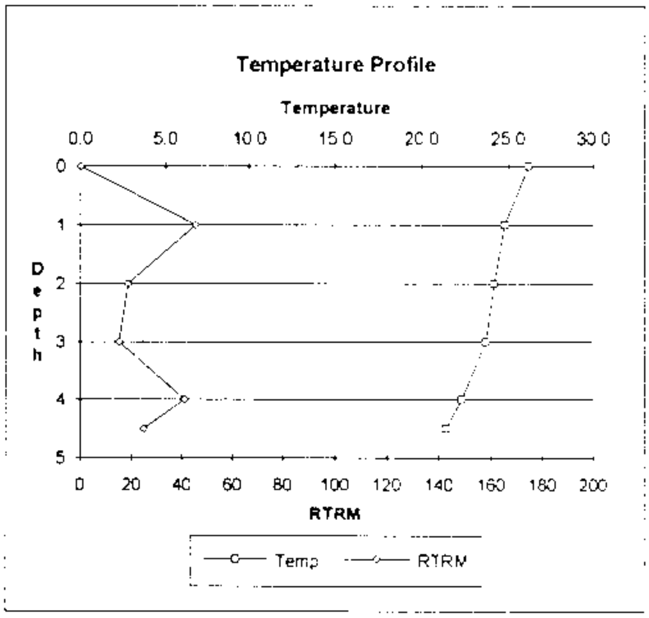
Mohegan Lake

Station	*1*	
Date	6/9/93	
SECCHI	0.7	*meters*
Anoxic Boundry	3.56	*meters*

4

Depth	Temp	DO	%SAT	RTRM	RVG
0	26.2	12.8	158	0	0
1	24.8	8.9	107	45	56
2	24.2	4.8	57	19	24
3	23.7	2.0	24	15	20
4	22.3	0.2	2	41	56
4.5	21.4	0.1	1	25	36



