

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



REPORT
ON
BELTON RESERVOIR
BELL AND CORYELL COUNTIES
TEXAS
EPA REGION VI
WORKING PAPER No. 633

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

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WITH THE COOPERATION OF THE
TEXAS WATER QUALITY BOARD
AND THE
TEXAS NATIONAL GUARD
FEBRUARY, 1977

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F O R E W O R D

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

<u>NAME</u>	<u>COUNTY</u>
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

Medina

Meredith

O. C. Fisher (San Angelo)

Palestine

Possum Kingdom

Sam Rayburn

Somerville

E. V. Spence

Stamford

Stillhouse Hollow

Tawakoni

Texoma

Travis

Trinidad

Twin Buttes

White River

Whitney

Wright Patman (Texarkana)

Burnet, Llano

Bandera, Medina

Hutchinson, Moore,
Potter

Tom Green

Anderson, Cherokee,
Henderson, Smith

Palo Pinto, Stephens,
Young

Angelina, Jasper
Nacogdoches, Sabine, San
Augustine

Burleson, Lee, Washington

Coke

Haskell

Bell

Hunt, Rains, Van Zandt

Cooke, Grayson TX; Bryan,
Johnston, Love, Marshall, OK

Burnet, Travis

Henderson

Tom Green

Crosby

Bosque, Hill

Bowie, Cass

BELTON RESERVOIR

STORET NO. 4803

I. CONCLUSIONS

A. Trophic Condition:

Survey data indicate that Belton Reservoir is meso-eutrophic; i.e., moderately well supplied with nutrients and productive. Whether nutrient enrichment is beneficial or deleterious depends on the actual or potential effect on the uses of the reservoir. In this regard, no nuisance conditions are known to personnel of the Texas Water Quality Board and there is little or no impairment of the designated beneficial uses of Belton Reservoir.

Belton Reservoir ranked eleventh in overall trophic quality when the 39 Texas reservoirs sampled in 1974 were compared using a combination of six parameters*. Three of the reservoirs had less median total phosphorus, two had less and five had the same median dissolved orthophosphorus, 28 had less median inorganic nitrogen, 12 had less mean chlorophyll a, and one had greater mean Secchi disc transparency. Marked depression of hypolimnetic dissolved oxygen occurred at all four sampling stations in May and August.

Survey limnologists did not observe macrophytes or algal blooms during any sampling time, but chlorophyll a concentrations were somewhat high at station 4 in May, August, and November and at station 1 in August (see page 9).

* See Appendix A.

B. Rate-Limiting Nutrient:

The algal assay results indicate phosphorus was the limiting nutrient when the assay samples were collected in May and November. The reservoir data indicate phosphorus limitation at all sampling times.

C. Nutrient Controllability:

1. Point sources--The phosphorus contribution of known point sources amounted to 12.2% of the total load to Belton Reservoir during the sampling year. Most of the point-source load was contributed by Copperas Cove (8.7%) and Gatesville (2.5%).

The present phosphorus loading of $3.95 \text{ g/m}^2/\text{yr}$ is over seven times that proposed by Vollenweider (Vollenweider and Dillon, 1974) as a eutrophic loading (see page 16), and all phosphorus inputs to Belton Reservoir should be minimized to the greatest practicable degree to slow the aging of the reservoir.

2. Non-point sources--Non-point sources contributed 87.8% of the total phosphorus load to the reservoir. The Leon River contributed 16.8% of the total; Cowhouse Creek, 65.3%; and the ungaged tributaries contributed an estimated 5.3%.

The phosphorus export rates of the Leon River and Cowhouse Creek were 5 and $71 \text{ kg/km}^2/\text{yr}$, respectively (see page 15). The export rate of the Leon River compares quite well to rates of tributaries of other Texas reservoirs, but the export rate of Cowhouse Creek was considerably higher. This higher rate may be due to unidentified point sources rather than to non-point source inputs. There are a

number of small communities served by septic tanks that may be impacting Cowhouse Creek, but more extensive sampling would have to be done to establish the significance of these possible sources.

II. RESERVOIR AND DRAINAGE BASIN CHARACTERISTICS[†]

A. Morphometry^{††}:

1. Surface area: 50.27 kilometers².
2. Mean depth: 10.8 meters.
3. Maximum depth: >25.6 meters.
4. Volume: 545.188 x 10⁶ m³.
5. Mean hydraulic retention time: 1.6 years (based on 1972-1976 mean outflow).

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

1. Tributaries -

<u>Name</u>	<u>Drainage area (km²)*</u>	<u>Mean flow (m³/sec)*</u>
Leon River	6,728.8	10.11
Cowhouse Creek	1,815.6	5.41
Minor tributaries & immediate drainage -	<u>636.6</u>	<u>2.80</u>
Totals	9,181.0	18.32

2. Outlet -

City of Killeen aqueduct	0.0	0.70**
Leon River	<u>9,230.8</u>	<u>16.41</u>
Totals	9,230.8***	17.11***

C. Precipitation****:

1. Year of sampling: 89.1 centimeters.
2. Mean annual: 86.4 centimeters.

[†] Table of metric conversions--Appendix B.

^{††} At conservation pool level; Barrows, 1977.

* For limits of accuracy, see Working Paper No. 175, "...Survey Methods, 1973-1976".

