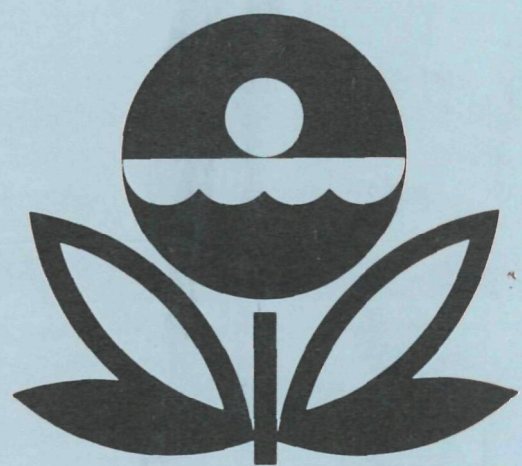
U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL EUTROPHICATION SURVEY

WORKING PAPER SERIES



REPORT

ON

CHICOT LAKE

CHICOT COUNTY

ARKANSAS

EPA REGION VI

WORKING PAPER No. 484

CORVALLIS ENVIRONMENTAL RESEARCH LABORATORY - CORVALLIS, OREGON

and

ENVIRONMENTAL MONITORING & SUPPORT LABORATORY - LAS VEGAS, NEVADA

☆G.P.O. 699-440

REPORT
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WITH THE COOPERATION OF THE
ARKANSAS DEPARTMENT OF POLLUTION
CONTROL AND ECOLOGY
AND THE
AKRANSAS NATIONAL GUARD
JANUARY, 1977

REPORT ON CHICOT LAKE

CHICOT COUNTY, 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

Working Paper No. 484

OFFICE OF RESEARCH AND DEVELOPMENT
U.S. ENVIRONMENTAL PROTECTION AGENCY

January 1977

CONTENTS

FOREWORD

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

OBJECTIVES

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

ANALYTIC APPROACH

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

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

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

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

LAKE ANALYSIS

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

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

ACKNOWLEDGMENTS

The staff of the National Eutrophication Survey (Office of Research and Development, U.S. Environmental Protection Agency) expresses sincere appreciation to the 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.

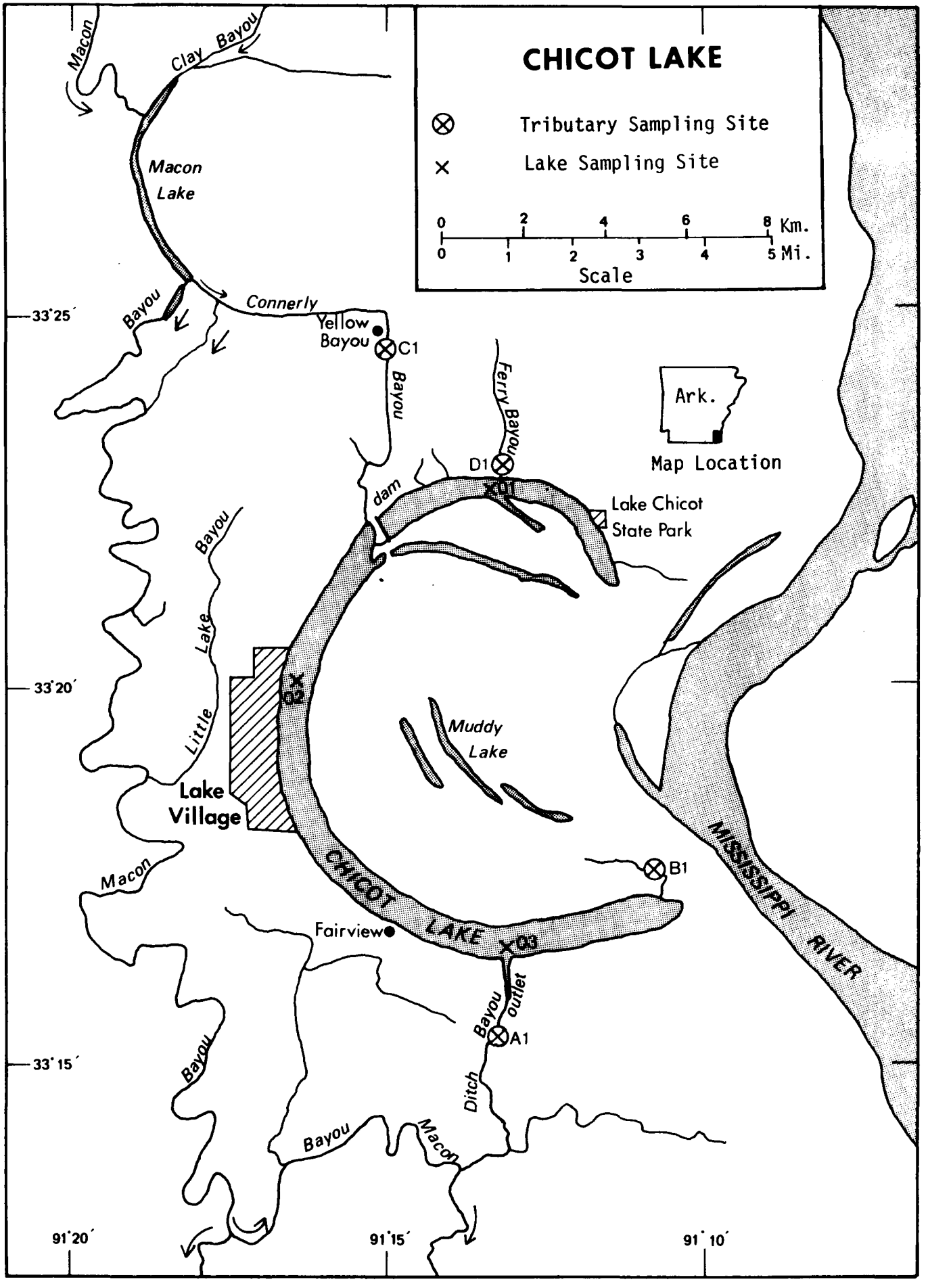
Major General Thomas C. Armstrong, the Adjutant General of Arkansas, and Project Officer Colonel Lavaun M. James, who directed the volunteer efforts of the Arkansas National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY

