

# Public Water Supplies in Southern Texas

By W. L. BROADHURST, R. W. SUNDSTROM, and J. H. ROWLEY

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**UNITED STATES DEPARTMENT OF THE INTERIOR**

**Oscar L. Chapman, *Secretary***

**GEOLOGICAL SURVEY**

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# CONTENTS

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	Page
Abstract.....	1
Introduction.....	2
Extent of region and scope of report.....	2
Acknowledgments.....	3
Ground water.....	4
Area A.....	5
Area B.....	6
Area C.....	7
Area D.....	7
Surface water.....	8
Chemical character of water.....	9
Analyses of water.....	9
Mineral constituents in solution.....	9
Standards of water quality.....	12
Chemical character of ground-water supplies.....	13
Chemical character of surface-water supplies.....	13
Bibliography.....	15
Public water supplies.....	16
Aransas County.....	16
Rockport.....	16
Atascosa County.....	17
Campbellton.....	17
Christine.....	17
Coughran.....	18
Jourdanton.....	18
North Pleasanton.....	19
Pleasanton.....	20
Poteet.....	20
Bandera County.....	21
Bandera.....	21
Bee County.....	21
Beeville.....	21
Pettus.....	23
Bexar County.....	24
Alamo Heights.....	24
San Antonio.....	25
Brooks County.....	28
Falfurrias.....	28
Caldwell County.....	30
Dale.....	30
Fentress.....	31
Lockhart.....	31
Luling.....	32

Public water supplies—Continued	Page
Caldwell County—Continued	
Lytton Springs.....	33
Martindale.....	34
Maxwell.....	34
McMahan.....	35
Uhland.....	35
Calhoun County.....	36
Port Lavaca.....	36
Seadrift.....	37
Cameron County.....	37
Brownsville.....	37
Combes.....	38
Harlingen.....	38
La Feria.....	39
Los Fresnos.....	40
Port Isabel.....	40
Rio Hondo.....	40
San Benito.....	41
Comal County.....	41
New Braunfels.....	41
De Witt County.....	42
Cuero.....	42
Nordheim.....	45
Yorktown.....	46
Dimmit County.....	46
Asherton.....	46
Big Wells.....	47
Brundage.....	48
Carrizo Springs.....	48
Catarina.....	49
Duval County.....	50
Benavides.....	50
Freer.....	51
San Diego.....	52
Frio County.....	53
Dilley.....	53
Pearsall.....	54
Goliad County.....	56
Goliad.....	56
Gonzales County.....	57
Gonzales.....	57
Nixon.....	57
Waelder.....	58
Guadalupe County.....	58
Marion.....	58
Seguin.....	59
Hays County.....	59
Buda.....	59
Kyle.....	60
San Marcos.....	61

## Public water supplies—Continued

	Page
Hidalgo County.....	62
Alamo.....	62
Donna.....	62
Ed Couch.....	63
Edinburg.....	63
Elsa.....	64
McAllen.....	65
Mercedes.....	66
Mission.....	67
Pharr.....	67
San Juan.....	68
Weslaco.....	69
Jim Hogg County.....	70
Hebbronville.....	70
Jim Wells County.....	72
Alice.....	72
Orange Grove.....	74
Premont.....	75
Karnes County.....	75
Falls City.....	75
Gillett.....	76
Karnes City.....	76
Kenedy.....	77
Runge.....	78
Kendall County.....	79
Boerne.....	79
Kinney County.....	80
Brackettville.....	80
Kleberg County.....	80
Kingsville.....	80
La Salle County.....	82
Cotulla.....	82
Fowlerton.....	84
Live Oak County.....	84
George West.....	84
Three Rivers.....	85
Maverick County.....	85
Eagle Pass.....	85
Medina County.....	86
Devine.....	86
Hondo.....	86
Nueces County.....	87
Agua Dulce.....	87
Bishop.....	88
Corpus Christi.....	88
Port Aransas.....	90
Robstown.....	90
Refugio County.....	91
Austwell.....	91
Refugio.....	92
Woodsboro.....	93

Public water supplies—Continued	Page
San Patricio County.....	93
Aransas Pass.....	93
Mathis.....	95
Odem.....	95
Sinton.....	96
Taft.....	97
Starr County.....	98
Rio Grande City.....	98
Roma.....	99
Uvalde County.....	100
Sabinal.....	100
Uvalde.....	101
Victoria County.....	102
Victoria.....	102
Webb County.....	104
Laredo.....	104
Willacy County.....	107
Lyford.....	107
Raymondville.....	107
Wilson County.....	108
Floresville.....	108
Poth.....	108
Saspamco.....	109
Stockdale.....	110
Zapata County.....	110
Zapata.....	110
Zavala County.....	111
Crystal City.....	111
La Pryor.....	112
Index.....	113

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## ILLUSTRATION

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PLATE 1. Map showing public water supplies in southern Texas and areal subdivisions.....	2
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# PUBLIC WATER SUPPLIES IN SOUTHERN TEXAS

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By W. L. BROADHURST, R. W. SUNDSTROM, and J. H. ROWLEY

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## ABSTRACT

This report gives a summarized description of the public water supplies in 42 counties of southern Texas, extending from the Rio Grande northward to the northern boundaries of Kinney, Uvalde, Bandera, Kendall, and Hays Counties and eastward to the eastern boundaries of Caldwell, Gonzales, DeWitt, Victoria, and Calhoun Counties. It gives the available data as follows for each of the 114 communities: Population of the community; name of the official from whom the information was obtained; ownership of water works, whether private or municipal; source of supply, whether ground or surface water; the amount of water consumed; the facilities for storage; the number of customers served; the character of the chemical and sanitary treatment, if any; and chemical analyses of the water. Where ground water is used, the following information also is given: Records of wells, including drillers' logs; character of the pumping equipment; yield of the wells and records of water levels, where they are available.

The communities served by these public supplies had a population of 668,000 in 1940. Ground water is used by 79 of these communities and surface water by 31. The total amount of water consumed averages about 95 million gallons a day, of which about 55 million gallons is obtained from ground water and about 40 million gallons from surface water.

The extreme northern part of the region lies on the Edwards Plateau, and the remainder lies within the Gulf Coastal Plain. The rocks that crop out in the region are practically all sedimentary and consist chiefly of limestone, shale, clay, sandstone, sand, and gravel. They range in geologic age from Lower Cretaceous to Quaternary.

The general geologic structure of the region is comparatively simple. The most prominent features are the regional gulfward dip of the formations at an angle greater than the slope of the land surface, which is a significant factor governing the occurrence of artesian water, and faulting along the Balcones fault zone which controls the occurrence and movement of ground water in the Edwards and associated limestones.

Among the most important aquifers are the Edwards limestone of Lower Cretaceous age; the Carrizo sand, sands of the Mount Selman formation, the Oakville sandstone, and the Goliad sand of Tertiary age; and the Lissie formation and sands of the Beaumont clay of Quaternary age. Each of these units has outcrop areas from which the beds dip beneath younger formations to increasingly greater depths.

For convenience in summarizing the sources of municipal water supplies, the region has been divided into four areas, as shown on plate 1. In area A, Bandera obtains its water from sands in the Trinity group; Divine in southeastern Medina

County obtains water from sands in the Wilcox group or the Carrizo sand; and Boerne in southern Kendall County obtains its supply from Recent alluvium. The remainder of the municipalities in the area obtain water from the Edwards limestone, which has the greatest perennial yield of any aquifer in Texas. In area B, the Carrizo sand is the important aquifer in most of the area, although in the northeastern part several towns that are above the outcrop of the Carrizo sand obtain water from sands in the Wilcox group. In area C, all of the cities and towns use surface water with the exception of Falls City, Gonzales, and Three Rivers. In area D, which is adjacent to the Gulf Coast, the principal sources of ground water are the Catahoula tuff, the Oakville sandstone, sands of the Lagarto clay, the Goliad sand, the Lissie formation, and sands of the Beaumont clay.

Most of the public supplies obtained from surface water in Southern Texas are filtered and frequently are given further treatment that alters the chemical character of the water. All except two of the supplies from the Rio Grande are given some chemical treatment and about two-thirds of them are filtered. Of the 182 analyses given in this report, 138 are from wells or springs. In general, the supplies from wells conform to the accepted standards of water quality. In dissolved solids about one-fourth of the waters have less than 500 parts per million; about three-eighths have between 500 and 1,000 parts per million; and the remainder have more than 1,000 parts per million. Less than half of the supplies have chlorides of more than 250 parts per million, and few have sulfates of more than 250 parts per million. About one-third of the waters is in the soft to moderately soft range of hardness; about one-third is in the moderately hard to hard range and one-third is in the very hard range. The chemical composition of the surface water varies through a rather wide range. At Rio Grande City, samples collected from the Rio Grande between 1935 and 1942 show dissolved solids ranging from 225 to 1,760 parts per million. At Three Rivers, samples collected from the Nueces River from 1941 to 1945 show dissolved solids ranging from 195 to 1,068 parts per million. At Spring Branch on the Guadalupe River, samples collected in 1942 show dissolved solids ranging from 150 to 540 parts per million; samples collected at Goliad from the San Antonio River in 1942 show dissolved solids ranging from 110 to 750 parts per million.

## INTRODUCTION

### EXTENT OF REGION AND SCOPE OF REPORT

This is the second of a series of reports giving summary descriptions of the public water supplies in Texas. The first, a mimeographed report covering 77 counties in eastern Texas, was released by the Texas State Board of Water Engineers in February 1945.<sup>1</sup>

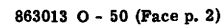
The region covered by the present report includes the 42 counties that extend from the Rio Grande northward and northeastward to the northern boundaries of Kinney, Uvalde, Bandera, Kendall, and Hays Counties and the northeastern boundaries of Caldwell, Gonzales, DeWitt, Victoria, and Calhoun Counties (See pl. 1). It comprises 43,897 square miles and in 1940 had a population of 1,147,340.

The 114 cities and towns in this region that have public water-

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<sup>1</sup> Published also by Geological Survey as Sundstrom, R. W., Hastings, W. W., Broadhurst, W. L., Public Water supplies in eastern Texas: U. S. Geol. Survey Water-Supply Paper 1047, 1948.





supply systems had a population of 668,000 in 1940. They use on the average about 95,000,000 gallons of water a day, of which about 55,000,000 gallons is ground water and about 40,000,000 gallons is surface water. Ground water is used by 83 of the communities and surface water by 30; one town, Fentress, in Caldwell County has a supply utilizing both ground and surface water.

The need for certain basic data in the studies of quantitative and qualitative problems of public water supplies has long been apparent. This is especially true in Texas where, in recent years, there has been an enormous increase in the demand for water for public and industrial uses. The phenomenal growth of many Texas cities has resulted in the need from time to time for expanding or rebuilding the waterworks systems. Most of the communities throughout the State originally used ground water, and most of them still do. Some still use the original source of supply, some have developed additional sources of ground water, and others have changed from inadequate supplies of ground water to surface water.

The available information for each community is given in condensed form as follows: Population in 1940; name of official from whom the information was obtained; ownership of waterworks, whether private or municipal; source of supply, whether ground water or surface water; the amount of water consumed; the facilities for storage; the number of consumers served; the character of the chemical and sanitary treatment of the water; and chemical analyses of the water. Where ground water is used the following is also given: Records of wells, including depth, diameter, and drillers' logs; character of pumping equipment; yield of the wells; records of water levels, if available; and temperature of the water. Unfortunately many communities have kept poor records, or no records at all, of the amount of ground water pumped and the resulting decline of water level or artesian pressure in the wells since they were drilled, and for such localities the information given is necessarily incomplete. The availability of this information is vitally important, particularly in areas where the withdrawals from underground supplies are approaching the limits of safety or where large increases in withdrawals are anticipated.

#### ACKNOWLEDGMENTS

Grateful acknowledgment is made to the well drillers, city officials, and others who furnished most of the descriptive material that is given for each public supply. The investigation was made possible through the cooperation of the Geological Survey, United States Department of the Interior, and the Texas State Board of Water Engineers. The greater part of the field work was done and most of this report was prepared by W. L. Broadhurst and R. W. Sundstrom of the

Geological Survey, under the direction of W. N. White, district engineer in charge of the ground-water investigations in Texas. Most of the analyses of water were made in the laboratory of the Geological Survey at Austin, and the section on chemical character of water was prepared by J. H. Rowley under the direction of W. W. Hastings, district chemist in charge of the laboratory.

### GROUND WATER

The scope of this report does not permit a discussion of the more complex details of the occurrence of ground water in each locality, and the following statements are brief and general. In several parts of the region, however, detailed studies of the geology and ground-water resources have been made and reports covering them have been issued. The reader is referred to the bibliography on pages 15 and 16 for a list of the reports.

The extreme northern part of the region lies on the Edwards Plateau, and the remainder lies within the Gulf Coastal Plain. The rocks that crop out in the region are mostly sedimentary and consist chiefly of limestones, shales, clays, sandstones, sands, and gravels. They range in geologic age from Lower Cretaceous to Quaternary. Igneous rocks are exposed in a few localities along the Balcones fault zone, which extends from Uvalde County eastward and northeastward through Medina, Bexar, Comal, and Hays Counties, but these rocks are not known to yield water.

The general geologic structure of the region is comparatively simple. The most prominent features are the regional gulfward dip of the formations at an angle greater than the slope of the land surface, which is a significant factor governing the occurrence of artesian water, and the faulting along the Balcones fault zone, which controls the occurrence and movement of ground water in the Edwards and associated limestones.

Among the most important aquifers are the Edwards limestone of Lower Cretaceous age; the Carrizo sand, sands of the Mount Selman formation, the Oakville sandstone, and the Goliad sand, of Tertiary age; and the Lissie formation and sands of the Beaumont clay, of Quaternary age. Each of these units has outcrop areas from which the beds dip beneath younger formations to increasingly greater depths.

In general, each water-bearing formation is underlain and overlain by relatively impermeable clays or shales that serve effectively as confining beds. Hence, the fresh water that occurs in each water-bearing formation is derived mostly from precipitation or seepage from streams on the outcrop areas of that particular formation. In

the outcrop areas of water-bearing formations the water occurs under water-table conditions; that is, the water will not rise in wells above the level at which it is encountered by the drill. The water moves slowly from the outcrop down the dip between impermeable beds, where it is confined under artesian conditions, which will cause it to rise in wells above the level at which it is encountered. The water may or may not rise to the surface and overflow, depending on the hydrostatic pressure in the aquifer and the altitude of the land surface at the well site.

For convenience in summarizing the sources of the municipal water supplies, the region has been divided into four areas: A, B, C, and D on the map. (See pl. 1.)

*Area A.*—This area consists of a narrow belt extending from the Rio Grande northeastward across the Edwards Plateau along and adjacent to the Balcones fault zone. With the exception of Eagle Pass in Maverick County, which obtains water from the Rio Grande, all cities and towns in the area use ground water.

Sands in the Trinity group, the basal unit of the Lower Cretaceous series, crop out in the Edwards Plateau along the northern boundary of the area and dip southeastward. Bandera in east-central Bandera County is the only town in the area that obtains water from these sands. Devine in southeastern Medina County obtains water from sands in the Wilcox group or the Carrizo sand, and Boerne in southern Kendall County obtains its supply from Recent alluvium. The remaining municipalities in the area obtain water from the Edwards limestone, which has the greatest perennial yield of any aquifer in Texas. The large springs at San Marcos, New Braunfels, San Antonio, and other places along the Balcones fault zone, which are among the largest in the Southwest, issue from solution channels in the Edwards limestone. At San Antonio and vicinity artesian wells in the Edwards limestone supply more than 100 million gallons a day for municipal, industrial, military, and agricultural purposes.

Listed below are the municipalities in Area A whose public supplies are obtained from ground-water sources and also the probable water-bearing formation or group of formations from which the water is drawn.

*Municipalities in Area A and probable water-bearing formation from which water is drawn*

Alamo Heights.....	Edwards limestone.
Bandera.....	Trinity group.
Boerne.....	Recent alluvium.
Brackettville.....	Edwards limestone.
Buda.....	Do.
Devine.....	Carrizo sand or Wilcox group.

*Municipalities in Area A and probable water-bearing formation from which water is drawn—Continued*

Hondo.....	Edwards limestone.
Kyle.....	Do.
New Braunfels.....	Do.
Sabinal.....	Do.
San Antonio.....	Do.
San Marcos.....	Do.
Uvalde.....	Do.

*Area B.*—This area joins Area A on the southeast. The Carrizo sand is generally the principal aquifer, although in the northeastern part of the area several towns that are northwest of the outcrop of the Carrizo sand obtain water from sands in the Wilcox group. The Carrizo sand crops out in a narrow belt that extends from the Rio Grande north and northeastward across Dimmit, Zavala, Frio, Atascosa, Wilson, Guadalupe, and Caldwell Counties. The sand dips southeastward toward the Gulf, and in LaSalle County it yields water suitable for municipal use at a depth of more than 2,500 feet, whereas in Gonzales County it yields rather highly mineralized water at a depth of 1,650 feet. A few towns in the area obtain water from the Mount Selman formation and a few rely on shallow wells in Pliocene or Pleistocene terrace deposits. Three towns, Campbellton, Fentress, and Seguin, use surface water.

Listed below are the municipalities in Area B whose public supplies are obtained from ground-water sources, and also the probable water-bearing formation or group of formations from which the water is drawn.

*Municipalities using ground water, and probable water-bearing formations*

Asherton.....	Carrizo sand.
Big Wells.....	Do.
Brundage.....	Do.
Carrizo Springs.....	Do.
Catarina.....	Do.
Christine.....	Mount Selman formation.
Cotulla.....	Carrizo sand.
Coughran.....	Mount Selman formation.
Crystal City.....	Carrizo sand.
Dale.....	Wilcox group.
Dilley.....	Carrizo sand.
Floresville.....	Do.
Fowlerton.....	Mount Selman formation.
Jourdanton.....	Carrizo sand
La Pryor.....	Do.
Lockhart.....	Pliocene or Pleistocene terrace deposits.
Luling.....	Wilcox group.
Lytton Springs.....	Do.
McMahan.....	Do.

*Municipalities using ground water, and probable water-bearing formations—Con.*

Marion.....	Austin chalk.
Martindale.....	Pliocene or Pleistocene terrace deposits.
Maxwell.....	Do.
Nixon.....	Carrizo sand.
North Pleasanton.....	Do.
Pearsall.....	Do.
Pleasanton.....	Mount Selman formation.
Poteet.....	Carrizo sand.
Poth.....	Do.
Sasamco.....	Wilcox group.
Stockdale.....	Queen City sand member of the Mount Selman formation.
Uhland.....	-----

*Area C.*—This area is L shaped, extending through the central part of the region and southeastward along the Rio Grande from Laredo to the Gulf. All cities and towns in the area use surface water, and with the exception of Falls City, Gonzales, and Three Rivers they all obtain water from the Rio Grande.

*Area D.*—In Area D, which is adjacent to the gulf coast, the principal sources of ground water are the Catahoula tuff, the Oakville sandstone, sands in the Lagarto clay, the Goliad sand, the Lissie formation, and sands of the Beaumont clay. With the exception of Corpus Christi, Raymondville, and Robstown, all communities in this area use ground water, most of which is obtained from the above-named sands.

Listed below are the cities and towns in Area D whose public supplies are obtained from ground-water sources and also the probable water-bearing formation or group of formations from which the water is drawn.

*Municipalities using ground water, and probable water-bearing formation*

Agua Dulce.....	Goliad sand.
Aransas Pass.....	Beach deposits or sands in Beaumont clay.
Austwell.....	Sands in Beaumont clay.
Beeville.....	-----
Benevedas.....	Goliad sand.
Bishop.....	Goliad sand or Lissie formation.
Combes.....	Recent alluvium.
Cuero.....	Catahoula tuff and Oakville sandstone.
Falfurrias.....	Goliad sand.
Freer.....	Catahoula tuff.
George West.....	Catahoula tuff or Oakville sandstone.
Gillett.....	Yegua formation.
Goliad.....	Sands in Lagarto clay or Goliad sand.
Hebbronville.....	Catahoula tuff or Oakville sandstone.
Karnes City.....	Catahoula tuff.

*Municipalities using ground water, and probable water-bearing formation—Con.*

Kenedy.....	Oakville sandstone.
Kingsville.....	Goliad sand or Lissie formation.
La Feria.....	.....
Lyford.....	Goliad sand or Lissie formation.
Mathis.....	Goliad sand.
Nordheim.....	Catahoula tuff or Oakville sandstone.
Odem.....	Sands in Beaumont clay.
Orange Grove.....	Goliad sand.
Pettus.....	Oakville sandstone or sands in Lagarto clay.
Port Aransas.....	Beach deposits.
Port Lavaca.....	Lissie formation or sands in Beaumont clay.
Premont.....	Goliad sand.
Refugio.....	Do.
Rockport.....	Beach deposits or sands in Beaumont clay.
Runge.....	Oakville sandstone.
San Diego.....	Goliad sand?
Seadrift.....	Beach deposits or sands in Beaumont clay.
Sinton.....	Goliad sand and Lissie formation.
Woodsboro.....	Lissie formation.
Yorktown.....	Catahoula tuff or Oakville sandstone.

**SURFACE WATER**

In the region covered by this report surface water is used by 31 communities including one town, Fentress, in Caldwell County, where a well also is used. Of the 31 communities 24 are in Area C where little or no ground water suitable for public supply is available. The average total consumption of surface water for municipal use in the region is about 40,000,000 gallons a day.

In Area A the public supply of Eagle Pass is obtained from the Rio Grande, and the requirement for the city averages about 900,000 gallons a day.

In Area B water for Campbellton in Atascosa County is obtained from the Atascosa River; a part of the supply for Fentress in Caldwell County is obtained from the San Marcos River; and at Seguin in Guadalupe County the supply is obtained from the Guadalupe River. The requirements for Seguin are by far the largest and average about 1,000,000 gallons a day.

In Area C, 24 of the municipalities use an average of about 19,000,000 gallons a day from the Rio Grande. The requirements for Laredo, which is about 7,000,000 gallons a day, is by far the largest in this area. Small quantities of water are pumped from the San Antonio River for a part of the public supply of Falls City. Gonales uses

about 350,000 gallons a day from the Guadalupe River; and Three Rivers uses about 100,000 gallons a day from the Frio River.

In Area D Raymondville uses about 500,000 gallons a day from the Rio Grande. Corpus Christi uses about 16,000,000 gallons a day and Robstown about 640,000 gallons a day from the Nueces River.

## CHEMICAL CHARACTER OF WATER

### ANALYSES OF WATER

The analyses in this report deal with the dissolved mineral constituents in water and have no bearing on the sanitary fitness of the water. Of the 182 analyses listed, 10 were made by the Texas State Department of Health and 172 were made by the Geological Survey.

As the chemical quality of water from an individual well seldom shows any appreciable variation, except in very shallow wells or wells in aquifers subject to salt-water encroachment, a single analysis of water from a well is generally representative of the character of the water over long periods. For supplies that are treated or are obtained from streams, periodic analyses are needed to determine the range in the chemical character of the water. Water from most rivers shows a wide range in dissolved minerals and hardness during the year.

About a third of the public supplies from wells listed in this report receive treatment. All except two of the supplies from streams are given some chemical treatment and about two-thirds of them are filtered. The processes used for each supply are listed in the report in the order of their use.

The analyses were made by methods in general use.<sup>2</sup> They include results for silica ( $\text{SiO}_2$ ), iron (Fe), calcium (Ca), magnesium (Mg), sodium (Na), potassium (K) (or sodium and potassium as sodium), bicarbonate ( $\text{HCO}_3$ ), sulfate ( $\text{SO}_4$ ), chloride (Cl), fluoride (F), nitrate ( $\text{NO}_3$ ), dissolved solids, total hardness as  $\text{CaCO}_3$ , and hydrogen-ion concentration (pH). The mineral constituents are reported in parts per million and in equivalents per million for those radicals that enter into ionic balance.

### MINERAL CONSTITUENTS IN SOLUTION

Rain and snow are almost free from mineral constituents, but when the water reaches the earth it begins to dissolve the minerals in the rocks and soils over which it flows or through which it percolates. The amount and type of minerals that are dissolved depend on the solubility and type of rocks and soils present and the length of time

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<sup>2</sup> Collins, W. D., Notes on practical water analysis: U. S. Geol. Survey Water-Supply Paper 596-H 1928; Am. Public Health Assoc.; Standard Methods for the Examination of Water and Sewage, 7th ed., 1932.



the water is in contact with those materials. The constituents given in the analyses in this report are discussed in the following paragraphs.

Silica ( $\text{SiO}_2$ ) is found in all natural waters and is usually present in greater quantities in ground waters than in surface waters. The presence of silica in water does not affect its usefulness except when the water is used for boilers. It contributes to the formation of boiler scale, either directly as a silica scale that causes local overheating or by cementing the other minerals together into a hard, troublesome scale that causes loss in heat transfer.

Iron (Fe) is dissolved from practically all rocks. It is often dissolved from pipes, hot-water lines, and boilers in quantities large enough to be objectionable. Waters low in dissolved mineral matter and waters of low pH tend to be relatively corrosive. Even a small amount of iron in water is undesirable because the iron precipitates on exposure to air, causing "red water" and resulting in stains on enameled or porcelain ware and fixtures and on clothing and other fabrics washed in the water. Iron is easily removed from many waters by aeration and filtration.

Calcium (Ca) and magnesium (Mg) are found in waters that have come in contact with limestone, dolomite, calcareous sand, and gypsum. They are also the chief basic constituents in many soft waters. Magnesium is found in considerable quantities when the waters are contaminated with sea water or have come in contact with deposits of sea salts. The scale found in containers where water is heated or evaporated is almost entirely caused by the presence of calcium and magnesium.

Sodium (Na) and potassium (K) are found in all natural waters; the quantity of potassium generally is comparatively small. Sodium is the chief basic constituent in sea water and most brines. In semi-arid regions, large quantities of sodium salts may be dissolved from soils and alkali deposits. Sodium sulfate may be present in large quantities in streams that receive drainage from irrigated land. Moderate quantities of sodium and potassium have no effect on the suitability of the water either for domestic or for most industrial uses. Higher quantities may cause trouble in operation of high-pressure steam boilers.

Carbonate ( $\text{CO}_3$ ) and bicarbonate ( $\text{HCO}_3$ ) in water are present mainly as a result of the action of carbon dioxide in solution on carbonates in soils and rocks. Carbonate is not generally found in natural waters. Bicarbonate has little effect on the suitability of water for municipal supplies, except that when present in very large amounts it affects the potability of the water.

Sulfate ( $\text{SO}_4$ ) may be dissolved in large quantities from gypsum or from deposits of sodium sulfate. Sulfate is also found in considerable

quantities in water from mines and beds of shale as a result of the oxidation of sulfides of iron. The content of sulfate is increased by the use of alum as a coagulant in the treatment of the water. High sulfate in waters in combination with high calcium and magnesium causes the formation of hard scale in steam boilers; this combination increases the cost of softening the water.

Chloride (Cl) in large amounts, in combination with sodium, causes a salty taste, making the water undesirable for drinking. Appreciable quantities of chloride in equilibrium with calcium and magnesium may increase the corrosiveness of water. In some Texas waters sodium chloride is the main chemical constituent and occurs in such concentrations as to cause the water to be unsatisfactory for some industrial uses.

Nitrate ( $\text{NO}_3$ ) is considered to be the final oxidation product of nitrogenous organic material. Some nitrate may be dissolved from rocks and soils but very few rocks contain appreciable amounts of nitrate salts. Nitrate has no effect on the value of water for ordinary purposes. It may serve as an indicator of contamination by sewage or other organic material.

Fluoride (F) is reported to occur in the rocks of the earth's crust in about half the amount reported for chloride. However, the amount of fluoride in natural water is much less than the amount of chloride. The relation of the occurrence of fluoride in water to mottled enamel of teeth has been recognized for some time.<sup>3</sup> Mottled enamel has been found to be associated with the use, by children less than 8 years of age, of drinking water having a fluoride content of 1.0 part per million or more.<sup>4</sup> Additional studies<sup>5</sup> have indicated that the occurrence of dental caries (decay) has been decreased by the use of drinking water containing measurable amounts of fluoride, though not so much as 1.0 part per million.

The figure for dissolved solids represents the total of the dissolved mineral constituents in the water, including any organic matter and water of crystallization. The palatability of water is affected by the amount of dissolved solids. Most waters with more than 1,000 parts per million of total solids are undesirable for municipal supply.

The hydrogen-ion concentration (pH) of a water indicates its degree of acidity or alkalinity, a factor which determines the corrosiveness of the water. Dissolved oxygen, carbon dioxide, free acid, and acid-

<sup>3</sup> Smith, H. V., and Smith, M. C., Mottled enamel in Arizona and its correlation with concentration of fluorides in water supplies: *Ariz. Univ. Coll. ex. Bull.*, 43, p. 284, 1932.

<sup>4</sup> Dean, H. Trendley, Chronic endemic dental fluorosis: *Amer. Med. Assoc. Jour.* vol. 107, pp. 1269-1272, 1936.

<sup>5</sup> Dean, H. T., Jac. P., Arnold, F. A., Jr., and Elvove, E., Domestic water and dental caries: *Public Health Rept.*, vol. 56, pp. 365-381, 761-792, 1941.

generating salts are the main constituents that cause corrosion; alkalinity is a factor that decreases corrosion. Water for public use should not be corrosive because it will attack and destroy metal surfaces, resulting in an increase in the iron content of the water and damage to the pipes used in the distribution system. Proper control of the pH by treatment will prevent corrosion.

Hardness is probably the most important factor to be considered in deciding on the suitability of a water supply for industrial or domestic use. Hardness is due almost entirely to the calcium and magnesium present in the water. It is commonly known that limestone waters are hard, whereas sandstone waters are soft. The two types of hardness are carbonate and noncarbonate. Carbonate hardness is that caused by calcium and magnesium equivalent to the bicarbonate contained in the water, and the noncarbonate hardness is the remainder of the hardness. These two terms are approximately equivalent to the old terms "temporary hardness" and "permanent hardness," respectively. The scale caused by the carbonate hardness may be porous and easily removed, but the scale due to noncarbonate hardness is hard and very difficult to remove. Hardness is recognized by the layman in terms of the amount of soap required to make a good lather and by the deposits of insoluble material formed when water is heated or evaporated. The treatment necessary to soften water depends on the kind and amount of hardness. The following degrees of hardness of water are referred to in this report: With hardness of 50 parts per million or less the waters are considered soft; with 50 to 100 parts per million, moderately soft; with 100 to 150 parts per million, moderately hard; with 150 to 250 parts per million, hard; and above 250 parts per million, very hard.