** White, 1976.

*** Includes area of reservoir; lesser outflow due to evaporation.

**** See Working Paper No. 175.

III. RESERVOIR WATER QUALITY SUMMARY

Belton Reservoir 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 four stations on the reservoir (see map, page v). During each visit, a single depth-integrated (4.6 m 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 25.3 meters at station 1, 25.6 meters at station 2, 25.3 meters at station 3, and 11.0 meters at station 4.

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 BELTON RESERVOIR
STORET CODE 4803

1ST SAMPLING (3/13/74)

2ND SAMPLING (5/20/74)

3RD SAMPLING (8/14/74)

4 SITES

4 SITES

4 SITES

PARAMETER	RANGE	MEAN	MEDIAN	RANGE	MEAN	MEDIAN	RANGE	MEAN	MEDIAN
TEMP (C)	11.6 - 18.9	16.0	16.8	13.9 - 26.9	22.4	24.3	15.4 - 29.2	24.8	27.3
DISS OXY (MG/L)	7.0 - 9.8	8.8	9.0	0.1 - 8.6	4.6	4.4	0.0 - 7.6	3.8	5.2
CNDCTVY (MCROMO)	335. - 435.	378.	378.	356. - 498.	431.	428.	381. - 480.	443.	451.
PH (STAND UNITS)	7.9 - 8.4	8.2	8.3	7.5 - 8.5	8.1	8.1	7.5 - 8.5	8.0	8.0
TOT ALK (MG/L)	144. - 158.	149.	147.	130. - 152.	142.	145.	*****	*****	*****
TOT P (MG/L)	0.008 - 0.123	0.018	0.011	0.011 - 0.075	0.022	0.017	*****	*****	*****
ORTHU P (MG/L)	0.004 - 0.014	0.008	0.008	0.003 - 0.009	0.006	0.006	*****	*****	*****
NO2+NO3 (MG/L)	0.120 - 0.220	0.162	0.160	0.050 - 0.300	0.143	0.120	*****	*****	*****
AMMONIA (MG/L)	0.020 - 0.100	0.035	0.030	0.020 - 0.110	0.050	0.040	*****	*****	*****
KJEL N (MG/L)	0.200 - 0.500	0.335	0.300	0.300 - 0.800	0.457	0.400	*****	*****	*****
INORG N (MG/L)	0.140 - 0.300	0.197	0.190	0.080 - 0.380	0.193	0.160	*****	*****	*****
TOTAL N (MG/L)	0.360 - 0.700	0.497	0.460	0.450 - 0.900	0.600	0.600	*****	*****	*****
CHLRPYL A (UG/L)	1.1 - 3.2	1.7	1.3	3.2 - 24.9	10.4	6.8	4.8 - 35.0	14.5	9.1
SECCHI (METERS)	3.0 - 6.1	5.0	5.5	1.1 - 2.4	2.0	2.3	2.2 - 5.2	3.5	3.4

A. SUMMARY OF PHYSICAL AND CHEMICAL CHARACTERISTICS FOR BELTON RESERVOIR
STORET CODE 4803

4TH SAMPLING (11/ 1/74)

PARAMETER	4 SITES			
	RANGE	MEAN	MEDIAN	
TEMP (C)	19.2 - 21.6	21.0	21.1	
DISS OXY (MG/L)	5.8 - 7.8	6.9	6.8	
CNDCTVY (MCROMO)	131. - 371.	320.	363.	
PH (STAND UNITS)	7.7 - 8.0	7.9	7.8	
TOT ALK (MG/L)	73. - 132.	118.	127.	
TOT P (MG/L)	0.013 - 0.311	0.069	0.020	
ORTHO P (MG/L)	0.005 - 0.057	0.016	0.011	
NO2+NO3 (MG/L)	0.060 - 0.810	0.191	0.140	
AMMONIA (MG/L)	0.020 - 0.140	0.044	0.030	
KJEL N (MG/L)	0.200 - 1.200	0.422	0.400	
INORG N (MG/L)	0.110 - 0.910	0.235	0.170	
TOTAL N (MG/L)	0.320 - 1.510	0.613	0.480	
CHLRPYL A (UG/L)	1.4 - 12.5	5.4	3.8	
SECCHI (METERS)	0.5 - 2.3	1.8	2.1	

B. Biological characteristics:

1. Phytoplankton -

<u>Sampling Date</u>	<u>Dominant Genera</u>	<u>Algal Units per ml</u>
03/13/74	1. <u>Chroomonas sp.</u>	539
	2. <u>Cryptomonas sp.</u>	135
	3. <u>Scenedesmus sp.</u>	67
	4. <u>Pennate diatoms</u>	34
	5. <u>Sphaerocystis sp.</u>	34
	Total	809
05/20/74	1. <u>Oocystis sp.</u>	2,057
	2. <u>Microcystis sp.</u>	853
	3. <u>Coelastrum sp.</u>	552
	4. <u>Dinobryon sp.</u>	452
	5. <u>Chroomonas sp.</u>	401
	Other genera	953
	Total	5,268
08/14/74	1. <u>Raphidiopsis sp.</u>	885
	2. <u>Anabaenopsis sp.</u>	442
	3. <u>Oscillatoria sp.</u>	221
	4. <u>Carteria sp.</u>	184
	5. <u>Pennate diatoms</u>	148
	Other genera	533
	Total	2,433
11/01/74	1. <u>Chroomonas sp.</u>	499
	2. <u>Merismopedia sp.</u>	461
	3. <u>Anabaenopsis sp.</u>	384
	4. <u>Dactylococcopsis sp.</u>	269
	5. <u>Raphidiopsis sp.</u>	192
	Other genera	577
	Total	2,382

