

**U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL EUTROPHICATION SURVEY
WORKING PAPER SERIES**



REPORT
ON
BADIN LAKE
MONTGOMERY AND STANLY COUNTIES
NORTH CAROLINA
EPA REGION IV
WORKING PAPER No. 377

PACIFIC NORTHWEST ENVIRONMENTAL RESEARCH LABORATORY

An Associate Laboratory of the

NATIONAL ENVIRONMENTAL RESEARCH CENTER - CORVALLIS, OREGON

and

NATIONAL ENVIRONMENTAL RESEARCH CENTER - LAS VEGAS, NEVADA

REPORT
ON
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WITH THE COOPERATION OF THE
NORTH CAROLINA DEPARTMENT OF NATURAL AND ECONOMIC RESOURCES
AND THE
NORTH CAROLINA NATIONAL GUARD

JUNE, 1975

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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 North Carolina Department of Natural and Economic Resources for professional involvement and to the North Carolina National Guard for conducting the tributary sampling phase of the Survey.

Lewis R. Martin, Director of the Division of Environmental Management; Darwin L. Coburn, Chief of the Water Quality Section; and Julian R. Taylor, Supervisor of the Monitoring Program Unit; 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.

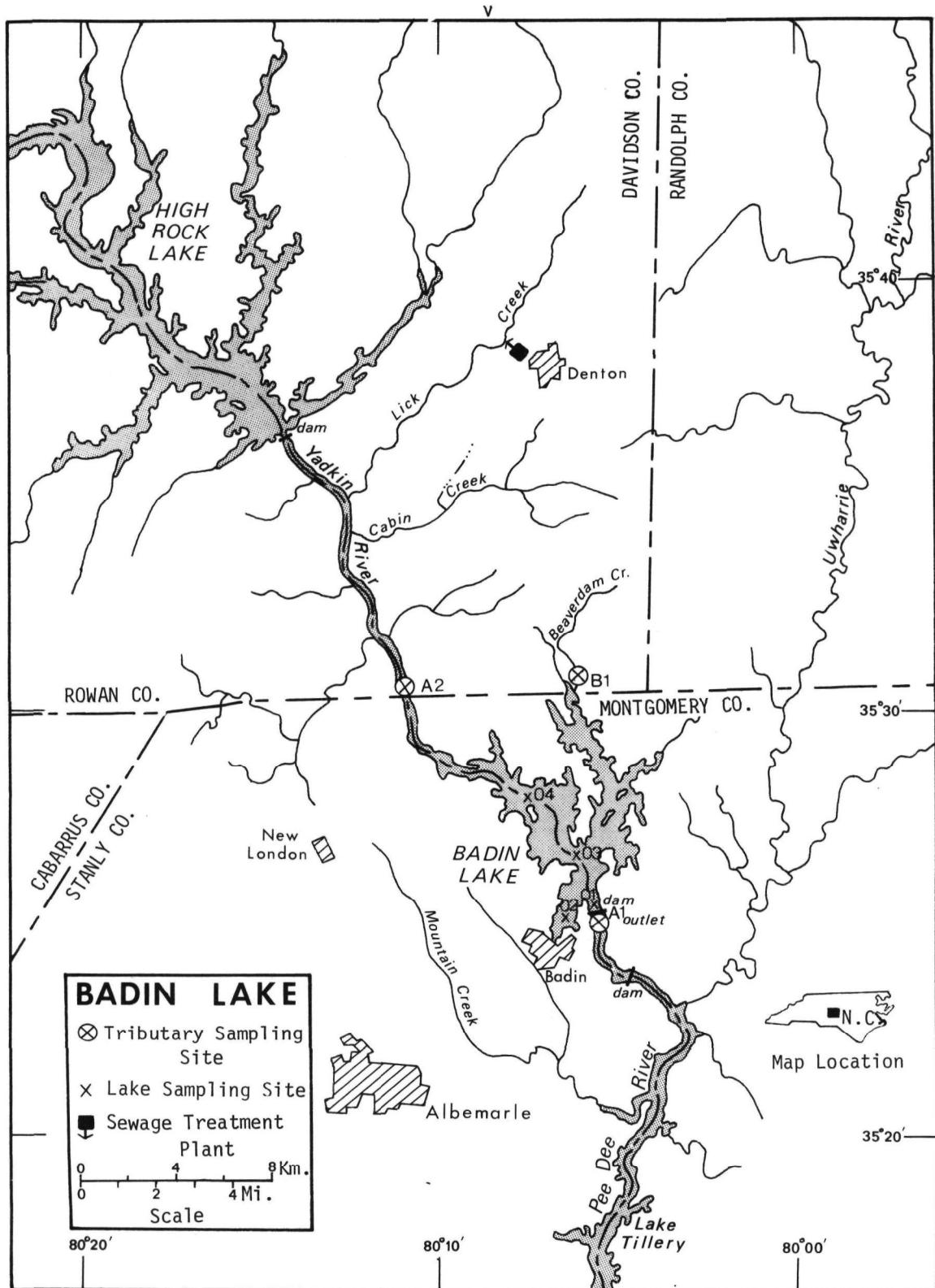
Major General William M. Buck, formerly Adjutant General of North Carolina, and Project Officer Colonel Arthur J. Bouchard, who directed the volunteer efforts of the North Carolina National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY

STUDY LAKES

STATE OF NORTH CAROLINA

<u>LAKE NAME</u>	<u>COUNTY</u>
Badin	Montgomery, Stanly
Blewett Falls	Anson, Richmond
Chatuge	Clay, NC; Towns, GA
Fontana	Graham, Swain
Hickory	Alexander, Caldwell, Catawba
High Rock	Davidson, Rowan
Hiwassee	Cherokee
James	Burke, McDowell
John H. Kerr (Nut Bush Creek)	Granville, Vance, Warren, NC; Halifax, Mecklenburg, VA
Junaluska	Haywood
Lookout Shoals	Alexander, Catawba, Iredell
Mountain Island	Gaston, Mecklenburg
Norman	Catawba, Iredell, Lincoln, Mecklenburg
Rhodhiss	Burke, Caldwell
Santeetlah	Graham
Tillery	Montgomery, Stanly
Waccamaw	Columbus
Waterville	Haywood
Wylie	Gaston, Mecklenburg, NC; York, SC



BADIN LAKE
STORET NO. 3701

I. CONCLUSIONS

A. Trophic Condition:

Survey data indicate that Badin Lake is eutrophic. However, because of the short hydraulic retention time of 28 days, the lake more closely resembles a slow-flowing river, and the term "over-enriched" may be a more appropriate description of the condition of this water body.

