

LAKE WATER QUALITY ASSESSMENT REPORT
NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF WATER RESOURCES

FARRINGTON LAKE
EAST BRUNSWICK TOWNSHIP, MIDDLESEX COUNTY

Patrick Goan
Senior Environmental
Specialist

Robert Runyon
Chief, Bureau of Monitoring
Management

PREFACE

The 1986 revisions to the Clean Water Act requires states to provide the United States Environmental Protection Agency (USEPA) with water quality information on public lakes. This information is a prerequisite for eligibility in the USEPA Clean Lakes Program.

The New Jersey Department of Environmental Protection obtained a grant to assess the water quality of the State's lakes during 1989. The objectives of the FY 89 Project were to acquire limited limnological data for 21 lakes. The data was analyzed to determine the trophic status for each lake.

Lakes were selected based on several criteria which included; the amount of public access the lake provided, it's recreational usage (e.g. swimming, fishing, ...) and it's value as a local resource. The following lakes were surveyed during 1989:

COUNTY	LAKE
Burlington	Lake Absegami Crystal Lake Evans Pond Indian Mills Lake Jefferson Lake Smithville Lake
Camden	Cooper River Lake
Cape May	East Creek Pond Lake Nummy
Gloucester	Greenwich Lake Iona Lake Narriticon Lake
Mercer	Mercer County Park Lake Rosedale Lake
Middlesex	Brainerd Lake Farrington Lake
Monmouth	Mac's Pond
Morris	Lake Ames Mount Hope Pond
Ocean	Lake Carasaljo
Passaic	Shepherds Lake

CONTENTS

	Page
Preface.....	1
Contents.....	2
Scope of Survey.....	3
Explanation of Parameters Sampled.....	4-7
Lake Trophic States.....	8
Introduction	9
Physical/Chemical Results.....	10
Biological Results.....	11
Conclusion.....	12
References.....	13
Appendix.....	14
Appendix includes	
-Data	
-Algae identification	
-Map of lake and watershed	
-Map with sampling stations	

SCOPE OF SURVEY

The quality of a lake's water is determined by many factors. These factors may be found within the lake itself or they may come from the watershed surrounding it. The collection of data through sampling and measurements can help to determine what may be influencing the lake's water quality. Although the scope covered by this report is somewhat limited, the following data may be found:

1. Limited Historical Data
2. Geology
3. Morphology and Hydrology
4. Physical & Chemical Data Results
5. Biological Data

All lakes in the program were monitored three times during the year; once each during the spring, summer and fall. Samples were taken at the major inlets and at sites deemed representative of the entire lake. Samples were taken above the outlet when a boat was unavailable. The samples were analyzed for the following parameters:

In-situ analysis:

1. Temperature
2. Dissolved Oxygen
3. pH
4. Depth and Secchi readings
5. Visual check of Macrophytes

Laboratory Analysis (NJ Department of Health):

1. Bacterial Analysis
2. Alkalinity
3. Nutrients

Biological Analysis (Bio-Monitoring Unit of the NJDEP):

1. Chlorophyll a
2. Algal Scan (Microscopic)
3. Macrophyte Survey

EXPLANATION OF PARAMETERS SAMPLED

PHYSICAL AND CHEMICAL PARAMETERS

1. TEMPERATURE AND DISSOLVED OXYGEN (D.O.):

The temperature of a shallow lake generally follows climatic changes. As the temperature of the water increases the dissolved oxygen level of the water decreases. A deeper lake will usually stratify thermally, during the summer. A warmer, less dense layer of water (epilimnion) will float on a cooler, denser layer of water (hypolimnion). These two layers are separated by a zone of rapidly changing temperature and density called the metalimnion. The metalimnion, can form a barrier, which can keep the hypolimnion from being reoxygenated from the atmosphere. In a productive (eutrophic) lake this can cause anoxic conditions in the hypolimnion as oxygen is used up by animals and decomposers (bacteria).

2. ALKALINITY AND pH:

Alkalinity is a measurement that indicates the degree to which an aquatic system can buffer pH changes that can occur during photosynthesis and/or by the introduction of pollutants. The toxicity of certain pollutants can be reduced by this buffering action. A minimum of 20 mg/L CaCO₃ has been recommended, except where natural conditions are lower (Quality Criteria for Water, 1986, EPA 440/5-86-001). The Pine Barrens are an example of an area where natural conditions favor low alkalinity. PH is a measurement of hydrogen ion activity or the acid-base equilibrium in natural waters. The pH can be raised by the photosynthetic processes of algae and/or macrophytes.

