AN ASSESSMENT OF THE WATER QUALITY OF BIG BOWMAN POND

RENSSELAER COUNTY, NEW YORK

Completed by

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TABLE OF CONTENTS

Background

Big Bowman Pond is located in the south-central portion of Rensselaer County in the Town of Sand Lake. The lake's watershed is located on the Rensselaer Plateau. Elevations within the watershed range from 1400 feet at the surface of the lake to 1580 feet above sea level.

The lake has a surface area of 29.4 acres and a steeply sloping watershed of 251 acres. The lake has a maximum depth of 9.2 meters (28 ft.) and exhibits thermal stratification. The only outlet is located on the northwestern margin of the lake. There are few weedbeds although pond lilies are present in moderate numbers at the outlet and the northern bay. In the 1972 RPI Survey, Big Bowman pond was classified as mesotrophic while a study by Malcolm Pernie Engineering in 1978 determined that the pond was better classified as oligotrophic to mesotrophic. These classifications indicate that nutrients necessary for the growth of algae in the waters of the pond are low to moderate.

The surficial geology is primarily glacial till (a sand and gravel soil without exposed bedrock). The soil associations are Worth-Empeyville-Westbury deposits with many stones, boulders, and outcropings. The former deposits are developed on acid glacial till from sandstone. Drainage in these deposits is moderate to poor, and their ability to furnish lime, nitrogen and phosphorus to plants via root uptake is low to medium.

Bedrock in the watershed is composed of Rensselaer graywacke.

Table 1. Physical Features of Big Bowman Pond.

BIG BOWMAN POND - Sand Lake, Rensselaer County, New York	
Latitude	42 degrees 39 minutes
Longitude	73 degrees 29 minutes
Maximum Depth	9.2 meters (28 feet)
Surface Area	11 hectares (29.4 acres)
Watershed Area	113 hectares (251 acres)
Elevation Above Sea Level	466 meters (1400 feet)
Annual Precipitation	40-50 inches
Mean Annual Temperature	49° Fahrenheit (9.4°C)

Big Bowman Pond is a residential/recreational lake with boating, fishing and swimming the primary uses. There is limited public access. The watershed is moderately populated, but areas of undeveloped shoreline with potential for residential use remain. The population in 1972 was 20 year round residents with a summer peak of 167. Commercial land use on the shore of the lake is minimal. Sewage treatment is on an individual septic system basis. Rensselaer County Department of Health (RDOH) conducted septic surveys in the watershed of Big Bowman Pond in 1977. Fifty seven homes were surveyed and the results are available from RDOH. Big Bowman has only once been found to have coliform counts of over 1,000 organisms per 100 ml. It is however prone to nuisance algal blooms. Measures to control development in the watershed include large lot zoning; building lots in this area have been zoned to a minimum of one to two acres to assure adaquate land area for on-site sewage treatment. In addition, the Town of Sand Lake has designated the shoreline of its lakes within 100 feet of the high water mark as "scenic districts" requiring special permits for new construction in these areas.

Copper sulfate has never been added to Big Bowman Pond on a regular basis in an attempt to control algae or aquatic macrophytes. Tests of water quality have indicated that the water is soft and non-alkaline (RPI Survey, 1972).

Sampling Locations

In order to characterize the chemistry of Big Bowman Pond water, six sampling sites were selected (Figure 1 and Table 2). Sites were selected to provide samples representative of the lake as a whole. Selection criteria include: water depth, degree of shoreline development, density of aquatic weed growth, and proximity to inlets or outlets.

Table 2. Chemical Water Quality Sampling Sites.

Site	Name	Location
1	North Bay	The sampling site was located in front of a green house on the east shore, midlake with a red shake sided house on the west shore. Maximum water depth at this site was 1.5 meters.
2	Outlet	The sampling site was located 40 meters from shore in the center of the outlet bay. Maximum water depth at this site was 2 meters.
3	Midlake	The sampling site was located West of a birch tree above a large rock and East of the point that is to the South of the outlet. Maximum water depth at this site was 9.2 meters.
4	Midlake Deep	The sampling site was at the same point as site number three. This is the deep point sample. Depth of this sample was 9 meters.

5	East	The sampling site was located in the mouth of the east bay. The site was just south of the east point in the center of the bay. Maximum water depth at this site was 2.7 meters.
6	South	The sampling site was in the center of the southern section of the lake. To the West was a red house, to the South was a brown bungalow with light green trim, to the East was a shed near a red house with yellow trim, and to the North was the midlake sample site.

Sampling Methods

At each lake site various types of water samples were collected: a surface grab for coliform bacteria analysis, an integrated sample to a predetermined depth (1, 2, 3, or 5 meters), a deep point sample from near the bottom of the lake in deep waters (i.e. greater than 8 meters), and specimens of aquatic vegetation.

Samples for coliform bacteria analysis were collected by submerging a sterile 500 milliliter bottle below the surface of the water and then inverting it to fill in such a manner that the mouth of the bottle was as far as possible from human skin. Care was taken to avoid collecting portions of the surface film in the sample. All samples were analysed within 6 hours of collection.

Integrated samples, encompassing a portion of the water column, were collected with a polyvinyl chloride hose. The hose was weighted at one end and lowered to the desired depth. The opposite end of the tube was sealed and the entire tube retrieved. The sample was drained into a collection bottle and mixed. Integrated samples were collected at all sites. At sites where the depth was 5 meters or greater, deep water point samples were taken using a Van Dorn collection bottle. The Van Dorn bottle was lowered to the depth in the lake where the sample was to be collected and remotely triggered to shut, thus collecting a sample of water at the depth where it was triggered.

At each site, the following measurements were made if conditions permitted: 1) water transparency by Secchi depth, 2) water depth, 3) temperature, and 4) dissolved oxygen (D.O.) using a YSI Model 54 D.O./Temperature Meter. Water samples collected by the two previously described methods (integrator hose and Van Dorn collection bottle) were stored on ice until return to the laboratory. Immediately upon returning to the laboratory a portion of each sample was analysed for pH, specific conductance and alkalinity. A separate portion to be used for total phosphorus determination was frozen until analysed. A third portion was preserved with nitric acid for determination of metals. The remainder of each sample was filtered (0.4 um

Nuclepore filter) and stored at 4° C until analysed for nitrate, ammonia, sulfate, chloride and soluble silica concentrations. The analytical methods used for all determinations are listed in Appendix A.

