

**U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL EUTROPHICATION SURVEY**

WORKING PAPER SERIES



REPORT
ON
BLUE MOUNTAIN LAKE
LOGAN AND YELL COUNTIES
ARKANSAS
EPA REGION VI
WORKING PAPER No. 482

**CORVALLIS ENVIRONMENTAL RESEARCH LABORATORY - CORVALLIS, OREGON
and
ENVIRONMENTAL MONITORING & SUPPORT LABORATORY - LAS VEGAS, NEVADA**

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ON
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ARKANSAS
EPA REGION VI
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WITH THE COOPERATION OF THE
ARKANSAS DEPARTMENT OF POLLUTION
CONTROL AND ECOLOGY
AND THE
ARKANSAS NATIONAL GUARD
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REPORT ON BLUE MOUNTAIN LAKE
LOGAN AND YELL COUNTIES, ARKANSAS
EPA REGION VI

by

National Eutrophication Survey

Water and Land Monitoring Branch
Monitoring Applications Laboratory
Environmental Monitoring & Support Laboratory
Las Vegas, Nevada

and

Eutrophication Survey Branch
Corvallis Environmental Research Laboratory
Corvallis, Oregon

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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 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 [§14(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 Arkansas Department of Pollution Control and Ecology for professional involvement, to the Arkansas National Guard for conducting the tributary sampling phase of the Survey, and to those Arkansas wastewater treatment plant operators who provided effluent samples and flow data.

The staff of the Water Division of the Arkansas Department of Pollution Control and Ecology 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 Thomas C. Armstrong, the Adjutant General of Arkansas, and Project Officer Colonel Lavaun M. James, who directed the volunteer efforts of the Arkansas National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY

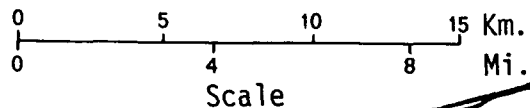
STUDY LAKES

STATE OF ARKANSAS

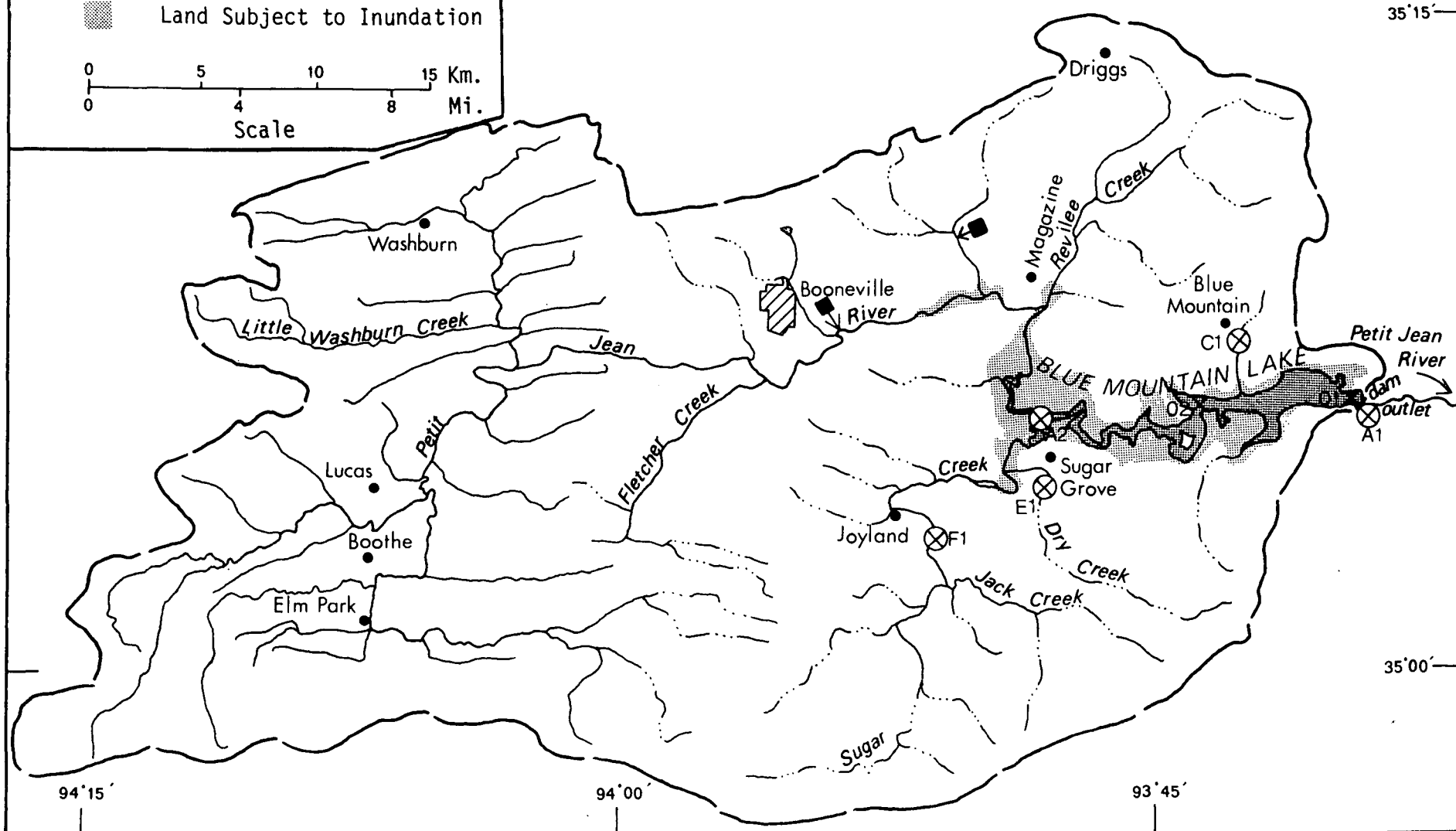
<u>LAKE NAME</u>	<u>COUNTY</u>
Beaver	Benton, Carroll, Washington
Blackfish	Crittenden, St. Francis
Blue Mountain	Logan, Yell
Bull Shoals	Baxter, Boone, Marion (Taney, Ozark in MO)
Catherine	Garland, Hot Spring
Chicot	Chicot
DeGray	Clark, Hot Spring
Erling	Lafayette
Grand	Chicot
Greer's Ferry	Van Buren, Cleburne
Hamilton	Garland
Millwood	Hempstead, Howard, Little River, Sevier
Nimrod	Perry, Yell
Norfork	Baxter, Fulton (Ozark in MO)
Ouachita	Garland, Montgomery
Table Rock	Boone, Carroll (Barry, Taney in MO)

