

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



REPORT  
ON  
LAKE FORT PHANTOM HILL  
JONES COUNTY  
TEXAS  
EPA REGION VI  
WORKING PAPER No. 644

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

REPORT

ON

LAKE FORT PHANTOM HILL

JONES COUNTY

TEXAS

EPA REGION VI

WORKING PAPER No. 644

WITH THE COOPERATION OF THE

TEXAS WATER QUALITY BOARD

AND THE

TEXAS NATIONAL GUARD

MARCH, 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.

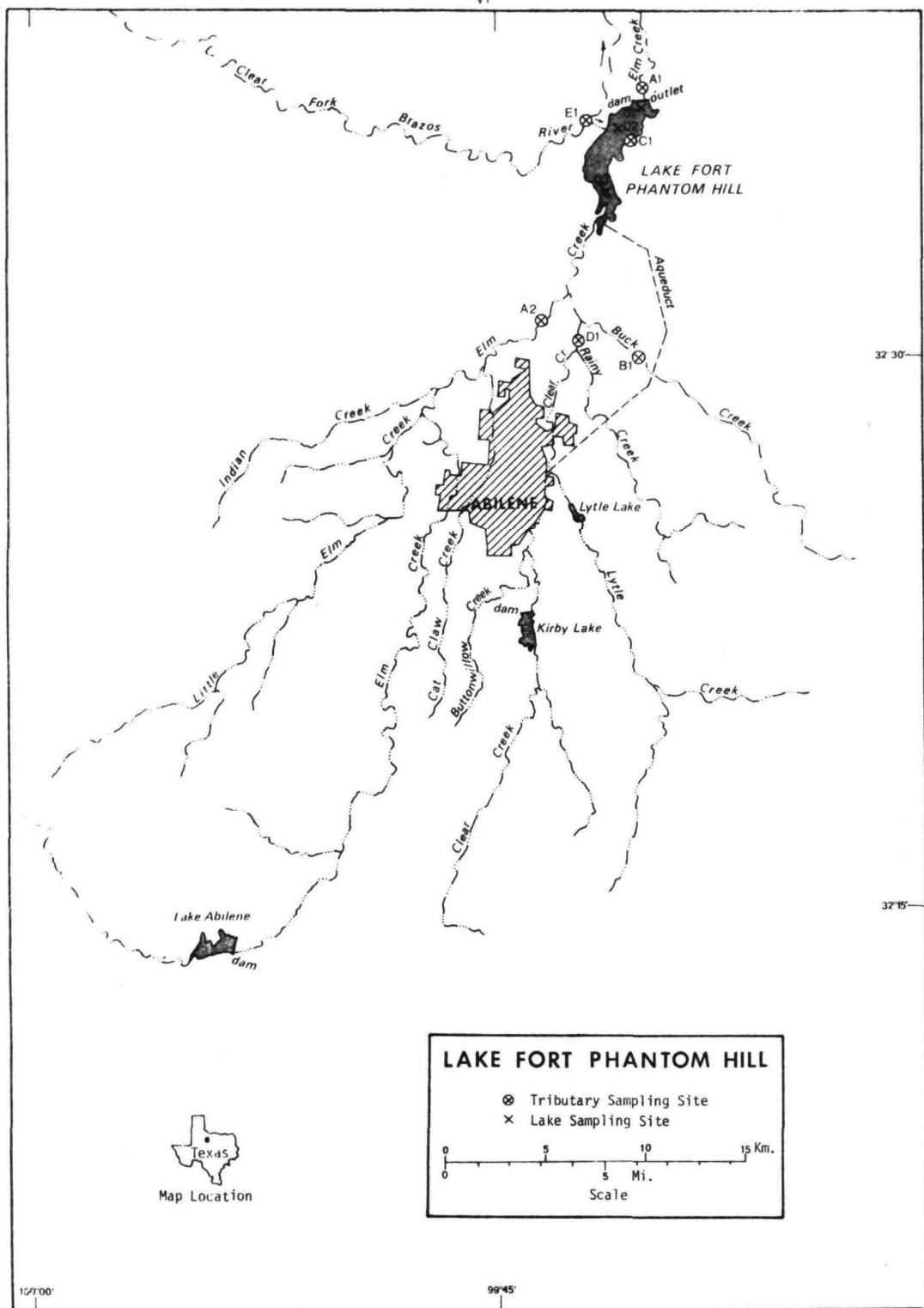
## NATIONAL EUTROPHICATION SURVEY

## 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	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



LAKE FORT PHANTOM HILL  
STORET 4814

I. CONCLUSIONS

A. Trophic Condition:

Survey data indicate that Lake Fort Phantom Hill 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, 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 this water body.

