

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



REPORT
ON
CROSS LAKE
CADDO PARISH
LOUISIANA
EPA REGION VI
WORKING PAPER No. 538

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

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ON
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WITH THE COOPERATION OF THE
LOUISIANA WILD LIFE AND FISHERIES COMMISSION
AND THE
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REPORT ON CROSS LAKE
CADDY PARISH, LOUISIANA
EPA REGION VI

by
National Eutrophication Survey
Water and Land Quality Branch
Monitoring Operations Division
Environmental Monitoring & Support Laboratory
Las Vegas, Nevada

and

Special Studies Branch
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Corvallis, Oregon

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CONTENTS

	<u>Page</u>
Foreword	ii
List of Louisiana 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	13
V. Literature Reviewed	19
VI. Appendices	20

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 Louisiana Wild Life and Fisheries Commission, Division of Water Pollution Control for professional involvement, to the Louisiana National Guard for conducting the tributary sampling phase of the Survey, and to those Louisiana wastewater treatment plant operators who provided effluent samples and flow data.

Robert A. Lafleur, Chief; J. Dale Givens, Assistant Chief; Lewis R. Still, Biologist; Louis Johnson, Biologist; Lee Cau-barreaux, Biologist; Darrell Reed, Engineer; Dempsey Alford, Biologist; and Elwood Goodwin, Water Quality Control Technician, all of the Louisiana Wild Life and Fisheries Commission, Division of Water Pollution Control reviewed the preliminary reports and provided critiques most useful in the preparation of this Working Paper Series.

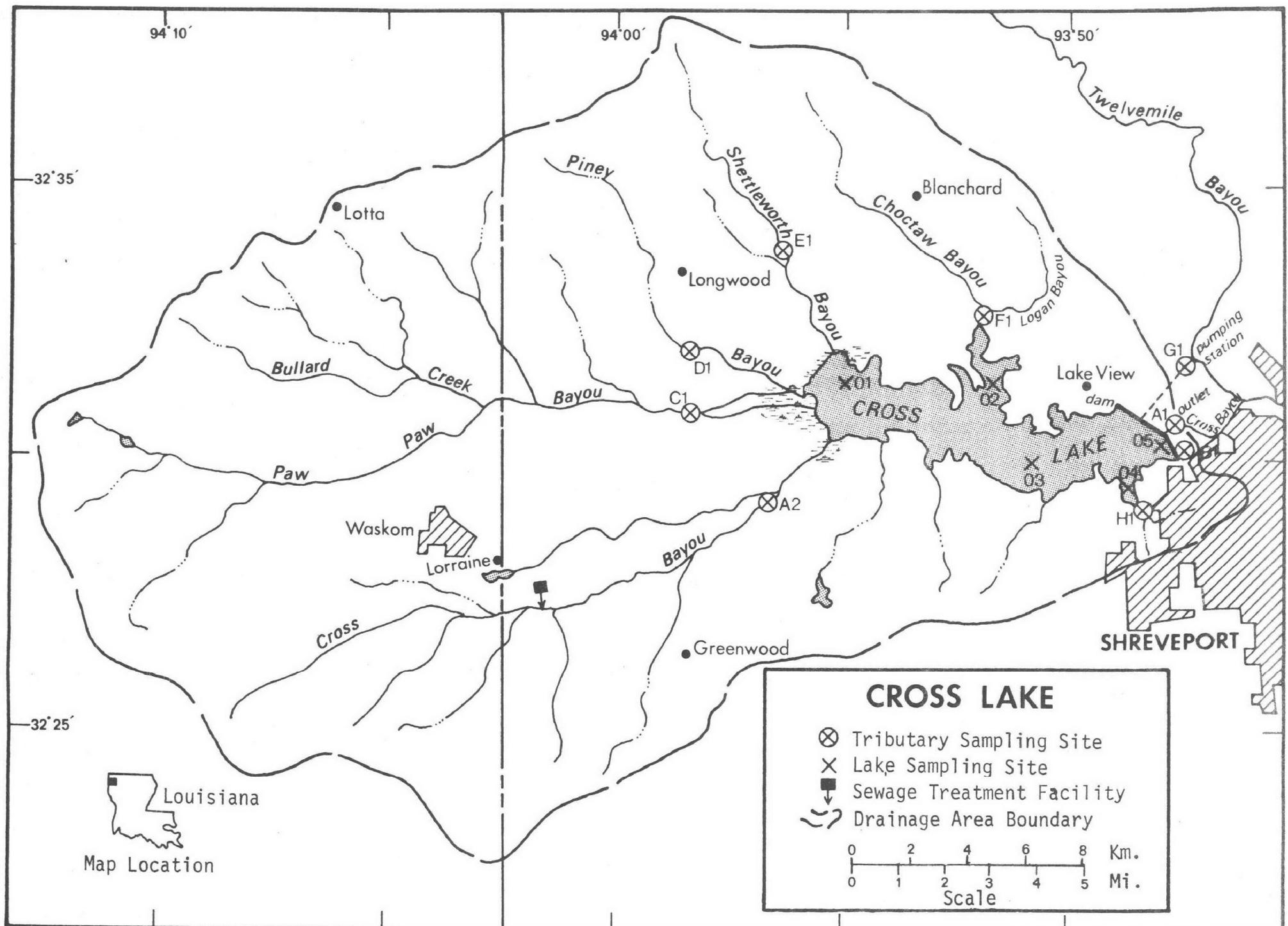
Major General O'Neil Daigle, Jr., the Adjutant General of Louisiana, and Project Officer Colonel Lawrence P. Dupre, who directed the volunteer efforts of the Louisiana National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY

STUDY LAKES

STATE OF LOUISIANA

<u>LAKE NAME</u>	<u>PARISH</u>
Anacoco Lake	Vernon
Lake Bistineau	Bienville, Webster
Black Bayou	Caddo
Black Lake	Natchitoches and Red River
Bruin Lake	Tensas
Bundick Lake	Beauregard
Caddo Lake	Caddo (Menon and Harrison in Texas)
Cocodrie Lake	Concordia
Cocodrie Lake (Lower)	Rapides
Concordia Lake	Concordia
Cotile Lake	Rapides
Cross Lake	Caddo
D'Arbonne Lake	Union
False River Lake	Pointe Coupee
Indian Creek Reservoir	Rapides
Saline Lake	LaSalle
Turkey Creek Lake	Franklin
Lake Vernon	Vernon
Lake Verret	Assumption



REPORT ON CROSS LAKE, LOUISIANA
STORET NO. 2210

1. CONCLUSIONS

A. Trophic Condition:*

Survey data indicate that Cross Lake is 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 the lake.

Chlorophyll a levels ranged from 8.7 µg/l in March to 73.8 µg/l in June with a mean of 38.4 µg/l. Potential for primary production as measured by algal assay control yield was high. Of the 19 Louisiana lakes studied in 1974, 10 had greater median total phosphorus, 12 had greater median dissolved orthophosphorus, and 14 had greater median inorganic nitrogen than Cross Lake.

Survey limnologists reported algal blooms in August and November. Ketelle and Uttermark (1971) state that Cross Lake had past problems with brine from oil field operations, but that this problem has been greatly curtailed.