STUDY LAKES

STATE OF ARKANSAS

LAKE NAME	COUNTY
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)


CHICOT LAKE
Tributary Sampling Site
Lake Sampling Site
0 2 4 6 8 Km.
0 1 2 3 4 5 Mi.
Scale
Ark.
Map Location
Macon
Clay Bayou
Macon Lake
Bayou
Connerly
Yellow Bayou
C1
Bayou
Ferry Bayou
D1
dam
X01
Lake Chicot State Park
Bayou
Lake
Little
33°25´
33°20´
33°15´
X02
Muddy Lake
Lake Village
Macon
CHICOT LAKE
X03
B1
Fairview
MISSISSIPPI RIVER
Bayou outlet
A1
Ditch
Bayou
Macon
Bayou
91°20´
91°15´
91°10´

REPORT ON LAKE CHICOT, ARKANSAS

STORET NO. 0506

I. CONCLUSIONS

A. Trophic Condition:*

Based upon field observations and Survey data, Lake Chicot is considered eutrophic, i.e., nutrient rich and highly 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 a low of 1.1 µg/l in the summer to a high of 30.5 µg/l in the spring with a mean of 13.7 µg/l. The mean Secchi disc transparency was 66 cm (26 inches) at Station 01, and 20 cm (8 inches) at the less productive but more highly enriched lake Stations 02 and 03, suggesting light is the growth limiting factor in parts of Lake Chicot rather than nutrient availability. Of the 16 Arkansas lakes sampled in 1974, only 1 had greater median total phosphorus, dissolved orthophosphorus, and inorganic nitrogen levels than Lake Chicot.

Survey limnologists observed an algal bloom during the October sampling period and floating aquatics in the

*See Appendix E

vicinity of sampling Station 01. In 1971, Ketelle and Uttormark reported siltation and insecticides contributed from agricultural runoff to be major lake problems.

B. Rate-Limiting Nutrient:

Algal assay results indicate that Lake Chicot was limited by available nitrogen during the spring and fall sampling seasons. Spikes with nitrogen or phosphorus and nitrogen simultaneously resulted in increased assay yields. The addition of phosphorus alone did not produce a growth response. The lake ratios of available inorganic nitrogen to orthophosphorus (N/P) also indicate primary limitation by nitrogen during spring and fall, but phsophorus limitation during the summer.

