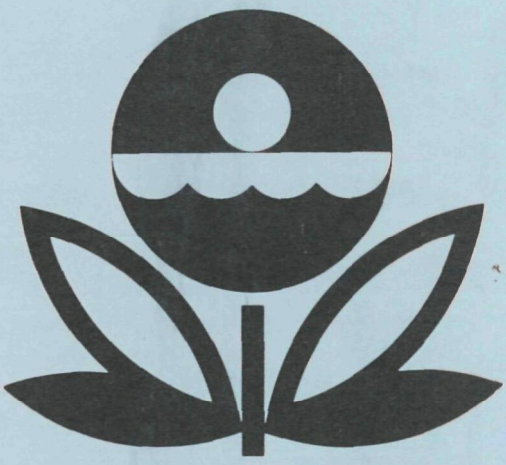
U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL EUTROPHICATION SURVEY
WORKING PAPER SERIES



REPORT
ON
BRAUNIG LAKE
BEXAR COUNTY
TEXAS
EPA REGION VI
WORKING PAPER No. 634

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

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REPORT
ON
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BEXAR COUNTY
TEXAS
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WITH THE COOPERATION OF THE
TEXAS WATER QUALITY BOARD
AND THE
TEXAS NATIONAL GUARD
APRIL, 1977

CONTENTS

FOREWORD

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

OBJECTIVES

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

ANALYTIC APPROACH

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

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

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

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

LAKE ANALYSIS

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

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

ACKNOWLEDGEMENT

The staff of the National Eutrophication Survey (Office of Research & Development, U. S. Environmental Protection Agency) expresses sincere appreciation to the Texas Water Quality Board for professional involvement, to the Texas National Guard for conducting the tributary sampling phase of the Survey, and to those Texas wastewater treatment plant operators who voluntarily provided effluent samples.

Hugh C. Yantis, Jr., Executive Director of the Texas Water Quality Board, and John B. Latchford, Jr., Director, and the staff of the Field Operations Division 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 Bishop, the Adjutant General of Texas, and Project Officer Colonel William L. Seals, who directed the volunteer efforts of the Texas National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

