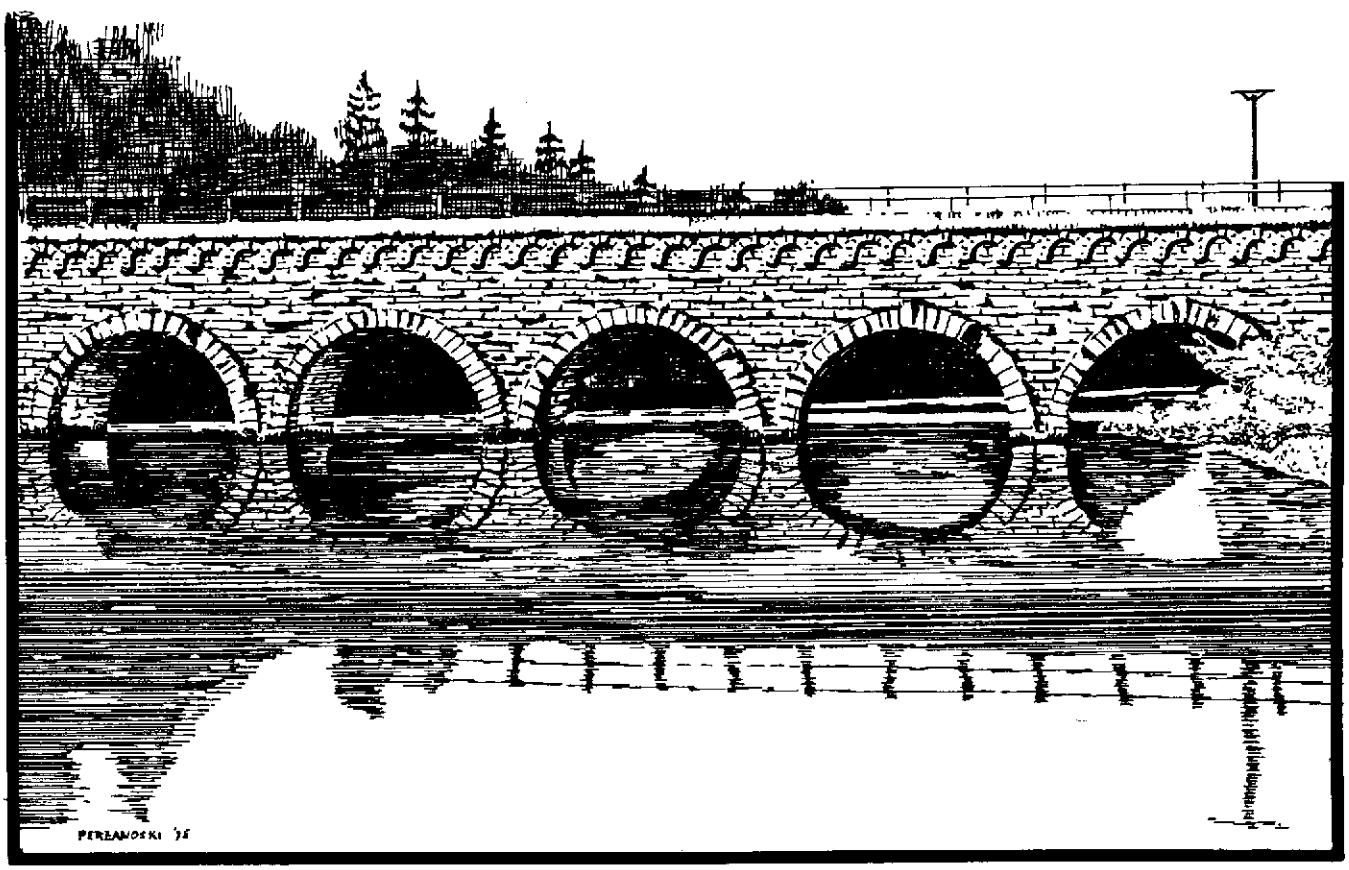
1974 ASSABET RIVER BASIN

Baseline Water Quality Studies of Selected Lakes and Ponds



Massachusetts Department of Environmental Quality Engineering

DIVISION of WATER POLLUTION CONTROL

Thomas C. McMahon, Director

BASELINE WATER QUALITY SURVEYS OF SELECTED LAKES AND PONDS IN THE ASSABET RIVER BASIN 1974

Eben W. Chesebrough, M.S.
Senior Chemist

Arthur J. Screpetis
Biologist

Water Quality Section
Massachusetts Division of Water Pollution Control

Westborough, Massachusetts
March 1976

Cover

Aqueduct Traversing the Assabet River
at Northborough, Massachusetts

Publication Number: 13,160-64-140-3-83-C.R.
Approved by John J. Manton, State Purchasing Agent

ACKNOWLEDGMENTS

The Division of Water Pollution Control wishes to thank those whose efforts have made the 1974 Assabet River Basin Baseline Lake Surveys and this report possible. The following groups and individuals have been particularly helpful:

George Minasian and the staff of the Lawrence Experiment Station who performed the analyses on the chemical samples from the lake studies.

Matthew Scott and the Maine Department of Environmental Protection for advice on methodology.

The Massachusetts Division of Fisheries and Wildlife who provided much unpublished data included within the appendices.

Stephen Travis of the Massachusetts Division of Water Pollution Control, Water Quality Section, who performed the identification of the lake macroinvertebrates.

TABLE OF CONTENTS

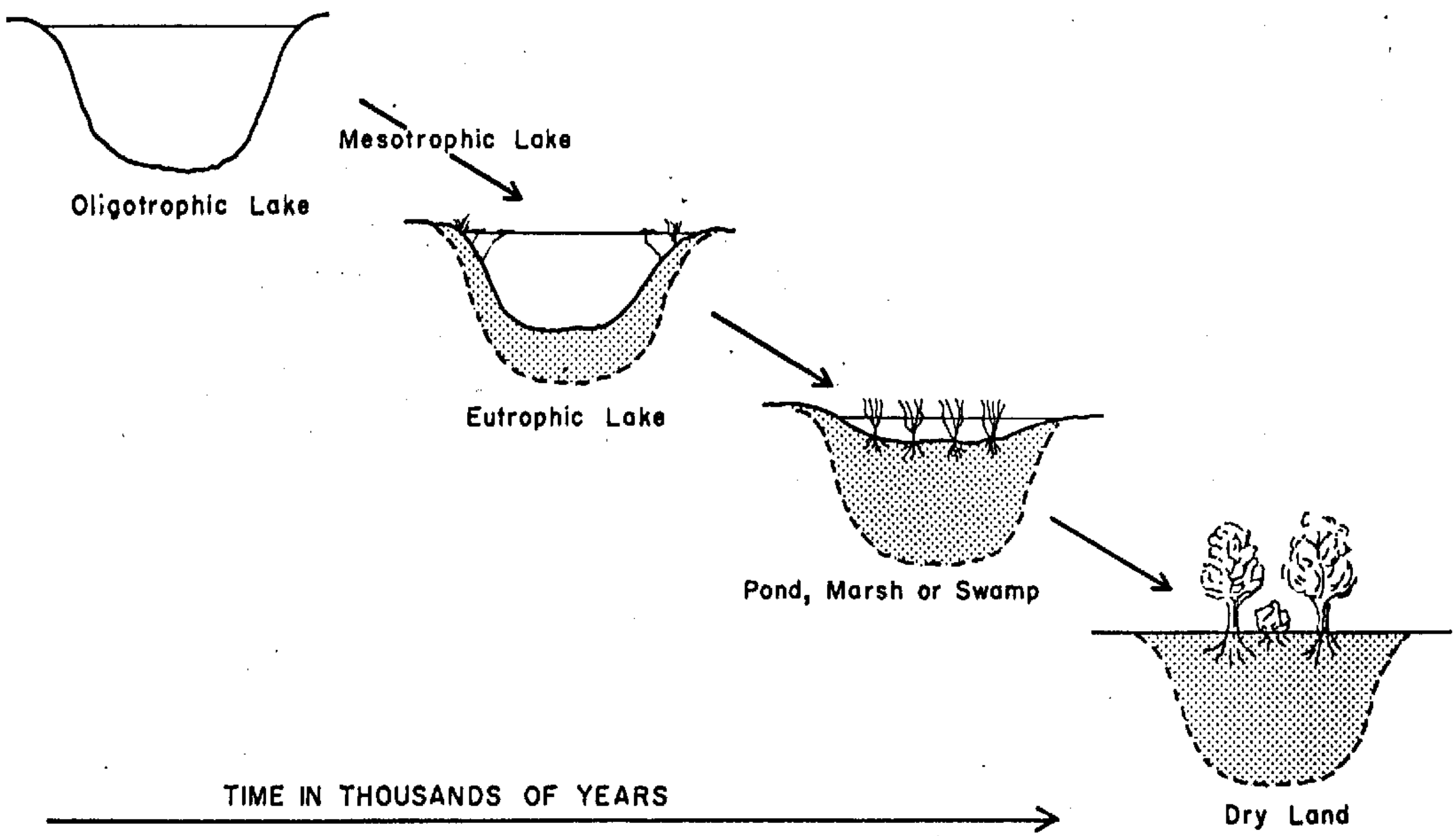
LIST OF TABLES

LIST OF FIGURES

A NOTE ON LIMNOLOGY AND THE LAKE AS AN ECOSYSTEM

Limnology is the study of inland fresh waters, especially lakes and ponds (lentic water vs. lotic water for streams and rivers). The science encompasses the geological, physical, chemical, and biological events that operate together in a lake basin and are dependent on each other (Hutchinson, 1957). It is the study of both biotic and abiotic features that make up a lake's ecosystem. As pointed out by Dillon (1974) and others before him, in order to understand lake conditions, one must realize that the entire watershed and not just the lake, or the lake and its shoreline, is the basic ecosystem. A very important factor, and one on which the life of the lake depends, is the gravitational movement of minerals from the watershed to the lake. Admittedly, the report contained herein concentrates mainly on the lake itself. Yet the foremost problem affecting the lakes and ponds today is accelerated cultural eutrophication, which originates in the watershed and is translated into various and sundry non-point sources of pollution. A great deal of lake restoration projects will have to focus on shoreland and lake watershed management.

FIGURE A



EUTROPHICATION – the process of aging by ecological succession.

Source: Measures for the Restoration and Enhancement of Quality of Freshwater Lakes. Washington, D.C.: United States Environmental Protection Agency, 1973.

EUTROPHICATION

The term "eutrophic" means well-nourished; thus, "eutrophication" refers to natural or artificial addition of nutrients to bodies of water and to the effects of added nutrients (Eutrophication: Causes, Consequences, and Correctives, 1969). The process of eutrophication is nothing new or invented by man. It is the process whereby a lake ages and eventually disappears. An undisturbed lake will slowly undergo a natural succession of stages, the end product usually being a bog and finally dry land (see Figure A). These stages can be identified by measuring various physical, chemical, and biological aspects of the lake's ecosystem. Man can and often does affect the rate of eutrophication. From a pollutional point of view, these effects are caused by increased population, industrial growth, agricultural practices, watershed development, recreational use of land and waters, and other forms of watershed exploitation.

For restorative or preservative purposes of a lake and its watershed, it is important to identify both a lake's problem and the cause of the problem. Problems associated with eutrophication include: nuisance algal blooms (especially blue-green algae); excessive aquatic plant growth; low dissolved oxygen content; degradation of sport fisheries; low transparency; mucky bottoms; changes in species type and diversity; and others. The pollutional cause is identified as either point or non-point in origin. A point source of pollution may be an inlet to the lake carrying some waste discharge from upstream. Or it may be an industrial, agricultural or domestic (i.e., washing machine pipe) waste discharge which can be easily identified, quantified, and evaluated.

Non-point sources of pollution, which are the more common type affecting a lake, are more difficult to identify. They include agricultural runoff, urban runoff, fertilizers, septic or cesspool leakage, land clearing, and many more. They are often difficult to quantify and thus evaluate.

An objective of a baseline survey is to measure a lake's trophic state, that is, to describe the point at which the lake is in the aging process. The measure most widely used is a lake's productivity. Technically, this involves finding out the amount of carbon fixed per meter per day by the primary producers. Since it is a rather involved procedure to do this, the baseline survey attempts to indirectly describe the lake's trophic state or level of biological productivity.

During the process of eutrophication, a lake passes through three major, broad stages of succession: oligotrophy, mesotrophy, and eutrophy. Each stage has its own characteristics (see Table A). Data from a baseline survey can be analysed for assessment of the lake's trophic state. Although the level of productivity is not quantified, the physical, chemical, and biological parameters measured go a long way in positioning the lake as to its trophic status. The perimeter survey helps locate and identify sources of pollution.

TABLE A

LAKE TROPHIC CHARACTERISTICS

1. Oligotrophic lakes:
   a. Very deep, thermocline high; volume of hypolimnion large; water of hypolimnion cold.
   b. Organic materials on bottom and in suspension very low.
   c. Electrolytes low, or variable; calcium, phosphorus, and nitrogen relatively poor; humic materials very low or absent.
   d. Dissolved oxygen content high at all depths and throughout year.
   e. Larger aquatic plants scanty.
   f. Plankton quantitatively restricted; species many; algal blooms rare; Chlorophyceae dominant.
   g. Profundal fauna relatively rich in species and quantity; _Tanytarsus_ type; _Corethra_ usually absent.
   h. Deep-dwelling, cold-water fishes (salmon, cisco, trout) common to abundant.
   i. Succession into eutrophic type.
2. Eutrophic lakes:
   a. Relatively shallow; deep, cold water minimal or absent.
   b. Organic materials on bottom and in suspension abundant.
   c. Electrolytes variable, often high; calcium, phosphorus, and nitrogen abundant; humic materials slight.
   d. Dissolved oxygen, in deeper stratified lakes of this type, minimal or absent in hypolimnion.
   e. Larger aquatic plants abundant.
   f. Plankton quantitatively abundant; quality variable; water blooms common; Myxophyceae and diatoms predominant.
   g. Profundal fauna, in deeper stratified lakes of this type, poor in species and quantity in hypolimnion; _Chironomus_ type; _Corethra_ present.
   h. Deep-dwelling, cold-water fishes usually absent; suitable for perch, pike, bass, and other warm-water fishes.
   i. Succession into pond, swamp, or marsh.
3. Dystrophic lakes:
   a. Usually shallow; temperature variable; in bog surroundings or in old mountains.
   b. Organic materials in bottom and in suspension abundant.
   c. Electrolytes low; calcium, phosphorus, and nitrogen very scanty; humic materials abundant.
   d. Dissolved oxygen almost or entirely absent in deeper water.
   e. Larger aquatic plants scanty.
   f. Plankton variable; commonly low in species and quantity; Myxophyceae may be very rich quantitatively.
   g. Profundal macrofauna poor to absent; all bottom deposits with very scant fauna; _Chironomus_ sometimes present; _Corethra_ present.
   h. Deep-dwelling cold-water fishes always absent in advanced dystrophic lakes; sometimes devoid of fish fauna; when present, fish production usually poor.
   i. Succession into peat bog.

SOURCE: Welch, P.S., _Limnology_, McGraw Hill Book Co., New York, 1952. (Reprinted with permission from the publisher.)