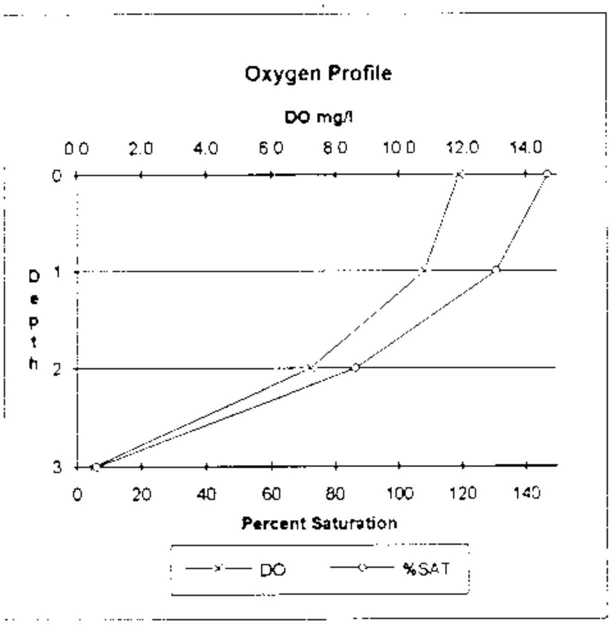


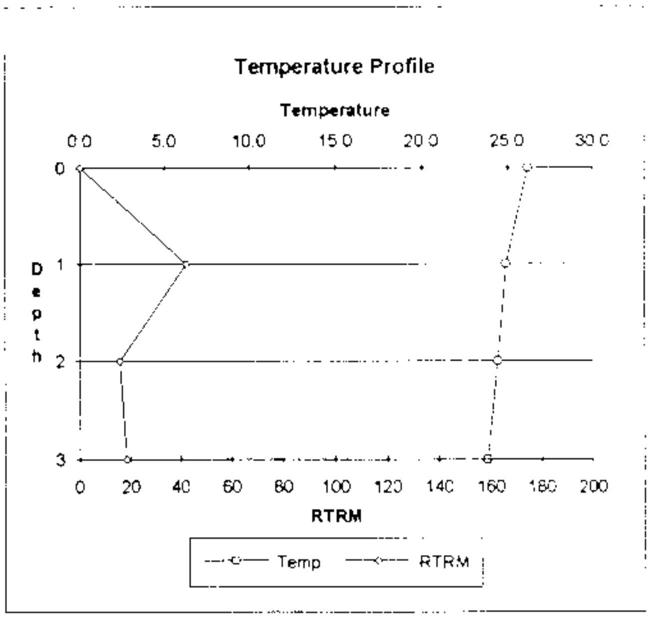
Mohegan Lake

Station 2
Date 8/9/93
SECCHI 0.7 *meters*
Anoxic Boundry 2.93 *meters*

3

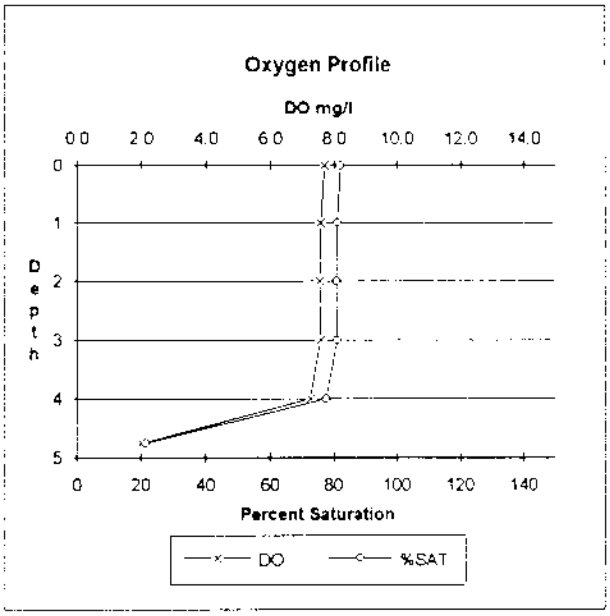
Depth	Temp	DO	%SAT	RTRM	RVG
0	26.2	11.9	147	0	0
1	24.9	10.8	131	42	52
2	24.4	7.2	86	16	20
3	23.8	0.5	6	18	24

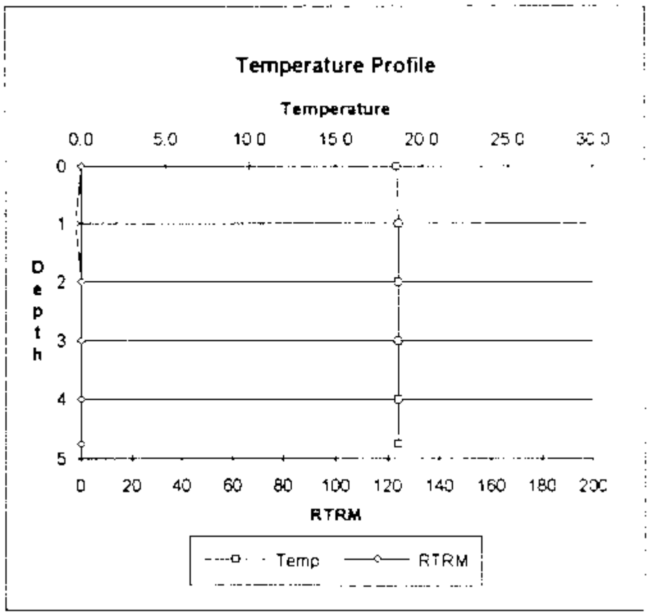




Mohegan Lake		
Station	1	
Date	9/22/93	
SECCHI	1.1	meters
Anoxic Boundry	none	meters

Depth	Temp	DO	%SAT	RTRM	RVG
0	18.5	7.7	82	0	0
1	18.6	7.6	81	-2	-4
2	18.6	7.6	81	0	0
3	18.6	7.6	81	0	0
4	18.6	7.3	78	0	0
4.75	18.6	2.0	21	0	0



