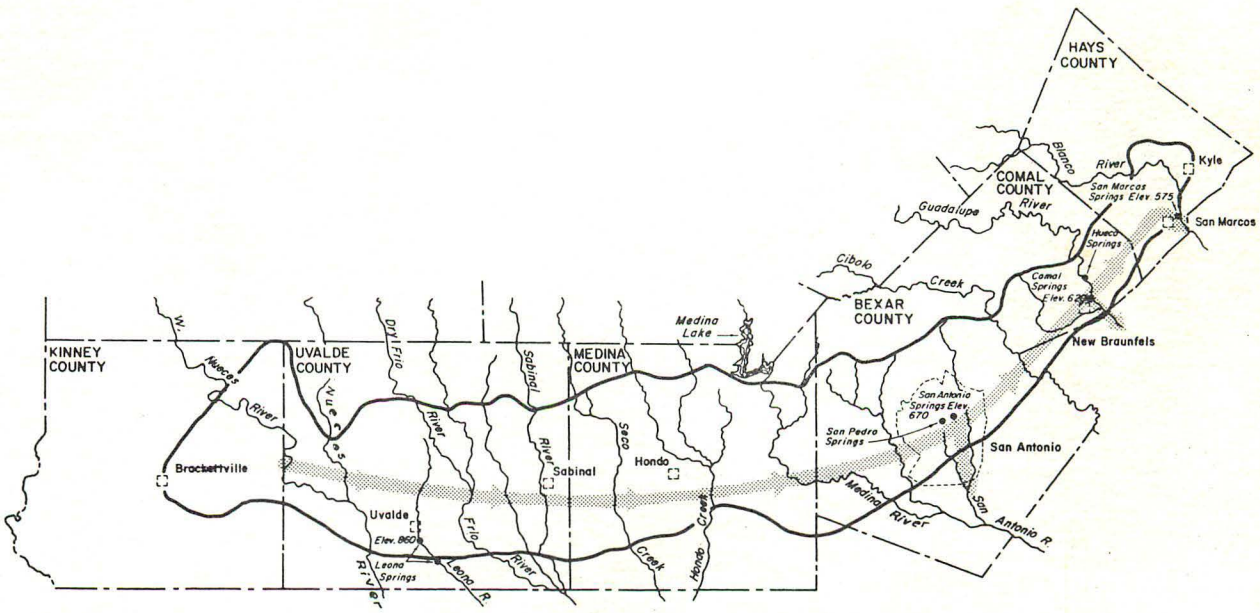
Chemical and Bacteriological Quality of Water at Selected Sites in the San Antonio Area, Texas August 1968 — April 1972

Edwards Underground Water District
San Antonio, Texas



Prepared in cooperation with the U. S. Geological Survey and the Texas Water Development Board

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By

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ABSTRACT

Urban development on or adjacent to the recharge zone of the Edwards aquifer is causing concern about the possible pollution of ground water in the aquifer, which is the principal source of water supply for the San Antonio area. Water-quality data for many wells and springs and for selected sites on streams that cross the recharge zone of the aquifer are being collected to provide background information and to detect any current pollution of ground water in the area.

Water from the Edwards aquifer is very hard and of the calcium bicarbonate type. The concentrations of dissolved solids in samples from wells and springs ranged from about 200 to 470 mg/l (milligrams per liter); the chloride and sulfate concentrations ranged from 6.5 to 62 mg/l and from 0.0 to 65 mg/l, respectively. The nitrate and phosphate contents of the ground water ranged from 0.0 to 15 mg/l and from 0.00 to 0.37 mg/l.

The concentrations of these and other constituents show that the chemical quality of water in the Edwards aquifer has not been degraded significantly by domestic, industrial, or agricultural effluents. However, variations in the number of coliforms, the concentrations of nitrate and phosphate, and the presence of fecal coliforms and fecal streptococci in samples from some wells show that fecal pollution is reaching the aquifer.

Most of these wells, which are located in or just downdip from the recharge zone, are poorly sealed or inadequately cased. The areal variation in the locations of these wells indicates that pollution of ground water in the aquifer is very localized. Pollution results principally from runoff from the land surface and from effluent from septic tanks which enters the aquifer through fractures in the recharge zone or which infiltrates through the thin soil into poorly sealed or inadequately cased wells in or adjacent to the recharge zone.

Trace amounts of several pesticides have been detected in samples from two wells in the San Antonio area. Field investigations showed the source of pesticides in these wells to be surface drainage that entered the wellbores.

Water-quality data collected at sites on streams that cross the recharge zone of the Edwards aquifer show the chemical composition of surface water to be very similar to that of ground water in the area. Water in most streams is very hard and of the calcium bicarbonate type. Limited data on the bacteriological quality show that coliforms were present at each of the sites sampled and that fecal coliforms and fecal streptococci were present at most sites. Although the number of these bacteria varied greatly in both time and place, their density in samples from most sites were low for untreated surface water.

INTRODUCTION

Purpose

The Edwards and associated limestones (aquifer) is the principal source of water in the San Antonio area for municipal supply, defense establishments, industrial use, and agricultural use. Geologic and hydrologic investigations of the Edwards aquifer have been carried on for many years by the U.S. Geological Survey in cooperation with the Texas Water Development Board, Edwards Underground Water District, and other local agencies. As part of these investigations, considerable data on the inorganic chemical quality of water in the Edwards aquifer have been and are being collected.

In recent years, urban growth on or adjacent to the recharge area has caused an increasing concern about the possible pollution of water in the Edwards aquifer. Therefore, in 1968, the Geological Survey, in cooperation with the Edwards Underground Water District and the Texas Water Development Board, began a continuing program to collect historical reference data for detecting any current pollution and for determining changes in the quality of water in the aquifer. Results of the study from August 1968 to August 1969 were reported by Reeves and Blakey (1970).

The purpose of this report is to provide a compilation of water-quality data collected from August 1969 to April 1972 and to evaluate the results of the study from its outset to the present time.

Location of the San Antonio Area and Description of the Edwards Aquifer System

The San Antonio area, for the purposes of this report, includes all or parts of Bexar, Comal, Edwards, Hays, Medina, Uvalde, and Kinney Counties in south-central Texas (fig. 1).

The Edwards aquifer system consists of the Edwards and associated limestones of Cretaceous age that are in hydraulic continuity. The following description of the aquifer system is from Maclay and Rettman (1972, p. 3-8).

"Development of the aquifer system, through the process of solution, began shortly after emergence of the land during Late Cretaceous or early Tertiary time. Rainfall, which becomes acidic by the solution of carbon dioxide from the atmosphere and soil, infiltrates through the unsaturated zone to the saturated zone, and then migrates toward the area of ground-water discharge. During this process, large quantities of limestones, composed of the carbonate of calcium and magnesium, are removed by solution, leaving a system of interconnected tubes, voids, channels, and fissures.

"The ground-water reservoir in the Edwards and associated limestones is recharged primarily by infiltration of surface water from streams that traverse the outcrop area and by direct infiltration of precipitation on the outcrop."

Methods of Investigation

Potential sources of pollution of water in the Edwards ground-water reservoir include effluent from septic tanks and sewage treatment plants, leakage from sewage-collection systems, sanitary landfills, industrial and agricultural wastes, and runoff from residential subdivisions. The greatest threat of pollution exists where wastes are released by design or by accident on the fractured and cavernous outcrop area of the Edwards aquifer, or to streams that cross this area.

Other parts of the aquifer are overlain by formations that are practically impervious; consequently, most of the wells and springs selected for sampling are located in or near the outcrop area. Although sampling has been concentrated in or near the outcrop area north and northwest of San Antonio, wells and springs in other areas were sampled to provide background information on water quality and to determine if pollution entering the recharge zone is causing significant deterioration of the quality of water in other areas. Streams that cross the recharge zone were sampled to provide information on the quality of the recharge. The locations of wells, springs, and sites on streams that were sampled during the study are shown on figure 1.

Some of the parameters or constituents that frequently are indicative of pollution of water and that were measured during this study include coliforms, fecal coliforms, fecal streptococci, nitrogen species (ammonia, nitrite, and nitrate), phosphate, and MBAS (methylene blue active substances).

The coliform group of organisms has been used as an indicator of the sanitary quality of water since about 1880. This group includes organisms that vary in their natural sources and habitats. Although all the subgroups may be found in feces of warm-blooded animals and in water polluted by feces, some subgroups have a wide environmental distribution and commonly are present on vegetation and in soil (U.S. Public Health Service, 1962, p. 14-15). Therefore, a positive test for total coliforms in untreated water is indicative rather than specific for the presence of fecal pollution.

The fecal coliform components of the coliform group are characteristically inhabitants of the intestines of warm-blooded animals. Therefore, the presence of fecal coliform organisms in water is an indication of recent and possible dangerous fecal pollution. According to Geldreich (1966, p. 109), the fecal coliform test, in conjunction with the total coliform determination, yields the best specific data on the proportion of fecal pollution with which to discriminate between pollution derived from warm-blooded animals and that from other sources. However, Geldreich (1966, p. 109) cautions that the absence of fecal coliforms in waters with various densities of other coliforms may indicate less recent fecal pollution. Such waters are not necessarily free of pathogens.

The occurrence of fecal streptococci in water is being used increasingly as a bacteriological indicator of pollution. According to Geldreich and Kenner (1969, p. 340), the presence of fecal streptococci in streams usually indicates fecal pollution, and their absence would suggest little or no warm-blooded animal pollution. However, Geldreich and Kenner (1969, p. 348) caution that two varieties of fecal streptococci are of limited sanitary significance because of their wide environmental distribution. According to the National Technical Advisory Committee to the Secretary of the Interior (Federal Water Pollution Control Administration, 1968, p. 12), fecal streptococci determinations should not be used as primary criteria for evaluating the sanitary quality of water, but are useful as a supplement to the fecal coliform test where more precise determination of sources of contamination is necessary.

Phosphorus and nitrogen compounds are components of metabolic wastes from animals and always are present in sewage. The use of sodium phosphate as a builder in household detergents probably has caused a significant increase in the output of phosphorus in domestic wastes in recent years. Nitrogen and phosphorus compounds also are common in many industrial wastes. Consequently, phosphorus and nitrogen are abundant in most polluted waters.

Some phosphorus and nitrogen in water may result naturally from leaching of soil and rocks and decomposition of plants. Fertilizers also may add to the concentrations of phosphorus and nitrogen in water. Thus, the presence of these constituents in water is indicative rather than specific for pollution.

According to Goerlitz and Brown (1972, p. 11), MBAS, synthetic detergents, or surfactants occur in natural water almost exclusively as a result of pollution. Some materials other than man-made surface-active agents react with methylene blue to give positive interferences, but the occurrence of these materials at interference levels is rare (Environmental Protection Agency, 1971, p. 132).

Analyses of at least one sample from many of the data-collection sites shown on figure 1 have included determinations for these properties or constituents. Other determinations that often are indicative of pollution are BOD (biochemical oxygen demand), minor elements (including heavy metals), and pesticides. Samples from selected sites were analyzed for these properties or constituents. Samples from many of the sites were analyzed for principal inorganic parameters.

Analytical methods were those in common usage by the U.S. Geological Survey and have been described by Brown, Skougstad, and Fishman (1970) and Goerlitz and Brown (1972).

Bacteriological analyses were begun at the data-collection sites immediately after the samples were collected. Samples for the determination of nitrogen, phosphorus, and MBAS were treated with mercuric chloride (40 milligrams of mercury per liter of sample) and (or) were refrigerated in darkness until analysis was begun. Samples for the determination of BOD were refrigerated in darkness and were transported to the laboratory for analysis with a minimum of delay. Samples for the determination of trace metals were filtered through 0.45-μm membrane filters and were acidified to a pH of 3.0 or less with double-distilled nitric acid at the data-collection sites. Samples for the determination of pesticides were refrigerated at about 1°C until analysis was begun.

WELL-NUMBERING SYSTEM

The well-numbering system in Texas was developed by the Texas Water Development Board for use throughout the State. Under this system, each 1-degree quadrangle is given a number consisting of two digits. These are the first two digits in the well number. Each 1-degree quadrangle is divided into 7-1/2-minute quadrangles which are given 2-digit numbers from 01 to 64. These are the third and fourth digits of the well number. Each 7-1/2-minutes quadrangle is divided into 2-1/2-minute quadrangles which are given a single digit number from 1 to 9. This is the fifth digit of the well number. Finally, each well within a 2-1/2-minute quadrangle is given a 2-digit number in the order in which it was inventoried, starting with 01. These are the last two digits of the well number.

Only the last three digits of the well number are shown at each location on figure 1; the first four digits are shown in the northwest corner of each 7-1/2 minute quadrangle.

In addition to the seven-digit well number, a two-letter prefix is used to identify the county. The prefix for counties where wells were sampled are as follows: AY, Bexar; DX, Comal; JJ, Edwards; LR, Hays; TD, Medina; and YP, Uvalde.

WATER QUALITY

Ground Water

Results of analyses of water samples collected from wells and springs in the Edwards aquifer during the period August 1968 to August 1969 were compiled by Reeves and Blakey (1970). Water-quality data for wells and springs sampled after August 1969 (except for pesticides) are shown in table 1. The following discussions of the quality of ground and surface waters in the San Antonio area are based on data collected during both periods. Results of analyses for pesticides are discussed in a subsequent section.

Water from the Edwards aquifer is usually very hard and of the calcium bicarbonate type. The concentration of dissolved solids (as determined by laboratory analysis or estimated from the specific conductance) ranged from about 200 mg/l (milligrams per liter) in a sample collected from well JJ-70-06-502 on Feb. 3, 1970, to 470 mg/l in a sample collected from well AY-68-36-106 on Nov. 12, 1969. Data on figure 2 show that the dissolved-solids content of ground water in the area usually ranges from 250 to 350 mg/l. Samples from only four wells contained more than 350 mg/l dissolved solids.

The chloride and sulfate concentrations in most samples of ground water from the area were low. The chloride concentration ranged from 6.5 mg/l in a sample from well AY-68-29-409 on Apr. 2, 1969, to 62 mg/l in a sample from well JJ-70-06-302 on Feb. 3, 1970. Data on figure 3 and table 1 show that the chloride content of the water usually ranges from about 6 to 20 mg/l. Samples from only seven wells contained more than 20 mg/l chloride.

The sulfate concentration ranged from 0.0 mg/l in a sample from well AY-68-29-105 on Apr. 12, 1972, to 65 mg/l in a sample from well AY-68-27-401 on Apr. 12, 1972. Data on figure 4 show that the sulfate content of the water usually ranges from 0.0 to 30 mg/l. Samples from only 13 wells contained more than 30 mg/l sulfate.

The concentration of nitrate in samples of ground water from the Edwards aquifer ranged from 0.0 to 15 mg/l; samples from only nine wells contained more than 10 mg/l. The nitrate content of water from some of the wells, though low, was fairly variable. For example, the nitrate content of samples from well AY-68-28-506 ranged from 5.8 to 15 mg/l, and the nitrate content of samples from well AY-68-27-509 ranged from 4.9 to 12 mg/l. The nitrate content of water from four other wells varied by as much as 2 mg/l.

The phosphate content of ground water in the area is much less than the nitrate content. The maximum phosphate concentration measured was 0.37 mg/l in a sample from well AY-68-27-504 on Mar. 3, 1971. No measurable phosphate was found in samples from 18 wells, and samples from only five wells contained more than 0.10 mg/l phosphate. The phosphate content of samples collected from these five wells varied considerably. For example, the phosphate content of samples from well AY-68-27-504 ranged from 0.00 to 0.37 mg/l, and the phosphate content of samples from well AY-68-27-509 ranged from 0.00 to 0.21 mg/l.

Water from most of the wells and springs contained no measurable MBAS; the maximum concentration measured was 0.16 mg/l in a sample from well AY-68-29-809 on Apr. 2, 1969. A sample from well AY-68-29-409 on Apr. 2, 1969, contained 0.10 mg/l; no other sample contained more than 0.04 mg/l MBAS.

The BOD, which is a measure of the biodegradable organic material, was low in most samples of ground water in the area. The maximum BOD measured was 3.0 mg/l in a sample from well AY-68-29-809 on Oct. 31, 1968; most other samples contained less than 0.5 mg/l.

The concentrations of most of the minor elements were either less than detectable limits or were very low in most of the samples analyzed. The following is a list of the minor elements measured and their respective ranges.

Constituents	Range (mg/l)
Aluminum	0.00 - 0.10
Arsenic	.00
Boron	.03 - .15
Copper	.000 - .40
Iodide	.01 - .16
Iron	.00 - 2.9
Lead	.000 - .010
Lithium	.00 - .01
Manganese	.00 - .81
Mercury	<.0005 - .014
Nickel	.000 - .020
Strontium	.10 - .59
Zinc	.00 - .96

The results of these and other determinations indicate that the inorganic and organic chemical quality of water in the Edwards aquifer has not been degraded significantly by the entrance of domestic, industrial, or agricultural wastes. The fairly large variation of nitrate and phosphate concentrations in water from a few wells is presumptive evidence that pollutants are reaching the aquifer. This presumptive evidence is substantiated by the results of bacteriological analyses.

Results of analyses of water from the Edwards aquifer for total coliforms, fecal coliforms, and fecal streptococci during the period August 1969 to April 1972 are shown in table 1; results of analyses from August 1968 to April 1972 are summarized on figure 5 and in the following table.

Zone of Edwards aquifer where well or spring is located	Type of bacteria	No. of wells and springs in which at least one sample was positive	No. of wells in which all samples were negative	Total
Recharge	Total coliforms	a30	10	a40
	Fecal coliforms	9	25	34
	Fecal streptococci	12	24	36
Artesian	Total coliforms	29	20	49
	Fecal coliforms	5	30	35
	Fecal streptococci	8	29	37

a Includes 2 springs

The tabulation shows that at least one sample from each of 87 wells (38 wells in the recharge zone and 49 wells in the artesian zone) and two springs (both in the recharge zone) were analyzed for total coliforms. These organisms were found in at least one sample from each of 57 wells (28 wells in the recharge zone and 29 wells in the artesian zone) and two springs.

The density of total coliform organisms in samples from the recharge zone ranged from 0 in many samples to 19,000 colonies per 100 ml (milliliters) in a sample collected from well AY-68-27-507 on June 3, 1971, after pumping for 10 minutes. The density of total coliform organisms in samples from the artesian zone ranged from 0 in many samples to 14,000 colonies per 100 ml in a sample from well AY-68-29-503 on Mar. 7, 1971. Samples from only 19 wells had a coliform density of more than 100 colonies per 100 ml; 11 of the wells are located in the recharge zone, eight wells are located in the artesian zone just downdip from the recharge zone.

The absence or low density of coliform organisms in samples from many wells indicates that the amount of fecal pollution reaching the Edwards aquifer is small in comparison to the volume of water available for dispersion and dilution. The high coliform density in some wells in or just downdip from the recharge zone indicates that this zone, which is characterized by areas of thin soil or bare rock, is susceptible to pollution. Even so, the coliform density of water in this zone varied considerably in time and place.

The variation in the density of coliforms in samples from a particular well is illustrated by analyses for well AY-68-27-603 (table 1). The coliform density of water from this well, when first sampled on Aug. 4, 1971, after about a 5-inch rain, was 3,900 colonies per 100 ml. The number of coliform organisms has declined progressively since the first sampling period. In April 1972, after about 3-1/2 months of deficient rainfall, no coliform organisms were found in samples from the well.

During the period of intensive rainfall in August 1971, a significant increase in the number of coliforms was noted in samples collected from other wells in or near the recharge zone. Most of the samples with a high coliform density during this and other periods were from poorly sealed or inadequately cased wells used for small domestic supplie Conversely, samples collected from properly constructed and sealed public-supply wells in the artesian zone of the reservoir were free of coliforms.

As discussed previously, a positive test for total coliforms in untreated water is indicative rather than specific for the presence of fecal pollution. However, positive analyses for fecal coliforms and fecal streptococci in water usually verify the presence of fecal pollution. The density of fecal coliforms in samples from 34 wells in the recharge zone of the Edwards aquifer ranged from 0 in many samples to 500 colonies per 100 ml in a sample collected from well AY-68-27-603 on Aug. 4, 1971, following a period of intensive rainfall. At least one sample from each of nine wells in the recharge zone contained fecal coliforms.

The density of fecal streptococci in samples collected from 36 wells in the recharge zone ranged from 0 in many samples to 820 colonies per 100 ml in a sample from well AY-68-27-603 on Aug. 4, 1971. At least one sample from each of 12 wells in the recharge zone contained fecal streptococci.

The density of fecal coliforms in samples from 35 wells in the artesian zone ranged from 0 in many samples to 20 colonies per 100 ml in a sample from well AY-68-27-603 on Aug. 4, 1971. At least one sample from each of five wells in the artesian zone contained fecal coliforms.

The density of fecal streptococci in samples collected from 37 wells in the artesian zone ranged from 0 in many samples to 59 colonies per 100 ml in a sample from well AY-68-29-403 on April 13, 1972. At least one sample from each of eight wells in the artesian zone contained fecal streptococci.

Each of the wells in the artesian zone that contained fecal coliforms and fecal streptococci are very near the recharge zone. Most of these wells and those in the recharge zone that contained fecal coliforms and fecal streptococci are poorly sealed or inadequately cased wells used for small domestic supplies. The density of both groups of bacteria in most samples from these wells varied considerably. For example, fecal coliforms and fecal streptococci were absent or the densities were very low in samples collected from well AY-68-27-509 before August 1971. However, on Aug. 5, 1971, after a prolonged period of rainfall, the densities of fecal coliforms and fecal streptococci increased to 130 colonies per 100 ml and 280 colonies per 100 ml, respectively. Similar increases in the densities of these groups of bacteria were noted in samples collected from other wells during this period of intensive rainfall.

