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DIAGNOSTIC AND MANAGEMENT ASSESSMENT OF LAKE POCOTOPAUG

DECEMBER 1993

Prepared for:

Town of East Hampton,
Connecticut

Diagnostic and Management Assessment of Lake Pocotopaug

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Diagnostic and Management Assessment of Lake Pocotopaug

1.0 Project Overview

Lake Pocotopaug is a freshwater lake with a surface area of 511 acres in the Town of East Hampton, Connecticut (Figure 1). The lake is composed of two major basins with maximum depths of 11 meters (36 feet) in the western basin (Oakwood) and 9 meters (30 feet) in the eastern basin (Markham). Lake Pocotopaug is a major recreational resource for East Hampton and is highly valued for the swimming, boating, fishing, and aesthetic enjoyment it provides to Town residents.

In an effort to protect Lake Pocotopaug from septic system impacts a sewer system serving near-shore dwellings was installed in the early 1980's. Local awareness and concern for the health of Lake Pocotopaug was triggered again in 1987 when fifteen acres of land in the immediate watershed area were stripped of vegetation for the Baker Hill subdivision. Runoff from this denuded site carried high concentrations of suspended solids and nutrients into the lake via an intermittent stream. In response to this event the East Hampton Board of Selectmen established the Lake Area Task Force to identify problems threatening the health of the lake ecosystem and to formulate recommendations for its protection. The Task Force submitted a report the following year that provided detailed and comprehensive recommendations for resolving recreational issues, preserving lake area aesthetics, and protecting Lake Pocotopaug through management of the watershed.

A severe algae bloom in 1990 provided the impetus for organizing a study of Lake Pocotopaug by interested townspeople. This Lake Study Group generated a well-documented database that includes monthly field measurements and water analysis during the growing seasons of 1991 and 1992. Severe algae blooms occurred in both these years. FM-East was contracted by the Town of East Hampton to conduct an additional season of measurement and sampling of Lake Pocotopaug and to design a strategy for suppressing the algae blooms. The Lake Study Group database for 1991-92 is of professional quality and has been incorporated into our analysis on an equal

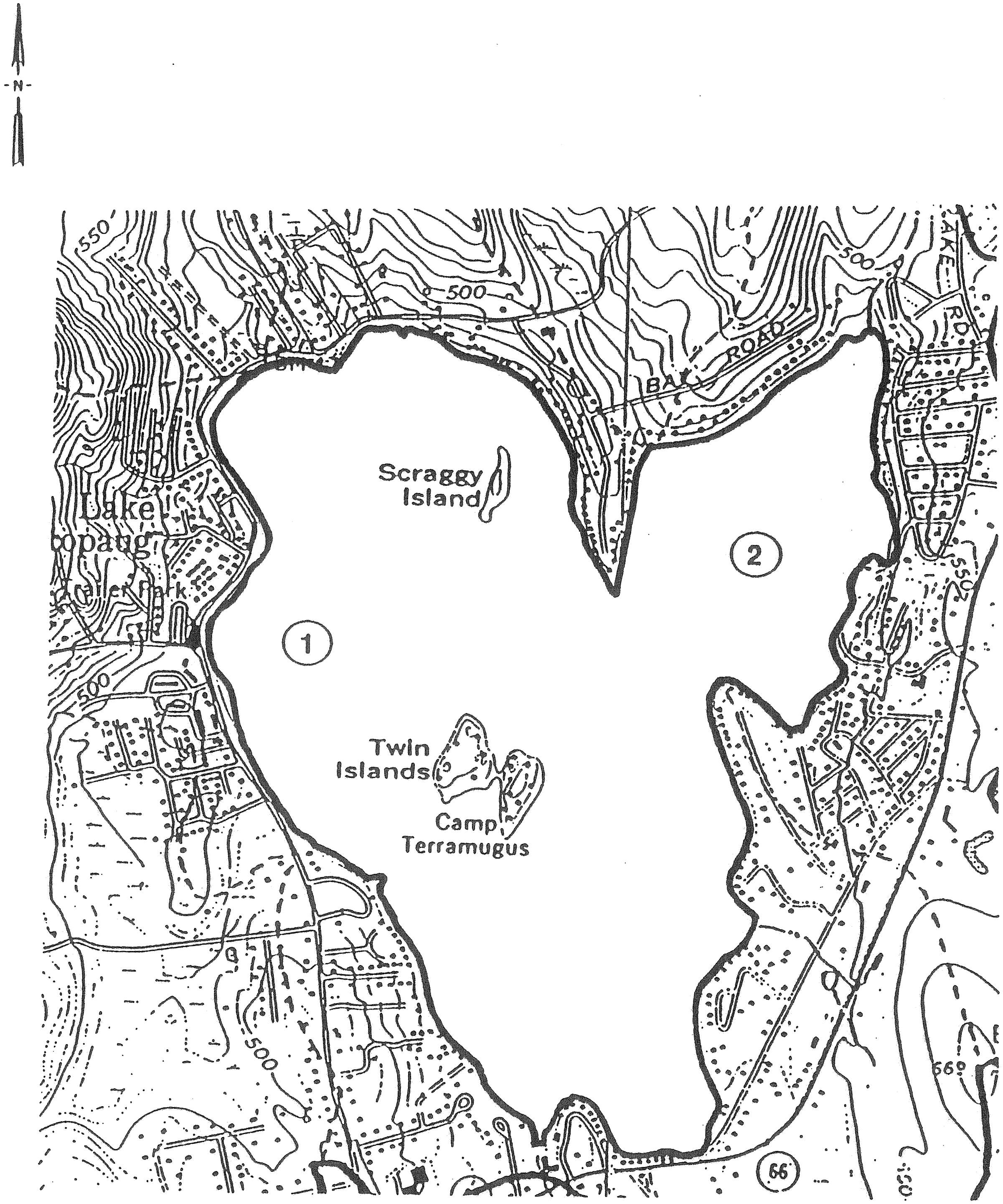


FIGURE 1: MAP OF LAKE POCOTOPAUG AND SAMPLING LOCATIONS

Fugro McClelland

footing with data generated in 1993 by FM-East. A synopsis of recent lake events and observations is given in Table 1.

Table 1
Chronology of Recent Lake Events

Year	Event
1992	• severe algae bloom mid-July through mid-September (minimum Secchi at Station 1 = 0.45 m on 15-August) • *Anabaena* identified as dominant organism on 12-July and 22-August; identified as component of plankton on 9-June by CT DHS Lab • Lake Study Group conducts lake and inlet sampling program
1991	• severe algae bloom September through October (minimum Secchi = 0.6 m on 21- September) • Lake Study Group conducts lake and inlet sampling program
1990	• severe algae bloom in late summer and fall (Secchi <1 m on 28-September documented by Marine Ecological Services) • *Anabaena* identified on dominant organism by CT DHS Lab on 13-September and by CT DEP on 19-September
1989	• pollution from Baker Hill subdivision documented by Environmental Consultants of Marlborough, Inc. on 6-May
1988	• CT DEP issues pollution abatement order on 29-June • pollution from Baker Hill subdivision documented by Environmental Consultants of Marlborough, Inc. on 25-May, 24-July, and 20-November • report of the Lake Area Task Force submitted 12-April • slick on lake resembling oil contamination identified as diatoms on 25-March by Environmental Science Corporation
1987	• pollution from Baker Hill subdivision documented by Environmental Consultants of Marlborough, Inc. on 28-October • Lake Area Task Force established by East Hampton Board of Selectmen in July • fifteen acres of land in the immediate watershed area stripped of vegetation in March for planned Baker Hill subdivision

2.0 Water Quality Characterization

2.1 Results of 1993 Sampling Program

A total of seven sampling efforts were conducted beginning in December, 1992 and then monthly from April through September of 1993. Field measurements and samples of water and plankton were taken at the Oakwood Basin (Station 1) and the Markham Basin (Station 2; see Figure 1).

Temperature and dissolved oxygen profiles of the water column were measured using a Yellow Springs Instruments Model 57 meter. Conductivity was measured with a Yellow Springs Instruments Model 33 meter. Water samples were collected from the epilimnion, metalimnion, and hypolimnion during periods of stratification (May through September) and near the top and bottom of the water column during periods of mixing. Phytoplankton and chlorophyll-A samples were depth-integrated to the limit of the photic zone. Qualitative samples of plankton were taken at Station 1 using a 35 micron mesh net manipulated vertically through the water column. Water transparency was measured using a Secchi disk. Water samples were delivered to Laboratory Resources, Inc. of Brooklyn, Connecticut on the day of collection.

Temperature and Dissolved Oxygen

Typical of most deep, temperate lakes, Lake Pocotopaug becomes thermally stratified in summer with surface waters absorbing solar energy and becoming warmer than underlying waters. The development of thermal stratification in spring and summer and the loss of heat leading to fall turnover are depicted in Figure 2. This depth/time diagram integrates many data points taken at different depths and times into a visual pattern showing seasonal dynamics within the lake.

In April the water column was isothermal (one temperature from top to bottom). The progressive formation of thermal stratification began in May. Thermal stratification was most pronounced in late July and early August. The lake began to lose heat in late August and wind energy caused a progressive lowering of the thermocline throughout

September. Eventually, wind energy acting on the surface mixed the entire water column, resulting in fall turnover. The water column was again isothermal by October 30th (measurements on this date from Lake Study Group).

The thermal stratification that develops each summer within Lake Pocotopaug causes the water column to be separated into three horizontal strata that are stable due to thermally induced differences in density. The warmer, less dense surface stratum is known as the epilimnion and the bottom stratum composed of cold, denser water is known as the hypolimnion. The zone of transition between those two strata is known as the metalimnion and the thermal gradient in this stratum is generally 4°C per meter of depth. The hypolimnion remains undisturbed during summer stratification and is isolated from atmospheric influences by the epilimnion. In Lake Pocotopaug the supply of dissolved oxygen in the hypolimnion is exhausted by decompositional processes and cannot be replenished until the entire water column is mixed at fall turnover.

The progressive depletion of dissolved oxygen in the hypolimnion of Lake Pocotopaug is depicted in Figure 3. Coincident with onset of thermal stratification in May, oxygen is lost and by the end of the month the bottom two meters of the water column have a dissolved oxygen concentration of less than one ppm. Oxygen is in demand by microbes decomposing organic material at the sediment-water interface and also by microbes decomposing organic particles that "rain" down from the overlying epilimnion. Demand for oxygen is so intense that by July the region of hypoxia (dissolved oxygen concentration less than one ppm) encompasses the bottom 4.5 meters of the water column and extends up into the metalimnion. Between the August and September sampling dates a strong wind event apparently "eroded" the metalimnion by mixing and reoxygenated the water column down to a depth of approximately 10 meters. The entire water column was replenished with oxygen by October 30th after fall turnover (measurements on this date from Lake Study Group).

Nutrients: Phosphorus and Nitrogen

Phosphorus and nitrogen are vital elements in the nutrition of phytoplankton (suspended algae). In most New England freshwater lakes, the supply of phosphorus

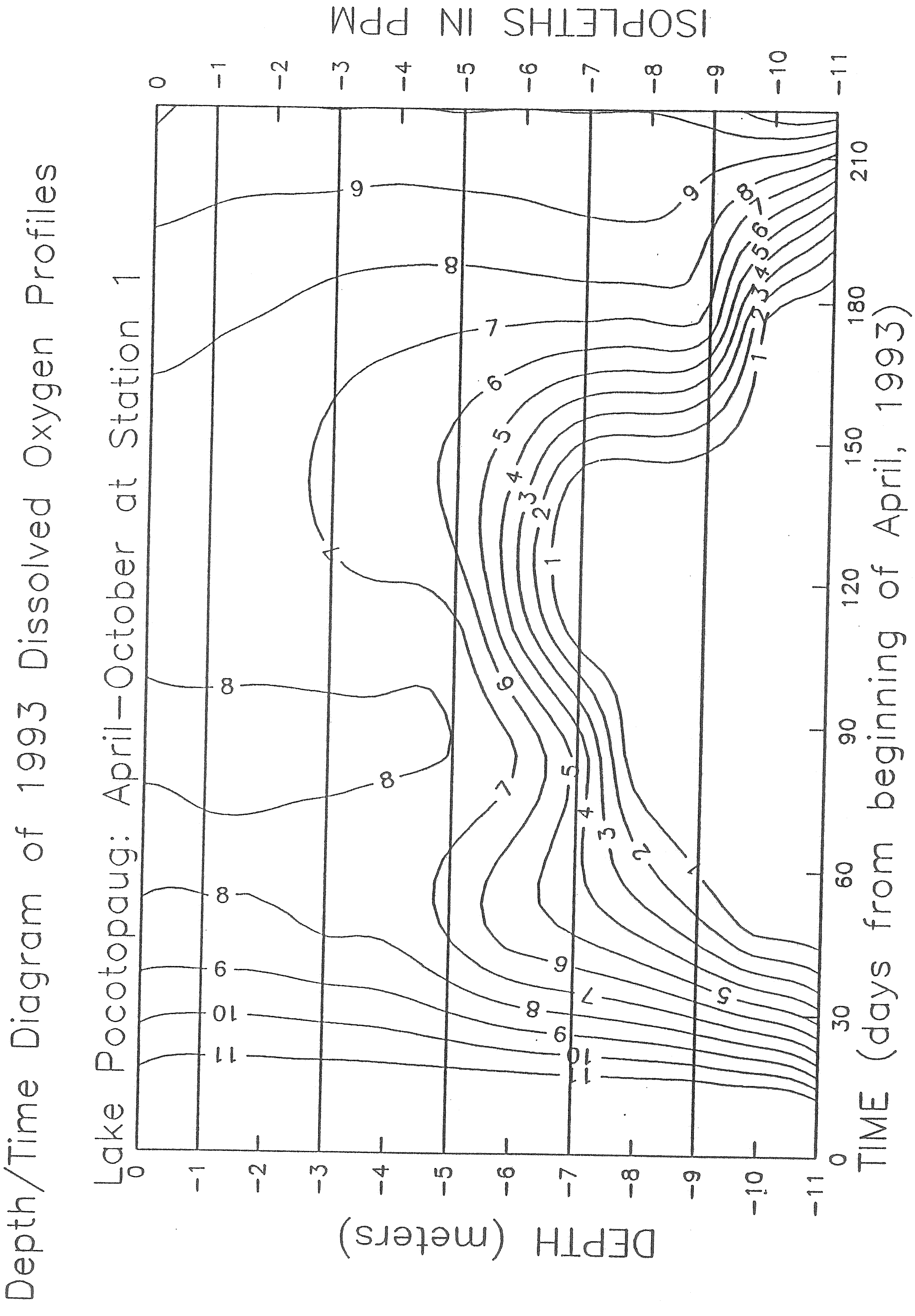

Depth/Time Diagram of 1993 Dissolved Oxygen Profiles
Lake Pocotopaug: April–October at Station 1
DEPTH (meters)
TIME (days from beginning of April, 1993)
ISOPLETHS IN PPM
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
-11
0
30
60
90
120
150
180
210

Figure 3

in the water is exhausted by biological uptake earlier than other nutrients, and thus it is phosphorus that limits the growth of algae. Concentrations of phosphorus measured throughout the water column in 1993 generally are low (Table 2). The median values fall mostly into the mesotrophic category of Frink and Norvell (1984). Unfortunately, the accuracy of the phosphorus data for 1993 is questionable for two reasons: (1) the increase in hypolimnetic concentrations expected during summer anoxic never appeared and (2) the values reported for Station 1 on 22-September are improbably high. The laboratory results demonstrate an increase in hypolimnetic concentrations of ammonia-nitrogen during summer anoxia and the lack of a parallel increase in phosphorus concentrations is highly unlikely. For this reason, the phosphorus measurements generated by the Lake Study Group in 1991-92 have been incorporated into the interpretation of lake dynamics in place of the 1993 phosphorus data (see Section 2.2). The role of nitrogen or phosphorus as the limiting nutrient in 1993 cannot be determined by calculating total nitrogen to total phosphorus ratios due to the anomalous phosphorus data.

Concentrations of total nitrogen (ammonia, nitrate, and organic forms) measured in surface waters in 1993 are low to moderate (Table 2). Median values for epilimnetic total nitrogen fall into the mesotrophic category of Frink and Norvell (1984). However, inorganic forms of nitrogen (ammonia and nitrate) are generally scarce in surface waters with concentrations frequently below the detection limit of 20 ppb. An increase in hypolimnetic concentrations of ammonia was observed during the period of anoxia (Figure 4). This pattern of increase during summer stratification is the result of release of ammonia from bottom sediments and is typical of lakes where anoxic conditions occur in the hypolimnion.

<u>Non-Nutrient Water Quality Parameters</u>

The waters of Lake Pocotopaug are "soft" in that they contain low concentrations of dissolved substances. This is reflected in the low concentrations of chloride ions, low conductivity values, and low alkalinities (Table 2). Conductivity is a measure of the amount of ions dissolved in the water. Conductivity increased slightly in the hypolimnion during the period of anoxia due to release of dissolved ions from the sediments. Alkalinity is a measure of the acid-neutralizing capacity of water. The low alkalinities measured in Lake Pocotopaug indicate that the lake is minimally "buffered" from inputs of acid and corresponding decreases in pH. Despite the low

Table 2
Comparison of FM-East Data for 1993
and Lake Study Group Data for 1991 - 92

Parameter	Sample Location (A=surface) (C=bottom)	FM-East Data for 1993			Lake Study Group Data for 1991 and 1992		
		Median	Minimum	Maximum	Median	Minimum	Maximum
Total Phosphorus (ppb)	1A	20	10	1200*	18	13	36
	1C	20	10	570	38	21	643
	2A	10	10	50	18.5	14	33
	2C	20	20	60*	57	16	645
Ammonia-N (ppb)	1A	50	20	160	49.5	10	640
	1C	280	40	1600	497.5	14	3100
	2A	60	20	120	47	10	680
	2C	230	100	630	362.5	19	2230
Nitrate-N (ppb)	1A	20	20	280	20	10	148
	1C	20	20	270	20	10	159
	2A	20	20	280	20	10	151
	2C	20	20	270	20	10	170
Organic-N (ppb)	1A	420	300	510	77	18	420
	1C	340	240	560	147.5	37	1000
	2A	300	230	640	84.5	30	206
	2C	425	180	580	219	30	1690
Secchi Transparency (meters)	1	2.3	1.1	3.9	1.55	0.5	2.5
	2	2.6	1.0	4.0	1.75	0.45	2.75
Turbidity (NTUs)	1A	1.5	0.5	3.0	2.1	1.1	13.0
	2A	1.4	0.5	3.2	2.25	1.0	9.7
Hydrogen Ion Activity (pH units)	1A	7.3	6.7	7.8	—	—	—
	1C	7.1	6.6	7.4	—	—	—
	2A	7.3	6.6	7.8	—	—	—
	2C	7.1	6.5	7.2	—	—	—
Alkalinity (ppm)	1A	6	4	9	—	—	—
	1C	10	5	35	—	—	—
	2A	7	4	10	—	—	—
	2C	8	6	31	—	—	—
Conductivity (µmhos/cm)	1A	65	44	77	—	—	—
	1C	62	44	91	—	—	—
	2A	66	48	78	—	—	—
	2C	62	48	89	—	—	—

* questionable values reported by the laboratory, see text for discussion.

