

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

LAKE AMES  
ROCKAWAY TOWNSHIP, MORRIS COUNTY

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## 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

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-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 CaCO<sub>3</sub> 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

Lake Ames is a 14 acre body of water located in Rockaway Township, Morris County. The lake is fed by two streams. The Hibernig Brook flows down a mountain slope into the lake while the second stream flows from Lake Telemark through a small area of homes and then wetlands before entering the lake. The lake has a small beach area that appears to no longer be used for swimming but is utilized for fishing. The maximum depth of the lake is about eight feet.

LAKE NUM. AND NAME: #4744 LAKE AMES

STUDY PERIOD: SPRING, SUMMER, FALL 1989

LOCATION: ROCKAWAY TWP., MORRIS CO.

U.S.G.S. QUAD: #6 DOVER

LAKE AREA: 14 ACRES

LAKE MAXIMUM DEPTH: 8 ft.

GEOLOGIC DESIGNATION: IGN LOSEE GNEISS

TRIBUTARIES: INLET #1 OUTLET LAKE DENMARK  
INLET #2 HIBERNIG BROOK

LAKE USE AND HISTORICAL NOTES: FISHING. SAMPLED 1976 AND 1977.

## RESULTS

### PHYSICAL/CHEMICAL PARAMETERS

#### Temperature and Dissolved Oxygen

Temperatures and dissolved oxygen levels were uniform throughout the water column for each monitoring run. Dissolved oxygen levels were never below 8.2 mg/l.

#### Secchi Disk

The transparency of the water ranged from 2.0 feet to 4.0 feet.

#### Alkalinity and pH

The alkalinity of the lake's water ranged from 15 mg/l to 36 mg/l offering limited buffering capacity. The pH of the lake was nearly the same for all three samplings. The pH ranged from 7.09 to 7.26.

#### Nutrients

Total phosphorus levels, in the water column, ranged from 0.03 mg/l in the spring to 0.05 mg/l during the fall.

## RESULTS

### BIOLOGICAL DATA

#### Chlorophyll a /Algae

Chlorophyll a levels for the spring and fall were about 5.0 mg/m<sup>3</sup>. During the summer, levels increased to 14.36 mg/m<sup>3</sup>. There was little diversity among algal species with Chlorophytes and Euglenophytes most prominent.

#### Macrophytes

Areal coverage of the lake by macrophytes was nearly 100%. Watershield (*Brasnia schreberi*) and white water lily (*Nymphaea odorata*) border the entire shoreline except for the beach area. This amounts to about 30% of the surface area of the lake. Water milfoil (*Myrophyllium* spp.) and fanwort (*Cabomba caroliniana*) were growing throughout the rest of the lake.

#### Bacteria

Fecal coliform levels were 20 mpn/100ml for both the spring and summer sample runs. A level of 2800 mpn/100ml was detected during the fall. Heavy rainfall the night before sampling may have had an effect on the Fecal coliform numbers for the fall sample.

## CONCLUSION

Lake Ames is considered to be in a eutrophic state because of several factors. There were moderately high levels of nutrients in the water column along with an elevated level of chlorophyll a, indicating an algal bloom during the summer. However, the largest problem affecting Lake Ames was the proliferation of aquatic macrophytes.

The recreational uses of the lake were severely impacted by the heavy macrophyte growth. There was a beach with swimming area that may have been utilized at one time but could no longer be used because of the macrophytes. And, fishing was restricted to only the center-most part of the lake where macrophytes were not growing on the surface.

The heavy macrophyte growth could have a negative impact on the ecology of the lake. As the macrophytes die they add to and enrich the lake's sediments. This could lead to more macrophyte growth and less open water area.

## 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	F COLI	F STREP	TOT COLI	FC/FS	SECCHI (ft.)
INLET #1	06/12/89	15.8	9.0	7.19	25	.03	<20	79	170	NA	
	08/08/89	16.3	8.9	7.39	47	.03	20	240	130	NA	
	09/21/89	18.3	8.2	7.09	17	.03	3500	>2400	3500	NA	
INLET #2	06/12/89	19.7	8.7	6.84	16	.04	50	49	230	1.02	
	08/08/89	25.0	5.4	7.08	27	.05	50	350	1800	.14	
	09/21/89	18.9	8.4	6.98	15	.05	3500	>2400	>24000	NA	
LAKE	06/12/89	22.5	9.2	7.09	19	.03	20	5	110	NA	4.0
	08/08/89	23.8	9.3	7.20	36	.04	20	23	140	NA	4.5
	09/21/89	19.1	8.2	7.26	15	.05	2800	920	9200	3.04	2.0

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION  
GEOLOGICAL SURVEY  
LABORATORY OPERATIONS SECTION

89/06/12  
Sample No. 61482  
Lakes Management  
Ames Lake, NJ

Plankton Identification

CHLOROPHYCEAE (green)

Chlorella vulgaris  
Scenedesmus quadricauda

EUGLENOPHYCEAE (motile green)

Phacus brevicauda  
Trachelomonas robusta

CHRYSOPHYCEAE (golden or brown)

Dinobryon bavaricum

BACILLARIOPHYCEAE (diatom)

Synedra ulna

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Chlorophyll Analysis

Chlorophyll "a" (mg/m<sup>3</sup>) = 5.49

Analyst(s)/Unit \_\_\_\_\_

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION  
GEOLOGICAL SURVEY  
LABORATORY OPERATIONS SECTION

89/08/08  
Sample No. 76847  
Lakes Management  
Ames Lake, NJ

Plankton Identification

CHLOROPHYCEAE (green)  
Staurastrum manfeldtii

EUGLENOPHYCEAE (motile green)  
Trachelomonas hispida  
T. robusta

DINOPHYCEAE (dinoflagellate)  
Ceratium hirundinella

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Macrophyte Identification

Brasenia schreberi  
Cabomba caroliniana

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Chlorophyll Analysis

Chlorophyll "a" (mg/m<sup>3</sup>) = 14.36

Analyst(s)/Unit \_\_\_\_\_





Green Pond No 2

Rockaway

POND

LAKE DENMARK

U.S. NAVAL RESERVATION LAKE DENMARK

U.S. MILITARY RESERVATION (PICATINNY ARSENAL)

Picatinny Lake

Mount Hope Mine

Mt Hope Lake

Meadow Lake

Lake Telemark

Lake Ames

01 MARCELIA 2 R M

35 TO INTERSTATE 80

453

(BOONTON) 6165 IV NW

4531

LAKE AMES

INLET

UPPER LAKE

X

SNAKEHILL ROAD

X

INLET

OUTLET

OUTLET

BEACH