BLUE MOUNTAIN LAKE

- ⊗ Tributary Sampling Site
- × Lake Sampling Site
- Sewage Treatment Facility
- ~ Drainage Area Boundary
- ▨ Land Subject to Inundation



Map Location



REPORT ON BLUE MOUNTAIN LAKE, ARKANSAS

STORET NO. 0503

I. CONCLUSIONS

A. Trophic Condition:*

On the basis of field observations and Survey data, Blue Mountain Lake is considered eutrophic, i.e., nutrient rich and productive. Whether such nutrient enrichment is to be considered beneficial or deleterious is determined by its actual or potential impact upon designated beneficial water uses of each lake.

Chlorophyll a values ranged from 5.3 $\mu\text{g/l}$ in the spring to 14.1 $\mu\text{g/l}$ in the fall, with a mean of 9.0 $\mu\text{g/l}$. Potentials for primary production as measured by algal assay control yields were moderate to high. Of the 16 Arkansas lakes sampled in 1974, 3 had higher median total phosphorus values, 4 had higher median orthophosphorus levels, and 7 had higher median inorganic nitrogen values than Blue Mountain Lake.

Dissolved oxygen levels were sharply depressed at Station 01 below 4.6 meters (15 feet) during summer sampling. Survey limnologists reported no other problem conditions in the lake. However, other studies (Arkansas Department of Pollution Control and Ecology, 1972) indicate that the shallow upper end of the lake may be trapping nutrients, resulting in heavy algal and macrophyte growth.

*See Appendix E

B. Rate-Limiting Nutrient:

Algal assay results indicate primary limitation by phosphorus in Blue Mountain Lake. Mean inorganic nitrogen to orthophosphorus (N/P) ratios for the lake were 16/1 and 26/1 in the summer and fall, respectively, indicating phosphorus limitation, and 9/1 in the spring, suggesting nitrogen limitation.

C. Nutrient Controllability:

1. Point sources -

During the sampling year, point sources were estimated to have contributed 30.0% of the total phosphorus load to Blue Mountain Lake. The city of Booneville contributed 28.3% of this load.

The total annual phosphorus loading of $1.44 \text{ g/m}^2/\text{yr}$ is slightly greater than Vollenweider's (1975) proposed eutrophic loading rate for lakes with such volume and retention time. However, loading calculations for the lake yield a large net export of phosphorus. This apparent phosphorus export could be attributed to undetected discharges reaching the lake from unmeasured industrial or municipal sources, to underestimation of the phosphorus load from septic tanks or to insufficient tributary sampling to determine an accurate nutrient budget for the lake. Although additional sampling is needed before definitive recommendations for the lake can be proposed, reduction of phosphorus loading from the Booneville plant to

the greatest practicable extent should aid in improving water quality in Blue Mountain Lake.

2. Nonpoint sources -

The mean annual phosphorus load from nonpoint sources was about 70.0% of the total reaching the lake measured tributaries accounted for over 63.0% of the total phosphorus load and the ungaged drainage areas were estimated to have contributed 5.4%.

II. LAKE AND DRAINAGE BASIN CHARACTERISTICS

Lake and drainage basin characteristics are itemized below. Lake morphometry was provided by the Arkansas Department of Pollution Control and Ecology; tributary flow data were provided by the Arkansas 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 mean flow of the outlet. Precipitation values are 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.

Tributary D-1, Cedar Creek, does not impact Blue Mountain Lake, but flows into the Petit Jean River below Blue Mountain Dam. For this reason, drainage area, flow, and nutrient loading values for D-1 have not been included with the other tributaries flowing into Blue Mountain Lake.

A. Lake Morphometry:

1. Surface area: 11.74 km².
2. Mean depth: 2.6 meters.
3. Maximum depth: 12.8 meters.
4. Volume: 30.837 x 10⁶ m³.
5. Mean hydraulic retention time: 25 days.

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

1. Tributaries -

<u>Name</u>	<u>Drainage area(km²)</u>	<u>Mean flow (m³/sec)</u>
A-2 Petit Jean River	898.7	10.68
E-1 Dry Creek	33.7	0.39
F-1 Sugar Creek	151.3	1.77
Minor tributaries and immediate drainage -	<u>139.8</u>	<u>1.77</u>
Totals	1,223.5	14.61

2. Outlet - A-1 Petit Jean River 1,263.9 14.81

C. Precipitation:

1. Year of sampling: 114.9 cm.
2. Mean annual: 114.2 cm.

III. LAKE WATER QUALITY SUMMARY

Blue Mountain Lake was sampled three times during the open-water season of 1974 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 one or more 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 and last visits, 18.9-liter depth-integrated samples were composited for algal assays. Maximum depths sampled were 8.5 meters at Station 01 and 2.7 meters at Station 02. 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.

