U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL EUTROPHICATION SURVEY

WORKING PAPER SERIES

REPORT

ON

FARRINGTON LAKE

MIDDLESEX COUNTY

NEW JERSEY

EPA REGION II

WORKING PAPER No. 366

CORVALLIS ENVIRONMENTAL RESEARCH LABORATORY - CORVALLIS, OREGON

and

ENVIRONMENTAL MONITORING & SUPPORT LABORATORY - LAS VEGAS, NEVADA

☆G.P.O. 699-440

1976

REPORT

ON

FARRINGTON LAKE

MIDDLESEX COUNTY

NEW JERSEY

EPA REGION II

WORKING PAPER No. 366

WITH THE COOPERATION OF THE

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

AND THE

NEW JERSEY NATIONAL GUARD

MAY 1976

CONTENTS

FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to freshwater lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point source discharge reduction and nonpoint source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's freshwater lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by the U.S. Environmental Protection Agency and to augment plans implementation by the states.

ACKNOWLEDGMENTS

The staff of the National Eutrophication Survey (Office of Research and Development, U.S. Environmental Protection Agency) expresses sincere appreciation to the New Jersey Department of Environmental Protection for professional involvement and to the New Jersey National Guard for conducting the tributary sampling phase of the Survey.

Douglas Clark, Chief of the Bureau of Water Quality Planning and Management, Mr. Frank Takacs, New Jersey National Eutrophication Survey Coordinator, Principal Environmental Specialist, and Robert Kotch, Senior Environmental Engineer, provided invaluable lake documentation and counsel during the Survey, reviewed the preliminary reports, and provided critiques most useful in the preparation of this Working Paper series.

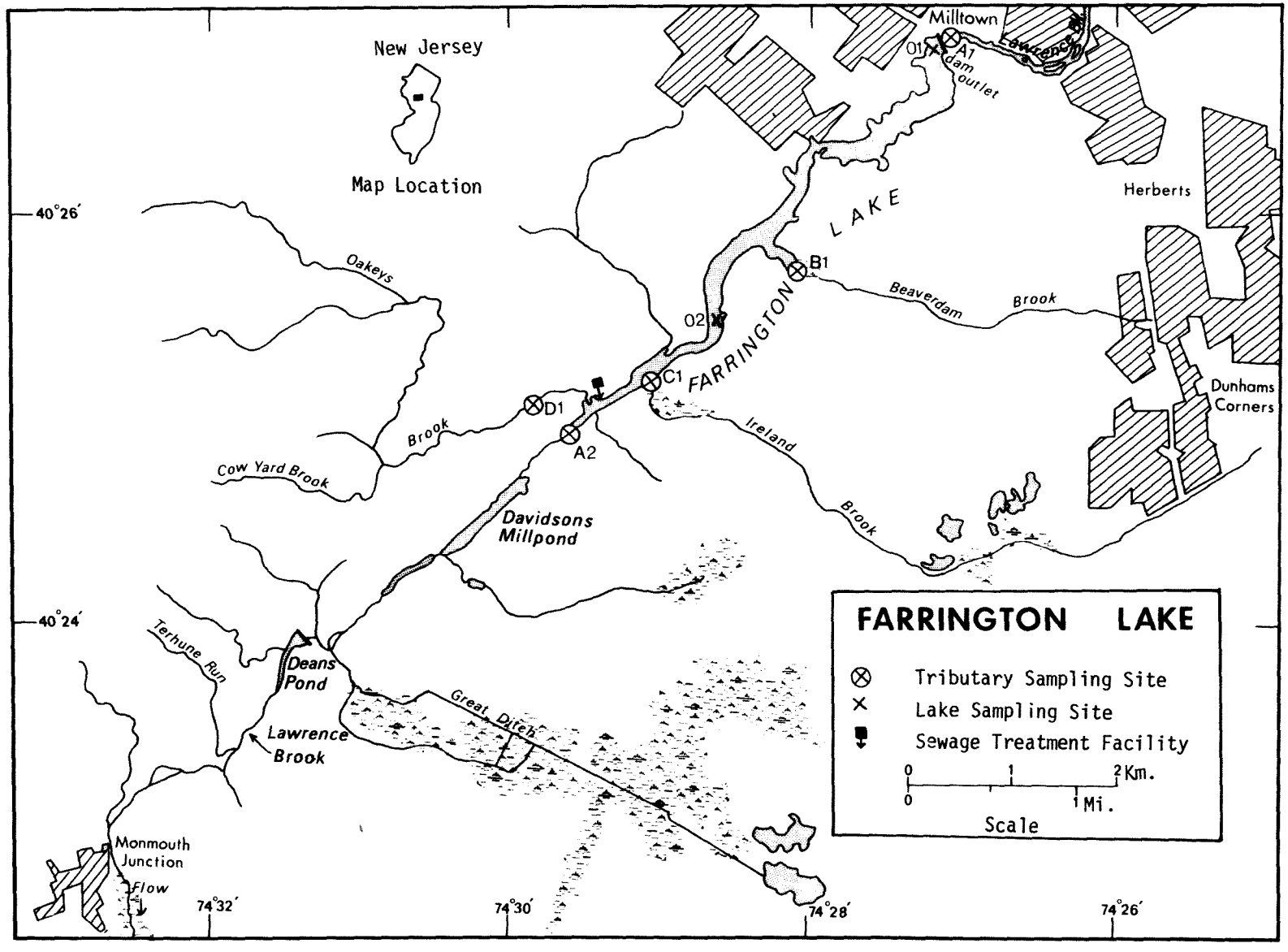
Major General William R. Sharp, Former Chief of Staff, Major General Wilfred G. Menard, Jr., Chief of Staff, and Project Officer Colonel Herbert D. Ruhlin, who directed the volunteer efforts of the New Jersey National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY

STUDY LAKES

STATE OF NEW JERSEY

LAKE NAME	COUNTY
Budd Lake	Morris
Duhernal Lake	Middlesex
Farrington Lake	Middlesex
Greenwood Lake	Passaic, N.J.; Orange, N.Y.
Lake Hopatcong	Morris, Sussex
Lake Musconetcong	Morris, Sussex
Oradell Reservoir	Bergen
Paulinskill Lake	Sussex
Pinecliff Lake	Passaic
Pompton Lakes	Passaic
Spruce Run Reservoir	Hunterdon
Union Lake	Cumberland
Wanaque Reservoir	Passaic


New Jersey
Map Location
40°26′
40°24′
74°32′
74°30′
74°28′
74°26′
Milltown
Lawrence
A1
Dam
Outlet
Herberts
LAKE
FARRINGTON
B1
Beaverdam
Brook
O2
C1
Dunhams
Corners
Oakeys
Brook
D1
A2
Cow Yard Brook
Ireland
Brook
Davidsons
Millpond
Terhune Run
Deans
Pond
Great Ditch
Lawrence
Brook
Monmouth
Junction
Flow
FARRINGTON LAKE
Tributary Sampling Site
Lake Sampling Site
Sewage Treatment Facility
0 1 2 Km.
0 1 Mi.
Scale

FARRINGTON LAKE, NEW JERSEY

STORET NO. 3413

I. CONCLUSIONS

A. Trophic Condition:

Based upon Survey data and field observations, Farrington Lake is considered eutrophic. This humic lake was characterized by abundant aquatic macrophytes, low Secchi disc transparency, and high nutrient concentrations. Chlorophyll a values ranged from a low of 1.5 µg/l in the spring to a high of 16.9 µg/l in the summer.

B. Rate-Limiting Nutrient:

Algal assay results indicate that Farrington Lake is limited by available phosphorus. Spikes with phosphorus, or phosphorus and nitrogen simultaneously resulted in increased assay yields. The addition of nitrogen alone did not produce a growth response. The mean total inorganic nitrogen to mean orthophosphorus ratio (N/P) further substantiates these results.

C. Nutrient Controllability:

1. Point Sources -

The only known point sources contributing to Farrington Lake are septic tanks. They contribute less than 0.1% of the total phosphorus load.

The calculations of loading based upon available nutrient concentrations and flow data indicate a net export of phosphorus and nitrogen, suggesting that the tributary sampling was inadequate to depict actual loading and export rates. Additional sampling and an evaluation of current land use and lakeshore construction are required before an accurate nutrient budget for the lake can be determined.

2. Nonpoint Sources -

Essentially all of the phosphorus loading to Farrington Lake was contributed by nonpoint sources. The major tributaries contributed 67.5% of the loading, while the minor tributaries and the ungaged areas contributed 31.0% of the loading.

II. LAKE AND DRAINAGE BASIN CHARACTERISTICS

Lake and drainage basin characteristics are itemized below. The lake surface area and mean depth were provided by the State of New Jersy. Tributary flow data were provided by the New Jersey District Office of the U.S. Geological Survey (USGS). Outlet drainage area includes the lake surface area. Mean hydraulic retention time was obtained by dividing the lake volume by the mean flow of the outlet. Precipitation values were estimated by methods as outlined in National Eutrophication Survey (NES) Working Paper No. 175. A table of metric/English conversions is included as Appendix A.

A. Lake Morphometry:

1. Surface area: 1.17 km^2.
2. Mean depth: 1.8 meters.
3. Maximum depth: 7.0 meters.
4. Volume: 2.106 x 10^6 m^3.
5. Mean hydraulic retention time: 25 days.

