LAKE WATER QUALITY ASSESSMENT REPORT

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

DIVISION OF WATER RESOURCES

EAST CREEK POND

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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

CONTENTS

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 $CaCO_3$ has been recommended, except where natural conditions are lower (Quality Critera 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 equilibruim 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 it's 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

East Creek Pond is a 62 acre body of water that is part of the Belleplain State Park, in Cape May County. The lake is fed by one main source, which is Savages Run Creek. It has a maximum depth of about eight feet near the outlet. There is a boat launch that is accessible by car and there are a number of areas along the shoreline from which to fish.

LAKE NUM. AND NAME: #2328 EAST CREEK POND

STUDY PERIOD: SPRING, SUMMER, FALL 1989

LOCATION: DENNIS TWP., CAPE MAY CO.

U.S.G.S. QUAD: #42 WOODBINE

LAKE AREA: 62 ACRES

LAKE MAXIMUM DEPTH: 8 ft.

TRIBUTARIES: SAVAGES RUN

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

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 water in the deepest part of the lake experienced a slight depression in it's dissolved oxygen level (Surface 8.1 mg/l ; Bottom 5.4 mg/l).

Secchi Disk

The transparency of the water ranged from 2.5 feet in the fall to 4.5 feet during the spring.

Alkalinity and pH

The alkalinity of the water was equal to or less than 1 mg/l for each sampling and therefore, offered poor buffering capacity. The pH ranged from 4.23 to 4.70.

Nutrients

Total phosphorus levels, in the water column, ranged from 0.02 mg/l for the summer to 0.04 mg/l for the spring and fall.

RESULTS

BIOLOGICAL DATA

Chlorophyll a/Algae

The chlorophyll a levels for the summer (4.27 mg/m^3) and fall (2.92 mg/m^3) were low as was the diversity of algal species. No chlorophyll a for the spring due to a malfunction in the lab.

Macrophytes

The upper half of the lake was inundated with macrophytes (100% areal coverage). The dominant species present were bladderwort (Utricularia purpurea) and water milfoil (Myriophyllum spp.). In the lower half, water milfoil and bladderwort were growing in the shallow areas along the shoreline and in the shallow coves. Areal coverage in the lower half was between 20 and 30 percent.

Bacteria

Fecal coliform levels ranged from less than 20 mpn/100ml to 70 mpn/100ml, indicating safe swimming conditions on these sampling dates.

CONCLUSION

Because of the proliferation of aquatic macrophytes, East Creek Pond is considered to be in a eutrophic state. The heavy aquatic macrophyte growth adversely affected the recreational usage of the lake. The macrophytes in the upper part of the lake precluded most fishing and boating opportunities there. Fishing from the shoreline, in the lower portion of the lake, was hampered because of aquatic weeds growing along the shoreline.

The heavy growth of macrophytes could adversely affect the ecology of the lake. Aquatic plants enrich the sediments when they die, bacteria that breakdown and decay the accumulated matter consume oxygen. Depth and stratification restrict oxygenation from the surface and the dark brown cedar water restricts the production of oxygen by the photosynthetic processes of aquatic plants in the lower depths. This may be why the dissolved oxygen level was low at the deepest part of the lake, during the summer. Dissolved oxygen levels under 4.0 mg/l could stress some bottom dwelling organisms and therefore, impact the lake's ecosystem.

REFERENCES

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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	ACIDITY	TOT P	ORTHO P	F COLI	F STREP	TOT COLI	FC/FS	SECCHI (feet)
INLET	04/12/89	9.3	9.4	4.19		66	.03	<.01	<20	27	<20		
	07/26/89	17.9	6.4	4.84	1		.05	.01	20	>2400	220		
	10/24/89	10.9	8.1	4.30		20	.04	.02	20	49	310		
UPPER	04/12/89	12.9	8.6	4.27		114	.03	<.01					3.0
	07/26/89	30.1	8.1	4.66	2		.03	.04					4.5
LOWER	04/12/89	14.6	8.6	4.23		54	.04	<.01	<20	>2	>20		4.5
	07/26/89	29.0	8.1	4.70	1		.02	.01	<20	>2	>20		3.5
	10/24/89	13.4	6.9	4.44	1		.04	.02	70	2	330		2.5

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
GEOLOGICAL SURVEY
LABORATORY OPERATIONS SECTION

89/07/26
Sample No. 61500
Lakes Management
East Creek Lake (lower lake), NJ

Plankton Identification

CHLOROPHYCEAE (green)
Chlorella vulgaris
Gloeocystis gigas
Nannochloris sp. **DOMINANT**

Macrophyte Identification

Utricularia purpurea

Chlorophyll Analysis

Chlorophyll "a" (mg/m^3) = 4.27

Analyst(s)/Unit _____

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
GEOLOGICAL SURVEY
LABORATORY OPERATIONS SECTION

89/10/24
Sample No. 79064
Lakes Management
East Creek Lake, NJ

Plankton Identification

CHLOROPHYCEAE (green)
Nannochloris sp.