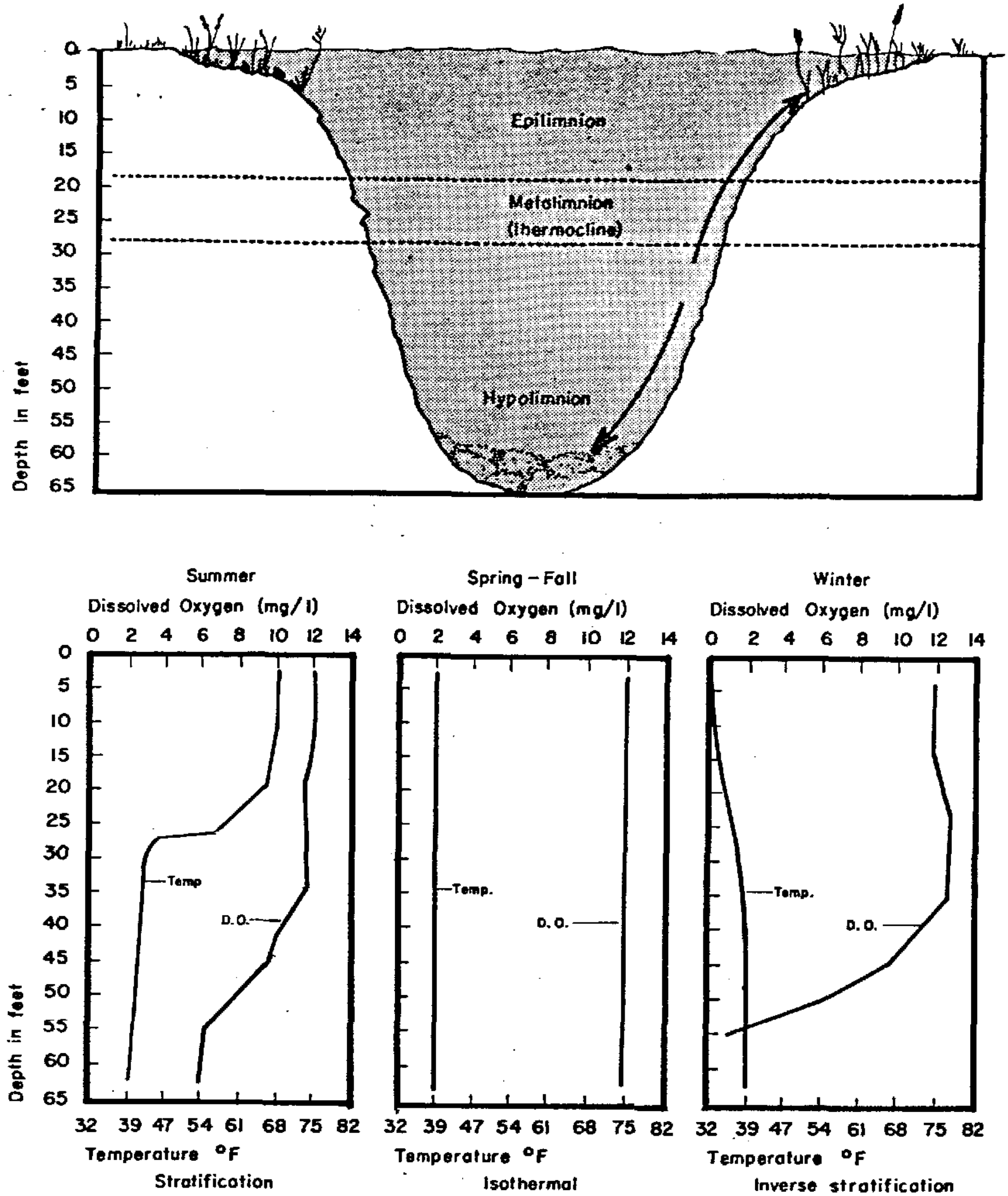
Figure B shows the various zones of a typical stratified lake. In addition to the lake's life history mentioned above, a lake also has characteristic annual cycles. Depending on the season, a lake has a particular temperature and dissolved oxygen profile (see Figure B). During the summer season, the epilimnion, or warm surface water, occupies the top zone. Below this is the metalimnion which is characterized by a thermocline. In a stratified lake this is the zone of rapid temperature change with depth. The bottom waters, or hypolimnion, contain colder water. The epilimnion is well mixed by wind action, whereas the hypolimnion does not normally circulate. During the spring and fall seasons these regions break down due to temperature change and the whole lake circulates as one body. In shallow lakes (e.g., 10-15 feet maximum depth) affected by wind action, these zones do not exist except for short periods during calm weather.

The summer season (July-August) is the best time to survey a lake in order to measure its trophic status. This is the time when productivity and biomass are at their highest and when their direct or indirect effects can best be measured and observed. Some of the lakes included in this report were surveyed during June, or the early summer season. For this reason the thermocline had not yet strongly developed and the oxygen demand in the hypolimnion had only begun to assert itself. In each case, reference is made to this situation and described for each lake.

The oxygen concentration in the hypolimnion is an important characteristic for a lake. A high level of productivity in the surface waters usually results in low oxygen concentrations in the lake's bottom. Low oxygen in the hypolimnion can adversely affect the life in the lake, especially the cold water fish which require a certain oxygen concentration.

Table B depicts concentrations of various substances and other data for two hypothetical lakes, one eutrophic, the other oligotrophic. It is intended as a guide for comparison to the lakes included in this report. Each lake, of course, is different from all others. There is no hard and fast rule as to critical concentrations for each lake. The morphology of a lake (e.g., mean depth) plays an important part in its general well-being. A small, deep lake will react differently to nutrient loading than a large, shallow lake. In the final analysis, each lake is found unique and must be evaluated on an individual basis.

Diagrammatic sketch showing thermal characteristics of temperate lakes



Source: Measures for the Restoration and Enhancement of Quality of Freshwater Lakes. Washington, D.C.: United States Environmental Protection Agency, 1973.

FIGURE B

TABLE B

SELECTED DATA FOR TWO HYPOTHETICAL LAKES [1]

Concentrations in mg/l

TROPHIC[2] STATUS	DISSOLVED OXYGEN AT BOTTOM	TRANSPARENCY (Secchi level)	NH_3	NO_3	TOTAL P	PHYTOPLANKTON	AQUATIC VEGETATION	FISHERIES
Lake A (Oligotrophic)	High >5.0	High	low <0.03	low <0.03	low <0.01	High diversity, low numbers, nearly complete absence of blue-greens	Sparse	Coldwater types
Lake B (Eutrophic)	Low <5.0	Low	high >0.03	high >0.03	high >0.01	Low diversity, high numbers, abundance of blue-greens.	Abundant	Warm water types

[1] Not established as State standards.

[2] Oligotrophic = nutrient poor

Eutrophic = high concentrations of nutrients

BASELINE LAKE and POND SURVEYS - 1974

FIGURE C

ASSABET RIVER BASIN LAKE SURVEYS

INTRODUCTION

Baseline lake studies were conducted on selected lakes and ponds within the Assabet River Basin during June and July, 1974. These surveys were run concurrently with the 1974 Assabet River water quality survey. The results of the river survey have been published by the Division in The Assabet River 1974 Water Quality Survey Data (Westborough, 1975).

The objectives of the lake baseline surveys were several:

1. Estimation of the lakes' trophic level;
2. Data collection for the state's lake identification and classification program;
3. Satisfaction of the requirements of Section 314, PL92-500, of the Federal Lake Program;
4. Satisfaction of public demand for attention to lake problems.

The baseline survey is accomplished in one day. It generally consists of a perimeter survey and sampling of the water column and sediments at the deep hole station. Inlets, outlets, and occasional special samples are also collected. The perimeter survey includes the qualitative mapping of aquatic vegetation. Also noted are watershed characteristics, including dominant tree type, land use, number and type of dwellings, and, of course, any direct discharges or septic tank problems. The results of a baseline survey enable the Division of Water Pollution Control to classify and identify the water quality of Massachusetts lakes. On the basis of such a survey, a lake may or may not be chosen for intensive, year-round study. The baseline surveys included in this report are of the following lakes and ponds:

Name	Municipalities	Area (acres)	Volume (acre ft.)
Flow Augmentation Pond	Westborough	333	924
Hocomonco Pond	Westborough	27	86
Rocky Pond	Boylston	61	384
Boons Pond	Stow/Hudson	166	1,844
Warners Pond	Concord	58	188
Lake Chauncy	Westborough	177	2,100

ASSABET RIVER BASIN GEOLOGY

Northeastern Massachusetts is crossed by several belts of hilly country which have a general northeast-southwest trend, separating broad tracts of lowland that are, to some extent, the valleys of the main streams. The only one of these hilly belts which can really be called a range extends from Shrewsbury northeast through Harvard and Westford into Chelmsford, separating the Nashua River Basin from the Assabet and Concord basins. This pseudo-range is mainly a belt of metamorphosed sedimentary rock which is more resistant than the granitic rocks on either side of it. In a broad sense, there is a relation between the topography and the rock structure, as the hilly belts are to a large extent underlain by granites and other igneous rocks, while the lowlands are underlain by sedimentary rocks. The rocks in this general area present a greater diversity in kind and structure than those of other areas of Massachusetts. Periods of sedimentation were often interrupted by periods of deformation and followed by periods of intrusion. The area has been several times folded and faulted and has been deeply eroded.

The headwaters of the Assabet River are underlain mainly by quartzite (Westboro Quartzite Formation) which progresses into a biotite schist (Marlboro Formation). There are many places where horizontal layers of conglomerate intermix with the schist formations. Finally, the northern part of the Assabet River Basin is composed primarily of quartzite or quartz-schist (Merrimack Quartzite Formation). This rock is, in general, more massively quartzitic toward the northwest and more slaty toward the southeast.

Many broad sand areas, some of them underlain by laminated clays, mark the sites of glacial lakes, many of them quite large, which were fed by the glacial waters and wholly or partly dammed back by the ice. One of these lakes was Lake Sudbury, which extended from South Framingham to Weston and from Concord to Wellesley. West of Lake Sudbury was the glacial Lake Assabet, outlined by the broad glacial sand plains of Westborough, Southborough, and Northborough, with lobes running north to Marlborough and Bolton. Finally, there was the great Lake Nashua, which extended broadly over the drainage area of the Nashua River from Boylston, past Clinton and Ayer, to East Pepperell. The valley deposits in the Assabet basin are morainic deposits or outwash plains left by the ice which retreated up the valley.

ASSABET LAKES SOILS DESCRIPTION

Flow Augmentation Pond, Westborough: Hinckley-Windsor-Muck Association - Drouthy gravelly and sandy soils and very poorly drained bog soils. The Hinckley and Windsor soils have formed on deep deposits of sand and/or gravel; while the muck soils, often extending twenty feet, occupy low-lying depression areas.

Hocomonco Pond, Westborough: Similar to Flow Augmentation Pond.

Rocky Pond, Boylston: Charlton-Paxton-Hollis Association - Well-drained upland soils with and without hardpans, and shallow to bedrock soils. The soils in this association are generally fine sandy loams.

Boons Pond, Stow and Hudson: Similar to Rocky Pond.

Warners Pond, Concord: Similar to Rocky Pond.

Lake Chauncy, Westborough: Similar to Flow Augmentation Pond.

LAKE METHODOLOGY

MORPHOLOGY

Bathymetric maps of the lakes were prepared either using an original from the Massachusetts Division of Fisheries and Wildlife or constructing one in the field using a fathometer (Raytheon model DE728A). Morphometric parameters were measured with a planimeter and rotometer according to Hutchinson (1957) and Welch (1948). Other pertinent map data were derived from U.S.G.S. topographic maps (7.5 minute series).

STATION LOCATION

For each lake surveyed, the following stations were established:

1. Deep hole station on the lake;
2. Inlet station(s);
3. Outlet station.

Occasional special samples were also collected if any waste discharge was suspected or observed.

DATA COLLECTION

Physical and Chemical Data

Temperature profiles were made "in situ" with a Thermo Fishometer (Bright Radio Laboratories, Inc., Oceanside, N.Y.). Transparency measurements were made with a standard 20 cm. secchi disc. Field pH tests were taken with a Hach model 17N Wide Range pH Test Kit. Water samples from the deep hole stations were collected with a standard type brass Kemmerer water sampler, while inlet and outlet samples were generally collected below the surface by hand. The sample for dissolved oxygen was collected in the manner prescribed by Welch (1948). The dissolved oxygen concentration was measured by azide modification of the Winkler technique (Standard Methods, APHA, 1971). Titrations were made within several hours after fixing in the field with the manganese sulfate and alkali-azide-iodide reagents. The sulfuric acid was added just prior to the titrations in the laboratory. Samples for chemical analyses were transported as soon as possible to the Lawrence Experiment Station of the Division of Environmental Health and analyzed according to Standard Methods (APHA, 1971). The following analyses were performed on each sample: pH, alkalinity, hardness, conductivity, silica, ammonia-nitrogen, nitrate-nitrogen, and total phosphorus. In addition, many of the lakes were also tested for chloride, iron, and manganese. Wind, weather, and air temperatures were routinely recorded on each survey, along with any other pertinent observations.

Biological Data

Phytoplankton

Phytoplankton samples were collected by a standard procedure prescribed by the Maine Department of Environmental Protection, Division of Lakes and Biological Studies. The sample consisted of a composite core taken with a ¼-inch I.D. plastic tube with a weight attached to one end. The tube was lowered at the deep hole station close to the bottom, pinched below the meniscus, and raised into the boat. The sample was then allowed to drain into a clean and rinsed collection bottle. The procedure was repeated until a volume of 500 ml. was collected. Samples were normally analyzed for phytoplankton on the day of collection using a Whipple micrometer and Sedgewick-Rafter cell. Algae counts were reported as areal standard units (ASU) per ml. (Standard Methods, 1971).

Macroinvertebrates

Bottom invertebrate samples were collected at the deep hole station using a 6x6 inch Ekman dredge (0.25 square feet). A total of four samples were taken, emptied into a bucket and mixed; then a one-quart volume subsample was taken and put in a plastic container, sieved (#30 standard sieve), and "picked" within one week of collection and preserved in 70% ethyl alcohol for later identification.

Aquatic Vegetation

The aquatic vegetation in the lake was located and mapped by slowly examining the entire littoral zone of the lake by boat. Where the bottom was not visible, it was semi-quantitatively dragged for aquatic plants. Identification for the most part was made "in situ" except for a few samples which were taken back to the lab and identified according to Fasset (1957), Weldon *et al*. (1973), or Hotchkiss (1972). Some aquatic macrophytes could not be keyed to species because the plants were not in flower or fruit at the time of the survey.

BASELINE LAKE SURVEYS

FLOW AUGMENTATION POND

This shallow pond, impounded by the George H. Nichols Dam, forms the head-waters of the Assabet River. It is located in the Town of Westborough and has a watershed of seven square miles, including portions of Grafton and Shrewsbury. The dam was constructed in 1969 and included a siphon-type outlet to the Assabet River. The outflow for June 4-7, 1974, averaged 7.0 cfs. The dam was built for the purpose of "fish and wildlife development and flood prevention" by the Massachusetts Water Resources Commission. When the pond area behind the dam was cleared, however, the stumps, roots, and other vegetation were not removed. Indeed, a good part of the pond area was not even cleared of trees. The result has been a large amount of organic decay with depressed oxygen levels and poor water quality.

The depth and area of the Flow Augementation Pond are highly variable depending upon the season and amount of rainfall in the watershed. During the spring, the pond is normally quite full; whereas during the late summer, it is often reduced to small pools of water scattered around the main basin.

Because it was built in 1969, the Flow Augmentation Pond should be considered still young, or more precisely, a recently reclaimed swamp area. For this reason it is only beginning to establish itself as a pond and wildlife habitat. With time, it will pass through various successional stages before its water quality, flora, and fauna stabilize themselves.

During the June baseline survey, no aquatic vegetation was observed along the littoral zone. For this reason, an aquatic vegetation map has been ommitted.

HOCOMONCO POND

This very small (27 acres), shallow pond is located in Westborough about 1,000 feet north of the Flow Augmentation Pond. It has a very small watershed area of 0.38 square miles in Westborough with an outlet flowing into the Assabet River. There are only some five dwellings around the pond, and the Westborough airport is located to the north. A single inlet is located on the west shore and drains mostly swampy land. During the survey, many old tires were observed on the shore and an old gravel pit sighted near the southwest shore. The pond is not heavily used for recreational purposes.

ROCKY POND

Rocky Pond (61 acres) is located in Boylston and has a small watershed (0.42 square miles) in Boylston and a small part of Northborough. The lake has a north and a south basin, the former of which is the deeper with a maximum depth of 20 feet. Houses around the lake are mostly concentrated along the western shore with two dwellings on the eastern shore. There are no inlets to the lake, and the outlet forms Cold Harbor Brook which joins the Assabet River in Northborough. It is easy to see how the pond got its name because the perimeter and littoral zone are covered with rocks and boulders, some of which are quite formidible. There is also a small island in the southern basin.

BOONS POND

This unusually shaped lake of 166 acres is located in Stow and Hudson and has a watershed of 1.75 square miles covering portions of Stow, Hudson, Sudbury, and Maynard. The lake is L-shaped with the deep basin (20 feet) located in the northern half. There are two major inlets flowing into the southern end of the lake, and the outlet flows immediately into the Assabet River. The shore and littoral zone are well covered with rocks and gravel. The lake's perimeter has one of the highest densities of dwellings around it in the Commonwealth. Except for the eastern end, the area around the lake is saturated with houses and cottages. The lake's unusual shape is reflected in a very high development of shoreline index of 3.8.