B. Tributary and Outlet (see Appendix B for flow data):

1. Tributaries -

Name	Drainage area(km^2)	Mean flow (m^3/sec)
A(2) Lawrence Creek	31.6	0.40
B(1) Beaverdam Brook	5.2	0.04
C(1) Ireland Creek	16.9	0.18
D(1) Oakeys Brook	10.5	0.09
Minor tributaries and immediate drainage -	23.8	0.32
Totals	88.0	1.03

2. Outlet -

A(1) Lawrence Brook	89.1	0.98

C. Precipitation:

1. Year of sampling: 143.6 cm.

2. Mean annual: 109.8 cm.

III. LAKE WATER QUALITY SUMMARY

Farrington Lake was sampled three times during the open-water season of 1973 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from two stations on the lake and from a number of depths at each station (see map, page v). During each visit, depth-integrated samples were collected from each station for chlorophyll *a* analysis and phytoplankton identification and enumeration. During the first visit, 18.9-liter depth-integrated samples were composited for algal assays. Maximum depths sampled were 5.5 meters at Station 1 and 3.0 meters at Station 2. For a more detailed explanation of NES methods, see NES Working Paper No. 175.

The results obtained are presented in full in Appendix C and are summarized in III A for waters at the surface and at the maximum depth for each site. Results of the phytoplankton counts and chlorophyll *a* determinations are included in III B. Results of the limiting nutrient study are presented in III C.

FARRINGTON LAKE
STORET CODE 3413

PHYSICAL AND CHEMICAL CHARACTERISTICS

PARAMETER	(4/16/73) S*** = 2 N*	RANGE	MEDIAN	MAX DEPTH RANGE (METERS)	(7/22/73) S*** = 2 N*	RANGE	MEDIAN	MAX DEPTH RANGE (METERS)	(10/ 2/73) S*** = 2 N*	RANGE	MEDIAN	MAX DEPTH RANGE (METERS)
TEMPERATURE (DEG CENT)												
0.-1.5 M DEPTH	4	12.0- 12.6	12.1	0.0- 1.5	4	23.9- 27.2	25.5	0.0- 1.5	3	19.9- 20.6	20.2	0.0- 1.5
MAX DEPTH**	2	11.3- 12.0	11.6	1.5- 4.6	2	17.0- 22.5	19.8	3.0- 5.5	2	19.3- 20.6	19.9	0.0- 3.7
DISSOLVED OXYGEN (MG/L)												
0.-1.5 M DEPTH	2	10.1- 10.6	10.3	1.2- 1.5	3	3.2- 7.8	6.7	0.0- 1.5	2	6.6- 8.4	7.5	0.0- 1.5
MAX DEPTH**	2	8.8- 10.6	9.7	1.5- 4.6	2	0.6- 5.5	3.0	3.0- 5.5	2	2.0- 8.4	5.2	0.0- 3.7
CONDUCTIVITY (UMHOS)												
0.-1.5 M DEPTH	4	90.- 102.	98.	0.0- 1.5	4	85.- 102.	92.	0.0- 1.5	3	250.- 270.	260.	0.0- 1.5
MAX DEPTH**	2	90.- 102.	96.	1.5- 4.6	2	104.- 120.	112.	3.0- 5.5	2	260.- 270.	265.	0.0- 3.7
PH (STANDARD UNITS)												
0.-1.5 M DEPTH	4	6.6- 6.6	6.6	0.0- 1.5	3	6.1- 6.6	6.3	0.0- 1.5	3	6.3- 6.5	6.4	0.0- 1.5
MAX DEPTH**	2	6.6- 6.6	6.6	1.5- 4.6	2	6.1- 6.3	6.2	3.0- 5.5	2	6.2- 6.4	6.3	0.0- 3.7
TOTAL ALKALINITY (MG/L)												
0.-1.5 M DEPTH	4	10.- 10.	10.	0.0- 1.5	3	10.- 10.	10.	0.0- 1.5	3	15.- 16.	16.	0.0- 1.5
MAX DEPTH**	2	10.- 10.	10.	1.5- 4.6	2	13.- 22.	18.	3.0- 5.5	2	15.- 17.	16.	0.0- 3.7
TOTAL P (MG/L)												
0.-1.5 M DEPTH	4	0.031-0.046	0.039	0.0- 1.5	3	0.087-0.090	0.089	0.0- 1.5	3	0.043-0.072	0.053	0.0- 1.5
MAX DEPTH**	2	0.033-0.052	0.042	1.5- 4.6	2	0.096-0.101	0.098	3.0- 5.5	2	0.053-0.055	0.054	0.0- 3.7
DISSOLVED ORTHO P (MG/L)												
0.-1.5 M DEPTH	4	0.007-0.013	0.010	0.0- 1.5	3	0.010-0.014	0.013	0.0- 1.5	3	0.011-0.012	0.011	0.0- 1.5
MAX DEPTH**	2	0.007-0.010	0.008	1.5- 4.6	2	0.017-0.020	0.018	3.0- 5.5	2	0.011-0.014	0.012	0.0- 3.7
NO2+NO3 (MG/L)												
0.-1.5 M DEPTH	4	0.740-0.940	0.840	0.0- 1.5	3	0.570-0.620	0.570	0.0- 1.5	3	0.500-0.640	0.510	0.0- 1.5
MAX DEPTH**	2	0.720-0.920	0.820	1.5- 4.6	2	0.080-0.850	0.465	3.0- 5.5	2	0.430-0.640	0.535	0.0- 3.7
AMMONIA (MG/L)												
0.-1.5 M DEPTH	4	0.070-0.100	0.080	0.0- 1.5	3	0.080-0.140	0.100	0.0- 1.5	3	0.090-0.180	0.170	0.0- 1.5
MAX DEPTH**	2	0.070-0.100	0.085	1.5- 4.6	2	0.170-0.840	0.505	3.0- 5.5	2	0.090-0.340	0.215	0.0- 3.7
KJELDAHL N (MG/L)												
0.-1.5 M DEPTH	4	0.400-0.500	0.450	0.0- 1.5	3	1.000-1.600	1.300	0.0- 1.5	3	0.900-1.200	1.100	0.0- 1.5
MAX DEPTH**	2	0.400-0.400	0.400	1.5- 4.6	2	1.200-1.700	1.450	3.0- 5.5	2	1.000-1.100	1.050	0.0- 3.7
SECCHI DISC (METERS)												
	2	0.6- 1.2	0.9		2	0.9- 0.9	0.9		2	1.0- 1.2	1.1	