Badin Lake ranked fifteenth in overall trophic quality when the 16 North Carolina lakes sampled in 1973 were compared using a combination of six parameters*. Ten of the lakes had less median total phosphorus, 11 had less median dissolved phosphorus, 11 had less mean chlorophyll a, and 11 had greater mean Secchi disc transparency. Marked depression of dissolved oxygen with depth occurred at all sampling stations in July and at stations 1 and 3 in September.

Survey limnologists noted extensive growths of emergent aquatic vegetation along the shoreline near sampling stations 2, 3, and 4; and a 45- to 55-fold increase in phytoplankton numbers occurred in July and September, and blue-green genera were dominant (see page 7).

* See Appendix A.

B. Rate-Limiting Nutrient:

The algal assay results indicate Badin Lake was phosphorus limited at the time the sample was taken (03/24/73). The lake data indicate phosphorus limitation at all sampling stations and times; i.e., the mean inorganic nitrogen to orthophosphorus ratios were 26 to 1 or greater.

C. Nutrient Controllability:

1. Point sources--It is estimated that the community of Denton contributed only 0.3% of the total phosphorus load to Badin Lake during the sampling year.

The present phosphorus loading rate of $16.66 \text{ g/m}^2/\text{yr}$ is nearly seven times that proposed by Vollenweider (Vollenweider and Dillon, 1974) as a eutrophic rate (see page 14); and, while Vollenweider's model may not be applicable to water bodies with short hydraulic retention times, the existing trophic condition of Badin Lake is evidence of excessive nutrient loads.

Control of phosphorus only at the Denton wastewater treatment plant probably would have little effect on Badin Lake. However, a high degree of phosphorus control at the point sources impacting upstream High Rock Lake* (see map, page v) should result in a significant improvement in the trophic condition of Badin Lake, since the primary productivity of the latter is phosphorus-limited.

* Working Paper No. 381.

Considering only the phosphorus contributions of the point sources impacting High Rock Lake within the 40-kilometer limit of the Survey* and the retention in that lake during the sampling year (54%), it is calculated that 137,000 kg of the upstream point-source phosphorus load also impacted Badin Lake; i.e., 46% of the 298,000 kg point-source load impacting High Rock Lake.

2. Non-point sources--The Yadkin River contributed the largest phosphorus load of the sampled tributaries. However, on the basis of Survey data and other studies (Anonymous, 1973), much of this load can be attributed to the point sources impacting High Rock Lake as discussed above.

* See Working Paper No. 175, "...Survey Methods, 1973-1976".

II. LAKE AND DRAINAGE BASIN CHARACTERISTICS[†]

A. Lake Morphometry^{††}:

1. Surface area: 24.17 kilometers².
2. Mean depth: 14.2 meters.
3. Maximum depth: 53 meters.
4. Volume: 344×10^6 m³.
5. Mean hydraulic retention time: 28 days.

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

1. Tributaries -

<u>Name</u>	<u>Drainage area (km²)*</u>	<u>Mean flow (m³/sec)*</u>
Yadkin River	10,657.8	139.8
Beaverdam Creek	23.1	0.2
Minor tributaries & immediate drainage -	<u>113.3</u>	<u>1.4</u>
Totals	10,794.2	141.4

2. Outlet -

Yadkin River	10,818.4**	141.4
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C. Precipitation***:

1. Year of sampling: 135.1 centimeters.
2. Mean annual: 119.0 centimeters.

[†] Table of metric conversions--Appendix B.

^{††} Park, 1974.

^{*} 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

Badin 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 four stations on the lake and from a number of depths at each station (see map, page v). During each visit, a single depth-integrated (4.6 m to surface) sample was composited from the four 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 50.6 meters at station 1, 16.5 meters at station 2, 35.7 meters at station 3, and 18.6 meters at station 4.

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 BADIN LAKE
STORET CODE 3701