The presence of fecal coliforms and fecal streptococci, the variations in the number of total coliforms, and the concentrations of nitrate and phosphate in samples from some of the wells show that fecal pollution is reaching the Edwards ground-water reservoir. The source of pollution in some wells has not been determined definitely because of the heterogeneity of the Edwards aquifer and the variations in the rates and directions of the movement of water in the fractured and cavernous limestones. However, the areal variation in the locations of the wells where pollution has been noted and where background information (obtained for these wells during sanitary surveys) is available indicates that pollution is localized. The problem results principally from polluted runoff from the land surface and from effluent from septic tanks entering through fractures in the recharge zone or infiltrating through the thin soil mantle into poorly sealed or inadequately cased wells in both the recharge and artesian zones.

The data indicate that the degradation of the quality of water throughout much of the ground-water reservoir has been minor. However, if development on the recharge zone of the aquifer continues at an accelerated rate and if stringent precautions are not taken to prevent the increased waste load from reaching the aquifer, deterioration of the chemical and bacteriological quality of the water can be expected.

Surface Water

Surface-water sampling sites are located in the outcrop area or on streams that flow into the outcrop area. Data collected at these sites (table 2) show the chemical composition of surface water to be very similar to that of ground water in the area. Water in most streams is very hard and of the calcium bicarbonate type.

Limited data on the bacteriological quality show that coliform organisms were present at each of the sites sampled and that fecal coliforms and fecal streptococci were present at most sites. Although the bacterial densities at most sites were low for untreated surface waters, they varied greatly in both time and place because of changes in dilution levels with varying volumes of inflows and because of changes in nutrient levels, climatic conditions, and other environmental factors that affect the bacteria's survival rate.

Sites 2 to 6 span a 20-mile reach of the Frio River from near Leakey to Concan (fig. 1). While the permanent population in the drainage area of this reach of the Frio River is small, Garner Park, located between sites 4 and 5, receives a large number of visitors each year. Domestic waste from the park probably affects the water quality of the Frio River downstream.

Figure 6 shows the observed variation in coliform density and water discharge during four studies at these sites since 1968. The apparent effects of Garner Park on the Frio River are shown by the large increases in coliform densities from site 4 to site 5 on July 29, 1969, and June 2, 1971. The number of coliform colonies were low at sites 3 to 6 during February 1970, probably resulting from low levels of coliforms reaching the stream and low survival rates in the cold water (11.0° to 14.5°C). However, these limited data represent only a brief period and the water present at the time of sampling. Variations in coliform densities are probably much greater in both time and place than those observed.

Data collected at sites 2 through 34 provide an indication of the quality of surface waters in the area and generally show higher bacteria levels downstream from urban development. The dilution of man-made wastes by natural streamflow was so great in most streams that the effects of wastes could not be evaluated from chemical characteristics. However, nitrate concentrations ranged from 0.0 to 14 mg/l in the samples collected, indicating that much greater sources of nitrates were available in some drainage areas than in others. Except for the evaluation of general trends in coliform densities in the Frio River (fig. 6), the extent of water-quality deterioration of surface waters flowing into the recharge zone cannot be predicted from available data.

Pesticides in Ground and Surface Waters

Since 1968, water from the following 12 wells and seven surface sites in the San Antonio area have been analyzed for pesticides (nine insecticides and three herbicides):

AY-68-28-506	[1] Site C - downstream from San Antonio
AY-68-28-903	airport sewage-treatment plant
AY-68-29-102	Site 6 - Frio River at Concan
AY-68-29-204	Site 10 - Nueces River at Laguna
AY-68-29-403	Site 12 - Sabinal River near Sabinal
AY-68-29-503	Site 17 - Medina River near Pipe Creek
AY-68-29-810	Site 27 - San Geronimo Creek 5.6 miles
AY-68-36-410	south-southwest of San Geronimo
JJ-55-63-701	Site 34 - Blanco River near Wimberley
JJ-55-63-703	
YP-69-35-804	
YP-69-50-107	

[1] For location of site, see Reeves and Blakey (1970, p. 6).

All pesticide concentrations were less than 0.005 ug/l (micrograms per liter) except for water from the two Uvalde County wells (YP) and Site C.

Water samples collected in 1968 from well YP-69-35-804 contained DDE [1,1-dichloro-2, 2-bis (p-chlorophenyl) ethylene] and DDT [1,1,1-trichloro-2, 2-bis (p-chlorophenyl) ethane] in following concentrations:

	DDE	DDT
May 21, 1968	0.02 µg/l	0.17 µg/l
June 13, 1968	.04 µg/l	1.0 µg/l
August 10, 1968	.01 µg/l	.06 µg/l

A water sample collected from well YP-69-50-107 on August 8, 1969 contained 0.08 µg/l Dieldrin, but a subsequent sample collected October 23, 1969 contained less than 0.005 µg/l Dieldrin. Field investigations showed that the source of pesticides in these wells was surface drainage that entered the well bores.

A water sample collected downstream from the San Antonio airport sewage-treatment plant in September 1968 contained 0.15 µg/l DDD [1, 1-dichloro-2,2-bis (p-chlorophenyl) ethane], 0.10 µg/l DDE, 0.06 µg/l DDT and 0.02 µg/l Dieldrin. Other insecticide and herbicide concentrations were less than 0.005 µg/l.

Since 1969 the Geological Survey, in cooperation with the Texas Water Development Board, has collected data on quality of urban runoff in San Antonio. Maximum concentrations observed for selected pesticides in San Antonio urban runoff include 1.0 µg/l DDD, 1.1 µg/l DDE, 6.6 µg/l DDT, 1.9 µg/l chlordane, 8.1 µg/l 2,4-D (2,4-dichlorophenoxyacetic acid), and 13 µg/l 2,4,5-T (2,4,5-trichlorophenoxyacetic acid). Water-quality data collected in the urban study for 1969 and 1970 were reported by Schulze, Dupuy, and Manigold (1970) and Dupuy and Schulze (1971). Unpublished data collected since 1971 are available in the office of the U.S. Geological Survey, Austin, Texas.

Levels of pesticides observed in surface and ground waters in the San Antonio area are substantially below the permissible limits for public water supplies (Federal Water Pollution Control Administration, 1968, p. 20). However, the nearly nonrestricted movement of liquids from the surface to the aquifer in the outcrop area and numerous wells in the artesian zone provide an ever-present hazard to the aquifer if a major surface spill of a toxic substance should occur.

SUMMARY OF CONCLUSIONS

Ground water from the Edwards aquifer is usually very hard and of the calcium bicarbonate type. The dissolved-solids content of the water usually ranges from 250 to 350 mg/l; the chloride content usually ranges from about 6 to 20 mg/l; and the sulfate content usually ranges from 0.0 to 30 mg/l. The observed range in concentrations of nitrate and phosphate in samples from the ground-water reservoir was 0.0-15 mg/l and 0.0-0.37 mg/l, respectively. The nitrate and phosphate contents of water from some of the wells, though low, were fairly variable.

Bacteriological indicators of pollution were found in samples from the recharge and artesian zones of the aquifer. Coliform organisms were found in at least one sample from 28 wells in the recharge zone and 29 wells in the artesian zone. Although the coliform density in samples from many of these wells were low, samples from 11 wells in the recharge zone and eight wells in the artesian zone just downdip from the recharge zone contained more than 100 coliform colonies per 100 ml. The high coliform density in these wells indicates that the recharge zone, which is characterized by areas of thin soil or bare rock, is susceptible to pollution.

At least one sample from each of nine wells in the recharge zone and five wells in the artesian zone contained fecal coliforms. At least one sample from each of 12 wells in the recharge zone and eight wells in the artesian zone contained fecal streptococci. The presence of these bacteria, the variations in the number of total coliforms, and the concentrations of nitrate and phosphate in some wells show that fecal pollution is reaching the ground-water reservoir.

The areal variation in the locations of these wells and background information obtained during sanitary surveys indicate that pollution is localized and results principally from runoff from the land surface and from effluent from septic tanks entering the aquifer through fractures in the recharge zone or infiltrating through the thin soil into poorly sealed or inadequately cased wells in the recharge and artesian zones.

Although degradation of the quality of water throughout much of the ground-water reservoir has been minor, increased waste loads from an accelerated rate of development on the recharge zone can be expected to cause a deterioration in the quality of water unless stringent precautions are taken to prevent the wastes from reaching the aquifer.

The chemical composition of water in streams that cross the recharge zone of the Edwards aquifer is very similar to that of ground water in the area. Water in most streams is very hard and of the calcium bicarbonate type.

Coliforms were present at each of the surface-water data-collection sites, and fecal coliforms and fecal streptococci were present at most sites. Although the densities of these bacteria were low for untreated surface water, they varied greatly in both time and place.

Trace concentrations of several pesticides have been observed in samples from two wells and from urban runoff in the San Antonio area, but the levels observed are well below the permissible limits for public water supplies.

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TABLE 1.--Quality-of-water data from wells and springs in the San Antonio area

(Results in milligrams per liter except as indicated)

Well number	AY-68-27-302	AY-68-27-302	AY-68-27-401	AY-68-27-401	AY-68-27-503	AY-68-27-503	AY-68-27-503	AY-68-27-503	AY-68-27-504
Date of collection	Apr. 5, 1972	Apr. 5, 1972	Apr. 12, 1972	Apr. 12, 1972	Jan. 27, 1972	Apr. 4, 1972	Apr. 7, 1971	Aug. 5, 1971	Mar. 3, 1971
Depth of well (ft)	365	365	--	--	435	435	435	435	508
Sampled after pumping	10 minutes	60 minutes	10 minutes	60 minutes	Many hours	10 minutes	Many hours	Many hours	60 minutes
Discharge (gpm)	10	10	5	5	200	100	100	100	500
Silica (SiO_2)	--	15	--	14	--	--	--	--	--
Calcium (Ca)	--	87	82	82	--	--	--	--	--
Magnesium (Mg)	--	12	18	16	--	--	--	--	17
Sodium (Na)	--	1/ 5.5	--	1/ 17	--	--	--	--	--
Potassium (K)	--	--	--	--	--	--	--	--	--
Bicarbonate (HCO_3)	--	302	266	260	--	--	--	288	--
Carbonate (CO_3)	--	0	0	0	--	--	--	0	--
Sulfate (SO_4)	--	9.2	65	65	--	--	--	21	33
Chloride (Cl)	9.1	10	15	15	--	17	--	14	14
Fluoride (F)	--	.1	--	.3	--	--	--	--	--
Bromide (Br)	--	--	--	--	--	--	--	--	--
Iodide (I)	--	--	--	--	--	--	--	--	--
Hardness as $CaCO_3$	--	270	280	270	--	--	--	270	--
Sodium adsorption ratio (SAR)	--	.1	--	.5	--	--	--	--	--
Specific conductance (micromhos at 25°C)	515	500	571	571	511	557	--	523	--
pH	--	7.9	7.2	7.2	--	--	--	7.7	--
Temperature (°C)	23.0	23.0	22.0	22.0	22.0	--	--	--	--
Dissolved solids (calc)	--	297	--	343	--	--	--	--	--
Ammonia (NH_4)	--	.00	--	.00	--	--	.00	.00	.00
Nitrate (NO_3)	--	8.9	--	5.3	--	--	7.9	7.1	7.3
Nitrite (NO_2)	--	.00	--	.00	--	--	.00	.00	.00
Phosphate (PO_4)	--	.02	--	.00	--	--	.00	.00	.37
Detergents (MBAS)	--	.00	--	.00	--	--	.01	.00	.00
Biochemical oxygen demand (BOD)	--	--	--	--	--	--	--	--	.6
Coliform (colonies per 100 ml)	0	0	2300	2200	0	1	0	30	1400
Fecal coliform (colonies per 100 ml)	0	0	0	0	0	0	0	0	0
Streptococci (colonies per 100 ml)	0	0	23	10	0	0	0	0	0
Aluminum (Al)	--	--	--	--	--	--	--	--	--
Arsenic (As)	--	--	--	--	--	--	--	.00	.00
Boron (B)	--	--	--	--	--	--	--	--	--
Copper (Cu)	--	--	--	--	--	--	--	.007	.004
Iron (Fe)	--	--	--	--	--	--	--	--	--
Lead (Pb)	--	--	--	--	--	--	--	.000	.000
Lithium (Li)	--	--	--	--	--	--	--	--	--
Manganese (Mn)	--	--	--	--	--	--	--	--	--
Mercury (Hg)	--	--	--	--	--	--	--	<.0005	<.0005
Zinc (Zn)	--	--	--	--	--	--	--	.00	.01

1/ Sodium and potassium calculated as sodium (Na).

TABLE 1.--Quality-of-water data from wells and springs in the San Antonio area--Continued

(Results in milligrams per liter except as indicated)

Well number	AY-68-27-504	AY-68-27-504	AY-68-27-504	AY-68-27-504	AY-68-27-504	AY-68-27-504	AY-68-27-504	AY-68-27-507	AY-68-27-507
Date of collection	Jan. 27, 1972	Jan. 27, 1972	Jan. 27, 1972	Jan. 27, 1972	Apr. 4, 1972	Apr. 5, 1972	Apr. 12, 1972	Apr. 28, 1971	June 3, 1971
Depth of well (ft)	508	508	508	508	508	508	508	385	385
Sampled after pumping	10 minutes	40 minutes	90 minutes	150 minutes	Many hours	10 minutes	Many hours	60 minutes	10 minutes
Discharge (gpm)	525	525	525	525	375	375	435	9	9
Silica (SiO_2)	--	11	--	11	--	--	--	--	--
Calcium (Ca)	--	93	--	94	--	--	--	--	--
Magnesium (Mg)	13	13	--	13	--	--	--	--	--
Sodium (Na)	--	9.2	--	9.0	--	--	--	--	--
Potassium (K)	--	1.4	--	1.4	--	--	--	--	--
Bicarbonate (HCO_3)	--	306	--	306	--	--	--	--	--
Carbonate (CO_3)	--	0	--	0	--	--	--	--	--
Sulfate (SO_4)	24	24	--	24	--	--	--	--	--
Chloride (Cl)	15	16	--	15	16	16	--	--	--
Fluoride (F)	--	.2	--	.2	--	--	--	--	--
Bromide (Br)	--	--	--	--	--	--	--	--	--
Iodide (I)	--	--	--	--	--	--	--	--	--
Hardness as $CaCO_3$	--	290	--	290	--	--	--	--	--
Sodium adsorption ratio (SAR)	.2	.2	--	.2	--	--	--	--	--
Specific conductance (micromhos at 25°C)	--	557	--	561	556	557	564	502	500
pH	--	8.0	--	7.9	--	--	--	--	--
Temperature (°C)	20.0	20.0	--	20.0	22.0	22.0	--	--	--
Dissolved solids (calc)	--	326	--	326	--	--	--	--	--
Ammonia (NH_4)	.13	.05	.03	.08	--	--	--	--	.00
Nitrate (NO_3)	8.4	8.0	8.0	8.0	--	--	--	--	7.5
Nitrite (NO_2)	.00	.00	.00	.00	--	--	--	--	.00
Phosphate (PO_4)	.06	.00	.00	.00	--	--	--	--	.00
Detergents (MBAS)	.00	.00	.00	.00	--	--	--	--	.00
Biochemical oxygen demand (BOD)	--	--	--	--	--	--	--	--	--
Coliform (colonies per 100 ml)	9	5	6	0	510	1100	0	950	19000
Fecal coliform (colonies per 100 ml)	0	0	0	0	0	0	0	22	1
Streptococci (colonies per 100 ml)	0	1	0	0	0	0	0	49	3
Aluminum (Al)	--	--	--	--	--	--	--	--	--
Arsenic (As)	--	--	--	.00	--	--	--	--	--
Boron (B)	--	--	--	--	--	--	--	--	--
Copper (Cu)	--	.003	--	.003	--	--	--	--	--
Iron (Fe)	--	.00		.00	--	--	--	--	--
Lead (Pb)	--	.000	--	.000	--	--	--	--	--
Lithium (Li)	--	--	--	--	--	--	--	--	--
Manganese (Mn)	--	--	--	--	--	--	--	--	--
Mercury (Hg)	--	<.002	--	<.002	--	--	--	--	--
Zinc (Zn)	--	.06	--	.05	--	--	--	--	--

TABLE 1.--Quality-of-water data from wells and springs in the San Antonio area--Continued

(Results in milligrams per liter except as indicated)

Well number	AY-68-27-507	AY-68-27-507	AY-68-27-507	AY-68-27-507	AY-68-27-507	AY-68-27-507	AY-68-27-508	AY-68-27-508
Date of collection	June 3, 1971	June 3, 1971	June 3, 1971	June 3, 1971	Apr. 4, 1972	Apr. 4, 1972	Sept. 15, 1969	Aug. 5, 1971
Depth of well (ft)	385	385	385	385	385	385	320	320
Sampled after pumping	40 minutes	90 minutes	150 minutes	210 minutes	10 minutes	60 minutes	10 minutes	60 minutes
Discharge (gpm)	9	9	9	9	9	9	10	10
Silica (SiO_2)	--	--	--	--	--	--	11	--
Calcium (Ca)	--	--	--	--	--	--	85	--
Magnesium (Mg)	--	--	--	--	--	--	13	--
Sodium (Na)	6.4	--	6.5	6.4	--	--	1/ 7.6	--
Potassium (K)	1.1	--	1.1	1.2	--	--	--	--
Bicarbonate (HCO_3)	268	--	268	268	--	--	294	288
Carbonate (CO_3)	0	--	0	0	--	--	0	0
Sulfate (SO_4)	25	--	25	24	--	--	16	26
Chloride (Cl)	14	--	14	14	11	11	12	13
Fluoride (F)	--	--	--	--	--	--	.2	--
Bromide (Br)	--	--	--	--	--	--	--	--
Iodide (I)	--	--	--	--	--	--	--	--
Hardness as $CaCO_3$	260	--	260	260	--	--	270	280
Sodium adsorption ratio (SAR)	--	--	--	--	--	--	.2	--
Specific conductance (micromhos at 25°C)	507	504	504	504	468	479	517	526
pH	7.7	--	7.7	7.7	--	--	7.4	7.5
Temperature (°C)	--	--	--	--	22.0	--	22.0	--
Dissolved solids (calc)	--	--	--	--	--	--	299	--
Ammonia (NH_4)	.00	.00	.00	.00	.00	--	.00	.00
Nitrate (NO_3)	7.5	8.0	7.5	8.0	6.1	--	8.9	9.3
Nitrite (NO_2)	.00	.00	.00	.00	.00	--	.00	.00
Phosphate (PO_4)	.00	.00	.03	.15	.02	--	.03	.00
Detergents (MBAS)	.00	.00	.00	.00	.00	--	--	.00
Biochemical oxygen demand (BOD)	.2	--	.2	1.1	--	--	.4	--
Coliform (colonies per 100 ml)	5400	1000	500	64	0	0	3	10
Fecal coliform (colonies per 100 ml)	0	0	0	0	0	0	0	0
Streptococci (colonies per 100 ml)	0	0	0	0	0	0	0	0
Aluminum (Al)	.00	--	.01	.00	--	--	--	--
Arsenic (As)	--	--	--	--	--	--	--	.00
Boron (B)	.04	--	.15	.03	--	--	--	--
Copper (Cu)	.004	--	.007	.003	--	--	--	.002
Iron (Fe)	.01	--	.00	.00	--	--	--	--
Lead (Pb)	.000	--	.000	.000	--	--	--	.000
Lithium (Li)	--	--	--	--	--	--	--	--
Manganese (Mn)	--	--	--	--	--	--	--	--
Mercury (Hg)	--	--	--	--	--	--	--	< .0005
Zinc (Zn)	.38	--	.31	.30	--	--	--	.46

1/ Sodium and potassium calculated as sodium (Na).

TABLE 1.--Quality-of-water data from wells and springs in the San Antonio area--Continued

(Results in milligrams per liter except as indicated)

Well number	AY-68-27-509	AY-68-27-509	AY-68-27-509	AY-68-27-509	AY-68-27-509	AY-68-27-509	AY-68-27-509	AY-68-27-509	AY-68-27-509
Date of collection	Sept. 15, 1969	Feb. 17, 1971	Feb. 17, 1971	Feb. 17, 1971	Feb. 17, 1971	Mar. 3, 1971	Mar. 3, 1971	Mar. 3, 1971	Mar. 3, 1971
Depth of well (ft)	343	343	343	343	343	343	343	343	343
Sampled after pumping	10 minutes	10 minutes	40 minutes	90 minutes	150 minutes	10 minutes	40 minutes	90 minutes	150 minutes
Discharge (gpm)	8	8	8	8	8	8	8	8	8
Silica (SiO_2)	11	--	--	--	--	--	--	--	--
Calcium (Ca)	88	--	91	--	--	--	--	--	--
Magnesium (Mg)	14	--	16	--	--	--	--	--	--
Sodium (Na)	1/ 7.6	--	--	--	--	--	--	--	--
Potassium (K)	--	--	--	--	--	--	--	--	--
Bicarbonate (HCO_3)	296	--	308	--	--	--	--	--	--
Carbonate (CO_3)	0	--	0	--	--	--	--	--	--
Sulfate (SO_4)	26	--	33	--	--	--	--	--	--
Chloride (Cl)	14	--	15	--	--	--	--	--	--
Fluoride (F)	.2	--	--	--	--	--	--	--	--
Bromide (Br)	--	--	--	--	--	--	--	--	--
Iodide (I)	--	--	--	--	--	--	--	--	--
Hardness as $CaCO_3$	280	--	290	--	--	--	--	--	--
Sodium adsorption ratio (SAR)	.2	--	--	--	--	--	--	--	--
Specific conductance (micromhos at 25°C)	539	--	570	--	--	--	--	--	--
pH	7.4	--	7.4	--	--	--	--	--	--
Temperature (°C)	23.0	--	--	--	--	--	--	--	--
Dissolved solids (calc)	312	--	--	--	--	--	--	--	--
Ammonia (NH_4)	.00	.00	--	.00	--	.00	.00	.00	.00
Nitrate (NO_3)	4.9	7.1	--	7.1	--	8.1	7.1	7.1	8.1
Nitrite (NO_2)	.00	.00	--	.00	--	.00	.00	.00	.00
Phosphate (PO_4)	.09	.21	--	.21	--	.12	.12	.12	.12
Detergents (MBAS)	--	.00	--	.00	--	.00	.00	.00	.00
Biochemical oxygen demand (BOD)	.3	2.1	--	1.7	--	--	--	--	--
Coliform (colonies per 100 ml)	225	1400	3500	1800	6500	820	2000	300	660
Fecal coliform (colonies per 100 ml)	3	0	0	1	0	0	0	0	0
Streptococci (colonies per 100 ml)	7	0	0	0	7	0	1	0	0
Aluminum (Al)	--	--	--	--	--	--	--	--	--
Arsenic (As)	--	--	.00	--	--	--	--	--	--
Boron (B)	--	--	--	--	--	--	--	--	--
Copper (Cu)	--	--	.001	--	--	--	--	--	--
Iron (Fe)	--	--	--	--	--	--	--	--	--
Lead (Pb)	--	--	.000	--	--	--	--	--	--
Lithium (Li)	--	--	--	--	--	--	--	--	--
Manganese (Mn)	--	--	--	--	--	--	--	--	--
Mercury (Hg)	--	--	< .0005	--	--	--	--	--	--
Zinc (Zn)	--	--	.04	--	--	--	--	--	--

1/ Sodium and potassium calculated as sodium (Na).