Lake Fort Phantom Hill ranked twenty-fourth in overall trophic quality when the 39 Texas reservoirs sampled in 1974 were compared using a combination of six water quality parameters\*. Twenty-nine of the reservoirs had less median total phosphorus, 32 had less median dissolved orthophosphorus, 13 had less median inorganic nitrogen, ten had less mean chlorophyll a, and 30 had greater mean Secchi disc transparency.

No significant depression of dissolved oxygen occurred at any of the sampling stations and times. However, the lake is aerated from March to October to prevent stratification (Weems, 1976).

Survey limnologists did not observe macrophytes or surface algal concentrations during the sampling visits. However, it was noted that the lake at times was very turbid, and the low mean

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\* See Appendix A.

Secchi disc transparencies (range of 0.02 to 0.9 meters) indicate that at times primary productivity may be light-limited.

B. Rate-Limiting Nutrient:

The algal assay results indicate that nitrogen was the limiting nutrient in October. The lake data indicate nitrogen at all sampling times.

C. Nutrient Controllability:

1. Point-sources--No known wastewater treatment plants impacted Lake Fort Phantom Hill during the sampling year. Septic tanks serving lakeshore dwellings were estimated to have contributed about 3% of the total phosphorus load, but a shoreline survey would be necessary to determine the actual significance of these sources.

The present phosphorus loading of 0.37 g/m<sup>2</sup>/year is slightly more than that proposed by Vollenweider (Vollenweider and Dillon, 1974) as a eutrophic loading (see page 14). However, the hydraulic retention time of the lake is estimated and may be in error due to variability of inflows (see page 10).

2. Non-point sources--Non-point sources accounted for about 97% of the total phosphorus load reaching Lake Fort Phantom Hill. More than 49% of the total was contributed by the gaged tributaries, and an estimated 43% was contributed by the ungaged tributaries and immediate drainage.

## II. LAKE AND DRAINAGE BASIN CHARACTERISTICS<sup>†</sup>

### A. Morphometry<sup>††</sup>:

1. Surface area: 10.93 kilometers<sup>2</sup>.
2. Mean depth: 5.6 meters.
3. Maximum depth: ? meters.
4. Volume:  $61.208 \times 10^6 \text{ m}^3$ .
5. Mean hydraulic retention time: 2.2 years (based on outflows).

### B. Tributary and Outlet:

(See Appendix C for flow data)

#### 1. Tributaries -

Name	Drainage area (km <sup>2</sup> ) <sup>†††</sup>	Mean flow (m <sup>3</sup> /sec) <sup>†††</sup>
Elm Creek	644.9	0.203
Cedar Creek	414.4	0.128 <sup>††</sup>
Clear Fork Brazos River diversion	-	0.237 <sup>††</sup>
Minor tributaries & immediate drainage -	<u>167.8</u>	<u>0.630</u>
Totals	1,227.1	1.198*

#### 2. Outlet -

Abilene Aqueduct	-	0.660 <sup>††</sup>
Elm Creek	<u>1,238.0**</u>	<u>0.208</u>
Totals	1,238.0	0.868

### C. Precipitation\*\*\*:

1. Year of sampling: 85.0 centimeters.
2. Mean annual: 59.9 centimeters.

<sup>†</sup> Table of metric conversions--Appendix B.

<sup>††</sup> Weems, 1976.

<sup>†††</sup> For limits of accuracy, see Working Paper No. 175, "...Survey Methods, 1973-1976".

\* Sum of inflows adjusted to equal sum of outflows plus evaporation; see page 10.

\*\* Includes area of lake.

\*\*\* See Working Paper No. 175.

### III. WATER QUALITY SUMMARY

Lake Fort Phantom Hill 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 two or more depths at three 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 October visit, 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 15.8 meters at station 1, 10.7 meters at station 2, and 6.1 meters at station 3.

The sampling results are presented in full in Appendix D and are summarized in the following table.