BACILLARIOPHYCEAE (diatom)
Nitzschia acicularis
Synedra fasicula

CRYPTOPHYCEAE (colorless or brownish)
Cryptomonas erosa

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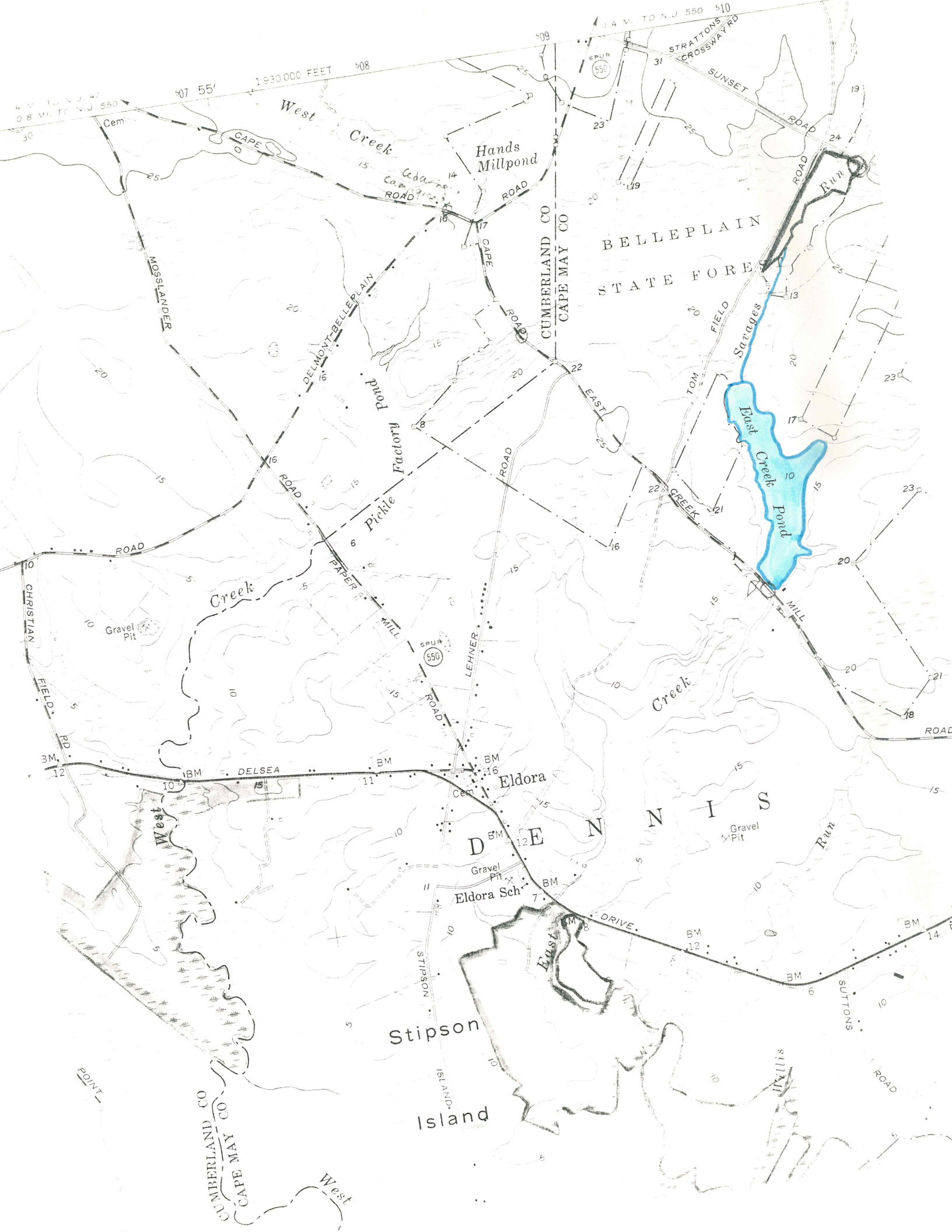
Chlorophyll Analysis

