U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL EUTROPHICATION SURVEY

WORKING PAPER SERIES

REPORT

ON

CONEWAGO (PINCHOT) LAKE

YORK COUNTY

PENNSYLVANIA

EPA REGION III

WORKING PAPER No. 423

PACIFIC NORTHWEST ENVIRONMENTAL RESEARCH LABORATORY

An Associate Laboratory of the

NATIONAL ENVIRONMENTAL RESEARCH CENTER - CORVALLIS, OREGON

and

NATIONAL ENVIRONMENTAL RESEARCH CENTER - LAS VEGAS, NEVADA

☆ GPO—697-032

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WITH THE COOPERATION OF THE

PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL RESOURCES

AND THE

PENNSYLVANIA NATIONAL GUARD

JUNE, 1975

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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 fresh water 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 non-point 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 fresh water 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 EPA and to augment plans implementation by the states.

ACKNOWLEDGMENT

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

Walter A. Lyon, Director of the Bureau of Water Quality Management, Richard M. Boardman, Chief of the Division of Water Quality, and James T. Ulanoski, Aquatic Biologist of the Division of Water Quality, 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.

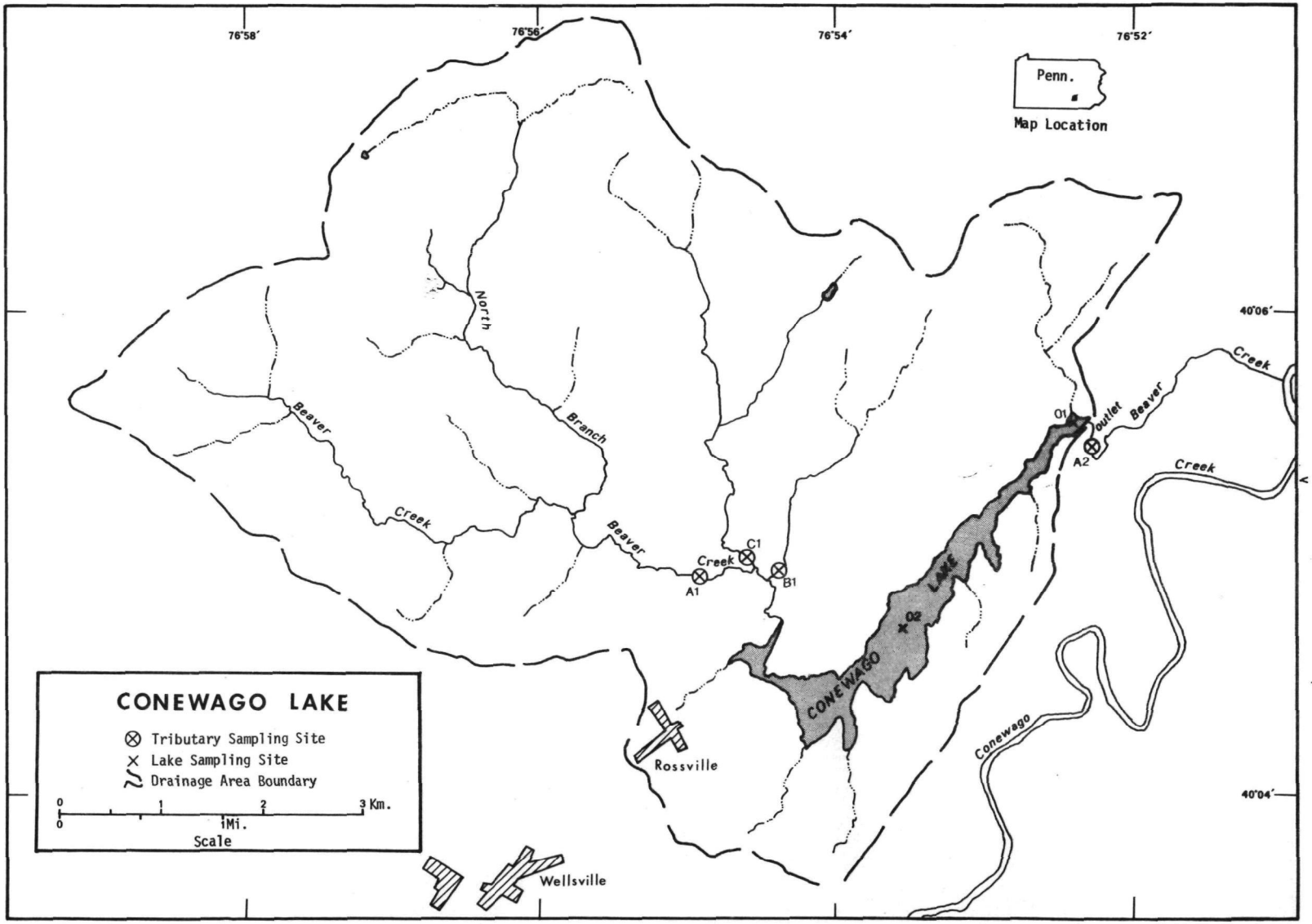
Major General Harry J. Mier, Jr., the Adjutant General of Pennsylvania, and Project Officer Major Ronald E. Wickard, who directed the volunteer efforts of the Pennsylvania National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY

STUDY LAKES

STATE OF PENNSYLVANIA

LAKE NAME	COUNTY
Allegheny Reservoir	McKean, Warren, PA; Cattaraugus, NY
Beaver Run Reservoir	Westmoreland
Beltzville	Carbon
Blanchard Reservoir	Centre
Canadohta	Crawford
Conneaut	Crawford
Conewago (Pinchot)	York
Greenlane	Montgomery
Harveys	Luzerne
Indian	Somerset
Naomi	Monroe
Ontelaunee	Berks
Pocono	Monroe
Pymatuning Reservoir	Crawford, PA; Ashtabula, OH
Shenango River Reservoir	Mercer
Stillwater	Monroe
Wallenpaupack	Pike, Wayne


76°58′
76°56′
76°54′
76°52′
Penn.
Map Location
40°06′
40°04′
North
Branch
Beaver
Creek
Beaver
Creek
Beaver
Creek
Outlet
Creek
O1
A2
C1
B1
A1
CONEWAGO
LAKE
+02
Rossville
Wellsville
Conewago
CONEWAGO LAKE
Tributary Sampling Site
Lake Sampling Site
Drainage Area Boundary
0 1 2 3 Km.
0 1Mi.
Scale

CONEWAGO (PINCHOT) LAKE*

STORET NO. 4226

I. CONCLUSIONS

A. Trophic Condtion:

Survey data indicate that Conewago Lake is eutrophic. It ranked twelfth in overall trophic quality when the 17 Pennsylvania lakes sampled in 1973 were compared using a combination of six lake parameters**. Eleven of the lakes had less median total phosphorus, 11 had less and two had the same median dissolved phosphorus, seven had less median inorganic nitrogen, ten had less mean chlorophyll a, and 11 had greater mean Secchi disc transparency. Depletion of dissolved oxygen with depth occurred at station 1 in July.

Survey limnologists observed rooted aquatic vegetation along the shoreline near station 2 in July, 1973, and the lake is reported to support dense growths of unicellular algae and rooted aquatic plants (Ketelle and Uttormark, 1971).

B. Rate-Limiting Nutrient:

The algal assay results indicate phosphorus limitation in April. The lake data indicate phosphorus limitation at all sampling times.

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* Table of metric conversions--Appendix A.
** See Appendix B.

C. Nutrient Controllability:

1. Point sources--There were no known phosphorus point sources during the sampling year except for a few shoreline septic tanks which were estimated to have contributed a negligible amount of the total phosphorus load to the lake.

The estimated present phosphorus loading rate of 0.39 $g/m^2/yr$ is only 0.03 $g/m^2/yr$ greater than that proposed by Vollenweider (Vollenweider and Dillon, 1974) as an oligotrophic rate (see page 12). Nonetheless, Conewago Lake is eutrophic and has been eutrophic since it was formed by impoundment of Beaver Creek. Algal and aquatic weed problems began to occur less than two years after the impoundment filled with water (Ott, et al., 1973).

Apparently, the existing trophic condition of the lake is the result of internal recycling of the nutrients originally present in the fertile farm lands inundated by the impoundment supplemented by tributary-contributed nutrients. Also, five sewage lift-stations serve the various facilities in Gifford Pinchot State Park, and these lift-stations are known to have overflowed to the lake at least two times when pumping capacities were exceeded during periods of peak park use (Ulanoski, 1975). Considering the relatively small tributary nutrient loads, the

lift-station overflows may be a significant source of nutrients, but further study is needed to determine this.

The morphometry of the lake also is conducive to the development of nuisance aquatic growths. In the study by Ott, et al. (op. cit.), it was determined that 68 percent of the lake bottom and 89% of the water volume are within the trophogenic zone, and 61 percent of the bottom and 84 percent of the water volume are subjected to almost continuous nutrient replenishment as a result of circulation.

2. Non-point sources--Essentially all of the phosphorus input to Conewago Lake during the sampling year was from non-point sources.