TABLE 1.--Quality-of-water data from wells and springs in the San Antonio area--Continued

(Results in milligrams per liter except as indicated)

Well number	AY-68-27-509	AY-68-27-509	AY-68-27-509	AY-68-27-509	AY-68-27-509	AY-68-27-509	AY-68-27-509	AY-68-27-509	AY-68-27-509
Date of collection	Mar. 3, 1971	Mar. 3, 1971	Mar. 3, 1971	Mar. 3, 1971	Mar. 4, 1971	Mar. 4, 1971	Mar. 4, 1971	Mar. 4, 1971	Aug. 5, 1971
Depth of well (ft)	343	343	343	343	343	343	343	343	343
Sampled after pumping	270 minutes	390 minutes	510 minutes	630 minutes	10 minutes	40 minutes	90 minutes	150 minutes	60 minutes
Discharge (gpm)	8	8	8	8	8	8	8	8	8
Silica (SiO_2)	--	--	--	--	--	--	--	--	--
Calcium (Ca)	--	--	--	91	--	--	--	--	--
Magnesium (Mg)	--	16	--	16	--	--	--	--	--
Sodium (Na)	--	--	--	--	--	--	--	--	--
Potassium (K)	--	--	--	--	--	--	--	--	--
Bicarbonate (HCO_3)	--	--	--	310	--	--	--	--	--
Carbonate (CO_3)	--	--	--	0	--	--	--	--	--
Sulfate (SO_4)	--	29	--	29	--	--	--	--	--
Chloride (Cl)	--	14	--	14	--	--	--	--	--
Fluoride (F)	--	--	--	--	--	--	--	--	--
Bromide (Br)	--	--	--	--	--	--	--	--	--
Iodide (I)	--	--	--	--	--	--	--	--	--
Hardness as $CaCO_3$	--	--	--	290	--	--	--	--	--
Sodium adsorption ratio (SAR)	--	--	--	--	--	--	--	--	--
Specific conductance (micromhos at 25°C)	--	--	--	561	--	--	--	--	--
pH	--	--	--	8.0	--	--	--	--	--
Temperature (°C)	--	--	--	--	--	--	--	--	--
Dissolved solids (calc)	--	--	--	--	--	--	--	--	--
Ammonia (NH_4)	.00	.00	.00	.00	--	--	--	--	.00
Nitrate (NO_3)	7.7	7.3	6.7	8.5	--	--	--	--	12
Nitrite (NO_2)	.00	.00	.00	.00	--	--	--	--	.00
Phosphate (PO_4)	.12	.12	.12	.12	--	--	--	--	.00
Detergents (MBAS)	.00	.00	.00	.00	--	--	--	--	.03
Biochemical oxygen demand (BOD)	--	--	--	--	--	--	--	--	--
Coliform (colonies per 100 ml)	540	400	420	210	460	150	240	330	5800
Fecal coliform (colonies per 100 ml)	0	0	0	0	0	0	0	0	130
Streptococci (colonies per 100 ml)	0	0	0	0	1	2	0	0	280
Aluminum (Al)	--	--	--	--	--	--	--	--	--
Arsenic (As)	--	.00	--	.00	--	--	--	--	--
Boron (B)	--	--	--	--	--	--	--	--	--
Copper (Cu)	--	.005	--	.003	--	--	--	--	--
Iron (Fe)	--	--	--	--	--	--	--	--	--
Lead (Pb)	--	.000	--	.000	--	--	--	--	--
Lithium (Li)	--	--	--	--	--	--	--	--	--
Manganese (Mn)	--	--	--	--	--	--	--	--	--
Mercury (Hg)	--	<.0005	--	<.0005	--	--	--	--	--
Zinc (Zn)	--	.04	--	.03	--	--	--	--	--

TABLE 1.--Quality-of-water data from wells and springs in the San Antonio area--Continued

(Results in milligrams per liter except as indicated)

Well number	AY-68-27-510	AY-68-27-510	AY-68-27-511	AY-68-27-511	AY-68-27-602	AY-68-27-602	AY-68-27-603	AY-68-27-603	AY-68-27-603
Date of collection	Mar. 3, 1971	Apr. 28, 1971	Aug. 5, 1971	Aug. 5, 1971	Aug. 4, 1971	Aug. 4, 1971	Aug. 4, 1971	Aug. 4, 1971	Aug. 11, 1971
Depth of well (ft)	390	390	365	365	389	389	360	360	360
Sampled after pumping	15 minutes	60 minutes	10 minutes	60 minutes	10 minutes	60 minutes	10 minutes	60 minutes	10 minutes
Discharge (gpm)	12	12	7	7	15	15	20	20	20
Silica (SiO_2)	11	--	--	11	--	11	--	11	--
Calcium (Ca)	--	--	--	86	--	83	--	86	--
Magnesium (Mg)	16	--	--	14	--	14	--	13	--
Sodium (Na)	--	--	--	1/ 5.7	--	1/ 4.8	--	1/ 6.0	--
Potassium (K)	--	--	--	--	--	--	--	--	--
Bicarbonate (HCO_3)	--	--	--	292	--	288	--	294	--
Carbonate (CO_3)	--	--	--	0	--	0	--	0	--
Sulfate (SO_4)	20	--	--	14	--	12	--	14	--
Chloride (Cl)	12	--	--	15	--	13	--	13	--
Fluoride (F)	.2	--	--	.2	--	.2	--	.2	--
Bromide (Br)	--	--	--	--	--	--	--	--	--
Iodide (I)	--	--	--	--	--	--	--	--	--
Hardness as $CaCO_3$	--	--	--	270	--	260	--	270	--
Sodium adsorption ratio (SAR)	.2	--	--	.2	--	.1	--	.2	--
Specific conductance (micromhos at 25°C)	--	493	--	524	--	509	-	519	--
pH	--	--	--	7.7	--	7.8	--	7.7	--
Temperature (°C)	--	--	--	--	--	--	--	--	--
Dissolved solids (calc)	--	--	--	301	--	289	--	296	--
Ammonia (NH_4)	.00	--	--	.00	--	.00	--	.00	--
Nitrate (NO_3)	8.0	--	--	11	--	9.3	--	8.0	--
Nitrite (NO_2)	.00	--	--	.00	--	.00	--	.00	--
Phosphate (PO_4)	.00	--	--	.00	--	.00	--	.00	--
Detergents (MBAS)	.00	.01	--	.00	--	.00	--	.00	--
Biochemical oxygen demand (BOD)	.2	--	--	--	--	--	--	--	--
Coliform (colonies per 100 ml)	0	15	32	19	230	2300	3900	2500	260
Fecal coliform (colonies per 100 ml)	0	0	1	0	0	0	500	230	18
Streptococci (colonies per 100 ml)	0	0	0	0	0	1	820	580	22
Aluminum (Al)	--	--	--	--	--	--	--	--	--
Arsenic (As)	.00	--	--	.00	--	.00	--	.00	--
Boron (B)	--	--	--	--	--	--	--	--	--
Copper (Cu)	.020	--	--	.011	--	.004	--	.003	--
Iron (Fe)	--	--	--	--	--	--	--	--	--
Lead (Pb)	.000	--	--	.000	--	.000	--	.000	--
Lithium (Li)	--	--	--	--	--	--	--	--	--
Manganese (Mn)	--	--	--	--	--	--	--	--	--
Mercury (Hg)	<.0005	--	--	<.0005	--	<.0005	--	<.0005	--
Zinc (Zn)	.34	--	--	.23	--	.32	--	--	--

1/ Sodium and potassium calculated as sodium (Na).

TABLE 1.--Quality-of-water data from wells and springs in the San Antonio area--Continued

(Results in milligrams per liter except as indicated)

Well number	AY-68-27-603	AY-68-27-603	AY-68-27-603	AY-68-27-603	AY-68-27-603	AY-68-27-604	AY-68-27-604	AY-68-27-605	AY-68-27-605
Date of collection	Aug. 11, 1971	Jan. 27, 1972	Jan. 27, 1972	Apr. 4, 1972	Apr. 4, 1972	Apr. 6, 1972	Apr. 6, 1972	Apr. 6, 1972	Apr. 6, 1972
Depth of well (ft)	360	360	360	360	360	363	363	305	305
Sampled after pumping	60 minutes	10 minutes	60 minutes	10 minutes	60 minutes	10 minutes	60 minutes	10 minutes	60 minutes
Discharge (gpm)	20	20	20	20	20	12	12	36	36
Silica (SiO_2)	--	--	--	--	--	--	15	--	16
Calcium (Ca)	--	--	--	--	--	--	84	--	88
Magnesium (Mg)	--	--	--	--	--	--	14	--	15
Sodium (Na)	--	--	--	--	--	--	1/ 8.7	--	1/ 7.8
Potassium (K)	--	--	--	--	--	--	--	--	--
Bicarbonate (HCO_3)	--	--	--	--	--	--	300	--	318
Carbonate (CO_3)	--	--	--	--	--	--	0	--	0
Sulfate (SO_4)	14	--	--	--	--	--	14	--	12
Chloride (Cl)	12	--	--	--	--	12	12	11	11
Fluoride (F)	--	--	--	--	--	--	.2	--	.2
Bromide (Br)	--	--	--	--	--	--	--	--	--
Iodide (I)	--	--	--	--	--	--	--	--	--
Hardness as $CaCO_3$	-	--	--	--	--	--	270	--	280
Sodium adsorption ratio (SAR)	--	--	--	--	--	--	.2	--	.2
Specific conductance (micromhos at 25°C)	--	544	542	557	554	529	528	549	546
pH	--	--	--	--	--	--	7.3	--	7.3
Temperature (°C)	--	--	--	--	--	22.0	22.0	23.0	23.0
Dissolved solids (calc)	--	--	--	--	--	--	306	--	317
Ammonia (NH_4)	.00	--	--	--	--	--	.00	--	.00
Nitrate (NO_3)	8.9	--	--	--	--	--	9.7	--	11
Nitrite (NO_2)	.00	--	--	--	--	--	.00	--	.00
Phosphate (PO_4)	.00	--	--	--	--	--	.00	--	.02
Detergents (MBAS)	.00	--	--	--	--	--	.01	--	.00
Biochemical oxygen demand (BOD)	--	--	--	--	--	--	--	--	--
Coliform (colonies per 100 ml)	160	100	350	0	0	0	0	0	0
Fecal coliform (colonies per 100 ml)	21	0	0	0	0	0	0	0	0
Streptococci (colonies per 100 ml)	24	0	0	0	0	0	0	0	0
Aluminum (Al)	--	--	--	--	--	--	--	--	--
Arsenic (As)	--	--	--	--	--	--	--	--	--
Boron (B)	--	--	--	--	--	--	--	--	--
Copper (Cu)	--	--	--	--	--	--	--	--	--
Iron (Fe)	--	--	--	--	--	--	--	--	--
Lead (Pb)	--	--	--	--	--	--	--	--	--
Lithium (Li)	--	--	--	--	--	--	--	--	--
Manganese (Mn)	--	--	--	--	--	--	--	--	--
Mercury (Hg)	--	--	--	--	--	--	--	--	--
Zinc (Zn)	.11	--	--	--	--	--	--	--	--

1/ Sodium and potassium calculated as sodium (Na).

TABLE 1.--Quality-of-water data from wells and springs in the San Antonio area--Continued

(Results in milligrams per liter except as indicated)

Well number	AY-68-28-103	AY-68-28-103	AY-68-28-201	AY-68-28-201	AY-68-28-201	AY-68-28-201	AY-68-28-202	AY-68-28-202	AY-68-28-203
Date of collection	Apr. 6, 1971	Apr. 6, 1971	Sept. 19, 1969	Apr. 2, 1970	Feb. 17, 1971	Feb. 17, 1971	Apr. 2, 1970	Apr. 4, 1972	Apr. 2, 1970
Depth of well (ft)	401	401	387	387	387	387	457	457	435
Sampled after pumping	15 minutes	60 minutes	10 minutes	10 minutes	10 minutes	40 minutes	Many hours	Continuous	Many hours
Discharge (gpm)	5	5	8	8	8	8	125	125	350
Silica (SiO_2)	--	12	11	--	--	--	10	--	11
Calcium (Ca)	--	94	92	--	--	92	86	--	80
Magnesium (Mg)	--	11	9.8	--	--	9.7	14	--	14
Sodium (Na)	--	1/ 2.3	1/ 5.7	--	--	--	6.9	--	5.7
Potassium (K)	--	--	--	--	--	--	1.2	--	1.1
Bicarbonate (HCO_3)	--	304	298	--	--	292	292	--	290
Carbonate (CO_3)	--	0	0	--	--	0	0	--	0
Sulfate (SO_4)	--	14	15	--	--	18	28	--	18
Chloride (Cl)	--	9.6	11	--	--	11	9.3	8.8	9.0
Fluoride (F)	--	.2	.1	--	--	--	.1	--	.1
Bromide (Br)	--	--	--	--	--	--	--	--	--
Iodide (I)	--	--	--	--	--	--	--	--	--
Hardness as $CaCO_3$	--	280	270	--	--	270	270	--	260
Sodium adsorption ratio (SAR)	--	.1	.2	--	--	--	.2	--	.2
Specific conductance (micromhos at 25°C)	--	524	514	--	--	521	524	504	502
pH	--	7.6	7.5	--	--	7.2	7.2	--	7.2
Temperature (°C)	--	22.0	23.0	23.0	--	--	22.0	--	--
Dissolved solids (calc)	--	301	300	--	--	--	304	--	286
Ammonia (NH_4)	--	.00	--	.00	.00	--	.00	--	.00
Nitrate (NO_3)	--	8.9	8.5	11	12	--	4.5	--	4.0
Nitrite (NO_2)	--	.00	--	.00	.00	--	.00	--	.00
Phosphate (PO_4)	--	.00	--	.01	.00	--	.01	--	.01
Detergents (MBAS)	--	.01	--	--	.00	--	--	--	--
Biochemical oxygen demand (BOD)	--	.5	--	.0	.8	--	.0	--	.0
Coliform (colonies per 100 ml)	1	0		76	36	62	2	0	0
Fecal coliform (colonies per 100 ml)	0	0	--	0	0	0	0	0	0
Streptococci (colonies per 100 ml)	0	0	--	0	0	0	0	0	0
Aluminum (Al)	--	--	--	--	--	--	--	--	--
Arsenic (As)	--	.00	--	--	--	.00	--	--	--
Boron (B)	--	--	--	--	--	--	--	--	--
Copper (Cu)	--	.005	--	--	--	.003	--	--	--
Iron (Fe)	--	--	--	--	--	--	--	--	--
Lead (Pb)	--	.000	--	--	--	.002	--	--	--
Lithium (Li)	--	--	--	--	--	--	--	--	--
Manganese (Mn)	--	--	.00	--	--	--	--	--	--
Mercury (Hg)	--	<.0005	--	--	--	<.0005	--	--	--
Zinc (Zn)	--	.29	--	--	--	.06	--	--	--

1/ Sodium and potassium calculated as sodium (Na).

TABLE 1.--Quality-of-water data from wells and springs in the San Antonio area--Continued

(Results in milligrams per liter except as indicated)

Well number	AY-68-28-203	AY-68-28-301	AY-68-28-302	AY-68-28-302	AY-68-28-401	AY-68-28-402	AY-68-28-402	AY-68-28-403	AY-68-28-501
Date of collection	Apr. 4, 1972	Oct. 13, 1969	Oct. 13, 1969	Dec. 3, 1969	Apr. 6, 1971	Apr. 6, 1971	Apr. 6, 1971	Apr. 29, 1971	Apr. 2, 1970
Depth of well (ft)	435	400	442	442	500	320	320	600	469
Sampled after pumping	--	Many hours	10 minutes	10 minutes	60 minutes	15 minutes	60 minutes	Many hours	10 minutes
Discharge (gpm)	350	30	40	40	1000	15	15	10	100
Silica (SiO_2)	--	12	12	--	12	--	13	--	10
Calcium (Ca)	--	84	80	--	67	--	72	74	88
Magnesium (Mg)	--	9.6	9.6	--	12	--	18	19	14
Sodium (Na)	--	3.9	3.0	--	1/ 3.0	--	--	--	6.9
Potassium (K)	--	1.1	1.4	--	--	--	--	--	1.2
Bicarbonate (HCO_3)	--	252	270	--	228	--	288	292	294
Carbonate (CO_3)	--	0	0	--	0	--	0	0	0
Sulfate (SO_4)	--	34	13	--	13	--	6.4	8.4	29
Chloride (Cl)	8.3	9.0	7.2	--	10	--	8.5	10	8.8
Fluoride (F)	--	.1	.1	--	.2	--	.2	--	.1
Bromide (Br)	--	--	--	--	--	--	--	--	--
Iodide (I)	--	--	--	--	--	--	--	--	--
Hardness as $CaCO_3$	--	250	240	--	220	--	250	260	280
Sodium adsorption ratio (SAR)	--	.1	.1	--	.1	--	--	--	.2
Specific conductance (micromhos at 25°C)	492	489	461	--	426	--	469	493	521
pH	--	7.1	7.2	--	7.5	--	7.7	7.3	7.3
Temperature (°C)	--	23.0	23.0	22.0	23.0	22.0	22.0	--	21.5
Dissolved solids (calc)	--	283	262	--	239	--	--	--	307
Ammonia (NH_4)	--	--	--	--	.00	--	--	--	--
Nitrate (NO_3)	--	5.0	2.8	--	10	--	--	--	--
Nitrite (NO_2)	--	--	--	--	.00	--	--	--	--
Phosphate (PO_4)	--	.04	.02	--	.03	--	--	--	--
Detergents (MBAS)	--	--	--	--	.01	--	.00	.03	--
Biochemical oxygen demand (BOD)	--	.2	.1	--	.4	--	.5	--	--
Coliform (colonies per 100 ml)	0	7	2300	380	0	35	24	--	--
Fecal coliform (colonies per 100 ml)	0	0	130	0	0	0	0	--	--
Streptococci (colonies per 100 ml)	0	0	110	5	0	8	1	--	--
Aluminum (Al)	--	--	--	--	--	--	--	--	--
Arsenic (As)	--	--	--	--	.00	--	.00	--	--
Boron (B)	--	--	--	--	--	--	--	--	--
Copper (Cu)	--	--	--	--	.000	--	.007	--	--
Iron (Fe)	--	--	--	--	--	--	--	--	--
Lead (Pb)	--	--	--	--	.000	--	.000	--	--
Lithium (Li)	--	--	--	--	--	--	--	--	--
Manganese (Mn)	--	--	--	--	--	--	--	--	--
Mercury (Hg)	--	--	--	--	<.0005	--	<.0005	--	--
Zinc (Zn)	--	--	--	--	.07	--	.16	--	--

1/ Sodium and potassium calculated as sodium (Na).