C. Nutrient Controllability:

1. Point sources -

There are no known point sources contributing to Lake Chicot. The present loading of 6.64 $g/m^2/yr$ is nearly eight times that proposed by Vollenweider (1975) as eutrophic for a lake of such volume and retention time. However, Vollenweider's model may not apply to highly turbid lakes, like Lake Chicot, where light penetration in the surface waters is severely restricted by the high concentrations of suspended solids.

Although there are no known point sources impacting Lake Chicot, nutrient levels and background nutrient loadings for

the tributaries flowing into the lake are unusually high (see Section IV-D). Determination of the extent of agricultural runoff and of unknown sources contributing to the lake is needed to determine the cause of such high nutrient inputs to the lake.

2. Nonpoint sources -

Nonpoint sources contributed all of the nutrient loads reaching Lake Chicot. Connerly Bayou contributed 90.7% of the total phosphorus load and minor tributaries were estimated to have contributed 9.0% of the total.

In general, few lakes are nitrogen limited as a result of low nitrogen. Rather, excessive phosphorus levels shift limitations to nitrogen or other factors. Regardless of the primary nutrient limitation suggested by either algal assay or nutrient ratios, the most feasible approach to nutrient control, if desirable, is through available phosphorus control technology and subsequent establishment of phosphorus limitation within the water body.

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 the 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.

A. Lake Morphometry:

1. Surface area: 21.45 km^2.
2. Mean depth: 2.7 meters.
3. Maximum depth: 7.6 meters.
4. Volume: 58.837 x 10^6 m^3.
5. Mean hydraulic retention time: 49 days.

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

1. Tributaries -

Name	Drainage area(km^2)	Mean flow (m^3/sec)
C-1 Connerly Bayou	932.4	12.21
Minor tributaries and immediate drainage -	92.6	1.41
Totals	1,025.0	13.62
2. Outlet - A-1 Ditch Bayou	1,046.4	13.82

C. Precipitation:

1. Year of sampling: 161.3 cm.
2. Mean annual: 160.3 cm.

III. LAKE WATER QUALITY SUMMARY

Lake Chicot 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 three stations on the lake and from a number of depths at each station (see map, page v). During each visit, depth-integrated samples were collected from each station for chlorophyll a analysis and phytoplankton identification and enumeration. During the first and last visits, 18.9-liter depth-integrated samples were composed for algal assays. Maximum depths sampled were 4.6 meters at Station 01, 7.0 meters at Station 02, and 8.8 meters at Station 03. 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.