Of the measured tributaries, Beaver Creek contributed a total of 15.0%. The ungaged drainage area was estimated to have contributed 40.2% of the total phosphorus load.

The phosphorus exports of the Conewago Lake tributaries ranged from 6 to 16 $kg/km^2/yr$ (see page 12). These export rates are quite low and are comparable to the rates of other unimpacted Pennsylvania streams sampled elsewhere.

II. LAKE AND DRAINAGE BASIN CHARACTERISTICS

A. Lake Morphometry†:

1. Surface area: 1.38 kilometers^2.
2. Mean depth: 2.7 meters.
3. Maximum depth: 5.2 meters.
4. Volume: 3.726×10^6 m^3.
5. Mean hydraulic retention time: 72 days (based on outlet flow).

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

1. Tributaries -

Name	Drainage area (km^2)*	Mean flow (m^3/sec)*
Beaver Creek	13.4	0.4
Unnamed Stream (B-1)	3.5	<0.1
Unnamed Stream (C-1)	6.7	0.1
Minor tributaries & immediate drainage -	20.6	0.3
Totals	44.2	0.8

2. Outlet -

Beaver Creek	45.6**	0.6

C. Precipitation***:

1. Year of sampling: 108.9 centimeters.
2. Mean annual: 94.8 centimeters.

† Ulanoski, 1975.
* For limits of accuracy, see Working Paper No. 175, "...Survey Methods, 1973-1976".
** Includes area of lake.
*** See Working Paper No. 175.

III. LAKE WATER QUALITY SUMMARY

Conewago 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, a single depth-integrated (near bottom to surface) sample was composited from the stations for phytoplankton identification and enumeration; and during the first visit, a single 18.9-liter depth-integrated sample was composited for algal assays. Also each time, a depth-integrated sample was collected from each of the stations for chlorophyll a analysis. The maximum depths sampled were 5.8 meters at station 1 and 2.4 meters at station 2.

The lake sampling results are presented in full in Appendix D and are summarized in the following table.

A. SUMMARY OF PHYSICAL AND CHEMICAL CHARACTERISTICS FOR PINCHOT LAKE
STORET CODE 4226

	1ST SAMPLING (4/13/73) 2 SITES			2ND SAMPLING (7/24/73) 2 SITES			3RD SAMPLING (10/ 2/73) 2 SITES		
PARAMETER	RANGE	MEAN	MEDIAN	RANGE	MEAN	MEDIAN	RANGE	MEAN	MEDIAN
TEMP (C)	10.0 - 10.9	10.5	10.6	16.4 - 27.6	24.8	26.2	19.3 - 19.6	19.5	19.5
DISS OXY (MG/L)	10.8 - 10.9	10.8	10.8	0.0 - 8.9	4.8	5.0	4.8 - 5.2	5.0	5.0
CNDCTVY (MCROMO)	128. - 135.	131.	132.	133. - 150.	146.	149.	128. - 130.	129.	128.
PH (STAND UNITS)	7.4 - 7.9	7.7	7.8	6.9 - 8.6	7.5	7.2	6.7 - 7.0	6.8	6.8
TOT ALK (MG/L)	27. - 29.	28.	29.	46. - 57.	50.	49.	51. - 52.	52.	52.
TOT P (MG/L)	0.017 - 0.028	0.023	0.024	0.024 - 0.045	0.032	0.027	0.041 - 0.058	0.049	0.049
ORTHO P (MG/L)	0.007 - 0.010	0.008	0.007	0.006 - 0.010	0.008	0.008	0.013 - 0.017	0.014	0.013
NO2+NO3 (MG/L)	0.160 - 0.220	0.186	0.190	0.050 - 0.080	0.070	0.070	0.040 - 0.060	0.047	0.045
AMMONIA (MG/L)	0.040 - 0.050	0.046	0.050	0.070 - 0.560	0.182	0.090	0.260 - 0.320	0.282	0.275
KJEL N (MG/L)	0.400 - 0.400	0.400	0.400	0.500 - 1.300	0.920	0.900	1.200 - 1.400	1.300	1.300
INORG N (MG/L)	0.200 - 0.270	0.232	0.240	0.140 - 0.640	0.252	0.170	0.300 - 0.380	0.330	0.320
TOTAL N (MG/L)	0.560 - 0.620	0.586	0.590	0.580 - 1.380	0.990	0.970	1.260 - 1.450	1.347	1.340
CHLRPYL A (UG/L)	10.4 - 13.6	12.0	12.0	13.8 - 14.4	14.1	14.1	13.6 - 17.9	15.7	15.7
SECCHI (METERS)	0.5 - 0.8	0.6	0.6	1.0 - 1.9	1.4	1.4	0.9 - 2.1	1.5	1.5