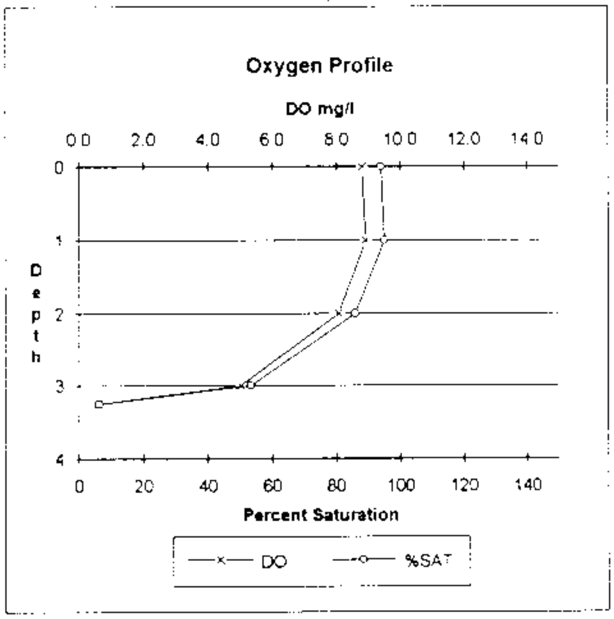


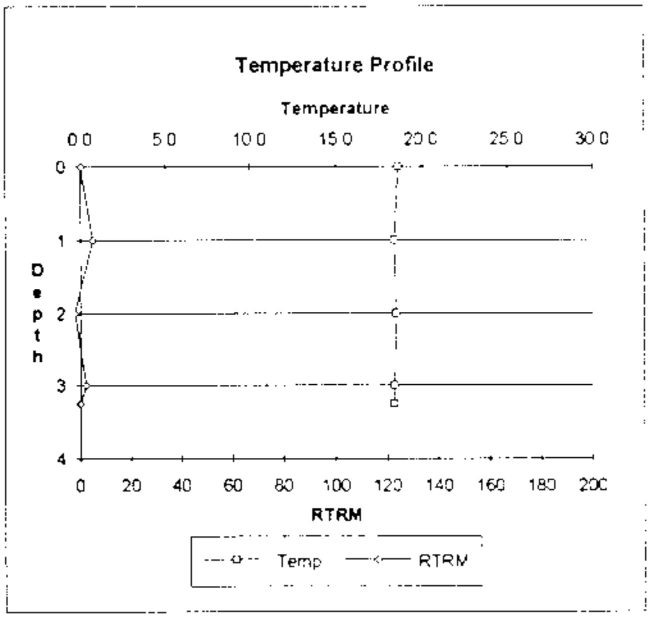
Mohegan Lake

Station	2	
Date	9/22/93	
SECCHI	1 0	*meters*
Anoxic Boundry	3 23	*meters*

4

Depth	*Temp*	*DO*	*%SAT*	*RTRM*	*RVG*
0	18.6	8 8	94	0	0
1	18 4	8.9	95	5	8
2	18.5	8 0	86	-2	-4
3	18 4	5 0	53	2	4
3 25	18.4	0 6	6	0	0





(Bio)Chemical Structure and Function

Total Phosphorus

* Mohegan Lake appears to be "phosphorus limited" (although at times it was light-limited due to high TP and N availability).

* TP concentrations increased with depth, exhibiting a steep concentration gradient despite artificial circulation aeration. Sediment-TP release rate experiments are recommended for further study.

* Although TP concentrations are indicative of a eutrophic lake ecosystem, the concentrations are not so high as to be discouraging about potential lake improvement. Decreasing TP to below 20 ppb appears to be achievable and would result in very observable lake improvement.

Inorganic Nitrogen - Ammonia and Nitrate

* Ammonia concentration increased with depth. (Nitrification was somewhat limited in early summer.)

* Nitrate concentrations increased with depth. (Denitrification capacity appears to be exceeded at times.)

* In August, ammonia concentrations crashed while nitrate increased sharply. This was likely due to increased conversion of ammonia to nitrate (nitrification) which is temperature- and DO-dependent. The high nitrate is desirable as it tends to encourage more desirable phytoplankton community structure (Greens over Bluegreens - see Phytoplankton) and enhances denitrification at the sediment-water interface. Improving the behavior of the nitrogen cycle of Mohegan Lake via an improved aeration approach offers substantial potential.

Alkalinity

* Lowest (background) alkalinity was 75 mg/liter, indicative of a moderately well buffered lake. Alkalinity increased with depth (despite aeration-circulation). Alkalinity suggests that the lake's anaerobic respiration system may be dominated by sulfur (sulfide generating lakes). If so, iron-phosphorus binding capacity may have become severely limited, causing the sediment-water interactions and depth gradients identified previously. Further analysis, especially focusing on iron availability is recommended. Mohegan Lake is in no jeopardy of acid rain impacts.

Conductivity

* Conductivity ranges from ca. 285-451 and tends to increase with depth.