*See Appendix E.

B. Rate-Limiting Nutrient:

Algal assay results indicate that Cross Lake was limited by available phosphorus levels during spring and autumn sampling. The addition of phosphorus alone or nitrogen and phosphorus simultaneously resulted in increases in assay yield. No growth response accompanied additions of nitrogen alone. Mean inorganic nitrogen to orthophosphorus (N/P) ratios for the lake data, however, were 13/1 or less on all four sampling occasions, suggesting nitrogen limitation.

C. Nutrient Controllability:

1. Point sources -

The mean annual phosphorus load from point sources was estimated to be approximately 14.6% of the total load reaching Cross Lake. The city of Waskom contributed this entire point source load.

The annual phosphorus loading of 0.34 g P/m²/yr for Cross Lake is less than Vollenweider's (1975) eutrophic level but greater than the oligotrophic level. However, loading for at least one of the ungauged tributaries of Cross Lake was probably underestimated (see Section IV-E). Any addition to the existing phosphorus loading of this lake should be carefully evaluated until a complete nutrient budget for the lake can be determined.

2. Nonpoint sources -

The phosphorus load from nonpoint sources was 85.4% of the total reaching the lake during the sampling year. Cross Bayou contributed 14.3%, Paw Paw Bayou contributed 26.4%, and the ungaged tributaries and immediate drainage were estimated to have contributed 27.2% of the nonpoint source phosphorus load. Loading calculations for Cross Lake yield a net export of nitrogen, indicating sampling and/or estimation procedures were not adequate to depict actual nitrogen loading and export rates.

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 State of Louisiana; tributary flow data were provided by the Louisiana 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.

A. Lake Morphometry:

1. Surface area: 35.77 km^2 .
2. Mean depth: 2.7 meters.
3. Maximum depth: 3.3 meters.
4. Volume: $95.719 \times 10^6 \text{ m}^3$.
5. Mean hydraulic retention time: 180 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 Cross Bayou	132.9	0.99
C-1 Paw Paw Bayou	208.5	1.54
E-1 Shettleworth Bayou	25.5	0.19
F-1 Logan Bayou	48.7	0.37
Minor tributaries and immediate drainage -	<u>205.1</u>	<u>1.78</u>
Totals	620.7	4.87
2. Outlets -		
A-1 Cross Bayou	655.3	4.85
B-1 Shreveport Municipal Water Supply Intake	<u>0.0</u>	<u>1.30</u>
Totals	655.3	6.15

C. Precipitation:

1. Year of sampling: 156.1 cm.
2. Mean annual: 113.7 cm.

III. LAKE WATER QUALITY SUMMARY

Cross Lake was sampled four 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 five 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 1.5 meters at Station 01, 1.5 meters at Station 02, 3.0 meters at Station 03, 1.5 meters at Station 04, and 2.4 meters at Station 05. 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	Nº	(3/23/74)			(6/ 3/74)			(8/26/74)				
		S*** = 5	MAX DEPTH RANGE		S*** = 5	MAX DEPTH RANGE		S*** = 5	MAX DEPTH RANGE			
TEMPERATURE (DEG CENT)												
0.-1.5 M DEPTH	6	17.0- 17.6	17.4	0.0- 1.5	8	26.3- 27.5	26.8	0.0- 1.5	9	27.4- 29.2	28.4	
MAX DEPTH**	4	17.0- 17.6	17.3	0.0- 3.0	5	26.0- 27.1	26.6	0.0- 3.0	5	27.4- 29.2	28.4	
DISSOLVED OXYGEN (MG/L)												
0.-1.5 M DEPTH	4	7.8- 8.2	8.1	0.0- 1.5	3	5.8- 7.4	6.2	1.5- 1.5	9	3.6- 6.0	5.0	
MAX DEPTH**	4	7.8- 8.2	8.1	0.0- 3.0	4	5.8- 6.6	6.1	1.5- 3.0	5	4.0- 6.0	5.0	
CONDUCTIVITY (UMHOS)												
0.-1.5 M DEPTH	6	111.- 135.	115.	0.0- 1.5	8	204.- 245.	231.	0.0- 1.5	9	184.- 189.	185.	
MAX DEPTH**	4	112.- 135.	116.	0.0- 3.0	5	204.- 239.	230.	0.0- 3.0	5	184.- 189.	185.	
PH (STANDARD UNITS)												
0.-1.5 M DEPTH	6	6.9- 7.4	7.0	0.0- 1.5	8	7.5- 8.8	8.3	0.0- 1.5	9	6.9- 8.5	7.3	
MAX DEPTH**	4	6.9- 7.4	7.0	0.0- 3.0	5	7.5- 8.7	7.8	0.0- 3.0	5	6.9- 8.5	7.3	
TOTAL ALKALINITY (MG/L)												
0.-1.5 M DEPTH	8	14.- 23.	20.	0.0- 1.5	8	19.- 27.	22.	0.0- 1.5	9	34.- 39.	37.	
MAX DEPTH**	5	14.- 24.	20.	0.0- 3.0	5	20.- 24.	22.	0.0- 3.0	5	34.- 39.	37.	
TOTAL P (MG/L)												
0.-1.5 M DEPTH	8	0.043-0.074	0.049	0.0- 1.5	8	0.054-0.085	0.059	0.0- 1.5	9	0.154-0.210	0.179	
MAX DEPTH**	5	0.044-0.074	0.049	0.0- 3.0	5	0.059-0.086	0.066	0.0- 3.0	5	0.154-0.210	0.177	
DISSOLVED ORTHO P (MG/L)												
0.-1.5 M DEPTH	8	0.009-0.011	0.009	0.0- 1.5	8	0.008-0.026	0.012	0.0- 1.5	9	0.071-0.090	0.080	
MAX DEPTH**	5	0.009-0.011	0.010	0.0- 3.0	5	0.008-0.026	0.009	0.0- 3.0	5	0.074-0.089	0.080	
NO2+NO3 (MG/L)												
0.-1.5 M DEPTH	8	0.050-0.090	0.075	0.0- 1.5	8	0.020-0.070	0.040	0.0- 1.5	9	0.020-0.040	0.020	
MAX DEPTH**	5	0.050-0.090	0.080	0.0- 3.0	5	0.020-0.040	0.030	0.0- 3.0	5	0.020-0.020	0.020	
AMMONIA (MG/L)												
0.-1.5 M DEPTH	8	0.050-0.070	0.060	0.0- 1.5	8	0.040-0.060	0.045	0.0- 1.5	9	0.020-0.060	0.040	
MAX DEPTH**	5	0.050-0.070	0.060	0.0- 3.0	5	0.030-0.060	0.040	0.0- 3.0	5	0.040-0.060	0.060	
KJELDAHL N (MG/L)												
0.-1.5 M DEPTH	8	0.600-0.800	0.700	0.0- 1.5	8	0.800-1.400	1.000	0.0- 1.5	9	0.800-1.600	1.200	
MAX DEPTH**	5	0.600-0.800	0.600	0.0- 3.0	5	0.800-1.400	0.800	0.0- 3.0	5	0.800-1.600	1.000	
SECCHI DISC (METERS)	5	0.8-	0.8	0.8	5	0.4-	0.6	0.5	5	0.5-	0.6	0.5