LAKE CHICOT
STORET CODE 0506

A. PHYSICAL AND CHEMICAL CHARACTERISTICS

PARAMETER	(3/26/74) S*** = 3 N*	RANGE	MEDIAN	MAX DEPTH RANGE (METERS)	(6/ 5/74) S*** = 3 N*	RANGE	MEDIAN	MAX DEPTH RANGE (METERS)	(10/16/74) S*** = 3 N*	RANGE	MEDIAN	MAX DEPTH RANGE (METERS)
TEMPERATURE (DEG CENT)												
0.-1.5 M DEPTH	6	13.0- 13.3	13.2	0.0- 1.5	6	24.6- 26.6	26.1	0.0- 1.5	6	18.9- 19.6	19.5	0.0- 1.5
MAX DEPTH**	3	12.5- 13.2	13.0	4.0- 6.7	3	23.3- 25.3	25.3	4.6- 8.8	3	18.6- 19.6	19.2	4.0- 7.0
DISSOLVED OXYGEN (MG/L)												
0.-1.5 M DEPTH	3	9.0- 10.0	9.0	1.5- 1.5	3	5.0- 7.4	6.5	1.5- 1.5	6	6.2- 8.4	7.6	0.0- 1.5
MAX DEPTH**	3	9.0- 9.4	9.0	4.0- 6.7	3	0.2- 5.4	3.2	4.6- 8.8	3	5.0- 8.0	7.2	4.0- 7.0
CONDUCTIVITY (UMHOS)												
0.-1.5 M DEPTH	6	144.- 185.	175.	0.0- 1.5	6	264.- 294.	289.	0.0- 1.5	6	187.- 210.	195.	0.0- 1.5
MAX DEPTH**	3	144.- 187.	174.	4.0- 6.7	3	166.- 310.	237.	4.6- 8.8	3	187.- 208.	199.	4.0- 7.0
PH (STANDARD UNITS)												
0.-1.5 M DEPTH	6	7.7- 8.3	7.8	0.0- 1.5	6	7.1- 8.2	7.5	0.0- 1.5	6	7.4- 7.9	7.7	0.0- 1.5
MAX DEPTH**	3	7.6- 7.9	7.8	4.0- 6.7	3	6.8- 7.3	7.0	4.6- 8.8	3	7.4- 7.8	7.4	4.0- 7.0
TOTAL ALKALINITY (MG/L)												
0.-1.5 M DEPTH	6	69.- 111.	88.	0.0- 1.5	6	70.- 123.	86.	0.0- 1.5	6	84.- 125.	93.	0.0- 1.5
MAX DEPTH**	3	67.- 119.	85.	4.0- 6.7	3	36.- 125.	71.	4.6- 8.8	3	84.- 125.	93.	4.0- 7.0
TOTAL P (MG/L)												
0.-1.5 M DEPTH	6	0.076-0.395	0.347	0.0- 1.5	6	0.093-0.230	0.191	0.0- 1.5	6	0.112-0.162	0.145	0.0- 1.5
MAX DEPTH**	3	0.094-0.387	0.308	4.0- 6.7	3	0.160-0.321	0.238	4.6- 8.8	3	0.130-0.149	0.149	4.0- 7.0
DISSOLVED ORTHO P (MG/L)												
0.-1.5 M DEPTH	6	0.028-0.151	0.120	0.0- 1.5	6	0.046-0.097	0.089	0.0- 1.5	6	0.028-0.092	0.077	0.0- 1.5
MAX DEPTH**	3	0.026-0.151	0.122	4.0- 6.7	3	0.083-0.104	0.098	4.6- 8.8	3	0.034-0.076	0.067	4.0- 7.0
NO2+NO3 (MG/L)												
0.-1.5 M DEPTH	6	0.020-0.740	0.710	0.0- 1.5	6	0.100-1.940	1.615	0.0- 1.5	6	0.020-0.380	0.200	0.0- 1.5
MAX DEPTH**	3	0.030-0.730	0.730	4.0- 6.7	3	0.060-1.930	1.850	4.6- 8.8	3	0.020-0.380	0.190	4.0- 7.0
AMMONIA (MG/L)												
0.-1.5 M DEPTH	6	0.020-0.110	0.075	0.0- 1.5	6	0.060-0.140	0.095	0.0- 1.5	6	0.020-0.070	0.040	0.0- 1.5
MAX DEPTH**	3	0.050-0.120	0.090	4.0- 6.7	3	0.120-0.260	0.250	4.6- 8.8	3	0.050-0.070	0.060	4.0- 7.0
KJELDAHL N (MG/L)												
0.-1.5 M DEPTH	6	0.500-0.800	0.650	0.0- 1.5	6	0.400-1.100	0.650	0.0- 1.5	6	0.400-1.200	0.700	0.0- 1.5
MAX DEPTH**	3	0.600-0.700	0.600	4.0- 6.7	3	0.700-1.000	0.800	4.6- 8.8	3	0.400-0.600	0.500	4.0- 7.0
SECCHI DISC (METERS)												
	3	0.1- 0.8	0.1		3	0.1- 0.7	0.1		3	0.4- 0.5	0.5	

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

B. Biological Characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera		Algal Units per ml
03/26/74	1.	Stephanodiscus	1,904
	2.	Melosira	368
	3.	Cryptomonas	246
	4.	Actinastrum	154
	5.	Dactylococcopsis	92
		Other genera	92
		Total	2,856
06/05/74	1.	Merismopedia	566
	2.	Melosira	536
	3.	Cryptomonas	447
	4.	Oscillatoria	209
	5.	Cyclotella	179
		Other genera	1,072
		Total	3,009
10/16/74	1.	Cyanophytan Filament	2,281
	2.	Melosira	1,313
	3.	Flagellates	726
	4.	Stephanodiscus	726
	5.	Synedra	311
		Other genera	1,383
		Total	6,740