B. Biological characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera	Algal Units per ml
04/13/73	1. Dinobryon	3,750
	2. Flagellates	2,720
	3. Cryptomonas	555
	4. Schoederia	370
	5. Fragilaria	370
	Other genera	370
	Total	8,135
07/24/73	1. Arthrospira	3,551
	2. Melosira	383
	3. Flagellates	383
	4. Closterium	230
	5. Trachelomonas	179
	Other genera	485
	Total	5,211
10/02/73	1. Flagellates	601
	2. Anabaena	565
	3. Oocystis	209
	4. Cyclotella	49
	5. Coelastrum	49
	Other genera	221
	Total	1,694

2. Chlorophyll *a* -

Sampling Date	Station Number	Chlorophyll *a* (µg/l)
04/13/73	01	13.6
	02	10.4
07/24/73	01	14.4
	02	13.8
10/02/73	01	13.6
	02	17.9

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	0.012	0.200	0.2
0.050 P	0.062	0.200	5.8
0.050 P + 1.0 N	0.062	1.200	20.9
1.0 N	0.012	1.200	0.2

2. Discussion -

The control yield of the assay alga, *Selenastrum capricornutum*, indicates that the potential primary productivity of Conewago Lake was moderate at the time the sample was collected. There was a significant increase in yield when orthophosphorus was added, but there was no change in yield when only nitrogen was added. Based on these results, phosphorus limitation is indicated.

The lake data also indicate phosphorus limitation; i.e., the mean N/P ratios were 24/1 or greater on all sampling occasions, and phosphorus limitation would be expected.

IV. NUTRIENT LOADINGS
(See Appendix E for data)

For the determination of nutrient loadings, the Pennsylvania 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 May, 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 Pennsylvania District Office of the U.S. Geological Survey for the tributary sites nearest the lake.

In this report, nutrient loads for sampled tributaries were determined by using a modification of a U.S. Geological Survey computer program for calculating stream loadings*. Nutrient loads shown are those measured minus point-source loads, if any.

Nutrient loads for unsampled "minor tributaries and immediate drainage" ("ZZ" of U.S.G.S.) were estimated using the means of the nutrient exports, in $kg/km^2/year$, at stations A-1, B-1, and C-1 and multiplying the means by the ZZ area in km^2.

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* See Working Paper No. 175.

A. Waste Sources:

1. Known municipal - None

2. Known industrial - None

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

Source	kg P/yr	% of total
a. Tributaries (non-point load) -		
Beaver Creek	215	40.2
Unnamed Stream (B-1)	20	3.7
Unnamed Stream (C-1)	60	11.2
b. Minor tributaries & immediate drainage (non-point load) -	215	40.2
c. Known municipal STP's - None	-	-
d. Septic tanks* -	insignificant	-
e. Known industrial - None	-	-
f. Direct precipitation** -	25	4.7
Total	535	100.0

2. Outputs -

Lake outlet - Beaver Creek 465

3. Net annual P accumulation - 70 kg.

* Only four shoreline dwellings are served by septic tanks (Ulanoski, 1975); see Working Paper No. 175.
** See Working Paper No. 175.

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

Source	kg N/yr	% of total
a. Tributaries (non-point load) -		
Beaver Creek	9,575	40.4
Unnamed Stream (B-1)	770	3.3
Unnamed Stream (C-1)	2,650	11.2
b. Minor tributaries & immediate drainage (non-point load) -	9,140	38.6
c. Known municipal STP's - None	-	-
d. Septic tanks* -	45	0.2
e. Known industrial - None	-	-
f. Direct precipitation** -	1,490	6.3
Total	23,670	100.0

2. Outputs -

Lake outlet - Beaver Creek 19,180

3. Net annual N accumulation - 4,490 kg.

* Only four shoreline dwellings are served by septic tanks (Ulanoski, 1975); see Working Paper No. 175.
** See Working Paper No. 175.

