AREAL AND TEMPORAL VARIATIONS IN THE QUALITY OF SURFACE WATER IN HYDROLOGIC ACCOUNTING UNIT 120301, UPPER TRINITY RIVER BASIN, TEXAS

By Frank C. Wells, Jack Rawson, and Wanda J. Shelby

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DONALD PAUL HODEL, Secretary

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Dallas L. Peck, Director

For additional information write to:

District Chief
U.S. Geological Survey
649 Federal Building
300 E. Eighth Street
Austin, TX 78701

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METRIC CONVERSIONS

For use of those readers who may prefer metric units rather than inch-pound units, the conversion factors for the terms used in this report are listed below:

From	Multiply by	To obtain
acre	0.4047	hectare
acre-foot (acre-ft, AC-FT)	1,233	cubic meter
cubic foot per second (ft^3/s, CFS)	0.02832	cubic meter per second
foot (ft)	0.3048	meter
inch (in.)	25.40	millimeter
micromho per centimeter at 25° Celsius (UMHOS)	1.000	microsiemens per centimeter at 25° Celsius
mile (mi)	1.609	kilometer
pound per square mile per day ($lb/mi^2/d$)	0.1751	kilogram per square kilometer per day
square mile (mi^2)	2.590	square kilometer
ton	0.9072	megagram
ton per day (ton/d)	0.9072	megagram per day
ton per square mile per day ($ton/mi^2/d$)	0.3502	megagram per square kilometer per day

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ABSTRACT

Hydrologic Accounting Unit 120301 is located in north-central Texas and includes that part of the Trinity River basin upstream from the National Stream Quality Accounting Network station 08062700, Trinity River at Trinidad, Texas. Normal annual precipitation ranges from about 28 inches in the western part of the basin to almost 40 inches in the eastern part. The population of the upper Trinity River basin was nearly 3 million in 1980. Total water use in 1980 was approximately 826,000 acre-feet, of which 90 percent was obtained from surface-water resources.

Mean discharges for most stations in the study area during the 1973-82 water years were significantly larger than mean discharges for the period of record. Mean discharges throughout most of the study area during the 1982 water year were more than 300 percent of the long-term mean flow.

Water in the upper Trinity River basin upstream of the Dallas-Fort Worth metroplex is generally a calcium bicarbonate type water. In the West Fork Trinity River downstream from Fort Worth and the main stem of the Trinity River from Dallas to Trinidad, the water is a mixed sodium calcium bicarbonate type water. Average dissolved-solids concentrations during the study period ranged from 174 milligrams per liter in the Elm Fork Trinity River near Lewisville to 682 milligrams per liter in Mountain Creek near Cedar Hill. Discharge-weighted average dissolved-solids concentrations during 1973-82 water years ranged from 165 milligrams per liter in the Elm Fork Trinity River near Lewisville to 416 milligrams per liter at Mountain Creek near Cedar Hill.

Daily dissolved-solids loads increased from 225 tons at West Fork Trinity River at Beach Street, Fort Worth, to 2,410 tons in the Trinity River at Trinidad. In the 450 square miles of intervening drainage area between West Fork Trinity River at Beach Street, Fort Worth, and West Fork Trinity River at Grand Prairie, the average daily dissolved-solids load increased by 305 tons.

Upstream of the municipal waste effluents in the Dallas-Fort Worth metroplex, average dissolved-oxygen concentrations generally exceed 7.0 milligrams per liter, average dissolved-oxygen percent-saturation values generally exceed 70 percent, and average biochemical oxygen demand concentrations generally were less than 4.0 milligrams per liter. Downstream of the municipal waste effluents, average dissolved-oxygen concentrations generally did not exceed 5.0 milligrams per liter, average dissolved-oxygen percent-saturation values generally were less than 50 percent, and average biochemical oxygen demand concentrations generally were greater than 12.0 milligrams per liter.

Average concentrations of total nitrogen and total phosphorus increase significantly downstream of municipal waste effluents in the Dallas-Fort Worth metroplex. At West Fork Trinity River at Grand Prairie, Trinity River below Dallas, and East Fork Trinity River near Crandall, average total-nitrogen concentrations were in excess of 9.0 milligrams per liter and average total-phosphorus concentrations were in excess of 3.7 milligrams per liter.

Total-organic nitrogen was the dominant nitrogen species upstream of the Dallas-Fort Worth metroplex, except at Elm Fork Trinity River near Sanger where nitrate was the predominant nitrogen species. Average total organic-nitrogen concentrations upstream of the major waste effluents generally did not exceed 1.0 milligram per liter. Total ammonia nitrogen was the dominant nitrogen species downstream of municipal waste effluents. Total ammonia-nitrogen concentrations at East Fork Trinity River near Crandall ranged from 0.00 to 24.0 milligrams per liter and were greater than 6.0 milligrams per liter in more than 50 percent of the samples analyzed.

Concentrations of arsenic, barium, cadmium, chromium, copper, mercury, selenium, and zinc have not been detected in excess of the U.S. Environmental Protection Agency maximum or secondary contaminant levels. Lead has been detected in excess of the 50 micrograms per liter maximum contaminant level, and iron has been detected in excess of the 300 micrograms per liter secondary maximum contaminant level at two sites on streams in the study area. Manganese has been detected in excess of the 50 micrograms per liter secondary maximum contaminant level at 14 sites on streams. Downstream of the Dallas-Fort Worth metroplex, manganese concentrations have exceeded 50 micrograms per liter in more than 50 percent of the samples analyzed.

Concentrations of the organochlorine insecticides lindane, chlordane, and dieldrin have not exceeded 0.30 microgram per liter. The maximum concentration of diazinon detected was 7.7 micrograms per liter at Trinity River below Dallas. Concentrations of the chlorophenoxy herbicide 2,4-D has been detected in excess of 4.0 micrograms per liter at Trinity River below Dallas and Trinity River near Rosser.

Specific conductance and concentrations of dissolved solids and major ions generally varied inversely with streamflow. Lowest values or concentrations generally occured during high streamflow periods in April, May, and June.

Seasonal variations in concentrations of dissolved oxygen were inversely related to seasonal variations in water temperature.

In effluent-dominated reaches of rivers, the smallest concentrations of total nitrogen and total phosphorus generally occured during high streamflow periods in April, May, and June.

Trend analyses for selected inorganic constituents or properties were performed at 17 streamflow stations, and significant trends were detected in one or more constituents at six stations. Uptrends were detected in dissolved solids, dissolved calcium, dissolved sodium, dissolved chloride, dissolved sulfate, and hardness at East Fork Trinity River near Crandall. Downtrends in volume-weighted average concentrations of dissolved solids, dissolved chloride, dissolved sulfate, and hardness were detected in Lake Arlington.

Trend analyses for dissolved oxygen, dissolved-oxygen percent saturation, and biochemical oxygen demand were performed at eight sites on streams in the upper Trinity River basin. Trends were detected in one or more of the constituents or properties at five locations. Uptrends in dissolved oxygen were detected at Trinity River below Dallas and Trinity River near Rosser. A downtrend in dissolved oxygen was detected at Trinity River at Grand Prairie, Texas.

Trend analyses for total nitrogen, organic nitrogen, ammonia nitrogen, nitrite plus nitrate nitrogen, and total phosphorus were performed at eight sites on streams. Trends were detected in one or more of these constituents at all eight locations. Total-organic nitrogen showed uptrends at six locations, and total phosphorus showed downtrends at five locations.

Data collected at Trinity River at Trinidad do not represent areal variations throughout accounting unit 12030100. The data-collection program recommended to do so consists of bimonthly sampling for major inorganic constituents, nutrients, dissolved oxygen, biochemical oxygen demand, and indicator bacteria; quarterly sampling for dissolved minor elements; and semiannual sampling for total pesticides at 13 streamflow stations. In addition, three intensive water-quality surveys per year would be conducted on nine of the major reservoirs in the accounting unit.

In assessing the value of daily sampling over periodic sampling, monthly and annual discharge-weighted average concentrations for four constituents or properties and loads for three constituents were compared using different sampling intervals. Data from the tests indicate that monthly and yearly discharge-weighted average concentrations and loads can be estimated within specified accuracy limits and daily measurements of specific conductance would not be required.

INTRODUCTION

The National Stream Quality Accounting Network (NASQAN) is operated by the U.S. Geological Survey to provide a uniform continuing measure of the quantity and quality of flow in streams of the United States on regional and national bases. The design of the network is described in U.S. Geological Survey Circular 719 (Ficke and Hawkinson, 1975). Data-collection activities at the first 50 NASQAN (National Stream Quality Accounting Network) stations were either initiated or upgraded in January 1973 to meet the design specifications for network operation. Appropriations during subsequent fiscal years permitted expansion of the program to include at least one station in each unit of the designed level I accounting network, thereby placing 345 stations in operation during fiscal year 1975 and 517 stations in operation during fiscal year 1982. There are currently 501 active stations in the NASQAN program.

The primary objective of NASQAN is to obtain information on the quantity and quality of water moving within and from the United States through a systematic and uniform process of data collection, summarization, analysis, and reporting, such that the data may be used: (1) To describe the areal variability of water quality in the Nation's streams through analysis of data from this and other programs, (2) to detect changes with time in the pattern of occurrence of water-quality characteristics, and (3) to provide a consistent national data base useful for water-quality assessment and hydrologic research. Many of the stations included in NASQAN previously were operated as parts of other local or special-purpose programs. Consequently, considerable historical data exist for some of the stations. However, before the implementation of NASQAN, available data were inadequate to determine areal differences and temporal changes in water quality on a nationwide basis because many of the local or special-purpose stations were operated for short periods, were moved frequently, or lacked standardization of constituents measured.

NASQAN, a fixed-frequency, fixed-station network, was designed to remedy most of these deficiencies. Stations in the network generally will be operated indefinitely. Changes in the suite of characteristics measured and in the frequency of measurement are made only after it has been demonstrated that such modifications will not adversely affect the fulfillment of network objectives.

Most NASQAN stations are located near the downstream ends of hydrologic accounting units so that approximately 90 percent of the surface water leaving the accounting unit is measured. Some stations are located upstream from major pollution sources; others are located downstream from such sources. Consequently, the water quality within some of the individual hydrologic accounting units may vary greatly. Standard statistical summaries and analyses of trends by the Geological Survey, based on data collected at NASQAN stations, have provided useful information concerning the water quality of the Nation's surface-water resources. (See "Selected References.") However, use of data from a single station near the terminus of a hydrologic accounting unit to represent water quality throughout an accounting unit may yield erroneous conclusions concerning the variability of water-quality conditions within or between hydrologic accounting units and thus, throughout the Nation. Recognizing these potential deficiences in the evaluation of NASQAN data, the Geological Survey has initiated a series of pilot studies using available data for NASQAN and adjacent non-network stations to describe the variability of water quality in selected hydrologic accounting units and to relate the variability to general causative factors.

PURPOSE AND SCOPE

The Texas District of the Geological Survey prepared this report on the quality of surface water in the upper Trinity River basin as part of a series of pilot studies to determine the adequacy of fixed-frequency data collected at selected NASQAN stations to describe the areal and temporal variability of water quality throughout the respective hydrologic accounting units.

The area encompassed by this study and referred to as the "upper Trinity River basin" includes that part of the Trinity River basin upstream from NASQAN station 08062700, Trinity River at Trinidad, Texas. This area is designated on Hydrologic Unit Map--1974 (U.S. Geological Survey, 1976) as hydrologic accounting unit 120301.

The study of the quality of surface water in this hydrologic accounting unit was designed to accomplish the following objectives.

(1) Describe, on both spatial and temporal bases, the quality of surface water throughout the hydrologic accounting unit upstream from the NASQAN station.

(2) Relate both the spatial and temporal variability of water quality to general causes such as basin characteristics, including land and water uses.

(3) Assess the ability of water-quality data collected at the NASQAN station to represent, on both spatial and temporal bases, the water quality for the hydrologic accounting unit.

(4) If water-quality data at the NASQAN station do not represent water quality throughout the hydrologic accounting unit, describe the minimum data-collection program necessary to do so.

(5) Assess the usefulness of daily values versus periodic water-quality data to accomplish the other four objectives.

Before 1968, analyses of water samples collected by the Geological Survey from streams and reservoirs throughout Texas usually included only the principal inorganic constituents and related properties. To supplement this information, the water-quality sampling program by the Geological Survey in cooperation with State, Federal, and local agencies was expanded to include the periodic determination of biochemical oxygen demand (BOD), dissolved oxygen (DO), macronutrients (total nitrogen and phosphorus), and minor elements for selected sites on many of the major streams and reservoirs (Rawson, 1974). Sampling for these parameters or constituents at most sites in the upper Trinity River basin was begun after 1972. Consequently, this report is based on water-quality data collected during the 10-year period from October 1972 through September 1982 (water years 1973-82).

BASIN DESCRIPTION

Location, Physiography, and Stream System

The upper Trinity River basin (fig. 1) comprises an area of about 8,540 mi^2 in north-central Texas. The land surface of the area generally slopes from the northwest to southeast, but locally toward the Trinity River and its tributaries. Altitudes range from about 1,400 ft in the northwest to less than 300 ft in the southeast along the Trinity River.

The physiography of the region is controlled chiefly by the types of rock outcrops. Resistant rocks form prominent westward-facing escarpments in some areas of the western part of the basin in Jack, Wise, and Parker Counties, but most of this area is rolling to hilly. Most of the bedrock in the western part of the basin is sandstone or sandy shale. Soils on the rugged hills are stony, but sandy loams predominate on the more gently rolling land. Although part of the land has been cleared for fields, most of the land is covered by grasses and timber.

The area in the central and eastern parts of the basin consists of a series of north-trending belts of treeless, grass-covered prairies and timbered rolling hills. A narrow belt north and south of Fort Worth in the central part of the basin is gently rolling to almost level grassland. The limestone bedrock is hard and resistant to erosion. Soils vary but predominantly are of limestone origin. The eastern half of the basin is predominantly a grass-

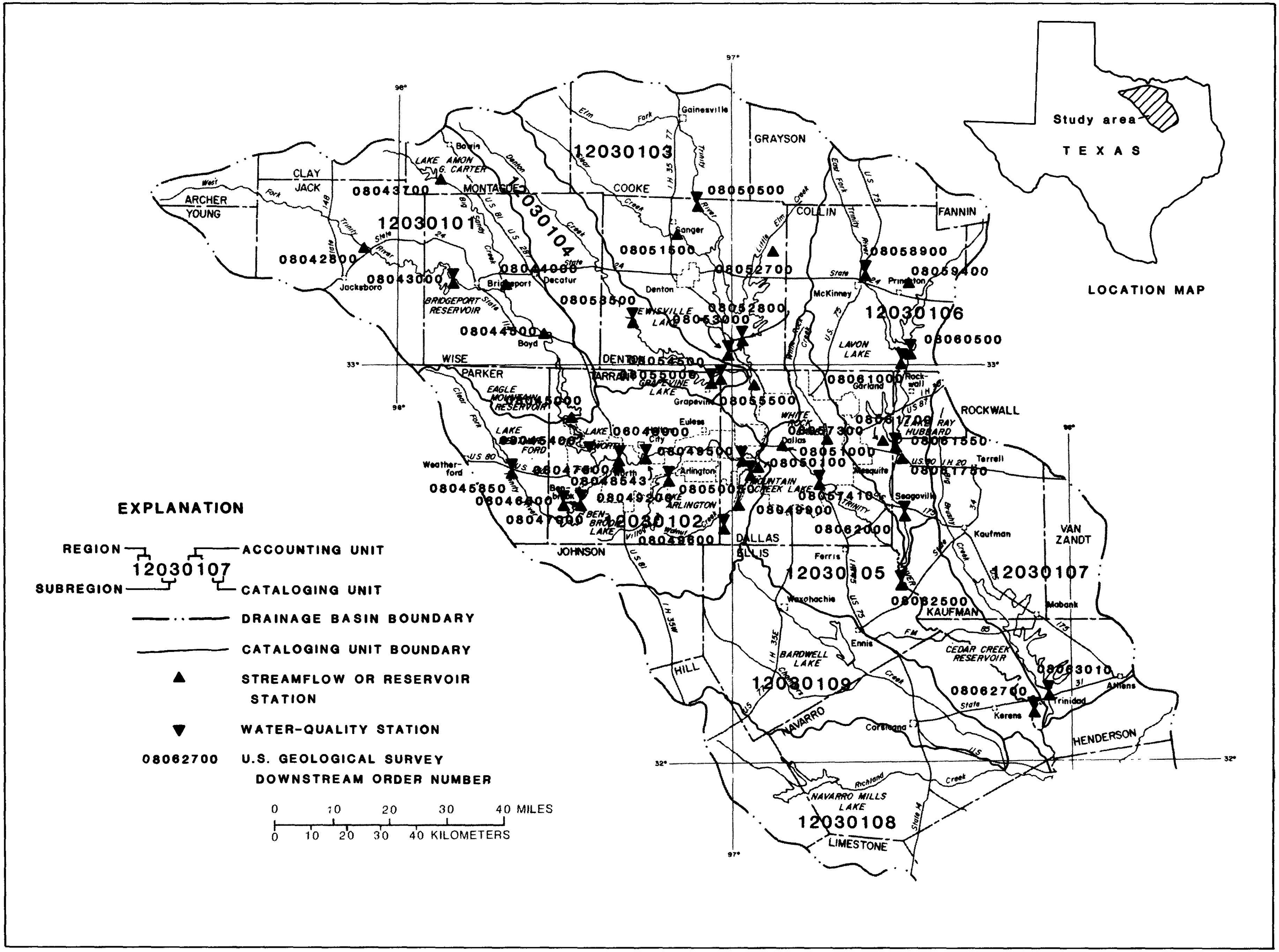

Figure 1.--Hydrologic units and location of selected streamflow, reservoir, and water-quality stations.

covered prairie. The black, fine-grained clay soils are some of the most productive in Texas.

The West Fork Trinity River, the principal headwater stream of the Trinity River, originates in southeastern Archer County and flows southeastward for about 185 mi to its confluence with the Elm Fork Trinity River to form the Trinity River in the western part of Dallas County (fig. 1). For the purposes of this report, the West Fork Trinity River upstream from this junction is designated as the main stem. Principal tributaries of the West Fork Trinity River, in downstream order, include Big Sandy Creek, Clear Fork Trinity River, Village Creek, and Mountain Creek.

The Elm Fork Trinity River originates in eastern Montague County, flows southeastward for about 85 mi, and joins the West Fork Trinity River in Dallas County. Principal tributaries include Clear Creek and Denton Creek.

The East Fork Trinity River, the major tributary downstream from the confluence of the West and Elm Forks, originates in Grayson County, flows southward for about 80 mi, and joins the mainstem Trinity River in southwestern Kaufman County.

Geology

The geology of the upper Trinity River basin has been described by Peckham and others (1963, p. 16-20); and the following description has been abstracted from the published report.

Rocks exposed in the upper Trinity River basin consist of a series of north-trending belts of sedimentary deposits and rocks of Pennsylvanian, Cretaceous, and Tertiary age. The locations of the outcrop areas are shown in figure 2. The lithology of the geologic units from youngest to oldest and their water-bearing properties are summarized in table 1.

During Pennsylvanian time, deposition of sediments in a large sea produced a sequence of marine sand, shale, and limestone. These undifferentiated rocks of Pennsylvanian age crop out in the northwestern part of the upper Trinity River basin and dip regionally toward the north and west (fig. 2). Because most of these rocks have relatively small permeabilities and dip in the opposite direction of the slope of the land surface, the quantity of water moving through them is small.

Following a period of uplifting and erosion, deposition of sediments during Cretaceous time produced a sequence of marine sand, shale, and limestone on truncated Pennsylvanian rocks. These sedimentary rocks of Cretaceous age are exposed at the surface as a series of north-trending belts in the central two-thirds of the upper Trinity River basin and consist of the Trinity, Fredericksburg, and Washita Groups, the Woodbine Formation, and the Eagle Ford, Austin, Taylor, and Navarro Groups. The Cretaceous rocks dip east and south but at a lesser rate than the slope of the land surface, which has facilitated the regional southeastward movement of freshwater from the outcrop areas to downdip areas of lower altitudes.

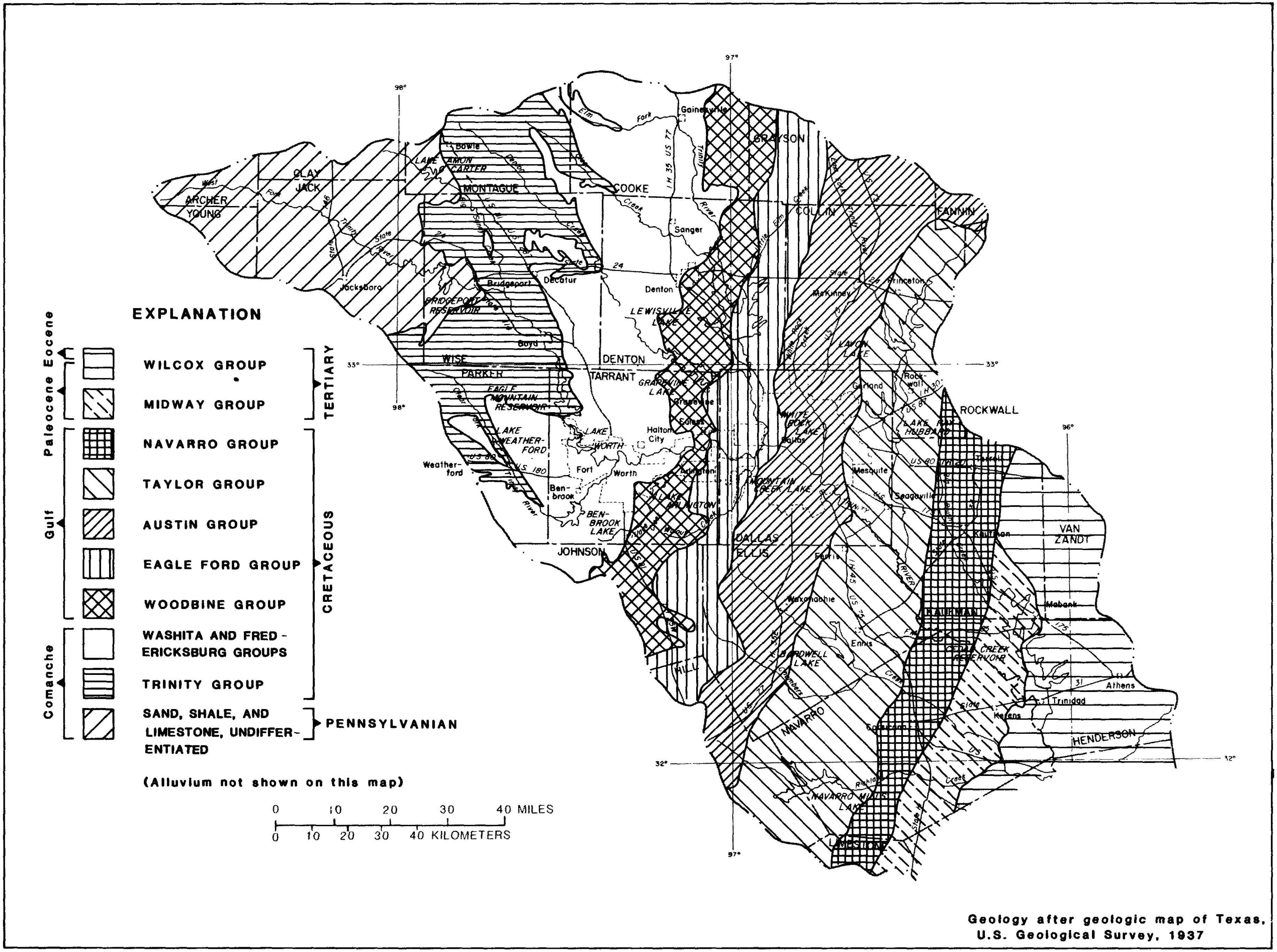

Figure 2.--General geology.

Table 1.--Geologic units and their water-bearing characteristics

System	Series	Group and formation	Stratigraphic unit	Approximate thickness (feet)	Character of rocks	Water-bearing characteristics
Tertiary	Eocene	Wilcox		0-3,500+	Interbedded sand and shale with some lignite beds.	Yields only small quantities of water.
	Paleocene	Midway		0- 900+	Massive shale with a few thin sand streaks and limestone beds.	Yields only small quantities of water from a limestone lentil in Limestone County.
Cretaceous	Gulfian	Navarro	Kemp Clay	0- 500	Clay.	Not known to yield usable water in the basin.
			Nacatoch Formation	0- 200	Fine-grained sand and sandy clay.	Yields small to moderate quantities of water in and near the outcrop.
			Neylandville Formation	0- 300	Limestone, marl, and clay.	Not known to yield usable water in the basin.
		Taylor	Undivided	0-1,200	Clay, marl, and chalk, with some sand and sandy marl.	Yields only small quantities of water in the out crop.
		Austin	Undivided	0- 800	Chalk, marl, and limestone.	Not known to yield usable water in the basin.
		Eagle Ford	Undivided	0- 640	Shale with thin laminated beds of sandstone and limestone.	Yields only small quantities of poor quality water the outcrop.
		Woodbine Formation		0- 500	Ferruginous sand, sandstone, clay, and some lignite.	Yields moderate to large quantities water.
	Comanchean	Washita	Undivided	0- 690	Alternating shale, limestone, clay, and some sand.	Yields only small quantities of water in the outcrop.
		Fredericksburg	Undivided	0- 370	Shale, clay, marl, limestone, and shell agglomerate.	Not known to yield usable water in the basin.
		Trinity	Trinity Group Undifferentiated (0-1,200): Paluxy Formation	0- 450	Fine-grained sand, sandy shale, shale, sand lenses, and anhydrite.	Yields moderate quantities of water.
			Trinity Group Undifferentiated (0-1,200): Glen Rose Formation	0-1,000	Dense to marly limestone, marl, shale, sand lenses, and anhydrite.	Yields small quantities of water in localized areas.
			Trinity Group Undifferentiated (0-1,200): Travis Peak Formation	200-900	Coarse- to fine-grained sand, shaly sand, and sandy shale; shale; varicolored shale and clay with some thin limestone lentils.	Yields large quantities of water.
Pennsylvanian	Undifferentiated				Shale, limestone, sandstone, and conglomerate.	Yields small to moderate quantities of water in localized area.

Following a period of uplifting of the area where Cretaceous rocks are exposed and subsidence of areas southward toward the Gulf of Mexico, repeated transgression and regression of the sea resulted in the deposition of marine and continental deposits of Tertiary age. The marine sediments consist predominantly of clay, shale, and marl with minor amounts of sand. Continental deposits consist of sand and lesser amounts of clay, shale, and lignite. The Midway and Wilcox Group of Tertiary age crop out near the western limit of the upper Trinity River basin and dip eastward.

Climate

Monthly and annual summaries of climatological records for Texas are published by the U.S. National Oceanic and Atmospheric Administration (NOAA). The following summary of climatological data for the upper Trinity River basin has been abstracted from these publications. (See "Selected References.")

Climatological normals published by NOAA, and included in this report, are based on a 30-year period and are updated every 10 years by adding data for the most recent 10 years and subtracting data for the oldest 10 years.

The climate of the upper Trinity River basin is humid subtropical with hot summers. The high summer temperatures usually are associated with fair skies, westerly winds, and low humidities. The extremely hot temperatures that sometimes occur during summer usually do not prevail for an extended period. Although winters are usually mild, "northers" occur during the colder months and often are accompanied by sudden decreases in temperature.

In the Dallas-Fort Worth metroplex near the center of the basin, the normal annual air temperature based on records for 1941-70 is about 65.5°F (18.6°C). The normal monthly air temperature ranges from about 35°F (2°C) in January to about 85°F (29°C) in July. Daily temperatures for the period of record have ranged from about -3°F (-19°C) to about 115°F (46°C). The first freeze usually occurs in late November, but has occurred as early as October. The last freeze usually occurs in mid-February but has occurred as late as mid-April.

The normal annual precipitation based on records for 1941-70 ranges from about 28 in. in the western part of the basin to about 40 in. in the eastern part and averages about 32 in. (fig. 3). A large part of the annual precipitation results from thunderstorm activity, with occasional intense rainfall during brief periods. Greatest amounts of rain generally occur in the spring, usually during April and May. Hail normally falls in the area for brief periods during 2 or 3 days a year. Snow occurs only rarely throughout most of the area and is unimportant as a source of moisture.

In the Dallas-Fort Worth metroplex near the center of the basin, the normal annual precipitation based on records for 1941-70 is about 32.3 in. The normal monthly precipitation ranges from about 1.8 in. for January to about 4.5 in. for May (table 2). Annual precipitation for 1973-82 averaged about 34.6 in. or about 107 percent of the 1941-70 normal.

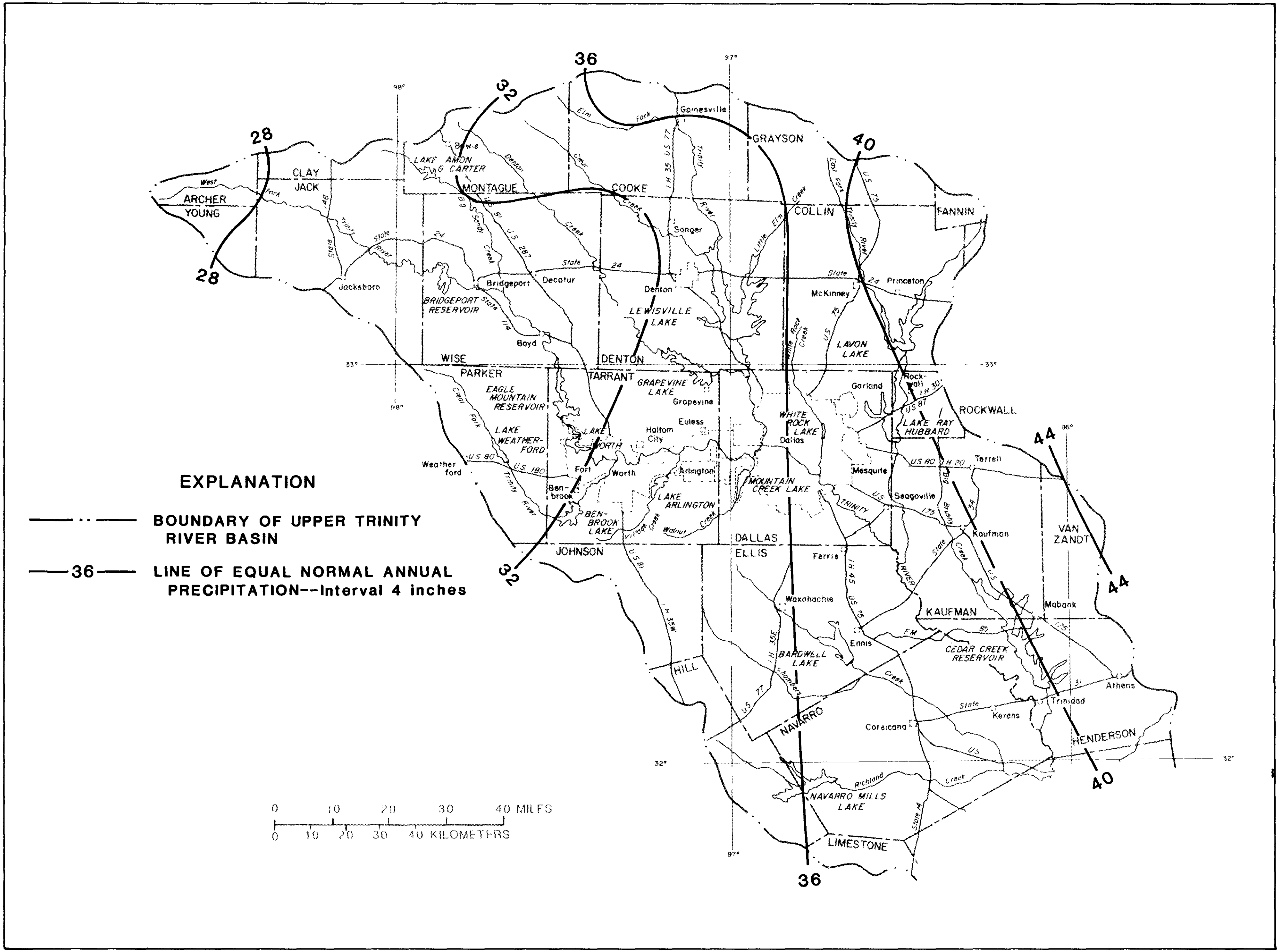

Figure 3.-Distribution of normal annual precipitation

Table 2.--Precipitation data for Dallas-Fort Worth, Texas (Regional Airport)

Year(s)	Precipitation (inches)												
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	annual
1941-70 (normal)	1.80	2.36	2.54	4.30	4.47	3.05	1.84	2.26	3.15	2.68	2.03	1.82	32.30
1973	3.26	1.92	2.28	6.06	3.18	5.88	11.13	.01	7.16	6.85	2.06	.83	50.62
1974	1.79	1.01	.80	2.51	6.00	5.44	.67	4.19	6.04	5.93	3.32	1.93	39.63
1975	3.34	3.72	1.67	3.40	6.88	1.95	5.06	.30	.87	Trace	.42	1.49	29.10
1976	.13	.52	2.29	5.71	6.03	1.40	3.83	4.75	5.02	3.46	.50	1.99	35.63
1977	2.39	1.68	5.88	4.31	.99	.69	2.20	2.33	1.72	2.96	1.79	.25	27.19
1978	1.41	3.33	2.66	1.34	8.01	.77	.33	1.53	.93	.55	2.73	.78	24.37
1979	3.35	1.52	6.33	2.03	5.90	1.36	1.94	2.47	.99	3.38	.43	2.72	32.42
1980	2.52	.84	1.24	2.23	3.01	1.25	.71	Trace	6.54	1.08	1.23	1.43	22.08
1981	.58	1.44	3.39	2.69	6.24	7.85	1.81	2.32	2.40	14.18	1.53	.17	44.60
1982	2.33	1.89	1.71	2.71	13.66	4.28	2.73	.52	.58	3.36	4.22	2.76	40.75
1973-82	2.11	1.79	2.82	3.30	5.99	3.09	3.04	1.84	3.22	4.18	1.82	1.44	34.64
Percentage off 1941-70 normal	117	76	111	77	134	101	165	81	102	125	90	79	107

Population and Municipalities

The population in the upper Trinity River basin increased from about 1,760,000 in 1960 to about 3 million in 1980, an average rate of increase of about 3.5 percent per year. Although each of the counties lying wholly or partly within the upper Trinity River basin gained population, the largest gains occurred in Dallas and Tarrant Counties and in other counties adjacent to the Dallas-Fort Worth metroplex. The population density (1980 census) ranges from less than 20 people per square mile in several of the counties near the northwestern and southeastern boundaries of the basin to more than 1,000 people per square mile in Dallas and Tarrant Counties (fig. 4).

Dallas and Fort Worth are the two most populous cities in the basin and comprise a large metropolitan area near the center of the basin. Dallas has the second largest population in the State and the seventh largest in the Nation; whereas Fort Worth has the fifth largest population in the State. Six other cities in the area have populations of more than 70,000. The 1960 and 1980 populations for each of these cities are shown in the following tabulation.

City	County	1960 population	1980 population
Dallas	Dallas, Collin	679,684	904,078
Fort Worth	Tarrant	356,268	385,141
Arlington	Tarrant	44,775	160,123
Garland	Dallas	38,501	132,857
Irving	Dallas	45,985	109,943
Richardson	Dallas, Collin	16,810	72,496
Plano	Collin	3,695	72,331
Grand Prairie	Dallas, Tarrant	30,386	71,462

Water Utilization and Surface-Water Resources Development

The principal use of surface water in the upper Trinity River basin is for municipal purposes. Surface water also is used for industrial purposes, mining, irrigation, watering of livestock, production of hydro-electric power, preservation of fish and wildlife, and recreation. Water-use information compiled by the Texas Department of Water Resources for 1980 and the projected use in the year 2000 for 14 counties in the study area are given in table 3. In 1980, total water use for the 14 counties listed in table 3 was approximately 826,000 acre-ft, of which about 90 percent, or nearly 736,000 acre-ft, was surface water. Municipal use accounted for nearly 80 percent of the total water used; and 90 percent, or nearly 586,000 acre-ft, of water used for municipal purposes was surface water. The Texas Department of Water Resources projects that by the year 2000, water demand in the 14-county area will be nearly 1,250,000

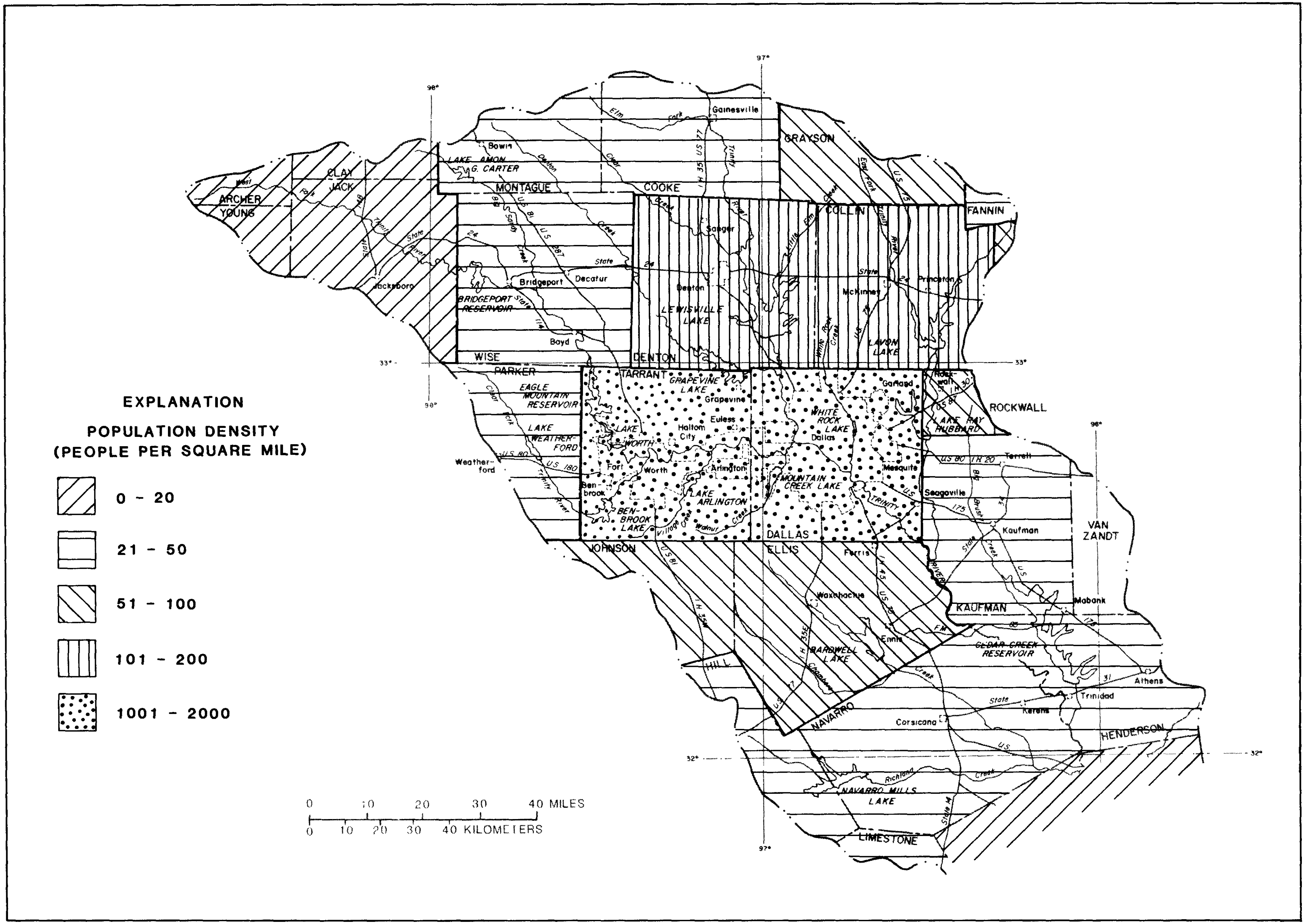

Figure 4.-Population density

Table 3.--Water use in 1980 and projected water use for year 2000 in a 14-county area

(quantities in acre-feet)

County	Water source	Municipal	Manufac-turing	Steam electric	Irriga-tion	Mining	Livestock	Total	Total water use	Projected use year 2000
Collin	ground water	1,610	160	300	0	0	230	2,310	31,310	78,900
	surface water	25,800	560	1,600	110	0	900	29,000		
Cooke	ground water	4,540	310	0	100	600	870	6,420	7,290	10,400
	surface water	0	0	0	130	0	740	870		
Dallas	ground water	14,000	1,700	670	0	0	81	16,400	421,300	627,500
	surface water	346,000	32,700	21,700	0	4,040	370	404,900		
Denton	ground water	7,590	10	0	200	1	870	8,670	27,900	45,100
	surface water	17,400	580	710	20	9	770	19,500		
Ellis	ground water	3,760	1,800	0	0	0	150	5,710	12,450	26,700
	surface water	4,880	870	0	0	9	980	6,740		
Grayson	ground water	11,600	3,290	0	2,610	10	210	17,800	27,900	45,100
	surface water	5,100	1,070	0	2,620	0	1,320	10,100		
Henderson	ground water	2,900	22	150	100	304	740	4,240	11,400	40,200
	surface water	3,000	44	3,040	0	12	1,080	7,120		
Jack	ground water	364	0	0	0	72	87	520	2,000	3,020
	surface water	762	2	0	0	0	720	1,480		
Kaufman	ground water	393	103	0	0	0	154	650	8,230	15,600
	surface water	5,990	312	0	0	0	1,283	7,580		
Montague	ground water	1,070	0	0	50	190	160	1,470	4,690	7,310
	surface water	1,670	4	0	320	60	1,170	3,220		
Parker	ground water	3,260	1	0	0	0	240	3,510	11,200	21,800
	surface water	3,390	170	150	1,840	1,110	1,000	7,670		
Tarrant	ground water	18,000	1,280	0	50	0	390	19,700	241,800	363,100
	surface water	168,000	49,000	4,180	530	0	280	222,100		
Rockwall	ground water	240	0	0	0	0	11	250	2,700	6,540
	surface water	2,330	7	0	0	0	110	2,440		
Wise	ground water	1,790	16	0	75	0	800	2,680	15,900	26,800
	surface water	2,020	5,510	0	1,420	3,700	570	13,200		

acre-ft per year, or a 51-percent increase from 1980. Water necessary to meet this increased demand will be supplied from new reservoirs to be constructed within the Trinity River basin or from new or existing reservoirs in adjacent river basins.

The population growth, increased demand for water, and need for flood control have resulted in the construction of a large network of reservoirs in the upper Trinity River basin. According to Texas Water Development Board Report 126 (Dowell and Petty, 1973), 15 reservoirs with capacities greater than 5,000 acre-ft have been constructed in the drainage area of the Trinity River upstream from Trinidad. The locations of these reservoirs, which have a combined conservation-storage capacity of about 3,110,000 acre-ft, are shown in figure 1. The capacities of these reservoirs at the top of the conservation pool, dates storage began, purposes of impoundment, and other pertinent data have been summarized by the Trinity River Authority (1974, p. 8.1) and are shown in table 4.

Land Use

The Texas Conservation Needs Committee (1970) has estimated county-by-county land-use data for the entire State based on the results of field surveys conducted in 1967 by the U.S. Soil Conservation Service. On the basis of these data, the Trinity River Authority (1974, p. 9.1-9.11) has compiled land-use data for the Trinity River basin. Although considerable change in one or more classes of land use may have occurred, estimates based on the 1967 surveys and presented in the following table should be fairly representative of current conditions in the upper Trinity River basin.

Land-use class	Approximate area in square miles	Approximate percent of total drainage area
Pasture and rangeland	4,010	47
Cropland	1,960	23
Forest land	1,280	15
Urban or developed land	940	11
Other land	350	4
TOTAL	8,540	100

These estimates show that the predominant class of land use throughout most of the basin is pasture and rangeland. Approximately 47 percent of the total drainage area is assigned to this class. However, the percentage generally decreases in the downstream direction, from approximately 60 percent of the drainage area upstream from Fort Worth to approximately 40 pecent of the drainage area downstream from Dallas.

Conversely, the percentage of cropland, which averages about 23 percent of the total drainage area, increases from approximately 13 percent in the area

Table 4.--Major reservoirs in the upper Trinity River basin

Station number	Reservoir	Stream on which dam is located	Year storage began	Drainage area (square miles)	Top of conservation pool			Gross evaporation (inches per year)	Purpose 1/
					Elevation (feet)	Area (acres)	Capacity (acre-feet)		
05043000	Bridgeport	West Fork Trinity River	1932	1,111	836.0	13,000	386,420	71.0	S,R,FC
08043700	Amon G. Carter	Big Sandy Creek	1956	100	920.0	1,540	20,050	70.5	S,R
08045000	Eagle Mountain	West Fork Trinity River	1934	1,970	646.1	9,200	190,460	70.5	S,C,R,FC
08045400	Lake Worth	West Fork Trinity River	1914	2,064	594.3	3,560	38,130	70.5	S,R
--	Lake Weatherford	Clear Fork Trinity River	1957	109	896.0	1,210	19,470	71.5	S,C,R
08046500	Benbrook Lake	Clear Fork Trinity River	1952	429	694.0	3,770	88,250	71.0	S,R,FC
08049200	Lake Arlington 2/	Village Creek	1957	143	550.0	2,275	45,710	69.0	S,C,R
08050050	Mountain Creek Lake	Mountain Creek	1937	295	457.0	2,710	22,840	67.0	C,R
08502800	Lewisville Lake	Elm Fork Trinity River	1954	1,660	515.0	23,280	464,500	66.5	S,R,FC
08054500	Grapevine Lake	Denton Creek	1952	695	535.0	7,380	181,100	67.5	S,R,FC
--	North Lake 3/	South Fork Grapevine Creek	1957	3	510.0	800	17,000	67.0	R,C
08057300	White Rock Lake	White Rock Creek	1910	100	458.0	1,119	10,740	64.0	S,C,R
08060500	Lavon Lake	East Fork Trinity	1953	770	492.0	21,400	456,500	62.0	S,C,R,FC
08061550	Lake Ray Hubbard	East Fork Trinity River	1968	1,071	435.5	22,745	489,900	62.5	S,C,R
08063010	Cedar Creek Reservoir	Cedar Creek	1965	1,007	322.0	33,750	679,200	57.0	S,R
	TOTAL					147,739	3,110,270		

1/ S, domestic, municipal, and(or) industrial supply; C, power-plant cooling; R, recreation; FC, flood control.
2/ Runoff supplemented by surface water diverted from Cedar Creek Reservoir.
3/ Runoff supplemented by surface water diverted from Elm Fork Trinity River.

upstream from Fort Worth to approximately 38 percent in the area downstream from Dallas.

Urban and developed areas, most of which are included in or are satellite to the Dallas-Fort Worth metroplex, comprise approximately 11 percent of the total drainage area.

Potential Point Sources of Surface-Water Pollution

Potential point sources of surface-water pollution in the upper Trinity River basin include domestic, municipal, and industrial wastewater-treatment plants; water-treatment plants; cattle and swine feedlots; electrical-power generating plants; mines; and solid-waste disposal sites. According to a survey by the Trinity River Authority (1974, p. 22.1-22.14) waste-control orders for 283 facilities in or proximate to the upper Trinity River basin had been issued as of October 1973. The location of these facilities, which include 208 wastewater-treatment plants, 29 water-treatment plants, 10 feedlots, 21 electrical-power generating plants, 7 sites of mining operations, and 8 solid-waste disposal sites, are shown in figure 5.

The majority of the basin's population, and thus the larger domestic and municipal wastewater treatment facilities, are located in the Dallas-Fort Worth metroplex. Treatment plants throughout this area and in most other areas of the basin provide at least secondary treatment of wastewaters.

For a more comprehensive discussion of the locations of waste-treatment facilities and the types of wastes generated, the reader is referred to the county-by-county inventory by the Trinity River Authority (1974, p. 22.1-22.14).

STREAMFLOW

During the 1982 water year, the Geological Survey operated 30 continuous streamflow stations in the upper Trinity River basin. Streamflow records for selected stations are summarized in table 5; locations of the stations are shown in figure 1. These data show that the mean discharge for the NASQAN station Trinity River at Trinidad (08062700) during the 1973-82 base period of this study was about 103 percent of the mean discharge for the 1965-82 period of record. Although mean discharges for a few of the other stations were slightly smaller during the base period than during the period of record, the mean discharges for most stations were significantly larger during the 1973-82 period. These larger-than-normal flows are attributed mostly to the intense rainfall and runoff that occurred in October 1981 and May 1982 (table 2). Mean flows in streams throughout most of the upper Trinity River basin during the 1982 water year were more than 300 percent of the long-term mean flows.

Dry-weather flows in many of the streams in the area are sustained either by releases from reservoirs or by effluent from wastewater-treatment plants and usually are minimum during the hot summer from July through September. With the onset of cooler fall weather, streamflow usually increases in response to increases in precipitation. Both precipitation and streamflow throughout most of the basin usually are maximum during the spring from April through June. The seasonal pattern of streamflow for two stations in the basin during

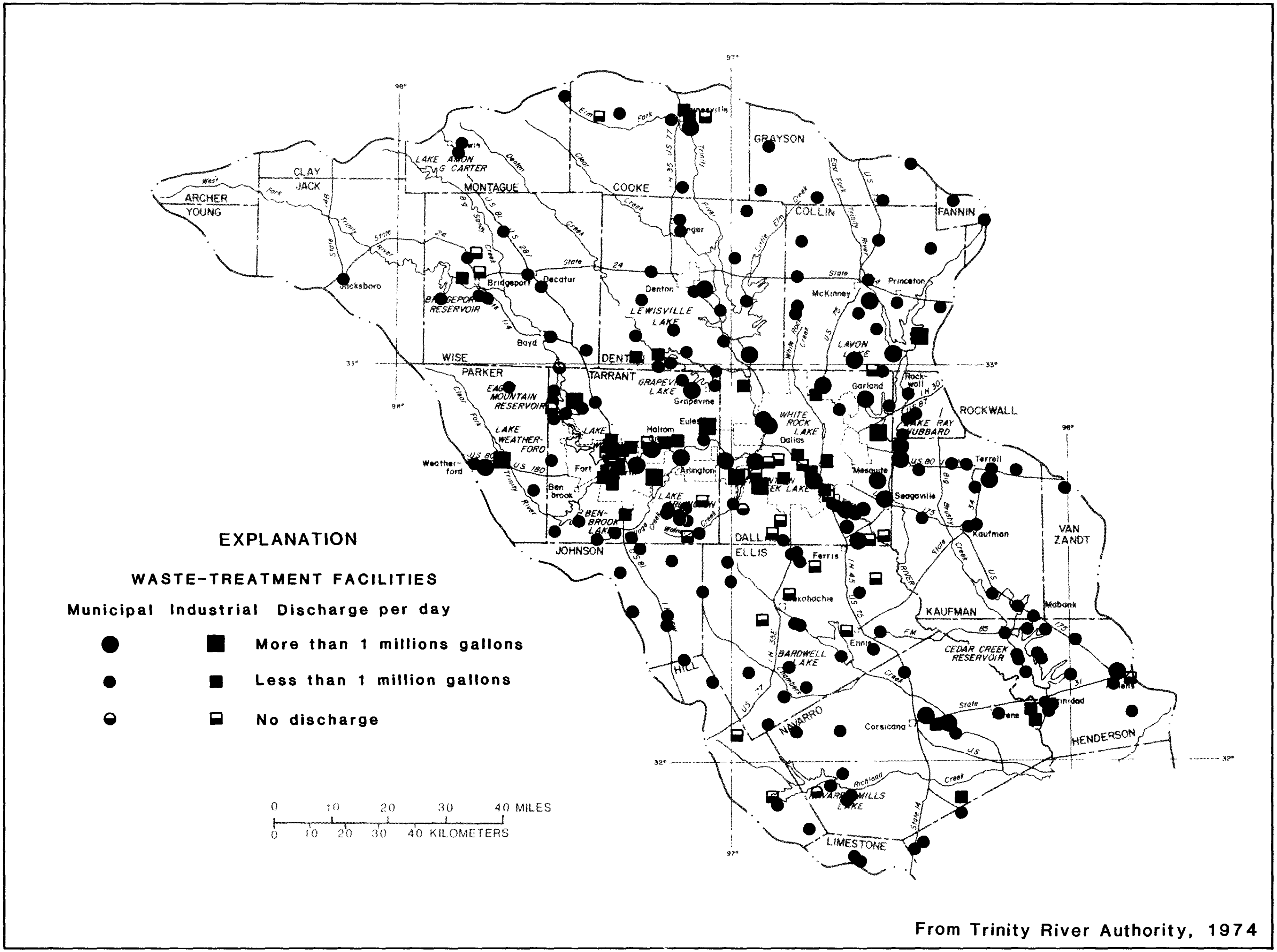

Figure 5.-Locations of waste-treatment facilities

Table 5.--Summary of streamflow records for selected continuous gaging stations

[ft^3/s, cubic feet per second]

Station number	Station	Period of record 1/	Mean discharge, period of record (ft^3/s)	Mean discharge 1973-82 (ft^3/s)	Percent difference
08042800	West Fork Trinity River near Jacksboro	1957-82	103	95.6	-7.2
08044000	Big Sandy Creek near Bridgeport	1937-82	73.8	71.5	-3.1
08044500	West Fork Trinity River near Boyd	1948-82	236	267	13.1
08047000	Clear Fork Trinity River near Benbrook	1953-82	70.4	100	42.0
08047500	Clear Fork Trinity River at Fort Worth	1953-82	102	137	34.3
08048000	West Fork Trinity River at Fort Worth	1921-82	378	383	1.3
08048543	West Fork Trinity River at Beach Street, Fort Worth	1977-82	490	--	--
08049500	West Fork Trinity River at Grand Prairie	1926-82	565	689	21.9
08049600	Mountain Creek near Cedar Hill	1961-82	47.1	46.3	-1.7
08050100	Mountain Creek at Grand Prairie	1961-82	98.8	110	11.3
08050500	Elm Fork Trinity River near Sanger	1950-82	162	209	29.0
08053000	Elm Fork Trinity River near Lewisville	1955-82	672	798	18.8
08055000	Denton Creek near Grapevine	1953-82	162	206	27.2
08055500	Elm Fork Trinity River near Carrollton	1955-82	769	935	21.6
08057000	Trinity River at Dallas	1904-82	1,539	1,954	27.0
08057410	Trinity River below Dallas	1958-82	1,840	2,250	22.3
08058900	East Fork Trinity River at McKinney	1976-82	98.4	--	--
08061000	East Fork Trinity River near Lavon	1954-82	354	344	-2.8
08061750	East Fork Trinity River near Forney	1974-82	565	--	--
08062000	East Fork Trinity River near Crandall	1954-82	595	663	11.4
08062500	Trinity River near Rosser	1925, 1939-82	2,638	3,116	18.1
08062700	Trinity River at Trinidad	1965-82	3,766	3,886	3.2

1/ If flow is regulated by reservoirs, the period of record is shown only for regulated flow.

the 1973-82 base period is shown in figure 6. The large increase of mean monthly discharge during October and November of the base period is atypical. Mean monthly discharges for both months during the base period were significantly larger than those for the period of record because of intense rainfall in October 1981. For a more detailed account of streamflow during this flood, the reader is referred to Buckner and Kurklin (1984). Effects of the October storm on median monthly discharge generally were insignificant. Consequently, the graphs of median monthly discharge in figure 6 reflect the more typical pattern of seasonal variations in streamflow.