A. SUMMARY OF PHYSICAL AND CHEMICAL CHARACTERISTICS FOR FT PHANTOM HILL LAKE  
STORET CODE 4814

PARAMETER	1ST SAMPLING ( 3/ 6/74)				2ND SAMPLING ( 5/15/74)				3RD SAMPLING ( 8/ 5/74)			
	3 SITES				3 SITES				3 SITES			
	RANGE	MEAN	MEDIAN	RANGE	MEAN	MEDIAN	RANGE	MEAN	MEDIAN	RANGE	MEAN	MEDIAN
TEMP (C)	11.9 - 15.4	13.7	13.4	23.8 - 24.5	24.2	24.1	25.5 - 26.4	26.1	26.3			
DISS OXY (MG/L)	8.8 - 9.4	9.2	9.3	7.0 - 7.8	7.4	7.4	5.2 - 7.0	6.5	6.8			
CNDCTVY (MCROMO)	615. - 660.	635.	630.	839. - 858.	845.	843.	961. - 987.	976.	978.			
PH (STAND UNITS)	8.1 - 8.4	8.3	8.3	8.3 - 8.3	8.3	8.3	8.2 - 8.4	8.3	8.3			
TOT ALK (MG/L)	167. - 173.	170.	170.	165. - 170.	167.	168.	162. - 167.	164.	164.			
TOT P (MG/L)	0.034 - 0.057	0.042	0.039	0.047 - 0.534	0.110	0.061	0.044 - 0.074	0.056	0.056			
ORTHO P (MG/L)	0.018 - 0.028	0.022	0.022	0.017 - 0.033	0.023	0.020	0.006 - 0.022	0.010	0.008			
NO2+NO3 (MG/L)	0.030 - 0.090	0.048	0.050	0.040 - 0.080	0.059	0.065	0.020 - 0.100	0.029	0.020			
AMMONIA (MG/L)	0.030 - 0.080	0.042	0.030	0.030 - 0.060	0.049	0.050	0.020 - 0.070	0.039	0.035			
KJEL N (MG/L)	0.400 - 1.200	0.645	0.500	0.200 - 1.100	0.500	0.450	0.300 - 0.500	0.400	0.400			
INORG N (MG/L)	0.060 - 0.170	0.090	0.080	0.070 - 0.140	0.108	0.110	0.040 - 0.160	0.068	0.055			
TOTAL N (MG/L)	0.440 - 1.240	0.694	0.570	0.270 - 1.180	0.559	0.505	0.320 - 0.530	0.429	0.420			
CHLRPYL A (UG/L)	2.9 - 3.1	3.0	3.1	4.9 - 7.8	5.9	5.0	13.7 - 15.3	14.7	15.0			
SECCHI (METERS)	0.6 - 0.8	0.7	0.8	0.2 - 0.5	0.3	0.3	0.6 - 0.9	0.8	0.9			

A. SUMMARY OF PHYSICAL AND CHEMICAL CHARACTERISTICS FOR FT PHANTOM HILL LAKE  
STORET CODE 4814

4TH SAMPLING (10/30/74)

PARAMETER	RANGE	3 SITES	
		MEAN	MEDIAN
TEMP (C)	18.8 - 19.2	18.9	18.9
DISS OXY (MG/L)	6.4 - 7.6	7.2	7.2
CNDCTVY (MCROMO)	372. - 410.	399.	402.
PH (STAND UNITS)	7.9 - 8.0	8.0	8.0
TOT ALK (MG/L)	112. - 120.	117.	118.
TOT P (MG/L)	0.081 - 0.099	0.092	0.092
ORTHO P (MG/L)	0.062 - 0.080	0.073	0.073
N02+N03 (MG/L)	0.270 - 0.290	0.278	0.280
AMMONIA (MG/L)	0.030 - 0.050	0.041	0.040
KJEL N (MG/L)	0.300 - 0.600	0.400	0.400
INORG N (MG/L)	0.310 - 0.340	0.319	0.320
TOTAL N (MG/L)	0.570 - 0.890	0.678	0.670
CHLRPYL A (UG/L)	1.3 - 1.9	1.7	1.8
SECCHI (METERS)	0.6 - 0.6	0.6	0.6

## B. Biological characteristics:

## 1. Phytoplankton -

<u>Sampling Date</u>	<u>Dominant Genera</u>	<u>Algal Units per ml</u>
03/06/74	1. <u>Chroomonas sp.</u> 2. <u>Selenastrum sp.</u> 3. <u>Microcystis sp.</u> 4. <u>Cryptomonas sp.</u> 5. <u>Dactylococcopsis sp.</u> Other genera	706 445 131 105 78 <u>183</u>
	Total	1,648
05/15/74	1. <u>Chroomonas sp.</u> 2. <u>Microcystis sp.</u> 3. <u>Cryptomonas sp.</u> 4. <u>Centric diatoms</u> 5. <u>Euglena sp.</u> Other genera	743 496 212 177 177 <u>744</u>
	Total	2,549
08/05/74	1. <u>Coscinodiscus sp.</u> 2. <u>Chroomonas sp.</u> 3. <u>Chlamydomonas sp.</u> 4. <u>Zoospores</u> 5. <u>Merismopedia sp.</u> Other genera	3,378 622 445 356 267 <u>1,022</u>
	Total	6,090
10/30/74	1. <u>Chroomonas sp.</u> 2. <u>Oocystis sp.</u> 3. <u>Chlamydomonas sp.</u> 4. <u>Centric diatoms</u> 5. <u>Microcystis sp.</u> Other genera	803 223 178 178 134 <u>402</u>
	Total	1,918