TABLE 1.--Quality-of-water data from wells and springs in the San Antonio area--Continued

(Results in milligrams per liter except as indicated)

Well number	AY-68-28-502	AY-68-28-502	AY-68-28-505	AY-68-28-505	AY-68-28-505	AY-68-28-505	AY-68-28-505	AY-68-28-505	AY-68-28-505
Date of collection	Apr. 2, 1970	Apr. 4, 1972	Nov. 12, 1969	Aug. 4, 1971	Aug. 4, 1971	Aug. 11, 1971	Aug. 11, 1971	Jan. 27, 1972	Apr. 5, 1972
Depth of well (ft)	506	506	456	456	456	456	456	456	456
Sampled after pumping	10 minutes	Continuous	15 minutes	10 minutes	60 minutes	10 minutes	60 minutes	30 minutes	10 minutes
Discharge (gpm)	110	110	10	10	10	10	10	10	10
Silica (SiO_2)	--	--	13	--	--	--	--	--	--
Calcium (Ca)	--	--	98	--	--	--	--	--	--
Magnesium (Mg)	--	--	6.2	--	--	--	--	--	--
Sodium (Na)	--	--	2.3	--	--	--	--	--	--
Potassium (K)	--	--	1.0	--	--	--	--	--	--
Bicarbonate (HCO_3)	--	--	312	--	318	--	--	--	--
Carbonate (CO_3)	--	--	0	--	0	--	--	--	--
Sulfate (SO_4)	--	--	5.6	--	6.0	--	--	--	--
Chloride (Cl)	--	9.2	8.4	--	10	--	--		10
Fluoride (F)	--	--	.1	--	--	--	--	--	--
Bromide (Br)	--	--	--	--	--	--	--	--	--
Iodide (I)	--	--	--	--	--	--	--	--	--
Hardness as $CaCO_3$	--	--	270	--	270	--	--	--	--
Sodium adsorption ratio (SAR)	--	--	.1	--	--	--	--	--	--
Specific conductance (micromhos at 25°C)	--	526	505	--	519	--	--	521	550
pH	--	--	7.8	--	7.7	--	--	--	--
Temperature (°C)	--	--	23.0	--	--	--	--	--	--
Dissolved solids (calc)	--	--	291	--	--	--	--	--	--
Ammonia (NH_4)	.00	--	--	--	.00	--	.00	--	--
Nitrate (NO_3)	4.1	--	3.3	--	3.5	--	4.0	--	--
Nitrite (NO_2)	.00	--	--	--	.00	--	.00	--	--
Phosphate (PO_4)	.01	--	.03	--	.00	--	.00	--	--
Detergents (MBAS)	--	--	--	--	.00	--	.00	--	--
Biochemical oxygen demand (BOD)	.0	--	.2	--	--	--	--	--	--
Coliform (colonies per 100 ml)	11	0	0	1100	310	0	2	0	8
Fecal coliform (colonies per 100 ml)	0	0	0	20	18	0	0	0	0
Streptococci (colonies per 100 ml)	0	0	0	46	15	0	1	0	0
Aluminum (Al)	--	--	--	--	--	--	--	--	--
Arsenic (As)	--	--	--	--	.00	--	--	--	--
Boron (B)	--	--	--	--	--	--	--	--	--
Copper (Cu)	--	--	--	--	.002	--	--	--	--
Iron (Fe)	--	--	--	--	--	--	--	--	--
Lead (Pb)	--	--	--	--	.000	--	--	--	--
Lithium (Li)	--	--	--	--	--	--	--	--	--
Manganese (Mn)	--	--	--	--	--	--	--	--	--
Mercury (Hg)	--	--	--	--	<.0005	--	--	--	--
Zinc (Zn)	--	--	--	--	.08	--	--	--	--

TABLE 1.--Quality-of-water data from wells and springs in the San Antonio area--Continued

(Results in milligrams per liter except as indicated)

Well number	AY-68-28-505	AY-68-28-506	AY-68-28-506	AY-68-28-506	AY-68-28-601	AY-68-28-602	AY-68-28-603	AY-68-28-603	AY-68-28-604
Date of collection	Apr. 5, 1972	Apr. 2, 1970	Feb. 3, 1971	Mar. 4, 1971	Dec. 3, 1969	Nov. 12, 1969	Apr. 5, 1972	Apr. 5, 1972	Apr. 5, 1972
Depth of well (ft)	456	490	490	490	425	391	377	377	344
Sampled after pumping	60 minutes	10 minutes	10 minutes	40 minutes	10 minutes	15 minutes	10 minutes	60 minutes	10 minutes
Discharge (gpm)	10	20	20	20	50	10	15	15	10
Silica (SiO_2)	--	9.0	--	--	14	14	--	16	--
Calcium (Ca)	--	100	--	--	88	118	--	92	--
Magnesium (Mg)	--	3.5	--	--	8.1	5.4	--	6.4	--
Sodium (Na)	--	4.4	--	--	16	8.5	--	1/ 6.4	--
Potassium (K)	--	1.0	--	--	1.0	1.4	--	--	--
Bicarbonate (HCO_3)	--	288	--	--	292	352	--	304	
Carbonate (CO_3)	--	0	--	--	0	0	--	0	--
Sulfate (SO_4)	--	13	14	--	24	13	--	5.6	--
Chloride (Cl)	10	7.8	9.0	--	14	17	9.1	8.8	10
Fluoride (F)	--	.0	--	--	.2	.1	--	.1	--
Bromide (Br)	--	--	--	--	--	--	--	--	--
Iodide (I)	--	--	--	--	--	--	--	--	--
Hardness as $CaCO_3$	--	260	--	--	250	320	--	260	--
Sodium adsorption ratio (SAR)	--	.1	--	--	.4	.2	--	.2	--
Specific conductance (micromhos at 25°C)	541	504	--	--	537	620	498	498	509
pH	--	7.1	--	--	7.4	7.5	--	7.2	--
Temperature (°C)	--	21.0	17.5	--	23.0	21.0	22.0	22.0	22.0
Dissolved solids (calc)	--	296	--	--	314	363	--	286	--
Ammonia (NH_4)	--	.00	.00	--	.00	--	--	.00	--
Nitrate (NO_3)	--	15	5.8	--	4.9	13	--	2.2	--
Nitrite (NO_2)	--	.00	.00	--	.00	--	--	.00	--
Phosphate (PO_4)	--	.04	.12	--	.02	.01	--	.02	--
Detergents (MBAS)	--	--	.00	--	--	--	--	.00	--
Biochemical oxygen demand (BOD)	--	.0	.3	--	.2	.2	--	--	--
Coliform (colonies per 100 ml)	2	210	45	840	0	24	13	2	47
Fecal coliform (colonies per 100 ml)	0	2	0	4	0	0	0	0	0
Streptococci (colonies per 100 ml)	0	2	0	3	0	0	0	0	0
Aluminum (Al)	--	--	--	--	--	--	--	--	--
Arsenic (As)	--	--	.00	--	--	--	--	--	--
Boron (B)	--	--	--	--	--	--	--	--	--
Copper (Cu)	--	--	.013	--	--	--	--	--	--
Iron (Fe)	--	.03	--	--	--	--	--	--	--
Lead (Pb)	--	--	.000	--	--	--	--	--	--
Lithium (Li)	--	--	--	--	--	--	--	--	--
Manganese (Mn)	--	--	--	--	--	--	--	--	--
Mercury (Hg)	--	--	<.0005	--	--	--	--	--	--
Zinc (Zn)	--	--	.96	--	--	--	--	--	--

1/ Sodium and potassium calculated as sodium (Na).

TABLE 1.--Quality-of-water data from wells and springs in the San Antonio area--Continued

(Results in milligrams per liter except as indicated)

Well number	AY-68-28-604	AY-68-28-702	AY-68-28-702	AY-68-28-703	AY-68-28-903	AY-68-29-102	AY-68-29-104	AY-68-29-104	AY-68-29-104
Date of collection	Apr. 5, 1972	Nov. 12, 1969	Aug. 4, 1971	Nov. 12, 1969	Apr. 6, 1971	Feb. 3, 1971	Aug. 4, 1971	Aug. 6, 1971	Aug. 11, 1971
Depth of well (ft)	344	450	450	300	762	525	602	602	602
Sampled after pumping	60 minutes	15 minutes	Many hours	10 minutes	Several hours	Many hours	Many hours	Many hours	Several hours
Discharge (gpm)	10	1000	1000	15	3500	80	140	120	120
Silica (SiO_2)	17	12	--	12	14	--	12	--	--
Calcium (Ca)	95	84	--	78	100	84	79	--	--
Magnesium (Mg)	6.0	16	--	15	13	18	23	--	--
Sodium (Na)	1/ 6.0	8.5	--	7.1	1/ 8.3	--	1/ 3.7	--	--
Potassium (K)	--	1.4	--	1.3	--	--	--	--	--
Bicarbonate (HCO_3)	304	300	296	288	340	304	324	--	312
Carbonate (CO_3)	0	0	0	0	0	0	0	--	0
Sulfate (SO_4)	6.4	24	24	16	16	29	14	--	14
Chloride (Cl)	10	13	14	11	14	10	11	--	9.0
Fluoride (F)	.1	.2	--	.2	.2	--	.3	--	--
Bromide (Br)	--	--	--	--	--	--	--	--	--
Iodide (I)	--	--	--	--	--	--	--	--	--
Hardness as $CaCO_3$	260	280	280	260	300	280	290	--	280
Sodium adsorption ratio (SAR)	.2	.2	--	.2	.2	--	.1	--	--
Specific conductance (micromhos at 25°C)	510	542	542	500	591	536	536	529	518
pH	7.3	7.4	7.6	7.5	7.5	7.7	7.6	--	7.8
Temperature (°C)	22.0	22.0	--	21.5	22.0	23.0	--	--	--
Dissolved solids (calc)	295	314	--	288	340	--	306	--	--
Ammonia (NH_4)	.00	--	.00	--	.00	.00	.00	--	.00
Nitrate (NO_3)	5.3	7.3	8.0	5.4	7.6	2.2	4.0	--	4.0
Nitrite (NO_2)	.00	--	.00	--	.00	.00	.00	--	.00
Phosphate (PO_4)	.03	.01	.00	.01	.00	.15	.00	--	.00
Detergents (MBAS)	.00	--	.00	--	.01	.00	.00	--	.00
Biochemical oxygen demand (BOD)	--	.1	--	.2	.6	.9	--	--	--
Coliform (colonies per 100 ml)	570	1	83	42	0	0	3600	2000	79
Fecal coliform (colonies per 100 ml)	0	0	0	0	0	0	33	200	2
Streptococci (colonies per 100 ml)	0	0	0	0	0	0	170	140	5
Aluminum (Al)	--	--	--	--	--	--	--	--	--
Arsenic (As)	--	--	.00	--	.00	.00	.00	--	--
Boron (B)	--	--	--	--	--	--	--	--	--
Copper (Cu)	--	--	.000	--	.002	.006	.004	--	--
Iron (Fe)	--	--	--	--	--	--	--	--	--
Lead (Pb)	--	--	.000	--	.000	.000	.000	--	--
Lithium (Li)	--	--	--	--	--	--	--	--	--
Manganese (Mn)	--	--	--	--	--	--	--	--	--
Mercury (Hg)	--	--	.0006	--	<.0005	<.0005	<.0005	--	--
Zinc (Zn)	--	--	.00	--	.09	.02	.00	--	--

1/ Sodium and potassium calculated as sodium (Na).

TABLE 1.--Quality-of-water data from wells and springs in the San Antonio area--Continued

(Results in milligrams per liter except as indicated)

Well number	AY-68-29-104	AY-68-29-104	AY-68-29-104	AY-68-29-104	AY-68-29-104	AY-68-29-104	AY-68-29-104	AY-68-29-104	AY-68-29-104
Date of collection	Jan. 26, 1972	Jan. 26, 1972	Jan. 26, 1972	Feb. 9, 1972	Feb. 9, 1972	Feb. 9, 1972	Feb. 9, 1972	Feb. 9, 1972	Feb. 24, 1972
Depth of well (ft)	602	602	602	602	602	602	602	602	602
Sampled after pumping	10 minutes	40 minutes	90 minutes	10 minutes	40 minutes	90 minutes	150 minutes	210 minutes	10 minutes
Discharge (gpm)	400	400	400	400	400	400	400	400	400
Silica (SiO_2)	--	--	--	--	--	--	--	--	--
Calcium (Ca)	--	--	--	--	--	--	--	--	--
Magnesium (Mg)	--	--	--	--	--	--	--	--	--
Sodium (Na)	--	--	--	--	--	--	--	--	--
Potassium (K)	--	--	--	--	--	--	--	--	--
Bicarbonate (HCO_3)	--	--	--	--	--	--	--	--	--
Carbonate (CO_3)	--	--	--	--	--	--	--	--	--
Sulfate (SO_4)	--	--	--	--	--	--	--	--	--
Chloride (Cl)	--	--	--	--	--	--	--	--	10
Fluoride (F)	--	--	--	--	--	--	--	--	--
Bromide (Br)	--	--	--	--	--	--	--	--	--
Iodide (I)	--	--	--	--	--	--	--	--	--
Hardness as $CaCO_3$	--	--	--	--	--	--	--	--	--
Sodium adsorption ratio (SAR)	--	--	--	--	--	--	--	--	--
Specific conductance (micromhos at 25°C)	--	--	550	552	534	557	570	529	--
pH	--	--	--	--	--	--	--	--	--
Temperature (°C)	--	--	--	--	--	--	--	--	--
Dissolved solids (calc)	--	--	--	--	--	--	--	--	--
Ammonia (NH_4)	--	--	--	--	--	--	.00	--	--
Nitrate (NO_3)	--	--	--	--	--	--	3.5	--	3.7
Nitrite (NO_2)	--	--	--	--	--	--	.00	--	.00
Phosphate (PO_4)	--	--	--	--	--	--	.06	--	.06
Detergents (MBAS)	--	--	--	--	--	--	.00	--	.00
Biochemical oxygen demand (BOD)	--	--	--	--	--	--	--	--	--
Coliform (colonies per 100 ml)	620	350	180	340	80	56	15	140	64
Fecal coliform (colonies per 100 ml)	0	0	0	0	0	0	0	0	0
Streptococci (colonies per 100 ml)	0	0	0	0	0	0	0	0	0
Aluminum (Al)	--	--	--	--	--	--	--	--	--
Arsenic (As)	--	--	--	--	--	--	--	--	--
Boron (B)	--	--	--	--	--	--	--	--	--
Copper (Cu)	--	--	--	--	--	--	--	--	--
Iron (Fe)	--	--	--	--	--	--	--	--	--
Lead (Pb)	--	--	--	--	--	--	--	--	--
Lithium (Li)	--	--	--	--	--	--	--	--	--
Manganese (Mn)	--	--	--	--	--	--	--	--	--
Mercury (Hg)	--	--	--	--	--	--	--	--	--
Zinc (Zn)	--	--	--	--	--	--	--	--	--

TABLE 1.--Quality-of-water data from wells and springs in the San Antonio area--Continued

(Results in milligrams per liter except as indicated)

Well number	AY-68-29-104	AY-68-29-104	AY-68-29-104	AY-68-29-104	AY-68-29-104	AY-68-29-104	AY-68-29-104	AY-68-29-104	AY-68-29-104
Date of collection	Feb. 24, 1972	Feb. 24, 1972	Feb. 24, 1972	Feb. 24, 1972	Feb. 24, 1972	Mar. 23, 1972	Mar. 23, 1972	Mar. 23, 1972	Mar. 23, 1972
Depth of well (ft)	602	602	602	602	602	602	602	602	602
Sampled after pumping	40 minutes	90 minutes	120 minutes	150 minutes	210 minutes	10 minutes	40 minutes	90 minutes	150 minutes
Discharge (gpm)	400	400	400	400	400	400	400	400	400
Silica (SiO_2)	--	--	--	--	--	--	--	--	--
Calcium (Ca)	--	--	--	--	--	--	--	--	--
Magnesium (Mg)	--	--	--	--	--	--	--	--	--
Sodium (Na)	--	--	--	--	--	--	--	--	--
Potassium (K)	--	--	--	--	--	--	--	--	--
Bicarbonate (HCO_3)	--	--	--	--	--	--	--	--	--
Carbonate (CO_3)	--	--	--	--	--	--	--	--	--
Sulfate (SO_4)	--	--	--	--	--	--	--	--	--
Chloride (Cl)	10	10	10	10	10	9.0	--	10	8.9
Fluoride (F)	--	--	--	--	--	--	--	--	--
Bromide (Br)	--	--	--	--	--	--	--	--	--
Iodide (I)	--	--	--	--	--	--	--	--	--
Hardness as $CaCO_3$	--	--	--	--	--	--	--	--	--
Sodium adsorption ratio (SAR)	--	--	--	--	--	--	--	--	--
Specific conductance (micromhos at 25°C)					--	--	--	--	--
pH	--	--	--	--	--	--	--	--	--
Temperature (°C)	--	--	--	--	--	--	--	--	--
Dissolved solids (calc)	--	--	--	--	--	--	--	--	--
Ammonia (NH_4)	--	--	--	--	--	--	--	--	--
Nitrate (NO_3)	3.7	--	--	--	--	4.4	--	--	--
Nitrite (NO_2)	.00	--	--	--	--	.00	--	--	--
Phosphate (PO_4)	.08	--	--	--	--	.09	--	--	--
Detergents (MBAS)	.00	--	--	--	--	.00	--	--	--
Biochemical oxygen demand (BOD)	--	--	--	--	--	--	--	--	--
Coliform (colonies per 100 ml)	64	4	4	60	120	210	60	12	4
Fecal coliform (colonies per 100 ml)	0	0	0	0	0	0	0	0	0
Streptococci (colonies per 100 ml)	0	0	0	0	2	0	0	0	0
Aluminum (Al)	--	--	--	--	--	--	--	--	--
Arsenic (As)	--	--	--	--	--	--	--	--	--
Boron (B)	--	--	--	--	--	--	--	--	--
Copper (Cu)	--	--	--	--	--	--	--	--	--
Iron (Fe)	--	--	--	--	--	--	--	--	--
Lead (Pb)	--	--	--	--	--	--	--	--	--
Lithium (Li)	--	--	--	--	--	--	--	--	--
Manganese (Mn)	--	--	--	--	--	--	--	--	--
Mercury (Hg)	--	--	--	--	--	--	--	--	--
Zinc (Zn)	--	--	--	--	--	--	--	--	--

TABLE 1.--Quality-of-water data from wells and springs in the San Antonio area--Continued

(Results in milligrams per liter except as indicated)

Well number	AY-68-29-104	AY-68-29-104	AY-68-29-104	AY-68-29-104	AY-68-29-104	AY-68-29-104	AY-68-29-104	AY-68-29-104	AY-68-29-104
Date of collection	Mar. 23, 1972	Mar. 23, 1972	Mar. 23, 1972	Mar. 23, 1972	Mar. 23, 1972	Mar. 23, 1972	Mar. 23, 1972	Mar. 23, 1972	Mar. 23, 1972
Depth of well (ft)	602	602	602	602	602	602	602	602	602
Sampled after pumping	210 minutes	270 minutes	300 minutes	330 minutes	360 minutes	40 minutes	90 minutes	120 minutes	150 minutes
Discharge (gpm)	400	400	400	400	400	400	400	400	400
Silica (SiO_2)	--	--	--	--	--	--	--	--	--
Calcium (Ca)	--	--	--	--	--	--	--	--	--
Magnesium (Mg)	--	--	--	--	--	--	--	--	--
Sodium (Na)	--	--	--	--	--	--	--	--	--
Potassium (K)	--	--	--	--	--	--	--	--	--
Bicarbonate (HCO_3)	--	--	--	--	--	--	--	--	--
Carbonate (CO_3)	--	--	--	--	--	--	--	--	--
Sulfate (SO_4)	--	--	--	--	--	--	--	--	--
Chloride (Cl)	8.7	8.7	9.0	8.9	8.7	11	10	11	10
Fluoride (F)	--	--	--	--	--	--	--	--	--
Bromide (Br)	--	--	--	--	--	--	--	--	--
Iodide (I)	--	--	--	--	--	--	--	--	--
Hardness as $CaCO_3$	--	--	--	--	--	--	--	--	--
Sodium adsorption ratio (SAR)	--	--	--	--	--	--	--	--	--
Specific conductance (micromhos at 25°C)	--	--	--	--	--	--	--	--	--
pH	--	--	--	--	--	--	--	--	--
Temperature (°C)	--	--	--	--	--	--	--	--	--
Dissolved solids (calc)	--	--	--	--	--	--	--	--	--
Ammonia (NH_4)	--	.00	--	--	.00	--	--	--	--
Nitrate (NO_3)	--	3.5	--	--	4.0	--	--	--	--
Nitrite (NO_2)	--	.00	--	--	.00	--	--	--	--
Phosphate (PO_4)	--	.09	--	--	.08	--	--	--	--
Detergents (MBAS)	--	.00	--	--	.00	--	--	--	--
Biochemical oxygen demand (BOD)	--	--	--	--	--	--	--	--	--
Coliform (colonies per 100 ml)	8	0	0	60	60	31	9	9	14
Fecal coliform (colonies per 100 ml)	0	0	0	0	0	--	--	--	--
Streptococci (colonies per 100 ml)	0	0	0	0	0	--	--	--	--
Aluminum (Al)	--	--	--	--	--	--	--	--	--
Arsenic (As)	--	--	--	--	--	--	--	--	--
Boron (B)	--	--	--	--	--	--	--	--	--
Copper (Cu)	--	--	--	--	--	--	--	--	--
Iron (Fe)	--	--	--	--	--	--	--	--	--
Lead (Pb)	--	--	--	--	--	--	--	--	--
Lithium (Li)	--	--	--	--	--	--	--	--	--
Manganese (Mn)	--	--	--	--	--	--	--	--	--
Mercury (Hg)	--	--	--	--	--	--	--	--	--
Zinc (Zn)	--	--	--	--	--	--	--	--	--

TABLE 1.--Quality-of-water data from wells and springs in the San Antonio area--Continued

(Results in milligrams per liter except as indicated)

Well number	AY-68-29-104	AY-68-29-104	AY-68-29-104	AY-68-29-104	AY-68-29-104	AY-68-29-104	AY-68-29-104	AY-68-29-104	AY-68-29-104
Date of collection	Mar. 23, 1972	Mar. 23, 1972	Mar. 23, 1972	Mar. 23, 1972	Mar. 30, 1972	Mar. 30, 1972	Mar. 30, 1972	Mar. 30, 1972	Mar. 30, 1972
Depth of well (ft)	602	602	602	602	602	602	602	602	602
Sampled after pumping	180 minutes	210 minutes	240 minutes	270 minutes	300 minutes	330 minutes	360 minutes	390 minutes	420 minutes
Discharge (gpm)	400	400	400	400	400	400	400	400	400
Silica (SiO_2)	--	--	--	--	--	--	--	--	--
Calcium (Ca)	--	--	--	--	--	--	--	--	--
Magnesium (Mg)	--	--	--	--	--	--	--	--	--
Sodium (Na)	--	--	--	--	--	--	--	--	--
Potassium (K)	--	--	--	--	--	--	--	--	--
Bicarbonate (HCO_3)	--	--	--	--	--	--	--	--	--
Carbonate (CO_3)	--	--	--	--	--	--	--	--	--
Sulfate (SO_4)	--	--	--	--	--	--	--	--	--
Chloride (Cl)	10	10	10	10	9.8	10	10	9.8	9.7
Fluoride (F)	--	--	--	--	--	--	--	--	--
Bromide (Br)	--	--	--	--	--	--	--	--	--
Iodide (I)	--	--	--	--	--	--	--	--	--
Hardness as $CaCO_3$	--	--	--	--	--	--	--	--	--
Sodium adsorption ratio (SAR)	--	--	--	--	--	--	--	--	--
Specific conductance (micromhos at 25°C)	--	--	--	--	--	--	--	--	--
pH	--	--	--	--	--	--	--	--	--
Temperature (°C)	--	--	--	--	--	--	--	--	--
Dissolved solids (calc)	--	--	--	--	--	--	--	--	--
Ammonia (NH_4)	--	.00	--	--	--	--	--	--	--
Nitrate (NO_3)	--	3.5	--	--	--	--	--	--	--
Nitrite (NO_2)	--	.00	--	--	--	--	--	--	--
Phosphate (PO_4)	--	.02	--	--	--	--	--	--	--
Detergents (MBAS)	--	.00	--	--	--	--	--	--	--
Biochemical oxygen demand (BOD)	--	--	--	--	--	--	--	--	--
Coliform (colonies per 100 ml)	1	0	2	0	13	12	0	10	11
Fecal coliform (colonies per 100 ml)	--	--	--	--	--	0	--	--	--
Streptococci (colonies per 100 ml)	--	--	--	--	--	0	--	--	--
Aluminum (Al)	--	--	--	--	--	--	--	--	--
Arsenic (As)	--	--	--	--	--	--	--	--	--
Boron (B)	--	--	--	--	--	--	--	--	--
Copper (Cu)	--	--	--	--	--	--	--	--	--
Iron (Fe)	--	--	--	--	--	--	--	--	--
Lead (Pb)	--	--	--	--	--	--	--	--	--
Lithium (Li)	--	--	--	--	--	--	--	--	--
Manganese (Mn)	--	--	--	--	--	--	--	--	--
Mercury (Hg)	--	--	--	--	--	--	--	--	--
Zinc (Zn)	--	--	--	--	--	--	--	--	--