2. Chlorophyll a -

Sampling Date	Station Number	Chlorophyll a (µg/l)
03/26/74	01	30.5
	02	3.0
	03	1.6
06/05/74	01	30.5
	02	4.0
	03	1.1
10/16/74	01	29.2
	02	16.4
	03	7.2

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

a. 03/26/74

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum Yield (mg/l-dry wt.)
Control	0.095	0.440	13.8
0.05 P	0.145	0.440	13.5
0.05 P + 1.00 N	0.145	1.440	39.6
1.00 N	0.095	1.440	37.6

b. 10/16/74

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum Yield (mg/l-dry wt.)
Control	0.065	0.334	8.5
0.05 P	0.115	0.334	8.5
0.05 P + 1.00 N	0.115	1.334	22.6
1.00 N	0.065	1.334	16.2

2. Discussion -

The control yield of the assay alga, Selenastrum capricornutum, indicates that Lake Chicot had extremely high potential for primary productivity during the spring and fall sampling periods. The lake was nitrogen limited at those times as indicated by the increased yields of the test alga in response to the addition of inorganic nitrogen. Spikes with phosphorus and nitrogen simultaneously resulted in a maximum yield. Spikes with phosphorus alone did not produce a response beyond the control yield.

The mean N/P ratios in the lake data were 6/1 and 4/1 in the spring and fall, respectively, indicating primary limitation by nitrogen. The lake N/P ratio during summer sampling was 17/1, suggesting phosphorus limitation at that time (a mean 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 January, March, and April when two samples were collected. Sampling was begun in June 1974, and was completed in June 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 $kg/km^2/yr$, in Connerly Creek at Station C-1, and multiplying the means by the ZZ area in km^2.

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 (nonpoint load) -		
C-1 Connerly Bayou	129,285	90.7
b. Minor tributaries and immediate drainage (nonpoint load) -	12,870	9.0
c. Known municipal STP's - None		
d. Septic tanks* -	5	<0.1
e. Known industrial - None		
f. Direct precipitation** -	375	0.3
Totals	142,535	100.0

2. Output - A-1 Ditch Bayou 115,735

3. Net annual P accumulation - 26,800

*Estimate based on 20 lakeside residences and 1 state park.
**Estimated (see NES Working Paper No. 175).

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

Source	kg N/yr	% of total
a. Tributaries (nonpoint load) -		
C-1 Connerly Bayou	773,015	88.5
b. Minor tributaries and immediate drainage (nonpoint load) -	76,765	8.8
c. Known municipal STP's - None		
d. Septic tanks* -	250	<0.1
e. Known industrial - None		
f. Direct precipitation** -	23,155	2.7
Totals	873,185	100.0

2. Output - A-1 Ditch Bayou 700,900

3. Net annual N accumulation - 172,285

*Estimate based on 20 lakeside residences and 1 state park.
**Estimated (see NES Working Paper No. 175).

D. Mean Annual Nonpoint Nutrient Export by Subdrainage Area:

Tributary	kg $P/km^2/yr$	kg $N/km^2/yr$
Connerly Bayou	139	829

E. Mean Nutrient Concentration in Ungaged Streams:

Tributary	Mean Total P (mg/l)	Mean Total N (mg/l)
B-1 Unnamed Creek	0.513	2.036
D-1 Ferry Bayou	0.408	1.768

Nutrient concentrations for the above two tributaries are in line with those found in the gaged tributary (C-1 Connerly Bayou) flowing into Lake Chicot.

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 ($g/m^2/yr$)
Estimated loading for Lake Chicot	6.64
Vollenweider's eutrophic loading	0.88
Vollenweider's oligotrophic loading	0.44

V. LITERATURE REVIEWED

Ketelle, Martha J. and Paul D. Uttormark, 1971. Problem Lakes in the United States. U.S. Environmental Protection Agency Project #1610 EHR. University of Wisconsin, Madison, Wisc.

