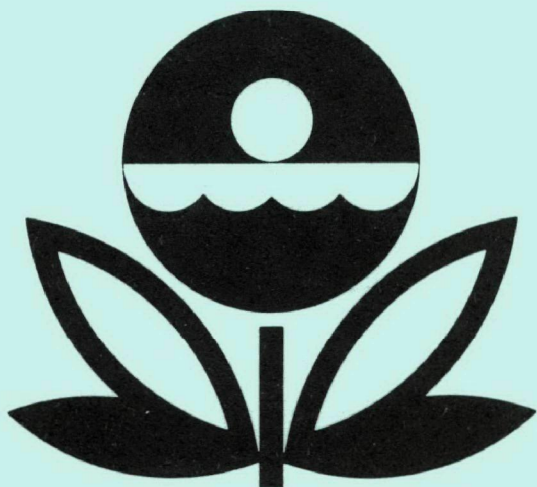


**U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL EUTROPHICATION SURVEY
WORKING PAPER SERIES**



REPORT
ON
DEGRAY RESERVOIR
CLARK AND HOT SPRING COUNTIES
ARKANSAS
EPA REGION VI
WORKING PAPER No. 485

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

REPORT
ON
DEGRAY RESERVOIR
CLARK AND HOT SPRING COUNTIES
ARKANSAS
EPA REGION VI
WORKING PAPER No. 485

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

REPORT ON DEGRAY RESERVOIR
CLARK AND HOT SPRING 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

Working Paper No. 485

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

January 1977

CONTENTS

	<u>Page</u>
Foreword	ii
List of Arkansas Study Lakes	iv
Lake and Drainage Area Map	v
<u>Sections</u>	
I. Conclusions	1
II. Lake and Drainage Basin Characteristics	4
III. Lake Water Quality Summary	6
IV. Nutrient Loadings	12
V. Literature Reviewed	18
VI. Appendices	19

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.

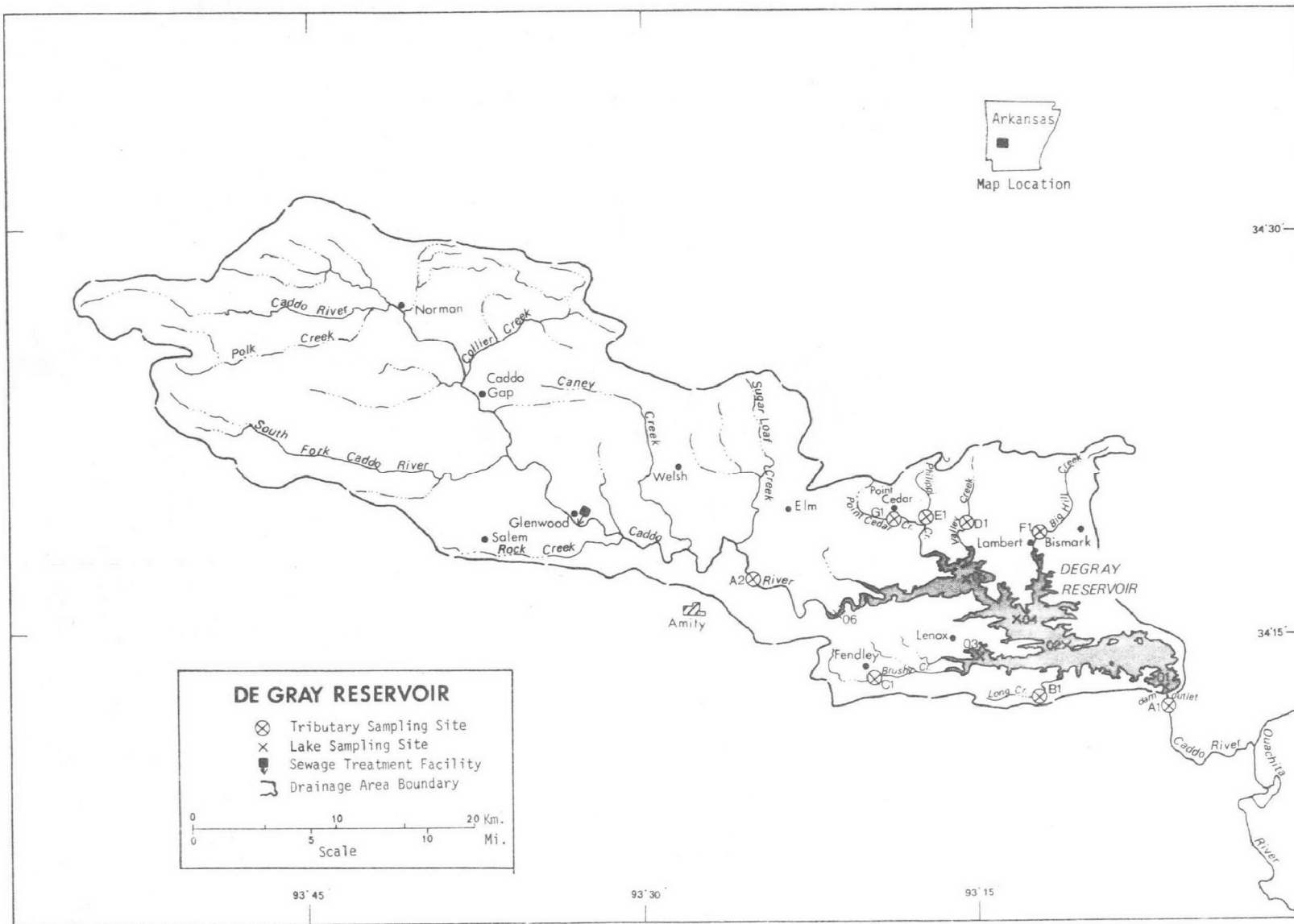
Major General Thomas C. Armstrong, the Adjutant General of Arkansas, and Project Officer Colonel Lavaun M. James, who directed the volunteer efforts of the Arkansas National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY

STUDY LAKES

STATE OF ARKANSASLAKE NAMECOUNTY

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)



REPORT ON DEGRAY RESERVOIR, ARKANSAS

STORET NO. 0507

I. CONCLUSIONS

A. Trophic Condition:

Based upon field observations and Survey data DeGray Reservoir is considered mesotrophic. Chlorophyll a values ranged from a low of 1.4 $\mu\text{g/l}$ in the spring to a high of 29.0 $\mu\text{g/l}$ in the summer with a mean of 10.1 $\mu\text{g/l}$. The mean Secchi disc reading for the lake was 205 cm (81 inches). Of the 16 Arkansas lakes sampled in 1974, 11 had greater median total phosphorus and median inorganic nitrogen values, and 13 had greater median dissolved orthophosphorus levels than DeGray Reservoir.