#### STANDARDS OF WATER QUALITY

The effect of various constituents in water that is used for public supply and for industrial purposes, with reference to Texas well waters, is discussed by Cohen in an early bulletin by the Texas State Department of Health.<sup>6</sup> The standards most widely used at present for judging the quality of domestic water supplies are those of the United States Public Health Service for the drinking and culinary water supply used by common carriers in interstate commerce.<sup>7</sup>

<sup>6</sup> Cohen, Chester A., Chemical analyses of Texas well waters: Texas State Dept. of Health Bull., 1931.

<sup>7</sup> Public Health Service drinking water standards: Public Health Reports, vol. 61, pp. 371-384, 1946.

**CHEMICAL CHARACTER OF GROUND-WATER SUPPLIES**

Of the 182 analyses given in this report 138 are for public supplies obtained from wells or springs. In general, these supplies conform to the accepted standards of water quality. Of dissolved solids about one-fourth of the waters have less than 500 parts per million, about three-eighths have between 500 and 1,000 parts per million, and the remainder have more than 1,000 parts per million. Less than half the supplies have chloride contents of more than 250 parts per million, and only a very few have sulfate contents of more than 250 parts per million.

With regard to hardness about one-third of the waters are soft to moderately soft, about one-third are moderately hard to hard, and about one-third are very hard.

All the cities and towns in this region that are served with ground water are in areas A, B, and D. (See map, pl. 1.) In area A the ground-water supplies are generally very hard, but most of them have less than 500 parts per million of dissolved solids. In area B the dissolved solids are usually above 500 parts per million but seldom exceed 1,000 parts per million, and some of the supplies are soft although about half are considered hard. In area D many of the ground-water supplies have dissolved solids above 1,000 parts per million; these are generally hard.

**CHEMICAL CHARACTER OF SURFACE-WATER SUPPLIES**

The mineral content and hardness of some surface waters vary widely from time to time, the concentration usually decreasing during periods of high flow and increasing during periods of low flow. Therefore, the analysis of a single sample from a surface source may be entirely inadequate as an index of the suitability of the water for public supply. A daily sampling program continued for years may be necessary in order to determine the extremes and average in mineral content.

In the region covered by this report, 23 public supplies are obtained from the Rio Grande, 2 from the Nueces River, 2 from the Guadalupe River, and 1 each from the Atascosa, Frio, San Antonio, and San Marcos Rivers.

Considerable information is available concerning the quality of the water in the Rio Grande, Nueces, San Antonio, and Guadalupe Rivers. The average composition together with the maximum and minimum

concentrations shown by the available records are given in the table below.

*Average and extremes in composition of the water of the Rio Grande, Nueces, San Antonio, and Guadalupe Rivers*

	Specific conductance ( $K \times 10^4$ at 25° C.	Calcium (Ca)	Magne- sium (Mg)	Sodium and po- tassium (Na+K)	Bicar- bonate ( $HCO_3$ )	Sulfate ( $SO_4$ )	Chlo- ride (Cl)	Dis- solved solids	Total hardness as $CaCO_3$
<b>Rio Grande at Rio Grande City, 1935-42 <sup>1</sup></b>									
Average-----	101	80	19	101	142	195	126	591	280
Minimum-----	50	39	12	37	115	73	35	255	147
Maximum-----	282	179	63	344	154	580	514	1,760	705
<b>Nueces River at Three Rivers, 1941-45 <sup>2</sup></b>									
Average-----	95.9	58	11	120	205	80	142	512	190
Minimum-----	27.2	38	3.5	18	138	17	12	195	109
Maximum-----	183	115	25	248	380	205	287	1,068	390
<b>Guadalupe River at Spring Branch, 1942 <sup>2</sup></b>									
Average-----	50.5	62	22	16	272	21	21	290	245
Minimum-----	23.9	-----	-----	-----	-----	-----	6.0	150	-----
Maximum-----	88.1	-----	-----	-----	302	86	86	540	352
<b>San Antonio River at Goliad, 1942 <sup>2</sup></b>									
Average-----	75.1	89	16	40	276	67	54	473	288
Minimum-----	17.4	-----	-----	-----	-----	-----	9.0	110	-----
Maximum-----	121	-----	-----	-----	-----	-----	192	750	-----

<sup>1</sup> Analyzed by International Boundary Commission.

<sup>2</sup> Analyzed by U. S. Geological Survey.

A study of the records compiled by the International Boundary Commission indicates that there is little change in the composition of water in the Rio Grande between Rio Grande City and Brownsville. Therefore, the data available for the Rio Grande at Rio Grande City are probably representative of the composition of the water served to all users in the lower valley. The analyses of samples collected in 1946, during the preparation of this report, from public supplies served by the Rio Grande, are on the whole very close to the average analysis given in the table. Three supplies show a slightly higher concentration than the average, but only one, the Laredo supply, approaches the maximum concentration shown at Rio Grande City between 1935 and 1942.

The analyses of single samples collected in 1946 from public supplies from the Nueces River show a lower concentration than was recorded at Three Rivers during the period 1941-45.

The public supplies of Gonzales County and Seguin in Guadalupe County are obtained from the Guadalupe River. The analysis of a single sample at Gonzales shows a concentration that is twice the

average for the river at Spring Branch, whereas the analysis for Seguin shows a concentration that is slightly below the average at Spring Branch.

The analysis of the sample obtained from the San Antonio River at Falls City, Karnes County, shows about the same concentration as the average given in the table for the San Antonio River at Goliad.

The analysis of a sample obtained at Fentress, Caldwell County, which is served from the San Marcos River, shows a water that is low in dissolved solids but very hard. The sample obtained at Three Rivers from the Frio River was hard but the amount of dissolved solids was just below 500 parts per million. The sample from Atascosa River water at Campbellton, Atascosa County, had a dissolved solids content above 1,000 parts per million and was very hard. The sulfate was slightly less than 250 parts per million; the chloride was more than 250 parts per million.

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In addition to the above-listed reports, mimeographed publications containing records of wells and springs, drillers' logs, partial chemical analyses of water from wells and springs, and maps showing the location of wells have been released by the Texas State Board of Water Engineers for the following counties in the region: Aransas, Bee, Brooks, Calhoun, Comal, DeWitt, Dimmit, and Zavala, Gonzales, Guadalupe, Hays, Hidalgo, Jim Hogg, Jim Wells, Karnes, Kendall, Kinney, Live Oak, Nueces, Refugio, San Patricio, Victoria, and Wilson.

## UNPUBLISHED REPORTS

The following manuscript reports giving results of ground-water investigations are available for reference in the offices of the Geological Survey and Texas State Board of Water Engineers at Austin:

- 1940, Ground water in the Corpus Christi area.  
 1942, Relation of shallow ground water to Las Moras Springs.  
 1942, Ground water in the vicinity of San Marcos and Buda.  
 1943, Recent observations of ground-water conditions in the vicinity of Kingsville.  
 1944, Ground-water supply for the Celanese plant at Bishop.  
 1944, Ground-water conditions in the Premont-Falfurrias district, Texas.  
 1946, Ground water in the lower Rio Grande Valley.

## PUBLIC WATER SUPPLIES

## ARANSAS COUNTY

## ROCKPORT

Population in 1940: 1,729.

Source of information: Tom Shults, water superintendent, July 17, 1945.

Ownership: Municipal.

Source of supply: 3 wells.

Well 1. Six blocks north of elevated tank; drilled in 1938 by Layne-Texas Co.; depth, 78 feet; diameter, 13 to 6 inches; screen from 68 to 78 feet; deep-well turbine pump and 3-horsepower electric motor.

Well 2. About 200 feet from well 1; drilled in 1938 by Layne-Texas Co.; depth, 78 feet; diameter, 13 to 6 inches; screen from 68 to 78 feet; deep-well turbine pump and 3-horsepower electric motor.

Well 3. One block west of well 2; drilled in 1944 by Layne-Texas Co.; depth, 78 feet; diameter, 16 to 8½ inches; screen from 53 to 78 feet; deep-well turbine pump and 3-horsepower electric motor; static water level, 16 feet below land surface, Aug. 6, 1944; pumping level, 61 feet below land surface when pumping 28 gallons a minute, August 6, 1944.

Pumpage (estimated): 75,000 gallons a day for 3 months; 50,000 gallons a day for 9 months.

Storage: Elevated tank, 50,000 gallons; ground reservoir, 55,000 gallons.

Number of customers: 400.

Treatment: None.

## Analyses

[Collected July 17, 1945. pH for each well is 7.6. Analyzed by J. H. Rowley]

	Well 1		Well 3	
	Parts per million	Equivalents per million	Parts per million	Equivalents per million
Silica (SiO <sub>2</sub> ).....	17		15	
Iron (Fe).....	.43		.15	
Calcium (Ca).....	92	4.59	96	4.79
Magnesium (Mg).....	16	1.32	13	1.07
Sodium (Na).....	182	7.90	116	5.06
Potassium (K).....	12	.31	13	.33
Bicarbonate (HCO <sub>3</sub> ).....	339	5.56	315	5.16
Sulfate (SO <sub>4</sub> ).....	15	.31	5.7	.12
Chloride (Cl).....	292	8.24	211	5.95
Fluoride (F).....	0	.00	.2	.01
Nitrate (NO <sub>3</sub> ).....	.5	.01	.8	.01
Dissolved solids.....	869		670	
Total hardness as CaCO <sub>3</sub> .....	296		293	

*Driller's log, well 3*

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
White sand.....	18	18	White sand.....	6	65
Gray sand.....	29	47	Brown sandy clay and fine-		
Clay and sandy clay.....	8	55	grained sand.....	15	80
Sandy clay.....	4	59			

**ATASCOSA COUNTY****CAMPBELLTON**

Population in 1940: 250.

Source of information: J. N. Ahns, superintendent, Aug. 14, 1945.

Ownership: Municipal.

Source of supply: Atascosa River. Water is pumped from river to an automatic pressure system.

Pumpage: No information.

Storage: Pressure tank, 1,500 gallons.

Number of customers: 50.

Treatment: None.

*Analysis*

[Collected Aug. 14, 1945. pH is 8.2. Analyzed by J. H. Rowley]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> ).....	16		Sulfate (SO <sub>4</sub> ).....	223	4.64
Iron (Fe).....	.47		Chloride (Cl).....	265	7.47
Calcium (Ca).....	46	2.30	Fluoride (F).....	1.0	.05
Magnesium (Mg).....	21	1.73	Nitrate (NO <sub>3</sub> ).....	.5	.01
Sodium (Na).....	283	12.29	Dissolved solids.....	1,030	
Potassium (K).....	26	.67	Total hardness as CaCO <sub>3</sub> .....	202	
Bicarbonate (HCO <sub>3</sub> ).....	294	4.82			

**CHRISTINE**

Population in 1940: 286.

Source of information: Glen Patterson, water superintendent, May 25, 1944.

Ownership: Municipal.

Source of supply: One well in north part of town; drilled in 1917; depth, 1,314 feet; diameter, 6 to 4 inches; well flows with a head of 25 feet above land surface; well is connected directly with the mains.

Pumpage: No information.

Storage: None.

Treatment: None.



*Analysis*

[Collected May 25, 1944. pH is 8.2. Analyzed by J. H. Rowley]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> )	14		Sulfate (SO <sub>4</sub> )	152	3.16
Iron (Fe)	.08		Chloride (Cl)	497	14.02
Calcium (Ca)	4.8	0.24	Fluoride (F)	1.7	.09
Magnesium (Mg)	1.4	.12	Nitrate (NO <sub>3</sub> )	2.0	.03
Sodium (Na)	667	29.01	Dissolved solids	1,710	
Potassium (K)	4.6	.12	Total hardness as CaCO <sub>3</sub>	18	
Bicarbonate (HCO <sub>3</sub> )	743	12.17			

**COUGHRAN**

Population in 1940: 50.

Source of information: W. H. Gibson, owner, Aug. 14, 1945.

Owner: W. H. Gibson.

Source of supply: One well, northeast of railroad station in Coughran; depth, 885 feet; diameter, 6 inches; well flows into elevated tank; artesian pressure, 20.5 feet above land surface, May 1944.

Pumpage: No information.

Storage: Elevated tank, 5,000 gallons.

Number of customers: 15.

Treatment: None.

*Analysis*

[Collected Aug. 14, 1945. pH is 8.4. Analyzed by J. H. Rowley]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> )	16		Sulfate (SO <sub>4</sub> )	94	1.96
Iron (Fe)	.14		Chloride (Cl)	164	4.63
Calcium (Ca)	3.7	0.18	Fluoride	1.0	.05
Magnesium (Mg)	1.2	.10	Nitrate (NO <sub>3</sub> )	0	.00
Sodium (Na)	373	16.22	Dissolved solids	996	
Potassium (K)	15	.38	Total hardness as CaCO <sub>3</sub>	14	
Bicarbonate (HCO <sub>3</sub> )	624	10.42			

**JOURDANTON**

Population in 1940: 950.

Source of information: Eva Childress, city secretary, Aug. 14, 1945.

Ownership: Municipal.

Source of supply: One well at standpipe; drilled in 1930 by Layne-Texas Co.; depth, 1,635 feet; diameter, 10 to 6 inches; deep-well turbine pump and electric motor; static water level, 20 feet below land surface; yield, 161 gallons a minute with draw-down of 57.5 feet.

Pumpage: No information.

Storage: Elevated tank, 55,000 gallons; ground-storage reservoir, 50,000 gallons.

Number of customers: 248.

Treatment: Chlorination.

*Analysis*

[Collected Aug. 14, 1945. pH is 7.6. Analyzed by J. H. Rowley]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> ).....	13	-----	Sulfate (SO <sub>4</sub> ).....	31	0.65
Iron (Fe).....	.67	-----	Chloride (Cl).....	32	.90
Calcium (Ca).....	69	3.44	Fluoride (F).....	.4	.02
Magnesium (Mg).....	13	1.07	Nitrate (NO <sub>3</sub> ).....	.5	.01
Sodium (Na).....	26	1.15	Dissolved solids.....	336	-----
Potassium (K).....	11	.28	Total hardness as CaCO <sub>3</sub> .....	226	-----
Bicarbonate (HCO <sub>3</sub> ).....	266	4.36			

*Driller's log*

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Surface soil.....	4	4	Shale and boulders.....	56	842
Clay.....	50	54	Rock.....	2	844
Rock.....	1	55	Shale.....	13	857
Blue shale.....	14	69	Sand.....	53	910
Rock.....	2	71	Sandy shale.....	65	975
Blue shale and boulders.....	115	186	Rock.....	2	977
Rock.....	1	187	Hard shale.....	20	997
Blue shale.....	13	200	Sand.....	46	1,043
Rock (pyrites).....	2	202	Sandy shale.....	26	1,069
Hard sand.....	22	224	Rock.....	2	1,071
Blue shale and boulders.....	20	244	Shale.....	15	1,086
Rock.....	2	246	Sand.....	43	1,129
Shale and sand.....	14	260	Rock.....	3	1,132
Rock.....	1	261	Shale.....	16	1,148
Shale.....	19	280	Rock.....	2	1,150
Rock.....	2	282	Sand.....	24	1,174
Sand.....	24	306	Rock.....	1	1,175
Shale and boulders.....	23	329	Shale.....	17	1,192
Rock (pyrites).....	3	332	Sand (good).....	51	1,243
Shale.....	21	353	Rock.....	4	1,247
Rock.....	1	354	Shale.....	46	1,293
Shale.....	10	364	Rock.....	3	1,296
Rock.....	1	365	Shale and boulders.....	85	1,381
Shale and boulders.....	147	512	Rock.....	2	1,383
Hard sand.....	23	535	Shale.....	8	1,391
Shale and boulders.....	23	558	Rock.....	6	1,397
Sand.....	20	578	Shale and boulders.....	47	1,444
Shale and boulders.....	22	600	Rock.....	3	1,447
Sandy shale.....	80	680	Sand (dry).....	45	1,492
Rock.....	1	681	Shale.....	16	1,508
Sandy shale.....	104	785	Sand (hard streaks).....	96	1,604
Rock.....	1	786	Coarse-grained white sand.....	31	1,635

**NORTH PLEASANTON**

Population in 1940: 673.

Source of information: Hammond Rose, owner of distribution system, Aug. 14, 1945.

Ownership: Municipal (Missouri Pacific Railway Co. owns the well, Hammond Rose owns the distribution system).

Source of supply: One well at Missouri-Pacific Railroad shops; drilled in 1928; depth, 1,550 feet; diameter, 8 inches; well flows directly into distribution system; artesian head 69 feet above land surface, May 9, 1944.

Pumpage: Estimated 15,000 gallons a day.

Storage: None.

Number of customers: 75.

Treatment: None.

*Analysis*

[Collected Aug. 14, 1945. pH is 7.5. Analyzed by J. H. Rowley]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> ).....	13		Sulfate (SO <sub>4</sub> ).....	40	0.83
Iron (Fe).....	.89		Chloride (Cl).....	36	1.02
Calcium (Ca).....	64	3.19	Nitrate (NO <sub>3</sub> ).....	0	.00
Magnesium (Mg).....	7.8	.64	Fluoride (F).....	1.0	.05
Sodium (Na).....	27	1.19	Dissolved solids.....	303	
Potassium (K).....	10	.26	Total hardness as CaCO <sub>3</sub> .....	192	
Bicarbonate (HCO <sub>3</sub> ).....	206	3.38			

**PLEASANTON**

Population in 1949: 2,074.

Source of information: B. B. Gillett, Aug. 14, 1945.

Ownership: Municipal.

Source of supply: One well at elevated tank; drilled in 1917; depth, 815 feet; diameter, 8 to 4 inches; deep-well turbine pump and electric motor; static water level about 10 feet below land surface; well flows when drilled; yield, 150 gallons a minute.

Pumpage: Estimated average, 50,000 gallons a day; maximum in summer, about 100,000 gallons a day.

Storage: Elevated tank, 75,000 gallons; concrete ground reservoir, 75,000 gallons. Number of customers: 430.

Treatment: None.

*Analysis, well 1*

[Collected Aug. 14, 1945. pH is 8.0 Analyzed by J. H. Rowley]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> ).....	15		Sulfate (SO <sub>4</sub> ).....	0.7	0.01
Iron (Fe).....	.05		Chloride (Cl).....	94	2.65
Calcium (Ca).....	7.8	0.39	Fluoride (F).....	.2	.01
Magnesium (Mg).....	3.8	.31	Nitrate (NO <sub>3</sub> ).....	0	.00
Sodium (Na).....	175	7.62	Dissolved solids.....	480	
Potassium (K).....	6.3	.16	Total hardness as CaCO <sub>3</sub> .....	35	
Bicarbonate (HCO <sub>3</sub> ).....	354	5.81			

**POTEET**

Population in 1940: 2,315.

Source of information: H. R. De Viviss, water superintendent, Aug. 14, 1945.

Ownership: Municipal.

Source of supply: One well at elevated tank; drilled in 1928 by J. Wolfe; depth, 835 feet; diameter, 6 inches; centrifugal pump and electric motor; well flows with a head of 12 feet above land surface, Apr. 25, 1944.

Pumpage: Estimated 38,000 gallons a day in summer, 10,000 gallons a day in winter.

Storage: Elevated tank, 55,000 gallons.

Number of customers: 357.

Treatment: None.

*Analysis, well 1*

[Collected Aug. 14, 1945. pH is 7.8. Analyzed by J. H. Rowley]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> ).....	17	-----	Sulfate (SO <sub>4</sub> ).....	33	0.0687
Iron (Fe).....	1.3	-----	Chloride (Cl).....	49	1.382
Calcium (Ca).....	25	1.248	Fluoride (F).....	.2	.011
Magnesium (Mg).....	5.0	.411	Nitrate (NO <sub>3</sub> ).....	0	.000
Sodium (Na).....	24	1.065	Dissolved solids.....	196	-----
Potassium (K).....	5.6	.143	Total hardness as CaCO <sub>3</sub> .....	83	-----
Bicarbonate (HCO <sub>3</sub> ).....	48	.787			

**BANDERA COUNTY****BANDERA**

Population in 1940: 1,250.

Source of information: F. C. Billins, president of district, Nov. 2, 1945.

Owner: Bandera Water Control and Improvement District No. 1.

Source of supply: 2 wells.

Well 1. Drilled in 1940; depth 467 feet; diameter, 10 inches; deep-well cylinder and pump jack driven by electric motor; static water level, 40 feet below land surface; yield, 26 gallons a minute (breaks suction at yield in excess of 26 gallons a minute).

Well 2. Drilled in 1945 by Rayfield Bros.; depth, 435 feet; diameter, 6 inches; deep-well cylinder and pump jack driven by electric motor; yield, 40 gallons a minute.

Pumpage (estimated): Summer, 430,000 gallons; winter, 200,000 gallons.

Storage: Elevated tank, 60,000 gallons; ground storage, 60,000 gallons.

Treatment: None.

Number of customers: 250.

*Analyses*

[Collected Nov. 2, 1945. pH: Well 1, 6.9; well 2, 7.2. Analyzed by J. H. Rowley and C. B. Cibulka]

	Well 1		Well 2	
	Parts per million	Equivalents per million	Parts per million	Equivalents per million
Silica (SiO <sub>2</sub> ).....	13	-----	14	-----
Iron (Fe).....	.06	-----	1.1	-----
Calcium (Ca).....	86	4.29	73	3.64
Magnesium (Mg).....	62	5.10	51	4.19
Sodium (Na).....	39	1.70	38	1.64
Potassium (K).....	20	.51	21	.54
Bicarbonate (HCO <sub>3</sub> ).....	358	5.87	362	5.93
Sulfate (SO <sub>4</sub> ).....	220	4.58	139	2.89
Chloride (Cl).....	36	1.02	37	1.04
Fluoride (F).....	2.4	.13	2.8	.15
Nitrate (NO <sub>3</sub> ).....	0	.00	0	.00
Dissolved solids.....	682	-----	560	-----
Total hardness as CaCO <sub>3</sub> .....	464	-----	392	-----

**BEE COUNTY****BEEVILLE**

Population in 1940: 6,789.

Source of information: C. R. Gordon, manager, April 19, 1945.

Owner: Central Power &amp; Light Co.

Source of supply: 3 wells.

Well 2. At pump station; drilled in 1937 by Layne-Texas Co.; depth, 1,539 feet; diameter, 15½ to 8 inches; deep-well turbine pump and 40-horsepower electric motor; pump set at 184 feet; static water level, 56 feet below land surface when drilled, 61 feet on June 26, 1934, 63 feet on November 10, 1939, and 73 feet on November 11, 1942; yield, 500 gallons a minute; temperature, 95° F.

Well 3. At pump station; drilled in 1941 by Layne-Texas Co.; depth, 1,539 feet; diameter, 12¾ to 6½ inches; screen from 1,484 to 1,533 feet; deep-well turbine pump and 50-horsepower electric motor; pump set at 215 feet; static water level, 68 feet below land surface in April 1943; yield, 490 gallons a minute; temperature, 95° F.

Well 4. At intersection of Monroe and Cleveland Streets; drilled in 1945 by Layne-Texas Co.; depth, 622 feet; diameter, 14 to 8½ inches; screens between 528 and 622 feet; static water level reported 84 feet below land surface when drilled; yield, during test, 400 gallons a minute with draw-down of 95 feet (new well unused to date).

Pumpage: Maximum, 750,000 gallons; average, 500,000 gallons a day.

Storage: Elevated tank, 150,000 gallons; concrete ground reservoir, 50,000 gallons.

Number of customers: 1,207.

Treatment: Chlorination.

### Analysis, well 3

[Collected Apr. 19, 1945. pH is 7.5. Analyzed by J. H. Rowley]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> ).....	19	-----	Sulfate (SO <sub>4</sub> ).....	0.9	0.02
Iron (Fe).....	.15	-----	Chloride (Cl).....	480	13.54
Calcium (Ca).....	7.1	0.35	Fluoride (F).....	1.8	.09
Magnesium (Mg).....	1.3	.11	Nitrate (NO <sub>3</sub> ).....	.8	.01
Sodium (Na).....	514	22.36	Dissolved solids.....	1,350	-----
Potassium (K).....	27	.69	Total hardness as CaCO <sub>3</sub> .....	23	-----
Bicarbonate (HCO <sub>3</sub> ).....	601	9.85			

### Driller's logs

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Well 2					
Soil.....	15	15	Rock.....	5	755
Rock (caliche).....	13	28	Brown clay, hard.....	60	815
Hard sand rock and lime rock.....	42	70	Clay, hard.....	15	830
Sand.....	22	92	Rock.....	5	835
Sandy shale.....	88	180	Clay.....	10	845
Red clay.....	50	230	Gumbo.....	65	910
Sand.....	55	285	Sandy shale.....	25	935
Red clay.....	120	405	Clay.....	40	975
Broken formation.....	20	425	Shale.....	325	1,300
Clay.....	10	435	Shale and boulders.....	25	1,325
Rock.....	15	450	Tough clay.....	15	1,340
Clay and rock.....	10	460	Shale.....	25	1,365
Gumbo.....	70	530	Hard sand.....	3	1,368
Sand and clay layers.....	75	605	Sand rock.....	12	1,380
Rock.....	5	610	Hard shale.....	8	1,388
Clay.....	15	625	Sand rock.....	12	1,400
Rock.....	5	630	Shale.....	70	1,470
Gumbo.....	120	750	Sand, some layers of shale.....	69	1,539

*Driller's logs—Continued*

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
<b>Well 3</b>					
Soil.....	5	5	Fine-grained sand and clay.....	22	758
Sand and caliche.....	7	12	Brown clay.....	50	808
Caliche.....	11	23	Sandy clay, layer of rock.....	25	833
Sand and caliche.....	16	39	Gumbo.....	68	901
Caliche.....	5	44	Sandy clay.....	28	929
Sand and caliche.....	3	47	Clay.....	35	964
Hard caliche.....	107	154	Sandy shale.....	30	994
Red clay.....	24	178	Shale.....	27	1,021
Rock.....	8	186	Hard shale.....	7	1,028
Red clay and lime.....	30	216	Sandy shale.....	51	1,079
Sand.....	6	222	Hard shale.....	17	1,096
Cavity.....	5	227	Sandy shale.....	5	1,011
Sand, hard layers.....	47	274	Hard shale.....	46	1,147
Clay.....	15	289	Sandy shale.....	9	1,156
Lime rock.....	8	297	Sand.....	10	1,166
Red clay.....	6	303	Sandy shale.....	10	1,176
Lime rock.....	9	312	Shale.....	25	1,201
Brown clay.....	79	391	Sand and sandy shale.....	25	1,126
Sand.....	21	412	Hard shale.....	19	1,245
Rock.....	1	413	Sandy shale and sand.....	25	1,270
Clay.....	14	427	Hard shale.....	17	1,287
Sand.....	8	435	Sandy shale and boulders.....	25	1,312
Clay, layers of rock.....	20	455	Shale.....	14	1,326
Clay.....	78	523	Shale and lime.....	34	1,360
Sand.....	15	538	Hard shale.....	9	1,369
Clay.....	2	540	Hard sand.....	9	1,378
Sand.....	21	561	Sandy shale.....	13	1,391
Clay.....	19	580	Rock.....	1	1,392
Sand.....	9	589	Sandy shale and boulders.....	18	1,410
Clay.....	6	595	Hard sand and shale.....	25	1,435
Rock.....	2	597	Sandy shale.....	29	1,464
Clay.....	3	600	Shale.....	17	1,481
Sand.....	27	627	Good sand.....	50	1,531
Clay.....	5	633	Shale.....	4	1,539
Gumbo.....	103	736			

<b>Well 4</b>					
Soil.....	5	5	Lime.....	6	362
Sand and caliche.....	6	11	Clay and lime.....	36	398
Caliche.....	19	30	Sandy clay, layers rock.....	36	434
Sandy caliche.....	7	37	Clay and hard layers.....	90	524
Caliche and sand.....	5	42	Sand.....	24	548
Sandy caliche.....	96	138	Clay.....	4	552
Caliche and red clay.....	33	171	Sand.....	11	563
Red clay.....	25	196	Sandy clay.....	7	570
Red clay and lime.....	30	226	Clay.....	7	577
Sand.....	58	284	Sand.....	41	618
Clay and sand breaks.....	62	346	Clay.....	4	622
Clay.....	10	356			

**PETTUS**

Population in 1940: 700.

Source of information: C. R. Gordon, manager, Apr. 19, 1945.

Owner: Central Power & Light Co.

Source of supply: 2 wells.

Well 1. At standpipe; drilled in 1930 by Layne-Texas Co.; depth, 238 feet; diameter, 8¼ to 6 inches; Hi-Lift pump and 5-horsepower electric motor; standby well.

Well 2. About 50 feet south of well 1; drilled in 1944 by Layne-Texas Co.; depth, 367 feet; diameter, 8¼ to 6 inches; underreamed and gravel-walled; screen from 327 to 367 feet; deep-well submersible pump and 5-horsepower electric motor; yield, 40 gallons a minute.

Pumpage (estimated): Average, 25,000 to 30,000 gallons a day.

Storage: Standpipe, 50,000 gallons.

Number of customers: 62.

Treatment: Occasional chlorination.

*Analysis, well 2*

[Collected Apr. 18, 1945. pH is 7.2. Analyzed by J. H. Rowley]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> ).....	33	-----	Sulfate (SO <sub>4</sub> ).....	81	1.69
Iron (Fe).....	1.9	-----	Chloride (Cl).....	428	12.07
Calcium (Ca).....	182	9.08	Fluoride (F).....	.6	.03
Magnesium (Mg).....	31	2.55	Nitrate (NO <sub>3</sub> ).....	1.2	.02
Sodium (Na).....	166	7.23	Dissolved solids.....	582	-----
Potassium (K).....	23	.59	Total hardness as CaCO <sub>3</sub> .....	1,120	-----
Bicarbonate (HCO <sub>3</sub> ).....	344	5.64			

*Driller's log, well 1*

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Surface.....	10	10	Clay, hard layers.....	25	210
Hard rock.....	7	17	Sand.....	53	263
Hard caliche.....	14	31	Clay.....	48	311
Hard sand.....	4	35	Sand.....	3	314
Hard caliche.....	14	49	Gumbo.....	1	315
Soft sand.....	12	61	Sand.....	21	336
Lime rock.....	2	63	Gumbo.....	20	356
Packsand.....	9	72	Hard sand.....	14	370
Clay.....	58	130	Sand.....	3	373
Sand.....	15	145	Gumbo.....	12	385
Clay, hard layers.....	25	170	Sand.....	20	405
Sand.....	15	185	Gumbo.....	2	407

**BEXAR COUNTY**

**ALAMO HEIGHTS**

Population in 1940: 5,700.