A. PHYSICAL AND CHEMICAL CHARACTERISTICS

(3/28/74)					(6/ 6/74)					(10/18/74)				
S*** = 2					S*** = 2					S*** = 2				
PARAMETER	N#	RANGE	MEDIAN	MAX DEPTH RANGE (METERS)	N#	RANGE	MEDIAN	MAX DEPTH RANGE (METERS)	N#	RANGE	MEDIAN	MAX DEPTH RANGE (METERS)		
TEMPERATURE (DEG CENT)														
0.-1.5 M DEPTH	3	10.6- 15.2	11.1	0.0- 1.5	4	22.6- 22.9	22.8	0.0- 1.5	4	17.9- 18.0	17.9	0.0- 1.5		
MAX DEPTH**	2	10.2- 15.2	12.7	0.0- 4.6	2	21.6- 22.8	22.2	2.7- 7.9	2	17.5- 18.0	17.8	0.9- 8.5		
DISSOLVED OXYGEN (MG/L)														
0.-1.5 M DEPTH	2	8.4- 10.0	9.2	0.0- 1.5	2	4.4- 4.6	4.5	1.5- 1.5	4	7.8- 8.8	8.5	0.0- 1.5		
MAX DEPTH**	2	8.4- 9.8	9.1	0.0- 4.6	2	0.4- 6.4	3.4	2.7- 7.9	2	7.8- 8.6	8.2	0.9- 8.5		
CONDUCTIVITY (UMHOS)														
0.-1.5 M DEPTH	0	*****-*****	*****	****-*****	4	85.- 97.	93.	0.0- 1.5	4	47.- 49.	48.	0.0- 1.5		
MAX DEPTH**	0	*****-*****	*****	****-*****	2	96.- 98.	97.	2.7- 7.9	2	47.- 49.	48.	0.9- 8.5		
PH (STANDARD UNITS)														
0.-1.5 M DEPTH	3	6.8- 7.1	7.0	0.0- 1.5	3	6.6- 6.7	6.6	0.0- 1.5	4	6.6- 6.7	6.7	0.0- 1.5		
MAX DEPTH**	2	7.0- 7.1	7.0	0.0- 4.6	2	6.5- 6.6	6.5	2.7- 7.9	2	6.6- 6.7	6.6	0.9- 8.5		
TOTAL ALKALINITY (MG/L)														
0.-1.5 M DEPTH	3	10.- 24.	12.	0.0- 1.5	4	23.- 24.	24.	0.0- 1.5	4	17.- 20.	19.	0.0- 1.5		
MAX DEPTH**	2	10.- 24.	17.	0.0- 4.6	2	24.- 32.	28.	2.7- 7.9	2	19.- 20.	20.	0.9- 8.5		
TOTAL P (MG/L)														
0.-1.5 M DEPTH	3	0.054-0.065	0.056	0.0- 1.5	4	0.072-0.104	0.086	0.0- 1.5	4	0.047-0.058	0.055	0.0- 1.5		
MAX DEPTH**	2	0.058-0.065	0.061	0.0- 4.6	2	0.093-0.115	0.104	2.7- 7.9	2	0.050-0.057	0.053	0.9- 8.5		
DISSOLVED ORTHO P (MG/L)														
0.-1.5 M DEPTH	3	0.016-0.021	0.018	0.0- 1.5	4	0.010-0.012	0.010	0.0- 1.5	4	0.004-0.006	0.004	0.0- 1.5		
MAX DEPTH**	2	0.018-0.024	0.021	0.0- 4.6	2	0.010-0.011	0.010	2.7- 7.9	2	0.004-0.004	0.004	0.9- 8.5		
NO2+NO3 (MG/L)														
0.-1.5 M DEPTH	3	0.040-0.110	0.100	0.0- 1.5	4	0.040-0.120	0.060	0.0- 1.5	4	0.040-0.100	0.065	0.0- 1.5		
MAX DEPTH**	2	0.040-0.110	0.100	0.0- 4.6	2	0.030-0.050	0.040	2.7- 7.9	2	0.050-0.090	0.070	0.9- 8.5		
AMMONIA (MG/L)														
0.-1.5 M DEPTH	3	0.070-0.080	0.070	0.0- 1.5	4	0.100-0.120	0.115	0.0- 1.5	4	0.030-0.040	0.040	0.0- 1.5		
MAX DEPTH**	2	0.070-0.080	0.075	0.0- 4.6	2	0.120-0.150	0.135	2.7- 7.9	2	0.040-0.050	0.045	0.9- 8.5		
KJELDAHL N (MG/L)														
0.-1.5 M DEPTH	3	0.200-0.600	0.300	0.0- 1.5	4	0.400-0.800	0.600	0.0- 1.5	4	0.200-0.600	0.400	0.0- 1.5		
MAX DEPTH**	2	0.300-0.600	0.450	0.0- 4.6	2	0.500-0.500	0.500	2.7- 7.9	2	0.400-0.400	0.400	0.9- 8.5		
SECCHI DISC (METERS)														
	2	0.3- 0.3	0.3		2	0.3- 0.4	0.3		2	0.3- 0.7	0.6			

* N = NO. OF SAMPLES

** MAXIMUM DEPTH SAMPLED AT EACH SITE

*** S = NO. OF SITES SAMPLED ON THIS DATE

B. Biological Characteristics:

1. Phytoplankton -

<u>Sampling Date</u>	<u>Dominant Genera</u>	<u>Algal Units per ml</u>
03/28/74	1. <u>Melosira</u>	2,302
	2. <u>Chroomonas</u>	1,069
	3. <u>Dactylococcopsis</u>	781
	4. <u>Cryptomonas</u>	247
	5. <u>Asterionella</u>	164
	Other genera	<u>288</u>
	Total	4,851
06/06/74	1. <u>Melosira</u>	3,828
	2. <u>Euglena</u>	58
	3. <u>Nitzschia</u>	58
	4. <u>Anabaena</u>	29
	5. <u>Crucigenia</u>	29
	Other genera	<u>29</u>
	Total	4,031
10/18/74	1. <u>Melosira</u>	1,830
	2. <u>Stephanodiscus</u>	790
	3. <u>Chlamydomonas</u>	333
	4. <u>Dactylococcopsis</u>	166
	5. <u>Oscillatoria</u>	166
	Other genera	<u>374</u>
	Total	3,659

2. Chlorophyll a -

<u>Sampling Date</u>	<u>Station Number</u>	<u>Chlorophyll a (µg/l)</u>
03/28/74	01	5.3
	02	7.2
06/06/74	01	7.9
	02	10.0
10/18/74	01	9.4
	02	14.1