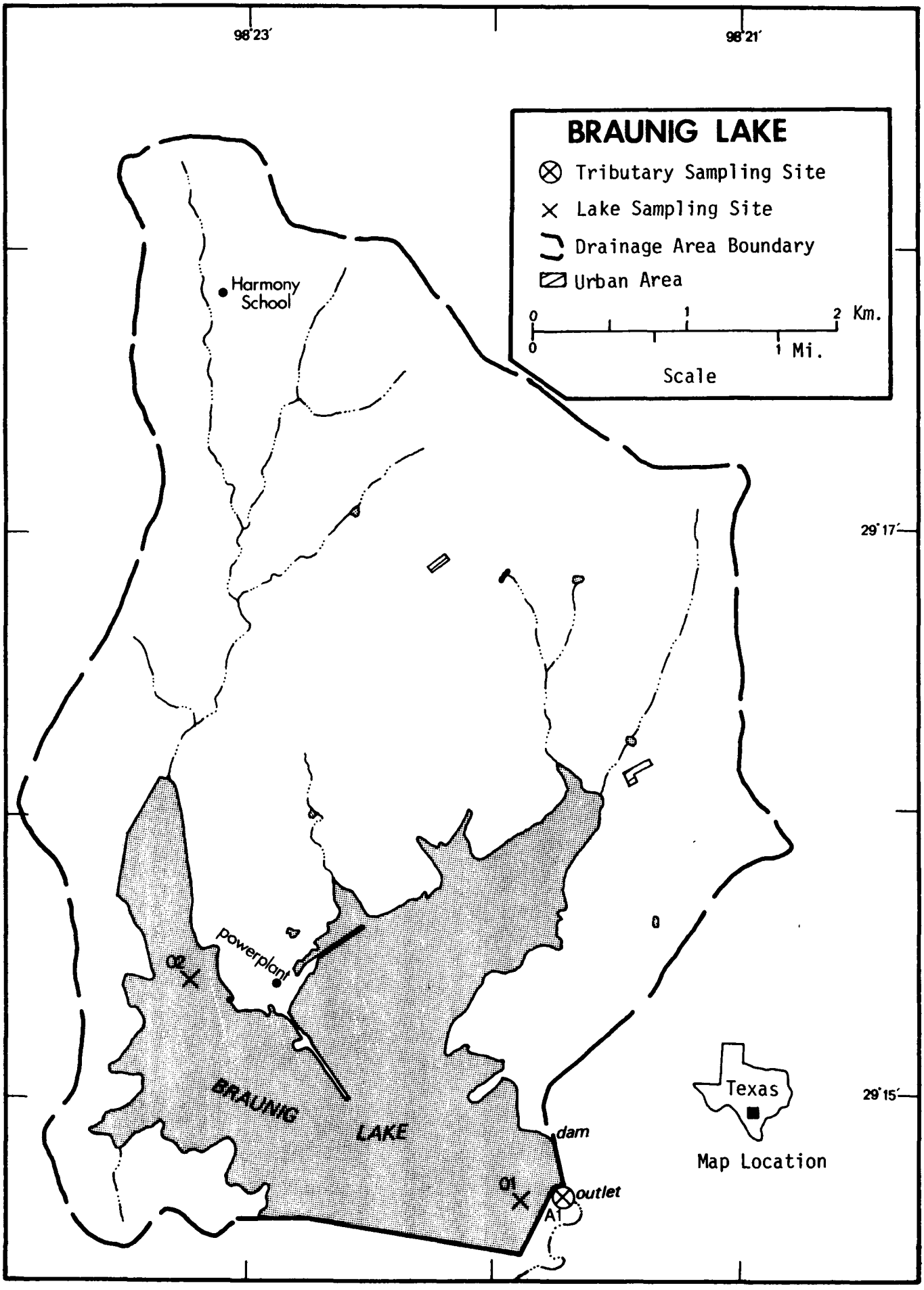
NATIONAL EUTROPHICATION SURVEY

STUDY RESERVOIRS

State of Texas

NAME	COUNTY
Amistad	Val Verde
Bastrop	Bastrop
Belton	Bell, Coryell
Braunig	Bexar
Brownwood	Brown
Buchanan	Burnet, Llano
Caddo	Harrison, Marion, TX; Caddo Parish, LA
Calaveras	Bexar
Canyon	Comal
Colorado City	Mitchell
Corpus Christi	Jim Wells, Live Oak, San Patricio
Diversion	Archer, Baylor
Eagle Mountain	Tarrant, Wise
Fort Phantom Hill	Jones
Houston	Harris
Kemp	Baylor
Lake O'The Pines	Camp, Marion, Morris, Upshur
Lavon	Collin
Lewisville (Garza-Little Elm)	Denton
Livingston	Polk, San Jacinto, Trinity, Walker

Lyndon B. Johnson	Burnet, Llano
Medina	Bandera, Medina
Meredith	Hutchinson, Moore, Potter
O. C. Fisher (San Angelo)	Tom Green
Palestine	Anderson, Cherokee, Henderson, Smith
Possum Kingdom	Palo Pinto, Stephens, Young
Sam Rayburn	Angelina, Jasper Nacogdoches, Sabine, San Augustine
Somerville	Burleson, Lee, Washington
E. V. Spence	Coke
Stamford	Haskell
Stillhouse Hollow	Bell
Tawakoni	Hunt, Rains, Van Zandt
Texoma	Cooke, Grayson TX; Bryan, Johnston, Love, Marshall, OK
Travis	Burnet, Travis
Trinidad	Henderson
Twin Buttes	Tom Green
White River	Crosby
Whitney	Bosque, Hill
Wright Patman (Texarkana)	Bowie, Cass


98°23'
98°21'
BRAUNIG LAKE
Tributary Sampling Site
Lake Sampling Site
Drainage Area Boundary
Urban Area
0 1 2 Km.
0 1 Mi.
Scale
Harmony School
29°17'
29°15'
powerplant
BRAUNING LAKE
dam
outlet
A1
Texas
Map Location

BRAUNIG LAKE

STORET NO. 4804

I. INTRODUCTION

Braunig Lake was included in the National Eutrophication Survey as a water body of interest to the Texas Water Quality Board. Tributaries and nutrient sources were not sampled, and this report relates only to the lake sampling data.

II. CONCLUSIONS

A. Trophic Condition:

Survey data indicate that Braunig Lake is eutrophic; i.e., well supplied with nutrients and quite productive. Whether nutrient enrichment is beneficial or deleterious depends on the actual or potential effect on the uses of the lake. In this regard, the Texas Water Quality Board has indicated that there is little or no known impairment of the designated beneficial uses of this water body.