2. Chlorophyll a -

<u>Sampling Date</u>	<u>Station Number</u>	<u>Chlorophyll <u>a</u> ($\mu\text{g/l}$)</u>
03/13/74	1	1.1
	2	1.3
	3	1.4
	4	3.2
05/20/74	1	3.2
	2	7.4
	3	6.3
	4	24.9
08/14/74	1	35.0
	2	5.7
	3	4.8
	4	12.5
11/01/74	1	1.4
	2	3.9
	3	3.8
	4	12.5

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

a. March sample -

<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	0.223	0.1
0.050 P	0.055	0.223	0.6
0.050 P + 1.0 N	0.055	1.223	5.4
1.0 N	0.005	1.223	0.1

b. November sample -

<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	0.132	0.3
0.050 P	0.055	0.132	4.1
0.050 P + 1.0 N	0.055	1.132	16.5
1.0 N	0.005	1.132	0.2

2. Discussion -

The control yields of the assay alga, Selenastrum capricornutum, indicate that the potential primary productivity of Belton Reservoir was low at the times the assay samples were collected. Both assays yielded similar results. There was a significant growth response when phosphorus was added alone, but no change in yield occurred with the addition of only nitrogen. These results indicate that phosphorus was limiting at the times of sample collection (03/13/74 and 11/01/74).

The reservoir data substantiate the assay findings. The mean inorganic nitrogen to orthophosphorus ratios were 25 to 1 in March, 32 to 1 in May, and 15 to 1 in November.

IV. NUTRIENT LOADINGS (See Appendix E for data)

For the determination of nutrient loadings, the Texas National Guard collected monthly near-surface grab samples from each of the tributary sites indicated on the map (page vi), except for the months of April and May when two samples were collected. Sampling was begun in September, 1974, and was completed in August, 1975.

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

In this report, nutrient loads for sampled tributaries were calculated using mean annual concentrations and mean annual flows. Nutrient loads shown are those measured minus point-source loads, if any.

Nutrient loads for unsampled "minor tributaries and immediate drainage" ("ZZ" of U.S.G.S.) were estimated using the mean concentrations in the Leon River at station A-2 and the mean annual ZZ flow.

The operators of the Copperas Cove and Moody wastewater treatment plants provided monthly effluent samples and corresponding flow data. The communities of Gatesville and Morgan's Point did not participate; nutrient loads were estimated at 1.134 kg P and 3.401 kg N/capita/year, and flows were estimated at 0.3785 m³/capita/day.

A. Waste Sources:

1. Known municipal[†] -

<u>Name</u>	<u>Pop. Served</u>	<u>Treatment</u>	<u>Mean Flow (m³/d)</u>	<u>Receiving Water</u>
Copperas Cove -				
NE	10,000	stab. pond	3,064.0	House Creek
NW	7,500	stab. pond	1,900.9	House Creek
Moody	1,286	Imhoff tank	447.1	Stampede Creek
Gatesville*	4,400	tr. filter	1,665.4	Leon River
Morgan's Point**	160	?	60.6	Belton Reservoir

2. Known industrial - None

[†] Treatment plant questionnaires.

* Anonymous, 1971.

** Wyatt, 1976.

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

<u>Source</u>	<u>kg P/ yr</u>	<u>% of total</u>
a. Tributaries (non-point load) -		
Leon River	33,270	16.8
Cowhouse Creek	129,665	65.3
b. Minor tributaries & immediate drainage (non-point load) -	10,595	5.3
c. Known municipal STP's -		
Copperas Cove		
NE	10,525	5.3
NW	6,795	3.4
Moody	1,720	0.9
Gatesville	4,990	2.5
Morgan's Point	180	0.1
d. Septic tanks* -	50	<0.1
e. Known industrial - None	-	-
f. Direct precipitation** -	<u>870</u>	<u>0.4</u>
Total	198,660	100.0

2. Outputs -

Lake outlet - Killeen aqueduct	375
Leon River	<u>17,080</u>
Total	17,455

3. Net annual P accumulation - 181,205 kg.

* Estimate based on 120 lakeshore dwellings, nine parks, and one campground;
see Working Paper No. 175.

** See 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 (non-point load) -		
Leon River	470,930	49.4
Cowhouse Creek	235,100	24.6
b. Minor tributaries & immediate drainage (non-point load) -	134,570	14.1
c. Known municipal STP's -		
Copperas Cove		
NE	21,565	2.3
NW	15,115	1.6
Moody	5,380	0.6
Gatesville	14,965	1.6
Morgan's Point	545	<0.1
d. Septic tanks* -	1,945	0.2
e. Known industrial - None	-	-
f. Direct precipitation** -	<u>53,740</u>	<u>5.6</u>
Total	953,855	100.0

2. Outputs -

Lake outlet - Killeen aqueduct	13,620
Leon River	<u>467,310</u>
Total	480,930

3. Net annual N accumulation - 472,925 kg.

* Estimate based on 120 lakeshore dwellings, nine parks, and one campground,
see Working Paper No. 175.