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

a. 03/28/74

<u>Spike (mg/l)</u>	<u>Ortho P Conc. (mg/l)</u>	<u>Inorganic Conc. (mg/l)</u>	<u>Maximum Yield (mg/l-dry wt.)</u>
Control	0.015	0.153	1.9
0.05 P	0.065	0.153	7.1
0.05 P + 1.0 N	0.065	1.153	25.5
1.00 N	0.015	1.153	2.1

b. 10/18/74

<u>Spike (mg/l)</u>	<u>Ortho P Conc. (mg/l)</u>	<u>Inorganic Conc. (mg/l)</u>	<u>Maximum Yield (mg/l-dry wt.)</u>
Control	0.010	0.092	0.8
0.05 P	0.060	0.092	5.0
0.05 P + 1.00 N	0.060	1.092	16.4
1.00 N	0.010	1.092	0.6

2. Discussion -

The control yields of the assay alga, Selenastrum capricornutum, indicate that the potential for primary production in Blue Mountain Lake was high during spring sampling and moderately high during fall. In both assays, substantial growth responses to the addition of phosphorus alone, as well as the lack of response to the addition of nitrogen indicate phosphorus limitation. Maximum growth yields were achieved with the simultaneous addition of both nutrients.

Mean N/P ratios in the lake data were 16/1 and 26/1 for the summer and fall sampling periods, indicating primary limitation by phosphorus, but 9/1 in the spring, suggesting nitrogen limitation at that time (an N/P ratio of 14/1 or greater generally reflects phosphorus limitation).

IV. NUTRIENT LOADINGS (See Appendix D for data)

For the determination of nutrient loadings, the Arkansas 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 March and April when two samples were collected. Sampling was begun in June 1975, and was completed in May 1975.

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

In this report, nutrient loads for sampled tributaries were determined by using a modification of a 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 nutrient loads, in $\text{kg}/\text{km}^2/\text{yr}$, in Dry Creek and Sugar Creek at Stations E-1 and F-1, and multiplying the means by the ZZ area in km^2 .

The operator of the Booneville wastewater treatment plant provided monthly effluent samples and corresponding flow data. Nutrient loads for the Arkansas Children's Colony wastewater treatment plant were estimated at 1.134 kg P and 3.401 kg N/Capita/yr.

A. Waste Sources:

1. Known municipal -

<u>Name</u>	<u>Population Served</u>	<u>Treatment</u>	<u>Mean Flow (m³/d x 10³)</u>	<u>Receiving Water</u>
Booneville	3,263	Activated sludge	1.597	Petit Jean River
Arkansas Children's Colony*	255*	Trickling filter	0.965**	Petit Jean River

2. Known industrial - None

*Arkansas Department of Pollution Control and Ecology, 1975.

**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 (nonpoint load) -		
A-2 Petit Jean River	9,425	55.9
E-1 Dry Creek	250	1.6
F-1 Sugar Creek	990	5.9
b. Minor tributaries and immediate drainage (nonpoint load) -	910	5.4
c. Known municipal STP's -		
Booneville	4,775	28.3
Arkansas Children's Colony	290	1.7
d. Septic tanks* -	5	<0.1
e. Known industrial - None		
f. Direct precipitation** -	<u>205</u>	<u>1.2</u>
Totals	16,850	100.0
2. Output - A-1 Petit Jean River	31,255	
3. Net annual P export*** -	14,405	

*Estimate based on 10 lakeside residences and 4 parks.

**Estimated (see NES Working Paper No. 175).

***Export probably due to unknown sources and/or sampling error.

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

<u>Source</u>	<u>kg N/yr</u>	<u>% of total</u>
a. Tributaries (nonpoint load) -		
A-2 Petit Jean River	344,485	81.1
E-1 Dry Creek	7,180	1.7
F-1 Sugar Creek	27,865	6.6
b. Minor tributaries and immediate drainage (nonpoint load) -	27,750	6.5
c. Known municipal STP's -		
Booneville	3,430	0.8
Arkansas Children's Colony	865	0.2
d. Septic tanks* -	250	0.1
e. Known industrial - None		
f. Direct precipitation** -	<u>12,675</u>	<u>3.0</u>
Totals	424,500	100.0

2. Output - A-1 Petit Jean River 343,495

3. Net annual N accumulation - 81,005

*Estimate based on 10 lakeside residences and 4 parks.

**Estimated (see NES Working Paper No. 175).

D. Mean Annual Nonpoint Nutrient Export by Subdrainage Area:

<u>Tributary</u>	<u>kg P/km²/yr</u>	<u>kg N/km²/yr</u>
Petit Jean River	10	383
Dry Creek	7	213
Sugar Creek	6	184

E. Mean Nutrient Concentrations in Ungaged Streams:

<u>Tributary</u>	<u>Mean Total P (mg/l)</u>	<u>Mean Total N (mg/l)</u>
C-1 Unnamed Stream	0.022	0.644
D-1 Cedar Creek	0.028	0.913

Nutrient levels for tributary C-1, Unnamed Stream, are in line with the nutrient levels found in the measured unimpacted tributaries entering the lake. Although Cedar Creek, tributary D-1, is outside the Blue Mountain Lake watershed, it was sampled as a special Land Use Study site. Phosphorus levels for that tributary are comparable to the other streams entering the lake, however, nitrogen values are somewhat higher.

F. Yearly Loadings:

In the following table, the existing phosphorus annual loading is compared to the relationship proposed by Vollenweider (1975). Essentially, his eutrophic loading is that at which the receiving waters would become eutrophic or remain eutrophic; his oligotrophic 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 eutrophic and oligotrophic.

Note that Vollenweider's model may not apply to lakes with short hydraulic retention times or in which light penetration is severely restricted by high concentrations of suspended solids in the surface waters.