Survey limnologists did not observe any nuisance conditions during their visits to the lake.

B. Rate-Limiting Nutrient:

Algal assay results indicate that DeGray Reservoir is limited by available phosphorus. Spikes with phosphorus alone or nitrogen and phosphorus simultaneously resulted in increased assay yields. The addition of nitrogen alone did not produce a growth response. The ratios of total inorganic nitrogen to orthophosphorus (N/P) in the lake data suggest nitrogen limitation in the spring and phosphorus limitation in the summer and fall.

*See Appendix E

C. Nutrient Controllability:

1. Point sources -

The mean annual phosphorus load from point sources was estimated to be 10.6% of the total load reaching DeGray Reservoir. The city of Glenwood contributed this entire point source load.

The present phosphorus loading of $0.22 \text{ g P/m}^2/\text{yr}$ is less than that proposed by Vollenweider (1975) as an oligotrophic rate (see Section IV-F). However, summer chlorophyll a values in the lake (18.9 - 29.0 $\mu\text{g/l}$) indicate a much higher biological response to existing nutrient levels than would ordinarily be expected. In light of this demonstrated increase in summer lake productivity, it would be desirable to reduce phosphorus contributions from the city of Glenwood to the greatest practicable extent in order to protect the existing high water quality of DeGray Reservoir.

Loading calculations based upon available nutrient concentrations yield an apparent net export of nitrogen from the impoundment, indicating that sampling was not adequate to depict actual loading and/or export rates of that nutrient.

2. Nonpoint sources -

Nonpoint sources contributed 88.3% of the phosphorus load reaching DeGray Reservoir. Measured tributaries accounted for 64.8% of the total phosphorus load and the ungaged tributaries were estimated to contribute 15.1%.

The nonpoint phosphorus exports (Section IV-D) of the Caddo River, Whitener Creek, and Big Hill Creek are quite comparable to the exports of the unimpacted tributaries of nearby Ouachita, Hamilton, and Catherine Lakes (mean of 10 kg P/km²/yr, range of 6 to 19 kg P/km²/yr).

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: 54.23 km².
2. Mean depth: 14.9 meters.
3. Maximum depth: 60.3 meters.
4. Volume: 807.566 x 10⁶ m³.
5. Mean hydraulic retention time: 477 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 Caddo River	784.8	13.88
D-1 Whitener Creek	19.7	0.26
F-1 Big Hill Creek	18.1	0.27
Minor tributaries and immediate drainage -	<u>296.5</u>	<u>5.33</u>
Totals	1,119.1	19.74

2. Outlet - A-1 Caddo River 1,173.3 19.58

C. Precipitation:

1. Year of sampling: 169.5 cm.
2. Mean annual: 133.5 cm.

III. LAKE WATER QUALITY SUMMARY

DeGray Reservoir 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 six stations on the lake (Station 06 was not sampled the second round) 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 composited for algal assays. Maximum depths sampled were 50.6 meters at Station 01, 38.1 meters at Station 02, 9.8 meters at Station 03, 14.6 meters at Station 04, 12.2 meters at Station 05, and 9.1 meters at Station 06. 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.

PHYSICAL AND CHEMICAL CHARACTERISTICS

PARAMETER	N*	(5/ 5/72)			N*	(3/25/74)			N*	(10/16/74)		
		S*** = 5	MAX DEPTH RANGE (METERS)	MEDIAN		S*** = 6	MAX DEPTH RANGE (METERS)	MEDIAN		S*** = 6	MAX DEPTH RANGE (METERS)	MEDIAN
TEMPERATURE (DEG CENT)												
0.-1.5 M DEPTH	16	24.1- 26.4	26.0	0.0- 1.5	12	12.1- 13.3	12.6	0.0- 1.5	12	17.5- 21.3	20.0	0.0- 1.5
MAX DEPTH**	5	7.7- 18.2	12.7	9.8- 50.0	6	7.8- 12.7	10.5	9.1- 47.2	6	8.0- 19.3	14.8	7.6- 50.6
DISSOLVED OXYGEN (MG/L)												
0.-1.5 M DEPTH	7	7.8- 8.2	8.0	1.5- 1.5	6	9.0- 10.0	9.5	1.5- 1.5	12	6.2- 8.4	7.8	0.0- 1.5
MAX DEPTH**	5	0.2- 3.6	1.2	9.8- 50.0	6	4.6- 9.4	7.4	9.1- 47.2	6	0.0- 6.0	0.4	7.6- 50.6
CONDUCTIVITY (UMHOS)												
0.-1.5 M DEPTH	16	56.- 99.	95.	0.0- 1.5	12	31.- 47.	33.	0.0- 1.5	12	27.- 63.	38.	0.0- 1.5
MAX DEPTH**	5	42.- 109.	85.	9.8- 50.0	6	28.- 47.	32.	9.1- 47.2	6	35.- 109.	52.	7.6- 50.6
PH (STANDARD UNITS)												
0.-1.5 M DEPTH	16	7.4- 8.8	7.6	0.0- 1.5	12	6.9- 7.3	7.0	0.0- 1.5	12	6.2- 7.1	6.6	0.0- 1.5
MAX DEPTH**	5	6.2- 6.5	6.3	9.8- 50.0	6	6.2- 7.1	6.6	9.1- 47.2	6	6.1- 6.8	6.4	7.6- 50.6
TOTAL ALKALINITY (MG/L)												
0.-1.5 M DEPTH	10	19.- 27.	25.	0.0- 1.5	12	18.- 27.	21.	0.0- 1.5	12	19.- 37.	23.	0.0- 1.5
MAX DEPTH**	5	21.- 37.	26.	9.8- 50.0	5	16.- 26.	18.	9.1- 47.2	6	20.- 46.	31.	7.6- 50.6
TOTAL P (MG/L)												
0.-1.5 M DEPTH	10	0.013-0.028	0.018	0.0- 1.5	12	0.012-0.024	0.015	0.0- 1.5	12	0.017-0.029	0.022	0.0- 1.5
MAX DEPTH**	5	0.013-0.047	0.020	9.8- 50.0	5	0.016-0.117	0.021	9.1- 47.2	6	0.019-0.247	0.077	7.6- 50.6
DISSOLVED ORTHO P (MG/L)												
0.-1.5 M DEPTH	10	0.002-0.012	0.002	0.0- 1.5	12	0.012-0.015	0.014	0.0- 1.5	12	0.003-0.005	0.003	0.0- 1.5
MAX DEPTH**	5	0.002-0.009	0.003	9.8- 50.0	5	0.014-0.018	0.016	9.1- 47.2	6	0.003-0.031	0.005	7.6- 50.6
NO2+NO3 (MG/L)												
0.-1.5 M DEPTH	10	0.020-0.120	0.060	0.0- 1.5	12	0.050-0.140	0.095	0.0- 1.5	12	0.020-0.030	0.020	0.0- 1.5
MAX DEPTH**	5	0.060-0.300	0.280	9.8- 50.0	5	0.040-0.260	0.150	9.1- 47.2	6	0.020-0.030	0.020	7.6- 50.6
AMMONIA (MG/L)												
0.-1.5 M DEPTH	10	0.030-0.060	0.040	0.0- 1.5	12	0.020-0.060	0.030	0.0- 1.5	12	0.020-0.050	0.030	0.0- 1.5
MAX DEPTH**	5	0.050-0.520	0.090	9.8- 50.0	5	0.040-0.070	0.040	9.1- 47.2	6	0.030-2.160	0.525	7.6- 50.6
KJELDAHL N (MG/L)												
0.-1.5 M DEPTH	10	0.200-0.600	0.300	0.0- 1.5	12	0.200-0.400	0.300	0.0- 1.5	12	0.200-0.600	0.400	0.0- 1.5
MAX DEPTH**	5	0.200-0.700	0.200	9.8- 50.0	5	0.200-0.500	0.200	9.1- 47.2	6	0.200-2.400	0.950	7.6- 50.6
SECCHI DISC (METERS)												
	8	1.6- 2.3	2.1		6	0.4- 3.7	1.9		6	1.2- 3.1	2.3	