## 2. Chlorophyll a -

<u>Sampling Date</u>	<u>Station Number</u>	<u>Chlorophyll a (<math>\mu\text{g/l}</math>)</u>
03/06/74	1	3.1
	2	2.9
	3	3.1
05/15/74	1	5.0
	2	4.9
	3	7.8
08/05/74	1	13.7
	2	15.3
	3	15.0
10/30/74	1	1.3
	2	1.9
	3	1.8

## C. Limiting Nutrient Study:

## 1. Autoclaved, filtered, and nutrient spiked -

<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	0.031	0.207	6.2
0.050 P	0.081	0.207	6.3
0.050 P + 1.0 N	0.081	1.207	25.9
1.0 N	0.031	1.207	15.9

## 2. Discussion -

The control yield of the assay alga, Selenastrum capricornutum, indicates that the potential primary productivity of Fort Phantom Hill was high at the time the sample was collected (10/30/74).

There was a significant increase in yield when only nitrogen was added, but not when phosphorus alone was added. Based on these results, nitrogen limitation is indicated at that time.

The lake data indicate nitrogen limitation at all sampling times; i.e., the mean inorganic nitrogen to orthophosphorus ratios were 8 to 1 or less at all sampling stations and times. However, the mean Secchi disc transparency of 0.6 meters indicates primary productivity may be light-limited at times rather than nutrient-limited.

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 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. Several factors affect the flow into and out of Lake Fort Phantom Hill. The City of Abilene diverts about  $0.66 \text{ m}^3/\text{sec}$  from the reservoir for municipal use (Anonymous, 1976), and water is pumped from the Clear Fork Brazos River into the lake at an average rate of  $0.24 \text{ m}^3/\text{sec}$  (Weems, 1976). Apparently, the variability of flow is high and is sometimes affected by irregular inflows such as the diversion of an undetermined amount of flood flow by gravity ditch from Deadman Creek to the reservoir (Anonymous, 1976).

In this report, nutrient loads for sampled tributaries were calculated using mean annual concentrations and mean annual flows. Nutrient loads for unsampled "minor tributaries and immediate drainage" ("ZZ" of U.S.G.S.) were estimated using the mean concentrations in Elm Creek at station A-2 and the mean annual ZZ flow.

No known wastewater treatment plants impacted Lake Fort Phantom Hill during the sampling year.

A. Waste Sources:

1. Known municipal - None
2. Known industrial - None

## 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) -		
Elm Creek	555	13.8
Cedar Creek	455	11.3
Clear Fork Brazos River diversion	970	24.1
b. Minor tributaries & immediate drainage (non-point load) -		
	1,730	43.0
c. Known municipal STP's - None	-	-
d. Septic tanks* -	125	3.1
e. Known industrial - None	-	-
f. Direct precipitation** -	<u>190</u>	<u>4.7</u>
Total	4,025	100.0

## 2. Outputs -

Lake outlet - Abilene Aqueduct	1,080
Elm Creek	<u>470</u>
Total	1,550

## 3. Net annual P accumulation - 2,475 kg.

\* Estimate based on 441 lakeshore dwellings; 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) -		
Elm Creek	10,520	11.5
Cedar Creek	6,470	7.1
Clear Fork Brazos River diversion	25,515	27.8
b. Minor tributaries & immediate drainage (non-point load) -	32,645	35.6
c. Known municipal STP's - None	-	-
d. Septic tanks* -	4,700	5.1
e. Known industrial - None	-	-
f. Direct precipitation** -	<u>11,800</u>	<u>12.9</u>
Total	91,650	100.0

## 2. Outputs -

Lake outlet - Abilene Aqueduct	17,860
Elm Creek	<u>7,190</u>
Total	25,050

## 3. Net annual N accumulation - 66,600 kg.

## D. Non-point Nutrient Export by Subdrainage Area:

<u>Tributary</u>	<u>kg P/km<sup>2</sup>/yr</u>	<u>kg N/km<sup>2</sup>/yr</u>
Elm Creek	<1	16
Cedar Creek	1	16

\* Estimate based on 441 lakeshore dwellings; see Working Paper No. 175.

\*\* See Working Paper No. 175.

## 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>
Buck Creek	0.049	2.202

## 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.

	<u>Total Phosphorus</u>		<u>Total Nitrogen</u>	
	<u>Total</u>	<u>Accumulated</u>	<u>Total</u>	<u>Accumulated</u>
grams/m <sup>2</sup> /yr	0.37	0.23	8.4	6.1

Vollenweider phosphorus loadings  
(g/m<sup>2</sup>/yr) based on mean depth and mean  
hydraulic retention time of Lake Fort Phantom Hill:

"Dangerous" (eutrophic loading)	0.32
"Permissible" (oligotrophic loading)	0.16

## V. LITERATURE REVIEWED

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- Vollenweider, R. A., and P. J. Dillon, 1974. The application of  
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sions from lake for municipal use; lake morphometry; pumping  
records for Clear Fork Brazos River). Abilene.