PARAMETER	1ST SAMPLING (3/23/73)				2ND SAMPLING (7/11/73)				3RD SAMPLING (9/19/73)			
	4 SITES				4 SITES				4 SITES			
	RANGE	MEAN	MEDIAN	RANGE	MEAN	MEDIAN	RANGE	MEAN	MEDIAN	RANGE	MEAN	MEDIAN
TEMP (C)	6.8 - 14.3	12.3	12.7	6.8 - 29.8	22.9	25.9	7.2 - 26.4	22.3	25.9	6.8 - 26.4	22.3	25.9
DISS OXY (MG/L)	7.6 - 9.6	9.0	9.2	0.1 - 8.0	2.2	1.4	0.1 - 6.4	3.1	4.0	0.1 - 6.4	3.1	4.0
CONDCTVY (MICROMHO)	50. - 70.	62.	62.	63. - 90.	72.	70.	50. - 75.	67.	68.	50. - 75.	67.	68.
PH (STAND UNITS)	7.1 - 7.6	7.4	7.4	6.4 - 9.4	7.0	6.6	6.2 - 6.9	6.5	6.5	6.2 - 6.9	6.5	6.5
TOT ALK (MG/L)	10. - 22.	13.	12.	14. - 35.	24.	24.	19. - 44.	24.	21.	19. - 44.	24.	21.
TOT P (MG/L)	0.077 - 0.168	0.110	0.095	0.025 - 0.064	0.038	0.040	0.013 - 0.043	0.023	0.024	0.013 - 0.043	0.023	0.024
ORTHOP P (MG/L)	0.020 - 0.038	0.024	0.023	0.002 - 0.021	0.010	0.011	0.006 - 0.018	0.010	0.009	0.006 - 0.018	0.010	0.009
NO2+NO3 (MG/L)	0.470 - 0.640	0.544	0.545	0.080 - 0.700	0.397	0.420	0.030 - 0.570	0.206	0.200	0.030 - 0.570	0.206	0.200
AMMONIA (MG/L)	0.150 - 0.240	0.190	0.195	0.070 - 0.410	0.158	0.150	0.020 - 0.880	0.189	0.095	0.020 - 0.880	0.189	0.095
KJEL N (MG/L)	0.200 - 0.800	0.403	0.400	0.200 - 0.800	0.445	0.500	0.200 - 2.400	0.611	0.500	0.200 - 2.400	0.611	0.500
INORG N (MG/L)	0.670 - 0.800	0.734	0.735	0.150 - 0.850	0.554	0.650	0.210 - 0.920	0.395	0.290	0.210 - 0.920	0.395	0.290
TOTAL N (MG/L)	0.670 - 1.370	0.947	0.940	0.430 - 1.260	0.841	0.870	0.400 - 2.670	0.817	0.725	0.400 - 2.670	0.817	0.725
CHLORPHYL A (UG/L)	3.2 - 5.5	4.5	4.6	4.5 - 7.7	6.1	6.1	9.2 - 11.8	10.4	10.3	9.2 - 11.8	10.4	10.3
SECCHI (METERS)	0.3 - 0.3	0.3	0.3	0.8 - 1.2	1.0	1.0	0.9 - 1.5	1.3	1.4	0.9 - 1.5	1.3	1.4

B. Biological characteristics:

1. Phytoplankton -

<u>Sampling Date</u>	<u>Dominant Genera</u>	<u>Algal units per ml</u>
03/23-24/73	1. <u>Cryptomonas sp.</u> 2. <u>Melosira sp.</u> 3. <u>Trachelomonas sp.</u> 4. <u>Asterionella sp.</u> 5. <u>Flagellates</u> Other genera	97 58 48 48 29 <u>98</u>
	Total	378
07/11/73	1. <u>Raphidiopsis sp.</u> 2. <u>Synedra sp.</u> 3. Coccoid cells 4. <u>Microcystis sp.</u> 5. <u>Scenedesmus sp.</u> Other genera	21,134 2,138 576 411 247 <u>575</u>
	Total	25,081
09/19/73	1. <u>Raphidiopsis sp.</u> 2. <u>Oscillatoria sp.</u> 3. <u>Scenedesmus sp.</u> 4. <u>Melosira sp.</u> 5. <u>Synedra sp.</u> Other genera	15,705 897 192 124 32 <u>36</u>
	Total	16,986

2. Chlorophyll a -

<u>Sampling Date</u>	<u>Station Number</u>	<u>Chlorophyll a ($\mu\text{g/l}$)</u>
03/23-24/73	01	5.5
	02	3.2
	03	5.2
	04	4.1
07/11/73	01	-
	02	-
	03	7.7
	04	4.5
09/19/73	01	9.9
	02	10.8
	03	11.8
	04	9.2

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

<u>Spike (mg/l)</u>	<u>Ortho P Conc. (mg/l)</u>	<u>Inorganic N Conc. (mg/l)</u>	<u>Maximum yield (mg/l-dry wt.)</u>
Control	0.028	0.424	6.3
0.050 P	0.078	0.424	14.4
0.050 P + 1.0 N	0.078	1.424	24.4
1.0 N	0.028	1.424	6.8

2. Discussion -

The control yield of the assay alga, Selenastrum capricornutum, indicates that the potential primary productivity of Badin Lake was high at the time the sample was collected (03/24/73). The addition of phosphorus alone resulted in an increase in yield which indicates phosphorus limitation

(note that the addition of only nitrogen did not significantly increase the yield over that of the control).

The lake data substantiate that Badin Lake was phosphorus limited. At all sampling stations and times, the mean inorganic nitrogen to orthophosphorus ratios were 26 to 1 or greater.

IV. NUTRIENT LOADINGS
(See Appendix E for data)

For the determination of nutrient loadings, the North Carolina 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 January and February when two samples were collected. Sampling was begun in March, 1973, and was completed in March, 1974.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the North Carolina 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 loads, in kg/km²/year, at station B-1 and multiplying the means by the ZZ area in km².

The operator of the Denton wastewater treatment plant did not participate in the Survey, and nutrient loads were estimated at 1.134 kg P and 3.401 kg N/capita/year.

* See Working Paper No. 175.

A. Waste Sources:

1. Known municipal* -

<u>Name</u>	<u>Pop. Served</u>	<u>Treatment</u>	<u>Mean Flow (m³/d)**</u>	<u>Receiving Water</u>
Denton	1,017	trickling filter	384.9	Lick Creek

2. Known industrial - None

* Anonymous, 1971.

** Estimated at 0.3785 m³/capita/day.

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

<u>Source</u>	<u>kg P/ yr</u>	<u>% of total</u>
a. Tributaries (non-point load) -		
Yadkin River	399,530	99.2
Beaverdam Creek	255	0.1
b. Minor tributaries & immediate drainage (non-point load) -	1,245	0.3
c. Known municipal STP's -		
Denton	1,155	0.3
d. Septic tanks* -	55	<0.1
e. Known industrial - None	-	-
f. Direct precipitation** -	<u>425</u>	<u>0.1</u>
Total	402,665	100.0

2. Outputs -

Lake outlet - Yadkin River 316,515

3. Net annual P accumulation - 86,150 kg.

* Estimate based on 201 lakeshore dwellings; see Working Paper No. 175.