** See Working Paper No. 175.

D. Non-point Nutrient Export by Subdrainage Area:

<u>Tributary</u>	<u>kg P/km²/yr</u>	<u>kg N/km²/yr</u>
Leon River	5	70
Cowhouse Creek	71	129

E. Mean Nutrient Concentrations in Ungaged Stream:

<u>Tributary</u>	<u>Mean Total P Conc. (mg/l)</u>	<u>Mean Total N Conc. (mg/l)</u>
Owl Creek	0.013	0.991

F. Yearly Loads:

In the following table, the existing phosphorus loadings are compared to those proposed by Vollenweider (Vollenweider and Dillon, 1974). Essentially, his "dangerous" loading is one at which the receiving water would become eutrophic or remain eutrophic; his "permissible" 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 "dangerous" and "permissible".

Note that Vollenweider's model may not be applicable to water bodies with short hydraulic retention times.

	Total Phosphorus		Total Nitrogen	
	Total	Accumulated	Total	Accumulated
grams/m ² /yr	3.95	3.60	19.0	9.4

Vollenweider phosphorus loadings
(g/m²/yr) based on mean depth and mean
hydraulic retention time of Belton Reservoir:

"Dangerous" (eutrophic loading)	0.52
"Permissible" (oligotrophic loading)	0.26

V. LITERATURE REVIEWED

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VI. APPENDICES

APPENDIX A

LAKE RANKINGS

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	2.792	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	HASTROP 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)	82 (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

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

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

03/15/76

LAKE CODE 4803 BELTON RESERVOIR

TOTAL DRAINAGE AREA OF LAKE(SQ KM) 9230.8

TRIBUTARY	SUB-DRAINAGE AREA(SQ KM)	NORMALIZED FLOWS(CMS)												
		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
4803A1	9230.8	12.43	14.53	20.61	16.57	28.01	32.56	20.64	7.65	4.67	15.77	13.82	9.49	16.41
4803A2	6728.8	8.72	10.28	8.83	12.60	33.70	10.93	6.46	2.15	4.42	13.28	5.15	4.59	10.11
4803D1	1815.6	5.49	5.78	5.78	7.05	16.99	3.62	2.01	1.50	2.80	7.45	3.06	3.31	5.41
4803ZZ	686.3	2.69	2.94	2.75	3.54	8.92	2.29	1.33	0.74	1.33	3.82	1.56	1.61	2.80

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 9230.8
SUM OF SUB-DRAINAGE AREAS = 9230.7

TOTAL FLOW IN = 219.48
TOTAL FLOW OUT = 196.75

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
4803A1	9	74	8.382	7	25.995				
	10	74	31.715	12	48.988				
	11	74	25.202	15	42.192				
	12	74	43.976	16	42.758				
	1	75	73.624	16	99.109				
	2	75	61.731	24	79.854				
	3	75	41.059	11	28.034				
	4	75	43.891	6	5.550	24	77.588		
	5	75	13.564	4	0.0	18	1.671		
	6	75	45.024	22	54.368				
	7	75	11.327	23	0.708				
	8	75	2.039	27	0.453				
4803A2	9	74	13.082	7	0.170				
	10	74	9.458	10	0.453				
	11	74	5.918	2	0.0				
	12	74	5.918	7	5.663				
	1	75	8.467	16	14.413				
	2	75	31.432	24	0.0	27	15.744		
	3	75	6.003						
	4	75	28.260	7	26.618	24	16.027		
	5	75	13.819	6	8.438	18	6.145		
	6	75	5.182						
	7	75	3.455	15	1.218				
	8	75	1.359	27	0.311				

TRIBUTARY FLOW INFORMATION FOR TEXAS

03/16/76

LAKE CODE 4803 BELTON RESERVOIR

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
4803D1	9	74	9.231	9	0.096				
	10	74	9.854	12	0.425				
	11	74	6.994	15	4.616				
	12	74	3.200	11	9.628				
	1	75	3.313	16	3.681				
	2	75	21.832	17	9.231				
	3	75	3.908	1	5.210				
	4	75	16.792	6	2.379	24	2.549		
	5	75	13.366	4	2.350	18	1.642		
	6	75	4.361	22	3.483				
	7	75	1.869	23	0.765				
	8	75	0.680	7	0.708				
4803Z2	9	74	2.690						
	10	74	2.322						
	11	74	2.633						
	12	74	1.218						
	1	75	1.246						
	2	75	8.240						
	3	75	1.472						
	4	75	6.343						
	5	75	5.040						
	6	75	1.642						
	7	75	0.708						
	8	75	0.255						