Braunig Lake ranked thirty-sixth when the 39 Texas reservoirs sampled in 1974 were compared using a combination of six parameters*. Thirty-six of the reservoirs had less median total and median dissolved phosphorus, 22 had less and one had the same median inorganic nitrogen, 35 had less mean chlorophyll a, and 19 had greater mean Secchi disc transparency. Near-depletion of dissolved oxygen with depth occurred at station 1 in May and August.

* See Appendix A.

B. Rate-Limiting Nutrient:

The algal assay results indicate primary productivity in Braunig Lake was limited by nitrogen. The lake data also indicate nitrogen limitation.

III. LAKE AND DRAINAGE BASIN CHARACTERISTICS†

A. Morphometry††:

1. Surface area: 5.46 kilometers^2.
2. Mean depth: 6 meters.
3. Maximum depth: >10.1 meters.
4. Volume: 32.760 x 10^6 m^3.
5. Mean hydraulic retention time: 3.7 years.

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

Name	Drainage area (km^2)*	Mean flow (m^3/sec)*
Unnamed Stream A-1	24.3**	0.28

C. Precipitation***:

1. Year of sampling: 94.0 centimeters.
2. Mean annual: 70.0 centimeters.

† Table of metric conversions--Appendix B.
†† Latchford, 1974.
* For limits of accuracy, see Working Paper No. 175, "...Survey Methods, 1973-1976"; lake level maintained by a diversion from the San Antonio River.
** Includes area of lake.
*** See Working Paper No. 175.

IV. WATER QUALITY SUMMARY

Braunig Lake was sampled four times in 1974 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from a number of depths at two stations on the lake (see map, page vi). During each visit, a single depth-integrated (4.6 m or near bottom to surface) sample was composited from the stations for phytoplankton identification and enumeration; and during the March and November visits, a single 18.9-liter depth-integrated sample was composited for algal assays. Also each time, a depth-integrated sample was collected from each of the stations for chlorophyll a analysis. The maximum depths sampled were 10.1 meters at station 1 and 4.6 meters at station 2.

The sampling results are presented in full in Appendix D and are summarized in the following table (the August nutrient samples were not preserved properly and were not analyzed).

A. SUMMARY OF PHYSICAL AND CHEMICAL CHARACTERISTICS FOR BRAUNIG LAKE
STORET CODE 4804

PARAMETER	1ST SAMPLING (3/12/74) 2 SITES RANGE	MEAN	MEDIAN	2ND SAMPLING (5/21/74) 2 SITES RANGE	MEAN	MEDIAN	3RD SAMPLING (8/14/74) 2 SITES RANGE	MEAN	MEDIAN
TEMP (C)	16.3 - 25.0	21.6	22.1	24.1 - 31.1	28.6	28.8	27.1 - 35.3	30.9	29.1
DISS OXY (MG/L)	1.8 - 8.2	5.0	5.3	0.6 - 8.0	4.4	4.5	0.2 - 8.2	5.3	5.8
CNDCTVY (MCROMO)	1005. - 1215.	1126.	1133.	1220. - 1407.	1335.	1344.	1328. - 1518.	1404.	1356.
PH (STAND UNITS)	7.5 - 8.6	8.2	8.4	7.9 - 8.8	8.5	8.6	8.2 - 9.3	8.9	9.1
TOT ALK (MG/L)	175. - 178.	177.	177.	164. - 175.	167.	166.	****** -**********		
TOT P (MG/L)	0.104 - 0.134	0.120	0.122	0.115 - 0.234	0.153	0.130	****** -**********		
ORTHO P (MG/L)	0.025 - 0.066	0.049	0.052	0.046 - 0.149	0.080	0.055	****** -**********		
NO2+NO3 (MG/L)	0.030 - 0.160	0.092	0.100	0.040 - 0.250	0.089	0.060	****** -**********		
AMMONIA (MG/L)	0.030 - 0.320	0.104	0.035	0.030 - 0.150	0.075	0.060	****** -**********		
KJEL N (MG/L)	1.000 - 1.300	1.112	1.100	0.800 - 1.400	0.937	0.900	****** -**********		
INORG N (MG/L)	0.060 - 0.430	0.196	0.145	0.070 - 0.320	0.164	0.120	****** -**********		
TOTAL N (MG/L)	1.030 - 1.360	1.205	1.225	0.850 - 1.450	1.026	0.965	****** -**********		
CHLRPYL A (UG/L)	23.9 - 25.1	24.5	24.5	14.5 - 14.5	14.5	14.5	24.5 - 33.7	29.1	29.1
SECCHI (METERS)	0.9 - 0.9	0.9	0.9	1.2 - 1.5	1.4	1.4	0.1 - 1.2	0.7	0.7