	Total Yearly Phosphorus Loading <u>(g/m²/yr)</u>
Estimated loading for Blue Mountain Lake	1.44
Vollenweider's eutrophic loading	1.17
Vollenweider's oligotrophic loading	0.59

V. LITERATURE REVIEWED

- Arkansas Department of Pollution Control and Ecology. 1972. Pollution Control Survey of Arkansas River Basins, August - October, 1972. Little Rock, Arkansas.
- Arkansas Department of Pollution Control and Ecology. 1975. Section 303(e) Basin Plan for Arkansas River Basin, Oklahoma State Line to Mouth. Little Rock, Arkansas.
- U.S. Environmental Protection Agency. 1975. National Eutrophication Survey Methods 1973-1976. Working Paper No. 175. National Environmental Research Center, Las Vegas, Nevada, and Pacific Northwest Environmental Research Laboratory, Corvallis, Oregon.
- Vollenweider, R. A. 1975. Input-Output Models With Special Reference to the Phosphorus Loading Concept in Limnology. Schweiz. Z. Hydrol. 37:53-84.

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 ARKANSAS

02/02/77

LAKE CODE 0503 BLUE MOUNTAIN LAKE

TOTAL DRAINAGE AREA OF LAKE(SQ KM) 1263.9

TRIBUTARY	SUR-DRAINAGE AREA(SQ KM)	NORMALIZED FLOWS(CMS)												
		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
0503A1	1263.9	18.35	23.79	24.41	22.77	27.72	16.62	9.32	6.12	3.74	2.49	8.07	14.89	14.81
0503A2	898.7	15.97	20.33	22.51	20.42	20.76	4.93	3.03	1.76	1.95	1.76	6.23	9.17	10.68
0503D1	28.7	0.496	0.629	0.697	0.631	0.643	0.153	0.093	0.054	0.059	0.054	0.193	0.286	0.331
0503E1	33.7	0.580	0.739	0.818	0.742	0.753	0.178	0.110	0.065	0.071	0.065	0.227	0.334	0.388
0503F1	151.3	2.64	3.37	3.74	3.37	3.43	0.82	0.50	0.29	0.32	0.29	1.03	1.52	1.77
0503Z2	151.5	2.65	3.37	3.74	3.37	3.43	0.82	0.50	0.29	0.32	0.29	1.03	1.52	1.77

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 1263.9
SUM OF SUB-DRAINAGE AREAS = 1263.9

TOTAL FLOW IN = 180.13
TOTAL FLOW OUT = 178.28

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
0503A1	6	74	29.166	22	41.059				
	7	74	1.501	20	0.708				
	8	74	0.708	16	0.708				
	9	74	7.447	22	19.539				
	10	74	0.680	19	0.340				
	11	74	5.918	23	35.396				
	12	74	32.848	23	41.626				
	1	75	30.950	18	33.980				
	2	75	43.523	22	44.174				
	3	75	29.280	9	9.628	23	62.297		
	4	75	58.134	5	67.960	19	74.756		
	5	75	41.654	17	58.050				
0503A2	6	74	21.209	22	3.540				
	7	74	0.323	20	0.0				
	8	74	0.343	16	0.003				
	9	74	4.219	22	3.540				
	10	74	1.048	19	0.241				
	11	74	30.016	23	5.097				
	12	74	10.477	23	3.823				
	1	75	14.243	18	7.362				
	2	75	31.998	22	44.457				
	3	75	47.063	9	10.902	23	16.990		
	4	75	14.017	5	9.911	19	3.398		
	5	75	29.591	17	6.201				

TRIBUTARY FLOW INFORMATION FOR ARKANSAS

02/02/77'

LAKE CODE 0503 BLUE MOUNTAIN LAKE

MEAN MONTHLY FLOWS AND DAILY FLOWS (CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
0503D1	6	74	0.680	22	0.113				
	7	74	0.011	20	0.0				
	8	74	0.011	17	0.0				
	9	74	0.136	22	0.116				
	10	74	0.034	19	0.0				
	11	74	0.957	23	0.164				
	12	74	0.334	23	0.125				
	1	75	0.456	18	0.238				
	2	75	1.019	22	1.416				
	3	75	1.506	9	0.348	23	0.538		
	4	75	0.447	5	0.314	19	0.108		
	5	75	0.946	17	0.198				
0503E1	6	74	0.796	22	0.133				
	7	74	0.011	20	0.0				
	8	74	0.014	17	0.0				
	9	74	0.159	22	0.136				
	10	74	0.040	19	0.0				
	11	74	1.121	23	0.198				
	12	74	0.394	23	0.142				
	1	75	0.532	18	0.283				
	2	75	1.195	22	1.671				
	3	75	1.764	9	0.396	23	0.566		
	4	75	0.524	5	0.368	19	0.127		
	5	75	1.107	17	0.232				
0503F1	6	74	3.568	22	0.566				
	7	74	0.054	20	0.003				
	8	74	0.057	16	0.003				
	9	74	0.711	22	0.595				
	10	74	0.176						
	11	74	5.012	23	0.850				
	12	74	1.764	23	0.651				
	1	75	2.396	18	1.246				
	2	75	5.352	22	7.362				
	3	75	7.929	9	1.841	23	2.832		
	4	75	2.359	5	1.642	19	0.566		
	5	75	4.984	17	1.045				
0503Z2	6	74	3.568	22	0.566				
	7	74	0.054	20	0.003				
	8	74	0.057	16	0.003	17	0.003		
	9	74	0.714	22	0.595				
	10	74	0.176	19	0.028				
	11	74	5.040	23	0.878				
	12	74	1.770	23	0.651				
	1	75	2.401	18	1.246				
	2	75	5.380	22	7.504				
	3	75	7.929	9	1.841	23	2.832		
	4	75	2.362	5	1.642	19	0.566		
	5	75	4.984	17	1.045				