Flow-duration curves for three stations (fig. 7) provide additional information on flow characteristics of streams in the basin. A curve with a steep slope, such as that for the Elm Fork Trinity River near Sanger (08050500), is typical of headwater streams. The steep slope generally indicates that base flow sustained from ground- or surface-water storage or inflow of waste effluents is small, that most of the flow consists of surface runoff, and that the flow is extremely variable. A curve with a flat slope at the lower end, such as that for the Trinity River at Trinidad (08062700), is typical of the mainstem Trinity River and some of the principal tributaries in which dry-weather flows are sustained by inflow of waste effluents and releases from reservoirs.

WATER QUALITY

Data Base

A network of daily and periodic water-quality stations on principal streams in Texas has been operated for many years by the Geological Survey in cooperation with the Texas Department of Water Resources and other State, Federal, and local agencies. To supplement the information being obtained from this network, a cooperative statewide reconnaissance by the Geological Survey and the Texas Department of Water Resources was begun in September 1961. As part of this reconnaissance, samples for the analysis of major inorganic constituents were collected periodically at numerous sites on streams throughout the Trinity River basin so that some water-quality information would be available in areas where water-development projects were likely to be built. The results of this water-quality reconnaissance for the Trinity River basin were summarized by Leifeste and Hughes (1967).

The cooperative water-quality program was expanded in January 1968 to include the periodic determination of biochemical oxygen demand, dissolved oxygen, nutrients, and pesticides at selected sites on streams throughout Texas. As part of a statewide study, these water-quality data collected for principal streams in the Trinity River basin through the 1972 water year were summarized by Rawson (1974).

Water-quality data for most major reservoirs in the Trinity River basin have been collected by the Geological Survey as part of a statewide reservoir inventory program. Since about 1969, at least one water sample per year for major inorganic analyses has been collected from most of the major reservoirs. More comprehensive seasonal water-quality data for six major reservoirs have been collected by the Geological Survey for 3 or more years since 1973. This data-collection program has been described by Wells and Schertz (1984).

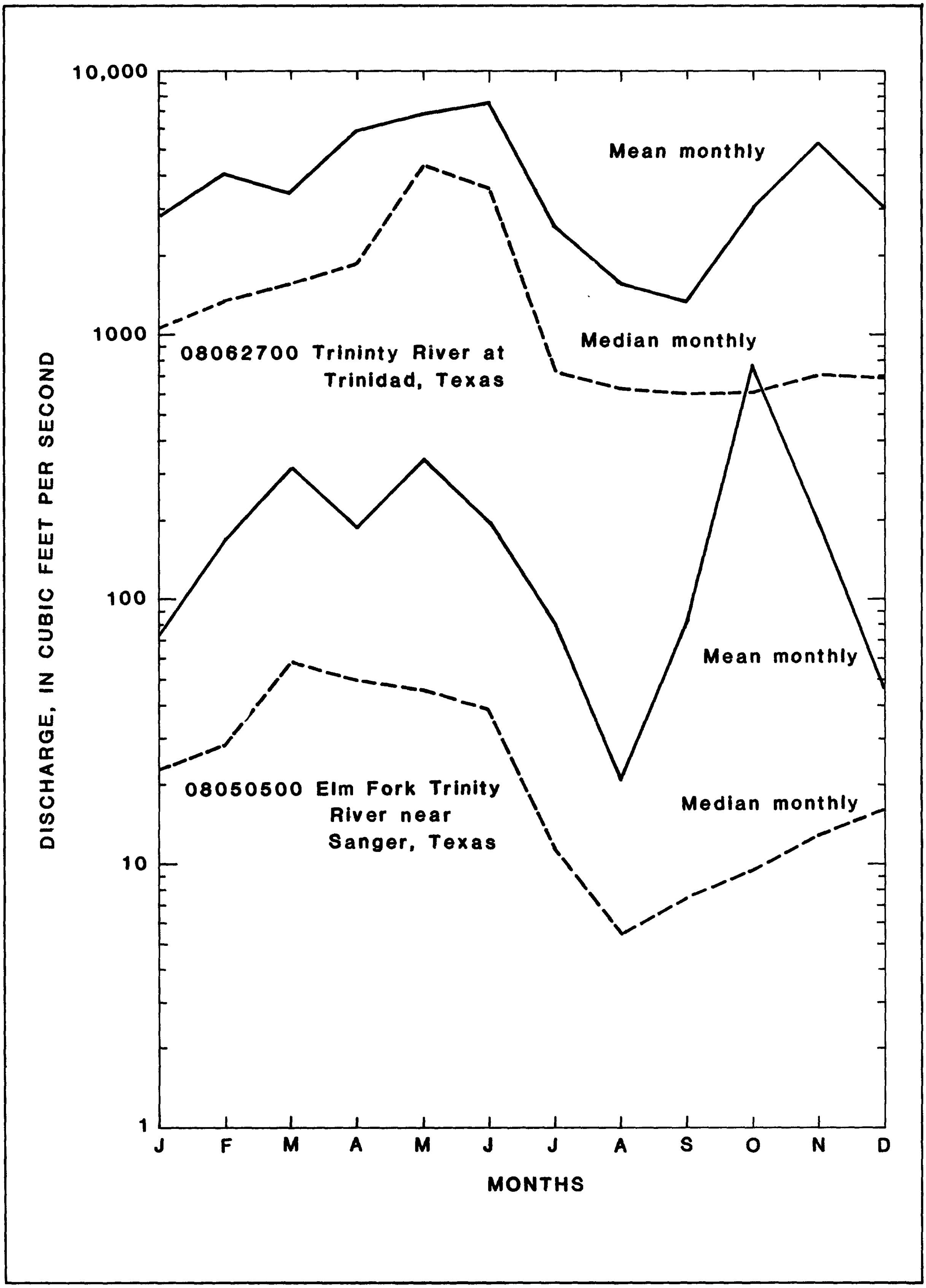

Figure 6.–Mean and median monthly dicharges for selected stations, 1973–82 water years

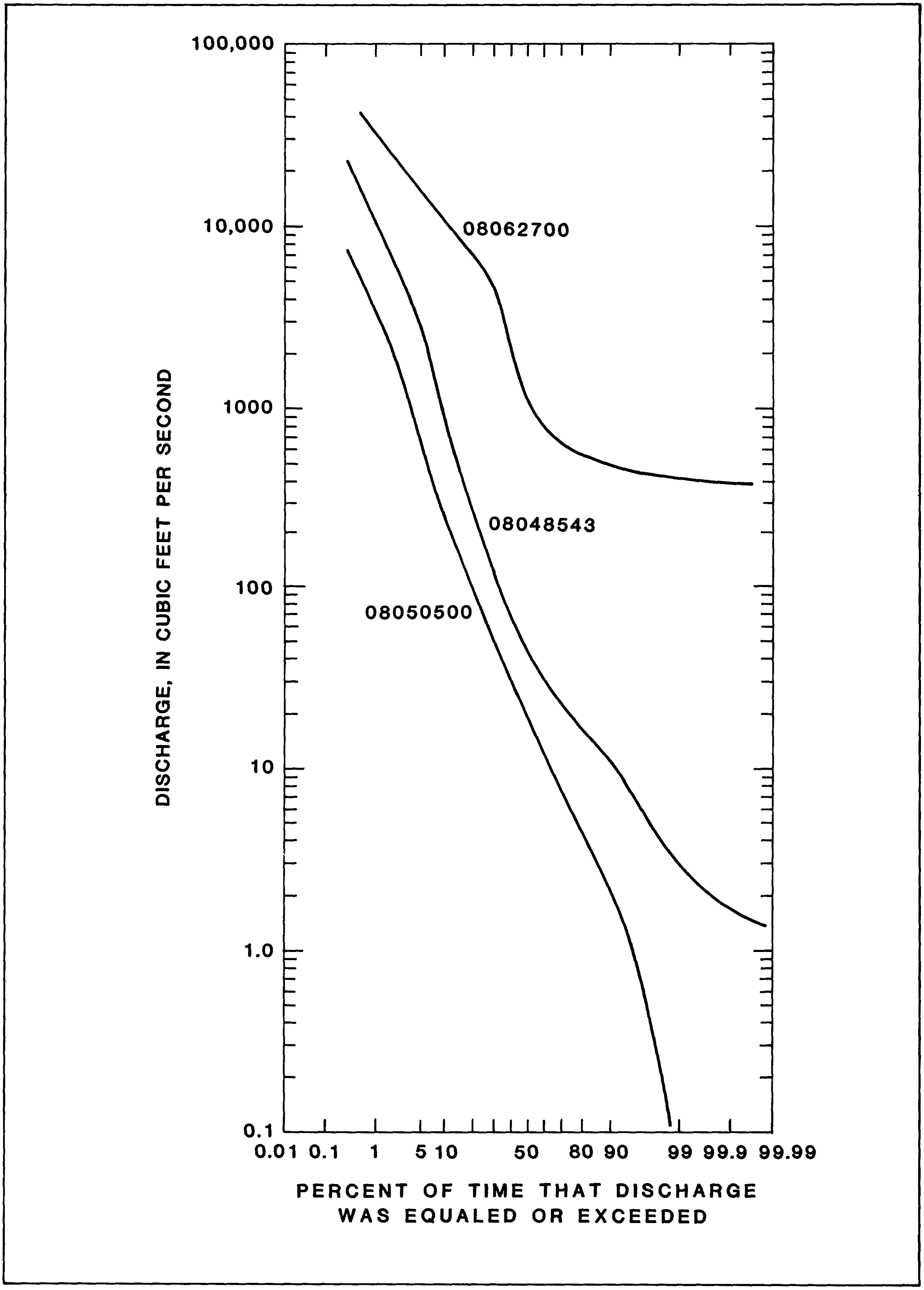

Figure 7.-Flow-duration curves for selected stations, 1973-82 water year

To supplement this network of daily, periodic, special-periodic, and reservoir stations, continuous automatic monitors for the determination of specific conductance, temperature, dissolved oxygen, and pH at four sites on the West Fork Trinity River and the mainstem Trinity River were installed and have been operated since 1976 or 1977. The periods of record and the types of data collected at each of the Geological Survey water-quality stations are summarized in table 6. Locations of the stations are shown in figure 1.

Statistical-Analysis Methodology

Statistical analysis of water-quality data was performed using the Statistical Analysis System (SAS)[1] developed by the SAS Institute of Cary, North Carolina (SAS Institute, Inc., 1982a, b). The SAS computer system has been interfaced with the Geological Survey's National Water Data Storage and Retrieval System (WATSTORE). The SAS computer programs provide data-management functions such as sorting, merging, copying, and condensing sets of data.

The principal SAS procedures used in the preparation of this report were the Univariate and the General Linear Model (GLM) procedures. The Univariate procedure was used to produce simple descriptive statistics of numeric variables including the number of observations on which calculations were based; the maximum, minimum, and mean values; and the standard deviation about the mean. The Univariate procedure also was used to provide detailed information on the distribution of data. For data with 5 or more observations, the 95th-, 75th-, 50th- (median), 25th-, and 5th-percentile values were determined and used to produce a duration table of selected variables. The resultant tables show the percentage of observations in which values were less than or equal to specified values.

The SAS GLM procedure uses the principle of least squares to fit a linear model to virtually any data. The GLM procedure was used in this report to develop regression equations expressing the mathematical relation between various dependent and independent variables. Only those regression equations that were determined to be significant at the 95-percent confidence level were used for data analysis in this report.

Two nonparametric SAS procedures (SEASKEN and SEASRS), developed by the Systems Analysis Group of the Geological Survey, were used to test for trends in water-quality data. A brief description of these procedures is presented in the section "Water Quality--Long-Term Variation." A more detailed description is presented by Crawford and others (1983).

Factors Influencing Water Quality

The concentrations of dissolved minerals and the chemical composition of surface waters depend upon many environmental factors. Some of the factors with potential for influencing the quality of water in streams and reservoirs in the upper Trinity River basin have been mentioned in previous sections of

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[1] Use of firm name in this report is for identification purposes only and does not constitute endorsement by the U.S. Geological Survey.

Table 6.--Summary of U.S. Geological Survey's water-quality data-collection program for streams and reservoirs

[I, major inorganic; M, minor elements; N, nutrients; Phyto, phytoplankton; Pest, pesticides; S, suspended sediment]

Station number	Station	Daily	Periodic	Reservoir survey	Reservoir inventory	Continuous monitor	Type of data
08042800	West Fork Trinity River near Jacksboro		1959, 1962				I
08043000	Bridgeport Reservoir above Bridgeport				1960, 1964, 1969-82		I
08044000	Big Sandy Creek near Bridgeport		1968-77				S
08045000	Eagle Mountain Reservoir above Fort Worth				1952-53, 1964 1970-81		
08045400	Lake Worth above Fort Worth				1970-82		I
08045850	Clear Fork Trinity River near Weatherford		1980-82				I,N,M
08046500	Benbrook Lake near Benbrook			1980-82	1957, 1962, 1964, 1969-79		I,N,Phyto
08047000	Clear Fork Trinity River near Benbrook		1980-82				I,N,M
08047500	Clear Fork Trinity River at Fort Worth	1948-52					I
08048000	West Fork Trinity River at Fort Worth		1952, 1964, 1968-76				I,N
08048543	West Fork Trinity River at Beach Street, Fort Worth		1976-82			1976-82	I,N
08049200	Lake Arlington at Arlington			1973-82	1964,1969-72		I,N
08049500	West Fork Trinity River at Grand Prairie		1966-82			1976-82	I,N,M
08049600	Mountain Creek near Cedar Hill		1974-82				I,N,M
08049900	Mountain Creek near Duncanville		1974-82				I,N,M
08050050	Mountain Creek Lake near Grand Prairie				1964-65 1969-82		I
08050500	Elm Fork Trinity River near Sanger		1962-64, 1967 1967-82				I,N,M
08051500	Clear Creek near Sanger		1959, 1966				I
08052700	Little Elm Creek near Aubrey		1962-67				I
08052800	Lewisville Lake near Lewisville			1975-82	1962, 1964, 1969-74		I
08053000	Elm Fork Trinity River near Lewisville	1981-82	1980-81				I,N,M
08053500	Denton Creek near Justin		1980-82				I,N,M
08054500	Grapevine Lake near Grapevine			1980-82	1964, 1969-79		I,N,Phyto
08055000	Denton Creek near Grapevine		1980-82				I,N,M
08055500	Elm Fork Trinity River near Carrollton		1952, 1971				I
08057000	Trinity River at Dallas		1952				I
08057410	Trinity River below Dallas	1967-76				1977-82	I,N,M,Pest
08058900	East Fork Trinity River at McKinney		1980-82				I,N,M
08060500	Lavon Lake near Lavon			1980-82	1962-64 1970-79		I,N,Phyto
08061000	East Fork Trinity River near Lavon		1980-82				I,N,M
08061550	Lake Ray Hubbard near Forney				1969-82		I
08061700	Duck Creek near Garland		1976-82				S
08601750	East Fork Trinity River near Forney	1981-82					I,N,M
08062000	East Fork Trinity River near Crandall	1967-81					I,N,M,Pest
08062500	Trinity River near Rosser	1954-76				1977-82	I,N,M,Pest
08063010	Cedar Creek Reservoir near Trinidad			1977-82			
08062700	Trinity River at Trinidad	1977-81	1967-77				I,N,M,Pest

this report. The potential influences on water quality by these and other factors, including climate, geology, patterns and characteristics of streamflow, disposition of municipal and industrial wastes, diversion of flow, and impoundment of water in reservoirs, are discussed in this section. A quantitative evaluation of the effects of each of these factors on the quality of surface water in the upper Trinity River basin is beyond the scope of this report. However, the effects of some of the factors will be evaluated qualitatively in subsequent sections.

Rainwater is formed by a natural distillation process and thus is nearly free of dissolved minerals. However, as the rainwater is formed, it usually dissolves carbon dioxide from the air. The solution of carbon dioxide greatly increases the solvent action of rainwater. As soon as the rain reaches land surface and begins to run off or to percolate through openings in soils and rocks, the water begins to dissolve the readily soluble mineral matter. The kinds and quantities of mineral constituents dissolved by the water depend principally on the chemical composition and physical structure of rocks and soils traversed by the water and on the duration of contact.

In streams where the flow is not regulated appreciably by reservoirs, the concentrations of dissolved minerals generally vary inversely with the water discharge. Minimum concentrations usually occur during large flows which consist predominantly of storm runoff that has been in contact with soluble minerals of the exposed rocks and soils for a relatively brief time. Conversely, the concentrations usually are maximum in small flows sustained predominantly by waste effluents or by ground-water discharge that has leached more soluble minerals during extended circulation through the soils and rocks.

Modifications of the environment by some of the activities of man often affect the quality of surface water. Waste products resulting from increased concentrations of people, animals, and industries in an urban environment tend to accumulate on the land surface until they are removed by storm runoff. Depletion of flow by diversion and consumptive use, increased evaporation due to reservoir storage, and return flows of municipal and industrial wastes and from irrigation generally increase the concentrations of dissolved inorganic and organic constituents in streams and reservoirs.

Impoundment of water in reservoirs may significantly alter the quality of the water. Some of the changes are detrimental; others are beneficial. Many of the detrimental effects are related to stratification due to temperature-induced density differences. Water at deep sites in many reservoirs during summer is separated into three fairly distinct strata: (1) The epilimnion--a warm, freely circulating surface stratum, (2) the metalimnion--a middle stratum characterized by a rapid decrease in temperature with increase in depth, and (3) the hypolimnion--a cold, stagnant lower stratum. During periods of summer stagnation, the decomposition of organic debris near the bottom of the reservoir results in deoxygenation of the hypolimnion and a corresponding increase in concentrations of nutrients, trace metals, and other constituents.

The principal beneficial effects of reservoir storage on the quality of water at sites downstream are related to settling of suspended material and the mixing of inflows. As a stream merges into a reservoir, velocities decrease and suspended material and associated constituents such as trace metals and nutrients settle to the bottom where they may be trapped. Although mixing of streamflow in the reservoir may be incomplete, especially during periods of summer stratification, regulation of flow by the reservoir generally decreases the variation of major dissolved constituents at downstream sites.

Water-Quality Standards

Water-quality standards and criteria for surface waters in Texas were developed by the Texas Water Quality Board and were approved by the U.S. Environmental Protection Agency (EPA) in 1973 (Texas Water Quality Board, 1973). The water-use classification for which standards and criteria have been established includes contact recreation waters, non-contact recreation waters, domestic raw water supplies, irrigation waters, and shellfish waters.

Regulations for selected water-quality constituents and properties for public water systems have been established by the U.S. Environmental Protection Agency (1976, 1977). According to the Texas Water Quality Board (1973, p. 4), it is the goal that all surface waters used for domestic raw water supply in the State conform to these Federal standards. However, in areas where no available source meets these standards, surface water may be deemed suitable for use as a domestic raw water supply if the chemical constituents do not pose a potential health hazard. The principal use of surface water in the upper Trinity River basin is for public supply. Consequently, regulations for public water systems are summarized in table 7 and are quoted in other sections of this report as a basis of comparison. For a discussion of standards and criteria for other water-use classifications, the reader is referred to the report by the Texas Water Quality Board (1973).

Areal Variations

Water Types

In areas where municipal and industrial influences are small, the quantities and kinds of minerals dissolved in surface water depend principally on the chemical composition and physical structure of the rocks and soils traversed by the water. Sedimentary rocks of the Pennsylvanian and Cretaceous ages that crop out in much of the study area are composed predominantly of marine sand, shale and limestone (fig. 2, table 1). Surface water that traverses these outcrops in the upper Trinity River basin upstream from the Dallas-Fort Worth metroplex is generally a calcium bicarbonate type (fig. 8). In the West Fork Trinity River downstream from Fort Worth and in the mainstem Trinity River between Dallas and Trinidad, the water is a mixed type with sodium and calcium the predominant cations and bicarbonate, sulfate, and chloride the predominant anions. The increase in the percentage of sodium, chloride, and sulfate within and downstream from the Dallas-Fort Worth metroplex probably results from the inflow of industrial and municipal waste effluents. Water in the Mountain Creek watershed generally is a mixed type in which calcium, sodium, and sulfate predominate. The source of abnormally high sulfate concentrations in the Mountain Creek watershed has not been identified. However, effluent from the production of cement or other industrial wastes are potential sources (oral communication, Richard Browning, Ph.D., Trinity River Authority).

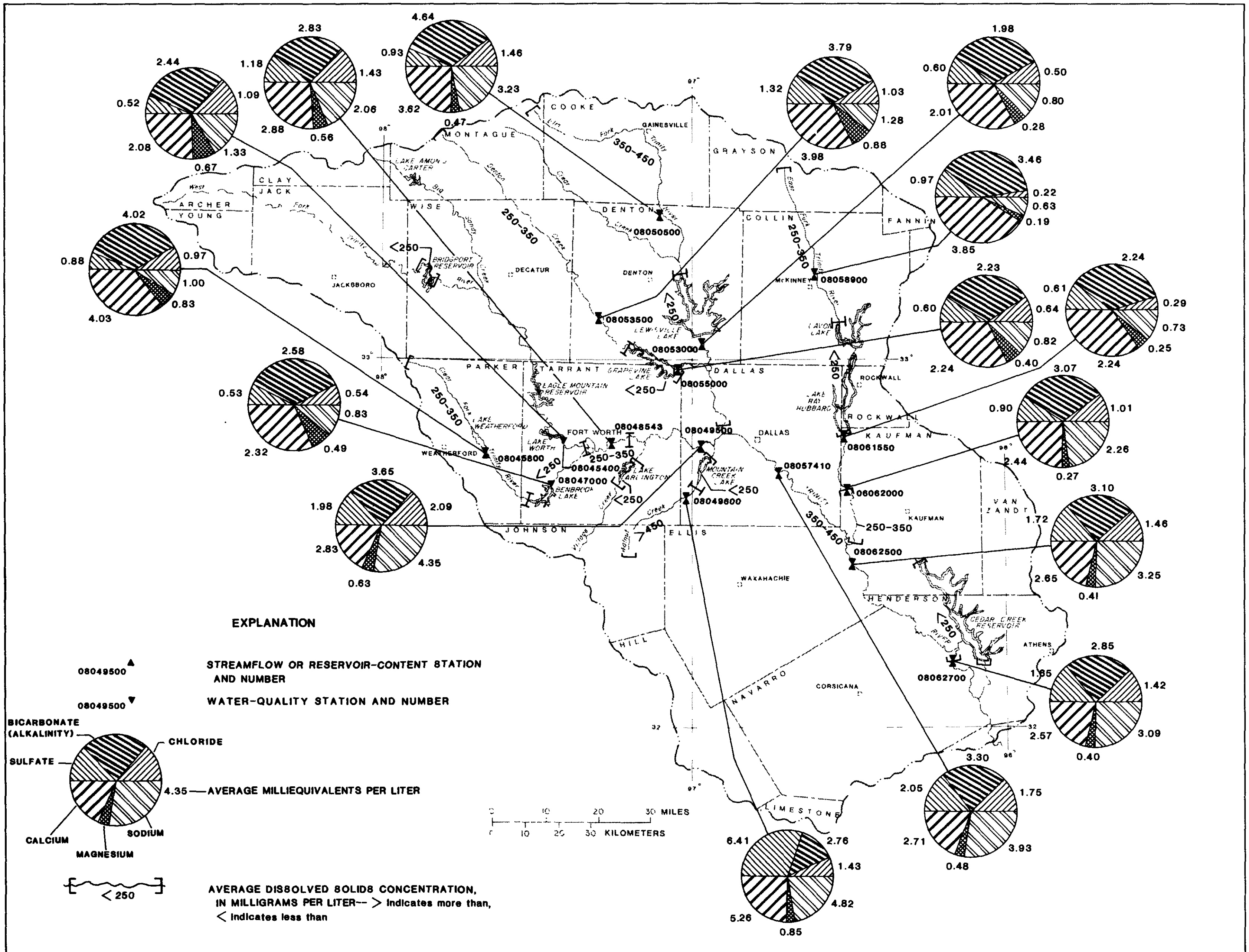

Figure 8.-Average concentrations of dissolved solids and geochemical types of surface waters

Table 7.--Summary of regulations for selected water-quality constituents and properties for public water systems

[µg/L, micrograms per liter; mg/L, milligrams per liter]

DEFINITIONS

Contaminant.--Any physical, chemical, biological, or radiological substance or matter in water.

Public water system.-A system for the provision of piped water to the public for human consumption, if such system has at least 15 service connections or regularly serves at least 25 individuals daily at least 60 days out of the year.

Maximum contaminant level.-The maximum permissible level of a contaminant in water which is delivered to the free-flowing outlet of the ultimate user of a public water system. Maximum contaminant levels are those levels set by the U.S. Environmental Protection Agency (1976) in the National Interim Primary Drinking Water Regulations. These regulations deal with contaminants that may have a signicant direct impact on the health of the consumer and are enforceable by the Environmental Protection Agency.

Secondary maximum
to the free-flowing outlet of the ultimate user of a public water system. Secondary maximum contaminant levels are those levels proposed by the Environmental Protection Agency (1977) in the National Secondary Drinking Water Regulations. These regulations deal with contaminants that may not have a significant direct impact on the health of the consumer, but their presence in excessive quantities may affect the esthetic qualities and discourage the use of a drinking-water supply by the public.

INORGANIC CHEMICALS AND RELATED PROPERTIES

Contaminant	Maximum contaminant level	Secondary maximum contaminant level
Arsenic (As)	50 µg/L	--
Barium (Ba)	1,000 µg/L	--
Cadmium (Cd)	10 µg/L	--
Chloride (Cl)	--	250 mg/L
Chromium (Cr)	50 µg/L	--
Copper (Cu)	--	1,000 µg/L
Iron (Fe)	--	300 µg/L
Lead (Pb)	50 µg/L	--
Manganese (Mn)	--	50 µg/L
Mercury (Hg)	2 µg/L	--
Nitrate (as N)	10 mg/l	--
pH	--	6.5 - 8.5
Selenium (Se)	10 µg/L	--
Silver (Ag)	50 µg/L	--
Sulfate (SO_4)	--	250 mg/L
Zinc (Zn)	--	5,000 µg/L
Dissolved solids	--	500 mg/l

Fluoride.--The maximum contamination level for fluoride depends on the annual average of the maximum daily air temperatures for the location in which the community water system is situated. A range of annual averages of maximum daily air temperatures and corresponding maximum contamination level for fluoride are given in the following tabulation.

Average of maximum daily air temperatures (degrees Celsius)	Maximum contaminant level for fluoride (mg/L)
12.0 and below	2.4
12.1 - 14.6	2.2
14.7 - 17.6	2.0
17.7 - 21.4	1.8
21.5 - 26.2	1.6
26.3 - 32.5	1.4

ORGANIC CHEMICALS

Chlorinated Hydrocarbons

Contaminant	Maximum contaminant level (µg/L)
Endrin	0.2
Lindane	4
Methoxychlor	100
Toxaphene	5

Chlorophenoxys

Contaminant	Maximum contaminant level (µg/L)
2,4-D	100
Silvex	10

Dissolved Solids

Concentrations

Statistical summaries of water-quality data collected periodically from streams and reservoirs in the upper Trinity River basin are shown in table 20 (supplemental information). These summaries provide an indication of the variability of water quality and thus are useful to water managers or to users who divert water directly from streams in areas where reservoir storage is not available. These data show that the concentrations of dissolved solids vary temporally and areally.

Mean dissolved-solids concentrations in samples collected from streams ranged from 174 mg/L (milligrams per liter) in the Elm Fork Trinity River near Lewisville (08053000) to 682 mg/L in Mountain Creek near Cedar Hill (08049600). Mean dissolved-solids concentrations at sites upstream from most major reservoirs ranged between 250 and 350 mg/L. Exceptions to this general pattern were Mountain Creek near Cedar Hill (08049600) and Elm Fork Trinity River near Sanger (08050500) where the mean concentrations were 682 mg/L and 398 mg/L, respectively. The mean concentrations of dissolved solids in the major reservoirs and in stream reaches immediately downstream from the reservoirs generally were significantly smaller than those upstream from the reservoirs. The smaller concentrations in the reservoirs and reservoir releases reflect a more prolonged effect of dilution by storm runoff. Mean dissolved-solids concentrations in reservoir inventory samples and volume-weighted average concentrations computed from data collected during comprehensive reservoir surveys seldom exceeded 250 mg/L. An exception to this general pattern was Mountain Creek Lake (08050050) where the dissolved-solids concentrations ranged from 190 to 458 mg/L and averaged 305 mg/L. According to a stream classification by the Texas Water Quality Board (1973, p. 33), most of the reach of the West Fork Trinity River and mainstem Trinity River between Fort Worth and Trinidad (fig. 8) is effluent dominated. Dry-weather flows in this reach consist mostly of effluents from waste-treatment plants. The mean concentration of dissolved solids in this reach ranged from 314 mg/L in the West Fork Trinity River at Beach Street, Fort Worth (08048543), which is upstream from most major waste effluents, to 445 mg/L in the West Fork Trinity River at Grand Prairie (08049500). Farther downstream, the mean dissolved-solids concentration of the Trinity River at Trinidad (08062700) was 349 mg/L. The smaller concentration at the terminus of this reach reflects dilution resulting from tributary inflow.

Dry-weather flows in most streams in the upper Trinity River basin are inadequate to supply most users. Consequently, reservoir storage is required to provide dependable water supplies. Before a reservoir is constructed, data are needed to reflect the quality of water that will be impounded. Discharge-weighted averages are more useful for this purpose than simple arithmetic means. Discharge-weighted averages for a specified time period are computed by multiplying daily discharges by daily concentrations and dividing the sum of these products by the total discharge for the time period. Discharge-weighted averages for a specified time period then approximate the chemical character of the water if all the water passing a site during the time period were impounded and mixed in a reservoir with no adjustment for evaporation or chemical change that might occur during storage.

Discharge-weighted average concentrations of dissolved solids for selected daily, continuous, and periodic water-quality stations were computed from the daily or continuous records of specific conductance and streamflow or from the relation between dissolved solids and streamflow. Statistical summaries of these data are shown in table 8. A comparison of data in tables 8 and 20 shows that the discharge-weighted average concentrations of dissolved solids for most streams are significantly smaller than simple arithmetic mean concentrations. This relation is typical for most streams whose small flows are significantly more mineralized than large flows.

The discharge-weighted average concentrations of dissolved solids during the 1973-82 water years ranged from 165 mg/L in the Elm Fork Trinity River near Lewisville (08053000) to 416 mg/L in Mountain Creek near Cedar Hill (08049600). The discharge-weighted average concentrations of dissolved solids in the effluent-dominated reach of the West Fork Trinity River and mainstem Trinity River ranged from 201 mg/L in the West Fork Trinity River at Beach Street, Fort Worth (08048543) to 285 mg/L in the West Fork Trinity River at Grand Prairie (08049500). Farther downstream in the Trinity River at Trinidad, the discharge-weighted average concentration of dissolved solids was 230 mg/L.

The U.S. Environmental Protection Agency has established maximum and secondary maximum contaminant levels for selected major inorganic constituents in public water systems. (See table 7 and the section "Water-Quality Standards.") According to these regulations, the secondary maximum contaminant levels for dissolved solids, chloride, and sulfate are 500 mg/L, 250 mg/L, and 250 mg/L, respectively. At least one sample from each of nine stations in the upper Trinity River basin exceeded the secondary maximum contaminant level for dissolved solids (fig. 9). The maximum monthly discharge-weighted average concentration of dissolved solids for five stations exceeded 500 mg/L (table 8). However, the discharge-weighted average concentration for only one station, Mountain Creek near Cedar Hill (08049600), exceeded 500 mg/L during more than 25 percent of the months from October 1972 to September 1982.

Sulfate is the predominant anion in Mountain Creek. The concentration of dissolved sulfate in about 70 percent of the samples from Mountain Creek near Cedar Hill (08049600) exceeded 250 mg/L (table 20).

<u>Loads and yields</u>

The load of a dissolved or suspended constituent transported by a stream is the total mass of the constituent transported during a specified period and is computed by the following equation:

$$L = 0.0027\ QCT \qquad (1)$$

where L = load, in tons;
Q = discharge, in cubic feet per second;
C = concentration, in milligrams per liter;
T = number of days; and
0.0027 = factor for converting the product of the concentration and discharge to tons per day.

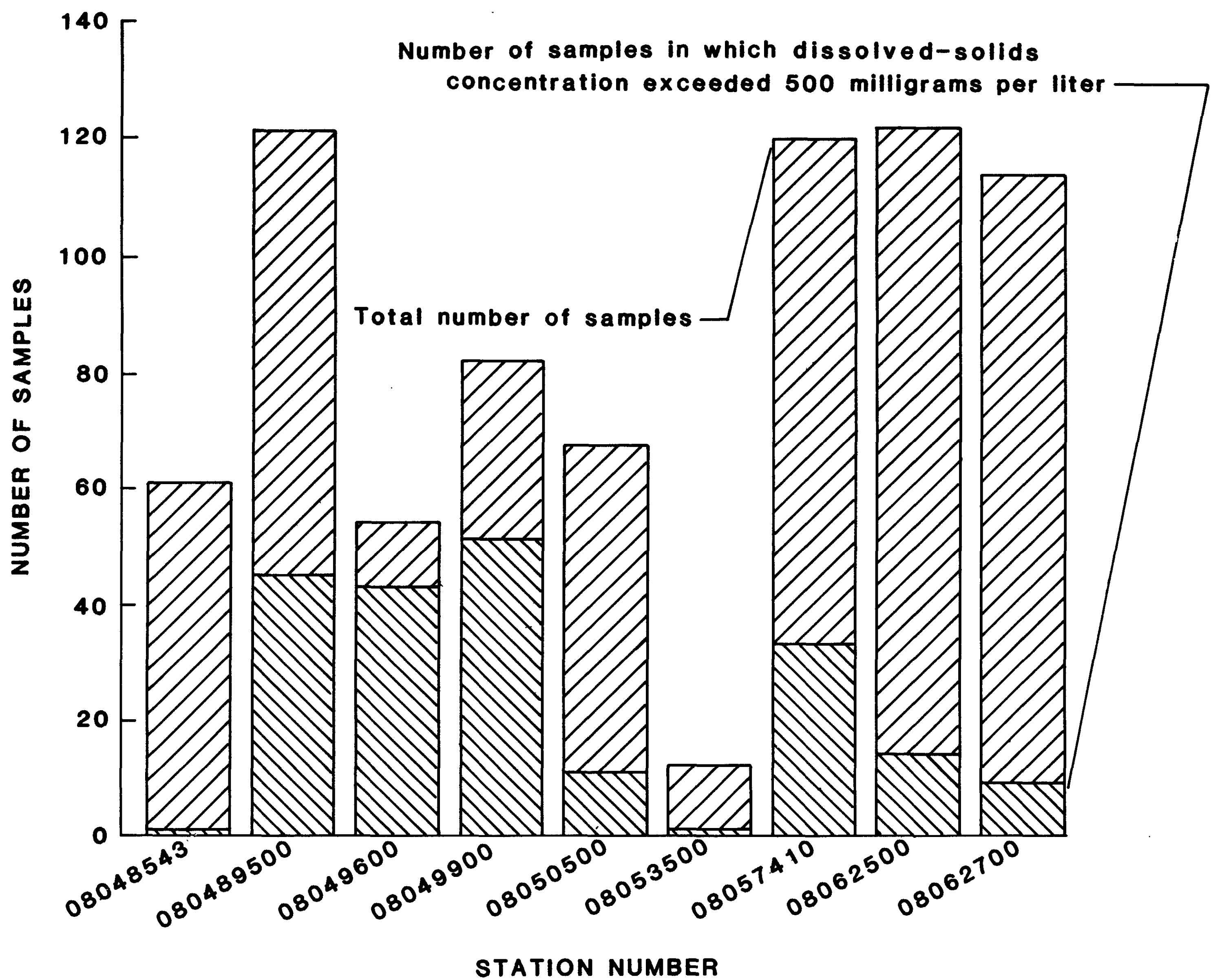

Figure 9.-Water-quality stations at which water samples have contained dissolved-solids concentrations in excess of 500 milligrams per liter

Table 8.--Statistical summary of discharge-weighted average dissolved-solids concentrations at selected sites on streams, 1973-82 water years

(Concentration units are milligrams per liter)

Station number	Station name	Sample size	Maximum monthly discharge-weighted average	Minimum monthly discharge-weighted average	Percent of time monthly discharge-weighted average concentrations were equal to or less than values indicated					Discharge-weighted average concentration, water years 1973-82
					95	75	50	25	5	
08048543	West Fork Trinity River at Beach Street	120	419	149	389	301	263	228	181	201
08049500	West Fork Trinity River at Grand Prairie	120	629	175	594	488	386	303	228	285
08049600	Mountain Creek near Cedar Hill 1/	96	1020	353	812	585	508	439	384	416
08050500	Elm Fork Trinity River near Sanger	120	620	207	470	407	339	288	252	259
08053000	Elm Fork Trinity River near Lewisville	120	233	128	211	208	201	173	155	165
08057410	Trinity River below Dallas	120	549	169	532	450	366	284	169	273
08062000	East Fork Trinity River near Crandall	120	380	136	354	301	249	188	165	182
08062500	Trinity River near Rosser	120	514	169	498	421	328	251	191	248
08062700	Trinity River near Trinidad	120	487	173	460	387	300	239	181	230

1/ Statistics do not include values for those months when stream had no flow.

Dissolved-solids loads transported by a stream are cumulative; consequently, loads transported during a specified period generally increase in a downstream direction except where water is delayed significantly by reservoir storage or diverted from the stream. Loads and yields (loads per unit area per unit time) for intervening areas between two stations on a stream may be computed by the following equations:

$$L_{ida} = L_{ds} - L_{us} \qquad (2)$$

and

$$Y_{ida} = L_{ida} \div A \div T \qquad (3)$$

where L_{ida} = load, in tons, from intervening drainage area;
L_{ds} = load, in tons, at downstream station;
L_{us} = load, in tons, at upstream station;
Y_{ida} = yield from intervening drainage area, in tons per square mile per day;
A = area, in square miles, of intervening drainage area; and
T = number of days.

Cumulative loads and yields of dissolved solids for selected drainage areas in the upper Trinity River basin are summarized in table 9. Variations in monthly dissolved-solids loads transported by the West Fork Trinity River at Beach Street, Fort Worth (08048543) and Trinity River at Trinidad (08062700) during the 1973-82 water years are shown in figure 10. Neither the loads nor the yields have been adjusted for reservoir storage or diversion. Nevertheless, the data are useful for delineating areas that are major contributors of dissolved solids. Because loads are cumulative and are directly related to discharge, the largest loads were in the Trinity River at Trinidad (08062700). Daily dissolved-solids loads increased from 225 tons in the West Fork Trinity River at Beach Street, Fort Worth (08048543) to 2,410 tons in the Trinity River at Trinidad (08062700). The dissolved-solids yield from the drainage area in this reach averaged 0.31 ton/mi^2/d (ton per square mile per day). Yields by intervening areas in this reach of the main stem (as computed by equation 3) ranged from 0.23 to 0.68 ton/mi^2/d. The largest yield was from the drainage area between the stations West Fork Trinity River at Beach Street, Fort Worth (08048543) and West Fork Trinity River at Grand Prairie (08049500). Mean discharge in this subreach of the West Fork Trinity River increased from 417 to 689 ft^3/s; and the average daily load of dissolved solids increased from 268 tons to 530 tons (table 9).

The second largest dissolved-solids yield in the reach of the main stem between Fort Worth and Trinidad was 0.35 ton/mi^2/d from the intervening drainage area between the West Fork Trinity River at Grand Prairie (08049500) and Trinity River below Dallas (08057410). Mean discharge in this subreach increased from 689 to 2,250 ft^3/s; and the average load of dissolved solids increased from 530 to 1,660 tons. Both of these subreaches in the Dallas-Fort Worth area are within the effluent-dominated reach of the Trinity River. Consequently, the inflow of waste effluents probably is responsible for a large part of the increase in yield from these drainage areas. The West Fork Trinity River at Beach Street, Fort Worth (08048543) is upstream from most of the major municipal and industrial waste-treatment plants (fig. 5), but downstream from Bridgeport and Eagle Mountain Reservoirs and Lake Worth (fig. 1). The yield

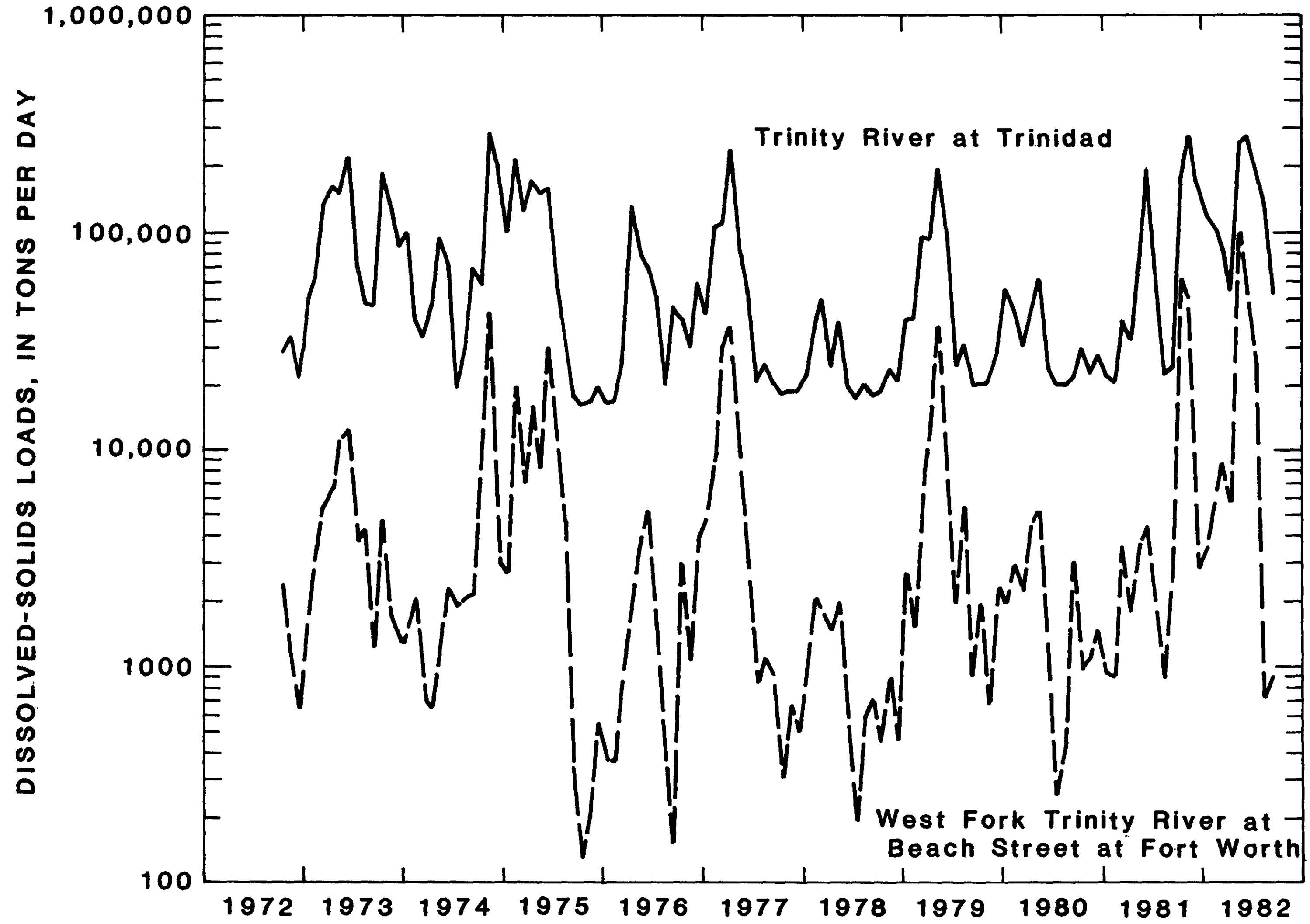

Figure 10.-Variations in monthly dissolved-solids loads, West Fork Trinity River at Beach Street, Forth Worth, and Trinity River at Trinidad

Table 9.--Statistical summary of dissolved-solids loads and yields at selected sites on streams, 1973-82 water years

[mi^2, square miles; ft^3/s, cubic feet per second; $ton/mi^2/d$, tons per square mile per day]

ation nber	Station name	Drain-age area (mi^2)	Mean dis-charge (ft^3/s)	Daily mean load (tons)	Yield (ton/ mi^2/d)	Maximum monthly load (tons)	Minimum monthly load (tons)	Percent of time monthly loads were equal to or less than values indicated				
								95	85	50	25	5
48543	West Fork Trinity River at Beach Street, Fort Worth	2,615	1/ 417	268	0.10	107,000	195	43,100	5,400	2,320	982	443
49500	West Fork Trinity River at Grand Prairie	3,065	689	530	.17	138,000	4,780	62,600	15,600	10,200	7,270	5,680
49600	Mountain Creek near Cedar Hill	119	463	52	.44	12,100	0	9,010	1,790	312	2.4	0
50500	Elm Fork Trinity River near Sanger	381	209	146	.38	101,000	.7	17,900	5,540	1,310	312	501
53000	Elm Fork Trinity River near Lewisville	1,673	798	355	.21	72,000	873	49,600	11,500	3,910	2,660	1,590
57410	Trinity River below Dallas	6,278	2,250	1,660	.26	247,000	16,700	160,000	56,400	30,300	22,000	17,500
62000	East Fork Trinity River near Crandall	1,256	663	326	.26	72,000	784	37,400	14,300	2,900	1,490	784
62500	Trinity River near Rosser	8,147	3,116	2,090	.26	293,000	15,200	207,000	79,300	37,900	24,000	19,000
62700	Trinity River at Trinidad	9,550	3,886	2,410	.25	297,000	16,200	227,000	99,500	44,800	22,400	18,000

Station was installed in October 1976. Records for West Fork Trinity River at Fort Worth (08048000) were used for water years 1973-76.

of dissolved solids from the area upstream from Fort Worth was 0.10 ton/mi^2/d. Although influenced by reservoir storage, the yield from this drainage area indicates that dissolved-solids yields from areas not significantly affected by waste effluents in the upper Trinity River basin generally are small.

Data for Mountain Creek and the Elm and East Forks Trinity River indicate that yields from drainage areas of tributaries generally are significantly larger than yields from the drainage area of the West Fork Trinity River upstream from Fort Worth but significantly smaller than yields from the effluent-dominated reach between Fort Worth and Grand Prairie. The minimum dissolved-solids yield from these areas was 0.16 ton/mi^2/d for the intervening drainage area of the Elm Fork Trinity River between the stations near Sanger (08050500) and near Lewisville (08053000). The yield from the drainage area upstream from the station near Sanger (08050500) was 0.38 ton/mi^2/d. Most of the major waste-treatment plants in the drainage area of the Elm Fork Trinity River are upstream from the station near Sanger (fig. 5). Although reservoir storage by Lewisville Lake in the intervening area downstream from Sanger may be responsible for part of the difference in yields from the two areas, the inflow of waste effluents in the reach upstream from Sanger probably was responsible for part of the difference.

Dissolved Oxygen and Biochemical Oxygen Demand

Dissolved oxygen is of primary importance in aquatic ecosystems because fish and other aquatic life require adequate levels of dissolved oxygen for egg and larvae development and normal growth and activity. Although no specific dissolved-oxygen concentration is favorable for all aquatic species and ecosystems, small dissolved-oxygen concentrations are unfavorable to almost all aquatic organisms. The minimum dissolved-oxygen level set for most streams in the State is 5.0 mg/L (Texas Water Quality Board, 1973). However, this standard does not apply to a few of the effluent-dominated reaches of streams in the upper Trinity River basin.

Biodegradation of organic wastes in a stream removes oxygen. The quantity of biodegradable oxygen-consuming wastes typically is determined by the standard 5-day BOD analysis, which measures the amount of oxygen consumed biochemically during a 5-day period at an incubation temperature of 20°C.

The primary process by which a stream replaces oxygen consumed in the biodegradation of organic waste is atmospheric aeration, the physical adsorption of oxygen from the atmosphere. Photosynthetic activity by aquatic plants also may provide large amounts of oxygen to lakes or streams. Langbein and Durum (1967) have shown that aeration of a stream usually increases in response to increases in velocity but decreases with increasing depth. McCutcheon and others (written communication, 1983) found that the reaeration coefficients in a 13.5-mi reach of the West Fork Trinity River downstream from the Beach Street gage in Fort Worth (08048543) was near zero in pools but increased significantly in riffle-dominated areas. They also found that photosynthetic activity plays an important role in oxygen production in some areas of the 13.5-mi reach.

Results of periodic measurements of dissolved oxygen and BOD at selected sites (fig. 11 and table 20) indicate that the discharge of municipal waste

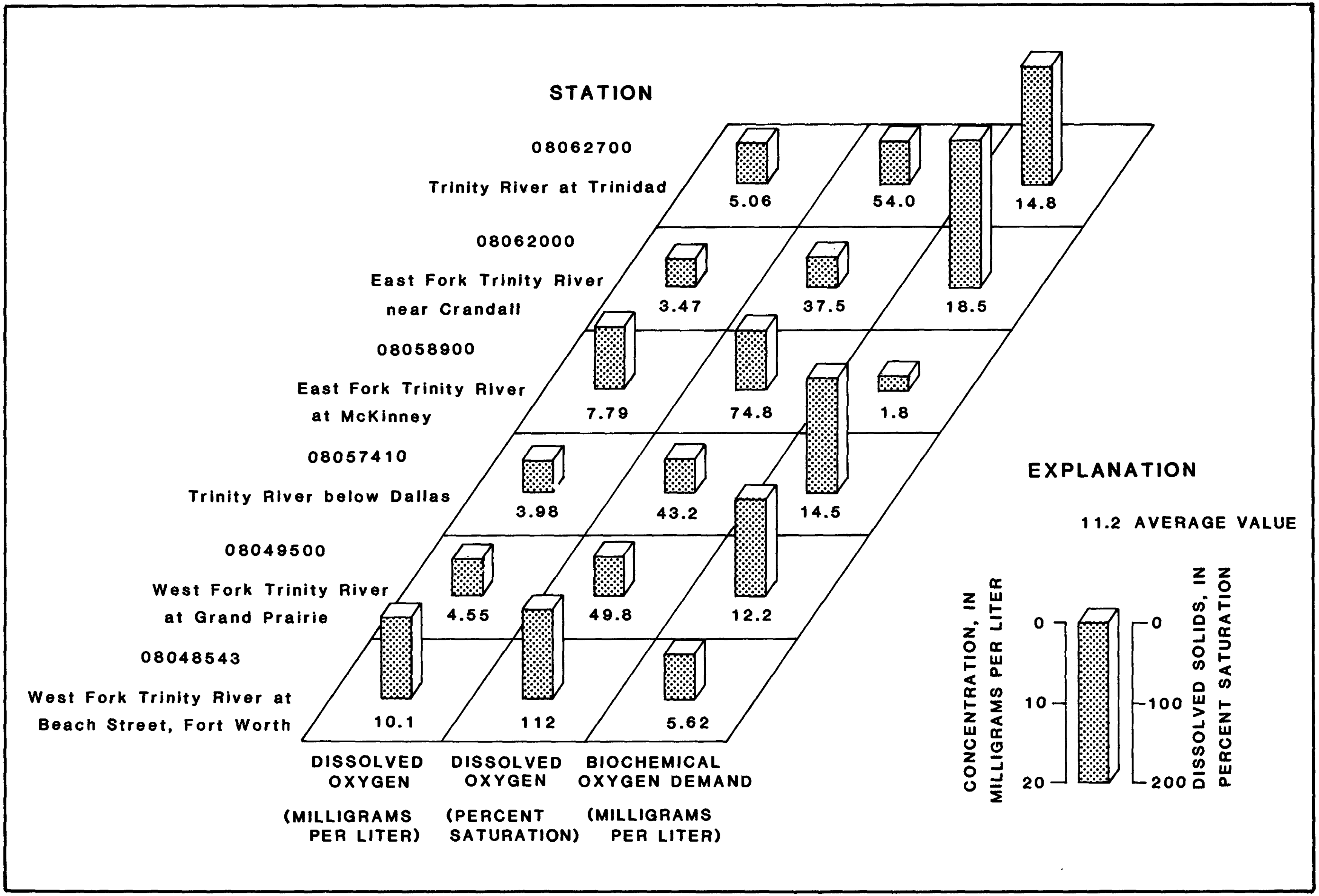

Figure 11.–Variations in average dissolved–oxygen concentrations, dissolved–oxygen percent–saturation values, and bicohemical oxygen demand concentrations at selected sites on streams

effluents is the principal factor responsible for the areal variations of dissolved-oxygen and BOD concentrations and dissolved-oxygen percent-saturation values in streams of the upper Trinity River basin. Upstream from the major sources of municipal waste effluents in the Dallas-Fort Worth metroplex, average dissolved-oxygen concentrations in streams generally exceeded 7.0 mg/L, average dissolved-oxygen percent-saturation values generally were greater than 70 percent, and average BOD concentrations generally were less than 4.0 mg/L. In the effluent-dominated reaches of of the West Fork Trinity River and Trinity River downstream from Fort Worth and the East Fork Trinity River near Crandall (08062000), average dissolved-oxygen concentrations generally were less than 5.0 mg/L, average dissolved-oxygen percent-saturation values generally were less than 50 percent, and average BOD concentrations generally were greater than 12.0 mg/L.