A. SUMMARY OF PHYSICAL AND CHEMICAL CHARACTERISTICS FOR BRAUNIG LAKE
STORET CODE 4804

4TH SAMPLING (11/ 5/74)

PARAMETER	RANGE (2 SITES)	MEAN	MEDIAN
TEMP (C)	25.9 - 28.1	26.6	26.3
DISS OXY (MG/L)	4.6 - 6.2	5.3	5.0
CNDCTVY (MCROMO)	1207. - 1259.	1222.	1213.
PH (STAND UNITS)	8.5 - 8.6	8.5	8.5
TOT ALK (MG/L)	124. - 168.	161.	168.
TOT P (MG/L)	0.193 - 0.209	0.200	0.199
ORTHO P (MG/L)	0.115 - 0.134	0.123	0.125
NO2+NO3 (MG/L)	0.110 - 0.160	0.123	0.120
AMMONIA (MG/L)	0.020 - 0.060	0.040	0.040
KJEL N (MG/L)	0.200 - 1.200	0.914	0.900
INORG N (MG/L)	0.130 - 0.200	0.163	0.160
TOTAL N (MG/L)	0.310 - 1.360	1.037	1.020
CHLRPYL A (UG/L)	20.0 - 25.9	22.9	22.9
SECCHI (METERS)	0.7 - 1.2	1.0	1.0

B. Biological characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera	Algal Units per ml
03/12/74	1. Centric diatoms	7,060
	2. Nitzschia sp.	5,758
	3. Merismopedia sp.	2,673
	4. Dactylococcopsis sp.	2,193
	5. Tetraedron sp.	1,988
	Other genera	1,851
	Total	21,523
05/21/74	1. Nitzschia sp.	654
	2. Chlorophytan coccoid cells	551
	3. Tetraedron sp.	482
	4. Mesostigma sp.	413
	5. Oscillatoria sp.	275
	Other genera	1,342
	Total	3,717
08/14/74	1. Centric diatoms	3,480
	2. Scenedesmus sp.	1,723
	3. Chlorococcalean coccoid cells	1,505
	4. Merismopedia sp.	627
	5. Oscillatoria sp.	564
	Other genera	2,980
	Total	10,879
11/05/74	1. Oscillatoria sp.	4,143
	2. Dactylococcopsis sp.	909
	3. Scenedesmus sp.	775
	4. Chlorophytan coccoid cells	642
	5. Lyngbya sp.	561
	Other genera	2,353
	Total	9,383

2. Chlorophyll *a* -

Sampling Date	Station Number	Chlorophyll *a* (µg/l)
03/12/74	1	25.1
	2	23.9
05/21/74	1	14.5
	2	14.5
08/14/74	1	24.5
	2	33.7
11/05/74	1	25.9
	2	20.0

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

a. March sample -

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum yield (mg/l-dry wt.)
Control	0.055	0.152	4.3
0.050 P	0.105	0.152	6.2
0.050 P + 1.0 N	0.105	1.152	19.6
1.0 N	0.055	1.152	14.4

b. November sample -

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum yield (mg/l-dry wt.)
Control	0.117	0.195	7.6
0.050 P	0.167	0.195	7.8
0.050 P + 1.0 N	0.167	1.195	33.2
1.0 N	0.117	1.195	33.1

2. Discussion -

The control yields of the assay alga, Selenastrum capricornutum, indicate that the potential primary productivity of Braunig Lake was high at the times the samples were collected. In both assays, there was an insignificant change in yield with the addition of orthophosphorus but a large increase in yield when only nitrogen was added. This indicates Braunig Lake was limited by nitrogen when sampled.

The lake data also indicate nitrogen limitation; i.e., inorganic nitrogen to orthophosphorus ratios were 5 to 1 or less at all stations in March, May, and November.

V. NUTRIENT LOADINGS

Insufficient flows in the tributaries during the sampling year prevented sampling. Therefore, estimates of nutrient loadings are not available.

VI. LITERATURE REVIEWED

Latchford, John B., Jr., 1974. Personal communication (morphometry). TX Water Qual. Bd., Austin.