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	2.042	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	CADDY 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)	343
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	CADDY 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)	75 ( 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 UP TO 40 μ	INDEX NO
4829	SOMERVILLE LAKE	29 ( 11)	55 ( 21)	24 ( 9)	3 ( 1)	67 ( 25)	30 ( 10)	208
4830	STAMFORD LAKE	18 ( 7)	47 ( 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	BASTRUP 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	CADDY 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  $8.107 \times 10^{-4}$  = 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

04/14/76

LAKE CODE 4814 FORT PHANTOM HILL RES.

TOTAL DRAINAGE AREA OF LAKE(SQ KM) 1238.0

TRIBUTARY	SUH-DRAINAGE AREA(SQ KM)	NORMALIZED FLOWS(CMS)												MEAN
		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
4814A1	1238.0	0.006	0.000	0.000	0.190	1.019	0.184	0.051	0.011	0.510	0.481	0.008	0.017	0.208
4814A2	644.9	0.006	0.005	0.038	0.028	0.481	1.161	0.190	0.057	0.085	0.311	0.017	0.052	0.203
4814D1	414.4	0.003	0.003	0.005	0.017	0.311	0.736	0.122	0.023	0.051	0.198	0.011	0.048	0.128
4814ZZ	178.7	0.001	0.001	0.002	0.008	0.133	0.317	0.054	0.013	0.023	0.086	0.005	0.022	0.056

## SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 1238.0  
SUM OF SUB-DRAINAGE AREAS = 1238.0TOTAL FLOW IN = 4.63  
TOTAL FLOW OUT = 2.48

## MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
4814A1	9	74	13.592	7	0.003				
	10	74	44.741	5	0.028				
	11	74	5.663	2	8.495				
	12	74	1.133	7	1.416				
	1	75	1.416	4	2.832				
	2	75	2.832	1	1.416				
	3	75	1.416	1	1.416				
	4	75	0.991	5	1.133	19	0.850		
	5	75	0.566	3	0.566	17	0.566		
	6	75	1.133	7	1.133				
	7	75	0.850	5	0.850				
	8	75	0.566	2	1.133				
4814A2	9	74	11.327	7	0.057				
	10	74	19.822	5	1.982				
	11	74	4.248	2	4.814				
	12	74	0.850	7	1.133				
	1	75	0.708	4	0.850				
	2	75	4.248	1	2.124				
	3	75	0.566	1	0.708				
	4	75	0.283	5	0.283	19	0.283		
	5	75	0.283	3	0.283	17	0.283		
	6	75	0.566	7	0.425				
	7	75	0.142	5	0.142				
	8	75	0.283	2	0.057				

## TRIBUTARY FLOW INFORMATION FOR TEXAS

04/14/76

LAKE CODE 4814 FORT PHANTOM HILL RES.

## MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
481401	9	74	7.079	7	0.014				
	10	74	5.047	5	0.510				
	11	74	1.416	2	2.832				
	12	74	0.283	7	0.283				
	1	75	0.283	4	0.283				
	2	75	1.416	1	0.708				
	3	75	0.283	1	0.425				
	4	75	0.170	5	0.170	19	0.170		
	5	75	0.170	3	0.170	17	0.170		
	6	75	0.425	7	0.283				
	7	75	0.085	5	0.085				
	8	75	0.028	2	0.028				
481422	9	74	0.850						
	10	74	4.248						
	11	74	1.416						
	12	74	0.283						
	1	75	0.142						
	2	75	0.850						
	3	75	0.170						
	4	75	0.142						
	5	75	0.113						
	6	75	0.170						
	7	75	0.057						
	8	75	0.057						