EXPLANATION OF PARAMETERS SAMPLED

3. NUTRIENT ANALYSIS:

Phosphorus and nitrogen are the major nutrients required by algae for growth. In New Jersey's lakes, phosphorus is the nutrient most often responsible for limiting algal growth. Dissolved orthophosphorus is believed to approximate the solid reactive phosphorus used by all photosynthetic organisms (aquatic plants/algae). However, all forms of total phosphorus can become reactive through biological decomposition and can be used as nutrients to enhance weed growth and/or algae blooms.

Nutrients can enter a lake or its watershed via point (i.e. sewerage treatment plant) or nonpoint sources (i.e. fertilizer runoff from lawns). Nutrients may also be recycled from the sediments in the lake.

4. SECCHI DISC TRANSPARENCY:

A greater depth of light transmission generally indicates good water quality (low algal growth). However, heavy macrophyte growth can also keep the water clear. The macrophytes may outcompete the algae for nutrients and therefore, restrict most algal growth. Erosion from the watershed or upwelling of the lake's sediments, from adverse weather conditions, could also decrease the water's transparency. To determine the transparency of a lake's water a secchi disk is used. The secchi disk is an 8 inch black and white disk. Measurements are taken by lowering the disk until it is no longer visible.

EXPLANATION OF PARAMETERS SAMPLED

BIOLOGICAL DATA

1. BACTERIAL ANALYSIS:

Bacterial samples for Total coliform, Fecal coliform (FC) and Fecal streptococcus (FS) were taken at the inlets and in-lake. While sources are difficult to determine with 3 sampling runs, the ratio of FC/FS can imply whether the source is from human or animal waste.

FC/FS Possible Bacterial source (Millipore Corp. 1972)

>4	-Human wastes
2-4	-Mainly human wastes and other sources
1-2	-Inconclusive
0.7-1	-Mainly animal wastes and other sources
<.7	-Animal wastes

A lake's water is considered unsafe for swimming when Fecal coliform levels exceed 200 mpn/100ml.

2. CHLOROPHYLL a/ALGAE

Chlorophyll a is a pigment that is present in all types of algae. The chlorophyll a content of the water can indicate the amount of planktonic algae present in the lake. Algae are an important part of a lake ecosystem because they are a vital part of the food chain. However, an excessive amount of algae can negatively impact a lake. Excessive algae growth can inhibit the growth of other plants, cause aesthetic problems and curtail recreational uses. Through the processes of photosynthesis, increased algal growth can raise the dissolved oxygen level in a lake during the daytime (sunlight) and decrease the dissolved oxygen level during the night (dark). Depressed dissolved oxygen levels, if extreme, could cause fishkills.

EXPLANATION OF PARAMETERS SAMPLED

3. ALGAL SURVEY:

As the growing season proceeds, a succession of algal communities typically occurs in a lake. During the spring and fall, diatoms are usually dominant. In the early summer, chlorophytes (green algae) become dominant. As available nutrients change during the summer, filamentous green or blue-green algae may become dominant. These may float to the surface forming mats that can cause aesthetic and recreational problems.

High chlorophyll a levels with little algal species diversity are indicative of nutrient rich water.

4. MACROPHYTE SURVEY:

Macrophytes are also a vital part of a lake. They provide cover for fish and food for wildlife. However, excessive macrophyte growth can limit the recreational uses of a lake including swimming, fishing and boating. A visual survey was done to identify and determine areal coverage of macrophytes.

LAKE TROPHIC STATES

Lake eutrophication (aging) is a natural process resulting from the gradual accumulation of nutrients, increased productivity, and filling in from sediments, silt and organic matter.

Lakes usually follow a progression through a series of trophic states, which are the following:

1. Oligotrophic
-nutrient poor and low biological productivity.
2. Mesotrophic
-intermediate levels of nutrients and biological productivity.
3. Eutrophic
-nutrient rich and highly productive.

Accelerated or cultural eutrophication occurs to a lake when nutrients, silt and organic matter inputs are increased by activity in the watershed. Several examples of increased inputs include; a sewage treatment plant discharging into a lake, runoff of fertilizers from farms or lawns, and erosion from new construction sites. Because of New Jersey's large population, all lakes in the State are considered to be threatened by accelerated eutrophication.

INTRODUCTION

Farrington Lake is a 203 acre body of water located in East Brunswick Township, Middlesex County. The lake has a maximum depth of about twenty feet and is fed by two main sources, which are the Lawrence and Beaverdam Brooks. Farrington Lake and it's surrounding area are utilized heavily for recreational purposes, including fishing and boating. There also are several day camps for children situated along the shoreline of the lake.