Continuous four-parameter water-quality monitors were installed at four sites on streams in the study area in late 1976 and 1977 to determine the impacts of municipal waste effluents on water quality, particularly with respect to dissolved oxygen. The monitor, located on the West Fork Trinity River at Beach Street, Fort Worth (08048543), is upstream from the major municipal waste-treatment plants and most industrial waste-treatment plants, but downstream from much of the city of Fort Worth and surrounding communities. The water-quality monitors on the West Fork Trinity River at Grand Prairie (08049500), Trinity River below Dallas (08057410), and Trinity River near Rosser (08062500) are located in effluent-dominated reaches near the Dallas-Fort Worth metroplex. Records published by the North Central Texas Council of Governments (Champagne and Promise, 1983) indicate that between May 1977 and April 1982 an average of 11.9 ton/d of BOD were discharged into the West Fork Trinity River between the gages at Beach Street at Fort Worth and at Grand Prairie, an average of 14.5 tons/d were discharged into the West Fork Trinity River and Trinity River between the Grand Prairie gage and the gage below Dallas, and an average of 7.2 tons/d were discharged into the Trinity River downstream from the gage below Dallas and in the East Fork Trinity River downstream from Lake Ray Hubbard.

Records of dissolved oxygen for the continuous monitors are summarized in table 10. These records show that the large BOD loads resulted in a significant decrease in daily mean dissolved-oxygen concentrations in the effluent-dominated reaches of the West Fork Trinity River and Trinity River downstream from the Beach Street gage at Fort Worth. Between the Beach Street gage at Fort Worth and the gage at Grand Prairie, the daily mean dissolved-oxygen concentration decreased from 8.8 to 4.1 mg/L. Little recovery occurred downstream from Grand Prairie. Daily mean dissolved-oxygen concentrations in the Trinity River below Dallas and Trinity River at Rosser were 4.5 and 4.4 mg/L, respectively.

Photosynthesis by aquatic plants has a significant influence on the concentrations of dissolved oxygen in some areas of the basin, particularly in the reservoirs upstream from the Dallas-Fort Worth metroplex and in the West Fork Trinity River at Beach Street, Fort Worth. Atmospheric aeration generally cannot produce dissolved-oxygen concentrations that exceed 100-percent saturation. Dissolved-oxygen concentrations that exceed 100-percent saturation are indicative of photosynthetic production of oxygen. During summer or other warm-weather periods, photosynthesis by phytoplankton and other aquatic plants often produces dissolved-oxygen concentrations that exceed 100-percent saturation in

Table 10.--Statistical summary of daily-mean dissolved-oxygen concentrations at selected sites on streams, 1978-82 water years

[Concentration units are milligrams per liter]

Station number	Station name	Maximum	Minimum	Mean	Standard deviations	Percent of time daily-mean dissolved-oxygen concentrations exceeded values indicated				
						95	75	50	25	5
08048543	West Fork Trinity River at Beach Street, Fort Worth	16.0	0.8	8.8	2.04	12.2	10.2	8.6	7.5	5.6
08049500	West Fork Trinity River at Grand Prairie	13.3	.0	4.1	2.34	8.7	5.7	3.7	2.4	0.8
08057410	Trinity River below Dallas	11.8	.0	4.5	2.16	8.6	5.8	4.3	2.9	1.4
08062500	Trinity River near Rosser	12.9	.1	4.4	2.14	9.0	5.4	4.3	2.9	1.7

the upper 10 to 20 ft of the reservoirs in the study area. Photosynthesis by periphyton and other aquatic plants in the West Fork Trinity River in the Fort Worth area often produces dissolved-oxygen concentrations that exceed 100-percent saturation. Results of periodic measurements in the West Fork Trinity River at Fort Worth (08048000) and West Fork Trinity River at Beach Street, Fort Worth (08048543) show that dissolved-oxygen concentrations during approximately 30 and 50 percent of the measurements exceeded 100-percent saturation. Hourly dissolved-oxygen records from the four-parameter water-quality monitor at West Fork Trinity River at Beach Street, Fort Worth, show that large diurnal variations of dissolved oxygen occurred frequently especially during the warm summer periods of prolonged sunlight (fig. 12). The minimum concentrations usually occurred about 8:00 a.m. after periods of darkness and respiration by aquatic plants. The maximum concentrations usually occurred between 3:00 and 5:00 p.m. after periods of photosynthesis by aquatic plants. Less pronounced diurnal fluctuations also occurred in the West Fork Trinity River at Grand Prairie. Diurnal variations in the Trinity River below Dallas and Trinity River near Rosser generally were less than 3.0 mg/L.

Total Nitrogen and Total Phosphorus

Concentrations

Potential sources of nitrogen and (or) phosphorus in an aqueous environment include municipal and industrial waste effluents, drainage from agricultural and urban areas, decomposition of plant and animal debris, suspended and bottom sediments, natural weathering of rocks and soils, and precipitation. Available data indicate that the principal sources of these macronutrients in most streams in the upper Trinity River basin are waste effluents. Nitrogen in surface waters may exist in several forms or oxidation states, the composition and quantities of which generally are controlled by biochemical decomposition of organic nitrogen to more highly oxidized forms. Bacterial decomposition of organic nitrogen produces ammonia nitrogen, and nitrification of ammonia by nitrifying bacteria produces nitrite and nitrate nitrogen. Nitrate nitrogen generally is the most prevalent form of inorganic nitrogen in unpolluted waters. Concentrations of ammonia nitrogen and nitrite nitrogen generally do not exceed 1.0 mg/L in unpolluted flowing waters (National Academy of Sciences, National Academy of Engineering, 1973). Nitrogen and phosphorus in water may be present in both the dissolved and suspended phases. In the following discussion, the term "total" is used to indicate the total quantity of dissolved and suspended nitrogen or phosphorus.

Concentrations of total nitrogen and total phosphorus in streams varied widely throughout the upper Trinity River basin (fig. 13 and table 20). The smallest concentrations of these nutrients occurred in headwater streams upstream from the Dallas-Fort Worth metroplex. In most of these streams, average concentrations of total nitrogen were less than 2.0 mg/L and average concentrations of total phosphorus were less than 0.20 mg/L. A notable exception to this areal pattern was the Elm Fork Trinity River near Sanger (08050500) where the average total-nitrogen concentration was 2.36 mg/L, and the average total-phosphorus concentration was 0.80 mg/L. Total-nitrogen concentrations at this site increased in response to increases in streamflow; whereas, total-phosphorus concentrations generally decreased as streamflow increased. This relation indi-

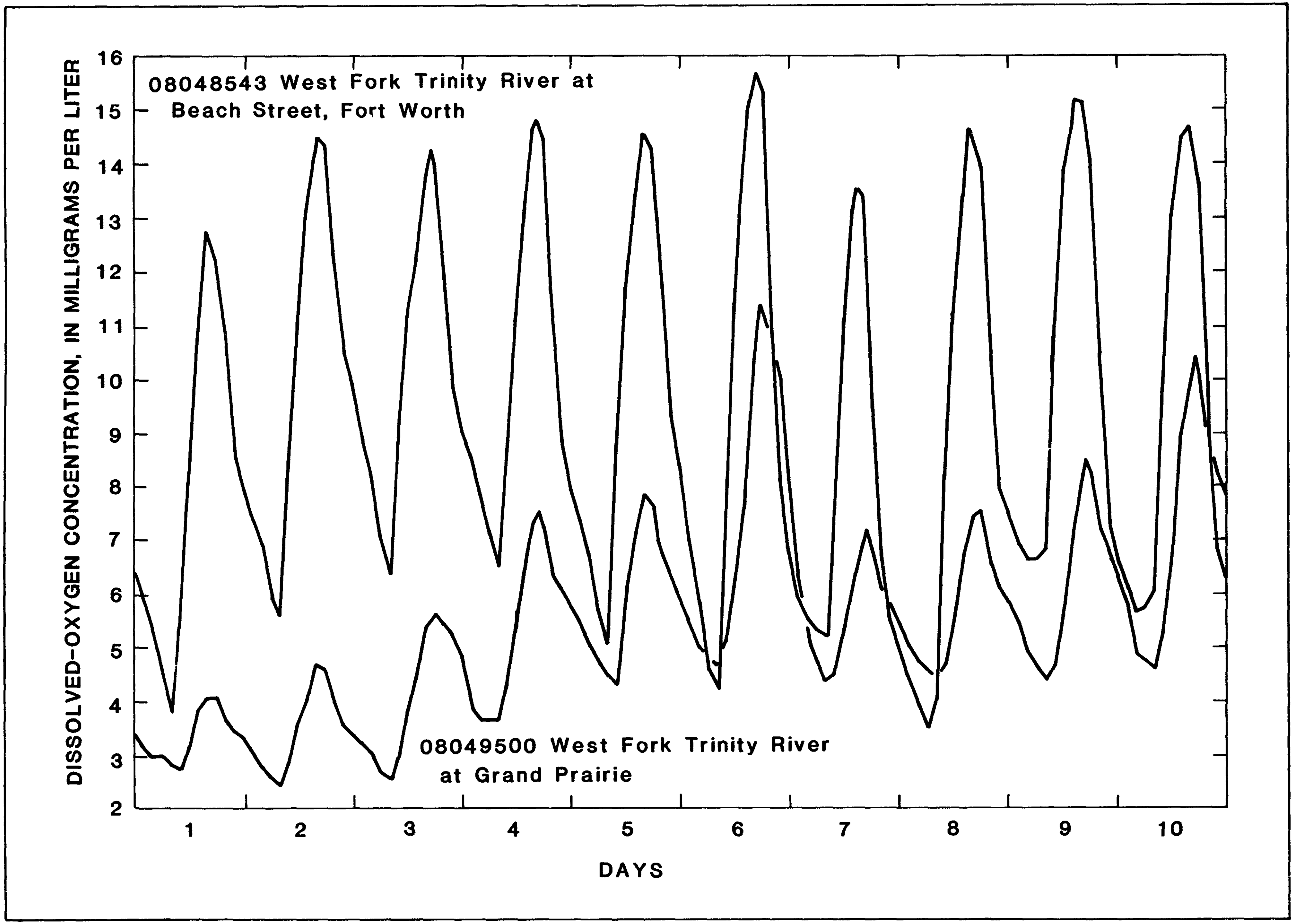

Figure 12.–Diurnal variations in dissolved–oxygen concentrations, West Fork Trinity River at Beach Street, Fort Worth, and West Fork Trinity River at Grand Prairie, August 1–10, 1981

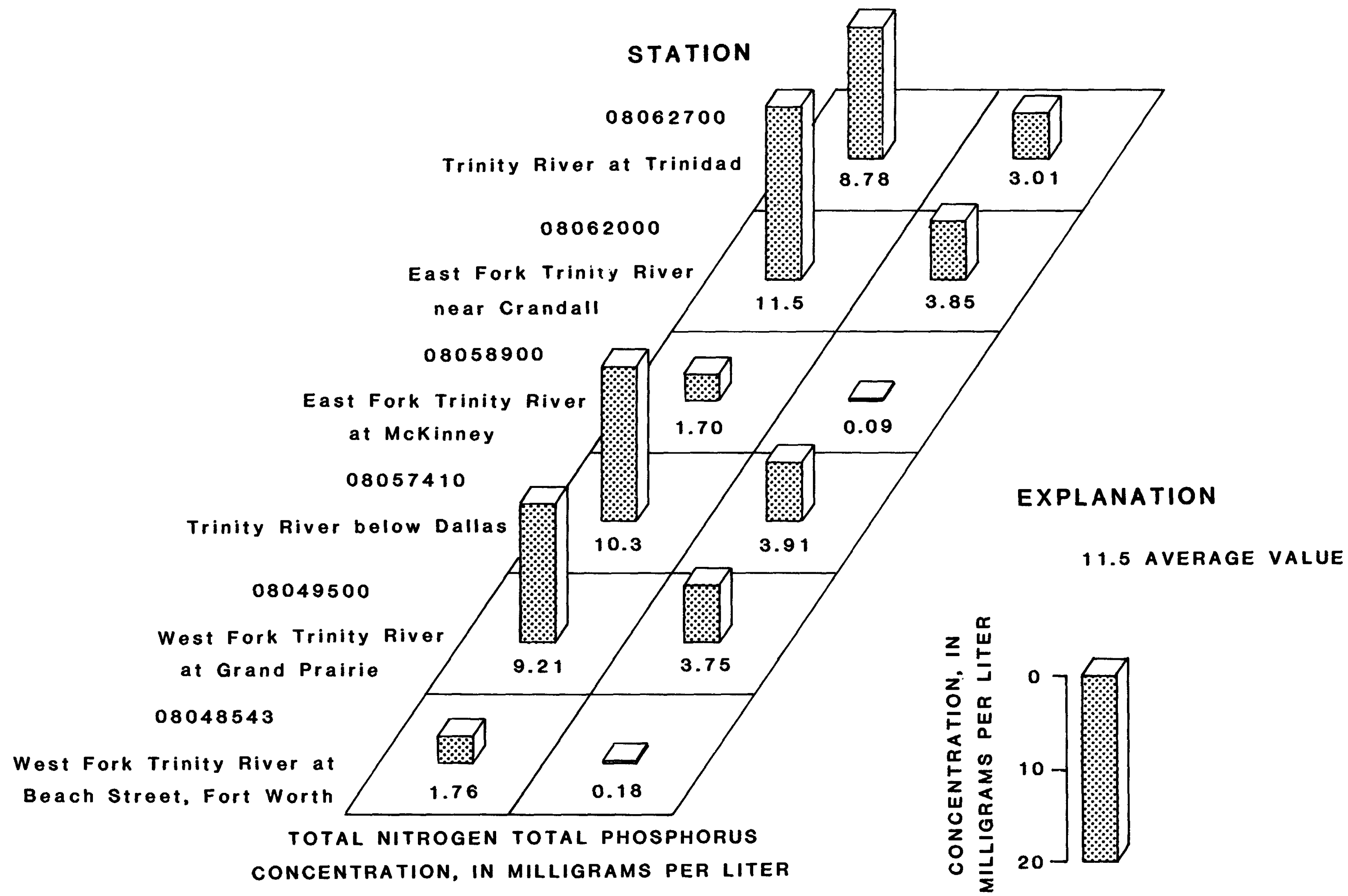

Figure 13.–Variations in average total-nitrogen and average total-phosphorus concentrations at selected sites on streams

cates that the atypical nutrient concentrations probably resulted from both agricultural runoff and inflow of waste effluents.

Total-organic nitrogen was the dominant nitrogen species in most headwater streams upstream from the Dallas-Fort Worth metroplex. Average concentrations of total-organic nitrogen in most of these streams were less than 1.0 mg/L. Total-nitrate nitrogen, the second most dominant species in these streams, averaged less than 0.6 mg/L. A notable exception to this areal pattern was the Elm Fork Trinity River near Sanger (08050500) where concentrations of nitrate nitrogen, the dominant species, averaged 1.21 mg/L.

Total-nitrogen and total-phosphorus concentrations were significantly larger downstream from the waste-treatment plants in the Dallas-Fort Worth metroplex. In reaches of the West Fork Trinity River downstream from Fort Worth and the Trinity River in the Dallas area, average concentrations of total nitrogen increased from 1.76 mg/L in the West Fork Trinity River at Beach Street, Fort Worth (08048543) to 9.21 mg/L at the Grand Prairie gage and to 10.3 mg/L in the Trinity River below Dallas (08057410). Average total-phosphorus concentrations in this reach increased from 0.18 mg/L at West Fork Trinity River at Beach Street to 3.75 mg/L at Grand Prairie and to 3.91 mg/L at Trinity River below Dallas.

Average concentrations of total nitrogen and total phosphorus in the East Fork Trinity River also increased significantly downstream from waste-treatment plants. Average total-nitrogen concentrations increased from 1.90 mg/L in East Fork Trinity River at McKinney (08058900) to 11.5 mg/L in the East Fork Trinity River near Crandall (08062000). Total-phosphorus concentrations in this reach increased from 0.09 mg/L at East Fork Trinity at McKinney to 3.85 mg/L near East Fork Trinity River near Crandall.

Total-ammonia nitrogen was the dominant nitrogen species in most streams at sites downstream from waste-treatment plants; organic nitrogen was the second most dominant species (fig. 14). In reaches of the West Fork Trinity River downstream from Fort Worth and the Trinity River in the Dallas area, average concentrations of total-ammonia nitrogen increased from 0.28 mg/L in the West Fork Trinity River at Beach Street, Fort Worth (08048543) to 5.70 mg/L in the Trinity River below Dallas (08057410). Average concentrations of total-organic nitrogen in this reach increased from 1.05 to 2.55 mg/L. The maximum average total ammonia-nitrogen and total organic-nitrogen concentrations in the study area were 6.75 and and 3.21 mg/L on the East Fork Trinity River near Crandall (08062000). Total ammonia-nitrogen concentrations at this site, which is downstream from major waste-treatment plants, ranged from 0.00 to 24.0 mg/L and exceeded 6.0 mg/L in about 50 percent of the samples analyzed.

Discharge-weighted average concentrations of total nitrogen and total phosphorus were computed for seven sites on streams where significant relations existed between concentrations and streamflow. These data, which are summarized in table 11, show that discharge-weighted average concentrations of both nutrients in the effluent-dominated reaches of the West Fork Trinity, the Trinity River, and the East Fork Trinity River were significantly smaller than corresponding simple average concentrations. For example, the discharge-weighted average concentrations of total-nitrogen and total-phosphorus concen-

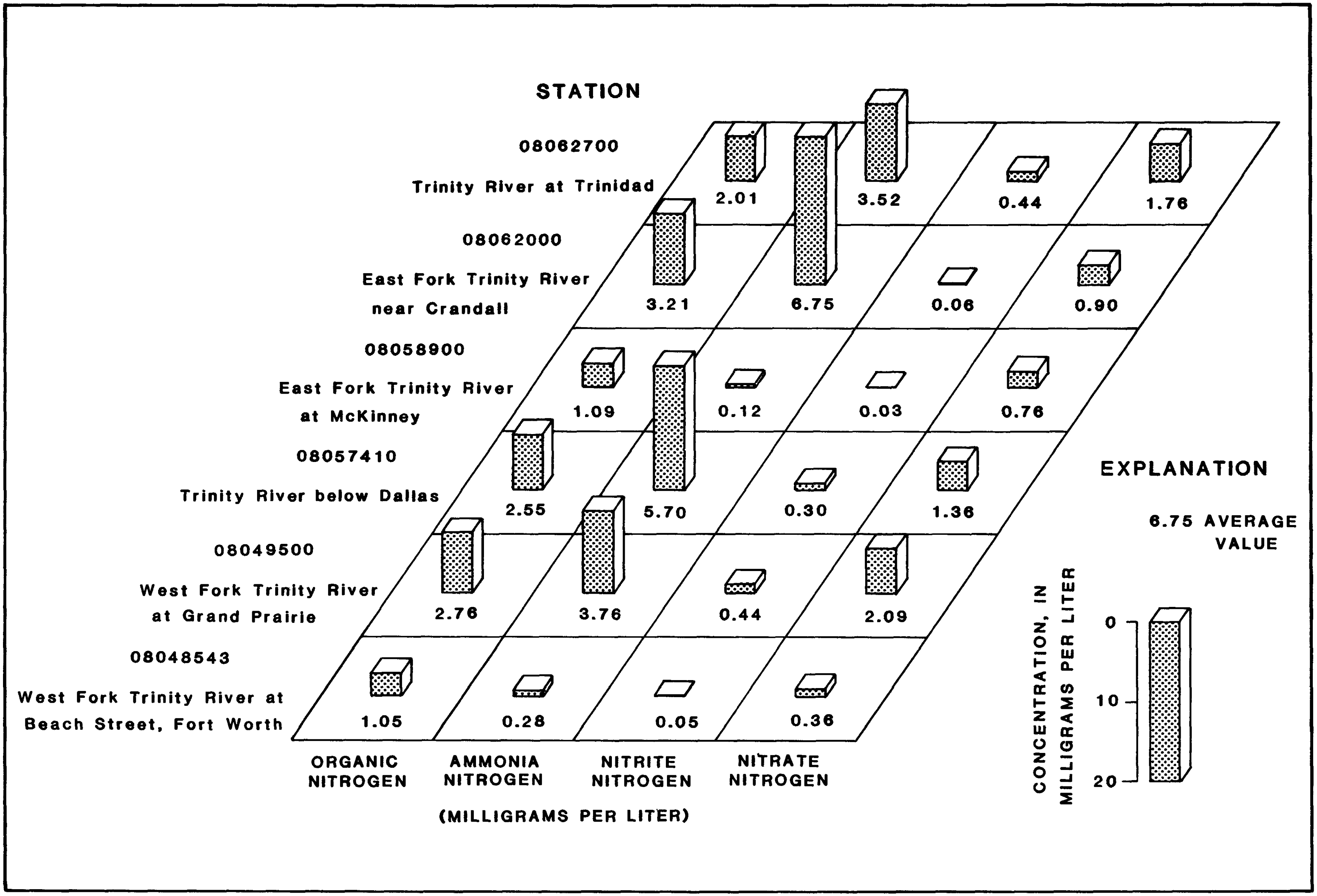

Figure 14.–Variations in average concentrations of total–organic nitrogen, total–ammonia nitrogen, total–nitrite nitrogen, and total–nitrate nitrogen at selected sites on streams

Table 11.--Statistical summary of discharge-weighted average concentrations of total nitrogen and total phosphorus at selected sites on streams, 1973-82 water years

Concentrations of total nitrogen, in milligrams per liter

Station number	Station name	Sample size	Maximum	Minimum	Percent of time monthly discharge-weighted average concentrations were equal to or less than value indicated					Discharge-weighted average concentration, water years 1973-81
					95	75	50	25	5	
08049500	West Fork Trinity River at Grand Prairie	120	11.9	0.88	11.2	9.1	6.1	4.1	1.6	3.3
08049600	Mountain Creek near Cedar Hill 1/	96	3.4	.73	3.0	2.5	2.0	1.7	1.0	2.8
08050500	Elm Fork Trinity River near Sanger	120	4.6	1.3	3.6	3.2	2.6	2.1	1.8	3.7
08057410	Trinity River below Dallas	120	14.8	1.3	13.4	11.0	7.5	4.1	1.9	3.9
08062000	East Fork Trinity River near Crandall	120	22.1	.44	15.8	12.7	6.5	1.7	.82	1.7
08062500	Trinity River near Rosser	120	15.8	1.5	14.1	11.0	7.1	3.8	1.90	3.7
08062700	Trinity River at Trinidad	120	12.9	1.8	12.0	9.9	5.6	3.4	2.0	3.5

Concentrations of total phosphorus, in milligrams per liter

Station number	Station name	Sample size	Maximum	Minimum	Percent of time monthly discharge-weighted average concentrations were equal to or less than value indicated					Discharge-weighted average concentration, water years 1973-81
					95	75	50	25	5	
08049500	West Fork Trinity River at Grand Prairie	120	5.1	0.19	4.6	3.6	2.2	1.4	0.19	1.1
08049600	Mountain Creek near Cedar Hill 1/	96	0.22	.04	0.19	.16	.12	.10	.06	.16
08050500	Elm Fork Trinity River near Sanger	120	3.3	.04	1.1	.58	.27	.14	.08	.11
08057410	Trinity River below Dallas	120	5.2	.35	4.6	3.7	2.5	1.3	.53	1.2
08062000	East Fork Trinity River near Crandall	120	7.7	.11	5.4	4.2	2.1	.46	.21	.51
08062500	Trinity River near Rosser	120	5.9	.31	5.2	3.8	2.2	1.0	.42	1.0
08062700	Trinity River at Trinidad	120	5.2	.25	4.7	3.6	1.6	.74	.29	.83

1/ Statistics do not include values for those months when stream had no flow.

trations in the West Fork Trinity River at Grand Prairie were less than 6.1 and 2.2 mg/L during 50 percent of the months from October 1972 to September 1982. The average concentrations of total nitrogen and total phosphorus in samples collected from this site (table 20) were about 9.2 and 3.8 mg/L. This pattern is typical of effluent-dominated streams in which concentrations decrease with increase in streamflow, but is atypical for streams where nitrogen and phosphorus are associated with suspended sediments. For example, the concentrations of total nitrogen in the Elm Fork Trinity River near Sanger (08050500) increased in response to increase in discharge. The average concentration of total nitrogen in samples collected from this site (table 20) were 2.4 mg/L, whereas the discharge-weighted average concentration was equal to or less than 2.6 mg/L during 50 percent of the months from October 1972 to September 1982. This relation indicates that a large part of the nitrogen in the Elm Fork Trinity River resulted from fertilizers or organic debris associated with sediments in agricultural runoff.

The maximum contaminant level of nitrate nitrogen in public water systems set by EPA is 10 mg/L. Available data indicate that concentrations of total nitrate nitrogen in water-supply reservoirs in the upper Trinity River basin are smaller than this limit. However, at least one sample collected from the Trinity River below Dallas (08057410), East Fork Trinity River near Crandall (08062000), and Trinity River near Rosser (08062500) contained more than 10 mg/L (table 20).

<u>Loads and yields</u>

Loads and yields of total nitrogen and total phosphorus were computed for seven sites on streams where significant relations exist between concentrations and streamflow. These data are summarized in table 12. For other stations on streams where no significant relations exist between concentrations and streamflow, the average concentrations were used to estimate loads and yields. These estimated data are not shown in table 12 but were used as bases for comparison of loads and yields from selected drainage areas and for delineating areas that are major contributors of total nitrogen and total phosphorus.

Because loads are cumulative and are directly related to streamflow, loads increased greatly in the reach between Fort Worth and Trinidad. The daily loads of total nitrogen increased from 1.98 tons at the West Fork Trinity River at Beach Street, Fort Worth (08048543) to 36.3 tons at the Trinity River at Trinidad (08062700); the daily loads of total phosphorus increased from 0.20 to 8.76 tons. The estimated total nitrogen and total phosphorus yields by the total drainage area upstream from Fort Worth were 1.51 and 0.15 $lb/mi^2/d$ (pounds per square mile per day). The yields of both nutrients increased greatly between Fort Worth and Dallas but decreased significantly between Dallas and Trinidad. The yields of total nitrogen and total phosphorus averaged 11.6 and 3.93 $lb/mi^2/d$ between Fort Worth and Dallas and 7.76 and 0.81 $lb/mi^2/d$ between Dallas and Trinidad. Yields from several of the drainage areas of tributaries downstream from Fort Worth also were large. Yields of total nitrogen and total phosphorus from the drainage area of the East Fork Trinity River near Crandall (08062000) averaged 4.94 and 1.44 $lb/mi^2/d$. Most of the reaches of the West Fork Trinity River and Trinity River between Fort Worth and Trinidad and part of the East Fork Trinity River have been designated as effluent-

Table 12.--Statistical summary of total-nitrogen and total-phosphorus loads and yields at selected sites on streams, 1973-82 water years

[lb/mi^2/d, pounds per square mile per day]

Station number	Station name	Annual-mean total-nitrogen load (tons)	Daily-mean total-nitrogen load (tons)	Total-nitrogen yield (lb/mi^2/d)	Annual-mean total-phosphorus load (tons)	Daily-mean total-phosphorus load (tons)	Total-phosphorus yield (lb/mi^2/d)
08049500	West Fork Trinity River at Grand Prairie	2,230	6.11	3.99	744	2.04	1.33
08049600	Mountain Creek near Cedar Hill	126	.35	5.88	7.9	.02	.34
08050500	Elm Fork Trinity River near Sanger	756	2.06	10.8	21.9	.06	.31
08057410	Trinity River below Dallas	8,630	23.6	7.51	2,720	7.44	2.37
08062000	East Fork Trinity River near Crandall	1,130	3.10	4.94	332	.91	1.44
08062500	Trinity River near Rosser	11,400	31.1	7.63	3,200	8.76	2.15
08062700	Trinity River at Trinidad	13,200	36.3	7.60	3,210	8.76	1.83

dominated reaches; consequently, most of the large yields of both nutrients from these reaches are attributed to the inflow of waste effluents. Total-nitrogen yields from the Elm Fork Trinity River also were significantly larger than yields from the West Fork Trinity River upstream from Fort Worth. Total-nitrogen yields from the drainage area of the Elm Fork Trinity River near Sanger (08050500) averaged 10.8 $lb/mi^2/d$, but total-phosphorus yields averaged only 0.31 $lb/mi^2/d$. Part of the total-nitrogen yield from this area is attributed to fertilizers and organic debris in runoff from agricultural areas.

Dissolved Trace Elements

Excessive concentrations of trace elements (mostly metals) in a water supply may render the water unsuitable for municipal and domestic uses because of harmful physiological effects. Many trace elements also may be concentrated at successive steps in the aquatic food chain rendering fish and other aquatic life undesirable for human consumption. Concentrations of dissolved trace elements in surface waters in the upper Trinity River basin generally are small, often less than detectable limits. Data for selected dissolved trace elements are summarized in table 20. Minimum values of 0.00 µg/L (microgram per liter) indicate that one or more values were less than detectible limits. Concentrations of most of the dissolved trace elements, including arsenic, barium, cadmium, chromium, copper, mercury, selenium, silver, and zinc were less than maximum or secondary maximum contaminant levels set by EPA for public water supplies (table 7). Because of the small concentrations, areal variations were not delineated for most dissolved trace metals.

Dissolved-iron concentrations exceeded 300 µg/L in approximately 10 percent of the samples analyzed from the West Fork Trinity River at Grand Prairie (08049500), Trinity River below Dallas (08057410), and Trinity River near Rosser (08062500). One sample from the East Fork Trinity River at McKinney (08058900) also contained more than 300 µg/L dissolved iron. One or more samples from the Clear Fork Trinity River at Weatherford (08045850) and Trinity River below Dallas (08057410) contained more than 50 µg/L dissolved lead. Samples for the analysis of dissolved manganese were collected from 16 sites on streams. The concentration of dissolved manganese exceeded 50 µg/L in at least 1 sample from 14 of these sites [all but Denton Creek near Justin (08053500) and East Fork Trinity River near Lavon (08061000)]. Based on records of 20 or more samples, manganese concentrations at sampling sites on effluent-dominated reaches of streams in the area of the Dallas-Fort Worth metroplex generally exceeded 50 µg/L in at least 50 percent of the samples analyzed. Available data indicate that dissolved-manganese concentrations at other sites on streams generally were less than 20 µg/L in 50 percent of the samples analyzed.

The concentrations of dissolved iron and dissolved manganese in deep areas of reservoirs in the upper Trinity River basin during periods of thermal stratification generally were much larger than concentrations in streams. Water near the bottom of deep sites in most of the reservoirs during summer often contained more than 500 µg/L. After prolonged periods of summer stratification, concentrations near the bottom of some deep sites in the reservoirs have exceeded 1,000 µg/L.

Total Recoverable Pesticides

Samples for selected pesticide analyses were collected at four sites on streams in the upper Trinity River basin, including the Trinity River below Dallas (08057410), East Fork Trinity River near Crandall (08062000), Trinity River near Rosser (08062500), and Trinity River at Trinidad (08062700). These analyses included selected organochlorine insecticides, organophosphorus insecticides, and chlorophenoxy acid herbicides (table 20). The organochlorine and organophosphorus insecticides are used to control insects that are harmful to man or animals, either directly as disease vectors or indirectly as destroyers of crops. Governmental regulations have restricted or banned the use of several of the organochlorine insecticides in recent years because of their extreme stability and toxicity. Consequently, the use of organophosphorus insecticides has increased. Lindane, chlordane, and dieldrin were the most frequently detected organochlorine insecticides; however, concentrations of these compounds have not been detected in excess of 0.30 µg/L (table 20). Malathion and diazinon were the most frequently detected organophosphorus insecticides. The maximum concentration of malathion detected was 0.42 µg/L in a sample from the Trinity River near Rosser (08062500). The maximum concentrations of diazinon detected were 7.7 µg/L in a sample from the Trinity River below Dallas (08057410) and 1.2 µg/L in a sample from the East Fork Trinity River near Crandall (08062000).

Chlorophenoxy acid herbicides are used to control or destroy unwanted vegetation in streams and reservoirs, along roadways, and in agricultural or residential areas. The most frequently detected chlorophenoxy acid herbicides in samples from streams in the upper Trinity River basin were 2,4-D and 2,4,5-T. The maximum concentration of 2,4,5-T was 0.76 µg/L in a sample from the Trinity River near Rosser (08062500). The maximum concentration of 2,4-D was 4.2 µg/L in samples from the Trinity River below Dallas (08057410) and Trinity River near Rosser (08062500).

Seasonal Variations in Streams

Dissolved Solids

Seasonal variations in dissolved solids may be caused by seasonal variations in environmental factors such as rainfall, runoff, types and quantities of waste effluents, irrigation return flows, and reservoir releases. Data collected at periodic intervals are inadequate to describe seasonal variations of dissolved solids in most streams in the study area. Consequently, daily or continuous records of specific conductance were used in the following analysis.

Because specific conductance is directly related to concentrations of dissolved solids and major ions, the patterns of seasonal variation for these constituents are very similar. Most of the sites for which long-term daily or continuous records of specific conductance are available are in the effluent-dominated reaches of major streams. Specific-conductance values at these sites were maximum in dry-weather flows sustained by waste effluents and reservoir releases. As the flow increased in response to flood runoff, specific-conductance values decreased. The typical pattern of seasonal variation of streamflow and specific conductance in the effluent-dominated reaches are shown in figure 15. The mean monthly specific-conductance values were minimum

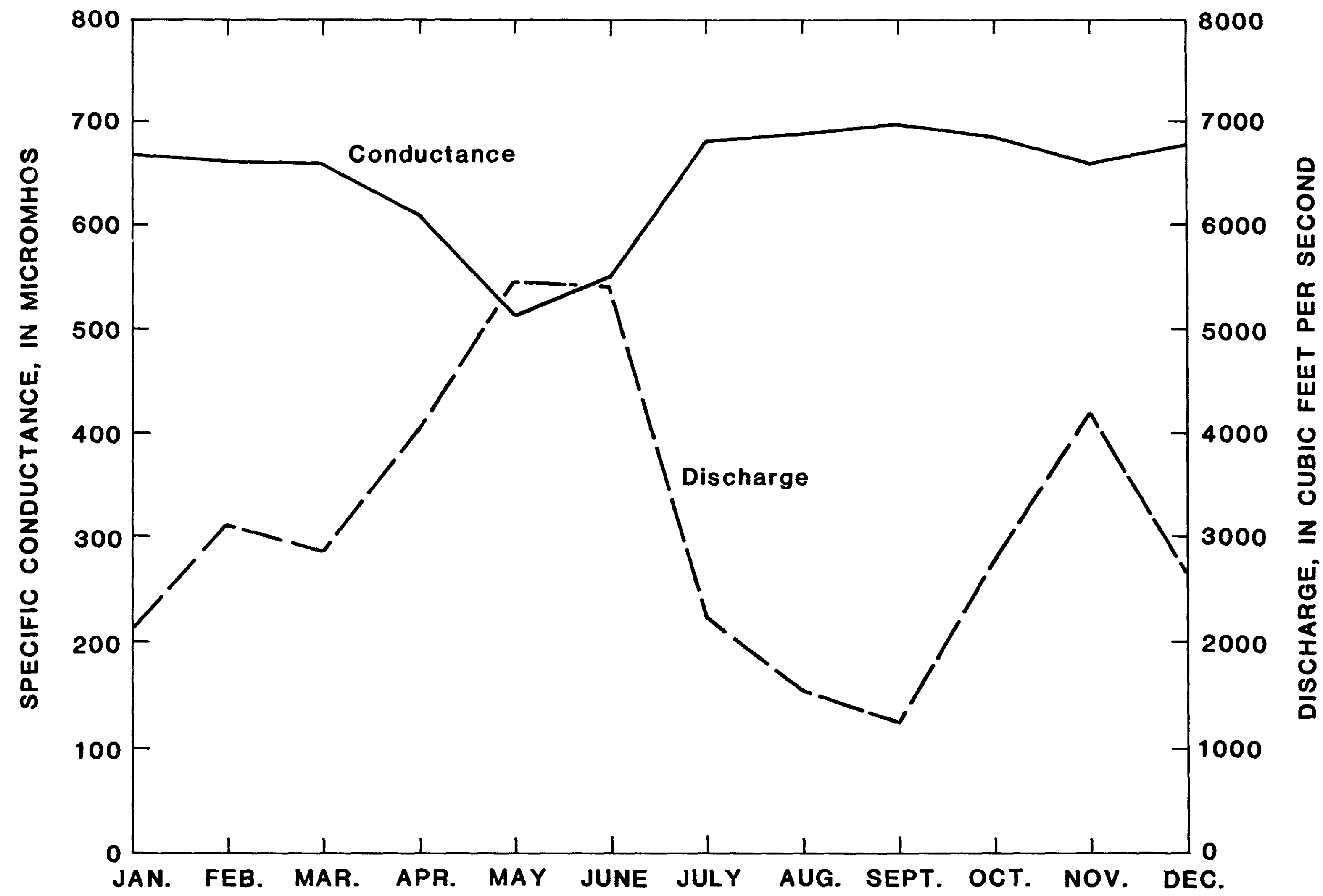

Figure 15.-Variations in mean monthly specific-conductance values and mean monthly discharges, Trinity River at Trinidad (08062700)

from April through June, when mean monthly discharges were largest, and were maximum during July through September, when discharges were smallest. No long-term daily or continuous specific-conductance data are available for sites upstream from the major reservoirs or for reaches not dominated by waste effluents. However, periodic records indicate that the specific-conductance values for dry-weather flows throughout the basin are significantly larger than values for storm runoff. This relation indicates that the specific-conductance values, and thus the concentrations of dissolved solids and major dissolved-inorganic constituents in streams throughout the basin generally were minimum during April through June and were maximum during July through September.

Dissolved Oxygen and Biochemical Oxygen Demand

Seasonal variations in dissolved-oxygen concentrations in streams generally are related inversely to seasonal variations in water temperature. The solubility of oxygen in water increases as water temperature decreases. Water temperature also affects the metabolic activity of microorganisms that utilize oxygen in the degradation of organic material in the water. Colder water temperatures reduce the metabolic activity of the microorganisms and the quantity of oxygen that they consume. The relation of dissolved oxygen in the West Fork Trinity River at Beach Street, Fort Worth (08048543) to water temperature is shown in figure 16. This pattern of seasonal variations is typical for other streams in the basin.

Potential factors that may result in significant variations of BOD concentrations in streams in the upper Trinity River basin include variations in streamflow, quantities and types of organic material in waste effluents, organic debris in the drainage areas and in bottom sediments of streams, water temperature, toxic materials that may inhibit the oxidation of organic material by bacteria, and the availability of dissolved oxygen. Some of these factors vary seasonally; some are relatively constant; others vary erratically. Consequently, the concentration of BOD varies seasonally at sites on some streams in the basin but erratically at other sites. Figure 17 shows the seasonal pattern of variations for the West Fork Trinity River at Beach Street, Fort Worth (08048543), Elm Fork Trinity River near Sanger (08050500), and Trinity River below Dallas (08057410). The West Fork Trinity River at Beach Street, Fort Worth, is upstream from most of the major municipal and industrial waste-treatment plants but receives runoff from a predominantly urbanized area. The Trinity River below Dallas is downstream from many major waste-treatment plants and the urbanized Dallas-Fort Worth metroplex. The BOD concentrations in the streams were significantly larger at the site below Dallas, but the pattern of seasonal variations at the two sites were similar.

Concentrations of BOD in the West Fork Trinity River at Beach Street, Fort Worth, were minimum during warm weather from June through October, increased significantly after the onset of cold weather in December, and peaked during May when rainfall and runoff were maximum. This relation indicates that seasonal variations in urban runoff from the Fort Worth area and in water temperature resulted in significant seasonal variations of BOD concentrations in the stream.

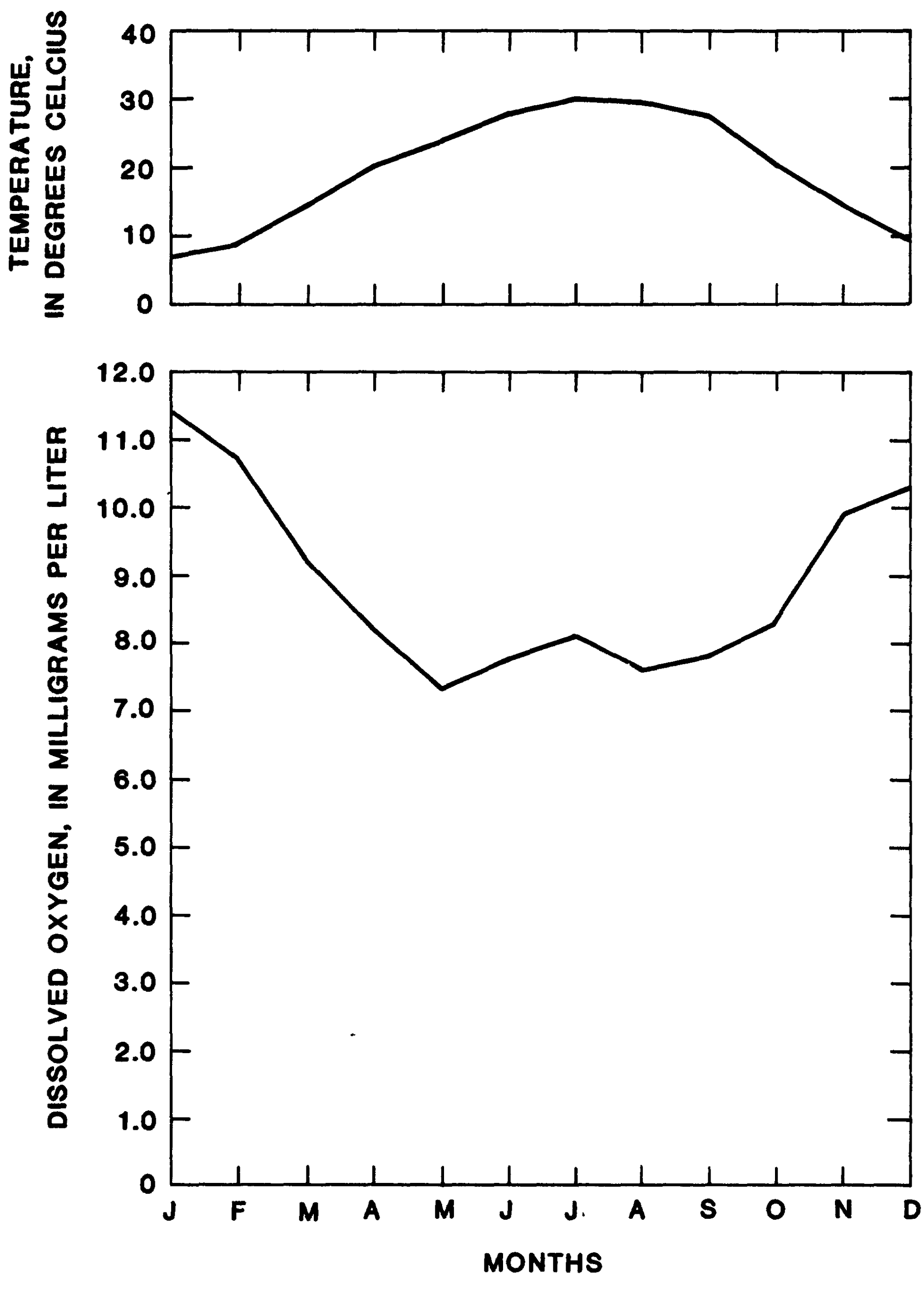

Figure 16.-Variations in mean monthly dissolved-oxygen concentrations and mean monthly water temperature, West Fork Triniry River at Beach Street, Fort Worth (08048543)

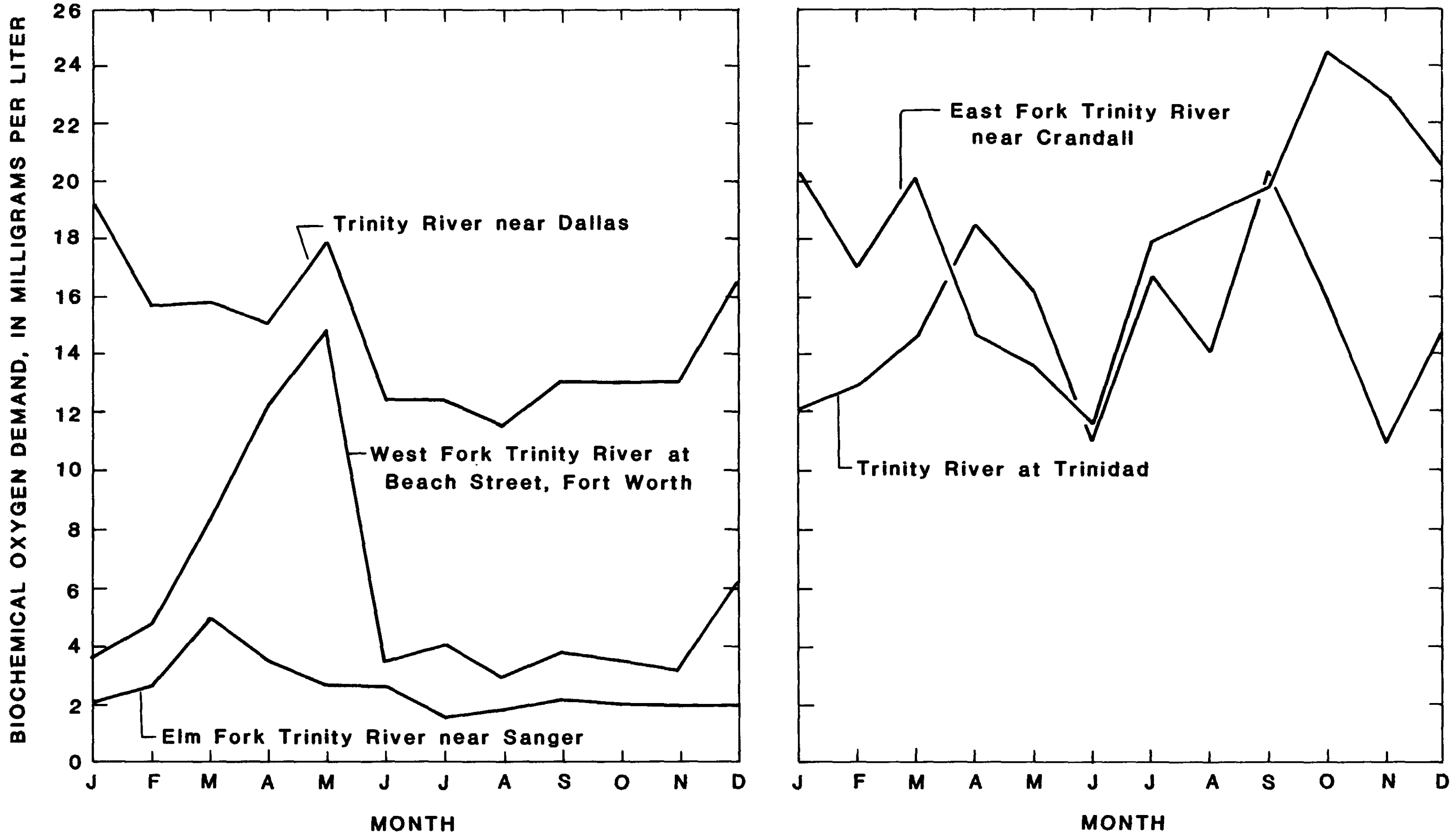

Figure 17.–Variations in mean monthly biochemical oxygen demand at selected sites on streams in the upper TRinity River basin

Concentrations of BOD in the Trinity River below Dallas also were minimum during warm weather from June through October and increased significantly after the onset of cold weather in December. However, concentrations peaked in January and May during the onset of runoff after several months of dry weather. BOD concentrations in storm runoff generally were larger during early rising stages than during receding stages. These relations indicate that variations in several factors including urban runoff, water temperature, and resuspension of organic material in bottom sludges by storm runoff resulted in seasonal variations of BOD.

The drainage area of the Elm Fork Trinity River near Sanger is predominantly rural. BOD concentrations at this site generally were minimum from July through January and peaked after the onset of spring runoff in March. This relation indicates that organic debris in the spring runoff from the rural drainage area resulted in seasonal variations of BOD.

The East Fork Trinity River near Crandall (08062000) and Trinity River at Trinidad (08062700) are in effluent-dominated reaches and are downstream from major reservoirs. Flows at these sites are composites of reservoir releases, waste effluents, and urban runoff. Consequently, the concentration of BOD in flows at these sites varied significantly, but showed no distinctive seasonal pattern (fig. 18).

Total Nitrogen and Total Phosphorus

Potential factors that may result in significant seasonal variations in concentrations of total nitrogen and total phosphorus in streams in the upper Trinity River basin include variations in streamflow, waste effluents, fertilizers in return flows from agricultural and residential areas, and suspended and bottom sediments. No distinctive pattern of seasonal variations was noted at sites outside the effluent-dominated reaches of streams in the basin. Data in figure 18, for example, show no significant seasonal variations in total nitrogen in the Elm Fork Trinity River near Sanger (08050500). The concentrations of total phosphorus were relatively constant, except for peaks in November and January. Although several small cities discharge waste effluents upstream from this site, most of the drainage area is rural. Consequently, the peak concentrations of total phosphorus that occur after the onset of fall runoff in November probably are related to sediments originating in agricultural areas and from the decomposition of organic debris.

The concentrations of total nitrogen and total phosphorus in the effluent-dominated reach of streams varied significantly. Data for the Trinity River at Trinidad, for example, show that the concentrations of both nutrients were minimum in May and June during and after storm runoff. The concentrations increased significantly thereafter when the flows were predominantly waste effluents.

Ammonia nitrogen is the dominant component of total nitrogen in the effluent-dominated reaches of streams in the basin. Data in figure 19 show that the concentrations of total-ammonia nitrogen in the Trinity River below Dallas (08057410) and East Fork Trinity River near Crandall (08062000) were minimum in May and June during and after storm runoff. The concentrations increased significantly thereafter when the flows were predominantly waste effluents.