** See Working Paper No. 175.

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

<u>Source</u>	<u>kg N/ yr</u>	<u>% of total</u>
a. Tributaries (non-point load) -		
Yadkin River	5,179,290	98.7
Beaverdam Creek	6,170	0.1
b. Minor tributaries & immediate drainage (non-point load) -		
	30,250	0.6
c. Known municipal STP's -		
Denton	3,460	0.1
d. Septic tanks* -		
	2,140	<0.1
e. Known industrial - None		
	-	-
f. Direct precipitation* -		
	<u>26,095</u>	<u>0.5</u>
Total	5,247,405	100.0

2. Outputs -

Lake outlet - Yadkin River 5,275,525

3. Net annual N loss - 28,120 kg.

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

<u>Tributary</u>	<u>kg P/km²/yr</u>	<u>kg N/km²/yr</u>
Yadkin River	37	486
Beaverdam Creek	11	267

* Estimate based on 201 lakeshore dwellings; see Working Paper No. 175.

** See Working Paper No. 175.

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 Accumulated	Total Nitrogen Total Accumulated
grams/m ² /yr	16.66	3.56
		217.1 Loss*

Vollenweider loading rates for phosphorus (g/m²/yr) based on mean depth and mean hydraulic retention time of Badin Lake:

"Dangerous" (eutrophic rate)	2.50
"Permissible" (oligotrophic rate)	1.25

* There was an apparent loss of nitrogen during the sampling year. This may have been due to nitrogen fixation in the lake, solubilization of previously sedimented nitrogen, recharge with nitrogen-rich ground water, or unknown and unsampled point sources discharging directly to the lake. Whatever the cause, a similar nitrogen loss has occurred at Shagawa Lake, Minnesota, which has been intensively studied by EPA's National Eutrophication and Lake Restoration Branch (Malueg et al., 1975).

V. LITERATURE REVIEWED

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VI. APPENDICES

APPENDIX A

LAKE RANKINGS

LAKES RANKED BY INDEX NOS.

RANK	LAKE CODE	LAKE NAME	INDEX NO
1	3719	LAKE WACCAMAW	534
2	3716	SANTEELAH LAKE	446
3	3711	MOUNTAIN ISLAND LAKE	419
4	3707	HIWASSEE LAKE	414
5	3704	FONTANA LAKE	392
6	3713	LAKE NORMAN	346
7	3708	LAKE JAMES	334
8	3710	LOOKOUT SHOALS	327
9	3715	RHODHISS LAKE	296
10	3705	LAKE HICKORY	283
11	3717	LAKE TILLERY	246
12	3709	LAKE JUNALUSKA	220
13	3702	BLEWETT FALLS LAKE	200
14	3718	WATERVILLE RESERVOIR	140
15	3701	BADIN LAKE	124
16	3706	HIGH ROCK LAKE	76

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
3701	BADIN LAKE	33 (5)	7 (1)	27 (4)	27 (4)	3 (0)	27 (4)	124
3702	BLEWETT FALLS LAKE	7 (1)	13 (2)	7 (1)	73 (11)	93 (14)	7 (1)	200
3704	FONTANA LAKE	100 (15)	33 (5)	93 (14)	100 (15)	3 (0)	63 (9)	392
3705	LAKE HICKORY	27 (4)	60 (9)	53 (8)	13 (2)	80 (12)	50 (7)	283
3706	HIGH ROCK LAKE	13 (2)	20 (3)	0 (0)	0 (0)	23 (2)	20 (3)	76
3707	HIWASSEE LAKE	87 (13)	80 (12)	87 (13)	47 (7)	50 (7)	63 (9)	414
3708	LAKE JAMES	60 (9)	87 (13)	80 (12)	7 (1)	23 (2)	77 (11)	334
3709	LAKE JUNALUSKA	47 (7)	27 (4)	43 (6)	20 (3)	50 (7)	33 (5)	220
3710	LOOKOUT SHOALS	53 (8)	47 (7)	60 (9)	67 (10)	60 (9)	40 (6)	327
3711	MOUNTAIN ISLAND LAKE	73 (11)	73 (11)	43 (6)	53 (8)	87 (13)	90 (13)	419
3713	LAKE NORMAN	67 (10)	53 (8)	73 (11)	40 (6)	23 (2)	90 (13)	346
3715	RHODHISSE LAKE	20 (3)	67 (10)	33 (5)	93 (14)	70 (10)	13 (2)	296
3716	SANTEELAH LAKE	93 (14)	93 (14)	100 (15)	60 (9)	23 (2)	77 (11)	446
3717	LAKE TILLERY	40 (6)	40 (6)	13 (2)	33 (5)	70 (10)	50 (7)	246
3718	WATERVILLE RESERVOIR	0 (0)	0 (0)	20 (3)	80 (12)	40 (6)	0 (0)	140
3719	LAKE WACCAMAW	80 (12)	100 (15)	67 (10)	87 (13)	100 (15)	100 (15)	534

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
3701	BADIN LAKE	0.042	0.680	466.750	7.190	14.900	0.012
3702	BLEWETT FALLS LAKE	0.090	0.655	476.889	4.167	10.800	0.034
3704	FONTANA LAKE	0.011	0.550	392.650	3.438	14.900	0.007
3705	LAKE HICKORY	0.047	0.320	461.000	7.275	13.400	0.008
3706	HIGH ROCK LAKE	0.090	0.580	477.454	14.283	14.800	0.017
3707	HIWASSEE LAKE	0.015	0.240	420.555	5.678	14.200	0.007
3708	LAKE JAMES	0.020	0.160	428.866	7.660	14.800	0.006
3709	LAKE JUNALUSKA	0.031	0.560	462.000	7.233	14.200	0.009
3710	LOOKOUT SHOALS	0.026	0.370	459.167	4.200	13.800	0.008
3711	MOUNTAIN ISLAND LAKE	0.018	0.270	462.000	5.580	12.800	0.005
3713	LAKE NORMAN	0.019	0.330	446.667	5.807	14.800	0.005
3715	RHOHIISS LAKE	0.061	0.305	462.111	3.578	13.600	0.019
3716	SANTEELAH LAKE	0.011	0.160	366.400	5.360	14.800	0.006
3717	LAKE TILLERY	0.040	0.470	468.600	6.827	13.600	0.008
3718	WATERVILLE RESERVOIR	0.103	0.860	468.333	3.817	14.400	0.041
3719	LAKE WACCAMAW	0.018	0.120	455.667	3.583	9.800	0.004