LAKE NUM.AND NAME: #4128 FARRINGTON LAKE

STUDY PERIOD: SPRING, SUMMER, FALL 1989

LOCATION: EAST BRUNSWICK TWP., MIDDLESEX CO.

U.S.G.S. QUAD: #19 NEW BRUNSWICK

LAKE AREA: 203 ACRES

LAKE MAXIMUM DEPTH: 23 ft.

GEOLOGIC DESIGNATION: TRB BRUNSWICK /MAGOTHY RARITAN S.E. /OPS
PENNSAUKEN SAND

TRIBUTARIES: INLET #1 LAWRENCE BROOK
INLET #2 BEAVERDAM BROOK

LAKE USE AND HISTORICAL NOTES: FISHING AND BOATING. SAMPLED
BY NJDEP IN 1976, 1977, 1978
AND 1981.

COMMENTS: MACROPHYTES INCLUDE WHITE WATER LILY, WATERSHIELD AND
COONTAIL. POTENTIAL RUNOFF FROM WOODLANDS, HOMES AND
SOME AGRICULTURE.

RESULTS

PHYSICAL/CHEMICAL PARAMETERS

Temperature and Dissolved Oxygen

Temperatures and dissolved oxygen levels were uniform throughout the water column during the spring and fall. The dissolved oxygen level of the hypolimnion was only 1.6 mg/l during the summer when the lake was stratified.

Secchi Disk

The transparency of the lake's water ranged from 1.0 foot to 2.5 feet.

Alkalinity and pH

The alkalinity of the water ranged from 10 mg/l to 16 mg/l and therefore, offered little buffering capacity. The pH ranged from 6.25 in the fall to 6.78 during the summer.

Nutrients

Total phosphorus levels in the water column ranged from 0.06 mg/l to 0.12 mg/l.

RESULTS

BIOLOGICAL DATA

Chlorophyll a/Algae

Chlorophyll a levels were high during the spring (17.35 mg/m³) and summer (19.97 mg/m³) but were lower in the fall (4.34 mg/m³). There was a moderate amount of algal species diversity during the summer sampling. There was no dominant species found in any sample.

Macrophytes

White water lily (*Nymphaea* spp.), watershield (*Brasenia schreberi*) and coontail (*Ceratophyllum demersum*) were growing along the shoreline and in the lake's coves. The macrophytes appeared to be growing wherever the depth of the lake was five feet or less. Because of the size and many coves of Farrington Lake, it was difficult to obtain the percent of areal coverage by macrophytes. However, a rough estimate would be between 30 and 40 percent.

Bacteria

Fecal coliform levels for the spring were 700 mpn/100ml which is above the limit set for swimmable waters. Counts for the summer (<20 mpn/100ml) and fall (50 mpn/100ml) indicated safe swimming conditions on these sampling dates.

CONCLUSION

Farrington Lake is considered to be eutrophic because of several factors which include, high nutrient levels, high productivity including algae and macrophytes and low levels of dissolved oxygen in the hypolimnion. High total phosphorus levels, that are well above the level (0.02 mg/l) that distinguishes eutrophic from non-eutrophic waters, enhanced the productivity in the lake.

The heavy macrophyte growth had a negative effect on some of the recreational uses of the lake. Because of the shallowness along the shoreline and consequent macrophyte growth, sections of the lake were not accessible to fishing. And, although the main boat launch was clear, another boat launch encountered on the lake was not in use because of heavy aquatic weed growth.

The macrophyte and algae growth were also affecting the ecology of the lake. Several factors including the heavy algal and macrophyte growth contributed to the near anoxic conditions in the hypolimnion. As algae and macrophytes die they accumulate on the bottom of the lake. The combination of respiration by increased bacteria populations, that consume the dead plant material, along with the respiration of other organisms depletes oxygen levels in the hypolimnion. Because the lake is stratified, it is difficult for oxygen from the surface to mix with and replenish the water in the hypolimnion. Depth and low transparency also restrict aquatic plants from producing oxygen by photosynthetic processes in the lower depths of the lake.

Low dissolved oxygen levels such as those in Farrington Lake's hypolimnion could stress certain organisms which inhabit this area including favorable fish species. Furthermore, anoxic conditions favor the release of nutrients trapped in the sediments, which could lead to more algal production.

REFERENCES

Aquatic Vegetation of New Jersey. 1965. Rutgers Extension Service Bulletin # 382.

Lake and Reservoir Restoration Guidance Manual. 1988. North American Lake Management Society. First Edition.