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 0506 CHICOT LAKE

TOTAL DRAINAGE AREA OF LAKE(SQ KM) 1046.4

TRIBUTARY	SUB-DRAINAGE AREA(SQ KM)	NORMALIZED FLOWS(CMS) JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
0506A1	1046.4	19.03	31.35	28.49	26.22	25.06	8.24	3.91	2.12	3.20	3.74	5.38	10.42	13.82
0506C1	932.4	16.93	27.86	25.32	23.33	22.29	7.33	3.48	1.88	1.90	3.34	4.79	9.26	12.21
0506ZZ	114.0	1.94	3.20	2.92	2.68	2.56	0.84	0.40	0.22	0.33	0.38	0.55	1.06	1.41

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 1046.4
SUM OF SUB-DRAINAGE AREAS = 1046.4
TOTAL FLOW IN = 164.78
TOTAL FLOW OUT = 167.15

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
0506A1	6	74	52.669	22	35.679				
	7	74	7.362	29	20.671				
	8	74	6.711	15	7.362				
	9	74	44.174	18	29.733				
	10	74	6.711	17	5.692				
	11	74	13.819	22	11.893				
	12	74	14.640						
	1	75	36.246	7	37.661	16	49.554		
	2	75	60.315	19	47.006				
	3	75	56.067	14	67.677	19	89.764		
	4	75	31.715	14	45.024	22	19.114		
	5	75	45.873						
	6	75	45.873	5	45.307				
0506C1	6	74	45.873	22	56.634				
	7	74	6.570	29	7.079				
	8	74	5.069	15	3.115				
	9	74	40.776	18	32.564				
	10	74	4.955	17	2.973				
	11	74	12.629	22	17.556				
	12	74	8.608						
	1	75	28.600	7	33.414	16	44.174		
	2	75	58.050	19	41.909				
	3	75	50.404	14	210.394	19	79.854		
	4	75	23.050	14	40.210	22	17.018		
	5	75	39.644						
	6	75	39.644	5	39.644				

TRIBUTARY FLOW INFORMATION FOR ARKANSAS 02/02/77

LAKE CODE 0506 CHICOT LAKE

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
0506ZZ	6	74	5.635	22	6.909				
	7	74	0.793	29	0.850				
	8	74	0.623	15	0.368				
	9	74	4.955	18	3.964				
	10	74	0.595	17	0.368				
	11	74	1.529	22	2.152				
	12	74	1.048						
	1	75	3.483	7	4.106	16	5.409		
	2	75	7.079	19	5.125				
	3	75	6.173	14	25.712	19	9.769		
	4	75	2.832	14	4.899	22	2.095		
	5	75	4.955						
	6	75	4.955	5	4.955				

APPENDIX C

PHYSICAL AND CHEMICAL DATA

STORET RETRIEVAL DATE 77/02/02

050601
33 22 37.0 091 13 22.0 3
LAKE CHICOT
05017 ARKANSAS
101192

/TYPA/AMBNT/LAKE

11EPALES 04001002
0017 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
74/03/26	12 05	0000	13.3		32	184	8.30	107	0.030	0.800	0.020	0.032
	12 05	0005	13.2	10.0		185	8.20	111	0.020	0.600	0.020	0.028
	12 05	0013	12.5	9.4		187	7.90	119	0.050	0.700	0.030	0.026
74/06/05	11 10	0000	26.1		28	290	8.20	121	0.080	0.700	0.190	0.046
	11 10	0005	26.2	7.4		294	8.10	123	0.060	0.600	0.100	0.046
	11 10	0015	25.3	0.2		310	7.35	125	0.260	0.800	0.060	0.104
74/10/16	12 10	0000	19.6	7.4	18	210	7.79	122	0.040	1.200	0.030	0.031
	12 10	0005	19.4	6.2		193	7.66	125	0.020	0.700	0.020K	0.028
	12 10	0013	19.2	5.0		208	7.44	125	0.050	0.600	0.020K	0.034

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
74/03/26	12 05	0000	0.083	30.5	
	12 05	0005	0.076		
	12 05	0013	0.094		
74/06/05	11 10	0000	0.148	30.5	
	11 10	0005	0.093		
	11 10	0015	0.160		
74/10/16	12 10	0000	0.143	29.2	
	12 10	0005	0.112		
	12 10	0013	0.149		