APPENDIX B

CONVERSIONS 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 C

TRIBUTARY FLOW DATA

TRIBUTARY FLOW INFORMATION FOR NORTH CAROLINA

10/21/75

LAKE CODE 3701 BADIN LAKE

TOTAL DRAINAGE AREA OF LAKE(SQ MI) 4177.00

TRIBUTARY	SUB-DRAINAGE AREA(SQ MI)	NORMALIZED FLOWS(CFS)												MEAN
		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
3701A1	4177.00	6070.00	6840.00	7230.00	6620.00	4960.00	4060.00	3710.00	4100.00	3970.00	4000.00	3870.00	4630.00	4994.03
3701A2	4115.00	5990.00	6720.00	7100.00	6530.00	4920.00	4030.00	3680.00	4070.00	3930.00	3970.00	3840.00	4580.00	4936.08
3701B1	8.90	12.00	18.00	17.00	12.00	6.20	4.20	4.90	5.20	4.90	4.10	4.60	7.80	8.35
3701Z2	53.10	75.00	100.00	115.00	73.00	37.00	25.00	29.00	31.00	29.00	24.00	28.00	46.00	50.73

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 4177.00
SUM OF SUB-DRAINAGE AREAS = 4177.00TOTAL FLOW IN = 60072.89
TOTAL FLOW OUT = 60060.00

MEAN MONTHLY FLOWS AND DAILY FLOWS(CFS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
3701A1	3	73	10900.00	25	7940.00				
	4	73	11300.00	29	28700.00				
	5	73	8400.00						
	6	73	6700.00	3	8020.00				
	7	73	5200.00	8	10.00				
	8	73	5900.00	5	8920.00				
	9	73	3070.00	9	10.00				
	10	73	3450.00	14	10.00				
	11	73	3800.00	4	1520.00				
	12	73	6120.00	2	10.00				
	1	74	10100.00	6	8290.00	16	7580.00		
	2	74	8890.00	3	9220.00	14	8800.00		
	3	74	6110.00	3	7460.00				
	3701A2	3	10800.00	25	8070.00				
		4	11000.00	29	28200.00				
		5	73	8350.00					
		6	73	6600.00	3	7160.00			
		7	73	5160.00	8	35.00			
		8	73	5840.00	5	9020.00			
		9	73	3060.00	9	25.00			
		10	73	3410.00	14	15.00			
		11	73	3660.00	4	1540.00			
		12	73	6240.00	2	25.00			
		1	74	10000.00	6	8470.00	18	7470.00	
		2	74	8770.00	3	7600.00	14	8420.00	
		3	74	6030.00	3	7400.00			

TRIBUTARY FLOW INFORMATION FOR NORTH CAROLINA

10/21/75

LAKE CODE 3701 BAUIN LAKE

MEAN MONTHLY FLOWS AND DAILY FLOWS(CFS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
3701B1	3	73	23.00	25		12.00			
	4	73	38.00	29		12.00			
	5	73	8.50						
	6	73	9.00	3		4.90			
	7	73	5.80	8		4.80			
	8	73	4.30	5		7.90			
	9	73	1.80	9		1.10			
	10	73	0.70	14		0.70			
	11	73	1.20	4		0.90			
	12	73	4.90	2		1.60			
	1	74	15.00	6		6.90	18		4.00
	2	74	17.00	3		54.00	14		8.00
3	74	9.60	3		7.00				
3701ZZ	3	73	135.00						
	4	73	180.00						
	5	73	50.00						
	6	73	55.00						
	7	73	35.00						
	8	73	25.00						
	9	73	11.00						
	10	73	5.00						
	11	73	10.00						
	12	73	29.00						
	1	74	87.00						
	2	74	105.00						
3	74	57.00							

APPENDIX D

PHYSICAL and CHEMICAL DATA

STORED RETRIEVAL DATE 75/10/20

370191
 35 25 20.0 050 05 35.0
 BAUDIN LAKE
 37167 NORTH CAROLINA

DATE FROM TO	TIME OF DAY	DEPTH FEET	WATER TEMP CENT	00010 DUOLU 00	00300 TRANSP SECCHI	00077 FIELD INCHES	00094 MICROMHO	00400 PH SU	00410 ALK CACO3	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-UIS ORTHO MG/L P	11EPALES		2111202	
														3	0170 FEET	DEPTH	0170
73/03/23	13 50	0000	14.1			10		70	7.40	14	0.220	0.300	0.520		0.026		
	13 50	0006	14.3	9.6				65	7.40	13	0.200	0.200	0.480		0.026		
	13 50	0014	14.1	9.6				65	7.40	12	0.210	0.200	0.490		0.025		
	13 50	0022	14.0	9.6				65	7.40	10	0.200	0.200	0.480		0.025		
	13 50	0030	13.8	9.6				65	7.40	10	0.200	0.200	0.470		0.024		
	13 50	0045	13.7	9.5				65	7.20	19	0.240	0.500	0.470		0.033		
	13 50	0065	13.7	9.3				65	7.20	22	0.210	0.400	0.470		0.026		
	13 50	0080	9.8	9.0				62	7.10	20	0.180	0.300	0.560		0.026		
	13 50	0100	8.8	8.8				62	7.20	19	0.150	0.200	0.580		0.025		
	13 50	0125	7.2	7.5				62	7.20	21	0.180	0.300	0.560		0.026		
	13 50	0145	7.1	6.3				60	7.20	12	0.160	0.300	0.540		0.038		
	13 50	0165	7.1	7.8				55	7.30	20	0.230	0.400	0.540		0.030		
73/07/11	09 45	0000	28.9			48		75	9.00	21	0.090	0.800	0.100		0.005		
	09 45	0006	28.9	8.0				69	8.70	19	0.070	0.600	0.080		0.007		
	09 45	0015	26.3	2.2				69	6.60	20	0.150	0.500	0.420		0.013		
	09 45	0030	25.9	1.8				70	6.50	21	0.170	0.400	0.480		0.011		
	09 45	0050	25.4	1.0				70	6.50	20	0.170	0.500	0.490		0.012		
	09 45	0075	19.0	1.5				70	6.50	23	0.120	0.400	0.540		0.021		
	09 45	0100	10.7	0.6				70	6.40	21	0.070	0.400	0.700		0.015		
	09 45	0125	7.2	0.3				78	6.40	24	0.160	0.500	0.690		0.015		
	09 45	0156	6.8	0.2				83	6.50	28	0.290	0.700	0.560		0.014		
73/09/19	14 05	0000	26.4			56		66	6.90	21	0.050	0.500	0.220		0.007		
	14 05	0015	26.1	4.4				65	6.60	21	0.060	0.500	0.230		0.007		
	14 05	0015	26.0	4.2				67	6.50	21	0.060	0.300	0.230		0.011		
	14 05	0040	26.0	3.8				68	6.50	22	0.060	0.200K	0.230		0.009		
	14 05	0070	25.4	2.0				70	6.40	25	0.160	0.200K	0.200		0.007		
	14 05	0080	17.4	0.3				60	6.30	22	0.080	0.200K	0.440		0.009		
	14 05	0105	10.3	0.2				50	6.20	21	0.110	0.200K	0.570		0.010		
	14 05	0130	7.5	0.3				59	6.60	36	0.700	0.800	0.130		0.007		
	14 05	0155	7.2	0.1				72	6.60	44	0.880	1.200	0.040		0.010		