* N = NO. OF SAMPLES

** MAXIMUM DEPTH SAMPLED AT EACH SITE

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

(11/11/74)

S*** = 5
MAX
DEPTH
RANGE

PARAMETER	N*	RANGE	MEDIAN	MAX DEPTH RANGE (METERS)	
TEMPERATURE (DEG CENT)					
0.-1.5 M DEPTH	9	16.0- 18.1	17.4	0.0-	1.5
MAX DEPTH**	5	16.0- 18.0	17.4	0.0-	3.0
DISSOLVED OXYGEN (MG/L)					
0.-1.5 M DEPTH	9	6.0- 12.8	8.2	0.0-	1.5
MAX DEPTH**	5	8.2- 12.8	8.4	0.0-	3.0
CONDUCTIVITY (UMMOS)					
0.-1.5 M DEPTH	9	108.- 137.	119.	0.0-	1.5
MAX DEPTH**	5	108.- 135.	119.	0.0-	3.0
PH (STANDARD UNITS)					
0.-1.5 M DEPTH	9	6.4- 6.9	6.7	0.0-	1.5
MAX DEPTH**	5	6.4- 6.9	6.6	0.0-	3.0
TOTAL ALKALINITY (MG/L)					
0.-1.5 M DEPTH	8	18.- 21.	19.	0.0-	1.5
MAX DEPTH**	4	18.- 21.	20.	0.0-	3.0
TOTAL P (MG/L)					
0.-1.5 M DEPTH	8	0.044-0.058	0.048	0.0-	1.5
MAX DEPTH**	4	0.048-0.058	0.052	0.0-	3.0
DISSOLVED ORTHO P (MG/L)					
0.-1.5 M DEPTH	8	0.005-0.008	0.005	0.0-	1.5
MAX DEPTH**	4	0.005-0.008	0.006	0.0-	3.0
NO2+NO3 (MG/L)					
0.-1.5 M DEPTH	8	0.020-0.020	0.020	0.0-	1.5
MAX DEPTH**	4	0.020-0.020	0.020	0.0-	3.0
AMMONIA (MG/L)					
0.-1.5 M DEPTH	8	0.020-0.030	0.020	0.0-	1.5
MAX DEPTH**	4	0.020-0.030	0.020	0.0-	3.0
KJELDAHL N (MG/L)					
0.-1.5 M DEPTH	8	0.600-0.700	0.600	0.0-	1.5
MAX DEPTH**	4	0.500-0.700	0.600	0.0-	3.0
SECCHI DISC (METERS)					
	5	0.6- 0.8	0.7		

* 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>
03/23/74	1. <u>Melosira</u> 2. Pennate diatom 3. <u>Microcystis</u> 4. Lunate cell 5. <u>Ankistrodesmus</u>	8,560 1,863 1,514 1,398 1,165
	Other genera	<u>5,415</u>
	Total	19,915
06/03/74	1. <u>Anabaenopsis</u> 2. <u>Raphidiopsis</u> 3. <u>Chroococcus</u> 4. <u>Lyngbya</u> 5. <u>Anabaena</u>	22,203 3,021 2,491 2,279 1,749
	Other genera	<u>11,829</u>
	Total	43,572
08/26/74	1. <u>Anabaenopsis</u> 2. <u>Raphidiopsis</u> 3. <u>Merismopedia</u> 4. <u>Oscillatoria</u> 5. Flagellates	180,343 20,210 3,042 1,817 1,095
	Other genera	<u>6,863</u>
	Total	213,370
11/11/74	1. <u>Dactylococcopsis</u> 2. <u>Ankistrodesmus</u> 3. <u>Microcystis</u> 4. <u>Chroococcus</u> 5. <u>Merismopedia</u>	4,566 4,206 3,091 2,445 1,007
	Other genera	<u>5,500</u>
	Total	20,815

2. Chlorophyll a -

<u>Sampling Date</u>	<u>Station Number</u>	<u>Chlorophyll a (μg/l)</u>
03/23/74	01	8.7
	02	14.5
	03	14.5
	04	14.8
	05	10.2
06/03/74	01	69.8
	02	73.8
	03	73.8
	04	62.2
	05	58.6
08/26/74	01	55.5
	02	39.2
	03	59.4
	04	69.2
	05	56.8
11/11/74	01	14.8
	02	19.0
	03	15.1
	04	18.8
	05	19.0

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

a. 03/23/74 - Stations 01-05

<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	0.007	0.165	1.0
0.05 P	0.057	0.165	4.6
0.05 P + 1.0 N	0.057	1.165	16.8
1.00 N	0.007	1.165	0.9

b. 11/11/74 - Stations 01-03

<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	0.012	0.055	2.2
0.05 P	0.062	0.055	5.1
0.05 P + 1.0 N	0.062	1.055	19.0
1.00 N	0.012	1.055	2.4

c. 11/11/74 - Stations 04-05

<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	0.021	0.113	4.1
0.05 P	0.071	0.113	5.4
0.05 P + 1.0 N	0.071	1.113	17.8
1.00 N	0.021	1.113	5.2

2. Discussion -

The control yield of the assay alga, Selenastrum capricornutum, indicates that the potential for primary production in Cross Lake was moderately high during spring and high at the time of autumn assay sample collection. During autumn, the potential for primary production was higher for lake

Stations 04 and 05 than for Stations 01 to 03. This is possibly due to the proximity of Stations 04 and 05 to the discharge of tributary H-1, Unnamed Stream, which flows through Shreveport.

In all assays, growth response with the addition of phosphorus as well as the lack of response to the addition of nitrogen indicates phosphorus limitation. Maximum growth yield was achieved with the simultaneous addition of both phosphorus and nitrogen.

The mean N/P ratios for Cross Lake were 13/1 or less on all four sampling occasions suggesting nitrogen limitation in the lake (a mean N/P of 14/1 or more is considered indicative of phosphorus limitation).

It should be noted that significant chemical changes took place in Louisiana lake samples between collection and algal assay. The assay data should be considered in this context and until such differences are resolved, used with caution for any prediction of actual lake conditions. Such chemical changes are likely to alter the assay control yield as well as modify the N/P ratio.

IV. NUTRIENT LOADINGS (See Appendix D for data)

For the determination of nutrient loadings, the Louisiana 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 June and February 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 Louisiana 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 Paw Paw Bayou, Shettleworth Bayou, and Logan Bayou at Stations C-1, E-1, and F-1, and multiplying the means by the ZZ area in km².

The operator of the Waskom wastewater treatment plant provided monthly effluent samples and corresponding flow data.

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>
Waskom	1,460	Imhoff tank	0.659	Cross Bayou

2. Known industrial - None

*Treatment plant questionnaire.