* N = NO. OF SAMPLES
** MAXIMUM DEPTH SAMPLED AT EACH SITE
*** S = NO. OF SITES SAMPLED ON THIS DATE

B. Biological Characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera		Algal Units per ml
07/22/73	1.	Melosira	2,710
	2.	Trachelomonas	1,019
	3.	Flagellates	895
	4.	Attheya	621
	5.	Oscillatoria	323
		Other genera	945
		Total	6,513
10/02/73	1.	Flagellates	8,474
	2.	Dinobryon	1,932
	3.	Melosira	772
	4.	Asterionella	359
	5.	Tabellaria	331
		Other genera	249
		Total	12,117

2. Chlorophyll a -

Sampling Date	Station Number	Chlorophyll a (µg/liter)
04/16/73	1	2.3
	2	1.5
07/22/73	1	2.2
	2	16.9
10/02/73	1	10.6
	2	16.2

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

Spike(mg/l)	Ortho P Conc.(mg/l)	Inorganic N Conc.(mg/l)	Maximum yield (mg/l-dry wt.)
Control	0.010	0.725	0.7
0.05 P	0.060	0.725	14.1
0.05 P + 1.0 N	0.060	1.725	16.0
1.00 N	0.010	1.725	0.6

2. Discussion -

The control yield of the assay alga, Selenastrum capricornutum, indicates that the potential for primary productivity in Farrington Lake was moderately high at the time of sampling. The lake was phosphorus limited at that time as indicated by the increased yield of the test alga in response to an addition of orthophosphorus. Spikes with phosphorus and nitrogen simultaneously resulted in a maximum yield. Spikes with nitrogen alone did not produce any response beyond the control yield.

The N/P ratio of 90/1 during spring sampling further indicates phosphorus limitation.

IV. NUTRIENT LOADINGS
(See Appendix D for data)

For the determination of nutrient loadings, the New Jersey National Guard collected monthly near-surface grab samples from each of the tributary sites indicated on the map (page v), except for the high runoff months of February and March when two samples were collected. Sampling was begun in July 1973, and was completed in April 1974.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the New Jersey District Office of USGS for the tributary sites nearest the lake.

In this report, nutrient loads for sampled tributaries were determined by using a modification of the USGS computer program for calculating stream loadings. Nutrient loads indicated for tributaries are those measured minus known point source loads, if any.

Nutrient loadings for unsampled "minor tributaries and immediate drainage" ("ZZ" of USGS) were estimated by using the mean annual concentrations in Beaverdam Brook at Station B(1) and mean annual ZZ flow.

A. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

Source	kg P/yr	% of total
a. Tributaries (nonpoint load) -		
A(2) Lawrence Creek	420	31.3
B(1) Beaverdam Brook	50	3.7
C(1) Ireland Creek	190	14.2
D(1) Oakeys Brook	245	18.3
b. Minor tributaries and immediate drainage (nonpoint load) -	415	31.0
c. Known municipal STP's - None		
d. Septic tanks* -	<5	<0.1
e. Known industrial - None		
f. Direct precipitation** -	20	1.5
Total	1,340	100.0
2. Output - A(1) Lawrence Brook	1,370	
3. Net annual P export*** -	30	

*Estimate based on 6 lakeside residences.
**Estimated (see NES Working Paper No. 175).
***Export probably due to unknown sources and/or sampling error.

B. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

Source		kg N/yr	% of total
a.	Tributaries (nonpoint load) -		
	A(2) Lawrence Creek	24,240	35.4
	B(1) Beaverdam Brook	2,475	3.6
	C(1) Ireland Creek	14,705	21.4
	D(1) Oakeys Brook	5,530	8.0
b.	Minor tributaries and immediate drainage (nonpoint load) -	20,435	29.7
c.	Known municipal STP's - None		
d.	Septic tanks* -	65	0.1
e.	Known industrial - None		
f.	Direct precipitation** -	1,265	1.8
	Total	68,715	100.0

2. Output - A(1) Lawrence Brook 71,185

3. Net annual N export*** - 2,470

*Estimate based on 6 lakeside residences.
**Estimated (see NES Working Paper No. 175).
***Export probably due to unknown point sources and/or sampling error.