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

Tributary	kg P/km^2/yr	kg N/km^2/yr
Beaver Creek	16	715
Unnamed Stream (B-1)	6	220
Unnamed Stream (C-1)	9	396

E. Yearly Loading Rates:

In the following table, the existing phosphorus loading rates are compared to those proposed by Vollenweider (Vollenweider and Dillon, 1974). Essentially, his "dangerous" rate is the rate at which the receiving water would become eutrophic or remain eutrophic; his "permissible" rate is that which would result in the receiving water remaining oligotrophic or becoming oligotrophic if morphometry permitted. A mesotrophic rate 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 Phosphorus		Total Nitrogen	
	Total	Accumulated	Total	Accumulated
grams/m^2/yr	0.39	0.05	17.2	3.3

Vollenweider loading rates for phosphorus (g/m^2/yr) based on mean depth and mean hydraulic retention time of Conewago Lake:

"Dangerous" (eutrophic rate)	0.72
"Permissible" (oligotrophic rate)	0.36

V. LITERATURE REVIEWED

Ketelle, Martha J., and Paul D. Uttormark, 1971. Problem lakes in the United States. EPA Water Poll. Contr. Res. Ser., Proj. #16010 EHR, Washington, D.C.

Ott, A. N., J. L. Barker, and D. J. Growitz; 1973. Physical, chemical, and biological characteristics of Conewago Lake drainage basin, York County, Pennsylvania. Water Res. Bull. #8, PA Dept. Env. Resources and U.S. Geological Survey, Harrisburg.

Ulanoski, James, 1975. Personal communication (lake morphometry; shoreline septic tanks; park waste treatment facilities). PA Dept. Env. Resources, Harrisburg.

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.

VII. 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

LAKE RANKINGS

LAKES RANKED BY INDEX NOS.

RANK	LAKE CODE	LAKE NAME	INDEX NO
1	4224	LAKE NAOMI	445
2	4220	BELTZVILLE DAM	423
3	4222	HARVEY'S LAKE	413
4	4228	STILLWATER LAKE	401
5	4227	POCONO LAKE	389
6	4223	INDIAN LAKE	388
7	3641	ALLEGHENY RESERVOIR	385
8	4229	LAKE WALLENPAUPACK	371
9	4221	CANADOHTA LAKE	369
10	4219	BEAVER RUN RESERVOIR	360
11	4204	CONNEAUT LAKE	307
12	4226	PINCHOT LAKE	256
13	4213	PYMATUNING RESERVOIR	206
14	4216	SHENANGO RIVER RESERVOIR	157
15	4225	ONTELAUNEE DAM	101
16	4201	BLANCHARD RESERVOIR	85
17	4207	GREENLANE DAM	53

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 P	INDEX NO
3641	ALLEGHENY RESERVOIR	56 (9)	38 (6)	63 (10)	100 (16)	69 (11)	59 (8)	385
4201	BLANCHARD RESERVOIR	13 (2)	13 (2)	25 (4)	31 (5)	3 (0)	0 (0)	85
4204	CONNEAUT LAKE	44 (7)	63 (10)	69 (11)	56 (9)	34 (5)	41 (6)	307
4207	GREENLANE DAM	6 (1)	6 (1)	19 (3)	13 (2)	3 (0)	6 (1)	53
4213	PYMATUNING RESERVOIR	0 (0)	72 (11)	6 (1)	0 (0)	100 (16)	28 (4)	206
4216	SHENANGO RIVER RESERVOIR	19 (3)	44 (7)	13 (2)	6 (1)	47 (7)	28 (4)	157
4219	BEAVER RUN RESERVOIR	94 (15)	19 (3)	88 (14)	81 (13)	19 (2)	59 (8)	360
4220	BELTZVILLE DAM	88 (14)	25 (4)	94 (15)	94 (15)	34 (5)	88 (13)	423
4221	CANADOHTA LAKE	50 (8)	97 (15)	56 (9)	19 (3)	59 (9)	88 (13)	369
4222	HARVEY'S LAKE	63 (10)	81 (13)	100 (16)	63 (10)	47 (7)	59 (8)	413
4223	INDIAN LAKE	100 (16)	31 (5)	75 (12)	75 (12)	19 (2)	88 (13)	388
4224	LAKE NAOMI	81 (13)	88 (14)	44 (7)	69 (11)	88 (14)	75 (12)	445
4225	ONTELAUNEE DAM	25 (4)	0 (0)	0 (0)	44 (7)	19 (2)	13 (2)	101
4226	PINCHOT LAKE	31 (5)	56 (9)	31 (5)	38 (6)	81 (13)	19 (3)	256
4227	POCONO LAKE	38 (6)	97 (15)	50 (8)	88 (14)	75 (12)	41 (6)	389
4228	STILLWATER LAKE	72 (11)	72 (11)	38 (6)	25 (4)	94 (15)	100 (16)	401
4229	LAKE WALLENPAUPACK	72 (11)	50 (8)	81 (13)	50 (8)	59 (9)	59 (8)	371