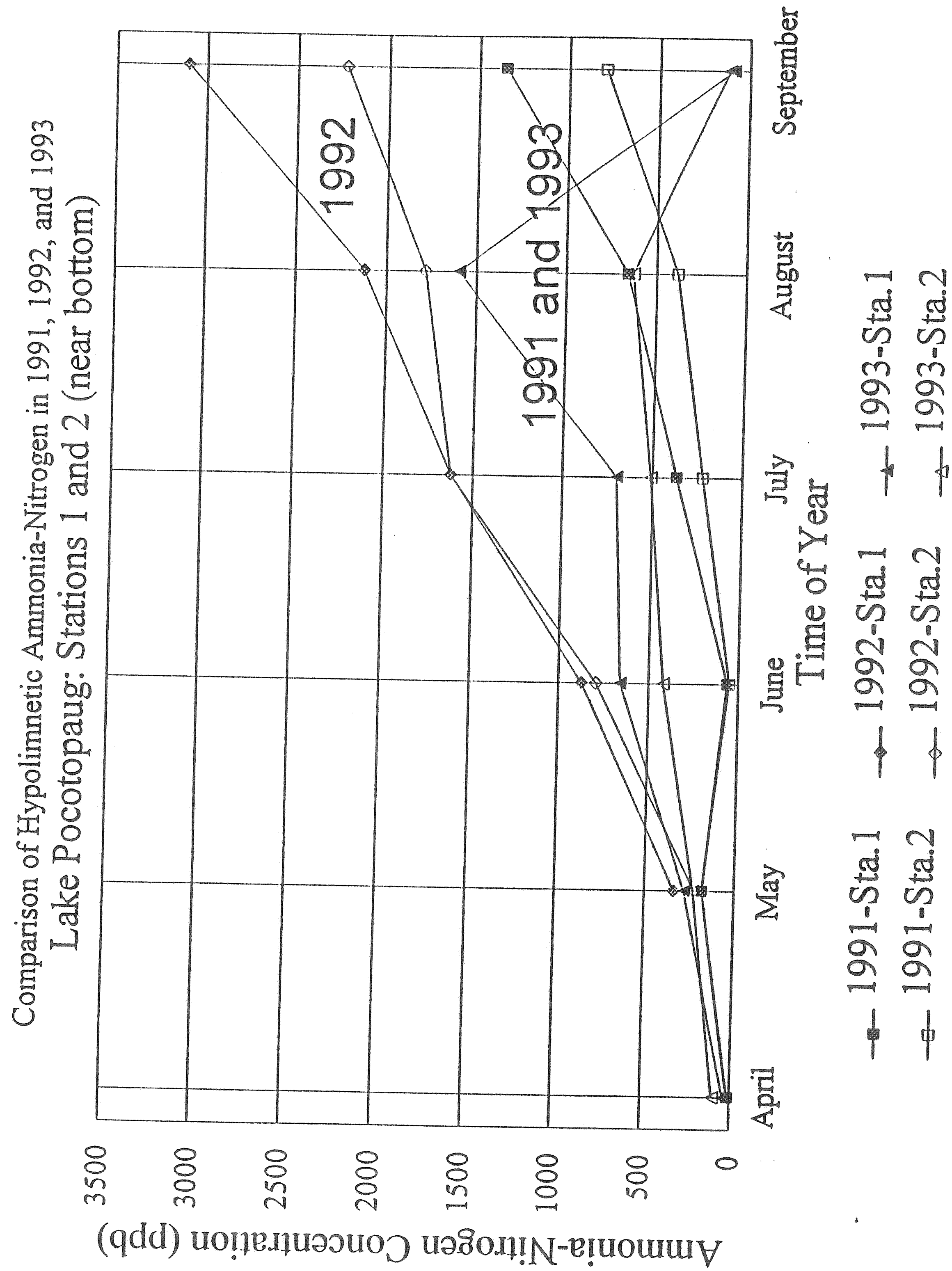

Comparison of Hypolimnetic Ammonia-Nitrogen in 1991, 1992, and 1993
Lake Pocotopaug: Stations 1 and 2 (near bottom)
Ammonia-Nitrogen Concentration (ppb)
3500
3000
2500
2000
1500
1000
500
0
April
May
June
July
August
September
Time of Year
1992
1991 and 1993
1991-Sta.1
1991-Sta.2
1992-Sta.1
1992-Sta.2
1993-Sta.1
1993-Sta.2

Figure 4

alkalinities, pH values in Lake Pocotopaug are generally alkaline (greater than neutral value of pH = 7) and no significant fluctuations were observed. Photosynthesis by phytoplankton is a process that removes carbon dioxide and caused slightly higher pH values in surface waters during the summer.

Turbidity is a measure of the intensity of light scattering by particles suspended in water. Values in Lake Pocotopaug are generally low, but a slight increase in hypolimnetic values is evident during summer stratification (Table 2). This is probably due to an accumulation of detrital particles, mostly the remains of dead plankton, that sink down from the epilimnion.

Secchi transparency values ranged from 1 to 4 meters with median values of 2.3 meters and 2.6 meters at Stations 1 and 2 respectively (Table 2). These values place lake Pocotopaug in the meso-eutrophic category of Frink and Norvell (1984). This same category is indicated by the maximum chlorophyll-A concentrations of 10.5 ppb and 15.0 ppb measured on 21-July at Stations 1 and 2 respectively. However, it is puzzling that these high chlorophyll-A concentrations occurred when Secchi transparencies were at or near their maximum values. Throughout June, July, and August, Secchi transparency remained greater than 3 meters Minimum transparency values of around 1 meter were not observed until the last sampling effort in September.

2.2 Comparison to Lake Study Group Data for 1991 - 92

The most obvious difference between the way Lake Pocotopaug functioned in 1993 as compared to 1991 and 1992 is the much greater water clarity enjoyed in 1993 and, especially, the lack of a mid-summer algae bloom as had occurred in the previous year. The degree of contrast between 1993 and 1991-92 is evident in the measurements of Secchi transparency (Figure 5) and turbidity. Median, minimum, and maximum values measured for Secchi transparency are all higher in 1993 compared to 1991-92 whereas the median, minimum, and maximum measurements of turbidity are all lower in 1993 (Table 2).

Algae blooms are probabilistic phenomena that are triggered when optimum conditions are attained simultaneously by a variety of factors including light,

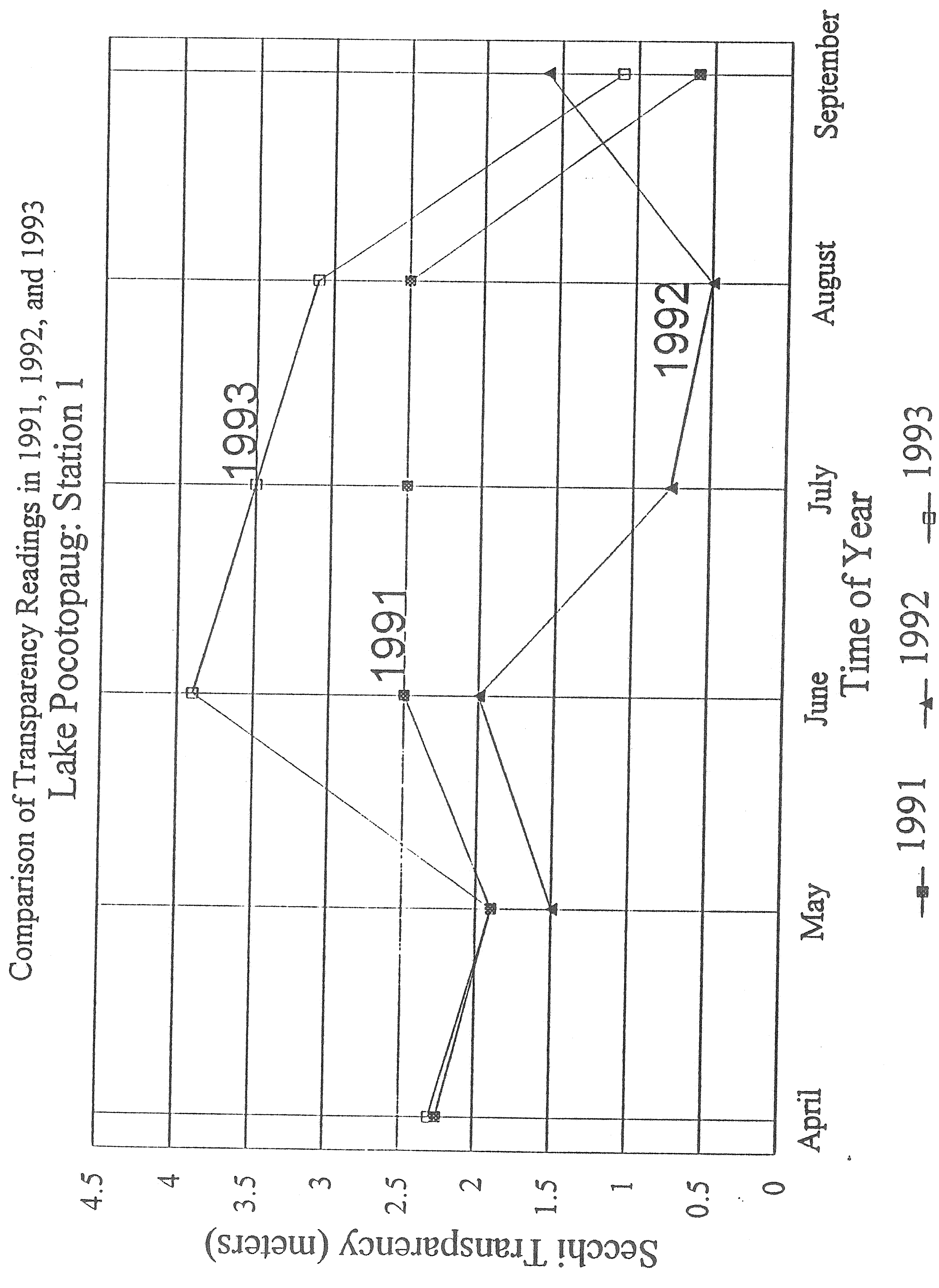

Comparison of Transparency Readings in 1991, 1992, and 1993
Lake Pocotopaug: Station 1
Secchi Transparency (meters)
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
April
May
June
July
August
September
Time of Year
1991
1992
1993
1991
1992
1993

Figure 5

temperature, availability of nutrients, and absence of pathogens and predators. For this reason, algae blooms are often impossible to predict and a precise explanation for a specific bloom event is difficult. However, the great contrast in transparency and algal growth between 1992 and 1993 may be attributable to differences in the stratification process mediated by springtime meteorological influences. Specifically, water column mixing by strong winds appears to have been minimal in the spring of 1992 in comparison to spring 1993.

The lack of mixing in spring of 1992 is evident in the depth/time diagrams for temperature and dissolved oxygen measurements (Figures 6 and 7 respectively). These diagrams show that thermal stratification and the development of anoxia in the hypolimnion were already underway at the beginning of May. In contrast, Figures 2 and 3 for 1993 show that the water column was still nearly isothermal at the beginning of May and that the development of anoxia did not begin until mid-month; only after mixing of the whole water column was prevented by the onset of stratification. The early onset of stratification in 1992 hastened the period of oxygen depletion in the hypolimnion such that, by late June, the region of anoxia extended up to within 6 meters of the surface.

As a result of the pronounced period of anoxia in 1992, large amounts of phosphorus and ammonia-nitrogen were released from the sediments and established a steep concentration gradient in the hypolimnion (Figures 8 and 9). The close proximity of these high nutrient concentrations to surface waters probably resulted in internal "loading" of nutrients to the epilimnion with algae responding and growing to bloom densities in July.

In 1993, anoxia developed more gradually in the hypolimnion and only briefly extended up beyond a depth of 7 meters (Figure 3, compare to Figure 7 for 1992). A close proximity between the region of anoxia and the epilimnion did not occur until August in 1993. The September bloom of *Anabaena* and *Staurastrum* probably grew in response to delivery of nutrients to surface waters as the metalimnion was eroded downward by wind mixing. The 1993 pattern of lake function that includes late onset of stratification (late April to early May), a region of anoxia generally limited to depths

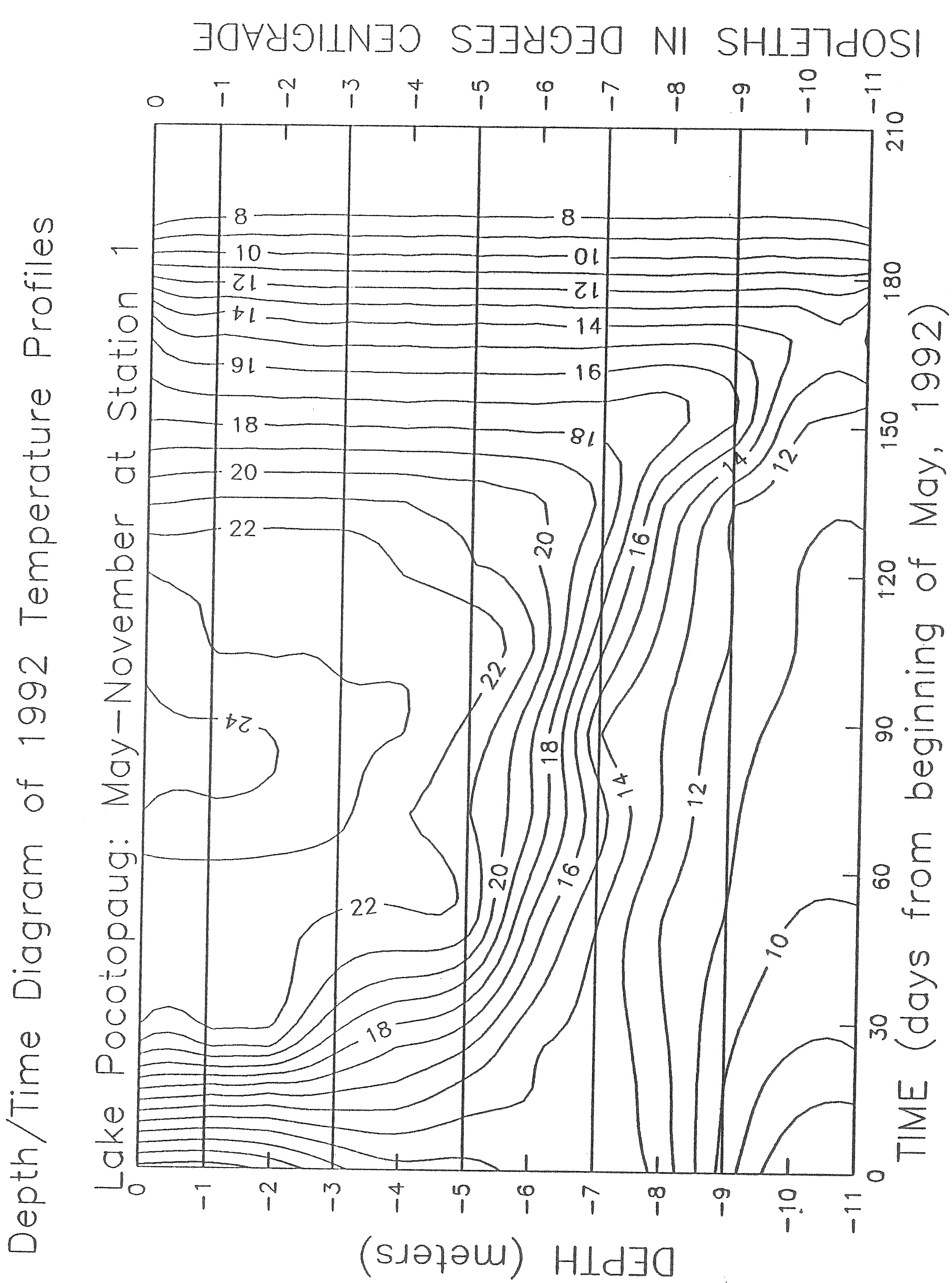

Depth/Time Diagram of 1992 Temperature Profiles
Lake Pocotopaug: May–November at Station 1
ISOPLETHS IN DEGREES CENTIGRADE
DEPTH (meters)
TIME (days from beginning of May, 1992)
0
−1
−2
−3
−4
−5
−6
−7
−8
−9
−10
−11
0
30
60
90
120
150
180
210
8
10
12
14
16
18
20
22
24