Source of information: Paul G. Villaret, water superintendent, Nov. 16, 1945.

Ownership: Municipal.

Source of supply: 3 wells near city hall.

Well 1. Old well just northeast of city hall; depth, about 550 feet; deep-well turbine pump and 60-horsepower electric motor; yield, 450 gallons a minute.

Well 2. About 200 feet west of well 1; depth, about 550 feet; deep-well turbine pump and 40-horsepower electric motor; yield, 300 gallons a minute.

Well 3. About 300 feet northwest of well 1, drilled in 1939 by I. L. Dingham, depth, 603 feet; diameter, 13 inches; cased to 424 feet; deep-well turbine pump and 60-horsepower electric motor; yield, 450 gallons a minute.

Pumpage: Average, 395,000 gallons a day during August 1945.

Storage: Elevated tank, 100,000 gallons; concrete ground reservoir, 150,000 gallons.

Number of customers: 1,350.

Treatment: None.

*Analysis, well 1*

[Collected Nov. 16, 1945. pH is 7.7. Analyzed by J. H. Rowley]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> ).....	12	-----	Sulfate (SO <sub>4</sub> ).....	17	0.354
Iron (Fe).....	.06	-----	Chloride (Cl).....	12	.338
Calcium (Ca).....	67	3.344	Fluoride (F).....	.2	.011
Magnesium (Mg).....	16	1.316	Nitrate (NO <sub>3</sub> ).....	3.5	.056
Sodium (Na).....	3.4	.148	Dissolved solids.....	261	-----
Potassium (K).....			Total-hardness as CaCO <sub>3</sub> .....	233	-----
Bicarbonate (HCO <sub>3</sub> ).....	247	4.049			

*Driller's log, well 3*

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil.....	2	2	Hard brown Edwards lime- stone.....	5	485
Caliche.....	22	24	Soft brown Edwards lime- stone.....	25	510
Caliche and yellow clay.....	54	78	Hard brown Edwards lime- stone.....	16	526
Hard blue clay.....	12	90	Soft white lime.....	10	536
Yellow clay.....	20	110	Hard limestone.....	2	538
Gray shale.....	35	145	Soft limestone.....	11	549
Hard Taylor chalk.....	50	195	Hard limestone.....	1	550
Austin chalk, brown.....	30	225	Soft porous spongy limestone.....	2	552
Hard gray chalky shale.....	20	245	Soft lime rock.....	2	554
Hard gray chalky rock, Austin.....	42	287	Hard Edwards limestone, soft streaks.....	18	572
Eagle Ford lignite.....	22	309	Soft honeycomb lime.....	1½	572½
Buda lime.....	56	365	Hard lime rock.....	5½	578
Del Rio blue clay.....	50	415	Soft honeycomb lime.....	2	580
Del Rio yellow soft sticky clay.....	7	422	Hard Edwards limestone.....	16	596
Hard sandy yellow lime (13' O. D. Casing cemented at 424 feet).....	2	424	Soft honeycomb limestone.....	4	600
Hard tan limestone.....	16	440	Cavity.....	2	602
Hard white limestone.....	10	450	Very hard Edwards lime rock.....	1½	603½
White Edwards limestone.....	30	480			

## SAN ANTONIO

Population in 1940: 253,854.

Source of information: W. D. Masterson, water superintendent, Nov. 15, 1945.

Ownership: Municipal.

Source of supply: 38 wells.

*Austin Road (Terrell Hills).* 1 well, depth 600 feet.*North Brackenridge Park station.* 1 well; drilled in 1940; depth, 700 feet; diameter, 15 inches; deep-well turbine pump and electric motor; yield, 2,800 gallons a minute.*Brackenridge Park station.* 13 wells; depths range from 750 to about 900 feet; diameters are 15, 12, and 8 inches; wells have natural flow but are equipped with booster pumps; temperature, 76° F.*Market Street station.* 11 wells; drilled between 1894 and 1936; depths range from 880 to 936 feet; diameters are 15 and 12 inches; wells have natural flow but are equipped with booster pumps; temperature, 76° F.*Mission station.* 8 wells; drilled between 1914 and 1945; depths range from about 1,400 to 1,800 feet; diameters are 15, 12, and 10 inches; wells have natural flow but are equipped with booster pumps. Well 8, on bank of San Antonio River; drilled by Draper & Dozier in 1945; depth, 1,400 feet; diameter, 22 to 12½ inches; deep-well turbine pump and electric motor; static water level, 68 feet above land surface; yield, when pumped, 6,250 gallons a minute; temperature, 81.5° F.



*Los Angeles Heights station.* 1 well; drilled in 1941; depth 1,000 feet; diameter, 15 to 12 inches; deep-well submersible pump and electric motor; yield, 1,400 gallons a minute.

*Olmos Heights station.* 1 well; drilled in 1940; depth, 900 feet; diameter, 15 to 12 inches, deep-well turbine pump and electric motor; yield, 1,400 gallons a minute.

*West Mistletoe station.* 1 well; drilled in 1942; depth, 900 feet; diameter, 15 inches; deep-well submersible pump and electric motor; yield, 2,100 gallons a minute.

*Woodlawn Lake station.* 1 well; drilled in 1942; depth, 900 feet; diameter, 12 inches; deep-well turbine pump and electric motor; yield, 2,100 gallons a minute.

*Average pumpage, in millions of gallons a day*

[Maximum, 56,000,000 gallons a day in August 1944. Total capacity of wells is 98,000,000 gallons a day]

Month	1939	1940	1941	1942	1943	1944	1945
January.....	19.4	24.0	21.9	23.8	27.8	27.6	30.3
February.....	22.2	24.0	22.7	25.4	32.3	28.4	32.9
March.....	21.1	24.1	20.7	24.0	27.0	25.5	29.3
April.....	30.1	27.6	24.8	26.9	34.3	32.2	34.5
May.....	31.1	26.7	24.4	26.0	37.4	30.3	38.1
June.....	33.0	28.3	27.6	35.5	35.2	37.9	45.3
July.....	34.7	28.3	33.5	32.2	38.8	44.9	45.9
August.....	29.1	38.0	38.7	38.4	44.7	49.2	46.5
September.....	30.4	31.4	32.1	31.4	33.2	36.7	46.7
October.....	28.9	24.8	23.9	27.1	29.0	33.7	-----
November.....	25.7	23.0	24.5	28.5	29.9	33.1	-----
December.....	22.5	21.0	21.7	25.9	26.3	29.2	-----

Storage: 3 elevated tanks: Hildebrand Avenue tank, 1,000,000 gallons; Morning-side Avenue tank, 1,500,000 gallons; and Terrell Hills tank, 250,000 gallons. Standpipe on Dakota Street, 2,500,000 gallons.

Number of customers: 58,049.

Treatment: Chlorination at Market Street station, which is connected with the Mission station and serves the southern part of the city.

*Analyses*

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
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**Brackenridge Park station**

[Composite sample of 13 wells; collected Nov. 15, 1945. pH is 8.1 Analyzed by J. H. Rowley]

Silica (SiO <sub>2</sub> ).....	11	-----	Sulfate (SO <sub>4</sub> ).....	13	0.271
Iron (Fe).....	.46	-----	Chloride (Cl).....	12	.338
Calcium.....	65	3.244	Fluoride (F).....	0	-----
Magnesium (Mg).....	16	1.316	Nitrate (NO <sub>3</sub> ).....	3.2	.052
Sodium (Na).....	2.1	.092	Dissolved solids.....	258	-----
Potassium (K).....	1.6	.041	Total hardness as CaCO <sub>3</sub> .....	228	-----
Bicarbonate (HCO <sub>3</sub> ).....	246	4.032			

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
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**Market Street station**

[Composite of 11 wells; collected Nov. 15, 1945. pH is 8.2. Analyzed by J. H. Rowley]

Silica (SiO <sub>2</sub> ).....	12	-----	Sulfate (SO <sub>4</sub> ).....	13	0.271
Iron (Fe).....	.08	-----	Chloride (Cl).....	12	.338
Calcium (Ca).....	66	3.294	Fluoride (F).....	0	.000
Magnesium (Mg).....	15	1.234	Nitrate (NO <sub>3</sub> ).....	4.9	.079
Sodium (Na).....	2.9	.125	Dissolved solids.....	252	-----
Potassium (K).....	2.0	.051	Total hardness as CaCO <sub>3</sub> .....	226	-----
Bicarbonate (HCO <sub>3</sub> ).....	245	4.016			

**Mission station, well 8**

[Collected Nov. 15, 1945. pH is 8.0. Analyzed by J. H. Rowley]

Silica (SiO <sub>2</sub> ).....	15	-----	Sulfate (SO <sub>4</sub> ).....	35	0.73
Iron (Fe).....	.06	-----	Chloride (Cl).....	19	.54
Calcium (Ca).....	68	3.39	Fluoride (F).....	.2	.01
Magnesium (Mg).....	18	1.48	Nitrate (NO <sub>3</sub> ).....	3.2	.05
Sodium (Na).....	7.8	.34	Dissolved solids.....	295	-----
Potassium (K).....	2.0	.05	Total hardness as CaCO <sub>3</sub> .....	244	-----
Bicarbonate (HCO <sub>3</sub> ).....	240	3.93			

*Drillers' logs*

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
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**Brackenridge Park station**

Pit.....	41	41	Hard white lime.....	6	751
Blue shale and shells.....	197	238	Porous yellow lime.....	5	756
Austin chalk.....	67	305	Soft yellow lime.....	8	764
Eagle Ford lime and shells.....	220	525	Hard yellow lime.....	3	767
Lignite.....	32	557	Honeycomb, big water.....	9	776
Buda lime.....	48	605	Hard yellow lime.....	4	780
Del Rio mud.....	54	659	Honeycomb.....	3	783
Edwards lime, light-gray.....	8	667	Hard gray lime and flint.....	9	792
Soft yellow lime.....	3	670	Honeycomb.....	3	795
Gray and yellow lime.....	23	693	Hard flinty lime.....	4	799
Yellow lime, 3-inch crevices at 710 and 733 feet.....	40	733	Honeycomb.....	4	803
Porous yellow lime.....	12	745	Hard flinty lime.....	9	812
			Honeycomb.....	3	815
			Hard flinty lime.....	7	822

**Market Street station, well 1**

Alluvial soil.....	16	16	Blue clay.....	40	760
Blue clay.....	400	416	Hard limestone.....	120	880
Limestone.....	304	720			

*Driller's logs—Continued*

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
<b>Market Street station, well 15</b>					
Rotary to surface-----	6	6	Austin chalk, brown-----	32	522
Sandy soil and rock-----	10	16	Very rough white chalk-----	6	528
Yellow and blue clay-----	13	29	Dark brown chalk-----	52	580
Gravel and sand-----	4	33	Gray Austin chalk-----	52	632
Blue shale-----	91	124	Eagle Ford lignite-----	26	658
Shale and shell rocks-----	36	160	Buda lime-----	54	712
Shale-----	46	206	Del Rio-----	61	773
Rock-----	15	221	Hard limey shale-----	10	783
Hard gray shale-----	41	262	Georgetown lime-----	23	806
Very hard gray shale-----	37	299	"Doughby" Edwards-----	2	808
Rock-----	3	302	Hard brown Edwards-----	4	812
Hard gray shale-----	2	304	Hard and soft lime, brown-----	16	828
Rock-----	2	306	Cavity-----	2	830
Very hard gray shale-----	18	324	Hard and soft lime-----	38	868
Very hard rock, chalk-----	9	333	Porous or cavity-----	1	869
Hard gray shale-----	3	336	Hard lime-----	17	886
Hard rock, chalk-----	2	338	Porous or cavity-----	2	888
Broken lime and hard shale-----	15	353	Hard lime with soft streaks-----	5	893
Very hard limestone-----	8	361	Hard and soft lime with porous or honeycomb structure-----	42	935
Hard gray sticky shale-----	29	390	Exceptionally hard rock, black flint-----	1	936
Broken lime, streak of shale, Taylor-----	94	484			
Austin chalk, white-----	6	490			

**Mission station, well 8**

Gravel and clay-----	30	30	Shale-----	31	1,236
Yellow clay-----	15	45	Lime-----	21	1,257
Gravel-----	5	50	Lime-----	10	1,267
Blue clay-----	30	80	Shale and lime-----	18	1,285
Brown shale-----	700	780	Lime-----	22	1,307
Hard Taylor-----	250	1,030	Lost circulation-----	5	1,312
Austin chalk-----	175	1,205	Edwards limestone-----	78	1,400

**BROOKS COUNTY****FALFURRIAS**

Population in 1940: 2,800.

Source of information: Ted Lester, operator, Mar. 10, 1945.

Owner: Central Power & Light Co.

Source of supply: 3 wells at water and ice plant near center of city.

Well 1. Drilled in 1922 by Chester Downs; depth, 749 feet; diameter, 5 $\frac{1}{16}$  inches; 63 feet of screen at bottom; air-lift; static water level 26.2 feet below land surface on November 5, 1943; yield, 140 gallons a minute; stand-by well; temperature, 84° F.

Well 2. Drilled in 1930 by Layne-Texas Co.; depth, 755 feet; diameter, 12 to 8 inches; 61 feet of screen at bottom; deep-well turbine pump and 30-horsepower electric motor; static water level, 25.4 feet below land surface on November 5, 1943; yield, 200 gallons a minute.

Well 3. Drilled in 1945 by Layne-Texas Co.; depth, 787 feet; diameter, 10 $\frac{1}{4}$  to 5 $\frac{1}{2}$  inches; screen from 678 to 766 feet; deep-well turbine pump and 25-horsepower electric motor; static water level, 54.7 feet below land surface in March 1945; yield, 305 gallons a minute with a draw-down of 128 feet after 8 hours pumping.

*Average pumpage, in thousands of gallons a day*

	1941	1942	1943	1944	1945
January.....		126	139	160	245
February.....		140	168	182	280
March.....		135	161	208	
April.....		152	180	254	
May.....		145	218	255	
June.....		220	191	254	
July.....		142	225	283	
August.....		169	274	325	
September.....		163	218	263	
October.....	114	152	173	276	
November.....	143	175	161	258	
December.....	111	122	153	267	

Storage: Concrete ground reservoir, 50,000 gallons; elevated tank, 50,000 gallons.  
 Number of customers: 631.

Treatment: Occasional chlorination.

*Analyses*

[Collected Mar. 10, 1945. pH: Well 1, 8.1; well 2, 7.8. Analyzed by M. L. Beyley]

	Well 1		Well 2	
	Parts per million	Equivalents per million	Parts per million	Equivalents per million
Silica (SiO <sub>2</sub> ).....	23		23	
Iron (Fe).....	1.1		.08	
Calcium (Ca).....	42	2.10	40	2.00
Magnesium (Mg).....	17	1.40	17	1.40
Sodium (Na).....	161	7.02	167	7.27
Potassium (K).....	9.1	.23	9.9	.25
Bicarbonate (HCO <sub>3</sub> ).....	286	4.69	289	4.74
Sulfate (SO <sub>4</sub> ).....	42	.87	41	.85
Chloride (Cl).....	183	5.16	188	5.30
Fluoride (F).....	.6	.03	.6	.03
Nitrate (NO <sub>3</sub> ).....	0	.00	0	.00
Dissolved solids.....	619		629	
Total hardness as CaCO <sub>3</sub> .....	175		170	

*Drillers' logs*

	Well 2			Well 3	
	Thick-ness (feet)	Depth (feet)		Thick-ness (feet)	Depth (feet)
Soil.....	1	1	Soil.....	1	1
Clay.....	6	7	Clay.....	7	8
White sand.....	12	19	Sand.....	12	20
Clay.....	3	22	Clay.....	3	23
Hard caliche.....	18	40	Hard caliche.....	17	40
Clay.....	14	54	Clay and caliche.....	36	76
Soft caliche.....	15	69	Sandy clay.....	26	102
Hard dry clay.....	8	77	Caliche.....	10	112
Soft clay.....	23	100	Clay and lime.....	90	202
Hard caliche.....	9	109	Sand and clay.....	27	249
Tough clay and lime.....	21	130	Sand.....	6	255
Tough clay and lime rock.....	74	204	Sand and clay.....	65	320
Sand and soft clay.....	12	216	Hard clay.....	60	380
Clay.....	4	220	Sand and boulders.....	20	400
Sand.....	6	226	Clay and sand.....	24	424
Clay.....	5	231	Sand.....	10	434
Sand and clay.....	23	254	Hard clay.....	59	493
Soft clay.....	46	300	Brown sand.....	18	511

*Drillers' logs—Continued*

	Well 2			Well 3	
	Thick- ness (feet)	Depth (feet)		Thick- ness (feet)	Depth (feet)
Hard dry clay .....	52	352	Hard sand and lime .....	54	565
Rock .....	2	354	Lime .....	2	567
Clay .....	6	360	Sand .....	35	602
Sand and boulders .....	20	380	Sand and lime .....	5	607
Tough clay .....	23	403	Sand .....	18	625
Sand .....	9	412	Hard clay and sand .....	20	645
Gumbo .....	27	439	Hard clay .....	51	696
Sand (broken) .....	6	445	Sand .....	20	716
Gumbo .....	22	467	Borken sand .....	68	784
Tough lime .....	3	470	Clay and sand .....	3	787
Sand .....	4	474			
Hard clay .....	3	477			
Sand (fine-grained brown water sand) .....	20	497			
Hard sand and lime .....	43	540			
Tough gumbo .....	7	547			
Hard water sand .....	23	570			
Gumbo .....	4	574			
Soft water sand .....	17	591			
Gumbo .....	6	597			
Sand .....	27	624			
Tough gumbo .....	58	682			
Sand (good) .....	68	750			
Sand rock .....	1	751			
Gumbo .....	4	755			

**CALDWELL COUNTY****DALE**

Population in 1940: 200.

Source of information: A. R. Osteen, owner, Feb. 27, 1946.

Owner: A. R. Osteen.

Source of supply: Well near M. K. & T. Railway track in southeast edge of town; drilled in 1927 by A. R. Osteen; depth, 110 feet; diameter, 7 inches; cylinder pump and electric motor; static water level, 71.6 feet below land surface on Feb. 27, 1946.

Pumpage: No record.

Storage: Elevated tank, about 3,000 gallons.

Number of customers: 20.

Treatment: None.

*Analysis*

[Collected Feb. 27, 1946. pH is 7.4. Analyzed by J. H. Rowley]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> ) .....	36	-----	Sulfate (SO <sub>4</sub> ) .....	72	1.50
Iron (Fe) .....	88	-----	Chloride (Cl) .....	85	2.40
Calcium (Ca) .....	132	6.59	Fluoride (F) .....	.0	.00
Magnesium (Mg) .....	18	1.48	Nitrate (NO <sub>3</sub> ) .....	.8	.01
Sodium (Na) .....	36	1.57	Dissolved solids .....	647	-----
Potassium (K) .....	17	.43	Total hardness as CaCO <sub>3</sub> .....	404	-----
Bicarbonate (HCO <sub>3</sub> ) .....	376	6.16			

**FENTRESS**

Population in 1940: 250.

Source of information: J. C. Dauchy, gin operator, Feb. 9, 1943.

Owner: Fentress-Prairie Lea Utilities Co.

Source of supply: San Marcos River and well; water is pumped both from the river and a concrete-curbed dug well about 40 feet deep near the river bank; a low dam has been constructed below the pumping station to provide channel storage; the station is equipped with three Triplex pumps; this plant supplies Fentress, Prairie Lea, and a rural area consisting of 7,700 acres of farms.

Pumpage: No data available.

Storage: Elevated tank at Fentress, estimated 15,000 gallons; elevated tank at Prairie Lea, 15,000 gallons; elevated tank in rural area, 60,000 gallons.

Number of customers: 159.

Treatment: Chlorination.

*Analysis of well water*

[Collected Feb. 9, 1943. pH is 8.0. Analyzed by J.H. Rowley]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> ).....	15	-----	Sulfate (SO <sub>4</sub> ).....	26	0.54
Iron (Fe).....	.05	-----	Chloride (Cl).....	20	.56
Calcium (Ca).....	67	3.34	Fluoride (F).....	.6	.03
Magnesium (Mg).....	19	1.56	Nitrate (NO <sub>3</sub> ).....	10	.16
Sodium (Na).....	12	.51	Dissolved solids.....	300	-----
Potassium (K).....	3.4	.09	Total hardness as CaCO <sub>3</sub> ).....	245	-----
Bicarbonate (HCO <sub>3</sub> ).....	257	4.21			

**LOCKHART**

Population in 1940: 5,018.

Source of information: M. Lancaster, manager, Public Utilities Co., Feb. 6, 1946.

Ownership: Municipal.

Source of supply: Spring and two large open-pit wells.

Spring. At old waterworks on Brazos Street, four-tenths mile east of elevated tank; yield, 350 gallons a minute.

Well 2. One block east of water tower; depth about 20 feet; yield, 600 gallons a minute; water unused since 1943.

Well 3. 150 yards northwest of elevated tank; yield, 375 gallons a minute.

Pumpage: Maximum, 218,000; minimum, 172,000; average, 195,000 gallons a day.

Storage: Elevated tank, 300,000 gallons; ground reservoir, 430,000 gallons.

Number of customers: 1,095.

Treatment: Coagulation, sedimentation, and chlorination.

L

*Analyses*

[Collected Feb. 8, 1946. pH: spring, 7.3; well 2 and 3, 7.4. Analyzed by C. B. Cibulka]

	Spring		Well 2		Well 3	
	Parts per million	Equivalents per million	Parts per million	Equivalents per million	Parts per million	Equivalents per million
Silica (SiO <sub>2</sub> ).....	14		12		15	
Iron (Fe).....	.04		.96		.14	
Calcium (Ca).....	126	6.29	246	12.28	166	8.29
Magnesium (Mg).....	6.1	.50	15	1.23	10	.82
Sodium (Na).....	54	2.34	269	11.70	147	6.40
Potassium (K).....	12	.31	15	.38	11	.28
Bicarbonate (HCO <sub>3</sub> ).....	322	5.28	293	4.80	308	5.05
Sulfate (SO <sub>4</sub> ).....	47	.98	321	6.68	174	3.62
Chloride (Cl).....	82	2.31	465	13.11	218	6.15
Fluoride (F).....	.0	.00	.6	.03	.0	.00
Nitrate (NO <sub>3</sub> ).....	54	.87	60	.97	60	.97
Dissolved solids.....	566		1,620		979	
Total hardness as CaCO <sub>3</sub> .....	340		676		456	

**LULING**

Population in 1940: 4,437.

Source of information: A. O. Krauskoff, water superintendent, Feb. 7, 1946.

Ownership: Municipal.

Source of supply: 2 wells about 300 feet apart, at the Central Power &amp; Light Co. plant, between Davis and Fannin Streets.

Well 1. Depth, 320 feet; diameter, 16 to 8 inches; deep-well turbine pump and 30-horsepower electric motor; pump set at 125 feet; yield, 460 gallons a minute.

Well 2. Depth, 304 feet; diameter, 16 to 8 inches; deep-well turbine pump and 25-horsepower electric motor; pump set at 168 feet; yield, 300 gallons a minute.

Pumpage (estimated): Average, 185,000 gallons a day; summer, 325,000 gallons a day.

Storage: 2 standpipes, 188,000 and 84,600 gallons; ground reservoir, 50,000 gallons.

Number of customers: 1,181.

Treatment: None.

*Analyses*

[Collected Feb. 9, 1943. pH for each well is 8.4. Analyzed by J. H. Rowley]

	Well 1		Well 2	
	Parts per million	Equivalents per million	Parts per million	Equivalents per million
Silica (SiO <sub>2</sub> ).....	6.0		8.0	
Iron (Fe).....	.02		.09	
Calcium (Ca).....	2.7	0.13	2.0	0.10
Magnesium (Mg).....	1.7	.14	1.4	.12
Sodium (Na).....	419	18.20	416	18.09
Potassium (K).....	5.0	.13	5.2	.13
Bicarbonate (HCO <sub>3</sub> ).....	628	10.28	545	8.92
Sulfate (SO <sub>4</sub> ).....	178	3.71	227	4.73
Chloride (Cl).....	163	4.60	170	4.79
Fluoride (F).....	.2	.01	.0	.00
Nitrate (NO <sub>3</sub> ).....	.0	.00	.0	.00
Dissolved solids.....	1,085		1,098	
Total hardness as CaCO <sub>3</sub> .....	14		11	

*Drillers' logs*

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
<b>Well 1</b>					
Gravel.....	20	20	Sand rock.....	3	176
Sand.....	20	40	Rock.....	4	180
Sand rock.....	1	41	Sand.....	26	206
Blue shale.....	38	79	Rock.....	2	208
Rock.....	2	81	Sand.....	6	214
Mud and sand.....	11	92	Rock.....	2	216
Lignite.....	15	107	Sand.....	58	274
Hard shale.....	33	140	Rock.....	2	276
Soft shale.....	12	152	Sand.....	4	280
Fine-grained sand.....	15	167	Rock.....	2	282
Shale.....	6	173	Sand.....	38	320
<b>Well 2</b>					
Clay and boulders.....	48	48	Sand.....	11	187
Clay and sand.....	63	111	Gumbo.....	4	191
Rock.....	5	116	Sand.....	42	233
Sand.....	5	121	Gumbo.....	3	236
Rock gumbo.....	4	125	Sand.....	10	246
Sand.....	20	145	Gumbo.....	5	251
Gumbo.....	20	165	Sand.....	27	278
Sand.....	7	172	Sand and boulders.....	22	299
Gumbo.....	4	176	Lignite.....	4	304

**LYTTON SPRINGS**

Population in 1940: 200.

Source of information: D. R. Strawn, operator, Feb. 27, 1946.

Owners: Lytton Springs Park Association. Lytton Springs Gin Co.

Source of supply: Large pit in creek channel and well.

System a. Pit in creek channel owned by Lytton Springs Park Association; dug by L. Glasscock; depth, 18 feet; diameter, 16 feet; piston-type pump and gasoline engine; static water level, 16.9 feet below land surface on February 27, 1946; temperature, 58½° F.

System b. Well owned by Lytton Springs Gin Co.; dug by Mr. Crosswaite; depth, 49 feet; diameter, 17½ feet; jet-type pump and 1½-horsepower electric motor; static water level, 4.74 feet below land surface on Feb. 27, 1946; yield, 12 gallons a minute; temperature, 63° F.

Pumpage: No record.

Storage: Steel ground tank, 20,000 gallons.

Number of customers: 25.

Treatment: None.

*Analysis of well water*

[Collected Feb. 27, 1946. pH is 7.2. Analyzed by J. H. Rowley]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> ).....	35	-----	Sulfate (SO <sub>4</sub> ).....	20	0.416
Iron (Fe).....	1.7	-----	Chloride (Cl).....	51	1.438
Calcium (Ca).....	46	2.296	Fluoride (F).....	.2	.011
Magnesium (Mg).....	6.7	.551	Nitrate (NO <sub>3</sub> ).....	9.8	.158
Sodium (Na).....	36	1.566	Dissolved solids.....	298	-----
Potassium (K).....	4.6	.118	Total hardness as CaCO <sub>3</sub> .....	142	-----
Bicarbonate (HCO <sub>3</sub> ).....	153	2.508			



## MARTINDALE

Population in 1940: 500.

Source of information: Gin operator, Feb. 9, 1943.

Owner: A. H. Smith Gin Co.

Source of supply: Dug well; depth, 27 feet; diameter, 60 inches; 2 Triplen 5-inch pumps.

Pumpage: No data available.

Storage: Elevated tank, 20,000 gallons.

Number of customers: 90.

Treatment: None.

## Analysis

[Collected Feb. 9, 1943. pH is 7.6. Analyzed by J. H. Rowley.]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> ).....	14		Sulfate (SO <sub>4</sub> ).....	19	0.40
Iron (Fe).....	.08		Chloride (Cl).....	21	.59
Calcium (Ca).....	90	4.49	Fluorine (F).....	.2	.01
Magnesium (Mg).....	23	1.89	Nitrate (NO <sub>3</sub> ).....	57	.92
Sodium (Na).....	18	.78	Dissolved solids.....	406	
Potassium (K).....	3.4	.09	Total hardness as CaCO <sub>3</sub> .....	319	
Bicarbonate (HCO <sub>3</sub> ).....	325	5.33			

## MAXWELL

Population in 1940: 250.

Source of information: B. E. Scheele and A. R. Hoffman, Feb. 14, 1946.

Owners: Upper Terrace Waterworks, Schawe Gin Co., Lower Terrace Waterworks, A. R. Hoffman and O. M. Hoffman.

Source of supply: 2 dug wells.

Upper Terrace Waterworks. Dug well 1¼ miles north of Maxwell; dug in 1916; depth, 20 feet; diameter, 148 to 60 inches; brick walls; piston-type pump and Diesel engine; static water level, 12.1 feet below land surface on Feb. 14, 1946; yield, 400 gallons a minute.

Lower Terrace Waterworks. Dug well 2 miles southwest of Maxwell; dug in 1925; depth, 25 feet; diameter, 69 inches; brick and concrete walls; piston-type pump and 10-horsepower electric motor; static water level, 8.2 feet below land surface on Feb. 14, 1946; reported yield, about 400 gallons a minute with draw-down of 1.5 feet after pumping 24 hours.

Pumpage (estimated): Upper Terrace Waterworks, about 10,000 gallons a day in winter and 30,000 gallons a day in summer; Lower Terrace Waterworks, average about 15,000 gallons a day.

Storage: Upper Terrace Waterworks, concrete ground reservoir, 100,000 gallons; Lower Terrace Waterworks, elevated wooden tank, 20,000 gallons. (Water systems have separate distribution lines).

Number of customers: Upper Terrace, 18; Lower Terrace, 24.

Treatment: None.