APPENDIX C
PHYSICAL AND CHEMICAL DATA

STORET RETRIEVAL DATE 77/02/02

050301
35 06 14.0 093 39 05.0 3
BLUE MOUNTAIN LAKE
05149 ARKANSAS

101091

/TYP/AMBNT/LAKE

11EPALES 04001002
0022 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CONDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CAC03 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
74/03/28	15 30	0000	11.1		12		7.00	10	0.070	0.300	0.100	0.021
	15 30	0005	10.6	10.0			6.80	12	0.080	0.200	0.110	0.016
	15 30	0015	10.2	9.8			7.00	10	0.080	0.300	0.110	0.024
74/06/06	09 55	0000	22.6		14	85		24	0.100	0.700	0.120	0.010
	09 55	0005	22.6	4.6		91	6.65	23	0.110	0.400	0.060	0.010
	09 55	0015	22.5	4.0		91	6.50	24	0.110	0.400	0.050	0.012
	09 55	0026	21.6	0.4		96	6.50	32	0.150	0.500	0.030	0.010
74/10/18	10 30	0000	17.9	8.4	28	47	6.65	17	0.030	0.400	0.080	0.005
	10 30	0005	17.9	7.8		47	6.64	19	0.040	0.200	0.100	0.006
	10 30	0015	17.6	8.2		47	6.63	19	0.040	0.300	0.080	0.004
	10 30	0028	17.5	7.8		47	6.61	20	0.050	0.400	0.090	0.004

DATE FROM TO	TIME OF	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
74/03/28	15 30	0000	0.056	5.3	
	15 30	0005	0.054		
	15 30	0015	0.058		
74/06/06	09 55	0000	0.074	7.9	
	09 55	0005	0.072		
	09 55	0015	0.077		
	09 55	0026	0.093		
74/10/18	10 30	0000	0.053	9.4	
	10 30	0004			1.0
	10 30	0005	0.047		
	10 30	0015	0.047		
	10 30	0028	0.050		

STORET RETRIEVAL DATE 77/02/02

050302
35 06 07.0 093 43 22.0 3
BLUE MOUNTAIN LAKE
05083 ARKANSAS

101091

/TYP/AMBNT/LAKE

11EPALES 04001002
0003 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 CONDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CAC03 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
74/03/28	15 45	0000	15.2	8.4	12		7.10	24	0.070	0.600	0.090	0.018
74/06/06	10 30	0000	22.9		12	95	6.70	23	0.120	0.800	0.060	0.012
	10 30	0005	22.9	4.4		97	6.60	24	0.120	0.500	0.040	0.011
	10 30	0009	22.8	6.4		98	6.60	24	0.120	0.500	0.050	0.011
74/10/18	10 50	0000	17.9	8.8	18	49	6.67	20	0.040	0.600	0.040	0.004
	10 50	0003	18.0	8.6		49	6.69	19	0.040	0.400	0.050	0.004

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
74/03/28	15 45	0000	0.065	7.2	
74/06/06	10 30	0000	0.098	10.0	
	10 30	0005	0.104		
	10 30	0009	0.115		
74/10/18	10 50	0000	0.058	14.1	
	10 50	0003	0.057		1.0

APPENDIX D
TRIBUTARY AND WASTEWATER
TREATMENT PLANT DATA

STREET RETRIEVAL DATE 75/11/28
 NATL EUTROPHICATION SURVEY
 EPA- LAS VEGAS

0503A1
 35 05 55.0 093 38 55.0
 PETIT JEAN RIVER
 05 7.5 BLUE MTN DAM
 3/BLUE MOUNTAIN LAKE
 BANK AT OUTLET AQUEDUCT DISCH S OF DAM
 11EPALES 2111204
 4 0000 FEET DEPTH

DATE	TIME	DEPTH	00630 NH3-N N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHOD MG/L P	00665 PHOS-TOT MG/L P
FROM	TO	FEET					
74/06/22	11 30		0.020	0.400	0.035	0.085	0.105
74/07/20	10 25		0.016	0.600	0.035	0.010	0.045
74/08/16	12 45		0.200	0.400	0.035	0.025	0.095
74/09/22	13 00		0.192	0.500	0.030	0.010	0.065
74/10/19	12 15		0.080	0.500	0.050	0.015	0.050
74/12/23	13 05		0.072	0.600	0.070	0.020	0.050
75/01/18	12 30		0.056	0.400	0.048	0.020	0.050
75/02/22	09 45		0.089	0.700	0.048	0.016	0.050
75/03/09	11 00		0.035	0.700	0.033	0.018	0.040
75/03/23	13 25		0.090	0.700	0.033	0.009	0.060
75/04/05	11 40		0.065	0.950	0.050	0.015	0.050
75/04/19	12 30		0.080	0.800	0.030	0.020	0.140
75/05/17	15 30		0.620	0.550	0.045	0.020	0.080

STATION DATA - VAL DATE 75/11/28
 NATE EUTROPHICATION SURVEY
 EPA- LAS VEGAS

050342
 35 04 50.0 093 48 10.0
 PETIT JEAN RIVER
 05 LOGAN COUNTY MAP
 T/BLUE MOUNTAIN LAKE
 2NDRY RD BRG 1 MI N OF SUGAR GROVE
 11EPALES 2111204
 4 0000 FEET DEPTH

DATE	TIME	DEPTH	00630 NO2EN03 A-TOTAL MG/L	00625 TDT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS P MG/L P	00665 PHOS-TOT P MG/L P
74/06/22	10	40	0.004	0.400	0.015	0.005	0.055
74/07/20	09	15	0.014	0.600	0.010	0.010	0.055
74/08/16	11	50	0.016	0.700	0.020	0.025	0.045
74/09/22	11	45	0.144	0.500	0.045	0.035	0.105
74/10/19	11	25	0.008	0.500	0.045	0.010	0.040
74/12/23	12	05	0.016	1.000	0.055	0.015	0.030
75/01/18	11	25	0.048	0.550	0.048	0.010	0.030
75/02/22	08	50	0.048	0.200	0.024	0.008K	0.010
75/03/09	09	45	0.033	1.000	0.024	0.015	0.040
75/03/23	12	40	0.031	2.000	0.042	0.005	0.040
75/04/05	11	00		0.800	0.025	0.015	0.040
75/04/19	11	30	0.075	0.850	0.025	0.020	0.070
75/05/17	14	00	0.055	2.400	0.140	0.060	