APPENDIX D

PHYSICAL and CHEMICAL DATA

STORET RETRIEVAL DATE 76/02/11

480301
31 06 24.0 097 28 31.0
BELTON RESERVOIR
48027 TEXAS

11EPALES
3

2111202
0078 FEET DEPTH

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
74/03/13	13 10	0000	16.8		240	374	8.35	145	0.020	0.300	0.150	0.010
	13 10	0010	16.8	9.6		374	8.35	144	0.020	0.400	0.150	0.011
	13 10	0020	16.7	9.6		372	8.30	145	0.020	0.300	0.150	0.011
	13 10	0040	14.8	9.8		356	8.20	144	0.030	0.300	0.160	0.008
	13 10	0060	12.2	9.6		335	8.15	145	0.040	0.300	0.150	0.014
	13 10	0073	11.6	9.0		343	8.10	145	0.050	0.300	0.160	0.012
74/05/20	14 50	0000	24.1		95	428	8.50	140	0.040	0.800	0.100	0.009
	14 50	0005	23.8	8.6		421	8.50	140	0.020	0.400	0.070	0.009
	14 50	0020	23.8	7.0		420	8.20	145	0.030	0.400	0.120	0.007
	14 50	0030	21.8	7.0		408	8.20	143	0.040	0.400	0.120	0.008
	14 50	0050	17.1	4.4		378	7.75	148	0.040	0.400	0.210	0.006
	14 50	0077	13.9	2.8		356	7.70	152	0.040	0.300	0.300	0.005
74/08/14	14 50	0000	28.3	6.4	205	465	8.50					
	14 50	0020	27.7	6.4		451	8.40					
	14 50	0035	26.9	5.2		439	8.00					
	14 50	0055	16.8	0.2		392	7.80					
	14 50	0073	15.4	0.2		381	7.90					
74/11/01	14 40	0000	21.1	7.2	84	369	7.85	131	0.050	0.600	0.160	0.009
	14 40	0005	21.1	6.8		369	7.85	132	0.030	0.400	0.130	0.006
	14 40	0020	21.1	6.4		369	7.81	132	0.020	0.300	0.130	0.005
	14 40	0040	21.1	6.4		369	7.81	127	0.040	0.300	0.140	0.005
	14 40	0060	21.1			371	7.81	129	0.030	0.300	0.130	0.012
	14 40	0083	21.1	6.8		371	7.79	130	0.020	0.400	0.130	0.013

STORET RETRIEVAL DATE 76/02/11

480301
31 06 24.0 097 28 31.0
BELTON RESERVOIR
48027 TEXAS

11EPALES
3

2111202
0078 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLORPHYL A UG/L	00031 INCDT LT REMNING PERCENT
74/03/13	13 10	0000	0.008	1.1	
	13 10	0010	0.010		
	13 10	0020	0.009		
	13 10	0040	0.010		
	13 10	0060	0.009		
	13 10	0073	0.013		
74/05/20	14 50	0000	0.019	3.2	
	14 50	0005	0.017		
	14 50	0020	0.016		
	14 50	0030	0.017		
	14 50	0050	0.016		
	14 50	0077	0.018		
74/08/14	14 50	0000		35.0	
	14 50	0033			5.0
	14 50	0045			1.0
74/11/01	14 40	0000	0.028	1.4	
	14 40	0001			50.0
	14 40	0005	0.014		
	14 40	0014			1.0
	14 40	0020	0.013		
	14 40	0040	0.013		
	14 40	0060	0.013		
	14 40	0083	0.013		

STORET RETRIEVAL DATE 76/02/11

480302
31 08 42.0 097 31 44.0
BELTON RESERVOIR
48027 TEXAS

11EPALES
3

2111202
0066 FEET DEPTH

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
74/03/13	13 45	0000	17.6		204	381	8.35	147	0.020	0.400	0.120	0.010
	13 45	0005	17.5			382	8.35	148	0.020	0.300	0.120	0.011
	13 45	0015	17.3	9.0		381	8.35	147	0.030	0.300	0.130	0.009
	13 45	0035	14.6	9.0		355	8.20	146	0.030	0.300	0.160	0.007
	13 45	0061	12.3	8.0		342	8.00	146	0.060	0.300	0.180	0.006
74/05/20	15 20	0000	26.9		85	431	8.50	136	0.050	0.700	0.080	0.004
	15 20	0005	26.0	8.0		425	8.30	133	0.040	0.400	0.060	0.004
	15 20	0018	25.5	2.6		424	7.80	146	0.040	0.300	0.270	0.003
	15 20	0055	16.8	4.4		375	7.70	146	0.050	0.400	0.270	0.003
	15 20	0084	14.2	0.3		372	7.55	148	0.090	0.400	0.290	0.003
74/08/14	15 40	0000	29.2	7.2	134	468	8.40					
	15 40	0015	28.3	7.6		456	8.40					
	15 40	0030	27.3	5.2		443	8.00					
	15 40	0040	24.3	0.2		440	7.50					
	15 40	0049	19.0	0.4		411	7.50					
74/11/01	15 15	0000	21.6	7.8	84	369	8.05	131	0.020K	0.300	0.120	0.011
	15 15	0005	21.6	7.8		369	8.03	130	0.020K	0.200	0.120	0.013
	15 15	0015	21.5	7.8		369	7.95	130	0.020	0.300	0.120	0.014
	15 15	0025	21.4	6.8		371	7.87	128	0.030	0.200	0.120	0.006
	15 15	0045	21.2	6.0		367	7.73	126	0.020	0.200	0.150	0.006
	15 15	0066	20.2	6.4		167	7.83	88	0.140	1.200	0.120	0.038

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/02/11

480302
31 08 42.0 097 31 44.0
BELTON RESERVOIR
48027 TEXAS

11EPALES
3

2111202
0066 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
74/03/13	13 45	0000	0.009	1.3	
	13 45	0005	0.015		
	13 45	0015	0.013		
	13 45	0035	0.011		
	13 45	0061	0.010		
74/05/20	15 20	0000	0.013	7.4	
	15 20	0005	0.013		
	15 20	0018	0.012		
	15 20	0055	0.011		
	15 20	0084	0.031		
74/08/14	15 40	0000		5.7	
74/11/01	15 15	0000	0.018	3.9	
	15 15	0001			50.0
	15 15	0005	0.015		
	15 15	0015	0.025		1.0
	15 15	0025	0.015		
	15 15	0045	0.016		
	15 15	0066	0.300		