NJDEP. 1987. Water Resources Field Procedures Manual.

Trudeau, Philip N. 1982. Nuisance Aquatic Plants and Aquatic Plant Management Programs in The United States.

USEPA 1980. Clean Lakes Program Guidance Manual. EPA 440/5-81-003.

Wetzel, Robert G. 1983. Limnology. Saunders College Publishing, New York.

APPENDIX

STATION	DATE	TEMP	D O	pH	ALK	TOT P	ORTHO P	F COLI	F STREP	TOT COLI	FC/FS	SECCHI (feet)
INLET #1	05/25/89	14.8	7.9	7.00	34	.11	.01	1300	920	5400	1.41	
	08/10/89	24.1	7.4	6.84	19	.06	<.01	<20	2	40	NA	
	10/25/89	12.2	8.8	6.24	10	.07	.03	50	17	1100	NA	
INLET #2	05/25/89	14.5	6.4	6.60	10	.10	.01	700	350	16000	2	
	08/10/89	18.0	7.7	6.27	26	.03	<.01	230	220	9200	1.05	
	10/25/89	10.8	9.4	5.81	5	.07	.03	20	49	1100	NA	
LAKE	05/25/89	16.0	8.6	6.70	12	.08	<.01	700	46	5400	15.22	2.0
	08/10/89	25.4	7.4	6.78	16	.06	<.01	<20	<2	20	NA	2.5
	10/25/89	12.2	7.9	6.25	10	.12	.06	50	14	700	NA	1.0

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
GEOLOGICAL SURVEY
LABORATORY OPERATIONS SECTION

89/05/25
Sample No. 76012
Lakes Management
Farrington Lake, NJ

Plankton Identification

CHLOROPHYCEAE (green)

Chlorella vulgaris
Closteriopsis longissima
Nannochloris bacillaris

CHRYSOPHYCEAE (golden or brown)

Dinobryon sociale
Mallomonas caudata

CRYPTOPHYCEAE (colorless or brownish)

Cryptomonas erosa

MYXOPHYCEAE (blue-green or other color)

Oscillatoria chlorina

Chlorophyll Analysis

Chlorophyll "a" (mg/m³) = 17.35

Analyst/Unit _____

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
GEOLOGICAL SURVEY
LABORATORY OPERATIONS SECTION

89/08/10
Sample No. 61495
Lakes Management
Farrington Lake, NJ

Plankton Identification

CHLOROPHYCEAE (green)

Chlorella vulgaris
Micractinium pusillum
Nannochloris sp.
Scenedesmus quadricauda
Staurostrum dejectum
S. manfeldtii
Tetraedron sp.

EUGLENOPHYCEAE (motile green)

Euglena caudata
Trachelomonas hispida
T. robusta
T. volvocina

CHRYSOPHYCEAE (golden or brown)

Dinobryon sociale

BACILLARIOPHYCEAE (diatom)

Asterionella formosa

MYXOPHYCEAE (blue-green or other color)

Lyngbya limnetica
Merismopedia minima
Oscillatoria chlorina

=====
Chlorophyll Analysis

Chlorophyll "a" (mg/m³) = 19.97

Analyst(s)/Unit _____

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
GEOLOGICAL SURVEY
LABORATORY OPERATIONS SECTION

89/10/25
Sample No. 53446
Lakes Management
Farrington Lake, NJ

Plankton Identification

CHLOROPHYCEAE (green)

Nannochloris sp.

EUGLENOPHYCEAE (motile green)

Lepocinclis acicularis

CHRYSOPHYCEAE (golden or brown)

Synura uvella

BACILLARIOPHYCEAE (diatom)

Nitzschia acicularis

CRYPTOPHYCEAE (colorless or brownish)