— K VALUE KNOWN TO BE LESS THAN —
 INDICATED

STOPPED RETRIEVAL DATE 75/11/28
 NATL EUTROPHICATION SURVEY
 EPA- LAS VEGAS

050301
 35 07 44.0 093 42 45.0
 UNNAMED STREAM
 05 LOGAN COUNTY MAP
 T/BLUE MOUNTAIN LAKE
 2NDRY RD BRDG 1.2 MI S OF AR HWY 10 JCT
 11EPALPS 2111204
 4 0000 FEET DEPTH

DATE	TIME	DEPTH	00630 NH3-N N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS OPHOS MG/L P	00665 PHOS-TOT MG/L P
FROM	OF	FEET					
TO	DAY						
74/06/22	11	50	0.044	0.200	0.015	0.005	0.025
74/07/20	10	05	0.024	0.600	0.035	0.005	0.040
74/08/16	13	00	0.015	0.200	0.015	0.015	0.020
74/09/22	12	45	0.032	0.200	0.025	0.010	0.030
74/10/19	12	35	0.008	0.300	0.025	0.010	0.010
74/12/23	13	25	0.080	0.500	0.045	0.010	0.020
75/01/18	13	00	0.056	0.200	0.016	0.010	0.025
75/02/22	10	05	0.104	0.400	0.016	0.008K	0.040
75/03/09	11	30	0.160	0.700	0.015	0.005	0.020
75/03/23	13	40	0.071	0.800	0.025	0.009	0.050
75/04/05	13	00	0.120	0.400	0.030	0.015	0.020
75/04/19	14	00	0.075	0.675	0.017	0.020	
75/05/17	15	00	0.015	2.100	0.045	0.010	0.040

— K VALUE KNOWN TO BE LESS THAN —
 INDICATED

START RETRIEVAL DATE 75/11/23
 NATL EUTROPHICATION SURVEY
 PDA- LAS VEGAS

J50301
 35 05 45.0 093 39 40.0
 CEDAR CREEK
 05 7.5 BLUE MTH DAM
 T/BLUE MOUNTAIN LAKE
 KING 1.2 MI E OF NATL FOREST RD JCT
 HEPALES 2111204
 4 0000 FEET DEPTH

DATE	TIME	DEPTH	00630	00625	00610	00671	00665
FROM	OF		NO2-NH3	TOT NUEL	NH3-N	PHOS-DIS	PHOS-TOT
TO	DAY	FEET	N-TOTAL	N	TOTAL	DEPTH	
			MG/L	MG/L	MG/L	MG/L P	MG/L P
74/06/22	11 10		0.012	0.200	0.020	0.005	0.020
74/09/22	12 25		0.032	0.200	0.030	0.005	0.030
74/10/19	11 55		0.008	0.100	0.017	0.005	0.020
74/12/23	12 45		0.024	0.800	0.075	0.010	0.020
75/01/18	11 30		0.016	0.200	0.016	0.010	0.025
75/02/22	09 25		0.032	0.400	0.016	0.008K	0.010
75/03/09	10 15		0.033	1.600	0.025	0.018	0.050
75/03/23	13 00		0.016	0.650	0.042	0.024	0.030
75/04/05	11 30		0.030	3.450	0.065	0.005K	0.010K
75/04/19	11 00		0.020	0.300	0.010	0.005	0.040
75/05/17	14 30		0.015	1.100	0.025	0.005K	0.040

— K VALUE KNOWN TO BE LESS THAN —
 INDICATED

START DATE 75/11/28
 STATE EUTROPHICATION SURVEY
 EPA- LAS VEGAS

0503E1
 05 04 10.0 093 48 00.0
 DRY CREEK
 05 LOGAN COUNTY WAD
 T/BLUE MOUNTAIN LAKE
 3/4 OFF ZNDARY RD 1 MI S OF SUGAR GROVE
 11EPALES 2111204
 4 0000 FEET DEPTH

DATE	TIME	DEPTH	00630 NH3-N MG/L	00625 TIT KJFL MG/L	00610 NH3-N MG/L	00671 PHOS-015 MG/L P	00555 PHOS-TOT MG/L P
74/06/22	10	25	0.003	0.100K	0.015	0.005K	0.015
74/09/22	11	30	0.016	0.107K	0.020	0.005	0.015
74/10/19	10	45	0.008	0.100	0.020	0.010	0.010
74/12/23	11	30	0.005	0.600	0.040	0.005	0.020
75/01/13	11	20	0.003	0.700	0.032	0.005K	0.030
75/02/22	08	15	0.015	0.400	0.016	0.008K	0.010K
75/03/09	09	00	0.160	0.750	0.020	0.025	0.025
75/03/23	12	00	0.009	0.400	0.024	0.005	0.025
75/04/05	09	30	0.010	0.350	0.020	0.005K	0.010K
75/04/19	09	00	0.015	0.250	0.018	0.005	0.030
75/05/17	13	20	0.015	2.000	0.045	0.006	0.030

K VALUE KNOWN TO BE LESS THAN
 INDICATED

SECRET RPT 15/01 DATE 75/11/28
 NATL AUTOPHOTOGRAPHY SURVEY
 EPA- LAS VEGAS

0503F1
 35 03 00.0 093 51 05.0
 SUGAR CREEK
 05 LOGAN COUNTY MAP
 T/BLUE MOUNTAIN LAKE
 2NDRY RD XING 1.5 MI SE OF JOYLAND
 11EPALES 2111274
 0000 FEET DEPTH

DATE	TIME	DEPTH	00630 N200-03 N-TOTAL MG/L	00625 TOT KUFL MG/L	00610 NHS-N TOTAL MG/L	00671 PHS-015 DEPTH MG/L P	00665 PHS-TOT MG/L P
74/06/22	09 45		0.008	0.100K	0.010	0.005K	0.020
74/07/20	08 35		0.012	0.200	0.020	0.010	0.015
74/08/16	11 15		0.012	0.400	0.015	0.007	0.018
74/09/22	11 00		0.016	0.100	0.015	0.010	0.020
74/12/23	11 45		0.008	0.500	0.050	0.005	0.010K
75/01/18	11 00		0.016	0.200	0.016	0.005	0.030
75/02/22	08 40		0.008	0.400	0.016	0.008K	0.010K
75/03/09	09 30		0.160	0.350	0.010	0.010	0.010
75/03/23	12 30		0.012	0.800	0.060	0.008K	0.010
75/04/19	09 30		0.260	0.200	0.015	0.005	0.040
75/05/17	13 00		0.010	1.300	0.030	0.010	0.030