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORED RETRIEVAL DATE 75/10/20

370101
35 25 20.0 080 05 35.0
BADIN LAKE
37167 NORTH CAROLINA

11EPALES 2111202
3 0170 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	PHOS-TOT MG/L P	CHLOROPHYL A UG/L	
73/03/23	13 50	0000	0.047	5.5	
	13 50	0006	0.042		
	13 50	0014	0.091		
	13 50	0022	0.089		
	13 50	0030	0.087		
	13 50	0045	0.097		
	13 50	0065	0.095		
	13 50	0080	0.078		
	13 50	0100	0.087		
	13 50	0125	0.088		
	13 50	0145	0.090		
	13 50	0166	0.108		
	73/07/11	09 45	0000	0.025	
09 45		0005	0.028		
09 45		0015	0.030		
09 45		0030	0.049		
09 45		0050	0.041		
09 45		0075	0.031		
09 45		0100	0.042		
09 45		0125	0.042		
09 45		0156	0.037		
73/09/19		14 05	0000	0.017	9.9
		14 05	0005	0.018	
		14 05	0015	0.016	
		14 05	0040	0.016	
	14 05	0070	0.017		
	14 05	0080	0.020		
	14 05	0105	0.024		
	14 05	0130	0.024		
	14 05	0155	0.025		

STATION RETRIEVAL DATE: 7/7/2020

370102
 35 24 57.0 080 06 33.0
 BODIN LAKE
 37167 NORTH CAROLINA

116102
 2111202
 0055 FEET DEPTH

DATE	TIME	DEPTH	WATER TEMP OF TO	DO610 DO	DO630 DO	DO677 TRANSP	00694 SECCHI	00400 CONDUCTVY FIELD	00410 PH	00610 ALK	00625 NH3-N	00630 TOT KJEL	00671 NO2&NO3 N-TOTAL	00671 PHTO-DIS ORTHO MG/L P
FROM TO	DAY	FEET	CENT	MG/L	MG/L	INCHES	MICROMHO	SU	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
7/3/2020	09 40	0000	12.3			10	65	7.30	11	0.180	0.600	0.520	0.027	
	09 40	0006	13.4				60	7.40	11	0.170	0.400	0.530	0.026	
	09 40	0012	13.2				60	7.40	12	0.170	0.400	0.520	0.025	
	09 40	0018	13.1				65	7.30	12	0.180	0.400	0.530	0.028	
	09 40	0025	12.9				60	7.30	12	0.170	0.400	0.530	0.021	
	09 40	0035	12.7				60	7.40	10	0.190	0.500	0.550	0.022	
	09 40	0051	12.2				60	7.30	10K	0.200	0.400	0.560	0.020	
7/3/2020	11 00	0000	27.4			36	69	8.50	22	0.080	0.600	0.130	0.004	
	11 00	0006	27.4				69	7.40	21	0.100	0.700	0.170	0.007	
	11 00	0015	27.1				69	6.90	21	0.070	0.500	0.220	0.004	
	11 00	0030	26.3				70	6.60	26	0.160	0.500	0.410	0.006	
	11 00	0045	25.4				70	6.60	27	0.190	0.500	0.410	0.006	
7/3/2020	13 40	0000	26.2			60	65	6.70	20	0.030	0.600	0.280	0.006	
	13 40	0005	26.3				64	6.60	20	0.030	0.400	0.280	0.007	
	13 40	0015	26.0				64	6.60	14	0.020	2.400	0.270	0.007	
	13 40	0030	26.1				64	6.40	20	0.030	0.400	0.270	0.011	
	13 40	0054	26.0				65	6.50	20	0.020	0.400	0.260	0.007	

116102
 32217
 DO610-TOT
 CHLOROPHYL
 FROM
OF
TO
DAY FEET MG/L P JI/L

7/3/2020	09 40	0000	1.084	7.2
	09 40	0006	1.088	
	09 40	0012	0.640	
	09 40	0018	1.077	
	09 40	0025	1.077	
	09 40	0035	1.131	
	09 40	0051	1.164	
7/3/2020	11 00	0000	1.044	
	11 00	0006	0.635	
	11 00	0015	1.032	
	11 00	0030	1.025	
	11 00	0045	1.037	
7/3/2020	13 40	0000	1.018	10.0
	13 40	0005	1.014	
	13 40	0015	1.013	
	13 40	0030	1.013	
	13 40	0054	1.014	