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 P
3641	ALLEGHENY RESERVOIR	0.016	0.380	414.250	3.700	13.800	0.006
4201	BLANCHARD RESERVOIR	0.064	1.300	453.143	15.187	14.900	0.046
4204	CONNEAUT LAKE	0.023	0.185	402.000	7.567	14.600	0.007
4207	GREENLANE DAM	0.066	1.475	460.222	24.011	14.900	0.020
4213	PYMATUNING RESERVOIR	0.070	0.180	467.750	56.333	7.700	0.008
4216	SHENANGO RIVER RESERVOIR	0.058	0.340	463.555	26.800	14.500	0.008
4219	BEAVER RUN RESERVOIR	0.009	0.835	384.833	5.183	14.800	0.006
4220	BELTZVILLE DAM	0.010	0.815	362.444	4.856	14.600	0.005
4221	CANADOHTA LAKE	0.020	0.130	436.000	19.167	14.100	0.005
4222	HARVEY'S LAKE	0.015	0.160	338.000	5.967	14.500	0.006
4223	INDIAN LAKE	0.008	0.520	400.222	5.211	14.800	0.005
4224	LAKE NAOMI	0.014	0.135	443.333	5.533	8.000	0.005
4225	ONTELAUNEE DAM	0.040	2.150	470.667	11.783	14.800	0.011
4226	PINCHOT LAKE	0.027	0.245	453.000	13.950	11.500	0.008
4227	POCONO LAKE	0.024	0.130	438.800	4.980	13.200	0.007
4228	STILLWATER LAKE	0.015	0.180	449.000	18.233	7.900	0.004
4229	LAKE WALLENPAUPACK	0.015	0.250	394.583	9.617	14.100	0.006

APPENDIX C

TRIBUTARY FLOW DATA

TRIBUTARY FLOW INFORMATION FOR PENNSYLVANIA 1/27/75

LAKE CODE 4226 CONEWAGO LAKE

TOTAL DRAINAGE AREA OF LAKE(SQ KM) 45.6

TRIBUTARY	SUB-DRAINAGE AREA(SQ KM)	NORMALIZED FLOWS(CMS) JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
4226A1	13.4	0.45	0.71	1.25	0.74	0.37	0.14	0.06	0.08	0.06	0.07	0.18	0.28	0.36
4226A2	45.6	0.71	0.93	1.27	0.96	0.62	0.37	0.22	0.26	0.22	0.25	0.42	0.54	0.56
4226B1	3.5	0.03	0.04	0.05	0.04	0.03	0.02	0.01	0.01	0.01	0.01	0.02	0.02	0.02
4226C1	6.7	0.12	0.16	0.21	0.16	0.10	0.06	0.04	0.05	0.04	0.04	0.07	0.09	0.09
4226ZZ	22.0	0.34	0.45	0.62	0.45	0.28	0.18	0.10	0.13	0.11	0.12	0.20	0.26	0.27

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 45.6
SUM OF SUB-DRAINAGE AREAS = 45.6
TOTAL FLOW IN = 9.06
TOTAL FLOW OUT = 6.78

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
4226A1	5	73	0.74	19	0.21				
	6	73	0.40	15	0.17				
	7	73	0.09	14	0.04				
	8	73	0.03	11	0.01				
	9	73	0.23	8	0.00				
	10	73	0.09	6	0.09				
	11	73	0.04	5	0.08				
	12	73	1.10	1	0.03				
	1	74	1.05	26	0.74				
	2	74	0.18	23	0.57				
	3	74	0.45	23	0.48				
	4	74	1.25	20	0.40				
4226A2	5	73	1.08	19	0.45				
	6	73	0.71	15	0.40				
	7	73	0.26	14	0.15				
	8	73	0.12	11	0.06				
	9	73	0.48	8	0.03				
	10	73	0.25	6	0.27				
	11	73	0.15	5	0.22				
	12	73	1.44	1	0.12				
	1	74	1.39	26	1.10				
	2	74	0.40	23	0.91				
	3	74	0.76	23	0.82				
	4	74	1.59	20	0.71				