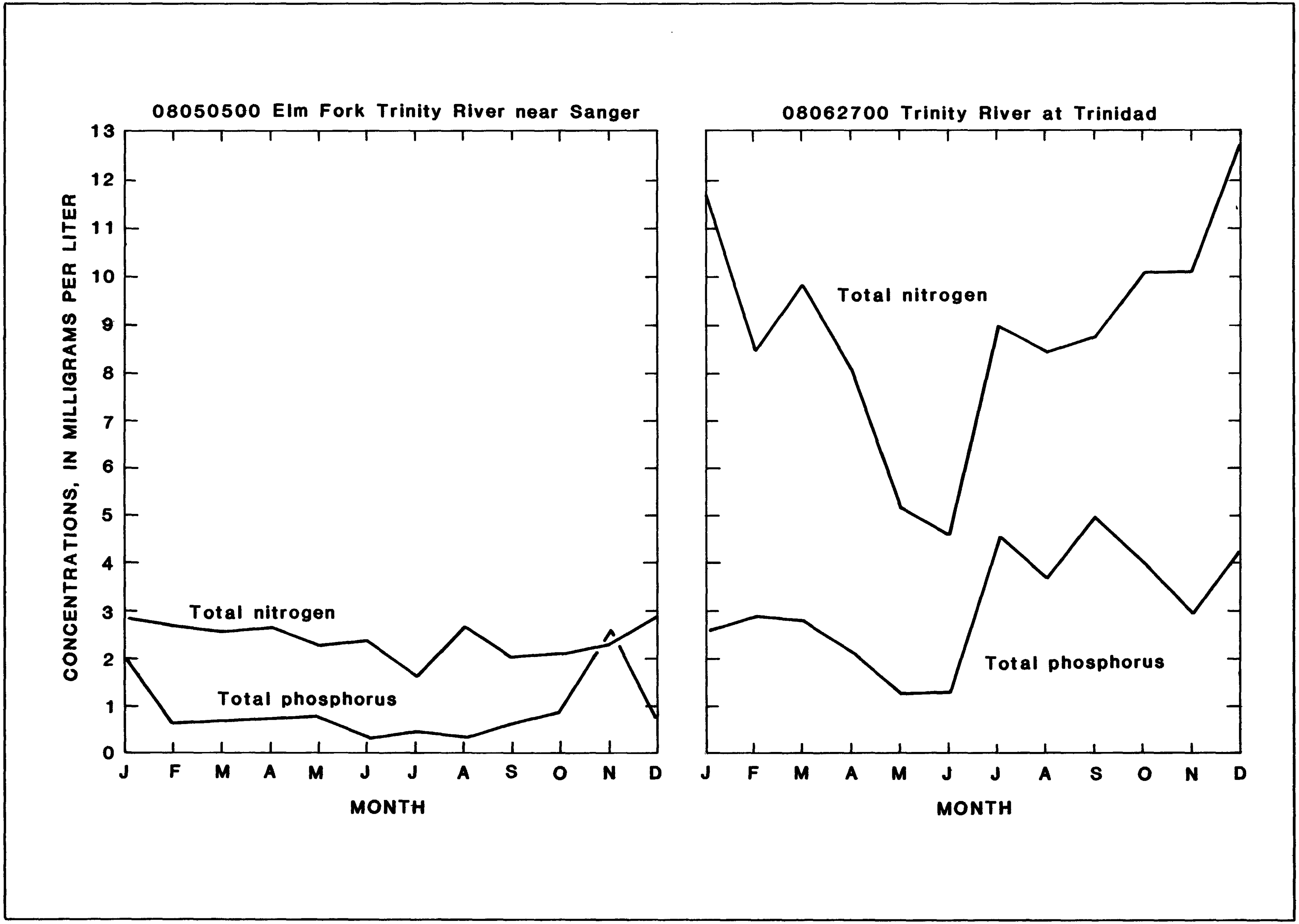

Figure 18.–Monthly variations in average concentrations of total nitrogen and total phosphorus, Elm Fork trinity River near Sanger and Trinity River at Trinidad

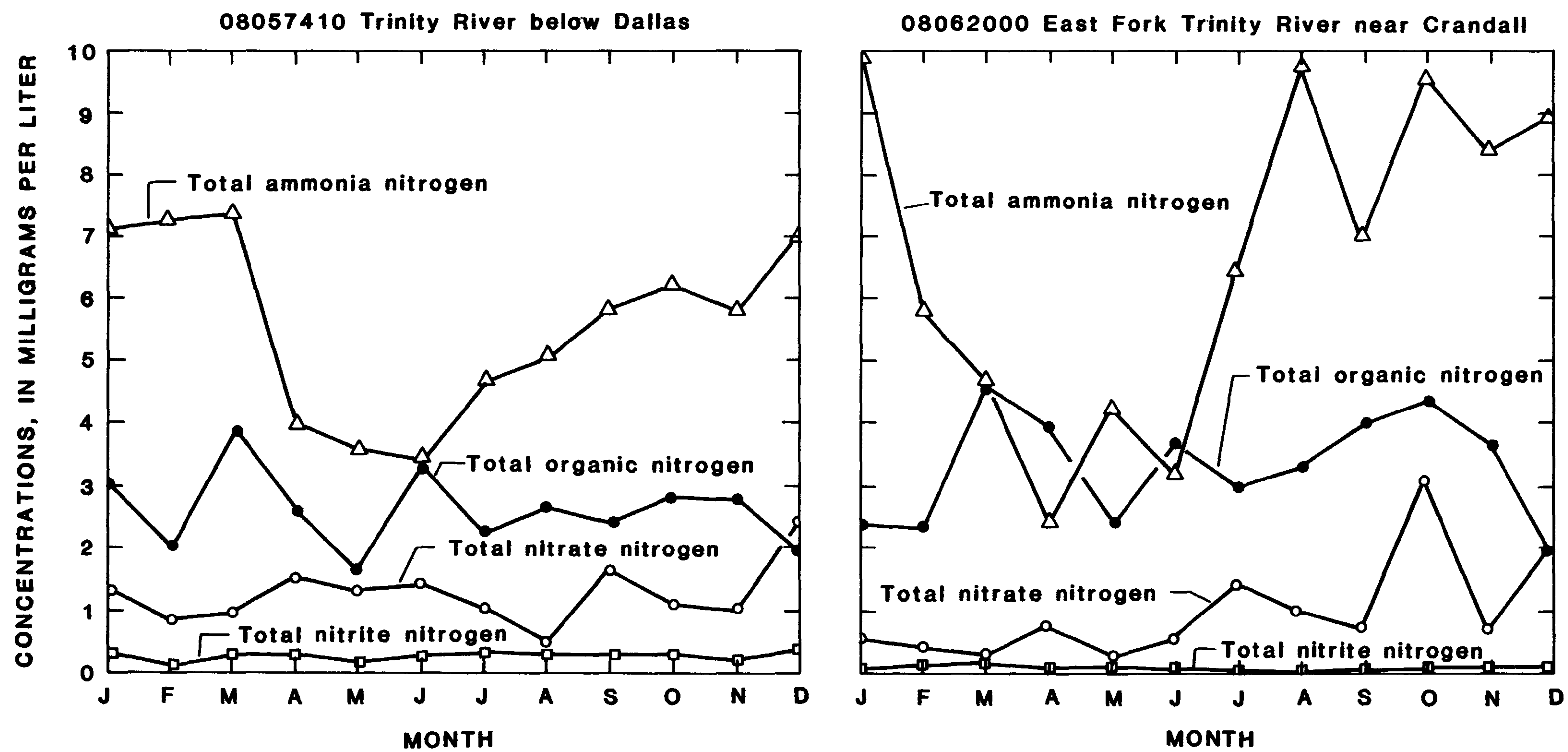

Figure 19.–Monthly variations in average concentrations of total–organic nitrogen, total–ammonia nitrogen, total–nitrite nitrogen, and total–nitrate nitrogen, Trinity River below Dallas and East Fork Trinity River near Crandall

The concentrations of other components of total nitrogen, including organic nitrogen, nitrite nitrogen, and nitrate nitrogen, in effluent-dominated reaches of streams varied erratically and showed no distinct seasonality.

Seasonal Variations in Reservoirs

Available data collected during seasonal water-quality surveys of selected reservoirs in the upper Trinity River basin indicate that seasonal variations of dissolved solids generally were small except during floods when inflows were extremely large. For example, during October 1975 to December 1980, the volume-weighted average concentrations of dissolved solids in Lewisville Lake on the Elm Fork Trinity River ranged from only about 170 to 200 mg/L (fig. 20). Monthly discharge of the Elm Fork Trinity River near Sanger (08050500) upstream from the reservoir ranged from less than 20 ft^3/s to more than 780 ft^3/s during this period. The monthly volume-weighted average concentration of dissolved solids during this period usually was minimum during summer or fall after the inflow of spring runoff. Inflows to the reservoir that resulted from storms in October 1981 and May 1982 caused a significant reduction in the dissolved-solids concentration. The volume-weighted average concentration of dissolved solids decreased from 200 mg/L in May 1981 to 134 mg/L in May 1982.

Thermal stratification and biological activity, both of which are controlled largely by water temperature, resulted in significant seasonal variations of dissolved oxygen in reservoirs in the upper Trinity River basin such as Lake Arlington (fig. 21). During winter circulation, the dissolved-oxygen concentration in most reservoirs exceeded 8.0 mg/L and was uniformly distributed from surface to bottom. During spring and summer, thermal stratification resulted in reduction of vertical circulation. Consequently, oxygen utilized in the biological decomposition of organic debris in the deep strata of reservoirs was not replaced, and vertical dissolved-oxygen gradients developed. Dissolved-oxygen concentrations of less than 1.0 mg/L were not uncommon in the hypolimnions of most reservoirs during late spring and summer.

Seasonal variations of inflows, thermal stratification, and biological activity also resulted in seasonal variations of some of the major nutrients, dissolved iron, and dissolved manganese in the reservoirs. Figures 20 and 22, for example, show that seasonal variation of total nitrite plus nitrate nitrogen in Lewisville Lake generally was directly related to the quanitity of inflow. During January 1975 to December 1979, monthly inflows peaked in spring. Concentrations of total nitrite plus nitrate nitrogen in Lewisville Lake during or immediately following these periods of large inflows usually exceeded 0.10 mg/L. The peak volume-weighted average concentration during this period was 0.68 mg/L in May 1979. After the cessation of large inflows, utilization of nitrite plus nitrate by algae and other aquatic organisms caused a significant reduction in concentrations. By late summer and early fall, volume-weighted average concentrations of total nitrite plus nitrate generally were less than 0.02 mg/L.

Figures 23 and 24 show that the seasonal variations of total phosphorus, total ammonia nitrogen, dissolved iron, and dissolved manganese in Cedar Creek Reservoir were related to thermal stratification. During periods of winter circulation when the water was nearly saturated with dissolved oxygen, the con-

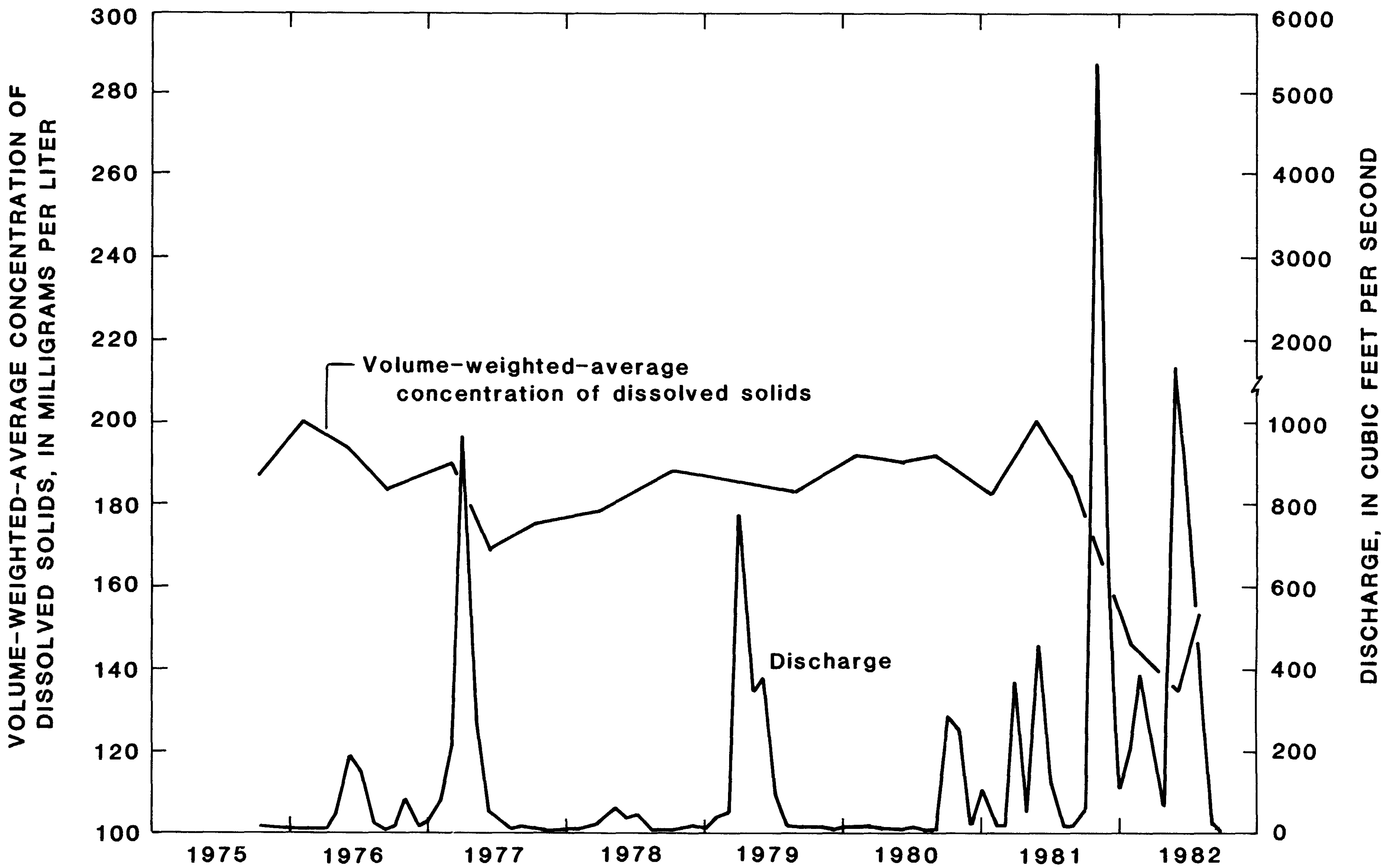

Figure 20.–Seasonal variations in volume-weighted average concentrations of dissolved solids in Lewisville Lake and mean monthly discharges at Elm Fork Trinity River near Sanger

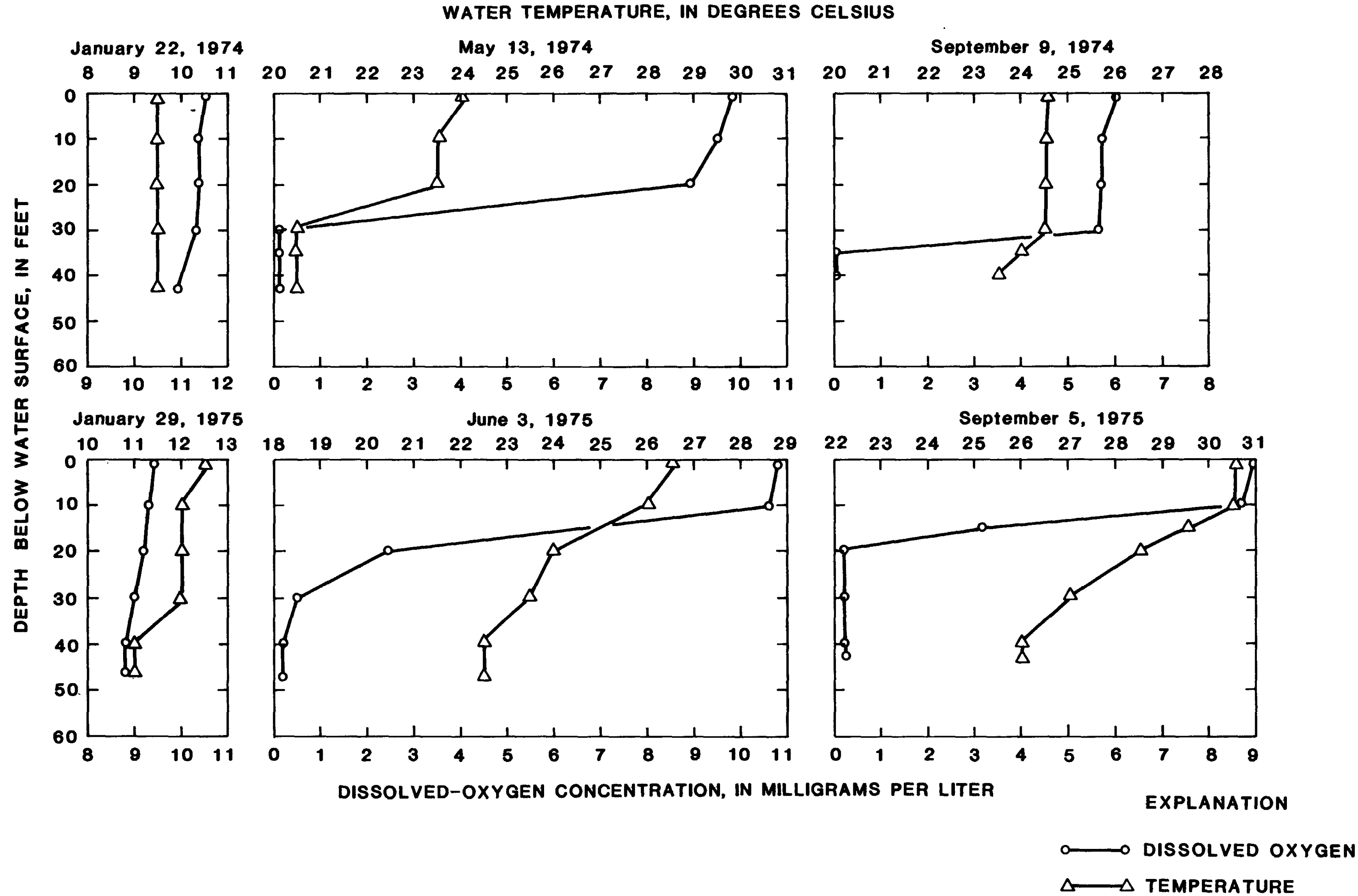

Figure 21.-Seasonal profiles of water temperature and dissolved oxygen at a deep site near the dam in Lake Arlington

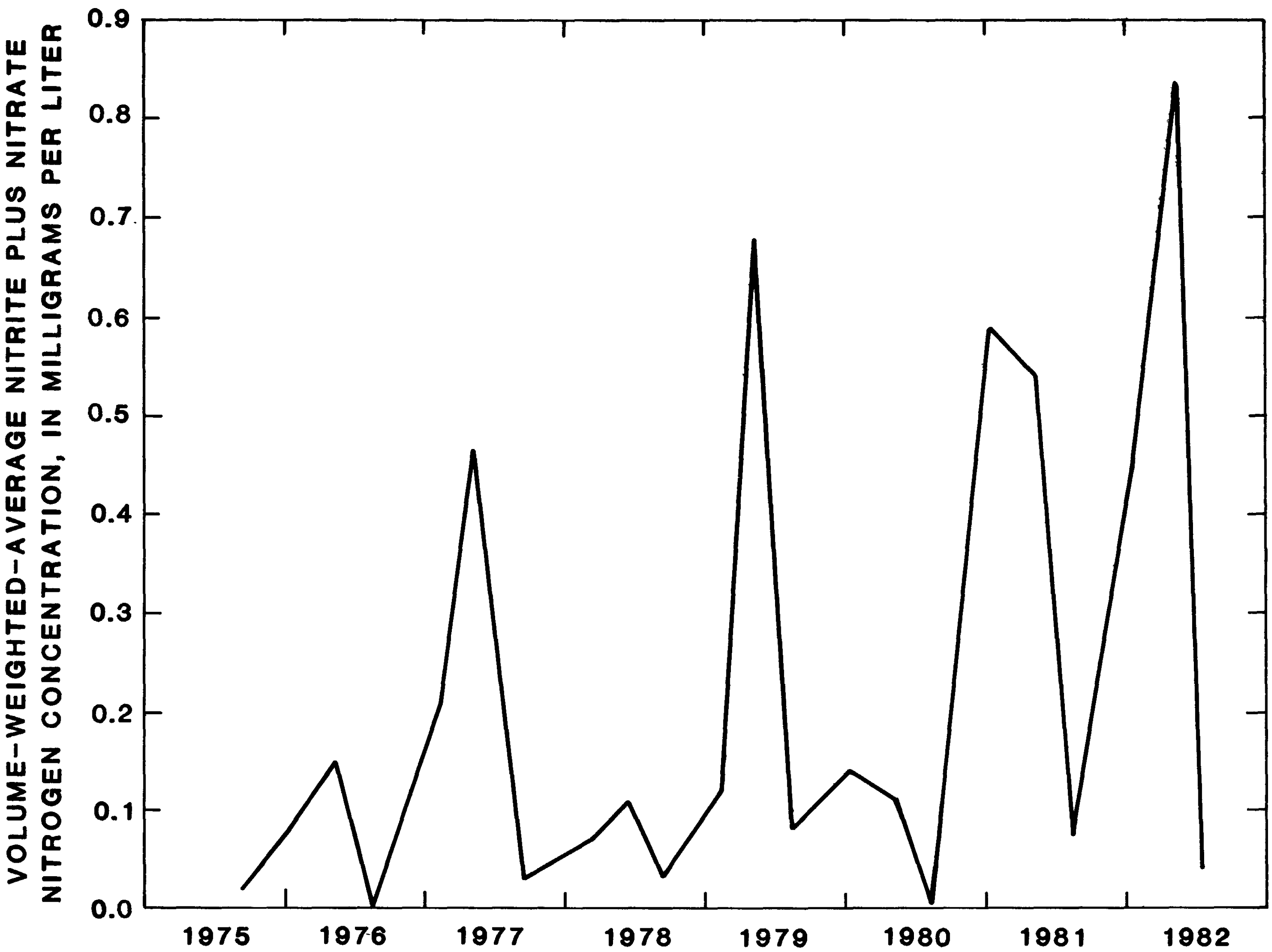

Figure 22.-Seasonal variations in volume-weighted average concentrations of total nitrite plus nitrate nitrogen in Lewisville Lake, 1975-82

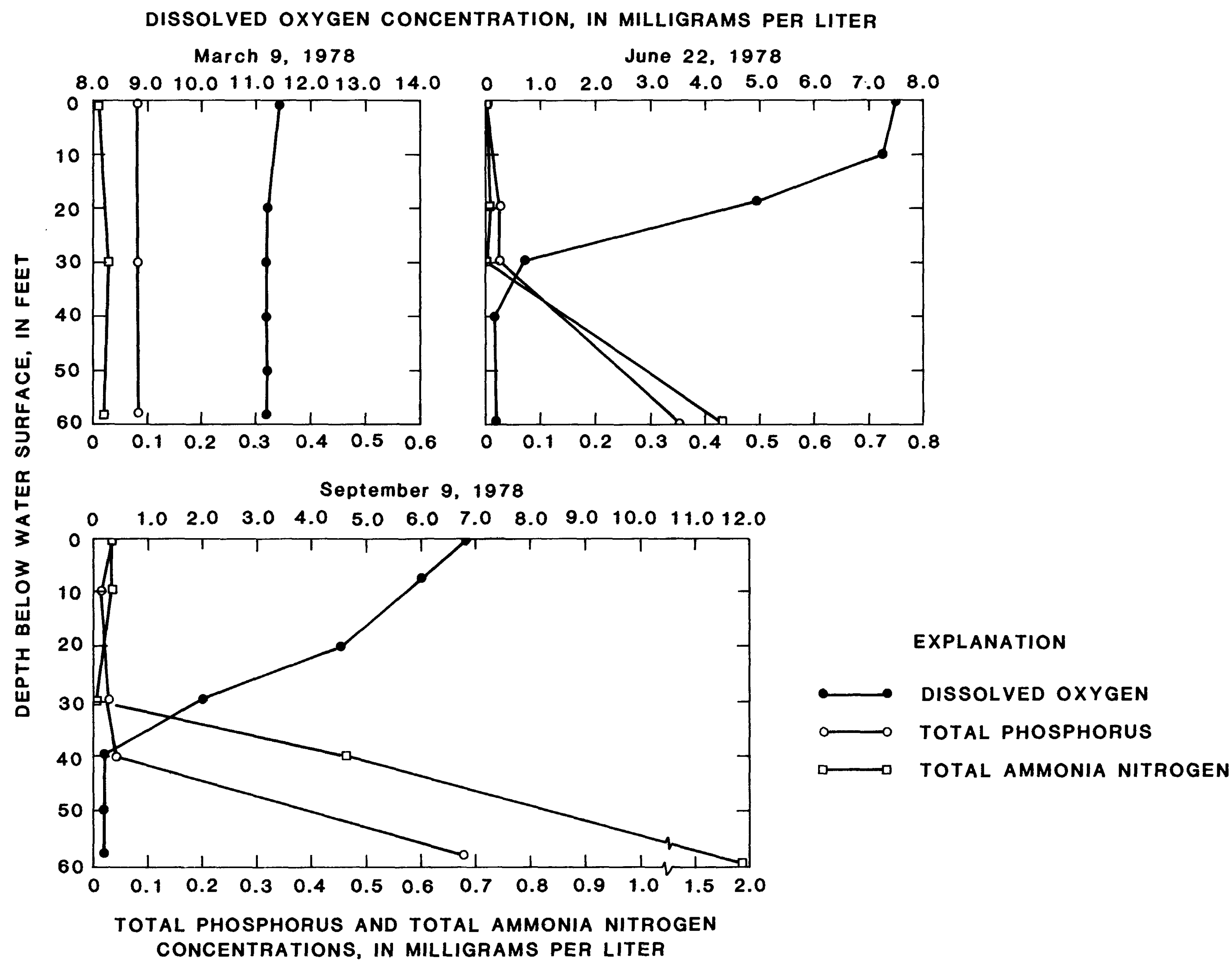

Figure 23.–Seasonal profiles of total phosphorus and total–ammonia nitrogen at a dssp site near the dam in Cedar Creek Reservoir

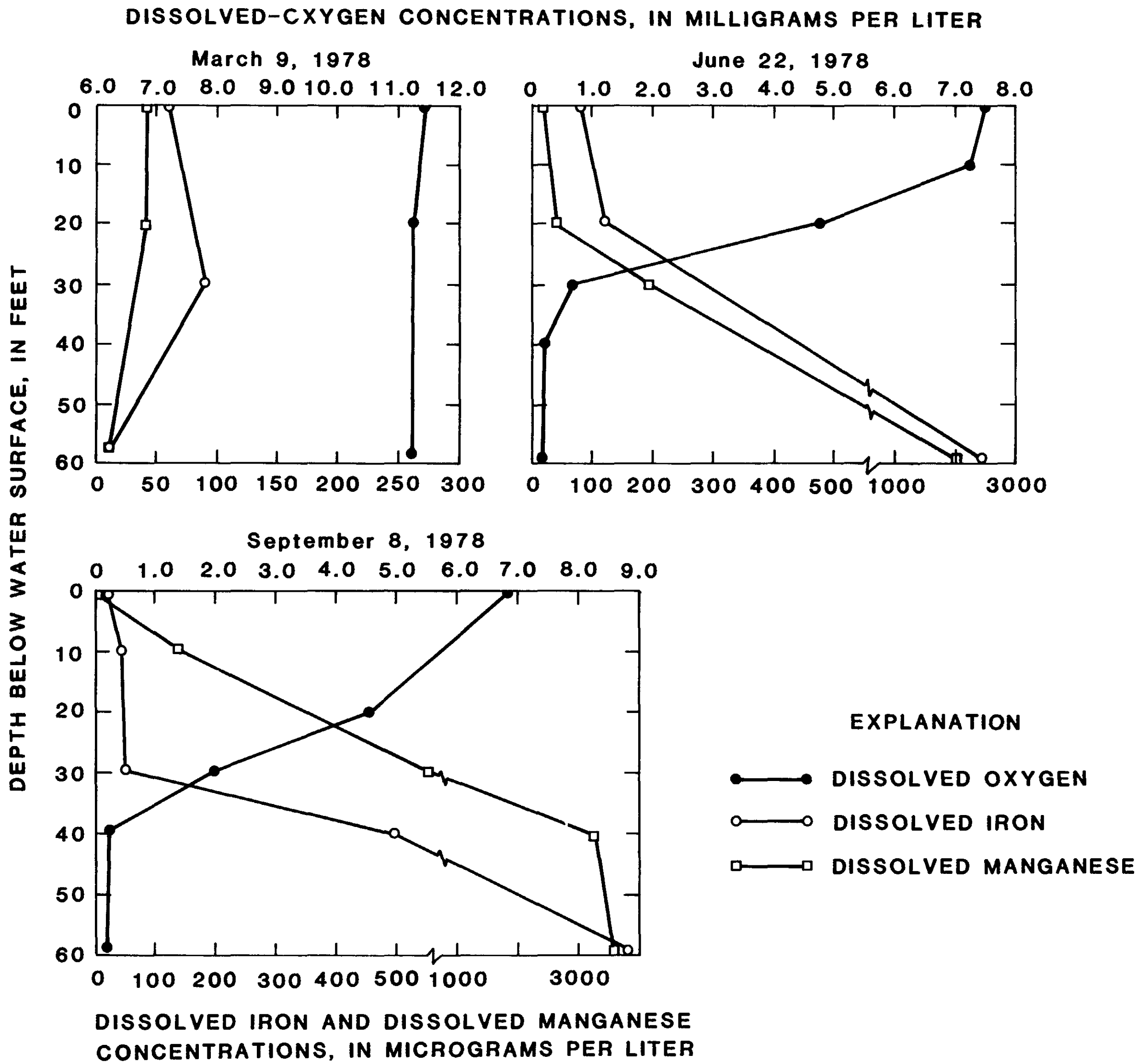

Figure 24.-Seasonal profiles of dissolved oxygen, dissolved iron, and dissolved manganese at a deep site near the dam in Cedar Creek Reservoir

centrations of these constituents at deep sites were nearly uniform from the water surface to the resevoir bottom. However, after the onset of thermal stratification during the spring and summer, dissolved oxygen utilized in the decomposition of organic debris in the deep stratum of the reservoir was not replaced. The decrease of dissolved oxygen in the hypolimnion was accompanied by biochemical reduction of organic debris and bottom sediments, which resulted in significant increase in concentrations of total phosphorus, total ammonia nitrogen, dissolved iron, and dissolved manganese.

Long-Term Variation

Methodology

Detection of trends in water quality is not a simple task. Concentrations of elements or compounds in water often change by only a few percent annually. Such changes are often masked by fluctuations in discharge, seasonal variations, and sampling and analytical variability. Changes in constituent concentration caused by variation of stream discharge are particularly troublesome in trend detection efforts. As discharge increases, many water-quality properties and constituents, such as dissolved solids, decrease in value or concentration. Other constituent concentrations such as suspended sediment generally increase with increasing streamflow.

In order to test for trends in water-quality constituents in streams and rivers, it is desirable to remove the effects of streamflow. Flow adjustment is an attempt to remove discharge-related variations in water quality which may be masking those variations attributable to changes in the constituent inputs to the stream or in the processes occurring in the stream. Smith and others (1982) describe a flow-adjustment procedure which develops a time series of flow-adjusted concentrations (FAC) for trend analysis. FAC in statistical terms is known as a residual and is defined as the actual constituent concentration minus the predicted concentration developed from a discharge-constituent relation. The FAC should be distributed randomly with a mean of zero over the period of record if no change in the processes that affect the water-quality constituent have occurred.

Some common models used in the flow adjustment procedure include the following:

1. $C = a + b(Q)$ — linear
2. $C = a + b \ln(Q)$ — log-linear
3. $C = a + b \dfrac{1}{1 + BQ}$ — hyperbolic — B a constant typically in the range $10^{-3}\overline{Q}^{-1} \leq B 10^{2} Q^{-1}$ where $\overline{Q}$ is the mean discharge.
4. $C = a + b \dfrac{1}{Q}$ — inverse
5. $C = a + b_1 Q + b_2 Q^2$ — quadratic

6. $\ln(C) = a + b \ln(Q)$ log-log
7. $\ln(C) = b_1 \ln(Q) + b_2 \ln(Q)^2$ log quadratic

where C is the concentration,
Q is the discharge,
a is the slope of the regression line for linear regression and a constant for quadratic regressions,
b is the intercept value for linear regression and a constant for quadratic regressions, and
B is the integer part of log 10(Q).

The log-log and log-quadratic models accounted for more variation in the discharge-constituent relationship than did the other models in this study. Selections of models were based on correlation coefficients of the various regression equations as well as an examination of the plots of the FAC concentrations with time.

The detection of trends in lakes and reservoirs are difficult because of the large amount of seasonal and areal variations of properties or constituents. To reduce the effects of areal variation in reservoirs, volume-weighted average concentrations of select constituents were used for trend analysis in reservoirs. No adjustment was made for variations in storage contents.

The statistical procedure for detection of trends used in this report is a nonparametric procedure which tests for monotonic trends in time in flow-adjusted concentrations or volume-weighted average concentrations using a modified form of Kendall's Tau, the Seasonal Kendall Test (Smith and others (1982), and Crawford and others (1983). In addition to estimating whether a trend exists, the test also estimates the magnitude of the trend. The test defines the Seasonal Kandall Slope Estimator to be the median of the differences (expressed as slopes) of the ordered pairs of data values that are compared in the Seasonal Kendall Test. If linear models were used to determine flow-adjusted concentrations, the median of these differences is taken to be the change in milligrams per liter per year. This value represents the change in concentration over time by factors other than discharge (changes in pollutant loading, changes in waste treatment facilities, etc.). The percent change per year is determined by dividing the "slope" or change in milligrams per liter per year by the mean concentration for the time period.

If log models were used to determine flow-adjusted concentrations, the "slope" or the median of the differences in the ordered pairs was transformed to percent change per year as described in Crawford, Slack, and Hirsch (1983, p. 12-13). This value was then multiplied by the mean concentration for the time period to determine the change or trend in concentrations over time by factors other than discharge.

Dissolved Solids and Major Inorganic

Constituents or Properties

Trend analyses for dissolved solids and selected major inorganic constituents or properties (calcium, magnesium, sodium, alkalinity, sulfate, chloride, and hardness) were performed on data collected at 17 sites on streams in the upper Trinity River basin. Significant trends were detected for one or more constituents at six of the sites. The magnitude of the trends in terms of milligrams per liter per year and percent change per year are presented in table 13.

A maximum uptrend of 5.8 mg/L/yr (milligrams per liter per year) in dissolved solids was detected at the East Fork Trinity River near Crandall (08062000). Uptrends also were detected for dissolved calcium, dissolved sodium, dissolved chloride, dissolved sulfate, and hardness at this location. Uptrends in dissolved sulfate ranging between 0.80 and 2.4 mg/L/yr were detected at four of the six gaging stations. The largest trend of any of these major inorganic constituents in the study area occurred at Mountain Creek near Cedar Hill, where a downtrend of 18.2 mg/L/yr was detected for hardness. A downtrend in dissolved calcium, a component of hardness, of 7.1 mg/L/yr also was detected at this site. Downtrends in total hardness ranging from 2.1 to 2.4 mg/L/yr were detected on the main stem of the Trinity River below Dallas (08054710), near Rosser (08062500), and at Trinidad (08062700).

Trend analyses for volume-weighted average concentrations of dissolved solids, dissolved chloride, dissolved sulfate, and hardness were performed on data collected from Lake Arlington, Lewisville Lake, and Cedar Creek Reservoir. Downtrends were detected in all four of the constituents in Lake Arlington (fig. 25). No trends in these constituents were detected in Lewisville Lake or Cedar Creek Reservoir. The magnitudes of the downtrends in Lake Arlington were 6.7 mg/L/yr for dissolved solids, 1.1 mg/L/yr for dissolved chloride, 1.5 mg/L/yr for dissolved sulfate, and 2.2 mg/L/yr for hardness. The downtrends are attributed primarily to the progressive cessation of releases of effluents from several municipal wastewater-treatment plants into the reservoir from 1967 to December 1976 (Andrews and Gibbons, 1983). The Seasonal Rank Sum Test (Crawford and others, 1983) confirmed at the 95-percent confidence level a shift or differences in the distribution of volume-weighted average concentration of these four constituents in Lake Arlington for the periods before and after January 1, 1977.

Biochemical Oxygen Demand and Dissolved Oxygen

Trend analyses for BOD, dissolved oxygen, and dissolved-oxygen percent saturation were performed on data collected periodically at eight sites on streams in the upper Trinity River basin. Water temperature, which is related inversely to dissolved oxygen, was included as an independent variable in the trend analysis of dissolved oxygen. The results of these analyses for five stations, at which a trend in BOD, dissolved oxygen, or dissolved-oxygen percent saturation was detected, are shown in table 14.

A BOD uptrend was detected at one station, and a BOD downtrend was detected at three stations. A BOD uptrend of 0.27 mg/L/yr was detected at Mountain Creek near Cedar Hill (08049600); but no trend in dissolved oxygen or dissolved oxygen percent saturation was detected at this station. Downtrends in BOD ranging from 0.45 to 1.64 mg/L/yr were detected at the West Fork Trinity River at Beach Street, Fort Worth (08048543), Trinity River below Dallas (08057410), and Trinity River near Rosser (08062500). Uptrends in concentrations of dissolved

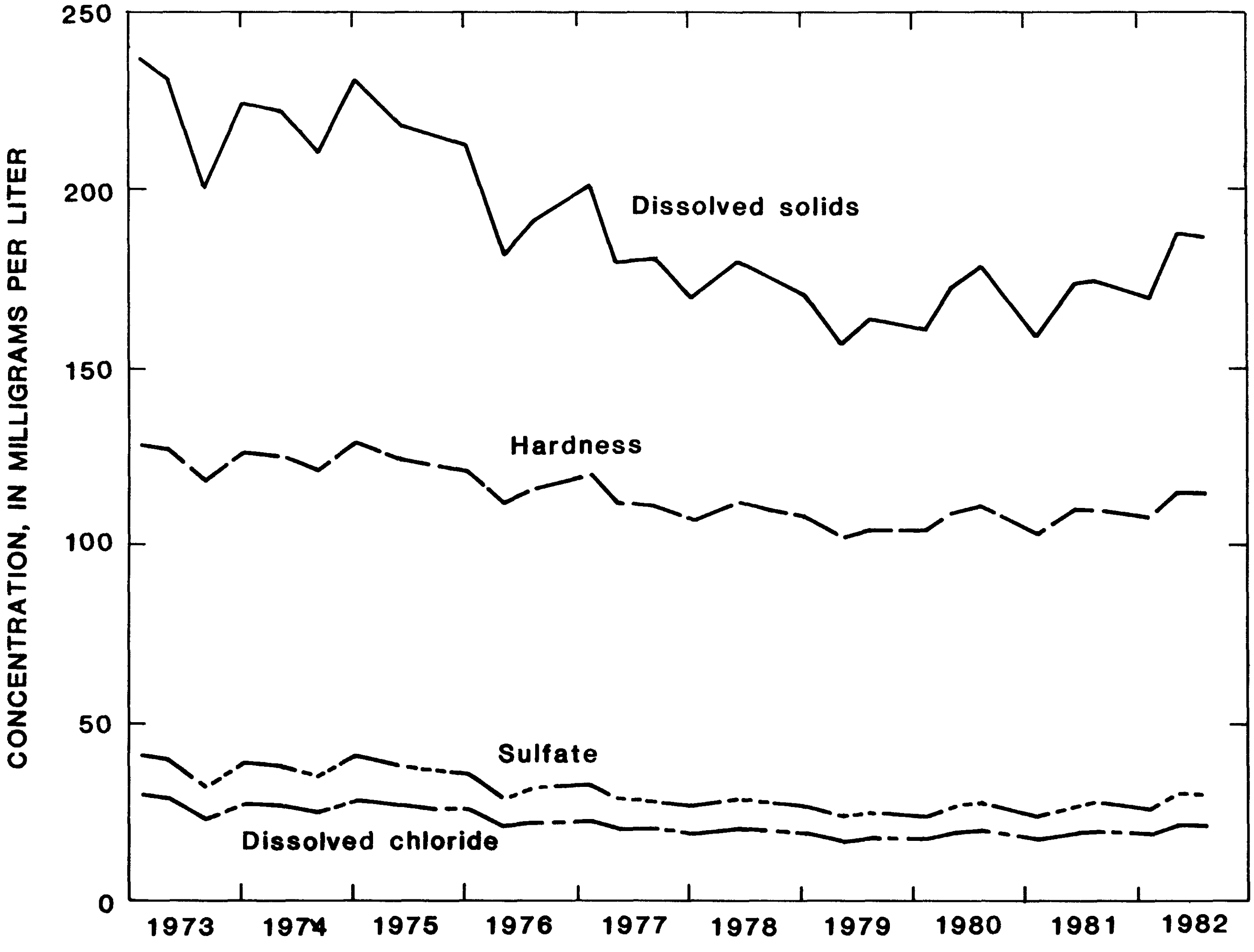

Figure 25.-Variations in volume-weighted average concentrations of dissolved solids, dissolved chloride, dissolved sulfate, and hardness in Lake Arlington, 1973-82

Table 13.--Results of trend test for selected inorganic constituents or properties at six sites on streams

[mg/L/yr, milligrams per liter per year; percent/yr, percent per year; + indicates uptrend; - indicates downtrend; -- indicates no trend]

Chemical property or constituent	08049500 West Fork Trinity River at Grand Prairie		08049600 Mountain Creek near Cedar Hill		08054710 Trinity River below Dallas		08062000 East Fork Trinity River near Crandall		08062500 Trinity River near Rosser		08062700 Trinity River at Trinidad	
	Mg/L/yr	Percent/yr	Mg/L/yr	Percent/yr	Mg/L/yr	Percent/yr	Mg/L/yr	Percent/yr	Mg/L/yr	Percent/yr	Mg/L/yr	Percent/yr
Dissolved solids	--	--	--	--	--	--	+5.8	+2.1	--	--	--	--
Dissolved calcium	--	--	-7.1	-6.7	--	--	+.6	+1.3	-0.8	-1.4	-0.8	-1.6
Dissolved magnesium	--	--	--	--	-0.8	-1.3	--	--	--	--	-.6	-1.6
Dissolved sodium	+2.4	+2.6	--	--	--	--	+1.0	+2.3	--	--	--	--
Hardness (as calcium carbonate)	--	--	-18.2	-6.4	-2.1	-1.3	+1.4	--	-2.3	-1.5	-2.4	-1.6
Alkalinity (as calcium carbonate)	+3.4	+2.0	--	--	--	--	--	--	--	--	-2.3	-1.6
Dissolved chloride	--	--	--	--	--	--	+1.5	+4.6	--	--	--	--
Dissolved sulfate	+2.4	+2.7	--	--	--	--	+.8	+1.8	+1.4	+1.8	+1.9	+2.5

Table 14.--Results of trend test for biochemical oxygen demand, dissolved oxygen, and dissolved-oxygen percent saturation based on periodic measurements at five sites on streams

[mg/L/yr, milligrams per liter per year ; percent/yr, percent per year; + indicates uptrend; - indicates downtrend; -- indicates no trend]

Station number	Station name	Biochemical oxygen demand		Dissolved oxygen		Dissolved-oxygen percent saturation	
		Mg/L/yr	Percent/yr	Mg/L/yr	Percent/yr	Mg/L/yr	Percent/yr
08048543	West Fork Trinity River at Beach Street, Fort Worth	-1.2	-22.2	+0.39	+3.8	+4.6	+4.1
08049500	West Fork Trinity River at Grand Prairie	--	--	-.21	-4.6	-1.7	-3.8
08049600	Mountain Creek near Cedar Hill	+.27	+6.7	--	--	--	--
08057410	Trinity River below Dallas	-1.6	-11.2	+.21	+5.3	+2.8	+6.6
08062500	Trinity River near Rosser	-.45	-3.1	+.20	+4.8	+2.4	+5.3

oxygen ranging from 0.20 to 0.30 mg/L/yr, and uptrends in dissolved-oxygen percent saturation ranging in values from 2.4 to 4.6 percent saturation per year were detected at these three stations. However, additional analyses discussed below indicate there probably is no uptrend in dissolved-oxygen concentrations at the Beach Street station. No trend in BOD was detected at the West Fork Trinity River at Grand Prairie (08049500), but downtrends of 0.21 mg/L/yr and 1.7 percent saturation per year were detected for dissolved oxygen.

Because of the interest in dissolved-oxygen data in the Trinity River basin, trend analysis for dissolved oxygen also was performed on mean-daily dissolved-oxygen concentrations using data collected at the four continuous-monitor gaging stations. To reduce the effects of serial correlation in daily-values data, trend analysis of daily dissolved-oxygen data was performed using the following data:

1. Monthly-mean dissolved-oxygen concentration, monthly-mean discharge, and monthly-mean temperature.
2. Maximum daily-mean dissolved-oxygen concentration for each month and the daily-mean discharge and the daily-mean water temperature for the day the maximum daily-mean dissolved-oxygen concentration occurred.
3. Minimum daily-mean dissolved-oxygen concentration for each month and the daily-mean discharge and the daily-mean water temperature for the day the minimum daily-mean dissolved-oxygen concentration occurred.
4. Median daily-mean dissolved-oxygen concentration for each month and the daily-mean discharge and the daily-mean water temperature for which the median daily-mean dissolved-oxygen concentration occurred.

The results of these trend analyses giving the estimated change in milligrams per liter per year and percent change per year are given in table 15. The results of the trend-analysis test using daily-mean dissolved-oxygen concentrations agree with tests performed using data collected at periodic intervals at the Dallas and Rosser gaging stations. Uptrends were detected on all four tests using daily-mean dissolved-oxygen data at both stations. The largest uptrends among the four tests were in the minimum daily-mean dissolved-oxygen concentrations for each month. Uptrends of 0.55 and 0.53 mg/L/yr in the minimum daily-mean dissolved-oxygen concentrations were detected at the Dallas and Rosser gaging stations. An uptrend in the minimum daily-mean dissolved-oxygen concentrations indicates that over the test period, minimum daily dissolved-oxygen concentrations are increasing. The increases in the minimum daily-mean concentrations also will account for the increases of nearly 0.30 mg/L/yr in the medium daily-mean dissolved-oxygen concentrations at both stations.

Results of trend-analysis tests on daily-mean dissolved-oxygen concentrations did not agree with trend-analysis tests using data collected at periodic intervals at the West Fork Trinity River at Beach Street and Grand Prairie stations. No trends were detected using daily-mean dissolved-oxygen concentrations at either station. Although no definite reason can be given to explain the differences in the tests, an examination of the statistical data and graphical output generated in the trend test yields some probable reasons for the differences.

At West Fork Trinity River at Beach Street, regression-analysis data show

Table 15.--Results of trend test for dissolved-oxygen concentrations based on continuous-monitor records for four sites on streams

[mg/L/yr, milligrams per liter per year; percent/yr, percent per year; + indicates uptrend; -- indicates no trend]

Station number	Station name	Monthly mean		Minimum mean daily		Median mean daily		Maximum mean daily	
		Mg/L/ yr	Percent/ yr	Mg/L/ yr	Percent/ yr	Mg/L/ yr	Percent/ yr	Mg/L/ yr	Percent/ yr
08048543	West Fork Trinity River at Beach Street, Fort Worth	--	--	--	--	--	--	--	--
08049500	West Fork Trinity River at Grand Prairie	--	--	--	--	--	--	--	--
08054710	Trinity River below Dallas	+0.35	+8.3	+0.55	+18.2	+0.31	+6.6	+0.28	+4.6
08062500	Trinity River near Rosser	+.13	+3.5	+.53	+19.7	+.29	+6.4	+.19	+3.4

that a significantly larger percentage of the variation in dissolved oxygen due to discharge was explained using data collected on a continuous basis rather than data collected at periodic intervals. This probably is due to the large diurnal fluctuations in dissolved oxygen that occur at West Fork Trinity River at Beach Street. An instantaneous measurement of dissolved oxygen at this station is not as representative of actual conditions as is the daily-mean dissolved oxygen concentrations. Additional statistical analysis of the data collected at periodic intervals indicates that the time of day the dissolved-oxygen measurement was made is highly significant, and when time of day was included in the trend-analysis test using data collected at periodic intervals, no trend in dissolved oxygen was detected. This additional data analysis indicates that there probably is no significant trend in dissolved oxygen at West Fork Trinity River at Beach Street.

At West Fork Trinity River at Grand Prairie, a longer period of record was available using data collected at periodic intervals (1973-82) than data collected on a continuous basis (1976-82). Graphical output of the trend-analysis test using data collected at periodic intervals indicates that both the instantaneous dissolved-oxygen concentrations and the flow-adjusted dissolved-oxygen concentrations appear to be significantly lower after 1977 than prior to that date. This would indicate that the trend-analysis test using data collected at periodic intervals probably is more valid because of the longer period of record, and a downtrend in dissolved oxygen is probable at West Fork Trinity River at Grand Prairie.

An extensive program to expand and upgrade the treatment of municipal wastes in the upper Trinity River basin was begun in the 1970's. Most of the downtrend in BOD and the uptrend in dissolved oxygen in the Trinity River downstream from Dallas is attributed to this sewage improvement program.

Total Nitrogen and Total Phosphorus

Trend analyses for total nitrogen; selected total-nitrogen species including total-organic nitrogen, total-ammonia nitrogen, and total nitrite plus nitrate nitrogen; and total phosphorus were performed on data collected periodically at eight sites on streams in the basin. Results of these analyses (table 16) show an uptrend for total nitrogen at three sites and an uptrend of one or more of the nitrogen species at each of the eight sites. The uptrend of total nitrogen ranged from 0.15 mg/L/yr at the Elm Fork Trinity River near Sanger (08050500) to 0.93 mg/L/yr at the East Fork Trinity River near Crandall (08062000). An uptrend of total-organic nitrogen at six sites ranged from 0.11 mg/L/yr at the Elm Fork Trinity River near Sanger (08050500) to 0.43 mg/L/yr at the East Fork Trinity River near Crandall (08062000). Uptrends of 0.06 and 0.37 mg/L/yr of total-ammonia nitrogen were detected at the West Fork Trinity River at Beach Street, Fort Worth (08048543) and the East Fork Trinity River near Crandall (08062000). An uptrend of total nitrite plus nitrate nitrogen at four sites ranged from 0.10 mg/L/yr at the East Fork Trinity River near Crandall (08062000) to 0.44 mg/L/yr at the Trinity River near Rosser (08062500). A downtrend of 0.31 mg/L/yr of total nitrite plus nitrate nitrogen was noted at the West Fork Trinity River at Grand Prairie (08049500).

Results of analyses for total phosphorus (table 16) show a downtrend at

Table 16.--Results of trend test for total nitrogen, total-organic nitrogen, total-ammonia nitrogen, total nitrite plus nitrate nitrogen, and total phosphorus at eight sites on streams

[mg/L/yr, milligrams per liter per year; percent/yr, percent per year; + indicates uptrend; - indicates downtrends; -- indicates no trend]

Station number	Station name	Total nitrogen		Total-organic nitrogen		Total-ammonia nitrogen		Total nitrite plus nitrate nitrogen		Total phosphorus	
		Mg/L/yr	Percent/yr	Mg/L/yr	Percent/yr	Mg/L/yr	Percent/yr	Mg/L/yr	Percent/yr	Mg/L/yr	Percent/yr
08048543	West Fork Trinity River at Beach Street	--	--	--	--	+0.06	+22.5	--	--	-0.03	-17.2
08049500	West Fork Trinity River at Grand Prairie	--	--	+0.39	+14.1	--	--	-0.31	-16.1	-.25	-6.6
08049600	Mountain Creek near Cedar Hill	+0.26	+13.9	+.13	+12.3	--	--	--	--	--	--
08050500	Elm Fork Trinity River near Sanger	+.15	+6.2	+.11	+12.6	--	--	--	--	--	--
08057410	Trinity River below Dallas	--	--	--	--	--	--	+.18	+12.7	-.20	-5.1
08062000	East Fork Trinity River near Crandall	+.93	+8.1	+.43	+13.5	+.37	+5.5	+.10	+23.3	-.20	-5.2
08062500	Trinity River near Rosser	--	--	+.17	+9.0	--	--	+.44	+24.0	-.22	-6.6
08062700	Trinity River at Trinidad	--	--	+.27	+13.7	--	--	+.35	+12.3	--	--

five sites and no significant trend at three sites. Downtrends ranged from 0.03 mg/L/yr at the West Fork Trinity River at Beach Street, Fort Worth (08048543) to 0.25 mg/L/yr at the West Fork Trinity River at Grand Prairie (08049500). Downtrends of about 0.20 mg/L/yr were also noted at three sites in effluent-dominated reaches of the East Fork Trinity River and the Trinity River. The occurrence of these relatively large downtrends of total phosphorus in the effluent-dominated reaches of streams is primarily attributed to the program to expand and upgrade the treatment of municipal wastes.

Trend analyses also were performed on volume-weighted average concentrations of total nitrite plus nitrate and total phosphorus in Lake Arlington, Lewisville Lake, and Cedar Creek Reservoir. No trends were detected in Cedar Creek Reservoir. An uptrend of 0.02 mg/L/yr in total nitrite plus nitrate was detected in Lewisville Lake (fig. 26). A downtrend in total phosphorus of 0.01 mg/L/yr was detected in Lake Arlington.

ABILITY OF NASQAN DATA TO REPRESENT WATER QUALITY

THROUGHOUT THE HYDROLOGIC ACCOUNTING UNIT

Two of the principal objectives of this study are to (1) assess the ability of water-quality data collected at NASQAN station 08062700, Trinity River at Trinidad, Texas to represent, on both an areal and temporal basis, the water quality in hydrologic accounting unit 120301 and (2) if water-quality data at Trinity River at Trinidad do not represent water quality throughout the hydrologic accounting unit, describe the minimum data-collection program necessary to do so. Previous sections of this report have shown that significant areal and temporal variations of water quality occur in streams in the basin. Most of the variations are caused by factors related to variations in land use and to variations in streamflow. Outside the Dallas-Fort Worth metroplex, most of the streams flow through rural, sparsely populated agricultural areas. Water-supply reservoirs have been constructed on most of the principal headwater streams. Impoundment of water in the reservoirs has decreased the variations in major dissolved constituents at sites downstream from the reservoir. However, as the streams flow through urbanized areas in the Dallas-Fort Worth metroplex, they receive urban runoff and large quantities of effluent from wastewater treatment plants. The inflow of these waste effluents and urban runoff has resulted in significant increases in concentrations of some constituents. Previous sections also have shown that the quality of water impounded in the reservoirs in the basin varies in response to variations in the quantity and quality of inflow. Although data collected at the NASQAN station Trinity River at Trinidad (08062700) provide an indication of the variability of the quality of water as it flows from the upper Trinity River basin, the data do not adquately represent the spatial and temporal variations in the quality of water throughout the basin.