WARNERS POND

Warners Pond is a small lake (58 acres) located in Concord with a comparatively large watershed (7.46 square miles) spread over Acton, Stow, Maynard, and Concord. Fort Pond Brook and Nashoba Brook enter the lake from the north, and the outlet flows over a dam directly into the Assabet River in West Concord. There are four islands on the lake, the largest of which measures some 12 acres. The lake's perimeter is mostly undeveloped except for a few dwellings scattered around the shore. During the survey, a 36" concrete drain was observed on the north shore and sampled.

LAKE CHAUNCY

Lake Chauncy is located in Westborough and has a fairly small watershed (1.21 square miles) in that town and a tiny portion of Northborough. Most of the watershed is swamp land. The area around the lake is largely undeveloped because most of it is state property. Both the Westborough State School and the Lyman State School (where the Water Quality Section of the Division of Water Pollution Control is housed) are located in the watershed. The Division of Fisheries and Wildlife manages part of the property for wildlife and beagle training. The inlets to the lake are swamp drainage; and the outlet flows into Little Chauncy Pond, thence to Bartlett Pond, and from there to the Assabet River via Stirrup Brook in Northborough.

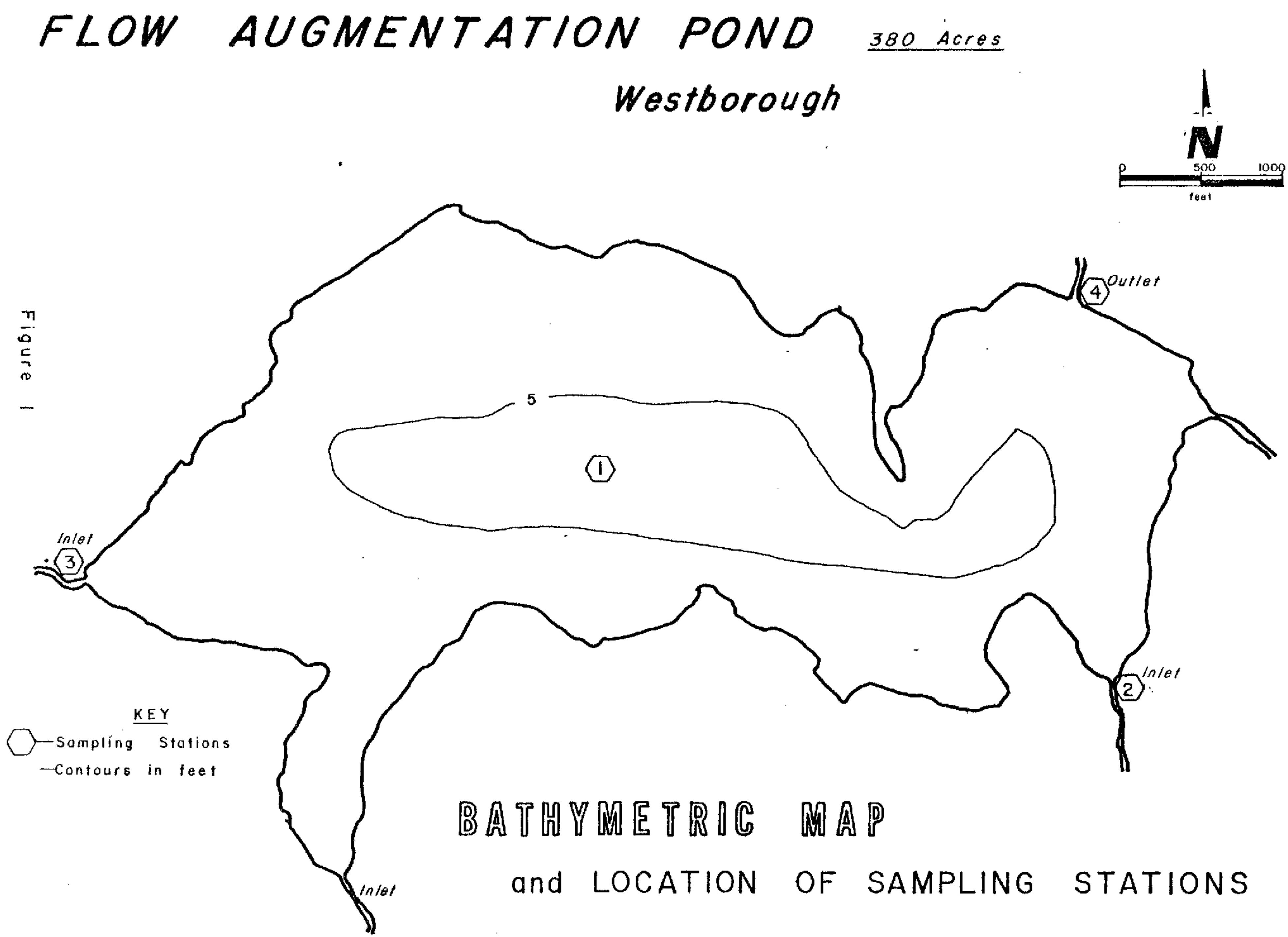

FLOW AUGMENTATION POND
380 Acres
Westborough
N
0
500
1000
feet
Outlet
4
Inlet
2
Inlet
3
Inlet
5
1
KEY
Sampling Stations
Contours in feet
BATHYMETRIC MAP
and LOCATION OF SAMPLING STATIONS

Figure 1

TABLE 1

FLOW AUGMENTATION POND

MORPHOMETRIC DATA

Maximum Length	6,700 feet
Maximum Effective Length	6,700 feet
Maximum Width	4,400 feet
Maximum Effective Width	4,400 feet
Maximum Depth	5.0 feet
Mean Depth	2.8 feet
Mean Width	2,165 feet
Area	333 acres
Volume	924 acre feet
Shoreline	24,920 feet
Development of Shoreline	1.8
Development of Volume	1.70
Mean to Maximum Depth Ratio	0.56 feet
Drainage Area	6.09 square miles

TABLE 2

FLOW AUGMENTATION POND

WATER QUALITY DATA (mg/1)

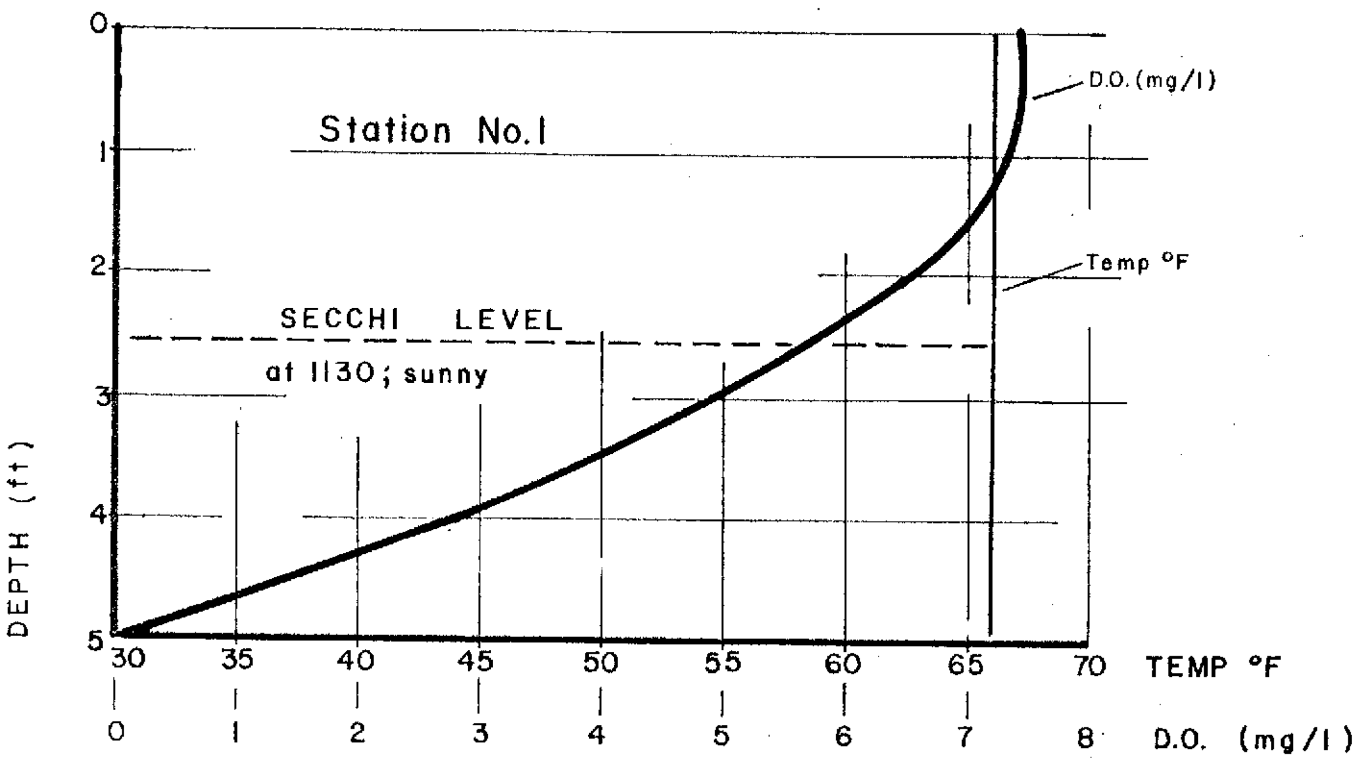
JUNE 3, 1974

DEPTH (feet)	TEMP. (°F)	D.O.	pH	TOTAL ALK.	NH_3-N	NO_3-N	TOTAL P	SUSP. SOLIDS	TOTAL SOLIDS	BOD_5
STATION 1 - POND CENTER										
Surface	66.0	7.4	7.0	--	--	--	--	--	--	--
2	66.0	6.5	7.0	--	--	--	--	--	--	--
4	66.0	2.8	6.8	19	0.40	0.1	0.14	--	--	--
5	66.0	0.0	6.8	--	--	--	--	--	--	--
STATION 2 - INLET										
Surface	70.0	7.0	6.8	18	0.43	0.1	0.17	--	--	--
STATION 3 - INLET										
Surface	70.0	6.5	6.8	18	0.01	0.0	0.04	--	--	--
STATION 4 - OUTLET										
Surface	72.1	9.3	6.9	20	0.06	0.1	0.16	25	98	4.2

TEMPERATURE & DISSOLVED OXYGEN PROFILE

(with SECCHI DISC READING)

June 3, 1974



FLOW AUGMENTATION POND

Figure 2

TABLE 3

FLOW AUGMENTATION POND

MICROSCOPIC EXAMINATION IN AREAL STANDARD UNITS/ml

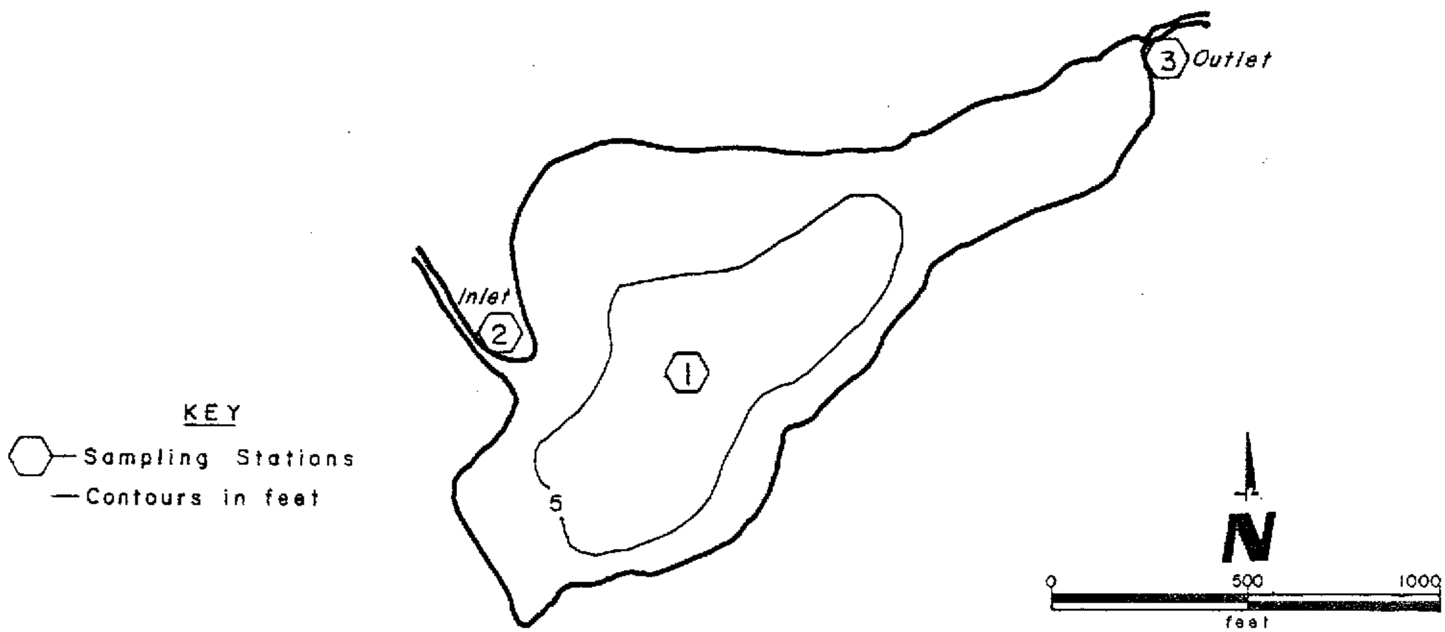
STATIONS 1 AND 4 - June 3, 1974

ORGANISM	STATION 1	STATION 4[1]
Bacillariophyceae		
Cymbella sp.	18	--
Melosira sp.	--	12
Navicula sp.	12	35
Cyanophyceae		
Merismopedium sp.	--	29
Chlorophyceae		
Ankistrodesmus sp.	--	12
Coelastrum sp.	53	209
Scenedesmus sp.	29	100
Staurastrum sp.	6	12
Selenastrum sp.	6	--
Sphaerocystis sp.	--	47
Pleurococcus sp.	35	47
Phiocytium sp.	12	--
Volvox sp.	--	734
Mastogophora		
Monas sp.	--	23
Synura sp.	--	88
Phacus sp.	12	--
Infusoria	6	--
Rotifera[2]		
Anuraea sp.	2	1
Amorphous Matter	7,497	9,408

[1]Composite during Assabet River Water Quality Survey.