Figure 6

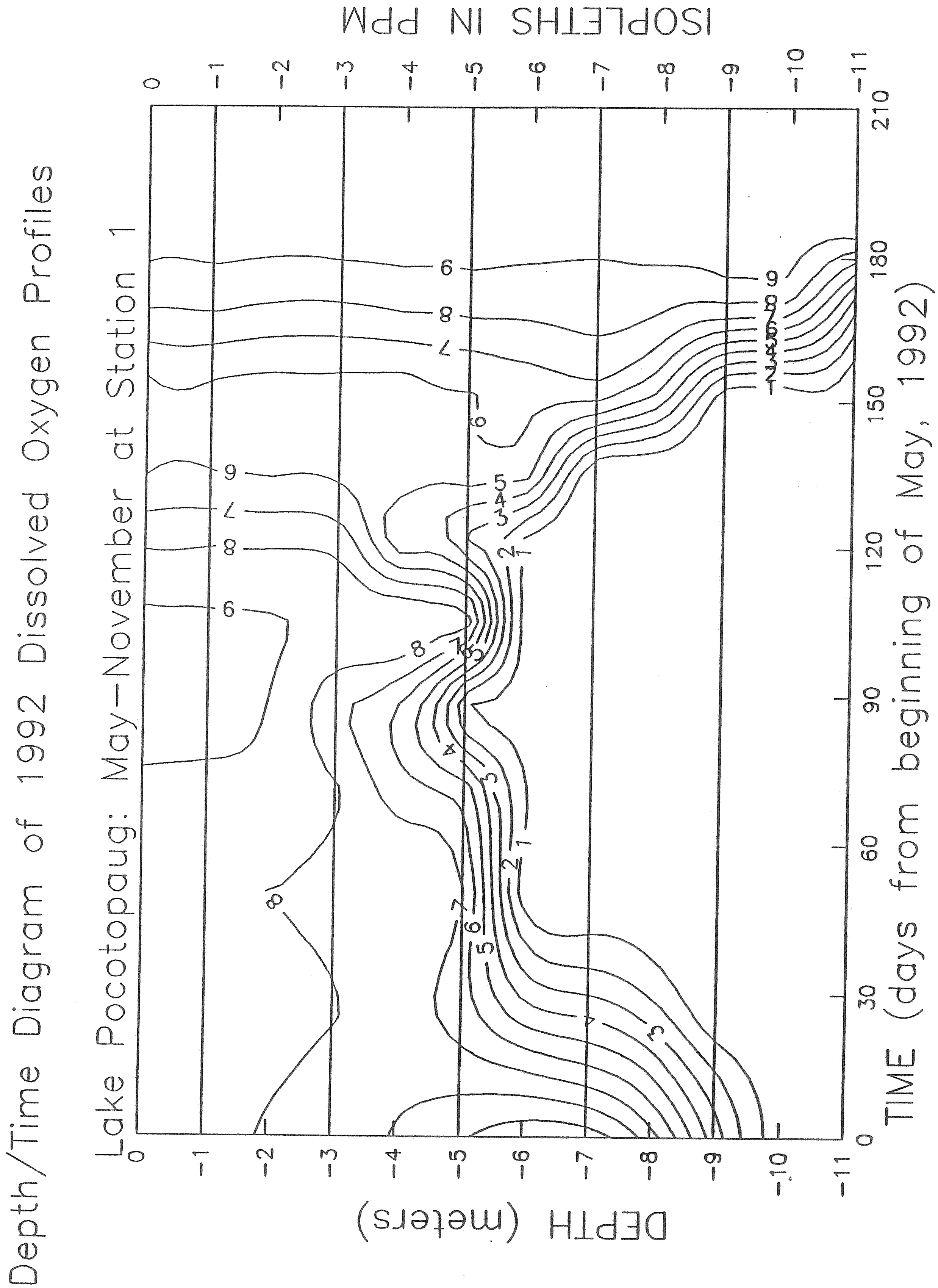
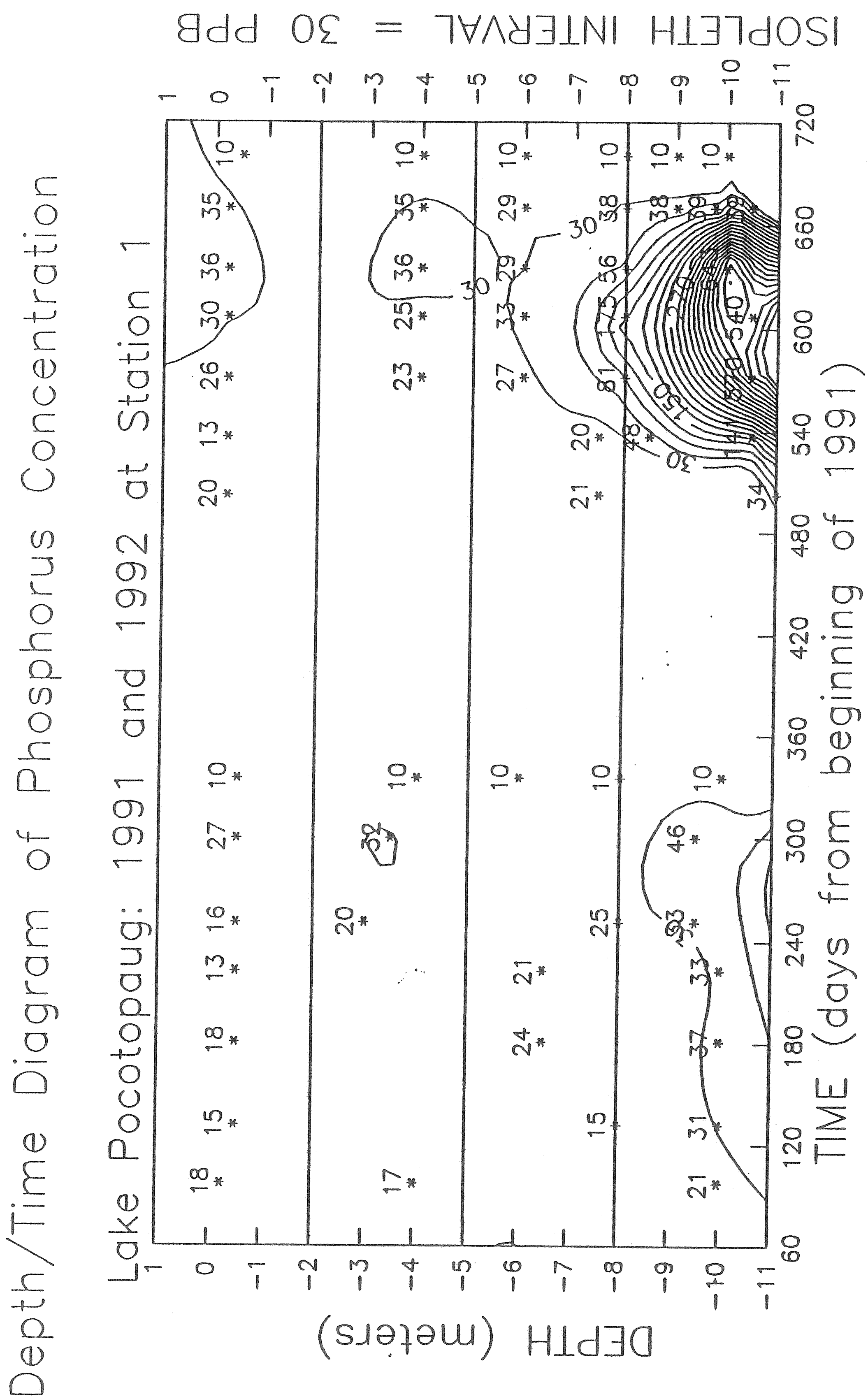

Depth/Time Diagram of 1992 Dissolved Oxygen Profiles
Lake Pocotopaug: May–November at Station 1
DEPTH (meters)
TIME (days from beginning of May, 1992)
ISOPLETHS IN PPM
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
-11
30
60
90
120
150
180
210

Figure 7



Depth/Time Diagram of Phosphorus Concentration
Lake Pocotopaug: 1991 and 1992 at Station 1
ISOPLETH INTERVAL = 30 PPB
DEPTH (meters)
TIME (days from beginning of 1991)

Figure 8

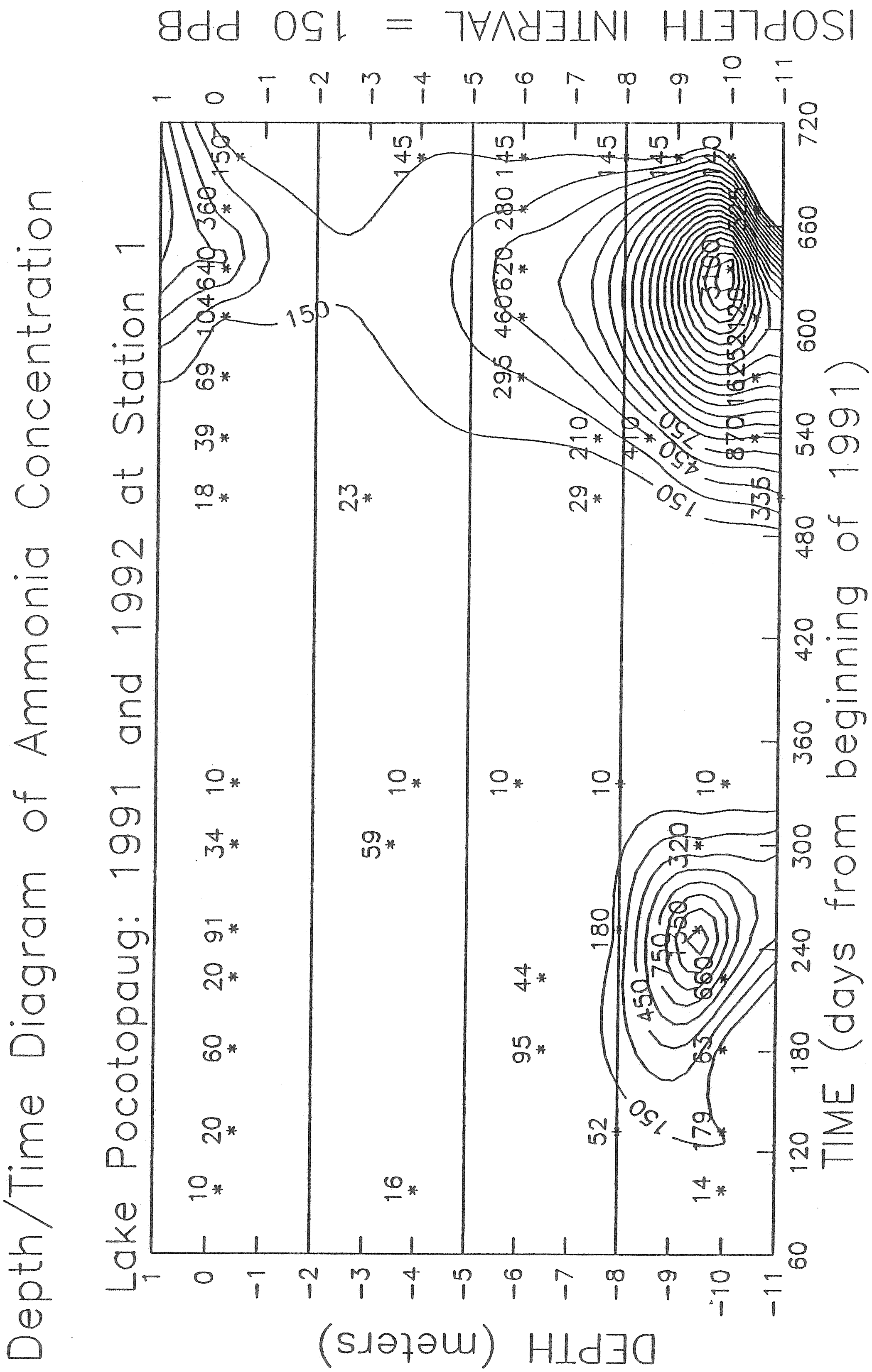

Depth/Time Diagram of Ammonia Concentration
Lake Pocotopaug: 1991 and 1992 at Station 1
ISOPLETH INTERVAL = 150 PPB
DEPTH (meters)
TIME (days from beginning of 1991)

Figure 9

greater than 7 meters, and a September bloom of algae is very similar to the 1991 pattern documented by the Lake Study Group.

As discussed in Section 2.1, the 1993 measurements of phosphorus reported by Laboratory Resources, Inc. are questionable, so comparison to data from 1991 to 1992 is ineffectual. It is probable that phosphorus release from the sediments in 1993 created a concentration gradient in the hypolimnion similar to that documented in 1991 by the Lake Study Group.

Comparison of ammonia-nitrogen measurements show median values at the surface to be similar between the two data sets, but that the high concentrations in the hypolimnion observed in 1992 were not attained in 1993 (Table 2). However, hypolimnetic concentrations in 1993 closely parallel the measurements documented for 1991 (Figure 4). Nitrate-nitrogen concentrations are consistently low from the top to the bottom of the water column in both the 1993 and 1991-92 data sets.

Measurements of organic-nitrogen are consistently higher in the 1993 data set, except for hypolimnetic maximums (Table 2). The epilimnetic concentrations reported for 1991-92 (median concentrations = 77 and 84.5 ppb at Stations 1 and 2 respectively) fall into the ultra-oligotrophic category of Wetzel (1983) and, therefore, are improbably low. The concentrations reported for 1993 are more realistic, falling into the range considered mesotrophic by Wetzel (1983). Additionally, historical data on Lake Pocotopaug from samples analyzed by the Connecticut Department of Health Services in 1990, 1991, and 1992 are in close agreement with the 1993 measurements of organic-nitrogen.

3.0 Biological Characterization

3.1 Results of 1993 Sampling Program

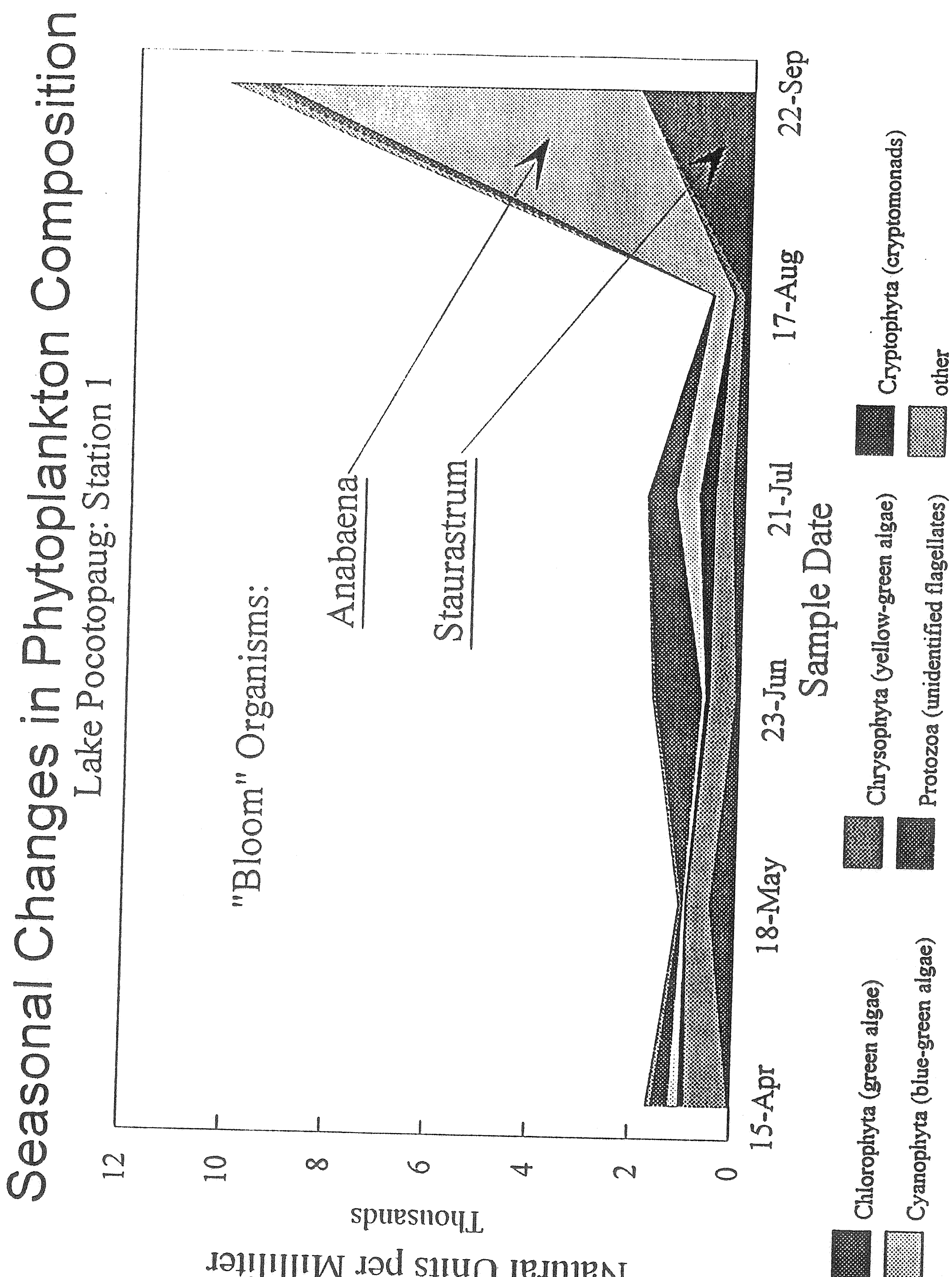
The biological sampling program conducted by FM-East focused on the phytoplankton (suspended algae) since water clarity and recreational use of Lake Pocotopaug have been impaired when large populations of these organisms "bloom". Composite samples of the water column to the limit of the photic zone (estimated at twice the Secchi reading) were collected for quantitative estimates of algae densities. Qualitative samples of plankton were taken at Station 1 using a 35 micron mesh net manipulated vertically through the water column. A plankton net concentrates the larger types of algae and also the microscopic animals (zooplankton) from a large volume of water and enables the relative abundance of these organisms to be determined. Algal species larger than 35 microns often account for most of the phytoplankton biomass in the water column. Zooplankton feed on algae and organic particles suspended in the water and, therefore, are an important factor determining water clarity.

Results of phytoplankton analysis document that diatoms (Chrysophyta), blue-green algae (Cyanophyta), and small flagellate organisms were the principal components of the community throughout most of the year (Table 3 and Figure 10). Among the diatoms, *Asterionella* was dominant in December, April, and May being replaced by *Tabellaria* during the remainder of the year. Among the blue-green algae, *Chroococcus* accounted for the large representation by this group in December, but the maximum densities occurring in September are almost entirely due to *Anabaena*. Unidentified flagellates of a very small size (5 microns) appeared in significant densities in April, June, July, and September. These flagellates appear colorless (lack the photosynthetic pigment chlorophyll) and are probably saprozoic (feeding by absorption of organic materials) protozoans of the class given the difficult name Zoomastigophorea. The green algae (Chlorophyta) generally were minor components of the phytoplankton community except in September when large numbers of the desmid *Staurastrum* appeared.