Results

Samples were collected from Big Bowman Pond on July 16 and November 1, 1985. The lake was thermally stratified throughout the summer months and destratification (turn over) was complete by the November 1 sampling (Figure 2). Thermal stratification, when used to describe a lake, refers to an increase or decrease in water temperature from the surface to the bottom of the lake. Since most of the heating of the lake occurs at the surface, temperature in the surface waters during the summer months is highest and decreases with depth. There is however, a zone of rapid temperature change over a small increase in depth (Figure 2). This zone is referred to as the thermocline. This thermocline acts as a barrier, effectively preventing mixing of the waters above it with the waters below it. The part of the lake above the thermocline is referred to as the epilimnion and the portion below the thermocline is known as the hypolimnion. From Figure 2, it is apparent that the thermocline in Big Bowman Pond occurs between 5 and 6 meters (16 and 19 feet) during the summer months.

Depth profiles of dissolved oxygen and temperature were made on July 16 and November 1 (see Figure 2). The low levels of oxygen in the hypolimnion (waters deeper than 7 meters) of Big Bowman Pond during the summer controls the type of organisms capable of utilizing this portion of the lake. This lack of oxygen is due to decomposition going on in the deep waters and sediments. Bacterial activity in the sediments of the lake bottom consumes oxygen and once the lake is stratified, the deep waters are effectively cut off from the primary source of oxygen to a lake, the atmosphere. A byproduct of some of the bacteria capable of living in the absence of dissolved oxygen is hydrogen sulfide which gives the water a "rotten egg" odor. Results from samples collected on July 16 (Figure 2) indicated that summer stratification was firmly established by this date.

The chemical constituents of primary concern for Big Bowman Pond residents would be those which promote the growth of algae and aquatic weeds. These materials, notably phosphorus and nitrogenous compounds, are fertilizers in that they are present in the shortest supply relative to the amounts needed to sustain algal growth. Addition of one or both of these nutrients generally results in a reduction of water quality since the concentrations of these nutrients control the amount of plant and thus animal material capable of growing in the lake. Sources of nitrogen and phosphorus to the lake include: the atmosphere through rain, snow, etc., surface runoff of soils, septic system leachate, resuspension from the sediments of the lake, runoff of fertilizers from farm fields or lawns and gardens, and fecal material from domestic animals.

Phosphorus is generally considered to be the primary limiting nutrient to plant growth. Total phosphorus concentrations listed in Tables 3 and 4 indicate that the amount of phosphorus in the surface waters of Big Bowman Pond is fairly low and comparable to other Rensselaer County lakes. At any one time, most of the phosphorus is probably tied up in the cellular material of the organisms in the lake. Phosphorus concentrations in the deeper waters of the lake (midlake) during the summer months were reasonable for a lake such as Big Bowman (11 ppb). As the lake turned over in the fall, rapid algal growth resulted from the phosphorus present in the deep waters being brought to the surface. The remains of an algal bloom were apparent during the late fall sampling trip.

The methods used to determine the amount of nitrogenous compounds in the lake water only measure materials not contained in living tissue or particulate material. From Table 3, it is apparent that there are little or no nitrogenous compounds (ammonia and nitrates) available in the surface waters during the period of summer stratification (July 16 sample). Most of the nitrogenous material is probably bound up in living tissue (i.e. algae, plants, fish, etc.). As there was not a discernable algal bloom occurring at the time of sampling, the lack of available ammonia and nitrates indicates that nitrogenous material may be limiting to algal productivity in Big Bowman Pond. The deeper waters of the lake (midlake sample) had considerable amounts of ammonia, a byproduct of the decomposition processes going on in the sediments. As the lake mixed during fall overturn, the nitrate and ammonia concentrations of the hypolimnion decreased (Table 3, November 1 sample). The resultant increase of nitrate and ammonia in the surface waters probably spurred the considerable growth of algae observed during the late fall sampling trip.

Alkalinity and pH records for Big Bowman Pond are listed in Table 3. The pH at all sites was approximately neutral (pH near 7.0). The ability of a lake to neutralize additions of acid via acid rain or surface runoff is measured by alkalinity or the buffering capacity present in the lake water. The alkalinity of Big Bowman Pond ranged from 12.0 to 16.0 mg/L as $CaCO_3$ in the surface waters (epilimnion). This alkalinity value is low but as evidenced by the neutral pH of the lake water, it presently has an adequate capacity to buffer any acids coming into the lake. The greatest amount of acid enters the lake during the spring when rapid melting of snow occurs. This is generally the time when the most acidic (less than 7) pH values are observed in lakes and streams. Since spring water samples were not included in this study, the effects of spring snowmelt on the pH of Big Bowman Pond remains to be determined.

Secchi depth is a simple measure of water transparency. Water transparency is controlled by the density of plankton and the amount of fine grained silts and clays present in the water. Nutrient rich lakes, for example Saratoga Lake listed in Table 4 for comparison, generally have large numbers of plankton in the water which result in low transparency results. Shallow lakes in areas where the soils are mainly fine clays and silts also have generally low Secchi transparency readings due to constant resuspension of the fine sediments via wave activity. Water transparency in Big Bowman Pond as measured with a Secchi disk averaged 5.0 meters (16 feet). This transparency is comparable to other lakes in Rensselaer County (Table 4).

Specific conductance is a measure of the total dissolved ions present in the water. Conductivity values in the surface waters ranged from 112.4 to 120 umhos. Samples taken from the hypolimnion, waters deeper than seven meters, exhibited considerably higher conductivities than other locations with a value of 130 umhos during summer stratification. Higher conductivities in the deeper waters are partially due to increased concentrations of ammonia and phosphorus. During fall overturn, the November 1 samples, conductivity values in the surface waters were slightly lower than recorded for summer samples. The fact that the conductivity at the deep midlake site was consistant with the surface waters of the lake indicates that mixing of the lake was complete. The midlake sample taken at 9 meters depth, was similar to the surface water results.

The chloride concentrations for all samples from Big Bowman Pond ranged from 16.6 to 18.3 milligrams per liter.

Concentrations of chloride in this range are average for Rensselaer County (Table 4) and present little or no hazard. Since spring samples were not collected specific statements on input of chlorides to the lake via road salt cannot be made at this time.

The coliform group of bacteria are used as the principal indicator of suitability of water for domestic and recreational use. These bacteria are found in the digestive tract of warm blooded animals and excreted with fecal material. Coliform bacteria though not generally pathogenic (disease causing) in humans indicate the presence of sewage which frequently carries other potentially pathogenic bacteria and viruses. Ratios of the different groups of coliform organisms are used to determine whether the sewage source was human or other warm blooded animal, e.g. cattle, poultry, etc. Assays of total and fecal coliform bacteria in Big Bowman Pond were made at various locations to determine potential locations of sewage input and to provide assurance that Big Bowman Pond remains within NYS guidelines for contact recreation (i.e. swimming). Levels of coliform bacteria in the lake (Table 3) are well below the allowable limits set by New York State for contact recreation (Table 5, Class B). The number of coliform bacteria in samples collected during the fall sampling were generally lower than results from the summer samples. Since coliform bacteria levels in samples taken during the time of greatest human activity (summer) were higher than samples collected in the fall, some sewage may be entering the lake.