VI. APPENDICES

APPENDIX A

LAKE RANKINGS

LAKES RANKED BY INDEX NOS.

RANK	LAKE CODE	LAKE NAME	INDEX NO
1	4809	CANYON RESERVOIR	445
2	4823	LAKE MEREDITH	441
3	4813	EAGLE MOUNTAIN LAKE	430
4	4816	KEMP LAKE	423
5	4801	AMISTAD LAKE	402
6	4805	BROWNWOOD LAKE	394
7	4802	BASTROP LAKE	393
8	4838	WHITE RIVER RESERVOIR	390
9	4825	POSSUM KINGDOM RESERVOIR	387
10	4835	TRAVIS LAKE	384
11	4803	BELTON RESERVOIR	384
12	4831	STILLHOUSE HOLLOW RESERV	372
13	4812	DIVERSION LAKE	372
14	4808	CALAVERAS LAKE	362
15	4839	WHITNEY LAKE	357
16	4822	MEDINA LAKE	342
17	4827	SAM RAYBURN RESERVOIR	322
18	4828	E V SPENCE RESERVOIR	321
19	4837	TWIN BUTTES RESERVOIR	311
20	4810	LAKE COLORADO CITY	310
21	4824	PALESTINE LAKE	302
22	4818	LAKE OF THE PINES	298
23	4807	CADDO LAKE	297
24	4814	FT PHANTOM HILL LAKE	296
25	4806	LAKE BUCHANAN	261
26	4830	STAMFORD LAKE	259
27	4819	LAVON RESERVOIR	258
28	4832	TAWAKONI LAKE	253

LAKES RANKED BY INDEX NOS.

RANK	LAKE CODE	LAKE NAME	INDEX NO
29	4821	LYNDON B JOHNSON LAKE	238
30	4834	TEXOMA LAKE	217
31	4829	SOMERVILLE LAKE	208
32	4826	SAN ANGELO RESERVOIR	200
33	4833	TEXARKANA LAKE	176
34	4815	GARZA LITTLE ELM RESERVO	173
35	4836	TRINIDAD	169
36	4804	BRAUNIG LAKE	159
37	4811	CORPUS CRISTI LAKE	155
38	4817	HOUSTON LAKE	139
39	4820	LIVINGSTON LAKE	91

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
4801	AMISTAD LAKE	0.013	0.500	371.474	2.042	14.900	0.009
4802	BASTROP LAKE	0.022	0.090	419.917	12.392	15.000	0.007
4803	BELTON RESERVOIR	0.016	0.185	378.312	8.025	15.000	0.007
4804	BRAUNIG LAKE	0.134	0.150	461.625	22.762	14.800	0.062
4805	BROWNWOOD LAKE	0.027	0.100	470.375	4.887	14.400	0.007
4806	LAKE BUCHANAN	0.036	0.250	437.625	8.606	15.000	0.012
4807	CADDO LAKE	0.055	0.070	463.333	14.808	11.400	0.013
4808	CALAVERAS LAKE	0.038	0.060	461.667	22.500	13.000	0.007
4809	CANYON RESERVOIR	0.010	0.450	384.812	2.500	14.800	0.006
4810	LAKE COLORADO CITY	0.042	0.090	473.625	12.675	10.200	0.012
4811	CORPUS CRISTI LAKE	0.113	0.130	475.187	19.756	14.000	0.050
4812	DIVERSION LAKE	0.025	0.080	470.111	15.867	9.000	0.009
4813	EAGLE MOUNTAIN LAKE	0.024	0.070	469.625	5.662	11.000	0.008
4814	FT PHANTOM HILL LAKE	0.060	0.105	474.909	6.317	9.800	0.022
4815	GARZA LITTLE ELM RESERVO	0.045	0.380	475.782	14.156	14.600	0.018
4816	KEMP LAKE	0.023	0.110	455.000	10.217	10.400	0.007
4817	HOUSTON LAKE	0.097	0.260	486.187	16.650	12.400	0.036
4818	LAKE OF THE PINES	0.031	0.090	440.000	12.919	15.000	0.011
4819	LAVON RESERVOIR	0.063	0.180	485.333	5.400	8.800	0.018
4820	LIVINGSTON LAKE	0.196	0.555	465.469	16.112	15.000	0.128
4821	LYNDON B JOHNSON LAKE	0.042	0.420	456.500	8.100	14.900	0.013
4822	MEDINA LAKE	0.010	0.600	403.562	12.944	15.000	0.004
4823	LAKE MEREDITH	0.021	0.070	439.312	3.037	14.900	0.009
4824	PALESTINE LAKE	0.031	0.180	442.625	10.619	14.800	0.010
4825	POSSUM KINGDOM RESERVOIR	0.023	0.070	419.045	9.495	15.000	0.009
4826	SAN ANGELO RESERVOIR	0.098	0.140	481.000	24.675	10.200	0.011
4827	SAM RAYBURN RESERVOIR	0.029	0.150	439.458	6.267	15.000	0.009
4828	E V SPENCE RESERVOIR	0.036	0.080	462.583	11.775	15.000	0.008