Both *Anabaena* and *Staurastrum* were consistent members of the plankton community for most of the period of study and eventually "bloomed" in September

Table 3
Results of Phytoplankton Analysis
(reported as natural units per milliliter)

Taxonomic Group	1-Dec. '92	1993 15-Apr.	18-May	23-Jun.	21-Jul.	17-Aug.	22-Sep.
STATION 1							
Chlorophyta							
desmids	0	0	36	0	0	0	2,080
other	0	36	358	71	245	97	149
Chrysophyta							
diatoms	1,572	756	464	251	280	218	0
other	107	107	0	286	70	0	0
Cryptophyta	464	107	0	71	315	0	0
Cyanophyta	1,642	214	72	72	455	388	7,132
unidentified flagellates	0	321	0	893	525	24	446
other	0	107	71	71	35	0	446
TOTAL	3,785	1,648	1,001	1,715	1,925	727	10,253
STATION 2							
Chlorophyta							
desmids	0	0	105	0	38	60	1,085
other	71	0	140	136	190	60	0
Chrysophyta							
diatoms	1,214	1,178	420	272	114	160	407
other	214	250	0	102	38	0	0
Cryptophyta	1,142	214	0	34	76	0	0
Cyanophyta	3,856	286	0	102	304	440	6,105
unidentified flagellates	0	821	0	544	988	20	1,085
other	0	143	0	68	76	20	0
TOTAL	6,497	2,892	665	1,258	1,824	760	8,682
NET SAMPLES							
Dominant Phytoplankton	*Asterionella*	*Asterionella* *Dinobryon* *Perdinium*	*Asterionella* *Staurastrum* *Mallomonas*	*Tabellaria* *Anabaena* *Sphaerocystis*	*Tabellaria* *Anabaena*	*Tabellaria* *Anabaena* *Staurastrum* *Coelosphaerium*	*Staurastrum* *Anabaena*
Dominant Zooplankton			*Difflugia* *Keratella* *Polyarthra*	*Polyarthra*	*Diaphanosoma* *Daphnia* *Diaptomus*		



Seasonal Changes in Phytoplankton Composition
Lake Pocotopaug: Station 1
"Bloom" Organisms:
Anabaena
Staurastrum
Natural Units per Milliliter
Thousands
0
2
4
6
8
10
12
15-Apr
18-May
23-Jun
21-Jul
17-Aug
22-Sep
Sample Date
Chlorophyta (green algae)
Cyanophyta (blue-green algae)
Chrysophyta (yellow-green algae)
Protozoa (unidentified flagellates)
Cryptophyta (cryptomonads)
other

Figure 10

causing transparency to diminish to around 1 meter. Analysis of supplementary samples collected by Tom Wells corroborate the above pattern of seasonal change in plankton composition (Table 4). In addition, they reveal that *Anabaena* and *Staurastrum* remained the dominant organisms through October and then only *Anabaena* persisted into November.

Zooplankton were not abundant except during May, June, and July. A type of zooplankton known as rotifers were dominant in May and June, represented by *Keratella* and *Polyarthra*. These rotifers are omnivorous, ingesting small algae, protozoans, and organic detritus. Also abundant in May was *Difflugia*, an ameboid protozoan living in a tiny case known as a "test". Zooplankton belonging to the Class Crustacea were abundant only in July, represented by the cladocerans *Diaphanosoma* and *Daphnia* and by the copepod *Diaptomus*. The cladocerans are exclusively filter-feeders and graze on algae. *Diaptomus* is also a filter-feeder, but some species are also raptorial and prey on other species of zooplankton.

3.2 Comparison to Historical Data

Historical records of the plankton community in Lake Pocotopaug reviewed as part of this study date back only to 1977 (Table 5). Review of these records indicates that diatoms (Chrysophyta) and the cyanophyte *Anabaena* have consistently been dominant members of the phytoplankton community in samples collected since that time. Diatoms, including *Asterionella* and *Tabellaria*, appear in abundance during the spring (March, April, and May). This pattern of springtime abundance by diatoms was also observed in 1993 and is typical of many temperate lakes. *Anabaena* is implicated as the dominant organism of "blooms" occurring in 1977, 1990, and 1992. This organism can multiply to bloom proportions as early as June and maintain high densities in the water column through September according to the historical records. As presented in Section 3.1 above, *Anabaena* was present in the plankton throughout the summer of 1993, but did not multiply to bloom densities until September.

Table 4
Supplementary Plankton Analyses

Date Collected	Location	Dominant Organisms
2-June 1993	From bottom in 3 feet of water adjacent to N. shore of Markhams Bay	*Spirogyra* filaments
21-June 1993	On surface at Sears Park	*Anabaena* "clumps"
3-August 1993	Station 1 (Secchi = 3.2 m)	*Anabaena* filaments, *Staurastrum*, *Coelosphaerium*, and *Tabellaria*
12-September 1993	South end of lake (water color green; Secchi = 1.1 m)	*Anabaena* filaments (thin "spaghetti" species) and *Staurastrum*
28-September 1993	Markhams Bay (Secchi = 1.7 m)	*Staurastrum* and short *Anabaena* filaments
6-October 1993	Markhams Bay (Secchi = 1.8 m)	*Staurastrum* and short *Anabaena* filaments
23-November 1993	Markhams Bay (Secchi = 1.8 m)	*Anabaena* "clumps"

Table 5
Historical Records of Plankton in Lake Pocotopaug

Sample Date	Information Source	Record of Observation
14-June 1977	CT DEP	"mild" bloom of *Anabaena* and *Aphanocapsa* coincident with fish kill (50 small yellow perch)
25-March 1988	Environmental Sciences Corporation	"oil-slick" identified as the diatoms *Asterionella* and *Tabellaria*
13-Sept. 1990	CT DHS Lab	*Anabaena*
19-Sept. 1990	CT DEP	*Anabaena*
9-April 1991	Dr. Lillian Harter	green algae (Chlorophyta) including *Staurastrum*, the diatom *Tabellaria*, the chrysophyte *Dinobryon*, and unidentified rotifers
15-May 1992	CT DHS Lab	diatoms (also filamentous *Mougeotia* and *Zygnema* probably from littoral zone)
15-May 1992	Dr. Lillian Harter	diatoms, *Staurastrum*, the protozoa *Paramecium*, and undentified rotifers
9-June 1992	CT DHS Lab	*Anabaena*, *Asterionella*, and 3 filamentous genera of green algae
12-July 1992	Dr. Lillian Harter	*Anabaena* the dominant organism (also diatoms and unidentified rotifers)
14-July 1992	CT DHS Lab	*Zygnema* (filamentous green algae probably from littoral zone)
22-Aug. 1992	Dr. Lillian Harter	*Anabaena* the dominant organism followed by the dinoflagellate *Gymnodinium*
6-Oct. 1992	CT DHS Lab	diatoms, *Scenedesmus*, and *Zygnema*

4.0 Review of the Lake Advisory Committee Phosphorus Budget and Trophic Assessment of Lake Pocotopaug

The Land Use Subcommittee is preparing a report on "Land Use and Phosphorus Input to Lake Pocotopaug" that makes use of the extensive database on inlet and tributary phosphorus concentrations generated by the Lake Study Group. This database documents phosphorus concentrations in all major discharges to the lake at various times since the sampling program was initiated in 1991. As a result of this sampling program, land use impacts are quantified using data representative of the unique geophysical setting of Lake Pocotopaug rather than relying on published nutrient export coefficients derived from other parts of the country. Our review of a draft of this report finds the analysis of the data, the conclusions, and the recommendations for watershed management to be well-documented and accurate.

As an extension of our review of "Land Use and Phosphorus Input to Lake Pocotopaug" we have calculated the hydrologic budget of the lake and use the trophic state model of Dillon and Rigler (1975) to evaluate the influence of internal loading. Data on physical characteristics of the lake (CT DEP, 1982 and Lake Area Task Force, 1988) were combined with hydrologic data (USGS, 1982 and Dunne and Leopold, 1978) to calculate the hydrologic budget of Lake Pocotopaug (Table 6). Our calculation estimates the residence time (also known as retention time) of water in the lake to be 285 days (0.78 yr), whereas the CT DEP (1982) estimate is 358 days (0.98 yr). Flushing rate is the inverse of residence time and is a measure of the rate at which the total volume of water in the lake is replenished. Our estimate for the flushing rate of Lake Pocotopaug is 1.3 volumes per year and this is incorporated into the trophic state model presented below.

Table 6
Annual Hydrologic Budget of Lake Pocotopaug*

INPUTS		
a.) runoff from watershed (USGS, 1982)	(68.8 cm) (963.6 ha)	= 663.0 ha - m = 6.63×10^6 m^3
b.) direct precipitation (USGS, 1982)	(120.2 cm) (207.1 ha)	= 248.9 ha - m = 2.489×10^6 m^3
LOSSES		
a.) outlet discharge (calculated as residual)		= 764.7 ha - m = 7.647×10^6 m^3
b.) evaporation from lake surface (28 in/yr; Dunne and Leopold, 1978)	(71.1 cm) (207.1 ha)	= 147.2 ha - m = 1.472×10^6 m^3

Total Throughput Volume for System (Q) = 911.9 ha - m

Areal Water Load (Q/surface area of lake) = 4.4 m/yr

Residence Time (time necessary for complete replacement of lake volume) = 0.78 years (285 days)

Flushing Rate (number of volume replacements per year) = 1.3 volumes/year

*assuming negligable inputs or losses via groundwater and no change in storage volume

Important Physical Characteristics of Lake Pocotopaug:

(from CT DEP, 1982 and Lake Area Task Force, 1988)

Surface Area	=	207.1 ha
Mean Depth	=	3.44 m
Volume	=	713.2 ha - m
Watershed Area	=	963.6 ha

(land area only, does not include lake surface)

The trophic state model of Dillon and Rigler (1975) is used to predict the phosphorus concentration of waters in Lake Pocotopaug under various conditions of phosphorus loading. The model takes the following form:

$$[P] = \frac{L(1 - R)}{(\bar{z})(p)}$$

Where [P] = predicted total phosphorus concentration (mg/L)
L = areal phosphorus loading rate (g/m^2 - yr)
R = phosphorus retention coefficient (unitless)
$\bar{z}$ = mean depth (meters)
p = flushing rate (volumes/yr)

The areal phosphorus loading rate (L) is calculated based on the current total load of 1,263 pounds per year (0.277 g/m^2 - yr) documented in "Land Use and Phosphorus Input to Lake Pocotopaug." Phosphorus retention (R) is estimated to be 75 percent using the formula R = 13.2/13.2 + areal water load (measured in meters per year; Dillon and Kirchner, 1975). Mean depth ($\bar{z}$) and flushing rate (p) are 3.44 m and 1.3 volumes/year respectively (Table 6). Using the above values the model predicts a phosphorus concentration (at spring turnover) of 15 ppb. This predicted concentration is in the range of phosphorus concentrations measured in spring of 1991 (also Lake Study Group data for 22-September, 1993) and indicates that the estimate of current phosphorus loading is reasonable.

As a way of estimating the impact of internal loading on phosphorus dynamics within Lake Pocotopaug, the epilimnion of the lake is treated as the lake volume subject to mixing rather than the whole volume of the lake at spring turnover. A depth of 6.4 meters was selected as a representative limit of the epilimnion during summer stratification. The volume of this "6.4 meter" lake is about 96.3 percent of the true volume (unpublished bathymetric data) and, therefore, the mean depth of the "6.4 meter" lake is calculated to be 3.32 meters. Solving the model using a mean depth of 3.32 meters instead of 3.44 meters results in a predicted phosphorus concentration of 16 ppb. This small increase from the value predicted for the whole lake demonstrates the small volume of the lake basin below a depth of 6.4 meters.

The final step in estimating the influence of internal loading is to calculate the load necessary to create a concentration of 30 ppb in the "6.4 meter" lake modeled above. The concentration of 30 ppb was selected because this is the average value measured in the epilimnion during July, August, September, and November of 1992 (a total of eight measurements at Stations 1 and 2). This calculation indicates that the areal phosphorus loading rate to the epilimnion (above 6.4 meters) must have been 0.518 g/m^2 - yr. This figure is comprised of the current total load of 1,263 pounds annually from watershed, atmosphere, and waterfowl plus an additional annual load 1,099 pounds of phosphorus. This additional load of 1,099 pounds annually represents the amount of phosphorus that reaches the epilimnion from "internal loading" during a season when thermal stratification and anoxia in the hypolimnion are pronounced. If the above exercise using a "6.4 meter" lake with a phosphorus concentration of 30 ppb is generally representative of phosphorus dynamics within Lake Poctotopaug, it indicates that internal loading can account for 47 percent of the total annual phosphorus load.

5.0 DIAGNOSTIC CONCLUSIONS

A key finding of the 1993 diagnostic program is that weather patterns in April determine, to a large degree, the condition of Lake Pocotopaug during the summer. A succession of springtime days that are sunny, warm, and windless will cause a pronounced thermal gradient to form early and relatively high in the water column. Early onset of thermal stratification in Lake Pocotopaug hastens the development of anoxia in the hypolimnion and creates a situation where internal loading of nutrients to the epilimnion can occur by mid-summer. This scenario was realized in 1992 and resulted in a severe bloom of algae in July.

In contrast, a spring that is relatively cool and windy will delay the onset of thermal stratification and cause the thermal gradient to form lower in the water column. A delay in the onset of stratification causes, in turn, a delay in the development of hypolimnetic anoxia and in the potential for internal loading of nutrients to the epilimnion. Both 1991 and 1993 appear to share this pattern of events and algae blooms in these years did not occur until September.

The fact that algae blooms have been documented each year since 1990 indicates that conditions in Lake Pocotopaug are predisposed to supply the nutrients necessary to cause rapid growth by algae populations. The similarity in pattern of lake function in 1991 and 1993 and the contrast of these years to 1992 provide strong evidence for the role of internal loading in triggering the algae blooms. The diagnosis that internal loading is the main factor leading to algae blooms was initially documented in the Lake Study Group Report for 1991-92. Our study verifies that phytoplankton and nutrient dynamics within Lake Pocotopaug are balanced such that the rate of internal loading to the epilimnion exceeds the threshold necessary to trigger a bloom. Additionally, our study demonstrates that the timing and severity of internal loading and algae blooms are predominantly influenced by springtime weather patterns. The objective of many of the in-lake management techniques described in the next section is to reduce internal loading in Lake Pocotopaug.

6.0 MANAGEMENT RECOMMENDATIONS

6.1 In-Lake Techniques

In-lake techniques focus on direct control of algae or of the internal conditions that promote their growth (Table 7). Selection of the most appropriate in-take technique is somewhat complicated because of uncertainty surrounding the timing and severity of bloom events. However, internal loading is the main factor contributing to bloom events and either aeration, nutrient inactivation, or a combination of the two techniques will function to reduce this source of phosphorus. Short-term reductions in algae populations and improved water clarity may be attained by treatment with an algicide. In-lake techniques are not a substitute for watershed management and should only be considered as one component of the overall management strategy. The only strategy that offers long-term protection for Lake Pocotopaug is one focused on the reduction and/or elimination of nutrient inputs from the watershed.

Chemical (Algicide) Treatment

Chemical treatment with copper-based algicides (i.e., copper sulfate) is the most commonly employed technique to control nuisance algal blooms. Copper sulfate has been used for decades to treat algae in recreational waterbodies and water supplies. Generally, copper sulfate is applied to the lake when the nuisance algae are present and their densities are increasing at an exponential rate. If used at the peak of the "bloom", there is greater risk of negative impacts to fisheries, due to oxygen depletion as the algae cells decay.

Dosages of copper sulfate applied are generally 0.25 ppm, or less, as permitted by the Pesticide Compliance Unit of Connecticut DEP and Connecticut Division of Fish and Wildlife. Typically, the entire lake surface area is treated to achieve dosage concentrations within the "top" 8 to 10 feet of the water column. Generally, copper sulfate toxicity to algae increases with decreasing alkalinity. In a soft water (low alkalinity) system such as Lake Pocotopaug, the total quantity of copper sulfate to be applied would be in the range of 2,800 pounds based on treating the "top" 8 feet of the water column.

Following application, copper sulfate begins to destroy the algae within a matter of hours by lysing (rupturing) their cell walls. Usually, within 48 to 72 hours of treatment, the algae have died and the water begins to clear. The water may not completely clear to "pre-bloom" conditions due to partially decomposed algae cells which remain in suspension. Improvement in water clarity is lake specific, but is usually impressive.

Greatest treatment effectiveness is achieved by application at the time of greatest population growth, which is prior to actual bloom formation and requires monitoring to detect. If treatment were to occur in mid/late July, one treatment may be adequate to control the algae through the summer. Two treatments per season may be required, however, if a bloom begins to form earlier in the summer.

A treatment of this magnitude should be performed by an experienced firm, licensed by Connecticut DEP for "aquatic" applications and insured. An "Application for Permit to Introduce Pesticides in Waters of the State" should be filed at least 60 days in advance of the proposed treatment date(s). The permit application is typically filed by the professional applicator selected to perform the work. Copper sulfate is usually applied from a boat, specially equipped with a pump and injection system. The estimated cost for a single application on Lake Pocotopaug is in the range of $4,800 including chemicals, labor, and equipment.

Algicide treatments can be an effective short-term strategy but should not be viewed as the primary means of managing the nuisance algae. While instances of direct mortality to warmwater fisheries following treatment are rare, copper-based algicides may inadvertently impact zooplankton, causing changes in community structure until populations recover. There is also some evidence that repetitive treatments may give rise to more copper resistant algae species. While the algae genus *Anabaena* is generally susceptible to copper sulfate at the dosage of 0.25 ppm, other algae such as *Staurastrum* may be more difficult to control.

Copper is a metal which persists in the lake bottom sediments. It has been documented that in lakes treated on multiple occasions with copper products in a single year and repetitively over several decades, copper in the sediments may bioaccumulate and be injurious to macroinvertebrates (fish food organisms) and juvenile fish. Toxicity is, in part, a function of copper "bioavailability" in the sediments which involves a complex series of chemical reactions and is very difficult to predict. For these reasons copper-based algicides should be used cautiously and not routinely to minimize risk to non-target organisms.

Hypolimnetic Withdrawal

This technique entails siphoning or pumping nutrient-enriched water from the hypolimnion (deep water area) to another location, usually the receiving waters downstream of the outlet. Withdrawal occurs continuously during the period of summer stratification. There are several problems which make this technique only marginally feasible at Lake Pocotopaug. First, the slight drop in elevation below the lake's outlet structure does not allow for gravity siphoning to a depth much beyond 5 to 10 feet, while an intake depth of 25 to 30 feet in the lake would be desired. Therefore, withdrawal would require pumping. Secondly, the separate locations of the lake's two major basins would require dual intakes with pipe running approximately two-thirds of a mile to the outlet. Further, a water diversion and discharge permit would be required from Connecticut DEP to send nutrient-laden, anoxic water downstream. It's doubtful that DEP would look favorably on this proposal without some form of prior treatment of the discharge water.