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 77/02/02

050602
33 20 05.0 091 16 40.0 3
LAKE CHICOT
05017 ARKANSAS
101791

/TYPA/AMBNT/LAKE

11EPALES 04001002
0020 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
74/03/26	12	25 0000	13.3		4	174	7.75	87	0.070	0.500	0.700	0.127
	12	25 0005	13.3	9.0		175	7.75	88	0.080	0.500	0.720	0.114
	12	25 0015	13.2	9.0		174	7.75	85	0.090	0.600	0.730	0.122
74/06/04	10	45 0000	26.6		3	288	7.08	81	0.110	0.700	1.450	0.096
	10	45 0005	26.5	6.5		293	7.60	91	0.080	0.400	1.940	0.097
	10	45 0015	25.9	6.6		315	7.22	80	0.110	0.500	1.950	0.100
	10	45 0023	25.3	5.4		237	7.00	71	0.120	0.700	1.850	0.098
74/10/16	11	50 0000	19.6	8.4	16	196	7.88	94	0.070	0.800	0.210	0.078
	11	50 0005	19.6	7.8		197	7.87	92	0.070	0.500	0.190	0.076
	11	50 0016	19.6	8.0		199	7.83	93	0.060	0.500	0.190	0.076

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
74/03/26	12	25 0000	0.378	3.0	
	12	25 0005	0.334		
	12	25 0015	0.308		
74/06/04	10	45 0000	0.201	4.0	
	10	45 0005	0.230		
	10	45 0015	0.195		
	10	45 0023	0.238		
74/10/16	11	50 0000	0.162	16.4	
	11	50 0004			1.0
	11	50 0005	0.148		
	11	50 0016	0.130		

STORET RETRIEVAL DATE 77/02/02

050603
33 16 25.0 091 13 15.0 3
LAKE CHICOT
05017 ARKANSAS
101792

/TYPA/AMBNT/LAKE

11EPALES 04001002
0027 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
74/03/26	12 50	0000	13.1		4	145	7.70	71	0.100	0.700	0.730	0.142
	12 50	0005	13.0	9.0		144	7.70	69	0.110	0.700	0.740	0.151
	12 50	0015	13.0	9.0		145	7.70	70	0.100	0.800	0.740	0.146
	12 50	0022	13.0	9.0		144	7.65	67	0.120	0.600	0.730	0.151
74/06/05	10 10	0000	24.7		3	281	7.45	74	0.140	1.100	1.780	0.088
	10 10	0005	24.6	5.0		264	7.16	70	0.140	0.600	1.910	0.091
	10 10	0015	23.9	3.8		183	7.31	43	0.240	0.900	1.860	0.099
	10 10	0029	23.3	3.2		166	6.80	36	0.250	1.000	1.930	0.083
74/10/16	11 20	0000	18.9	7.4	18	189	7.39	84	0.040	0.700	0.360	0.092
	11 20	0005	18.9	7.8		187	7.39	84	0.040	0.400	0.380	0.089
	11 20	0015	18.7	7.0		189	7.37	84	0.040	0.300	0.380	0.088
	11 20	0023	18.6	7.2		187	7.37	84	0.070	0.400	0.380	0.067

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
74/03/26	12 50	0000	0.395	1.6	
	12 50	0005	0.360		
	12 50	0015	0.358		
	12 50	0022	0.387		
74/06/05	10 10	0000	0.181	1.1	
	10 10	0005	0.217		
	10 10	0015	0.321		
	10 10	0029	0.321		
74/10/16	11 20	0000	0.153	7.2	
	11 20	0003			1.0
	11 20	0005	0.140		
	11 20	0015	0.152		
	11 20	0023	0.149		

APPENDIX D

TRIBUTARY DATA

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

05060A1
33 15 15.0 091 13 25.0
DITCH BAYOU
05 7.5 RED LEAF
O/CHICOT LAKE
BNK 750 FT FROM END OF DIRT ROAD
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
74/06/22	10 45		1.180	1.100	0.050	0.170	0.460
74/07/29	14 30		0.770	0.900	0.025	0.100	0.220
74/08/15	14 10		0.570	0.900	0.020	0.065	0.135
74/09/18	14 30		0.312	0.900	0.025	0.105	0.175
74/10/17	08 45		0.336	0.600	0.025	0.095	0.140
75/01/07	09 00		0.112	1.100	0.035	0.140	0.160
75/01/16	11 00		0.144	1.250	0.080	0.090	0.340
75/02/19	13 50		0.264	1.500	0.048	0.144	0.360
75/03/14	15 20		0.351	1.100	0.028	0.136	0.480
75/03/19	11 15		0.345	1.500	0.035	0.240	0.540
75/04/14	09 35		0.490	1.200	0.030	0.100	0.450
75/04/22	09 30		0.525	1.750	0.045	0.115	0.440
75/06/05	16 20		0.735	1.350	0.030	0.120	0.440