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 Cross Bayou	1,730	14.3
C-1 Paw Paw Bayou	3,185	26.4
E-1 Shettleworth Bayou	255	2.1
F-1 Logan Bayou	1,125	9.3
b. Minor tributaries and immediate drainage (nonpoint load) -		
	3,280	27.2
c. Known municipal STP's -		
Waskom	1,770	14.6
d. Septic tanks* -		
	105	0.9
e. Known industrial - None		
f. Direct precipitation** -		
	<u>625</u>	<u>5.2</u>
Totals	12,075	100.0

2. Outputs -

A-1 Cross Bayou	10,060
B-1 Shreveport Municipal Water Supply Intake	<u>1,905</u>
Total	11,965

3. Net annual P accumulation - 110

*Estimate based on 363 lakeside residences 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 Cross Bayou	22,370	13.5
C-1 Paw Paw Bayou	38,130	23.0
E-1 Shettleworth Bayou	4,540	2.7
F-1 Logan Bayou	11,700	7.0
b. Minor tributaries and immediate drainage, (nonpoint load) -	41,020	24.7
c. Known municipal STP's -		
Waskom	5,670	3.4
d. Septic tanks* -	3,905	2.4
e. Known industrial - None		
f. Direct precipitation** -	<u>38,615</u>	<u>23.3</u>
Totals	165,950	100.0

2. Outputs -

A-1 Cross Bayou	131,460
B-1 Shreveport Municipal Water Supply Intake	<u>36,320</u>
Total	167,780

3. Net annual P export*** -

1,830

*Estimate based on 363 lakeside residences 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>
Cross Bayou	13	168
Paw Paw Bayou	15	183
Shettleworth Bayou	10	178
Logan Bayou	23	240

E. Mean Nutrient Concentration in Ungaged Streams:

<u>Tributary</u>	<u>Mean Total P (mg/l)</u>	<u>Mean Total N (mg/l)</u>
D-1 Piney Bayou	0.068	0.944
G-1 Aqueduct from Twelvemile Bayou	0.125	0.869
H-1 Unnamed Stream	0.333	1.580

Nutrient levels in tributaries D-1 (Piney Bayou) and G-1 (Aque-
duct Bayou) are roughly in line with the other gaged tributaries en-
tering Cross Lake. However, levels for H-1 (Unnamed Stream) were sub-
stantially higher. This is probably attributable to the fact that
Unnamed Stream runs through the western residential section of Shreve-
port.

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.

<u>Total Yearly Phosphorus Loading (g/m²/yr)</u>	
Estimated loading for Cross Lake	0.34
Vollenweider's "eutrophic" loading	0.46
Vollenweider's "oligotrophic" loading	0.23

V. LITERATURE REVIEWED

- Ketelle, Martha J. and Paul D. Uttmark. 1971. Problem Lakes in the United States. U.S. Environmental Protection Agency Project #16010 EHR. University of Wisconsin, Madison, Wisconsin.
- 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.

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 LOUISIANA

04/11/77

LAKE CODE 2210 CROSS LAKE

TOTAL DRAINAGE AREA OF LAKE(SQ KM) 655.3

TRIBUTARY	SUB-DRAINAGE AREA(SQ KM)	NORMALIZED FLOWS(CMS)												MEAN
		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
2210A1	655.3	7.22	9.80	8.72	11.67	6.68	3.28	0.62	0.18	1.08	0.76	2.32	6.34	4.85
2210A2	132.9	1.472	1.982	1.784	2.379	1.359	0.651	0.125	0.037	0.218	0.156	0.481	1.274	0.986
2210B1	0.0	1.22	1.16	1.19	1.30	1.33	1.44	1.53	1.56	1.22	1.27	1.19	1.16	1.30
2210C1	208.5	2.294	3.115	2.775	3.710	2.124	1.048	0.195	0.057	0.340	0.244	0.736	2.010	1.542
2210E1	25.5	0.280	0.368	0.340	0.453	0.261	0.127	0.023	0.006	0.042	0.028	0.091	0.246	0.187
2210F1	48.7	0.538	0.736	0.651	0.878	0.510	0.246	0.045	0.014	0.079	0.057	0.190	0.481	0.366
2210Z2	240.9	2.662	3.596	3.200	4.276	2.464	1.218	0.227	0.065	0.396	0.280	0.850	2.322	1.783

SUMMARY

TOTAL DRAINAGE AREA OF LAKE =	655.3	TOTAL FLOW IN =	74.39
SUM OF SUB-DRAINAGE AREAS =	656.4	TOTAL FLOW OUT =	58.68

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
2210A1	6	74	22.795	9	130.257				
	7	74	0.176	5	0.017				
	8	74	0.051	12	0.017				
	10	74	0.736	7	0.054				
	11	74	12.035	7	2.662				
	12	74	10.760	7	62.297				
	1	75	20.105	7	13.054				
	2	75	25.995	5	79.004	26	4.219		
	3	75	18.746	23	5.040				
	4	75	3.879	5	2.124				
	5	75	22.399	3	57.200				
	6	74	4.616	9	24.069				
2210A2	7	74	0.878	5	0.088				
	8	74	0.010	12	0.003				
	10	74	0.153	7	0.011				
	11	74	2.435	7	0.538				
	12	74	2.180	7	12.743				
	1	75	4.078	7	2.633				
	2	75	5.267	5	15.999	26	0.850		
	3	75	3.794	23	1.019				
	4	75	0.793	5	0.425				
	5	75	4.531	3	11.582				

TRIBUTARY FLOW INFORMATION FOR LOUISIANA

04/11/77

LAKE CODE 2210 CROSS LAKE

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
2210B1	6	74	1.453	9	1.152				
	7	74	1.540	5	1.229				
	8	74	1.546	12	1.475				
	10	74	1.274	7	1.359				
	11	74	1.189	7	1.218				
	12	74	1.161	7	1.133				
	1	75	1.218	7	1.218				
	2	75	1.161	5	1.133	26	1.133		
	3	75	1.189	23	1.189				
	4	75	1.303	5	1.303				
	5	75	1.331	3	1.274				
2210C1	6	74	7.249	8	79.570				
	7	74	0.275	5	0.028				
	8	74	0.016	12	0.006				
	10	74	0.238	7	0.017				
	11	74	3.823	7	0.850				
	12	74	3.426	7	19.822				
	1	75	6.201	7	4.021				
	2	75	8.014	5	24.324	26	1.303		
	3	75	5.777	23	1.557				
	4	75	1.189	5	0.651				
	5	75	6.909	3	17.613				
2210E1	6	74	0.878	9	4.729				
	7	74	0.034	5	0.003				
	8	74	0.003	12	0.001				
	10	74	0.028	7	0.003				
	11	74	0.481	7	0.105				
	12	74	0.425	7	2.435				
	1	75	0.821	7	0.113				
	2	75	1.019	5	3.058	26	0.113		
	3	75	0.736	23	0.198				
	4	75	0.150	5	0.085				
	5	75	0.878	3	2.209				
2210F1	6	74	1.699	9	9.061				
	7	74	0.065	5	0.006				
	8	74	0.003	12	0.003				
	10	74	0.057	7	0.040				
	11	74	0.906	7	0.198				
	12	74	0.793	7	4.616				
	1	75	1.501	7	0.963				
	2	75	1.926	5	5.862	26	0.311		
	3	75	1.388	23	0.368				
	4	75	0.283	5	0.057				
	5	75	1.671	3	4.248				