A bathymetric map of Big Bowman Pond (Figure 3) is provided courtesy of the Malcolm Pirnie Comprehensive Sewerage Study, 1978.

Specimens of rooted aquatic plants (macrophytes) present were collected at each site. A list of the species collected is included as Table 6. Aquatic weeds do not presently appear to be a problem for boating but the densities observed in the north bay and to a lesser extent the outlet bay provide undesirable conditions for swimming. In all likelihood, the weed beds provide habitats for numerous fish and other organisms allowing for a good warm water sports fishery. Filamentous algae, primarily of the genera Spirogyra and Mugeotia, were observed growing in dense mats over the surfaces of rocks and aquatic weeds along the shoreline. A pamphlet on control techniques for both aquatic weeds and filamentous algae produced by NYS Dept. of Environmental Conservation is included for your information (Appendix C).

A list of the fish species reported for Big Bowman Pond (Table 7) is included courtesy of the NYS Department of Environmental Conservation.

A survey of water quality in Rensselaer County lakes was completed by RPI in 1972. Comparison of data from this report with the present study indicates that the chemistry of Big Bowman Pond water has remained fairly stable over the last 13 years (Table 8). Decreases in phosphorus, nitrate and ammonia concentrations in the lake water are apparent. Individual water samples collected in August of 1934 and 1967 by New York State and RPI respectively also indicate that water quality has remained stable and may even have improved over the last 52 years (Table 8).

SUMMARY AND SUGGESTIONS

At present, the water quality of Big Bowman Pond is quite adequate for the primary use of its' residents, namely recreation. The chemical and bacteriological results are well within guidelines set by New York State for these uses (Class B, Table 5). Use of Big Bowman Pond water for drinking or food preparation without prior treatment (chlorination) is probably not advisable. If it is necessary to use lake water for these purposes, chlorination is desirable to kill any potential pathogenic organisms and filtration to remove particulates is well worth the small additional cost. Location of intakes for lake water systems should be given careful consideration. The intake should be no deeper than 5 meters (15 feet) to assure well oxygenated water and should be no shallower than 2 meters (6 feet) to avoid sediments mixed by wave action and recreational activity. Without active concern the good water quality presently enjoyed by residents is not guaranteed.

Since the lake serves public and private users as a bathing area, elimination of all inputs from septic systems should be of primary concern. Initiation of a new Septic Survey by the Rensselaer County Department of Health (DOH) should be expedited.

The survey will determine any severe problems and it then becomes the Department of Health's responsibility to oversee correction of any problems encountered. If the DOH, as a result of a lack of manpower, is unable to complete the survey, the association members may wish to do their own survey. I have included a sample septic survey form for your information (Appendix B). The only shortcoming of doing your own survey is the lack of any legal right to force residents to correct failing systems. DOH may be willing on a case by case basis to help you with this. After completion of the survey, lake residents should still police themselves since systems that were operational during the survey may fail shortly afterward.

As previously discussed, nitrogen and phosphorus compounds entering the lake are likely to cause the greatest problems for recreational users. There are a number of ways that the amount of these nutrients entering the lake can be reduced. Methods for reduction will be discussed in relation to the source of input.

Nutrient additions from the atmosphere through rain, snow, etc. are a large part of the total nutrients added to a lake each year. The ability to reduce inputs from this source is limited. Reduction of the amount of impermeable surfaces adjacent to the lake (paved roads and driveways, sidewalks, etc.) will slow the flow of rainwater to the lake by forcing it to percolate through soils prior to entering the lake. Soils act as a natural filter removing much of the nitrogen and phosphorus compounds before the water reaches the lake. Eliminating stormwater drains emptying directly into the lake is also helpful. The drains may be redirected to small gravelled areas for slow dispersal of the water.

Sewage from failing or improperly located septic systems can be a major source of nutrients to a lake. In a properly maintained and located septic system, solid material is allowed to settle in the septic tank where microorganisms can decompose it into water soluble material. The water soluble components (leachate) are allowed to pass into lateral drainage fields where the liquid slowly percolates into adjacent soils. In the soil, chemical reactions and bacteria remove the nitrogen and phosphorus compounds from the water and convert it to insoluble material, cellular material and gaseous material. Thus, in a properly operating system nitrogen and phosphorus are removed before the water finally percolates back to the lake. In a system which is not operating properly, insufficient time is available for complete removal of nitrogen and phosphorus compounds before the leachate reaches the lake. Septic system failure is likely to occur when the systems are:

1) built in fill over an old wetland or natural drainage area whose water table is near the surface of the soil.
2) not of sufficient size to handle normal and peak loading rates.
3) located where the depth of soil present over bedrock is less than six feet.
4) located less than 50 feet from the shore of a lake or a

stream.

5) located in soils with extremely high permeability or steeply sloping ground resulting in too rapid a movement of liquid through the system.

6) receiving excessive amounts of undigestable or slowly digested materials (i.e. plastics, bone or eggshells) without frequent pumpout.

7) older than 30 years and have never been upgraded.

Extreme septic system failures may be observed as clogged toilets and drains or puddling of water on the surface of the ground near the location of the septic leaching device of the system. Puddling is most likely to occur when the soils are quite wet primarily during the spring of the year and after periods of heavy rain in the summer. Surface pooling of water is also most common at high water usage times of day, generally in the morning. Septic inputs directly into the lake generally result in excessive growth of dense filamentous mats of algae near the point where the sewage enters the lake.

Eroding soils carry considerable amounts of nutrients into the lake. Soils generally contain much greater amounts of nitrogen and phosphorus compounds than lake water. If soils are stabilized by good vegetation cover, only small amounts of nutrients are washed into the lake. If large areas of timber are logged or if roads and developments are improperly designed, large scale erosion of soils frequently results. Soil erosion may be controlled in several ways by: 1) maintaining or planting effective ground cover vegetation (e.g. Crown Vetch) in erosion prone areas, 2) restricting the amount of acreage that may be logged at any one time and the time of year when logging operations occur, 3) providing guidelines on road construction within the basin and methods that contractors use to develop property, and 4) maintenance of a vegetated area along the shoreline. Considerable amounts of soils are deposited in the lake by streams. Some of the soils may be removed by minimum adjustments to the stream bed to reduce the water velocity in the stream prior to entry into the lake. Reduced water velocity in the stream will cause the bulk of the suspended soils to be deposited in the low velocity area and with occasional cleanout this area can be maintained fairly easily. Your local Soil Conservation Service representative can provide valuable assistance in determining the extent of erosion problems and suggesting methods for soil conservation.