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/10/20

370103
35 26 27.0 080 06 01.0
BADIN LAKE
37167 NORTH CAROLINA

DATE FROM TO	TIME OF DAY	DEPTH FEET	WATER TEMP CENT	00010		00300		00077		00094		00400		00410		00610		00625		00630		00671	
				DO MG/L	TRANSP SECCHI INCHES	FIELD MICROMHO	SU	F ALK CACO3 MG/L	NH3-N TOTAL MG/L	TOT N MG/L	KJEL	N MG/L	N-TOTAL MG/L	PHOS-DIS ORTHO MG/L P									
73/03/24	10 30	0000	13.1			10		70	7.50	14	0.170	0.400	0.540	0.023									
	10 30	0006	13.0	9.6				60	7.50	14	0.160	0.400	0.540	0.023									
	10 30	0014	12.9	9.3				68	7.50	16	0.160	0.400	0.530	0.026									
	10 30	0022	12.8	9.4				68	7.40	14	0.170	0.400	0.540	0.022									
	10 30	0030	12.9	9.4				68	7.40	13	0.200	0.400	0.560	0.025									
	10 30	0040	12.7	9.2				65	7.40	10	0.200	0.500	0.570	0.021									
	10 30	0055	12.3	8.8				60	7.40	10K	0.210	0.500	0.570	0.023									
	10 30	0075	11.8	8.6				58	7.30	10K	0.200	0.500	0.580	0.020									
	10 30	0090	7.5	8.6				67	7.20	12	0.170	0.300	0.600	0.023									
	10 30	0115	6.8	7.9				64	7.20	10	0.150	0.300	0.640	0.022									
73/07/11	14 00	0000	29.8			40		72	9.40	23	0.080	0.500	0.080	0.002									
	14 00	0009	28.4	3.0				63	8.60	24	0.090	0.300	0.130	0.004									
	14 00	0015	26.5	2.6				70	6.60	24	0.190	0.200K	0.410	0.007									
	14 00	0030	25.8	2.0				70	6.50	23	0.170	0.200K	0.480	0.012									
	14 00	0045	25.3	1.0				70	6.40	24	0.100	0.200K	0.560	0.012									
	14 00	0060	23.6	0.3				70	6.40	23	0.120	0.200K	0.560	0.011									
	14 00	0080	16.4	0.2				72	6.40	27	0.150	0.200K	0.550	0.012									
	14 00	0100	10.7	0.2				80	6.50	29	0.200	0.300	0.560	0.012									
	14 00	0117	8.0	0.1				90	6.60	35	0.410	0.500	0.410	0.013									
73/09/19	13 10	0000	26.2			52		69	6.80	21	0.080	0.600	0.200	0.016									
	13 10	0005	25.4	3.2				68	6.40	20	0.080	0.400	0.230	0.010									
	13 10	0015	25.4	4.6				68	6.50	20	0.070	0.400	0.170	0.009									
	13 10	0035	25.4	5.2				69	6.50	20	0.070	0.600	0.140	0.012									
	13 10	0055	25.4	4.0				69	6.40	20	0.110	0.500	0.180	0.018									
	13 10	0075	24.5	1.2				68	6.40	21	0.200	0.600	0.200	0.010									
	13 10	0080	18.8	0.2				72	6.50	33	0.510	0.900	0.030	0.011									
	13 10	0095	11.8	0.2				59	6.50	27	0.370	0.800	0.280	0.012									
	13 10	0115	8.6	0.3				70	6.50	40	0.780	1.200	0.030	0.007									

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORED RETRIEVAL DATE 7/10/20

370103
35 26 27.0 080 06 01.0
BADIN LAKE
37167 NORTH CAROLINA

11EPALES 2111202
3 0119 FEET DEPTH

DATE	TIME	DEPTH	PHOS-TOT	CHLRPHYL
FROM	OF			A
TO	DAY	FEET	MG/L P	UG/L
73/03/24	10 30	0000	0.090	5.2
	10 30	0006	0.084	
	10 30	0014	0.088	
	10 30	0022	0.088	
	10 30	0030	0.104	
	10 30	0040	0.139	
	10 30	0055	0.142	
	10 30	0075	0.166	
	10 30	0090	0.086	
	10 30	0115	0.096	
73/07/11	14 00	0000	0.026	7.7
	14 00	0009	0.040	
	14 00	0015	0.044	
	14 00	0030	0.048	
	14 00	0045	0.033	
	14 00	0060	0.031	
	14 00	0080	0.032	
	14 00	0100	0.042	
	14 00	0117	0.040	
73/09/19	13 10	0000	0.027	11.8
	13 10	0005	0.021	
	13 10	0015	0.026	
	13 10	0035	0.028	
	13 10	0055	0.028	
	13 10	0075	0.021	
	13 10	0080	0.026	
	13 10	0095	0.027	
	13 10	0115	0.030	

STORET RETRIEVAL DATE 75/10/20

370104
35 27 58.0 080 07 28.0
BADIN LAKE
37 NORTH CAROLINA

11EPALES
3 2111202
0060 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CONDCTVY FIELD MICROMHO	00400 PH SU	00410 TALK 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
73/03/24	13 15	0000	13.6	9.3	10	70	7.50	11	0.210	0.800	0.570	0.022
	13 15	0006	12.7			58	7.60	10	0.200	0.500	0.580	0.020
	13 15	0012	12.6			58	7.50	10	0.220	0.400	0.580	0.022
	13 15	0020	12.6			55	7.50	11	0.180	0.500	0.550	0.021
	13 15	0030	12.5			55	7.50	11	0.200	0.500	0.580	0.021
	13 15	0045	12.4			50K	7.50	11	0.180	0.600	0.560	0.020
	13 15	0056	11.9			55	7.40	10	0.210	0.500	0.590	0.021
73/07/11	15 00	0000	29.3	3.8	30	70	8.30	25	0.110	0.500	0.200	0.005
	15 00	0006	27.2			70	6.80	25	0.150	0.400	0.330	0.004
	15 00	0015	26.2			70	6.70	24	0.200	0.300	0.440	0.008
	15 00	0030	25.9			70	6.60	23	0.210	0.400	0.470	0.012
	15 00	0045	25.4			70	6.50	26	0.150	0.400	0.540	0.016
	15 00	0061	23.1			78	6.60	29	0.360	0.700	0.380	0.009
	15 00	0076	21.2			78	6.60	29	0.360	0.700	0.380	0.009
73/09/19	12 50	0000	26.2	4.6	37	72	6.80	24	0.150	0.700	0.140	0.016
	12 50	0005	26.0			73	6.60	24	0.140	0.500	0.130	0.009
	12 50	0015	25.9			74	6.50	24	0.140	0.500	0.130	0.008
	12 50	0035	25.8			74	6.40	24	0.140	0.500	0.140	0.010
	12 50	0060	25.6			75	6.60	24	0.150	0.600	0.130	0.010