TABLE 1.--Quality-of-water data from wells and springs in the San Antonio area--Continued

(Results in milligrams per liter except as indicated)

Well number	AY-68-29-104	AY-68-29-104	AY-68-29-104	AY-68-29-104	AY-68-29-105	AY-68-29-105	AY-68-29-105	AY-68-29-106	AY-68-29-106
Date of collection	Mar. 30, 1972	Mar. 30, 1972	Mar. 30, 1972	Mar. 30, 1972	Nov. 12, 1969	Apr. 12, 1972	Apr. 12, 1972	Dec. 3, 1969	Aug. 10, 1971
Depth of well (ft)	602	602	602	602	285	285	285	490	490
Sampled after pumping	450 minutes	480 minutes	510 minutes	540 minutes	10 minutes	10 minutes	30 minutes	15 minutes	10 minutes
Discharge (gpm)	400	400	400	400	10	10	10	10	20
Silica (SiO_2)	--	--	--	--	13	--	--	12	--
Calcium (Ca)	--	--	--	--	112	--	--	74	--
Magnesium (Mg)	--	--	--	--	3.4	--	--	20	--
Sodium (Na)	--	--	--	--	5.2	--	--	6.4	--
Potassium (K)	--	--	--	--	.6	--	--	1.0	--
Bicarbonate (HCO_3)	--	--	--	--	352	--	--	308	--
Carbonate (CO_3)	--	--	--	--	0	--	--	0	--
Sulfate (SO_4)	--	--	--	--	.0	--	--	12	--
Chloride (Cl)	9.8	9.4	9.8	9.5	9.2	--	--	11	--
Fluoride (F)	--	--	--	--	.0	--	--	.3	--
Bromide (Br)	--	--	--	--	--	--	--	--	--
Iodide (I)	--	--	--	--	--	--	--	--	--
Hardness as $CaCO_3$	--	--	--	--	290	--	--	270	--
Sodium adsorption ratio (SAR)	--	--	--	--	.1	--	--	.2	--
Specific conductance (micromhos at 25°C)	--	--	--	--	558	554	553	517	--
pH	--	--	--	--	7.5	--	--	7.6	--
Temperature (°C)	--	--	--	--	23.0	23.0	23.0	23.5	--
Dissolved solids (calc)	--	--	--	--	319	--	--	289	--
Ammonia (NH_4)	--	--	--	--	--	--	--	.00	.00
Nitrate (NO_3)	--	--	--	--	2.1	--	--	1.3	1.3
Nitrite (NO_2)	--	--	--	--	--	--	--	.00	.00
Phosphate (PO_4)	--	--	--	--	.01	--	--	.02	.00
Detergents (MBAS)	--	--	--	--	--	--	--	--	.00
Biochemical oxygen demand (BOD)	--	--	--	--	--	--	--	.1	--
Coliform (colonies per 100 ml)	0	5	1	4	50	0	0	0	0
Fecal coliform (colonies per 100 ml)	--	--	--	0	0	0	0	0	0
Streptococci (colonies per 100 ml)	--	--	--	1	0	0	0	0	0
Aluminum (Al)	--	--	--	--	--	--	--	--	--
Arsenic (As)	--	--	--	--	--	--	--	--	--
Boron (B)	--	--	--	--	.03	--	--	--	--
Copper (Cu)	--	--	--	--	.020	--	--	--	--
Iron (Fe)	--	--	--	--	.00	--	--	--	--
Lead (Pb)	--	--	--	--	.010	--	--	--	--
Lithium (Li)	--	--	--	--	.01	--	--	--	--
Manganese (Mn)	--	--	--	--	0	--	--	--	--
Mercury (Hg)	--	--	--	--	--	--	--	--	--
Zinc (Zn)	--	--	--	--	.82	--	--	--	--

TABLE 1.--Quality-of-water data from wells and springs in the San Antonio area--Continued

(Results in milligrams per liter except as indicated)

Well number	AY-68-29-106	AY-68-29-203	AY-68-29-203	AY-68-29-204	AY-68-29-206	AY-68-29-206	AY-68-29-206	AY-68-29-302	AY-68-29-302
Date of collection	Aug. 10, 1971	Aug. 11, 1971	Aug. 11, 1971	Aug. 11, 1971	Apr. 2, 1970	Aug. 3, 1971	Aug. 3, 1971	Dec. 3, 1969	Aug. 3, 1971
Depth of well (ft)	490	239	239	280	390	390	390	385	385
Sampled after pumping	60 minutes	10 minutes	60 minutes	10 minutes	20 minutes	10 minutes	60 minutes	10 minutes	10 minutes
Discharge (gpm)	20	10	10	7	10	10	10	10	10
Silica (SiO_2)	--	--	--	--	10	--	--	12	--
Calcium (Ca)	--	--	--	--	90	--	--	94	--
Magnesium (Mg)	--	--	--	--	16	--	--	10	--
Sodium (Na)	--	--	--	--	4.8	--	--	4.1	--
Potassium (K)	--	--	--	--	1.0	--	--	.7	--
Bicarbonate (HCO_3)	--	--	324	--	332	--	348	320	--
Carbonate (CO_3)	--	--	0	--	0	--	0	0	--
Sulfate (SO_4)	7.6	--	10	9.6	9.6	--	5.6	8.4	--
Chloride (Cl)	12	--	7.8	7.6	7.4	--	9.6	6.8	--
Fluoride (F)	--	--	--	--	.1	--	--	.2	--
Bromide (Br)	--	--	--	--	--	--	--	--	--
Iodide (I)	--	--	--	--	--	--	--	--	--
Hardness as $CaCO_3$	--	--	290	--	290	--	310	280	--
Sodium adsorption ratio (SAR)	--	--	--	--	.1	--	--	.1	--
Specific conductance (micromhos at 25°C)	--	--	528	--	548	--	566	522	--
pH	--	--	7.7	--	7.3	--	7.7	7.8	--
Temperature (°C)	--	--	--	--	22.5	--	--	22.5	--
Dissolved solids (calc)	--	--	--	--	312	--	--	299	--
Ammonia (NH_4)	.00	.00	.00	.00	.00	--	.00	.00	--
Nitrate (NO_3)	1.8	5.8	6.2	7.1	9.7	--	8.4	6.2	--
Nitrite (NO_2)	.00	.00	.00	.00	.00	--	.00	.00	--
Phosphate (PO_4)	.00	.00	.00	.00	.02	--	.00	.02	--
Detergents (MBAS)	.00	.00	.00	.00	--	--	.04	--	--
Biochemical oxygen demand (BOD)	--	--	--	--	.0	--	--	.2	--
Coliform (colonies per 100 ml)	0	69	11	1	7	83	170	0	42
Fecal coliform (colonies per 100 ml)	0	0	0	0	0	2	8	0	0
Streptococci (colonies per 100 ml)	0	0	0	0	0	0	2	0	0
Aluminum (Al)	--	--	--	--	--	--	--	--	--
Arsenic (As)	.00	--	.00	--	--	--	.00	--	--
Boron (B)	--	--	--	--	--	--	--	--	--
Copper (Cu)	.002	--	.010	--	--	--	.002	--	--
Iron (Fe)	--	--	--	--	.02	--	--	--	--
Lead (Pb)	.000	--	.000	--	--	--	.000	--	--
Lithium (Li)	--	--	--	--	--	--	--	--	--
Manganese (Mn)	--	--	--	--	--	--	--	--	--
Mercury (Hg)	<.0005	--	.0009	--	--	--	<.0005	--	--
Zinc (Zn)	.16	--	.07	--	--	--	.20	--	--

TABLE 1.--Quality-of-water data from wells and springs in the San Antonio area--Continued

(Results in milligrams per liter except as indicated)

Well number	AY-68-29-302	AY-68-29-403	AY-68-29-403	AY-68-29-403	AY-68-29-403	AY-68-29-403	AY-68-29-403	AY-68-29-403	AY-68-29-403
Date of collection	Aug. 3, 1971	Sept. 15, 1969	Apr. 2, 1970	Feb. 3, 1971	Apr. 7, 1971	Apr. 7, 1971	Oct. 14, 1971	Apr. 13, 1972	Apr. 13, 1972
Depth of well (ft)	385	340	340	340	340	340	340	340	340
Sampled after pumping	60 minutes	10 minutes	10 minutes	10 minutes	10 minutes	60 minutes	30 minutes	10 minutes	60 minutes
Discharge (gpm)	10	10	10	10	10	10	10	10	10
Silica (SiO_2)	--	--	--	--	--	--	--	--	--
Calcium (Ca)	--	--	--	--	--	--	--	--	110
Magnesium (Mg)	--	--	--	9.5	--	--	--	--	8.8
Sodium (Na)	--	--	--	--	--	--	--	--	--
Potassium (K)	--	--	--	--	--	--	--	--	--
Bicarbonate (HCO_3)	320	--	--	--	--	--	--	--	364
Carbonate (CO_3)	0	--	--	--	--	--	--	--	0
Sulfate (SO_4)	8.4	--	--	9.6	--	--	--	--	9.6
Chloride (Cl)	8.2	--	--	8.2	--	--	--	--	8.2
Fluoride (F)	--	--	--	--	--	--	--	--	--
Bromide (Br)	--	--	--	--	--	--	--	--	--
Iodide (I)	--	--	--	--	--	--	--	--	--
Hardness as $CaCO_3$	290	--	--	--	--	--	--	--	310
Sodium adsorption ratio (SAR)	--	--	--	--	--	--	--	--	--
Specific conductance (micromhos at 25°C)	526	--	582	--	--	--	554	597	592
pH	7.6	--	--	--	--	--	--	--	7.3
Temperature (°C)	--	--	22.5	22.0	22.0	22.0	22.0	23.0	23.0
Dissolved solids (calc)	--	--	--	--	--	--	--	--	--
Ammonia (NH_4)	.00	--	.00	.00	--	--	--	--	.17
Nitrate (NO_3)	5.8	--	3.0	3.1	--	--	--	--	3.0
Nitrite (NO_2)	.00	--	.00	.00	--	--	--	--	.00
Phosphate (PO_4)	.00	--	.02	.00	--	--	--	--	.02
Detergents (MBAS)	.00	--	--	.00	--	--	--	--	.00
Biochemical oxygen demand (BOD)	--	--	.0	.2	--	--	--	--	--
Coliform (colonies per 100 ml)	33	67	740	120	18	170	--	32	44
Fecal coliform (colonies per 100 ml)	0	0	0	0	0	0	--	0	0
Streptococci (colonies per 100 ml)	1	1	0	0	0	0	--	0	59
Aluminum (Al)	--	--	--	--	--	--	--	--	--
Arsenic (As)	.00	--	--	.00	--	--	--	--	--
Boron (B)	--	--	--	--	--	--	--	--	--
Copper (Cu)	.002	--	--	.002	--	--	--	--	--
Iron (Fe)	--	--	--	--	--	--	--	--	--
Lead (Pb)	.000	--	--	.000	--	--	--	--	--
Lithium (Li)	--	--	--	--	--	--	--	--	--
Manganese (Mn)	--	--	--	--	--	--	--	--	--
Mercury (Hg)	<.0005	--	--	<.0005	--	--	.010	--	--
Zinc (Zn)	.19	--	--	.42	--	--	--	--	--

TABLE 1.--Quality-of-water data from wells and springs in the San Antonio area--Continued

(Results in milligrams per liter except as indicated)

Well number	AY-68-29-409	AY-68-29-409	AY-68-29-410	AY-68-29-410	AY-68-29-502	AY-68-29-502	AY-68-29-503	AY-68-29-503	AY-68-29-503
Date of collection	Aug. 12, 1971	Aug. 12, 1971	Feb. 3, 1971	Aug. 8, 1971	Apr. 2, 1970	Apr. 7, 1971	Sept. 15, 1969	Apr. 2, 1970	May 28, 1970
Depth of well (ft)	460	460	318	318	264	264	349	349	349
Sampled after pumping	30 minutes	60 minutes	10 minutes	Many hours	7 minutes	35 minutes	10 minutes	10 minutes	10 minutes
Discharge (gpm)	6	6	620	620	10	10	10	10	10
Silica (SiO_2)	--	--	--	--	--	--	--	--	--
Calcium (Ca)	--	--	--	--	--	--	--	--	--
Magnesium (Mg)	--	--	16	--	--	--	--	--	--
Sodium (Na)	--	--	--	--	--	--	--	--	--
Potassium (K)	--	--	--	--	--	--	--	--	--
Bicarbonate (HCO_3)	--	--	--	330	--	--	--	--	--
Carbonate (CO_3)	--	--	--	0	--	--	--	--	--
Sulfate (SO_4)	--	6.8	6.2	6.8	--	--	--	--	--
Chloride (Cl)	--	8.0	10	10	--	--	--	--	--
Fluoride (F)	--	--	--	--	--	--	--	--	--
Bromide (Br)	--	--	--	--	--	--	--	--	--
Iodide (I)	--	--	--	--	--	--	--	--	--
Hardness as $CaCO_3$	--	--	--	290	--	--	--	--	--
Sodium adsorption ratio (SAR)	--	--	--	--	--	--	--	--	--
Specific conductance (micromhos at 25°C)	--	--	--	537	571	--	--	534	--
pH	--	--	--	7.7	--	--	--	--	--
Temperature (°C)	--	--	21.5	23.0	22.0	22.0	--	22.0	--
Dissolved solids (calc)	--	--	--	--	--	--	--	--	--
Ammonia (NH_4)	--	.00	.00	.00	.00	--	--	.00	--
Nitrate (NO_3)	--	3.1	4.0	4.0	3.8	--	--	3.9	--
Nitrite (NO_2)	--	.00	.00	.00	.00	--	--	.00	--
Phosphate (PO_4)	--	.00	.00	.00	.04	--	--	.03	--
Detergents (MBAS)	--	.00	.00	.00	--	--	--	--	--
Biochemical oxygen demand (BOD)	--	--	.8	--	.0	--	--	.0	--
Coliform (colonies per 100 ml)	35	26	0	0	0	0	1500	410	1800
Fecal coliform (colonies per 100 ml)	1	0	0	0	0	0	0	0	0
Streptococci (colonies per 100 ml)	0	0	0	0	0	0	3	4	0
Aluminum (Al)	--	--	--	--	--	--	--	--	--
Arsenic (As)	--	.00	.00	--	--	--	--	--	--
Boron (B)	--	--	--	--	--	--	--	--	--
Copper (Cu)	--	.005	.005	--	--	--	--	--	--
Iron (Fe)	--	--	--	--	--	--	--	--	--
Lead (Pb)	--	.000	.000	--	--	--	--	--	--
Lithium (Li)	--	--	--	--	--	--	--	--	--
Manganese (Mn)	--	--	--	--	--	--	--	--	--
Mercury (Hg)	--	<.0005	<.0005	--	--	--	--	--	--
Zinc (Zn)	--	.23	.01	--	--	--	--	--	--

TABLE 1.--Quality-of-water data from wells and springs in the San Antonio area--Continued

(Results in milligrams per liter except as indicated)

Well number	AY-68-29-503	AY-68-29-503	AY-68-29-503	AY-68-29-503	AY-68-29-503	AY-68-29-503	AY-68-29-503	AY-68-29-503	AY-68-29-503
Date of collection	May 28, 1970	May 28, 1970	May 28, 1970	May 28, 1970	May 28, 1970	Feb. 3, 1971	Mar. 4, 1971	Mar. 7, 1971	June 17, 1971
Depth of well (ft)	349	349	349	349	349	349	349	349	349
Sampled after pumping	40 minutes	70 minutes	120 minutes	180 minutes	210 minutes	10 minutes	15 minutes	15 minutes	10 minutes
Discharge (gpm)	10	10	10	10	10	10	10	10	10
Silica (SiO_2)	--	--	--	--	--	--	--	--	--
Calcium (Ca)	--	--	--	--	95	98	--	--	--
Magnesium (Mg)	--	--	--	--	11	12	--	--	--
Sodium (Na)	--	--	--	--	--	--	--	--	--
Potassium (K)	--	--	--	--	--	--	--	--	--
Bicarbonate (HCO_3)	--	--	--	--	336	340	--	--	--
Carbonate (CO_3)	--	--	--	--	0	0	--	--	--
Sulfate (SO_4)	--	--	--	--	4.4	4.8	--	--	--
Chloride (Cl)	--	--	--	--	6.8	7.4	--	--	--
Fluoride (F)	--	--	--	--	--	--	--	--	--
Bromide (Br)	--	--	--	--	--	--	--	--	--
Iodide (I)	--	--	--	--	--	--	--	--	--
Hardness as $CaCO_3$	--	--	--	--	282	290	--	--	--
Sodium adsorption ratio (SAR)	--	--	--	--	--	--	--	--	--
Specific conductance (micromhos at 25°C)	--	--	--	--	533	537	--	--	--
pH	--	--	--	--	7.0	7.4	--	--	--
Temperature (°C)	--	--	--	--	--	21.5	--	--	23.0
Dissolved solids (calc)	--	--	--	--	--	--	--	--	--
Ammonia (NH_4)	--	.00	--	--	.00	.00	--	--	.00
Nitrate (NO_3)	--	3.8	--	--	3.8	4.4	--	--	4.2
Nitrite (NO_2)	--	.00	--	--	.00	.00	--	--	.00
Phosphate (PO_4)	--	.00	--	--	.00	.00	--	--	.00
Detergents (MBAS)	--	--	--	--	--	--	--	--	.00
Biochemical oxygen demand (BOD)	--	--	--	--	--	.3	--	--	--
Coliform (colonies per 100 ml)	410	--	250	100	--	57	14000	89	29
Fecal coliform (colonies per 100 ml)	--	--	0	0	--	0	0	0	0
Streptococci (colonies per 100 ml)	--	--	0	0	--	0	0	0	0
Aluminum (Al)	--	--	--	--	--	--	--	--	--
Arsenic (As)	--	--	--	--	--	.00	--	--	--
Boron (B)	--	--	--	--	--	--	--	--	--
Copper (Cu)	--	--	--	--	--	.040	--	--	--
Iron (Fe)	--	--	--	--	--	--	--	--	--
Lead (Pb)	--	--	--	--	--	.000	--	--	--
Lithium (Li)	--	--	--	--	--	--	--	--	--
Manganese (Mn)	--	--	--	--	--	--	--	--	--
Mercury (Hg)	--	--	--	--	--	<.0005	--	--	--
Zinc (Zn)	--	--	--	--	--	.10	--	--	--

TABLE 1.--Quality-of-water data from wells and springs in the San Antonio area--Continued

(Results in milligrams per liter except as indicated)

Well number	AY-68-29-503	AY-68-29-503	AY-68-29-503	AY-68-29-503	AY-68-29-503	AY-68-29-503	AY-68-29-503	AY-68-29-503	AY-68-29-503
Date of collection	June 17, 1971	June 17, 1971	June 17, 1971	June 17, 1971	June 17, 1971	June 17, 1971	June 18, 1971	June 18, 1971	June 18, 1971
Depth of well (ft)	349	349	349	349	349	349	349	349	349
Sampled after pumping	40 minutes	70 minutes	120 minutes	240 minutes	480 minutes	720 minutes	960 minutes	1200 minutes	1440 minutes
Discharge (gpm)	10	10	10	10	10	10	10	10	10
Silica (SiO_2)	13	--	--	--	13	--	12	--	--
Calcium (Ca)	--	--	--	--	--	--	--	--	--
Magnesium (Mg)	11	--	--	--	--	--	--	--	--
Sodium (Na)	--	--	--	--	--	--	--	--	--
Potassium (K)	--	--	--	--	--	--	--	--	--
Bicarbonate (HCO_3)	--	--	--	--	--	--	--	--	--
Carbonate (CO_3)	--	--	--	--	--	--	--	--	--
Sulfate (SO_4)	4.4	--	4.4	--	5.0	--	4.8	--	4.0
Chloride (Cl)	8.0	--	7.8	--	7.6	--	7.0	--	7.2
Fluoride (F)	.1	--	--	--	.1	--	.1	--	--
Bromide (Br)	--	--	--	--	--	--	--	--	--
Iodide (I)	--	--	--	--	--	--	--	--	--
Hardness as $CaCO_3$	--	--	--	--	--	--	--	--	--
Sodium adsorption ratio (SAR)	--	--	--	--	--	--	--	--	--
Specific conductance (micromhos at 25°C)	--	--	--	--	--	--	--	--	--
pH	7.7	--	7.6	--	7.7	--	7.7	--	7.7
Temperature (°C)	23.0	23.0	--	--	--	--	--	--	--
Dissolved solids (calc)	--	--	--	--	--	--	--	--	--
Ammonia (NH_4)	.00	.00	.00	.00	.00	.00	.00	.00	.00
Nitrate (NO_3)	4.2	4.4	4.1	4.1	4.5	3.9	4.0	1.9	4.0
Nitrite (NO_2)	.00	.00	.00	.00	.00	.00	.00	.00	.00
Phosphate (PO_4)	.00	.00	.00	.00	.00	.00	.00	.00	.00
Detergents (MBAS)	.00	.00	.00	.00	.00	.00	.00	.00	.00
Biochemical oxygen demand (BOD)	--	--	--	--	--	--	--	--	--
Coliform (colonies per 100 ml)	18	24	24	13	22	6	7	2	20
Fecal coliform (colonies per 100 ml)	0	0	0	0	0	0	0	0	0
Streptococci (colonies per 100 ml)	0	0	0	--	0	0	0	0	0
Aluminum (Al)	--	--	--	--	--	--	--	--	--
Arsenic (As)	.00	--	.00	--	.00	--	--	--	.00
Boron (B)	--	--	--	--	--	--	--	--	--
Copper (Cu)	.005	--	.004	--	.003	--	--	--	.002
Iron (Fe)	--	--	--	--	--	--	--	--	--
Lead (Pb)	.000	--	.000	--	.000	--	--	--	.000
Lithium (Li)	--	--	--	--	--	--	--	--	--
Manganese (Mn)	--	--	--	--	--	--	--	--	--
Mercury (Hg)	.0007	--	.0007	--	.0005	--	--	--	.0008
Zinc (Zn)	.03	--	.03	--	.04	--	--	--	.05