TRIBUTARY FLOW INFORMATION FOR PENNSYLVANIA 1/27/75

LAKE CODE 4226 CONEWAGO LAKE

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
422681	5	73	0.05	19	0.02				
	6	73	0.03	15	0.02				
	7	73	0.01	14	0.01				
	8	73	0.01	11	0.00				
	9	73	0.02	8	0.00				
	10	73	0.01	6	0.01				
	11	73	0.01	5	0.01				
	12	73	0.06	1	0.01				
	1	74	0.06	26	0.05				
	2	74	0.02	23	0.04				
	3	74	0.03	23	0.03				
	4	74	0.07	20	0.03				
4226C1	5	73	0.18	19	0.07				
	6	73	0.12	15	0.07				
	7	73	0.04	14	0.03				
	8	73	0.02	11	0.01				
	9	73	0.08	8	0.01				
	10	73	0.04	6	0.05				
	11	73	0.03	5	0.04				
	12	73	0.24	1	0.02				
	1	74	0.23	26	0.18				
	2	74	0.07	23	0.15				
	3	74	0.13	23	0.13				
	4	74	0.26	20	0.12				
4226ZZ	5	73	0.51	19	0.22				
	6	73	0.34	15	0.19				
	7	73	0.12	14	0.07				
	8	73	0.06	11	0.03				
	9	73	0.23	8	0.02				
	10	73	0.12	6	0.13				
	11	73	0.07	5	0.11				
	12	73	0.71	1	0.06				
	1	74	0.68	26	0.54				
	2	74	0.19	23	0.42				
	2	74	0.19	23	0.42				
	3	74	0.37	23	0.40				
	4	74	0.76	20	0.34				

APPENDIX D

PHYSICAL and CHEMICAL DATA

STORET RETRIEVAL DATE 75/01/27

422601
40 05 25.0 076 52 24.0
PINCHOT LAKE
42133 PENNSYLVANIA

11EPALES 2111202
3 0021 FEET DEPTH

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
73/04/13	14	50 0000	10.9		30	135	7.80	29	0.050	0.400	0.190	0.010
	14	50 0004	10.7	10.8		132	7.80	29	0.040	0.400	0.160	0.007
	14	50 0011	10.6	10.8		130	7.40	29	0.040	0.400	0.160	0.007
73/07/24	15	15 0000	27.1	6.4	74	149	7.70	46	0.070	1.000	0.070	0.010
	15	15 0005	26.7			149						
	15	15 0011	25.5	3.5		150	7.10	51	0.120	0.900	0.050	0.008
	15	15 0019	16.4	0.0		133	6.90	57	0.560	1.300	0.080	0.007
73/10/02	10	00 0000	19.4	5.2	84	128	7.00	51	0.280	1.400	0.050	0.013
	10	00 0010	19.5	5.2		128	6.80	51	0.270	1.300	0.040	0.013
	10	00 0018	19.3	4.8		128	6.80	52	0.260	1.300	0.040	0.017

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/04/13	14	50 0000	0.017	13.6
	14	50 0004	0.023	
	14	50 0011	0.024	
73/07/24	15	15 0000	0.027	14.4
	15	15 0011	0.036	
	15	15 0019	0.027	
73/10/02	10	00 0000	0.041	13.6
	10	00 0010	0.058	
	10	00 0018	0.042	

STORET RETRIEVAL DATE 75/01/27

422602
40 04 23.0 076 53 34.0
PINCHOT LAKE
42133 PENNSYLVANIA

11EPALES 2111202
3 0010 FEET DEPTH

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
73/04/13	15 20	0000	10.1		18	128	7.90	28	0.050	0.400	0.200	0.009
	15 20	0006	10.0	10.9		132	7.80	27	0.050	0.400	0.220	0.007
73/07/24	15 50	0000	27.6	8.9	40	150	8.60	49	0.070	0.900	0.070	0.006
	15 50	0008	25.8	5.0			7.20	49	0.090	0.500	0.080	0.008
73/10/02	10 25	0000	19.6	4.8	36	130	6.70	52	0.320	1.200	0.060	0.014
	10 25	0005	19.5			129						

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/04/13	15 20	0000	0.028	10.4
	15 20	0006	0.024	
73/07/24	15 50	0000	0.024	13.8
	15 50	0008	0.045	
73/10/02	10 25	0000	0.057	17.9

APPENDIX E

TRIBUTARY DATA

STORET RETRIEVAL DATE 75/02/03

4226A1
40 04 25.0 076 54 20.0
BEAVER CREEK
42011 7.5 WELLSVILLE
I/CONEWAGO LAKE
BRDG 212 NEAR MOUTH 1 MI S OF ROSSVILLE
11EPALES 2111204
4 0000 FEET DEPTH

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
73/05/19	09 23		0.140	0.260	0.009	0.007	0.015
73/06/15	09 30		0.250	6.800	0.340	0.011	0.045
73/07/14	09 55		0.220	0.700	0.092	0.015	0.030
73/08/11	09 29		0.120	1.690	0.060	0.010	0.015
73/09/08	09 55		0.017	0.500	0.036	0.008	0.020
73/10/06	08 55		0.036	0.300	0.042	0.010	0.040
73/11/03	08 55		0.060	0.550	0.020	0.008	0.020
73/12/01	09 55		0.112	0.600	0.208	0.008	0.035
74/01/26	08 30		0.490	0.100K	0.040	0.008	0.010
74/02/09	09 50		0.440	0.300	0.020	0.005K	0.005K
74/02/23	09 00		0.310	0.800	0.020	0.010	0.030
74/03/09	08 45		0.280	1.000	0.338	0.005	0.005K
74/03/23	08 30		0.276	0.600	0.025	0.005K	0.015
74/04/20	08 20		0.176	0.200	0.015	0.005K	0.020