STORET RETRIEVAL DATE 76/02/11

480303
31 09 08.0 097 30 19.0
BELTON RESERVOIR
48027 TEXAS

11EPALES
3 2111202
0078 FEET DEPTH

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
74/03/13	14 18	0000	18.0		228	393	8.35	147	0.030	0.300	0.160	0.004
	14 18	0010	17.7			391	8.35	147	0.030	0.300	0.160	0.011
	14 18	0020	17.3	8.6		388	8.35	149	0.030	0.300	0.170	0.006
	14 18	0040	13.9	9.0		355	8.20	149	0.030	0.200	0.160	0.005
	14 18	0073	12.3	7.0		352	7.90	148	0.100	0.500	0.200	0.008
74/05/20	15 50	0000	26.0		95	437	8.50	130	0.030	0.600	0.060	0.003
	15 50	0005	25.6	8.4		433	8.45	131	0.040	0.400	0.060	0.008
	15 50	0020	24.9	7.5		428	8.15	135	0.030	0.400	0.060	0.006
	15 50	0025	24.3	4.6		498	7.80	146	0.030	0.400	0.220	0.008
	15 50	0050	17.4	0.1		457	7.60	151	0.090	0.400	0.200	0.005
	15 50	0076	14.6	0.2		461	7.60	151	0.110	0.500	0.200	0.007
74/08/15	10 15	0000	28.7	7.4	135	467	8.30					
	10 15	0020	28.0	5.6		467	8.10					
	10 15	0030	27.3	1.4		468	7.80					
	10 15	0039	25.0	0.4		441	7.60					
	10 15	0060	16.8	0.0		399	7.70					
	10 15	0075	15.9	0.0		397	7.60					
74/11/01	11 30	0000	21.5	7.2	90	363	7.91	126	0.030	0.400	0.160	0.006
	11 30	0005	21.5	7.6		363	7.91	126	0.020	0.200	0.150	0.005
	11 30	0015	21.4	6.8		361	7.89	128	0.020	0.200	0.150	0.006
	11 30	0030	21.4	6.2		361	7.77	128	0.030	0.400	0.160	0.014
	11 30	0050	21.3	5.8		355	7.71	127	0.030	0.300	0.180	0.010
	11 30	0075	19.6	6.6		177	7.83	87	0.080	0.500	0.670	0.045
	11 30	0083	19.2	6.8		157	7.91	77	0.100	0.700	0.810	0.057

STORET RETRIEVAL DATE 76/02/11

480303
31 09 08.0 097 30 19.0
BELTON RESERVOIR
48027 TEXAS

11EPALES
3

2111202
0078 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
74/03/13	14 18	0000	0.011	1.4	
	14 18	0010	0.011		
	14 18	0020	0.011		
	14 18	0040	0.012		
	14 18	0073	0.123		
74/05/20	15 50	0000	0.014	6.3	
	15 50	0005	0.015		
	15 50	0020	0.016		
	15 50	0025	0.042		
	15 50	0050	0.018		
	15 50	0076	0.075		
74/08/15	10 15	0000		4.8	
	10 15	0033			1.0
74/11/01	11 30	0000	0.024	3.8	
	11 30	0001			50.0
	11 30	0005	0.018		
	11 30	0015	0.020		1.0
	11 30	0030	0.019		
	11 30	0050	0.040		
	11 30	0075	0.197		
	11 30	0083	0.311		

STORE1 RETRIEVAL DATE 76/02/11

480304
31 12 18.0 097 30 18.0
BELTON RESERVOIR
48027 TEXAS

11EPALES 2111202
3 0026 FEET DEPTH

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
74/03/13	14 50	0000	18.9		120	435	8.40	158	0.030	0.500	0.180	0.005
	14 50	0005	18.9	8.2		435	8.40	158	0.020	0.400	0.180	0.005
	14 50	0015	18.4	8.8		424	8.30	158	0.030	0.400	0.180	0.005
	14 50	0022	15.5	7.4		388	7.95	154	0.060	0.300	0.220	0.009
74/05/20	16 15	0000	26.6		45	476	8.50	140	0.030	0.600	0.050	0.006
	16 15	0005	26.5	8.2		475	8.45	140	0.030	0.400	0.050	0.007
	16 15	0015	26.0	1.8		470	7.95	145	0.080	0.500	0.090	0.005
	16 15	0023	25.3	2.0		485	7.95	146	0.100	0.500	0.130	0.006
74/08/15	09 45	0000	28.9	7.6	85	479	8.50					
	09 45	0010	28.9	7.6		479	8.50					
	09 45	0022	27.9	2.4		480	7.70					
74/11/01	10 55	0000	21.1	7.6	18	313	8.01	118	0.060	0.700	0.080	0.014
	10 55	0005	21.1	7.2		309	8.03	118	0.050	0.400	0.060	0.009
	10 55	0020	20.5	6.8		241	7.85	99	0.060	0.400	0.230	0.023
	10 55	0036	19.8	6.2		131	7.95	73	0.100	0.800	0.180	0.030

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
74/03/13	14 50	0000	0.016	3.2	
	14 50	0005	0.017		
	14 50	0015	0.016		
	14 50	0022	0.029		
74/05/20	16 15	0000	0.029	24.9	
	16 15	0005	0.027		
	16 15	0015	0.023		
	16 15	0023	0.022		
74/08/15	09 45	0000		12.5	
	09 45	0012			5.0
	09 45	0020			1.0
74/11/01	10 55	0000	0.058	12.5	
	10 55	0003			1.0
	10 55	0005	0.050		
	10 55	0020	0.081		
	10 55	0036	0.278		