TABLE 1.--Quality-of-water data from wells and springs in the San Antonio area--Continued

(Results in milligrams per liter except as indicated)

Well number	AY-68-29-503	AY-68-29-503	AY-68-29-503	AY-68-29-503	AY-68-29-503	AY-68-29-503	AY-68-29-503	AY-68-29-503	AY-68-29-503
Date of collection	June 18, 1971	June 18, 1971	June 18, 1971	June 19, 1971	June 19, 1971	June 19, 1971	June 20, 1971	June 20, 1971	June 20, 1971
Depth of well (ft)	349	349	349	349	349	349	349	349	349
Sampled after pumping	1680 minutes	1920 minutes	2160 minutes	2400 minutes	2640 minutes	2880 minutes	10 minutes	40 minutes	70 minutes
Discharge (gpm)	10	10	10	10	10	10	10	10	10
Silica (SiO_2)	--	--	--	--	--	13	--	--	--
Calcium (Ca)	--	--	--	--	--	--	--	--	--
Magnesium (Mg)	--	--	--	--	--	11	--	--	--
Sodium (Na)	--	--	--	--	--	--	--	--	--
Potassium (K)	--	--	--	--	--	--	--	--	--
Bicarbonate (HCO_3)	--	--	--	--	--	--	--	--	--
Carbonate (CO_3)	--	--	--	--	--	--	--	--	--
Sulfate (SO_4)	--	4.4	--	4.4	--	4.8	--	--	--
Chloride (Cl)	--	7.2	--	7.0	--	7.6	--	--	--
Fluoride (F)	--	--	--	--	--	.1	--	--	--
Bromide (Br)	--	--	--	--	--	--	--	--	--
Iodide (I)	--	--	--	--	--	--	--	--	--
Hardness as $CaCO_3$	--	--	--	--	--	--	--	--	--
Sodium adsorption ratio (SAR)	--	--	--	--	--	--	--	--	--
Specific conductance (micromhos at 25°C)	--	--	--	--	--	--	--	--	--
pH	--	7.7	--	7.6	--	7.6	--	--	--
Temperature (°C)	--	--	--	--	--	--	--	--	--
Dissolved solids (calc)	--	--	--	--	--	--	--	--	--
Ammonia (NH_4)	.00	.00	.00	.00	.00	.00	.00	.00	.00
Nitrate (NO_3)	3.2	4.1	4.0	4.0	4.0	4.0	4.1	4.1	4.1
Nitrite (NO_2)	.00	.00	.00	.00	.00	.00	.00	.00	.00
Phosphate (PO_4)	.00	.00	.00	.00	.00	.00	.00	.00	.00
Detergents (MBAS)	.00	.00	.00	.00	.00	.00	.00	.00	.00
Biochemical oxygen demand (BOD)	--	--	--	--	--	--	--	--	--
Coliform (colonies per 100 ml)	4	3	9	7	4	3	720	47	68
Fecal coliform (colonies per 100 ml)	0	0	0	0	0	0	0	0	0
Streptococci (colonies per 100 ml)	0	3	2	0	0	0	0	1	1
Aluminum (Al)	--	--	--	--	--	--	--	--	--
Arsenic (As)	--	--	--	--	--	.00	--	--	--
Boron (B)	--	--	--	--	--	--	--	--	--
Copper (Cu)	--	--	--	--	--	.003	--	--	--
Iron (Fe)	--	--	--	--	--	--	--	--	--
Lead (Pb)	--	--	--	--	--	.000	--	--	--
Lithium (Li)	--	--	--	--	--	--	--	--	--
Manganese (Mn)	--	--	--	--	--	--	--	--	--
Mercury (Hg)	--	--	--	--	--	.0006	--	--	--
Zinc (Zn)	--	--	--	--	--	.00	--	--	--

TABLE 1.--Quality-of-water data from wells and springs in the San Antonio area--Continued

(Results in milligrams per liter except as indicated)

Well number	AY-68-29-503	AY-68-29-503	AY-68-29-503	AY-68-29-503	AY-68-29-702	AY-68-29-702	AY-68-29-702	AY-68-29-805	AY-68-30-102
Date of collection	June 20, 1971	Oct. 14, 1971	Apr. 13, 1972	Apr. 13, 1972	Nov. 3, 1969	Feb. 18, 1971	Jan. 26, 1972	Apr. 29, 1971	Apr. 29, 1971
Depth of well (ft)	349	349	349	349	872	872	872	800	418
Sampled after pumping	120 minutes	30 minutes	10 minutes	60 minutes	Many hours	Many hours	Many hours	Several days	Many hours
Discharge (gpm)	10	10	10	10	1500	1500	1500	2700	1000
Silica (SiO_2)	--	--	--	--	12	12	--	--	--
Calcium (Ca)	--	--	--	97	87	90	--	80	92
Magnesium (Mg)	--	--	--	11	14	14	--	17	8.0
Sodium (Na)	--	--	--	--	7.1	1/ 9.2	--	--	--
Potassium (K)	--	--	--	--	1.1	--	--	--	--
Bicarbonate (HCO_3)	--	--	--	338	300	308	--	274	272
Carbonate (CO_3)	--	--	--	0	0	0	--	0	0
Sulfate (SO_4)	4.6	--	--	4.4	22	24	--	30	32
Chloride (Cl)	7.6	--	--	7.4	12	13	--	12	10
Fluoride (F)	--	--	--	--	.2	.2	--	--	--
Bromide (Br)	--	--	--	--	--	--	--	--	--
Iodide (I)	--	--	--	--	--	--	--	--	--
Hardness as $CaCO_3$	--	--	--	290	270	280	--	270	260
Sodium adsorption ratio (SAR)	--	--	--	--	.2	.2	--	--	--
Specific conductance (micromhos at 25°C)	--	--	545	543	530	546	538	519	506
pH	7.5	--	--	7.3	7.9	7.4	--	7.5	7.4
Temperature (°C)	--	22.0	23.0	23.0	21.0	--	--	--	22.0
Dissolved solids (calc)	--	--	--	--	310	320	--	--	--
Ammonia (NH_4)	.00	--	--	.00	--	.00	--	.00	.00
Nitrate (NO_3)	4.2	--	--	4.1	6.2	7.1	--	7.1	5.3
Nitrite (NO_2)	.00	--	--	.00	--	.00	--	.00	.00
Phosphate (PO_4)	.00	--	--	.01	--	.03	--	.02	.06
Detergents (MBAS)	.00	--	--	.00	--	.00	--	.02	.01
Biochemical oxygen demand (BOD)	--	--	--	--	--	.6	--	--	--
Coliform (colonies per 100 ml)	32	--	180	70	--	0	0	0	0
Fecal coliform (colonies per 100 ml)	0	--	0	0	--	0	0	0	0
Streptococci (colonies per 100 ml)	0	--	0	0	--	0	0	0	0
Aluminum (Al)	--	--	--	--	--	--	--	--	--
Arsenic (As)	.00	--	--	--	--	.00	--	--	--
Boron (B)	--	--	--	--	--	--	--	--	--
Copper (Cu)	.003	--	--	--	--	.001	--	.004	.002
Iron (Fe)	--	--	--	--	--	--	--	--	--
Lead (Pb)	.000	--	--	--	--	.000	--	.000	.000
Lithium (Li)	--	--	--	--	--	--	--	--	--
Manganese (Mn)	--	--	--	--	-	--	--	--	--
Mercury (Hg)	.0009	.014	--	--	--	<.0005	--	--	--
Zinc (Zn)	.01	--	--	--	--	.01	--	.00	.03

1/ Sodium and Potassium calculated as sodium (Na).

TABLE 1.--Quality-of-water data from wells and springs in the San Antonio area--Continued

(Results in milligrams per liter except as indicated)

Well number	AY-68-30-102	AY-68-30-103	AY-68-35-306	AY-68-36-102	AY-68-36-104	AY-68-36-106	AY-68-36-502	AY-68-37-101	AY-68-37-101
Date of collection	Apr. 6, 1972	Apr. 29, 1971	Apr. 7, 1971	Feb. 18, 1971	Jan. 26, 1972	Nov. 12, 1969	Feb. 18, 1971	June 3, 1971	Jan. 26, 1972
Depth of well (ft)	418	841	335	786	808	400	1224	1005	1005
Sampled after pumping	Many hours	30 minutes	Many hours	Many hours	Many hours	10	Many hours	Many hours	Many hours
Discharge (gpm)	1000	500	2000	1000	1500	10	2000	5000	3000
Silica (SiO_2)	--	12	12	12	--	28	13	--	--
Calcium (Ca)	--	92	75	85	--	122	67	--	--
Magnesium (Mg)	--	14	17	16	--	6.7	15	--	--
Sodium (Na)	--	--	--	1/ 8.3	--	41	1/ 7.2	7.2	--
Potassium (K)	--	--	--	--	--	1.8	--	1.4	--
Bicarbonate (HCO_3)	--	316	254	288	--	398	250	258	--
Carbonate (CO_3)	--	0	0	0	--	0	0	0	--
Sulfate (SO_4)	--	16	37	31	--	21	17	33	--
Chloride (Cl)	11	10	11	14	--	53	12	14	--
Fluoride (F)	--	.2	.2	.2	--	.4	--	--	--
Bromide (Br)	--	--	--	--	--	--	--	--	--
Iodide (I)	--	--	--	--	--	--	--	--	--
Hardness as $CaCO_3$	--	290	260	280	--	330	230	250	--
Sodium adsorption ratio (SAR)	--	.1	.2	.2	--	1.0	.2	--	--
Specific conductance (micromhos at 25°C)	516	543	495	542	541	779	453	501	515
pH	--	7.5	7.7	7.4	--	7.2	7.5	7.7	--
Temperature (°C)	--	--	23.0	--	--	--	--	--	--
Dissolved solids (calc)	--	307	293	318	--	470	260	--	--
Ammonia (NH_4)	--	.00	.00	.00	--	--	.00	.00	--
Nitrate (NO_3)	--	4.9	10	9.3	--	.1	5.8	7.1	--
Nitrite (NO_2)	--	.00	.00	.00	--	--	.00	.00	--
Phosphate (PO_4)	--	.00	.02	.03	--	.04	.00	.03	--
Detergents (MBAS)	--	.00	.01	.00	--	--	.00	.00	--
Biochemical oxygen demand (BOD)	--	--	.6	.6	--	.2	.6	--	--
Coliform (colonies per 100 ml)	2	0	27	0	1	10	0	0	0
Fecal coliform (colonies per 100 ml)	0	0	0	0	0	0	0	0	0
Streptococci (colonies per 100 ml)	0	0	0	0	0	0	0	0	0
Aluminum (Al)	--	--	--	--	--	--	--	.01	--
Arsenic (As)	--	--	.00	.00	--	--	.00	.00	--
Boron (B)	--	--	--	--	--	--	--	.08	--
Copper (Cu)	--	.005	.000	.005	--	--	.000	.002	--
Iron (Fe)	--	--	--	--	--	--	--	.01	--
Lead (Pb)	--	.000	.000	.006	--	--	.000	.000	--
Lithium (Li)	--	--	--	--	--	--	--	--	--
Manganese (Mn)	--	--	--	--	--	--	--	--	--
Mercury (Hg)	--	--	<.0005	<.0005	--	--	<.0005	<.0005	--
Zinc (Zn)	--	.07	.02	.02	--	--	.00	.00	--

1/ Sodium and potassium calculated as sodium (Na).

TABLE 1.--Quality-of-water data from wells and springs in the San Antonio area--Continued

(Results in milligrams per liter except as indicated)

Well number	AY-68-37-104	AY-68-37-404	DX-68-16-502	DX-68-22-301	DX-68-22-801	DX-68-23-301	DX-68-23-301	JJ-55-63-701	JJ-55-63-702
Date of collection	Nov. 3, 1969	Feb. 18, 1971	Nov. 21, 1968	May 19, 1970	May 19, 1970	Feb. 17, 1971	Aug. 12, 1971	Feb. 3, 1970	Feb. 3, 1970
Depth of well (ft)	995	1326	230	375	400	Spring	Spring	563	620
Sampled after pumping	Many hours	Many hours	10	10	15 minutes	Continuous flow	Continuous flow	20 minutes	60 minutes
Discharge (gpm)	3000	5000	300	15	10	2/ 2000	3/ 200	200	200
Silica (SiO_2)	12	12	12	12	12	13	--	--	--
Calcium (Ca)	73	67	88	101	93	79	--	--	--
Magnesium (Mg)	17	15	16	7.6	8.8	16	--	--	--
Sodium (Na)	6.9	1/ 7.6	7.6	.9	4.8	1/ 8.7	--	--	--
Potassium (K)	1.3	--	.9	1.1	1.0	--	--	--	--
Bicarbonate (HCO_3)	260	250	310	332	308	284	--	--	--
Carbonate (CO_3)	0	0	0	0	0	0	--	--	--
Sulfate (SO_4)	32	16	19	1.2	6.0	24	--	--	--
Chloride (Cl)	12	13	13	7.2	9.4	13	--	--	--
Fluoride (F)	.2	.1	.1	.0	.0	.2	--	--	--
Bromide (Br)	--	--	--	--	--	--	--	--	--
Iodide (I)	--	--	--	--	--	--	--	--	--
Hardness as $CaCO_3$	252	230	290	280	270	260	--	--	--
Sodium adsorption ratio (SAR)	.2	.2	.2	.0	.1	.2	--	--	--
Specific conductance (micromhos at 25°C)	497	455	554	540	529	519	516	385	400
pH	7.7	7.5	7.4	6.9	6.9	7.2	--	--	--
Temperature (°C)	23.0	--	--	22.0	22.0	--	24.0	22.5	22.0
Dissolved solids (calc)	288	260	316	297	296	301	--	--	--
Ammonia (NH_4)	--	.00	--	.00	.00	.00	--	.00	.00
Nitrate (NO_3)	5.3	6.6	6.9	3.4	10	7.1	--	3.6	7.2
Nitrite (NO_2)	--	.00	--	.00	.00	.00	--	.00	.00
Phosphate (PO_4)	--	.00	--	.02	.01	.03	--	.04	.01
Detergents (MBAS)	--	.00	--	--	--	.00	--	--	--
Biochemical oxygen demand (BOD)	--	.6	--	.1	.2	.7	--	.3	.0
Coliform (colonies per 100 ml)	--	0	--	220	5	14	29	0	0
Fecal coliform (colonies per 100 ml)	--	0	--	1	0	0	0	0	0
Streptococci (colonies per 100 ml)	--	0	--	0	0	0	0	0	0
Aluminum (Al)	--	--	--	--	--	--	--	--	--
Arsenic (As)	--	.00	--	--	--	.00	--	--	--
Boron (B)	--	--	--	--	--	--	--	--	--
Copper (Cu)	--	.000	--	--	--	.001	--	--	--
Iron (Fe)	--	--	.00	--	--	--	--	--	--
Lead (Pb)	--	.000	--	--	--	.000	--	--	--
Lithium (Li)	--	--	--	--	--	--	--	--	--
Manganese (Mn)	--	--	--	--	--	--	--	--	--
Mercury (Hg)	--	<.0005	--	--	--	<.0005	--	--	--
Zinc (Zn)	--	.01	--	--	--	.01	--	--	--

1/ Sodium and potassium calculated as sodium (Na).

2/ Sample collected at one of many spring discharge points. Total flow for Comal Springs was 246 cfs (cubic feet per second).

3/ Sample collected at one of many spring discharge points. Total flow for Comal Springs was 187 cfs (cubic feet per second).

TABLE 1.--Quality-of-water data from wells and springs in the San Antonio area--Continued

(Results in milligrams per liter except as indicated)

Well number	JJ-55-63-703	JJ-55-63-802	JJ-70-06-302	JJ-70-06-502	LR-68-16-603	LR-68-16-603	TD-68-33-301	TD-68-33-301	TD-68-34-401
Date of collection	Feb. 3, 1970	Feb. 3, 1970	Feb. 3, 1970	Feb. 3, 1970	Aug. 29, 1969	May 19, 1970	May 13, 1970	Apr. 11, 1972	Apr. 11, 1972
Depth of well (ft)	146	270	400	326	230	230	805	805	705
Sampled after pumping	60 minutes	20 minutes	40 minutes	30 minutes	10 minutes	10 minutes	Many hours	Many hours	3.5 hours
Discharge (gpm)	3	5	10	2	20	20	750	1100	1700
Silica (SiO_2)	--	28	--	--	11	--	12	--	16
Calcium (Ca)	68	100	74	60	88	--	68	68	66
Magnesium (Mg)	4.4	11	18	7.6	16	--	18	18	18
Sodium (Na)	9.4	19	5.1	2.6	1/ 9.9	--	6.0	--	1/ 7.4
Potassium (K)	.8	3.4	3.6	1.8	--	--	1.4	--	--
Bicarbonate (HCO_3)	212	228	204	192	312	--	230	230	224
Carbonate (CO_3)	0	0	0	0	0	--	0	0	0
Sulfate (SO_4)	7.6	20	13	9.2	21	--	50	49	50
Chloride (Cl)	18	46	62	14	16	--	11	12	12
Fluoride (F)	--	.0	--	--	.3	--	.2	--	.2
Bromide (Br)	--	--	--	--	--	--	--	--	--
Iodide (I)	--	--	--	--	--	--	--	--	--
Hardness as $CaCO_3$	190	290	260	180	290	--	240	240	240
Sodium adsorption ratio (SAR)	--	--	--	--	.3	--	.2	--	.2
Specific conductance (micromhos at 25°C)	401	671	681	385	567	599	484	486	483
pH	7.4	7.5	7.9	7.7	7.2	7.3	7.1	7.4	7.4
Temperature (°C)	17.0	23.0	--	14.0	23.0	--	21.5	22.0	22.0
Dissolved solids (calc)	--	347	--	--	322	--	282	--	282
Ammonia (NH_4)	.00	.00	.00	.00	--	.00	.00	.00	.00
Nitrate (NO_3)	2.8	7.3	7.6	2.8	7.3	8.3	2.3	2.4	2.0
Nitrite (NO_2)	.00	.00	.05	.00	--	.00	.00	.00	.00
Phosphate (PO_4)	.02	.00	.00	.01	--	.01	.00	.00	.00
Detergents (MBAS)	--	--	--	--	--	--	--	.00	.00
Biochemical oxygen demand (BOD)	.1	.1	.1	.0	--	.1	.2	--	--
Coliform (colonies per 100 ml)	88	180	32	96	--	60	0	0	1
Fecal coliform (colonies per 100 ml)	0	1	1	0	--	8	--	0	0
Streptococci (colonies per 100 ml)	12	10	11	52	--	31	0	0	0
Aluminum (Al)	--	--	--	--	--	--	--	--	--
Arsenic (As)	--	--	--	--	--	--	--	--	--
Boron (B)	--	--	--	--	--	--	--	--	--
Copper (Cu)	--	--	--	--	--	--	--	--	--
Iron (Fe)	--	--	--	--	.00	--	--	--	--
Lead (Pb)	--	--	--	--	--	--	--	--	--
Lithium (Li)	--	--	--	--	--	--	--	--	--
Manganese (Mn)	--	--	--	--	--	--	--	--	--
Mercury (Hg)	--	--	--	--	--	--	--	--	--
Zinc (Zn)	--	--	--	--	--	--	--	--	--

1/ Sodium and potassium calculated as sodium (Na).