*Analysis*

[Collected Feb. 14, 1946. pH of Lower Terrace Waterworks, 7.2. Analyzed by C. B. Cibulka]

	Upper Terrace Waterworks		Lower Terrace Waterworks	
	Parts per million	Equivalents per million	Parts per million	Equivalents per million
Silica (SiO <sub>2</sub> ).....			14	
Iron (Fe).....			.06	
Calcium (Ca).....	122	6.09	244	12.18
Magnesium (Mg).....	5.1	.42	28	2.30
Sodium (Na).....	38	1.64	155	6.75
Potassium (K).....			22	.56
Bicarbonate (HCO <sub>3</sub> ).....	268	4.39	265	4.34
Sulfate (SO <sub>4</sub> ).....	40	.83	183	3.81
Chloride.....	81	2.28	426	12.01
Fluoride (F).....			.6	.03
Nitrate (NO <sub>3</sub> ).....	40	.65	99	1.60
Dissolved solids.....	513		1,300	
Total hardness as CaCO <sub>3</sub> .....	326		724	

**McMAHAN**

Population in 1940: 250.

Source of information: J. Chamberlin, owner, Mar. 1, 1946.

Owner: J. Chamberlin.

Source of supply: Well located 100 yards north of cotton gin; drilled in 1929 by Mr. Dannelly, depth, 231 feet; diameter, 5 inches; jet-type pump and 1½-horsepower electric motor; static water level, 48 feet below land surface in November 1945; yield, 10 gallons a minute with pumping level at 64.8 feet below land surface on Mar. 1, 1946; temperature, 73° F.

Pumpage: No record.

Storage: Elevated wooden tank, 2,700 gallons.

Number of customers: 15.

Treatment: None.

*Analyses*

[Collected Mar. 18, 1946. pH is 7.5. Analyzed by J. H. Rowley.]

	Parts per million	Equivalents per million		Parts per million	Equivalents per million
Silica (SiO <sub>2</sub> ).....	22		Sulfate (SO <sub>4</sub> ).....	96	2.00
Iron (Fe).....	.19		Chloride (Cl).....	229	6.46
Calcium (Ca).....	96	4.79	Fluoride (F).....	.6	.03
Magnesium (Mg).....	59	4.85	Nitrate (NO <sub>3</sub> ).....	22	.35
Sodium (Na).....	134	5.84	Dissolved solids.....	946	
Potassium (K).....	16	.41	Total hardness as CaCO <sub>3</sub> .....	482	
Bicarbonate (HCO <sub>3</sub> ).....	430	7.05			

**UHLAND**

Population in 1940: 100.

Source of information: A. F. Garbrecht, owner, Feb. 8, 1946.

Owner: A. F. Garbrecht.

Source of supply: Spring 2½ miles west of Uhland in Hays County; rock walls and concrete cover; 4 miles of 2-inch pipe from spring to Uhland; gravity flow.

Flow: No record.

Storage: None.

Number of customers: 5.

Treatment: None.

*Analysis*

[Collected Feb. 8, 1946. pH is 7.3. Analyzed by C. B. Cibulka]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> ).....	14	-----	Sulfate (SO <sub>4</sub> ).....	24	0.50
Iron (Fe).....	.03	-----	Chloride (Cl).....	21	.59
Calcium (Ca).....	114	5.69	Fluoride (F).....	.6	.03
Magnesium (Mg).....	5.9	.49	Nitrate (NO <sub>3</sub> ).....	57	.92
Sodium (Na).....	9.7	.42	Dissolved solids.....	392	-----
Potassium (K).....	5.0	.13	Total hardness as CaCO <sub>3</sub> .....	309	-----
Bicarbonate (HCO <sub>3</sub> ).....	286	4.69			

**CALHOUN COUNTY****PORT LAVACA**

Population in 1940: 2,069.

Source of information: T. S. Upchurch, water superintendent, July 1945.

Ownership: Municipal.

Source of supply: 3 wells about 3¼ miles northwest of town.

Well 1. Drilled in 1935 by Layne-Texas Co.; depth, 240 feet; diameter, 8 inches; deep-well turbine pump and 5-horsepower electric motor; static water level, 14 feet below land surface on January 5, 1940; yield, 135 gallons a minute with draw-down of 30 feet.

Well 2. About 200 feet southeast of well 1; drilled in 1935 by Layne-Texas Co.; depth, 240 feet; diameter, 8 inches; deep-well turbine pump and 5-horsepower electric motor; yield, 135 gallons a minute.

Well 3. About 500 feet northeast of well 1; drilled in 1942 by Layne-Texas Co.; depth, 242 feet; deep-well turbine pump and 10-horsepower electric motor; yield, 300 gallons a minute.

*Average pumpage, in gallons a day, 1945*

January.....	160,000	April.....	180,700
February.....	175,000	May.....	191,300
March.....	183,200	June.....	189,000

Storage: Elevated tank, 75,000 gallons; 2 ground reservoirs, 50,000 gallons each.

Number of customers: 604.

Treatment: Chlorination.

*Analysis, well 3*

[Collected July 1945. pH is 7.40. Analyzed by J. H. Rowley]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> ).....	17	-----	Sulfate (SO <sub>4</sub> ).....	16	0.33
Iron (Fe).....	.05	-----	Chloride (Cl).....	195	5.50
Calcium (Ca).....	40	2.00	Fluoride (F).....	1.0	.05
Magnesium (Mg).....	14	1.15	Nitrate (NO <sub>3</sub> ).....	0	.00
Sodium (Na).....	234	10.17	Dissolved solids.....	768	-----
Potassium (K).....	7.7	.20	Total hardness as CaCO <sub>3</sub> .....	158	-----
Bicarbonate (HCO <sub>3</sub> ).....	466	7.64			

**SEADRIFT**

Population in 1940: 437.

Source of information: J. L. Wilson, water superintendent, July 1945.

Ownership: Municipal.

Source of supply: Well 3 miles southeast of town; drilled in 1939; depth, 86 feet; diameter, 6 inches; deep-well turbine pump and 3-horsepower electric motor; yield about 70 gallons a minute.

Pumpage (estimated): 2,500 gallons a day.

Storage: Elevated tank, 50,000 gallons.

Number of customers: 129.

Treatment: Aeration and chlorination.

*Analysis, well 1*

[Collected July 1945. pH is 7.5. Analyzed by J. H. Rowley]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> )	19		Sulfate (SO <sub>4</sub> )	26	0.54
Iron (Fe)	.08		Chloride (Cl)	134	3.78
Calcium (Ca)	39	1.95	Fluoride (F)	1.4	.07
Magnesium (Mg)	19	1.56	Nitrate (NO <sub>3</sub> )	1.2	.02
Sodium (Na)	134	5.84	Dissolved solids	536	
Potassium (K)	6.6	.17	Total hardness as CaCO <sub>3</sub>	176	
Bicarbonate (HCO <sub>3</sub> )	312	5.11			

**CAMERON COUNTY****BROWNSVILLE**

Population in 1940: 22,083.

Source of information: R. G. Hall, Aug. 3, 1945.

Ownership: Municipal.

Source of supply: Rio Grande.

Pumpage: Maximum 4,300,000 gallons; average, 2,500,000 gallons a day.

Storage: Ground reservoirs 8,000,000 gallons; no elevated tank, operates on high-pressure system with 85 to 90 pounds.

Treatment: Coagulation, sedimentation, rapid sand filtration, prechlorination and postchlorination.

*Analysis, finished water*

[Collected Aug. 3, 1945. pH is 7.8. Analyzed by C. B. Cibulka]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> )	11		Sulfate (SO <sub>4</sub> )	220	4.58
Iron (Fe)	.06		Chloride (Cl)	114	3.22
Calcium (Ca)	87	4.34	Fluoride (F)	.6	.03
Magnesium (Mg)	17	1.40	Nitrate (NO <sub>3</sub> )	3.2	.05
Sodium (Na)	91	3.96	Dissolved solids	634	
Potassium (K)	11	.28	Total hardness as CaCO <sub>3</sub>	287	
Bicarbonate (HCO <sub>3</sub> )	128	2.10			

## COMBES

Population in 1940: 300.

Source of information: C. P. Morgan, pumper, June 13, 1945.

Owner: Mrs. Doris Templeton.

Source of supply: 5 wells at southeast corner of town near irrigation canal; depth, 32 feet; diameter, 7 inches; 3 wells connected to piston suction pump with 5-horsepower electric motor and 2 wells equipped with windmills; static water level, 8.5 feet below land surface on June 13, 1945; combined yield about 30 gallons a minute; temperature, 75° F.

Pumpage (estimated): Maximum 30,000 gallons a day.

Storage: Steel pressure tank, 10,000 gallons; concrete ground reservoir, 30,000 gallons.

Number of customers: 100.

Treatment: None.

*Analysis of composite sample*

[Collected June 13, 1945. pH is 7.2. Analyzed by J. H. Rowley]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> ).....	32	-----	Sulfate (SO <sub>4</sub> ).....	356	7.41
Iron (Fe).....	.11	-----	Chloride (Cl).....	308	8.69
Calcium (Ca).....	114	5.69	Fluoride (F).....	1.0	.05
Magnesium (Mg).....	37	3.04	Nitrate (NO <sub>3</sub> ).....	5.4	.09
Sodium (Na).....	325	14.13	Dissolved solids.....	1,390	-----
Potassium (K).....	8.8	.23	Total hardness as CaCO <sub>3</sub> .....	436	-----
Bicarbonate (HCO <sub>3</sub> ).....	418	6.85			

## HARLINGEN

Population in 1940: 13,306.

Source of information: E. C. Bennett, manager, Central Power & Light Co., June 28, 1945.

Owner: Central Power & Light Co.

Source of supply: Canal from Rio Grande.

*Average pumpage, in gallons a day*

[Maximum 2,800,000 gallons a day]

	1942	1943	1944	1945
January.....	678,000	1,068,000	1,210,000	1,594,000
February.....	982,000	1,450,000	1,534,000	1,796,000
March.....	866,000	1,200,000	1,400,000	1,776,000
April.....	1,092,000	1,550,000	1,752,000	2,200,000
May.....	1,016,000	1,742,000	1,688,000	2,128,000
June.....	1,322,000	1,365,000	1,657,000	2,282,000
July.....	856,000	1,563,000	1,500,000	-----
August.....	1,155,000	2,050,000	1,752,000	-----
September.....	1,355,000	1,430,000	1,579,000	-----
October.....	1,244,000	1,085,000	1,376,000	-----
November.....	1,185,000	1,298,000	1,564,000	-----
December.....	1,265,000	1,172,000	-----	-----

Storage: Elevated tank, 150,000 gallons; impounding reservoir, 55,000,000 gallons.

Number of customers: 3,026.

Treatment: Aeration, coagulation, sedimentation, rapid sand filtration, pre-chlorination and postchlorination.

*Analysis of finished water*

[Collected Aug. 6, 1945. pH is 7.7. Analyzed by J. H. Rowley]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> ).....	12	-----	Sulfate (SO <sub>4</sub> ).....	198	4.12
Iron (Fe).....	.19	-----	Chloride (Cl).....	114	3.22
Calcium (Ca).....	92	4.59	Fluoride (F).....	1.8	.09
Magnesium (Mg).....	16	1.32	Nitrate (NO <sub>3</sub> ).....	3.0	.05
Sodium (Na).....	84	3.67	Dissolved solids.....	660	-----
Potassium (K).....	7.5	.19	Hardness as CaCO <sub>3</sub> .....	196	-----
Bicarbonate (HCO <sub>3</sub> ).....	140	2.29			

**LA FERIA**

Population in 1940: 1,614.

Source of information: O. O. Butcher, city secretary; H. T. Anderson, water superintendent, June 9, 1945.

Ownership: Municipal.

Source of supply: Well at concrete tank and city hall, drilled in 1929 by Layne-Texas Co.; depth, 216 feet; diameter, 16 to 8 inches; screens at 115-156 and 182-213 feet; deep-well turbine pump and 10-horsepower electric motor; static water level, 7 feet below land surface in December 1929 and 9.2 feet after pump had been shut down 20 minutes on June 9, 1945; yield, 380 gallons a minute with a draw-down of 21 feet; temperature, 78° F.

Pumpage (estimated): Average, 50,000 gallons a day.

Storage: Concrete ground reservoir, 45,000 gallons.

Number of customers: 310.

Treatment: None.

*Analysis*

[Collected June 9, 1945. pH is 7.4. Analyzed by J. H. Rowley]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> ).....	35	-----	Sulfate (SO <sub>4</sub> ).....	460	9.58
Iron (Fe).....	2.1	-----	Chloride (Cl).....	420	11.85
Calcium (Ca).....	96	4.79	Fluoride (F).....	1.2	.06
Magnesium (Mg).....	48	3.95	Nitrate (NO <sub>3</sub> ).....	6.1	.10
Sodium (Na).....	462	20.06	Dissolved solids.....	1,780	-----
Potassium (K).....	16	.41	Total hardness as CaCO <sub>3</sub> .....	437	-----
Bicarbonate (HCO <sub>3</sub> ).....	465	7.62			

*Driller's log*

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil.....	2	2	Sand.....	43	159
Clay.....	30	32	Sand rock.....	2	161
Sand.....	22	54	Clay.....	6	167
Tough clay.....	22	76	Sand and boulders.....	15	182
Sand.....	37	113	Rock.....	1	183
Clay.....	3	116	Clay.....	3	186

**LOS FRESNOS**

Population in 1940: 475.

Source of information: Hall Palmer, water superintendent, July 11, 1945.

Ownership: Municipal.

Source of supply: Canal from Rio Grande.

Pumpage: Average, 20,000 gallons a day.

Storage: Elevated tank, 25,000 gallons; ground reservoir, 45,000 gallons.

Number of customers: 125.

Treatment: Chlorination.

*Analysis of finished water*

[Collected Aug. 6, 1945. pH is 7.7. Analyzed by J. H. Rowley]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> )	12	-----	Sulfate (SO <sub>4</sub> )	198	4.12
Iron (Fe)	.19	-----	Chloride (Cl)	114	3.22
Calcium (Ca)	92	4.59	Fluoride (F)	1.8	.09
Magnesium (Mg)	16	1.32	Nitrate (NO <sub>3</sub> )	3.0	.05
Sodium (Na)	84	3.67	Dissolved solids	660	-----
Potassium (K)	7.5	.19	Total hardness as CaCO <sub>3</sub>	296	-----
Bicarbonate (HCO <sub>3</sub> )	140	2.29			

**PORT ISABEL**

Population in 1940: 1,440.

Source of information: B. B. Burnell, mayor, July 1945.

Ownership: Municipal.

Source of supply: Rio Grande.

Pumpage: No record.

Storage: Elevated tank, 50,000 gallons; impounding reservoirs, 12,000,000 gallons.

Number of customers: 400.

Treatment: Coagulation, sedimentation, rapid sand filtration, and chlorination.

*Analysis of finished water*

[Collected Aug. 6, 1945. pH is 7.7. Analyzed by J. H. Rowley]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> )	12	-----	Sulfate (SO <sub>4</sub> )	198	4.12
Iron (Fe)	.19	-----	Chloride (Cl)	114	3.22
Calcium (Ca)	92	4.59	Fluoride (F)	1.8	.09
Magnesium (Mg)	16	1.32	Nitrate (NO <sub>3</sub> )	3.0	.05
Sodium (Na)	84	3.67	Dissolved solids	660	-----
Potassium (K)	7.5	.19	Total hardness as CaCO <sub>3</sub>	296	-----
Bicarbonate (HCO <sub>3</sub> )	140	2.29			

**RIO HONDO**

Population in 1940: 804.

Source of information: H. E. Mallornee, city secretary, June 30, 1945.

Ownership: Municipal.

Source of supply: Canal from Rio Grande.

Pumpage: Maximum, 50,000 gallons; average, 30,000 gallons a day.

Storage: Elevated tank, 50,000 gallons.

Number of customers: 145.

Treatment: Chlorination.

*Analysis*

[Collected June 30, 1945. pH not determined. Analyzed by C. B. Cibulka]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> ).....			Sulfate (SO <sub>4</sub> ).....	238	4.96
Iron (Fe).....			Chloride (Cl).....	215	6.06
Calcium (Ca).....	82	4.09	Fluoride (F).....		
Magnesium (Mg).....	32	2.63	Nitrate (NO <sub>3</sub> ).....	.2	.00
Sodium (Na).....			Dissolved solids.....	877	
Potassium (K).....	153	6.64	Total hardness as CaCO <sub>3</sub> .....	336	
Bicarbonate (HCO <sub>3</sub> ).....	143	2.34			

**SAN BENITO**

Population in 1940: 9,501.

Source of information: S. C. Clark, Central Power and Light Co., July 12, 1945.

Owner: Central Power and Light Co.

Source of supply: Resaca de los Fresnos and canal from Rio Grande.

*Average pumpage, in gallons a day*

	1944	1945		1944	1945
January.....	488,000	551,000	July.....	465,000	
February.....	509,000	635,000	August.....	487,000	
March.....	570,000	590,000	September.....	397,000	
April.....	621,000	585,000	October.....	400,000	
May.....	520,000	648,000	November.....	400,000	
June.....	492,000	575,000	December.....	485,000	

Storage: Elevated tank, 150,000 gallons; clear well, 165,000 gallons.

Number of customers: 1,686.

Treatment: Aeration, coagulation, sedimentation, rapid sand filtration, pre-chlorination and postchlorination.

*Analysis of finished water*

[Collected Aug. 6, 1945. pH is 7.7. Analyzed by J. H. Rowley]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> ).....	12		Sulfate (SO <sub>4</sub> ).....	198	4.12
Iron (Fe).....	19		Chloride (Cl).....	114	3.22
Calcium (Ca).....	92	4.59	Fluoride (F).....	1.8	.09
Magnesium (Mg).....	16	1.32	Nitrate (NO <sub>3</sub> ).....	3.0	.05
Sodium (Na).....	84	3.67	Dissolved solids.....	660	
Potassium (K).....	7.5	.19	Total hardness as CaCO <sub>3</sub> .....	296	
Bicarbonate (HCO <sub>3</sub> ).....	140	2.29			

**COMAL COUNTY****NEW BRAUNFELS**

Population in 1940: 6,976.

Source of information: C. H. Wimberly, water superintendent, Dec. 4, 1943.

Ownership: Municipal.

Source of supply: 2 wells.

Well 1. Drilled in 1941; depth, 116 feet; diameter, 12 inches; centrifugal pump and electric motor; yield, 2,300 gallons a minute with draw-down of 7 feet after 12 hours pumping.



Well 2. About 30 feet north of well 1; drilled in 1941; depth, 102 feet; diameter, 8 inches; centrifugal pump and electric motor; yield, 1,200 gallons a minute.

*Average pumpage, gallons a day*

	1942	1943		1942	1943
January.....	810,000	851,000	July.....	1,253,000	1,677,000
February.....	830,000	1,100,000	August.....	1,230,000	1,850,000
March.....	940,000	1,068,000	September.....	1,300,000	
April.....	990,000	1,426,000	October.....	850,000	
May.....	890,000	1,630,000	November.....	1,068,000	
June.....	1,457,000	1,254,000	December.....	916,000	

Storage: 2 standpipes, 1,000,000 gallons and 370,000 gallons.

Number of customers: 2,200.

Treatment: None.

*Analyses*

[Collected Dec. 4, 1943. pH: well 1 is 7.2; well 2 is 7.1. Analyzed by J. H. Rowley]

	Well 1		Well 2	
	Parts per million	Equivalents per million	Parts per million	Equivalents per million
Silica (SiO <sub>2</sub> ).....	11		11	
Iron (Fe).....	.08		.02	
Calcium (Ca).....	73	3.64	73	3.64
Magnesium (Mg).....	17	1.40	17	1.40
Sodium (Na).....	5.1	.22	3.9	.17
Potassium (K).....	1.6	.04	1.6	.04
Bicarbonate (HCO <sub>3</sub> ).....	263	4.31	261	4.28
Sulfate (SO <sub>4</sub> ).....	24	.50	24	.50
Chloride (Cl).....	14	.39	13	.37
Fluoride (F).....	.2	.01	.2	.01
Nitrate (NO <sub>3</sub> ).....	5.8	.09	5.5	.09
Dissolved solids.....	281		283	
Total hardness as CaCO <sub>3</sub> .....	252		252	

*Driller's log, well 1*

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil and red clay.....	9	9	Limestone (Georgetown).....	30	58
Gravel.....	6	15	Limestone (Edwards).....	58	116
Hard gravel.....	13	28			

**DE WITT COUNTY**

**CUERO**

Population in 1940: 5,474.

Source of information: J. M. Johnson, water superintendent, Dec. 22, 1944.

Ownership: Municipal.

Source of supply: 6 wells.

Well 1. Northeast well of four at pump station; drilled in 1911; depth, 735 feet; diameter, 6 inches; flows about 75 gallons a minute; deep-well turbine pump and 10-horsepower electric motor; pump set at 50 feet; yield, 400 gallons a minute; temperature, 82° F.

Well 2. Southeast well of four at pump station; drilled in 1911; depth, 820 feet; diameter, 6 inches; flows about 75 gallons a minute; no pump; temperature, 84° F.

Well 3. Northwest well of four at pump station; drilled in 1915; depth, 1,190 feet; diameter, 6 inches; flows about 90 gallons a minute; no pump; temperature, 88½° F.

Well 4. Southwest well of four at pump station; drilled in 1918 by G. C. Witte; depth, 1,160 feet; diameter, 8 inches; flows about 200 gallons a minute; no pump; temperature, 90° F.

Well 5. On west Morgan Avenue about 300 feet southwest of pump station, drilled by Layne-Texas Co.; depth, 1,173 feet; diameter, 12 to 6 inches; screens at 1,072 to 1,134, and 1,149 to 1,170 feet; flows about 325 gallons a minute; deep-well turbine pump and 12½-horsepower electric motor; pump set at 65 feet; yield about 750 gallons a minute; temperature, 90° F.

Well 6. Near intersection of French and Hunt Streets about 3,000 feet northeast of pump station; drilled in 1943 by Layne-Texas Co.; depth, 1,207 feet; diameter, 12¼ to 6¾ inches; screens at 1,081 to 1,141 and 1,146 to 1,203 feet; flows about 325 gallons a minute; water level 19 feet above land surface when completed; deep-well turbine pump and 15-horsepower electric motor; pump set at 90 feet; draw-down, 56½ feet while pumping 800 gallons a minute; present yield about 750 gallons a minute; temperature, 91° F.

Pumpage (estimated): Maximum, 1,250,000; minimum, 750,000 gallons a day.

Storage: Ground reservoir, 175,000 gallons; elevated tank, 150,000 gallons.

Treatment: None.

### Analyses

[Collected Sept. 14, 1939. pH: wells 1, 3, 5, each 8.4; wells 2, 4 each 8.2; well 6, 7.8. Wells 1-5 analyzed by State health department; well 6, by J. H. Rowley]

	Well 1		Well 2		Well 3	
	Parts per million	Equivalents per million	Parts per million	Equivalents per million	Parts per million	Equivalents per million
Silica (SiO <sub>2</sub> )	15		13		18	
Iron (Fe)	.06		.05		.17	
Calcium (Ca)	9	0.45	8	0.40	10	0.50
Magnesium (Mg)	8	.66	6	.49	5	.41
Sodium (Na)	236	10.26	252	10.96	323	14.05
Potassium (K)						
Bicarbonate (HCO <sub>3</sub> )	393	6.44	433	7.10	470	7.70
Sulfate (SO <sub>4</sub> )	44	.92	43	.90	34	.71
Chloride (Cl)	144	4.06	137	3.86	231	6.51
Fluoride (F)	.6	.03	1.4	.07	.08	.04
Nitrate (NO <sub>3</sub> )						
Dissolved solids	643		673		846	
Total hardness as CaCO <sub>3</sub>	56		44		46	

	Well 4		Well 5		Well 6	
	Parts per million	Equivalents per million	Parts per million	Equivalents per million	Parts per million	Equivalents per million
Silica (SiO <sub>2</sub> )	20		20		25	
Iron (Fe)	.1		.05		.26	
Calcium (Ca)	9	0.45	8	0.40	8.8	0.44
Magnesium (Mg)	5	.41	3	.25	1.4	.12
Sodium (Na)	377	16.39	339	14.74	408	17.73
Potassium (K)						
Bicarbonate (HCO <sub>3</sub> )	539	8.83	488	8.00	565	9.26
Sulfate (SO <sub>4</sub> )	11	.23	42	0.87	1.1	0.02
Chloride (Cl)	291	8.21	231	6.51	334	9.42
Fluoride (F)	.6	.03	.6	.03	.4	.02
Nitrate (NO <sub>3</sub> )					.2	.00
Dissolved solids	966		875		1,070	
Total hardness as CaCO <sub>3</sub>	43		32		28	

*Drillers' logs*

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
<b>Well 3</b>					
Surface materials.....	32	32	Gumbo and thin rock.....	19	584
Gravel.....	8	40	Gumbo.....	87	671
Clay.....	2	42	Sand and rock.....	15	686
Clay and sand.....	68	110	Blue water sand.....	44	730
Rock and sand.....	90	200	Gumbo.....	60	790
Sand.....	26	226	Red and blue clay.....	46	836
Clay.....	10	236	Water sand and rock.....	35	871
Sand.....	4	240	White and blue clay.....	144	1,015
Shell rock and sand.....	8	248	Water sand.....	40	1,055
Sand rock and white lime.....	152	400	Red clay.....	6	1,061
Clay and sand.....	40	440	Water sand.....	6	1,067
Rock and clay.....	99	539	Red, white and blue clay.....	33	1,100
Clay.....	11	550	Water sand and thin rock.....	65	1,165
Clay and rock.....	15	565			
<b>Well 4</b>					
Surface soil and lime.....	32	32	Gumbo.....	75	550
Gravel, sand and water.....	8	40	Sand.....	15	565
Red clay.....	2	42	Gumbo.....	19	584
Sand.....	8	50	Rock.....	6	590
Clay.....	60	110	Gumbo.....	81	671
Sand and sand rock.....	110	220	Sand rock.....	15	686
Sand.....	6	226	Water sand (flow).....	44	730
Sand rock.....	10	236	Gumbo.....	106	836
Blue shale.....	8	240	Water sand (flow).....	35	871
Sand rock.....	52	300	Gumbo.....	144	1,015
Gumbo.....	60	360	Water sand (flow).....	40	1,055
Sand and lime.....	40	400	Gumbo.....	19	1,074
Gumbo.....	40	440	Dark-colored sand.....	6	1,080
Sand rock.....	35	475	Gumbo.....	22	1,102
			Water sand (flow).....	58	1,160
<b>Well 5</b>					
Surface sand.....	10	10	Loose sand.....	25	800
Gravel and boulders.....	10	20	Shale.....	6	806
Sand, in hard layers.....	43	63	Loose sand.....	22	828
Clay, in hard layers.....	34	97	Shale.....	17	845
Clay.....	20	117	Gumbo.....	55	900
Sand with hard layers.....	28	145	Tough shale.....	55	955
Clay.....	31	176	Gumbo.....	47	1,002
Sandy clay.....	40	216	Loose sand.....	21	1,023
Shale and rock.....	43	259	Gumbo.....	23	1,046
Rock and shale.....	10	269	Sand and sandy shale.....	6	1,052
Sand, in hard layers.....	30	299	Gumbo.....	19	1,071
Hard sandy shale.....	124	423	Hard sand.....	8	1,079
Tough shale.....	12	435	Loose sand.....	43	1,122
Hard sand.....	10	445	Sand.....	13	1,135
Sandy shale.....	53	498	Hard sand.....	5	1,140
Hard shale.....	17	515	Soft shale.....	6	1,146
Packed sand.....	20	535	Sand and gravel.....	27	1,173
Gumbo.....	63	598	Sandy shale.....	79	1,252
Hard shale.....	59	657	Gumbo.....	5	1,257
Loose sand.....	15	672	Shale.....	82	1,339
Hard sand.....	5	677	Sand, in hard layers.....	21	1,360
Loose sand.....	6	683	Shale.....	14	1,374
Hard sand.....	16	699	Sand.....	6	1,380
Shale.....	14	713	Shale.....	117	1,497
Sand.....	37	750	Sand.....	10	1,507
Soft shale.....	25	775	Shale.....	19	1,526

*Drillers' logs—Continued*

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
<b>Well 6</b>					
Soil and clay.....	8	8	Shale.....	31	746
Sand and gravel.....	17	25	Soft shale.....	11	757
Sand and boulders.....	25	50	Shale.....	27	784
Sandy clay and boulders.....	22	72	Sandy shale.....	10	794
Boulders.....	7	79	Sand, broken.....	52	846
Sand.....	8	87	Shale.....	24	870
Sand, lime and gravel.....	45	132	Sticky shale.....	104	974
Rock.....	3	135	Tough shale.....	42	1,016
Hard caliche.....	14	149	Sand.....	3	1,019
Clay and hard.....	67	216	Sand and gravel.....	11	1,030
Hard lime and shale.....	39	255	Clay breaks.....		
Rock and shale.....	25	280	Shale.....	12	1,042
Sand and sandy shale.....	29	309	Sandy clay and gravel.....	8	1,050
Sand.....	16	325	Tough shale.....	34	1,084
Tough shale.....	27	352	Sand.....	52	1,136
Fine-grained sand and gravel.....	26	378	Shale.....	6	1,142
Sandy shale.....	91	469	Sand.....	12	1,154
Shale.....	54	523	Sandy shale.....	13	1,167
Sandy shale.....	16	539	Sand and gravel.....	17	1,184
Clay and sand.....	50	589	Sandy shale, cut good.....	20	1,204
Sandy shale.....	83	672	Shale.....	3	1,207
Soft shale.....	43	715			

**NORDHEIM**

Population in 1940: 411.

Source of information: E. A. Stuermer, city secretary, Dec. 21, 1944.

Ownership: Municipal.

Source of supply: Well at elevated tank, drilled in 1923, depth 1,320 feet; diameter, 8 to 6 inches; casing perforated at 520–530 and 800–815 feet; water level, 180 feet below land surface in April 1939; deep-well turbine pump and 10-horsepower electric motor, pump set at 210 feet; yield, about 235 gallons a minute; temperature, 85° F.

Pumpage (estimated): Maximum, 100,000 gallons; minimum 50,000 gallons a day.

Storage: Ground reservoir, 50,000 gallons; elevated tank, 50,000 gallons.

Number of customers: 137.

Treatment: None.

*Analysis*

[Collected Dec. 21, 1945. pH is 7.1. Analyzed by J. H. Rowley]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> ).....	24	-----	Sulfate (SO <sub>4</sub> ).....	51	1.06
Iron (Fe).....	12	-----	Chloride (Cl).....	76	2.14
Calcium (Ca).....	39	1.95	Fluoride (F).....	.2	.01
Magnesium (Mg).....	7.9	.65	Nitrate (NO <sub>3</sub> ).....	0	.00
Sodium (Na).....	136	5.92	Dissolved solids.....	518	-----
Potassium (K).....	11	.28	Total hardness as CaCO <sub>3</sub> .....	130	-----
Bicarbonate (HCO <sub>3</sub> ).....	341	5.59			

## YORKTOWN

Population in 1940: 2,081.