Phosphorus Inactivation (Alum) Treatment

Aluminum sulfate (alum) has long been used in the treatment of drinking and wastewater to remove color, turbidity, and phosphorus. The aluminum binds with the phosphorus forming insoluble compounds (aluminum phosphate or an aluminum hydroxide complex) that are chemically stable under varying redox conditions (oxidizing or reducing environments) and anoxia. When applied in the water column of a lake, the aluminum and phosphorus combine to form a precipitate which sinks to the bottom and forms a flocculent layer over the sediments. Phosphorus release from the sediments is eliminated or retarded over a period of years once this layer of alum floc has formed.

During the previous two decades, the treatment of lakes with alum to remove phosphorus from the water column (i.e., phosphorus precipitation) and to bind phosphorus in the lake sediments (i.e., phosphorus inactivation) has become a recognized lake restoration technique. In simple terms, the alum binds with the phosphorus thereby making the "growth factor" for the algae unavailable. Throughout New England, an estimated dozen or more waterbodies have been treated with alum since the early 1980's. A number of these treatment projects have provided effective reductions in phosphorus and control of nuisance algae populations for 5-10 years or longer.

The longevity of control by alum treatment is maximized in waterbodies where watershed nutrient inputs have been reduced to less than "eutrophic" levels. Lakes that have longer water retention times (i.e., low flushing rates) generally benefit from additional years of nuisance algae control. This technique is especially successful in lakes with high rates of internal phosphorus loading characterized by anoxia (no oxygen) in the hypolimnion and high concentrations of hypolimnetic phosphorus. The above characteristics match well with Lake Pocotopaug, especially if the high priority recommendations for watershed management are initiated to reduce watershed inputs of phosphorus.

In soft water systems like Lake Pocotopaug, the addition of a base compound (usually sodium aluminate) must be applied with the alum, which is acidic, to prevent changes in pH. A series of laboratory "jar tests" are performed on the lake water to determine the dosage of alum required to remove phosphorus and to form a good quality floc. These tests are also used to finalize the ratio of alum to sodium aluminate required to maintain ambient pH of the lake during and after treatment. Within a pH range of about 6.0 to 8.5 aluminum will remain complexed and insoluble. Outside this pH range, soluble aluminum will form which can be toxic to fish and other aquatic life. A pH range of 6.5 to 7.8 was observed in Lake Pocotopaug in 1993.

The treatment area in Lake Pocotopaug would encompass the region north of the islands. Treatment would occur in water depths greater than 10 to 15 feet. This area of treatment is estimated at approximately 200 acres. The alum and sodium aluminate mixture is applied from a specially modified weed harvester (Figure 11). Based upon representative unit treatment costs reported elsewhere of approximately $800-1,000 per acre, an alum treatment of Lake Pocotopaug would cost in the range of $200,000.

Alum treatment may well be an appropriate long-term strategy for Lake Pocotopaug. This technique should not be implemented, however, until watershed phosphorus loadings have been reduced as much as possible.

Aeration

Aeration can be used to increase lake oxygen levels through mechanical agitation of waters or by pumping of compressed air and subsequent diffusion of oxygen. Oxygenated waters inhibit or greatly reduce sediment phosphorus release and may reduce the availability of dissolved inorganic phosphorus which is the principal growth factor for algae. Aeration is sometimes used in reservoirs to increase oxidation processes and lower iron concentrations. This technique is also applied to enhance fishery habitat in lakes with low oxygen levels.

Aeration has potential merit for use at Lake Pocotopaug and, along with nutrient inactivation, warrants careful consideration. The primary objective of aeration here would be to aerate the two deep lake basins, thereby reducing phosphorus release from the sediments and subsequent transfer of phosphorus to surface waters where algae blooms are triggered.

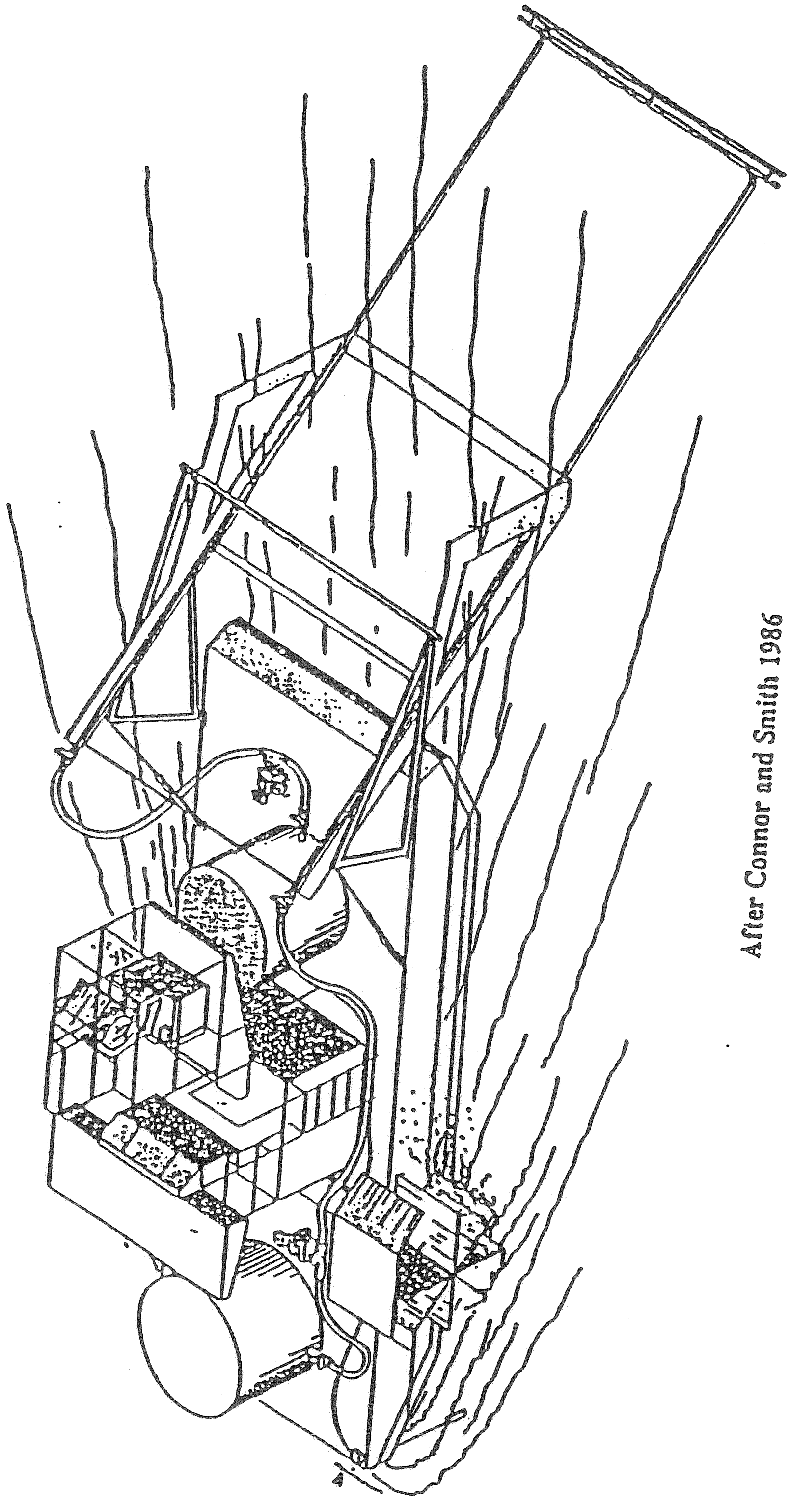


Figure 11 - Modified Harvester with Alum/Aluminate Distribution System

There are several types of aeration systems on the market, ranging from surface agitation (fountain type) units, destratification systems with bottom diffusers or perforated tubing, and partial/total air lift systems (Figure 12). Layer aeration is a variation of the air lift system where an oxygenated water mass is created to inhibit the passage of phosphorus from the hypolimnion to the overlying surface waters where it's available for uptake by algae.

Lake Pocotopaug does not support a cold water (trout) fishery although existing information indicates it was formerly stocked with trout on a "put and take" basis. Layered or hypolimnetic aeration could improve the ability of the lake to "hold-over" trout during summer months when the lake's deeper water becomes deficient in oxygen. A potential cold-water fishery should be viewed as a secondary benefit of this technique.

Layered aeration or some type of air-lift system that would not destratify the lake's summer thermal profile would be used at Pocotopaug. The track-record for such aeration systems achieving the desired objectives (i.e., reduced phosphorus cycling and control of algae blooms), however, is not nearly as good as the documented success for alum treatments.

Aeration carries substantial capital outlay and annual operation and maintenance costs. Based on two aeration systems required to aerate the two deep basins of Lake Pocotopaug, total capital costs are estimated at $100,000-150,000 with annual operation and maintenance costs in the range of $10,000.

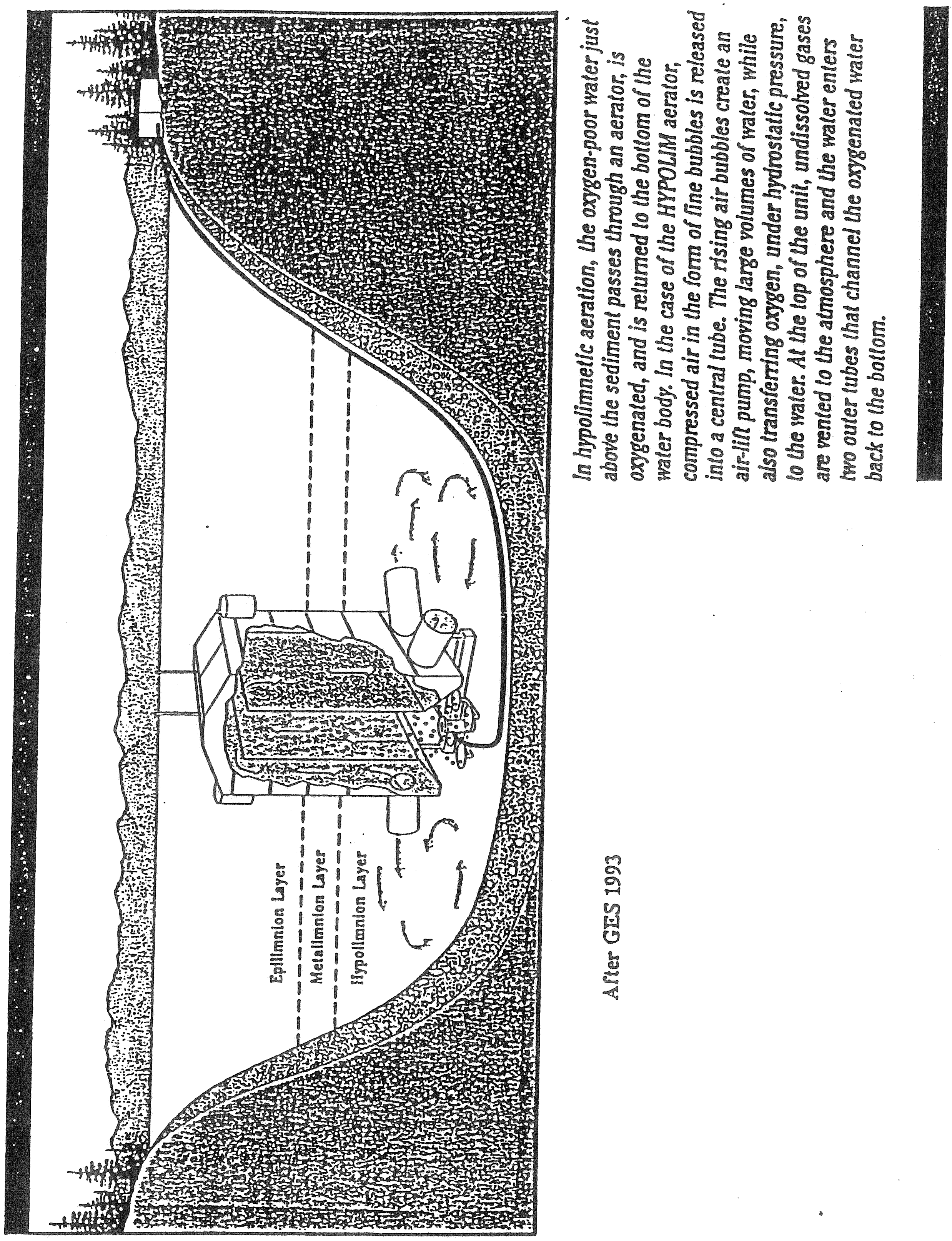


Figure 12 - Partial Lift Hypolimnetic Aeration System

Biomanipulation

Biomanipulation is a lake restoration technique that involves a manipulation of the food web to enhance grazing of suspended algae (phytoplankton) by zooplankton. Enhanced grazing by zooplankton can suppress phytoplankton populations and increase transparency in certain lakes. However, to create this situation requires the restructuring of the biological community at many levels in the food web. Biomanipulation is still in its infancy as a lake management technique and the benefits derived from manipulating the food web are difficult to control or predict. Therefore, this technique should no be relied on as the primary means for controlling algae blooms, but used as a supplement to more conventional techniques.

The technique of biomanipulation is dependent on a number of feeding linkages between members of the lake community. Ideally, a "cascade" of effects in the community leading to increased water clarity is triggered by the introduction of large predatory fish such as bass or pike. Studies demonstrate that this "cascade" of effects can proceed according to the following scenario: (1) introduction of large piscivorous (fish eating) fish causes increased predation on small planktivorous (zooplankton eating) fish such as small yellow perch or bluegills and a reduction in their populations, (2) a reduction in numbers of planktivorous fish results in less predation on zooplankton, especially the larger, more vulnerable forms such as *Daphnia*, and an increase in their populations, (3) an increase in numbers of large-bodied zooplankton results in intensified grazing on phytoplankton due to their faster feeding rates and the wider range of algae sizes ingested by them in comparison to small zooplankton, (4) an increase in grazing intensity by zooplankton suppresses the growth of algae populations, reduces the occurrence of "blooms", and improves water clarity.

The multiple linkages and "cascade" of food web effects that are inherent in biomanipulation dictate that the success of the technique is subject to many variables. Physical, chemical, or biological factors that influence specific components of the food web (phytoplankton, zooplankton, planktivorous fish, or piscivorous fish) also influence the outcome of biomanipulation. Selective grazing by zooplankton on phytoplankton is a factor that contributes to the uncertainty of biomanipulation as a restoration technique. Gelatinous green algae, filamentous cyanophytes ("blue-green algae"), and very large algal species are unmanageable by zooplankton or even toxic. Lakes which support "blooms" of these types of algae will not have a predictable response to increase in grazing pressure brought about by biomanipulation.

Current information on the fish community of Lake Pocotopaug is lacking. The most recent fishery information reviewed as part of this study dates back to a survey conducted in 1959 (CT State Board of Fisheries and Game). This survey documents the following species as common in the lake: smallmouth bass, yellow perch, rock bass, bluegill sunfish, and common sunfish. Except for the smallmouth bass, the above species are primarily insectivores as adults and planktivores as juveniles. At the time of the survey the only large piscivore was the smallmouth bass and appears to have been greatly outnumbered by the smaller species. Augmentation of the smallmouth bass population in Lake Pocotopaug may help to suppress the growth of algae if the current fish community is dominated by planktivorous species.

The cost of biomanipulation through stocking of smallmouth bass is highly variable, depending on the source of fish, level of stocking, and rate of survival. Adult bass are only available through a few private hatcheries. If a breeding population can be established and more restrictive creel limits are implemented (possibly with a catch and release policy or a slot limit on gamefish), further stocking would be necessary only infrequently. Otherwise, major stocking of adult bass would be necessary on an annual to once every three years basis. A budget of $5,000 to $10,000 per year for five years with declining expenditures for the next five years would allow experimental stocking that could determine the effectiveness of biomanipulation in Lake Pocotopaug. This approach would benefit greatly from a hypolimnetic aeration system that would expand the area of habitat with adequate oxygen. A stocking permit is required by the Connecticut DEP Fisheries Division.

6.2 Watershed Management

A comprehensive and far-sighted strategy for watershed management to protect Lake Pocotopaug has already been formulated by the Lake Area Task Force and the Land Use Subcommittee of the Lake Advisory Committee. The Report of the Lake Area Task Force (April, 1988; see Section IV - Environmental Issues) address specific problems facing Lake Pocotopaug in four major areas as follows: (1) establishing a system for coordinating assessment and management of Lake Pocotopaug, (2) implementing measures to reduce inputs of nutrients and sediments to the lake, (3) implementing land use controls to minimize watershed impacts on the lake, and (4) protecting the lake from potential contamination by petroleum products and other hazardous chemicals. A total of 23 specific recommendations are detailed in the above categories and, if implemented, will all contribute to the long-term health of Lake Pocotopaug.

More recently, the Land Use Subcommittee has emphasized the importance of managing stormwater runoff into Lake Pocotopaug ("Land Use and Phosphorus Input to Lake Pocotopaug", in preparation). They appropriately identify two ways this pollutant source must be controlled: (1) reduce the volume of stormwater runoff generated in the watershed and discharged into the lake, and (2) improve the quality of stormwater discharged into the lake (reduce concentrations of pollutants in the stormwater). The report of the Land Use Subcommittee lists policies, procedures, and structural approaches that should be prioritized for implementation in order to reduce the impacts of stormwater discharge on Lake Pocotopaug.

A specific recommendation we make as part of a program to manage stormwater is to modify the small pool that Hales Brook flows through along Lake Drive to function as a sedimentation basin for this major tributary. Sampling and calculations performed by members of the Land Use Subcommittee document that Hales Brook accounts for the greatest annual load of phosphorus of any tributary to the lake. Dredging out the sediments that have filled this pool and reconstructing the outlet could be done so that the flow from Hales Brook is detained and its load of suspended material can settle out. Functioning in this way, the pool will remove much of the load of suspended solids and associated phosphorus that enters the lake. The manuals by Schueler (1987) and Schueler et al (1992) should be consulted to identify engineering designs for stormwater management that would be suitable at this and other locations.

Improved management of personal property by local citizens is yet another aspect of watershed management and this has been addressed by the Land Use Subcommittee and Education Subcommittee. Homeowners in the watershed and, especially, owners of shoreline property are the focus of efforts to make them aware of their role in protecting Lake Pocotopaug. Topics included in this public awareness program include the following: controlling erosion, hooking up "grey water" discharges to the sewer system, discriminant use of lawn fertilizer, avoiding washing cars near catch basins, discouraging the feeding of gulls or other waterfowl, preventing the dumping of wastes or litter into stream channels or storm sewers, and the replanting of shoreline vegetation to serve as a buffer against pollutants in runoff. Publication of "Splash and Lake Pocotopaug" by the East Hampton Junior Women's Club extends the education effort to young people in the community.