Turbidity

* Mohegan Lake exhibited turbid waters, with modest increases with depth.

Total Iron - Total Manganese

* Iron concentrations were lower than expected; manganese was higher than expected. Indeed, manganese concentrations typically exceeded iron concentrations. This strongly suggests an "iron deficiency" and low sediment-phosphorus binding capacity. This could be corrected economically. Further testing is recommended.

pH

* The pH ranged from 6.5 to 7.8 (higher at the surface due to algal productivity -- lower at the bottom due to respiratory carbonic acid). The pH variability, despite aeration-circulation, indicates the "continuous culture behavior" and need for an improved aeration approach.

DIC

* Total dissolved inorganic carbon (carbon dioxide) was high and increased sharply with depth. Carbon dioxide is the only common product of all community respiration processes (aerobic and anaerobic respiration, fermentation). High DIC indicates high respiratory demand. High DIC favors green algae over bluegreen Cyanobacteria.

Mohegan Lake Chemistry Data

Total Phosphorus (ug/L)

Station 1	2-Jun	30-Jun	9-Aug	22-Sep
1 m	39	37	30	
2 m	50	~	27	
3 m	39	79	24	
4 m	84	226	55	
4.5 m	300	~	310	

Station 2	2-Jun	9-Aug	22-Sep
1 m	70	42	
2 m	67	27	
3 m	56	31	
3.5 m	90	~	

Ammonia Nitrogen as N (ug/L)

Station 1	2-Jun	30-Jun	9-Aug	22-Sep
1 m	85	20	< 10	
2 m	43	~	< 10	
3 m	85	200	69	
4 m	554	1250	< 10	
4.5 m	1030	~	106	

Station 2	2-Jun	9-Aug	22-Sep
1 m	236	< 10	
2 m	193	< 10	
3 m	109	< 10	
3.5 m	15	~	

Nitrite-Nitrate as N (ug/L)

Station 1	2-Jun	30-Jun	9-Aug	22-Sep
1 m	< 20	< 10	235	
2 m	120	~	190	
3 m	109	< 10	28	
4 m	< 20	< 10	1590	
4.5 m	388	~	1830	

Station 2	2-Jun	9-Aug	22-Sep
1 m	81	322	
2 m	< 20	100	
3 m	< 20	< 20	
3.5 m	517	~	

Alkalinity (mg/L)

Station 1	2-Jun	9-Aug	22-Sep
1 m	77	79	
2 m	79	75	
3 m	71	79	
4 m	81	111	
4.5 m	91	136	

Station 2	2-Jun	9-Aug	22-Sep
1 m	77	75	
2 m	75	79	
3 m	69	77	
3.5 m	72	~	

Specific Conductance (umhos/cm)

Station 1	2-Jun	30-Jun	9-Aug	22-Sep
1 m	345	285	358	
2 m	361	~	370	
3 m	365	300	371	
4 m	364	330	370	
4.5 m	373	~	451	

Station 2	2-Jun	9-Aug	22-Sep
1 m	356	367	
2 m	361	370	
3 m	363	409	
3.5 m	366	~	

Turbidity (NTU)

Station 1	*2-Jun*	*30-Jun*	*9-Aug*	*22-Sep*
1 m	2.8	2.1	2.2	
2 m	3.6	~	1.9	
3 m	3.7	3.2	2.7	
4 m	3.3	3.8	6.5	
4.5 m	9.2	~	11	

Station 2	*2-Jun*	*9-Aug*	*22-Sep*
1 m	3.4	2.5	
2 m	3.2	2	
3 m	3.2	2.3	
3.5 m	3.8	~	

Total Iron (mg/L)

Station 1	*2-Jun*	*30-Jun*	*9-Aug*	*22-Sep*
1 m	0.08	0.1	0.06	
2 m	0.09	~	0.1	
3 m	0.13	0.1	0.09	
4 m	0.12	0.35	0.1	
4.5 m	0.34 (0.44)*	~	0.4 (<0.01)*	

Station 2	*2-Jun*	*9-Aug*	*22-Sep*
1 m	0.1	0.15	
2 m	0.11	0.08	
3 m	0.1 (0.13)*	0.1 (<0.01)*	
3.5 m	0.1 (0.14)*	~	

* *Note: numbers in parentheses are for Ferrous Iron*

Total Manganese (mg/L)