The runoff of fertilizers applied to lawns and gardens can frequently add nitrogen and phosphorus to a lake. There are a number of "common sense" methods for reducing the inputs from these sources. Don't fertilize early in the spring or at other times when soils are saturated from recent rainstorms. Try to apply small amounts of fertilizer more frequently (i.e. twice per year add one-half the amount usually applied once per year). Don't locate vegetable gardens or other gardens that you plan to fertilize heavily close to the lake. Don't fertilize immediately before a rainstorm is forecast.

Continued monitoring of Big Bowman Pond water quality by your association is desirable. A chemical assay program as extensive as that presented in this report is not necessary on an annual basis. Lake Association members in conjunction with their water quality committee can make certain measurements that will prove useful in observing any long-term trends in water quality. The Fresh Water Institute currently assists the Lake George Association in operating a Lay Monitoring Program on Lake George. A similar program could be beneficial to Big Bowman Pond. Association members are provided with Secchi disks and thermometers to record the transparency and temperature of the lake once per week during the summer months. At the end of the year, the data is gathered and compared to results from previous years to provide a measure of any significant changes in water transparency. If your association is interested in initiating such a program, an FWI staff member would be glad to meet with you and discuss the training and equipment necessary. On a three or five year basis, more complete chemical assays and observations of the lake may be advisable. These lake observations and chemical assays may be conducted by such groups as Dyken Pond Environmental Management Center, RPI Freshwater Institute, RPI Department of Environmental Engineering, and many others. If the association feels that they want to collect samples and make their own assessments, laboratories such as Bender Labs in Albany, C.T. Male in Latham, or the Fresh Water Institute are certainly capable of sample analysis on a fee per sample basis.

An informed community is also an important asset. The FWI currently provides a lecture series at our Bolton Landing facility, one evening each week during the summer months, covering environmental and other topics of general interest. Your association could sponsor a similar program at little cost. I have enclosed a list of this summers lecturers to give you an idea of the agencies willing to provide lecturers (Appendix D). In addition, certain universities, state and local agencies offer summer programs and courses for children and adults at nominal costs. I have enclosed the course brochure for summer courses provided by the Fresh Water Institute and I'm sure that the Dyken Pond Environmental Management Center, Five Rivers Environmental Education Center or the Huyck Preserve have similar offerings and may even be willing to conduct one or two day field activities at Big Bowman Pond.

ACKNOWLEDGEMENTS

We would like to thank Sharon Dawes of the Big Bowman Pond Association for locating a boat for our use and access to the lake.

Table 3. Levels of bacteria of the coliform group in Big Bowman Pond.

Location: Big Bowman Pond
Date: July 16, 1985

Site	Total Coliforms colonies/100 ml	Fecal Coliforms colonies/100 ml	Fecal Streps colonies/100 ml
North Bay	0	2	3
Midlake	0	1	16
Beaver Dam	0	6	71

Location: Big Bowman Pond
Date: November 1, 1985

Site	Total Coliforms colonies/100 ml	Fecal Coliforms colonies/100 ml	Fecal Streps colonies/100 ml
North Bay	12	0	3
Midlake	6	0	22
Beaver Dam	18	0	5

Table 3. Results of Chemical Analysis of Water Samples from Big Bowman Pond.

Results of Water Chemistry from Big Bowman Pond

07/16/85

Site	Depth (meters)	Secchi Depth (meters)	Alkalinity mg/l as CaCO3	Conductivity (umhos)	Nitrate (ppm)	Ammonia (ppm)	pH	Calcium (ppm)	Total Phosphorus (ppb)	Silica (ppm)	Chloride (ppm)
North Bay	0-1		12.0	120	<0.01	<0.01	6.86		7	0.52	18.2
Outlet	0-2			118	<0.01	<0.01	7.15	7.0	7	0.52	17.6
Midlake	0-5	4.5	14.0	119	<0.01	<0.01	7.03	5.7	5	0.46	18.3
Midlake	9			130	0.02	0.18	6.34	6.1	11	0.59	16.6
West Cove	0-2		12.0	118	<0.01	<0.01	7.12	5.6	6	0.52	17.8
South Bay	0-2		12.0	118	<0.01	<0.01	7.17	5.8	6	0.50	16.8

<= Less Than. This notation is used to indicate concentrations below the analytical limit of detection.
ppm= Parts per Million
ppb= Parts per Billion

11/01/85

Site	Depth (meters)	Secchi Depth (meters)	Alkalinity mg/l as CaCO3	Conductivity (umhos)	Nitrate (ppm)	Ammonia (ppm)	pH	Calcium (ppm)	Total Phosphorus (ppb)	Silica (ppm)	Chloride (ppm)
North Bay	0-1		14.0	112.4	0.01	0.02	7.31	5.3	6	0.6	
Outlet	0-2			113.7	<0.01	0.02	7.04	6.3	4	0.61	
Midlake	0-5	5.5	16.0	113.7	0.01	0.03	6.89	5.6	6	0.62	
Midlake	9			113.7	<0.01	0.03	6.90	5.8	5	0.62	
West Cove	0-2		14.0	113.7	<0.01	0.03	7.03	5.6	7	0.62	
South Bay	0-2		14.0	115.0	0.01	0.03	6.97	5.6	6	0.62	

TABLE 4. Surface Water Chemistry for Selected Lakes.

Lake	Secchi Depth (meters)	Alkalinity (mg/l as CaCO3)	Specific Conductance (umhos)	Total Phosphorus (ppb)	Nitrate (ppm)	Ammonia (ppm)	Chloride (ppm)
Lake George New York	8.0	26.0	95.0	5.0	<0.01	<0.01	6.5
Babcock Lake Rensselaer Co., NY	3.7	16.0	72.0	13.0	0.01	0.03	9.6
Glass Lake Rensselaer Co., NY	3.3	24.0	67.0	13.0	0.01	<0.01	8.2
Crooked Lake Rensselaer Co., NY	3.5	15.0	71.0	15.0	0.01	0.03	10.0
Saratoga Lake Saratoga Co., NY	2.2	77.0		100.0	0.30	0.30	
Big Bowman Pond Rensselaer Co., NY	5.0	13.5	116.0	6.0	<0.01	<0.01	18.0

TABLE 5. Classifications and Standards for Fresh Surface Waters.