Considerable historical water-quality data exist for some streams in the basin. However, many of the local or special-purpose stations were operated for short periods and lacked standardization of constituents measured. Consequently, analysis of water-quality data for long-term trends was not possible for many of the streams in the basin. However, the section "Long-Term Variation" indicates that significant trends in one or more constituents occurred at

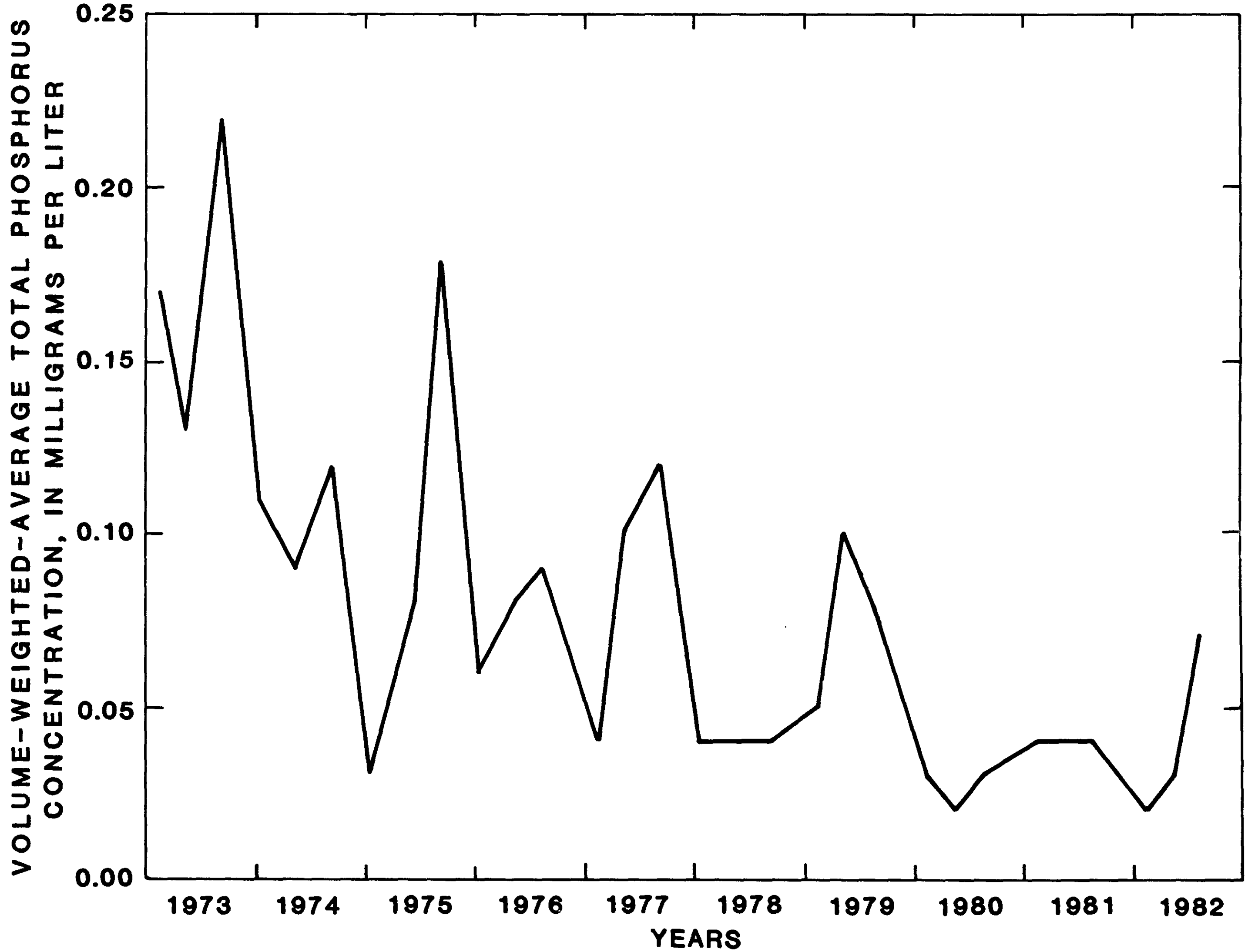

Figure 26.-Variations in volume-weighted average concentrations of total phosphorus in Lake Arlington, 1973-82

six sites on streams and in one reservoir. Analyses of data for the Trinity River at Trinidad showed no trend in dissolved solids; a small uptrend in dissolved sulfate; and small downtrends in dissolved calcium, dissolved magnesium, total hardness, and alkalinity (table 13). Uptrends in dissolved sulfate also were noted in the West Fork Trinity River at Grand Prairie (08049500), East Fork Trinity River at Crandall (08062000), and Trinity River near Rosser (08062500). Downtrends in dissolved calcium or dissolved magnesium and total hardness also were noted in Mountain Creek near Cedar Hill (08049600), Trinity River below Dallas (08054710), and Trinity River near Rosser (08062500). Uptrends in dissolved sodium and total alkalinity were noted in the West Fork Trinity River at Grand Prairie (08049500) but not in the Trinity River at Trinidad (08062700). Uptrends in dissolved solids, dissolved calcium, dissolved sodium, dissolved chloride, and hardness were noted in the East Fork Trinity River near Crandall (08062000) but not in the Trinity River at Trinidad (08062700). Small downtrends in dissolved solids, dissolved chloride, dissolved sulfate, and hardness were noted in Lake Arlington. Analyses of these records illustrate that data collected at the Trinity River at Trinidad (08062700) generally do not show some of the trends in major inorganic constituents that occurred at other sites on streams and reservoirs in the basin.

No trends in dissolved oxygen, dissolved-oxygen percent saturation, or BOD were detected in data collected at the Trinity River at Trinidad; yet trends in one or more of these properties or constituents were detected at five sites on streams in the basin (tables 14 and 15). Similarly, no trends in total nitrogen or total phosphorus were detected in data collected at the Trinity River at Trinidad; yet uptrends in total nitrogen were noted at three sites on streams in the basin, and downtrends in total phosphorus were noted at five sites on streams. Analyses of these records illustrate that data collected at the Trinity River at Trinidad generally do not show some of the trends in dissolved oxygen, BOD, total nitrogen, total phosphorus, and some of the other nutrient species that occurred at other sites on streams and reservoirs in the basin.

Factors that affect water quality in the upper Trinity River basin are changing continually. Population and demand for water are increasing rapidly, urbanized areas are being expanded at the expense of rural land, construction of reservoirs and increased consumptive water use are depleting flows in many of the principal tributaries, and return flows of municipal and industrial wastes are increasing. Although data from the NASQAN station Trinity River at Trinidad provide an indication of the integrated effects of some of these changes on the water quality, the data do not show many of the small or short-term changes or provide an indication of areas where significant changes in water quality are occurring.

The design of a data-collection network to measure areal and temporal variability and trends in water quality throughout any accounting unit is somewhat subjective and depends not only on the diversity of factors that affect water quality but also on the needs of those agencies or individuals responsible for conserving, developing, managing, and protecting the water resources. The authors realize that a data-collection network designed by one agency may not satisfy all of the data needs of others. However, the authors also recognize major deficiencies in the current data base obtained from the special-purpose stations in the basin. Long-term records are lacking for many of the major tributaries outside the Dallas-Fort Worth metroplex. Furthermore, many of the special-purpose stations lack standardization of constituents measured. To remedy these and other deficiencies, the authors recommend modifications of the current data-collection network needed to include 22 water-quality stations at sites on streams in the basin (fig. 27 and table 17). The minimum data collection needed for each of the sites on streams include bimonthly sampling for major dissolved inorganic constituents and related properties, total nutrients, BOD, dissolved oxygen, and indicator bacteria; quarterly sampling for dissolved minor elements; and semiannual sampling for total recoverable pesticides. At least three comprehensive water-quality surveys per year also are needed on each of eight major water-supply reservoirs in the basin.

ASSESSMENT OF DAILY VERSUS PERIODIC RECORDS OF SELECTED WATER-QUALITY CONSTITUENTS OR PROPERTIES

One of the principal objectives of this study is to assess the usefulness of daily versus periodic records for evaluating water quality. The U.S. Geological Survey operates stations at several sites on streams in the upper Trinity River basin where daily or continuous measurements of specific conductance are collected. The stations selected for this comparison include the Trinity River near Rosser (08062500) and the Trinity River at Trinidad (08062700). At each of these stations, at least six samples per year representing the range in specific conductance are collected and analyzed for specific conductance and the major dissolved-inorganic constituents and related properties. Regression equations relating specific conductance to dissolved solids, dissolved chloride, dissolved sulfate and hardness are developed. Correlations between specific conductance and the other four parameters generally are good; R-square values exceed 0.98. These regression equations and daily records of specific conductance and streamflow are used to compute daily, monthly, and annual discharge-weighted average concentrations of hardness and concentrations and loads of dissolved solids, dissolved chloride, and dissolved sulfate. Concentrations and loads computed by this method were used as the control data base from which to test the adequacy of corresponding concentrations and loads that were estimated from less frequent measurements of specific conductance.

In the first test, daily values of specific conductance were estimated from the relation between instantaneous discharge and specific conductance using data collected at periodic intervals--12 samples per year, 9 samples per year, and 6 samples per year. This data base represents an average of approximately 11 samples per year.

In the second test, daily values of specific conductance were estimated from regression analysis between daily-mean discharge and specific conductance using data collected on a once daily or continuous basis. Only data collected on the 15th of each month were used in the regression analysis to simulate data collected on a monthly basis. In the third and fourth tests, daily values of specific conductance were estimated in a manner similar to that for the second test. In the third test, only data collected on the 15th of each even month was used to simulate bimonthly sampling; and in the fourth test, only data collected on the 15th of each month in March, June, September, and December were used to simulate quarterly sampling.

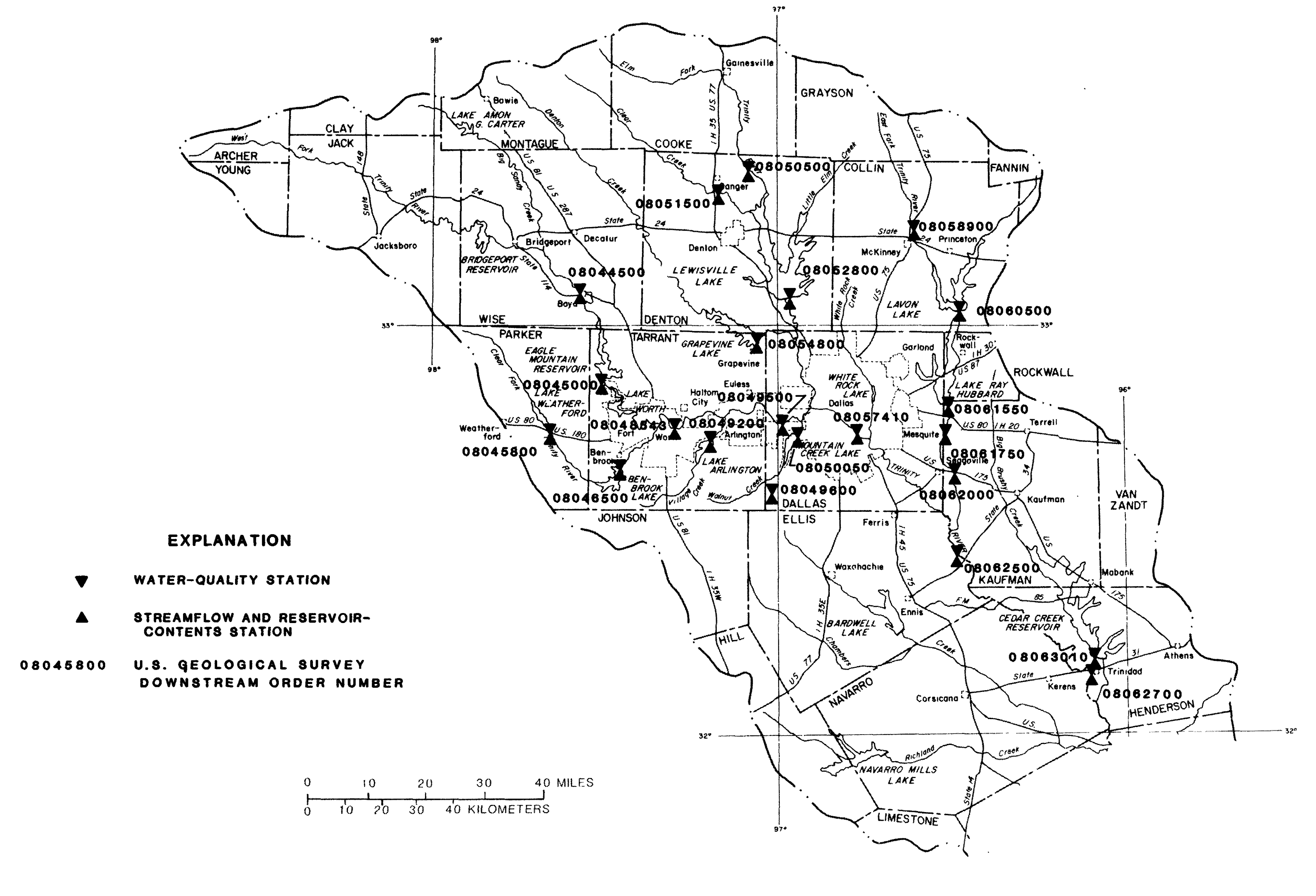

Figure 27.-Location of recommended water-quality stations on streams and reservoirs to define areal and temporal variations in water quality in Hydrologic Accounting Unit 120301

Table 17.--Data-collection network needed to measure areal and temporal variability in Hydrologic Accounting Unit 120301

Station number	Station name
	Sites on streams
08044500	West Fork Trinity River near Boyd, Texas
08045850	Clear Fork Trinity River near Weatherford, Texas
08048543	West Fork Trinity River at Beach Street, Fort Worth, Texas
08049500	West Fork Trinity River at Grand Prairie, Texas
08049600 1/	Mountain Creek near Cedar Hill, Texas
08050500 1/	Elm Fork Trinity River near Sanger, Texas
08051500	Clear Fork Trinity River near Sanger, Texas
08057410	Trinity River below Dallas, Texas
08058900	East Fork Trinity River at McKinney, Texas
08061750	East Fork Trinity River near Forney, Texas
08062000	East Fork Trinity River near Crandall, Texas
08062500	Trinity River near Rosser, Texas
08062700	Trinity River at Trinidad, Texas
	Comprehensive sampling on resevoirs
08045000	Eagle Mountain Reservoir above Fort Worth, Texas
08046500	Benbrook Lake near Benbrook, Texas
08049200	Lake Arlington at Arlington, Texas
08050050	Mountain Creek Lake near Grand Prairie, Texas
08052800	Lewisville Lake near Lewisville, Texas
08054500	Grapevine Lake near Grapevine, Texas
08060500	Lavon Lake near Lavon, Texas
08061550	Lake Ray Hubbard near Forney
08063010	Cedar Creek Reservoir near Trinidad

1/ Station will soon be inundated and the station will be moved upstream or incorporated in the comprehensive reservoir program.

R-square values for the relation between specific conductance and discharge for each test are given in the following table.

Station		Sampling frequency	Number of samples	R-square
08062500	Trinity River	Test 1-periodic	114	0.83
	near Rosser	Test 2-monthly	120	0.87
		Test 3-bimonthly	60	0.85
		Test 4-quarterly	40	0.80
08062700	Trinity River	Test 1-periodic	44	0.65
	at Trinidad	Test 2-monthly	47	0.69
		Test 3-bimonthly	23	0.60
		Test 4-quarterly	16	0.50

Monthly and annual discharge-weighted average concentrations and loads for the four tests were computed from the estimated values of daily specific conductance using the same regression equations used to develop the specific-conductance constituent relationship for the control base data.

Tables 18 and 19 summarize the number and percent of monthly and yearly discharge-weighted average concentrations and loads for the periodic, monthly, bimonthly, and quarterly sampling intervals associated with tests 1-4 which differed from the control base-data values by more than 10 percent. It should be noted that data in the tables may be somewhat misleading for dissolved chloride and dissolved sulfate because of the relatively small concentrations of these two constituents. Many of the estimated values of these constituents which differed from the control values by more than 10 percent actually differed by less than 10 mg/L. For example, 90 percent or more of the estimated discharge-weighted average concentrations of dissolved chloride for the periodic, monthly, and bimonthly sampling intervals for Trinity River at Trinidad differed by less than 10 mg/L.

The data in table 18 and 19 indicate that monthly and yearly discharge-weighted average concentrations and loads of select constituents or properties for the Trinity River near Rosser and at Trinidad can be estimated using data collected on a bimonthly interval with about the same amount of accuracy as data collected on a monthly interval. These data also show that the accuracy of the estimated values computed from periodic, monthly, and bimonthly intervals using the 4-year data base for the Trinity River at Trinidad did not differ greatly from corresponding values estimated for the Trinity River near Rosser using a 10-year data base. The data in test 4 (quarterly interval) for the 10-year period for Trinity River near Rosser compared favorably with data in tests 1-3. The data in test 4 for the 4-year period for Trinity River at Trinidad

Table 18.--Number and percentage of monthly and yearly discharge-weighted average concentrations of selected constituents or properties which differed from the control data base by more than 10 percent

Station and period of record	Constituent or property	Monthly discharge-weighted average concentrations, Sampling interval: Test 1--periodic estimated values		Test 2--monthly estimated values		Test 3--bimonthly estimated values		Test 4--quarterly estimated values		Yearly discharge-weighted average concentrations, Sampling interval: Test 1--periodic estimated values		Test 2--monthly estimated values		Test 3--bimonthly estimated values		Test 4--quarterly estimated values	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
08062500 Trinity River near Rosser (1973-82)	Dissolved solids	24	20.0	24	20.0	24	20.0	28	23.3	0	--	0	--	0	--	1	10.0
	Dissolved chloride	41	34.2	45	37.5	50	41.7	51	42.5	3	30.0	3	30.0	5	50.0	6	60.0
	Dissolved sulfate	27	22.5	27	22.5	27	22.5	33	27.5	2	20.0	2	20.0	2	20.0	2	20.0
	Hardness	3	2.5	3	2.5	3	2.5	4	3.3	0	--	0	--	0	--	0	--
08062700 Trinity River at Trinidad (1977-81)	Dissolved solids	4	8.3	8	16.6	7	14.6	21	43.8	0	--	0	--	0	--	3	75
	Dissolved chloride	16	33.3	19	39.6	15	31.2	28	58.3	0	--	1	25	0	--	3	75
	Dissolved sulfate	10	20.8	10	20.8	9	18.8	23	47.9	0	--	0	--	0	--	3	75
	Hardness	7	14.6	8	16.6	7	14.6	16	33.3	0	--	0	--	0	--	2	50

Table 19.--Number and percentage of monthly and yearly loads of selected constituents which differed from the control data base by more than 10 percent

Station		Constituent	Monthly loads, in tons — Sampling intervals								Yearly loads, in tons — Sampling intervals							
			Test 1--periodic estimated loads		Test 2--monthly estimated loads		Test 3--bimonthly estimated loads		Test 4--quarterly estimated loads		Test 1--periodic estimated loads		Test 2--monthly estimated loads		Test 3--bimonthly estimated loads		Test 4--quarterly estimated loads	
			Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
08062500	Trinity River near Rosser	Dissolved solids	24	20.0	24	20.0	24	20.0	28	23.3	0	--	0	--	0	--	1	10.0
		Dissolved chloride	42	35.0	44	36.7	50	41.7	51	42.5	1	10.0	2	20.0	3	30.0	4	40.0
		Dissolved sulfate	27	22.5	27	22.5	27	22.5	33	27.5	0	--	0	--	1	10	1	10.0
08062700	Trinity River near Trinidad	Dissolved solids	7	14.6	10	20.8	11	22.9	21	43.8	0	--	0	--	0	--	3	75
		Dissolved chloride	14	29.2	17	35.4	17	35.4	28	58.3	0	--	0	--	0	--	3	75
		Dissolved sulfate	7	14.6	9	18.8	10	20.9	23	47.9	0	--	0	--	0	--	3	75

did not compare favorably with data in tests 1-3. These data indicate that data collected at quarterly intervals over a 10-year period could be used to compute discharge-weighted average concentrations and loads with about the same amount of accuracy as data collected at more frequent intervals. However, data collected at quarterly intervals over a 4-year period could not be used to estimate discharge-weighted average concentrations and loads as accurately as data collected at more frequent intervals.

The data in tables 18 and 19 also show that if the user is willing to accept the following limitations, a bimonthly or more frequent interval of periodic data collection could be substituted for daily sampling of specific conductance.

1. Monthly discharge-weighted average concentrations of dissolved solids, dissolved sulfate, and hardness and monthly loads of dissolved solids and dissolved sulfate estimated with less than 10-percent error approximately 80 percent of the time.
2. Monthly discharge-weighted average concentrations and loads of dissolved chloride estimated with less than 10-percent error approximately 55 to 60 percent of the time.
3. Yearly discharge-weighted average concentrations of dissolved solids and hardness and yearly loads of dissolved solids with less than 10-percent error 90 percent of the time.
4. Yearly discharge-weighted average concentrations of dissolved sulfate with less than 10-percent error approximately 80 percent of the time, and yearly loads of dissolved sulfate with less than 10 percent error approximately 90 percent of the time.
5. Yearly discharge-weighted average concentrations of dissolved chloride with less than 10-percent error approximately 50 percent of the time, and yearly loads of dissolved chloride with less than 10-percent error approximately 70 percent of the time.

It should be noted that the interpretations presented in this section of the report apply only to the data analyzed for the Trinity River near Rosser and Trinity River at Trinidad stations.

SUMMARY

Hydrologic Accounting Unit 120301 is located in north-central Texas and includes that part of the Trinity River basin upstream from the NASQAN station 08062700 Trinity River at Trinidad, Texas. The land surface of the study area slopes generally from the northwest to the southeast and altitudes range from about 1,400 ft in the northwest to less than 300 ft in the southeast along the Trinity River.

The climate of the upper Trinity River basin is humid, subtropical with hot summers and mild winters. Monthly air temperatures range from about 35°F (1.7°C) in January to about 85°F (29°C) in July. The normal annual precipitation in the area ranges from about 28 in. in the western part of the basin to near 40 in. in the eastern part.

The population of the upper Trinity River basin increased from about

1,760,000 in 1960 to nearly 3 million in 1980, an average rate of increase of about 3.5 percent per year. Population densities range from less than 20 people per square mile in the northwestern and southeastern parts of the study area to more than 1,000 people per square mile in the Dallas-Fort Worth metroplex. Dallas and Fort Worth are the two largest cities in the study area. Six additional cities in the Dallas-Fort Worth metropolitan area have populations in excess of 70,000.

Total water use in the 14-county area was approximately 826,000 acre-ft in 1980. Ninety percent or nearly 736,000 acre-ft was obtained from surface-water supplies. The Texas Department of Water Resources projects that by the year 2000, water demand in the area will be nearly 1,250,000 acre-ft, a 51-percent increase from 1980. Much of the surface-water withdrawal is from reservoirs. There are currently 15 reservoirs in the study area with storage capacities greater than 5,000 acre-ft. The combined capacity of these reservoirs is about 3,110,000 acre-ft.

Approximately 47 percent of the land in the study area is used for pasture and range land. Approximately 23 percent of the land is used in the production of agricultural crops, and approximately 11 percent of the upper Trinity River basin is urban.

There are numerous potential point sources of surface-water pollution in the study area, most of which are located in the Dallas-Fort Worth metroplex. According to a survey by the Trinity River Authority, waste-control orders for approximately 280 facilities had been issued in or proximate to the study area. These facilities included 208 wastewater-treatment plants, 29 water-treatment plants, 21 electrical-power generating plants, 10 feed lots, 7 mining operations, and 8 solid-wastes disposal sites.

The mean discharges for most stations in the study area during the 1973-82 water years were significantly larger than the mean discharges for the period of record. These larger-than-normal flows are attributed to the intense rainfall and runoff that occurred in October 1981 and May 1982. Mean flows in streams throughout most of the upper Trinity River basin during the 1982 water year were more than 300 percent of the long-term mean flow.

Water in the upper Trinity River basin upstream of the Dallas-Fort Worth metroplex is generally calcium bicarbonate type water. In the West Fork Trinity River downstream of Fort Worth and on the main stem of the Trinity River from Dallas to Trinidad, the water is a mixed sodium calcium bicarbonate type water.

Average dissolved-solids concentrations in streams during the study period ranged from 174 mg/L in the Elm Fork Trinity River near Lewisville to 682 mg/L in Mountain Creek near Cedar Hill. The lowest average dissolved-solids concentrations occurred in the major reservoirs in the study area where concentrations seldom exceed 250 mg/L, except in Mountain Creek Lake.

Discharge-weighted average concentrations of dissolved solids during the 1973-82 water years ranged from 165 mg/L in the Elm Fork Trinity River near Lewisville (08053000) to 416 mg/L in Mountain Creek near Cedar Hill (08049600).

The discharge-weighted average concentrations of dissolved solids within and immediately upstream of the effluent-dominated reaches of the West Fork Trinity River and mainstem Trinity River ranged from 201 mg/L in the West Fork Trinity River at Beach Street, Fort Worth (08048543) to 285 mg/L in the West Fork Trinity River at Grand Prairie (08049500).

Daily dissolved-solids loads increased from 225 tons in the West Fork Trinity River at Beach Street, Fort Worth (08048543) to 2,410 tons in the Trinity River at Trinidad (08062700). The largest yield in the intervening drainage area between these stations was 0.68 ton/mi^2/d between the stations West Fork Trinity River at Beach Street, Fort Worth (08048543) and West Fork Trinity River at Grand Prairie (08049500). In the 450 mi^2 of intervening drainage area between these two stations, the average daily dissolved-solids load increased by 305 tons.

In the upper Trinity River basin upstream of the major municipal sewage effluents in the Dallas-Fort Worth metroplex, average dissolved-oxygen concentrations generally exceed 7.0 mg/L, average dissolved-oxygen percent-saturation values generally are greater than 70 percent, and average BOD concentrations generally are less than 4.0 mg/L. Within and downstream of the municipal sewage effluents, average dissolved-oxygen concentrations generally did not exceed 5.0 mg/L, average dissolved-oxygen percent-saturation values generally were less than 50 percent, and average BOD concentrations generally were greater than 12.0 mg/L.

Average concentrations of total nitrogen and total phosphorus in headwater streams upstream of the Dallas-Fort Worth metroplex were less than 2.0 mg/L and 0.20 mg/L, respectively. A notable exception was at Elm Fork Trinity River near Sanger where the average total-nitrogen concentration was 2.36 mg/L and the average total-phosphorus concentration was 0.80 mg/L. Within and downstream of the Dallas-Fort Worth metroplex, total-nitrogen and total-phosphorus concentrations increase significantly downstream of municipal waste-treatment plants in the Dallas-Fort Worth metroplex. At West Fork Trinity River at Grand Prairie, Trinity River below Dallas and East Fork Trinity River near Crandall average total-nitrogen concentrations were in excess of 9.0 mg/L and average total-phosphorus concentrations were in excess of 3.7 mg/L.

Total organic nitrogen was the dominant nitrogen species in most headwater streams upstream of the Dallas-Fort Worth metroplex except at Elm Fork Trinity River near Sanger where nitrate is the dominant species. Average total organic-nitrogen concentrations in most of these streams generally did not exceed 1.0 mg/L. Total ammonia nitrogen was the dominant nitrogen species downstream of the waste-treatment plants in the Dallas-Fort Worth metroplex. The highest average total ammonia-nitrogen concentration occurred at East Fork Trinity River near Crandall. Total ammonia-nitrogen concentrations at this location ranged from 0.00 to 24.0 mg/L and have been greater than 6.0 mg/L in more than 50 percent of the samples analyzed.

Daily loads of total nitrogen increased from 1.98 tons in the West Fork Trinity River at Beach Street, Fort Worth, to 36.3 tons at Trinity River at Trinidad; the daily loads of total phsophorus between these two sites increased from 0.20 to 8.76 tons. Estimated total-nitrogen and total-phosphorus yields from the total drainage area upstream from Fort Worth were 1.51 and 0.15 lb/mi^2/d, respectively. Yields of both nutrients increased greatly between Fort Worth and Dallas, averaging 11.6 and 3.93 lb/mi^2/d, respectively. Yields of total nitrogen and total phosphorus from the drainage area of the East Fork Trinity River near Crandall averaged 4.94 and 1.44 lb/mi^2/d.

Concentrations of trace metals in the upper Trinity River basin generally were quite low and often were less than the lower limits of detection. Concentrations of arsenic, barium, cadmium, chromium, copper, mercury, selenium, silver, and zinc were not detected in excess of the EPA's maximum or secondary contaminant levels. Iron concentrations exceeded secondary maximum contaminant levels at four river locations in the study. Lead was detected in excess of the 50 µg/L maximum contaminant level at Clear Fork Trinity River at Weatherford and Trinity River below Dallas. Manganese was detected in excess of the 50 µg/L secondary maximum contaminant level at 14 of the 16 river sampling locations. Based on records of 20 or more samples, manganese concentrations at sampling sites on the effluent-dominated reaches of streams in the Dallas-Fort Worth metroplex generally exceeded 50 µg/L in more than 50 percent of the samples analyzed. Manganese concentrations at other sites on streams generally were less than 20 µg/L in 50 percent of the samples analyzed.

Lindane, chlordane and dieldrin were the most frequently detected organochlorine insecticides. Concentrations of these compounds did not exceed 0.30 µg/L. Malathion and diazinon were the most frequently detected organophosphorus insecticides. Concentrations of malathion were not detected in excess of 0.42 µg/L. Maximum concentrations of diazinon detected were 1.2 µg/L at East Fork Trinity River near Crandall and 7.7 µg/L at Trinity River below Dallas. The most frequently detected chlorophenoxy herbicides were 2,4-D and 2,4,5-T. Concentrations of 2,4,5-T were not detected in excess of 0.76 µg/L. Concentrations of 2,4-D were detected in excess of 4.0 µg/L at Trinity River below Dallas and Trinity River near Rosser.

Specific conductance and concentrations of dissolved solids and major ions generally vary inversely with streamflow. Lowest values or concentrations generally occur during high streamflow periods of April, May, and June. Little variation was noted in these constituents downstream of the major reservoirs from July through March.

Seasonal variations in concentrations of dissolved oxygen in rivers in the study area are related inversely to seasonal variations in water temperature. The largest monthly-mean dissolved-oxygen concentrations occur during periods of cooler water temperatures, and the lowest monthly-mean dissolved-oxygen concentrations occur during warmer water temperatures.

Seasonal variations were detected in BOD concentrations at West Fork Trinity River at Beach Street, Forth Worth; Trinity River below Dallas; and Elm Fork Trinity River near Sanger. The smallest concentrations generally occurred during warm weather months, and the largest concentrations generally occurred during periods of high runoff, especially during the spring. Flows in the East Fork Trinity River near Crandall and Trinity River at Trinidad are composites of reservoir releases, waste effluents, and urban runoff. BOD concentrations at these sites varied significantly, but in no distinctive seasonal pattern.

No distinctive pattern of seasonal variations was noted for total nitrogen and total phosphorus outside of the effluent-dominated reaches of streams in the basin. The concentrations of total nitrogen and total phosphorus in the effluent-dominated streams showed seasonal variations. Data for the Trinity River at Trinidad show that concentrations of both nutrients were minimum in May and June during and after storm runoff and were maximum during low flow periods when the flows were predominantly waste effluents.

Seasonal variations of dissolved solids in reservoirs in the study area were small except during floods when inflows were extremely large. Significant seasonal variation of dissolved oxygen occurred in the reservoirs. During periods of winter circulation, dissolved-oxygen concentrations generally exceeded 8.0 mg/L and were uniformly distributed from surface to bottom. During periods of thermal stratification, dissolved-oxygen concentrations of less than 1.0 mg/L were not uncommon in the hypolimnion.

Seasonal variations also occurred in concentrations of nitrite plus nitrate nitrogen, ammonia nitrogen, and total phosphorus in the reservoirs in the study area. The largest concentrations of nitrite plus nitrate nitrogen occur during winter and spring, and lowest concentrations occur during the summer. Seasonal variations in concentrations of ammonia nitrogen and total phosphorus are related to thermal stratification. In deep areas of the reservoirs, during the summer months, chemical reduction of bottom sediments releases ammonia and phosphorus to the hypolimnion and concentrations of these nutrients increase significantly.

Trend analyses for dissolved solids and selected major inorganic constituents or properties were performed at 17 stream-gaging stations in the upper Trinity River basin. Significant trends were detected in one or more of the constituents or properties at six of the stations. Uptrends were detected in dissolved solids, dissolved calcium, dissolved sodium, dissolved chloride, dissolved sulfate, and hardness at East Fork Trinity River near Crandall. The largest trend in the study area occurred at Mountain Creek near Cedar Hill, Texas where a downtrend of 18.2 mg/L/yr in hardness was detected. Downtrends in volume-weighted average concentrations of dissolved solids, dissolved chloride, dissolved sulfate, and hardness were detected in Lake Arlington. No trends in these constituents were detected in Lewisville Lake or Cedar Creek Reservoir.

Trend analyses for dissolved oxygen, dissolved-oxygen percent saturation, and biochemical oxygen demand were performed on data collected at periodic intervals at eight locations in the upper Trinity River basin, and trends in one or more of the constituents were detected at five locations. Downtrends in BOD ranging from 0.45 to 1.64 mg/L/yr were detected at West Fork Trinity River at Beach Street, Fort Worth; Trinity River below Dallas; and Trinity River near Rosser. Uptrends in dissolved-oxygen concentrations ranging from 0.20 to 0.39 mg/L and in dissolved-oxygen percent saturation ranging from 2.4 to 4.6 percent per year also were detected at these three locations. Downtrends in disssolved oxygen of 0.21 mg/L/yr and in dissolved-oxygen percent saturation of 1.7 percent per year were detected at West Fork Trinity River at Grand Prairie.

Trend analysis of dissolved-oxygen data using daily-mean dissolved-oxygen concentrations agrees with the trend-analysis test performed with data collected at periodic intervals at Trinity River below Dallas and Trinity River near Rosser. Uptrends in dissolved oxygen were detected at both stations. Results of the trend-analysis test on daily-mean dissolved-oxygen concentrations did not agree with the trend-analysis test using data collected at periodic intervals at West Fork Trinity River at Beach Street, Fort Worth and West Fork Trinity River at Grand Prairie. No trends were detected at either station using daily-mean dissolved-oxygen concentrations. Additional data analyses at these two locations indicate that there probably is no trend in dissolved-oxygen concentrations at West Fork Trinity River at Beach Street, Fort Worth and that there probably is a downtrend in dissolved-oxygen concentrations at West Fork Trinity River at Grand Prairie.

Trend analyses for total nitrogen, total organic nitrogen, total ammonia nitrogen, total nitrite plus nitrate nitrogen and total phosphorus were performed at eight stream-gaging stations in the upper Trinity River basin. Organic nitrogen showed an uptrend at six stations, nitrite plus nitrate nitrogen showed an uptrend at four locations, and ammonia nitrogen showed uptrends at two locations. Total phosphorus showed downtrends at five locations. An uptrend of 0.02 mg/L/yr in volume-weighted average concentrations of nitrite plus nitrate was detected in Lewisville Lake, and a downtrend in total phosphorus of 0.01 mg/L/yr was detected in Lake Arlington.

Data collected at Trinity River at Trinidad do not adequately represent areal or temporal variations throughout the hydrologic accounting unit. The major tributaries upstream of the Dallas-Fort Worth metroplex flow through rural, sparsely populated, agricultural areas. In the Dallas-Fort Worth area, these tributaries and the main stem of the Trinity River receive large amounts of urban runoff as well as large amounts of effluents from wastewater-treatment plants resulting in increased concentrations of dissolved solids, biochemical oxygen demand, total nitrogen, total phosphorus, and dissolved manganese, and decreases in dissolved-oxygen concentrations. The trends detected in major inorganic constituents at Trinity River at Trinidad generally were representative of trends detected at other stations on the main stem of the Trinity River but were not representative of trends in inorganic constituents detected on the West Fork or the East Fork of the Trinity River. No trends in dissolved oxygen or biochemical oxygen demand were detected at Trinity River at Trinidad, yet trends in one or both of these constituents were detected at five locations upstream of Trinidad. Data collected at Trinity River at Trinidad did reflect the general uptrends in organic nitrogen and nitrite plus nitrate nitrogen detected at upstream locations, but did not reflect the general uptrends in total nitrogen or the downtrends in total phosphorus.

The data-collection program needed to define areal and temporal variability throughout Hydrologic Accounting Unit 120301 consists of bimonthly sampling of major inorganic constituents, total nutrients, BOD, dissoved oxygen, and indicator bacteria; quarterly sampling for dissolved minor elements; and semiannual sampling for total pesticides at 13 streamflow stations. In addition, three intensive water-quality surveys per year would be conducted on nine of the major reservoirs in the hyrologic accounting unit.

In assessing the value of daily sampling over periodic sampling, monthly and annual volume-weighted average concentrations and loads for four constituents or properties and loads for three constituents were compared using different sampling intervals. Tests were conducted on data for three different simulated sampling intervals and on actual data collected at periodic intervals at Trinity River at Trinidad for a 4-year period (1978-81) and at Trinity River near Rosser for a 10-year period (1973-82).

These data indicate that if the data user is willing to accept specified accuracy limits, bimonthly or more frequent interval data collection would be adequate to meet data needs, and daily sampling of specific conductance would not be required.

SELECTED REFERENCES

Andrews, F. L., and Gibbons, W. J., 1983, Water Quality of Lake Arlington on Village Creek, north-central Texas 1973-81: U.S. Geological Survey Water-Resources Investigations Report 83-4196, 126 p.

Briggs, J. C., and Ficke, J. F., 1978, Quality of rivers of the United States, 1975 water year--based on the National Stream Quality Accounting Network (NASQAN): U.S. Geological Survey Open-File Report 78-200, 474 p.

Buckner, H. D., and Kurklin, J. K., 1984, Floods in south-central Oklahoma and north-central Texas, October 1981: U.S. Geological Survey Open-File Report 84-065, 112 p.

Champagne, Larry, and Promise, John, 1983, Trinity River quality: North Central Texas Council of Governments CAM Report 83-1, p. 32.

Crawford, C. G., Slack, J. R., and Hirsch, R. M., 1983, Nonparametric tests for trends in water-quality data using the Statistical Analysis System: U.S. Geological Survey Open-File Report 83-550, 102 p.

Darton, N. H., Stevenson, L. W., and Gardner, J. A., compilers, 1937, Geologic map of Texas: U.S. Geological Survey, scale 1:500,000.

Dowell, C. L., and Petty, R. G., 1973, Dams and reservoirs in Texas, part 2: Texas Water Development Board Report 126, 327 p.

Ficke, J. F., and Hawkinson, R. O., 1975, The National Stream Quality Accounting Network (NASQAN)--some questions and answers: U.S. Geological Survey Circular 719, 23 p.

Hawkinson, R. O., Ficke, J. F., and Saindon, L. G., 1977, Quality of rivers of the United States, 1974 water year--based on the National Stream Quality Accounting Network (NASQAN): U.S. Geolological Survey Open-File Report 77-151, 199 p.

Hem, John D., 1970, Study and interpretation of the chemical characteristics of natural waters (2d ed.): U.S. Geological Survey Water-Supply Paper 1473, 363 p.

Langbein, W. B., and Durum, W. H., 1967, The aeration capacity of streams: U.S. Geological Survey Circular 542, 6 p.

Leifeste, D. K., and Hughes, L. S., 1967, Reconnaissance of the chemical quality of surface waters of the Trinity River basin, Texas: Texas Water Development Board Report 67, 65 p.

National Academy of Sciences, National Academy of Engineers, 1973 [1974], Water quality criteria, 1972: Washington, D.C., Report of the Committee on Water Quality Criteria, 594 p.

Peckham, R. C., Souders, V. L., Dillard, J. W., and Baker, B. B., 1963, Reconnaissance investigation of the ground-water resources of the Trinity River basin, Texas: Texas Water Commission Bulletin 6309, 110 p.

Rawson, Jack, 1974, The quality of surface waters in Texas: U.S. Geological Survey Water-Resources Investigations Report 7-74, 73 p.

SAS Institute, Inc., 1982a, SAS users guide-basics, 1982 edition: Cary, North Carolina, 924 p.

----- 1982b, SAS users guide-statistics, 1982 edition: Cary, North Carolina, 584 p.

Smith, R. A., Hirsch, R. M., and Slack, J. R., 1982, A study of the trends in total phosphorus measurements at NASQAN stations: U.S. Geological Survey Water-Supply Paper 2190, 34 p.

Steele, T. D., Gilroy, E. J., and Hawkinson, R. O., 1974, An assessment of the areal and temporal variations in streamflow quality using selected data from the National Stream Quality Accounting Network: U.S. Geological Survey Open-File Report 74-217.

Texas Conservation Needs Committee, 1970, Conservation needs inventory: Texas Conservation Needs Committee Report, 297 p.

Texas Department of Water Resources, 1981, Water use, projected water requirements, and related data and information for the Standard Metropolitan Statistical Areas in Texas: Texas Department of Water Resources Report LP-141, 224 p.

Texas Water Quality Board, 1973, Texas water quality standards: Texas Water Quality Board publication, 78 p.

Trinity River Authority, 1974, Trinity River basin water quality management plan: Trinity River Authority Report, 443 p.

U.S. Environmental Protection Agency, 1976, National interim primary drinking water regulations: Office of Water Supply, EPA-570/9-76-003, 159 p.

----- 1977, National secondary drinking water regulations: Federal Register, v. 42, No. 62, pt. I, p. 17143-17147.

U.S. Geological Survey, 1976, Hydrologic unit map--1974, State of Texas: U.S. Geological Survey, scale 1:500,000, 4 sheets.

U.S. National Oceanic and Atmospheric Administration, 1981, Local climatological data, annual summary with comparative data, 1981, Dallas-Fort Worth, Texas: Asheville, North Carolina, National Environmental, Data and Information Service, 4 p.

----- 1982, Local climatological data, monthly summaries, 1982, Dallas-Fort Worth, Texas: Asheville, North Carolina, National Environmental Data and Information Service, 48 p.

Wells, F. C., and Schertz, T. L., 1984, Computation and use of volume-weighted average concentrations to determine long-term variations of selected water-quality constituents in lakes and reservoirs: U.S. Geological Survey Water-Resources Investigations Report 83-4287, 8 p.

SUPPLEMENTAL INFORMATION

TABLE 20.--STATISTICAL SUMMARY OF SELECTED WATER-QUALITY DATA IN THE UPPER TRINITY RIVER BASIN, TEXAS

STATION NUMBER: 08043000 STATION NAME: BRIDGEPORT RESERVOIR ABOVE BRIDGEPORT, TEX.

LATITUDE: 331322 LONGITUDE: 0974954 COUNTY: WISE DRAINAGE AREA: 1111.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM JUN 1973 TO JUN 1982

	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
WATER-QUALITY CONSTITUENT	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	7	34.00	2.50	18.50	34.00	28.00	20.00	8.50	2.50
SPECIFIC CONDUCTANCE (UMHOS)	9	396.00	245.00	342.78	396.00	367.00	347.00	333.00	245.00
PH (UNITS)	5	8.20	7.10	--	8.20	8.15	7.90	7.15	7.10
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	5	16.00	1.40	7.14	16.00	15.00	2.60	1.55	1.40
ALKALINITY FIELD (MG/L AS CACO3)	9	123.00	85.00	109.78	123.00	116.00	113.00	105.00	85.00
BICARBONATE FET-FLD (MG/L AS HCO3)	7	150.00	128.00	138.00	150.00	142.00	140.00	128.00	128.00
CARBONATE FET-FLD (MG/L AS CO3)	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NITROGEN, NITRATE TOTAL (MG/L AS N)	1	0.20	0.20						
HARDNESS (MG/L AS CACO3)	9	140.00	93.00	122.56	140.00	130.00	120.00	120.00	93.00
HARDNESS, NONCARBONATE (MG/L CACO3)	9	22.00	6.00	13.33	22.00	16.50	14.00	9.00	6.00
CALCIUM DISSOLVED (MG/L AS CA)	9	42.00	31.00	38.67	42.00	42.00	39.00	36.00	31.00
MAGNESIUM, DISSOLVED (MG/L AS MG)	9	7.80	3.90	6.37	7.80	7.05	6.50	5.95	3.90
SODIUM, DISSOLVED (MG/L AS NA)	8	23.00	9.40	18.05	23.00	21.50	18.00	17.00	9.40
SODIUM ADSORPTION RATIO	9	0.90	0.40	0.72	0.90	0.85	0.70	0.70	0.40
PERCENT SODIUM	8	26.00	17.00	22.88	26.00	25.75	22.50	22.00	17.00
POTASSIUM, DISSOLVED (MG/L AS K)	8	5.80	4.40	5.18	5.80	5.58	5.20	4.83	4.40
CHLORIDE, DISSOLVED (MG/L AS CL)	9	38.00	15.00	28.22	38.00	33.00	27.00	26.00	15.00
SULFATE DISSOLVED (MG/L AS SO4)	9	27.00	11.00	18.00	27.00	22.00	16.00	16.00	11.00
FLUORIDE, DISSOLVED (MG/L AS F)	8	0.30	0.00	0.21	0.30	0.30	0.20	0.20	0.00
SILICA, DISSOLVED (MG/L AS SIO2)	9	7.70	4.50	5.93	7.70	6.30	5.90	5.50	4.50
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	9	219.00	134.00	185.89	219.00	204.00	188.00	175.00	134.00
SOLIDS, DISSOLVED (TONS PER AC-FT)	9	0.30	0.18	0.25	0.30	0.28	0.26	0.24	0.18

TABLE 20.--STATISTICAL SUMMARY OF SELECTED WATER-QUALITY DATA IN THE UPPER TRINITY RIVER BASIN, TEXAS--CONTINUED

STATION NUMBER: 08045400 STATION NAME: LAKE WORTH ABOVE FORT WORTH, TEX.

LATITUDE: 324721 LONGITUDE: 0972458 COUNTY: TARRANT DRAINAGE AREA: 2064.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM JUN 1973 TO JUL 1982

	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
WATER-QUALITY CONSTITUENT	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	8	28.00	12.00	22.44	28.00	27.87	24.25	15.63	12.00
SPECIFIC CONDUCTANCE (UMHOS)	9	465.00	318.00	418.22	465.00	441.00	424.00	408.50	318.00
PH (UNITS)	5	8.00	7.40	--	8.00	7.90	7.70	7.50	7.40
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	5	9.60	2.50	5.50	9.60	8.00	5.40	3.05	2.50
ALKALINITY FIELD (MG/L AS CACO3)	9	139.00	110.00	124.33	139.00	131.50	125.00	115.50	110.00
BICARBONATE FET-FLD (MG/L AS HCO3)	7	170.00	140.00	155.00	170.00	161.00	160.00	142.00	140.00
CARBONATE FET-FLD (MG/L AS CO3)	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NITROGEN, NITRATE TOTAL (MG/L AS N)	1	0.20	0.20						
HARDNESS (MG/L AS CACO3)	9	160.00	120.00	138.89	160.00	150.00	140.00	130.00	120.00
HARDNESS, NONCARBONATE (MG/L CACO3)	9	19.00	7.00	14.11	19.00	17.50	14.00	11.00	7.00
CALCIUM DISSOLVED (MG/L AS CA)	9	49.00	38.00	42.00	49.00	44.50	44.00	38.00	38.00
MAGNESIUM, DISSOLVED (MG/L AS MG)	9	9.40	5.70	8.09	9.40	9.05	8.60	6.85	5.70
SODIUM, DISSOLVED (MG/L AS NA)	8	31.00	14.00	27.13	31.00	30.00	29.00	27.00	14.00
SODIUM ADSORPTION RATIO	9	1.20	0.60	1.03	1.20	1.20	1.00	0.95	0.60
PERCENT SODIUM	8	32.00	20.00	28.88	32.00	32.00	29.50	28.00	20.00
POTASSIUM, DISSOLVED (MG/L AS K)	8	6.80	4.80	5.75	6.80	6.33	5.70	5.13	4.80
CHLORIDE, DISSOLVED (MG/L AS CL)	9	45.00	17.00	38.00	45.00	43.00	41.00	35.50	17.00
SULFATE DISSOLVED (MG/L AS SO4)	9	29.00	16.00	24.67	29.00	27.00	26.00	23.00	16.00
FLUORIDE, DISSOLVED (MG/L AS F)	8	0.50	0.20	0.31	0.50	0.38	0.30	0.23	0.20
SILICA, DISSOLVED (MG/L AS SIO2)	9	8.20	4.50	5.96	8.20	7.25	5.50	4.85	4.50
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	9	251.00	170.00	225.56	251.00	239.50	232.00	218.50	170.00
SOLIDS, DISSOLVED (TONS PER AC-FT)	9	0.34	0.23	0.31	0.34	0.33	0.31	0.30	0.23

TABLE 20.--STATISTICAL SUMMARY OF SELECTED WATER-QUALITY DATA IN THE UPPER TRINITY RIVER BASIN, TEXAS--CONTINUED

STATION NUMBER: 08045850 STATION NAME: CLEAR FORK TRINITY RIVER NEAR WEATHERFORD, TEX.

LATITUDE: 324425 LONGITUDE: 0973906 COUNTY: PARKER DRAINAGE AREA: 121.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM OCT 1980 TO AUG 1982

	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
WATER-QUALITY CONSTITUENT	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	12	24.50	5.50	17.21	24.50	24.00	16.75	14.00	5.50
STREAMFLOW, INSTANTANEOUS (CFS)	12	465.00	0.80	50.55	465.00	21.75	2.95	1.05	0.80
TURBIDITY (FTU)	12	200.00	0.50	31.70	200.00	31.25	12.45	2.48	0.50
COLOR (PLATINUM-COBALT UNITS)	12	120.00	0.00	17.75	120.00	23.75	5.00	3.50	0.00
SPECIFIC CONDUCTANCE (UMHOS)	12	700.00	200.00	535.67	700.00	678.25	597.50	380.00	200.00
OXYGEN, DISSOLVED (MG/L)	11	10.80	4.00	7.08	10.80	8.90	6.70	5.50	4.00
OXYGEN, DISSOLVED (PERCENT SATURATION)	11	91.00	49.00	72.55	91.00	89.00	69.00	61.00	49.00
OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L)	12	1.80	0.20	1.12	1.80	1.70	1.10	0.67	0.20
PH (UNITS)	12	8.10	7.50	--	8.10	8.00	7.85	7.63	7.50
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	12	13.00	1.10	6.94	13.00	11.50	7.10	2.55	1.10
ALKALINITY FIELD (MG/L AS CACO3)	12	300.00	72.00	204.33	300.00	267.50	210.00	132.50	72.00
SOLIDS, RESIDUE AT 105 DEG. C, SUSPENDED	12	81.00	0.00	31.33	81.00	44.50	24.00	11.50	0.00
NITROGEN, TOTAL (MG/L AS N)	10	1.20	0.53	0.86	1.20	1.05	0.87	0.59	0.53
NITROGEN, ORGANIC TOTAL (MG/L AS N)	11	1.50	0.41	0.68	1.50	0.79	0.64	0.48	0.41
NITROGEN, AMMONIA TOTAL (MG/L AS N)	12	0.19	0.00	0.09	0.19	0.13	0.09	0.06	0.00
NITROGEN, NITRITE TOTAL (MG/L AS N)	12	0.08	0.00	0.01	0.08	0.02	0.00	0.00	0.00
NITROGEN, NITRATE TOTAL (MG/L AS N)	8	0.15	0.00	0.06	0.15	0.14	0.06	0.00	0.00
NITROGEN,AMMONIA + ORGANIC TOTAL (MG/L AS N)	12	1.60	0.51	0.80	1.60	0.89	0.79	0.59	0.51
NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	12	0.27	0.00	0.09	0.27	0.19	0.06	0.00	0.00
PHOSPHORUS, TOTAL (MG/L AS P)	12	0.11	0.00	0.04	0.11	0.06	0.04	0.03	0.00
CARBON, ORGANIC TOTAL (MG/L AS C)	12	9.70	2.80	5.26	9.70	6.95	4.85	3.73	2.80
HARDNESS (MG/L AS CACO3)	12	330.00	78.00	233.17	330.00	305.00	250.00	152.50	78.00
HARDNESS, NONCARBONATE (MG/L CACO3)	12	40.00	6.00	29.25	40.00	38.25	35.00	18.75	6.00
CALCIUM DISSOLVED (MG/L AS CA)	12	120.00	25.00	80.75	120.00	107.50	87.00	49.25	25.00
MAGNESIUM, DISSOLVED (MG/L AS MG)	12	10.00	3.70	7.63	10.00	8.48	7.90	7.03	3.70
SODIUM, DISSOLVED (MG/L AS NA)	12	28.00	6.70	21.31	28.00	27.00	24.50	15.25	6.70
SODIUM ADSORPTION RATIO	12	0.80	0.30	0.62	0.80	0.70	0.70	0.53	0.30
PERCENT SODIUM	12	20.00	14.00	16.33	20.00	17.00	16.00	15.00	14.00
POTASSIUM, DISSOLVED (MG/L AS K)	12	3.80	1.70	2.69	3.80	3.20	2.65	2.23	1.70
CHLORIDE, DISSOLVED (MG/L AS CL)	12	40.00	10.00	30.00	40.00	37.75	32.50	22.25	10.00
SULFATE DISSOLVED (MG/L AS SO4)	12	49.00	5.00	31.82	49.00	43.00	36.00	18.50	5.00
FLUORIDE, DISSOLVED (MG/L AS F)	12	0.40	0.20	0.28	0.40	0.30	0.30	0.20	0.20
SILICA, DISSOLVED (MG/L AS SIO2)	12	16.00	5.00	11.59	16.00	15.00	14.50	7.33	5.00
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	12	430.00	102.00	308.67	430.00	394.00	337.00	204.50	102.00
SOLIDS, DISSOLVED (TONS PER DAY)	12	128.00	0.83	17.74	128.00	11.98	2.75	1.18	0.83
SOLIDS, DISSOLVED (TONS PER AC-FT)	12	0.58	0.14	0.42	0.58	0.54	0.46	0.28	0.14

TABLE 20.--STATISTICAL SUMMARY OF SELECTED WATER-QUALITY DATA IN THE UPPER TRINITY RIVER BASIN, TEXAS--CONTINUED

STATION NUMBER: 08045850 STATION NAME: CLEAR FORK TRINITY RIVER NEAR WEATHERFORD, TEX.

LATITUDE: 324425 LONGITUDE: 0973906 COUNTY: PARKER DRAINAGE AREA: 121.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM JAN 1981 TO AUG 1982

	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
WATER-QUALITY CONSTITUENT	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
ARSENIC DISSOLVED (UG/L AS AS)	6	2.00	1.00	1.50	2.00	2.00	1.50	1.00	1.00
BARIUM, DISSOLVED (UG/L AS BA)	6	200.00	63.00	115.50	200.00	147.50	100.00	90.75	63.00
CADMIUM DISSOLVED (UG/L AS CD)	6	2.00	0.00	0.33	2.00	0.50	0.00	0.00	0.00
CHROMIUM, DISSOLVED (UG/L AS CR)	6	10.00	0.00	3.33	10.00	10.00	0.00	0.00	0.00
COPPER, DISSOLVED (UG/L AS CU)	6	3.00	0.00	0.83	3.00	1.50	0.50	0.00	0.00
IRON, DISSOLVED (UG/L AS FE)	6	70.00	0.00	16.83	70.00	29.50	7.50	0.00	0.00
LEAD, DISSOLVED (UG/L AS PB)	6	75.00	0.00	14.83	75.00	27.00	1.50	0.00	0.00
MANGANESE, DISSOLVED (UG/L AS MN)	6	180.00	40.00	72.67	180.00	90.00	56.50	42.25	40.00
SILVER, DISSOLVED (UG/L AS AG)	6	2.00	0.00	0.50	2.00	1.25	0.00	0.00	0.00
ZINC, DISSOLVED (UG/L AS ZN)	6	80.00	0.00	18.33	80.00	28.25	8.00	2.25	0.00
SELENIUM, DISSOLVED (UG/L AS SE)	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MERCURY DISSOLVED (UG/L AS HG)	6	0.40	0.00	0.13	0.40	0.25	0.10	0.00	0.00

TABLE 20.--STATISTICAL SUMMARY OF SELECTED WATER-QUALITY DATA IN THE UPPER TRINITY RIVER BASIN, TEXAS--CONTINUED

STATION NUMBER: 08046500[a/] STATION NAME: BENBROOK LAKE NEAR BENBROOK, TEX.