[2]Number of individuals

HOCOMONCO POND 27 Acres
Westborough



BATHYMETRIC MAP
and LOCATION OF SAMPLING STATIONS

Figure 3

TABLE 4

HOCOMONCO POND

MORPHOMETRIC DATA

Maximum Length	2,300 feet
Maximum Effective Length	2,300 feet
Maximum Width	1,000 feet
Maximum Effective Width	1,000 feet
Maximum Depth	6.0 feet
Mean Depth	3.2 feet
Mean Width	511 feet
Area	27 acres
Volume	86 acre feet
Shoreline	5,780 feet
Development of Shoreline	1.5
Development of Volume	1.60
Mean to Maximum Depth Ratio	0.53 feet
Drainage Area	0.38 square miles

TABLE 5

HOCOMONCO POND

WATER QUALITY DATA (mg/1)

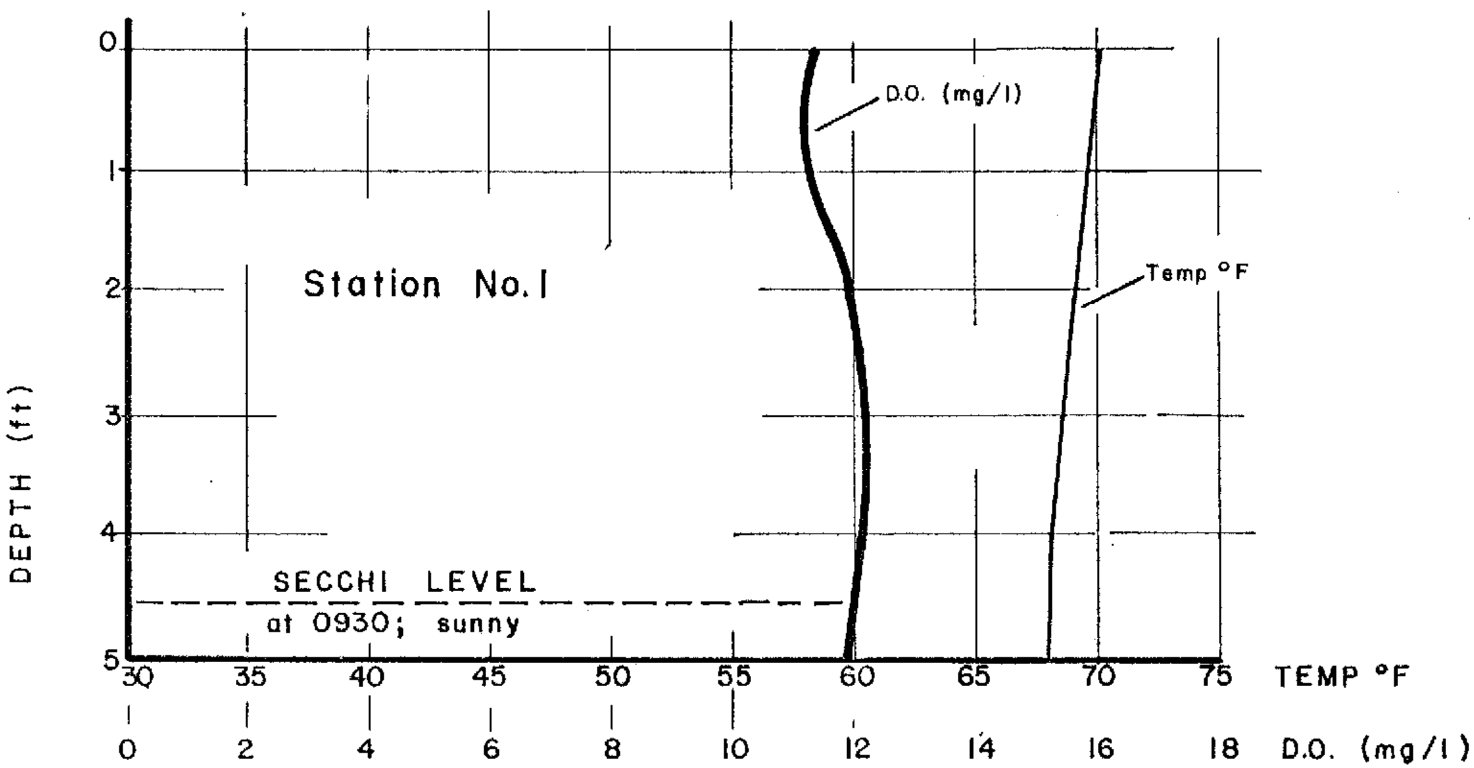
JUNE 4, 1974

DEPTH (feet)	TEMP. (^{o}F)	D.O.	pH	TOTAL ALK.	TOTAL HARD.	NH_3-N	NO_3-N	TOTAL P	SiO_2	SUSP. SOLIDS	TOTAL SOLIDS
					STATION 1 - CENTER HOLE						
Surface	70.0	11.2	8.0	---	---	---	---	---	---	---	---
1	---	---	---	---	---	---	---	---	---	---	---
2	69.0	11.9	7.7	27	38	0.02	0.2	0.20	2.6	---	---
3	---	---	---	---	---	---	---	---	---	---	---
4	68.0	12.1	---	---	---	---	---	---	---	---	---
5	68.0	11.9	8.0	---	---	---	---	---	---	---	---
					STATION 2 - INLET						
Surface	58.0	10.6	7.0	19	38	0.05	1.1	0.01	11	---	---
					STATION 3 - OUTLET						
Surface	72.1	8.3	7.3	28	---	0.02	0.2	0.03	---	4.5	80

TEMPERATURE & DISSOLVED OXYGEN PROFILE

(with SECCHI DISC READING)

June 4, 1974



HOCOMONCO POND

Figure 4

TABLE 6

HOCOMONCO POND

MICROSCOPIC EXAMINATION IN AREAL STANDARD UNITS/ml

STATION 1 - JUNE 4, 1974

ORGANISM	STATION 1
Bacillariophyceae	
Fragilaria sp.	18
Chlorophyceae	
Chorella sp.	12
Mastigophora	
Ceratium sp.	88
Mallomonas sp.	12
Rotifera[1]	
Anuraea sp.	2
Amorphous Matter	7,497

[1]Number of organisms

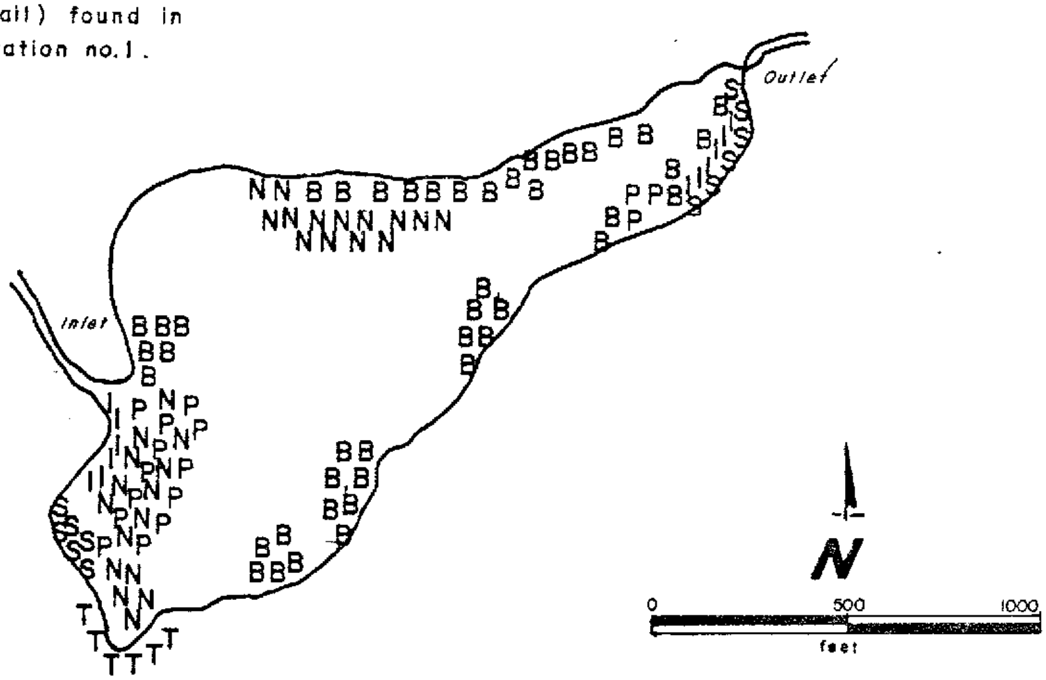
HOCOMONCO POND 27 Acres

Westborough

KEY

B—*Brasenia* sp. (watershield)
I—*Lobelia* sp. (Lobelia)
N—*Nuphar* sp. (yellow water lily)
P—*Potamogeton* sp. (pondweed)
S—*Sagittaria* sp. (arrowhead)
T—*Typha* sp. (cattails)

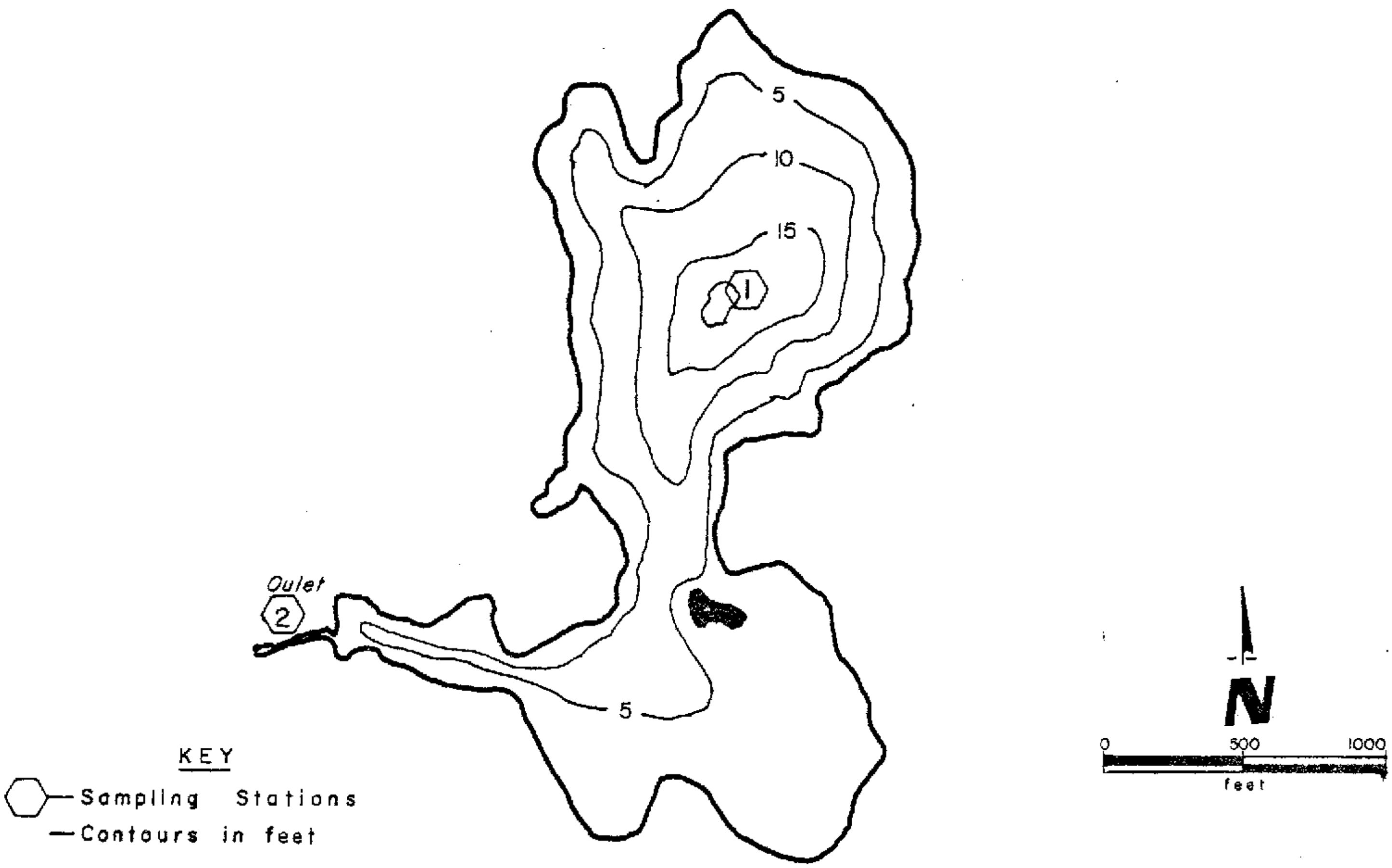
NOTE:
Plants not in flower.
Ceratophyllum (coontail) found in
Ekman sample at station no. 1.



AQUATIC VEGETATION

Figure 5

ROCKY POND 61 Acres
Boylston



BATHYMETRIC MAP
and LOCATION OF SAMPLING STATIONS

Figure 6

TABLE 7

ROCKY POND

MORPHOMETRIC DATA

Maximum Length	3,200 feet
Maximum Effective Length	3,200 feet
Maximum Width	2,100 feet
Maximum Effective Width	2,100 feet
Maximum Depth	20.0 feet
Mean Depth	6.3 feet
Mean Width	830 feet
Area	61 acres
Volume	384 acre feet
Shoreline	13,660 feet
Development of Shoreline	2.4
Development of Volume	0.95
Mean to Maximum Depth Ratio	0.31 feet
Drainage Area	0.42 square miles

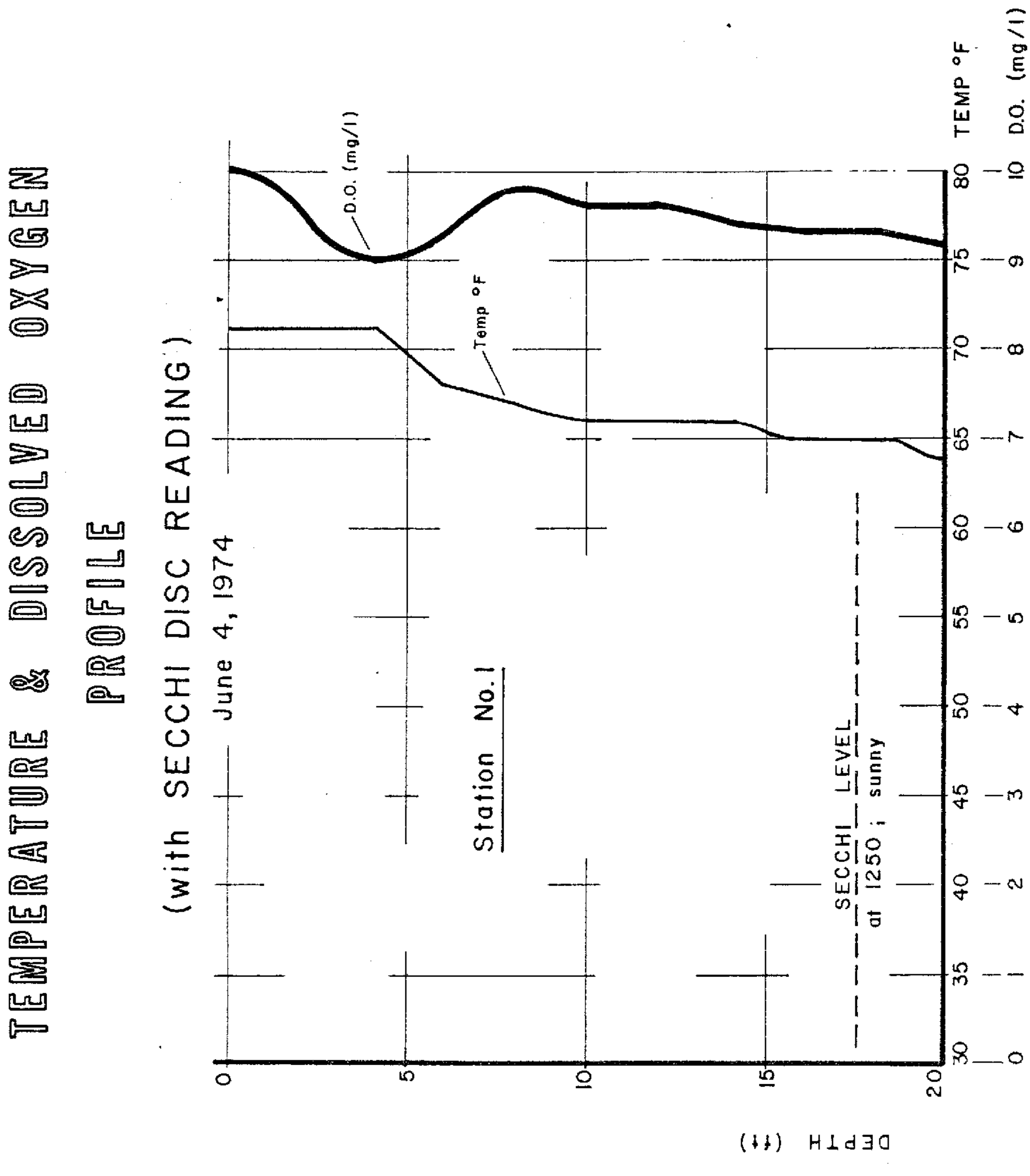
TABLE 8

ROCKY POND

WATER QUALITY DATA (mg/1)

JUNE 4, 1974

DEPTH (feet)	TEMP. (°F)	D.O.	pH	TOTAL ALK.	TOTAL HARD.	NH_3-N	NO_3-N	TOTAL P	SiO_2
				STATION 1 - DEEP HOLE					
Surface	71.0	10.0	--	--	--	--	--	--	--
2	71.0	9.5	--	--	--	--	--	--	--
4	71.0	9.0							
6	68.0	9.3	6.3	3.0	9.0	0.00	0.0	0.01	0.4
8	67.0	9.8	--	--	--	--	--	--	--
10	66.0	9.6	--	--	--	--	--	--	--
12	66.0	9.6	--	--	--	--	--	--	--
14	66.0	9.4	--	--	--	--	--	--	--
16	65.0	9.3	--	--	--	--	--	--	--
18	65.0	9.3	--	--	--	--	--	--	--
20	64.0	9.2	6.2	3.0	9.0	0.01	0.0	0.01	0.4
				STATION 2 - OUTLET					
Surface	73.0	10.8	6.2	3.0	9.0	0.00	0.0	0.01	0.4