— K VALUE KNOWN TO BE LESS THAN —
 INDICATED

STATION RETRIEVAL DATE 75/11/29
 WATER EUTROPHICATION SURVEY
 EPA- LAS VEGAS

0503A1 AS0503A1 P003263
 55 07 45.0 093 54 15.0
 BOONEVILLE
 05 15 BOONEVILLE
 T/BLUE MOUNTAIN LAKE
 PETIT JEAN RIVER
 11EPALES 2141204
 4 0000 FEET DEPTH

DATE	TIME	DEPTH	00620 NH ₃ -N N-TOTAL MG/L	00625 TOTAL N MG/L	00610 NH ₃ -N TOTAL MG/L	00671 PHOS-DIS ORTHOP MG/L P	00665 PHOS-TOT MG/L P	50051 FLOW RATE INST MGD	50053 CONDUIT FLOW-MGD MONTHLY
75/02/03	14	00	0.240	2.600	1.200	2.700	2.300	1.000	
75/03/04	09	00	0.320	7.600	2.160	2.100	3.200		
75/04/03	10	00	0.080	5.600	0.080K		2.500	0.040	
75/05/01	09	30	0.050	9.300	2.200	4.400	20.000	0.653	
75/06/25	16	00	0.125	5.700	0.450	6.200	6.400	1.000	0.280
75/07/01	13	15	0.075	6.900	0.290	6.150	6.500	0.400	
75/07/23	13	00	0.025	6.700	0.540	7.300	9.200	0.362	0.380
75/08/28	09	00	0.025	6.400	0.410	7.900	8.200	0.180	0.200
75/10/09	15	45	0.450	7.800	0.440	6.900	7.300	0.200	0.190
75/10/30	11	00						0.190	0.190

APPENDIX E
PARAMETRIC RANKINGS OF LAKES
SAMPLED BY NES IN 1974
STATE OF ARKANSAS

LAKE DATA TO BE USED IN RANKINGS

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500- MEAN SEC	MEAN CHLOROPH	15- MIN DO	MEDIAN DISS OXYGEN P
0501	BEAVER LAKE	0.022	0.330	415.667	3.921	14.400	0.006
0502	BLACKFISH LAKE	0.424	1.470	496.125	14.775	12.000	0.040
0503	BLUE MOUNTAIN LAKE	0.058	0.160	484.000	8.983	14.600	0.010
0504	BULL SHOALS LAKE	0.015	0.380	343.969	3.495	15.000	0.004
0505	LAKE CATHERINE	0.029	0.180	451.667	14.042	11.800	0.006
0506	LAKE CHICOT	0.162	0.450	486.000	13.722	14.800	0.049
0507	DEGRAY RESERVOIR	0.019	0.130	419.050	12.300	15.000	0.004
0508	LAKE ERLING	0.054	0.120	454.667	13.389	14.600	0.020
0509	GRAND LAKE	0.101	0.090	479.667	62.867	8.400	0.021
0510	LAKE HAMILTON	0.024	0.130	428.111	10.889	14.400	0.006
0511	MILLWOOD LAKE	0.040	0.120	466.778	14.967	9.800	0.008
0512	NIMPOD LAKE	0.039	0.160	469.000	15.833	8.800	0.006
0513	NORFOLK LAKE	0.015	0.320	356.321	3.441	15.000	0.005
0514	LAKE OUACHITA	0.015	0.155	389.144	4.344	15.000	0.006
0515	TABLE ROCK LAKE	0.022	0.350	410.778	9.103	15.000	0.007
0516	GREER'S LAKE	0.012	0.140	370.875	3.762	15.000	0.004

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 CHLOR-A	15- MIN DO	MEDIAN DISS OPTHO P
0501	BEAVER LAKE	63 (9)	27 (4)	67 (10)	87 (13)	40 (6)	63 (8)
0502	BLACKFISH LAKE	0 (0)	0 (0)	0 (0)	7 (1)	73 (11)	0 (0)
0503	BLUE MOUNTAIN LAKE	20 (3)	47 (7)	13 (2)	67 (10)	57 (8)	27 (4)
0504	BULL SHOALS LAKE	90 (13)	13 (2)	100 (15)	80 (12)	17 (0)	93 (13)
0505	LAKE CATHERINE	47 (7)	40 (6)	47 (7)	27 (4)	80 (12)	63 (8)
0506	LAKE CHICOT	7 (1)	7 (1)	7 (1)	33 (5)	47 (7)	7 (1)
0507	DEGRAY RESERVOIR	73 (11)	77 (11)	60 (9)	47 (7)	17 (0)	93 (13)
0508	LAKE ERLING	27 (4)	90 (13)	40 (6)	40 (6)	57 (8)	20 (3)
0509	GRAND LAKE	13 (2)	100 (15)	20 (3)	0 (0)	100 (15)	13 (2)
0510	LAKE HAMILTON	53 (8)	77 (11)	53 (8)	53 (8)	67 (10)	63 (8)
0511	MILLWOOD LAKE	33 (5)	90 (13)	33 (5)	20 (3)	87 (13)	33 (5)
0512	NIMROD LAKE	40 (6)	53 (8)	27 (4)	13 (2)	93 (14)	47 (7)
0513	NORFOLK LAKE	80 (12)	33 (5)	93 (14)	100 (15)	17 (0)	80 (12)
0514	LAKE OUACHITA	90 (13)	60 (9)	80 (12)	73 (11)	17 (0)	63 (8)
0515	TABLE ROCK LAKE	63 (9)	20 (3)	73 (11)	60 (9)	17 (0)	40 (6)
0516	GREER'S LAKE	100 (15)	67 (10)	87 (13)	93 (14)	17 (0)	93 (13)