Station 1	*2-Jun*	*30-Jun*	*9-Aug*	*22-Sep*
1 m	0.08	0.08	0.12	
2 m	0.11	~	0.15	
3 m	0.11	0.38	0.22	
4 m	0.3	1.5	1	
4.5 m	0.83 (1.5)*	~	1.7 (0.17)*	

Station 2	*2-Jun*	*9-Aug*	*22-Sep*
1 m	0.11	0.17	
2 m	0.13	0.13	
3 m	0.09 (0.23)*	0.12 (.07)*	
3.5 m	0.016 (0.22)	~	

reduced [illegible]

pH

Station 1	*2-Jun*	*30-Jun*	*9-Aug*	*22-Sep*
1 m	7.3	7.8	7.2	
2 m	7.3	~	7.2	
3 m	7.5	7.2	7.2	
4 m	7.1	6.8	6.7	
4.5 m	6.8	~	6.5	

Station 2	*2-Jun*	*9-Aug*	*22-Sep*
1 m	7.3	7.5	
2 m	7.5	7.5	
3 m	7.6	7.5	
3.5 m	7.3	~	

Note : ~ Indicates that no sample was taken

		Mohegan Lake Chemistry Data						1993	
		Dissolved Inorganic Carbon				**(mg C/L)**			
Station 1									
1 m	*2-Jun*	*30-Jun*	*9-Aug*	*22-Sep*		Station 2	*2-Jun*	*9-Aug*	*22-Sep*
2 m	14.3	15	15.4	14.8		1 m		13.8	20.2
3 m	14.7	~	~	~		2 m		13.6	~
4 m	15.1	15.8	15.6	19.3		3 m		13.3	20.9
4.5 m	17.2	22.8	26.8	~		3.5 m		~	~
	20	~	34.1	19.9					

* Secchi disk transparency was 1.6 meters in May and declined to less than 0.8m during the summer. Assuming a 2x Secchi parameter estimate for the compensation depth, waters deeper than 2.4 meters were tropholytic all of the time. Anoxia, sediment-water exchanges, and biological structure are related to the poor transparency and shallow compensation depth.

Phytoplankton

* Cyanobacteria (bluegreen algae) were dominant, comprising 34-71% of the phytoplankton community.

* Dominance by *Anabaena sp.* occurred early, and shifted to *Oscillatoria sp.* later during the summer. This shift is encouraging as it suggests a positive effect of aeration.

* Although Cyanobacteria were dominant most of the time, it was very encouraging to see a large proportion of the Phytoplankton Community consisting of Green and Diatom genera. This is likely due to internal nitrogen dynamics and high DIC availability (effects of artificial circulation). Biomanipulation is likely to become useful *following habitat improvement by a modified aeration approach.* The **composition** of the Phytoplankton Community is encouraging despite the **abundance** of algae.

Zooplankton

* The total abundance of zooplankton animals was very healthy, while composition was not. Small-bodied cladocera and cyclopoid copepods made up most of the community. These are not particularly good grazers (indeed, they are better at bactivory). The "healthy abundance" and poor species composition suggest a poor trophic level balance and/or lack of available habitat for desirable species. Habitat improvement followed by trophic level management (a.k.a. biomanipulation) offers substantial potential for improving lake quality.

MOHEGAN LAKE PHYTOPLANKTON CELL COUNTS

4.5 m STRAW SAMPLE

CELLS / ml

	2-Jun	30-Jun	9-Aug	22-Sep
BLUE GREENS				
Anabaena	7,697	2,405	0	4,179
Oscillatoria	0	1,638	1,506	0
GREENS				
Ankistrodesmus	0	67	112	45
Chlorella	0	0	0	112
Closterium	134	0	156	89
Cosmarium	0	0	22	0
Pediastrum	0	0	0	22
Scenedesmus	446	803	1,539	223
Staurastrum	45	0	0	0
DIATOMS				
Cyclotella	156	0	0	0
Cymbella	0	0	0	22
Fragilaria	312	223	379	982
Melosira	0	0	0	357
Stauroneis	0	0	22	45
Stephanodiscus	223	0	0	245
Synedra	0	45	0	335
CHRYSOPHYTES				
DINOFLAGELLATES				
Ceratium	0	22	0	67
CRYPTOPHYTES				
EUGLEONPHYTES				
Phacus	558	0	0	89
NANNOPLANKTON	2,499	469	714	982