Class	Best Usage	Limits	Dissolved Oxygen Standards: Trout Waters Minimum Daily Average	Trout Waters Minimum	Non Trout Waters Minimum Daily Average	Non Trout Waters Minimum	Coliform Standards*: Monthly Median Value	20% of Sample	Monthly Geometric Mean	pH	Total Dissolved solids	Phenolic Compounds
AA	Water Supply for Drinking or Food Processing	Waters will meet Health Department Standards	6 mg/l	5 mg/l	5 mg/l	4 mg/l	Less than 50/100 ml coliforms	Less than 240/100 m coliforms	---	6.5-8.5	As low as practicable, less than 500mg/l	Less than 0.001mg/l (phenol)
A	Water Supply for Drinking or Food Processing	Waters will meet Health Department Standards for Drinking Water with Approved Treatment	6 mg/l	5 mg/l	5 mg/l	4 mg/l	Less than 5000/100 ml coliforms	Less than 20,000/100 ml coliforms	Less than 200/100 ml fecal coliforms	6.5-8.5	As low as practicable, less than 500mg/l	Less than 0.005mg/l (phenol)
B	Contact recreation and other uses except water supply and food processing	------	6 mg/l	5 mg/l	5 mg/l	4 mg/l	** Less than 2,400/100 ml coliforms	** Less than 5,000/100 ml coliforms	** Less than 200/100ml fecal coliforms	6.5-8.5	None detrimental to aquatic life. Waters currently less than 500mg/l shall remain below this limit.	------
C	Fishing and other uses except water supply, food processing and contact recreation	------	6 mg/l	5 mg/l	5 mg/l	4 mg/l	------	------	** Less than 10,000/100ml coliforms and 2,000/100ml fecal coliforms	6.5-8.5	None detrimental to aquatic life. Waters currently less than 500mg/l shall remain below this limit.	------

D	Secondary contact recreation. Waters are not suitable for propagation of fish	Waters must be suitable for fish survival	------	------	-----	3 mg/l	------	------	------	6.0-9.5	------	------
N	Employment of water in its natural condition for whatever compatible purposes	No waste discharges without approved filtration through 200' of unconsolidated earth	Natural	Natural	Natural	Natural	Natural	Natural	Natural	Natural	Natural	------

Notes: Additional Standards applicable to the above classifications: Turbidity - no increase that will cause a substantial visible contrast to natural conditions; Color - None from man-made sources that will be detrimental to the specified best usage of waters; Suspended, colloidal or other solids - None from any waste discharge which will cause deposition to the best usage of water; Oil and floating substances - No residue attributable to a waste discharge nor visible oil films nor globules of grease; Taste and Odor producing substances, toxic wastes and deleterious substances - None that will be injurious to fish life or to make the waters unsafe or unsuitable for any classified use.

With reference to certain toxic substances affecting fish life, the establishment of any single numerical standard for waters of New York State would be too restrictive. There are many waters, which because of poor buffering capacity and composition will require special study to determine safe concentrations of toxic substances. However, most of the non-trout waters near industrial areas in this state will have an alkalinity of 80 mg/l or above. Without considering increased or decreased toxicity from possible combinations, the following may be considered as safe stream concentrations for certain substances to comply with the above standard for this type of water. Water of lower alkalinity must be considered since the toxic effect of most pollutants will be greatly increased. Ammonia or Ammonium Compounds - Not greater than 2.0 mg/l expressed as NH_3 at pH 8 or above: Cyanide - Not greater than 0.1 mg/l expressed as CN: Ferro or Ferricyanide - Not greater than 0.4 mg/l expressed as $Fe[CN]_6$: Copper - Not greater than 0.2 mg/l expressed as Cu: Zinc - Not greater than 0.3 mg/l expressed as Zn: Cadmuim - Not greater than 0.3 mg/l expressed as Cd.

Table 6. Rooted Aquatic Plants Found at Big Bowman Pond Sampling Sites.

Common Name	Classification	Frequency
Yellow Pond Lily	Nuphar advena	A
White Pond Lily	Nymphaea tuberosa	C
Fern Pond Weed	Potamegeton robbinsii	A
Broad Leafed Pond Weed	Potamegeton amplifolius	A
Pickerel Weed	Pontedaria chordata	C
Coontail	Ceratophyllum demersum	C
Waterweed	Elodea	A
Broad Leaved Cattail	Typha latifolia	C

A= Abundant
C= Common
O= Occasional

Table 7. Fish Indigenous to Big Bowman Pond.

Common Name	Classification
Largemouth Bass	Micropterus salmoides
Smallmouth Bass	Micropterus dolomieu
Chain Pickerel	Esox niger
Brown Bullhead	Ictalurus nebulosus
Pumpkinseed Sunfish	Lepomis gibbosus
Rock Bass	Ambloplites rupestris
Black Crappie	Pomoxis nigromaculatus
Yellow Perch	Perca flavescens

TABLE 8. Historical Surface Water Chemistries for Big Bowman Pond.

Date Analyst	Secchi Depth (meters)	Alkalinity (mg/l as CaCO3)	Total Phosphorus (ppb)	Nitrate (ppm)	Ammonia (ppm)
August 29, 1934 New York State	4.5	11.4			
August 1967 RPI		19.0	25	0.22	0.10
Summer 1972 RPI	3.7	17.6	35	0.11	
Summer 1985 RPI	5.0	13.5	6	<0.01	<0.01