TABLE 1.--Quality-of-water data from wells and springs in the San Antonio area--Continued

(Results in milligrams per liter except as indicated)

Well number	TD-68-41-303	TD-69-39-502	YP-69-36-701	YP-69-41-505	YP-69-43-102	YP-69-43-102	YP-69-50-203
Date of collection	Apr. 11, 1972	May 13, 1970	May 13, 1970	May 13, 1970	July 23, 1968	May 13, 1970	Mar. 23, 1970
Depth of well (ft)	717	530	500	260	685	685	525
Sampled after pumping	--	60 minutes	120 minutes	Many hours	10 minutes	Many hours	Several hours
Discharge (gpm)	350	800	500	1500	1600	1600	1400
Silica (SiO_2)	17	11	12	11	10	12	13
Calcium (Ca)	69	80	60	62	68	69	86
Magnesium (Mg)	14	10	15	11	14	13	9.7
Sodium (Na)	1/ 8.7	11	8.3	8.5	5.7	5.2	10
Potassium (K)	--	1.1	1.0	1.1	.9	1.0	1.1
Bicarbonate (HCO_3)	252	252	232	214	243	244	264
Carbonate (CO_3)	0	0	0	0	0	0	0
Sulfate (SO_4)	15	20	14	15	12	12	13
Chloride (Cl)	14	20	13	15	13	12	29
Fluoride (F)	.2	.1	.1	.1	.1	.0	.1
Bromide (Br)	--	--	--	--	--	--	--
Iodide (I)	--	--	--	--	--	--	--
Hardness as $CaCO_3$	230	240	210	200	230	230	250
Sodium adsorption ratio (SAR)	.2	.3	.2	.3	.2	.2	.3
Specific conductance (micromhos at 25°C)	472	503	439	421	440	451	538
pH	7.4	7.1	7.2	7.1	7.4	6.9	7.1
Temperature (°C)	24.0	21.5	--	21.0	23.0	22.0	23.0
Dissolved solids (calc)	270	288	247	238	250	255	300
Ammonia (NH_4)	.10	.00	.00	.00	--	.00	.00
Nitrate (NO_3)	8.1	11	9.4	9.2	7.7	11	8.0
Nitrite (NO_2)	.00	.00	.00	.00	--	.00	.00
Phosphate (PO_4)	.01	.00	.00	.00	--	.01	.02
Detergents (MBAS)	.00	--	--	--	--	--	--
Biochemical oxygen demand (BOD)	--	.2	.1	.1	--	.0	.0
Coliform (colonies per 100 ml)	0	34	8	11	--	48	0
Fecal coliform (colonies per 100 ml)	0	--	--	--	--	--	0
Streptococci (colonies per 100 ml)	0	0	0	0		0	0
Aluminum (Al)	--	--	--	--	--	--	.00
Arsenic (As)	--	--	--	--	--	--	.00
Boron (B)	--	--	--	--	--	--	--
Copper (Cu)	--	--	--	--	--	--	.010
Iron (Fe)	--	--	--	--	--	--	.00
Lead (Pb)	--	--	--	--	--	--	.000
Lithium (Li)	--	--	--	--	--	--	.00
Manganese (Mn)	--	--	--	--	--	--	.00
Mercury (Hg)	--	--	--	--	--	--	--
Zinc (Zn)	--	--	--	--	--	--	.01

1/ Sodium and potassium calculated as sodium (Na).

TABLE 2.--Quality-of-water data from sites other than wells and springs in the San Antonio area

(Results in milligrams per liter except as indicated)

	Site 3	Site 3	Site 4	Site 4	Site 5	Site 5	Site 6	Site 6	Site 7
	Frio R. at Hwy. 1120, 1 mile below Leaky.	Frio R. at Hwy. 1120, 1 mile below Leaky.	Frio R. at Hwy. 1050, above Garner Park.	Frio R. at Hwy. 1050, above Garner Park.	Frio R. at Mager's crossing, below Garner Park.	Frio R. at Mager's crossing, below Garner Park.	08195000 Frio R. at Concan	08195000 Frio R. at Concan	Nueces R. at county road crossing, 5.0 miles north of Vance.
Date of collection	Feb. 4, 1970	June 2, 1971	Feb. 4, 1970	June 2, 1971	Feb. 4, 1970	June 2, 1971	Feb. 4, 1970	June 2, 1971	Feb. 2, 1970
Discharge (cfs)	1/ 60	29	1/ 60	34	1/ 70	32	101	35	1/ 15
Silica (SiO_2)	--	--	--	--	--	--	--	--	--
Calcium (Ca)	--	--	--	--	--	--	--	--	--
Magnesium (Mg)	--	--	--	--	--	--	--	--	--
Sodium (Na)	--	--	--	--	--	--	--	--	--
Potassium (K)	--	--	--	--	--	--	--	--	--
Bicarbonate (HCO_3)	--	--	--	--	--	--	--	--	--
Carbonate (CO_3)	--	--	--	--	--	--	--	--	--
Sulfate (SO_4)	--	--	--	--	--	--	--	--	--
Chloride (Cl)	--	--	--	--	--	--	--	--	--
Fluoride (F)	--	--	--	--	--	--	--	--	--
Bromide (Br)	--	--	--	--	--	--	--	--	--
Iodide (I)	--	--	--	--	--	--	--	--	--
Hardness as $CaCO_3$	--	--	--	--	--	--	--	--	--
Sodium adsorption ratio (SAR)	--	--	--	--	--	--	--	--	--
Specific conductance (micromhos at 25°C)	446	435	445	437	457	405	439	388	406
pH	--	7.7	--	7.7	--	7.7	--	7.7	--
Temperature (°C)	13.0	25.5	13.0	27.0	11.0	26.0	11.0	28.0	14.5
Dissolved solids (calc)	--	--	--	--	--	--	--	--	--
Ammonia (NH_4)	.00	.00	.05	.00	.14	.00	.00	.00	.00
Nitrate (NO_3)	8.9	3.1	9.3	3.5	9.3	3.1	11	2.2	8.4
Nitrite (NO_2)	.00	.00	.00	.00	.00	.00	.00	.00	.00
Phosphate (PO_4)	.00	.00	.00	.00	.00	.09	.00	.00	.00
Detergents (MBAS)	--	.07	--	.00	--	.00	--	.00	--
Biochemical oxygen demand (BOD)	.1	.4	.1	1.2	.2	1.1	.2	.4	.0
Dissolved oxygen (DO)	--	9.4	9.2	9.2	--	8.4	--	9.0	--
Coliform (colonies per 100 ml)	32	5200	24	470	48	20000	44	1400	120
Fecal coliform (colonies per 100 ml)	8	4	0	8	10	42	2	4	1
Streptococci (colonies per 100 ml)	48	160	42	44	48	100	34	50	88
Aluminum (Al)	--	--	--	--	--	--	--	--	--
Arsenic (As)	--	--	--	--	--	--	--	--	--
Boron (B)	--	--	--	--	--	--	--	--	--
Copper (Cu)	--	--	--	--	--	--	--	--	--
Iron (Fe)	--	--	--	--	--	--	--	--	--
Lead (Pb)	--	--	--	--	--	--	--	--	--
Lithium (Li)	--	--	--	--	--	--	--	--	--
Manganese (Mn)	--	--	--	--	--	--	--	--	--
Mercury (Hg)	--	--	--	--	--	--	--	--	--
Zinc (Zn)	--	--	--	--	--	--	--	--	--

1/ Estimated.

TABLE 2.--Quality-of-water data from sites other than wells and springs in the San Antonio area--Continued

(Results in milligrams per liter except as indicated)

	Site 8	Site 9	Site 10	Site 10	Site 11	Site 12	Site 12	Site 13	Site 14
	Pulliam Creek at county road crossing, 4.0 miles northwest of Barksdale.	Nueces R. at Hwy. 55, 3.5 miles south of Camp Wood.	08190000 Nueces R. at Laguna.	08190000 Nueces R. at Laguna.	08196000 Dry Frio R. near Reagan Wells.	08198000 Sabinal R. near Sabinal.	08198000 Sabinal R. near Sabinal.	08201500 Seco Creek at Miller Ranch, near Utopia.	08200000 Hondo Creek near Tarpley.
Date of collection	Feb. 2, 1970	Feb. 2, 1970	Feb. 2, 1970	Aug. 26, 1971	Feb. 4, 1970	Feb. 4, 1970	Aug. 27, 1971	Mar. 23, 1970	Feb. 5, 1970
Discharge (cfs)	1/ 10	1/ 30	143	599	22	47	200	18	17
Silica (SiO_2)	--	--	--	--	--	--	--	--	--
Calcium (Ca)	--	--	58	--	65	65	--	64	72
Magnesium (Mg)	--	--	14	--	13	14	--	12	11
Sodium (Na)	--	--	9.1	--	8.9	7.4	--	6.9	8.8
Potassium (K)	--	--	.9	--	.6	1.0	--	1.0	.8
Bicarbonate (HCO_3)	--	--	216	246	224	216	254	198	218
Carbonate (CO_3)	--	--	0	0	0	0	0	0	0
Sulfate (SO_4)	--	--	15	15	20	32	24	39	40
Chloride (Cl)	--	--	16	17	15	14	16	13	13
Fluoride (F)	--	--	--	--	--	--	--	.2	--
Bromide (Br)	--	--	--	--	--	--	--	--	--
Iodide (I)	--	--	--	--	--	--	--	--	--
Hardness as $CaCO_3$	--	--	200	240	220	220	250	210	220
Sodium adsorption ratio (SAR)	--	--	--	--	--	--	--	.2	--
Specific conductance (micromhos at 25°C)	416	399	415	468	438	468	497	429	467
pH	--	--	7.5	8.0	8.0	7.7	7.7	7.5	7.7
Temperature (°C)	14.5	13.0	14.0	20.5	13.0	11.5	--	20.5	10.0
Dissolved solids (calc)	--	--	--	--	--	--	--	250	--
Ammonia (NH_4)	.00	.19	.00	--	.00	.00	--	--	.03
Nitrate (NO_3)	14	11	10	--	13	8.9	--	6.6	8.0
Nitrite (NO_2)	.00	.03	.00	--	.00	.00	--	.00	.00
Phosphate (PO_4)	.03	.06	.00	--	.00	.03	--	.06	.00
Detergents (MBAS)	--	--	--	--	--	--	--	--	--
Biochemical oxygen demand (BOD)	.1	.1	.1	--	.1	.2	--	.2	.1
Dissolved oxygen (DO)	--	--	--	--	--	--	--	--	--
Coliform (colonies per 100 ml)	92	1500	28	--	32	40	--	440	110
Fecal coliform (colonies per 100 ml)	32	20	0	--	0	0	--	6	12
Streptococci (colonies per 100 ml)	33	160	0	--	14	26	--	10	130
Aluminum (Al)	--	--	--	--	--	--	--	--	--
Arsenic (As)	--	--	--	--	--	--	--	--	--
Boron (B)	--	--	--	--	--	--	--	--	--
Copper (Cu)	--	--	--	--	--	--	--	--	--
Iron (Fe)	--	--	--	--	--	--	--	--	--
Lead (Pb)	--	--	--	--	--	--	--	--	--
Lithium (Li)	--	--	--	--	--	--	--	--	--
Manganese (Mn)	--	--	--	--	--	--	--	--	--
Mercury (Hg)	--	--	--	--	--	--	--	--	--
Zinc (Zn)	--	--	--	--	--	--	--	--	--

1/ Estimated.

TABLE 2.--Quality-of-water data from sites other than wells and springs in the San Antonio area--Continued

(Results in milligrams per liter except as indicated)

	Site 14	Site 15	Site 16	Site 17	Site 17	Site 18	Site 19	Site 20	Site 21
	08200000 Hondo Creek near Tarpley.	Middle Verde Creek at Hwy. 689, 16.6 miles north of Hondo.	Verde Creek at Hwy. 689, 4.6 miles north of Hondo.	08179000 Medina R. near Pipe Creek.	08179000 Medina R. near Pipe Creek.	Medina Lake at mouth of Plum Creek, and Hamilton Cove.	Medina Lake at Plum Creek Cove.	Medina Lake at Hamilton Cove.	Medina Lake at Angel Cove.
Date of collection	Aug. 27, 1971	Mar. 23, 1970	Aug. 27, 1971	Apr. 28, 1971	Aug. 30, 1971	Apr. 28, 1971	Apr. 28, 1971	Apr. 28, 1971	Apr. 28, 1971
Discharge (cfs)	36	1/ 20	1/ 50	20	446	--	--	--	--
Silica (SiO_2)	--	8.6	--	10	--	--	--	--	--
Calcium (Ca)	--	68	--	85	--	56	--	--	--
Magnesium (Mg)	--	14	--	23	--	19	--	--	--
Sodium (Na)	--	8.0	--	11	--	--	--	--	--
Potassium (K)	--	.8	--	--	--	--	--	--	--
Bicarbonate (HCO_3)	84	228	172	228	238	176	--	--	--
Carbonate (CO_3)	0	0	0	0	0	0	--	--	--
Sulfate (SO_4)	27	34	25	120	62	67	--	--	--
Chloride (Cl)	18	15	20	15	17	15	--	--	--
Fluoride (F)	--	.2	--	.3	--	--	--	--	--
Bromide (Br)	--	--	--	--	--	--	--	--	--
Iodide (I)	--	--	--	--	--	--	--	--	--
Hardness as $CaCO_3$	210	230	190	310	280	220	--	--	--
Sodium adsorption ratio (SAR)	--	.2	--	.3	--	--	--	--	--
Specific conductance (micromhos at 25°C)	419	469	389	596	543	447	446	445	445
pH	7.7	7.6	7.6	7.7	7.6	7.7	--	--	--
Temperature (°C)	22.0	16.0	22.0	21.0	--	--	--	--	23.0
Dissolved solids (calc)	--	265	--	373	--	--	--	--	--
Ammonia (NH_4)	--	.00	--	.00	--	.00	.00	.00	.00
Nitrate (NO_3)	--	4.4	--	1.3	--	.0	.4	.4	.4
Nitrite (NO_2)	--	.00	--	.00	--	.00	.00	.00	.00
Phosphate (PO_4)	--	.00	--	.06	--	.00	.00	.00	.00
Detergents (MBAS)	--	--	--	.07	--	.01	.00	.02	.10
Biochemical oxygen demand (BOD)	--	.2	--	1.6	--	--	--	--	--
Dissolved oxygen (DO)	--	--	--	--	--	--	--	--	--
Coliform (colonies per 100 ml)	--	900	--	31000	--	65	660	270	420
Fecal coliform (colonies per 100 ml)	--	13	--	130	--	0	1	1	0
Streptococci (colonies per 100 ml)	--	39	--	310	--	0	3	1	0
Aluminum (Al)	--	--	--	--	--	--	--	--	--
Arsenic (As)	--	--	--	.00	--	--	--	--	--
Boron (B)	--	--	--	--	--	--	--	--	--
Copper (Cu)	--	--	--	.002	--	--	--	--	--
Iron (Fe)	--	--	--	--	--	--	--	--	--
Lead (Pb)	--	--	--	.000	--	--	--	--	--
Lithium (Li)	--	--	--	--	--	--	--	--	--
Manganese (Mn)	--	--	--	--	--	--	--	--	--
Mercury (Hg)	--	--	--	<.0005	--	--	--	--	--
Zinc (Zn)	--	--	--	.02	--	--	--	--	--

1/ Estimated.

TABLE 2.--Quality-of-water data from sites other than wells and springs in the San Antonio area--Continued

(Results in milligrams per liter except as indicated)

	Site 22	Site 23	Site 24	Site 25	Site 26	Site 27	Site 27	Site 28	Site 29
	Medina Lake at north side of Red Cove.	Medina Lake at south side of Red Cove.	Medina Lake at Dam.	Medina R. at county road crossing, 0.8 miles south of Medina Dam.	08180500 Medina R. near Riomedina.	San Geronimo Creek 5.6 miles south southwest of San Geronimo.	San Geronimo Creek 5.6 miles south southwest of San Geronimo.	Helotes Creek at county road crossing, 3.4 miles upstream from Hwy. 16.	Lee Creek 0.2 mile upstream from mouth.
Date of collection	Apr. 28, 1971	Apr. 28, 1971	Apr. 28, 1971	Feb. 2, 1970	Mar. 23, 1970	Mar. 24, 1970	Aug. 30, 1971	Jan. 29, 1970	Jan. 29, 1970
Discharge (cfs)	--	--	--	--	46	1/ 4	6.2	1/ 0.2	1/ 0.8
Silica (SiO_2)	--	--	--	--	7.4	6.5	--	--	--
Calcium (Ca)	--	--	--	60	64	62	--	--	--
Magnesium (Mg)	--	--	--	16	15	16	--	--	--
Sodium (Na)	--	--	--	10	7.3	7.8	--	--	--
Potassium (K)	--	--	--	1.9	1.9	1.1	--	--	--
Bicarbonate (HCO_3)	--	--	--	192	205	220	184	--	--
Carbonate (CO_3)	--	--	--	0	0	0	0	--	--
Sulfate (SO_4)	--	--	--	58	51	34	33	--	--
Chloride (Cl)	--	--	--	14	14	14	15	--	--
Fluoride (F)	--	--	--	--	.2	.1	--	--	--
Bromide (Br)	--	--	--	--	--	--	--	--	--
Iodide (I)	--	--	--	--	--	--	--	--	--
Hardness as $CaCO_3$	--	--	--	220	220	220	200	--	--
Sodium adsorption ratio (SAR)	--	--	--	--	.2	.2	--	--	--
Specific conductance (micromhos at 25°C)	443	445	444	449	450	443	396	529	444
pH	--	--	--	7.8	7.7	7.6	7.7	7.6	7.7
Temperature (°C)	25.0	--	--	14.0	16.0	16.5	--	16.0	14.0
Dissolved solids (calc)	--	--	--	--	264	253	--	--	--
Ammonia (NH_4)	.00	.00	.00	.00	.00	.00	--	.03	.04
Nitrate (NO_3)	.0	.0	.4	3.1	1.8	3.1	--	.4	.0
Nitrite (NO_2)	.00	.00	.00	.00	.00	.00	--	.00	.00
Phosphate (PO_4)	.00	.00	.00	.00	.09	.09	--	.61	.15
Detergents (MBAS)	.01	.06	.05	--	--	--	--	--	--
Biochemical oxygen demand (BOD)	--	--	--	.0	.4	.5	--	.3	.1
Dissolved oxygen (DO)	--	--	--	--	--	--	--	8.9	7.7
Coliform (colonies per 100 ml)	240	200	55	2100	7100	760	--	1600	1200
Fecal coliform (colonies per 100 ml)	17	4	1	4	21	25	--	11	13
Streptococci (colonies per 100 ml)	28	4	0	150	59	57	--	51	48
Aluminum (Al)	--	--	--	--	--	.00	--	--	--
Arsenic (As)	--	--	--	--	--	.00	--	--	--
Boron (B)	--	--	--	--	--	--	--	--	--
Copper (Cu)	--	--	--	--	--	.000	--	--	--
Iron (Fe)	--	--	--	--	--	.00	--	--	--
Lead (Pb)	--	--	--	--	--	.000	--	--	--
Lithium (Li)	--	--	--	--	--	.00	--	--	--
Manganese (Mn)	--	--	--	--	--	.00	--	--	--
Mercury (Hg)	--	--	--	--	--	--	--	--	--
Zinc (Zn)	--	--	--	--	--	.01	--	--	--

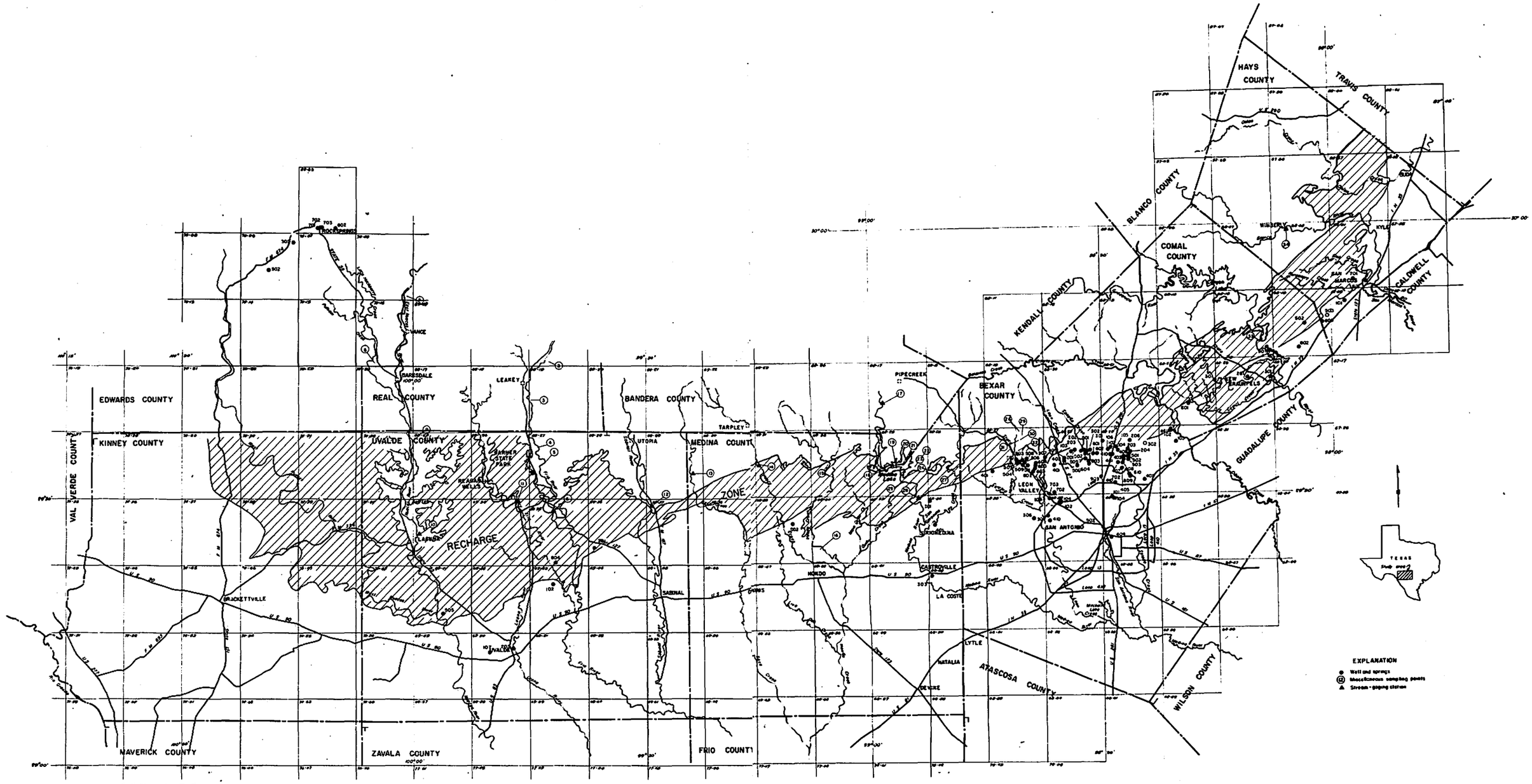
1/ Estimated.