APPENDIX C
PHYSICAL AND CHEMICAL DATA

STORET RETRIEVAL DATE 75/12/11
 NATL EUTROPHICATION SURVEY
 EPA-LAS VEGAS

221001
 32 31 45.0 093 54 58.0
 CROSS LAKE
 22 LOUISIANA

11EPALES
 4 2111202
 0005 FEET DEPTH

DATE	TIME	DEPTH	WATER FROM TO	TEMP CENT	00010 DO	00300 MG/L	00077 TRANSP SECCHI	00094 CNDCTVY FIELD MICROMHO	00400 PH SU	00410 TALK CACO ₃	00610 NH ₃ -N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO ₂ &NO ₃ N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
74/03/23	14 20	0000		17.6	7.8	30	135	7.00	14	0.060	0.700	0.050	0.011	
74/06/03	10 35	0000		27.5		17	245	8.45	27	0.050	1.000	0.070	0.008	
	10 35	0005		27.1	6.2		239	7.80	22	0.040	0.800	0.040	0.008	
74/08/26	10 40	0000		29.2	6.0	18	189	8.53	34	0.040	1.600	0.020K	0.077	
74/11/11	11 20	0000		17.4	7.8	27	137	6.54	21	0.020	0.600	0.020K	0.005	
	11 20	0005		17.4	8.4		135	6.43	21	0.020	0.600	0.020K	0.007	

DATE	TIME	DEPTH	PHOS-TOT FROM TO	00665 CHLRPHYL MG/L P	32217 A UG/L	00031 INCDT LT REMNING PERCENT
74/03/23	14 20	0000		0.044	8.7	
74/06/03	10 35	0000		0.057	69.8	
	10 35	0001			50.0	
	10 35	0004			1.0	
	10 35	0005		0.066		
74/08/26	10 40	0000		0.163	55.5	
74/11/11	11 20	0000		0.046	14.8	
	11 20	0005		0.055		

— K VALUE KNOWN TO BE LESS THAN
 INDICATED —

STORET RETRIEVAL DATE 75/12/11
 NATL EUTROPHICATION SURVEY
 EPA-LAS VEGAS

221002
 32 31 40.0 043 51 45.0
 CRUSS LAKE
 22 LOUISIANA

11EPALES
 4 2111202.
 0009 FEET DEPTH

DATE	TIME	DEPTH	WATER TEMP	00010 CENT	00300 MG/L	00077 SECCHI INCHES	00094 FIELD MICROMHO	00400 PH SU	00410 TALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 N2&N03 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
74/03/23	14 30	0000	17.5			32	111	7.40	16	0.050	0.700	0.050	0.009
	14 30	0005	17.4	8.2			112	7.40	20	0.070	0.600	0.090	0.010
74/06/03	09 05	0000	26.3			21	205	7.50	21	0.060	1.000	0.060	0.014
	09 05	0005	26.3	5.8			204	7.50	22	0.040	0.400	0.040	0.026
74/08/26	10 15	0000	28.4	6.0		18	185	8.11	36	0.020	1.200	0.020K	0.078
	10 15	0004	28.4	5.4			184	8.12	37	0.060	1.400	0.020	0.089
74/11/11	11 35	0000	18.1	8.2		27	119	6.71	20	0.030	0.600	0.020K	0.005
	11 35	0005	18.0	12.8			119	6.54	18	0.070K	0.600	0.020K	0.005

DATE	TIME	DEPTH	PHOS-TOT	00665 CHLRPHYL A UG/L	32217 INCDT LT REMNING PERCENT	00031
74/03/23	14 30	0000	0.046		14.5	
	14 30	0005	0.049			
74/06/03	09 05	0000	0.061	73.8		
	09 05	0001			50.0	
	09 05	0004			1.0	
	09 05	0005	0.059			
74/08/26	10 15	0000	0.170	39.2		
	10 15	0004	0.154			
74/11/11	11 35	0000	0.049	19.0		
	11 35	0005	0.048			

— K VALUE KNOWN TO BE LESS THAN
 INDICATED —

STORET RETRIEVAL DATE 75/12/11
 NATL EUTROPHICATION SURVEY
 EPA-LAS VEGAS

221003
 32 30 15.0 093 50 55.0
 CROSS LAKE
 22 LOUISIANA

11EPALES
 4 2111202
 0014 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	WATER TEMP CENT	00010 DO MG/L	00300 TRANSP INCHES	00077 SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 TALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
74/03/23	13 45	0000	17.5		30		115	6.95	22	0.060	0.700	0.070	0.010
	13 45	0005	17.4	8.0			115	6.95	23	0.060	0.600	0.080	0.009
	13 45	0010	17.3	8.0			115	6.95	24	0.060	0.600	0.080	0.009
74/06/03	10 10	0000	26.9		20		231	8.70	19	0.050	1.400	0.020	0.011
	10 10	0005	26.6	7.4			230	8.20	21	0.060	0.900	0.040	0.011
	10 10	0010	26.6	6.6			230	8.20	20	0.030	0.800	0.020K	0.008
74/08/26	10 00	0000	28.4	5.0	24		185	7.31	37	0.060	1.300	0.020K	0.090
	10 00	0005	28.4	5.0			186	7.28	37	0.030	0.900	0.020K	0.086
	10 00	0010	28.4	5.0			185	7.32	36	0.060	1.000	0.020	0.081
74/11/11	11 50	0000	17.9	6.0	33		124	6.77	19	0.020	0.600	0.020K	0.005
	11 50	0005	17.8	7.6			122	6.49	18	0.020	0.600	0.020K	0.005
	11 50	0010	17.8	8.4			123	6.65	20	0.020K	0.500	0.020K	0.005

DATE FROM TO	TIME OF DAY	DEPTH FEET	PHOS-TOT MG/L P	00665 CHLRPHYL UG/L	32217 INCDLT A REMNING PERCENT	00031
74/03/23	13 45	0000	0.051		14.5	
	13 45	0005	0.043			
	13 45	0010	0.045			
74/06/03	10 10	0000	0.060	73.8		
	10 10	0001			50.0	
	10 10	0005	0.054		1.0	
	10 10	0010	0.060			
74/08/26	10 00	0000	0.179	59.4		
	10 00	0005	0.171			
	10 00	0010	0.177			
74/11/11	11 50	0000	0.046		15.1	
	11 50	0005	0.044			
	11 50	0010	0.050			

— K VALUE KNOWN TO BE LESS THAN
 INDICATED —

STORET RETRIEVAL DATE 75/12/11
NATL EUTROPHICATION SURVEY
EPA-LAS VEGAS

221004
32 29 45.0 093 48 50.0
CHROSS LAKE
22 LOUISIANA

DATE FROM TO	TIME OF DAY	DEPTH FEET	11EPALES				P111202				00671 PHOS-DIS ORTHO P	
			00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CONDCTVY FIELD MICROMHU	00400 PH SU	00410 TALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L		00630 NO2&NO3 N-TOTAL MG/L
74/03/23	14	50 0000	17.0	8.2	30	117	6.95	23	0.070	0.800	0.090	0.011
74/06/03	09	35 0000	26.9		20	226	8.70	24	0.040	1.400	0.030	0.019
74/08/26	09	30 0000	28.1	3.6	18	187	6.87	37	0.030	1.600	0.040	0.071
	09	30 0005	28.1	4.0		186	6.91	37	0.040	0.900	0.020	0.074
74/11/11	14	00 0000	16.0	8.4	25	108	6.83	19	0.030	0.700	0.020K	0.008

