

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

ROSEDALE LAKE
HOPEWELL TOWNSHIP, MERCER 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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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

Rosedale Lake, which is part of a county park, is a 38 acre body of water located in Hopewell Township, Mercer County. The lake is fed by two main sources. The first is a small stormwater culvert that flows through an area of homes before entering the lake. The second is the Stony Brook which flows through some farmland, including cow pastures, before it reaches the lake. Rosedale Lake has a maximum depth of about ten feet. The majority of the lake is accessible to fishing from the shoreline and it is stocked with trout by the State.

LAKE NUM. AND NAME: #3984 ROSEDALE PARK LAKE

STUDY PERIOD: SPRING, SUMMER, FALL 1989

LOCATION: HOPEWELL TWP., MERCER CO.

U.S.G.S. QUAD: #18 PENNINGTON

LAKE AREA: 38 ACRES

LAKE MAXIMUM DEPTH: 10 ft.

TRIBUTARIES: INLET #1 STORMWATER CULVERT
INLET #2 STONY BROOK

LAKE USE AND HISTORICAL NOTES: FISHING. SAMPLED BY NJDEP IN
1980.

COMMENTS: MATS OF BLUE-GREENS FLOATING IN COVES AND LOWER
END OF LAKE AND GROWING ON SUBMERGED SUBSTRATES.
RAN TOTAL RESIDUE ON 10/4 SAMPLES.
LAKE WAS 33 mg/l. INLETS #1 AND #6
WERE 6 mg/l AND 8 mg/l RESPECTIVELY.

RESULTS

PHYSICAL/CHEMICAL PARAMETERS

Temperature and Dissolved Oxygen

Temperatures and dissolved oxygen levels were uniform throughout the water column except during the summer when the lake was stratified. During the summer the dissolved oxygen level in the hypolimnion of the lake was 0.3 mg/l while at the surface it was 8.6 mg/l.

Secchi Disk

The transparency of the lake's water was poor. Secchi disk readings were never greater than 1.5 feet.

Alkalinity and pH

The alkalinity of the water ranged from 30 mg/l to 40 mg/l and therefore, had a moderate buffering capacity. The pH of the water ranged from 7.53 in the fall to 8.58 in the spring.

Nutrients

Total phosphorus levels in the water column were high, ranging from 0.08 mg/l to 0.11 mg/l.

RESULTS

BIOLOGICAL DATA

Chlorophyll a/Algae

Chlorophyll a levels were high for both the summer (69.90 mg/m³) and fall (31.96 mg/m³). No analysis was performed on the spring sample due to a lab malfunction. There was a large diversity of planktonic algal species during the summer and fall. There also was a filamentous blue-green algae (*Oscillatoria princeps*) growing on submerged substrates and collecting in floating mats along the shoreline.

Macrophytes

Small areas of duckweed (*Lemnaceae* spp.) were observed on the lake during the summer and fall. Their areal coverage of the lake was less than 1%.

Bacteria

Fecal coliform levels were high in the inlets that fed the lake (up to 5400 mpn/100ml). However, these levels dissipated in the lake and ranged from less than 20 mpn/100ml to 50 mpn/100ml. These levels indicate safe swimming conditions on the sampling dates. This lake is not utilized for swimming.

CONCLUSION

Rosedale Lake is considered to be in a eutrophic state because of the heavy algae blooms occurring within its boundaries. Both planktonic and filamentous algae were negatively affecting the lake. The algal growth was enhanced by high levels of nutrients in the lake and in the streams that fed the lake.

The recreational use and ecology of the lake were impacted by the heavy algal blooms. The floating mats of blue-green algae congregated along the lower shoreline and hampered bank fishing. The heavy algal growth may also have contributed to the depleted dissolved oxygen levels in the hypolimnion. Aquatic plants, such as algae, organically enrich the lake's sediments when they die. The decomposition of these plants by bacteria increases oxygen consumption. The combination of decomposition and respiration by other organisms requires oxygen replenishment in the hypolimnion. Depth and the turbid quality of Rosedale Lake's water restricts oxygen producing photosynthesis by aquatic plants in the lower region of the lake. Furthermore, stratification restricts oxygen mixing from the surface to the hypolimnion. These factors may be the cause of the anoxic conditions present in the hypolimnion of Rosedale Lake. Dissolved oxygen levels under 4.0 mg/l can stress certain organisms, including favorable fish species. In 1988, a fishkill in Rosedale Lake, estimated at 3000 fish was attributed to lack of dissolved oxygen. Anoxic conditions also favor the release of nutrients from the lake's sediments which can lead to more algal production.