* 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>
03/25/74	1. <u>Ankistrodesmus</u>	287
	2. <u>Dynobryon</u>	223
	3. <u>Melosira</u>	191
	4. <u>Asterionella</u>	159
	5. <u>Tabellaria</u>	159
	Other genera	<u>606</u>
	Total	1,625
06/03,05/74	1. <u>Tabellaria</u>	6,083
	2. <u>Melosira</u>	1,182
	3. <u>Chroomonas</u>	634
	4. <u>Aphanizomenon</u>	317
	5. <u>Oscillatoria</u>	317
	Other genera	<u>663</u>
	Total	9,196
10/16/74	1. <u>Nitzschia</u>	238
	2. <u>Ankistrodesmus</u>	214
	3. <u>Chroomonas</u>	214
	4. <u>Mougeotia</u>	167
	5. <u>Raphidiopsis</u>	143
	Other genera	<u>1,002</u>
	Total	1,978

2. Chlorophyll a -

<u>Sampling Date</u>	<u>Station Number</u>	<u>Chlorophyll <u>a</u> ($\mu\text{g/l}$)</u>
03/25/74	01	2.6
	02	2.5
	03	3.1
	04	2.5
	05	3.0
	06	1.4
06/03/74	01	23.3
	02	29.0
	03	18.9
	04	25.3
	05	22.1
	06	----
10/16/74	01	4.4
	02	3.5
	03	3.8
	04	5.9
	05	9.7
	06	11.1

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

a. 03/25/74 - Stations 01-04

<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	0.010	0.161	0.1
0.05 P	0.060	0.161	3.8
0.05 P + 1.0 N	0.060	1.161	22.8
1.00 N	0.010	1.161	0.1

b. 03/25/74 - Stations 05-06

<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	0.005	0.088	0.1
0.05 P	0.055	0.088	3.1
0.05 P + 1.0 N	0.055	1.088	24.8
1.00 N	0.005	1.088	0.1

c. 10/16/74 - Stations 01-03

<u>Spike(mg/l)</u>	<u>Ortho P Conc.(mg/l)</u>	<u>Inorganic P Conc.(mg/l)</u>	<u>Maximum Yield (mg/l-dry wt.)</u>
Control	0.007	0.155	0.3
0.05 P	0.057	0.155	1.1
0.05 P + 1.0 N	0.057	1.155	3.8
1.00 N	0.007	1.155	0.3

d. 10/16/74 - Stations 04-06

<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	0.010	0.113	0.4
0.05 P	0.060	0.113	2.4
0.05 P + 1.0 N	0.060	1.113	10.6
1.00 N	0.010	1.113	0.4

2. Discussion -

The control yield of the assay alga, Selenastrum capricornutum, indicates that the potential for primary production was low on DeGray Reservoir during the spring and fall sampling periods. The lake was phosphorus limited at those times as indicated by the increased yield of the test alga in response to an addition of orthophosphorus. Spikes with phosphorus and nitrogen simultaneously resulted in maximum yields. Spikes with nitrogen alone did not produce a response beyond the control yield.

The mean total available inorganic nitrogen to orthophosphorus ratio in the spring lake data was 11/1, suggesting primary limitation by nitrogen. The ratios for the summer and fall data were 49/1 and 38/1, respectively, suggesting phosphorus limitation at those times (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 1974, 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 kg/km²/yr, in Whitener Creek and Big Hill Creek at Stations D-1 and F-1, and multiplying the means by the ZZ area in km².

Nutrient loads for the city of Glenwood 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>
Glenwood	1,212	Stabilization pond	0.459**	Caddo River

2. Known industrial - None

*U.S. EPA, 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 (nonpoint load) -		
A-2 Caddo River	7,395	62.9
D-1 Whitener Creek	100	0.9
F-1 Big Hill Creek	120	1.0
b. Minor tributaries and immediate drainage (nonpoint load) -	1,780	15.1
c. Known municipal STP's -		
Glenwood	1,375	11.7
d. Septic tanks* -	30	0.3
e. Known industrial - None		
f. Direct precipitation** -	<u>950</u>	<u>8.1</u>
Total	11,750	100.0

2. Output - A-1 Caddo River 10,270

3. Net annual P accumulation - 1,480

*Estimate based on 24 lakeside residences, 12 camps, and 1 park.
 **Estimated (see NES 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 (nonpoint load) -		
A-2 Caddo River	100,545	52.0
D-1 Whitener Creek	1,330	0.7
F-1 Big Hill Creek	1,920	1.0
b. Minor tributaries and immediate drainage (nonpoint load) -	25,795	13.3
c. Known municipal STP's -		
Glenwood	4,120	2.1
d. Septic tanks* -	1,135	0.6
e. Known industrial - None		
f. Direct precipitation** -	<u>58,545</u>	<u>30.3</u>
Total	193,390	100.0
2. Output - A-1 Caddo River	268,460	
3. Net annual N export*** -	75,070	

*Estimate based on 24 lakeside residences, 12 camps, and 1 park.

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

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

D. Mean Annual Nonpoint Nutrient Export by Subdrainage Area:

<u>Tributary</u>	<u>kg P/km²/yr</u>	<u>kg N/km²/yr</u>
Caddo River	9	128
Whitener Creek	5	68
Big Hill Creek	7	106

E. Mean Nutrient Concentrations in Ungaged Streams:

<u>Tributary</u>	<u>Mean Total P (mg/l)</u>	<u>Mean Total N (mg/l)</u>
B-1 Long Creek	0.022	0.238
C-1 Brushy Creek	0.020	0.414
E-1 Philippi Creek	0.015	0.364
G-1 Point Cedar Creek	0.022	0.245

Nutrient concentrations for the above tributaries are consistent with those found for the gaged tributaries entering DeGray Reservoir.