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TUT	32217 CHLRPHYL	00031 INCDT LT
			MG/L P	UG/L	A REMNING PERCENT
74/03/23	14	50 0000	0.074	14.8	
74/06/03	09	35 0000	0.085	62.2	
	09	35 0001			50.0
	09	35 0004			1.0
74/08/26	09	30 0000	0.195	69.2	
	09	30 0005	0.210		
74/11/11	14	00 0000	0.058	18.8	

— K VALUE KNOWN TO BE LESS THAN
INDICATED —

STORET RETRIEVAL DATE 75/12/11
 NATL EUTROPHICATION SURVEY
 EPA-LAS VEGAS

221005
 32° 30' 25.0" 093 48 00.0
 CROSS LAKE
 22 LOUISIANA

11EPALES
 4
 21112nd
 . 0010 FEET DEPTH

DATE	TIME	DEPTH	WATER FROM TO	00010 OF DAY	00300 TEMP CENT	00077 TRANSP MG/L	00044 SECCHI INCHES	00400 CONDCTVY FIELD MICROMHO	00410 PH SU	00610 ALK CACO ₃ MG/L	00625 NH ₃ -N TOTAL MG/L	00630 TOT KJEL N MG/L	00630 NO ₂ &NO ₃ N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
74/03/23	14 10	0000					30			20	0.040	0.700	0.080	0.009
	14 10	0005								16	0.050	0.500	0.050	0.009
74/06/03	09 50	0000	26.7				25	231	8.85	21	0.040	1.000	0.020	0.013
	09 50	0008	26.0		6.0			236	7.60	21	0.060	0.400	0.030	0.004
74/08/26	09 40	0000	27.5		3.6		24	185	6.92	39	0.060	1.100	0.020K	0.087
	09 40	0004	27.4		4.0			185	6.93	39	0.060	0.800	0.020K	0.080
74/11/11	14 10	0000	16.5		8.0		26	118	6.90	19	0.020K	0.600	0.020K	0.005
	14 10	0005	16.4		8.2			118	6.88					

DATE	TIME	DEPTH	PHOS-TOT	00665 CHLRPHYL A UG/L	32217 INC DT LT REMNING PERCENT	00031
FROM OF TO	DAY	FEET	MG/L P			
74/03/23	14 10	0000	0.050	10.2		
	14 10	0005	0.049			
74/06/03	09 50	0000	0.057	58.6		
	09 50	0001			50.0	
	09 50	0004			1.0	
	09 50	0008	0.086			
74/08/26	09 40	0000	0.196	56.8		
	09 40	0004	0.192			
74/11/11	14 10	0000	0.054	19.0		

— K VALUE KNOWN TO BE LESS THAN
 INDICATED —

APPENDIX D

**TRIBUTARY AND WASTEWATER
TREATMENT PLANT DATA**

STORET RETRIEVAL DATE 77/04/11

/TYPE/AMBN/TSTREAM

2210A1
32 30 50.0 093 47 50.0 4
CROSS BAYOU
22 7.5 N HIGHLANDS
0/CROSS LAKE 101691
2NDRY RD BRDG BELOW CROSS LK DAM SPILLWA
11EPALES 04001004
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 N026N03 MG/L	00625 TOT KJEL MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
74/06/06	14	35	0.100	2.300	0.105	0.010	0.070
74/06/09	09	15	0.012	1.200	0.010	0.010	0.045
74/07/05	14	00	0.052	1.000	0.040	0.010	0.085
74/08/12	10	40	0.072	1.200	0.075	0.015	0.080
74/10/07	10	20	0.032	0.800	0.035	0.015	0.080
74/11/07	13	35	0.024	0.600	0.185	0.080	0.130
74/12/07	09	30	0.008	0.600	0.015	0.010	0.035
75/01/07	10	00	0.008	0.400	0.008	0.005	0.030
75/02/05	08	35	0.032	0.850	0.048	0.048	0.145
75/02/26			0.016	0.550	0.056	0.016	0.060
75/03/23	09	15	0.007	1.000	0.032	0.007	0.040
75/04/05	09	30	0.005	0.550	0.015	0.010	0.050
75/05/03	08	30	0.015	0.750	0.035	0.010	0.040

STORET RETRIEVAL DATE 77/04/11

/TYPE/AMOUNT/STREAM

2210A2
32 29 30.0 094 56 30.0 4
CROSS BAYOU
22 15 GREENWOOD
T/CROSS LAKE 120191
UNIMPROVED RD XING 1 MI N JEFFESON PAGE
11EPALES 04001004
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL MG/L	00610 NH3-N N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
74/06/06	15 40		0.132	1.000	0.055	0.300	0.390
74/06/09	15 45		0.032	0.600	0.035	0.030	0.070
74/07/05	11 40		0.092	0.600	0.065	0.065	0.160
74/08/12	14 00		0.028	0.700	0.080	0.100	0.180
74/10/07	12 30		0.056	0.600	0.040	0.135	0.210
74/11/07	10 45		0.024	0.900	0.095	0.040	0.090
74/12/07	13 15		0.024	1.100	0.040	0.050	0.150
75/01/07	10 00		0.032	0.600	0.024	0.035	0.140
75/02/05	09 25		0.016	1.100	0.064	0.016	0.050
75/02/26			0.032	1.500	0.104	0.024	0.070
75/03/23	12 05		0.032	0.400	0.032	0.064	0.090
75/04/05	12 45		0.025	0.700	0.030	0.030	0.040
75/05/03	12 15		0.085	1.150	0.090	0.035	0.120

STORET RETRIEVAL DATE 77/04/11

/TYPE/AMOUNT/STREAM

221081
32 30 45.0 093 47 30.0 4
SHREVEPORT MNCPL WATER
22 7.5 N HIGHLANDS
0/CROSS LAKE 101691
RAW WTR TAP AT SPLWAY STN NEAR AMISS PLT
11EPALES 04001004
0000 FEET DEPTH CLASS 00

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
74/06/06	08	50	0.020	2.100	0.070	0.010	0.075
74/06/09	12	35	0.008	0.950	0.010	0.010	0.063
74/07/05	15	00	0.012	1.242	0.025	0.010	0.050
74/08/12	11	05	0.008	1.800	0.020	0.015	0.080
74/10/07	10	30	0.032	0.700	0.025	0.010	0.040
74/11/07	11	00	0.008	0.900	0.030	0.010	0.040
74/12/07	09	55	0.008	0.600	0.010	0.005	0.050
75/01/07	10	15	0.008	0.500	0.016	0.005	0.030
75/02/05	09	05	0.016	0.400	0.016	0.008	0.050
75/02/26			0.008	1.100	0.056	0.008K	0.040
75/03/23	09	30	0.016	0.800	0.016	0.008	0.040
75/04/05	09	35	0.005	0.650	0.040	0.005	0.010
75/05/03	09	00	0.015	0.850	0.030	0.005K	0.030