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

050681
33 17 22.0 091 10 55.0
UNNAMED CREEK
05 7.5 RED LEAF
T/CHICOT LAKE
2NDRY RD BRDG 0.5 MI SW LEVEE RD
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
74/06/22	11 20		0.040	1.100	0.065	0.185	0.450
74/07/29	14 45		0.168	1.600	0.110	0.220	0.610
74/08/15	14 00		0.300	1.500	0.090	0.155	0.500
74/09/18	15 00		0.168	1.500	0.190	0.160	0.310
74/10/17	09 00		0.088	2.000	0.130	0.290	0.440
75/01/07	08 40		0.152	1.500	0.050	0.230	0.540
75/01/16	10 30		0.040	1.200	0.064	0.080	0.250
75/02/19	13 30		0.072	1.900	0.096	0.088	0.420
75/03/14	15 00		0.185	3.300	0.271	0.136	0.910
75/03/19	11 00		0.105	2.000	0.075	0.083	0.560
75/04/14	09 15		0.510	2.800	0.105	0.162	0.860
75/04/22	09 10		0.060	1.980	0.115	0.090	0.385
75/06/05	16 05		0.055	2.150	0.080	0.065	0.440

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

0506C1
33 24 20.0 091 15 10.0
CONNERLY BAYOU
05 15 LAKE VILLAGE
T/CHICOT LAKE
2NDRY RD BRDG AT COMM OF YELLOW BAYOU
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
74/06/22	12	15	0.270	0.800	0.095	0.080	0.220
74/07/29				1.500	0.210	0.095	0.265
74/08/15	13	30	0.056	0.900	0.015	0.065	0.155
74/09/18	13	30	0.216	1.000	0.065	0.160	0.280
74/10/17	09	30	0.104	1.500	0.090	0.057	0.130
75/01/07	08	00	0.140	1.500	0.050	0.170	0.440
75/01/16	09	30	0.120	2.100	0.112	0.160	0.690
75/02/19	12	55	0.232	2.100	0.088	0.120	0.770
75/03/14	14	30	0.296	2.200	0.085	0.162	0.970
75/03/19	11	00	0.220	2.300	0.071	0.069	0.660
75/04/14	08	35	0.330	2.200	0.100	0.115	0.820
75/04/22	08	35	0.315	3.450	0.185	0.040	0.120
75/06/05	15	30	0.370	1.800	0.040	0.040	0.210

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

050601
33 22 50.0 091 13 20.0
FERRY BAYOU
05 7.5 LUNA
T/CHICOT LAKE
BRDG HWY 144 2.5 MI W HWY 257 JCT
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
74/06/22	11 50		0.016	0.700	0.025	0.080	0.180
74/07/29			0.012	0.800	0.012	0.085	0.185
74/08/15	13 40		0.012	1.100	0.025	0.100	0.280
74/09/18	14 45		0.008	0.900	0.010	0.015	0.075
74/10/17	09 15		0.256	1.600	0.065	0.170	0.630
75/01/07	08 20		0.216	1.900	0.055	0.330	0.920
75/01/16	09 45		0.072	1.000	0.032	0.055	0.140
75/02/19	13 10		0.080	1.300	0.080	0.112	0.400
75/03/14	14 45		0.120	2.700	0.060	0.170	0.630
75/03/19	10 40		0.840	2.600	0.162	0.102	0.690
75/04/14	08 50		1.500	2.600	0.180	0.180	0.840
75/04/22	08 45		0.080	1.400	0.240	0.026	0.220
75/06/05	14 45		0.025	1.150	0.030	0.038	0.120

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 CHLORA	15-MIN DO	MEDIAN DISS ORTHO P
0501	BEAVER LAKE	0.022	0.330	415.667	3.921	14.900	0.006
0502	BLACKFISH LAKE	0.424	1.470	496.125	19.775	12.000	0.090
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	3.995	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	0.089
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	NIMROD 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 CHLORA	15-MIN DO	MEDIAN DISS ORTHO 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)