Source of information: A. N. Schwarz, water superintendent, Dec. 21, 1944.

Ownership: Municipal.

Source of supply: Well across street from City hall, drilled in 1939 by Layne-Texas Co., drilled to 2,000 feet and plugged back to 960 feet; diameter, 16 to 8 inches; static water level, 26 feet below land surface when drilled and 33 feet on Dec. 21, 1944, after pump had been shut off 3 hours; deep-well turbine pump and electric motor, pump set at 76 feet; draw down, 83 feet pumping 508 gallons a minute; temperature, 86° F.

Pumpage (estimated): Maximum, 150,000 gallons; minimum, 75,000 gallons a day.

Storage: Ground reservoir, 150,000 gallons; elevated tank, 50,000 gallons.

Number of customers: 369.

Treatment: None.

## Analysis

[Collected Dec. 21, 1944. pH is 7.7. Analyzed by J. H. Rowley]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> ).....	26	-----	Sulfate (SO <sub>4</sub> ).....	76	1.58
Iron (Fe).....	14	-----	Chloride (Cl).....	102	2.88
Calcium (Ca).....	47	2.35	Fluoride (F).....	.1	.01
Magnesium (Mg).....	6.6	.54	Nitrate (NO <sub>3</sub> ).....	5	.01
Sodium (Na).....	155	6.72	Dissolved solids.....	603	-----
Potassium (K).....	18	.46	Total hardness as CaCO <sub>3</sub> .....	144	-----
Bicarbonate (HCO <sub>3</sub> ).....	341	5.59			

## Driller's log

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Hard clay.....	59	59	Hard shale.....	50	836
Sand.....	45	104	Shale.....	60	896
Packsand.....	1	105	Sand.....	27	923
Hard sand and boulders.....	24	129	Packsand.....	13	936
Clay.....	67	196	Shale.....	623	1,559
Hard sandy clay.....	78	274	Sand rock.....	1	1,560
Packsand.....	2	276	Hard shale.....	48	1,608
Sand.....	20	296	Hard shale and packsand.....	66	1,674
Gumbo.....	180	476	Sand rock.....	1	1,675
Hard shale.....	119	595	Hard shale.....	21	1,696
Sand.....	20	615	Packsand.....	5	1,701
Clay.....	11	626	Hard shale.....	68	1,769
Sand and layers of shale.....	23	649	Hard shale and sand rock.....	37	1,806
Sand.....	42	691	Rock.....	3	1,809
Gumbo.....	12	703	Hard shale and lime rock.....	67	1,876
Soft blue shale.....	83	786	Hard shale.....	124	2,000

## DIMMIT COUNTY

## ASHERTON

Population in 1940: 1,538.

Source of information: L. P. Butler, manager, May 11, 1945.

Owner: Central Power & Light Co.

Source of supply: Well at elevated tank; drilled in 1926 by Layne-Texas Co., depth, 640 feet; diameter, 12 inches; cases to 352 feet; deep-well turbine pump and 25-horsepower electric motor; static water level, 52.5 feet below land surface on June 19, 1927; yield, 420 gallons a minute; temperature, 84° F. Storage: Elevated tank, 50,000 gallons; concrete ground reservoir, capacity unknown.

Number of customers: 292.

Treatment: None.

*Analysis*

[Collected May 11, 1945. Analyzed by J. H. Rowley]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> )	17	-----	Sulfate (SO <sub>4</sub> )	200	4.16
Iron (Fe)	34	-----	Chloride (Cl)	122	3.44
Calcium (Ca)	60	2.99	Fluoride (F)	.8	.04
Magnesium (Mg)	15	1.23	Nitrate (NO <sub>3</sub> )	0	.00
Sodium (Na)	158	6.88	Dissolved solids	716	-----
Potassium (K)	20	.51	Total hardness as CaCO <sub>3</sub>	211	-----
Bicarbonate (HCO <sub>3</sub> )	242	3.97			

**BIG WELLS**

Population in 1940: 866.

Source of information: W. Lindenborn, water superintendent, May 11, 1945.

Ownership: Municipal.

Source of supply: Well one block west of elevated tank; drilled in 1937 by Cribbs and Davidson; depth, 1,355 feet; diameter, 10 to 8 inches; cased to 800 feet; deep-well turbine pump and 20-horsepower electric motor; static water level reported 54 feet below land surface on May 11, 1945; yield, 275 gallons a minute; temperature, 94° F.

Pumpage (estimated): Average, 25,000 gallons a day.

Storage: Elevated tank, 50,000 gallons; steel ground reservoir, 25,000 gallons.

Number of customers: 178.

Treatment: None.

*Analysis*

[Collected May 11, 1945. pH is 8.4. Analyzed by J. H. Rowley]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> )	17	-----	Sulfate (SO <sub>4</sub> )	90	1.87
Iron (Fe)	42	-----	Chloride (Cl)	85	2.40
Calcium (Ca)	4.3	0.21	Fluoride (F)	1.6	.08
Magnesium (Mg)	1.6	.13	Nitrate (NO <sub>3</sub> )	.2	.00
Sodium (Na)	223	9.71	Dissolved solids	612	-----
Potassium (K)	8.6	.22	Total hardness as CaCO <sub>3</sub>	17	-----
Bicarbonate (HCO <sub>3</sub> )	361	5.92			

*Driller's log, well 1*

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Yellow clay	0	20	Water sand	26	632
Blue shale	140	160	Gray shale	18	650
Water sand	30	190	Brown shale	5	655
Blue shale	17	207	Gray shale	10	665
Gray shale	15	222	Sandy shale	5	670
Blue shale	8	230	Water sand	25	695
Brown shale	30	260	Blue shale	29	724
Gray shale	50	310	Gray sandy shale	26	750
Sandy shale (little water)	10	320	Brown sandy shale	8	758
Water sand	10	330	Red shale	7	765
Blue shale	66	396	Broken sand	30	795
Red shale	4	400	Sandy shale	17	812
Blue shale	45	445	Blue shale	13	825
Hard gray shale	20	465	Brown shale	18	843
Brown lignite	14	479	Blue shale	10	853
Gray sandy shale	19	498	Gray gumbo	42	895
Brown shale	17	515	Broken water sand	55	950
Gray shale	35	550	Gummy shale	45	995
Brown shale	15	565	Sandy shale	15	1,010
Gray shale	15	580	Brown shale	60	1,170
Blue shale	18	598	Carrizo sand	90	1,260
Gray shale	8	606	Brown shale	95	1,355

## BRUNDAGE

Population in 1940: 50.

Source of information: W. H. Duncanson, operator, May 11, 1945.

Ownership: Municipal.

Source of supply: Well at elevated tank; drilled by Mr. Wheeler in 1909; depth, 1,170 feet; diameter, 6 inches; cylinder pump and 8-horsepower gasoline engine. Pumpage (estimated): Average, 4,000 to 5,000 gallons a day.

Storage: Elevated wooden tank, about 10,000 gallons.

Number of customers: 14.

Treatment: None.

## Analysis

[Collected May 11, 1945. pH is 7.8. Analyzed by J. H. Rowley]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> )	23		Sulfate (SO <sub>4</sub> )	54	1.12
Iron (Fe)	.73		Chloride (Cl)	47	1.33
Calcium (Ca)	36	1.80	Fluoride (F)	1.0	.06
Magnesium (Mg)	11	.90	Nitrate NO <sub>3</sub>	.8	.01
Sodium (Na)	112	4.87	Dissolved solids	454	
Potassium (K)	9.1	.23	Total hardness as CaCO <sub>3</sub>	135	
Bicarbonate (HCO <sub>3</sub> )	323	5.29			

## CARRIZO SPRINGS

Population in 1940: 2,494.

Source of information: Bert Holmgreen, water superintendent, May 10, 1945.

Ownership: Municipal.

Source of supply: 2 wells.

Well 1. At elevated tank; drilled in 1928 by W. D. Morrison; depth, 322 feet; diameter, 12½ inches; cased to 123 feet; deep-well turbine pump and 30-horsepower electric motor; static water level; 82.4 feet below land surface on March 12, 1930, and reported 105 feet in May 1945; yield, 676 gallons a minute.

Well 2. About 300 feet west of well 1; drilled in 1944 by Elmo Owens; depth, 338 feet; diameter, 16 inches; cased to 123 feet; deep-well submersible pump and 30-horsepower electric motor; static water level reported, 105 feet below land surface in May 1945; yield, 500 gallons a minute with draw-down of 25 feet; temperature, 78° F.

Pumpage: No data.

Storage: Elevated tank, 50,000 gallons; concrete ground reservoir, 60,000 gallons.

Number of customers: 508.

Treatment: None.

## Analysis, well 2

[Collected May 10, 1945. pH is 7.5. Analyzed by J. H. Rowley]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> )	24		Sulfate (SO <sub>4</sub> )	113	2.35
Iron (Fe)	.18		Chloride (Cl)	136	3.84
Calcium (Ca)	58	2.89	Fluoride (F)	.6	.03
Magnesium (Mg)	16	1.32	Nitrate (NO <sub>3</sub> )	4.0	.06
Sodium (Na)	117	5.08	Dissolved solids	606	
Potassium (K)	24	.61	Total hardness as Ca CO <sub>3</sub>	210	
Bicarbonate (HCO <sub>3</sub> )	221	3.62			

*Driller's log well 2*

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil and caliche.....	20	20	Carrizo sand.....	84	222
Dry sand.....	92	112	Light gray shale.....	33	255
Brown shale.....	3	115	Dark gray tight sand.....	15	270
Rock.....	3	118	Indio sand.....	55	325
Coarse-grained sand.....	20	138	Midway clay.....	13	338

## CATARINA

Population in 1940: 403.

Source of information: L. D. White, bookkeeper, May 11, 1945.

Owner: Catarina Water Supply Co.

Source of supply: Well at elevated tank; drilled in 1926 by Floyd Trim; depth, 1,334 feet; diameter, 12½ to 10 inches; cased to 1,025 feet; deep-well turbine pump and 50-horsepower electric motor; pump set at 240 feet; static water level, 103 feet below land surface on Dec. 22, 1938; yield, 600 gallons a minute; temperature, 96° F.

Pumpage (estimated): Average, 72,000 gallons a day.

Storage: Standpipe, estimated 175,000 gallons.

Number of customers: 53.

Treatment: None.

*Analysis*

[Collected May 11, 1945. pH is 7.9. Analyzed by J. H. Rowley]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> ).....	18	-----	Sulfate (SO <sub>4</sub> ).....	212	4. 41
Iron (Fe).....	30	-----	Chloride (Cl).....	378	10. 66
Calcium (Ca).....	16	0. 80	Fluoride (F).....	1. 0	. 05
Magnesium (Mg).....	6. 9	. 57	Nitrate (NO <sub>3</sub> ).....	1. 2	. 02
Sodium (Na).....	392	17. 06	Dissolved solids.....	1170	-----
Potassium (K).....	25	. 64	Total hardness as CaCO <sub>3</sub> .....	68	-----
Bicarbonate (HCO <sub>3</sub> ).....	240	3. 93			

*Driller's log*

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Sand.....	5	5	Blue shale.....	5	755
Sandy clay.....	25	30	Sand.....	35	790
Blue shale.....	20	50	Blue shale.....	15	805
Sand and coal.....	25	75	Black shale.....	45	850
Blue shale.....	90	165	Hard sand.....	15	865
Gray shale.....	60	250	Red shale.....	25	890
Gray sand (salt water).....	35	285	Sand.....	10	959
Blue shale.....	5	290	Black shale.....	20	920
Lime shell.....	5	295	Red shale.....	40	960
Blue shale.....	10	305	Brown shale.....	10	970
Red shale, lignite.....	20	325	Hard sand.....	10	980
Blue shale.....	35	360	Sand (fresh water).....	40	1, 020
Sand.....	55	415	Red shale.....	5	1, 025
Blue shale.....	15	430	Sand (artesian water).....	35	1, 060
Sand (salt water).....	35	465	Shale.....	10	1, 070
Blue shale.....	30	495	Sand (artesian water).....	15	1, 085
Gray sand (salt water).....	15	510	Shale.....	5	1, 090
Blue shale.....	50	560	Sand (artesian water).....	15	1, 105
Sand (fresh water).....	55	615	Red shale.....	10	1, 115
Whiteshale.....	25	640	Sand.....	15	1, 130
Red shale.....	20	660	Red shale.....	5	1, 135
Sand (fresh water).....	40	700	Sand (artesian water).....	195	1, 330
Red and blue shale.....	50	750	Clay.....	4	1, 334



## DUVAL COUNTY

## BENAVIDES

Population in 1940: 3,081.

Source of information: A. C. Canales, city alderman, March 7, 1945.

Ownership: Municipal.

Source of supply: 2 wells, 3 blocks south and 3 blocks west of railway depot.

Well 1. Drilled in 1938 by Gus Delaney; depth, 328 feet; diameter, 8 inches; deep-well submersible turbine pump and 20-horsepower electric motor set at 325 feet; static water level, 215 feet below land surface in December 1942; yield, about 100 gallons a minute; temperature, 81° F.

Well 2. Drilled in 1943 by Layne-Texas Co., Ltd.; depth, 615 feet; diameter, 12¾ to 8½ inches; screens at 209-244, 259-275, 327-356, 450-462 and 483-518 feet; deep-well turbine pump and 10-horsepower electric motor; static water level, 87.9 feet below land surface on Mar. 7, 1945; draw-down, 28 feet pumping 125 gallons a minute during pump test in October 1943; temperature, 80½° F.

Pumpage (estimated): Average, 200,000 gallons a day.

Storage: Ground reservoir, 55,000 gallons; elevated steel tank, 55,000 gallons.

Number of customers: 714.

Treatment: None.

## Analyses

[Data for both wells: Collected March 7, 1945. pH is 7.8. Analyzed by M. L. Begley]

	Well 1		Well 2	
	Parts per million	Equivalents per million	Parts per million	Equivalents per million
Silica (SiO <sub>2</sub> ).....	22	-----	29	-----
Iron (Fe).....	.02	-----	.02	-----
Calcium (Ca).....	42	2.10	41	2.05
Magnesium (Mg).....	17	1.40	17	1.40
Sodium (Na).....	392	17.05	364	15.81
Potassium (K).....	12	.31	12	.31
Bicarbonate (HCO <sub>3</sub> ).....	330	5.41	297	4.87
Sulfate (SO <sub>4</sub> ).....	253	5.27	231	4.81
Chloride (Cl).....	345	9.73	338	9.53
Fluoride (F).....	1.0	.05	.8	.04
Nitrate (NO <sub>3</sub> ).....	25	.40	20	.32
Dissolved solids.....	1,270	-----	1,200	-----
Total hardness as CaCO <sub>3</sub> .....	175	-----	172	-----

## Driller's log, well 2

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil.....	3	3	Clay.....	14	369
Sand and hard caliche.....	17	20	Sand.....	4	373
Caliche and sand.....	23	43	Clay and sand breaks.....	44	417
Hard caliche.....	17	60	Clay.....	13	430
Clay and caliche.....	24	84	Sandy clay.....	20	450
Sand.....	5	89	Broken sand.....	12	462
Hard caliche.....	14	103	Clay.....	21	483
Sandy clay.....	43	146	Sand.....	12	495
Clay.....	39	185	Sandy clay.....	3	498
Sandy clay.....	25	210	Sand.....	19	517
Fine-grained sand.....	35	245	Tough clay.....	28	545
Sandy clay.....	15	260	Sandy clay.....	26	571
Sand sandy clay.....	66	326	Tough clay.....	44	615
Broken sand.....	29	355			

## FREER

Population in 1940: 2,346.

Source of information: J. F. McCalla, engineer, March 6, 1945.

Owner: Freer Utilities Co. (Jarbee, Inc.).

Source of supply: 2 wells on Strip lease, three-quarters of a mile south of post office; 1 well on Moody "B" Salt Dome lease, 1¼ miles south of post office; 3 wells on Saxet lease, 1½ miles southwest of post office.

Well 1 (Strip lease). Drilled in 1937; depth, 450 feet; diameter, 7 inches, top of sand at about 365 feet; cylinder pump and rod line from well 2; 10-horsepower electric motor; static water level, about 165 feet below land surface; yield, 15 gallons a minute; temperature, 88½° F.

Well 2 (Strip lease). Drilled in 1938; depth, 570 feet; diameter, 7 inches; screen at 450–570 feet; cylinder pump and 10-horsepower electric motor; static water level about 165 feet below land surface; yield, 30 gallons a minute; temperature, 89° F.

Well 1 (Moody "B" lease). Drilled about 1933; depth, 700 feet; diameter, 7 inches; deep-well turbine pump and 10-horsepower electric motor; static water level, 172.4 feet below land surface on March 6, 1945; yield, 55 gallons a minute; temperature, 81° F.

Well 1 (Saxet lease). Drilled about 1932; depth, 600–700 feet; diameter, 7 inches; cylinder pump and rod line from oil well power plant, cylinder set at 450 feet; yield, 20 gallons a minute; temperature, 78° F.

Well 2 (Saxet lease). Drilled about 1938; depth, 200±feet; diameter, 7 inches; cylinder pump and rod line from oil well power plant, cylinder set at 180 feet; static water level, 140.4 feet below land surface on Mar. 6, 1945; yield, 10 gallons a minute.

Well 3 (Saxet lease). Drilled about 1938; depth, 200±feet; diameter, 7 inches; cylinder pump and rod line from oil well power plant, cylinder set at 175 feet; static water level, 149.1 feet below land surface; yield, 10 gallons a minute.

Pumpage (estimated): Average, 100,000 to 120,000 gallons a day.

Storage: Concrete ground reservoir, 120,000 gallons; wood tank on ground, 40,000 gallons; elevated tank, 75,000 gallons.

Treatment: None.

## Analyses

[Collected Mar 6, 1945. pH: well 1 (Strip lease), 7.5; well 2 (Strip lease) and well 1 (Saxet lease), 7.4; Well 1 (Woody "B" lease), 7.6. Analyzed by M. L. Begley]

	Well 1 (Strip lease)		Well 2 (Strip lease)	
	Parts per million	Equivalents per million	Parts per million	Equivalents per million
Silico (SiO <sub>2</sub> ).....	18		11	
Iron (Fe).....	4.6		79	
Calcium (Ca).....	52	2.60	52	2.60
Magnesium (Mg).....	12	.99	12	.99
Sodium (Na).....	1,660	72.15	1,650	71.92
Potassium (K).....	32	.82	32	.82
Bicarbonate (HCO <sub>3</sub> ).....	322	5.28	326	5.34
Sulfate (SO <sub>4</sub> ).....	7.8	.16	6.8	.14
Chloride (Cl).....	2,520	71.07	2,510	70.79
Fluoride (F).....	.2	.01	.2	.01
Nitrate (NO <sub>3</sub> ).....	2.2	.04	3.2	.05
Dissolved solids.....	4,460		4,440	
Total hardness as CaCO <sub>3</sub> .....	180		180	

*Analyses—Continued*

	Well 1 (Moody "B" lease)		Well 1 (Saxet lease)	
	Parts per million	Equivalents per million	Parts per million	Equivalents per million
Silica (SiO <sub>2</sub> ).....	82	-----	56	-----
Iron (Fe).....	.67	-----	.34	-----
Calcium (Ca).....	52	2.60	88	4.39
Magnesium (Mg).....	19	1.56	24	1.97
Sodium (Na).....	454	19.73	921	40.03
Potassium (K).....	22	.56	29	.74
Bicarbonate (HCO <sub>3</sub> ).....	495	8.11	353	5.79
Sulfate (SO <sub>4</sub> ).....	344	7.16	191	3.98
Chloride (Cl).....	316	8.91	1,320	37.23
Fluoride (F).....	.8	.04	.4	.02
Nitrate (NO <sub>3</sub> ).....	14	.23	7.0	.11
Dissolved solids.....	1,550	-----	2,810	-----
Total hardness as CaCO <sub>3</sub> .....	208	-----	318	-----

**SAN DIEGO**

Population in 1940: 2,674.

Source of information: A. R. Martinez, water superintendent, March 6, 1945.

Ownership: Municipal.

Source of supply: 2 wells located 3 blocks south of post office, west of U. S. Highway 59.

Well 1. Drilled in 1937 by Layne-Texas Co.; depth, 509 feet; diameter, 13½ to 6½ inches; screens at 402–468 and 484–505 feet; deep-well turbine pump and 20-horsepower electric motor; static water level, 90 feet below land surface on March 11, 1937; yield, 225 gallons a minute with draw-down of 90 feet; temperature, 81° F.

Well 2. Drilled in 1936 by Layne-Texas Co.; depth, 565 feet; diameter, 13½ to 6½ inches; screens at 390–445 and 468–492 feet; deep-well turbine pump and 20-horsepower electric motor; static water level, 98 feet below land surface on March 12, 1937; yield, 235 gallons a minute with draw-down of 125 feet; temperature, 81° F.

Pumpage (estimated): Maximum, 200,000 gallons; minimum, 60,000 gallons; average, 150,000 gallons a day.

Storage: Steel settling tank, 50,000 gallons; elevated tank, 100,000 gallons.

Number of customers: 725.

Treatment: None.

*Analyses*

[Collected Mar 6, 1945. pH for each well is 7.8. Analyzed by M. L. Begley]

	Well 1		Well 2	
	Parts per million	Equivalents per million	Parts per million	Equivalents per million
Silica (SiO <sub>2</sub> ).....	25	-----	22	-----
Iron (Fe).....	.09	-----	.05	-----
Calcium (Ca).....	29	1.45	28	1.40
Magnesium (Mg).....	12	.99	12	.99
Sodium (Na).....	231	10.03	248	10.78
Potassium (K).....	8.0	.20	8.2	.21
Bicarbonate (HCO <sub>3</sub> ).....	364	5.97	370	6.06
Sulfate (SO <sub>4</sub> ).....	94	1.96	109	2.27
Chloride (Cl).....	158	4.46	169	4.77
Fluoride (F).....	.7	.04	.7	.04
Nitrate (NO <sub>3</sub> ).....	15	.24	15	.24
Dissolved solids.....	754	-----	794	-----
Total hardness as CaCO <sub>3</sub> .....	122	-----	120	-----

*Drillers' Logs*

Well 1			Well 2		
	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil.....	5	5	Soil.....	5	5
Sand and caliche.....	60	65	Sand and caliche.....	36	41
Red clay and caliche.....	48	113	Caliche.....	30	71
Red clay.....	110	223	Red clay and caliche.....	142	213
Sandy clay.....	150	373	Sand.....	5	218
Hard caliche.....	23	396	Red clay and sand.....	16	234
Sand.....	18	414	Sand.....	4	238
Clay.....	21	435	Red clay.....	32	270
Sand.....	4	439	White clay and sand.....	81	351
Clay.....	36	475	Sand.....	31	382
Sand.....	26	501	Red clay and sand.....	27	409
Tough sand.....	8	509	Clay and sand.....	30	439
			Sand.....	18	457
			Hard shale.....	87	544
			Sandy shale.....	121	565

## FRIO COUNTY

## DILLEY

Population in 1940: 1,244.

Source of information: Gertrude Callender, city secretary, May 9, 1945.

Owner: International and Great Northern Railway (operated by City of Dilley).

Source of supply: Well one-fourth mile south of Dilley; drilled in 1924; depth, 2,010 feet; diameter, 10 inches; deep-well turbine pump and 15-horsepower electric motor, pump set at 80 feet; flowed when drilled; static water level, reported 40 feet below land surface in April 1945; yield, 240 gallons a minute with draw-down of about 40 feet; temperature, 101° F.

*Average pumpage, in gallons a day*

[Includes water used by railroad]

April 1940-41	April 1941-42	April 1942-43	April 1943-44	April 1944-45
66,700	70,500	69,000	80,000	90,000

Storage: Elevated tank, 50,000 gallons; concrete ground reservoir, 50,000 gallons.

Number of customers: 385.

Treatment: None.

*Analysis of water*

[Collected Apr. 9, 1945. pH is 7.9. Analyzed by State health department]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> ).....	27	-----	Sulfate (SO <sub>4</sub> ).....	47	0.98
Iron (Fe).....	.6	-----	Chloride (Cl).....	23	.65
Calcium (Ca).....	31	1.55	Fluoride (F).....	.66	.03
Magnesium (Mg).....	10	.82	Nitrate (NO <sub>3</sub> ).....	.4	.01
Sodium (Na).....	89	3.87	Dissolved solids.....	370	-----
Potassium (K).....			Total hardness as CaCO <sub>3</sub> .....	119	-----
Bicarbonate (HCO <sub>3</sub> ).....	280	4.59			

*Driller's log*

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil.....	19	19	Shale and boulders.....	38	952
Rock.....	3	22	Packsand.....	14	966
Yellow clay.....	16	38	Shale and boulders.....	89	1,055
Lignite.....	14	52	Gumbo and boulders.....	81	1,136
Packsand.....	12	64	Sand (water).....	30	1,166
Sandstone.....	12	76	Shale.....	10	1,176
Packsand and boulders.....	221	297	Hard sand.....	19	1,195
Rock.....	1	298	Shale and boulders.....	163	1,358
Fine-grained sand.....	55	353	Hard sand.....	30	1,390
Packsand.....	27	380	Shale.....	10	1,400
Rock.....	2	382	Hard sand.....	30	1,430
Shale and boulders.....	104	486	Gumbo and boulders.....	10	1,440
Rock.....	2	488	Shale and boulders.....	30	1,470
Blue gumbo.....	38	526	Hard sand.....	35	1,505
Rock.....	2	528	Sandy shale and boulders.....	62	1,567
Gumbo.....	40	568	Shale and boulders.....	24	1,591
Gumbo and boulders.....	13	581	Sand.....	9	1,600
Rock.....	3	584	Shale and boulders.....	14	1,614
Gumbo and boulders.....	46	630	Gumbo.....	10	1,624
Rock.....	3	633	Sand (water).....	30	1,654
Gumbo and lime.....	17	650	Sandy shale.....	60	1,714
Packsand.....	38	688	Gumbo.....	69	1,783
Rock.....	2	690	Shale.....	25	1,808
Gumbo and boulders.....	117	807	Hard sand.....	16	1,824
"Granite".....	4	811	Shale.....	10	1,834
Shale and boulders.....	30	841	Fine-grained sand.....	16	1,850
Shale.....	36	877	Shale.....	20	1,870
Rock.....	2	879	Sand (water).....	35	1,905
Sand and boulders.....	23	902	Lime rock.....	18	1,923
Shale and boulders.....	10	912	Sand (water).....	67	1,990
Rock.....	2	914	Hard shale.....	20	2,010

**PEARSALL**

Population in 1940: 3,164.

Source of information: K. F. Meyer, manager, May 9, 1945.

Owner: Central Power & Light Co.

Source of supply: 2 wells.

Well 1. At power plant one block southwest of railroad depot; drilled in 1926 by Layne-Texas Co.; depth, 1,303 feet (measured depth 1,216 feet in 1940); diameter, 16 to 6 inches; screens at 962-1066 and 1,132-1,241 feet; deep-well turbine pump and 40-horsepower electric motor, pump set at 135 feet; static water level reported, 60 feet below land surface in 1930; yield, 625 gallons a minute; temperature, 92° F.

Well 2. About 50 feet northeast of well 1; drilled in 1942 by Layne-Texas Co., Ltd., depth, 1,302 feet; diameter, 10¾ to 7 inches; screens at 1,135-1,246 and 1,271-1,297 feet; deep-well turbine pump and 30-horsepower electric motor, pump set at 150 feet; static water level, 88 feet below land surface on Oct. 23, 1942; yield, 640 gallons a minute with draw-down of 124 feet; temperature, 93½° F.

Pumpage: No record.

Storage: Elevated tank, 50,000 gallons; concrete ground reservoir, 73,000 gallons.

Number of customers: 583.

Treatment: Hypochlorination.

*Analyses*

[Collected: Well 1 Feb. 20, 1943. Analyzed by Texas State Department of Health. Well 2, May 9, 1945.  
pH is 7.1. Analyzed by J. H. Rowley]

	Well 1		Well 2	
	Parts per million	Equivalents per million	Parts per million	Equivalents per million
Silica (SiO <sub>2</sub> )	20		18	
Iron (Fe)	.4		.62	
Calcium (Ca)	89	4.44	95	4.74
Magnesium (Mg)	16	1.32	17	1.40
Sodium (Na)	28	1.22	17	.74
Potassium (K)	299	4.90	296	4.85
Bicarbonate (HCO <sub>3</sub> )	62	1.29	62	1.29
Sulfate (SO <sub>4</sub> )	28	.79	25	.71
Chloride (Cl)	.4	.02	.6	.03
Fluoride (F)	.4	.01	0	.00
Nitrate (NO <sub>3</sub> )	394		391	
Dissolved solids	288		307	
Total hardness as CaCO <sub>3</sub>				

*Driller's log, Well 2*

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Sandy clay	5	5	Rock	1	634
Sand and rock	30	35	Shale and boulders	3	637
Hard rock	1	36	Rock	1	638
Sand and hard shale	58	94	Shale and boulders	5	643
Sand and rock	1	95	Rock and shale	15	658
Sand and hard shale	32	127	Shale and layers of sand	21	679
Sand	21	148	Shale and layers of sand	10	689
Sand and layers of shale	18	166	Shale and sand breaks	13	702
Hard rock	2	168	Sand	15	717
Sand and rock	3	171	Shale and boulders	28	745
Sand and hard shale	20	191	Shale and layers of sand	11	756
Sand and rock	2	193	Hard sand	31	787
Sand and hard shale	56	249	Rock	1	788
Rock	2	251	Shale and boulders	2	790
Hard shale	15	266	Hard shale	4	794
Shale and layers of rock	4	270	Rock	1	795
Hard shale	36	306	Shale sand and boulders	76	871
Sand and boulders	16	322	Sand and boulders	21	892
Shale and boulders	4	326	Rock	1	893
Hard shale	11	337	Shale and boulders	9	902
Hard shale and boulders	39	376	Sand and breaks	15	917
Layers of shale and boulders	8	384	Sand and shale and breaks	23	940
Hard shale	4	388	Sandy shale	14	954
Shale and boulders	4	392	Sand and shale	47	1,001
Hard shale	46	438	Rock	1	1,002
Rock	2	440	Shale and boulders	63	1,065
Shale	21	461	Hard shale	16	1,081
Rock and layers of shale	24	485	Hard rock	2	1,083
Rock and shale	11	496	Shale and boulders	12	1,095
Hard shale	30	526	Hard shale	10	1,105
Shale and boulders	34	560	Sand (good)	23	1,128
Rock	2	562	Shale	18	1,139
Hard sand and shale	12	574	Sand and shale	18	1,157
Shale and boulders	41	615	Sand	90	1,247
Hard rock	1	615	Shale	25	1,272
Shale and boulders	10	626	Sand	5	1,277
Sand and shale	7	633	Sandy shale	25	1,302

## GOLIAD COUNTY

## GOLIAD

Population in 1940: 1,446.