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 77/04/11

/TYPE/AMOUNT/STREAM

2210C1
32 31 00.0 093 58 20.0 4
PAW PAW BAYOU
22 15 MOORINGSPORT
T/CROSS LAKE 101691
LA H/WY 169 BRDG 3.5 M S OF LONGWOOD
11EPALES 04001004
0000 FEET DEPTH CLASS 00

DATE	TIME	DEPTH	NO2&NO3	00630	00625	00610	00671	00665
FROM	OF		N-TOTAL	TOT	KJEL	NH3-N	PHOS-DIS	PHOS-TOT
TO	DAY	FEET	MG/L	MG/L	MG/L	MG/L	MG/L P	MG/L P
74/06/06	13	10		0.044	0.600	0.185	0.030	0.065
74/06/08	15	10		0.028	0.700	0.035	0.030	0.110
74/07/05	11	15		0.004	0.700	0.015	0.005	0.055
74/08/12	13	40		0.032	0.600	0.035	0.030	0.050
74/10/07	11	50		0.048	0.600	0.070	0.020	0.070
74/11/07	13	00		0.008	1.100	0.060	0.040	0.080
74/12/07				0.008	0.800	0.020	0.030	0.100
75/01/07	12	30		0.008	0.600	0.032	0.016	0.050
75/02/05	11	15		0.008	0.500	0.016	0.024	0.050
75/02/26				0.008	0.600	0.032	0.016	0.040
75/03/23	12	15		0.024	0.500	0.024	0.016	0.060
75/04/05	12	15		0.010	0.650	0.025	0.015	0.015
75/05/03	11	30		0.145	1.400	0.145	0.030	0.110

STORET RETRIEVAL DATE 77/04/11

/TYP/A/AMBNT/STPEAM

221001
32 32 10.0 093 58 25.0 4
PINEY BAYOU
22 15 MOORINGSPORT
T/CROSS LAKE 101691
LA HWY 169 BRDG 2 MI S OF LONGWOOD
11EPALES 04001004
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&N03	00625 TOT KJEL	00610 NH3-N	00671 PHOS-DIS	00665 PHOS-TOT
			MG/L	MG/L	TOTAL N	MG/L	ORTHO MG/L P
74/06/06	11 05		0.048	1.200	0.315	0.040	0.092
74/06/09	10 50		0.044	1.400	0.045	0.026	
74/07/05	11 10		0.112	0.500	0.080	0.060	0.105
74/08/12	13 30		0.016	0.800	0.130	0.050	0.120
74/10/07	11 35		0.048	1.300	0.168	0.020	0.060
74/11/07	12 55		0.016	0.800	0.780	0.020	0.060
74/12/07	12 45		0.024	0.900	0.030	0.020	0.070
75/01/07	12 15		0.048	0.500	0.032	0.010	0.040
75/02/05	10 55		0.032	0.700	0.040	0.016	0.050
75/02/26			0.040	1.065	0.080	0.016	0.045
75/03/23	11 50		0.048	0.400	0.032	0.016	0.050
75/04/05	12 05		0.055	0.650	0.040	0.015	0.015
75/05/03	11 45		0.070	1.450	0.175	0.015	0.110

STUPET RETRIEVAL DATE 77/04/11

/TYP/A/MBNT/STPREAM

2210E1
32 34 00.0 093 56 30.0 4
SHETTLWORTH BAYOU
22 15 MOORINGSPORT
T/CROSS LAKE 101691
2NDRY RD BRDG 2.7 MI E OF LONGWOOD
11EPALES 04001004
0000 FEET DEPTH CLASS 00

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
74/06/06			0.064	0.900	0.345	0.100	0.140
74/06/09	14 30		0.036	1.400	0.050	0.020	
74/07/05	10 58		0.136	0.500	0.055	0.025	0.050
74/08/12	13 10		0.036	0.600	0.110	0.074	0.185
74/10/07	11 25		0.048	0.700	0.115	0.040	0.085
74/11/07	12 50		0.008	0.700	0.040	0.045	0.070
74/12/07	12 00		0.016	0.700	0.035	0.010	0.050
75/01/07	11 45		0.016	0.300	0.016	0.010	0.020
75/02/05	10 15		0.010	0.500	0.035	0.015	0.040
75/02/26			0.008	0.400	0.028	0.008	0.030
75/03/23	11 30		0.024	0.300	0.024	0.008	0.030
75/04/05	11 50		0.005	0.350	0.020	0.010	0.010
75/05/03	11 15		0.080	2.200	0.280	0.025	

STORET RETRIEVAL DATE 77/04/11

/TYPEA/AMBNT/STREAM

2210F1
 32 32 35.0 093 51 53.0 4
 LOGAN BAYOU
 22 7.5 N HIGHLANDS
 T/CROSS LAKE 101691
 BNK UNMPRVD RD 1 M W KANSAS CITY RP XING
 11EPALES 04001004
 0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 N02&N03	00625 TOT KJEL	00610 NH3-N	00671 PHOS-DIS	00665 PHOS-TOT
			MG/L	MG/L	MG/L	MG/L P	MG/L P
74/06/06	13 45		0.044	1.100	0.410	0.110	0.190
74/06/09	13 55		0.116	1.100	0.125	0.045	0.110
74/07/05	10 30		0.232	1.100	0.280	0.035	0.105
74/08/12	12 15		0.028	1.300	0.400	0.050	0.125
74/10/07	11 10		0.064	0.800	0.145	0.085	0.150
74/11/07	12 30		0.032	0.600	0.125	0.055	0.125
74/12/07	11 25		0.200	1.300	0.065	0.035	0.100
75/01/07	11 15		0.128	0.650	0.032	0.020	0.060
75/02/05	12 20		0.152	0.300	0.064	0.040	0.120
75/02/26			0.072	0.600	0.032	0.016	0.060
75/03/23	10 00		0.112	0.500	0.032	0.024	0.070
75/04/05	11 15		0.155	0.775	0.115	0.030	0.030
75/05/03	11 00		0.140	1.250	0.200	0.045	0.120

STORET RETRIEVAL DATE 77/04/11

/TYPEA/AMBN/T/STPREAM

2210G1
32 32 05.0 093 47 25.0 4
AQUEDUCT TWELVEMILE BAY
22 7.5 N HIGHLANDS
T/CROSS LAKE 101691
PUMPING STATION AT TWELVEMILE BAYOU
11EPALES 04001004
0000 FEET DEPTH CLASS 00

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						
TO	DAY	FEET					
74/06/06	14	10	0.044	1.500	0.050	0.099	0.214
74/06/09	11	45	0.100	1.200	0.025	0.085	0.315
74/07/05	10	05	0.032	0.600	0.050	0.015	0.075
74/08/12	11	50	0.004	0.600	0.020	0.010	0.050
74/10/07	10	00	0.024	0.600	0.040	0.015	0.063
74/11/07	10	30	0.104	0.400	0.097	0.035	0.080
74/12/07	09	00	0.032	1.500	0.020	0.040	0.140
75/01/07	09	00	0.024	0.400	0.016	0.015	0.050
75/02/05	12	50	0.032	0.700	0.032	0.040	0.130
75/02/26			0.008	0.500	0.016	0.016	0.080
75/03/23	09	00	0.024	0.400	0.016	0.016	0.060
75/04/05	09	00	0.005	0.400	0.025	0.010	0.020
75/05/03	09	15	0.220	1.850	0.210	0.065	0.350