Figure 1.   Big Bowman Pond Sampling Site Locations

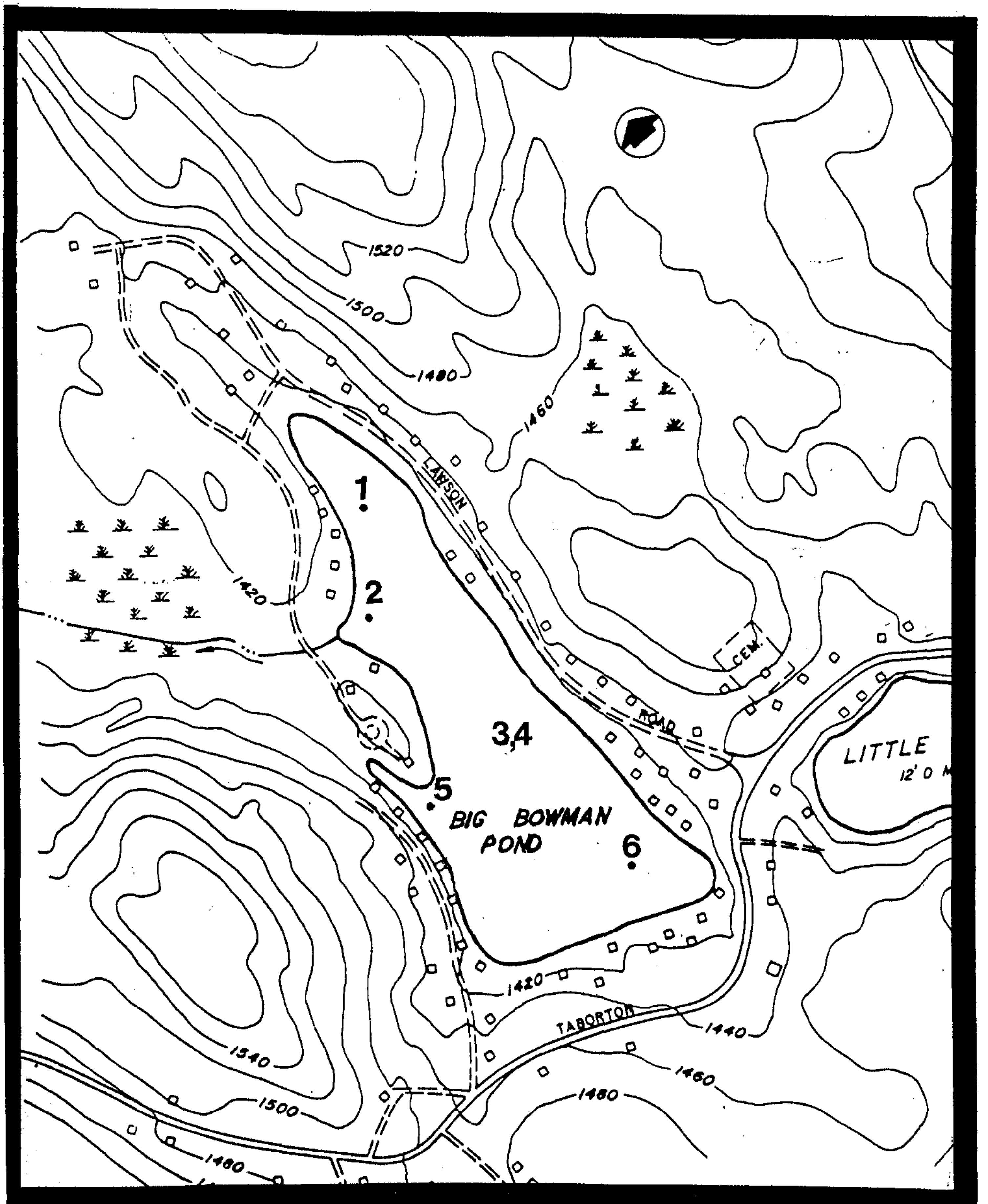


Figure 2. Profiles of Dissolved Oxygen and Temperature in Big Bowman Pond.

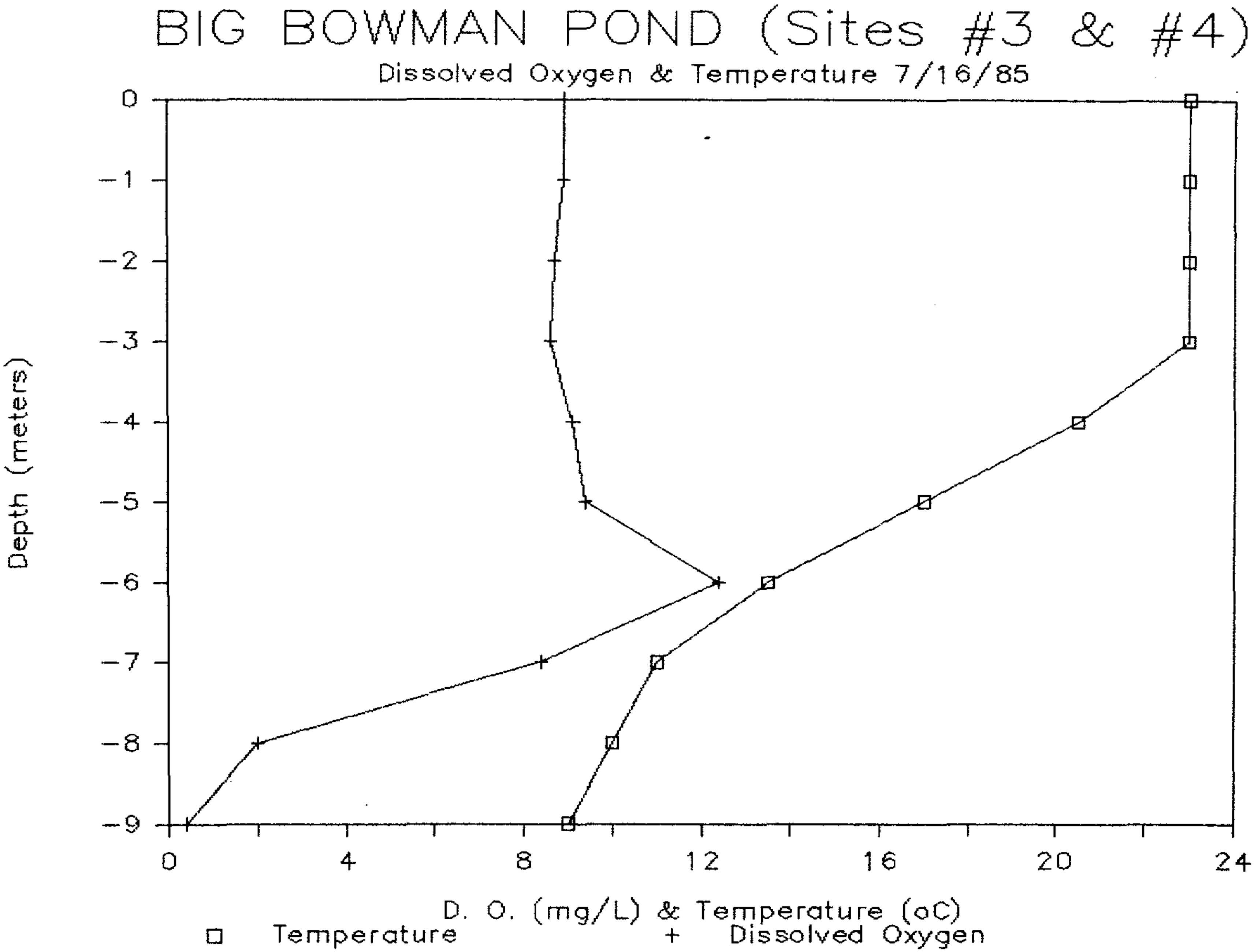


Figure 2 (cont.). Profiles of Dissolved Oxygen and Temperature in Big Bowman Pond.