MOHEGAN LAKE

PHYTOPLANKTON CELL COUNTS

TOTALS

	2-Jun	16-May	15-Jun	16-Jul
TOTAL BLUE-GREENS	7,697	4,044	1,506	4,179
TOTAL GREENS	625	870	1,830	491
TOTAL DIATOMS	692	268	402	1,986
TOTAL CHRYSOPHYTES	0	0	0	0
TOTAL DINOFLAGELLATES	0	22	0	67
TOTAL CRYPTOPHYTES	0	0	0	0
TOTAL EUGLENOPHYTES	558	0	0	89
TOTAL	9,571	5,204	3,737	6,812
NANNOPLANKTON	2,499	469	714	982
SAMPLE TOTAL	12,070	5,673	4,451	7,794

PERCENT COMPOSITION OF PHYTOPLANKTON

	2-Jun	30-Jun	9-Aug	22-Sep
TOTAL BLUE-GREENS	64	71	34	54
TOTAL GREENS	5	15	41	6
TOTAL DIATOMS	6	5	9	25
TOTAL CHRYSOPHYTES	0	0	0	0
TOTAL DINOFLAGELLATES	0	0	0	1
TOTAL CRYPTOPHYTES	0	0	0	0
TOTAL EUGLENOPHYTES	5	0	0	1
NANNOPLANKTON	21	8	16	13
SAMPLE TOTAL	100	100	100	100

MOHEGAN LAKE 1993 ZOOPLANK

Station 1

	2-Jun	30-Jun	9-Aug	22-Sep
LENGTH OF VERTICAL TOW (m) :	4	4	4	4
FRACTION COUNTED (ml/ml) :	0.03	0.04	0.03	0.03

NUMBERS COUNTED

	2-Jun	30-Jun	9-Aug	22-Sep
ROTIFERS	429	0	2	46
COPEOPOD NAUPLII	40	0	6	5
SMALL CLADOCERA (< 0.8 mm)	1419	591	119	114
LARGE CLADOCERA (> 0.8 mm)	0	0	0	8
SMALL CYCLOPOIDS (< 1.0 mm)	44	21	39	14
LARGE CYCLOPOIDS (> 1.0 mm)	11	1	0	3
SMALL CALANOIDS (< 1.0 mm)	0	0	0	0
LARGE CALANOIDS (> 1.0 mm)	0	0	0	0
TOTAL	1943	613	166	190
TOTAL CRUSTACEA (no Rotifers)	1514	613	164	144

ANIMALS / L

	2-Jun	30-Jun	9-Aug	22-Sep
ROTIFERS	357.6	0.0	1.9	34.9
COPEOPOD NAUPLII	33.3	0.0	5.6	3.8
SMALL CLADOCERA (< 0.8 mm)	1183.0	388.2	111.2	86.4
LARGE CLADOCERA (> 0.8 mm)	0.0	0.0	0.0	6.1
SMALL CYCLOPOIDS (< 1.0 mm)	36.7	13.8	36.5	10.6
LARGE CYCLOPOIDS (> 1.0 mm)	9.2	0.7	0.0	2.3
SMALL CALANOIDS (< 1.0 mm)	0.0	0.0	0.0	0.0
LARGE CALANOIDS (> 1.0 mm)	0.0	0.0	0.0	0.0
TOTAL	1619.8	402.6	155.2	144.0
TOTAL CRUSTACEA (no Rotifers)	1262.2	402.6	153.3	109.1

PERCENT COMPOSITION

ROTIFERS	22	0	1	24
COPEOPOD NAUPLII	2	0	4	3
SMALL CLADOCERA (< 0.8 mm)	73	96	72	60
LARGE CLADOCERA (> 0.8 mm)	0	0	0	4
SMALL CYCLOPOIDS (< 1.0 mm)	2	3	23	7
LARGE CYCLOPOIDS (> 1.0 mm)	1	0	0	2
SMALL CALANOIDS (< 1.0 mm)	0	0	0	0
LARGE CALANOIDS (> 1.0 mm)	0	0	0	0
TOTAL	100	100	100	100