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/02/03

4226A2
40 05 16.0 076 52 15.0
BEAVER CREEK
42 7.5 DOVER
O/CONEWAGO LAKE
SEC HWY BRDG 1 MI S OF MAYTOWN
11EPALES 2111204
4 0000 FEET DEPTH

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
73/05/19	09 51		0.042	0.430	0.021	0.005	0.020
73/06/15	09 00		0.023	0.500	0.028	0.006	0.025
73/07/14	10 35		0.110	0.420	0.126	0.010	0.020
73/08/11	09 39		0.052	0.880	0.086	0.005K	0.040
73/09/08	10 20		0.058	0.720	0.044	0.009	0.030
73/10/06	09 20		0.400	0.750	0.240	0.009	
73/11/03	08 30		0.216	0.600	0.056	0.008	0.035
73/12/01	10 25		0.232	1.000	0.336	0.005K	0.045
74/01/26	08 50		0.430	0.500	0.036	0.008	0.010
74/02/09	09 30		0.336	1.100	0.110	0.005K	0.015
74/02/23	09 35		0.360	1.500	0.090	0.005K	0.035
74/03/09	09 40		0.370	1.900	0.175	0.005	0.010
74/03/23	08 55		0.320	1.100	0.055	0.005K	0.030
74/04/20	08 00		0.184	0.400	0.065	0.005	0.035

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/02/03

4226B1
40 04 40.0 076 54 20.0
UNNAMED STREAM
42 7.5 DOVER
T/CONEWAGO LAKE
UNDRY RD 66032 BRIDGE
11EPALES 2111204
4 0000 FEET DEPTH

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
73/05/19	09 10		0.098	0.330	0.010	0.005K	0.010
73/06/15	09 20		0.140	0.380	0.028	0.005K	0.015
73/07/14	10 00		0.360	0.205	0.126	0.008	0.015
73/08/11	09 17		0.017	0.250	0.022	0.005K	0.030
73/09/08	10 02		0.115	0.690	0.150	0.011	0.030
73/10/06	09 00		0.147	1.450	0.260	0.005K	0.040
73/11/03	08 35		0.160	0.500	0.020	0.005K	0.015
73/12/01	10 00		0.192	0.275	0.044	0.005K	0.037
74/01/26	08 35		0.570	0.400	0.024	0.005K	0.005K
74/02/09	10 50		1.070	0.300	0.010	0.005K	0.050
74/02/23	09 05		0.620	0.300	0.035	0.020	0.030
74/03/09	09 00		0.530	2.700	0.680	0.005	0.005
74/03/23	08 35		0.430	1.200	0.040	0.005K	0.100
74/04/20	08 25		0.252	0.400	0.035	0.005K	0.015

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/02/03

4226C1
40 04 45.0 076 54 30.0
UNNAMED STREAM
42 7.5 DOVER
T/CONEWAGO LAKE
UNDRY RD CULVERT 1 MI NNE OF ROSSEVILLE
11EPALES 2111204
4 0000 FEET DEPTH

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
73/05/19	09 37		0.147	0.260	0.010	0.005K	0.010
73/07/14	10 15		0.110	0.350	0.180	0.009	0.020
73/08/11	09 24		0.370	0.320	0.027	0.005K	0.040
73/09/08	10 10		0.010K	0.720	0.084	0.010	0.030
73/10/06	09 07		0.038	0.850	0.190	0.005K	0.055
73/11/03	08 40		0.216	0.300	0.014	0.005K	0.005K
73/12/01	10 10		0.340	0.700	0.232	0.005K	0.035
74/01/26	08 40		0.890	0.300	0.032	0.005K	0.005
74/02/09	09 45		0.540	0.400	0.025	0.005K	0.005K
74/02/23	09 15		0.630	1.100	0.055	0.015	0.040
74/03/09	09 15		0.480	1.100	0.525	0.005	0.005
74/03/23	08 45		0.470	0.400	0.042	0.005K	0.015
74/04/20	08 30		0.216	0.200	0.010	0.005K	0.015

K VALUE KNOWN TO BE
LESS THAN INDICATED