In summary, local committee members have familiarized themselves with the full spectrum of watershed management techniques and have designed a strategy that addresses the specific problems facing Lake Pocotopaug. Furthermore, their efforts have prepared the way for prioritizing and implementing many of the recommendations for watershed management. The recommendations of the Lake Area Task Force and Lake Advisory Committee are "right on target" and deserve the support of all townspeople concerned about the long-term protection of Lake Pocotopaug.

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APPENDIX: FIELD SHEETS AND LABORATORY REPORTS

Summary of Water Quality Measurements (continued)

		1993								
	Dec. 1 '92	15-Apr	18-May	23-Jun	21-Jul	17-Aug	22-Sep	Median	Minimum	Maximum
Conductivity (umhos/cm)										
LP-1A	47	44	65	72	77	75	62	65	44	77
LP-1B			63	72	76	78	62	72	62	78
LP-1C	48	44	58	76	83	91	62	62	44	91
LP-2A	48	48	66	78	78	75	62	66	48	78
LP-2B			62	72	78	75	62	72	62	78
LP-2C	49	48	59	73	83	89	62	62	48	89
Hydrogen Ion Activity (pH units)										
LP-1A	6.7	7.3	7.2	7.8	7.7	7.8	7.2	7.3	6.7	7.8
LP-1B			7.8	7.8	7	7.3	6.8	7.3	6.8	7.8
LP-1C	6.7	7.1	6.6	7.1	7.2	7.4	7.4	7.1	6.6	7.4
LP-2A	6.6	7.2	7.3	7.8	7.5	7.8	6.8	7.3	6.6	7.8
LP-2B			7.2	7.6	7.4	7.1	7.2	7.2	7.1	7.6
LP-2C	6.6	7.1	6.5	6.9	7.1	7.2	7.2	7.1	6.5	7.2

LAKE POCOTOPAUG DIAGNOSTIC ASSESSMENT   Date: 1-December 1992

Start Time/End Time: 10:55am/2:45pm   Wind Speed/Direction: quiet

Cloud Cover: hazy 100%   Air Temp./D.O. Calibration: 9C/11.6ppm

Sampling Conducted By: D.Worden

FIELD MEASUREMENTS: Temperature (C), Dissolved Oxygen (ppm), Conductivity (umhos/cm), Hydrogen Ion Activity (pH units), Secchi Transparency (m), Maximum Depth (m)

Depth (m)	STATION 1 - OAKWOOD Temp.	D.O.		STATION 2 - MARKHAM Temp.	D.O.	
0	6.7	11.2	conduct.= 47	6.8	11.4	conduct.= 48
0.5	6.6	11.2		6.7	11.4	
1.0	6.3	11.2	pH = 6.7	6.7	11.4	pH = 6.6
1.5	6.3	11.2		6.6	11.4	
2.0	6.3	11.2		6.3	11.4	
2.5	6.3	11.2		6.3	11.4	
3.0	6.3	11.2		6.2	11.2	
3.5	6.2	11.3		6.2	11.2	
4.0	6.2	11.3		6.2	11.3	
4.5	6.2	11.3		6.2	11.3	
5.0	6.2	11.3		6.2	11.3	
5.5	6.2	11.3		6.1	11.3	
6.0	6.2	11.3		6.1	11.2	
6.5	6.2	11.4		6.1	11.2	
7.0	6.2	11.4		6.1	11.2	
7.5	6.2	11.4		6.1	11.2	
8.0	6.2	11.4		6.1	11.2	
8.5	6.2	11.4		6.1 C	11.2	
9.0	6.2	11.4		6.1	11.2	
9.5	6.2	11.4		6.1*	<1*	
10.0	6.2 C	11.4	conduct.= 48			conduct.= 49
10.5	6.2	11.4				
11.0	6.2*	<1*	pH = 6.7	*on bottom		pH = 6.6

Station 1: Secchi Transparency = 1.7
Max. Depth = 11.0

Station 2: Secchi Transparency = 1.9
Max. Depth = 9.5

ADDITIONAL OBSERVATIONS:

- 1A integrated sample to 3.4m
- 2A integrated sample to 3.8m

LAKE POCOTOPAUG DIAGNOSTIC ASSESSMENT Date: 15-April 1993

Start Time/End Time: 10:43am/2:02pm Wind Speed/Direction: 5mph South

Cloud Cover: 100% grey overcast Air Temp./D.O. Calibration: 14C/10.1ppm

Sampling Conducted By: D.Worden and T.Wells

FIELD MEASUREMENTS: Temperature (C), Dissolved Oxygen (ppm), Conductivity (umhos/cm), Hydrogen Ion Activity (pH units), Secchi Transparency (m), Maximum Depth (m)

	STATION 1 - OAKWOOD			STATION 2 - MARKHAM		
Depth (m)	Temp.	D.O.		Temp.	D.O.	
0	8.5	11.6	conduct.= 44	8.7	11.6	conduct.= 48
0.5	8.5	11.6		8.7	11.6	
1.0	8.5	11.6	pH = 7.3	8.6	11.6	pH = 7.2
1.5	8.3	11.6		8.6	11.6	
2.0	8.2	11.6		8.6	11.6	
2.5	8.2	11.6		8.3	11.6	
3.0	8.1	11.6		7.9	11.6	
3.5	8.1	11.6		7.8	11.6	
4.0	8.1	11.6		7.7	11.6	
4.5	8.0	11.6		7.6	11.6	
5.0	8.0	11.6		7.5	11.5	
5.5	8.0	11.6		7.4	11.4	
6.0	8.0	11.6		7.4	11.4	
6.5	7.9	11.5		7.3	11.4	
7.0	7.9	11.5		7.3	11.4	
7.5	7.9	11.4		7.2	11.2	
8.0	7.9	11.4		7.2 C	11.2	
8.5	7.9	11.4		7.2	11.1	
9.0	7.8	11.4				
9.5	7.7	11.1				
10.0	7.6 C	11.0	conduct.= 44			conduct.= 48
10.5	7.5	10.9				
11.0	7.4	10.6	pH = 7.1			pH = 7.1

Station 1: Secchi Transparency = 2.3
Max. Depth = 11.0

Station 2: Secchi Transparency = 2.6
Max. Depth = 8.7

ADDITIONAL OBSERVATIONS:
- Ekman taken at LP-1 (z=11.0m), collect Chaoborus and chironomids (sediment is fine organic mud, brown with some tan/rust compounds)
- 1A integrated sample to 4.6m, 2A integrated sample to 5.2m

LAKE POCOTOPAUG DIAGNOSTIC ASSESSMENT   Date: 18-May 1993

Start Time/End Time: 1:09pm/3:15pm   Wind Speed/Direction: ---

Cloud Cover: 100%   Air Temp./D.O. Calibration: 21C/8.9ppm

Sampling Conducted By: D.Worden, T.Wells, G.Pfaffenbach, and J.Pearce

FIELD MEASUREMENTS: Temperature (C), Dissolved Oxygen (ppm), Conductivity (umhos/cm), Hydrogen Ion Activity (pH units), Secchi Transparency (m), Maximum Depth (m)

	STATION 1 - OAKWOOD			STATION 2 - MARKHAM		
Depth (m)	Temp.	D.O.		Temp.	D.O.	
0	19.9	8.3	conduct.= 65	19.8	8.4	conduct.= 66
0.5	19.9	8.3		19.8	8.4	
1.0	19.2	8.2	pH = 7.2	19.8	8.4	pH = 7.3
1.5	19.0	8.2		19.6	8.4	
2.0	19.0	8.2		19.3	8.4	
2.5	19.0	8.1		19.2	8.4	
3.0	18.8	7.8		19.1	8.3	
3.5	18.8	7.8		18.8	8.1	
4.0	18.6	7.8		18.0	7.9	
4.5	18.4	7.6		16.2 B	8.0	
5.0	17.7 B	6.8		13.9	6.6	
5.5	16.0	5.6		13.0	7.0	
6.0	14.0	5.4	conduct.= 63	12.7	6.3	conduct.= 62
6.5	12.9	5.2		12.2	4.1	
7.0	12.3	4.8	pH = 7.8	11.9	3.2	pH = 7.2
7.5	12.1	4.5		11.6	1.6	
8.0	11.9	3.8		11.3	0.7	
8.5	11.7	3.1		11.2 C	0.1	
9.0	11.6	2.4		11.0	0.1	
9.5	11.3	1.4		10.9*	0.1*	
10.0	11.2 C	0.6	conduct.= 58			conduct.= 59
10.5	11.1	0.3				
11.0	11.0*	0.2*	pH = 6.6	*on bottom		pH = 6.5

Station 1: Secchi Transparency = 1.9
Max. Depth = 11.0

Station 2: Secchi Transparency = 2.2
Max. Depth = 9.5

ADDITIONAL OBSERVATIONS:
- 1A integrated sample to 3.8m, 2A integrated sample to 4.4m
- prepare duplicate and spiked samples

LAKE POCOTOPAUG DIAGNOSTIC ASSESSMENT Date: 23-June 1993

Start Time/End Time: 10:55am/2pm Wind Speed/Direction: 20mph N.W.

Cloud Cover: 0% but slight haze Air Temp./D.O. Calibration: 21C/8.9ppm

Sampling Conducted By: D.Worden and T.Wells

FIELD MEASUREMENTS: Temperature (C), Dissolved Oxygen (ppm), Conductivity (umhos/cm), Hydrogen Ion Activity (pH units), Secchi Transparency (m), Maximum Depth (m)

	STATION 1 - OAKWOOD			STATION 2 - MARKHAM		
Depth (m)	Temp.	D.O.		Temp.	D.O.	
0	22.8	8.2	conduct.= 72	23.6	8.2	conduct.= 78
0.5	22.8	8.2		23.6	8.2	
1.0	22.8	8.2	pH = 7.8	23.6	8.2	pH = 7.8
1.5	22.8	8.2		23.6	8.2	
2.0	22.8	8.2		23.6	8.2	
2.5	22.8	8.2		23.6	8.2	
3.0	22.8	8.2		23.6	8.2	
3.5	22.8	8.1		23.6	8.2	
4.0	22.8	8.1		23.5	8.2	
4.5	22.8	8.1		23.3	8.2	
5.0	22.6	8.0		21.2	8.9	
5.5	22.3	8.0		19.0 B	9.8	
6.0	18.2 B	7.1	conduct.= 72	17.2	7.9	conduct.= 72
6.5	17.5	6.1		15.6	3.9	
7.0	16.8	4.8	pH = 7.8	14.2	0.2	pH = 7.6
7.5	15.8	1.3		12.9	0	
8.0	14.0	0.1		12.0	0	
8.5	13.5	0		11.6 C	0	
9.0	12.0	0		11.3*	0*	
9.5	11.3	0				
10.0	11.1 C	0	conduct.= 76			conduct.= 73
10.5	10.9	0				
11.0	10.8*	0*	pH = 7.1	*on bottom		pH = 6.9

Station 1: Secchi Transparency = 3.9
Max. Depth = 11.0

Station 2: Secchi Transparency = 3.9
Max. Depth = 9.0

ADDITIONAL OBSERVATIONS:

- 1A and 2A integrated samples to 6m

LAKE POCOTOPAUG DIAGNOSTIC ASSESSMENT   Date: 21-July 1993

Start Time/End Time: 9:30am/1pm   Wind Speed/Direction: 0 to 3mph N.W.

Cloud Cover: 40%   Air Temp./D.O. Calibration: 22C/8.7ppm

Sampling Conducted By: D.Worden, T.Wells, P.Aarrestad, and T.King

FIELD MEASUREMENTS: Temperature (C), Dissolved Oxygen (ppm), Conductivity (umhos/cm), Hydrogen Ion Activity (pH units), Secchi Transparency (m), Maximum Depth (m)

Depth (m)	STATION 1 - OAKWOOD Temp.	STATION 1 - OAKWOOD D.O.	STATION 1 - OAKWOOD	STATION 2 - MARKHAM Temp.	STATION 2 - MARKHAM D.O.	STATION 2 - MARKHAM
0	24.3	7.6	conduct.= 77	25.0	7.7	conduct.= 78
0.5	24.3	7.6		25.0	7.7	
1.0	24.3	7.6	pH = 7.7	25.0	7.7	pH = 7.5
1.5	24.3	7.6		25.0	7.7	
2.0	24.3	7.6		24.9	7.7	
2.5	24.3	7.5		24.9	7.7	
3.0	24.3	7.4		24.8	7.6	
3.5	24.3	7.3		24.7	7.6	
4.0	24.3	7.3		24.6	7.5	
4.5	24.3	7.3		24.3	7.5	
5.0	24.3	7.2		24.1	6.9	
5.5	23.9	5.8		22.0 B	1.7	
6.0	23.1	3.5	conduct.= 76	20.9	0.2	conduct.= 78
6.5	21.5 B	0.1		17.8	0	
7.0	17.8	0	pH = 7.0	15.3	0	pH = 7.4
7.5	16.5	0		13.5	0	
8.0	15.2	0		12.2 C	0	
8.5	13.5	0		11.9	0	
9.0	12.2	0		11.8*	0*	
9.5	11.9 C	0				
10.0	11.5	0	conduct.= 83			conduct.= 83
10.5	11.2*	0*				
11.0			pH = 7.2	*on bottom		pH = 7.1

Station 1: Secchi Transparency = 3.5
Max. Depth = 10.5

Station 2: Secchi Transparency = 4.0
Max. Depth = 9.0

ADDITIONAL OBSERVATIONS:

- 1A and 2A integrated samples to 6m

LAKE POCOTOPAUG DIAGNOSTIC ASSESSMENT   Date: 17-August 1993

Start Time/End Time: 1:12pm/3:15pm   Wind Speed/Direction: 0 to 5mph South

Cloud Cover: 100% overcast   Air Temp./D.O. Calibration: 26.3C/8ppm

Sampling Conducted By: D.Worden, T.Wells, G.Pfaffenbach, and 4 reporters

FIELD MEASUREMENTS: Temperature (C), Dissolved Oxygen (ppm), Conductivity (umhos/cm), Hydrogen Ion Activity (pH units), Secchi Transparency (m), Maximum Depth (m)

	STATION 1 - OAKWOOD			STATION 2 - MARKHAM		
Depth (m)	Temp.	D.O.		Temp.	D.O.	
0	24.8	7.7	conduct.= 75	24.9	7.7	conduct.= 75
0.5	24.8	7.6		24.9	7.7	
1.0	24.8	7.6	pH = 7.8	24.9	7.7	pH = 7.8
1.5	24.8	7.5		24.9	7.7	
2.0	24.8	7.3		24.9	7.6	
2.5	24.8	7.1		24.8	7.5	
3.0	24.8	6.8		24.8	7.4	
3.5	24.8	6.5		24.8	7.4	
4.0	24.8	6.3		24.8	7.3	
4.5	24.8	5.9		24.7	7.1	
5.0	24.6	5.7		24.2	5.2	
5.5	24.2	4.1		23.4	3.3	
6.0	23.8	3.5	conduct.= 78	21.9 B	0.1	conduct.= 75
6.5	22.9 B	0.9		20.0	0	
7.0	20.7	0.1	pH = 7.3	17.4	0	pH = 7.1
7.5	18.3	0		15.4	0	
8.0	16.4	0		13.6 C	0	
8.5	14.4	0		12.9	0	
9.0	13.6	0		12.4*	0*	
9.5	12.9 C	0				
10.0	11.9	0	conduct.= 91			conduct.= 89
10.5	11.5*	0*				
11.0			pH = 7.4	*on bottom		pH = 7.2

Station 1: Secchi Transparency = 3.1
Max. Depth = 10.5

Station 2: Secchi Transparency = 3.2
Max. Depth = 9.0

ADDITIONAL OBSERVATIONS:

- 1A and 2A integrated samples to 6m

LAKE POCOTOPAUG DIAGNOSTIC ASSESSMENT Date: 22-September 1993

Start Time/End Time: 10:44am/1:30pm Wind Speed/Direction: 5 to 10mph N.E.

Cloud Cover: 100%, some drizzle Air Temp./D.O. Calibration: 15C/10.1ppm

Sampling Conducted By: D. Worden and T. Wells

FIELD MEASUREMENTS: Temperature (C), Dissolved Oxygen (ppm), Conductivity (umhos/cm), Hydrogen Ion Activity (pH units), Secchi Transparency (m), Maximum Depth (m)

	STATION 1 - OAKWOOD			STATION 2 - MARKHAM		
Depth (m)	Temp.	D.O.		Temp.	D.O.	
0	17.4	8.3	conduct.= 62	17.8	8.0	conduct.= 62
0.5	17.5	8.1		17.8	8.0	
1.0	17.5	8.1	pH =	17.8	8.0	pH =
1.5	17.5	8.1		17.8	8.0	
2.0	17.5	7.9		17.8	8.0	
2.5	17.5	7.7		17.8	8.0	
3.0	17.5	7.5		17.8	8.0	
3.5	17.5	7.4		17.8	8.0	
4.0	17.5	7.3		17.8	8.0	
4.5	17.5	7.2		17.8	8.0	
5.0	17.5	7.1		17.8	8.0	
5.5	17.5	7.0		17.8	8.0	
6.0	17.5	7.0	conduct.= 62	17.8	7.8	conduct.= 62
6.5	17.3	7.0		17.8	7.7	
7.0	17.3 B	6.9	pH =	17.8 B	7.5	pH =
7.5	17.3	6.8		17.8	7.4	
8.0	17.3	6.8		17.6	7.0	
8.5	17.2	6.7		17.0 C	4.9	
9.0	17.2	6.6		15.0*	0.2*	
9.5	14.1	1.1				
10.0	12.2	0.2	conduct.= 62			conduct.= 62
10.5	11.9 C	0.1				
11.0	11.8*	0.1*	pH =	*on bottom		pH =

Station 1: Secchi Transparency = 1.1
Max. Depth = 10.75

Station 2: Secchi Transparency = 1.0
Max. Depth = 8.75

ADDITIONAL OBSERVATIONS:

- 1A and 2A integrated samples to 2m
- prepare duplicate samples at 1B, 1C, 2B, and 2C

LABORATORY RESOURCES, INC.