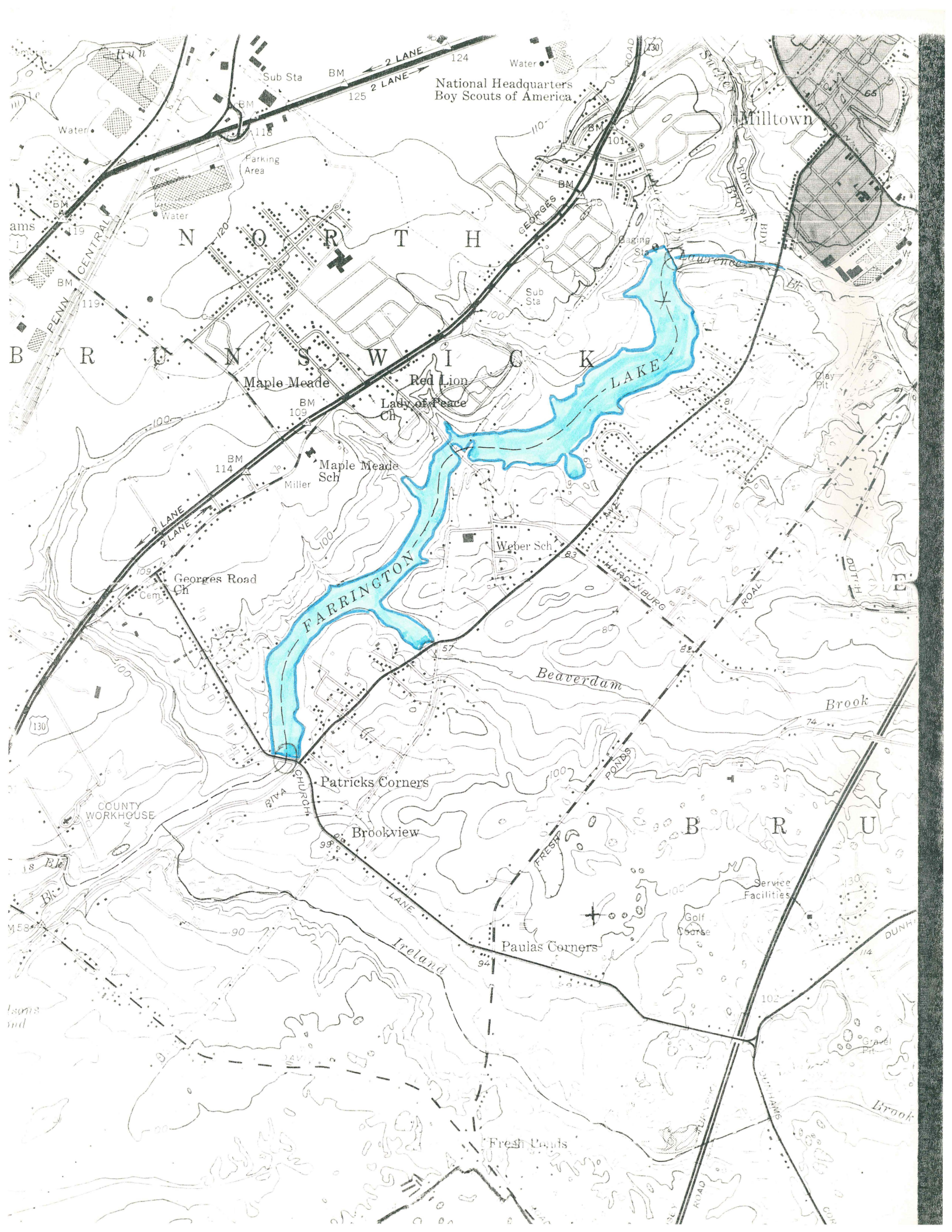
Cryptomonas ovata

=====

Chlorophyll Analysis

Chlorophyll "a" (mg/m³) = 4.34

Analyst/Unit _____



National Headquarters
Boy Scouts of America

Milltown

B
R
O
O
K
S
W
I
C
K
L
A
K
E

FARRINGTON
LAKE

B
R
O
O
K

Water

Water

Water

Clay Pit

COUNTY
WORKHOUSE

Service
Facilities

Golf
Course

Fresh Lands

Sub Sta

Sub Sta

Miller

Weber Sch

Patrick's Corners

Brookview

Paulas Corners

Parking Area

Georges Road
Ch

Red Lion
Lady of Peace
Ch

Maple Meade
Sch

Beaverdam
Brook

Brook

Brook

PENN
CENTRAL

130

ROAD
130

2 LANE
2 LANE

2 LANE
2 LANE

LANE

Ireland

FRESH
LANDS

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

ROAD

119

109

109

100

99

90

85

80

74

120

118

114

109

83

57

100

100

102

114

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

118

118

114

109

83

57

100

100

102

114

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

118

118

114

109

83

57

100

100

102

114

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

118

118

114

109

83

57

100

100

102

114

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

118

118

114

109

83

57

100

100

102

114

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

118

118

114

109

83

57

100

100

102

114

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

118

118

114

109

83

57

100

100

102

114

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

10

118

118

114

109

83

57

100

FARRINGTON LAKE

INLET

CHURCH LANE

X

UPPER
LAKE

INLET

X

X

ROUTE 130

OUTLET

X-Sample Sites