ROCKY POND

Figure 7

TABLE 9

ROCKY POND

MICROSCOPIC EXAMINATION IN AREAL STANDARD UNITS/ml

STATION 1 - JUNE 4, 1974

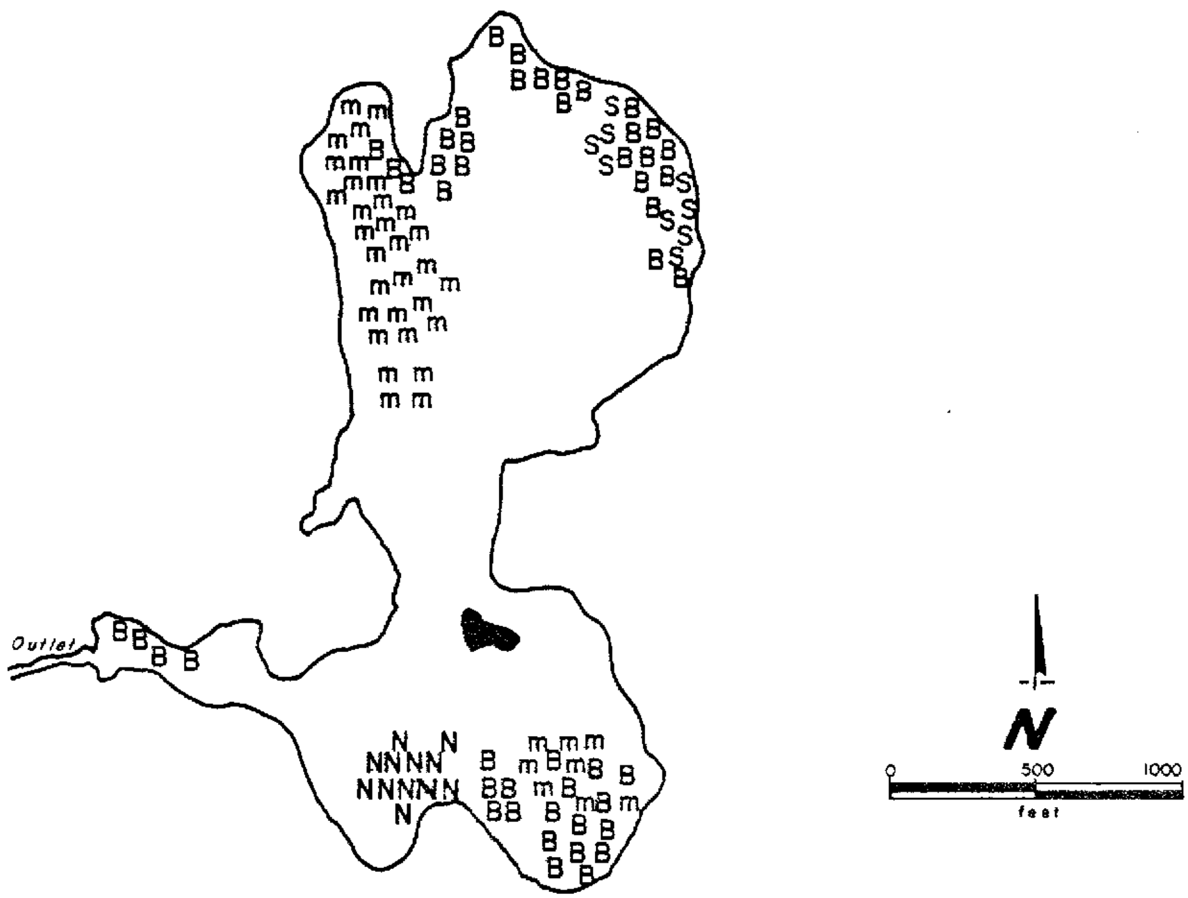
ORGANISM	STATION 1
Bacillariophyceae	
Cyclotella sp.	6
Chlorophyceae	
Pleurococcus sp.	29
Amorphous Matter	2,499

ROCKY POND *61 Acres*

Boylston

KEY

B—Brasenia sp. (water shield)
m—Myriophyllum (water milfoil)
N—Nuphar sp. (yellow water lily)
S—Sagittaria sp. (arrowhead)



AQUATIC VEGETATION

Figure 8

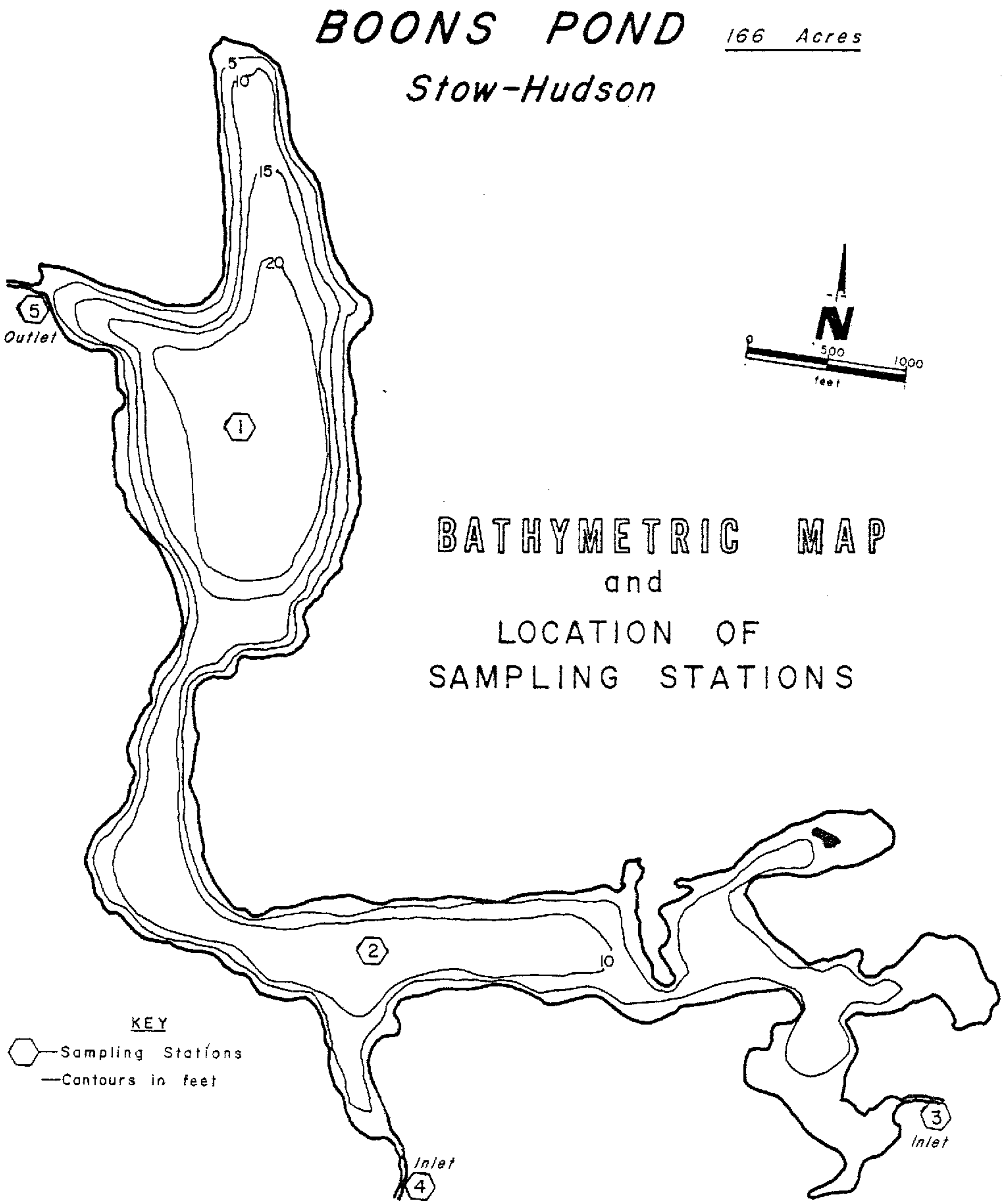

BOONS POND 166 Acres
Stow-Hudson
BATHYMETRIC MAP
and
LOCATION OF
SAMPLING STATIONS
N
0
500
1000
feet
5
10
15
20
10
1
2
3
4
5
Outlet
Inlet
Inlet
KEY
Sampling Stations
Contours in feet

Figure 9

TABLE 10

BOONS POND

MORPHOMETRIC DATA

Maximum Length	5,300 feet
Maximum Effective Length	5,300 feet
Maximum Width	1,900 feet
Maximum Effective Width	1,900 feet
Maximum Depth	20.0 feet
Mean Depth	11.0 feet
Mean Width	1,364 feet
Area	166 acres
Volume	1,844 acre feet
Shoreline	36,460 feet
Development of Shoreline	3.8
Development of Volume	1.65
Mean to Maximum Depth Ratio	0.55 feet
Drainage Area	1.75 square miles

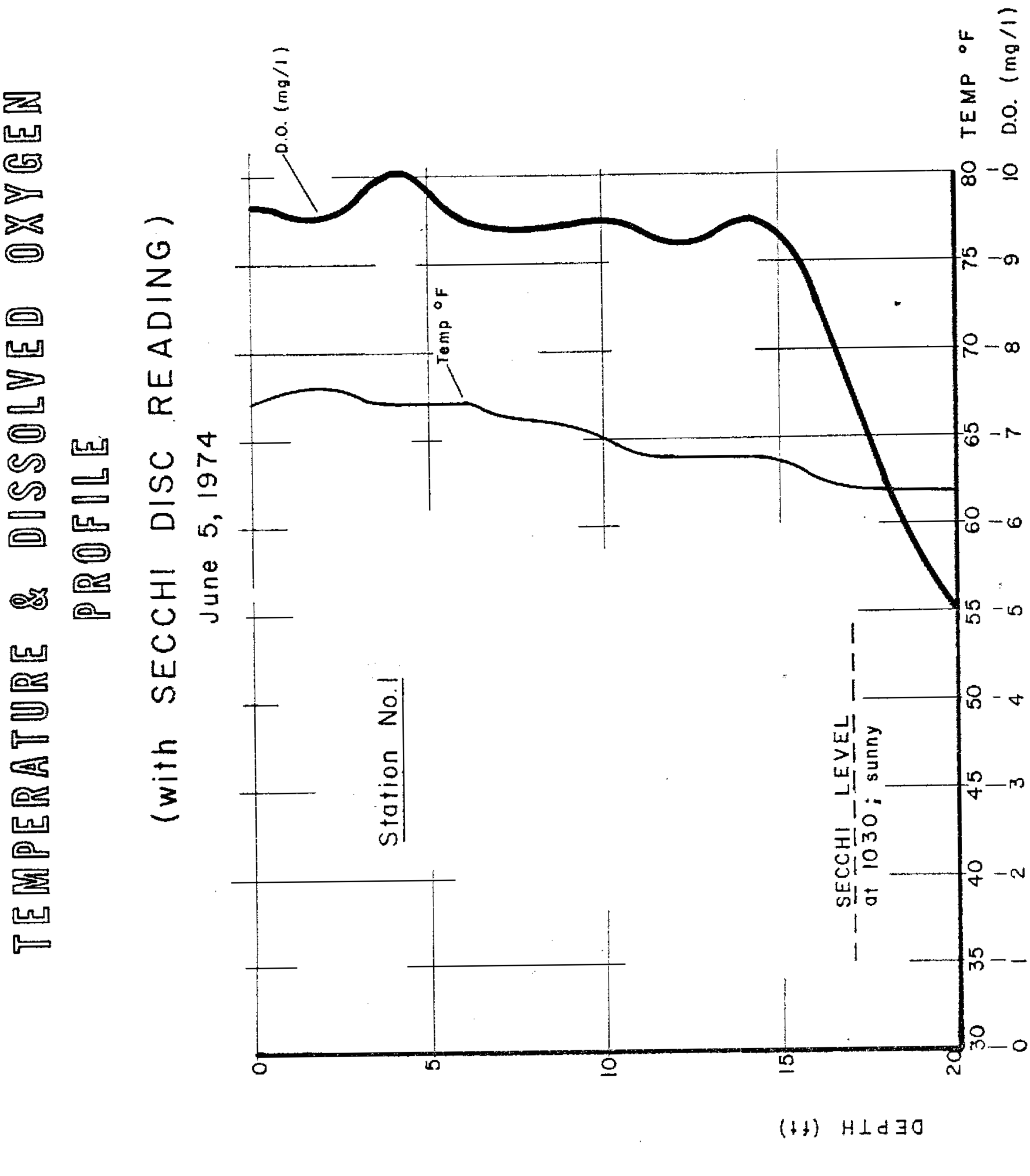
TABLE 11

BOONS POND

WATER QUALITY DATA (mg/l)

JUNE 5, 1974

DEPTH (feet)	TEMP. (°F)	D.O.	pH	TOTAL ALK.	TOTAL HARD.	NH_3-N	NO_3-N	TOTAL P	SiO_2	SUSP. SOLIDS	TOTAL SOLIDS
STATION 1 - NORTH BASIN											
Surface	67.0	9.6	--	--	--	--	--	--	--	--	--
2	68.0	9.5	--	--	--	--	--	--	--	--	--
4	67.0	10.0	--	--	--	--	--	--	--	--	--
6	67.0	9.5	6.9	13	16	0.03	0.1	0.14	0.6	--	--
8	66.0	9.4	--	--	--	--	--	--	--	--	--
10	65.0	9.5	--	--	--	--	--	--	--	--	--
12	64.0	9.2	--	--	--	--	--	--	--	--	--
14	64.0	9.5	--	--	--	--	--	--	--	--	--
16	63.0	8.6	--	--	--	--	--	--	--	--	--
18	62.0	6.5	--	--	--	--	--	--	--	--	--
20	62.0	5.0	6.7	9	12	0.12	0.1	0.04	0.6	--	--
STATION 2 - EAST BASIN											
Surface	68.0	9.2	7.0	9	12	0.07	0.1	0.03	0.3	--	--
2	69.0	9.7	--	--	--	--	--	--	--	--	--
4	69.0	9.4	--	--	--	--	--	--	--	--	--
6	67.0	10.0	--	--	--	--	--	--	--	--	--
8	66.0	9.7	--	--	--	--	--	--	--	--	--
10	66.0	9.5	6.8	9	12	0.09	0.1	0.01	0.6	--	--
STATION 3 - INLET											
Surface	59.0	4.2	4.6	1	8.0	0.03	0.0	0.03	10	--	--
STATION 4 - INLET											
Surface	58.0	9.1	6.1	5	12	0.06	0.7	0.04	10	--	--
STATION 5 - OUTLET											
Surface	68.0	9.8	7.0	9	12	0.02	0.01	0.01	0.4	3.0	5.0