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
4829	SOMERVILLE LAKE	0.053	0.115	473.833	24.491	13.000	0.013
4830	STAMFORD LAKE	0.073	0.060	482.714	18.457	10.600	0.012
4831	STILLHOUSE HOLLOW RESERV	0.018	0.160	406.250	3.917	15.000	0.010
4832	TAWAKONI LAKE	0.046	0.100	466.417	18.246	13.200	0.013
4833	TEXARKANA LAKE	0.106	0.120	478.500	19.119	12.400	0.030
4834	TEXOMA LAKE	0.042	0.160	451.321	12.493	15.000	0.018
4835	TRAVIS LAKE	0.018	0.250	389.913	5.595	15.000	0.007
4836	TRINIDAD	0.389	0.110	479.500	24.300	10.000	0.240
4837	TWIN BUTTES RESERVOIR	0.029	0.250	454.917	8.708	14.800	0.009
4838	WHITE RIVER RESERVOIR	0.020	0.110	434.500	4.333	15.000	0.009
4839	WHITNEY LAKE	0.028	0.120	430.500	6.912	15.000	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	INDEX NO
4801	AMISTAD LAKE	95 (36)	5 (2)	100 (38)	100 (38)	39 (14)	63 (21)	402
4802	BASTROP LAKE	79 (30)	76 (28)	82 (31)	47 (18)	17 (0)	92 (34)	393
4803	BELTON RESERVOIR	92 (35)	26 (10)	97 (37)	68 (26)	17 (0)	84 (31)	384
4804	BRAUNIG LAKE	5 (2)	42 (16)	50 (19)	8 (3)	49 (17)	5 (2)	159
4805	BROWNWOOD LAKE	66 (25)	70 (26)	29 (11)	87 (33)	58 (22)	84 (31)	394
4806	LAKE BUCHANAN	47 (18)	21 (7)	74 (28)	63 (24)	17 (0)	39 (14)	261
4807	CADDO LAKE	26 (10)	91 (33)	42 (16)	32 (12)	76 (29)	30 (10)	297
4808	CALAVERAS LAKE	45 (17)	100 (38)	47 (18)	11 (4)	67 (25)	92 (34)	362
4809	CANYON RESERVOIR	99 (37)	8 (3)	95 (36)	97 (37)	49 (17)	97 (37)	445
4810	LAKE COLORADO CITY	39 (14)	76 (28)	26 (10)	42 (16)	88 (33)	39 (14)	310
4811	CORPUS CRISTI LAKE	8 (3)	47 (18)	18 (7)	13 (5)	61 (23)	8 (3)	155
4812	DIVERSION LAKE	68 (26)	83 (31)	32 (12)	29 (11)	97 (37)	63 (21)	372
4813	EAGLE MOUNTAIN LAKE	71 (27)	91 (33)	34 (13)	79 (30)	79 (30)	76 (28)	430
4814	FT PHANTOM HILL LAKE	24 (9)	66 (25)	21 (8)	74 (28)	95 (36)	16 (6)	296
4815	GARZA LITTLE ELM RESERVO	34 (13)	13 (5)	16 (6)	34 (13)	55 (21)	21 (7)	173
4816	KEMP LAKE	76 (29)	61 (22)	55 (21)	55 (21)	84 (32)	92 (34)	423
4817	HOUSTON LAKE	16 (6)	16 (6)	0 (0)	24 (9)	72 (27)	11 (4)	139
4818	LAKE OF THE PINES	54 (20)	76 (28)	66 (25)	39 (15)	17 (0)	46 (17)	298
4819	LAVON RESERVOIR	21 (8)	29 (11)	3 (1)	84 (32)	100 (38)	21 (7)	258
4820	LIVINGSTON LAKE	3 (1)	3 (1)	39 (15)	26 (10)	17 (0)	3 (1)	91
4821	LYNDON B JOHNSON LAKE	39 (14)	11 (4)	53 (20)	66 (25)	39 (14)	30 (10)	238
4822	MEDINA LAKE	99 (37)	0 (0)	89 (34)	37 (14)	17 (0)	100 (38)	342
4823	LAKE MEREDITH	82 (31)	91 (33)	71 (27)	95 (36)	39 (14)	63 (21)	441
4824	PALESTINE LAKE	54 (20)	32 (12)	63 (24)	53 (20)	49 (17)	51 (19)	302
4825	POSSUM KINGDOM RESERVOIR	74 (28)	91 (33)	84 (32)	58 (22)	17 (0)	63 (21)	387
4826	SAN ANGELO RESERVOIR	13 (5)	45 (17)	8 (3)	0 (0)	88 (33)	46 (17)	200
4827	SAM RAYBURN RESERVOIR	59 (22)	39 (15)	68 (26)	76 (29)	17 (0)	63 (21)	322
4828	E V SPENCE RESERVOIR	50 (19)	83 (31)	45 (17)	50 (19)	17 (0)	76 (28)	321