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/10/20

370104
35 27 58.0 080 07 28.0
BADIN LAKE
37 NORTH CAROLINA

11EPALES 2111202
3 0060 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	PHOS-TOT MG/L P	CHLRPHYL UG/L
73/03/24	13 15	0000	0.139	4.1
	13 15	0006	0.145	
	13 15	0012	0.143	
	13 15	0020	0.143	
	13 15	0030	0.150	
	13 15	0045	0.149	
	13 15	0056	0.168	
73/07/11	15 00	0000	0.064	4.5
	15 00	0006	0.040	
	15 00	0015	0.048	
	15 00	0030	0.053	
	15 00	0045	0.044	
	15 00	0061	0.034	
73/09/19	12 50	0000	0.040	9.2
	12 50	0005	0.030	
	12 50	0015	0.031	
	12 50	0035	0.029	
	12 50	0060	0.043	

APPENDIX E

TRIBUTARY DATA

STORED RETRIEVAL DATE 75/10/20

3701A1 LS3701A1
35 25 00.0 080 05 30.0
YADKIN RIVER
37009 15 ALBEMARLE
0/BADIN LAKE
BADEN DAM 1.5 MI NE OF TOWN OF BADEN
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
73/03/25	10 25		0.430	0.640	0.138	0.038	0.120
73/04/29	07 02		0.450	0.440	0.068	0.029	0.065
73/06/03	08 20		0.370	0.460	0.100	0.016	0.065
73/07/08	08 30		0.530	0.320	0.054	0.011	0.035
73/08/05	08 30		0.240	0.760	0.082	0.014	0.040
73/09/09	08 31		0.490	1.150	0.100	0.016	0.030
73/10/14	08 50		0.270	1.450	0.210	0.021	0.050
73/11/04	08 35		0.280	0.500	0.126	0.013	0.035
74/01/06	08 45		0.540	0.900	0.168	0.026	0.085
74/01/18	11 00		0.620	1.100	0.140	0.045	0.100
74/02/03	09 30		0.540	0.300	0.076	0.032	0.095
74/02/14	10 40		0.504	0.400	0.070	0.035	0.120
74/03/03	08 30		0.460	1.000	0.085	0.030	0.075

STORED RETRIEVAL DATE 75/10/20

3701A2 LS3701A2
 35 30 00.0 080 11 00.0
 YAUKIN RIVER
 37 15 UENTON
 I/HADEN LAKE
 STOKES FERRY BRDG ON ST HWYS 8 AND 49
 11EPALES 2111204
 4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FFET	00630 N02&N03	00625 TUT KJEL	00610 NH3-N	00671 PHOS-DIS	00665 PHOS-TOT
			N-TOTAL MG/L	TOTAL MG/L	MG/L	MG/L P	MG/L P
73/03/25	11 55		0.390	0.630	0.120	0.052	0.125
73/04/29	10 10		0.252	0.560	0.093	0.018	0.070
73/06/03	09 40		0.480	0.660	0.066	0.027	0.125
73/07/08	06 10		0.198	0.520	0.027	0.005K	0.052
73/08/05	08 42		0.110	0.650	0.140	0.010	0.060
73/09/09	08 55		0.014	1.700	0.044	0.006	0.040
73/10/14	08 45		0.250	1.650	0.390	0.012	0.060
73/11/04	08 40		0.220	1.060	0.150	0.019	0.065
74/01/06	09 00		0.520	0.600	0.132	0.032	0.115
74/01/18	09 00		0.560	0.600	0.132	0.030	0.105
74/02/03	09 03		0.480	0.590	0.112	0.038	0.120
74/02/14	10 00		0.460	0.700	0.090	0.040	0.135
74/03/03	09 15		0.440	0.900	0.085	0.035	0.100

K VALUE KNOWN TO BE
 LESS THAN INDICATED

STORET RETRIEVAL DATE 75/10/20

370181 LS370181
35 31 00.0 080 06 00.0
BEAVERDAM CREEK
37 15 DENTON
T/BAUDIN LAKE
XING DAVIDSON CO RD 1156 3.5 NW BLAINE
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TU	TIME OF DAY	DEPTH FEET	00630 NU2AN03 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
73/03/25	11 20		0.231	0.460	0.024	0.010	0.040
73/04/29	09 03		0.150	0.520	0.040	0.007	0.040
73/06/03	10 00		0.083	0.420	0.027	0.005K	0.035
73/07/08	06 25		0.014	0.460	0.012	0.005K	0.025
73/08/05	09 25		0.010K	0.690	0.012		0.035
73/09/04	09 20		0.010K	0.785	0.013	0.006	0.030
73/10/14	09 00		0.084	1.250	0.069	0.008	0.040
73/11/04	09 15		0.210	0.950	0.048	0.010	0.035
73/12/02	09 20		0.220	0.600	0.032	0.005K	0.035
74/01/05	09 30		0.460	0.500	0.036	0.005K	0.020
74/01/18	09 15		0.128	0.400	0.044	0.008	0.015
74/02/03	09 40		0.200	1.200	0.064	0.016	0.050
74/02/14	10 25		0.252	1.000	0.100	0.010	0.060
74/03/03	10 05		0.040	0.300	0.025	0.005K	0.017

K VALUE KNOWN TO BE
LESS THAN INDICATED