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/m²/yr)	
Estimated loading for DeGray Reservoir	0.22
Vollenweider's eutrophic loading	0.64
Vollenweider's oligotrophic loading	0.32

V. LITERATURE REVIEWED

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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 $\times$ 2.471 = acres

Kilometers $\times$ 0.6214 = miles

Meters $\times$ 3.281 = feet

Cubic meters $\times$ 8.107×10^{-4} = acre/feet

Square kilometers $\times$ 0.3861 = square miles

Cubic meters/sec $\times$ 35.315 = cubic feet/sec

Centimeters $\times$ 0.3937 = inches

Kilograms $\times$ 2.205 = pounds

Kilograms/square kilometer $\times$ 5.711 = lbs/square mile

APPENDIX B
TRIBUTARY FLOW DATA

TRIBUTARY FLOW INFORMATION FOR ARKANSAS

02/02/77

LAKE CODE 0507 DEGRAY RESERVOIR

TOTAL DRAINAGE AREA OF LAKE(SQ KM) 1173.3

TRIBUTARY	SUB-DRAINAGE AREA(SQ KM)	NORMALIZED FLOWS(CMS)												MEAN
		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
0507A1	1173.3	22.54	21.15	15.18	19.48	24.38	19.48	16.34	20.70	19.96	20.25	15.46	20.02	19.58
0507A2	784.8	18.29	24.95	26.14	27.18	26.96	5.75	3.60	3.11	2.70	3.60	9.29	15.69	13.88
0507D1	19.7	0.040	0.524	0.549	0.572	0.566	0.122	0.076	0.065	0.057	0.076	0.195	0.328	0.262
0507F1	18.1	0.351	0.479	0.501	0.521	0.518	0.110	0.068	0.059	0.051	0.068	0.178	0.300	0.266
0507ZZ	350.7	7.02	9.60	10.05	10.45	10.36	2.21	1.38	1.19	1.04	1.38	3.57	6.03	5.33

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 1173.3
SUM OF SUB-DRAINAGE AREAS = 1173.3

TOTAL FLOW IN = 237.91
TOTAL FLOW OUT = 234.94

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
0507A1	6	74	115.533	22	166.503				
	7	74	12.035	20	32.848				
	8	74	6.428	17	4.701				
	9	74	27.751	21	10.307				
	10	74	28.600	19	52.103				
	11	74	66.828	23	75.323				
	12	74	62.014	21	59.465				
	1	75	18.802	18	0.425				
	2	75	36.246	22	22.993				
	3	75	36.812	8	18.802	22	10.421		
	4	75	38.511	7	41.343	19	0.425		
	5	75	61.164	17	84.951				
0507A2	6	74	78.154	22	13.309				
	7	74	2.500	20	1.246				
	8	74	6.654	17	6.230				
	9	74	18.151	21	2.350				
	10	74	10.534	19	2.605				
	11	74	52.669	23	12.856				
	12	74	21.011	21	8.495				
	1	75	16.792	18	9.911				
	2	75	39.360	22	26.901				
	3	75	44.741	8	12.743	22	24.069		
	4	75	15.971	7	27.751	19	9.911		
	5	75	34.547	17	8.495				

TRIBUTARY FLOW INFORMATION FOR ARKANSAS

02/02/77

LAKE CODE U507 DEGRAY RESERVOIR

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
0507D1	6	74	1.962	22	0.014				
	7	74	0.062	20	0.014				
	8	74	0.167	17	0.014				
	9	74	0.456	21	0.113				
	10	74	0.263	19	0.023				
	11	74	1.331	23	0.283				
	12	74	0.527	21	0.283				
	1	75	0.422	18	0.346				
	2	75	0.985	22	0.227				
	3	75	1.121	8	0.113	22	0.566		
	4	75	0.396	7	0.680	19	0.227		
	5	75	0.866	17	0.170				
0507F1	6	74	1.807	22	0.212				
	7	74	0.057	20	0.034				
	8	74	0.153	17	0.028				
	9	74	0.419	21	0.142				
	10	74	0.244	19	0.071				
	11	74	1.218	23	0.227				
	12	74	0.484	21	0.227				
	1	75	0.388	18	0.227				
	2	75	0.906	22	0.198				
	3	75	1.034	8	0.142	22	0.311		
	4	75	0.368	7	0.623	19	0.198		
	5	75	0.799	17	0.170				
0507Z2	6	74	35.113	22	5.947				
	7	74	1.119	20	0.566				
	8	74	2.973	17	2.775				
	9	74	8.127	21	1.048				
	10	74	4.701	19	1.161				
	11	74	23.560	23	5.748				
	12	74	9.401	21	3.823				
	1	75	7.504	18	4.248				
	2	75	17.528	22	12.035				
	3	75	19.992	8	5.663	22	10.760		
	4	75	7.136	7	12.459	19	4.248		
	5	75	15.433	17	3.823				