PERCENT OF LAKES WITH HIGHER VALUES (NUMBER OF LAKES WITH HIGHER VALUES)

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P	INDEX NO
4829	SOMERVILLE LAKE	29 (11)	55 (21)	24 (9)	3 (1)	67 (25)	30 (10)	208
4830	STAMFORD LAKE	18 (7)	97 (37)	5 (2)	18 (7)	82 (31)	39 (14)	259
4831	STILLHOUSE HOLLOW RESERV	88 (33)	37 (14)	87 (33)	92 (35)	17 (0)	51 (19)	372
4832	TAWAKONI LAKE	32 (12)	70 (26)	37 (14)	21 (8)	63 (24)	30 (10)	253
4833	TEXARKANA LAKE	11 (4)	51 (19)	13 (5)	16 (6)	72 (27)	13 (5)	176
4834	TEXOMA LAKE	39 (14)	34 (13)	61 (23)	45 (17)	17 (0)	21 (7)	217
4835	TRAVIS LAKE	88 (33)	21 (7)	92 (35)	82 (31)	17 (0)	84 (31)	384
4836	TRINIDAD	0 (0)	61 (22)	11 (4)	5 (2)	92 (35)	0 (0)	169
4837	TWIN BUTTES RESERVOIR	59 (22)	21 (7)	58 (22)	61 (23)	49 (17)	63 (21)	311
4838	WHITE RIVER RESERVOIR	84 (32)	61 (22)	76 (29)	89 (34)	17 (0)	63 (21)	390
4839	WHITNEY LAKE	63 (24)	51 (19)	79 (30)	71 (27)	17 (0)	76 (28)	357

APPENDIX B

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 C

TRIBUTARY FLOW DATA

TRIBUTARY FLOW INFORMATION FOR TEXAS 03/16/7-

LAKE CODE 4804 BRAUNIG

TOTAL DRAINAGE AREA OF LAKE(SQ KM) 24.3

TRIBUTARY	SUB-DRAINAGE AREA(SQ KM)	NORMALIZED FLOWS(CMS) JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
4804A1	24.3	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28
4804ZZ	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 24.3
SUM OF SUB-DRAINAGE AREAS = 0.0
TOTAL FLOW IN = 0.0
TOTAL FLOW OUT = 3.40

NOTE *** ELEVATION MAINTAINED BY PUMPING WATER FROM SAN ANTONIO RIVER.

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
4804A1	9	74	0.0	7	0.0				
	10	74	0.0	7	0.0				
	11	74	0.0	7	0.0				
	12	74	0.340	7	0.0				
	1	75	5.125	7	0.0				
	2	75	0.340	6	0.0				
	3	75	0.340	7	0.0				
	4	75	0.340	7	0.0	23	0.0		
	5	75	4.870	8	0.0	22	0.0		
	6	75	9.231	11	0.736				
	7	75	0.227	15	0.0				
	8	75	6.145	13	0.006				
4804ZZ	9	74	0.0						
	10	74	0.0						
	11	74	0.0						
	12	74	0.0						
	1	75	0.0						
	2	75	0.0						
	3	75	0.0						
	4	75	0.0						
	5	75	0.0						
	6	75	0.736						
	7	75	0.0						
	8	75	0.0						