C. Mean Annual Non-point Nutrient Export by Subdrainage Area:

Tributary	kg P/km^2/yr	kg N/km^2/yr
A(2) Lawrence Creek	13	767
B(1) Beaverdam Brook	10	476
C(1) Ireland Creek	11	870
D(1) Oakeys Brook	23	527

D. Yearly Loads:

In the following table, the existing phosphorus loadings are compared to those proposed by Vollenweider (Vollenweider and Dillon, 1974). Essentially, his "dangerous" loading is one at which the receiving water would become eutrophic or remain eutrophic; his "permissible" loading is that which would result in the receiving water remaining oligotrophic or becoming oligotrophic if morphometry permitted. A mesotrophic loading would be considered one between "dangerous" and "permissible".

Note that Vollenweider's model may not be applicable to water bodies with short hydraulic retention times.

	Total Yearly Phosphorus Loading (g/m^2/yr)
Estimated loading for Farrington Lake	1.14
Vollenweider's "dangerous" or eutrophic loading	0.98
Vollenweider's "permissible" or oligotrophic loading	0.49

V. LITERATURE REVIEWED

U.S. Environmental Protection Agency. 1975. National Eutrophication Survey Methods 1973-1976. Working Paper No. 175. Environmental Monitoring and Support Laboratory, Las Vegas, Nevada, and Corvallis Environmental Research Laboratory, Corvallis, Oregon.

Vollenweider, R. A., and P. J. Dillon, 1974. The application of the phosphorus loading concept to eutrophication research. Natl. Res. Council of Canada Publ. No. 13690, Canada Centre for Inland Waters, Burlington, Ontario.

VI. APPENDICES

APPENDIX A

CONVERSION FACTORS

CONVERSION FACTORS

Hectares x 2.471 = acres

Kilometers x 0.6214 = miles

Meters x 3.281 = feet

Cubic meters x 8.107×10^{-4} = acre/feet

Square kilometers x 0.3861 = square miles

Cubic meters/sec x 35.315 = cubic feet/sec

Centimeters x 0.3937 = inches

Kilograms x 2.205 = pounds

Kilograms/square kilometer x 5.711 = lbs/square mile

APPENDIX B

TRIBUTARY FLOW DATA

TRIBUTARY FLOW INFORMATION FOR NEW JERSEY 06/04/76

LAKE CODE 3413 FARRINGTON LAKE

TOTAL DRAINAGE AREA OF LAKE(SQ KM) 89.1

TRIBUTARY	SUB-DRAINAGE AREA(SQ KM)	NORMALIZED FLOWS(CMS) JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
3413A1	89.1	1.08	1.56	1.90	1.36	1.05	0.65	0.54	0.82	0.57	0.51	0.82	0.99	0.98
3413A2	31.6	0.51	0.62	0.76	0.59	0.40	0.20	0.25	0.25	0.23	0.24	0.34	0.42	0.40
3413B1	5.2	0.051	0.065	0.088	0.059	0.037	0.015	0.020	0.020	0.018	0.018	0.028	0.040	0.038
3413C1	16.9	0.249	0.283	0.368	0.275	0.181	0.082	0.105	0.102	0.096	0.099	0.142	0.195	0.181
3413D1	10.5	0.130	0.167	0.227	0.150	0.088	0.034	0.045	0.042	0.040	0.042	0.065	0.099	0.094
3413ZZ	25.0	0.40	0.48	0.59	0.48	0.31	0.16	0.20	0.20	0.18	0.19	0.27	0.34	0.32

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 89.1
SUM OF SUB-DRAINAGE AREAS = 89.1
TOTAL FLOW IN = 12.39
TOTAL FLOW OUT = 11.84

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
3413A1	7	73	1.824	21	1.557				
	8	73	0.493	11	0.510				
	9	73	0.428	8	0.425				
	10	73	0.708	14	0.269				
	11	73	0.892	11	0.510				
	12	73	3.483	9	5.069				
	1	74	1.968	5	2.124				
	2	74	1.178	12	0.850	23	1.586		
	3	74	2.138	16	1.529	30	2.832		
	4	74	1.968	21	1.133				
	5	74	1.218						
	6	74	0.578						
3413A2	7	73	0.821	21	0.368				
	8	73	0.204	11	0.190				
	9	73	0.161	8	0.113				
	10	73	0.311	14	0.127				
	11	73	0.311	11	0.235				
	12	73	1.048	9	0.708				
	1	74	0.736	5	0.765				
	2	74	0.481	12	0.368	23	0.963		
	3	74	0.765	16	0.396	30	0.850		
	4	74	0.793	21	0.453				
	5	74	0.425						
	6	74	0.311						