APPENDIX C
PHYSICAL AND CHEMICAL DATA

STORET RETRIEVAL DATE 77/02/02

050701
34 12 46.0 093 06 38.0 3
DEGRAY RESERVOIR
05019 ARKANSAS

101791

/TYPA/AMBNT/LAKE

11EPALES 04001002
0200 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 CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&N03 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
72/05/05	13 70	0000	24.8		64	88	7.50					
	13 70	0005	24.1	8.0		87	7.40					
	13 70	0015	24.5	7.6		81	6.75					
	13 70	0035	15.4	5.6		72	6.40					
	13 70	0055	9.4	5.2		64	6.40					
	13 70	0100	8.0	3.8		64	6.30					
	13 70	0164	7.7	3.6		70	6.20					
74/03/25	13 40	0000	12.5		14	33	7.00	19	0.030	0.400	0.140	0.014
	13 40	0005	12.1	9.8		31	7.00	18	0.020	0.300	0.140	0.012
	13 40	0045	9.0	8.6		27	6.60	15	0.030	0.200	0.190	0.012
	13 40	0070	8.5	8.0		27	6.50	14	0.040	0.200	0.210	0.007
	13 40	0155	8.0	6.0		28	6.30	16	0.040	0.500	0.260	0.018
74/06/05	13 10	0000	24.8		64	88	7.50	24	0.060	0.600	0.060	0.012
	13 10	0005	24.1	8.0		87	7.40	23	0.040	0.200	0.050	0.009
	13 10	0015	24.5	7.6		81	6.75	29	0.050	0.200K	0.060	0.009
	13 10	0035	15.4	5.6		72	6.40	24	0.040	0.200K	0.240	0.003
	13 10	0055	9.4	5.2		64	6.40	25	0.050	0.200K	0.270	0.007
	13 10	0100	8.0	3.8		64	6.30	26	0.040	0.200K	0.310	0.002
	13 10	0164	7.7	3.6		70	6.20	27	0.090	0.200K	0.300	0.002
74/10/16	16 00	0000	20.6	8.0	122	27	6.61	22	0.040	0.600	0.020K	0.003
	16 00	0005	20.6	8.0		27	6.49	20	0.020K	0.400	0.020K	0.003
	16 00	0020	20.0	8.2		25	6.31	19	0.020K	0.400	0.020K	0.004
	16 00	0040	15.9	0.6		9	5.59	24	0.020	0.400	0.020K	0.004
	16 00	0050	11.5	0.6		8	5.76	22	0.020K	0.300	0.220	0.002
	16 00	0070	8.8	2.0		11	5.87	22	0.020K	0.200K	0.270	0.003
	16 00	0100	8.0	1.4		69	5.91	22	0.020K	0.200	0.300	0.002
	16 00	0120	7.8	0.6		10	5.97	23	0.030	0.200K	0.300	0.002
	16 00	0140	7.9	0.4		27	6.33	30	0.240	0.400	0.150	0.002
	16 00	0166	8.0	0.4		43	6.57	46	0.700	1.000	0.020	0.003

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 77/02/02

050701
34.12 46.0 093 06 38.0 3
DEGRAY RESERVOIR
05019 ARKANSAS

101791

/TYP/AMBNT/LAKE

11EPALES 04001002
0200 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
72/05/05	13 70	0000		23.3	
74/03/25	13 40	0000	0.014	2.6	
	13 40	0005	0.012		
	13 40	0045	0.011		
	13 40	0070	0.010		
	13 40	0155	0.117		
74/06/05	13 10	0000	0.019	23.3	
	13 10	0005	0.016		
	13 10	0015	0.015		
	13 10	0035	0.012		
	13 10	0055	0.009		
	13 10	0100	0.009		
	13 10	0164	0.020		
74/10/16	16 00	0000	0.021	4.4	
	16 00	0005	0.017		
	16 00	0012			1.0
	16 00	0020	0.012		
	16 00	0040	0.019		
	16 00	0050	0.010		
	16 00	0070	0.009		
	16 00	0100	0.010		
	16 00	0120	0.011		
	16 00	0140	0.013		
	16 00	0166	0.061		

STORET RETRIEVAL DATE 77/02/02

050702
34 14 37.0 093 10 59.0 3
DEGRAY RESERVOIR
05019 ARKANSAS

101791

/TYP/AMNT/LAKE

11EPALES 04001002
0119 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
74/03/25	14 10	0000	13.1		121	31	7.00	20	0.030	0.400	0.120	0.014
	14 10	0005	12.6	10.0		31	7.00	25	0.020	0.300	0.120	0.014
	14 10	0050	9.9	6.4		29	6.60	25	0.030	0.200	0.180	0.014
	14 10	0110	7.8	4.6		29	6.20	23	0.040	0.200	0.250	0.016
74/06/03	15 37	0000	26.3		84	56	8.80	22	0.040	0.500	0.020	0.003
	15 37	0005	26.2	7.8		56	8.30	18	0.030	0.400	0.030	0.003
	15 37	0020	23.1	3.4		55	6.90	22	0.040	0.400	0.050	0.002K
	15 37	0035	15.7	4.2		44	6.60	19	0.020	0.200	0.210	0.002K
	15 37	0050	11.3	2.8		43	6.50	19	0.020	0.300	0.250	0.002
	15 37	0075	8.5	2.2		38	6.50	19	0.040	0.300	0.290	0.003
	15 37	0125	7.7	1.4		42	6.40	21	0.050	0.400	0.280	0.002
74/10/17	14 35	0000	19.7	7.4	96	33	6.38	23	0.020K	0.300	0.020K	0.003
	14 35	0005	19.7	7.4		35	6.33	22	0.020	0.200K	0.020K	0.004
	14 35	0020	19.6	7.0		29	6.15	22	0.020	0.200K	0.020K	0.004
	14 35	0035	19.1	6.4		25	5.77	21	0.030	0.200K	0.020K	0.003
	14 35	0040	15.9	0.2		33	5.91	26	0.090	0.200K	0.020K	0.008
	14 35	0050	11.6	0.4		27	5.97	24	0.100	0.200K	0.020K	0.008
	14 35	0060	9.8	0.4		27	6.09	26	0.200	0.200K	0.020K	0.023
	14 35	0070	9.0	0.2		31	6.21	26	0.260	0.400	0.020K	0.041
	14 35	0096	8.4	0.2		37	6.31	30	0.350	0.600	0.020K	0.031

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 77/02/02

050702

34 14 37.0 093 10 59.0 3

DEGRAY RESERVOIR

05019 ARKANSAS

101791

/TYP/AMBNT/LAKE

11EPALES 04001002

0119 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
74/03/25	14 10	0000	0.016	2.5	
	14 10	0005	0.014		
	14 10	0050	0.015		
	14 10	0110	0.016		
74/06/03	15 37	0000	0.024	29.0	
	15 37	0005	0.022		
	15 37	0020	0.022		
	15 37	0035	0.016		
	15 37	0050	0.015		
	15 37	0075	0.017		
	15 37	0125	0.047		
74/10/17	14 35	0000	0.018	3.5	
	14 35	0005	0.019		
	14 35	0013			1.0
	14 35	0020	0.018		
	14 35	0035	0.023		
	14 35	0040	0.022		
	14 35	0050	0.020		
	14 35	0060	0.038		
	14 35	0070	0.054		
	14 35	0096	0.093		

STORET RETRIEVAL DATE 77/02/02

050703
34 14 15.0 093 14 56.0 3
DEGRAY RESERVOIR
05019 ARKANSAS

/TYP/AMBNT/LAKE

11EPALES 04001002
0034 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
74/03/25	14 30	0000	13.3		84	31	6.90	23	0.030	0.400	0.110	0.014
	14 30	0005	12.9	9.2		31	6.90	21	0.040	0.300	0.110	0.014
	14 30	0030	12.7	9.4		31	6.80					
74/06/05	14 55	0000	26.4		80	95	7.60	25	0.050	0.200	0.120	0.002
	14 55	0005	26.2	8.0		94	7.55	24	0.040	0.200	0.070	0.002
	14 55	0015	24.6	4.2		88	6.50	25	0.110	0.200	0.120	0.005
	14 55	0025	21.2	1.0		86	6.50	24	0.070	0.200K	0.160	0.002K
	14 55	0032	18.2	1.0		86	6.35	26	0.090	0.200K	0.180	0.003
74/10/17	14 10	0000	19.6	6.6	84	33	6.19	21	0.030	0.500	0.020K	0.004
	14 10	0003	19.6	6.2		33	6.19					
	14 10	0005						19	0.020K	0.300	0.020K	0.003
	14 10	0020	19.4	6.0		33	6.09	20	0.020	0.200K	0.020K	0.003
	14 10	0030	19.3	6.0		35	6.09	20	0.030	0.200	0.020K	0.003