TOTAL CRUSTACEA (no Rotif
PERCENT COMPOSITION

COPEOPOD NAUPLII	3	0	4	3
SMALL CLADOCERA (< 0.8 mm)	94	96	73	79
LARGE CLADOCERA (> 0.8 mm)	0	0	0	6
SMALL CYCLOPOIDS (< 1.0 mm)	3	3	24	10
LARGE CYCLOPOIDS (> 1.0 mm)	1	0	0	2
SMALL CALANOIDS (< 1.0 mm)	0	0	0	0
LARGE CALANOIDS (> 1.0 mm)	0	0	0	0
TOTAL	100	100	100	100

Watershed

Our study focus in 1993 was on the internal structure and function of the lake, because we wanted to characterize the limnological features and management potential of the waterbody. Clearly, any future efforts to manage Mohegan Lake should also include the largest component of the lake ecosystem - it's watershed (the "paralimnion").

While in-lake techniques offer the greatest potential for improving lake quality in the immediate future, any in-lake efforts will ultimately fail if the watershed is not managed properly. During this study, the character of the watershed was also observed. Much of the watershed is developed, both residential and commercial, with resultant substantial runoff quality impacts. Upon first review, improving the quality of water the lake receives seems to be an overwhelming, cost-prohibitive, and perhaps impossible task. Not true! The developed nature of the watershed simply means some watershed management techniques will be more cost-effective than others. Indeed, much of the existing infrastructure (e.g. drainage conveyance structures) with relatively inexpensive modification may actually be advantageous. From a cursory review, it appears that Stormwater Management (especially first-flush approaches) offer the greatest potential improvement for watershed management. Further study which focuses on specific watershed areas and management techniques is recommended.

ECOSYSTEM CONSULTING
SERVICE, INC.

Ecosystem Consulting Service, Inc.
430 Talcott Hill Road
Coventry, CT 06238
(203) 742-0744

December 8, 1993

Mohegan Lake Improvement District
c/o James V. O'Gara, Jr.
RR 1 Box 355
Mohegan Lake, New York 10547

PROPOSAL

The following proposal outlines anticipated work and cost estimates for restoration activities at Mohegan Lake.

Line Items - Activities

- Microcosm Incubation

  These experiments are designed to provide diagnostic information about sediment-water interactions which contribute to algae blooms, and to test various treatment alternatives for remediation (e.g. alum surrogates).

- Ice Sampling

  Field sampling is proposed to determine winter events which lead to eutrophication problems during the subsequent growing season.

- Aeration Evaluation and Design

  This work is to identify what modifications to the existing system will result in more effective treatment.

- Monitoring; RSP

  This is a continuation of the diagnostic sampling program, including a Resident Sampling Program to control costs.

- Watershed Assessment

  This study area is to provide an overall evaluation of watershed impacts and to identify specific locations where improvement potential is greatest.

- Aeration Modification

  This is an estimate of costs to upgrade the existing aeration system; it assumes use of some existing facilities.

- Lake Treatment

  This is a "planning estimate" of costs for an initial lake treatment to be based on Microcosm results.

RWK/lr

Mohegan Lake Restoration Schedule and Cost Estimates

Project Steps & Timeframe	Dec-93	Jan-94	Feb-94	Mar-94	Apr-94	May-94	Jun-94	Jul-94	Aug-94	Sep-94	Oct-94	Nov-94	Dec-94	Jan-95	TOTALS	
Microcosm Incubation																
material expense	125	125	125	125											500	$500.00
man days	2	2	2	4											10	$6,000.00
expected billing															0	
Ice Sampling															0	
material expense		250	250												500	$500.00
man days		2.5	2.5												5	$3,000.00
expected billing															0	
Aeration Eval/Design															0	
material expense	100	200													300	$300.00
man days	1	3.5													4.5	$2,700.00
expected billing															0	
Aeration Modification															0	
material expense			5500	5500	5500										16500	$16,500.00
man days			10	15	20										45	$27,000.00
expected billing															0	
Monitoring; RSP															0	
material expense					150	150	150	150	150	150	150	150			1200	$1,200.00
man days					1	1	1	1	1	1	1	1			8	$4,800.00
expected billing															0	
Watershed Assessment															0	
material expense					50	50	50	50	50	50					300	$300.00
man days					1	1	1	1	3	1					8	$4,800.00
expected billing															0	
Lake Treatment															0	
material expense														3000	3000	$3,000.00
man days														5	5	$3,000.00
expected billing																

TOTAL= $73,600.00