Source of information: Frank Malech, water superintendent, April 20, 1945.

Ownership: Municipal.

Source of supply: 2 wells.

Well 1. On river bank; old well; depth, 325 feet; diameter, 8 inches; air lift; yield, 500 gallons a minute; stand-by well; temperature, 75° F.

Well 2. At pump station; drilled in 1936 by Layne-Texas Co.; depth, 461 feet; diameter, 8 to 6 inches; screens at 390-403 and 412-460 feet; deep-well turbine pump and 25-horsepower electric motor, pump set at 156 feet; static water level, 59 feet below land surface; yield, 261 gallons a minute with draw-down of 46 feet on Nov. 6, 1936; present static water level reported, 60 feet and yield, 175 gallons a minute; temperature, 78° F.

Pumpage: Maximum, 200,000 gallons and average, 100,000 gallons a day.

Storage: Standpipe, 85,000 gallons; concrete ground reservoir, 80,000 gallons.

Number of customers: 263.

Treatment: Chlorination.

*Analyses*

[Collected Apr. 20, 1945. pH for each well is 7.4. Analyzed by J. H. Rowley]

	Well 1		Well 2	
	Parts per million	Equivalents per million	Parts per million	Equivalents per million
Silica (SiO <sub>2</sub> ).....	53	-----	31	-----
Iron (Fe).....	8.4	-----	.44	-----
Calcium (Ca).....	70	3.49	112	5.59
Magnesium (Mg).....	20	1.64	31	2.55
Sodium (Na).....	90	3.93	92	4.02
Potassium (K).....	7.0	.18	9.8	.25
Bicarbonate (HCO <sub>3</sub> ).....	335	5.49	336	5.51
Sulfate (SO <sub>4</sub> ).....	38	.79	35	.73
Chloride (Cl).....	102	2.88	217	6.12
Fluoride (F).....	.6	.03	.6	.03
Nitrate (NO <sub>3</sub> ).....	2.8	.05	1.2	.02
Dissolved solids.....	557	-----	805	-----
Total hardness as CaCO <sub>3</sub> .....	256	-----	407	-----

*Driller's log, Well 2*

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil.....	2	2	Sand.....	15	221
Caliche.....	3	5	Hard sticky shale.....	122	343
Caliche and hard sand.....	12	17	Sand, broken with shale.....	10	353
Caliche and clay.....	13	30	Sticky shale.....	22	375
Hard caliche and sand.....	22	52	Sandy lime.....	7	382
Sand.....	20	72	Sand, broken with shale.....	20	402
Sand and clay.....	25	97	Sticky shale.....	5	407
Sticky shale.....	38	135	Sand, broken with shale.....	50	457
Hard sticky shale.....	71	206	Sticky shale.....	4	461

## GONZALES COUNTY

## GONZALES

Population in 1940: 4,722.

Source of information: Lewis Nix, water superintendent, Dec. 20, 1944.

Ownership: Municipal.

Source of supply: Guadalupe River.

*Average pumpage, in gallons a day, 1944*

January .....	256, 500	May .....	288, 300	September .....	530, 100
February .....	257, 800	June .....	429, 200	October .....	290, 000
March .....	269, 100	July .....	525, 900	November .....	290, 000
April .....	347, 300	August .....	469, 700		

Storage: Elevated tank, 100,000 gallons.

Number of customers: 1,163.

Treatment: Coagulation, sedimentation, rapid sand filtration, and prechlorination and postchlorination.

*Analysis of raw water*

[Collected Dec. 20, 1944. pH is 7.8. Analyzed by J. H. Rowley]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> ) .....	7.2	-----	Sulfate (SO <sub>4</sub> ) .....	47	0.98
Iron (Fe) .....	.19	-----	Chloride (Cl) .....	173	4.88
Calcium (Ca) .....	86	4.29	Fluoride (F) .....	.2	.01
Magnesium (Mg) .....	24	1.97	Nitrate (NO <sub>3</sub> ) .....	4.0	.06
Sodium (Na) .....	76	3.30	Dissolved solids .....	583	-----
Potassium (K) .....	9.5	.24	Total hardness as CaCO <sub>3</sub> .....	313	-----
Bicarbonate (HCO <sub>3</sub> ) .....	236	3.87			

## NIXON

Population in 1940: 1,835.

Source of information: Mayor, December 22, 1944.

Owner: Terrell Bartlett Co.

Source of supply: Well at elevated tank; drilled in 1929; depth, about 1,400 feet; diameter, 10 inches; centrifugal pump and electric motor; flows, static water level 15 feet above land surface in 1942 and 12.5 feet in 1944; yield, when pumped, about 150 gallons a minute.

Pumpage: Unknown.

Storage: Elevated tank, 75,000 gallons.

Number of customers: Unknown.

Treatment: None.

*Analysis*

[Collected Dec. 22, 1944. pH is 7.9. Analyzed by J. H. Rowley]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> ) .....	16	-----	Sulfate (SO <sub>4</sub> ) .....	30	0.625
Iron (Fe) .....	.2	-----	Chloride (Cl) .....	29	.818
Calcium (Ca) .....	44	2.196	Fluoride (F) .....	.5	.008
Magnesium (Mg) .....	7.2	.502	Nitrate (NO <sub>3</sub> ) .....	-----	-----
Sodium (Na) .....	29	1.260	Dissolved solids .....	249	-----
Potassium (K) .....	5.8	.148	Total hardness as CaCO <sub>3</sub> .....	139	-----
Bicarbonate (HCO <sub>3</sub> ) .....	168	2.754			



**WAEOLDER**

Population in 1940: 1,018.

Source of information: A. E. Bost, water superintendent, Dec. 20, 1944.

Ownership: Municipal.

Source of supply: Well drilled in 1926 by Bost Brothers; depth, 511 feet; deep-well turbine pump and 15-horsepower electric motor, pump set at 210 feet; reported static water level 50 feet below land surface; draw-down, 126 feet after pumping 150 gallons a minute for 3 weeks; temperature, 79° F.

Pumpage: Maximum, 156,000; minimum 72,000; average, 108,000 gallons a day.

Storage: Elevated tank, 60,000 gallons.

Number of customers: 287.

Treatment: None.

*Analysis*

[Collected Dec. 20, 1944. pH is 7.9. Analyzed by J. H. Rowley]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> )	19	-----	Sulfate (SO <sub>4</sub> )	142	2.96
Iron (Fe)	.31	-----	Chloride (Cl)	91	2.57
Calcium (Ca)	49	2.45	Fluoride (F)	.1	.01
Magnesium (Mg)	20	1.64	Nitrate (NO <sub>3</sub> )	1.5	.02
Sodium (Na)	103	4.47	Dissolved solids	544	-----
Potassium (K)	16	.41	Total hardness as CaCO <sub>3</sub>	204	-----
Bicarbonate (HCO <sub>3</sub> )	208	3.41			

**GUADALUPE COUNTY****MARION**

Population in 1940: 373.

Source of information: E. C. Schulz, city secretary, July 28, 1945.

Ownership: Municipal.

Source of supply: Well 4½ miles north of Marion; drilled in 1933; depth, 50 feet; diameter, 8 inches; deep-well turbine pump and 7½ horsepower electric motor static water level, 3 feet below land surface on July 28, 1944, after pump had been shut off 20 hours; yield, 80 gallons a minute with draw-down of about 2 feet after 1 hour pumping; temperature, 71° F.

Pumpage (estimated): Maximum, 25,000 gallons; minimum, 10,000 gallons; average 15,000 gallons a day.

Storage: Elevated tank, 50,000 gallons.

Number of customers: 96.

Treatment: Chlorination.

*Analysis*

[Collected July 28, 1944. pH is 7.3. Analyzed by J. H. Rowley]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> )	18	-----	Sulfate (SO <sub>4</sub> )	99	2.06
Iron (Fe)	.10	-----	Chloride (Cl)	80	2.26
Calcium (Ca)	140	6.99	Fluoride (F)	.9	.05
Magnesium (Mg)	15	1.23	Nitrate (NO <sub>3</sub> )	67	1.08
Sodium (Na)	67	2.90	Dissolved solids	685	-----
Potassium (K)	4.8	.12	Total hardness as CaCO <sub>3</sub>	411	-----
Bicarbonate (HCO <sub>3</sub> )	353	5.79			

## SEGUIN

Population in 1940: 7,006.

Source of information: P. B. Roessler, plant superintendent, July 28, 1944.

Ownership: Municipal.

Source of supply: Guadalupe River.

*Average pumpage, in gallons a day*

	1941	1942	1943	1944
January.....	476, 290	660, 806	584, 741	503, 000
February.....	477, 143	618, 982	640, 250	511, 206
March.....	499, 000	794, 000	700, 451	511, 110
April.....	586, 666	667, 766	902, 500	741, 060
May.....	720, 000	878, 709	1, 068, 516	778, 322
June.....	822, 433	1, 258, 533	1, 041, 660	1, 080, 100
July.....	1, 245, 796	1, 053, 387	1, 102, 516	-----
August.....	1, 277, 161	1, 036, 580	1, 398, 000	-----
September.....	917, 900	839, 800	842, 466	-----
October.....	620, 090	632, 322	705, 870	-----
November.....	653, 200	585, 733	659, 833	-----
December.....	588, 490	579, 451	540, 806	-----

Storage: Elevated tank, 100,000 gallons; standpipe, 290,000 gallons.

Number of customers: 1,900.

Treatment: Coagulation, sedimentation, rapid sand filtration, and chlorination.

*Analysis of raw water*

[Collected July 28, 1944. pH is 7.9. Analyzed by J. H. Rowley]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> ).....	12	-----	Sulfate (SO <sub>4</sub> ).....	22	0.46
Iron (Fe).....	.15	-----	Chloride (Cl).....	15	.42
Calcium (Ca).....	56	2.80	Fluoride (F).....	.2	.01
Magnesium (Mg).....	20	1.64	Nitrate (NO <sub>3</sub> ).....	3.8	.06
Sodium and Potassium (Na+K).....	18	.77	Dissolved solids.....	280	-----
Bicarbonate (HCO <sub>3</sub> ).....	260	4.26	Total hardness as CaCO <sub>3</sub> .....	222	-----

## HAYS COUNTY

## BUDA

Population in 1940: 300.

Source of information: John Howe, co-owner, Jan. 28, 1946.

Owner: John Howe and W. M. Moore.

Source of supply: Well 100 yards east of depot by water tower; drilled in 1941 by Mr. Tyler; depth, 325 feet; diameter, 10 inches; cased to about 200 feet; deep-well Hi-Lift pump and 5-horsepower electric motor; static water level reported 100 feet below land surface when drilled; yield, 22 gallons a minute; temperature, 66° F.

Pumpage (estimated): Average 10,000 gallons a day.

Storage: Elevated tank, 10,000 gallons.

Number of customers: 100.

Treatment: None.

*Analysis*

[Collected Jan. 28, 1946. pH is 8.2. Analyzed by J. H. Rowley]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> ).....	10	-----	Sulfate (SO <sub>4</sub> ).....	38	0.79
Iron (Fe).....	.05	-----	Chloride (Cl).....	12	.34
Calcium (Ca).....	58	2.89	Fluoride (F).....	1.8	.09
Magnesium (Mg).....	33	2.71	Nitrate (NO <sub>3</sub> ).....	0	0
Sodium (Na).....	3	.13	Dissolved solids.....	301	-----
Potassium (K).....	3	.008	Total hardness as CaCO <sub>3</sub> .....	280	-----
Bicarbonate (HCO <sub>3</sub> ).....	280	4.59			

**KYLE**

Population in 1940: 874.

Source of information: J. D. Scott, water superintendent, Nov. 2, 1945.

Ownership: Municipal.

Source of supply: Well on extension of Goforth Street approximately 640 feet east of property line of U. S. Highway 81; drilled in 1939; depth, 595 feet; diameter, 10 inches; deep-well turbine pump and 15-horsepower electric motor; static water level reported 130 feet below land surface in January 1939; yield, 75 gallons a minute with pumping level at 300 feet.

Pumpage (master meter): Minimum, 30,000 gallons; maximum, 60,000 gallons a day.

Storage: Elevated steel tank, 50,000 gallons.

Number of customers: 208.

Treatment: None.

*Analysis*

[Collected November 2, 1945. pH is 7.4. Analyzed by J. H. Rowley]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> ).....	17	-----	Sulfate (SO <sub>4</sub> ).....	172	3.58
Iron (Fe).....	1.1	-----	Chloride (Cl).....	46	1.30
Calcium (Ca).....	80	3.99	Fluoride (F).....	3.6	.19
Magnesium (Mg).....	45	3.70	Nitrate (NO <sub>3</sub> ).....	.2	.00
Sodium (Na).....	35	1.51	Dissolved solids.....	591	-----
Potassium (K).....	17	.43	Total hardness as CaCO <sub>3</sub> .....	384	-----
Bicarbonate (HCO <sub>3</sub> ).....	278	4.56			

*Driller's log, well 1*

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Surface soil.....	5	5	Buda lime.....	44	258
Hard Taylor marl.....	13	18	Del Rio clay.....	52	310
Hard cap rock.....	4	22	Georgetown limestone.....	30	340
Austin chalk.....	160	182	Edwards limestone.....	255	595
Eagle Ford shale.....	32	214			

## SAN MARCOS

Population in 1940: 6,006.

Source of information: W. N. Joiner, water superintendent.

Ownership: Municipal.

Source of supply: 2 wells.

Well 1. Drilled in 1914 by Walter Payne; depth, 115 feet; diameter, 8 inches (in 1941, well was lined with 6½-inch casing); four horizontal centrifugal pumps in 9-foot cistern; capacity of pumps was 1,000, 750, 700, and 400 gallons a minute; total capacity of pumps was 2,900 gallons a minute. Both wells 1 and 2 are connected to this series of pumps. About 1,000 gallons a minute is obtained from well 1, with a draw-down of about 3 feet; static water level near the surface of the pump-house floor.

Well 2. Drilled in 1941 by J. R. Johnson; depth, 115 feet; diameter, 12 inches; connected in conjunction with well 1 to horizontal centrifugal pumps.

*Average pumpage, in gallons a day*

	1943	1944		1943	1944
January.....		600,000	July.....	350,000	850,000
February.....		640,000	August.....	400,000	920,000
March.....		680,000	September.....	450,000	
April.....		720,000	October.....	490,000	
May.....		760,000	November.....	520,000	
June.....		800,000	December.....	560,000	

Storage: Concrete reservoir on hill 200 feet above pumping station, 365,000 gallons.

Number of customers: 1,500.

Treatment: Chlorination.

*Analysis of wells 1 and 2*

[Collected November 11, 1945. pH is 7.0. Analyzed by J. H. Rowley and C. B. Cibulka]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> ).....	12	-----	Sulfate (SO <sub>4</sub> ).....	23	0.48
Iron (Fe).....	.05	-----	Chloride (Cl).....	22	.62
Calcium.....	88	4.39	Fluoride (F).....	.4	.02
Magnesium (Mg).....	18	1.48	Nitrate (NO <sub>3</sub> ).....	4.3	.07
Sodium (Na).....	7.4	.32	Dissolved solids.....	337	-----
Potassium (K).....	5.8	.15	Total hardness as CaCO <sub>3</sub> .....	294	-----
Bicarbonate (HCO <sub>3</sub> ).....	314	5.15			

*Driller's log, well 2*

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Surface soil.....	16	16	Solid limestone.....	33	90
Yellow clay.....	20	36	Flint boulders.....	6	96
Yellow limestone.....	18	54	Honeycomb, yellow lime- stone (very porous).....	19	115
Broken limestone (very cavey).....	3	57			

**HIDALGO COUNTY****ALAMO**

Population in 1940: 1944.

Source of information: T. D. Jones, water superintendent, Aug. 6, 1945.

Ownership: Municipal.

Source of supply: Rio Grande, pumping station 2½ blocks south of the post office.

*Average pumpage, in gallons a day*

	1941	1942	1943	1944	1945
January.....	73,000	60,000	69,000	71,000	97,000
February.....	55,000	70,000	90,000	91,000	101,000
March.....	53,000	82,000	92,000	94,000	152,000
April.....	52,000	86,000	70,000	98,000	119,000
May.....	37,000	67,000	76,000	80,000	120,000
June.....	36,000	79,000	64,000	72,000	116,000
July.....	48,000	50,000	89,000	81,000	123,000
August.....	53,000	57,000	74,000	82,000	-----
September.....	48,000	63,000	46,000	57,000	-----
October.....	52,000	65,000	52,000	83,000	-----
November.....	55,000	73,000	60,000	93,000	-----
December.....	50,000	73,000	53,000	104,000	-----

Storage: Elevated tank, 100,000 gallons; concrete ground storage, 100,000 gallons.

Number of customers: 450.

Treatment: Coagulation, sedimentation, rapid sand filtration, and chlorination.

*Analyses*

[Collected Aug. 6, 1945. pH is 7.4 for finished water. Analyzed by J. H. Rowley and C. B. Cibulka]

	Finished water		Raw water	
	Parts per million	Equivalents per million	Parts per million	Equivalents per million
Silica (SiO <sub>2</sub> ).....	16	-----	-----	-----
Iron (Fe).....	.09	-----	-----	-----
Calcium (Ca).....	84	4.19	88	4.39
Magnesium (Mg).....	16	1.56	19	1.32
Sodium (Na).....	89	3.85	87	3.80
Potassium (K).....	6.5	.17		
Bicarbonate (HCO <sub>3</sub> ).....	150	2.46	162	2.66
Sulfate (SO <sub>4</sub> ).....	192	4.00	193	4.02
Chloride (Cl).....	106	2.99	107	3.02
Fluoride (F).....	.6	.03	-----	-----
Nitrate (NO <sub>3</sub> ).....	3.2	.05	3.0	.05
Dissolved solids.....	602	-----	648	-----
Total hardness as CaCO <sub>3</sub> .....	276	-----	298	-----

**DONNA**

Population in 1940: 4,712.

Source of information: E. L. Badeaux, water superintendent, Aug. 6, 1945.

Ownership: Municipal.

Source of supply: Rio Grande; pumping station three blocks from post office.

Pumpage (estimated): Maximum, 850,000 gallons a day; minimum, 350,000 gallons a day; average, 650,000 gallons a day.

Storage: Elevated tank, 120,000 gallons; concrete ground reservoir, 100,000 gallons.

Number of customers: 851.

Treatment: Coagulation, sedimentation, rapid sand filtration, and chlorination.

*Analyses*

[Collected Aug. 6, 1945. pH is 7.6 for finished water. Analyzed by J. H. Rowley and C. B. Cibulka]

	Finished water		Raw water	
	Parts per million	Equivalents per million	Parts per million	Equivalents per million
Silica (SiO <sub>2</sub> ).....	12			
Iron (Fe).....	.19			
Calcium (Ca).....	78	3.89	78	3.89
Magnesium (Mg).....	19	1.56	20	1.64
Sodium (Na).....	105	4.56	115	5.01
Potassium (K).....	8.0	.20		
Bicarbonate (HCO <sub>3</sub> ).....	125	2.05	149	2.45
Sulfate (SO <sub>4</sub> ).....	209	4.35	212	4.41
Chloride (Cl).....	131	3.69	130	3.67
Fluoride (F).....	2.0	.11		
Nitrate (NO <sub>3</sub> ).....	.8	.01	.8	.01
Dissolved solids.....	676		678	
Total hardness as Ca CO <sub>3</sub> .....	272		276	

**ED COUCH**

Population in 1940: 1,758.

Source of information: C. C. Moore, city secretary, Aug. 3, 1945.

Ownership: Municipal.

Source of supply: Rio Grande; pumping plant three blocks west and three blocks south of post office.

Pumpage (estimated): Average, 125,000 gallons a day.

Storage: Elevated tank, 50,000 gallons.

Number of customers: 285.

Treatment: Coagulation, sedimentation, and chlorination.

*Analyses*

[Collected Aug. 3, 1945. pH is 7.5 for finished water. Analyzed by C. B. Cibulka]

	Finished water		Raw water	
	Parts per million	Equivalents per million	Parts per million	Equivalents per million
Silica.....	8.0			
Iron (Fe).....	.54			
Calcium (Ca).....	94	4.69	89	4.44
Magnesium (Mg).....	17	1.40	16	1.32
Sodium (Na).....	96	4.16	107	4.66
Potassium (K).....	7.4	.19		
Bicarbonate (HCO <sub>3</sub> ).....	94	1.54	105	1.72
Sulfate (SO <sub>4</sub> ).....	262	5.45	256	5.33
Chloride (Cl).....	118	3.33	119	3.36
Fluoride (F).....	2.0	.11		
Nitrate (NO <sub>3</sub> ).....	.8	.01	.4	.01
Dissolved solids.....	700			
Total hardness as Ca CO <sub>3</sub> .....	304			

**EDINBURG**

Population in 1940: 8,718.

Source of information: T. J. Blane, chief operator, August 3, 1945.

Owner: Central Power &amp; Light Co.

Source of supply: Rio Grande, plant two blocks souths and four blocks east of the courthouse.

*Average pumpage, in gallons a day*

	1939	1940	1941	1942	1943	1944	1945
January.....	402,000	429,000	421,000	411,000	428,000	582,000	703,000
February.....	436,000	539,000	429,000	436,000	594,000	731,000	691,000
March.....	544,000	445,000	423,000	555,000	565,000	721,000	829,000
April.....	423,000	436,000	402,000	542,000	542,000	725,000	674,000
May.....	411,000	370,000	328,000	493,000	586,000	723,000	840,000
June.....	451,000	433,000	352,000	542,000	705,000	647,000	968,000
July.....	412,000	473,000	357,000	342,000	841,000	709,000	969,000
August.....	374,000	529,000	412,000	416,000	829,000	737,000	-----
September.....	346,000	386,000	338,000	408,000	456,000	487,000	-----
October.....	376,000	392,000	329,000	410,000	432,000	646,000	-----
November.....	409,000	337,000	373,000	510,000	468,000	664,000	-----
December.....	400,000	351,000	347,000	543,000	491,000	652,000	-----

Storage: Elevated tank, 70,000 gallons; concrete ground reservoir, 140,000 gallons.  
 Number of customers: 1,719.

Treatment: Aeration, coagulation, sedimentation, rapid sand filtration, and chlorination.

*Analyses*

[Collected Aug. 3, 1945. pH is 7.4 for finished water. Analyzed by C. B. Cibulka]

	Finished water		Raw water	
	Parts per million	Equivalents per million	Parts per million	Equivalents per million
Silica (SiO <sub>2</sub> ).....	15	-----	-----	-----
Iron (Fe).....	.11	-----	-----	-----
Calcium (Ca).....	85	4.24	83	4.14
Magnesium (Mg).....	16	1.32	17	1.40
Sodium (Na).....	88	3.81	92	3.98
Potassium (K).....	7.4	.19		
Bicarbonate (HCO <sub>3</sub> ).....	149	2.44	161	2.64
Sulfate (SO <sub>4</sub> ).....	193	4.02	186	3.87
Chloride (Cl).....	108	3.05	106	2.99
Fluoride (F).....	.4	.02	-----	-----
Nitrate (NO <sub>3</sub> ).....	1.8	.03	1.2	.02
Dissolved solids.....	615	-----	574	-----
Total-hardness as CaCO <sub>3</sub> .....	278	-----	277	-----

**ELSA**

Population in 1940: 1,006.

Source of information: Warren Turberville, city secretary, Aug. 3, 1945.

Ownership: Municipal.

Source of supply: Rio Grande, through canal; plant is one-half mile west of post office.

Pumpage (estimated): Maximum, 165,000 gallons a day; minimum, 120,000 gallons a day.

Storage: Elevated tank and open settling tank at ground level, 1,500,000 gallons.

Treatment: Coagulation, sedimentation, and chlorination.

*Analyses*

[Collected Aug. 3, 1945. pH is 7.3 for finished water. Analyzed by J. H. Rowley]

	Raw water		Finished water	
	Parts per million	Equivalents per million	Parts per million	Equivalents per million
Silica (SiO <sub>2</sub> ).....			12	
Iron (Fe).....			.31	
Calcium (Ca).....	90	4.49	86	4.29
Magnesium (Mg).....	19	1.56	17	1.40
Sodium (Na).....	86	3.76	92	3.98
Potassium (K).....			8.5	.22
Bicarbonate (HCO <sub>3</sub> ).....	122	2.00	117	1.92
Sulfate (SO <sub>4</sub> ).....	210	4.37	219	4.56
Chloride (Cl).....	119	3.36	116	3.27
Fluoride (F).....			2.2	.12
Nitrate (NO <sub>3</sub> ).....	4.8	.08	1.2	.02
Dissolved solids.....	640		659	
Total hardness as CaCO <sub>3</sub> .....	302		284	

**McALLEN**

Population in 1940: 11,822.

Source of information: W. M. Harris, general manager, August 7, 1945.

Ownership: Municipal.

Source of supply: Rio Grande, pumping plant 14 blocks east and 5 blocks north of post office.

*Average pumpage, in gallons a day*

	1939	1940	1941	1942	1943	1944	1945
January.....	716,000	945,000	785,000	829,000	960,000	1,347,000	708,000
February.....	815,000	1,162,000	704,000	900,000	1,314,000	1,597,000	1,440,000
March.....	972,000	1,024,000	670,000	1,084,000	1,192,000	1,461,000	1,808,000
April.....	881,000	958,000	750,000	1,060,000	1,247,000	1,652,000	1,525,000
May.....	904,000	807,000	656,000	1,026,000	1,367,000	1,638,000	1,855,000
June.....	912,000	896,000	716,000	1,097,000	1,458,000	1,465,000	2,054,000
July.....	1,060,000	813,000	916,000	719,000	1,588,000	1,632,000	1,898,000
August.....	1,028,000	1,116,000	939,000	905,000	1,574,000	1,395,000	
September.....	812,000	801,000	759,000	896,000	989,000	891,000	
October.....	773,000	725,000	698,000	803,000	1,068,000	1,114,000	
November.....	806,000	651,000	643,000	1,019,000	1,036,000	1,353,000	
December.....	899,000	671,000	705,000	1,020,000	1,214,000	1,330,000	

Storage: Elevated tank, 150,000 gallons; earthen reservoir, 10,000,000 gallons; concrete ground storage, 210,000 gallons.

Number of customers: 3,000.

Treatment: Aeration, coagulation, sedimentation, rapid sand filtration, and chlorination.



*Analyses*

Collected August 7, 1945. pH is 7.4 for finished water. Analyzed by J. H. Rowley]

	Finished water		Raw water	
	Parts per million	Equivalents per million	Parts per million	Equivalents per million
Silica (SiO <sub>2</sub> ).....	16			
Iron (Fe).....	13			
Calcium (Ca).....	88	4.39	86	4.29
Magnesium (Mg).....	17	1.40	18	1.48
Sodium (Na).....	88	3.84	88	3.82
Potassium (K).....	7.4	.19		
Bicarbonate (HCO <sub>3</sub> ).....	134	2.20	158	2.60
Sulfate (SO <sub>4</sub> ).....	212	4.41	190	3.96
Chloride (Cl).....	111	3.13	106	2.99
Fluoride (F).....	.8	.04		
Nitrate (NO <sub>3</sub> ).....	2.2	.04	2.5	.04
Dissolved solids.....	634		650	
Total hardness as CaCO <sub>3</sub> .....	290		288	

**MERCEDES**

Population in 1940: 7,624.

Source of information: E. L. Park, local manager, Aug. 4, 1945.

Owner: Central Power &amp; Light Co.

Source of supply: Rio Grande, pumping plant three blocks east of post office.

*Average pumpage, in gallons a day*

	1943	1944	1945		1943	1944	1945
January.....			569,000	July.....	331,000	328,000	423,000
February.....	603,500	398,200	830,000	August.....		528,000	
March.....		413,400	774,000	September.....		413,000	
April.....	520,766	510,000	866,000	October.....		444,000	
May.....	469,300	330,000	727,000	November.....		643,800	
June.....	263,800	404,000	764,000	December.....			

Storage: Standpipe, 80,000 gallons; concrete ground reservoir, 180,000; concrete ground reservoir, 70,000 gallons.

Number of customers: 1,236.

Treatment: Coagulation, sedimentation, rapid sand filtration, prechlorination, and postchlorination.

*Analyses*

[Collected Aug. 4, 1945. pH is 7.6 for finished water. Analyzed by C. B. Cibulka and J. H. Rowley]

	Finished water		Raw water	
	Parts per million	Equivalents per million	Parts per million	Equivalents per million
Silica (SiO <sub>2</sub> ).....	13			
Iron (Fe).....	.09			
Calcium (Ca).....	83	4.14	80	3.99
Magnesium (Mg).....	16	1.32	16	1.32
Sodium (Na).....	75	3.25	89	3.86
Potassium (K).....	9.3	.24		
Bicarbonate (HCO <sub>3</sub> ).....	119	1.95	152	2.50
Sulfate (SO <sub>4</sub> ).....	190	3.96	179	3.73
Chloride (Cl).....	103	2.90	103	2.90
Fluoride (F).....	1.8	.09		
Nitrate (NO <sub>3</sub> ).....	2.8	.05	2.5	.04
Dissolved solids.....	602		594	
Total hardness as CaCO <sub>3</sub> .....	273		266	

## MISSION

Population in 1940: 5,982.

Source of information: C. E. Langston, water superintendent, Aug. 7, 1945.

Ownership: Municipal.

Source of supply: Rio Grande; pumping plant is four blocks south and two and one-half blocks west of post office.