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLORPHYL A UG/L	00031 INCDT LT REMNING PERCENT
74/03/25	14 30	0000	0.015	3.1	
	14 30	0005	0.014		
74/06/05	14 55	0000	0.023	18.9	
	14 55	0005	0.028		
	14 55	0015	0.016		
	14 55	0025	0.017		
	14 55	0032	0.016		
74/10/17	14 10	0000	0.024	3.8	
	14 10	0005	0.026		
	14 10	0013			1.0
	14 10	0020	0.020		
	14 10	0030	0.019		

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 77/02/02

050704
34 15 34.0 093 13 07.0 3
DEGRAY RESERVOIR
05019 ARKANSAS

101791

/TYP/AMBNT/LAKE

11EPALES 04001002
0052 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
72/05/05	15 25	0000	26.0		90	98	7.60					
	15 25	0005	25.9	8.2		95	7.70					
	15 25	0015	25.4	7.4		91	7.30					
	15 25	0030	17.6	1.4		82	6.35					
	15 25	0048	12.7	1.2		85	6.30					
72/06/05	15 25	0000	26.0		90	98	7.60					
	15 25	0005	25.9	8.2		95	7.70					
	15 25	0015	25.4	7.4		91	7.30					
	15 25	0030	17.6	1.4		82	6.35					
	15 25	0048	12.7	1.2		85	6.30					
74/03/25	14 40	0000	12.8		144	34	7.25	22	0.030	0.300	0.080	0.014
	14 40	0005	12.6	10.0		33	7.25	19	0.040	0.300	0.080	0.015
	14 40	0045	10.2	8.0		32	6.65	18	0.040	0.200	0.150	0.015
74/06/05	15 25	0000	26.0		90	98	7.60	25	0.040	0.400	0.060	0.002K
	15 25	0005	25.9	8.2		95	7.70	25	0.040	0.200	0.040	0.002K
	15 25	0015	25.4	7.4		91	7.30	28	0.040	0.200	0.070	0.003
	15 25	0030	17.6	1.4		82	6.35	24	0.050	0.200K	0.200	0.004
	15 25	0048	12.7	1.2		85	6.30	26	0.070	0.200K	0.280	0.005
74/10/17	15 25	0000	20.0	7.8	96	41	6.59	26	0.030	0.400	0.020K	0.005
	15 25	0005	20.0	7.6		41	6.58	23	0.020K	0.300	0.020K	0.004
	15 25	0015	19.7	7.2		39	6.45	25	0.040	0.200	0.020K	0.008
	15 25	0025	19.6	6.6		39	6.37	25	0.030	0.200K	0.020K	0.005
	15 25	0035	18.9	2.8		49	6.12	28	0.460	0.500	0.020	0.011
	15 25	0046	13.7	0.0		61	6.35	31	0.730	1.900	0.020K	0.009

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 77/02/02

050704
34 15 34.0 093 13 07.0 3
DEGRAY RESERVOIR
05019 ARKANSAS

101791

/TYPA/AMBNT/LAKE

11EPALES 04001002
0052 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
72/05/05	15 25	0000		25.3	
72/06/05	15 25	0000		25.3	
74/03/25	14 40	0000	0.014	2.5	
	14 40	0005	0.015		
	14 40	0045	0.021		
74/06/05	15 25	0000	0.013	25.3	
	15 25	0005	0.017		
	15 25	0015	0.014		
	15 25	0030	0.022		
	15 25	0048	0.013		
74/10/17	15 25	0000	0.023	5.9	
	15 25	0001			50.0
	15 25	0005	0.022		
	15 25	0011			1.0
	15 25	0015	0.022		
	15 25	0025	0.023		
	15 25	0035	0.039		
	15 25	0046	0.247		

STORET RETRIEVAL DATE 77/02/02

050705
34 17 11.0 093 15 21.0 3
DEGRAY RESC VOIR
05059 ARKANSAS

101791

/TYPA/AMBNT/LAKE

11EPALES 04001002
0040 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
74/03/25	15 00	0000	12.6		66	35	7.05	18	0.030	0.300	0.070	0.014
	15 00	0005	12.4	9.2		36	7.00	18	0.030	0.200	0.060	0.013
	15 00	0035	10.8	6.8		36	6.55	16	0.060	0.200	0.120	0.014
74/06/05	16 00	0000	26.2		68	99	7.90	27	0.050	0.400	0.100	0.004
	16 00	0005	26.0			98	8.30	25	0.040	0.200	0.060	0.002K
	16 00	0012	25.7	7.4		96	7.60	26	0.060	0.200	0.070	0.004
	16 00	0020	22.2			90	6.60	25	0.540	0.700	0.060	0.009
	16 00	0040	14.4	0.2		109	6.50	37	0.520	0.700	0.060	0.009
74/10/17	15 50	0000	21.3	8.0	66	51	6.79	29	0.030	0.500	0.020K	0.004
	15 50	0005	20.9	7.8		51	6.81	26	0.050	0.200	0.020K	0.003
	15 50	0020	19.7	6.4		49	6.49	24	0.050	0.200K	0.020K	0.003
	15 50	0030	19.5	4.0		49	6.47	23	0.780	1.200	0.020K	0.004
	15 50	0039	15.8	0.4		109	6.45	31	2.160	2.400	0.030	0.006

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 77/02/02

050705

34 17 11.0 093 15 21.0 3

DEGRAY RESERVOIR

05059 ARKANSAS

101791

/TYP/AMBNT/LAKE

11EPALES 04001002

0040 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
74/03/25	15 00	0000	0.019	3.0	
	15 00	0005	0.020		
	15 00	0035	0.017		
74/06/05	16 00	0000	0.016	22.1	
	16 00	0005	0.016		
	16 00	0012	0.017		
	16 00	0020	0.038		
	16 00	0040	0.039		
74/10/17	15 50	0000	0.028	9.7	
	15 50	0005	0.029		
	15 50	0020	0.020		
	15 50	0030	0.028		
	15 50	0039	0.045		