APPENDIX D  
PHYSICAL and CHEMICAL DATA

481401  
 32 36 55.0 099 40 05.0  
 FT PHANTOM HILL LAKE  
 48253 TEXAS

DATE FROM TO	TIME OF DAY	DEPTH FEET	WATER TEMP CENT	11EPALES			2111202			00671			
				00010 DO	00300 TRANSP SECCHI	00077 INCHES	00094 FIELD MICROMHO	00400 PH	00410 ALK CACO <sub>3</sub>	00610 NH <sub>3</sub> -N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 -TOTAL MG/L	PHOS-DIS ORTHO MG/L P
74/03/06	15 35	0000	15.4			36	622	8.40	167	0.030	0.800	0.030	0.020
	15 35	0005	15.3	9.4			622	8.30	168	0.030	0.500	0.030	0.020
	15 35	0015	15.0	9.4			630	8.30	168	0.030	0.500	0.030	0.018
	15 35	0030	12.1	9.0			615	8.20	168	0.060	0.500	0.070	0.024
	15 35	0042	11.4	8.8			622	8.10	170	0.080	0.500	0.090	0.025
74/05/15	16 20	0000	24.2				858	8.30	167	0.050	0.600	0.040	0.018
	16 20	0005	24.4	7.8			846	8.30	166	0.060	0.400	0.070	0.020
	16 20	0015	24.1	7.4			844	8.30	165	0.040	0.300	0.060	0.020
	16 20	0030	24.0	7.4			841	8.30	165	0.060	0.300	0.070	0.017
	16 20	0042	23.8	7.6			839	8.30	165	0.060	0.200	0.070	0.017
74/08/05	10 20	0000	26.3	6.8		35	979	8.30	164	0.030	0.400	0.020	0.007
	10 20	0005	26.3	6.8			977	8.30	164	0.020K	0.400	0.020K	0.007
	10 20	0020	26.3	6.8			971	8.30	167	0.030	0.300	0.020	0.009
	10 20	0034	25.5	5.2			966	8.20	165	0.070	0.400	0.020	0.022
	09 25	0000	19.1	7.6		24	372	8.00	117	0.040	0.600	0.290	0.080
74/10/30	09 25	0005	19.2	7.2			398	8.00	117	0.050	0.400	0.290	0.079
	09 25	0015	19.2	7.2			396	7.95	116	0.030	0.300	0.280	0.072
	09 25	0032	19.1	7.4			395	8.00	112	0.040	0.300	0.290	0.066
	09 25	0052	19.0	7.2			390	8.00	114	0.040	0.500	0.290	0.062
			00665	32217	00031								
DATE FROM TO	TIME OF DAY	DEPTH FEET	PHOS-TOT MG/L P	CHLRPHYL A UG/L	INCUT LT REMNING PERCENT								
74/03/06	15 35	0000	0.046		3.1								
	15 35	0005	0.038										
	15 35	0015	0.034										
	15 35	0030	0.035										
	15 35	0042	0.057										
74/05/15	16 20	0000	0.062		5.0								
	16 20	0005	0.050										
	16 20	0015	0.047										
	16 20	0030	0.052										
	16 20	0042	0.050										
74/08/05	10 20	0000	0.046		13.7								
	10 20	0005	0.044										
	10 20	0020	0.046										
	10 20	0034	0.061										
	09 25	0000	0.093		1.3								
74/10/30	09 25	0005	0.091										
	09 25	0015	0.090										
	09 25	0032	0.081										
	09 25	0052	0.087										

K VALUE KNOWN TO BE  
LESS THAN INDICATED

STORED RETRIEVAL DATE 16/02/11

481402  
32 35 57.0 099 41 11.0  
FT PHANTOM HILL LAKE  
48253 TEXAS

STORET RETRIEVAL DATE 75/02/11

481403  
 32 34 16.0 099 41 13.0  
 FT PHANTOM HILL LAKE  
 48253 TEXAS

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 ALK CACO <sub>3</sub>	00610 NH <sub>3</sub> -N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 N-24403 -TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
			3	0010	FEET	DEPTH						
74/03/06	16 50	0000	14.1		24	660	8.30	172	0.060	0.800	0.050	0.028
	16 50	0006	14.0	9.2		660	8.30	173	0.040	1.000	0.050	0.023
74/05/15	09 50	0000	24.5		9	850	8.35	169	0.040	0.500	0.040	0.028
	09 50	0005	24.4	7.0		850	8.30	169	0.060	1.100	0.080	0.032
74/08/05	09 05	0000	25.6	6.8	24	961	8.40	162	0.060	0.400	0.100	0.017
	09 05	0006	25.6	6.8		966	8.40	163	0.040	0.400	0.020	0.013
74/10/30	10 15	0000	18.8	7.0	24	407	8.00	119	0.040	0.400	0.270	0.078
	10 15	0005	18.8	6.4		410	7.95	120	0.050	0.400	0.270	0.077
	10 15	0015	18.9	7.2		410	7.95	119	0.040	0.300	0.270	0.073
	10 15	0020	18.8	7.2		408	7.95	118	0.050	0.300	0.270	0.075

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL UG/L	00031 INC DT LT A REMNING PERCENT
74/03/06	16 50	0000	0.046	3.1	
	16 50	0006	0.045		
74/05/15	09 50	0000	0.109	7.8	
	09 50	0005	0.534		
74/08/05	09 05	0000	0.074	15.0	
	09 05	0006	0.060		
74/10/30	10 15	0000	0.096	1.8	
	10 15	0005	0.095		
	10 15	0015	0.097		
	10 15	0020	0.099		