TRIBUTARY FLOW INFORMATION FOR NEW JERSEY 06/04/76

LAKE CODE 3413 FARRINGTON LAKE

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
341381	7	73	0.091	21	0.034				
	8	73	0.015	11	0.014				
	9	73	0.011	8	0.007				
	10	73	0.027	14	0.008				
	11	73	0.027	11	0.018				
	12	73	0.125	9	0.076				
	1	74	0.079	5	0.082				
	2	74	0.045	12	0.034	23	0.113		
	3	74	0.085	16	0.037	30	0.093		
	4	74	0.091	21	0.042				
	5	74	0.037						
	6	74	0.025						
3413C1	7	73	0.396	21	0.167				
	8	73	0.082	11	0.076				
	9	73	0.062	8	0.042				
	10	73	0.139	14	0.048				
	11	73	0.139	11	0.096				
	12	73	0.538	9	0.340				
	1	74	0.368	5	0.368				
	2	74	0.215	12	0.167	23	0.481		
	3	74	0.368	16	0.178	30	0.396		
	4	74	0.396	21	0.207				
	5	74	0.187						
	6	74	0.130						
3413D1	7	73	0.238	21	0.079				
	8	73	0.034	11	0.028				
	9	73	0.024	8	0.015				
	10	73	0.065	14	0.017				
	11	73	0.065	11	0.040				
	12	73	0.340	9	0.198				
	1	74	0.204	5	0.218				
	2	74	0.110	12	0.079	23	0.311		
	3	74	0.224	16	0.088	30	0.246		
	4	74	0.238	21	0.105				
	5	74	0.093						
	6	74	0.059						
3413ZZ	7	73	0.651	21	0.283				
	8	73	0.161	11	0.150				
	9	73	0.127	8	0.091				
	10	73	0.246	14	0.102				
	11	73	0.246	11	0.187				
	12	73	0.821	9	0.566				
	1	74	0.595	5	0.595				
	2	74	0.368	12	0.283	23	0.765		
	3	74	0.595	16	0.311	30	0.680		
	4	74	0.623	21	0.368				
	5	74	0.340						
	6	74	0.246						

APPENDIX C

PHYSICAL AND CHEMICAL DATA

STORET RETRIEVAL DATE 76/06/04

341301
40 26 54.0 074 27 15.0 3
FARRINGTON LAKE
34023 NEW JERSEY
013391

11EPALES 2111202
0020 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/04/16	13 10	0000	12.6		24	90	6.60	10K	0.100	0.500	0.760	0.011
	13 10	0004	12.0	10.1		95	6.60	10K	0.090	0.500	0.740	0.013
	13 10	0015	11.3	8.8		90	6.60	10K	0.100	0.400	0.720	0.010
73/07/22	14 30	0000	25.5	3.2	36	85	6.30	10K	0.140	1.300	0.570	0.014
	14 30	0005	23.9			86						
	14 30	0010	21.5	0.7		80	5.90	10K	0.400	1.100	0.340	0.014
	14 30	0015	18.4			98						
	14 30	0018	17.0	0.6		120	6.30	22	0.840	1.700	0.080	0.020
73/10/02	11 45	0000	20.2		48	260	6.50	16	0.170	1.200	0.500	0.012
	11 45	0005	19.9	6.6		250	6.30	16	0.180	0.900	0.510	0.011
	11 45	0012	19.3	2.0		260	6.20	17	0.340	1.000	0.430	0.014

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/04/16	13 10	0000	0.046	2.3
	13 10	0004	0.045	
	13 10	0015	0.052	
73/07/22	14 30	0000	0.090	2.2
	14 30	0010	0.090	
	14 30	0018	0.096	
73/10/02	11 45	0000	0.072	10.6
	11 45	0005	0.043	
	11 45	0012	0.055	

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/06/04

341302
40 25 31.0 074 28 42.0 3
FARRINGTON LAKE
34023 NEW JERSEY
013391

11EPALES 2111202
0008 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/04/16	13 35	0000	12.2		48	100	6.60	10K	0.070	0.400	0.940	0.009
	13 35	0005	12.0	10.6		102	6.60	10K	0.070	0.400	0.920	0.007
73/07/22	15 00	0000	27.2	7.8	34	98	6.60	10K	0.080	1.600	0.570	0.010
	15 00	0005	25.6	6.7		102	6.10	10	0.100	1.000	0.620	0.013
	15 00	0010	22.5	5.5		104	6.10	13	0.170	1.200	0.850	0.017
73/10/02	11 30	0000	20.6	8.4	38	270	6.40	15	0.090	1.100	0.640	0.011

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/04/16	13 35	0000	0.031	1.5
	13 35	0005	0.033	
73/07/22	15 00	0000	0.089	16.9
	15 00	0005	0.087	
	15 00	0010	0.101	
73/10/02	11 30	0000	0.053	16.2