REFERENCES

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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	04/13/89	7.0	12.2	7.64	23	.05	<.01	170	170	1700	1	
	08/22/89	21.1	5.5	6.72	35	.07	.03	790	>2400	>24000	NA	
	10/04/89	12.2	8.9	7.01	24	.05	.04	3500	540	16000	6.48	
INLET #2	04/13/89	11.0	14.4	8.10	45	.07	.03	1300	220	3500	5.91	
	08/22/89	21.1	6.7	7.41	73	.10	.08	490	>2400	5400	NA	
	10/04/89	15.6	12.1	7.86	65	.10	.10	5400	>2400	9200	NA	
LAKE	04/13/89	11.3	11.5	8.58	30	.08	<.01	20	11	60	1.82	1.5
	08/22/89	25.2	8.6	8.18	42	.11	.03	<20	7	<20	NA	1.5
	10/04/89	17.6	8.2	7.53	32	.10	.03	50	70	490	NA	1.0

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
GEOLOGICAL SURVEY
LABORATORY OPERATIONS SECTION

89/08/22
Sample No. 69331
Lakes Management
Rosedale Park Lake, NJ

Page 1 of 2

Plankton Identification

CHLOROPHYCEAE (green)

Ankistrodesmus falcatus
Closteriopsis longissima
Errerella bornheimiensis
Lauterborniella elegantissima
Micractinium pusillum
Pediastrum duplex
Scenedesmus dimorphus
Staurastrum sp.
S. dejectum
Tetrastrum sp.

EUGLENOPHYCEAE (motile green)

Trachelomonas robusta
T. hispida

CHRYSOPHYCEAE (golden or brown)

Mallomonas caudata

BACILLARIOPHYCEAE (diatom)

Attheya zachariasii
Melosira sp.
Nitzschia acicularis
Synedra sp.

DINOPHYCEAE (dinoflagellate)

Ceratium hirundinella
Glenodinium penardiforme

MYXOPHYCEAE (blue-green or other color)

Microcystis aeruginosa
Oscillatoria chlorina
O. putrida

=====

Analyst(s)/Unit _____

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
GEOLOGICAL SURVEY
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89/08/22
Sample No. 69331
Lakes Management
Rosedale Park Lake, NJ

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Other Identification

The separate sample bottle contained a mat of
filamentous blue-green algae, *Oscillatoria princeps*.
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Chlorophyll Analysis

Chlorophyll "a" (mg/m³) = 69.90

Analyst(s)/Unit _____

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
GEOLOGICAL SURVEY
LABORATORY OPERATIONS SECTION

89/10/04
Sample No. 53441
Lakes Management
Rosedale Lake, NJ

Plankton Identification

CHLOROPHYCEAE (green)

Ankistrodesmus falcatus
Eudorina elegans
Nannochloris sp.
Pandorina morum
Pediastrum duplex
Tetraedron hastatum
T. limneticum

EUGLENOPHYCEAE (motile green)

Euglena caudata
Phacus pleuronectes
Trachelomonas charkowiensis
T. hispida
T. robusta
T. volvocina

CHRYSOPHYCEAE (golden or brown)

Synura uvella

BACILLARIOPHYCEAE (diatom)

Asterionella formosa
Attheya zacharias
Cocconeis placentula
Cyclotella sp.
Melosira sp.
Navicula sp.
Nitzschia acicularis
N. linearis
Synedra ulna