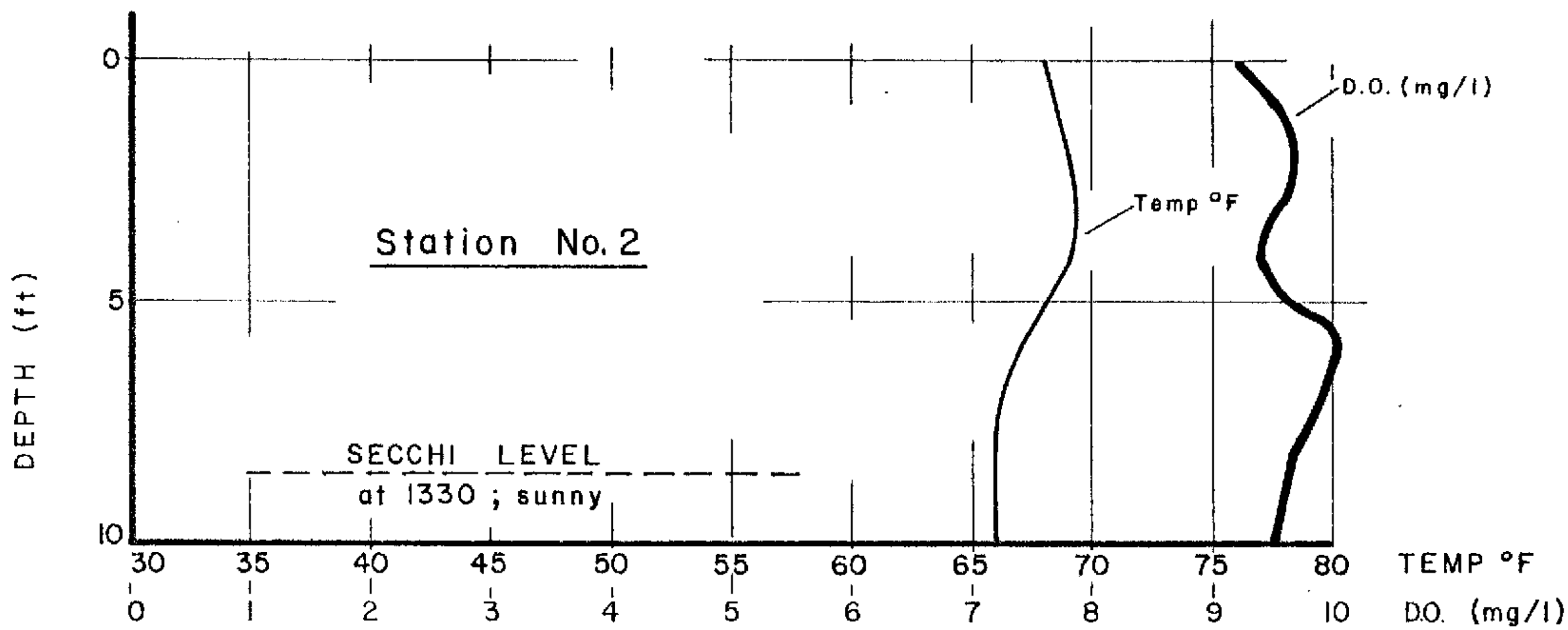
BOONS POND

Figure 10a

TEMPERATURE & DISSOLVED OXYGEN PROFILE

(with SECCHI DISC READING)

June 5, 1974



BOONS POND

Figure 10b

TABLE 12

BOONS POND

MICROSCOPIC EXAMINATION IN AREAL STANDARD UNITS/ml

STATIONS 1, 2, AND 5 - JUNE 5, 1974

ORGANISM	STATION 1	STATION 2	STATION 5[1]
Bacillariophyceae			
Cyclotella sp.	6	--	41
Melosira sp.	--	--	18
Tabellaria sp.	35	6	--
Cyanophyceae			
Anabaena sp.	--	--	100
Chlorophyceae			
Pediastrum sp.	147	--	--
Staurastrum sp.	--	--	29
Pleurococcus sp.	18	--	--
Mastigophora			
Synura sp.	--	194	--
Protozoa	--	--	6
Amorphous Matter	2,293	3,469	5,439

[1]Composite during Assabet River Water Quality Survey.

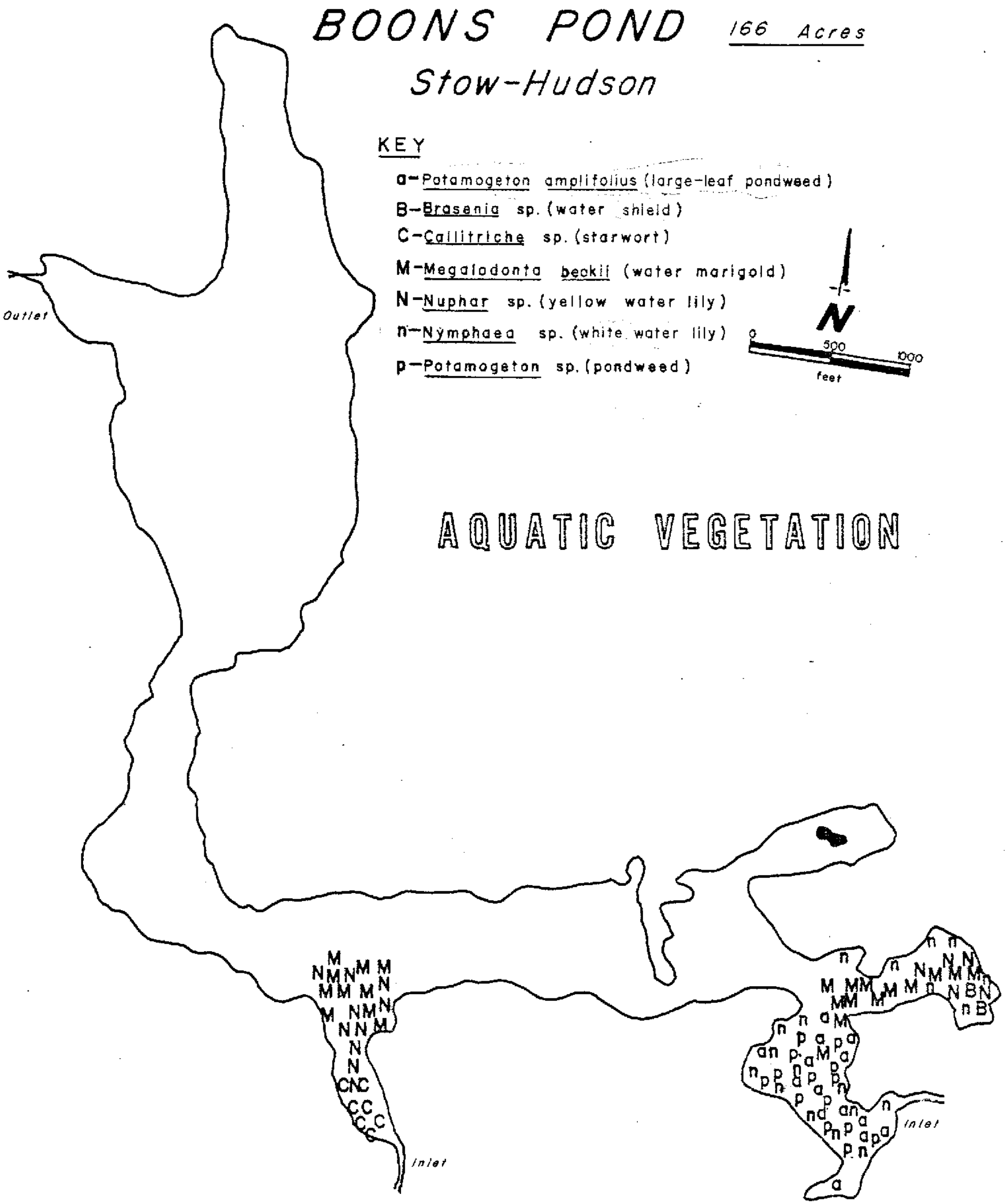

BOONS POND 166 Acres
Stow-Hudson
KEY
a—Potamogeton amplifolius (large-leaf pondweed)
B—Brasenia sp. (water shield)
C—Callitriche sp. (starwort)
M—Megalodonta beckii (water marigold)
N—Nuphar sp. (yellow water lily)
n—Nymphaea sp. (white water lily)
p—Potamogeton sp. (pondweed)
N
0 500 1000
feet
AQUATIC VEGETATION
Outlet
Inlet
Inlet

Figure 11

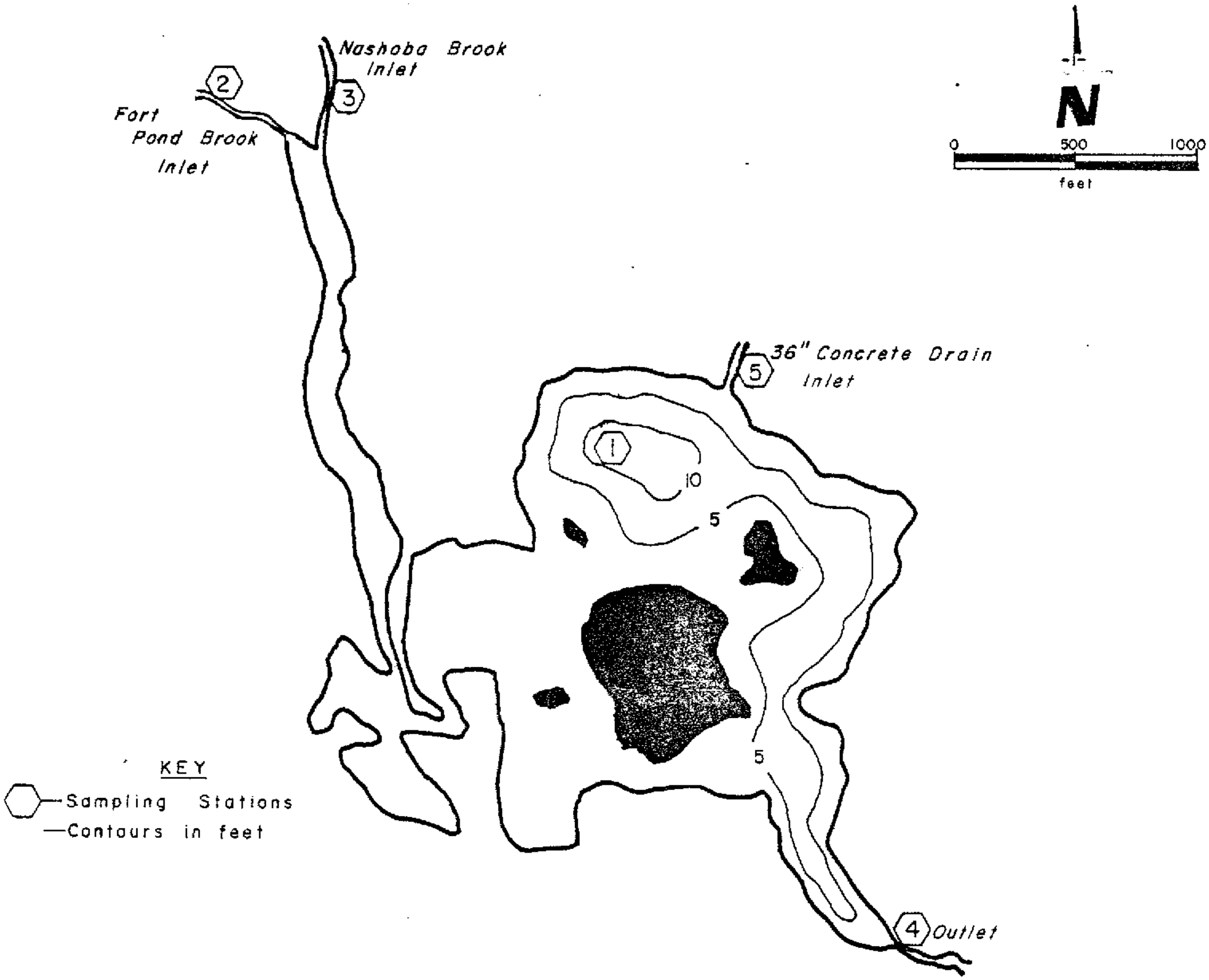
TABLE 13

WARNERS POND

MORPHOMETRIC DATA

Maximum Length	2,600 feet
Maximum Effective Length	2,600 feet
Maximum Width	2,100 feet
Maximum Effective Width	1,800 feet
Maximum Depth	12.0 feet
Mean Depth	3.2 feet
Mean Width	972 feet
Area	58 acres
Volume	188 acre feet
Shoreline - Main Basin	10,280 feet
Inlet Channel	9,180 feet
Development of Shoreline - Main Basin and Inlet Channel	3.5
Development of Volume	0.80
Mean to Maximum Depth Ratio	0.30 feet
Drainage Area	7.46 square miles

WARNERS POND 58 Acres
Concord



BATHYMETRIC MAP

and LOCATION OF SAMPLING STATIONS

Figure 12

TABLE 14

WARNERS POND

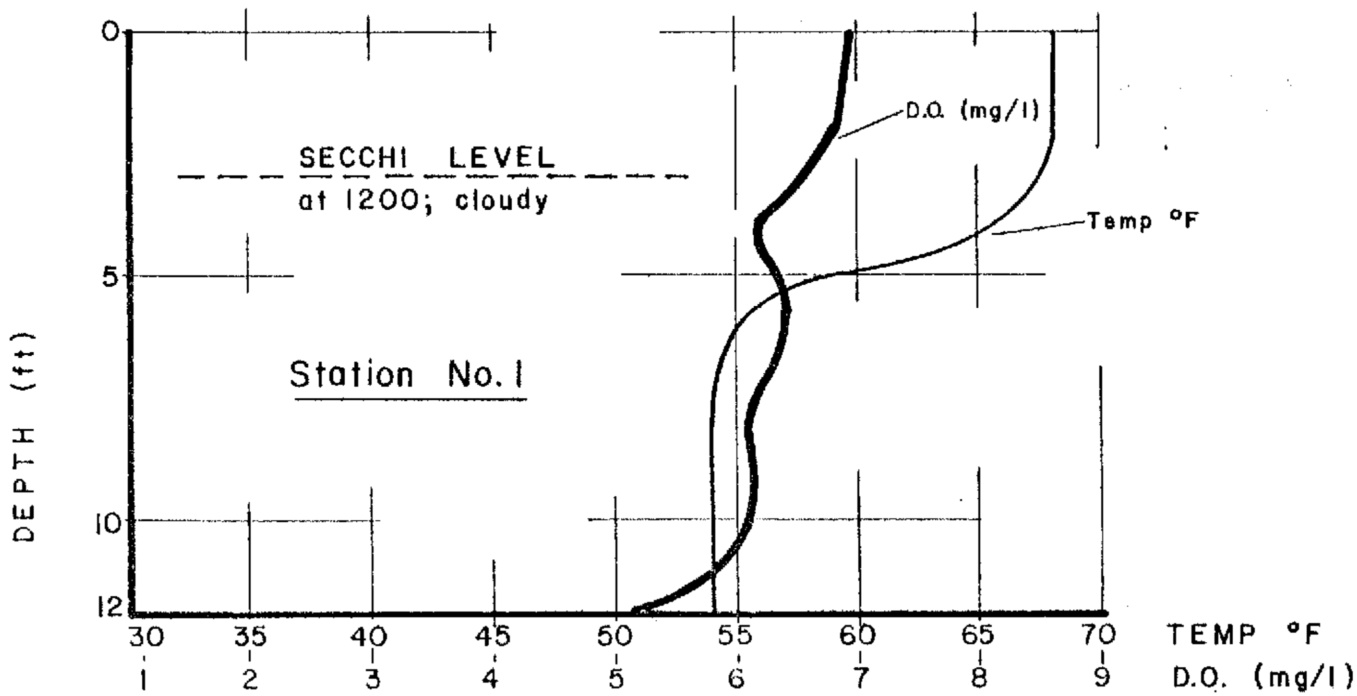
WATER QUALITY DATA (mg/1)

DEPTH (feet)	TEMP. (^oF)	D.O.	pH	TOTAL ALK.	TOTAL HARD.	NH_3-N	NO_3-N	TOTAL P	SiO_2	SUSP. SOLIDS	TOTAL SOLIDS
STATION 1 - DEEP HOLE											
Surface	68.0	6.9	7.1	18	28	0.00	0.3	0.06	5.0	---	---
2	68.0	6.8	---	---	---	---	---	---	---	---	---
4	65.0	6.2	---	---	---	---	---	---	---	---	---
6	55.0	6.4	6.7	16	28	0.10	0.3	0.03	6.8	---	---
8	54.0	6.1	---	---	---	---	---	---	---	---	---
10	54.0	6.1	---	---	---	---	---	---	---	---	---
12	54.0	5.1	6.7	16	28	0.14	0.3	0.06	6.8	---	---
STATION 2 - INLET (Fort Pond Brook)											
Surface	67.0	7.3	7.0	20	32	0.02	0.3	0.04	4.2	---	---
STATION 3 - INLET (Nashoba Brook)											
Surface	68.0	7.5	7.0	16	28	0.02	0.5	0.04	7.4	---	---
STATION 4 - 36" DRAIN PIPE INLET											
Pipe Inflow	56.0	9.4	6.7	18	41	0.05	0.9	0.02	10	---	---
STATION 5 - OUTLET											
Surface	70.0	7.7	6.8	18	29	0.00	0.2	0.03	5.2	5.0	111

TEMPERATURE & DISSOLVED OXYGEN PROFILE

(with SECCHI DISC READING)