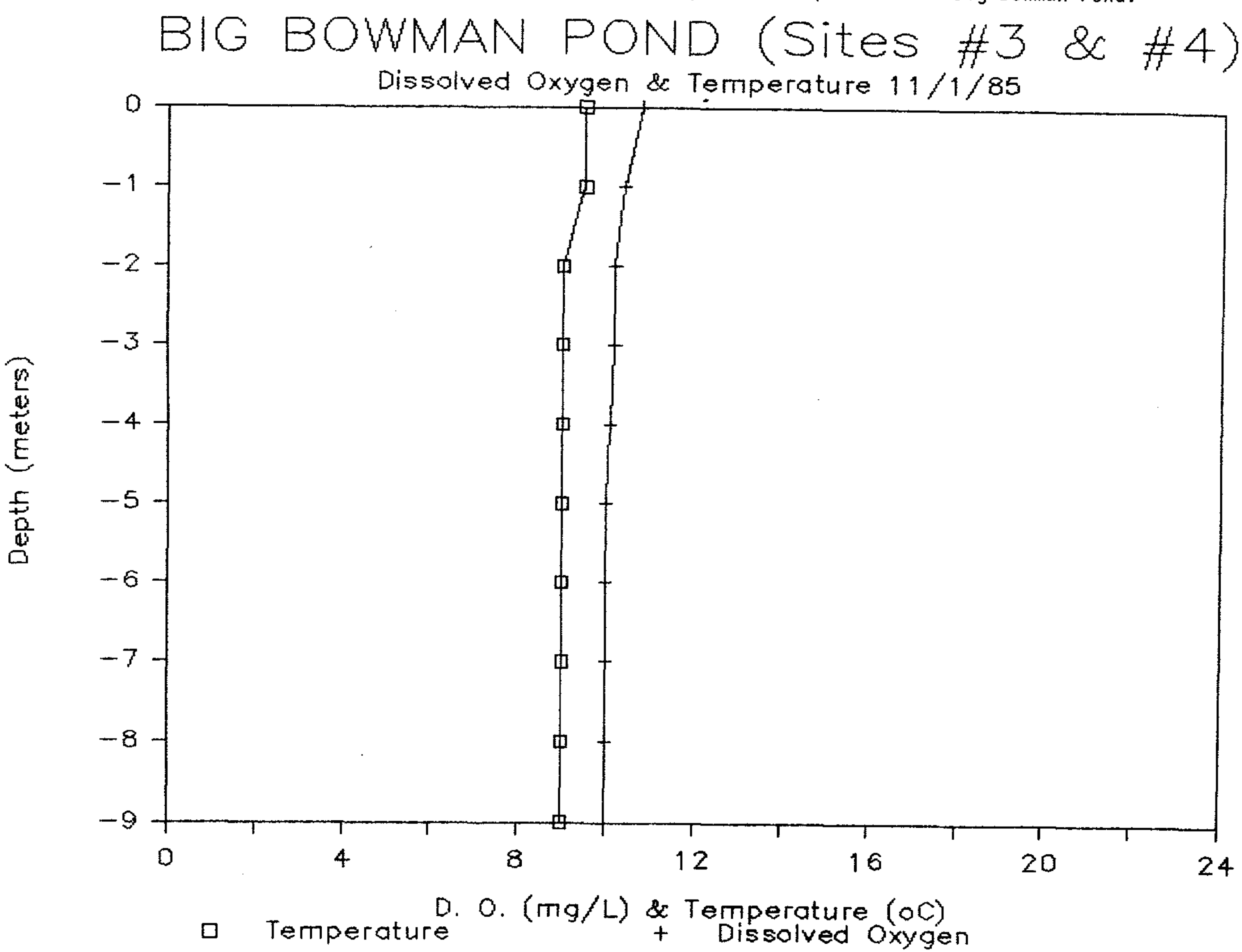
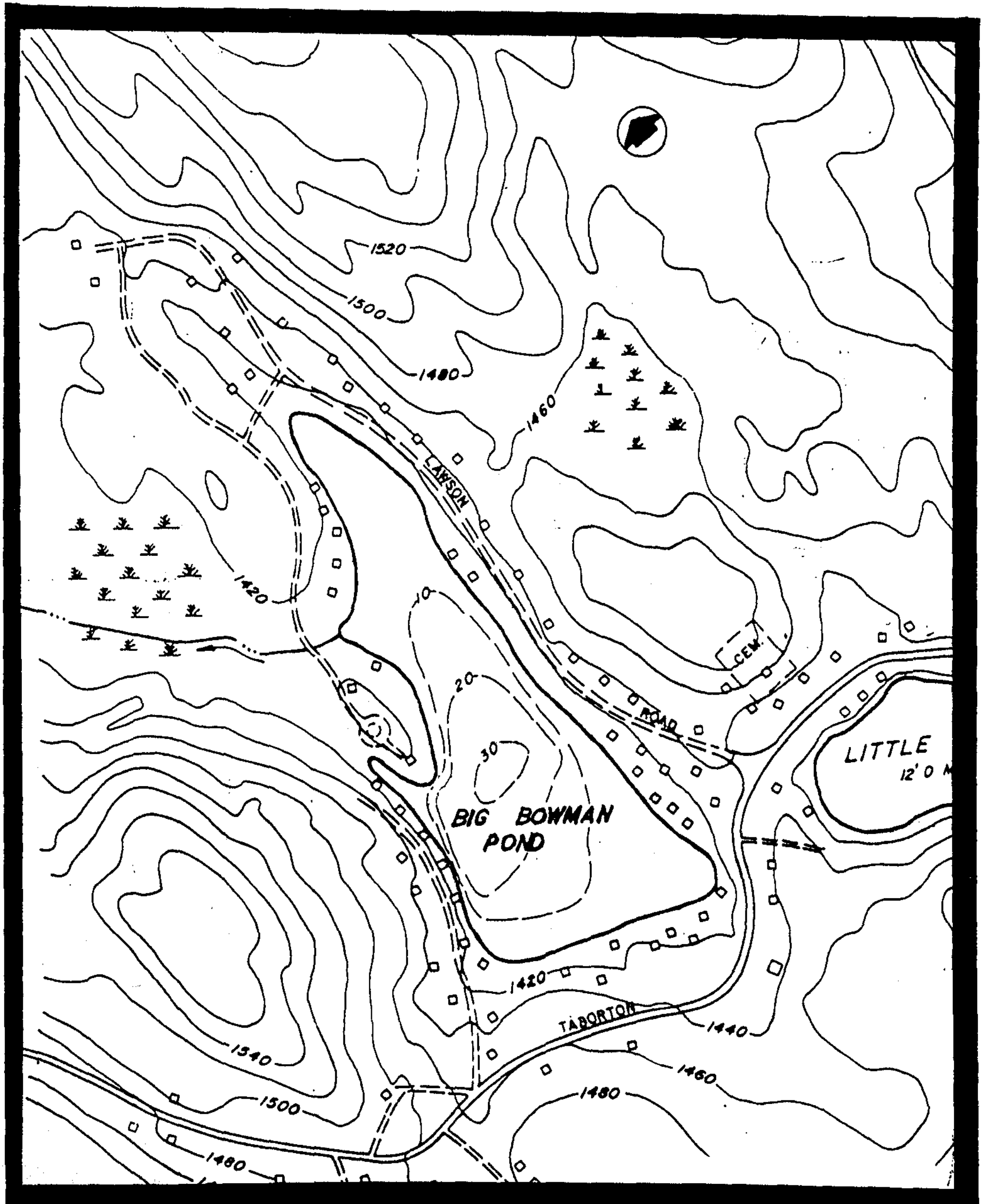