LATITUDE: 323902 LONGITUDE: 0972654 COUNTY: TARRANT DRAINAGE AREA: 429.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM JUN 1973 TO JUL 1979

	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
WATER-QUALITY CONSTITUENT	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	6	31.00	11.00	22.50	31.00	31.00	24.00	13.25	11.00
SPECIFIC CONDUCTANCE (UMHOS)	7	345.00	298.00	326.00	345.00	340.00	328.00	319.00	298.00
PH (UNITS)	6	8.00	7.10	--	8.00	7.85	7.65	7.40	7.10
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	6	17.00	2.30	6.43	17.00	9.05	4.85	2.98	2.30
ALKALINITY FIELD (MG/L AS CACO3)	7	121.00	98.00	108.43	121.00	115.00	105.00	105.00	98.00
BICARBONATE FET-FLD (MG/L AS HCO3)	7	147.00	120.00	132.14	147.00	140.00	128.00	128.00	120.00
CARBONATE FET-FLD (MG/L AS CO3)	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NITROGEN, NITRATE TOTAL (MG/L AS N)	1	0.10	0.10						
HARDNESS (MG/L AS CACO3)	7	130.00	120.00	122.86	130.00	130.00	120.00	120.00	120.00
HARDNESS, NONCARBONATE (MG/L CACO3)	7	18.00	8.00	14.29	18.00	17.00	14.00	13.00	8.00
CALCIUM DISSOLVED (MG/L AS CA)	7	41.00	37.00	39.29	41.00	41.00	39.00	38.00	37.00
MAGNESIUM, DISSOLVED (MG/L AS MG)	7	7.00	5.20	5.93	7.00	6.30	5.90	5.20	5.20
SODIUM, DISSOLVED (MG/L AS NA)	6	18.00	15.00	16.17	18.00	17.25	16.00	15.00	15.00
SODIUM ADSORPTION RATIO	7	0.70	0.60	0.66	0.70	0.70	0.70	0.60	0.60
PERCENT SODIUM	6	23.00	20.00	21.83	23.00	23.00	22.00	20.75	20.00
POTASSIUM, DISSOLVED (MG/L AS K)	6	4.10	3.50	3.80	4.10	4.03	3.80	3.58	3.50
CHLORIDE, DISSOLVED (MG/L AS CL)	7	23.00	16.00	19.57	23.00	22.00	19.00	18.00	16.00
SULFATE DISSOLVED (MG/L AS SO4)	7	25.00	21.00	22.86	25.00	24.00	23.00	21.00	21.00
FLUORIDE, DISSOLVED (MG/L AS F)	6	0.30	0.00	0.22	0.30	0.30	0.25	0.15	0.00
SILICA, DISSOLVED (MG/L AS SIO2)	7	7.70	2.10	5.16	7.70	7.00	6.00	2.50	2.10
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	7	193.00	166.00	177.29	193.00	185.00	176.00	169.00	166.00
SOLIDS, DISSOLVED (TONS PER AC-FT)	7	0.26	0.23	0.24	0.26	0.25	0.24	0.23	0.23

[a/]Data in this table represent approximately one sample per year collected near the dam or at the reservoir outflow. The table does not include data collected during comprehensive reservoir surveys.

TABLE 20.--STATISTICAL SUMMARY OF SELECTED WATER-QUALITY DATA IN THE UPPER TRINITY RIVER BASIN, TEXAS --CONTINUED

STATION NUMBER: 08047000 STATION NAME: CLEAR FORK TRINITY RIVER NEAR BENBROOK

LATITUDE: 323954 LONGITUDE: 0972630 COUNTY: TARRANT DRAINAGE AREA; 431.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM JAN 1981 TO JUL 1982

WATER-QUALITY CONSTITUENT	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	6	30.00	8.50	19.92	30.00	28.88	21.50	9.25	8.50
STREAMFLOW, INSTANTANEOUS (CFS)	6	42.00	0.70	19.55	42.00	36.00	16.50	5.87	0.70
TURBIDITY (FTU)	6	7.00	0.40	3.07	7.00	4.83	2.85	1.00	0.40
COLOR (PLATINUMCOBALT UNITS)	6	15.00	5.00	7.50	15.00	11.25	5.00	5.00	5.00
SPECIFIC CONDUCTANCE (UMHOS)	6	389.00	310.00	349.17	389.00	371.75	353.50	319.75	310.00
OXYGEN, DISSOLVED (MG/L)	6	11.10	6.20	8.35	11.10	10.87	7.55	6.72	6.20
OXYGEN, DISSOLVED (PERCENT SATURATION)	6	103.00	72.00	91.00	103.00	98.50	93.50	83.25	72.00
OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L)	6	2.20	0.50	1.23	2.20	1.60	1.15	0.88	0.50
PH (UNITS)	6	8.50	7.40	7.80	8.50	8.20	7.70	7.40	7.40
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	6	12.00	0.70	5.87	12.00	11.25	5.00	1.30	0.70
ALKALINITY FIELD (MG/L AS CACO3)	6	160.00	98.00	123.00	160.00	145.00	115.00	107.00	98.00
SOLIDS, RESIDUE AT 105 DEG. C, SUSPENDED (MG/L)	6	10.00	0.00	5.00	10.00	10.00	4.50	0.75	0.00
NITROGEN, TOTAL (MG/L AS N)	5	3.00	0.81	1.31	3.00	2.00	0.88	0.84	0.81
NITROGEN, ORGANIC TOTAL (MG/L AS N)	5	2.70	0.61	1.09	2.70	1.78	0.64	0.63	0.61
NITROGEN, AMMONIA TOTAL (MG/L AS N)	6	0.95	0.00	0.24	0.95	0.36	0.12	0.06	0.00
NITROGEN, NITRITE TOTAL (MG/L AS N)	6	0.02	0.00	0.01	0.02	0.02	0.02	0.00	0.00
NITROGEN, NITRATE TOTAL (MG/L AS N)	5	0.29	0.08	0.19	0.29	0.27	0.18	0.13	0.08
NITROGEN, AMMONIA + ORGANIC (MG/L AS N)	6	2.80	0.52	1.23	2.80	2.05	0.78	0.65	0.52
NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	6	0.29	0.00	0.17	0.29	0.25	0.20	0.08	0.00
PHOSPHORUS, TOTAL (MG/L AS P)	6	0.16	0.00	0.07	0.16	0.12	0.05	0.02	0.00
CARBON, ORGANIC TOTAL (MG/L AS C)	6	8.40	3.90	5.12	8.40	5.85	4.50	4.28	3.90
HARDNESS (MG/L AS CACO3)	6	180.00	110.00	140.00	180.00	157.50	135.00	125.00	110.00
HARDNESS, NONCARBONATE (MG/L CACO3)	6	22.00	10.00	18.17	22.00	22.00	21.00	12.25	10.00
CALCIUM DISSOLVED (MG/L AS CA)	6	62.00	34.00	46.50	62.00	53.00	45.00	40.75	34.00
MAGNESIUM, DISSOLVED (MG/L AS MG)	6	6.40	5.40	6.00	6.40	6.33	6.15	5.55	5.40
SODIUM, DISSOLVED (MG/L AS NA)	6	19.00	14.00	16.83	19.00	19.00	17.50	14.00	14.00
SODIUM ADSORPTION RATIO	6	0.80	0.50	0.65	0.80	0.73	0.65	0.58	0.50
PERCENT SODIUM	6	26.00	16.00	20.17	26.00	23.00	20.00	16.75	16.00
POTASSIUM, DISSOLVED (MG/L AS K)	6	4.10	3.50	3.85	4.10	4.10	3.90	3.58	3.50
CHLORIDE, DISSOLVED (MG/L AS CL)	6	23.00	15.00	19.17	23.00	21.50	19.00	17.25	15.00
SULFATE DISSOLVED (MG/L AS SO4)	6	31.00	17.00	25.33	31.00	30.25	27.00	19.25	17.00
FLUORIDE, DISSOLVED (MG/L AS F)	6	0.30	0.20	0.28	0.30	0.30	0.30	0.28	0.20
SILICA, DISSOLVED (MG/L AS SIO2)	6	9.50	0.50	5.02	9.50	7.55	5.45	1.85	0.50
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	6	240.00	170.00	196.67	240.00	210.00	195.00	177.50	170.00
SOLIDS, DISSOLVED (TONS PER DAY)	6	20.00	0.38	9.95	20.00	17.00	9.60	3.17	0.38
SOLIDS, DISSOLVED (TONS PER AC-FT)	6	0.32	0.24	0.27	0.32	0.28	0.27	0.24	0.24

TABLE 20.--STATISTICAL SUMMARY OF SELECTED WATER-QUALITY DATA IN THE UPPER TRINITY RIVER BASIN, TEXAS--CONTINUED

STATION NUMBER: 08047000 STATION NAME: CLEAR FORK TRINITY RIVER NEAR BENBROOK, TEX.

LATITUDE: 323954 LONGITUDE: 0972630 COUNTY: TARRANT DRAINAGE AREA: 431.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM JAN 1981 TO JUL 1982

	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
WATER-QUALITY CONSTITUENT	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
ARSENIC DISSOLVED (UG/L AS AS)	6	7.00	1.00	3.67	7.00	6.25	3.00	1.75	1.00
BARIUM, DISSOLVED (UG/L AS BA)	6	61.00	47.00	54.17	61.00	60.25	53.50	49.25	47.00
CADMIUM DISSOLVED (UG/L AS CD)	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CHROMIUM, DISSOLVED (UG/L AS CR)	6	40.00	0.00	8.33	40.00	17.50	0.00	0.00	0.00
COPPER, DISSOLVED (UG/L AS CU)	6	1.00	0.00	0.17	1.00	0.25	0.00	0.00	0.00
IRON, DISSOLVED (UG/L AS FE)	6	13.00	0.00	2.67	13.00	5.50	0.00	0.00	0.00
LEAD, DISSOLVED (UG/L AS PB)	6	12.00	0.00	2.33	12.00	4.50	0.00	0.00	0.00
MANGANESE, DISSOLVED (UG/L AS MN)	6	330.00	0.00	87.33	330.00	210.00	9.00	4.50	0.00
SILVER, DISSOLVED (UG/L AS AG)	6	1.00	0.00	0.33	1.00	1.00	0.00	0.00	0.00
ZINC, DISSOLVED (UG/L AS ZN)	6	20.00	0.00	5.50	20.00	11.75	2.00	0.00	0.00
SELENIUM, DISSOLVED (UG/L AS SE)	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MERCURY DISSOLVED (UG/L AS HG)	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

TABLE 20.--STATISTICAL SUMMARY OF SELECTED WATER-QUALITY DATA IN THE UPPER TRINITY RIVER BASIN, TEXAS--CONTINUED

STATION NUMBER: 08048000 STATION NAME: WEST FORK TRINITY RIVER AT FORT WORTH, TEX.

LATITUDE: 324539 LONGITUDE: 0971956 COUNTY: TARRANT DRAINAGE AREA: 2615.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM OCT 1972 TO SEPT 1976

	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
WATER-QUALITY CONSTITUENT	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	48	32.00	5.50	20.72	31.27	26.87	21.25	15.37	8.22
STREAMFLOW, INSTANTANEOUS (CFS)	36	2550.00	0.60	189.86	1597.99	168.25	27.00	12.00	1.45
SPECIFIC CONDUCTANCE (UMHOS)	48	630.00	255.00	425.98	595.15	484.50	421.00	354.75	285.20
OXYGEN, DISSOLVED (MG/L)	48	14.60	4.80	8.73	12.39	10.47	8.60	6.72	5.50
OXYGEN, DISSOLVED (PERCENT SATURATION)	48	157.00	51.00	95.31	142.40	109.75	92.00	80.25	62.90
OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L)	48	12.00	0.80	4.09	8.62	5.20	3.95	2.82	0.94
PH (UNITS)	48	8.50	6.40	--	8.25	7.77	7.50	7.10	6.54
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	48	105.00	0.70	17.87	89.15	22.75	9.05	4.58	1.75
ALKALINITY FIELD (MG/L AS CACO3)	48	215.00	65.00	143.02	188.65	165.75	141.00	121.50	97.70
BICARBONATE FET-FLD (MG/L AS HCO3)	48	262.00	79.00	174.37	230.20	202.50	172.00	148.50	119.15
CARBONATE FET-FLD (MG/L AS CO3)	48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NITROGEN, TOTAL (MG/L AS N)	30	1.80	0.50	1.04	1.75	1.22	0.97	0.78	0.52
NITROGEN, ORGANIC TOTAL (MG/L AS N)	48	1.40	0.05	0.58	1.25	0.84	0.60	0.25	0.08
NITROGEN, AMMONIA TOTAL (MG/L AS N)	48	0.70	0.00	0.15	0.58	0.23	0.09	0.03	0.00
NITROGEN, NITRITE TOTAL (MG/L AS N)	48	0.08	0.00	0.01	0.06	0.02	0.01	0.00	0.00
NITROGEN, NITRATE TOTAL (MG/L AS N)	48	1.10	0.00	0.17	0.68	0.27	0.08	0.01	0.00
NITROGEN,AMMONIA + ORGANIC TOTAL (MG/L AS N)	31	1.70	0.33	0.92	1.64	1.10	0.88	0.70	0.41
NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	30	0.74	0.00	0.15	0.73	0.26	0.08	0.01	0.00
PHOSPHORUS, TOTAL (MG/L AS P)	48	0.45	0.01	0.14	0.37	0.18	0.11	0.07	0.03
HARDNESS (MG/L AS CACO3)	48	240.00	85.00	163.85	225.50	190.00	160.00	140.00	114.50
HARDNESS, NONCARBONATE (MG/L CACO3)	48	40.00	3.00	20.67	39.00	27.00	19.50	14.00	6.35
CALCIUM DISSOLVED (MG/L AS CA)	48	85.00	26.00	55.54	74.55	64.75	54.00	46.25	38.45
MAGNESIUM, DISSOLVED (MG/L AS MG)	48	9.40	2.90	6.01	8.80	7.40	6.00	4.55	3.13
SODIUM, DISSOLVED (MG/L AS NA)	34	40.00	10.00	22.38	39.25	26.00	21.00	16.75	12.25
SODIUM ADSORPTION RATIO	48	1.20	0.40	0.76	1.20	0.90	0.75	0.60	0.40
PERCENT SODIUM	34	29.00	13.00	21.50	28.25	25.00	21.50	18.00	14.50
POTASSIUM, DISSOLVED (MG/L AS K)	34	5.20	3.00	4.16	5.13	4.45	4.25	3.78	3.08
CHLORIDE, DISSOLVED (MG/L AS CL)	48	53.00	11.00	26.48	46.30	31.75	25.00	19.25	12.45
SULFATE DISSOLVED (MG/L AS SO4)	48	55.00	20.00	32.75	50.55	37.75	30.00	26.00	21.00
FLUORIDE, DISSOLVED (MG/L AS F)	35	0.50	0.10	0.29	0.50	0.30	0.30	0.20	0.18
SILICA, DISSOLVED (MG/L AS SIO2)	48	11.00	0.90	5.57	11.00	6.58	5.55	4.20	1.48
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	48	347.00	137.00	237.62	334.95	260.25	231.00	200.25	154.95
SOLIDS, DISSOLVED (TONS PER DAY)	36	1320.00	0.33	109.66	883.95	95.85	17.90	10.50	1.15
SOLIDS, DISSOLVED (TONS PER AC-FT)	48	0.47	0.19	0.32	0.46	0.36	0.32	0.27	0.21

TABLE 20.--STATISTICAL SUMMARY OF SELECTED WATER-QUALITY DATA IN THE UPPER TRINITY RIVER BASIN, TEXAS--CONTINUED

STATION NUMBER: 08048543 STATION NAME: WEST FORK TRINITY RIVER AT BEACH STREET, FORT WORTH, TEX.

LATITUDE: 324506 LONGITUDE: 0971721 COUNTY: TARRANT DRAINAGE AREA: 2685.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM OCT 1972 TO AUG 1982

	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
WATER-QUALITY CONSTITUENT	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	63	33.00	2.00	19.63	31.90	28.00	19.50	12.00	5.00
STREAMFLOW, INSTANTANEOUS (CFS)	64	4540.00	2.70	253.30	1502.50	179.75	42.00	16.25	4.40
COLOR (PLATINUM-COBALT UNITS)	1	90.00	90.00						
SPECIFIC CONDUCTANCE (UMHOS)	63	893.00	210.00	551.92	852.00	623.00	549.00	445.00	354.80
OXYGEN, DISSOLVED (MG/L)	63	18.40	3.20	10.12	16.48	11.50	10.00	8.10	6.08
OXYGEN, DISSOLVED (PERCENT SATURATION)	63	256.00	43.00	112.41	221.60	119.00	101.00	87.00	69.20
OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L)	63	41.00	1.20	5.62	28.40	5.50	3.40	2.10	1.34
PH (UNITS)	63	9.00	7.40	--	8.56	8.10	7.90	7.70	7.40
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	63	12.00	0.20	4.14	9.96	5.40	3.50	2.10	0.62
ALKALINITY FIELD (MG/L AS CACO3)	63	197.00	67.00	144.22	186.80	160.00	148.00	131.00	96.00
BICARBONATE FET-FLD (MG/L AS HCO3)	48	240.00	82.00	174.15	234.60	197.50	170.00	152.50	100.10
CARBONATE FET-FLD (MG/L AS CO3)	48	18.00	0.00	0.81	8.65	0.00	0.00	0.00	0.00
NITROGEN, TOTAL (MG/L AS N)	62	5.40	0.66	1.76	3.47	2.20	1.45	1.10	0.89
NITROGEN, ORGANIC TOTAL (MG/L AS N)	62	2.80	0.20	1.05	2.57	1.13	0.94	0.75	0.38
NITROGEN, AMMONIA TOTAL (MG/L AS N)	63	1.40	0.00	0.28	0.87	0.39	0.17	0.06	0.02
NITROGEN, NITRITE TOTAL (MG/L AS N)	63	0.39	0.00	0.05	0.16	0.06	0.03	0.02	0.00
NITROGEN, NITRATE TOTAL (MG/L AS N)	61	1.80	0.02	0.36	1.09	0.48	0.28	0.13	0.02
NITROGEN,AMMONIA + ORGANIC TOTAL (MG/L AS N)	62	3.30	0.50	1.35	3.09	1.70	1.10	0.86	0.64
NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	62	2.20	0.03	0.41	1.17	0.55	0.32	0.14	0.03
PHOSPHORUS, TOTAL (MG/L AS P)	63	0.66	0.03	0.18	0.58	0.24	0.13	0.08	0.04
CARBON, ORGANIC TOTAL (MG/L AS C)	1	15.00	15.00						
HARDNESS (MG/L AS CACO3)	63	240.00	71.00	171.44	220.00	190.00	170.00	150.00	122.00
HARDNESS, NONCARBONATE (MG/L CACO3)	63	55.00	0.00	27.79	52.80	36.00	28.00	19.00	9.40
CALCIUM DISSOLVED (MG/L AS CA)	63	85.00	25.00	57.56	76.00	63.00	59.00	49.00	39.60
MAGNESIUM, DISSOLVED (MG/L AS MG)	63	11.00	2.10	6.80	9.68	8.10	6.60	5.70	4.42
SODIUM, DISSOLVED (MG/L AS NA)	63	110.00	13.00	42.81	106.20	52.00	37.00	29.00	15.20
SODIUM ADSORPTION RATIO	63	3.90	0.60	1.48	3.48	1.80	1.30	1.00	0.60
PERCENT SODIUM	62	58.00	18.00	32.44	54.70	37.00	31.00	27.00	19.15
POTASSIUM, DISSOLVED (MG/L AS K)	62	33.00	3.70	7.53	17.70	8.10	6.05	5.08	4.02
CHLORIDE, DISSOLVED (MG/L AS CL)	63	140.00	14.00	50.51	120.00	60.00	45.00	33.00	19.60
SULFATE DISSOLVED (MG/L AS SO4)	63	100.00	15.00	55.81	93.20	65.00	56.00	41.00	23.00
FLUORIDE, DISSOLVED (MG/L AS F)	63	1.00	0.20	0.42	0.78	0.50	0.40	0.30	0.20
SILICA, DISSOLVED (MG/L AS SIO2)	63	10.00	1.80	5.28	8.76	6.70	5.50	3.80	2.22
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	62	511.00	124.00	314.26	488.30	354.50	321.00	249.50	196.95
SOLIDS, DISSOLVED (TONS PER DAY)	62	2160.00	3.00	142.16	822.85	98.20	37.60	14.68	4.41
SOLIDS, DISSOLVED (TONS PER AC-FT)	63	0.69	0.17	0.43	0.66	0.48	0.44	0.34	0.27

TABLE 20.--STATISTICAL SUMMARY OF SELECTED WATER-QUALITY DATA IN THE UPPER TRINITY RIVER BASIN, TEXAS--CONTINUED

STATION NUMBER: 08049200 [a/] STATION NAME: LAKE ARLINGTON AT ARLINGTON, TEX.

LATITUDE: 324258 LONGITUDE: 0971132 COUNTY: TARRANT DRAINAGE AREA: 143.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM JUN 1973 TO SEPT 1977

WATER-QUALITY CONSTITUENT	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	10	30.50	8.50	21.90	30.50	29.13	26.00	11.62	8.50
SPECIFIC CONDUCTANCE (UMHOS)	10	418.00	317.00	358.50	418.00	383.75	358.50	331.50	317.00
OXYGEN, DISSOLVED (MG/L)	9	11.00	6.90	9.06	11.00	10.60	9.40	7.30	6.90
OXYGEN, DISSOLVED (PERCENT SATURATION)	9	132.00	83.00	101.22	132.00	121.00	93.00	88.50	83.00
PH (UNITS)	10	8.50	6.90	--	8.50	8.35	8.15	7.87	6.90
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	10	26.00	0.60	4.04	26.00	2.93	1.50	0.90	0.60
ALKALINITY FIELD (MG/L AS CACO3)	10	121.00	95.00	105.00	121.00	109.00	102.50	101.00	95.00
BICARBONATE FET-FLD (MG/L AS HCO3)	10	148.00	112.00	126.40	148.00	133.00	125.00	119.00	112.00
CARBONATE FET-FLD (MG/L AS CO3)	10	6.00	0.00	0.80	6.00	0.50	0.00	0.00	0.00
NITROGEN, AMMONIA TOTAL (MG/L AS N)	9	0.07	0.00	0.03	0.07	0.07	0.04	0.00	0.00
NITROGEN, NITRATE TOTAL (MG/L AS N)	1	0.30	0.30						
NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	9	0.28	0.00	0.07	0.28	0.16	0.01	0.00	0.00
PHOSPHORUS, TOTAL (MG/L AS P)	9	0.07	0.02	0.05	0.07	0.06	0.05	0.03	0.02
HARDNESS (MG/L AS CACO3)	10	130.00	110.00	116.00	130.00	120.00	115.00	110.00	110.00
HARDNESS, NONCARBONATE (MG/L CACO3)	10	17.00	5.00	11.30	17.00	14.50	12.00	8.00	5.00
CALCIUM DISSOLVED (MG/L AS CA)	10	41.00	34.00	37.60	41.00	39.50	37.50	35.75	34.00
MAGNESIUM, DISSOLVED (MG/L AS MG)	10	6.50	4.20	5.41	6.50	6.10	5.20	4.78	4.20
SODIUM, DISSOLVED (MG/L AS NA)	9	32.00	18.00	24.78	32.00	29.50	24.00	20.00	18.00
SODIUM ADSORPTION RATIO	10	1.30	0.80	1.06	1.30	1.22	1.10	0.88	0.80
PERCENT SODIUM	9	35.00	25.00	30.33	35.00	34.00	29.00	27.00	25.00
POTASSIUM, DISSOLVED (MG/L AS K)	9	5.30	4.00	4.68	5.30	4.95	4.70	4.45	4.00
CHLORIDE, DISSOLVED (MG/L AS CL)	10	29.00	17.00	23.30	29.00	27.50	22.50	19.75	17.00
SULFATE DISSOLVED (MG/L AS SO4)	10	45.00	30.00	35.40	45.00	40.75	33.50	30.00	30.00
FLUORIDE, DISSOLVED (MG/L AS F)	10	0.30	0.20	0.28	0.30	0.30	0.30	0.27	0.20
SILICA, DISSOLVED (MG/L AS SIO2)	10	5.80	0.30	2.97	5.80	3.95	3.00	1.75	0.30
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	10	234.00	174.00	198.50	234.00	211.25	197.00	181.75	174.00
SOLIDS, DISSOLVED (TONS PER AC-FT)	10	0.32	0.24	0.27	0.32	0.29	0.27	0.25	0.24

[a/] Data in this table represent approximately one sample per year collected near the dam or at the reservoir outflow. The table does not include data collected during comprehensive reservoir surveys.

TABLE 20.--STATISTICAL SUMMARY OF SELECTED WATER-QUALITY DATA IN THE UPPER TRINITY RIVER BASIN, TEXAS--CONTINUED

STATION NUMBER: 08049500 STATION NAME: WEST FORK TRINITY RIVER AT GRAND PRAIRIE, TEX.

LATITUDE: 324546 LONGITUDE: 0965942 COUNTY: DALLAS DRAINAGE AREA: 3065.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM OCT 1972 TO AUG 1982

	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
WATER-QUALITY CONSTITUENT	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	127	33.00	3.00	20.85	30.80	28.00	21.50	15.50	8.50
STREAMFLOW, INSTANTANEOUS (CFS)	116	8699.98	93.00	587.01	3445.00	392.00	193.50	148.25	117.55
TURBIDITY (JTU)	57	260.00	1.00	35.23	202.00	37.50	15.00	7.50	1.90
TURBIDITY (FTU)	33	750.00	0.20	58.68	498.00	32.50	10.00	4.30	0.62
COLOR (PLATINUM-COBALT UNITS)	89	140.00	0.00	20.96	57.50	25.00	20.00	10.00	5.00
SPECIFIC CONDUCTANCE (UMHOS)	128	1220.00	321.00	790.76	1125.50	958.00	812.50	639.50	394.80
OXYGEN, DISSOLVED (MG/L)	111	9.20	0.00	4.55	8.34	6.40	4.20	2.80	0.80
OXYGEN, DISSOLVED (PERCENT SATURATION)	111	112.00	0.00	49.77	84.00	68.00	51.00	33.00	9.60
OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L)	110	60.00	1.60	12.20	26.45	16.00	11.50	6.60	3.15
PH (UNITS)	128	8.60	6.70	--	8.05	7.67	7.50	7.30	7.00
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	122	58.00	0.70	14.70	34.70	19.00	12.50	7.30	2.10
ALKALINITY FIELD (MG/L AS CACO3)	122	279.00	38.00	179.79	244.80	205.00	184.00	159.75	113.20
BICARBONATE FET-FLD (MG/L AS HCO3)	107	340.00	46.00	217.91	296.00	250.00	220.00	192.00	138.20
CARBONATE FET-FLD (MG/L AS CO3)	107	2.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00
SOLIDS, RESIDUE AT 105 DEG. C, SUSPENDED	90	1980.00	0.00	117.42	574.00	97.00	33.50	15.00	3.55
NITROGEN, TOTAL (MG/L AS N)	89	61.00	0.91	9.21	18.00	11.50	7.60	5.20	2.25
NITROGEN, ORGANIC TOTAL (MG/L AS N)	109	47.00	0.00	2.76	10.55	2.40	1.50	0.90	0.17
NITROGEN, AMMONIA TOTAL (MG/L AS N)	110	14.00	0.00	3.76	12.00	5.08	2.80	1.20	0.19
NITROGEN, NITRITE TOTAL (MG/L AS N)	111	1.50	0.01	0.44	1.14	0.60	0.39	0.18	0.05
NITROGEN, NITRATE TOTAL (MG/L AS N)	124	9.10	0.00	2.09	6.50	2.90	1.55	0.58	0.01
NITROGEN,AMMONIA + ORGANIC TOTAL (MG/L AS N)	93	61.00	0.58	7.14	18.00	9.10	5.10	3.00	1.47
NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	90	7.50	0.00	1.91	6.03	2.60	1.60	0.60	0.07
PHOSPHORUS, TOTAL (MG/L AS P)	110	21.00	0.07	3.75	8.75	5.03	3.10	1.50	0.32
CARBON, ORGANIC TOTAL (MG/L AS C)	87	300.00	4.60	17.72	26.00	18.00	14.00	10.00	6.24
HARDNESS (MG/L AS CACO3)	122	230.00	71.00	172.63	220.00	190.00	170.00	150.00	121.50
HARDNESS, NONCARBONATE (MG/L CACO3)	122	89.00	0.00	9.63	34.00	17.25	1.50	0.00	0.00
CALCIUM DISSOLVED (MG/L AS CA)	122	80.00	19.00	56.75	72.85	64.00	56.50	49.75	41.00
MAGNESIUM, DISSOLVED (MG/L AS MG)	122	13.00	3.10	7.63	10.00	8.75	7.70	6.67	4.51
SODIUM, DISSOLVED (MG/L AS NA)	100	180.00	20.00	93.73	150.00	120.00	100.00	64.50	25.10
SODIUM ADSORPTION RATIO	122	6.70	0.70	3.07	5.49	4.10	3.15	1.90	1.00
PERCENT SODIUM	100	77.00	23.00	49.92	66.90	58.75	51.50	41.25	27.00
POTASSIUM, DISSOLVED (MG/L AS K)	100	22.00	4.30	10.78	16.00	13.00	11.00	8.20	5.00
CHLORIDE, DISSOLVED (MG/L AS CL)	122	180.00	13.00	70.63	120.00	90.25	70.00	49.50	25.60
SULFATE DISSOLVED (MG/L AS SO4)	122	170.00	23.00	90.16	150.00	110.00	88.50	68.00	32.30
FLUORIDE, DISSOLVED (MG/L AS F)	107	3.90	0.20	0.75	1.42	0.90	0.70	0.50	0.30
SILICA, DISSOLVED (MG/L AS SIO2)	122	18.00	3.30	9.33	13.00	11.00	9.35	7.80	5.45
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	122	707.00	189.00	444.84	639.65	542.00	461.50	356.50	225.00
SOLIDS, DISSOLVED (TONS PER DAY)	110	4910.00	100.00	493.57	2146.50	406.25	257.50	203.75	152.75
SOLIDS, DISSOLVED (TONS PER AC-FT)	122	0.96	0.26	0.60	0.87	0.74	0.63	0.49	0.31

TABLE 20.--STATISTICAL SUMMARY OF SELECTED WATER-QUALITY DATA IN THE UPPER TRINITY RIVER BASIN, TEXAS--CONTINUED

STATION NUMBER: 08049500 STATION NAME: WEST FORK TRINITY RIVER AT GRAND PRAIRIE, TEX.

LATITUDE: 324546 LONGITUDE: 0965942 COUNTY: DALLAS DRAINAGE AREA: 3065.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM JAN 1974 TO JUL 1981

	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
WATER-QUALITY CONSTITUENT	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
ARSENIC DISSOLVED (UG/L AS AS)	32	7.00	1.00	3.09	6.35	4.00	3.00	2.00	1.00
BARIUM, DISSOLVED (UG/L AS BA)	19	200.00	0.00	45.16	200.00	30.00	20.00	0.00	0.00
CADMIUM DISSOLVED (UG/L AS CD)	32	9.00	0.00	1.03	5.10	2.00	0.00	0.00	0.00
CHROMIUM, DISSOLVED (UG/L AS CR)	32	40.00	0.00	4.44	40.00	5.00	0.00	0.00	0.00
COBALT, DISSOLVED (UG/L AS CO)	12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
COPPER, DISSOLVED (UG/L AS CU)	32	14.00	0.00	3.81	12.05	5.75	3.00	0.50	0.00
IRON, DISSOLVED (UG/L AS FE)	32	680.00	0.00	75.00	355.00	70.00	40.00	32.50	0.00
LEAD, DISSOLVED (UG/L AS PB)	32	45.00	0.00	4.56	39.80	3.75	2.00	0.00	0.00
MANGANESE, DISSOLVED (UG/L AS MN)	32	290.00	0.00	97.50	238.00	150.00	90.00	42.50	0.00
NICKEL, DISSOLVED (UG/L AS NI)	12	26.00	2.00	12.75	26.00	18.00	13.00	5.25	2.00
SILVER, DISSOLVED (UG/L AS AG)	20	2.00	0.00	0.10	1.90	0.00	0.00	0.00	0.00
STRONTIUM, DISSOLVED (UG/L AS SR)	12	550.00	300.00	447.50	550.00	507.50	440.00	405.00	300.00
ZINC, DISSOLVED (UG/L AS ZN)	32	80.00	0.00	28.12	73.50	40.00	30.00	12.50	0.00
ALUMINUM, DISSOLVED (UG/L AS AL)	12	110.00	10.00	34.17	110.00	47.50	20.00	10.00	10.00
LITHIUM DISSOLVED (UG/L AS LI)	12	20.00	0.00	5.00	20.00	15.00	0.00	0.00	0.00
SELENIUM, DISSOLVED (UG/L AS SE)	20	4.00	0.00	0.20	3.80	0.00	0.00	0.00	0.00
MERCURY DISSOLVED (UG/L AS HG)	32	0.60	0.00	0.07	0.53	0.08	0.00	0.00	0.00

TABLE 20.--STATISTICAL SUMMARY OF SELECTED WATER-QUALITY DATA IN THE UPPER TRINITY RIVER BASIN, TEXAS--CONNTINUED

STATION NUMBER: 08049600 STATION NAME: MOUNTAIN CREEK NEAR CEDAR HILL, TEX.

LATITUDE: 323503 LONGITUDE: 0970123 COUNTY: DALLAS DRAINAGE AREA: 119.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM SEPT 1974 TO JUL 1982

	DESCRIPTIVE STATISTICS				PER CENT OF SAMPLES IN WHICH VALUE WERE LESS THAN OR EQUAL TO THOSE SHOWN				
WATER-QUALITY CONSTITUENT	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	71	29.00	2.50	16.86	27.70	22.00	18.50	10.50	5.90
STREAMFLOW, INSTANTANEOUS (CFS)	77	2999.99	0.00	183.78	2051.99	44.00	4.80	0.35	0.00
TURBIDITY (JTU)	30	600.00	1.00	71.33	424.00	80.00	30.00	13.25	2.10
TURBIDITY (FTU)	25	1400.00	0.80	163.97	1184.00	180.00	29.00	6.90	0.89
COLOR (PLATINUM-COBALT UNITS)	55	720.00	0.00	38.36	96.00	40.00	20.00	10.00	0.00
SPECIFIC CONDUCTANCE (UMHOS)	55	1820.00	316.00	1035.42	1526.00	1270.00	1060.00	821.00	368.60
OXYGEN, DISSOLVED (MG/L)	53	13.30	3.80	7.98	11.66	9.95	7.90	6.30	4.00
OXYGEN, DISSOLVED (PERCENT SATURATION)	53	118.00	36.00	80.92	101.00	91.50	86.00	73.50	46.50
OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L)	53	7.10	0.70	2.89	5.68	3.95	2.70	1.60	1.14
PH (UNITS)	55	8.30	7.10	--	8.20	7.90	7.80	7.50	7.28
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	55	19.00	1.40	5.83	18.00	8.20	4.20	2.80	1.48
ALKALINITY FIELD (MG/L AS CACO3)	55	253.00	66.00	140.36	195.20	164.00	148.00	115.00	79.40
BICARBONATE FET-FLD (MG/L AS HCO3)	45	308.00	94.00	170.42	231.20	200.00	170.00	140.00	104.60
CARBONATE FET-FLD (MG/L AS CO3)	45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SOLIDS, RESIDUE AT 105 DEG. C, SUSPENDED	55	2250.00	0.00	206.20	1500.00	159.00	32.00	14.00	6.00
NITROGEN, TOTAL (MG/L AS N)	50	8.60	0.44	1.84	4.51	2.20	1.25	0.97	0.56
NITROGEN, ORGANIC TOTAL (MG/L AS N)	54	2.90	0.33	1.07	2.35	1.22	0.91	0.71	0.44
NITROGEN, AMMONIA TOTAL (MG/L AS N)	54	0.56	0.00	0.08	0.30	0.10	0.06	0.04	0.01
NITROGEN, NITRITE TOTAL (MG/L AS N)	55	0.37	0.00	0.05	0.28	0.06	0.01	0.01	0.00
NITROGEN, NITRATE TOTAL (MG/L AS N)	52	6.30	0.00	0.59	2.84	0.59	0.20	0.04	0.00
NITROGEN,AMMONIA + ORGANIC TOTAL (MG/L AS N)	53	3.40	0.39	1.17	2.44	1.50	1.00	0.79	0.47
NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	53	6.70	0.00	0.62	2.98	0.65	0.19	0.03	0.00
PHOSPHORUS, TOTAL (MG/L AS P)	55	0.55	0.03	0.12	0.35	0.15	0.09	0.05	0.03
CARBON, ORGANIC TOTAL (MG/L AS C)	53	43.00	4.10	11.13	27.70	13.50	8.90	7.50	4.68
HARDNESS (MG/L AS CACO3)	54	540.00	110.00	296.30	480.00	340.00	285.00	227.50	142.50
HARDNESS, NONCARBONATE (MG/L CACO3)	54	323.00	27.00	156.07	314.50	196.25	142.00	99.00	44.00
CALCIUM DISSOLVED (MG/L AS CA)	54	190.00	39.00	105.50	170.00	120.00	100.00	81.50	51.00
MAGNESIUM, DISSOLVED (MG/L AS MG)	54	15.00	2.20	7.88	14.00	9.23	7.80	5.93	3.22
SODIUM, DISSOLVED (MG/L AS NA)	54	230.00	18.00	101.46	200.00	130.00	99.50	69.50	20.75
SODIUM ADSORPTION RATIO	54	5.80	0.70	2.67	5.63	3.33	2.50	1.90	0.88
PERCENT SODIUM	54	62.00	20.00	39.48	57.50	46.00	38.00	33.75	24.75
POTASSIUM, DISSOLVED (MG/L AS K)	55	58.00	1.60	15.83	45.20	20.00	12.00	8.40	4.42
CHLORIDE, DISSOLVED (MG/L AS CL)	55	150.00	7.40	50.80	110.00	71.00	46.00	34.00	7.92
SULFATE DISSOLVED (MG/L AS SO4)	55	570.00	73.00	308.36	494.00	400.00	320.00	230.00	85.00
FLUORIDE, DISSOLVED (MG/L AS F)	52	2.60	0.30	0.67	0.93	0.70	0.60	0.50	0.37
SILICA, DISSOLVED (MG/L AS SIO2)	54	25.00	1.00	7.34	13.75	8.88	7.20	5.08	1.90
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	54	1260.00	196.00	682.00	1070.00	883.75	692.00	533.25	229.50
SOLIDS, DISSOLVED (TONS PER DAY)	54	1560.00	0.02	98.26	999.50	59.13	6.80	0.82	0.02
SOLIDS, DISSOLVED (TONS PER AC-FT)	54	1.70	0.27	0.92	1.42	1.20	0.94	0.73	0.32

TABLE 20.--STATISTICAL SUMMARY OF SELECTED WATER-QUALITY DATA IN THE UPPER TRINITY RIVER BASIN, TEXAS--CONTINUED

STATION NUMBER: 08049600 STATION NAME: MOUNTAIN CREEK NEAR CEDAR HILL, TEX.

LATITUDE: 323503 LONGITUDE: 0970123 COUNTY: DALLAS DRAINAGE AREA: 119.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM OCT 1974 TO JUL 1982

	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
WATER-QUALITY CONSTITUENT	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
ARSENIC DISSOLVED (UG/L AS AS)	21	17.00	0.00	2.57	16.10	3.00	1.00	1.00	0.00
BARIUM, DISSOLVED (UG/L AS BA)	15	200.00	0.00	58.67	200.00	90.00	50.00	0.00	0.00
CADMIUM DISSOLVED (UG/L AS CD)	21	5.00	0.00	0.38	4.80	0.00	0.00	0.00	0.00
CHROMIUM, DISSOLVED (UG/L AS CR)	21	40.00	0.00	2.38	37.00	0.00	0.00	0.00	0.00
COBALT, DISSOLVED (UG/L AS CO)	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
COPPER, DISSOLVED (UG/L AS CU)	21	7.00	0.00	2.14	6.80	3.00	2.00	0.00	0.00
IRON, DISSOLVED (UG/L AS FE)	21	80.00	0.00	20.76	79.00	30.00	20.00	0.00	0.00
LEAD, DISSOLVED (UG/L AS PB)	21	3.00	0.00	0.57	2.90	1.50	0.00	0.00	0.00
MANGANESE, DISSOLVED (UG/L AS MN)	21	83.00	0.00	23.14	81.70	40.00	20.00	0.00	0.00
NICKEL, DISSOLVED (UG/L AS NI)	6	4.00	0.00	2.33	4.00	4.00	3.00	0.00	0.00
SILVER, DISSOLVED (UG/L AS AG)	14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
STRONTIUM, DISSOLVED (UG/L AS SR)	6	2000.00	700.00	1466.67	2000.00	1775.00	1600.00	1075.00	700.00
ZINC, DISSOLVED (UG/L AS ZN)	21	30.00	0.00	4.76	29.00	6.00	0.00	0.00	0.00
ALUMINUM, DISSOLVED (UG/L AS AL)	6	30.00	0.00	13.33	30.00	22.50	15.00	0.00	0.00
LITHIUM DISSOLVED (UG/L AS LI)	6	50.00	20.00	33.33	50.00	42.50	35.00	20.00	20.00
SELENIUM, DISSOLVED (UG/L AS SE)	15	7.00	0.00	1.07	7.00	1.00	1.00	0.00	0.00
MERCURY DISSOLVED (UG/L AS HG)	21	0.10	0.00	0.00	0.09	0.00	0.00	0.00	0.00

TABLE 20.--STATISTICAL SUMMARY OF SELECTED WATER-QUALITY DATA IN THE UPPER TRINITY RIVER BASIN, TEXAS--CONTINUED

STATION NUMBER: 08049900 STATION NAME: MOUNTAIN CREEK NEAR DUNCANVILLE, TEX.

LATITUDE: 323943 LONGITUDE: 0965856 COUNTY: DALLAS DRAINAGE AREA: 225.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM JUL 1974 TO JUL 1982

WATER-QUALITY CONSTITUENT	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	82	31.00	2.50	17.78	28.50	24.13	19.00	12.00	5.08
TURBIDITY (JTU)	51	1500.00	1.00	79.91	208.00	65.00	45.00	20.00	3.80
TURBIDITY (FTU)	30	1100.00	1.50	103.62	847.00	49.50	28.00	8.20	2.10
COLOR (PLATINUM-COBALT UNITS)	82	150.00	0.00	25.55	69.25	30.00	20.00	10.00	0.00
SPECIFIC CONDUCTANCE (UMHOS)	82	1510.00	235.00	929.37	1434.00	1232.50	858.50	695.00	411.45
OXYGEN, DISSOLVED (MG/L)	80	14.20	1.20	6.62	11.76	8.00	6.45	5.10	2.61
OXYGEN, DISSOLVED (PERCENT SATURATION)	80	135.00	16.00	68.21	98.90	81.00	69.00	53.00	29.05
OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L)	81	17.00	0.90	3.97	9.78	4.60	3.60	2.15	1.12
PH (UNITS)	82	8.60	6.70	--	8.20	7.80	7.60	7.40	7.01
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	81	41.00	0.80	9.98	23.60	13.50	8.10	4.45	1.61
ALKALINITY FIELD (MG/L AS CACO3)	81	328.00	66.00	164.35	270.70	194.50	156.00	130.00	81.00
BICARBONATE FET-FLD (MG/L AS HCO3)	71	400.00	82.00	204.96	347.60	248.00	194.00	160.00	105.20
CARBONATE FET-FLD (MG/L AS CO3)	71	10.00	0.00	0.20	0.40	0.00	0.00	0.00	0.00
SOLIDS, RESIDUE AT 105 DEG. C, SUSPENDED	82	2480.00	3.00	165.26	997.70	103.00	53.50	27.50	9.00
NITROGEN, TOTAL (MG/L AS N)	79	9.70	0.21	2.09	7.20	2.50	1.50	1.00	0.63
NITROGEN, ORGANIC TOTAL (MG/L AS N)	80	7.10	0.00	1.28	2.99	1.38	1.00	0.75	0.44
NITROGEN, AMMONIA TOTAL (MG/L AS N)	82	7.90	0.00	0.34	1.94	0.17	0.07	0.03	0.01
NITROGEN, NITRITE TOTAL (MG/L AS N)	82	0.26	0.00	0.04	0.16	0.05	0.02	0.01	0.00
NITROGEN, NITRATE TOTAL (MG/L AS N)	79	4.20	0.00	0.42	1.70	0.55	0.22	0.01	0.00
NITROGEN,AMMONIA + ORGANIC TOTAL (MG/L AS N)	82	8.70	0.21	1.61	5.10	1.60	1.20	0.82	0.53
NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	82	4.40	0.00	0.45	1.78	0.63	0.22	0.02	0.00
PHOSPHORUS, TOTAL (MG/L AS P)	82	4.90	0.01	0.35	1.88	0.25	0.14	0.07	0.04
CARBON, ORGANIC TOTAL (MG/L AS C)	79	36.00	2.60	10.57	24.00	12.00	9.60	6.80	4.60
HARDNESS (MG/L AS CACO3)	81	540.00	88.00	281.58	506.00	360.00	240.00	190.00	131.00
HARDNESS, NONCARBONATE (MG/L CACO3)	81	335.00	0.00	119.20	306.90	174.00	95.00	54.50	0.00
CALCIUM DISSOLVED (MG/L AS CA)	82	180.00	32.00	96.39	168.50	120.00	85.50	67.00	47.00
MAGNESIUM, DISSOLVED (MG/L AS MG)	81	24.00	1.90	10.02	20.90	14.00	7.80	6.10	3.83
SODIUM, DISSOLVED (MG/L AS NA)	81	190.00	10.00	84.30	139.00	110.00	87.00	55.00	27.10
SODIUM ADSORPTION RATIO	81	4.50	0.50	2.28	3.90	2.70	2.30	1.75	1.01
PERCENT SODIUM	81	58.00	19.00	37.60	54.00	42.00	36.00	32.00	26.00
POTASSIUM, DISSOLVED (MG/L AS K)	81	32.00	3.70	10.96	22.80	12.00	9.90	7.75	4.77
CHLORIDE, DISSOLVED (MG/L AS CL)	81	98.00	4.80	50.26	86.70	69.50	51.00	30.00	14.20
SULFATE DISSOLVED (MG/L AS SO4)	81	470.00	42.00	231.28	438.00	315.00	220.00	155.00	69.30
FLUORIDE, DISSOLVED (MG/L AS F)	75	1.10	0.30	0.57	0.80	0.70	0.60	0.50	0.38
SILICA, DISSOLVED (MG/L AS SIO2)	81	40.00	0.00	8.49	13.00	9.55	8.10	6.80	2.43
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	82	1030.00	145.00	593.76	964.55	799.50	544.50	425.25	243.75
SOLIDS, DISSOLVED (TONS PER AC-FT)	82	1.40	0.20	0.81	1.30	1.10	0.74	0.58	0.33

TABLE 20.--STATISTICAL SUMMARY OF SELECTED WATER-QUALITY DATA IN THE UPPER TRINITY RIVER BASIN, TEXAS--CONTINUED

STATION NUMBER: 08049900 STATION NAME: MOUNTAIN CREEK NEAR DUNCANVILLE, TEX.

LATITUDE: 323943 LONGITUDE: 0965856 COUNTY: DALLAS DRAINAGE AREA: 225.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM JUL 1974 TO JUL 1982

	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
WATER-QUALITY CONSTITUENT	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
ARSENIC DISSOLVED (UG/L AS AS)	29	11.00	0.00	2.48	8.00	3.00	2.00	1.00	0.00
BARIUM, DISSOLVED (UG/L AS BA)	19	700.00	0.00	109.32	700.00	100.00	58.00	0.00	0.00
CADMIUM DISSOLVED (UG/L AS CD)	29	6.00	0.00	0.41	4.50	0.00	0.00	0.00	0.00
CHROMIUM, DISSOLVED (UG/L AS CR)	29	10.00	0.00	1.21	10.00	0.00	0.00	0.00	0.00
COBALT, DISSOLVED (UG/L AS CO)	10	2.00	0.00	0.20	2.00	0.00	0.00	0.00	0.00
COPPER, DISSOLVED (UG/L AS CU)	29	50.00	0.00	3.07	29.50	2.00	0.00	0.00	0.00
IRON, DISSOLVED (UG/L AS FE)	29	130.00	0.00	22.76	110.00	25.00	20.00	0.00	0.00
LEAD, DISSOLVED (UG/L AS PB)	29	4.00	0.00	0.79	3.50	2.00	0.00	0.00	0.00
MANGANESE, DISSOLVED (UG/L AS MN)	29	300.00	0.00	57.55	260.00	85.00	20.00	1.00	0.00
NICKEL, DISSOLVED (UG/L AS NI)	10	3.00	0.00	1.60	3.00	3.00	2.00	0.00	0.00
SILVER, DISSOLVED (UG/L AS AG)	19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
STRONTIUM, DISSOLVED (UG/L AS SR)	10	1700.00	470.00	1160.00	1700.00	1500.00	1300.00	777.50	470.00
ZINC, DISSOLVED (UG/L AS ZN)	29	20.00	0.00	2.55	20.00	1.50	0.00	0.00	0.00
ALUMINUM, DISSOLVED (UG/L AS AL)	10	60.00	0.00	19.00	60.00	32.50	15.00	0.00	0.00
LITHIUM DISSOLVED (UG/L AS LI)	10	40.00	0.00	21.70	40.00	32.50	25.00	5.25	0.00
SELENIUM, DISSOLVED (UG/L AS SE)	19	1.00	0.00	0.21	1.00	0.00	0.00	0.00	0.00
MERCURY DISSOLVED (UG/L AS HG)	29	0.50	0.00	0.03	0.35	0.00	0.00	0.00	0.00

TABLE 20.--STATISTICAL SUMMARY OF SELECTED WATER-QUALITY DATA IN THE UPPER TRINITY RIVER BASIN, TEXAS--CONTINUED

STATION NUMBER: 08050050 STATION NAME: MOUNTAIN CREEK LAKE NEAR GRAND PRAIRIE, TEX.

LATITUDE: 324355 LONGITUDE: 0965635 COUNTY: DALLAS DRAINAGE AREA: 295.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM JUN 1973 TO DEC 1981

	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
WATER-QUALITY CONSTITUENT	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	10	28.50	7.50	16.55	28.50	21.25	15.50	11.38	7.50
SPECIFIC CONDUCTANCE (UMHOS)	10	728.00	329.00	501.00	728.00	571.25	492.00	431.25	329.00
PH (UNITS)	6	8.00	7.60	--	8.00	7.85	7.65	7.60	7.60
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	6	6.50	1.70	4.08	6.50	5.68	4.20	2.30	1.70
ALKALINITY FIELD (MG/L AS CACO3)	10	135.00	82.00	101.20	135.00	110.25	99.00	88.50	82.00
BICARBONATE FET-FLD (MG/L AS HCO3)	8	164.00	100.00	122.12	164.00	133.75	118.00	104.00	100.00
CARBONATE FET-FLD (MG/L AS CO3)	8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NITROGEN, NITRATE TOTAL (MG/L AS N)	1	0.80	0.80						
HARDNESS (MG/L AS CACO3)	10	270.00	130.00	168.00	270.00	175.00	155.00	150.00	130.00
HARDNESS, NONCARBONATE (MG/L CACO3)	10	137.00	42.00	67.20	137.00	79.25	58.00	52.75	42.00
CALCIUM DISSOLVED (MG/L AS CA)	10	96.00	46.00	58.80	96.00	60.00	54.00	52.50	46.00
MAGNESIUM, DISSOLVED (MG/L AS MG)	10	7.70	2.60	5.13	7.70	6.30	4.95	4.15	2.60
SODIUM, DISSOLVED (MG/L AS NA)	9	48.00	26.00	36.44	48.00	46.50	39.00	26.00	26.00
SODIUM ADSORPTION RATIO	10	1.70	0.60	1.20	1.70	1.45	1.20	1.00	0.60
PERCENT SODIUM	9	37.00	26.00	30.56	37.00	35.50	29.00	27.00	26.00
POTASSIUM, DISSOLVED (MG/L AS K)	9	7.90	2.00	6.33	7.90	7.55	6.80	5.80	2.00
CHLORIDE, DISSOLVED (MG/L AS CL)	10	29.00	6.10	18.41	29.00	23.50	19.00	13.00	6.10
SULFATE DISSOLVED (MG/L AS SO4)	10	190.00	59.00	116.90	190.00	150.00	107.50	90.00	59.00
FLUORIDE, DISSOLVED (MG/L AS F)	9	0.70	0.30	0.50	0.70	0.60	0.50	0.40	0.30
SILICA, DISSOLVED (MG/L AS SIO2)	10	9.00	1.50	4.58	9.00	7.50	4.20	2.10	1.50
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	10	458.00	190.00	305.20	458.00	345.75	293.00	257.00	190.00
SOLIDS, DISSOLVED (TONS PER AC-FT)	10	0.62	0.26	0.42	0.62	0.48	0.40	0.35	0.26

TABLE 20.--STATISTICAL SUMMARY OF SELECTED WATER-QUALITY DATA IN THE UPPER TRINITY RIVER BASIN, TEXAS--CONTINUED

STATION NUMBER: 08050500 STATION NAME: ELM FORK TRINITY RIVER NEAR SANGER, TEX.