June 6, 1974



WARNER'S POND

Figure 13

TABLE 15

WARNERS POND

MICROSCOPIC EXAMINATION IN AREAL STANDARD UNITS/ml

STATIONS 1 AND 4 - JUNE 6, 1974

ORGANISM	STATION 1	STATION 4[1]
Bacillariophyceae		
Cyclotella sp.	6	--
Surirella sp.	12	--
Mastigophora		
Monas sp.	--	6
Synura sp.	88	2
Amorphous Matter	3,969	3,205

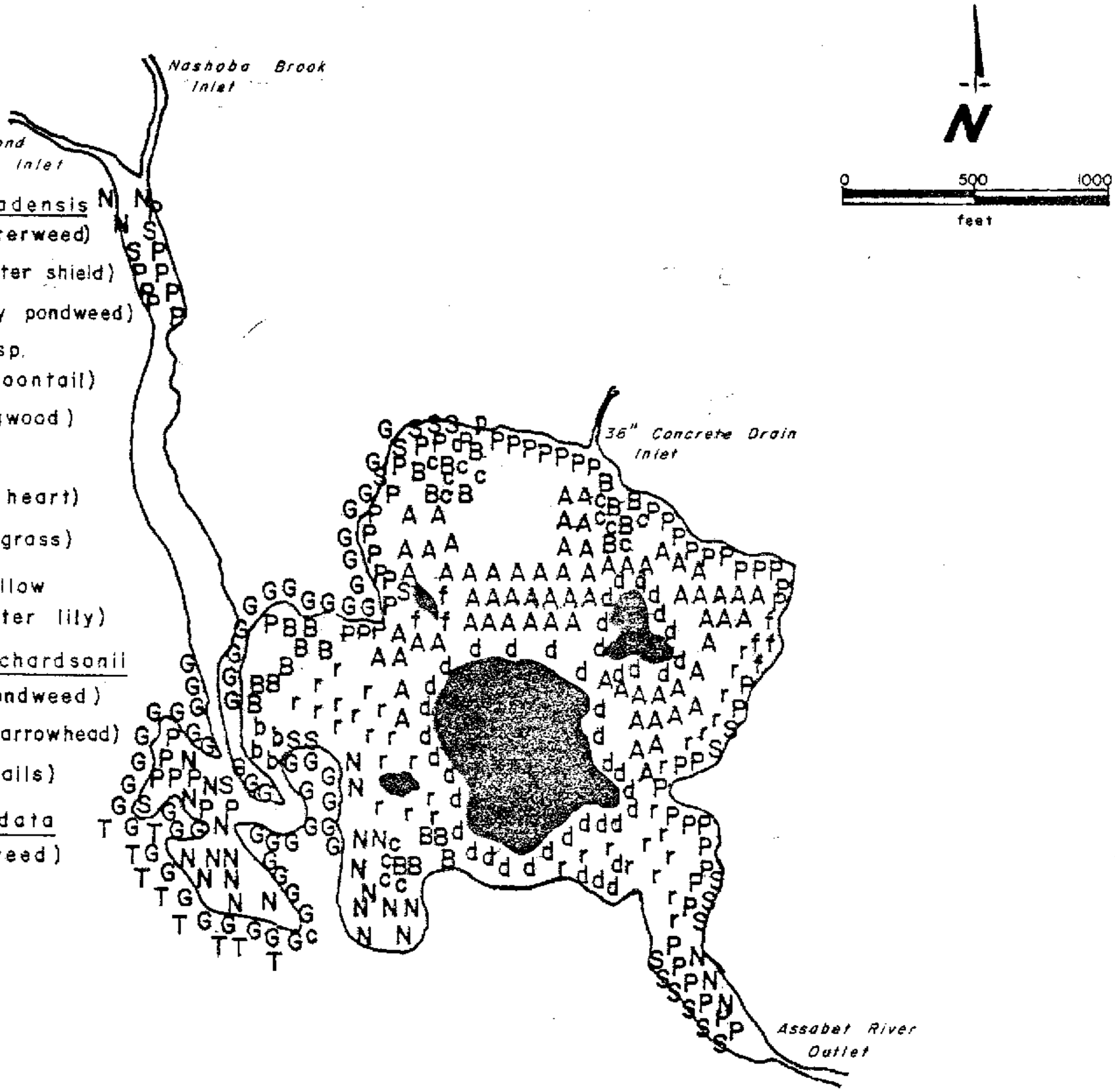
[1]Composite during Assabet River Water Quality Survey.

WARNERS POND 58 Acres

Concord

KEY

A — *Anacharis canadensis* (waterweed)
B — *Brasenia* sp. (water shield)
b — *Najas* sp. (bushy pondweed)
c — *Ceratophyllum* sp. (coontail)
d — *Cornus* sp. (dogwood)
f — *Nymphoides* sp. (floating heart)
G — *Gramineae* sp. (grass)
N — *Nuphar* sp. (yellow water lily)
r — *Potamogeton richardsonii* (pondweed)
S — *Sagittaria* sp. (arrowhead)
T — *Typha* sp. (cattails)
P — *Pontederia cordata* (pickerelweed)



AQUATIC VEGETATION

Figure 14

TABLE 16

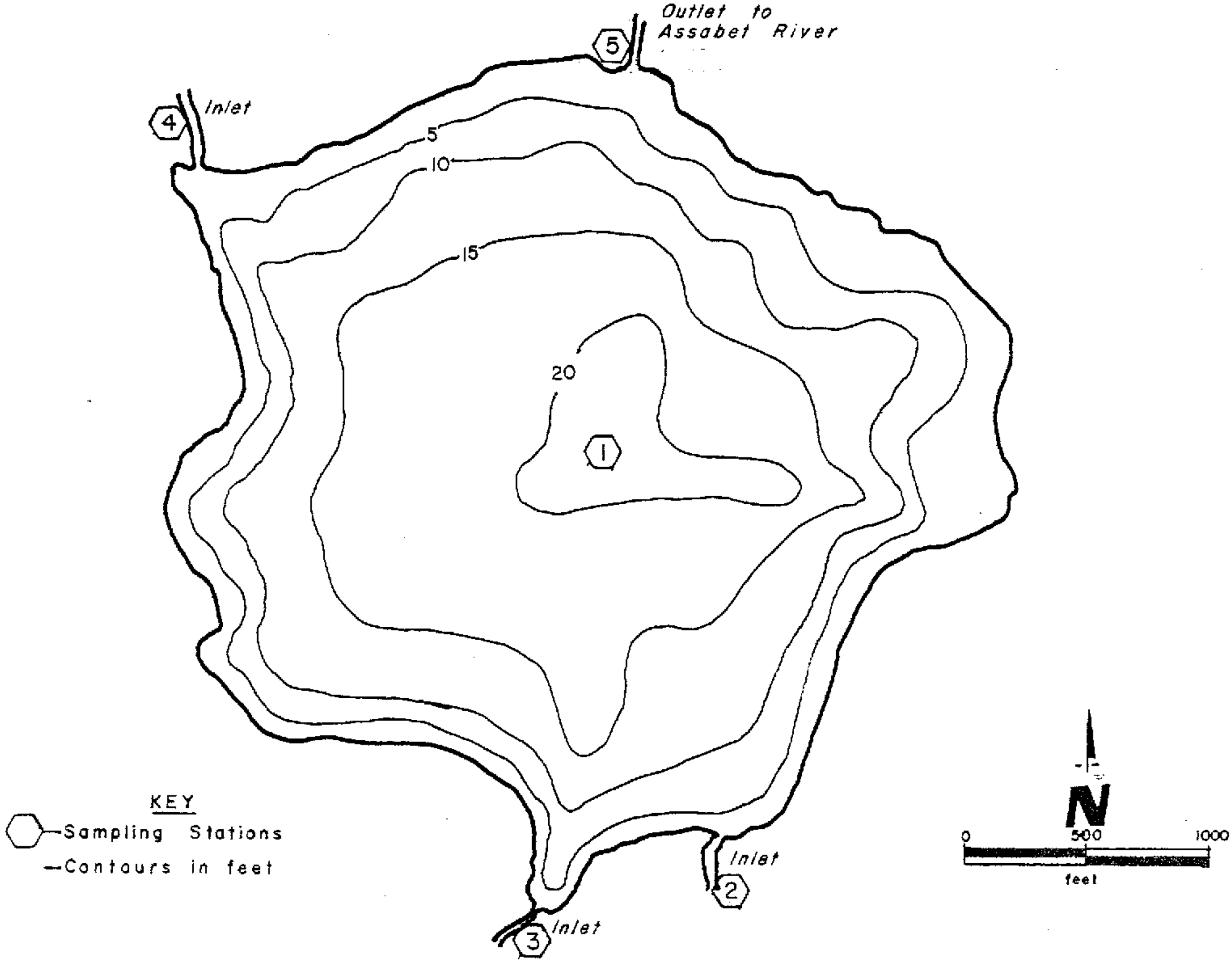
LAKE CHAUNCY

MORPHOMETRIC DATA

Maximum Length	3,600 feet
Maximum Effective Length	3,600 feet
Maximum Width	3,500 feet
Maximum Effective Width	3,500 feet
Maximum Depth	20.0 feet
Mean Depth	11.9 feet
Mean Width	2,142 feet
Area	177 acres
Volume	2,100 acre feet
Shoreline	12,960 feet
Development of Shoreline	1.3
Development of Volume	1.79
Mean to Maximum Depth Ratio	0.59 feet
Drainage Area	1.21 square miles

CHAUNCY LAKE 177 Acres

Westborough



BATHYMETRIC MAP

and LOCATION OF SAMPLING STATIONS

Figure 15

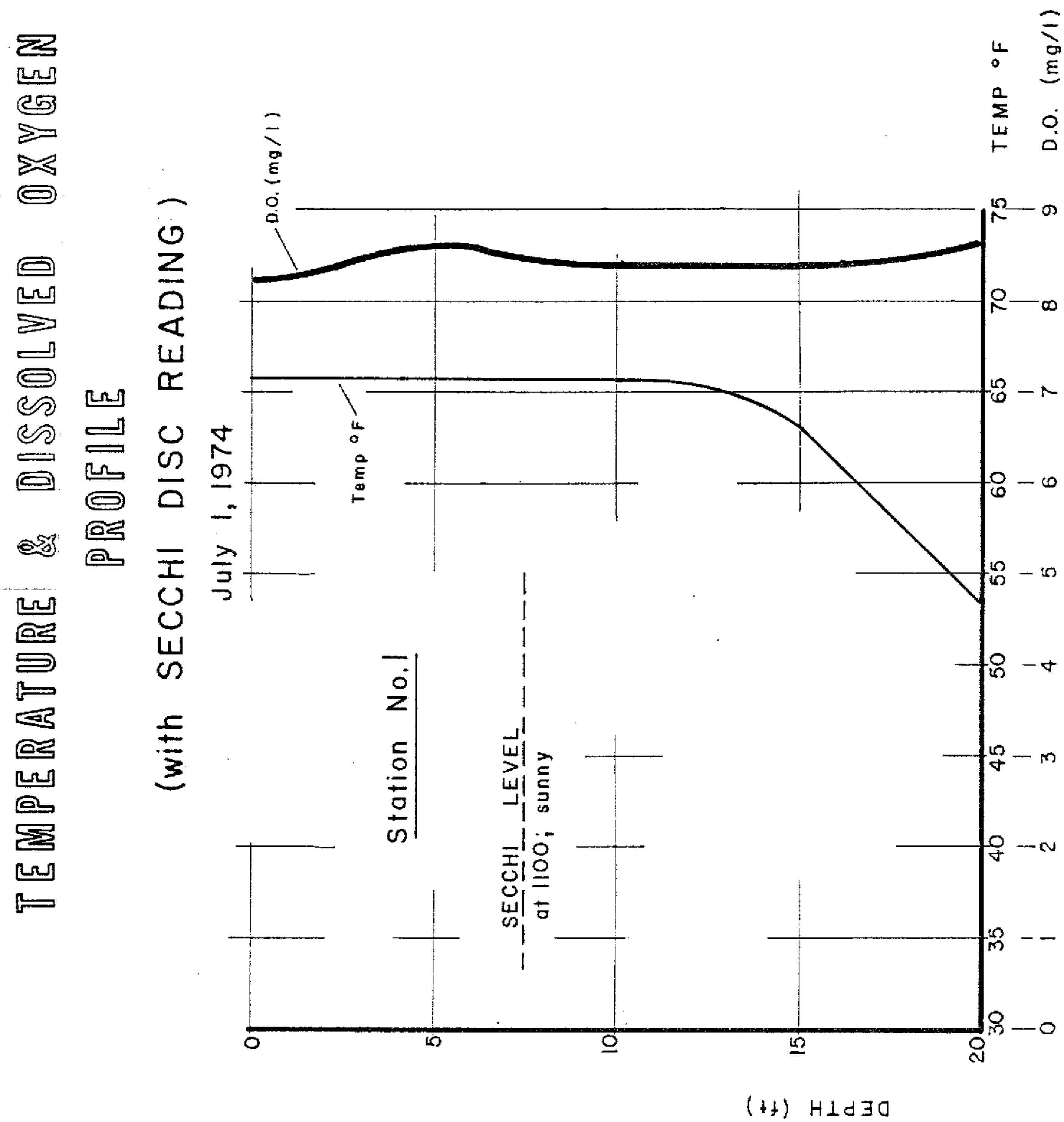
TABLE 17

LAKE CHAUNCY

WATER QUALITY DATA (mg/1)

JULY 1, 1974

DEPTH (feet)	TEMP. (°F)	D.O.	pH	TOTAL ALK.	TOTAL HARD.	NH_3-N	NO_3-N	TOTAL P	SiO_2	CONDUCTIVITY (umho/cm)
STATION 1 - DEEP CENTER										
Surface	65.5	8.2	7.3	23	40	0.00	0.0	0.03	3.6	150
5	65.5	8.6	7.3	--	--	--	--	--	--	--
10	65.5	8.4	7.3							
15	63.0	8.4	6.9	31	44	0.16	0.0	0.05	4.7	160
20	53.5	8.6	6.9	--	--	--	--	--	--	--
STATION 2 - INLET										
Surface	63.0	1.5	6.3	30	47	0.09	0.0	0.25	16	200
STATION 3 - INLET										
Surface	65.0	3.6	6.8	50	65	1.2	0.0	0.07	6.9	220
STATION 4 - OUTLET										
Surface	66.0	8.4	6.6	23	40	0.00	0.0	0.05	4.6	150



LAKE CHAUNCY

Figure 16

TABLE 18

LAKE CHAUNCY

MICROSCOPIC EXAMINATION IN AREAL STANDARD UNITS/ml

STATIONS 1 AND 5 - JULY 1, 1974

ORGANISM	STATION 1	STATION 5[1]
Cyanophyceae		
Anabaena sp.	473	---
Aphanizomenon sp.	65	---
Polycystis sp.	2,341	BLOOM
Ciliophora		
Paramecium sp.	---	BLOOM[2]
Amorphous Matter	9,205	---

[1]Special grab at outlet

[2]Too numerous to count

CHAUNCY LAKE
177 Acres

Westborough

KEY

L —*Lemna* sp. (duckweed)

m —*Myriophyllum* (water milfoil)

N —*Nuphar* sp. (yellow water lily)

n —*Nymphaea* sp. (white water lily)

P —*Pontedria cordata* (pickerelweed)