APPENDIX D

PHYSICAL and CHEMICAL DATA

STORET RETRIEVAL DATE 76/02/11

480401
29 14 16.0 098 22 16.0
BRAUNIG LAKE
48029 TEXAS

11EPALES 2111202
3 0037 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
74/03/12	15 30	0000	24.1		36	1190	8.55	176	0.040	1.200	0.160	0.062
	15 30	0006	23.3	8.2		1170	8.55	178	0.030	1.000	0.090	0.047
	15 30	0015	21.6	7.2		1120	8.30	177	0.030	1.000	0.140	0.066
	15 30	0025	19.1	1.8		1050	7.60	177	0.310	1.200	0.110	0.058
	15 30	0033	16.3	2.0		1005	7.55	178	0.320	1.200	0.110	0.055
74/05/21	15 30	0000	31.1		60	1407	8.85	164	0.060	1.400	0.050	0.053
	15 30	0005	30.5	8.0		1385	8.80	164	0.030	0.900	0.040	0.046
	15 30	0015	27.8	4.6		1299	8.45	168	0.070	0.900	0.250	0.132
	15 30	0028	24.1	0.6		1220	7.95	175	0.150	0.800	0.050	0.149
74/08/14	15 20	0000	29.1	5.8	48	1356	9.10					
	15 20	0005	29.0	5.0		1355	9.00					
	15 20	0015	28.4	3.2		1341	8.60					
	15 20	0028	27.1	0.2		1328	8.20					
74/11/05	14 10	0000	25.9	4.8	47	1207	8.55	167	0.040	1.200	0.160	0.134
	14 10	0005	26.3	5.0		1213	8.51	168	0.030	1.100	0.120	0.125
	14 10	0015	26.1	4.8		1211	8.49	168	0.040	0.900	0.120	0.127
	14 10	0031	25.9	4.6		1209	8.46	168	0.060	0.900	0.120	0.128

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
74/03/12	15 30	0000	0.134	25.1	
	15 30	0006	0.124		
	15 30	0015	0.130		
	15 30	0025	0.120		
	15 30	0033	0.124		
74/05/21	15 30	0000	0.121	14.5	
	15 30	0005	0.115		
	15 30	0015	0.202		
	15 30	0028	0.234		
74/08/14	15 20	0000		24.5	
	15 20	0007			1.0
74/11/05	14 10	0000	0.209	25.9	
	14 10	0005	0.195		
	14 10	0015	0.193		
	14 10	0031	0.201		

STORET RETRIEVAL DATE 76/02/11

480402
29 15 24.0 098 23 14.0
BRAUNIG LAKE
48029 TEXAS

11EPALES
3

2111202
0018 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
74/03/12	16 00	0000	25.0		36	1215	8.60	175	0.030	1.300	0.040	0.025
	16 00	0006	22.7	4.4		1145	8.50	177	0.030	1.000	0.030	0.030
	16 00	0014	21.0	6.2		1111	8.20	178	0.040	1.000	0.060	0.050
74/05/21	15 55	0000	30.7		48	1384	8.80	164	0.060	0.900	0.070	0.049
	15 55	0005	29.2	4.4		1353	8.55	166	0.050	0.800	0.060	0.056
	15 55	0010	28.4	5.6		1335	8.60	166	0.040	0.900	0.060	0.055
	15 55	0015	27.3	3.0		1295	8.25	170	0.140	0.900	0.130	0.099
74/08/14	13 45	0000	35.3	8.0	4	1518	9.30					
	13 45	0005	34.4	8.2		1502	9.20					
	13 45	0010	33.1	6.4		1430	9.10					
74/11/05	14 35	0000	28.1	6.2	28	1259	8.59	168	0.050	0.900	0.120	0.118
	14 35	0005	27.7	6.0		1240	8.53	167	0.040	1.200	0.110	0.115
	14 35	0015	26.4	6.0		1218	8.48	124	0.020K	0.200	0.110	0.117

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
74/03/12	16 00	0000	0.106	23.9	
	16 00	0006	0.104		
	16 00	0014	0.117		
74/05/21	15 55	0000	0.115	14.5	
	15 55	0005	0.134		
	15 55	0010	0.127		
	15 55	0015	0.176		
74/08/14	13 45	0000		33.7	
	13 45	0010			1.0
74/11/05	14 35	0000	0.204	20.0	
	14 35	0005	0.199		
	14 35	0015	0.199		

K VALUE KNOWN TO BE
LESS THAN INDICATED