LATITUDE: 332311 LONGITUDE: 0970505 COUNTY: DENTON DRAINAGE AREA: 381.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM OCT 1972 TO AUG 1982

	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
WATER-QUALITY CONSTITUENT	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	84	29.50	1.50	17.16	27.37	23.50	18.00	10.13	4.13
STREAMFLOW, INSTANTANEOUS (CFS)	84	4449.99	0.00	143.42	550.00	101.75	24.50	5.40	1.12
TURBIDITY (JTU)	28	80.00	1.00	24.11	75.50	38.75	15.00	8.50	2.35
TURBIDITY (FTU)	23	140.00	0.90	27.04	132.00	34.00	14.00	8.20	1.20
COLOR (PLATINUMCOBALT UNITS)	51	80.00	0.00	22.14	64.00	30.00	20.00	8.00	0.00
SPECIFIC CONDUCTANCE (UMHOS)	67	1130.00	282.00	691.90	963.60	836.00	698.00	531.00	361.00
OXYGEN, DISSOLVED (MG/L)	59	16.60	3.90	8.13	13.20	9.40	7.80	6.30	4.40
OXYGEN, DISSOLVED (PERCENT SATURATION)	59	131.00	49.00	82.64	128.00	91.00	83.00	72.00	54.00
OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L)	59	11.00	0.30	2.57	6.20	3.00	2.10	1.40	0.70
PH (UNITS)	67	8.90	6.70	--	8.30	8.10	7.80	7.50	7.00
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	67	50.00	0.80	10.62	33.60	14.00	7.70	4.30	1.94
ALKALINITY FIELD (MG/L AS CACO3)	67	443.00	102.00	233.52	374.20	281.00	233.00	160.00	116.20
BICARBONATE FET-FLD (MG/L AS HCO3)	55	540.00	124.00	289.47	464.00	360.00	284.00	200.00	146.00
CARBONATE FET-FLD (MG/L AS CO3)	55	33.00	0.00	0.96	8.80	0.00	0.00	0.00	0.00
SOLIDS, RESIDUE AT 105 DEG. C, SUSPENDED	51	279.00	0.00	55.04	217.20	76.00	30.00	21.00	4.80
NITROGEN, TOTAL (MG/L AS N)	50	5.30	0.81	2.36	4.64	2.80	2.30	1.60	1.02
NITROGEN, ORGANIC TOTAL (MG/L AS N)	56	2.20	0.06	0.87	1.81	1.20	0.79	0.53	0.19
NITROGEN, AMMONIA TOTAL (MG/L AS N)	58	0.43	0.00	0.11	0.38	0.15	0.07	0.02	0.00
NITROGEN, NITRITE TOTAL (MG/L AS N)	58	0.28	0.00	0.04	0.12	0.06	0.03	0.02	0.00
NITROGEN, NITRATE TOTAL (MG/L AS N)	63	4.00	0.00	1.21	2.70	1.60	1.10	0.74	0.08
NITROGEN,AMMONIA + ORGANIC TOTAL (MG/L AS N)	50	2.80	0.31	1.10	2.13	1.40	0.92	0.78	0.51
NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	50	3.40	0.01	1.25	3.02	1.63	1.05	0.74	0.07
PHOSPHORUS, TOTAL (MG/L AS P)	58	4.50	0.07	0.80	3.02	1.15	0.39	0.24	0.12
CARBON, ORGANIC TOTAL (MG/L AS C)	48	19.00	2.40	7.95	16.10	9.80	7.05	5.50	3.36
HARDNESS (MG/L AS CACO3)	67	310.00	92.00	207.79	310.00	260.00	220.00	160.00	120.00
HARDNESS, NONCARBONATE (MG/L CACO3)	67	131.00	0.00	16.79	48.60	29.00	10.00	0.00	0.00
CALCIUM DISSOLVED (MG/L AS CA)	67	112.00	32.00	73.55	110.00	90.00	79.00	55.00	41.80
MAGNESIUM, DISSOLVED (MG/L AS MG)	67	16.00	2.80	5.93	8.92	7.00	6.00	4.30	2.88
SODIUM, DISSOLVED (MG/L AS NA)	52	210.00	18.00	73.44	167.00	97.75	60.50	40.50	22.65
SODIUM ADSORPTION RATIO	67	9.50	0.50	2.21	6.00	2.60	1.50	1.20	0.70
PERCENT SODIUM	52	81.00	21.00	40.40	71.75	47.50	35.50	29.25	22.00
POTASSIUM, DISSOLVED (MG/L AS K)	52	8.20	2.20	4.82	7.44	5.75	4.55	3.80	2.56
CHLORIDE, DISSOLVED (MG/L AS CL)	67	150.00	10.00	53.60	90.40	67.00	50.00	37.00	23.00
SULFATE DISSOLVED (MG/L AS SO4)	67	68.00	6.00	42.69	66.00	52.00	44.00	34.00	16.80
FLUORIDE, DISSOLVED (MG/L AS F)	60	2.30	0.00	0.29	0.49	0.30	0.20	0.20	0.10
SILICA, DISSOLVED (MG/L AS SIO2)	67	15.00	0.40	9.21	14.60	12.00	9.60	7.30	1.52
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	67	652.00	167.00	398.00	577.00	474.00	413.00	287.00	199.80
SOLIDS, DISSOLVED (TONS PER DAY)	60	470.00	1.10	64.57	301.10	83.23	18.65	5.93	1.43
SOLIDS, DISSOLVED (TONS PER AC-FT)	67	0.89	0.23	0.54	0.78	0.64	0.56	0.39	0.27

TABLE 20.--STATISTICAL SUMMARY OF SELECTED WATER-QUALITY DATA IN THE UPPER TRINITY RIVER BASIN, TEXAS--CONTINUED

STATION NUMBER: 08050500 STATION NAME: ELM FORK TRINITY RIVER NEAR SANGER, TEX.

LATITUDE: 332311 LONGITUDE: 0970505 COUNTY: DENTON DRAINAGE AREA: 381.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM OCT 1973 TO AUG 1982

	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
WATER-QUALITY CONSTITUENT	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
ARSENIC DISSOLVED (UG/L AS AS)	33	10.00	0.00	3.15	7.90	4.00	3.00	1.50	0.70
BARIUM, DISSOLVED (UG/L AS BA)	21	300.00	0.00	81.57	290.00	99.50	70.00	0.00	0.00
CADMIUM DISSOLVED (UG/L AS CD)	33	31.00	0.00	1.21	11.40	0.00	0.00	0.00	0.00
CHROMIUM, DISSOLVED (UG/L AS CR)	33	20.00	0.00	1.15	13.00	0.00	0.00	0.00	0.00
COBALT, DISSOLVED (UG/L AS CO)	12	2.00	0.00	0.33	2.00	0.00	0.00	0.00	0.00
COPPER, DISSOLVED (UG/L AS CU)	33	13.00	0.00	2.12	8.80	3.00	2.00	0.00	0.00
IRON, DISSOLVED (UG/L AS FE)	33	80.00	0.00	18.64	73.00	25.00	20.00	0.00	0.00
LEAD, DISSOLVED (UG/L AS PB)	33	4.00	0.00	0.76	4.00	1.50	0.00	0.00	0.00
MANGANESE, DISSOLVED (UG/L AS MN)	33	70.00	0.00	12.91	49.70	20.00	6.00	0.00	0.00
NICKEL, DISSOLVED (UG/L AS NI)	12	5.00	0.00	3.17	5.00	5.00	3.50	2.00	0.00
SILVER, DISSOLVED (UG/L AS AG)	21	2.00	0.00	0.10	1.80	0.00	0.00	0.00	0.00
STRONTIUM, DISSOLVED (UG/L AS SR)	12	650.00	330.00	503.33	650.00	600.00	495.00	412.50	330.00
ZINC, DISSOLVED (UG/L AS ZN)	33	40.00	0.00	6.97	40.00	9.50	0.00	0.00	0.00
ALUMINUM, DISSOLVED (UG/L AS AL)	12	40.00	0.00	19.25	40.00	37.50	15.00	3.25	0.00
LITHIUM DISSOLVED (UG/L AS LI)	12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SELENIUM, DISSOLVED (UG/L AS SE)	21	2.00	0.00	0.57	1.90	1.00	1.00	0.00	0.00
MERCURY DISSOLVED (UG/L AS HG)	33	0.80	0.00	0.08	0.73	0.00	0.00	0.00	0.00

TABLE 20.--STATISTICAL SUMMARY OF SELECTED WATER-QUALITY DATA IN THE UPPER TRINITY RIVER BASIN, TEXAS--CONTINUED

STATION NUMBER: 08052800 [a] STATION NAME: LEWISVILLE LAKE NEAR LEWISVILLE, TEX.

LATITUDE: 330409 LONGITUDE: 0965751 COUNTY: DENTON DRAINAGE AREA: 1660.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM JUN 1973 TO SEPT 1977

	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
WATER-QUALITY CONSTITUENT	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	9	29.00	4.50	19.89	29.00	27.25	22.50	11.00	4.50
SPECIFIC CONDUCTANCE (UMHOS)	9	397.00	315.00	356.00	397.00	387.00	351.00	333.00	315.00
OXYGEN, DISSOLVED (MG/L)	7	13.10	6.60	9.43	13.10	11.50	8.80	8.00	6.60
OXYGEN, DISSOLVED (PERCENT SATURATION)	7	113.00	82.00	100.71	113.00	111.00	105.00	94.00	82.00
PH (UNITS)	9	8.50	7.20	--	8.50	8.40	8.20	7.70	7.20
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	9	14.00	0.60	3.21	14.00	4.30	1.40	0.80	0.60
ALKALINITY FIELD (MG/L AS CACO3)	9	117.00	97.00	105.33	117.00	114.50	102.00	97.50	97.00
BICARBONATE FET-FLD (MG/L AS HCO3)	9	142.00	112.00	127.67	142.00	139.50	124.00	119.00	112.00
CARBONATE FET-FLD (MG/L AS CO3)	9	3.00	0.00	0.33	3.00	0.00	0.00	0.00	0.00
NITROGEN, AMMONIA TOTAL (MG/L AS N)	7	0.04	0.00	0.01	0.04	0.04	0.01	0.00	0.00
NITROGEN, NITRATE TOTAL (MG/L AS N)	1	0.80	0.80						
NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	7	0.57	0.00	0.12	0.57	0.11	0.08	0.00	0.00
PHOSPHORUS, TOTAL (MG/L AS P)	7	0.08	0.01	0.03	0.08	0.03	0.03	0.02	0.01
HARDNESS (MG/L AS CACO3)	9	150.00	110.00	125.56	150.00	135.00	120.00	115.00	110.00
HARDNESS, NONCARBONATE (MG/L CACO3)	9	28.00	11.00	20.56	28.00	24.50	20.00	17.50	11.00
CALCIUM DISSOLVED (MG/L AS CA)	9	50.00	37.00	43.44	50.00	47.50	43.00	40.00	37.00
MAGNESIUM, DISSOLVED (MG/L AS MG)	9	4.90	3.30	4.16	4.90	4.65	4.10	3.70	3.30
SODIUM, DISSOLVED (MG/L AS NA)	8	24.00	17.00	20.62	24.00	22.75	21.00	18.25	17.00
SODIUM ADSORPTION RATIO	9	1.00	0.70	0.82	1.00	0.90	0.80	0.75	0.70
PERCENT SODIUM	8	28.00	22.00	25.63	28.00	27.75	25.50	24.25	22.00
POTASSIUM, DISSOLVED (MG/L AS K)	8	4.20	3.60	3.93	4.20	4.08	4.00	3.73	3.60
CHLORIDE, DISSOLVED (MG/L AS CL)	9	30.00	18.00	24.44	30.00	29.00	24.00	20.50	18.00
SULFATE DISSOLVED (MG/L AS SO4)	9	35.00	27.00	31.44	35.00	33.50	32.00	29.00	27.00
FLUORIDE, DISSOLVED (MG/L AS F)	8	0.40	0.20	0.28	0.40	0.30	0.30	0.20	0.20
SILICA, DISSOLVED (MG/L AS SIO2)	9	6.80	2.70	4.50	6.80	5.30	4.50	3.30	2.70
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	9	220.00	173.00	196.33	220.00	211.50	197.00	181.00	173.00
SOLIDS, DISSOLVED (TONS PER AC-FT)	9	0.30	0.23	0.27	0.30	0.29	0.27	0.25	0.23

[a] Data in this table represent approximately one sample per year collected near the dam or at the reservoir outflow. The table does not include data collected during comprehensive reservoir surveys.

TABLE 20.--STATISTICAL SUMMARY OF SELECTED WATER-QUALITY DATA IN THE UPPER TRINITY RIVER BASIN, TEXAS--CONTINUED

STATION NUMBER: 08053000 STATION NAME: ELM FORK TRINITY RIVER NEAR LEWISVILLE, TEX.

LATITUDE: 330243 LONGITUDE: 0965741 COUNTY: DENTON DRAINAGE AREA: 1673.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM JAN 1981 TO JUL 1982

	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
WATER-QUALITY CONSTITUENT	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	9	28.50	5.00	17.89	28.50	25.50	21.00	8.50	5.00
STREAMFLOW, INSTANTANEOUS (CFS)	9	15000.00	74.00	4114.33	15000.00	6540.00	3220.00	252.50	74.00
TURBIDITY (FTU)	9	370.00	1.50	88.00	370.00	175.00	20.00	5.25	1.50
COLOR (PLATINUM-COBALT UNITS)	9	40.00	5.00	25.00	40.00	32.50	25.00	17.50	5.00
SPECIFIC CONDUCTANCE (UMHOS)	9	435.00	234.00	311.33	435.00	361.00	285.00	255.00	234.00
OXYGEN, DISSOLVED (MG/L)	9	12.80	7.20	9.22	12.80	11.45	8.40	7.60	7.20
OXYGEN, DISSOLVED (PERCENT SATURATION)	9	106.00	76.00	95.67	106.00	101.00	99.00	91.00	76.00
OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L)	9	2.40	0.60	1.27	2.40	1.70	1.20	0.70	0.60
PH (UNITS)	9	8.10	7.40	--	8.10	8.10	7.90	7.65	7.40
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	9	7.50	1.30	3.02	7.50	4.05	2.70	1.55	1.30
ALKALINITY FIELD (MG/L AS CACO3)	9	110.00	85.00	95.89	110.00	105.00	95.00	86.00	85.00
SOLIDS, RESIDUE AT 105 DEG. C, SUSPENDED	9	714.00	0.00	160.22	714.00	328.50	18.00	5.50	0.00
NITROGEN, TOTAL (MG/L AS N)	9	3.20	1.00	1.79	3.20	2.75	1.30	1.05	1.00
NITROGEN, ORGANIC TOTAL (MG/L AS N)	8	2.10	0.37	1.05	2.10	1.55	0.90	0.64	0.37
NITROGEN, AMMONIA TOTAL (MG/L AS N)	9	0.41	0.00	0.21	0.41	0.36	0.20	0.11	0.00
NITROGEN, NITRITE TOTAL (MG/L AS N)	9	0.18	0.00	0.05	0.18	0.10	0.02	0.00	0.00
NITROGEN, NITRATE TOTAL (MG/L AS N)	6	0.92	0.08	0.51	0.92	0.79	0.63	0.09	0.08
NITROGEN,AMMONIA + ORGANIC TOTAL (MG/L AS N)	9	2.50	0.52	1.23	2.50	1.75	1.00	0.79	0.52
NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	9	1.10	0.10	0.55	1.10	0.81	0.53	0.29	0.10
PHOSPHORUS, TOTAL (MG/L AS P)	9	0.38	0.01	0.12	0.38	0.21	0.06	0.03	0.01
CARBON, ORGANIC TOTAL (MG/L AS C)	9	11.00	4.20	6.77	11.00	9.10	5.70	4.55	4.20
HARDNESS (MG/L AS CACO3)	9	140.00	100.00	113.33	140.00	125.00	110.00	100.00	100.00
HARDNESS, NONCARBONATE (MG/L CACO3)	9	35.00	9.00	18.89	35.00	26.00	16.00	13.00	9.00
CALCIUM DISSOLVED (MG/L AS CA)	9	50.00	35.00	40.22	50.00	43.50	39.00	36.50	35.00
MAGNESIUM, DISSOLVED (MG/L AS MG)	9	4.70	2.40	3.47	4.70	4.20	3.70	2.65	2.40
SODIUM, DISSOLVED (MG/L AS NA)	9	28.00	8.10	15.79	28.00	22.00	14.00	11.00	8.10
SODIUM ADSORPTION RATIO	9	1.10	0.40	0.68	1.10	0.95	0.60	0.50	0.40
PERCENT SODIUM	9	29.00	14.00	21.44	29.00	28.00	20.00	17.00	14.00
POTASSIUM, DISSOLVED (MG/L AS K)	9	5.40	3.30	4.28	5.40	5.05	4.20	3.70	3.30
CHLORIDE, DISSOLVED (MG/L AS CL)	9	27.00	12.00	17.78	27.00	23.00	16.00	12.50	12.00
SULFATE DISSOLVED (MG/L AS SO4)	9	55.00	6.00	29.00	55.00	44.00	27.00	14.50	6.00
FLUORIDE, DISSOLVED (MG/L AS F)	9	0.40	0.20	0.26	0.40	0.30	0.20	0.20	0.20
SILICA, DISSOLVED (MG/L AS SIO2)	9	8.10	3.50	5.71	8.10	7.50	5.50	4.40	3.50
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	9	241.00	129.00	174.11	241.00	200.50	158.00	148.50	129.00
SOLIDS, DISSOLVED (TONS PER DAY)	9	6400.00	48.10	1715.27	6400.00	2600.00	1160.00	130.15	48.10
SOLIDS, DISSOLVED (TONS PER AC-FT)	9	0.33	0.18	0.24	0.33	0.27	0.21	0.21	0.18

TABLE 20.--STATISTICAL SUMMARY OF SELECTED WATER-QUALITY DATA IN THE UPPER TRINITY RIVER BASIN, TEXAS--CONTINUED

STATION NUMBER: 08053000 STATION NAME: ELM FORK TRINITY RIVER NEAR LEWISVILLE, TEX.

LATITUDE: 330243 LONGITUDE: 0965741 COUNTY: DENTON DRAINAGE AREA: 1673.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM JAN 1981 TO JUL 1982

	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
WATER-QUALITY CONSTITUENT	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
ARSENIC DISSOLVED (UG/L AS AS)	5	4.00	1.00	2.60	4.00	4.00	2.00	1.50	1.00
BARIUM, DISSOLVED (UG/L AS BA)	5	50.00	35.00	42.60	50.00	50.00	40.00	36.50	35.00
CADMIUM DISSOLVED (UG/L AS CD)	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CHROMIUM, DISSOLVED (UG/L AS CR)	5	10.00	0.00	2.00	10.00	5.00	0.00	0.00	0.00
COPPER, DISSOLVED (UG/L AS CU)	5	1.00	0.00	0.40	1.00	1.00	0.00	0.00	0.00
IRON, DISSOLVED (UG/L AS FE)	5	38.00	0.00	16.80	38.00	29.00	20.00	3.00	0.00
LEAD, DISSOLVED (UG/L AS PB)	5	23.00	0.00	8.80	23.00	21.50	1.00	0.00	0.00
MANGANESE, DISSOLVED (UG/L AS MN)	5	180.00	3.00	58.00	180.00	130.00	20.00	5.00	3.00
SILVER, DISSOLVED (UG/L AS AG)	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ZINC, DISSOLVED (UG/L AS ZN)	5	18.00	0.00	9.60	18.00	17.50	10.00	1.50	0.00
SELENIUM, DISSOLVED (UG/L AS SE)	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MERCURY DISSOLVED (UG/L AS HG)	5	0.10	0.00	0.02	0.10	0.05	0.00	0.00	0.00

TABLE 20.--STATISTICAL SUMMARY OF SELECTED WATER-QUALITY DATA IN THE UPPER TRINITY RIVER BASIN, TEXAS--CONTINUED

STATION NUMBER: 08053500 STATION NAME: DENTON CREEK NEAR JUSTIN, TEX.

LATITUDE: 330708 LONGITUDE: 0971725 COUNTY: DENTON DRAINAGE AREA: 400.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM OCT 1972 TO AUG 1982

	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
WATER-QUALITY CONSTITUENT	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	36	27.50	3.00	16.72	27.07	22.87	16.00	12.12	3.00
STREAMFLOW, INSTANTANEOUS (CFS)	39	1060.00	0.04	121.86	391.00	180.00	56.00	14.00	0.25
TURBIDITY (FTU)	12	130.00	1.60	36.03	130.00	65.50	7.70	3.23	1.60
COLOR (PLATINUMCOBALT UNITS)	12	50.00	0.00	17.92	50.00	30.00	12.50	5.00	0.00
SPECIFIC CONDUCTANCE (UMHOS)	12	848.00	305.00	591.75	848.00	802.50	583.00	394.75	305.00
OXYGEN, DISSOLVED (MG/L)	12	12.60	4.20	7.92	12.60	9.15	7.30	6.80	4.20
OXYGEN, DISSOLVED (PERCENT SATURATION)	12	95.00	53.00	81.09	95.00	89.75	83.00	76.57	53.00
OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L)	12	2.50	0.80	1.63	2.50	2.40	1.60	1.00	0.80
PH (UNITS)	12	8.20	7.40	--	8.20	8.10	8.05	7.93	7.40
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	12	11.00	1.70	4.13	11.00	4.83	3.40	2.58	1.70
ALKALINITY FIELD (MG/L AS CACO3)	12	270.00	110.00	192.50	270.00	225.00	200.00	145.00	110.00
SOLIDS, RESIDUE AT 105 DEG. C, SUSPENDED	12	214.00	8.00	51.00	214.00	99.25	15.50	9.50	8.00
NITROGEN, TOTAL (MG/L AS N)	12	1.90	0.66	1.06	1.90	1.42	0.91	0.78	0.66
NITROGEN, ORGANIC TOTAL (MG/L AS N)	9	1.40	0.39	0.74	1.40	0.93	0.62	0.53	0.39
NITROGEN, AMMONIA TOTAL (MG/L AS N)	12	0.25	0.00	0.10	0.25	0.16	0.10	0.01	0.00
NITROGEN, NITRITE TOTAL (MG/L AS N)	12	0.10	0.00	0.01	0.10	0.02	0.00	0.00	0.00
NITROGEN, NITRATE TOTAL (MG/L AS N)	7	0.29	0.00	0.13	0.29	0.23	0.15	0.03	0.00
NITROGEN,AMMONIA + ORGANIC TOTAL (MG/L AS N)	12	1.60	0.38	0.82	1.60	0.88	0.76	0.63	0.38
NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	12	0.81	0.00	0.25	0.81	0.34	0.21	0.09	0.00
PHOSPHORUS, TOTAL (MG/L AS P)	12	0.32	0.00	0.07	0.32	0.08	0.05	0.02	0.00
CARBON, ORGANIC TOTAL (MG/L AS C)	12	11.00	3.50	7.01	11.00	9.98	6.25	4.25	3.50
HARDNESS (MG/L AS CACO3)	12	350.00	140.00	243.33	350.00	315.00	255.00	165.00	140.00
HARDNESS, NONCARBONATE (MG/L CACO3)	12	97.00	18.00	51.33	97.00	82.00	46.00	21.75	18.00
CALCIUM DISSOLVED (MG/L AS CA)	12	114.00	46.00	79.75	114.00	95.75	82.50	58.00	46.00
MAGNESIUM, DISSOLVED (MG/L AS MG)	12	23.00	3.70	10.76	23.00	16.25	8.55	5.45	3.70
SODIUM, DISSOLVED (MG/L AS NA)	12	55.00	7.90	27.33	55.00	39.25	24.50	14.25	7.90
SODIUM ADSORPTION RATIO	12	1.40	0.30	0.75	1.40	0.95	0.75	0.45	0.30
PERCENT SODIUM	12	29.00	11.00	18.42	29.00	22.25	18.00	14.50	11.00
POTASSIUM, DISSOLVED (MG/L AS K)	12	6.60	2.20	3.78	6.60	4.65	3.65	2.70	2.20
CHLORIDE, DISSOLVED (MG/L AS CL)	12	73.00	13.00	36.67	73.00	60.25	24.50	20.25	13.00
SULFATE DISSOLVED (MG/L AS SO4)	12	120.00	20.00	63.50	120.00	90.25	60.50	37.50	20.00
FLUORIDE, DISSOLVED (MG/L AS F)	12	0.30	0.20	0.28	0.30	0.30	0.30	0.23	0.20
SILICA, DISSOLVED (MG/L AS SIO2)	12	15.00	2.00	9.58	15.00	12.00	11.00	7.53	2.00
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	12	504.00	179.00	347.08	504.00	476.50	344.00	224.50	179.00
SOLIDS, DISSOLVED (TONS PER DAY)	12	513.00	0.02	102.49	513.00	130.00	62.25	3.43	0.02
SOLIDS, DISSOLVED (TONS PER AC-FT)	12	0.69	0.24	0.47	0.69	0.65	0.47	0.31	0.24

TABLE 20.--STATISTICAL SUMMARY OF SELECTED WATER-QUALITY DATA IN THE UPPER TRINITY RIVER BASIN, TEXAS--CONTINUED

STATION NUMBER: 08053500 STATION NAME: DENTON CREEK NEAR JUSTIN, TEX.

LATITUDE: 330708 LONGITUDE: 0971725 COUNTY: DENTON DRAINAGE AREA: 400.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM JAN 1981 TO AUG 1982

	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
WATER-QUALITY CONSTITUENT	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
ARSENIC DISSOLVED (UG/L AS AS)	6	3.00	1.00	1.50	3.00	2.25	1.00	1.00	1.00
BARIUM, DISSOLVED (UG/L AS BA)	6	110.00	80.00	101.67	110.00	110.00	105.00	95.00	80.00
CADMIUM DISSOLVED (UG/L AS CD)	6	1.00	0.00	0.17	1.00	0.25	0.00	0.00	0.00
CHROMIUM, DISSOLVED (UG/L AS CR)	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
COPPER, DISSOLVED (UG/L AS CU)	6	2.00	0.00	0.33	2.00	0.50	0.00	0.00	0.00
IRON, DISSOLVED (UG/L AS FE)	6	20.00	0.00	6.67	20.00	20.00	0.00	0.00	0.00
LEAD, DISSOLVED (UG/L AS PB)	6	14.00	0.00	3.50	14.00	6.50	1.50	0.00	0.00
MANGANESE, DISSOLVED (UG/L AS MN)	6	34.00	3.00	18.00	34.00	31.75	15.00	8.25	3.00
SILVER, DISSOLVED (UG/L AS AG)	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ZINC, DISSOLVED (UG/L AS ZN)	6	12.00	3.00	8.17	12.00	10.50	10.00	3.75	3.00
SELENIUM, DISSOLVED (UG/L AS SE)	6	1.00	0.00	0.17	1.00	0.25	0.00	0.00	0.00
MERCURY DISSOLVED (UG/L AS HG)	6	0.80	0.00	0.22	0.80	0.43	0.10	0.00	0.00

TABLE 20.--STATISTICAL SUMMARY OF SELECTED WATER-QUALITY DATA IN THE UPPER TRINITY RIVER BASIN, TEXAS--CONTINUED

STATION NUMBER: 08054500 [a/] STATION NAME: GRAPEVINE LAKE NEAR GRAPEVINE, TEX.

LATITUDE: 325821 LONGITUDE: 0970322 COUNTY: TARRANT DRAINAGE AREA: 695.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM JUN 1973 TO JAN 1979

	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
WATER-QUALITY CONSTITUENT	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	7	26.00	2.00	16.29	26.00	24.50	16.00	13.50	2.00
SPECIFIC CONDUCTANCE (UMHOS)	7	425.00	354.00	380.86	425.00	395.00	373.00	358.00	354.00
PH (UNITS)	6	8.20	7.30	--	8.20	8.12	7.90	7.67	7.30
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	6	11.00	1.30	4.03	11.00	5.53	3.10	1.83	1.30
ALKALINITY FIELD (MG/L AS CACO3)	7	139.00	107.00	119.00	139.00	128.00	115.00	110.00	107.00
BICARBONATE FET-FLD (MG/L AS HCO3)	7	169.00	130.00	144.86	169.00	156.00	140.00	134.00	130.00
CARBONATE FET-FLD (MG/L AS CO3)	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NITROGEN, NITRATE TOTAL (MG/L AS N)	1	0.30	0.30						
HARDNESS (MG/L AS CACO3)	7	160.00	140.00	145.71	160.00	160.00	140.00	140.00	140.00
HARDNESS, NONCARBONATE (MG/L CACO3)	7	32.00	16.00	24.71	32.00	29.00	25.00	21.00	16.00
CALCIUM DISSOLVED (MG/L AS CA)	7	55.00	43.00	47.00	55.00	53.00	45.00	43.00	43.00
MAGNESIUM, DISSOLVED (MG/L AS MG)	7	6.90	5.00	6.34	6.90	6.80	6.50	6.10	5.00
SODIUM, DISSOLVED (MG/L AS NA)	6	21.00	18.00	19.50	21.00	21.00	19.50	18.00	18.00
SODIUM ADSORPTION RATIO	7	0.80	0.60	0.71	0.80	0.80	0.70	0.60	0.60
PERCENT SODIUM	6	25.00	19.00	22.17	25.00	24.25	22.50	19.75	19.00
POTASSIUM, DISSOLVED (MG/L AS K)	6	4.40	3.50	4.00	4.40	4.25	4.15	3.58	3.50
CHLORIDE, DISSOLVED (MG/L AS CL)	7	33.00	18.00	24.43	33.00	26.00	25.00	19.00	18.00
SULFATE DISSOLVED (MG/L AS SO4)	7	36.00	29.00	31.43	36.00	34.00	30.00	29.00	29.00
FLUORIDE, DISSOLVED (MG/L AS F)	6	0.50	0.10	0.27	0.50	0.35	0.30	0.10	0.10
SILICA, DISSOLVED (MG/L AS SIO2)	7	11.00	0.40	5.80	11.00	7.30	5.90	3.50	0.40
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	7	233.00	189.00	209.29	233.00	223.00	207.00	198.00	189.00
SOLIDS, DISSOLVED (TONS PER AC-FT)	7	0.32	0.26	0.28	0.32	0.30	0.28	0.27	0.26

[a/] Data in this table represent approximately one sample per year collected near the dam or at the reservoir outflow. The table does not include data collected during comprehensive reservoir surveys.

TABLE 20.--STATISTICAL SUMMARY OF SELECTED WATER-QUALITY DATA IN THE UPPER TRINITY RIVER BASIN, TEXAS--CONTINUED

STATION NUMBER: 08055000 STATION NAME: DENTON CREEK NEAR GRAPEVINE, TEX.

LATITUDE: 325913 LONGITUDE: 0970045 COUNTY: TARRANT DRAINAGE AREA: 705.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM JAN 1981 TO JUL 1982

	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
WATER-QUALITY CONSTITUENT	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	6	29.00	6.50	19.00	29.00	26.00	21.75	9.13	6.50
STREAMFLOW, INSTANTANEOUS (CFS)	6	1960.00	25.00	668.50	1960.00	1810.00	111.00	39.25	25.00
TURBIDITY (FTU)	6	46.00	1.20	19.38	46.00	39.25	14.35	2.85	1.20
COLOR (PLATINUMCOBALT UNITS)	6	50.00	5.00	20.83	50.00	35.00	15.00	8.75	5.00
SPECIFIC CONDUCTANCE (UMHOS)	6	393.00	259.00	345.17	393.00	387.75	354.00	308.50	259.00
OXYGEN, DISSOLVED (MG/L)	6	11.90	6.20	8.47	11.90	11.30	7.40	6.65	6.20
OXYGEN, DISSOLVED (PERCENT SATURATION)	6	101.00	73.00	89.33	101.00	98.75	89.00	82.75	73.00
OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L)	6	1.50	0.50	0.97	1.50	1.42	0.90	0.57	0.50
PH (UNITS)	6	7.90	7.30	--	7.90	7.90	7.80	7.60	7.30
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	6	12.00	2.40	4.78	12.00	6.45	3.40	2.78	2.40
ALKALINITY FIELD (MG/L AS CACO3)	6	120.00	100.00	113.33	120.00	120.00	115.00	107.50	100.00
SOLIDS, RESIDUE AT 105 DEG. C, SUSPENDED	6	50.00	7.00	24.83	50.00	37.25	23.00	11.50	7.00
NITROGEN, TOTAL (MG/L AS N)	5	1.70	0.80	1.13	1.70	1.45	1.10	0.83	0.80
NITROGEN, ORGANIC TOTAL (MG/L AS N)	6	1.10	0.36	0.72	1.10	0.88	0.72	0.54	0.36
NITROGEN, AMMONIA TOTAL (MG/L AS N)	6	0.29	0.04	0.17	0.29	0.25	0.17	0.10	0.04
NITROGEN, NITRITE TOTAL (MG/L AS N)	6	0.03	0.00	0.01	0.03	0.02	0.02	0.00	0.00
NITROGEN, NITRATE TOTAL (MG/L AS N)	4	0.50	0.09						
NITROGEN,AMMONIA + ORGANIC TOTAL (MG/L AS N)	6	1.20	0.51	0.88	1.20	1.05	0.94	0.65	0.51
NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	6	0.52	0.00	0.24	0.52	0.39	0.25	0.08	0.00
PHOSPHORUS, TOTAL (MG/L AS P)	6	0.11	0.01	0.06	0.11	0.08	0.07	0.04	0.01
CARBON, ORGANIC TOTAL (MG/L AS C)	6	6.70	4.40	5.60	6.70	6.40	5.50	5.00	4.40
HARDNESS (MG/L AS CACO3)	6	140.00	110.00	133.33	140.00	140.00	140.00	125.00	110.00
HARDNESS, NONCARBONATE (MG/L CACO3)	6	31.00	8.00	19.50	31.00	28.75	21.00	8.00	8.00
CALCIUM DISSOLVED (MG/L AS CA)	6	49.00	38.00	45.00	49.00	49.00	46.00	41.00	38.00
MAGNESIUM, DISSOLVED (MG/L AS MG)	6	6.20	3.10	4.90	6.20	5.98	5.00	3.93	3.10
SODIUM, DISSOLVED (MG/L AS NA)	6	23.00	8.10	16.35	23.00	23.00	16.50	10.28	8.10
SODIUM ADSORPTION RATIO	6	0.90	0.40	0.65	0.90	0.90	0.65	0.40	0.40
PERCENT SODIUM	6	26.00	14.00	20.00	26.00	25.25	20.50	14.00	14.00
POTASSIUM, DISSOLVED (MG/L AS K)	6	5.30	3.20	4.35	5.30	5.08	4.30	3.80	3.20
CHLORIDE, DISSOLVED (MG/L AS CL)	6	26.00	12.00	18.83	26.00	24.50	18.00	14.25	12.00
SULFATE DISSOLVED (MG/L AS SO4)	6	41.00	6.00	28.83	41.00	39.50	32.00	18.75	6.00
FLUORIDE, DISSOLVED (MG/L AS F)	6	0.40	0.20	0.27	0.40	0.33	0.25	0.20	0.20
SILICA, DISSOLVED (MG/L AS SIO2)	6	8.20	0.90	5.55	8.20	8.05	6.00	3.38	0.90
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	6	221.00	140.00	192.33	221.00	215.00	195.00	177.50	140.00
SOLIDS, DISSOLVED (TONS PER DAY)	6	1000.00	14.40	303.67	1000.00	748.00	60.05	21.23	14.40
SOLIDS, DISSOLVED (TONS PER AC-FT)	6	0.30	0.19	0.26	0.30	0.29	0.27	0.24	0.19

TABLE 20.--STATISTICAL SUMMARY OF SELECTED WATER-QUALITY DATA IN THE UPPER TRINITY RIVER BASIN, TEXAS--CONTINUED

STATION NUMBER: 08055000 STATION NAME: DENTON CREEK NEAR GRAPEVINE, TEX.

LATITUDE: 325913 LONGITUDE: 0970045 COUNTY: TARRANT DRAINAGE AREA: 705.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM JAN 1981 TO JUL 1982

	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
WATER-QUALITY CONSTITUENT	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
ARSENIC DISSOLVED (UG/L AS AS)	6	3.00	1.00	1.67	3.00	2.25	1.50	1.00	1.00
BARIUM, DISSOLVED (UG/L AS BA)	6	100.00	42.00	61.00	100.00	70.00	58.00	46.50	42.00
CADMIUM DISSOLVED (UG/L AS CD)	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CHROMIUM, DISSOLVED (UG/L AS CR)	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
COPPER, DISSOLVED (UG/L AS CU)	6	2.00	0.00	0.50	2.00	1.25	0.00	0.00	0.00
IRON, DISSOLVED (UG/L AS FE)	6	91.00	0.00	28.83	91.00	42.25	20.00	12.00	0.00
LEAD, DISSOLVED (UG/L AS PB)	6	14.00	0.00	2.33	14.00	3.50	0.00	0.00	0.00
MANGANESE, DISSOLVED (UG/L AS MN)	6	280.00	5.00	57.33	280.00	94.75	10.00	5.75	5.00
SILVER, DISSOLVED (UG/L AS AG)	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ZINC, DISSOLVED (UG/L AS ZN)	6	20.00	0.00	7.67	20.00	13.25	7.50	0.00	0.00
SELENIUM, DISSOLVED (UG/L AS SE)	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MERCURY DISSOLVED (UG/L AS HG)	6	0.10	0.00	0.02	0.10	0.03	0.00	0.00	0.00

TABLE 20.--STATISTICAL SUMMARY OF SELECTED WATER-QUALITY DATA IN THE UPPER TRINITY RIVER BASIN, TEXAS--CONTINUED

STATION NUMBER: 08057410 STATION NAME: TRINITY RIVER BELOW DALLAS, TEX.

LATITUDE: 324226 LONGITUDE: 0964408 COUNTY: DALLAS DRAINAGE AREA: 6278.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM OCT 1972 TO AUG 1982

	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
WATER-QUALITY CONSTITUENT	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	140	31.00	5.00	20.61	30.00	26.50	21.25	15.50	8.52
STREAMFLOW, INSTANTANEOUS (CFS)	133	24399.95	220.00	2296.99	9525.97	2854.99	723.00	458.00	324.90
TURBIDITY (JTU)	72	320.00	2.00	48.79	194.00	60.00	30.00	15.00	6.00
TURBIDITY (FTU)	33	110.00	2.00	19.12	103.00	20.00	12.00	6.35	2.14
COLOR (PLATINUMCOBALT UNITS)	105	100.00	5.00	30.05	60.00	40.00	30.00	20.00	5.00
SPECIFIC CONDUCTANCE (UMHOS)	126	1070.00	320.00	725.06	1006.50	890.25	767.00	566.75	348.75
OXYGEN, DISSOLVED (MG/L)	111	11.80	0.00	3.98	8.16	5.60	3.90	2.10	0.20
OXYGEN, DISSOLVED (PERCENT SATURATION)	111	100.00	0.00	43.22	83.40	60.00	44.00	24.00	2.60
OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L)	110	50.00	1.00	14.47	31.45	19.00	13.00	8.47	4.51
PH (UNITS)	126	8.20	6.50	--	7.90	7.50	7.30	7.10	6.80
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	120	72.00	1.50	20.76	57.80	25.00	17.00	11.00	2.74
ALKALINITY FIELD (MG/L AS CACO3)	120	239.00	90.00	162.89	230.00	184.00	160.00	139.25	110.00
BICARBONATE FET-FLD (MG/L AS HCO3)	105	292.00	110.00	202.28	281.40	231.50	200.00	171.00	135.80
CARBONATE FET-FLD (MG/L AS CO3)	105	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SOLIDS, RESIDUE AT 105 DEG. C, SUSPENDED	105	770.00	2.00	103.80	507.20	99.00	48.00	29.50	9.00
NITROGEN, TOTAL (MG/L AS N)	93	23.00	1.40	10.32	17.30	15.00	11.00	6.10	1.94
NITROGEN, ORGANIC TOTAL (MG/L AS N)	110	14.00	0.00	2.55	7.65	3.60	1.70	0.84	0.25
NITROGEN, AMMONIA TOTAL (MG/L AS N)	110	16.00	0.11	5.70	12.00	8.75	6.00	2.00	0.49
NITROGEN, NITRITE TOTAL (MG/L AS N)	111	1.10	0.02	0.30	0.76	0.38	0.23	0.13	0.04
NITROGEN, NITRATE TOTAL (MG/L AS N)	121	12.00	0.00	1.36	3.89	1.70	1.10	0.50	0.09
NITROGEN,AMMONIA + ORGANIC TOTAL (MG/L AS N)	93	21.00	0.90	8.89	17.00	13.00	8.60	4.20	1.37
NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	93	4.90	0.03	1.42	3.71	2.05	1.20	0.59	0.17
PHOSPHORUS, TOTAL (MG/L AS P)	111	14.00	0.00	3.91	8.70	5.50	3.80	1.70	0.43
CARBON, ORGANIC TOTAL (MG/L AS C)	97	48.00	2.30	16.24	28.00	20.00	16.00	11.50	5.79
HARDNESS (MG/L AS CACO3)	120	240.00	89.00	159.24	209.50	180.00	160.00	140.00	120.00
HARDNESS, NONCARBONATE (MG/L CACO3)	120	90.00	0.00	14.00	42.00	27.50	3.00	0.00	0.00
CALCIUM DISSOLVED (MG/L AS CA)	120	80.00	31.00	54.62	72.95	61.00	53.00	47.25	41.00
MAGNESIUM, DISSOLVED (MG/L AS MG)	120	12.00	2.60	5.79	7.89	6.60	5.80	5.00	3.60
SODIUM, DISSOLVED (MG/L AS NA)	99	140.00	16.00	83.68	140.00	110.00	89.00	49.00	22.00
SODIUM ADSORPTION RATIO	120	5.50	0.50	2.83	5.20	4.00	2.90	1.40	0.81
PERCENT SODIUM	99	67.00	21.00	48.43	65.00	60.00	52.00	39.00	25.00
POTASSIUM, DISSOLVED (MG/L AS K)	99	19.00	1.10	10.82	17.00	14.00	11.00	8.20	4.60
CHLORIDE, DISSOLVED (MG/L AS CL)	120	99.00	9.40	58.16	95.00	78.00	60.00	33.25	19.05
SULFATE DISSOLVED (MG/L AS SO4)	119	170.00	24.00	94.14	140.00	120.00	100.00	75.00	33.00
FLUORIDE, DISSOLVED (MG/L AS F)	103	2.80	0.30	1.02	2.10	1.40	1.00	0.50	0.30
SILICA, DISSOLVED (MG/L AS SIO2)	120	29.00	2.30	10.81	16.95	12.00	11.00	8.30	5.41
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	119	610.00	173.00	412.56	578.00	510.00	438.00	319.00	204.00
SOLIDS, DISSOLVED (TONS PER DAY)	119	13800.00	326.00	1630.18	5609.99	1980.00	821.00	620.00	448.00
SOLIDS, DISSOLVED (TONS PER AC-FT)	119	0.83	0.24	0.56	0.78	0.69	0.59	0.43	0.28

TABLE 20.--STATISTICAL SUMMARY OF SELECTED WATER-QUALITY DATA IN THE UPPER TRINITY RIVER BASIN, TEXAS--CONTINUED

STATION NUMBER: 08057410 STATION NAME: TRINITY RIVER BELOW DALLAS, TEX.

LATITUDE: 324226 LONGITUDE: 0964408 COUNTY: DALLAS DRAINAGE AREA: 6278.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM OCT 1972 TO JUL 1981

	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
WATER-QUALITY CONSTITUENT	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
ARSENIC DISSOLVED (UG/L AS AS)	37	23.00	0.00	5.89	23.00	7.00	6.00	2.00	0.00
BARIUM, DISSOLVED (UG/L AS BA)	19	300.00	0.00	31.58	300.00	20.00	20.00	0.00	0.00
CADMIUM DISSOLVED (UG/L AS CD)	37	54.00	0.00	2.73	9.90	2.00	2.00	0.00	0.00
CHROMIUM, DISSOLVED (UG/L AS CR)	37	21.00	0.00	4.89	20.10	10.00	0.00	0.00	0.00
COBALT, DISSOLVED (UG/L AS CO)	17	4.00	0.00	0.71	4.00	1.00	0.00	0.00	0.00
COPPER, DISSOLVED (UG/L AS CU)	37	56.00	0.00	9.59	29.00	14.50	7.00	3.00	0.00
IRON, DISSOLVED (UG/L AS FE)	37	450.00	0.00	88.92	369.00	100.00	70.00	45.00	0.00
LEAD, DISSOLVED (UG/L AS PB)	37	80.00	0.00	6.89	44.00	7.50	4.00	0.00	0.00
MANGANESE, DISSOLVED (UG/L AS MN)	37	170.00	0.00	77.57	152.00	105.00	80.00	50.00	0.00
NICKEL, DISSOLVED (UG/L AS NI)	17	110.00	2.00	27.24	110.00	42.00	25.00	5.00	2.00
SILVER, DISSOLVED (UG/L AS AG)	20	2.00	0.00	0.20	2.00	0.00	0.00	0.00	0.00
STRONTIUM, DISSOLVED (UG/L AS SR)	17	610.00	290.00	420.59	610.00	495.00	430.00	335.00	290.00
ZINC, DISSOLVED (UG/L AS ZN)	37	90.00	0.00	33.95	72.00	45.00	40.00	20.00	0.00
ALUMINUM, DISSOLVED (UG/L AS AL)	17	200.00	0.00	44.71	200.00	60.00	30.00	20.00	0.00
LITHIUM DISSOLVED (UG/L AS LI)	17	20.00	0.00	4.71	20.00	10.00	0.00	0.00	0.00
SELENIUM, DISSOLVED (UG/L AS SE)	20	3.00	0.00	0.30	2.90	0.00	0.00	0.00	0.00
NAPHTHALENES, POLYCHLOR. TOTAL (UG/L)	14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ALDRIN, TOTAL (UG/L)	29	0.03	0.00	0.00	0.02	0.00	0.00	0.00	0.00
LINDANE TOTAL (UG/L)	28	0.10	0.00	0.03	0.10	0.05	0.02	0.00	0.00
CHLORDANE, TOTAL (UG/L)	28	0.30	0.00	0.06	0.25	0.10	0.05	0.00	0.00
DDD, TOTAL (UG/L)	29	0.04	0.00	0.00	0.02	0.00	0.00	0.00	0.00
DOE, TOTAL (UG/L)	29	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DDT, TOTAL (UG/L)	29	0.07	0.00	0.01	0.05	0.00	0.00	0.00	0.00
DIELDRIN TOTAL (UG/L)	29	0.14	0.00	0.02	0.11	0.04	0.01	0.01	0.00
ENDOSULFAN, TOTAL (UG/L)	13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ENDRIN, TOTAL (UG/L)	29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ETHION, TOTAL (UG/L)	18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOXAPHENE, TOTAL (UG/L)	24	0.70	0.00	0.03	0.52	0.00	0.00	0.00	0.00
HEPTACHLOR, TOTAL (UG/L)	29	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HEPTACHLOR EPOXIDE TOTAL (UG/L)	29	0.03	0.00	0.00	0.02	0.00	0.00	0.00	0.00
METHOXYCHLOR, TOTAL (UG/L)	3	0.01	0.00						
PCB, TOTAL (UG/L)	29	2.00	0.00	0.07	1.00	0.00	0.00	0.00	0.00
MALATHION, TOTAL (UG/L)	30	0.39	0.00	0.07	0.31	0.09	0.04	0.00	0.00
PARATHION, TOTAL (UG/L)	30	0.02	0.00	0.00	0.01	0.00	0.00	0.00	0.00
DIAZINON, TOTAL (UG/L)	30	7.70	0.00	0.70	4.01	0.72	0.44	0.26	0.03
METHYL PARATHION, TOTAL (UG/L)	30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,4-D, TOTAL (UG/L)	28	4.20	0.00	0.44	3.48	0.39	0.14	0.05	0.00
2,4,5-T TOTAL (UG/L)	28	0.48	0.00	0.08	0.42	0.10	0.03	0.00	0.00
SILVEX, TOTAL (UG/L)	28	0.38	0.00	0.02	0.25	0.00	0.00	0.00	0.00
TOTAL TRITHION (UG/L)	18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
METHYL TRITHION, TOTAL (UG/L)	18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MERCURY DISSOLVED (UG/L AS HG)	37	0.60	0.00	0.05	0.24	0.05	0.00	0.00	0.00

TABLE 20.--STATISTICAL SUMMARY OF SELECTED WATER-QUALITY DATA IN THE UPPER TRINITY RIVER BASIN, TEXAS--CONTINUED

STATION NUMBER: 08058900 STATION NAME: EAST FORK TRINITY RIVER AT MCKINNEY, TEX.

LATITUDE: 331438 LONGITUDE: 0963631 COUNTY: COLLIN DRAINAGE AREA: 164.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM OCT 1980 TO AUG 1982

WATER-QUALITY CONSTITUENT	SAMPLE SIZE	DESCRIPTIVE STATISTICS MAXIMUM	MINIMUM	MEAN	PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN 95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	12	29.50	3.00	17.75	29.50	23.50	18.25	13.75	3.00
STREAMFLOW, INSTANTANEOUS (CFS)	12	1420.00	0.80	247.57	1420.00	233.25	35.50	9.87	0.80
TURBIDITY (FTU)	12	410.00	1.90	74.10	410.00	85.50	27.50	8.03	1.90
COLOR (PLATINUMCOBALT UNITS)	12	60.00	0.00	18.33	60.00	27.50	10.00	6.25	0.00
SPECIFIC CONDUCTANCE (UMHOS)	12	680.00	275.00	443.42	680.00	521.75	458.00	312.75	275.00
OXYGEN, DISSOLVED (MG/L)	12	12.40	4.60	7.79	12.40	8.75	7.15	6.45	4.60
OXYGEN, DISSOLVED (PERCENT SATURATION)	12	97.00	19.00	74.83	97.00	86.00	78.00	76.00	19.00
OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L)	12	4.60	0.90	1.80	4.60	1.92	1.60	1.12	0.90
PH (UNITS)	12	8.00	7.70	--	8.00	8.00	7.90	7.80	7.70
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	12	6.60	2.10	4.45	6.60	5.08	4.75	3.43	2.10
ALKALINITY FIELD (MG/L AS CACO3)	12	260.00	110.00	175.83	260.00	207.50	180.00	125.00	110.00
SOLIDS, RESIDUE AT 105 DEG. C, SUSPENDED	12	429.00	12.00	109.83	429.00	149.75	38.00	22.50	12.00
NITROGEN, TOTAL (MG/L AS N)	12	4.70	1.20	1.90	4.70	2.10	1.70	1.25	1.20
NITROGEN, ORGANIC TOTAL (MG/L AS N)	11	1.70	0.60	1.09	1.70	1.40	0.97	0.78	0.60
NITROGEN, AMMONIA TOTAL (MG/L AS N)	12	0.27	0.00	0.12	0.27	0.18	0.13	0.06	0.00
NITROGEN, NITRITE TOTAL (MG/L AS N)	12	0.09	0.00	0.03	0.09	0.05	0.02	0.00	0.00
NITROGEN, NITRATE TOTAL (MG/L AS N)	9	2.70	0.17	0.76	2.70	0.88	0.64	0.31	0.17
NITROGEN,AMMONIA + ORGANIC TOTAL (MG/L AS N)	12	1.90	0.76	1.18	1.90	1.63	1.00	0.81	0.76
NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	12	2.80	0.20	0.72	2.80	0.76	0.58	0.32	0.20
PHOSPHORUS, TOTAL (MG/L AS P)	12	0.39	0.00	0.09	0.39	0.09	0.06	0.02	0.00
CARBON, ORGANIC TOTAL (MG/L AS C)	12	20.00	3.70	8.56	20.00	11.50	7.20	4.85	3.70
HARDNESS (MG/L AS CACO3)	12	310.00	120.00	200.83	310.00	247.50	205.00	137.50	120.00
HARDNESS, NONCARBONATE (MG/L CACO3)	12	56.00	10.00	26.92	56.00	39.50	23.50	14.25	10.00
CALCIUM DISSOLVED (MG/L AS CA)	12	120.00	46.00	77.17	120.00	93.50	79.00	53.00	46.00
MAGNESIUM, DISSOLVED (MG/L AS MG)	12	3.70	1.20	2.33	3.70	2.80	2.60	1.50	1.20
SODIUM, DISSOLVED (MG/L AS NA)	12	23.00	4.60	12.57	23.00	15.75	13.50	7.90	4.60
SODIUM ADSORPTION RATIO	12	0.60	0.20	0.40	0.60	0.50	0.40	0.33	0.20
PERCENT SODIUM	12	14.00	7.00	11.33	14.00	13.00	12.00	9.25	7.00
POTASSIUM, DISSOLVED (MG/L AS K)	12	4.70	2.10	3.07	4.70	3.88	2.75	2.28	2.10
CHLORIDE, DISSOLVED (MG/L AS CL)	12	15.00	3.40	7.83	15.00	9.73	8.25	4.95	3.40
SULFATE DISSOLVED (MG/L AS SO4)	12	95.00	17.00	46.50	95.00	59.00	45.00	32.75	17.00
FLUORIDE, DISSOLVED (MG/L AS F)	12	0.40	0.20	0.32	0.40	0.40	0.30	0.30	0.20
SILICA, DISSOLVED (MG/L AS SIO2)	12	11.00	2.40	8.08	11.00	9.63	8.80	6.58	2.40
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	12	421.00	158.00	263.33	421.00	314.00	270.00	179.75	158.00
SOLIDS, DISSOLVED (TONS PER DAY)	12	606.00	0.56	123.79	606.00	144.75	36.35	7.40	0.56
SOLIDS, DISSOLVED (TONS PER AC-FT)	12	0.57	0.22	0.36	0.57	0.43	0.37	0.25	0.22

TABLE 20.--STATISTICAL SUMMARY OF SELECTED WATER-QUALITY DATA IN THE UPPER TRINITY RIVER BASIN, TEXAS--CONTINUED

STATION NUMBER: 08058900 STATION NAME: EAST FORK TRINITY RIVER AT MCKINNEY, TEX.