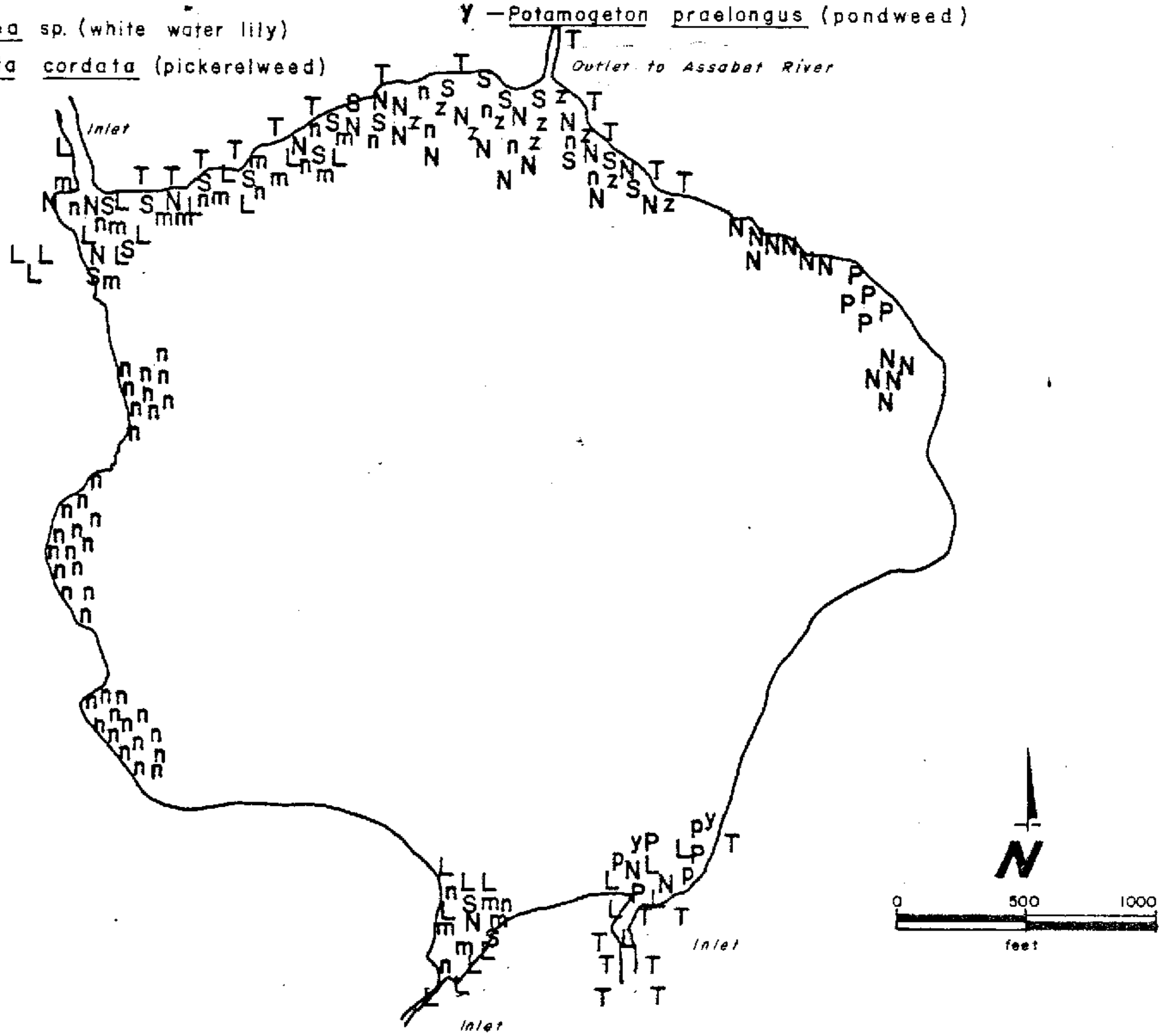
z —*Sparganium* (bur reed)

p —*Potamogeton* sp. (pondweed)

S —*Sagittaria* sp. (arrowhead)

T —*Typha* sp. (cattails)

y —*Potamogeton praelongus* (pondweed)



AQUATIC VEGETATION

Figure 17

TABLE 19

ASSABET RIVER BASIN

LAKE MACROINVERTEBRATES

LAKE/POND	ORGANISMS	NUMBER
Flow Augmentation Pond Station 1 - Deep Hole June 3, 1974	Oligochaeta (aquatic worms)	
	Naididae	
	Nais sp.	50
	Tubificidae	
	Limnodrilus claparadianus	2
	Gastropoda (univalve mollusks)	
	Planorbidae	
	Helisoma sp.	1
	Diptera (true flies)	
	Chironomidae	
	Chironomus sp.	189
	Stictochironmus sp.	1
	Calopsectra gregarius	2
	Glyptotendipes senilis	10
	Dicrotendipes nervosus	1
	Calopsectra sp.	1
	Microtendipes pedellus	3
Boons Pond Station 1 - Northern Basin June 5, 1974	Oligochaeta	
	Tubificidae	
	Limnodrilus hoffmeisteri	15
	Diptera	
	Chironomidae (Orthocladiinae)	1
	Chaoboridae	
	Chaoborus punctipennis	1
Station 2 - Southern Basin June 5, 1974	Oligochaeta	
	Tubificidae	
	Limnodrilus hoffmeisteri	7
	Diptera	
	Chironomidae (Orthocladiinae)	3
	Parachironomus abortivus	1
	Chaoboridae	
	Chaoborus punctipennis	1

TABLE 19 (Continued)

LAKE/POND	ORGANISMS	NUMBER
Lake Chauncy Station 1 - Deep Hole July 1, 1974	Oligochaeta	
	Tubificidae	
	Limnodrilus hoffmeisteri	9
	Diptera	
	Chironomidae (Orthocladiinae)	19
	Chaoboridae	
	Chaoborus punctipennis	17
Warners Pond Station 1 - Deep Hole June 6, 1974	Oligochaeta	
	Naididae	
	Nais sp.	12
	Tubificidae	
	Limnodrilus sp.	5
	Pelecypoda (bivalve mollusks)	
	Sphaeridae	
	Pisidium sp.	1
	Diptera	
	Chaoboridae	
	Chaoborus punctipennis	3

DESCRIPTION OF TERMS

MAXIMUM LENGTH: Length of line connecting two most remote extremities of lake. Represents true open-water length; does not cross any land other than islands.

MAXIMUM EFFECTIVE LENGTH: Length of straight line connecting most remote extremities of lake along which wind and wave action occur without any kind of land interruption. Often identical with maximum length.

MAXIMUM WIDTH: Length of straight line connecting most remote transverse extremities over water at right angles to maximum length axis.

MAXIMUM EFFECTIVE WIDTH: Similar to maximum effective length only at right angles to it.

MAXIMUM DEPTH: Maximum depth known for lake.

MEAN DEPTH: Volume of lake divided by its surface area.

MEAN WIDTH: Area of lake divided by maximum length.

AREA: Refers to surface area of lake exclusive of islands. Determined by planimetry from outline of map.

VOLUME: Determined by computing the volume of each horizontal stratum as limited by the several submerged contours on the bathymetric (hydrographic) map and taking the sum of the volumes of all such strata.

SHORELINE: Length of lake's perimeter, measured from map with rotometer (map measurer).

DEVELOPMENT OF SHORELINE: Degree of regularity or irregularity of shoreline expressed as index figure. It is the ratio of the length of the shoreline to the length of the circumference of a circle of an area equal to that of the lake. It cannot be less than unity. The quantity can be regarded as a measure of the potential effect of littoral processes on the lake.

DEVELOPMENT OF VOLUME: Defined as the ratio of the volume of the lake to that of a cone of basal area equal to the lake's area and height equal to the maximum depth.

MEAN DEPTH - MAXIMUM DEPTH RATIO: Mean depth divided by maximum depth. It serves as an index figure which indicates in general the character of the approach of basin shape to conical forms.

LENTIC: Relating to still or calm water, as lakes or ponds.

LOTIC: Relating to moving water, as rivers or streams.

EPILIMNION: The circulating, superficial layer of a lake or pond lying above the metalimnion which does not exhibit thermal stratification.

METALIMNION: The layer of water in a lake between the epilimnion and hypolimnion in which the temperature exhibits the greatest difference in a vertical direction.

HYPOLIMNION: The deep layer of a lake lying below the metalimnion and removed from surface influences (i.e., not circulating).

THERMOCLINE: Coincident with metalimnion; relates to lake zone with greatest temperature change in a vertical direction.

CLINOGRADE: A stratification curve of temperature or of a chemical substance in a lake that exhibits a uniform slope from the surface into deep water.

ORTHOGRADE: A stratification curve for temperature or a chemical substance in a lake which has a straight uniform course.

HETEROGRADE: A stratification curve for temperature or a chemical substance in a lake that exhibits a non-uniform slope from top to bottom. It can be positive (metalimnetic maximum) or negative (metalimnetic minimum).

CULTURAL EUTROPHICATION: Enrichment or rapid increase in productivity of a body of water caused by man. It is an accelerated process as opposed to natural, slow aging of a body of water. Visual effects include nuisance algal blooms, low transparency, extensive aquatic plant growth, loss of cold water fisheries due to oxygen depletion, and others. It is caused by the rapid increase in nutrient additions to the lake.

AQUATIC PLANTS: An aquatic can be defined as a vascular plant that germinates and grows with at least its base in the water and is large enough to be seen with the naked eye. The following three broad categories are recognized:

1. EMERGENT: Those plants rooted at the bottom and projecting out of the water for part of their length.
   Examples: Arrowhead (*Sagittaria* sp.)
   Pickerelweed (*Pontederia* sp.)
2. FLOATING: Those which wholly or in part float on the surface of the water and usually do not project above it.
   Examples: Water shield (*Brasenia* sp.)
   Yellow water lily (*Nuphar* sp.)
3. SUBMERGED: Those which are continuously submerged (except sometimes for floating or emergent inflorescences).
   Examples: Bladderwort (*Utricularia* sp.)
   Pondweed (*Potamogeton* sp.)

SESTON: All the particulate matter suspended in the water.

DIMICTIC LAKE: One with spring and fall turnovers (temperate lakes).

SILICA: This substance (SiO_2) is necessary for diatom growth. The concentration of silica is often closely linked with the diatom population's growth. The limiting concentration is usually considered to be 0.5 mg/l.

REFERENCES

1. American Public Health Association, Standard Methods for the Examination of Water and Wastewater. New York, 1971.

2. Commonwealth of Massachusetts, Water Resources Commission, Division of Water Pollution Control, Assabet River: 1974 Water Quality Survey Data. Westborough, Massachusetts, 1975.

3. Dillon, P.J., A Manual for Calculating the Capacity of a Lake for Development. Ontario, Canada: Ontario Ministry of the Environment, Water Resources Branch, 1974.

4. Edmonson, W.T. (Ed.), Ward and Whipple, Fresh-Water Biology. New York: John Wiley and Sons, 1959.

5. Fassett, Norman C., A Manual of Aquatic Plants. Madison, Wisconsin: University of Wisconsin Press, 1972.

6. Hogan, Paul M., Assabet River: 1974 Water Quality Analysis. Westborough, Massachusetts: Commonwealth of Massachusetts, Water Resources Commission, Division of Water Pollution Control,1975.

7. Hotchkiss, Neil, Common Marsh, Underwater and Floating-Leaved Plants of the United States and Canada. New York: Dover Publications, Inc., 1972.

8. Hutchinson, G.E., A Treatise on Limnology, Volume I: Geography, Physics, and Chemistry. New York: John Wiley and Sons, Inc., 1957.

9. -----, A Treatise on Limnology, Volume II: Introduction to Lake Biology and the Limnoplankton. New York: John Wiley and Sons, Inc., 1967.

10. McCabe, Britton C., Fisheries Report for Lakes of Central Massachusetts, 1944-1945. Boston, Massachusetts: Commonwealth of Massachusetts, Division of Fisheries and Game, 1946.

11. McCann, James A., John B. Dixon, and Robert W. Schleger, An Inventory of the Ponds, Lakes, and Reservoirs of Massachusetts - Middlesex County. Amherst, Massachusetts: Water Resources Research Center, University of Massachusetts, 1972.

12. McCann, James A., Hermon J. Covey, Robert P. Corrinet, and Paul E. Ostroski, An Inventory of the Ponds, Lakes, and Reservoirs of Massachusetts - Worcester County. Amherst, Massachusetts: Water Resources Research Center, University of Massachusetts, 1972.

13. Maine Department of Environmental Protection, Division of Lakes and Biological Studies, Standard Procedures for Biological Evaluation. Augusta, Maine, 1974.

14. -----, *Standard Procedures for Sampling Benthic Macroinvertebrate Communities.* Augusta, Maine, 1974.

15. National Academy of Science, *Eutrophication: Causes, Consequences, and Correctives*. Washington, D.C., 1967.

16. Needham, James G., and Paul R. Needham, *A Guide to the Study of Fresh-Water Biology*. San Francisco: Holden-Day, Inc., 1962.

17. Palmer, Mervin C., *Algae in Water Supplies*. Washington, D.C.: United States Department of Health, Education, and Welfare, Public Health Service, 1962.

18. Pennak, Robert W., *Fresh-Water Invertebrates of the United States*. New York: Ronald Press Co., 1953.

19. Pollock, S.J., D.F. Farrell, and W.W. Caswell, *Water Resources of the Assabet River Basin, Central Massachusetts*. Washington, D.C.: United States Department of the Interior, Geological Survey, Water Resources Division, 1969.

20. Pollock, S.J., and W.B. Fleck, *Massachusetts Basic-Data Report No. 8, Ground-Water Series, Assabet River Basin*. Boston: United States Department of the Interior, Geological Survey, 1964.

21. Prescott, G.W., *The Aquatic Plants*. Dubuque, Iowa: William C. Brown Co., 1969.

22. -----, *The Fresh-Water Algae*. Dubuque, Iowa: William C. Brown Co., 1954.

23. Ruttner, Franz, *Fundamentals of Limnology*. Toronto, Canada: University of Toronto Press, 1953.

24. Smith, Gilbert M., *Fresh-Water Algae of the United States*. New York: McGraw-Hill Book Co., 1950.

25. Stroud, Richard H., *Fisheries Report for some Central, Eastern, and Western Massachusetts Lakes, Ponds, and Reservoirs, 1951-1952*. Boston: Commonwealth of Massachusetts, Division of Fisheries and Game, 1955.

26. United States Environmental Protection Agency, *Measures for the Restoration and Enhancement of Quality of Freshwater Lakes*. Washington, D.C., 1973.

27. Weber, C.I. (Ed.), *Biological Field and Laboratory Methods for Measuring the Quality of Surface Waters and Effluents*. Cincinnati, Ohio: United States Environmental Protection Agency, National Environmental Research Center, Office of Research and Development, 1973.

28. Welch, Paul S., *Limnological Methods*. New York: McGraw-Hill Book Co., 1948.

29. -----, Limnology. New York: McGraw-Hill Book Co., 1952.

30. Weldon, L.W., R.D. Blackburn, and D.S. Harrison, Common Aquatic Weeds. New York: Dover Publications, Inc., 1973.

APPENDIX A

ASSABET RIVER LAKES AND PONDS

TEMPERATURE (°F) AND DISSOLVED OXYGEN (mg/l) CONCENTRATIONS

DEEP HOLE STATIONS

BOONS POND 8/10/45

Depth (ft)	Temp.	D.O.
1	79.0	8.0
10	74.0	8.1
18	73.0	7.9

LAKE CHAUNCY 8/9/44

Depth (ft)	Temp.	D.O.
1	78.0	8.6
5	77.0	8.6
10	76.0	8.2
12	75.0	5.0
15	73.0	1.4

HOCOMONCO POND 7/14/52

Depth (ft)	Temp.	D.O.
1	81.0	---
2	80.0	---
3	77.0	---
4	76.0	9.0
5	75.0	---
6	75.0	---
7	75.0	8.6
8	74.0	---

ROCKY POND 7/25/51

Depth (ft)	Temp.	D.O.
1	78.0	6.8
10	76.0	---
12	76.0	6.4
13	75.0	---
15	74.0	5.1
17	69.0	---
19	66.0	1.3
20	65.0	---

Source: Massachusetts Division of Fisheries and Wildlife.

APPENDIX A

ASSABET RIVER LAKES AND PONDS

TEMPERATURE (^{o}F) AND DISSOLVED OXYGEN (mg/l) CONCENTRATIONS

DEEP HOLE STATIONS

BOONS POND 8/10/45

Depth (ft)	Temp.	D.O.
1	79.0	8.0
10	74.0	8.1
18	73.0	7.9

LAKE CHAUNCY 8/9/44

Depth (ft)	Temp.	D.O.
1	78.0	8.6
5	77.0	8.6
10	76.0	8.2
12	75.0	5.0
15	73.0	1.4

HOCOMONCO POND 7/14/52

Depth (ft)	Temp.	D.O.
1	81.0	---
2	80.0	---
3	77.0	---
4	76.0	9.0
5	75.0	---
6	75.0	---
7	75.0	8.6
8	74.0	---

ROCKY POND 7/25/51

Depth (ft)	Temp.	D.O.
1	78.0	6.8
10	76.0	---
12	76.0	6.4
13	75.0	---
15	74.0	5.1
17	69.0	---
19	66.0	1.3
20	65.0	---

Source: Massachusetts Division of Fisheries and Wildlife.