STORET RETRIEVAL DATE 77/02/02

.050706
34 15 41.0 093 21 22.0 3
DEGRAY RESERVOIR
05019 ARKANSAS

191791

/TTPA/AMBNT/LAKE

11EPALES 04001002
0036 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	01077 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 ORTH0 MG/L P
74/03/25	15 15	0000	12.6		48	47	7.25	27	0.050	0.200	0.060	0.015
	15 15	0005	12.4	9.0		47	7.15	27	0.060	0.200	0.050	0.014
	15 15	0030	12.3	8.8		47	7.15	26	0.070	0.200	0.040	0.016
74/10/17	16 15	0000	21.2	8.4	48	63	7.15	37	0.050	0.500	0.030	0.004
	16 15	0005	17.5	7.8		63	6.91	35	0.030	0.400	0.020K	0.003
	16 15	0015	19.3	7.2		61	6.83	38	0.020	0.400	0.020K	0.004
	16 15	0025	19.0	6.0		67	6.81	36	0.060	0.900	0.020K	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
74/03/25	15 15	0000	0.024	1.4	
	15 15	0005	0.022		
	15 15	0030	0.026		
74/10/17	16 15	0000	0.025	11.1	
	16 15	0005	0.022		
	16 15	0006			1.0
	16 15	0015	0.022		
	16 15	0025	0.243		

K VALUE KNOWN TO BE
LESS THAN INDICATED

APPENDIX D

TRIBUTARY DATA

SYDNEY RETRIEVAL DATE 75/11/26
 NATL EUTROPHICATION SURVEY
 EPA- LAS VEGAS

050741
 34 12 30.0 093 06 30.0
 CAJON RIVER
 05 CLARK CO HWY MAP
 J/DEGRAY RES
 SEC 37 RPTS .8 MI DOWNSTPM FFM DEGRAY DAM
 11EPALES 2111204
 4 0000 FEET DEPTH

DATE	TIME	DEPTH	00630 NH3-N MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS P MG/L P	00665 PHOS-TOT MG/L P
74/06/22	14 10		0.040	0.200	0.015	0.005	0.020
74/07/20	10 25		0.040	0.200	0.010	0.005	0.010
74/08/17	10 25		0.004	0.200	0.010	0.005K	0.005
74/09/21	10 20		0.044	0.200	0.010	0.005K	0.020
74/10/19	09 10		0.015	0.100	0.015	0.005K	0.050K
74/12/21	10 31		0.048	0.300	0.052	0.005K	0.010K
75/01/18	10 15		0.072	0.200	0.056	0.005	0.025
75/02/22	09 59		0.184	0.200	0.016	0.010	0.013
75/03/08	10 16		0.168	0.200	0.016	0.008K	0.010K
75/03/22	10 00		0.175	0.300	0.018	0.005K	0.010
75/04/07	10 03		0.080	0.800	0.025	0.010	0.020
75/04/19	10 10		0.145	0.300	0.030	0.005	0.010K
75/05/17	10 06		0.085	1.600	0.035	0.005K	0.020

— K VALUE KNOWN TO BE LESS THAN —
 INDICATED

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

J50712
 34 17 05.0 093 24 57.0
 CADDY PIVER
 05 7.5 AMITY
 T/DEGRAY RES
 BRDG HWY 84 3.25 MI NE OF AMITY
 11EPALES 2111204
 4 0000 FEET DEPTH

DATE	TIME	DEPTH	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
FROM	OF	FEET					
TO	DAY						
74/06/22	11	50	0.020	0.100K	0.015	0.005	0.020
74/07/20	09	20	0.008	0.300	0.020	0.010	0.025
74/08/17	09	20	0.004	0.100K	0.005	0.029	0.050
74/09/21	09	15	0.060	0.250	0.025	0.010	0.020
74/10/19	08	05	0.008	0.200	0.020	0.010	0.020
74/12/21	09	42	0.096	0.100K	0.015	0.010	0.010
75/01/18	09	05	0.072	0.100K	0.032	0.015	0.017
75/02/22	09	00	0.032	0.100K	0.008		0.010K
75/03/08	09	22	0.008	0.200	0.015	0.008K	0.010K
75/03/22	08	50	0.070	0.150	0.009	0.006	0.020
75/04/07	08	56	0.005	0.050K	0.015	0.005K	0.020
75/04/19	09	10	0.005	0.300	0.015	0.005	0.010
75/05/17	09	12	0.065	0.600	0.010	0.009	0.040

— K VALUE KNOWN TO BE LESS THAN —
 INDICATED

STORET RETRIEVAL DATE 75/11/23
 NATL EUTROPHICATION SURVEY
 EPA- LAS VEGAS

050731
 34 12 40.0 193 12 15.0
 LONG CREEK
 05 7.5 DEGRAY
 T/DEGRAY RES
 BRDG SKYLINE OF RD OLD TRAM RD JCT
 11EPALES 2111204
 4 0000 FEET DEPTH

DATE	TIME	DEPTH	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS OPTHD MG/L P	00665 PHOS-TOT MG/L P
FROM	OF						
TO	DAY	FEET					
74/06/22	13	30	0.004	0.100	0.020	0.005K	0.020
74/09/21	10	35	0.072	0.200	0.050	0.010	0.030
74/10/19	08	55	0.008	0.100	0.015	0.005K	0.020
74/12/21	10	18	0.008	0.100K	0.015	0.005	0.010K
75/01/18	10	00	0.008	0.100K	0.016	0.005	0.022
75/02/22	09	46	0.008	0.100K	0.016	0.016	0.030
75/03/08	10	03	0.006	0.100K	0.018	0.005K	0.015
75/03/22	09	50	0.009	0.100	0.030	0.005	0.010
75/04/07	09	25	0.005	0.100	0.020	0.005	0.020
75/04/19	10	00	0.005	0.500	0.025	0.005K	0.020
75/05/17	09	45	0.015	0.450	0.100	0.025	0.030

K VALUE KNOWN TO BE LESS THAN
 INDICATED

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

050701
 36 08 55.0 093 58 27.0
 WHITENESS CREEK
 05 1.5 POINT CEDAR
 T/DEGRAY DES
 3NK 150 FT S SEC RD 4 M SW OF SPPG VLY
 11EPALES 2111204
 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 ORTHOP MG/L P	00665 PHOS-TOT MG/L P
74/06/22	09	40	0.016	0.100K	0.015	0.010	0.015
74/07/20	08	40	0.012	0.100K	0.010	0.010	0.010
74/08/17	08	45	0.004	0.100K	0.010	0.005	0.005
74/09/21	08	00	0.015	0.100	0.010	0.005K	0.010
74/10/19	07	20	0.008	0.100K	0.010	0.005K	0.010K
74/12/21	09	10	0.008	0.100K	0.010	0.005	0.010
75/01/18	08	30	0.010	0.150	0.008	0.005	0.010
75/02/22	08	35	0.010	0.100	0.008K	0.005K	0.010K
75/03/08	08	55	0.008	0.300	0.010	0.008K	0.030
75/03/22	08	15	0.009	0.050K	0.005K	0.005K	0.010
75/04/07	08	19		0.400	0.005	0.005K	0.020
75/04/19	08	35	0.010	0.200	0.010	0.005K	0.010K
75/05/17	08	35	0.020	0.250	0.015	0.006	0.020