APPENDIX E
TRIBUTARY AND WASTEWATER
TREATMENT PLANT DATA

STORET RETRIEVAL DATE 75/03/10

4803A1
31 06 15.0 097 28 15.0 4
LEON RIVER
48 7.5 BELTON
0/BELTON RESERVOIR
50 FT N OF 2NDARY RD 2.0 MI NW RT 317
11EPALES 2111204
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
74/09/07	17 13		0.032	0.700	0.035	0.005K	
74/10/12	11 10		0.112	0.800	0.200	0.015	0.030
74/11/15	09 30		0.192	0.800	0.040	0.010	0.030
75/01/16	10 40		0.240	0.700	0.056	0.008	0.020
75/02/24	11 45		0.248	0.550	0.032	0.008K	0.020
75/03/11	10 25		0.250	0.700	0.035	0.010	0.040
75/04/06	10 00		0.290	1.180	0.040	0.010	0.060
75/04/24	12 00		0.330	0.350	0.025	0.005K	0.010
75/05/18	09 40		0.370	0.200	0.020	0.005K	0.010
75/06/22	12 30		0.360	0.350	0.050	0.005K	0.020
75/07/23	10 40		0.040	0.750	0.390	0.030	0.050
75/08/27	10 35		0.040	1.250	0.430	0.037	0.070

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/03/10

4803A2
 31 23 50.0 097 31 50.0 4
 LEON RIVE
 48 7.5 LEON JCT
 T/HELTON RESERVOIR
 BRUG ON HAY 931 4 MI NE OF LEON JCT
 IIEPALES 2111204
 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
74/09/07	11 40		2.000	0.700	0.040	0.065	0.125
74/10/10	11 30		1.360	0.400	0.020	0.045	0.070
74/12/07	09 30		0.650	1.000	0.096	0.040	0.070
75/01/16	12 50		0.368	1.100	0.032	0.032	0.170
75/02/24	12 30		0.660	1.000	0.025	0.080	0.090
75/02/27	13 30		0.345	1.150	0.017	0.025	0.132
75/04/07	11 30		0.210	0.300	0.110	0.020	0.020
75/04/24	13 00		0.260	1.150	0.040	0.040	0.240
75/05/06	13 30		0.450	0.900	0.030	0.040	0.160
75/05/18	09 50		0.315	0.650	0.010	0.030	0.170
75/07/15	14 20		0.450	1.650	0.035	0.030	0.110
75/08/27	13 30		0.620	0.600	0.010	0.012	0.080

STORET RETRIEVAL DATE 76/03/10

480381
31 07 37.0 097 31 20.0 4
AQUEDUCT
48 7.5 BLAND
O/BELTON RESERVOIR
SAMP AT INTAKE OF WTR FILTRATION PLANT
11EPALES 2111204
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
74/09/07	16	28	0.104	0.400	0.015	0.005	0.010
74/10/12	10	55	0.112	0.500	0.050	0.005K	0.010K
74/11/16	09	45	0.200	0.300	0.035	0.010	0.020
74/12/07	10	10	0.208	0.900	0.048	0.015	0.015
75/01/16	09	55	0.248	0.900	0.040	0.020	0.040
75/02/24	10	34	0.272	0.400	0.024	0.008K	0.010K
75/03/11	10	10	0.260	0.475	0.022	0.012	0.025
75/04/06	09	45	0.315	0.300	0.035	0.005	0.010K
75/04/24	11	50	0.375	0.250	0.025	0.010	0.020
75/05/05	19	50	0.360	0.200	0.015	0.010	0.010
75/05/16	09	20	0.300	0.150	0.015	0.005	0.010K
75/06/22	12	20	0.230	0.300	0.020	0.010	0.040
75/07/23	10	20	0.060	0.200	0.045	0.005	0.010K
75/08/27	10	20	0.075	0.250	0.045	0.010	0.010

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/03/10

4803C1
31 13 35.0 097 32 15.0 4
OWL CREEK
48 7.5 BLAND
T/BLTON RESERVOIR
50 FT S OF 2NDARY RD 2.5 MI SE OF CHURCH
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE	TIME	DEPTH	00630 NO2-N 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 TO	OF DAY	FEET					
74/09/08	10	10	0.540	1.300	0.010	0.005K	0.005K
74/10/15	08	00	1.010	0.200	0.025	0.005K	0.010K
75/01/20	08	30	0.840	0.300	0.016	0.008K	0.010K
75/02/17	08	30	0.960	0.300	0.008	0.008	0.010K
75/03/12	08	00	0.860	0.300	0.010	0.010	0.010
75/04/06	08	00	0.690	0.600	0.015	0.005K	0.050K
75/04/22	09	30	0.560	0.200	0.020	0.005K	0.010K
75/05/07	08	30	0.420	0.100	0.007	0.005K	0.010K
75/05/28	09	30	0.540	0.150	0.010	0.005K	0.010K
75/06/22	08	00	0.530	0.150	0.010	0.010	0.010
75/07/09	08	00	0.525	0.200	0.015	0.005K	0.010K
75/08/27	09	00	0.370	0.250	0.030	0.005	0.010K