K VALUE KNOWN TO BE
LESS THAN INDICATED

APPENDIX D

TRIBUTARY DATA

STORET RETRIEVAL DATE 76/06/04

3413A1
40 27 00.0 074 27 12.0 4
LAWRENCE BROOK
34 7.5 NEW BRUNSWIC
O/FARRINGTON LAKE 013391
BANK OFF DAM ACCESS RD ABOV SUCKER BROOK
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/07/21	15 20		0.540	1.000	0.220	0.034	0.070
73/08/11	15 30		0.540	1.050	0.220	0.014	0.050
73/09/08	13 30		0.260	1.400	0.620	0.027	0.055
73/10/14	09 40		0.550	2.800	0.940	0.011	0.045
73/11/11	15 40		0.640	2.400	0.198	0.058	
73/12/09	10 15		0.384	1.600	0.116	0.024	
74/01/05	13 30		0.570	0.300	0.044	0.016	0.060
74/02/12	15 30		1.040	0.400	0.050	0.005	0.032
74/02/23	09 30		1.300	0.400	0.035	0.005	0.025
74/03/16	13 15		1.300	3.300	0.190	0.005	0.030
74/03/30	15 30		0.830	2.700	0.130	0.015	0.050
74/04/21	15 40		0.630	0.600	0.020	0.015	0.015

STORET RETRIEVAL DATE 76/06/04

3413A2
40 24 58.0 074 29 40.0 4
LAWRENCE CREEK
34 7.5 NEW BRUNSWIC
T/FARRINGTON LAKE 013391
DAVIDSONS MILL RD BRDG SE OF US 130 JCT
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/07/21	16 05		0.960	1.680	0.280	0.034	0.055
73/08/11	14 00		1.100	0.620	0.084	0.009	0.040
73/09/08	15 10		0.950	1.200	0.062	0.015	0.025
73/10/14	11 20		1.260	1.050	0.138	0.007	0.020
73/11/11	14 45		0.940	0.700	0.054	0.012	0.055
73/12/09	11 35		0.750	0.400	0.044	0.008	0.030
74/01/05	15 00		0.890	0.300	0.040	0.012	0.025
74/02/12	14 30		1.200	0.300	0.030	0.010	0.020
74/02/23	10 20		1.090	0.300	0.020	0.015	0.040
74/03/16	14 40		1.090	1.400	0.065	0.010	0.025
74/03/30	14 40		1.090	1.400	0.070	0.010	0.025
74/04/21	14 35		0.890	0.900	0.035	0.030	0.030

STORET RETRIEVAL DATE 76/06/04

341381
40 25 50.0 074 28 06.0 4
BEAVERDAM BROOK
34 7.5 NEW BRUNSWIC
T/FARRINGTON LAKE 013391
RIVA AVE BRDG NE OF PATRICKS CORNERS
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/07/21	15 45		0.450	1.600	0.270	0.029	0.100
73/08/11	13 10		0.480	0.750	0.138	0.010	0.045
73/09/08	14 15		0.520	0.580	0.120	0.014	0.045
73/10/14	10 00		1.700	2.200	0.800	0.005K	0.020
73/11/11	13 30		1.240	0.700	0.078	0.009	0.055
73/12/09	09 40		1.180	0.700	0.076	0.016	0.050
74/01/05	14 00		0.950	0.300	0.044	0.008	0.025
74/02/12	13 35		1.340	0.300	0.025	0.005K	0.020
74/02/23	09 45		1.280	0.500	0.060	0.005	0.055
74/03/16	13 45		1.760	0.600	0.060	0.005K	0.010
74/03/30	13 40		1.120	2.200	0.160	0.010	0.040
74/04/21	13 35		1.400	0.450	0.025	0.005	0.025

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/06/04

3413C1
40 25 14.0 074 29 08.0 4
IRELAND CREEK
34 7.5 NEW BRUNSWIC
T/FARRINGTON LAKE 013391
RIVA AVE BRDG SW OF PATRICKS CORNERS
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/07/21	16 00		1.400	1.150	0.210	0.017	0.065
73/08/11	14 20		1.960	0.480	0.140	0.005K	0.020
73/09/08	15 45		2.000	0.300	0.040	0.010	0.020
73/10/14	10 20		1.900	1.550	0.510	0.005K	0.015
73/11/11	14 10		1.460	0.550	0.048	0.011	0.060
74/01/05	14 30		1.010	0.800	0.072	0.008	0.025
74/02/12	14 00		1.680	0.300	0.030	0.005K	0.010
74/02/23	10 00		1.180	0.500	0.035	0.010	0.040
74/03/16	14 10		1.760	1.500	0.065	0.005K	0.015
74/03/30	14 10		1.120	3.600	0.135	0.010	0.070
74/04/21	14 05		1.300	0.500	0.020	0.005	0.025