Chlorophyll "a" (mg/m^3) = 2.92

Analyst/Unit _____


West Creek
Hands Millpond
Cedars Cem
CAPE MAY ROAD
MOSSLANDER
DELMONT-BELLEPLAIN
CUMBERLAND CO
CAPE MAY CO
BELLEPLAIN STATE FOREST
Pickle Factory Pond
PAPER MILL ROAD
LEHNER ROAD
EAST CREEK ROAD
TOM FIELD
Savages Run
East Creek Pond
MILL Creek
CHRISTIAN FIELD RD
Gravel Pit
SPUR 550
DELSEA
Eldora
Cem
DENNIS
Eldora Sch
West Run
East Run
STRATTONS CROSSWAY RD
SUNSET ROAD
DRIVE
SUTTONS ROAD
STIPSON ISLAND
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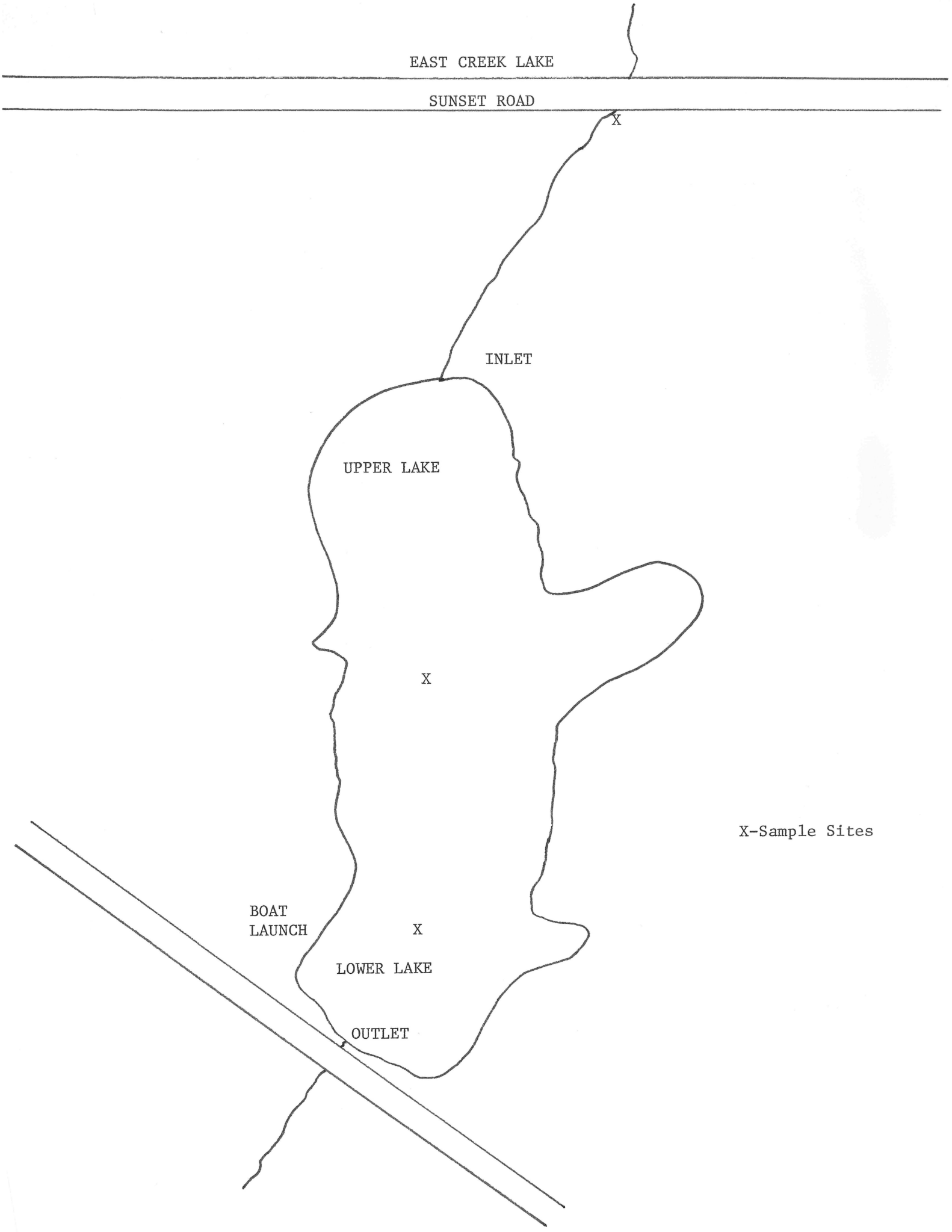
EAST CREEK LAKE
SUNSET ROAD
X
INLET
UPPER LAKE
X
X-Sample Sites
BOAT
LAUNCH
X
LOWER LAKE
OUTLET