Figure 3. Depth (bathymetric) map of Big Bowman Pond.



APPENDICES

Appendix A. Analytical Methods and Equipment.

Analysis	Method	Instrument
pH	Expanded Scale pH/millivolt meter	Orion, Model 811
Alkalinity	Gran Plot Titration	Orion, Model 811
Specific Conductance	Wheatstone Bridge type meter	YSI, Model 31
Chloride	Automated Ferricyanide (EPA Method 325.2)	Technicon Autoanalyzer II
Nitrate	Automated Cadmium Reduction (EPA Method 353.2)	Technicon Autoanalyzer II
Ammonia	Automated Phenate (EPA Method 350.1)	Technicon Autoanalyzer II
Total Phosphorus	Single Reagent Ascorbic Acid (EPA Method 365.2)	Bausch and Lomb Spectronics 70
Soluble Silica	Automated Molybdate (Standard Methods, 425E)	Technicon Autoanalyser II
Copper	Direct Aspiration (EPA Method 220.1)	Perkin-Elmer Model 403
Total Coliform	Membrane Filtration (Standard Methods, 909A)	
Fecal Coliform	Membrane Filtration (Standard Methods, 909C)	

EPA Methods = USEPA, 1979, Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, Cincinnati, OH.

Standard Methods = APHA-AWWA-WPCF, 1980, Standard Methods for the Analysis of Water and Wastewater, 15th edition, American Public Health Association, Washington, D.C. 1134 pp.

APPENDIX B.

FORM NO.__________

SANITARY SURVEY

1. SITE DESCRIPTION

   A. NAME OF OCCUPANT____

   B. MAILING ADDRESS____
   Street Address, Box Number

   ____
   City, Town, Zip Code

   ____
   Telephone

   C. NAME OF OWNER____

   D. PROPERTY LOCATION____

   E. TAX MAP NUMBER____

2. TYPE OF BUILDING

   A. PRIVATE RESIDENCE
   B. APARTMENT BUILDING
   C. HOTEL OR MOTEL NUMBER OF UNITS____________
   D. RESTAURANT
   E. OTHER DESCRIPTION_______________

   ____

   F. YEAR BUILDING CONSTRUCTED_________________________________

   G. LENGTH OF OCCUPANCY:
   SEASONAL FROM________TO_______
   YEAR ROUND
   VACANT

   H. AVERAGE NUMBER OF OCCUPANTS OR PATRONS_________
   I. COLOR AND CONSTRUCTION TYPE_____________________________
   ____

J. APPROXIMATE SIZE (FT^2) OF LAWN AND GARDEN________________
K. USE LAWN OR GARDEN FERTILIZER
YES_____ ANNUAL AMT (IF KNOWN)_____LBS.

3. WATER SUPPLY

A. TYPE PUBLIC MAINS
PRIVATE WELL APPROXIMATE DEPTH (FEET)_____

B. CHLORINATED YES
NO

C. WATER USAGE

SHOWERS ______
BATH TUBS ______
DISHWASHERS ______
GARBAGE DISPOSAL ______
SINKS ______
TOILETS ______
WASHING MACHINE ______

4. WASTEWATER DISPOSAL FACILITIES

A. TYPE OF SYSTEM

CESSPOOL__ SEPTIC TANK-SEEPAGE PIT__
SEPTIC TANK-TILE FIELD__ HOLDING TANK__
OTHER DESCRIPTION________________________________
____

B. TANK CONSTRUCTION

SIZE (gallons)_______________________
AGE (years) _______________________
TYPE OF CONSTRUCTION:
CONCRETE___
METAL___
OTHER___ DESCRIPTION________________________
____

HOW MANY YEARS SINCE PUMPED?____________________

APPROXIMATE DISTANCE FROM LAKE (feet)___________

C. TILE FIELD

APPROXIMATE LENGTH (feet)____________
AGE (years)
APPROXIMATE DISTANCE FROM LAKE (feet)_________________

D. SEEPAGE PITS

NUMBER OF PITS________ AGE(years)___________
SIZE________ APPROXIMATE DISTANCE FROM LAKE
(feet)___________

E. SKETCH OF BUILDING AND SYSTEM

5. PROBLEMS

A. WHAT PROBLEMS HAS YOUR SYSTEM CAUSED?

ODORS____
SLOW DRAINING OF PLUMBING____
SURFACING OF SEWAGE________
BACKUP OF SEWAGE INTO HOUSE____
NONE _____
OTHER___ DESCRIPTION___________________________________
____

B. HOW OFTEN DO PROBLEMS OCCUR?_____________________________
____

C. IF YOU LIVE ALONG THE LAKESHORE, DO YOU NOTICE ANY OF THE FOLLOWING, ADJACENT TO YOUR PROPERTY?

ALGAE OR SCUM ON ROCKS ________
AQUATIC VEGETATION ("WEEDS") ________

6. OTHER INFORMATION

A. WHAT TYPE OF SOIL DO YOU HAVE:

SANDY LOAM SILTY LOAM
CLAY DON'T KNOW

B. SOIL COLOR

BLACK-DARK BROWN
LIGHT BROWN
GRAY
REDDISH-BROWN

C. HOW WELL DRAINED IS YOUR SOIL?

WELL DRAINED_________
DRAINS SLOWLY________
DON'T KNOW___________

D. ARE THERE ROCK OUTCROPS ON YOUR PROPERTY?

YES _____
NO _____

E. WOULD YOU BE WILLING TO ALLOW AN ONSITE TEST OF YOUR WASTEWATER DISPOSAL SYSTEM: YES____ NO____

7. SIGNATURE OF PERSON (S) WHO FILLED OUT FORM

____ DATE______________

8. COMMENTS OR REMARKS

____

____

____

____

____