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/06/04

3413D1
40 25 05.0 074 29 58.0 4
OAKEYS BROOK
34 7.5 NEW BRUNSWIC
T/FARRINGTON LAKE 013391
DAVIDSONS MILL RD BANK SE OF US 130 JCT
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/07/21	16	15	1.260	1.100	0.100	0.046	0.210
73/08/11	14	50	1.000	0.440	0.132	0.008	0.030
73/09/08	15	30	1.100	2.200	1.050	0.010	0.040
73/10/14	11	15	1.300	0.350	0.046	0.025	0.047
73/11/11	15	15	1.360	0.300	0.028	0.039	0.080
73/12/09	12	05	0.590	1.425	0.148	0.240	0.318
74/01/05	15	30	0.528	0.300	0.036	0.016	0.030
74/02/12	14	50	0.880	0.300	0.025	0.010	0.025
74/02/23	10	40	0.552	0.500	0.035	0.025	0.065
74/03/16	15	15	0.630	1.600	0.100	0.020	0.045
74/03/30	15	00	0.630	2.600	0.165	0.025	0.060
74/04/21	15	05	0.510	0.600	0.020	0.027	0.030

APPENDIX E

PARAMETRIC RANKINGS OF LAKES SAMPLED BY NES IN 1973

STATE OF NEW JERSEY

LAKE DATA TO BE USED IN RANKINGS

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500- MEAN SEC	MEAN CHLORA	15- MIN DO	MEDIAN DISS ORTHO P
3402	BUDD LAKE	0.082	0.205	474.000	48.500	7.400	0.012
3403	GREENWOOD LAKE	0.021	0.100	414.250	11.920	14.800	0.007
3406	ORADELL RESERVOIR	0.055	0.990	462.500	22.267	13.600	0.008
3409	PINECLIFF LAKE	0.070	0.175	465.500	38.960	11.000	0.011
3410	POMPTON LAKES	0.071	0.795	463.167	23.033	11.800	0.029
3412	DUHERNAL LAKE	0.082	1.420	466.667	6.800	8.600	0.010
3413	FARRINGTON LAKE	0.055	0.770	462.000	8.283	14.400	0.012
3415	LAKE HOPATCONG	0.022	0.120	416.333	13.627	14.900	0.007
3417	LAKE MUSCONETCONG	0.036	0.140	436.000	11.067	6.000	0.010
3419	PAULINS KILL LAKE	0.133	0.950	460.500	7.017	9.000	0.065
3420	SPRUCE RUN RESERVOIR	0.020	0.470	428.667	15.333	15.000	0.007
3422	UNION LAKE	0.063	1.150	463.200	22.080	12.800	0.018
3423	WANAQUE RESERVOIR	0.014	0.120	355.333	7.111	14.800	0.005

PERCENT OF LAKES WITH HIGHER VALUES (NUMBER OF LAKES WITH HIGHER VALUES)

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P	INDEX NO
3402	BUDD LAKE	12 (1)	58 (7)	0 (0)	0 (0)	92 (11)	29 (3)	191
3403	GREENWOOD LAKE	83 (10)	100 (12)	92 (11)	58 (7)	21 (2)	83 (9)	437
3406	ORADELL RESERVOIR	54 (6)	17 (2)	42 (5)	25 (3)	42 (5)	67 (8)	247
3409	PINECLIFF LAKE	33 (4)	67 (8)	17 (2)	8 (1)	67 (8)	42 (5)	234
3410	POMPTON LAKES	25 (3)	33 (4)	33 (4)	17 (2)	58 (7)	8 (1)	174
3412	DUHERNAL LAKE	12 (1)	0 (0)	8 (1)	100 (12)	83 (10)	58 (7)	261
3413	FARRINGTON LAKE	54 (6)	42 (5)	50 (6)	75 (9)	33 (4)	29 (3)	283
3415	LAKE HOPATCONG	75 (9)	87 (10)	83 (10)	50 (6)	8 (1)	83 (9)	386
3417	LAKE MUSCONETCONG	67 (8)	75 (9)	67 (8)	67 (8)	100 (12)	50 (6)	426
3419	PAULINS KILL LAKE	0 (0)	25 (3)	58 (7)	92 (11)	75 (9)	0 (0)	250
3420	SPRUCE RUN RESERVOIR	92 (11)	50 (6)	75 (9)	42 (5)	0 (0)	83 (9)	342
3422	UNION LAKE	42 (5)	8 (1)	25 (3)	33 (4)	50 (6)	17 (2)	175
3423	WANAQUE RESERVOIR	100 (12)	87 (10)	100 (12)	83 (10)	21 (2)	100 (12)	491

LAKES RANKED BY INDEX NOS.

RANK	LAKE CODE	LAKE NAME	INDEX NO
1	3423	WANAQUE RESERVOIR	491
2	3403	GREENWOOD LAKE	437
3	3417	LAKE MUSCONETCONG	426
4	3415	LAKE HOPATCONG	386
5	3420	SPRUCE RUN RESERVOIR	342
6	3413	FARRINGTON LAKE	283
7	3412	DUHERNAL LAKE	261
8	3419	PAULINS KILL LAKE	250
9	3406	ORADELL RESERVOIR	247
10	3409	PINECLIFF LAKE	234
11	3402	BUDD LAKE	191
12	3422	UNION LAKE	175
13	3410	POMPTON LAKES	174