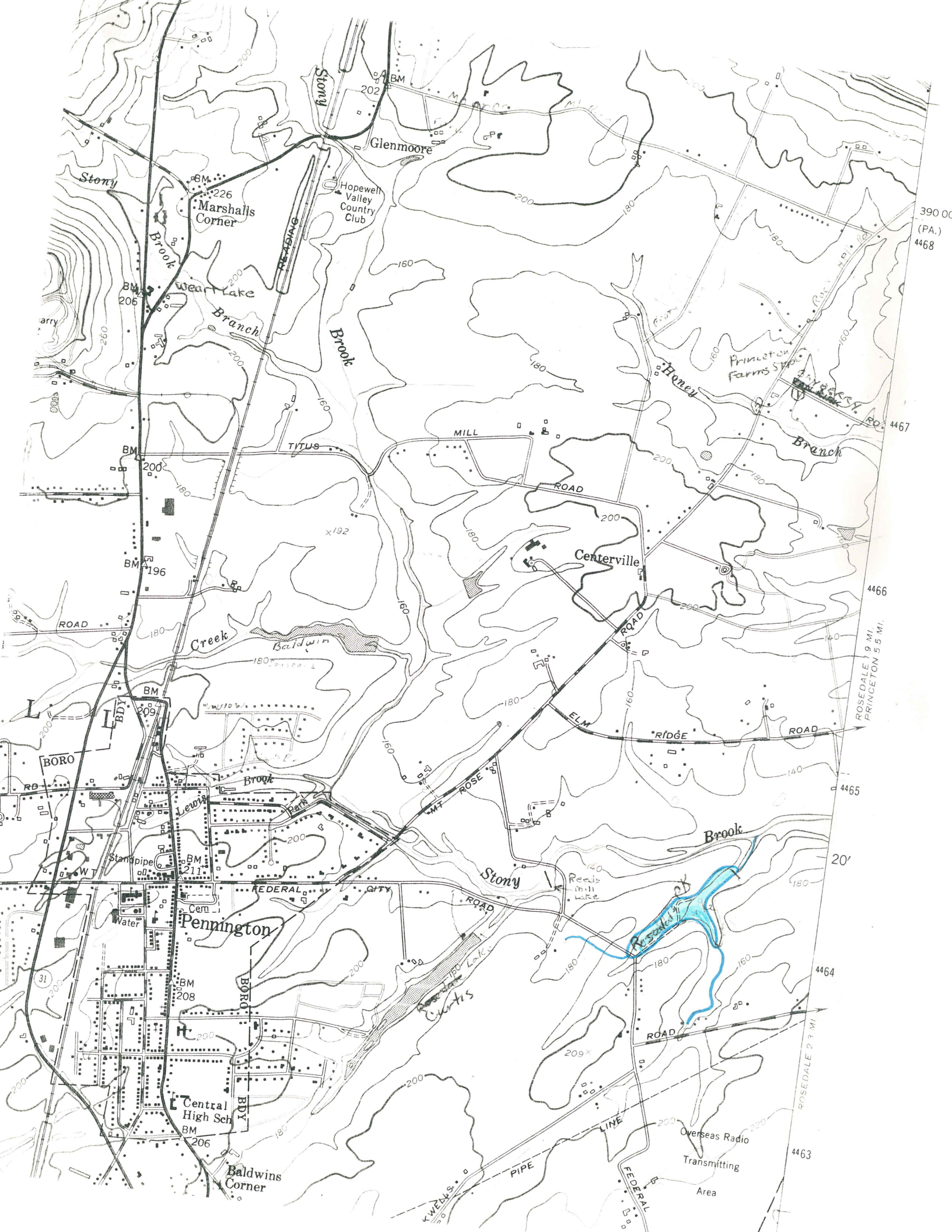
DINOPHYCEAE (dinoflagellate)

Glenodinium gymnodinium

CRYPTOPHYCEAE (colorless or brownish)

Cryptomonas ovata

Analyst/Unit _____



390.00
(PA.)
4468

4467

4466

ROSEDALE 9 MI.
PRINCETON 5.5 MI.

4465

4464

ROSEDALE 2.7 MI.

4463

ROSEDALE LAKE

OUTLET

ROSEDALE
PARK

X-Sample Sites

X

X INLET

FEDERAL CITY ROAD

X
INLET