**APPENDIX E**

**TRIBUTARY DATA**

STORET RETRIEVAL DATE 76/03/10

4814A1  
32 37 05.0 099 40 05.0 4  
ELM CREEK  
48434 7.5 HAMBY  
0/LA FORT PHANTOM HILL  
BANK SAMP FOOT OF DAM OFF 2NDRY RD 1082  
11EPALES 2111204  
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 N026N03 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS URTHO MG/L P	00665 PHOS-TOT MG/L P
74/09/07	11 15		0.016	0.800	0.045	0.010	0.040
74/10/05	12 25		0.216	0.500	0.030	0.060	0.080
74/11/02	10 20		0.296	0.500	0.027	0.067	0.100
74/12/07	11 00		0.320	0.500	0.032	0.070	0.080
75/01/04	14 35		0.304	0.700	0.040	0.055	0.070
75/02/01	10 55		2.380	1.100	0.080	0.048	0.120
75/03/01	14 25		0.220	1.250	0.060	0.035	0.040
75/04/05	15 05		0.010	0.950	0.030	0.010	0.030
75/04/19	14 55		0.075		0.260	0.020	0.180
75/05/03	18 15		0.030	1.950	0.105	0.015	
75/05/17	11 40		0.010	0.350	0.015	0.005	0.010
75/06/07	11 15		0.040	0.500	0.060	0.010	0.020
75/07/05	11 45		0.045	0.600	0.020	0.005K	0.040
75/08/02	09 45		0.015	0.650	0.020	0.020	0.120

K VALUE KNOWN TO BE  
LESS THAN INDICATED

STORED RETRIEVAL DATE 76/03/10

4514A2  
 32 31 05.0 099 43 25.0 4  
 ELM CREEK  
 48 7.5 HAMBY  
 T/LN FORT PHANTOM HILL  
 2NDRY RD BRDG AT HWY 600 & 2NDRY RD 3034  
 11EPALES 2111204  
 0000 FEET DEPTH CLASS 00

DATE	TIME	DEPTH	N026N03	00630	00625	00610	00671	00665
FROM	OF		N-TOTAL	TUT KJEL	N	NH3-N	PHOS-PIS	PHOS-TOT
TO	JAY	FEET		MG/L	MG/L	MG/L	MG/L P	MG/L P
74/09/07	09 40			0.430	0.800	0.025	0.025	0.105
74/10/05	10 20			0.576	0.500	0.010	0.010	0.060
74/11/02	09 45			0.352	0.900	0.085	0.045	0.230
74/12/07	10 00			0.990	1.100	0.024	0.015	0.020
75/01/04	13 55			0.920	0.700	0.016	0.010	0.035
75/02/01	09 05			1.020	1.300	0.144	0.150	0.210
75/03/01	13 20			1.000	1.600	0.035	0.005	0.020
75/04/05	13 50			0.770	0.450	0.050	0.005	0.040
75/04/19	12 50			0.930	1.100	0.060	0.005	0.070
75/05/03	17 00			0.710	0.550	0.025	0.010	
75/05/17	10 40			0.670	0.500	0.010	0.015	0.080
75/06/07	10 00			0.420	1.550	0.030	0.035	
75/07/05	10 05			0.990	0.600	0.020	0.005K	0.070
75/08/02	08 10			0.920	0.650	0.015	0.025	0.100

K VALUE KNOWN TO BE  
 LESS THAN INDICATED

STORET RETRIEVAL DATE 76/03/10

481481  
32 30 40.0 099 41 25.0 4  
BUCK CREEK  
48 7.5 HAMBY  
T/LK FORT PHANTOM HILL  
2NDRY RD 2833 BRDG 2 MI N OF HWY 351  
11EPALES 2111204  
0000 FEET DEPTH CLASS 00

DATE	TIME	DEPTH	N02&N03	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	TOTAL	ORTHO	MG/L P
74/10/05	11	00		1.440	1.100	0.030	0.020	0.040
74/11/02	11	50		0.464	1.500	0.065	0.030	0.100
74/12/07	10	35		0.820	1.600	0.048	0.005	0.020
75/01/04	14	15		1.060	0.800	0.040	0.005	0.020
75/02/01	09	55		3.130	1.000	0.088	0.063	0.120
75/03/01	13	45		0.575	1.500	0.065	0.005K	0.010
75/04/05	14	15		0.125	1.050	0.070	0.015	
75/04/19	13	35		0.055	1.400	0.060	0.010	0.030

K VALUE KNOWN TO BE  
LESS THAN INDICATED

STORED RETRIEVAL DATE 76/03/10

4814C1  
32 35 45.0 099 40 47.0 4  
ABILENE AQUEDUCT  
48 7.5 HAMBY  
0/LR FORT PHANTOM HILL  
AT AQUEDUCT INTAKE PUMPING STA E SIDE LR  
11EPALES 2111204  
0000 FEET DEPTH CLASS 00