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/03/10

480301
31 12 50.0 097 47 30.0 4
COWHOUSE CREEK
48 15 FORT HOOD
T/BELTON RESERVOIR
MID XING H.W. BRDG 6.0 MI N OF FORT HOOD
11EPALES 2111204
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
74/09/09	10	00	0.264	0.700	0.010	0.360	0.390
74/10/12	10	15	0.890	0.300	0.040	0.980	0.980
74/11/15	10	10	0.768	0.800	0.045	0.290	0.330
74/12/11	10	45	0.800	1.300	0.328	0.408	0.480
75/01/16	10	25	1.000	1.100	0.192	0.650	0.720
75/02/17	10	00	0.672	0.900	0.104	0.432	0.500
75/03/01	09	45	1.200	0.550	0.085	0.908	0.920
75/04/06	09	10	1.400	0.700	0.085	1.200	1.200
75/04/24	10	20	1.300	0.500	0.045	1.350	1.450
75/05/04	19	15	0.390	0.300	0.030	0.790	0.815
75/05/18	08	45	0.630	0.500	0.020	0.375	0.400
75/06/22	10	40	0.450	0.450	0.040	0.840	0.890
75/07/23	09	20	0.090	0.400	0.035	0.525	0.580
75/08/07	09	40	0.040	0.900	0.015	0.910	0.980

STORET RETRIEVAL DATE 76/03/16

4803AA PU4803XA P010000
 31 08 00.0 097 52 30.0 4
 COPPERAS COVE NE
 48021 7.5COPPERAS COVE
 T/CROSS
 TURKEY RUN
 11EPALES 2141204
 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	50051 FLOW RATE INST MGD	50053 CONDUIT FLOW-MGD MONTHLY
FROM	OF								
TO	DAY	FEET							
74/09/26	08	00	0.320	17.000	2.200	5.100	7.500	0.672	0.801
74/10/17	10	15	0.440	23.000	6.000	2.500	11.500	0.847	0.897
74/11/20	10	00	0.080	14.000	2.200	6.200	7.600	0.756	0.814
74/12/20	10	00	0.080	20.000	5.200	6.900	9.400	0.847	0.825
75/01/21	13	00	0.080	28.000	0.400K		10.000	0.430	0.346
75/02/20	10	15	0.080	17.000	2.640	5.600	6.500	0.737	0.855
75/03/20	10	15	0.080	5.000	4.200	5.800	7.700	0.847	0.855
75/04/17	10	15	0.050	25.000	7.600	6.700	11.000	0.847	0.867
75/05/20	10	15	0.050	20.000	4.700	6.300	9.600	0.847	0.845
75/06/19	10	15	0.050	17.000	0.050	4.000	8.200	0.847	0.902
75/07/23	10	00	0.025	17.000	1.200	7.900	9.300	0.847	0.842
75/08/20	10	00	0.025	29.000	3.600	6.000	13.500	0.937	0.864

K VALUE KNOWN TO BE
 LESS THAN INDICATED

STORET RETRIEVAL DATE 76/03/10

4803YA PD4803YA P007500
 31 09 00.0 097 55 00.0 4
 COPPERAS COVE NW
 48 7.5COPPERAS COVE
 T/CROSS
 HOUSE CREEK
 11EPALES 2141204
 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	50051 FLOW RATE INST MGD	50053 CONDUIT FLOW-MGD MONTHLY
74/09/26	08 15		0.120	18.500	4.500	5.150	8.200	0.294	0.375
74/10/17	10 00		0.040	30.000	9.600	1.650	13.000	0.430	0.353
74/11/20	10 15		0.080	19.000	5.100	6.100	8.800	0.430	0.307
74/12/20	10 15		0.080	26.000	11.500	7.600	10.500	0.245	0.457
75/01/21	13 15		0.080	24.000	5.900		9.200	0.756	0.849
75/02/20	10 00		0.080	22.000	7.950	5.500	8.400	0.294	0.350
75/03/20	10 00		0.080	13.000	11.000	9.600	9.900	0.430	0.470
75/04/17	10 00		0.050	24.000	9.300	5.750	10.500	0.430	0.423
75/05/20	10 00		0.050	23.000	7.900	4.500	9.900	0.430	0.533
75/06/19	10 00		0.050	20.000	4.600	5.500	9.000	0.782	0.688
75/07/23	10 15		0.050	14.500	7.600	6.250	9.000	0.667	0.643
75/08/20	10 15		0.025	29.000	10.000	3.600	11.500	0.559	0.578

STORET RETRIEVAL DATE 76/03/10

48032A PD48032A P001286
 31 18 00.0 097 22 00.0 4
 CITY IMHOFF PLANT
 48 7.5 MOODY
 T/CROSS
 BRAZOS RIVER BASIN
 11EPALES 2141204
 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	50051 FLOW RATE INST MGD	50053 CONDUIT FLOW-MGD MONTHLY
75/03/12	11 00		0.080	25.500	4.500	4.500	8.300	0.072	0.049
75/03/18	11 30		0.080	16.000	1.200	5.300	6.400	0.075	0.070
75/04/10			1.440	21.000	0.320		7.800	0.062	0.060
75/05/02	14 15		0.150	33.000	1.350	4.200	9.800	0.026	0.022
75/06/16	14 30		0.200	41.000		2.900	7.500	0.486	0.374
75/09/02	09 30		0.175	34.500	0.250	8.700	12.800	0.250	0.086
	09 31		0.190	42.000	0.450	5.600	25.000		
75/09/09	09 40		0.050	34.500	1.650	12.000	16.000	0.200	0.072
	09 41		0.050	35.000	0.780	11.500	15.500		
75/10/01	10 00		0.425	24.000	1.350	9.600	12.000	0.165	0.165
	10 01		0.400	27.000	1.000	9.600	12.000	0.165	0.165