STORET RETRIEVAL DATE 77/04/11

/TYPE/AMOUNT/STREAM

2210H1
32 29 10.0 093 48 20.0 4
UNNAMED STREAM
22 7.5 SHREVEPORT W
T/CROSS LAKE 101691
LK SHORE DR 0.5 MI W OF JUDSON SCHOOL
11EPALES 04001004
0000 FEET DEPTH CLASS 00

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
74/06/06	09 09		0.044	2.200	0.145	0.110	0.360
74/06/09	11 10		0.192	2.700	0.130	0.105	0.810
74/07/05	12 05		0.008	1.200	0.035	0.020	0.140
74/08/12	11 25		0.004	1.300	0.025	0.145	0.315
74/10/07	10 37		0.056	1.200	0.230	0.120	0.280
74/11/07	11 15		0.024	1.000	0.030	0.105	0.210
74/12/07	10 30		0.352	1.500	0.255	0.375	0.550
75/01/07	10 45		0.144	0.900	0.080	0.115	0.290
75/02/05	11 45		0.040	1.100	0.088	0.048	0.140
75/02/26			0.008	0.800	0.032	0.016	0.070
75/03/23	09 50		0.064	0.900	0.188	0.144	0.320
75/04/05	09 50		0.070	1.300	0.345	0.115	0.220
75/05/03	09 30		0.440	3.000	0.520	0.370	0.630

STORET RETRIEVAL DATE 77/04/11

2210AA PR2210AA P001460
 32 33 00.0 094 00 00.0 4
 WASKOM
 22 7.5 WASKOM
 T/CADDY 101691
 CROSS BAYOU
 11EPALES 00001004
 0000 FEET DEPTH CLASS 00

/AMBNT/STREAM

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL	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	50051 FLOW RATE INST MGD	50053 CONDUIT FLOW-MGD MONTHLY
74/09/23	09 15		0.120	29.000	15.700	6.500	9.300	0.200	0.250
74/10/23	09 00		0.160	40.000	21.000	9.100		0.165	0.150
74/12/10	09 00		0.560	17.000	3.600	2.400	4.600	0.154	0.150
74/12/26	09 00		0.080	19.000	7.100	4.000	5.000	0.050	0.050
75/01/30	08 15		0.320	17.000	3.950	2.800	3.300	0.175	0.175
75/02/26	08 00		0.675	8.500		1.950	2.600	0.198	0.198
75/03/27	14 00		0.320	20.000	4.640	3.880	6.900	0.172	0.172
75/04/29	08 00		0.050	15.500	6.300	4.200	5.400	0.175	0.175
75/05/30	08 00		0.300	7.500	1.300	1.150	2.100	0.150	0.150
75/06/30	14 00		0.379	29.000	15.800	8.300	14.000	0.250	0.200
75/07/31	08 30		0.025	34.000	19.000	7.750	8.900	0.250	0.220
75/08/29	08 00		0.025	31.000	20.000	9.300	10.500	0.200	0.200

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

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
2201	ANACOCO LAKE	0.031	0.080	455.833	8.700	10.400	0.007
2202	BRUIN LAKE	0.057	0.250	450.333	16.350	15.000	0.012
2203	LAKE BISTINEAU	0.061	0.100	458.000	12.933	13.200	0.018
2204	BLACK BAYOU	0.046	0.090	453.417	17.818	12.200	0.009
2205	BUNDICK LAKE	0.157	0.135	469.667	20.467	10.600	0.073
2207	COCODRIE LAKE	0.090	0.400	479.000	35.300	7.700	0.026
2208	COTILE LAKE	0.037	0.100	442.333	12.650	14.000	0.011
2209	CONCORDIA LAKE	0.076	0.080	468.333	32.950	14.800	0.009
2210	CROSS LAKE	0.057	0.080	475.250	38.385	11.400	0.010
2211	D'ARBONNE LAKE	0.038	0.100	458.250	6.800	13.200	0.011
2212	FALSE RIVER LAKE	0.082	0.130	442.500	24.550	14.900	0.023
2213	INDIAN CREEK	0.031	0.150	458.333	21.467	14.800	0.010
2214	SALINE LAKE	0.111	0.350	493.000	15.333	9.600	0.025
2215	TURKEY CREEK LAKE	0.176	0.170	477.833	21.967	14.600	0.033
2216	LAKE VERRET	0.163	0.100	481.428	62.028	12.000	0.056
2217	LAKE VERNON	0.018	0.120	436.667	4.900	14.400	0.007
2219	BLACK LAKE	0.077	0.150	454.000	12.733	11.600	0.015
2220	COCODRIE	0.106	0.050	478.333	33.433	11.800	0.014
4807	CADDY LAKE	0.049	0.070	463.562	20.125	10.000	0.008

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
2201	ANACOCO LAKE	92 (16)	83 (14)	67 (12)	89 (16)	83 (15)	94 (17)
2202	BRUIN LAKE	61 (11)	11 (2)	83 (15)	61 (11)	0 (0)	50 (9)
2203	LAKE BISTINEAU	50 (9)	58 (9)	61 (11)	72 (13)	42 (7)	33 (6)
2204	BLACK BAYOU	72 (13)	72 (13)	78 (14)	56 (10)	50 (9)	81 (14)
2205	BUNDICK LAKE	11 (2)	33 (6)	33 (6)	44 (8)	78 (14)	0 (0)
2207	COCODRIE LAKE	28 (5)	0 (0)	11 (2)	11 (2)	100 (18)	17 (3)
2208	COTILE LAKE	83 (15)	58 (9)	94 (17)	83 (15)	33 (6)	61 (11)
2209	CONCORDIA LAKE	44 (8)	83 (14)	39 (7)	22 (4)	14 (2)	81 (14)
2210	CROSS LAKE	56 (10)	83 (14)	28 (5)	6 (1)	72 (13)	69 (12)
2211	D'ARBONNE LAKE	78 (14)	58 (9)	56 (10)	94 (17)	42 (7)	56 (10)
2212	FALSE RIVER LAKE	33 (6)	39 (7)	89 (16)	28 (5)	6 (1)	28 (5)
2213	INDIAN CREEK	92 (16)	28 (5)	50 (9)	39 (7)	14 (2)	69 (12)
2214	SALINE LAKE	17 (3)	6 (1)	0 (0)	67 (12)	94 (17)	22 (4)
2215	TURKEY CREEK LAKE	0 (0)	17 (3)	22 (4)	33 (6)	22 (4)	11 (2)
2216	LAKE VERRET	6 (1)	58 (9)	6 (1)	0 (0)	56 (10)	6 (1)
2217	LAKE VERNON	100 (18)	44 (8)	100 (18)	100 (18)	28 (5)	100 (18)
2219	BLACK LAKE	39 (7)	22 (4)	72 (13)	78 (14)	67 (12)	39 (7)
2220	COCODRIE	22 (4)	100 (18)	17 (3)	17 (3)	61 (11)	44 (8)
4807	CADDY LAKE	67 (12)	94 (17)	44 (8)	50 (9)	89 (16)	89 (16)