*Average pumpage, in gallons a day*

	1939	1940	1941	1942	1943	1944	1945
January.....	379,000	382,000	423,000	456,000	523,000	920,000	958,000
February.....	417,000	444,000	346,000	525,000	682,000	1,057,000	918,000
March.....	544,000	430,000	330,000	622,000	624,000	891,000	1,100,000
April.....	497,000	462,000	409,000	571,000	647,000	886,000	841,000
May.....	450,000	438,000	353,000	493,000	769,000	859,000	1,050,000
June.....	435,000	499,000	411,000	633,000	730,000	758,000	1,059,000
July.....	604,000	426,000	488,000	418,000	826,000	785,000	-----
August.....	556,000	651,000	584,000	435,000	898,000	812,000	-----
September.....	383,000	482,000	419,000	398,000	546,000	524,000	-----
October.....	410,000	456,000	387,000	556,000	486,000	670,000	-----
November.....	363,000	333,000	412,000	680,000	600,000	775,000	-----
December.....	386,000	352,000	347,000	640,000	628,000	805,000	-----

Storage: Elevated tank, 100,000 gallons; concrete ground reservoir, 50,000 gallons; earthen settling basin, 7,000,000 gallons.

Number of customers: 1,355.

Treatment: Aeration, coagulation, sedimentation, rapid sand filtration, pre-chlorination, and postchlorination.

*Analyses*

[Collected Aug. 7, 1945. pH is 7.4 for finished water. Analyzed by C. B. Cibulka]

	Finished water		Raw water	
	Parts per million	Equivalents per million	Parts per million	Equivalents per million
Silica (SiO <sub>2</sub> ).....	15	-----	-----	-----
Iron (Fe).....	22	-----	-----	-----
Calcium (Ca).....	76	3.79	84	4.19
Magnesium (Mg).....	15	1.23	18	1.48
Sodium (Na).....	102	4.45	82	3.57
Potassium (K).....	6.5	.17	150	2.46
Bicarbonate (HCO <sub>3</sub> ).....	131	2.15	183	3.81
Sulfate (SO <sub>4</sub> ).....	212	4.41	104	2.93
Chloride (Cl).....	106	2.99	2.5	.04
Fluoride (F).....	.8	.04	-----	-----
Nitrate (NO <sub>3</sub> ).....	2.8	.05	-----	-----
Dissolved solids.....	623	-----	617	-----
Total hardness as CaCO <sub>3</sub> .....	251	-----	284	-----

## PHARR

Population in 1940: 4,784.

Source of information: L. M. Flowers, city secretary, Aug. 7, 1945.

Ownership: Municipal.

Source of supply: Rio Grande; pumping plant is three-fourths mile south of post office.

*Average pumpage, in gallons a day*

	1941	1942	1943	1944	1945
January.....	312,000	250,000	240,000	323,000	382,000
February.....	340,000	280,000	340,000	446,000	443,000
March.....	270,000	326,000	379,000	438,000	568,000
April.....	250,000	337,000	338,000	491,000	468,000
May.....	180,000	368,000	332,000	442,000	479,000
June.....	150,000	265,000	305,000	347,000	492,000
July.....	180,000	140,000	350,000	463,000	389,000
August.....	200,000	180,000	346,000	375,000	-----
September.....	160,000	170,000	191,000	195,000	-----
October.....	140,000	160,000	179,000	296,000	-----
November.....	140,000	220,000	204,000	300,000	-----
December.....	180,000	230,000	234,000	345,000	-----

Storage: Elevated tank, 100,000 gallons; concrete ground reservoir, 100,000 gallons.

Number of customers: 1,100.

Treatment: Coagulation, sedimentation, rapid sand filtration, prechlorination, and postchlorination.

*Analyses*

[Collected Aug. 7, 1945. pH is 7.4 for finished water. Analyzed by C. B. Cibulka and J. H. Rowley]

	Finished water		Raw water	
	Parts per million	Equivalents per million	Parts per million	Equivalents per million
Silica (SiO <sub>2</sub> ).....	15	-----	-----	-----
Iron (Fe).....	.26	-----	-----	-----
Calcium (Ca).....	86	4.29	93	4.64
Magnesium (Mg).....	16	1.32	19	1.56
Sodium (Na).....	92	4.00	90	3.91
Potassium (K).....	7.2	.18		
Bicarbonate (HCO <sub>3</sub> ).....	139	2.28	174	2.86
Sulfate (SO <sub>4</sub> ).....	203	4.23	199	4.14
Chloride (Cl).....	113	3.19	108	3.05
Fluoride (F).....	.8	.04	-----	-----
Nitrate (NO <sub>3</sub> ).....	3.0	.05	3.8	.06
Dissolved solids.....	631	-----	693	-----
Total hardness as CaCO <sub>3</sub> .....	280	-----	310	-----

**SAN JUAN**

Population in 1940: 2,264.

Source of information: Mrs. Viola Hewitt, city clerk, Aug. 6, 1945.

Ownership: Municipal.

Source of supply: Rio Grande; plant is one and one-half blocks south of post office. Pumpage (estimated): Maximum, 100,000 gallons a day; average, 80,000 gallons a day.

Storage: Elevated tank, 55,000 gallons; concrete ground storage reservoir, 100,000 gallons.

Treatment: Aeration, coagulation, sedimentation, rapid sand filtration, prechlorination, and postchlorination.

*Analyses*

[Collected Aug. 6, 1945. pH is 7.7 for finished water. Analyzed by J. H. Rowley]

	Finished water		Raw water	
	Parts per million	Equivalents per million	Parts per million	Equivalents per million
Silica (SiO <sub>2</sub> ).....	12	-----	-----	-----
Iron (Fe).....	.19	-----	-----	-----
Calcium (Ca).....	92	4.59	92	4.59
Magnesium (Mg).....	16	1.32	18	1.48
Sodium (Na).....	84	3.67	-----	-----
Potassium (K).....	7.5	.19	86	3.67
Bicarbonate (HCO <sub>3</sub> ).....	140	2.29	178	2.92
Sulfate (SO <sub>4</sub> ).....	198	4.12	185	3.85
Chloride (Cl).....	114	3.22	108	3.05
Fluoride (F).....	1.8	.09	-----	-----
Nitrate (NO <sub>3</sub> ).....	3.0	.05	.5	.01
Dissolved solids.....	660	-----	664	-----
Total hardness as CaCO <sub>3</sub> .....	296	-----	304	-----

**WESLACO**

Population in 1940: 6,883.

Source of information: V. C. Thompson, city manager, Aug. 6, 1945.

Ownership: Municipal.

Source of supply: Rio Grande; plant is 1½ miles north of post office.

*Average pumpage, in gallons a day*

	1942	1943	1944	1945
January.....	597,000	835,000	980,000	1,043,000
February.....	661,000	1,238,000	1,181,000	1,017,000
March.....	802,000	894,000	1,110,000	1,236,000
April.....	765,000	835,000	1,187,000	1,155,000
May.....	665,000	820,000	976,000	1,067,000
June.....	651,000	724,000	696,000	906,000
July.....	450,000	818,000	663,000	996,000
August.....	380,000	830,000	605,000	-----
September.....	425,000	489,000	382,000	-----
October.....	430,000	-----	584,000	-----
November.....	650,000	-----	632,000	-----
December.....	790,000	760,000	798,000	-----

Storage: Elevated concrete tank, 300,000 gallons; concrete ground storage, 85,000 gallons.

Number of customers: 1,300.

Treatment: Coagulation, sedimentation, rapid sand filtration, prechlorination, and postchlorination.

*Analyses*

[Collected Aug. 6, 1945. pH is 7.6 for finished water. Analyzed by J. H. Rowley and C. B. Cibulka]

	Finished water		Raw water	
	Parts per million	Equivalents per million	Parts per million	Equivalents per million
Silica (SiO <sub>2</sub> ).....	12	-----	-----	-----
Iron (Fe).....	.14	-----	-----	-----
Calcium (Ca).....	84	4.19	78	3.89
Magnesium (Mg).....	16	1.32	17	1.40
Sodium (Na).....	73	3.17	-----	-----
Potassium (K).....	7.7	.20	86	3.75
Bicarbonate (HCO <sub>3</sub> ).....	119	1.95	145	2.38
Sulfate (SO <sub>4</sub> ).....	186	3.87	178	3.71
Chloride (Cl).....	104	2.93	103	2.90
Fluoride (F).....	1.8	.09	-----	-----
Nitrate (NO <sub>3</sub> ).....	2.5	.04	2.8	.05
Dissolved solids.....	591	-----	595	-----
Total hardness as CaCO <sub>3</sub> .....	276	-----	264	-----

## JIM HOGG COUNTY

## HEBBRONVILLE

Population in 1940: 2,400.

Source of information: W. A. Donnelly, owner, Aug. 8, 1945.

Ownership: Hebbbronville Utilities, Inc.

Source of supply: 3 wells.

Well 1. One block east and four blocks south of post office; drilled in 1936 by Layne-Texas Co.; depth, 1,198 feet; diameter, 8 to 6 inches; deep-well turbine pump and 20-horsepower electric motor, pump set at 169 feet; well flowing when drilled; static water level, 35 feet below land surface on Aug. 8, 1945; yield, 135 gallons a minute.

Well 2. Six blocks north and five blocks west of post office; drilled in 1939 by Layne-Texas Co.; depth, 992 feet; diameter, 10 $\frac{3}{4}$  to 6 $\frac{1}{2}$  inches; deep-well turbine pump and 15-horsepower electric motor, pump set at 164 feet; static water level 38.1 feet below land surface on Aug. 8, 1945; yield, 50 gallons a minute.

Well 3. Six blocks north and five blocks west of post office; drilled in 1944 by Layne-Texas Co., Ltd., depth, 970 feet; diameter, 12 $\frac{3}{4}$  to 5 inches; deep-well turbine pump and 40-horsepower electric motor; pump set at 240 feet; static water level, 39 feet below land surface on Aug. 8, 1945; yield, 200 gallons a minute.

*Average pumpage, in gallons a day*

	1944	1945		1944	1945
January		76,483	July	119,738	
February		104,653	August	188,474	
March	51,422	118,777	September	52,436	
April	164,470	177,152	October	59,497	
May	118,880	197,440	November	45,357	
June	96,053	119,845	December	78,916	

Treatment: None.

*Analysis, well 1*

[Collected Aug. 8, 1945. pH is 7.7. Analyzed by C. B. Cibulka]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> )	38		Sulfate (SO <sub>4</sub> )	131	2.73
Iron (Fe)	.17		Chloride (Cl)	361	10.18
Calcium (Ca)	18	0.90	Fluoride (F)	.4	.02
Magnesium (Mg)	3.7	.30	Nitrate (NO <sub>3</sub> )	12	.19
Sodium (Na)	342	14.86	Dissolved solids	1,020	
Potassium (K)	12	.31	Total hardness as CaCO <sub>3</sub>	60	
Bicarbonate (HCO <sub>3</sub> )	198	3.25			

*Drillers' logs*

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
<b>Well 1</b>					
Sandy soil.....	1	1	Hard shale.....	94	461
Caliche and sand.....	7	8	Sandy lime.....	16	477
Fine sand and caliche.....	7	15	Hard shale, sand and gravel.....	11	488
Caliche.....	31	46	Sandy lime and shale.....	20	508
Hard caliche.....	2	48	Sticky shale.....	4	512
Hard sand and caliche rock.....	14	62	Shale.....	45	557
Hard rock.....	2	64	Sandy shale.....	25	582
Hard sand and caliche rock.....	4	68	Hard shale-sand streaks.....	16	598
Hard rock.....	2	70	Shale.....	14	612
Hard sand and caliche.....	25	95	Gumbo.....	8	620
Clay.....	10	105	Shale.....	29	649
Hard, dry, sandy clay.....	164	269	Lime, sandy.....	15	664
Sand and gravel.....	14	283	Shale.....	123	787
Hard shale.....	8	291	Sand.....	22	809
Sand and gravel.....	11	302	Shale.....	59	868
Hard sand and boulders.....	3	305	Gumbo.....	51	919
Shale.....	7	312	Sand.....	4	923
Sandy shale.....	4	316	Shale.....	43	966
Hard sand.....	8	324	Sand and gravel.....	14	980
Hard shale.....	2	326	Shale.....	61	1,041
Hard sand.....	31	357	Sandy lime.....	11	1,052
Hard sand and gravel.....	10	367	Shale.....	146	1,198

**Well 2**

Soil.....	7	7	Hard shale.....	11	568
Caliche.....	6	13	Sand and shale.....	17	585
Sand.....	7	20	Sand, shale layers.....	9	594
Caliche.....	11	31	Sand.....	5	599
Hard sand and caliche.....	5	36	Hard shale.....	10	609
Sand, rock and caliche.....	22	58	Shale.....	5	614
Sand, rock.....	2	60	Sand and shale.....	5	619
Sand and caliche.....	6	66	Shale.....	1	620
Sand, rock.....	5	71	Sand.....	5	625
Caliche.....	27	98	Sand and shale.....	7	632
Sand and caliche.....	11	109	Shale.....	7	639
Hard clay.....	8	117	Sticky shale.....	7	646
Sand.....	12	129	Sand and shale.....	3	649
Hard clay.....	36	165	Sandy shale.....	57	706
Hard shale.....	6	171	Blue shale and shells.....	33	739
Hard clay.....	40	211	Sand.....	10	749
Hard sand, clay.....	8	219	Sand and shale.....	10	759
Hard sand.....	5	224	Sand, shale and shells.....	20	779
Hard clay.....	7	231	Shale and sand.....	8	787
Sand, gravel, shells.....	7	238	Sand and shale.....	15	802
Hard clay.....	15	253	Shale and sand.....	18	820
Sand and gravel.....	23	276	Sand.....	6	826
Clay.....	3	279	Sandstone.....	3	829
Sand and gravel.....	52	331	Sand, hard.....	11	840
Hard clay.....	24	355	Shale and shell.....	36	876
Soft clay.....	19	374	Hard sand and gravel.....	21	897
Hard clay.....	5	379	Hard shale.....	3	900
Sand.....	7	386	Hard sand and gravel.....	5	905
Sandy clay.....	13	399	Shale.....	12	917
Hard sand.....	5	404	Sand and shale.....	2	919
Sandy clay.....	15	419	Shale, hard layers.....	1	920
Hard sand and lignite.....	44	463	Sand and shale.....	3	923
Hard brown shale.....	14	477	Hard sand and gravel.....	3	926
Sandy shale.....	7	484	Hard sand.....	9	935
Hard sand.....	8	492	Shale.....	3	938
Shale.....	18	510	Sand and shale.....	14	952
Sandy shale.....	5	515	Hard sand and gravel.....	19	971
Shale.....	11	526	Shale.....	21	992
Sandy shale.....	31	557			

*Drillers' logs—Continued*

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
<b>Well 3</b>					
Soil.....	3	3	Shale and sand breaks.....	19	563
Caliche.....	2	5	Sand.....	8	571
Sand.....	12	17	Sand and shale breaks.....	15	586
Hard caliche.....	8	25	Hard sand.....	10	596
Hard caliche and sand.....	12	37	Hard shale.....	8	604
Sand, rock and caliche.....	15	52	Shale.....	13	617
Sand, rock.....	3	55	Sandy shale.....	14	631
Sand and caliche.....	11	66	Hard shale.....	10	641
Hard sand, rock.....	5	71	Shale.....	24	665
Caliche and sand breaks.....	36	107	Sandy shale.....	26	691
Clay.....	10	117	Shale and hard layers.....	40	731
Sand.....	12	129	Sand.....	10	741
Clay and hard layers.....	76	205	Sand and shale.....	19	760
Sandy clay.....	11	216	Sand.....	19	779
Sand and clay.....	14	230	Shale.....	5	784
Sand and shells.....	7	237	Sand.....	11	795
Clay.....	15	252	Hard shale and lime.....	14	809
Sand, gravel and caliche.....	54	306	Sand and shale breaks.....	20	829
Sand and gravel.....	28	334	Sand and gravel.....	11	840
Clay.....	39	373	Hard shale.....	8	848
Clay and sand breaks.....	10	383	Shale.....	24	872
Hard sandy clay.....	14	397	Hard sand and gravel.....	26	898
Sand.....	8	405	Shale.....	12	910
Sandy clay.....	14	419	Sand and shale.....	11	921
Hard sand.....	31	450	Sand.....	8	929
Sand and hard layers.....	11	461	Sand and gravel.....	6	935
Shale.....	5	466	Shale.....	3	938
Shale and hard layers.....	15	481	Gravel and shale.....	12	950
Sand and shale breaks.....	11	492	Sand and gravel.....	17	967
Shale and hard layers.....	52	544	Shale.....	3	970

**JIM WELLS COUNTY****ALICE**

Population in 1940: 7,792.

Source of information: R. W. Manning, water superintendent, May 8, 1945.

Ownership: Municipal.

Source of supply: 5 wells.

Well 1. Center well at waterworks; drilled in 1928 by Layne-Texas Co.; drilled to 2,068 feet and plugged back to 992 feet; diameter, 16 to 8 inches; screens from 837 to 867 and 945 to 986 feet; submersible turbine pump and 30-horsepower electric motor; static water level, 55.5 feet below land surface on Feb. 28, 1928, 58.5 feet on Jan. 2, 1934, and 110 feet on May 8, 1945; yield, 375 gallons a minute; temperature, 86° F.

Well 2. At city waterworks; drilled in 1938 by Frank Whitson; depth, 622 feet; diameter, 5 inches; deep-well turbine pump and 20-horsepower electric motor; static water level reported 149 feet below land surface in 1945; yield, 110 gallons a minute; temperature, 84½° F.

Well 3. Two blocks northeast of city waterworks; drilled in 1940 by A. E. Fawcett; depth, 647 feet; diameter, 10 inches; submersible turbine pump and electric motor; static water level reported 192 feet below land surface in 1945; yield, 325 gallons a minute; temperature, 82½° F.

Well 4. At city waterworks; drilled in 1944 by Carl Vickers; depth, 550 feet; diameter, 10 inches, 42 feet of screen at bottom; deep-well turbine pump and 30-horsepower electric motor; static water level reported 152 feet below land surface in 1945; yield, 167 gallons a minute; temperature, 81° F.

Well 5. On 5th St. between Texas Ave. and South Woodlawn Dr.; drilled in 1945 by Layne-Texas Co., Ltd.; depth, 900 feet; diameter, 16 to 8 inches; static water level reported 150 feet below land surface in 1945; yield, 430 gallons a minute with draw-down of 250 feet after 15 days pumping during test; well not in use.

Pumpage: Maximum, 1,100,000 gallons a day; minimum, 800,000 gallons a day; average, 1,000,000 gallons a day.

Storage: Elevated concrete tank, 85,000 gallons; 4 concrete ground reservoirs, combined capacity, 980,000 gallons.

Number of customers: 2,065.

Treatment: None.

### Analyses

[Collected: wells 1, 2, 3, 4, March 5, 1945; well 5, September 27, 1945. pH; well 1, 7.2; wells 2, 3, 4, 7.4; and well 5, 7.8. Analyzed by J. H. Rowley]

	Well 1		Well 2		Well 3	
	Parts per million	Equivalents per million	Parts per million	Equivalents per million	Parts per million	Equivalents per million
Silica (SiO <sub>2</sub> )	29		22		18	
Iron (Fe)	.02		.03		.05	
Calcium (Ca)	23	1.15	20	1.00	43	2.15
Magnesium (Mg)	8.8	.72	8.1	.67	23	1.89
Sodium (Na)	333	14.49	290	12.59	398	17.29
Potassium (K)	11	.28	9.9	.25	12	.51
Bicarbonate (HCO <sub>3</sub> )	345	5.65	353	5.79	315	5.16
Sulfate (SO <sub>4</sub> )	196	4.08	117	2.44	165	3.44
Chloride (Cl)	237	6.68	214	6.04	448	12.64
Fluoride (F)	1	.05	.9	.05	.9	.05
Nitrate (NO <sub>3</sub> )	11	.18	12	.19	22	.35
Dissolved solids	1,020		876		1,200	
Total hardness as CaCO <sub>3</sub>	94		84		202	

	Well 4		Well 5	
	Parts per million	Equivalents per million	Parts per million	Equivalents per million
Silica (SiO <sub>2</sub> )	25		18	
Iron (Fe)	.05		.04	
Calcium (Ca)	42	2.10	30	1.50
Magnesium (Mg)	22	1.81	17	1.40
Sodium (Na)	313	13.60	317	13.77
Potassium (K)	11	.28	10	.26
Bicarbonate (HCO <sub>3</sub> )	362	5.93	358	5.87
Sulfate (SO <sub>4</sub> )	115	2.39	128	2.66
Chloride (Cl)	325	9.17	289	8.15
Fluoride (F)	2.1	.11	1.2	.06
Nitrate (NO <sub>3</sub> )	12	.19	12	.19
Dissolved solids	1,050		999	
Total hardness as CaCO <sub>3</sub>	196		145	



*Driller's log, well 1*

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil.....	4	4	Shale.....	20	698
Clay.....	6	10	Gumbo.....	22	720
Sand.....	15	25	Shale and sand.....	92	812
Clay and gravel.....	59	84	Gumbo.....	15	837
Rock.....	6	90	Sand.....	24	861
Caliche.....	66	156	Shale and sand.....	88	949
Clay and gravel.....	43	109	Sand.....	43	992
Clay.....	194	393	Gumbo.....	91	1,083
Rock.....	1	394	Sand.....	59	1,142
Clay.....	9	403	Gumbo.....	135	1,277
Sand.....	20	423	Sand.....	52	1,329
Clay.....	73	496	Gumbo.....	46	1,375
Sand.....	39	535	Sand.....	10	1,385
Gumbo.....	3	538	Gumbo.....	62	1,447
Sand.....	15	553	Gumbo and sand layers.....	111	1,558
Rock.....	1	554	Sand.....	22	1,580
Clay.....	41	595	Gumbo.....	73	1,653
Sand.....	27	622	Sand.....	14	1,667
Gumbo.....	4	626	Gumbo.....	214	1,881
Rock.....	1	627	Shale.....	81	1,962
Sand.....	18	645	Sand.....	23	1,985
Gumbo.....	14	659	Sand and shale.....	83	2,068
Sand.....	19	678			

**ORANGE GROVE**

Population in 1940: 906.

Source of information: Richard Riedesel, water superintendent, June 2, 1945.

Ownership: Municipal.

Source of supply: 2 wells.

Well 1. In Orange Grove; drilled in 1936 by Mr. Jackson; depth, 288 feet; diameter, 8 inches; deep-well turbine pump and 5½-horsepower electric motor; static water level reported, 120 feet below land surface in 1945; yield, 75 gallons a minute; temperature, 78½° F.

Well 2. In Orange Grove; drilled in 1942 by Ed Juergens; depth, 520 feet; diameter, 8 inches; 50 feet of screen at bottom; deep-well turbine pump and 7½-horsepower electric motor; static water level reported, 120 feet below land surface in 1945; yield, 100 gallons a minute; temperature, 81½° F.

Pumpage: Average 75,000 gallons a day.

Storage: Elevated tank, 50,000 gallons; concrete ground reservoir, 50,000 gallons.

Number of customers: 174.

Treatment: None.

*Analyses*

[Collected June 2, 1945. pH is 7.6. Analyzed by J. H. Rowley]

	Well 1		Well 2	
	Parts per million	Equivalents per million	Parts per million	Equivalents per million
Silica (SiO <sub>2</sub> ).....	20	-----	22	-----
Iron (Fe).....	3.2	-----	2.0	-----
Calcium (Ca).....	70	3.49	40	2.00
Magnesium (Mg).....	27	2.22	17	1.40
Sodium (Na).....	297	12.93	259	11.28
Potassium (K).....	-----	-----	9.3	.24
Bicarbonate (HCO <sub>3</sub> ).....	389	6.38	423	6.93
Sulfate (SO <sub>4</sub> ).....	124	2.58	121	2.52
Chloride (Cl).....	332	9.36	188	5.30
Fluoride (F).....	1.2	.06	.6	.03
Nitrate (NO <sub>3</sub> ).....	13	.26	8.5	.14
Dissolved solids.....	1,080	-----	890	-----
Total hardness as CaCO <sub>3</sub> .....	286	-----	170	-----

**PREMONT**

Population in 1940: 1,080.

Source of information: John W. Duerksen, city secretary, Feb. 8, 1945.

Ownership: Municipal.

Source of supply: Two wells, on city lot at elevated tank in Premont.

Well 1. Drilled in 1939 by Peurifoy and Patterson; depth, 520 feet; diameter, 8 inches; deep-well turbine pump and electric motor; static water level 78.7 feet below land surface on Jan. 2, 1945; pumping level, 86.75 feet; yield, 120 gallons a minute.

Well 2. Drilled in 1945; depth, 506 feet; deep-well turbine pump and electric motor.

Pumpage: Estimated maximum, 125,000 gallons a day; average, 50,000 gallons a day.

Storage: Ground reservoir, 50,000 gallons; elevated tank, 50,000 gallons.

Number of customers: 230.

Treatment: None.

*Analyses*

[Collected well 1, October 14, 1943; well 2, June 1945. pH: well 1, 7.5; well 2, 7.4. Analyzed by J. H. Rowley

	Well 1		Well 2	
	Parts per million	Equivalents per million	Parts per million	Equivalents per million
Silica (SiO <sub>2</sub> ).....	14	-----	41	-----
Iron (Fe).....	52	08	58	10
Calcium (Ca).....	19	2.60	21	2.89
Magnesium (Mg).....	181	1.56	184	1.73
Sodium (Na).....	25	7.87	184	7.98
Potassium (K).....	284	.64	9.0	.23
Bicarbonate (HCO <sub>3</sub> ).....	67	4.66	289	4.74
Sulfate (SO <sub>4</sub> ).....	224	1.39	69	1.44
Chloride (Cl).....	17	6.32	222	6.26
Fluoride (F).....	5	.03	1.0	.05
Nitrate (NO <sub>3</sub> ).....	764	.27	21	.34
Dissolved solids.....	208	-----	783	-----
Total hardness as CaCO <sub>3</sub> .....	208	-----	231	-----

*Driller's log, well 1*

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Caliche.....	16	16	Sandy red shale.....	160	410
Caliche with sand streaks.....	234	250	Sand.....	110	520

**KARNES COUNTY****FALLS CITY**

Population in 1940: 500.

Source of information: F. P. Moczygemba, owner, Apr. 17, 1945.

Owner: F. P. Moczygemba.

Source of supply: San Antonio River; centrifugal pump and 20-horsepower electric motor; capacity, 250 gallons a minute.

Pumpage: Maximum, 50,000 gallons; minimum, 5,000 gallons a day; water is not sold for drinking purposes.

Storage: Elevated tank, 40,000 gallons.

Number of customers: 60.

Treatment: None.

*Analysis of raw water*

[Collected Apr. 17, 1945. pH is 8.1. Analyzed by J. H. Rowley]

	Parts per million	Equiva- lents per million		Part per million	Equiva- lents per million
Silica (SiO <sub>2</sub> )-----	13	-----	Sulfate (SO <sub>4</sub> )-----	59	1.23
Iron (Fe)-----	.81	-----	Chloride (Cl)-----	47	1.33
Calcium (Ca)-----	90	4.49	Fluoride (F)-----	.6	.03
Magnesium (Mg)-----	21	1.73	Nitrate (NO <sub>3</sub> )-----	12	.19
Sodium (Na)-----	19	.81	Dissolved solids-----	428	-----
Potassium (K)-----	6.6	.17	Total hardness as CaCO <sub>3</sub> -----	311	-----
Bicarbonate (HCO <sub>3</sub> )-----	270	4.42			

**GILLETT**

Population in 1940: 200.

Source of information: J. M. Golson, owner, Apr. 17, 1945.

Owner: J. M. Golson.

Source of supply: Well just east of Modern Garage; drilled in 1927 by J. M. McCuller; depth, 165 feet; diameter, 4 inches; cylinder pump and ½-horsepower electric motor, cylinder set at 80 feet; static water level, 58 feet below land surface on Apr. 17, 1945; yield, about 3 gallons a minute.

Pumpage: No record.

Storage: Elevated tank, 1,500 gallons.

Number of customers: 19.

Treatment: None.

*Analysis*

[Collected Apr. 17, 1945. pH is 7.5. Analyzed by J. H. Rowley]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> )-----	11	-----	Sulfate (SO <sub>4</sub> )-----	891	18.55
Iron (Fe)-----	1.2	-----	Chloride (Cl)-----	585	16.50
Calcium (Ca)-----	280	13.98	Fluoride (F)-----	.6	.03
Magnesium (Mg)-----	73	6.00	Nitrate (NO <sub>3</sub> )-----	4.0	.06
Sodium (Na)-----	440	19.15	Dissolved solids-----	2,510	-----
Potassium (K)-----	60	1.53	Total hardness as CaCO <sub>3</sub> -----	999	-----
Bicarbonate (HCO <sub>3</sub> )-----	337	5.52			

**KARNES CITY**

Population in 1940: 1,571.

Source of information: Alvin Salge, city clerk, Apr. 17, 1945.

Ownership: Municipal.

Source of supply: 2 wells.

Well 1. At pump station; drilled in 1922; depth, 860 feet; diameter, 12 inches; deep-well turbine pump and 20-horsepower electric motor, pump set at 300 feet; yield, 175 gallons a minute with draw-down of 30 feet; temperature, 92° F.

Well 2. About 100 feet west of well 1; drilled in 1922; depth, 860 feet; diameter, 10 inches; Hi-Lift pump and 7½-horsepower electric motor, pump set at 300 feet; yield, 60 gallons a minute; static water level reported 185 feet below land surface on Mar. 31, 1937.

Pumpage: No record.

Storage: Elevated tank, 50,000 gallons; concrete ground reservoir, 60,000 gallons.

Number of customers: 315.

Treatment: Occasional chlorination.

### *Analysis, Well 1*

[Collected Apr. 17, 1945. pH is 8.2. Analyzed by J. H. Rowley]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> ).....	72	-----	Sulfate (SO <sub>4</sub> ).....	109	2.27
Iron (Fe).....	.03	-----	Chloride (Cl).....	420	11.85
Calcium (Ca).....	6.7	0.33	Fluoride (F).....	2.2	.12
Magnesium (Mg).....	.6	.05	Nitrate (NO <sub>3</sub> ).....	1.8	.03
Sodium (Na).....	433	18.84	Dissolved solids.....	1,230	-----
Potassium (K).....	21	.54	Total hardness as CaCO <sub>3</sub> .....	19	-----
Bicarbonate (HCO <sub>3</sub> ).....	292	5.49			

### KENEDY

Population in 1940: 2,891.

Source of information: F. E. Moses, water superintendent, Apr. 18, 1945.

Ownership: Municipal.

Source of supply: 3 wells.