TABLE 2.--Quality-of-water data from sites other than wells and springs in the San Antonio area--Continued

(Results in milligrams per liter except as indicated)

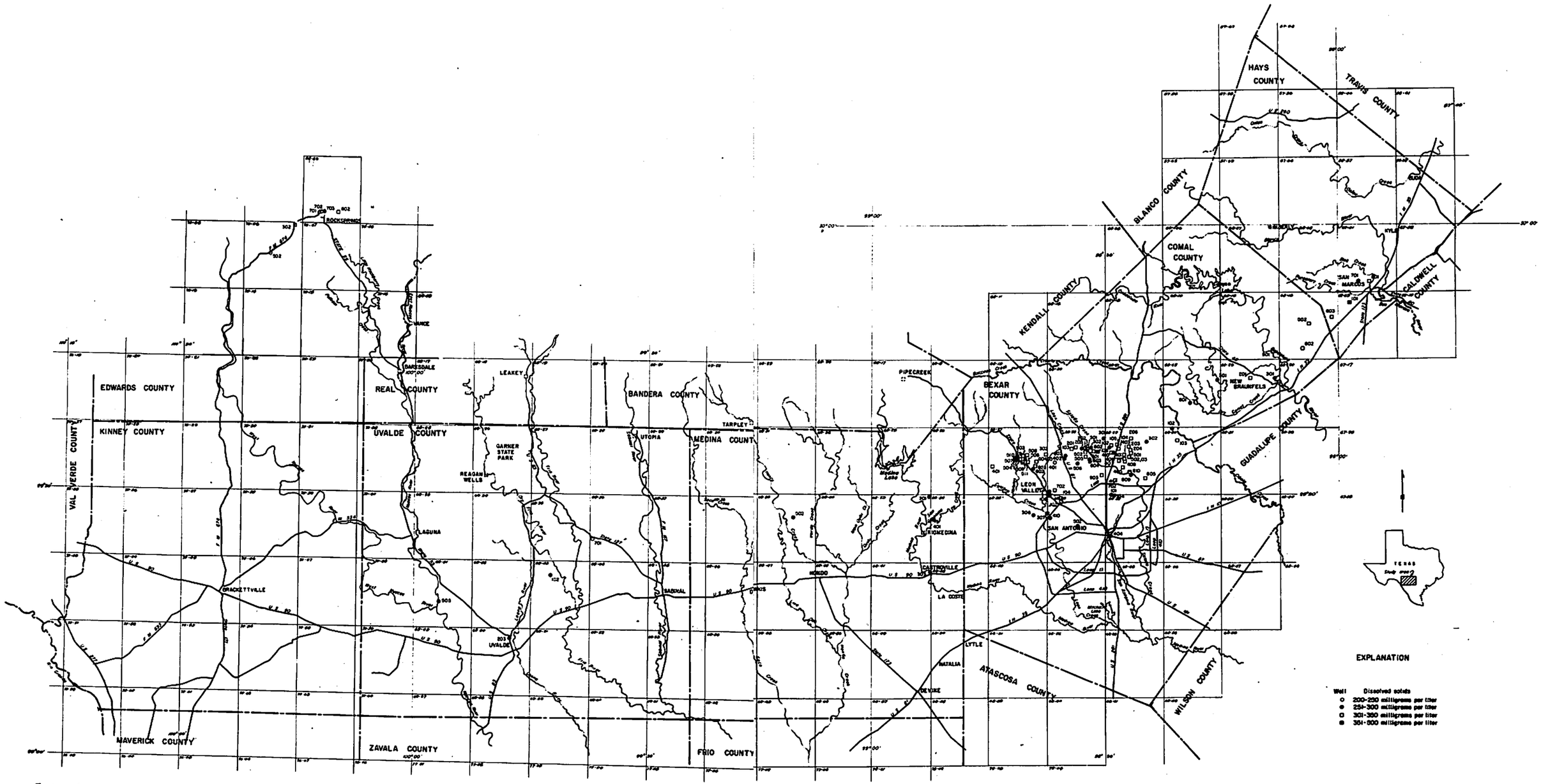
	Site 30	Site 31	Site 32	Site 32	Site 33	Site 34	Site	Site	Site
	Helotes Creek at county road crossing, 2.2 miles upstream from Hwy. 16.	Chimenea Creek 100 feet upstream from mouth.	Helotes Creek at county road crossing, 0.5 miles upstream from Hwy. 16.	Helotes Creek at county road crossing, 0.5 miles upstream from Hwy. 16.	Guadalupe R. at second crossing, 2.0 miles downstream from Deep Creek.	08171000 Blanco R. at Wimberley.			
Date of collection	Jan. 29, 1970	Jan. 29, 1970	Sept. 15, 1969	Jan. 29, 1970	Mar. 24, 1970	Mar. 24, 1970			
Discharge (cfs)	1/ 1.7	1/ 0.4	1/ 0.3	1/ 0.4	--	322			
Silica (SiO_2)	--	--	13	3.4	8.3	6.8			
Calcium (Ca)	--	--	63	68	52	71			
Magnesium (Mg)	--	--	16	16	16	14			
Sodium (Na)	--	--	8.4	13	8.6	7.2			
Potassium (K)	--	--	--	1.1	2.2	1.0			
Bicarbonate (HCO_3)	--	--	236	260	216	264			
Carbonate (CO_3)	--	--	0	0	0	0			
Sulfate (SO_4)	--	--	24	21	17	16			
Chloride (Cl)	--	--	16	21	16	12			
Fluoride (F)	--	--	.1	.1	.2	.2			
Bromide (Br)	--	--	--	--	--	--			
Iodide (I)	--	--	--	--	--	--			
Hardness as $CaCO_3$	--	--	220	240	200	230			
Sodium adsorption ratio (SAR)	--	--	.2	.4	.3	.2			
Specific conductance (micromhos at 25°C)	521	489	441	481	401	468			
pH	7.5	7.4	7.8	7.9	7.9	7.4			
Temperature (°C)	13.5	12.0	27.0	13.0	15.0	19.0			
Dissolved solids (calc)	--	--	257	272	228	262			
Ammonia (NH_4)	.13	.22	.00	.09	.00	.00			
Nitrate (NO_3)	.4	.4	.4	.0	1.8	3.5			
Nitrite (NO_2)	.00	.00	.00	.00	.00	.00			
Phosphate (PO_4)	.31	.30	.09	.15	.12	.09			
Detergents (MBAS)	--	--	--	--	--	--			
Biochemical oxygen demand (BOD)	.1	.1	1.0	.2	.2	.2			
Dissolved oxygen (DO)	8.4	8.6	--	8.1	--	--			
Coliform (colonies per 100 ml)	2800	310	13000	4200	1700	3100			
Fecal coliform (colonies per 100 ml)	84	9	210	40	5	15			
Streptococci (colonies per 100 ml)	170	37	4700	170	24	40			
Aluminum (Al)	--	--	--	--	--	.10			
Arsenic (As)	--	--	--	--	--	.00			
Boron (B)	--	--	--	--	--	--			
Copper (Cu)	--	--	--	--	--	.000			
Iron (Fe)	--	--	--	--	--	.00			
Lead (Pb)	--	--	--	--	--	.000			
Lithium (Li)	-	--	--	--	--	.00			
Manganese (Mn)	--	--	--	--	--	.00			
Mercury (Hg)	--	--	--	--	--	--			
Zinc (Zn)	--	--	--	--	--	.02			

1/ Estimated.



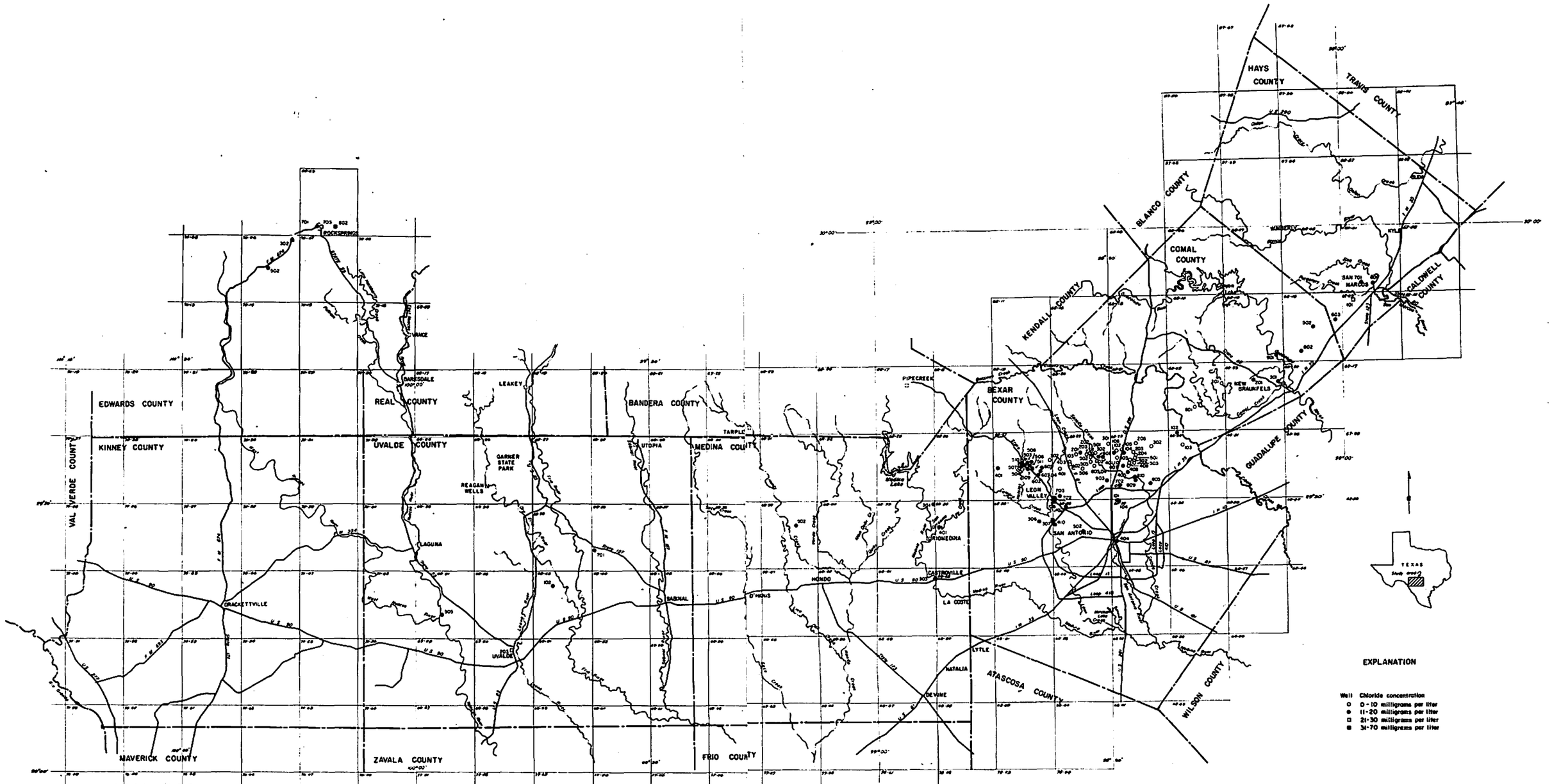
Base by USGS, 1:250,000

FIGURE 1.- Locations of water-quality data-collection sites



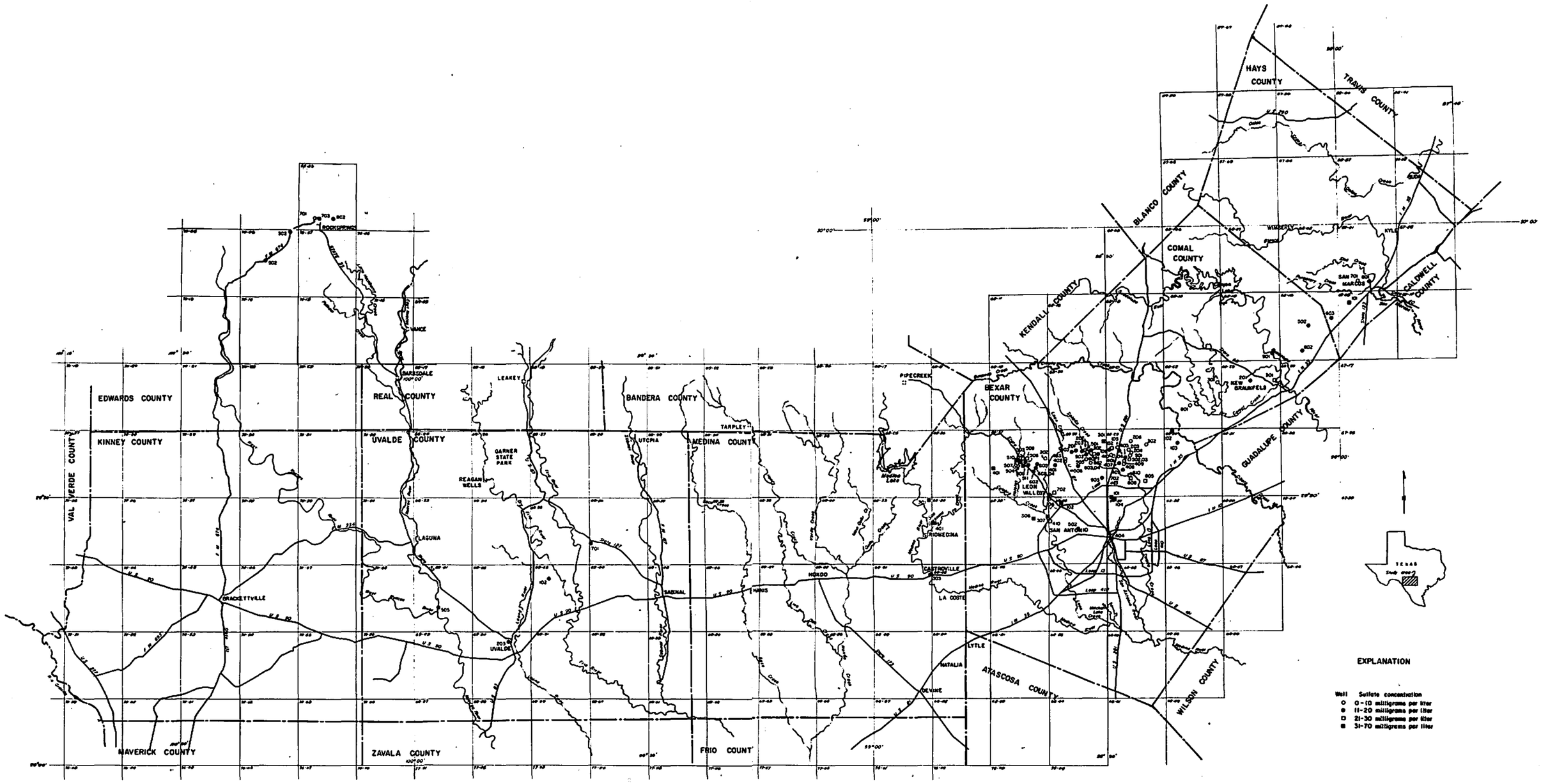
Base by USGS, 1:250,000

FIGURE 2- Concentrations of dissolved solids in water from wells and springs



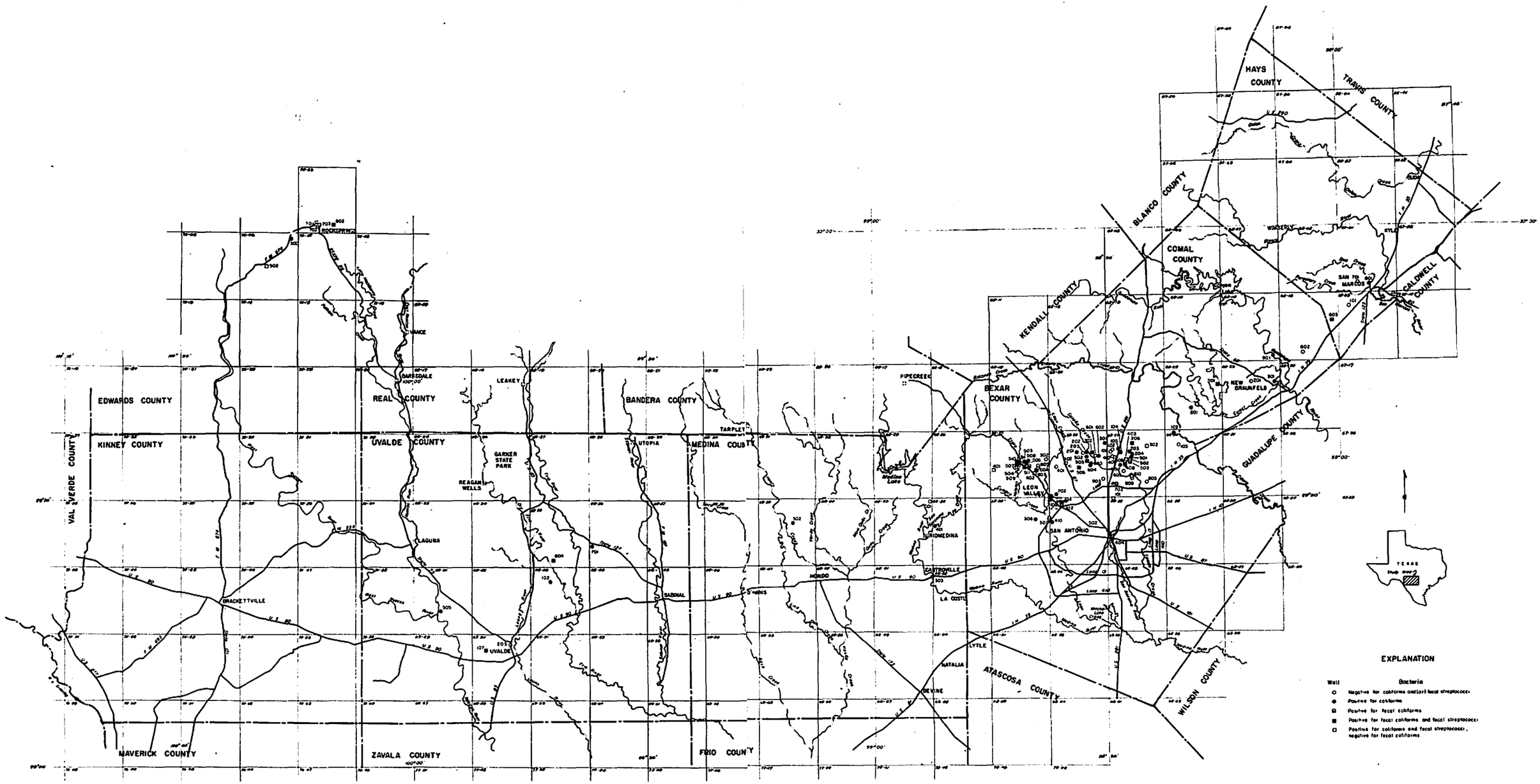
Base by USGS, 1:250,000

FIGURE 3.- Concentrations of chloride in water from wells and springs



Drawn by U.S.G.S., 1970, [illegible]

FIGURE 4.- Concentrations of sulfate in water wells and springs



Base by U.S. Geological Survey, 1:250,000

FIGURE 5—Locations of wells and springs that were coliform, fecal coliforms, and fecal streptococci

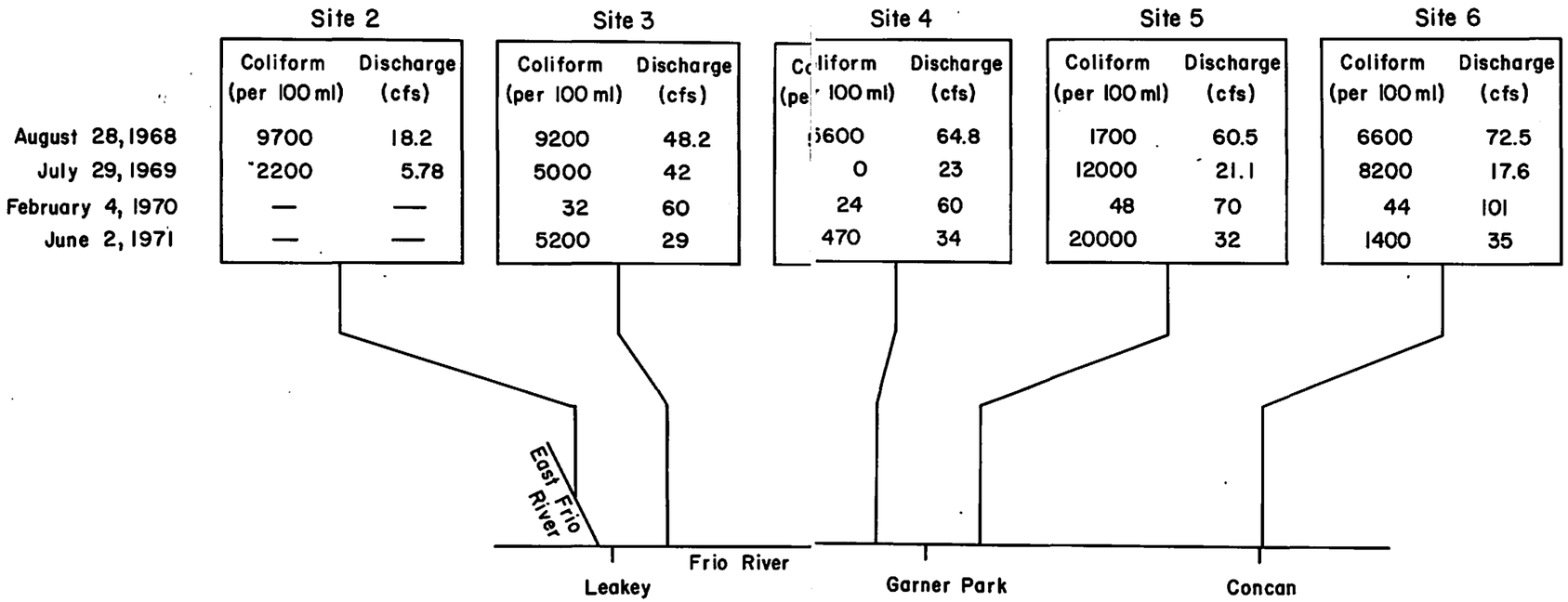


FIGURE 6.- Coliform density and streamflow of the Frio River from Leakey to Concan