EASTERN SCIENTIFIC DIVISION
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BROOKLYN, CT 06234
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Report to: DAVID WORDEN
FUGRO-McCLELLAND, INC.
P.O. BOX 1840
SANDWICH, MA 02563

Work ID: LAKE POCOTOPAUG EAST HAMPTON
Work Order #: E212053

Date Received: 12/01/92

PO Number: 2129

Analysis Performed	Results	Detection Limits	Date of Analysis	Method of Analysis
Sample ID: LP-1A		Date Collected: 12/01/92		
ALKALINITY	5		12/02/92	EPA 310.1
AMMONIA-N	0.15	0.02	12/02/92	EPA 350.1
CHLORIDE	6.6	0.5	12/02/92	EPA 325.2
NITRATE-N	0.28	0.02	12/02/92	EPA 353.1
TOTAL KJELDAHL NITROGEN-N	0.66	0.03	12/02/92	EPA 351.2
TURBIDITY (NTU)	2.7	0.1	12/01/92	EPA 180.1
CHLOROPHYLL A (mg/cubic m)	7.2	0.010	12/09/92	
PHOSPHOROUS	ND	0.01	12/16/92	EPA 365.2
Sample ID: LP-1C		Date Collected: 12/01/92		
ALKALINITY	10		12/02/92	EPA 310.1
AMMONIA-N	0.14	0.02	12/02/92	EPA 350.1
CHLORIDE	6.6	0.5	12/02/92	EPA 325.2
NITRATE-N	0.27	0.02	12/02/92	EPA 353.1
TOTAL KJELDAHL NITROGEN-N	0.64	0.03	12/02/92	EPA 351.2
TURBIDITY (NTU)	2.5	0.1	12/01/92	EPA 180.1
PHOSPHOROUS	ND	0.01	12/16/92	EPA 365.2
Sample ID: LP-2A		Date Collected: 12/01/92		
ALKALINITY	10		12/02/92	EPA 310.1
AMMONIA-N	0.12	0.02	12/02/92	EPA 350.1
CHLORIDE	6.9	0.5	12/02/92	EPA 325.2
NITRATE-N	0.28	0.02	12/02/92	EPA 353.1
TOTAL KJELDAHL NITROGEN-N	0.58	0.03	12/02/92	EPA 351.2
TURBIDITY (NTU)	2.7	0.1	12/01/92	EPA 180.1
CHLOROPHYLL A (mg/cubic m)	7.8	0.010	12/09/92	
PHOSPHOROUS	ND	0.01	12/16/92	EPA 365.2

All measurements are in mg/l unless otherwise specified
ND = None Detected/Below stated detection limit
All soils/sludges samples reported on a dry weight basis

Analysis Performed	Results	Detection Limits	Date of Analysis	Method of Analysis
Sample ID: LP-2C		Date Collected: 12/01/92		
ALKALINITY	7		12/02/92	EPA 310.1
AMMONIA-N	0.12	0.02	12/02/92	EPA 350.1
CHLORIDE	6.9	0.5	12/02/92	EPA 325.2
NITRATE-N	0.27	0.02	12/02/92	EPA 353.1
TOTAL KJELDAHL NITROGEN-N	0.70	0.03	12/02/92	EPA 351.2
TURBIDITY (NTU)	2.5	0.1	12/01/92	EPA 180.1
PHOSPHOROUS	0.02	0.01	12/16/92	EPA 365.2

All measurements are in mg/l unless otherwise specified
ND = None Detected/Below stated detection limit
All soils/sludges samples reported on a dry weight basis

Report is an accurate analysis of sample received at this laboratory.

T. F. McCommas

T.F. McCommas, Director 12/16/92
Robert LaFerriere, G.M.
CT Laboratory PH 0465

LABORATORY RESOURCES, INC.

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MAY -5 1993

Report to: DAVID WORDEN
FUGRO-McCLELLAND, INC.
P.O. BOX 1840
SANDWICH, MA 02563

Work ID: LAKE POCOTOPAUG-EAST HAMPTON
Work Order #: E304366
(revised report)

Date Received: 04/15/93 PO Number:

Analysis Performed	Results	Detection Limits	Date of Analysis	Method of Analysis
Sample ID: LP-1A		Date Collected: 04/15/93		
ALKALINITY	4		04/26/93	EPA 310.1
AMMONIA-N	ND	0.02	04/21/93	EPA 350.1
CHLORIDE	7.2	0.5	04/16/93	EPA 325.2
NITRATE-N	0.15	0.02	04/15/93	EPA 353.1
TOTAL KJELDAHL NITROGEN-N	0.30	0.03	04/21/93	EPA 351.2
PHOSPHOROUS, TOTAL	0.02	0.01	04/22/93	EPA 365.2
TURBIDITY (NTU)	1.5	0.1	04/15/93	EPA 180.1
CHLOROPHYLL A (mg/cubic m)	0.31	0.01	04/29/93	
Sample ID: LP-1C		Date Collected: 04/15/93		
ALKALINITY	5		04/26/93	EPA 310.1
AMMONIA-N	0.04	0.02	04/21/93	EPA 350.1
CHLORIDE	7.1	0.5	04/16/93	EPA 325.2
NITRATE-N	0.16	0.02	04/15/93	EPA 353.1
TOTAL KJELDAHL NITROGEN-N	0.30	0.03	04/21/93	EPA 351.2
PHOSPHOROUS, TOTAL	0.02	0.01	04/22/93	EPA 365.2
TURBIDITY (NTU)	1.5	0.1	04/15/93	EPA 180.1
Sample ID: LP-2A		Date Collected: 04/15/93		
ALKALINITY	7		04/26/93	EPA 310.1
AMMONIA-N	0.03	0.02	04/21/93	EPA 350.1
CHLORIDE	7.7	0.5	04/16/93	EPA 325.2
NITRATE-N	0.16	0.02	04/15/93	EPA 353.1
TOTAL KJELDAHL NITROGEN-N	0.31	0.03	04/21/93	EPA 351.2
PHOSPHOROUS, TOTAL	0.01	0.01	04/22/93	EPA 365.2
TURBIDITY (NTU)	1.4	0.1	04/15/93	EPA 180.1
CHLOROPHYLL A (mg/cubic m)	0.41	0.01	04/29/93	

All measurements are in mg/l unless otherwise specified
ND = None Detected/Below stated detection limit
All soils/sludges samples reported on a dry weight basis

Analysis Performed	Results	Detection Limits	Date of Analysis	Method of Analysis
Sample ID: LP-2C		Date Collected: 04/15/93		
ALKALINITY	6		04/26/93	EPA 310.1
AMMONIA-N	0.10	0.02	04/21/93	EPA 350.1
CHLORIDE	7.8	0.5	04/16/93	EPA 325.2
NITRATE-N	0.19	0.02	04/15/93	EPA 353.1
TOTAL KJELDAHL NITROGEN-N	0.28	0.03	04/21/93	EPA 351.2
PHOSPHOROUS, TOTAL	0.02	0.01	04/22/93	EPA 365.2
TURBIDITY (NTU)	1.5	0.1	04/15/93	EPA 180.1

All measurements are in mg/l unless otherwise specified
ND = None Detected/Below stated detection limit
All soils/sludges samples reported on a dry weight basis

Report is an accurate analysis of sample received at this laboratory.

T. F. McCommas

T.F. McCommas, Director 05/03/93
Robert LaFerriere, G.M.
CT Laboratory PH 0465

LABORATORY RESOURCES, INC.

EASTERN SCIENTIFIC DIVISION
RTE 205 THE REGIONAL BLDG.
P.O. BOX 700
BROOKLYN, CT 06234
TEL.-(203)774-6814 FAX-(203)774-2689

Report to: DAVID WORDEN
FUGRO-McCLELLAND, INC.
P.O. BOX 1840
SANDWICH, MA 02563

Work ID: LAKE POCOTOPAUG
Work Order #: E305506

Date Received: 05/18/93

PO Number: NONE GIVEN

Analysis Performed	Results	Detection Limits	Date of Analysis	Method of Analysis
Sample ID: LP-1A		Date Collected: 05/18/93		
ALKALINITY	6		05/21/93	EPA 310.1
AMMONIA-N	0.02	0.02	05/27/93	EPA 350.1
CHLORIDE	7.0	0.5	05/25/93	EPA 325.2
NITRATE-N	ND	0.02	05/21/93	EPA 353.1
TOTAL KJELDAHL NITROGEN-N	0.34	0.03	05/28/93	EPA 351.2
TOTAL PHOSPHOROUS	0.01	0.01	05/26/93	EPA 365.2
TURBIDITY (NTU)	1.0	0.1	05/19/93	EPA 180.1
CHLOROPHYLL A (mg/cubic m)	2.07	0.01	06/01/93	
Sample ID: LP-1B		Date Collected: 05/18/93		
ALKALINITY	8		05/21/93	EPA 310.1
AMMONIA-N	0.07	0.02	05/27/93	EPA 350.1
CHLORIDE	6.9	0.5	05/25/93	EPA 325.2
NITRATE-N	ND	0.02	05/21/93	EPA 353.1
TOTAL KJELDAHL NITROGEN-N	0.64	0.03	05/28/93	EPA 351.2
TOTAL PHOSPHOROUS	0.03	0.01	05/26/93	EPA 365.2
TURBIDITY (NTU)	1.2	0.1	05/19/93	EPA 180.1
Sample ID: LP-1C		Date Collected: 05/18/93		
ALKALINITY	9		05/21/93	EPA 310.1
AMMONIA-N	0.28	0.02	05/27/93	EPA 350.1
CHLORIDE	6.6	0.5	05/25/93	EPA 325.2
NITRATE-N	ND	0.02	05/21/93	EPA 353.1
TOTAL KJELDAHL NITROGEN-N	0.62	0.03	05/28/93	EPA 351.2
TOTAL PHOSPHOROUS	0.57	0.01	05/26/93	EPA 365.2
TURBIDITY (NTU)	1.1	0.1	05/19/93	EPA 180.1

All measurements are in mg/l unless otherwise specified
ND = None Detected/Below stated detection limit
All soils/sludges samples reported on a dry weight basis

Analysis Performed	Results	Detection Limits	Date of Analysis	Method of Analysis
Sample ID: LP-2A		Date Collected: 05/18/93		
ALKALINITY	5		05/24/93	EPA 310.1
AMMONIA-N	0.07	0.02	05/27/93	EPA 350.1
CHLORIDE	6.9	0.5	05/25/93	EPA 325.2
NITRATE-N	ND	0.02	05/21/93	EPA 353.1
TOTAL KJELDAHL NITROGEN-N	0.36	0.03	05/28/93	EPA 351.2
TOTAL PHOSPHOROUS	0.01	0.01	05/26/93	EPA 365.2
TURBIDITY (NTU)	1.0	0.1	05/19/93	EPA 180.1
CHLOROPHYLL A (mg/cubic m)	2.33	0.01	06/01/93	
Sample ID: LP-2B		Date Collected: 05/18/93		
ALKALINITY	13		05/24/93	EPA 310.1
AMMONIA-N	0.06	0.02	05/27/93	EPA 350.1
CHLORIDE	8.2	0.5	05/25/93	EPA 325.2
NITRATE-N	0.90	0.02	05/21/93	EPA 353.1
TOTAL KJELDAHL NITROGEN-N	0.46	0.03	05/28/93	EPA 351.2
TOTAL PHOSPHOROUS	0.01	0.01	05/26/93	EPA 365.2
TURBIDITY (NTU)	2.0	0.1	05/19/93	EPA 180.1
Sample ID: LP-2C		Date Collected: 05/18/93		
ALKALINITY	8		05/24/93	EPA 310.1
AMMONIA-N	0.23	0.02	05/27/93	EPA 350.1
CHLORIDE	6.8	0.5	05/25/93	EPA 325.2
NITRATE-N	ND	0.02	05/21/93	EPA 353.1
TOTAL KJELDAHL NITROGEN-N	0.64	0.03	05/28/93	EPA 351.2
TOTAL PHOSPHOROUS	0.02	0.01	05/26/93	EPA 365.2
TURBIDITY (NTU)	1.1	0.1	05/19/93	EPA 180.1

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ND = None Detected/Below stated detection limit
All soils/sludges samples reported on a dry weight basis

Report is an accurate analysis of
sample received at this laboratory.

T.F. McCommas, Director 06/01/93
Robert LaFerriere, G.M.
CT Laboratory PH 0465

LABORATORY RESOURCES, INC.

EASTERN SCIENTIFIC DIVISION
RTE 205 THE REGIONAL BLDG.
P.O. BOX 700
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TEL.-(203)774-6814 FAX-(203)774-2689

Report to: DAVID WORDEN
FUGRO-McCLELLAND, INC.
P.O. BOX 1840
SANDWICH, MA 02563

Work ID: LAKE PCOTOPAUG
Work Order #: E306664

Date Received: 06/23/93

PO Number:

Analysis Performed	Results	Detection Limits	Date of Analysis	Method of Analysis
Sample ID: LP-1A		Date Collected: 06/23/93		
ALKALINITY	5.0		07/03/93	EPA 310.1
AMMONIA-N	ND	0.02	06/24/93	EPA 350.1
CHLORIDE	8.4	0.5	06/24/93	EPA 325.2
NITRATE-N	ND	0.02	06/24/93	EPA 353.1
TOTAL KJELDAHL NITROGEN-N	0.42	0.03	06/25/93	EPA 351.2
TOTAL PHOSPHOROUS	ND	0.01	06/24/93	EPA 365.2
TURBIDITY (NTU)	0.5	0.1	06/23/93	EPA 180.1
CHLOROPHYLL A (mg/cubic m)	6.4	0.01	07/07/93	
Sample ID: LP-1B		Date Collected: 06/23/93		
ALKALINITY	6.0		07/03/93	EPA 310.1
AMMONIA-N	ND	0.02	06/24/93	EPA 350.1
CHLORIDE	8.2	0.5	06/24/93	EPA 325.2
NITRATE-N	ND	0.02	06/24/93	EPA 353.1
TOTAL KJELDAHL NITROGEN-N	0.38	0.03	06/25/93	EPA 351.2
TOTAL PHOSPHOROUS	ND	0.01	06/24/93	EPA 365.2
TURBIDITY (NTU)	0.5	0.1	06/23/93	EPA 180.1
Sample ID: LP-1C		Date Collected: 06/23/93		
ALKALINITY	20		07/03/93	EPA 310.1
AMMONIA-N	0.66	0.02	06/24/93	EPA 350.1
CHLORIDE	7.8	0.5	06/24/93	EPA 325.2
NITRATE-N	ND	0.02	06/24/93	EPA 353.1
TOTAL KJELDAHL NITROGEN-N	1.0	0.03	06/25/93	EPA 351.2
TOTAL PHOSPHOROUS	0.01	0.01	06/24/93	EPA 365.2
TURBIDITY (NTU)	1.7	0.1	06/23/93	EPA 180.1

All measurements are in mg/l unless otherwise specified
ND = None Detected/Below stated detection limit
All soils/sludges samples reported on a dry weight basis

Analysis Performed	Results	Detection Limits	Date of Analysis	Method of Analysis
Sample ID: LP-2A		Date Collected: 06/23/93		
ALKALINITY	7.0		07/03/93	EPA 310.1
AMMONIA-N	ND	0.02	06/24/93	EPA 350.1
CHLORIDE	8.2	0.5	06/24/93	EPA 325.2
NITRATE-N	ND	0.02	06/24/93	EPA 353.1
TOTAL KJELDAHL NITROGEN-N	0.64	0.03	06/25/93	EPA 351.2
TOTAL PHOSPHOROUS	0.01	0.01	06/24/93	EPA 365.2
TURBIDITY (NTU)	0.6	0.1	06/23/93	EPA 180.1
CHLOROPHYLL A (mg/cubic m)	7.0	0.01	07/07/93	
Sample ID: LP-2B		Date Collected: 06/23/93		
ALKALINITY	17		07/03/93	EPA 310.1
AMMONIA-N	ND	0.02	06/24/93	EPA 350.1
CHLORIDE	8.0	0.5	06/24/93	EPA 325.2
NITRATE-N	ND	0.02	06/24/93	EPA 353.1
TOTAL KJELDAHL NITROGEN-N	0.51	0.03	06/25/93	EPA 351.2
TOTAL PHOSPHOROUS	ND	0.01	06/24/93	EPA 365.2
TURBIDITY (NTU)	0.6	0.1	06/23/93	EPA 180.1
Sample ID: LP-2C		Date Collected: 06/23/93		
ALKALINITY	6.0		07/03/93	EPA 310.1
AMMONIA-N	0.42	0.02	06/24/93	EPA 350.1
CHLORIDE	8.2	0.5	06/24/93	EPA 325.2
NITRATE-N	ND	0.02	06/24/93	EPA 353.1
TOTAL KJELDAHL NITROGEN-N	0.93	0.03	06/25/93	EPA 351.2
TOTAL PHOSPHOROUS	0.02	0.01	06/24/93	EPA 365.2
TURBIDITY (NTU)	2.0	0.1	06/23/93	EPA 180.1

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All soils/sludges samples reported on a dry weight basis

Report is an accurate analysis of sample received at this laboratory.

T. F. McCommas

T.F. McCommas, Director 07/07/93
Robert LaFerriere, G.M.
CT Laboratory PH 0465

LABORATORY RESOURCES, INC.