DATE	TIME	DEPTH	N02&N03	00630	00625	00610	00671	00665
FROM	OF		N-TOTAL	TOT KJEL	N	NH3-N	PHOS-0.015	PHOS-TOT
TO	DAY	FEET	MG/L	MG/L	MG/L	MG/L	MG/L P	MG/L P
74/09/07	13	30		0.012	0.900	0.035	0.010	0.045
74/10/05	11	50		0.224	0.600	0.040	0.060	0.090
74/11/02	11	15		0.288	0.700	0.030	0.065	0.100
74/12/07	10	50		0.336	0.900	0.024	0.060	0.090
75/01/04	14	25		0.296	0.500	0.024	0.050	0.070
75/02/01	10	20		0.227	0.700	0.040	0.040	0.070
75/03/01	14	00		0.200	1.400	0.055	0.030	0.040
75/04/05	14	45		0.005	0.600	0.010	0.010	0.010
75/04/19	14	05		0.015	0.700	0.030	0.010	0.020
75/05/03	18	05		0.005	1.000	0.035	0.015	0.050
75/05/17	11	20		0.005	0.450	0.005K	0.005	0.040
75/06/07	11	00		0.030	0.600	0.050	0.015	0.030
75/07/05	11	15		0.015	0.650	0.025	0.005	0.030
75/08/02	09	20		0.010	0.650	0.007	0.020	0.050

K VALUE KNOWN TO BE  
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/03/10.

481401  
32 30 35.0 099 42 20.0 4  
CEJAR CREEK  
48 7.5 HAMBY  
T/LR FORT PHANTOM HILL  
BANK SAMPL 2NDRY RD 1 MI E JCT w HAY 500  
11EPALES 2111204  
0000 FEET DEPTH CLASS 00

DATE FROM TU	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	10 40		0.012	1.200	0.055	0.055	0.185
74/10/05	10 40		0.810	1.000	0.045	0.050	0.120
74/11/02	10 55		0.296	1.200	0.050	0.065	0.180
74/12/07	10 20		1.010	1.600	0.064	0.025	0.060
75/01/04	14 05		0.850	1.100	0.080	0.050	0.100
75/02/01	09 30		0.768	1.200	0.120	0.032	0.090
75/03/01	13 35		0.520	1.250	0.020	0.010	0.050
75/04/05	14 00		0.510	1.100	0.060		0.020
75/04/19	13 20		0.220	1.050	0.015	0.015	0.070
75/05/03	17 30		0.210	2.200	0.080	0.010	0.120
75/05/17	10 55		0.050	0.650	0.020	0.020	0.060
75/06/07	10 25		0.300	1.080	0.035	0.060	0.130
75/07/05	10 35		0.045	1.000	0.015	0.085	0.190
75/08/02	08 30		0.010	1.200	0.010	0.110	0.210

STORED RETRIEVAL DATE 76/03/10

4814E1  
32 36 25.0 099 42 10.0 4  
CLEAR FK BRAZOS RIVER  
48 7.5 HAMBY  
T/LK FORT PHANTOM HILL  
2NURY RD 1082 BRDG 0.5 MI E OF HWY 600  
11EPALES 21112J4  
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NU2&N03	00625 TOT KJEL	00610 NH3-N	00671 PHOS-UIS	00665 PHOS-TOT
			N-TOTAL MG/L	N MG/L	TOTAL MG/L	URTHO MG/L P	MG/L P
74/09/07	11 25		0.960	1.200	0.035	0.025	0.105
74/10/05	12 50		2.240	0.900	0.015	0.020	0.110
74/11/02	10 05		1.520	1.300	0.040	0.085	0.290
74/12/07	11 30		4.400	0.600	0.032	0.005	0.010K
75/01/04	14 50		4.640	0.700	0.032	0.030	0.050
75/02/01	11 35		4.090	1.200	0.136	0.096	0.195
75/03/01	14 40		4.300	1.300	0.045	0.005	0.080
75/04/05	15 35		1.050	0.400	0.025	0.005K	0.040
75/04/19	15 20		2.400	1.500	0.070	0.007	0.070
75/05/03	18 40		1.720	0.350	0.055		0.010K
75/05/17	12 15		2.600	0.700	0.015	0.060	0.120
75/06/07	11 40		1.250	1.700	0.055	0.100	0.440
75/07/05	12 20		1.100	1.230	0.025	0.045	0.145
75/08/02	10 20		1.000	1.450	0.020	0.065	0.160

K VALUE KNOWN TO BE  
LESS THAN INDICATED