LATITUDE: 331438 LONGITUDE: 0963631 COUNTY: COLLIN DRAINAGE AREA: 164.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM JAN 1981 TO AUG 1982

	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
WATER-QUALITY CONSTITUENT	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
ARSENIC DISSOLVED (UG/L AS AS)	6	4.00	1.00	1.67	4.00	2.50	1.00	1.00	1.00
BARIUM, DISSOLVED (UG/L AS BA)	6	200.00	60.00	94.33	200.00	118.25	76.50	61.50	60.00
CADMIUM DISSOLVED (UG/L AS CD)	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CHROMIUM, DISSOLVED (UG/L AS CR)	6	10.00	0.00	3.33	10.00	10.00	0.00	0.00	0.00
COPPER, DISSOLVED (UG/L AS CU)	6	2.00	0.00	0.50	2.00	1.25	0.00	0.00	0.00
IRON, DISSOLVED (UG/L AS FE)	6	470.00	0.00	90.83	470.00	147.50	14.50	4.50	0.00
LEAD, DISSOLVED (UG/L AS PB)	6	2.00	0.00	0.33	2.00	0.50	0.00	0.00	0.00
MANGANESE, DISSOLVED (UG/L AS MN)	6	170.00	40.00	81.17	170.00	132.50	58.50	40.00	40.00
SILVER, DISSOLVED (UG/L AS AG)	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ZINC, DISSOLVED (UG/L AS ZN)	6	50.00	0.00	17.83	50.00	38.00	9.00	3.75	0.00
SELENIUM, DISSOLVED (UG/L AS SE)	6	1.00	0.00	0.83	1.00	1.00	1.00	0.75	0.00
MERCURY DISSOLVED (UG/L AS HG)	6	0.80	0.00	0.27	0.80	0.43	0.20	0.08	0.00

TABLE 20.--STATISTICAL SUMMARY OF SELECTED WATER-QUALITY DATA IN THE UPPER TRINITY RIVER BASIN, TEXAS--CONTINUED

STATION NUMBER: 08060500 [a/] STATION NAME: LAVON LAKE NEAR LAVON, TEX.

LATITUDE: 330154 LONGITUDE: 0962856 COUNTY: COLLIN DRAINAGE AREA: 770.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM JUN 1973 TO JAN 1979

	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
WATER-QUALITY CONSTITUENT	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	5	28.00	4.50	18.80	28.00	27.50	20.00	9.50	4.50
SPECIFIC CONDUCTANCE (UMHOS)	6	328.00	296.00	318.17	328.00	326.50	322.00	310.25	296.00
PH (UNITS)	5	8.00	7.30	--	8.00	7.95	7.90	7.45	7.30
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	5	12.00	2.50	5.26	12.00	9.05	3.00	2.60	2.50
ALKALINITY FIELD (MG/L AS CACO3)	6	131.00	107.00	119.83	131.00	126.50	123.00	109.25	107.00
BICARBONATE FET-FLD (MG/L AS HCO3)	6	160.00	130.00	146.00	160.00	154.00	150.00	133.00	130.00
CARBONATE FET-FLD (MG/L AS CO3)	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NITROGEN, NITRATE TOTAL (MG/L AS N)	1	0.50	0.50						
HARDNESS (MG/L AS CACO3)	6	140.00	120.00	133.33	140.00	140.00	140.00	120.00	120.00
HARDNESS, NONCARBONATE (MG/L CACO3)	6	19.00	6.00	12.67	19.00	16.00	12.50	9.75	6.00
CALCIUM DISSOLVED (MG/L AS CA)	6	53.00	42.00	48.17	53.00	50.75	49.50	44.25	42.00
MAGNESIUM, DISSOLVED (MG/L AS MG)	6	3.40	2.40	2.88	3.40	3.33	2.80	2.55	2.40
SODIUM, DISSOLVED (MG/L AS NA)	5	14.00	9.80	11.36	14.00	13.00	11.00	9.90	9.80
SODIUM ADSORPTION RATIO	6	0.60	0.30	0.45	0.60	0.53	0.45	0.38	0.30
PERCENT SODIUM	5	19.00	13.00	15.40	19.00	17.50	16.00	13.00	13.00
POTASSIUM, DISSOLVED (MG/L AS K)	5	4.40	3.40	3.92	4.40	4.30	4.00	3.50	3.40
CHLORIDE, DISSOLVED (MG/L AS CL)	6	9.30	3.60	7.37	9.30	8.70	7.85	6.23	3.60
SULFATE DISSOLVED (MG/L AS SO4)	6	31.00	22.00	26.67	31.00	28.75	26.50	25.00	22.00
FLUORIDE, DISSOLVED (MG/L AS F)	5	0.30	0.20	0.28	0.30	0.30	0.30	0.25	0.20
SILICA, DISSOLVED (MG/L AS SIO2)	6	9.60	1.70	6.30	9.60	9.45	7.45	2.08	1.70
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	6	186.00	161.00	177.83	186.00	184.50	179.50	173.00	161.00
SOLIDS, DISSOLVED (TONS PER AC-FT)	6	0.25	0.22	0.24	0.25	0.25	0.25	0.23	0.22

[a/] Data in this table represent approximately one sample per year collected near the dam or at the reservoir outflow. The table does not include data collected during comprehensive reservoir surveys.

TABLE 20.--STATISTICAL SUMMARY OF SELECTED WATER-QUALITY DATA IN THE UPPER TRINITY RIVER BASIN, TEXAS--CONTINUED

STATION NUMBER: 08061000 STATION NAME: EAST FORK TRINITY RIVER NEAR LAVON, TEX.

LATITUDE: 330125 LONGITUDE: 0962831 COUNTY: COLLIN DRAINAGE AREA: 773.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM FEG 1981 TO JUL 1982

	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
WATER-QUALITY CONSTITUENT	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	6	32.00	4.00	20.33	32.00	30.13	21.50	11.13	4.00
STREAMFLOW, INSTANTANEOUS (CFS)	6	4700.00	0.01	1231.90	4700.00	2825.00	245.40	0.45	0.01
TURBIDITY (FTU)	6	17.00	2.20	6.43	17.00	10.85	3.80	2.80	2.20
COLOR (PLATINUM-COBALT UNITS)	6	25.00	5.00	10.83	25.00	13.75	10.00	5.00	5.00
SPECIFIC CONDUCTANCE (UMHOS)	6	439.00	248.00	343.83	439.00	421.00	336.00	278.75	248.00
OXYGEN, DISSOLVED (MG/L)	6	11.80	4.10	8.15	11.80	10.67	7.85	6.27	4.10
OXYGEN, DISSOLVED (PERCENT SATURATION)	6	109.00	47.00	88.17	109.00	103.00	93.00	76.25	47.00
OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L)	6	1.80	0.60	1.40	1.80	1.65	1.50	1.20	0.60
PH (UNITS)	6	8.30	7.40	--	8.30	8.00	7.80	7.70	7.40
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	6	8.50	1.20	4.18	8.50	5.58	3.85	2.63	1.20
ALKALINITY FIELD (MG/L AS CACO3)	6	150.00	100.00	128.33	150.00	142.50	135.00	107.50	100.00
SOLIDS, RESIDUE AT 105 DEG. C, SUSPENDED	6	17.00	0.00	7.83	17.00	15.50	6.00	2.25	0.00
NITROGEN, TOTAL (MG/L AS N)	5	1.70	0.94	1.21	1.70	1.45	1.10	1.02	0.94
NITROGEN, ORGANIC TOTAL (MG/L AS N)	6	1.30	0.70	0.93	1.30	1.15	0.86	0.75	0.70
NITROGEN, AMMONIA TOTAL (MG/L AS N)	6	0.14	0.04	0.09	0.14	0.12	0.09	0.07	0.04
NITROGEN, NITRITE TOTAL (MG/L AS N)	6	0.03	0.00	0.01	0.03	0.02	0.01	0.01	0.00
NITROGEN, NITRATE TOTAL (MG/L AS N)	5	0.31	0.03	0.15	0.31	0.25	0.12	0.06	0.03
NITROGEN,AMMONIA + ORGANIC TOTAL (MG/L AS N)	6	1.40	0.84	1.03	1.40	1.25	0.93	0.86	0.84
NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	6	0.34	0.00	0.14	0.34	0.24	0.12	0.03	0.00
PHOSPHORUS, TOTAL (MG/L AS P)	6	0.07	0.00	0.04	0.07	0.06	0.04	0.03	0.00
CARBON, ORGANIC TOTAL (MG/L AS C)	6	19.00	4.40	7.80	19.00	10.38	5.50	4.78	4.40
HARDNESS (MG/L AS CACO3)	6	160.00	110.00	138.33	160.00	152.50	140.00	125.00	110.00
HARDNESS, NONCARBONATE (MG/L CACO3)	6	17.00	0.00	9.33	17.00	15.50	9.00	4.50	0.00
CALCIUM DISSOLVED (MG/L AS CA)	6	56.00	39.00	49.33	56.00	54.50	50.00	45.00	39.00
MAGNESIUM, DISSOLVED (MG/L AS MG)	6	4.80	2.00	3.33	4.80	4.50	3.25	2.23	2.00
SODIUM, DISSOLVED (MG/L AS NA)	6	31.00	6.70	16.93	31.00	29.50	13.80	7.15	6.70
SODIUM ADSORPTION RATIO	6	1.10	0.30	0.65	1.10	1.10	0.55	0.30	0.30
PERCENT SODIUM	6	30.00	11.00	19.33	30.00	28.50	17.50	11.75	11.00
POTASSIUM, DISSOLVED (MG/L AS K)	6	4.50	3.60	4.02	4.50	4.28	4.00	3.75	3.60
CHLORIDE, DISSOLVED (MG/L AS CL)	6	22.00	4.60	11.73	22.00	20.50	9.20	5.20	4.60
SULFATE DISSOLVED (MG/L AS SO4)	6	58.00	16.00	29.67	58.00	50.50	20.00	16.00	16.00
FLUORIDE, DISSOLVED (MG/L AS F)	6	0.40	0.20	0.30	0.40	0.33	0.30	0.28	0.20
SILICA, DISSOLVED (MG/L AS SIO2)	6	8.00	2.70	4.68	8.00	5.98	4.20	3.45	2.70
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	6	261.00	136.00	197.00	261.00	258.00	186.00	151.00	136.00
SOLIDS, DISSOLVED (TONS PER DAY)	6	1980.00	0.00	502.66	1980.00	1100.25	114.28	0.32	0.00
SOLIDS, DISSOLVED (TONS PER AC-FT)	6	0.35	0.18	0.27	0.35	0.35	0.25	0.20	0.18

TABLE 20.--STATISTICAL SUMMARY OF SELECTED WATER-QUALITY DATA IN THE UPPER TRINITY RIVER BASIN, TEXAS--CONTINUED

STATION NUMBER: 08061000 STATION NAME: EAST FORK TRINITY RIVER NEAR LAVON, TEX.

LATITUDE: 330125 LONGITUDE: 0962831 COUNTY: COLLIN DRAINAGE AREA: 773.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM FEG 1981 TO JUL 1982

	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
WATER-QUALITY CONSTITUENT	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
ARSENIC DISSOLVED (UG/L AS AS)	6	13.00	1.00	4.50	13.00	7.00	3.00	1.75	1.00
BARIUM, DISSOLVED (UG/L AS BA)	6	70.00	42.00	56.50	70.00	70.00	56.00	44.25	42.00
CADMIUM DISSOLVED (UG/L AS CD)	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CHROMIUM, DISSOLVED (UG/L AS CR)	6	10.00	0.00	1.67	10.00	2.50	0.00	0.00	0.00
COPPER, DISSOLVED (UG/L AS CU)	6	2.00	0.00	0.67	2.00	1.25	0.50	0.00	0.00
IRON, DISSOLVED (UG/L AS FE)	6	17.00	0.00	4.33	17.00	11.00	0.00	0.00	0.00
LEAD, DISSOLVED (UG/L AS PB)	6	11.00	0.00	2.00	11.00	3.50	0.00	0.00	0.00
MANGANESE, DISSOLVED (UG/L AS MN)	6	11.00	0.00	4.50	11.00	8.75	3.50	0.75	0.00
SILVER, DISSOLVED (UG/L AS AG)	6	1.00	0.00	0.17	1.00	0.25	0.00	0.00	0.00
ZINC, DISSOLVED (UG/L AS ZN)	6	12.00	0.00	3.33	12.00	6.75	1.50	0.00	0.00
SELENIUM, DISSOLVED (UG/L AS SE)	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MERCURY DISSOLVED (UG/L AS HG)	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

TABLE 20.--STATISTICAL SUMMARY OF SELECTED WATER-QUALITY DATA IN THE UPPER TRINITY RIVER BASIN, TEXAS--CONTINUED

STATION NUMBER: 08061550 STATION NAME: LAKE RAY HUBBARD NEAR FORNEY, TEX.

LATITUDE: 324800 LONGITUDE: 0962945 COUNTY: KAUFMAN DRAINAGE AREA: 1071.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM JUN 1973 TO MAY 1982

WATER-QUALITY CONSTITUENT	DESCRIPTIVE STATISTICS: SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN: 95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	7	26.50	2.00	16.14	26.50	24.50	19.00	7.50	2.00
SPECIFIC CONDUCTANCE (UMHOS)	8	353.00	283.00	319.25	353.00	333.25	317.00	309.75	283.00
PH (UNITS)	5	8.10	7.10	--	8.10	8.00	7.80	7.35	7.10
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	5	18.00	1.60	6.42	18.00	11.80	4.00	2.25	1.60
ALKALINITY FIELD (MG/L AS CACO3)	8	130.00	98.00	114.75	130.00	120.00	117.50	106.25	98.00
BICARBONATE FET-FLD (MG/L AS HCO3)	6	158.00	120.00	139.67	158.00	149.00	143.00	126.00	120.00
CARBONATE FET-FLD (MG/L AS CO3)	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NITROGEN, NITRATE TOTAL (MG/L AS N)	1	0.90	0.90						
HARDNESS (MG/L AS CACO3)	8	140.00	110.00	125.00	140.00	130.00	125.00	120.00	110.00
HARDNESS, NONCARBONATE (MG/L CACO3)	8	16.00	6.00	11.25	16.00	14.25	11.50	8.00	6.00
CALCIUM DISSOLVED (MG/L AS CA)	8	52.00	40.00	45.37	52.00	48.75	45.00	41.50	40.00
MAGNESIUM, DISSOLVED (MG/L AS MG)	8	3.50	2.60	3.03	3.50	3.38	3.00	2.70	2.60
SODIUM, DISSOLVED (MG/L AS NA)	7	21.00	10.00	14.43	21.00	19.00	13.00	11.00	10.00
SODIUM ADSORPTION RATIO	8	0.90	0.40	0.59	0.90	0.75	0.50	0.50	0.40
PERCENT SODIUM	7	26.00	13.00	19.57	26.00	26.00	18.00	16.00	13.00
POTASSIUM, DISSOLVED (MG/L AS K)	7	5.90	3.40	4.07	5.90	4.50	3.70	3.50	3.40
CHLORIDE, DISSOLVED (MG/L AS CL)	8	16.00	5.60	9.69	16.00	12.20	9.20	6.82	5.60
SULFATE DISSOLVED (MG/L AS SO4)	8	40.00	22.00	28.75	40.00	34.50	26.00	25.00	22.00
FLUORIDE, DISSOLVED (MG/L AS F)	7	0.40	0.30	0.36	0.40	0.40	0.40	0.30	0.30
SILICA, DISSOLVED (MG/L AS SIO2)	8	4.30	1.10	2.29	4.30	3.22	2.00	1.30	1.10
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	8	194.00	161.00	176.50	194.00	178.50	176.00	174.25	161.00
SOLIDS, DISSOLVED (TONS PER AC-FT)	8	0.26	0.22	0.24	0.26	0.24	0.24	0.24	0.22

TABLE 20.--STATISTICAL SUMMARY OF SELECTED WATER-QUALITY DATA IN THE UPPER TRINITY RIVER BASIN, TEXAS--CONTINUED

STATION NUMBER: 08061750 STATION NAME: EAST FORK TRINITY RIVER NEAR FORNEY, TEX.

LATITUDE: 324627 LONGITUDE: 0963012 COUNTY: KAUFMAN DRAINAGE AREA: 1118.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM NOV 1981 TO AUG 1982

	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
WATER-QUALITY CONSTITUENT	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	6	29.00	9.00	21.00	29.00	28.25	22.00	14.25	9.00
STREAMFLOW, INSTANTANEOUS (CFS)	6	3090.00	35.00	1772.67	3090.00	3022.50	2220.00	62.00	35.00
TURBIDITY (FTU)	6	15.00	2.10	7.68	15.00	12.75	6.60	3.38	2.10
COLOR (PLATINUM-COBALT UNITS)	6	40.00	5.00	15.83	40.00	32.50	7.50	5.00	5.00
SPECIFIC CONDUCTANCE (UMHOS)	6	676.00	248.00	394.33	676.00	605.50	296.00	263.00	248.00
OXYGEN, DISSOLVED (MG/L)	6	12.00	0.30	6.77	12.00	10.80	8.30	1.05	0.30
OXYGEN, DISSOLVED (PERCENT SATURATION)	6	109.00	4.00	73.67	109.00	107.50	104.00	11.50	4.00
OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L)	6	22.00	1.70	7.77	22.00	17.50	2.35	2.07	1.70
PH (UNITS)	6	8.40	7.70	--	8.40	8.40	8.15	7.85	7.70
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	6	8.10	0.70	2.77	8.10	4.65	1.75	0.78	0.70
ALKALINITY FIELD (MG/L AS CACO3)	6	210.00	98.00	134.33	210.00	187.50	110.00	98.00	98.00
SOLIDS, RESIDUE AT 105 DEG. C, SUSPENDED	6	25.00	3.00	13.67	25.00	20.50	12.50	8.25	3.00
NITROGEN, TOTAL (MG/L AS N)	5	14.00	1.10	6.24	14.00	13.50	1.80	1.20	1.10
NITROGEN, ORGANIC TOTAL (MG/L AS N)	6	12.00	0.53	3.56	12.00	6.53	1.65	0.76	0.53
NITROGEN, AMMONIA TOTAL (MG/L AS N)	6	8.30	0.16	1.82	8.30	3.28	0.31	0.22	0.16
NITROGEN, NITRITE TOTAL (MG/L AS N)	6	0.15	0.00	0.05	0.15	0.11	0.03	0.00	0.00
NITROGEN, NITRATE TOTAL (MG/L AS N)	4	0.31	0.05						
NITROGEN,AMMONIA + ORGANIC TOTAL (MG/L AS N)	6	14.00	0.89	5.45	14.00	13.25	1.90	0.97	0.89
NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	6	0.34	0.00	0.21	0.34	0.31	0.21	0.15	0.00
PHOSPHORUS, TOTAL (MG/L AS P)	6	2.50	0.05	0.65	2.50	1.45	0.10	0.06	0.05
CARBON, ORGANIC TOTAL (MG/L AS C)	6	21.00	5.20	10.13	21.00	18.75	5.65	5.28	5.20
HARDNESS (MG/L AS CACO3)	6	200.00	100.00	133.33	200.00	162.50	120.00	107.50	100.00
HARDNESS, NONCARBONATE (MG/L CACO3)	6	9.00	0.00	5.00	9.00	9.00	6.00	0.00	0.00
CALCIUM DISSOLVED (MG/L AS CA)	6	74.00	37.00	48.17	74.00	59.75	42.50	37.75	37.00
MAGNESIUM, DISSOLVED (MG/L AS MG)	6	3.60	2.60	2.88	3.60	3.08	2.75	2.68	2.60
SODIUM, DISSOLVED (MG/L AS NA)	6	50.00	9.40	25.07	50.00	46.25	17.00	11.35	9.40
SODIUM ADSORPTION RATIO	6	1.70	0.40	0.93	1.70	1.63	0.70	0.48	0.40
PERCENT SODIUM	6	38.00	16.00	25.50	38.00	35.00	24.00	16.75	16.00
POTASSIUM, DISSOLVED (MG/L AS K)	6	8.50	3.90	5.53	8.50	7.98	4.50	3.98	3.90
CHLORIDE, DISSOLVED (MG/L AS CL)	6	48.00	7.20	22.67	48.00	47.25	13.00	7.65	7.20
SULFATE DISSOLVED (MG/L AS SO4)	6	61.00	19.00	34.00	61.00	46.75	31.00	19.75	19.00
FLUORIDE, DISSOLVED (MG/L AS F)	6	1.30	0.30	0.58	1.30	0.93	0.40	0.30	0.30
SILICA, DISSOLVED (MG/L AS SIO2)	6	8.80	1.60	4.43	8.80	7.60	3.65	1.68	1.60
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	6	379.00	140.00	223.83	379.00	333.25	174.50	152.75	140.00
SOLIDS, DISSOLVED (TONS PER DAY)	6	1440.00	30.00	785.60	1440.00	1312.50	950.50	61.95	30.00
SOLIDS, DISSOLVED (TONS PER AC-FT)	6	0.52	0.19	0.30	0.52	0.45	0.24	0.21	0.19

TABLE 20.--STATISTICAL SUMMARY OF SELECTED WATER-QUALITY DATA IN THE UPPER TRINITY RIVER BASIN, TEXAS--CONTINUED

STATION NUMBER: 08061750 STATION NAME: EAST FK TRINITY RIVER NEAR FORNEY, TEX.

LATITUDE: 324627 LONGITUDE: 0963012 COUNTY: KAUFMAN DRAINAGE AREA: 1118.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM JAN 1982 TO AUG 1982

	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
WATER-QUALITY CONSTITUENT	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
ARSENIC DISSOLVED (UG/L AS AS)	2	3.00	2.00						
BARIUM, DISSOLVED (UG/L AS BA)	2	46.00	29.00						
CADMIUM DISSOLVED (UG/L AS CD)	2	0.00	0.00						
CHROMIUM, DISSOLVED (UG/L AS CR)	2	0.00	0.00						
COPPER, DISSOLVED (UG/L AS CU)	2	6.00	0.00						
IRON, DISSOLVED (UG/L AS FE)	2	11.00	0.00						
LEAD, DISSOLVED (UG/L AS PB)	2	2.00	1.00						
MANGANESE, DISSOLVED (UG/L AS MN)	2	70.00	1.00						
SILVER, DISSOLVED (UG/L AS AG)	2	0.00	0.00						
ZINC, DISSOLVED (UG/L AS ZN)	2	63.00	4.00						
SELENIUM, DISSOLVED (UG/L AS SE)	2	0.00	0.00						
MERCURY DISSOLVED (UG/L AS HG)	2	0.00	0.00						

TABLE 20.--STATISTICAL SUMMARY OF SELECTED WATER-QUALITY DATA IN THE UPPER TRINITY RIVER BASIN, TEXAS--CONTINUED

STATION NUMBER: 08062000 STATION NAME: EAST FORK TRINITY RIVER NR CRANDALL,TEX.

LATITUDE: 323819 LONGITUDE: 0962917 COUNTY: KAUFMAN DRAINAGE AREA: 1256.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM OCT 1972 TO SEPT 1981

WATER-QUALITY CONSTITUENT	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	121	32.00	4.00	19.38	30.00	26.75	20.50	12.75	6.10
STREAMFLOW, INSTANTANEOUS (CFS)	122	5799.99	23.00	591.82	2943.49	562.50	80.50	45.75	26.15
TURBIDITY (JTU)	71	300.00	3.00	29.92	97.00	35.00	15.00	10.00	4.00
TURBIDITY (FTU)	32	260.00	0.80	25.29	182.00	23.25	10.50	4.50	0.87
COLOR (PLATINUM-COBALT UNITS)	104	300.00	0.00	40.26	100.00	53.75	30.00	20.00	5.00
SPECIFIC CONDUCTANCE (UMHOS)	121	858.00	252.00	518.92	758.00	653.50	549.00	353.50	294.20
OXYGEN, DISSOLVED (MG/L)	104	13.00	0.00	3.47	10.15	5.97	2.65	0.32	0.00
OXYGEN, DISSOLVED (PERCENT SATURATION)	104	150.00	0.00	37.50	106.50	67.75	32.00	4.00	0.00
OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L)	104	56.00	1.40	18.50	49.25	24.50	17.00	7.57	2.42
PH (UNITS)	121	8.30	6.40	--	8.08	7.70	7.40	7.20	6.90
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	108	96.00	1.30	15.42	44.00	18.75	12.00	5.80	2.80
ALKALINITY FIELD (MG/L AS CACO3)	108	243.00	81.00	150.56	211.65	180.00	148.00	124.25	101.15
BICARBONATE FET-FLD (MG/L AS HCO3)	99	296.00	100.00	181.82	256.00	216.00	174.00	151.00	128.00
CARBONATE FET-FLD (MG/L AS CO3)	100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SOLIDS, RESIDUE AT 105 DEG. C, SUSPENDED	103	618.00	1.00	59.22	268.00	58.00	30.00	20.00	5.20
NITROGEN, TOTAL (MG/L AS N)	84	30.00	0.69	11.54	25.75	17.00	13.00	4.03	1.10
NITROGEN, ORGANIC TOTAL (MG/L AS N)	103	18.00	0.00	3.21	12.00	4.00	2.00	0.80	0.16
NITROGEN, AMMONIA TOTAL (MG/L AS N)	104	24.00	0.00	6.75	16.75	11.00	6.05	1.03	0.10
NITROGEN, NITRITE TOTAL (MG/L AS N)	104	0.82	0.00	0.06	0.28	0.06	0.02	0.01	0.00
NITROGEN, NITRATE TOTAL (MG/L AS N)	113	20.00	0.00	0.90	4.82	0.33	0.10	0.01	0.00
NITROGEN,AMMONIA + ORGANIC TOTAL (MG/L AS N)	86	29.00	0.52	11.22	24.30	17.00	13.00	3.30	0.71
NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	84	14.00	0.00	0.41	1.47	0.28	0.09	0.02	0.00
PHOSPHORUS, TOTAL (MG/L AS P)	103	14.00	0.07	3.85	9.96	5.60	3.30	0.84	0.19
CARBON, ORGANIC TOTAL (MG/L AS C)	101	61.00	4.00	18.70	39.00	24.00	17.00	10.00	5.30
HARDNESS (MG/L AS CACO3)	108	190.00	82.00	131.06	165.50	140.00	130.00	110.00	100.00
HARDNESS, NONCARBONATE (MG/L CACO3)	108	60.00	0.00	5.65	26.65	9.00	0.00	0.00	0.00
CALCIUM DISSOLVED (MG/L AS CA)	108	69.00	27.00	47.05	61.10	52.00	47.00	41.00	32.90
MAGNESIUM, DISSOLVED (MG/L AS MG)	109	8.10	1.00	3.34	4.70	3.80	3.20	2.75	2.05
SODIUM, DISSOLVED (MG/L AS NA)	90	110.00	10.00	44.89	85.00	63.00	47.50	20.00	11.55
SODIUM ADSORPTION RATIO	108	5.00	0.10	1.73	3.66	2.50	1.55	0.70	0.40
PERCENT SODIUM	90	67.00	14.00	38.06	57.90	50.00	43.00	24.00	15.00
POTASSIUM, DISSOLVED (MG/L AS K)	90	14.00	3.20	7.96	13.00	11.00	7.65	4.87	3.86
CHLORIDE, DISSOLVED (MG/L AS CL)	109	87.00	4.30	33.10	72.50	50.50	30.00	13.50	7.10
SULFATE DISSOLVED (MG/L AS SO4)	108	73.00	10.00	41.66	67.55	51.75	42.00	28.00	23.00
FLUORIDE, DISSOLVED (MG/L AS F)	92	3.40	0.20	1.15	2.73	1.60	0.90	0.40	0.30
SILICA, DISSOLVED (MG/L AS SIO2)	109	23.00	0.90	8.13	14.00	10.00	8.10	5.50	2.25
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	107	452.00	132.00	275.36	399.20	341.00	286.00	195.00	166.80
SOLIDS, DISSOLVED (TONS PER DAY)	106	2400.00	20.00	314.58	1415.00	432.00	62.90	42.43	25.67
SOLIDS, DISSOLVED (TONS PER AC-FT)	107	0.62	0.18	0.37	0.54	0.46	0.39	0.26	0.23

TABLE 20.--STATISTICAL SUMMARY OF SELECTED WATER-QUALITY DATA IN THE UPPER TRINITY RIVER BASIN, TEXAS--CONTINUED

STATION NUMBER: 08062000 STATION NAME: EAST FORK TRINITY RIVER NR CRANDALL, TEX.

LATITUDE: 323819 LONGITUDE: 0962917 COUNTY: KAUFMAN DRAINAGE AREA: 1256.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM OCT 1975 TO JUL 1981

	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
WATER-QUALITY CONSTITUENT	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
ARSENIC DISSOLVED (UG/L AS AS)	22	11.00	1.00	3.05	10.10	3.00	3.00	2.00	1.00
BARIUM, DISSOLVED (UG/L AS BA)	18	200.00	0.00	59.44	200.00	117.50	20.00	0.00	0.00
CADMIUM DISSOLVED (UG/L AS CD)	22	6.00	0.00	0.91	5.55	2.00	0.00	0.00	0.00
CHROMIUM, DISSOLVED (UG/L AS CR)	22	40.00	0.00	5.09	37.00	8.25	0.00	0.00	0.00
COBALT, DISSOLVED (UG/L AS CO)	4	0.00	0.00						
COPPER, DISSOLVED (UG/L AS CU)	22	41.00	0.00	8.18	40.10	10.50	3.00	0.00	0.00
IRON, DISSOLVED (UG/L AS FE)	22	230.00	30.00	90.91	224.00	120.00	80.00	40.00	30.00
LEAD, DISSOLVED (UG/L AS PB)	22	48.00	0.00	5.73	43.80	6.50	2.00	0.00	0.00
MANGANESE, DISSOLVED (UG/L AS MN)	22	190.00	4.00	79.73	182.50	112.50	70.00	50.00	6.40
NICKEL, DISSOLVED (UG/L AS NI)	4	28.00	7.00						
SILVER, DISSOLVED (UG/L AS AG)	18	1.00	0.00	0.11	1.00	0.00	0.00	0.00	0.00
STRONTIUM, DISSOLVED (UG/L AS SR)	4	750.00	520.00						
ZINC, DISSOLVED (UG/L AS ZN)	22	60.00	0.00	18.91	58.50	22.50	20.00	6.75	0.00
ALUMINUM, DISSOLVED (UG/L AS AL)	4	120.00	20.00						
LITHIUM DISSOLVED (UG/L AS LI)	4	1.00	0.00						
SELENIUM, DISSOLVED (UG/L AS SE)	18	5.00	0.00	0.50	5.00	0.25	0.00	0.00	0.00
NAPHTHALENES, POLYCHLOR. TOTAL (UG/L)	8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ALDRIN, TOTAL (UG/L)	10	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00
LINDANE TOTAL (UG/L)	10	0.05	0.00	0.02	0.05	0.03	0.02	0.01	0.00
CHLORDANE, TOTAL (UG/L)	10	0.20	0.00	0.06	0.20	0.10	0.05	0.00	0.00
DDD, TOTAL (UG/L)	10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DDE, TOTAL (UG/L)	10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DDT, TOTAL (UG/L)	10	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00
DIELDRIN TOTAL (UG/L)	10	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00
ENDOSULFAN, TOTAL (UG/L)	10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ENDRIN, TOTAL (UG/L)	10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ETHION, TOTAL (UG/L)	10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOXAPHENE, TOTAL (UG/L)	10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HEPTACHLOR, TOTAL (UG/L)	10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HEPTACHLOR EPOXIDE TOTAL (UG/L)	10	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00
METHOXYCHLOR, TOTAL (UG/L)	4	0.00	0.00						
PCB, TOTAL (UG/L)	10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MALATHION, TOTAL (UG/L)	10	0.15	0.00	0.05	0.15	0.10	0.03	0.00	0.00
PARATHION, TOTAL (UG/L)	10	0.02	0.00	0.00	0.02	0.00	0.00	0.00	0.00
DIAZINON, TOTAL (UG/L)	10	1.20	0.22	0.70	1.20	0.87	0.74	0.46	0.22
METHYL PARATHION, TOTAL (UG/L)	10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,4-D, TOTAL (UG/L)	9	0.09	0.00	0.04	0.09	0.07	0.05	0.00	0.00
2,4,5-T TOTAL (UG/L)	9	0.04	0.00	0.01	0.04	0.01	0.00	0.00	0.00
SILVEX, TOTAL (UG/L)	9	0.01	0.00	0.00	0.01	0.01	0.00	0.00	0.00
TOTAL TRITHION (UG/L)	10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
METHYL TRITHION, TOTAL (UG/L)	10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MERCURY DISSOLVED (UG/L AS HG)	22	0.60	0.00	0.07	0.54	0.10	0.00	0.00	0.00

TABLE 20.--STATISTICAL SUMMARY OF SELECTED WATER-QUALITY DATA IN THE UPPER TRINITY RIVER BASIN, TEXAS--CONTINUED

STATION NUMBER: 08062500 STATION NAME: TRINITY RIVER NEAR ROSSER, TEXAS

LATITUDE: 322535 LONGITUDE: 0962746 COUNTY: KAUFMAN DRAINAGE AREA: 8146.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM OCT 1972 TO AUG 1982

	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
WATER-QUALITY CONSTITUENT	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	139	32.00	4.50	19.97	30.50	26.50	21.00	14.00	7.00
STREAMFLOW, INSTANTANEOUS (CFS)	136	38899.93	330.00	4084.27	17164.94	5574.99	1055.00	592.50	399.10
TURBIDITY (JTU)	68	250.00	3.00	56.84	180.00	80.00	37.50	15.00	3.45
TURBIDITY (FTU)	33	210.00	1.10	37.60	189.00	28.50	14.00	5.70	1.31
COLOR (PLATINUM-COBALT UNITS)	101	140.00	0.00	27.97	60.00	35.00	25.00	10.00	5.00
SPECIFIC CONDUCTANCE (UMHOS)	127	991.00	232.00	649.73	933.20	845.00	700.00	441.00	326.40
OXYGEN, DISSOLVED (MG/L)	107	11.80	0.20	4.16	8.38	5.60	4.00	2.40	0.60
OXYGEN, DISSOLVED (PERCENT SATURATION)	108	95.00	2.00	44.38	80.10	58.50	46.50	27.25	6.00
OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L)	108	52.00	2.10	14.45	30.10	18.75	14.00	7.95	2.54
PH (UNITS)	127	8.30	6.40	--	7.90	7.60	7.40	7.20	6.90
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	121	97.00	1.30	16.50	42.30	21.00	13.00	7.15	2.90
ALKALINITY FIELD (MG/L AS CACO3)	121	240.00	81.00	153.59	219.50	180.00	145.00	125.50	110.00
BICARBONATE FET-FLD (MG/L AS HCO3)	106	292.00	99.00	191.20	268.65	220.00	189.50	157.50	134.70
CARBONATE FET-FLD (MG/L AS CO3)	106	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SOLIDS, RESIDUE AT 105 DEG. C, SUSPENDED	101	816.00	1.00	125.34	387.10	188.00	54.00	26.00	9.40
NITROGEN, TOTAL (MG/L AS N)	78	23.00	1.10	9.71	19.10	14.00	9.90	4.68	1.60
NITROGEN, ORGANIC TOTAL (MG/L AS N)	105	10.00	0.00	1.90	6.17	2.30	1.20	0.69	0.00
NITROGEN, AMMONIA TOTAL (MG/L AS N)	106	16.00	0.08	5.06	12.65	8.90	4.40	0.84	0.21
NITROGEN, NITRITE TOTAL (MG/L AS N)	107	1.50	0.00	0.36	0.97	0.60	0.27	0.11	0.01
NITROGEN, NITRATE TOTAL (MG/L AS N)	120	14.00	0.00	1.66	6.29	1.78	0.94	0.51	0.02
NITROGEN,AMMONIA + ORGANIC TOTAL (MG/L AS N)	87	23.00	0.79	7.52	18.00	12.00	7.30	3.00	1.04
NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	79	7.40	0.00	1.85	5.00	2.60	1.50	0.83	0.01
PHOSPHORUS, TOTAL (MG/L AS P)	107	16.00	0.11	3.40	8.76	5.10	2.80	1.10	0.27
CARBON, ORGANIC TOTAL (MG/L AS C)	96	38.00	4.20	14.77	27.15	17.75	14.00	11.00	6.92
HARDNESS (MG/L AS CACO3)	121	220.00	94.00	152.93	200.00	170.00	150.00	140.00	120.00
HARDNESS, NONCARBONATE (MG/L CACO3)	121	56.00	0.00	13.09	40.80	22.50	12.00	0.00	0.00
CALCIUM DISSOLVED (MG/L AS CA)	121	79.00	35.00	53.14	71.80	59.00	52.00	47.00	40.10
MAGNESIUM, DISSOLVED (MG/L AS MG)	121	7.50	1.30	4.91	6.69	5.80	5.20	4.00	2.92
SODIUM, DISSOLVED (MG/L AS NA)	100	130.00	12.00	69.16	120.00	100.00	72.50	32.25	18.00
SODIUM ADSORPTION RATIO	121	5.40	0.30	2.39	4.79	3.60	2.20	0.90	0.51
PERCENT SODIUM	100	67.00	17.00	44.03	63.95	57.75	47.00	29.00	23.00
POTASSIUM, DISSOLVED (MG/L AS K)	100	16.00	2.50	9.29	15.00	12.00	9.50	6.02	4.30
CHLORIDE, DISSOLVED (MG/L AS CL)	121	97.00	5.40	48.70	88.90	73.00	50.00	23.50	14.00
SULFATE DISSOLVED (MG/L AS SO4)	121	140.00	19.00	78.40	120.00	105.00	89.00	47.50	26.30
FLUORIDE, DISSOLVED (MG/L AS F)	104	2.60	0.30	0.92	1.80	1.30	0.80	0.40	0.30
SILICA, DISSOLVED (MG/L AS SIO2)	121	17.00	1.00	9.62	16.00	12.00	9.50	7.25	4.51
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	121	558.00	133.00	362.25	524.90	471.00	398.00	246.50	183.10
SOLIDS, DISSOLVED (TONS PER DAY)	121	15400.00	447.00	2387.65	9151.00	3180.00	1030.00	699.00	538.80
SOLIDS, DISSOLVED (TONS PER AC-FT)	121	0.76	0.18	0.49	0.71	0.64	0.54	0.34	0.25

TABLE 20.--STATISTICAL SUMMARY OF SELECTED WATER-QUALITY DATA IN THE UPPER TRINITY RIVER BASIN, TEXAS--CONTINUED

STATION NUMBER: 08062500 STATION NAME: TRINITY RIVER NEAR ROSSER, TEX.

LATITUDE: 322535 LONGITUDE: 0962746 COUNTY: KAUFMAN DRAINAGE AREA: 8146.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM OCT 1972 TO JUL 1981

	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
WATER-QUALITY CONSTITUENT	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
ARSENIC DISSOLVED (UG/L AS AS)	35	20.00	0.00	6.06	16.80	7.00	5.00	3.00	0.00
BARIUM, DISSOLVED (UG/L AS BA)	20	300.00	0.00	55.50	295.00	55.00	25.00	0.00	0.00
CADMIUM DISSOLVED (UG/L AS CD)	36	7.00	0.00	0.86	6.15	1.00	0.00	0.00	0.00
CHROMIUM, DISSOLVED (UG/L AS CR)	36	25.00	0.00	2.36	20.75	0.00	0.00	0.00	0.00
COBALT, DISSOLVED (UG/L AS CO)	16	2.00	0.00	0.13	2.00	0.00	0.00	0.00	0.00
COPPER, DISSOLVED (UG/L AS CU)	36	22.00	0.00	4.72	21.15	6.00	3.50	2.00	0.00
IRON, DISSOLVED (UG/L AS FE)	36	2300.00	0.00	132.22	557.49	110.00	45.00	20.00	0.00
LEAD, DISSOLVED (UG/L AS PB)	36	13.00	0.00	1.89	10.45	3.00	0.00	0.00	0.00
MANGANESE, DISSOLVED (UG/L AS MN)	36	170.00	0.00	58.69	161.50	87.50	60.00	7.25	0.00
NICKEL, DISSOLVED (UG/L AS NI)	16	52.00	0.00	19.31	52.00	34.50	13.50	6.25	0.00
SILVER, DISSOLVED (UG/L AS AG)	20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
STRONTIUM, DISSOLVED (UG/L AS SR)	16	620.00	340.00	458.12	620.00	535.00	435.00	390.00	340.00
ZINC, DISSOLVED (UG/L AS ZN)	36	50.00	0.00	18.03	41.50	30.00	20.00	0.00	0.00
ALUMINUM, DISSOLVED (UG/L AS AL)	16	90.00	0.00	35.44	90.00	57.50	30.00	12.50	0.00
LITHIUM DISSOLVED (UG/L AS LI)	16	20.00	0.00	1.25	20.00	0.00	0.00	0.00	0.00
SELENIUM, DISSOLVED (UG/L AS SE)	20	5.00	0.00	0.25	4.75	0.00	0.00	0.00	0.00
NAPHTHALENES, POLYCHLOR. TOTAL (UG/L)	15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ALDRIN, TOTAL (UG/L)	29	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00
LINDANE TOTAL (UG/L)	29	0.07	0.00	0.01	0.05	0.02	0.00	0.00	0.00
CHLORDANE, TOTAL (UG/L)	29	0.30	0.00	0.05	0.30	0.05	0.00	0.00	0.00
DDD, TOTAL (UG/L)	29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DDE, TOTAL (UG/L)	29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DDT, TOTAL (UG/L)	29	0.04	0.00	0.00	0.02	0.00	0.00	0.00	0.00
DIELDRIN TOTAL (UG/L)	29	0.14	0.00	0.02	0.09	0.02	0.01	0.01	0.00
ENDOSULFAN, TOTAL (UG/L)	13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ENDRIN, TOTAL (UG/L)	29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ETHION, TOTAL (UG/L)	19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOXAPHENE, TOTAL (UG/L)	23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HEPTACHLOR, TOTAL (UG/L)	29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HEPTACHLOR EPOXIDE TOTAL (UG/L)	29	0.03	0.00	0.00	0.01	0.00	0.00	0.00	0.00
METHOXYCHLOR, TOTAL (UG/L)	4	0.00	0.00						
PCB, TOTAL (UG/L)	29	0.70	0.00	0.02	0.35	0.00	0.00	0.00	0.00
MALATHION, TOTAL (UG/L)	29	0.42	0.00	0.04	0.28	0.05	0.01	0.00	0.00
PARATHION, TOTAL (UG/L)	29	0.02	0.00	0.00	0.01	0.00	0.00	0.00	0.00
DIAZINON, TOTAL (UG/L)	29	0.81	0.00	0.32	0.77	0.53	0.28	0.09	0.00
METHYL PARATHION, TOTAL (UG/L)	29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,4-D, TOTAL (UG/L)	27	4.20	0.00	0.32	3.08	0.11	0.05	0.02	0.00
2,4,5-T TOTAL (UG/L)	27	0.76	0.00	0.06	0.53	0.05	0.02	0.00	0.00
SILVEX, TOTAL (UG/L)	27	0.23	0.00	0.01	0.15	0.01	0.00	0.00	0.00
TOTAL TRITHION (UG/L)	19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
METHYL TRITHION, TOTAL (UG/L)	19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MERCURY DISSOLVED (UG/L AS HG)	36	0.60	0.00	0.05	0.60	0.00	0.00	0.00	0.00

TABLE 20.--STATISTICAL SUMMARY OF SELECTED WATER-QUALITY DATA IN THE UPPER TRINITY RIVER BASIN, TEXAS--CONTINUED

STATION NUMBER: 08062700 STATION NAME: TRINITY RIVER AT TRINIDAD, TEX.

LATITUDE: 320805 LONGITUDE: 0960620 COUNTY: HENDERSON DRAINAGE AREA: 8538.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM OCT 1972 TO AUG 1982

	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
WATER-QUALITY CONSTITUENT	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
TEMPERATURE (DEG C)	114	33.00	4.50	20.48	31.00	27.50	21.25	13.88	6.38
STREAMFLOW, INSTANTANEOUS (CFS)	114	41799.92	380.00	4350.61	21324.99	5947.50	918.00	544.00	409.50
TURBIDITY (JTU)	11	600.00	10.00	79.09	600.00	40.00	20.00	15.00	10.00
TURBIDITY (FTU)	41	240.00	1.10	47.78	169.00	71.00	29.00	9.65	1.33
SPECIFIC CONDUCTANCE (UMHOS)	114	1010.00	263.00	618.22	934.75	793.75	637.00	413.75	308.50
OXYGEN, DISSOLVED (MG/L)	114	11.80	0.20	5.06	9.70	6.32	4.80	3.60	1.57
OXYGEN, DISSOLVED (PERCENT SATURATION)	114	100.00	2.00	53.99	89.00	64.25	54.00	42.75	19.00
OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L)	114	56.00	1.20	14.83	32.00	20.00	14.00	7.32	2.00
PH (UNITS)	114	8.10	6.40	--	8.00	7.60	7.35	7.20	6.87
CARBON DIOXIDE DISSOLVED (MG/L AS CO2)	114	99.00	1.70	15.12	37.75	18.25	12.00	7.45	2.97
ALKALINITY FIELD (MG/L AS CACO3)	114	231.00	74.00	143.00	199.75	164.00	139.00	120.00	97.00
BICARBONATE FET-FLD (MG/L AS HCO3)	96	282.00	90.00	177.82	254.30	202.00	170.00	150.00	119.25
CARBONATE FET-FLD (MG/L AS CO3)	96	39.00	0.00	0.41	0.00	0.00	0.00	0.00	0.00
NITROGEN, TOTAL (MG/L AS N)	87	22.00	0.71	8.78	19.60	12.00	8.70	4.10	1.52
NITROGEN, ORGANIC TOTAL (MG/L AS N)	107	12.00	0.00	2.01	6.26	2.60	1.40	0.74	0.04
NITROGEN, AMMONIA TOTAL (MG/L AS N)	107	17.00	0.00	3.52	11.20	5.60	2.40	0.52	0.08
NITROGEN, NITRITE TOTAL (MG/L AS N)	86	4.70	0.01	0.44	1.16	0.55	0.29	0.11	0.02
NITROGEN, NITRATE TOTAL (MG/L AS N)	86	6.00	0.14	1.76	4.63	2.23	1.45	0.83	0.33
NITROGEN,AMMONIA + ORGANIC TOTAL (MG/L AS N)	95	19.00	0.08	5.68	16.20	9.00	4.40	1.80	0.90
NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	88	10.00	0.17	2.86	7.10	4.00	2.25	1.13	0.40
PHOSPHORUS, TOTAL (MG/L AS P)	114	15.00	0.09	3.01	7.35	4.85	2.35	0.81	0.25
CARBON, ORGANIC TOTAL (MG/L AS C)	30	33.00	6.70	14.82	28.60	19.00	13.50	12.00	6.92
HARDNESS (MG/L AS CACO3)	114	230.00	93.00	148.51	190.00	160.00	150.00	130.00	110.00
HARDNESS, NONCARBONATE (MG/L CACO3)	114	48.00	0.00	12.46	37.75	19.00	13.00	0.00	0.00
CALCIUM DISSOLVED (MG/L AS CA)	114	80.00	30.00	51.55	66.50	56.00	52.00	46.00	38.75
MAGNESIUM, DISSOLVED (MG/L AS MG)	114	9.00	2.70	4.82	7.10	5.70	4.90	3.88	3.00
SODIUM, DISSOLVED (MG/L AS NA)	103	130.00	12.00	65.40	120.00	96.00	66.00	29.00	16.00
SODIUM ADSORPTION RATIO	114	5.30	0.50	2.30	4.53	3.50	2.20	0.90	0.60
PERCENT SODIUM	103	67.00	16.00	43.21	62.60	56.00	45.00	30.00	21.00
POTASSIUM, DISSOLVED (MG/L AS K)	103	17.00	1.90	8.87	15.00	12.00	8.30	5.60	4.14
CHLORIDE, DISSOLVED (MG/L AS CL)	113	98.00	10.00	48.31	89.30	70.00	47.00	23.00	13.40
SULFATE DISSOLVED (MG/L AS SO4)	113	130.00	24.00	76.45	120.00	100.00	83.00	43.00	31.00
FLUORIDE, DISSOLVED (MG/L AS F)	101	2.60	0.20	0.86	1.69	1.20	0.80	0.40	0.30
SILICA, DISSOLVED (MG/L AS SIO2)	113	16.00	2.20	9.04	15.00	11.00	9.00	6.45	4.55
COLIFORM, TOTAL, IMMED. (COLS. PER 100 ML)	10	1399997	890.00	252138	1399997	364999	27999.94	14375	890.00
COLIFORM, FECAL, 0.7 UM-MF (COLS./100 ML)	52	49999.91	13.00	1886.09	12699.97	670.00	230.00	61.25	28.15
STREPTOCOCCI FECAL, KF AGAR (COLS. / 100 ML)	52	9199.98	3.00	1017.58	6114.99	700.00	350.00	42.50	10.55
SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED	52	607.00	176.00	391.67	551.70	480.25	414.50	314.00	184.30
SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	113	550.00	140.00	349.30	510.70	451.50	366.00	232.50	182.70
SOLIDS, DISSOLVED (TONS PER DAY)	113	27300.00	353.00	2717.55	10839.99	3430.00	896.00	666.00	497.90
SOLIDS, DISSOLVED (TONS PER AC-FT)	113	0.83	0.19	0.49	0.74	0.63	0.51	0.32	0.25

TABLE 20.--STATISTICAL SUMMARY OF SELECTED WATER-QUALITY DATA IN THE UPPER TRINITY RIVER BASIN, TEXAS--CONTINUED

STATION NUMBER: 08062700 STATION NAME: TRINITY RIVER AT TRINIDAD, TEX.

LATITUDE: 320805 LONGITUDE: 0960620 COUNTY: HENDERSON DRAINAGE AREA: 8538.00 SQUARE MILES

SUMMARY OF SELECTED WATER QUALITY DATA COLLECTED AT PERIODIC INTERVALS FROM NOV 1977 TO AUG 1982

	DESCRIPTIVE STATISTICS				PERCENT OF SAMPLES IN WHICH VALUES WERE LESS THAN OR EQUAL TO THOSE SHOWN				
WATER-QUALITY CONSTITUENT	SAMPLE SIZE	MAXIMUM	MINIMUM	MEAN	95	75	MEDIAN 50	25	5
ARSENIC DISSOLVED (UG/L AS AS)	20	24.00	2.00	7.40	23.70	8.75	6.50	3.00	2.00
BARIUM, DISSOLVED (UG/L AS BA)	20	300.00	0.00	54.35	295.00	42.25	40.00	22.50	0.00
CADMIUM DISSOLVED (UG/L AS CD)	20	4.00	0.00	0.80	3.95	2.00	0.00	0.00	0.00
CHROMIUM, DISSOLVED (UG/L AS CR)	20	10.00	0.00	1.00	10.00	0.00	0.00	0.00	0.00
COBALT, DISSOLVED (UG/L AS CO)	20	2.00	0.00	0.20	2.00	0.00	0.00	0.00	0.00
COPPER, DISSOLVED (UG/L AS CU)	20	8.00	0.00	3.50	7.95	5.00	4.00	2.00	0.00
IRON, DISSOLVED (UG/L AS FE)	20	80.00	0.00	19.95	78.00	30.00	20.00	0.00	0.00
LEAD, DISSOLVED (UG/L AS PB)	20	12.00	0.00	1.55	11.55	2.75	0.00	0.00	0.00
MANGANESE, DISSOLVED (UG/L AS MN)	20	100.00	0.00	19.40	98.00	35.00	7.00	1.25	0.00
NICKEL, DISSOLVED (UG/L AS NI)	12	23.00	5.00	12.25	23.00	20.25	11.00	5.00	5.00
SILVER, DISSOLVED (UG/L AS AG)	20	1.00	0.00	0.05	0.95	0.00	0.00	0.00	0.00
ZINC, DISSOLVED (UG/L AS ZN)	20	40.00	0.00	15.20	40.00	27.50	14.00	3.25	0.00
SELENIUM, DISSOLVED (UG/L AS SE)	20	1.00	0.00	0.10	1.00	0.00	0.00	0.00	0.00
NAPHTHALENES, POLYCHLOR. TOTAL (UG/L)	2	0.00	0.00						
ALDRIN, TOTAL (UG/L)	4	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00
LINDANE TOTAL (UG/L)	14	0.02	0.00	0.00	0.02	0.00	0.00	0.00	0.00
CHLORDANE, TOTAL (UG/L)	14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DDD, TOTAL (UG/L)	14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DDE, TOTAL (UG/L)	14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DDT, TOTAL (UG/L)	14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DIELDRIN TOTAL (UG/L)	14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ENDOSULFAN, TOTAL (UG/L)	2	0.00	0.00						
ENDRIN, TOTAL (UG/L)	14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ETHION, TOTAL (UG/L)	12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOXAPHENE, TOTAL (UG/L)	13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HEPTACHLOR, TOTAL (UG/L)	14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HEPTACHLOR EPOXIDE TOTAL (UG/L)	14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
METHOXYCHLOR, TOTAL (UG/L)	14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PCB, TOTAL (UG/L)	12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MALATHION, TOTAL (UG/L)	12	0.18	0.00	0.02	0.18	0.01	0.00	0.00	0.00
PARATHION, TOTAL (UG/L)	12	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00
DIAZINON, TOTAL (UG/L)	12	0.77	0.00	0.08	0.77	0.07	0.00	0.00	0.00
METHYL PARATHION, TOTAL (UG/L)	12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,4-D, TOTAL (UG/L)	4	0.14	0.00						
2,4,5-T TOTAL (UG/L)	4	0.01	0.00						
SILVEX, TOTAL (UG/L)	4	0.00	0.00						
TOTAL TRITHION (UG/L)	12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
METHYL TRITHION, TOTAL (UG/L)	12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MERCURY DISSOLVED (UG/L AS HG)	19	0.20	0.00	0.04	0.20	0.10	0.00	0.00	0.00

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