EASTERN SCIENTIFIC DIVISION
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Report to: DAVID WORDEN
FUGRO-McCLELLAND, INC.
P.O. BOX 1840
SANDWICH, MA 02563

Work ID: LAKE POCOTOPAUG
Work Order #: E307511

Date Received: 07/21/93

PO Number: NONE GIVEN

Analysis Performed	Results	Detection Limits	Date of Analysis	Method of Analysis
Sample ID: LP-1A		Date Collected: 07/21/93		
ALKALINITY	6		07/29/93	EPA 310.1
AMMONIA-N	0.05	0.02	07/22/93	EPA 350.1
CHLORIDE	8.7	0.5	07/21/93	EPA 325.2
NITRATE-N	ND	0.02	07/21/93	EPA 353.1
TOTAL KJELDAHL NITROGEN-N	0.47	0.03	07/27/93	EPA 351.2
TOTAL PHOSPHOROUS	0.02	0.01	07/26/93	EPA 365.2
TURBIDITY (NTU)	0.6	0.1	07/21/93	EPA 180.1
CHLOROPHYLL A (mg/cubic m)	10.5	0.01	08/02/93	
Sample ID: LP-1B		Date Collected: 07/21/93		
ALKALINITY	20		07/29/93	EPA 310.1
AMMONIA-N	0.04	0.02	07/22/93	EPA 350.1
CHLORIDE	8.9	0.5	07/21/93	EPA 325.2
NITRATE-N	ND	0.02	07/21/93	EPA 353.1
TOTAL KJELDAHL NITROGEN-N	0.41	0.03	07/27/93	EPA 351.2
TOTAL PHOSPHOROUS	0.02	0.01	07/26/93	EPA 365.2
TURBIDITY (NTU)	0.7	0.1	07/21/93	EPA 180.1
Sample ID: LP-1C		Date Collected: 07/21/93		
ALKALINITY	26		07/29/93	EPA 310.1
AMMONIA-N	0.70	0.02	07/22/93	EPA 350.1
CHLORIDE	8.3	0.5	07/21/93	EPA 325.2
NITRATE-N	ND	0.02	07/21/93	EPA 353.1
TOTAL KJELDAHL NITROGEN-N	0.94	0.03	07/27/93	EPA 351.2
TOTAL PHOSPHOROUS	0.04	0.01	07/26/93	EPA 365.2
TURBIDITY (NTU)	2.5	0.1	07/21/93	EPA 180.1

All measurements are in mg/l unless otherwise specified
ND = None Detected/Below stated detection limit
All soils/sludges samples reported on a dry weight basis

Analysis Performed	Results	Detection Limits	Date of Analysis	Method of Analysis
Sample ID: LP-2A		Date Collected: 07/21/93		
ALKALINITY	4		07/29/93	EPA 310.1
AMMONIA-N	0.07	0.02	07/22/93	EPA 350.1
CHLORIDE	8.9	0.5	07/21/93	EPA 325.2
NITRATE-N	ND	0.02	07/21/93	EPA 353.1
TOTAL KJELDAHL NITROGEN-N	0.30	0.03	07/27/93	EPA 351.2
TOTAL PHOSPHOROUS	ND	0.01	07/26/93	EPA 365.2
TURBIDITY (NTU)	0.5	0.1	07/21/93	EPA 180.1
CHLOROPHYLL A (mg/cubic m)	15.0	0.01	08/02/93	
Sample ID: LP-2B		Date Collected: 07/21/93		
ALKALINITY	4		07/29/93	EPA 310.1
AMMONIA-N	0.15	0.02	07/22/93	EPA 350.1
CHLORIDE	8.9	0.5	07/21/93	EPA 325.2
NITRATE-N	ND	0.02	07/21/93	EPA 353.1
TOTAL KJELDAHL NITROGEN-N	0.34	0.03	07/27/93	EPA 351.2
TOTAL PHOSPHOROUS	ND	0.01	07/26/93	EPA 365.2
TURBIDITY (NTU)	0.6	0.1	07/21/93	EPA 180.1
Sample ID: LP-2C		Date Collected: 07/21/93		
ALKALINITY	31		07/31/93	EPA 310.1
AMMONIA-N	0.51	0.02	07/22/93	EPA 350.1
CHLORIDE	9.0	0.5	07/21/93	EPA 325.2
NITRATE-N	0.02	0.02	07/21/93	EPA 353.1
TOTAL KJELDAHL NITROGEN-N	0.95	0.03	07/27/93	EPA 351.2
TOTAL PHOSPHOROUS	0.06	0.01	07/26/93	EPA 365.2
TURBIDITY (NTU)	6.8	0.1	07/21/93	EPA 180.1

All measurements are in mg/l unless otherwise specified
ND = None Detected/Below stated detection limit
All soils/sludges samples reported on a dry weight basis

Report is an accurate analysis of sample received at this laboratory.

T.F. McCommas, Director 08/04/93
Robert LaFerriere, G.M.
CT Laboratory PH 0465

LABORATORY RESOURCES, INC.

EASTERN SCIENTIFIC DIVISION
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Report to: DAVID WORDEN
FUGRO-McCLELLAND, INC.
P.O. BOX 1840
SANDWICH, MA 02563

Work ID: EAST HAMPTON
Work Order #: E308549

Date Received: 08/17/93

PO Number: NONE GIVEN

Analysis Performed	Results	Detection Limits	Date of Analysis	Method of Analysis
Sample ID: LP-1A		Date Collected: 08/17/93		
ALKALINITY	7		08/27/93	EPA 310.1
AMMONIA-N	0.06	0.02	08/18/93	EPA 350.1
CHLORIDE	7.9	0.5	08/20/93	EPA 325.2
NITRATE-N	0.06	0.02	08/20/93	EPA 353.1
TOTAL KJELDAHL NITROGEN-N	0.47	0.03	08/21/93	EPA 351.2
TOTAL PHOSPHOROUS	0.02	0.01	08/19/93	EPA 365.2
TURBIDITY (NTU)	1.6	0.1	08/21/93	EPA 180.1
CHLOROPHYLL A (mg/cubic m)	2.0	0.01	08/31/93	
Sample ID: LP-1B		Date Collected: 08/17/93		
ALKALINITY	8		08/27/93	EPA 310.1
AMMONIA-N	0.11	0.02	08/18/93	EPA 350.1
CHLORIDE	7.7	0.5	08/20/93	EPA 325.2
NITRATE-N	0.03	0.02	08/20/93	EPA 353.1
TOTAL KJELDAHL NITROGEN-N	0.39	0.03	08/21/93	EPA 351.2
TOTAL PHOSPHOROUS	0.02	0.01	08/19/93	EPA 365.2
TURBIDITY (NTU)	1.0	0.1	08/21/93	EPA 180.1
Sample ID: LP-1C		Date Collected: 08/17/93		
ALKALINITY	35		08/27/93	EPA 310.1
AMMONIA-N	1.6	0.2	08/18/93	EPA 350.1
CHLORIDE	7.4	0.5	08/20/93	EPA 325.2
NITRATE-N	ND	0.02	08/20/93	EPA 353.1
TOTAL KJELDAHL NITROGEN-N	1.3	0.03	08/31/93	EPA 351.2
TOTAL PHOSPHOROUS	0.02	0.01	08/19/93	EPA 365.2
TURBIDITY (NTU)	6.2	0.1	08/21/93	EPA 180.1

All measurements are in mg/l unless otherwise specified
ND = None Detected/Below stated detection limit
All soils/sludges samples reported on a dry weight basis

Analysis Performed	Results	Detection Limits	Date of Analysis	Method of Analysis
Sample ID: LP-2A		Date Collected: 08/17/93		
ALKALINITY	8		08/27/93	EPA 310.1
AMMONIA-N	0.04	0.02	08/18/93	EPA 350.1
CHLORIDE	7.5	0.5	08/20/93	EPA 325.2
NITRATE-N	0.02	0.02	08/20/93	EPA 353.1
TOTAL KJELDAHL NITROGEN-N	0.34	0.03	08/21/93	EPA 351.2
TOTAL PHOSPHOROUS	0.01	0.01	08/19/93	EPA 365.2
TURBIDITY (NTU)	1.6	0.1	08/21/93	EPA 180.1
CHLOROPHYLL A (mg/cubic m)	2.2	0.01	08/31/93	
Sample ID: LP-2B		Date Collected: 08/17/93		
ALKALINITY	9		08/27/93	EPA 310.1
AMMONIA-N	0.10	0.02	08/18/93	EPA 350.1
CHLORIDE	7.6	0.5	08/20/93	EPA 325.2
NITRATE-N	ND	0.02	08/20/93	EPA 353.1
TOTAL KJELDAHL NITROGEN-N	3.1	0.1	08/21/93	EPA 351.2
TOTAL PHOSPHOROUS	0.01	0.01	08/19/93	EPA 365.2
TURBIDITY (NTU)	1.5	0.1	08/21/93	EPA 180.1
Sample ID: LP-2C		Date Collected: 08/17/93		
ALKALINITY	27		08/27/93	EPA 310.1
AMMONIA-N	0.63	0.02	08/18/93	EPA 350.1
CHLORIDE	7.5	0.5	08/20/93	EPA 325.2
NITRATE-N	ND	0.02	08/20/93	EPA 353.1
TOTAL KJELDAHL NITROGEN-N	ND	0.03	08/31/93	EPA 351.2
TOTAL PHOSPHOROUS	0.02	0.01	08/19/93	EPA 365.2
TURBIDITY (NTU)	3.7	0.1	08/21/93	EPA 180.1

All measurements are in mg/l unless otherwise specified
ND = None Detected/Below stated detection limit
All soils/sludges samples reported on a dry weight basis

Report is an accurate analysis of
sample received at this laboratory.

T.F. McCommas

T.F. McCommas, Director 09/01/93
Robert LaFerriere, G.M.
CT Laboratory PH 0465

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Report to: DAVID WORDEN
FUGRO-McCLELLAND, INC.
P.O. BOX 1840
SANDWICH, MA 02563

Work ID: LAKE POCOTOPAUG
Work Order #: E309664

Date Received: 09/22/93 PO Number:

Analysis Performed	Results	Detection Limits	Date of Analysis	Method of Analysis
Sample ID: LP-1A		Date Collected: 09/22/93		
ALKALINITY	9		09/30/93	EPA 310.1
AMMONIA-N	0.16	0.02	09/27/93	EPA 350.1
CHLORIDE	17	0.5	09/24/93	EPA 325.2
NITRATE-N	ND	0.02	09/24/93	EPA 353.1
pH (units)	7.2		09/23/93	EPA 150.1
TOTAL KJELDAHL NITROGEN-N	0.63	0.03	09/27/93	EPA 351.2
TOTAL PHOSPHOROUS	1.2	0.05	09/30/93	EPA 365.2
TURBIDITY (NTU)	3.0	0.1	09/23/93	EPA 180.1
CHLOROPHYLL A (mg/cubic m)	2.18	0.01	09/29/93	
Sample ID: LP-1B		Date Collected: 09/22/93		
ALKALINITY	7		09/30/93	EPA 310.1
AMMONIA-N	0.12	0.02	09/27/93	EPA 350.1
CHLORIDE	8.1	0.5	09/24/93	EPA 325.2
NITRATE-N	ND	0.02	09/24/93	EPA 353.1
pH (units)	6.8		09/23/93	EPA 150.1
TOTAL KJELDAHL NITROGEN-N	0.49	0.03	09/27/93	EPA 351.2
TOTAL PHOSPHOROUS	0.45	0.01	09/30/93	EPA 365.2
TURBIDITY (NTU)	3.5	0.1	09/23/93	EPA 180.1

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All soils/sludges samples reported on a dry weight basis

Work Order #: E309664

Analysis Performed	Results	Detection Limits	Date of Analysis	Method of Analysis
Sample ID: LP-1C		Date Collected: 09/22/93		
ALKALINITY	9		09/30/93	EPA 310.1
AMMONIA-N	0.09	0.02	09/27/93	EPA 350.1
CHLORIDE	8.0	0.5	09/24/93	EPA 325.2
NITRATE-N	ND	0.02	09/24/93	EPA 353.1
pH (units)	7.4		09/23/93	EPA 150.1
TOTAL KJELDAHL NITROGEN-N	0.65	0.03	09/27/93	EPA 351.2
TOTAL PHOSPHOROUS	0.21	0.01	09/30/93	EPA 365.2
TURBIDITY (NTU)	3.3	0.1	09/23/93	EPA 180.1
Sample ID: LP-2A		Date Collected: 09/22/93		
ALKALINITY	9		09/30/93	EPA 310.1
AMMONIA-N	0.06	0.02	09/27/93	EPA 350.1
CHLORIDE	8.1	0.5	09/24/93	EPA 325.2
NITRATE-N	ND	0.02	09/24/93	EPA 353.1
pH (units)	6.8		09/23/93	EPA 150.1
TOTAL KJELDAHL NITROGEN-N	0.45	0.03	09/27/93	EPA 351.2
TOTAL PHOSPHOROUS	0.05	0.01	09/30/93	EPA 365.2
TURBIDITY (NTU)	3.2	0.1	09/23/93	EPA 180.1
CHLOROPHYLL A (mg/cubic m)	2.12	0.01	09/29/93	
Sample ID: LP-2B		Date Collected: 09/22/93		
ALKALINITY	7		09/30/93	EPA 310.1
AMMONIA-N	0.23	0.02	09/27/93	EPA 350.1
CHLORIDE	8.1	0.5	09/24/93	EPA 325.2
NITRATE-N	ND	0.02	09/24/93	EPA 353.1
pH (units)	7.2		09/23/93	EPA 150.1
TOTAL KJELDAHL NITROGEN-N	0.50	0.03	09/27/93	EPA 351.2
TOTAL PHOSPHOROUS	0.03	0.01	09/30/93	EPA 365.2
TURBIDITY (NTU)	3.5	0.1	09/23/93	EPA 180.1
Sample ID: LP-2C		Date Collected: 09/22/93		
ALKALINITY	9		09/30/93	EPA 310.1
AMMONIA-N	0.11	0.02	09/27/93	EPA 350.1
CHLORIDE	8.0	0.5	09/24/93	EPA 325.2
NITRATE-N	ND	0.02	09/24/93	EPA 353.1
pH (units)	7.2		09/23/93	EPA 150.1
TOTAL KJELDAHL NITROGEN-N	0.51	0.03	09/27/93	EPA 351.2
TOTAL PHOSPHOROUS	0.02	0.01	09/30/93	EPA 365.2
TURBIDITY (NTU)	3.0	0.1	09/23/93	EPA 180.1

All measurements are in mg/l unless otherwise specified
ND = None Detected/Below stated detection limit
All soils/sludges samples reported on a dry weight basis

Report is an accurate analysis of
sample received at this laboratory.

T.F. McCommas, Director 10/05/93
Robert LaFerriere, G.M.
CT Laboratory PH 0465

Summary of Water Quality Measurements: Lake Pocotopaug - East Hampton, Connecticut

	Dec. 1 '92	1993 15-Apr	18-May	23-Jun	21-Jul	17-Aug	22-Sep	Median	Minimum	Maximum
Alkalinity (ppm)										
LP-1A	5	4	6	5	6	7	9	6	4	9
LP-1B			8	6	20	8	7	8	6	20
LP-1C	10	5	9	20	26	35	9	10	5	35
LP-2A	10	7	5	7	4	8	9	7	4	10
LP-2B				17	4	9	7	8	4	17
LP-2C	7	6	8	6	31	27	9	8	6	31
Ammonia-N (ppb)										
LP-1A	150	20	20	20	50	60	160	50	20	160
LP-1B			70	20	40	110	120	70	20	120
LP-1C	140	40	280	660	700	1600	90	280	40	1600
LP-2A	120	30	70	20	70	40	60	60	20	120
LP-2B				20	150	100	230	125	20	230
LP-2C	120	100	230	420	510	630	110	230	100	630
Chloride (ppm)										
LP-1A	6.6	7.2	7	8.4	8.7	7.9	17	7.9	6.6	17
LP-1B			6.9	8.2	8.9	7.7	8.1	8.1	6.9	8.9
LP-1C	6.6	7.1	6.6	7.8	8.3	7.4	8	7.4	6.6	8.3
LP-2A	6.9	7.7	6.9	8.2	8.9	7.5	8.1	7.7	6.9	8.9
LP-2B				8	8.9	7.6	8.1	7.6	8.05	8.9
LP-2C	6.9	7.8	6.8	8.2	9	7.5	8	7.8	6.8	9
Nitrate-N (ppb)										
LP-1A	280	150	20	20	20	60	20	20	20	280
LP-1B			20	20	20	30	20	20	20	30
LP-1C	270	160	20	20	20	20	20	20	20	270
LP-2A	280	160	20	20	20	20	20	20	20	280
LP-2B				20	20	20	20	20	20	20
LP-2C	270	190	20	20	20	20	20	20	20	270

Summary of Water Quality Measurements (continued)

	Dec. 1 '92	1993 15-Apr	18-May	23-Jun	21-Jul	17-Aug	22-Sep	Median	Minimum	Maximum
Organic-N (ppb)										
LP-1A	510	300	340	420	420	410	470	420	300	510
LP-1B			570	380	370	280	370	370	280	570
LP-1C	500	260	340	340	240	error	560	340	240	560
LP-2A	460	280	290	640	230	300	390	300	230	640
LP-2B				510	190	3000	270	390	190	3000
LP-2C	580	180	410	510	440	error	400	425	180	580
Turbidity (NTUs)										
LP-1A	2.7	1.5	1	0.5	0.6	1.6	3	1.5	0.5	3
LP-1B			1.2	0.5	0.7	1	3.5	1	0.5	3.5
LP-1C	2.5	1.5	1.1	1.7	2.5	6.2	3.3	2.5	1.1	6.2
LP-2A	2.7	1.4	1	0.6	0.5	1.6	3.2	1.4	0.5	3.2
LP-2B				0.6	0.6	1.5	3.5	1.05	0.6	3.5
LP-2C	2.5	1.5	1.1	2	6.8	3.7	3	2.5	1.1	6.8
Total Phosphorus (ppb)										
LP-1A	10	20	10	10	20	20	1200	20	10	1200
LP-1B			30	10	20	20	450	20	10	450
LP-1C	10	20	570	10	40	20	210	20	10	570
LP-2A	10	10	10	10	10	10	50	10	10	50
LP-2B				10	10	10	30	10	10	30
LP-2C	20	20	20	20	60	20	20	20	20	60
Chlorophyll-A (ppb)										
LP-1A	7.2	0.31	2.07	6.4	10.5	2	2.18	2.18	0.31	10.5
LP-2A	7.8	0.41	2.33	7	15	2.2	2.12	2.33	0.41	15
Secchi Transparency (m)										
LP-1	1.7	2.3	1.9	3.9	3.5	3.1	1.1	2.3	1.1	3.9
LP-2	1.9	2.6	2.2	3.9	4	3.2	1	2.6	1	4

Summary of Water Quality Measurements (continued)

	Dec. 1 '92	1993 15-Apr	18-May	23-Jun	21-Jul	17-Aug	22-Sep	Median	Minimum	Maximum
Conductivity (umhos/cm)										
LP-1A	47	44	65	72	77	75	62	65	44	77
LP-1B			63	72	76	78	62	72	62	78
LP-1C	48	44	58	76	83	91	62	62	44	91
LP-2A	48	48	66	78	78	75	62	66	48	78
LP-2B			62	72	78	75	62	72	62	78
LP-2C	49	48	59	73	83	89	62	62	48	89
Hydrogen Ion Activity (pH units)										
LP-1A	6.7	7.3	7.2	7.8	7.7	7.8	7.2	7.3	6.7	7.8
LP-1B			7.8	7.8	7	7.3	6.8	7.3	6.8	7.8
LP-1C	6.7	7.1	6.6	7.1	7.2	7.4	7.4	7.1	6.6	7.4
LP-2A	6.6	7.2	7.3	7.8	7.5	7.8	6.8	7.3	6.6	7.8
LP-2B			7.2	7.6	7.4	7.1	7.2	7.2	7.1	7.6
LP-2C	6.6	7.1	6.5	6.9	7.1	7.2	7.2	7.1	6.5	7.2