K VALUE KNOWN TO BE LESS THAN
 INDICATED

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

050701
 34 13 30.0 093 19 41.0
 BRUSHY CREEK
 05 15 ANTOINE
 T/DEGRAY RES
 BRDG HWY 8 0.75 MI N SKYLINE DR JCT
 11EPALES 2111294
 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	00605 PHOS-TOT MG/L P
74/06/22	13 35		0.128	1.100	0.040		
74/09/21	09 45		0.088	0.200	0.010	0.005	0.025
74/10/19	08 37		0.016	0.100	0.005	0.005K	0.020
74/12/21	10 01		0.056	0.100	0.010	0.005	0.020
75/01/18	09 35		0.091	0.100K	0.005	0.009	0.020
75/02/22	09 30		0.056	0.100K	0.016	0.016	0.016
75/03/08	09 50		0.024	0.200	0.024	0.008K	0.020
75/03/22	09 30		0.049	0.250	0.010	0.005	0.020
75/04/07	09 08		0.185	0.050K	0.025	0.010	0.010
75/04/19	09 40		0.030	0.500	0.035	0.005	0.020
75/05/17	09 36		0.120	0.350	0.020	0.010	0.030

K VALUE KNOWN TO BE LESS THAN
 INDICATED

START RETRIEVAL DATE 75/11/23
 NATL EUTROPHICATION SURVEY
 EPA- LAC VEGAS

0507E1
 3+ 19 25.0 093 17 20.0
 PHILIPPI CREEK
 05 7.5 POINT CEDAR
 T/DEGRAY RES
 2NDARY TO BRDG 0.9 MI S HWY 84 JCT
 TLEPALES 2111204
 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2EN03 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHOP MG/L P	00665 PHOS-TOT MG/L P
74/06/22	10 15		0.056	0.100	0.015	0.005	0.015
74/07/20	08 55		0.036	1.100	0.315	0.010	0.010
74/08/17	09 00		0.040	0.100K	0.010	0.005K	0.005K
74/09/21	08 50		0.036	0.500	0.020	0.005	0.020
74/10/19	07 35		0.008	0.100K	0.010	0.005	0.006
75/01/19	08 40		0.064	0.100K	0.008K	0.005	0.020
75/02/22	08 45		0.048	0.100	0.008	0.008	0.010K
75/03/08	09 02		0.016	0.200	0.012	0.016	0.016
75/03/22	08 25		0.046	0.250	0.005K	0.005K	0.010
75/04/07	08 27			0.100	0.005K	0.005K	0.020
75/04/19	08 45		0.030	0.225	0.010	0.005K	0.015
75/05/17	08 45		0.070	0.100	0.010	0.010	0.020

— K VALUE KNOWN TO BE LESS THAN —
 INDICATED

SYNTHETIC DATA 7/11/73
NATL BUREAU OF STANDARDS
EPA- L-10-100

053771
34 13 37.0 003 12 17.1
BIG HILL CREEK
00 7.5 15.00K
T/DEBRAY RES
ZENERY 1 0000 0.5 MG/L OF LAMBERT
LAPALLES 2111204
4 0000 FEET DEPTH

DATE	TIME	DEPTH	00650	00625	00610	00671	00685
TO	OF	FEET	MG/L	MG/L	MG/L	MG/L P	MG/L P
74/06/22	09	15	0.052	0.100K	0.020	0.005	0.010
74/07/20	08	30	0.088	0.100K	0.025	0.005	0.010
74/08/17	08	30	0.072	0.100	0.007	0.010	0.025
74/09/21	08	25	0.064	0.200	0.010	0.005	0.015
74/10/19	07	15	0.015	0.100K	0.010	0.020	0.020
74/12/21	08	50	0.096	0.100K	0.010	0.005K	0.010
75/01/18	08	15	0.136	0.100K	0.024	0.005K	0.020
75/02/22	08	25	0.080	0.100K	0.040	0.008K	0.010K
75/03/08	08	43	0.050	0.100	0.016	0.016	0.016
75/03/22	08	10	0.098	0.050K	0.005K	0.005K	0.010
75/04/07	08	07		0.550	0.005K	0.005K	0.020
75/04/19	08	30	0.065	0.250	0.025	0.005	0.010K
75/05/17	08	24	0.095	0.400	0.015	0.010	0.020

K VALUE KNOWN TO BE LESS THAN
INDICATED

STATION ELEVATION DATE 75/11/28
 NAME OF TREATMENT SURVEY
 ROAD LINE VESSEL

050731
 34 19 25.0 093 18 25.0
 POINT OF DEPARTURE
 05 7.5 POINT OF DEPARTURE
 T/DEBRAY RESERVATION
 2/03/20 0.3 MY S HWY 84 JCT
 LLEPALES 2111204
 0000 FEET DEPTH

DATE	TIME	DEPTH	00630	00625	00610	00671	00605
TIME	DAY	FEET	MG/L	MG/L	MG/L	MG/L P	MG/L P
74/06/22	11 05		0.024	0.100K	0.020	0.005K	0.020
74/09/21	09 00		0.032	0.300	0.020	0.005K	0.020
74/10/19	07 45		0.008	0.100K	0.020	0.005	0.010K
74/12/21	09 25		0.016	0.200	0.015	0.005	0.020
75/01/18	08 50		0.040	0.200	0.016	0.005	0.040
75/02/22	08 50		0.024	0.200	0.016	0.016	0.016
75/03/08	09 10		0.012	0.300	0.016	0.005K	0.020
75/03/22	08 30		0.022	0.100	0.005K	0.005K	0.020
75/04/07	08 34			0.100	0.005K	0.005K	0.020
75/04/19	09 50		0.010	0.150	0.010	0.005	0.020
75/05/17	09 00		0.055	0.300	0.010	0.005	0.020

— K VALUE KNOWN TO BE LESS THAN —
 INDICATED

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 CHLOROP	15- MIN DU	MEDIAN DISS OPTHO P
0501	HEAVER LAKE	0.022	0.330	415.557	3.921	14.900	0.006
0502	BLACKFISH LAKE	0.424	1.470	496.125	17.775	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	343.964	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	446.000	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	384.144	4.344	15.000	0.006
0515	TABLE ROCK LAKE	0.022	0.350	410.778	9.103	15.000	0.007
0516	GHEER'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)	7 (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)	90 (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	DEGPAY 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)