Well 1. About 400 feet west of pump station; drilled in 1926 by Layne-Texas Co., depth, 402 feet; diameter, 16 inches; 60 feet of screen at bottom; deep-well turbine pump and 20-horsepower electric motor pump set at 140 feet; static water level reported 38 feet below land surface; yield, 345 gallons a minute with draw-down of 57 feet after pumping 24 hours on Mar. 30, 1937; water level, 89 feet; yield, 277 gallons a minute with draw-down of 40 feet in July 1943; present yield, 275 gallons a minute; temperature, 79° F.

Well 2. At pump station, drilled in 1929 by Layne-Texas Co.; depth, 419 feet; diameter, 16 inches; deep-well turbine pump and 20-horsepower electric motor, pump set at 140 feet; static water level reported 38 feet below land surface on Mar. 30, 1937; yield, 277 gallons a minute in July 1943.

Well 3. About 400 feet south of pump station; drilled in 1943 by Layne-Texas Co., Ltd.; depth, 400 feet, diameter, 13½ to 6½ inches; underreamed and gravel walled; screen from 334 to 396 feet; deep-well turbine pump and 25-horsepower electric motor, pump set at 170 feet; static water level, 90 feet below land surface; yield, 375 gallons a minute with draw-down of 75 feet on July 25, 1943 (wells 1 and 2 pumping when test was made); temperature, 79° F.

Pumpage: Maximum, 675,000 gallons; average, 500,000 gallons a day.

Storage: 2 elevated tanks, 100,000 and 50,000 gallons, ground reservoir, 200,000 gallons.

Number of customers: 644.

Treatment: None.

*Analyses*

[Collected Apr. 18, 1945. pH for each well is 7.4. Analyzed by J. H. Rowley]

	Well 1		Well 2		Well 3	
	Parts per million	Equivalents per million	Parts per million	Equivalents per million	Parts per million	Equivalents per million
Silica (SiO <sub>2</sub> )	47		48		46	
Iron (Fe)	.20		.34		.18	
Calcium (Ca)	101	5.04	92	4.69	68	3.39
Magnesium (Mg)	15	1.23	12	.99	9.4	.77
Sodium (Na)	364	15.81	401	17.44	341	14.82
Potassium (K)	34	.87	35	.90	31	.79
Bicarbonate (HCO <sub>3</sub> )	381	6.25	400	6.66	428	7.02
Sulfate (SO <sub>4</sub> )	108	2.25	156	3.25	112	2.33
Chloride (Cl)	505	14.24	495	13.96	365	10.29
Fluoride (F)	1.2	.06	1.0	.05	1.0	.05
Nitrate (NO <sub>3</sub> )	9.6	.15	6.5	.10	5.0	.08
Dissolved solids	1,370		1,440		1,190	
Total hardness as CaCO <sub>3</sub>	314		279		208	

*Drillers' logs*

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
<b>Well 1</b>					
Soil	5	5	Gumbo	35	170
Hard sandy clay	10	15	Clay	30	200
Sand	20	35	Sand	15	215
Clay	40	75	Hard dry gumbo	125	340
Sand	20	95	Sand	60	400
Clay	40	135	Gumbo	2	402
<b>Well 3</b>					
Soil	8	8	Tough sticky shale	68	202
Clay	12	20	Sand	17	219
Sand	19	39	Shale	127	346
Clay	39	78	Sand	51	397
Sand	30	108	Tough sticky shale	3	400
Hard shale	26	134			

**RUNGE**

Population in 1940: 1,001.

Source of information: V. D. Goehring, manager, Apr. 18, 1945.

Owner: Central Power &amp; Light Co.

Source of supply: 2 wells.

Well 1. At pump station; drilled in 1914 by city of Runge; depth, 156 feet; cylinder pump and 15-horsepower electric motor; static water level reported 96 feet below land surface on March 16, 1945; yield, 100 gallons a minute; stand-by well.

Well 2. At elevated tank; drilled in 1935 by Layne-Texas Co., depth, 212 feet; diameter, 10 inches; screen from 156 to 190 feet; deep-well turbine pump and 10-horsepower electric motor, pump set at 169 feet; static water level reported 95 feet below land surface on Mar. 31, 1935; yield, 132 gallons a minute with draw-down of 26 feet after 14 hours' pumping on Aug. 18, 1935; water level, 97, feet; yield, 150 gallons a minute on Mar. 16, 1945.

Pumpage: Average, 26,500 gallons a day.

Storage: Elevated tank, 50,000 gallons; concrete ground reservoir, 49,400 gallons.

Number of customers: 232.

Treatment: Chlorination.

*Analysis, well 2*

[Collected Apr. 18, 1945. pH is 7.1. Analyzed by J. H. Rowley]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> ).....	20	-----	Sulfate (SO <sub>4</sub> ).....	36	0.75
Iron (Fe).....	.19	-----	Chloride (Cl).....	315	8.88
Calcium (Ca).....	130	6.49	Fluoride (F).....	1.0	.05
Magnesium (Mg).....	36	2.96	Nitrate (NO <sub>3</sub> ).....	6.7	.11
Sodium (Na).....	98	4.27	Dissolved solids.....	962	-----
Potassium (K).....	27	.69	Total hardness as CaCO <sub>3</sub> .....	472	-----
Bicarbonate (HCO <sub>3</sub> ).....	282	4.62			

*Driller's log, well 2*

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil.....	4	4	Clay.....	20	136
Hard yellow clay.....	62	66	Hard clay and boulders.....	18	154
Rock.....	1	67	Sand.....	34	188
Hard clay.....	29	96	Clay.....	24	212
Clay and boulders.....	20	116			

**KENDALL COUNTY**

**BOERNE**

Population in 1940: 1,271.

Source of information: A. C. Richter, manager of utilities, Nov. 2, 1945.

Ownership: Municipal.

Source of supply: 2 wells.

Well 1. Drilled about 1929; depth, 40 feet; diameter, 10 inches; deep-well turbine pump and 15-horsepower electric motor; static water level, 31 feet below land surface; yield, 178 gallons a minute.

Well 2. About 10 feet from well 1; drilled in 1945 by Lewis Berkman; depth, 40 feet; diameter, 10 inches; deep-well turbine pump and 20-horsepower electric motor; yield, 210 gallons a minute.

Pumpage: Summer average 195,000 gallons; winter average 98,000 gallons.

Storage: Elevated tank.

Number of customers: 428.

Treatment: Chlorination.

*Analysis, well 1*

[Collected Nov. 2, 1945. pH is 6.8. Analyzed by C. B. Cibulka and J. H. Rowley]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> ).....	12	-----	Sulfate (SO <sub>4</sub> ).....	69	1.44
Iron (Fe).....	.04	-----	Chloride (Cl).....	20	.56
Calcium (Ca).....	104	5.19	Fluoride (F).....	.4	.02
Magnesium (Mg).....	18	1.48	Nitrate (NO <sub>3</sub> ).....	10	.16
Sodium (Na).....	8.3	.36	Dissolved solids.....	415	-----
Potassium (K).....	2.6	.07	Total hardness as CaCO <sub>3</sub> .....	334	-----
Bicarbonate (HCO <sub>3</sub> ).....	300	4.92			

**KINNEY COUNTY****BRACKETTVILLE**

Population in 1940: 2,653.

Source of information: O. F. Seargeant, water superintendent, Nov. 2, 1945.

Ownership: U. S. Government and Municipal.

Source of supply: Los Moras Spring at Fort Clark, two blocks south of the city hall.

Pumpage (estimated): 25,000 gallons a day in summer; 13,000 gallons a day in winter.

Storage: Elevated tank, 75,000 gallons.

Number of customers: 650.

Treatment: Chlorination.

*Analysis*

[Collected Nov. 2, 1945. pH is 7.4. Analyzed by C. B. Cibulka and J. H. Rowley]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> )	11		Sulfate (SO <sub>4</sub> )	6.7	0.14
Iron (Fe)	.08		Chloride (Cl)	14	.39
Calcium (Ca)	66	3.29	Fluoride (F)	.6	.03
Magnesium (Mg)	6.8	.56	Nitrate (NO <sub>3</sub> )	4.8	.08
Sodium (Na)	20	.86	Dissolved solids	262	
Potassium (K)	4.2	.11	Total hardness as CaCO <sub>3</sub>	192	
Bicarbonate (HCO <sub>3</sub> )	255	4.18			

**KLEBERG COUNTY****KINGSVILLE**

Population in 1940: 7,782.

Source of information: P. H. Barnhill, June 6, 1945.

Ownership: Municipal.

Source of supply: 4 wells.

Well 2. Drilled in 1935 by the Layne-Texas Co.; depth, 730 feet; diameter, 12 inches; deep-well turbine pump and 30-horsepower electric motor; yield on test, 634 gallons a minute June 20, 1935, and 499 gallons a minute on April 13, 1945; temperature, 85° F.

Well 3. Drilled in 1939 by A. H. Masarian; depth, 725 feet; diameter, 8 inches; deep-well turbine pump and 15-horsepower electric motor; yield, 148 gallons a minute on April 13, 1945.

Well 4. Drilled in 1939 by Otto Caster; depth, 725 feet; diameter, 8 inches; deep-well turbine pump and 20-horsepower electric motor; yield, 260 gallons a minute on April 13, 1945.

Well 5. Drilled in 1943 by the Layne-Texas Co.; depth, 737 feet, diameter, 16 to 8 inches; deep-well turbine pump and 50-horsepower electric motor; static water level, 105 feet below pump base, June 30, 1943; yield, 850 gallons a minute with a pumping level of 148 feet on June 30, 1943, and 774 gallons a minute on April 13, 1945; temperature, 85° F.

*Average pumpage, in gallons a day*

	1940	1941	1942	1943	1944
January.....	615,000	659,000	649,000	966,000	730,000
February.....	707,000	620,000	705,000	1,080,000	627,000
March.....	809,000	603,000	869,000	1,241,000	865,000
April.....	961,000	771,000	1,266,000	1,778,000	1,276,000
May.....	965,000	660,000	1,451,000	2,046,000	1,465,000
June.....	756,000	632,000	1,649,000	1,604,000	1,347,000
July.....	1,173,000	925,000	1,240,000	1,973,000	1,466,000
August.....	1,432,000	1,110,000	1,503,000	1,849,000	1,867,000
September.....	904,000	1,035,000	1,106,000	1,324,000	1,242,000
October.....	782,000	768,000	1,129,000	1,329,000	1,451,000
November.....	629,000	881,000	1,318,000	945,000	1,373,000
December.....	563,000	1,112,000	1,125,000	653,000	1,241,000

Storage: Ground storage reservoir and elevated tank.

Number of customers: 2,995.

Treatment: Periodic chlorination.

*Analyses*

[Collected: Wells 2 and 5, Mar. 16, 1945; wells 3 and 4, Feb. 5, 1943. pH: well 2, 8.0; well 3, 8.3; well 4, 8.2; well 5, 7.9. Analyzed by J. H. Rowley]

	Well 2		Well 5	
	Parts per million	Equivalents per million	Parts per million	Equivalents per million
Silica (SiO <sub>2</sub> ).....	14	-----	17	-----
Iron (Fe).....	.02	-----	.03	-----
Calcium (Ca).....	22	1.10	21	1.05
Magnesium (Mg).....	8.6	.71	7.5	.62
Sodium (Na).....	305	13.27	308	13.37
Potassium (K).....	14	.36	12	.31
Bicarbonate (HCO <sub>3</sub> ).....	307	5.04	315	5.17
Sulfate (SO <sub>4</sub> ).....	162	3.37	162	3.37
Chloride (Cl).....	242	6.83	235	6.63
Fluoride (F).....	.9	.05	.5	.03
Nitrate (NO <sub>3</sub> ).....	9.0	.15	9.2	.15
Dissolved solids.....	956	-----	951	-----
Total hardness as CaCO <sub>3</sub> .....	90	-----	84	-----

	Well 3		Well 4	
	Parts per million	Equivalents per million	Parts per million	Equivalents per million
Silica (SiO <sub>2</sub> ).....	18	-----	11	-----
Iron (Fe).....	.08	-----	.02	-----
Calcium (Ca).....	33	1.65	24	1.20
Magnesium (Mg).....	11	.90	9.6	.79
Sodium (Na).....	358	15.56	317	13.78
Potassium (K).....	267	4.38	304	4.98
Bicarbonate (HCO <sub>3</sub> ).....	270	5.62	163	3.39
Sulfate (SO <sub>4</sub> ).....	278	7.84	255	7.19
Chloride (Cl).....	.2	.01	.4	.02
Fluoride (F).....	16	.26	12	.19
Nitrate (NO <sub>3</sub> ).....	1,114	-----	959	-----
Dissolved solids.....	128	-----	100	-----
Total hardness as CaCO <sub>3</sub> .....	-----	-----	-----	-----



*Driller's log, well 5*

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Top soil.....	6	6	Fine-grained sand.....	32	286
White clay.....	26	32	Shale.....	16	302
Fine-grained sand.....	4	36	Sand.....	12	314
White clay.....	50	86	Sand.....	82	396
Shale and layers of fine sand.....	53	139	Sand and layers of shale.....	38	434
Hard shale.....	20	159	Shale.....	23	457
Fine-grained sand.....	34	193	Sand.....	10	467
Soft shale.....	39	232	Shale.....	7	474
Sand.....	15	247	Shale and layers of sand.....	108	582
Shale.....	7	254	Sand.....	155	737

**LA SALLE COUNTY****COTULLA**

Population in 1940: 3,633.

Source of information: John Wildenthal, water superintendent, May 11, 1945.

Ownership: Municipal.

Source of supply: 2 wells.

Well 1. At elevated tank; drilled in 1916 by F. M. Burkett; depth, 2,300 feet; diameter, 6 inches; screen from 2,188 to 2,300 feet; reported natural flow, 240 gallons a minute; centrifugal pump; yield about 400 gallons a minute; temperature, 104° F.

Well 2. Located about 1 mile northwest of well 1; drilled in 1940 to a depth of 6,366 feet and plugged back to 2,483 feet; diameter, 10¾ inches; cemented from 2,483 to surface, gun perforated from 2,100 to 2,483 feet; natural flow, 165 gallons a minute 3 feet above land surface on Oct. 22, 1942; reported yield, with test pump, 516 gallons a minute with draw-down of 98 feet below land surface (total draw-down about 150 feet); temperature, 107° F.

Pumpage (estimated): Maximum, 400,000 gallons; minimum, 150,000 gallons; average, about 250,000 to 300,000 gallons a day.

Storage: Elevated tank, 100,000 gallons, concrete ground reservoir, 125,000 gallons.

Number of customers: 566.

Treatment: None.

*Analyses*

[Collected: well 1, September 15, 1942; well 2, Oct. 21, 1942. pH: well 1, 8.4; well 2, 8.3.

Analyzed by: W. W. Hastings]

	Well 1		Well 2	
	Parts per million	Equivalents per million	Parts per million	Equivalents per million
Silica (SiO <sub>2</sub> ).....	26		19	
Iron (Fe).....	.02		.04	
Calcium (Ca).....	2.2	0.11	2.3	0.11
Magnesium (Mg).....	1.1	.09	1.6	.13
Sodium (Na).....	214	9.32	230	9.98
Potassium (K).....				
Bicarbonate (HCO <sub>3</sub> ).....		5.59	380	6.23
Sulfate (SO <sub>4</sub> ).....	79	1.64	84	1.75
Chloride (Cl).....	81	2.28	78	2.20
Fluoride (F).....	.1	.01	.7	.04
Nitrate (NO <sub>3</sub> ).....	0	0	0	0
Dissolved solids.....	571		614	
Total hardness as CaCO <sub>3</sub> .....	10		12	

*Drillers' logs*

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
<b>Well 1</b>					
Gravel and clay.....	20	20	Blue mud.....	41	1,051
Soft sandstone.....	41	61	Sandstone (flowing water).....	55	1,106
Blue sandstone (water).....	55	116	Blue mud and shale.....	65	1,171
Hard sandstone with boulders.....	12	128	Hard sandstone.....	13	1,184
Soft sandstone (water).....	20	148	Blue mud.....	22	1,206
Shale.....	57	205	Hard rock.....	4	1,210
Soft sandstone.....	15	220	Sandstone.....	16	1,226
Blue shale.....	24	244	Blue mud and shale.....	43	1,269
Sandstone (water).....	36	280	Hard sandstone.....	13	1,282
Blue mud.....	35	315	Soft sandstone.....	19	1,301
Sandstone (water).....	15	330	Blue mud, shale and hard rock.....	126	1,427
Dark-colored mud.....	43	373	Sandstone.....	35	1,462
Soft sandstone.....	14	387	Blue mud.....	26	1,488
Light-blue mud.....	22	409	Sandstone.....	10	1,498
Dark-colored mud.....	28	437	Gray mud.....	11	1,509
Blue mud.....	13	450	Hard sandstone.....	19	1,538
Soft sand.....	16	466	Blue mud.....	7	1,545
Brown blue and white mud.....	172	638	Sandstone.....	27	1,572
Sand and shale.....	9	647	Pink mud.....	13	1,585
Light-blue and brown mud.....	39	686	Sandstone.....	28	1,613
Hard rock.....	2	688	Brown mud.....	17	1,630
Brown mud.....	23	711	Hard sandstone.....	40	1,670
Hard sandstone.....	9	720	Mud, shale and hard rock.....	89	1,759
Dark-colored mud.....	27	747	Sandstone (flowing water).....	35	1,794
Hard rock.....	6	753	Hard sandstone.....	100	1,894
Dark-colored mud.....	6	759	Gray mud.....	6	1,900
Hard rock.....	16	775	Sand (water).....	45	1,945
Dark-colored mud.....	13	788	Blue mud.....	5	1,950
Soft sandstone.....	27	815	Hard sandstone.....	19	1,969
Black shale.....	5	820	Light shale.....	13	1,982
Lignite.....	4	824	Hard shale.....	6	1,988
Mud, dark-colored shale and rock.....	86	910	Sandstone (water).....	39	2,027
Black shale.....	4	914	Dark-colored shale.....	51	2,078
Coal.....	1	915	Hard sandstone.....	40	2,118
Sandstone (water).....	25	940	Soft sandstone (water).....	11	2,129
Blue mud.....	13	953	Dark-colored shale.....	26	2,155
Sandstone.....	20	973	Hard sandstone.....	11	2,166
Blue mud.....	29	1002	Blue shale.....	22	2,188
Sand.....	8	1010	Sandstone (flowing water).....	12	2,200
			Sandstone.....	100	2,300
<b>Well 2</b>					
Rotary floor.....	16	16	Hard sand.....	44	1,094
Hard rock.....	98	114	Shale with streaks of sand.....	194	1,288
Unreported.....	19	133	Medium hard sand.....	20	1,308
Broken sand.....	192	325	Shale with hard sand streaks.....	50	1,358
Hard sand and broken shale.....	240	565	Hard broken sand.....	68	1,426
Sticky shale.....	36	601	Shale with some sand.....	492	1,918
Hard sand.....	7	608	Sticky shale with streaks of hard sand.....	44	1,962
Sandy shale.....	56	664	Broken sand.....	29	1,991
Hard sand.....	3	667	Hard sand lime streaks.....	35	2,026
Sandy shale.....	23	690	Hard sand.....	79	2,105
Hard sand.....	8	698	Soft sand.....	105	2,210
Sticky shale.....	8	706	Broken sand.....	60	2,270
Hard sand.....	48	754	Hard sand.....	15	2,285
Shale with streaks of lignite.....	31	785	Shale with hard sand streaks.....	60	2,345
Soft sand.....	24	809	Hard sand.....	70	2,415
Shale with streaks of hard sand.....	86	695	Soft sand.....	57	2,472
Sand.....	11	906	Hard sand.....	58	2,530
Sticky shale with streaks of sand.....	56	962	Shale.....	650	3,180
Hard sand.....	22	984	Hard sand.....	30	3,210
Shale.....	66	1,050	Soft sand.....	2	3,212
			Shale.....	280	3,492

## FOWLERTON

Population in 1940: 600.

Source of information: O. W. Herman, storekeeper, May 11, 1945.

Ownership: Municipal.

Source of supply: Well in northwest part of town; drilled in 1912 by Fowlerton Bros.; depth about 1,700 feet; diameter, 8 inches; natural flow into mains; quantity, pressure, and temperature unknown.

Pumpage: No record.

Storage: None; flows directly into main.

Number of customers: 50.

Treatment: None.

*Analysis*

[Collected May 11, 1945. pH is 8.0. Analyzed by J. H. Rowley]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> )-----	37	-----	Sulfate (SO <sub>4</sub> )-----	192	4.00
Iron (Fe)-----	.63	-----	Chloride (Cl)-----	422	11.90
Calcium (Ca)-----	3.1	0.15	Fluoride (F)-----	4.4	.23
Magnesium (Mg)-----	.7	.06	Nitrate (NO <sub>3</sub> )-----	1.0	.02
Sodium (Na)-----	933	40.58	Dissolved solids-----	2,360	-----
Potassium (K)-----	13	.33	Total hardness as CaCO <sub>3</sub> -----	10	-----
Bicarbonate (HCO <sub>3</sub> )-----	1,530	24.97			

## LIVE OAK COUNTY

## GEORGE WEST

Population in 1940: 1,250.

Source of information: Walter E. Lamm, co-owner, Apr. 19, 1945.

Owner: George West Utilities Co.

Source of supply: Well at ice plant; drilled in 1914; depth, 500 feet; diameter, 10 inches; deep-well turbine pump and 10-horsepower electric motor; static water level, 38.4 feet below land surface in August 1934; yield, 235 gallons a minute with draw-down of 45 feet after several hours pumping; temperature, 81° F.

Pumpage: Maximum, 100,000 gallons; average, 60,000 gallons a day.

Storage: Elevated tank, 50,000 gallons; concrete ground reservoir, 55,000 gallons.

Number of customers: 150.

Treatment: None.

*Analysis*

[Collected Apr. 19, 1945. pH is 7.4. Analyzed by J. H. Rowley]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> )-----	30	-----	Sulfate (SO <sub>4</sub> )-----	316	6.58
Iron (Fe)-----	.56	-----	Chloride (Cl)-----	267	7.53
Calcium (Ca)-----	74	3.69	Fluoride (F)-----	1.4	.07
Magnesium (Mg)-----	20	1.64	Nitrate (NO <sub>3</sub> )-----	0	.00
Sodium (Na)-----	300	13.06	Dissolved solids-----	1,230	-----
Potassium (K)-----	55	1.41	Total hardness as CaCO <sub>3</sub> -----	266	-----
Bicarbonate (HCO <sub>3</sub> )-----	343	5.62			

## THREE RIVERS

Population in 1940: 1,337.

Source of information: Bryan Boyd, city secretary, Apr. 19, 1945.

Ownership: Municipal.

Source of supply: Frio River (part of supply is obtained from two dug wells on river bank).

Pumpage: Maximum, 150,000 gallons a day.

Storage: Elevated tank, 50,000 gallons; concrete ground reservoir, 550,000 gallons.

Number of customers: 350.

Treatment: Chlorination.

*Analyses*

[Collected Apr. 19, 1945. pH: dug well, 7.0; Frio River, 7.7. Analyzed by J. H. Rowley]

	Dug well		Frio River (raw water)	
	Parts per million	Equivalents per million	Parts per million	Equivalents per million
Silica (SiO <sub>2</sub> )	51		14	
Iron (Fe)	.14		.48	
Calcium (Ca)	226	11.28	69	3.44
Magnesium (Mg)	17	1.40	11	.90
Sodium (Na)	106	4.63	88	3.84
Potassium (K)	33	.84		
Bicarbonate (HCO <sub>3</sub> )	481	7.88	227	3.72
Sulfate (SO <sub>4</sub> )	130	2.71	66	1.37
Chloride (Cl)	266	7.50	108	3.05
Fluoride (F)	.2	.01	.2	.01
Nitrate (NO <sub>3</sub> )	3.0	.05	1.8	.03
Dissolved solids	1,070		481	
Total hardness as CaCO <sub>3</sub>	634		217	

## MAVERICK COUNTY

## EAGLE PASS

Population in 1940: 6,459.

Source of information: J. A. Slaughter, local manager, May 10, 1945.

Owner: Central Power and Light Co.

Source of supply: Rio Grande through 5 dug wells in river bed.

Pumpage: Maximum, 1,300,000 gallons; minimum, 600,000 gallons; average, 800,000 to 900,000 gallons a day.

Storage: Elevated tank, 20,000 gallons; concrete ground reservoir, 500,000 gallons.

Number of customers: 1,352.

Treatment: Chlorination.

*Analysis of composite sample from five wells*

[Collected May 10, 1945. pH is 7.3. Analyzed by J. H. Rowley]

	Parts per million	Equivalents per million		Parts per million	Equivalents per million
Silica (SiO <sub>2</sub> )	18		Sulfate (SO <sub>4</sub> )	272	5.66
Iron (Fe)	.71		Chloride (Cl)	245	6.91
Calcium (Ca)	116	5.79	Fluoride (F)	1.2	.06
Magnesium (Mg)	32	2.63	Nitrate (NO <sub>3</sub> )	2.2	.04
Sodium (Na)	174	7.56	Dissolved solids	980	
Potassium (K)	11	.28	Total hardness as CaCO <sub>3</sub>	421	
Bicarbonate (HCO <sub>3</sub> )	219	3.59			

## MEDINA COUNTY

## DEVINE

Population in 1940: 1,398.

Source of information: R. L. Connely, water superintendent, Feb. 19, 1946.

Ownership: Municipal.

Source of supply: 2 wells.

Well 1. Located 3 blocks north and 2 blocks east of post office; drilled about 1938; depth, 350 feet; deep-well turbine pump and 10-horsepower electric motor, pump set at 190 feet; yield, 125 gallons a minute.

Well 2. Drilled about 1928; depth, 250 feet; deep-well turbine pump and 10-horsepower electric motor, pump set at 190 feet; yield, 125 gallons a minute.

Pumpage: Maximum, 100,000 gallons; minimum, 50,000 gallons; average, 70,000 gallons a day.

Storage: Elevated tank, 50,000; concrete ground reservoir, 50,000 gallons.

Number of customers: 325.

Treatment: None.

*Analyses*

[Collected Feb. 19, 1946. pH: well 1, 7.6; well 2, 7.7. Analyzed by C. B. Cibulka]

	Well 1		Well 2	
	Parts per million	Equivalents per million	Parts per million	Equivalents per million
Silica (SiO <sub>2</sub> )	11		13	
Iron (Fe)	.83		2.5	
Calcium (Ca)	70	3.49	63	3.14
Magnesium (Mg)	16	1.32	15	1.23
Sodium (Na)	111	4.82	98	4.25
Potassium (K)	15	.38	10	.26
Bicarbonate (HCO <sub>3</sub> )	388	6.36	346	5.67
Sulfate (SO <sub>4</sub> )	76	1.58	77	1.60
Chloride (Cl)	71	2.00	56	1.58
Fluoride (F)	.6	.03	.6	.03
Nitrate (NO <sub>3</sub> )	2.5	.04	.0	.00
Dissolved solids	564		503	
Total hardness as CaCO <sub>3</sub>	240		218	

## HONDO

Population in 1940: 2,500.

Source of information: Homer Wilson, water superintendent, Nov. 2, 1945.

Ownership: Municipal.

Source of supply: 2 wells.

Well 1. At elevated tank, drilled in 1900; depth, 1,450 feet; diameter, 8 to 6 inches; cased to 1,400 feet; deep-well turbine pump and 40-horsepower electric motor; static water level, 165 feet below land surface; yield, 400 gallons a minute with draw-down of 75 feet.

Well 2. About 50 feet from well 1; drilled in 1910; depth, 1,460 feet; diameter, 10 to 6 inches; deep-well turbine pump and 40-horsepower electric motor; yield, 500 gallons a minute with draw-down of 55 feet.

Pumpage: Summer peak, 1,080,000; winter average, 360,000 gallons.

Storage: Elevated tank, 50,000 gallons.

Treatment: None.

Number of customers: 800.

*Analyses*

[Collected Nov. 2, 1945. pH: Well 1, 7.0; well 2, 7.2. Analyzed by J. H. Rowley and C. B. Cibulka]

	Well 1		Well 2	
	Parts per million	Equivalents per million	Parts per million	Equivalents per million
Silica (SiO <sub>2</sub> ).....	14		13	
Iron (Fe).....	.08		.05	
Calcium (Ca).....	66	3.29	64	3.19
Magnesium (Mg).....	16	1.32	16	1.32
Sodium (Na).....	4.8	.21	7.1	.31
Potassium (K).....	3.4	.09	4.4	.11
Bicarbonate (HCO <sub>3</sub> ).....	244	4.00	255	4.18
Sulfate (SO <sub>4</sub> ).....	16	.33	14	.29
Chloride (Cl).....	18	.51	14	.39
Fluoride (F).....	.2	.01	.2	.01
Nitrate (NO <sub>3</sub> ).....	3.8	.06	3.5	.06
Dissolved solids.....	263		262	
Total hardness as CaCO <sub>3</sub> .....	230		226	

**NUECES COUNTY****AGUA DULCE**

Population in 1940: 750.

Source of information: Frank Whitson, well driller, July 18, 1945.

Ownership: Municipal.

Source of supply: Well at elevated tank; drilled in 1940 by Frank Whitson; depth, 596 feet; diameter, 8 to 4 inches; 40 feet of 4-inch screen; deep-well turbine pump and electric motor; static water level reported 80 feet below land surface; yield, 30 gallons a minute.

Pumpage (estimated): Summer, 35,000 gallons a day; winter, 30,000 gallons a day.

Storage: Elevated tank, 50,000 gallons; ground reservoir, 50,000 gallons.

Number of customers: 110.

Treatment: Aeration, sedimentation, filtration, and chlorination.

*Analysis*

[Collected July 18, 1945. pH is 8.0. Analyzed by J. H. Rowley]

	Parts per million	Equivalents per million		Parts per million	Equivalents per million
Silica (SiO <sub>2</sub> ).....	8.0		Sulfate (SO <sub>4</sub> ).....	231	4.81
Iron (Fe).....	.02		Chloride (Cl).....	535	15.09
Calcium (Ca).....	28	1.40	Fluoride (F).....	.4	.02
Magnesium (Mg).....	12	.99	Nitrate (NO <sub>3</sub> ).....	24	.39
Sodium (Na).....	511	22.20	Dissolved solids.....	1,520	
Potassium (K).....	24	.61	Total hardness as CaCO <sub>3</sub> .....	150	
Bicarbonate (HCO <sub>3</sub> ).....	298	4.89			

*Driller's log*

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Shale.....	312	312	Sand.....	25	445
Sand.....	15	327	Shale.....	30	475
Shale.....	30	357	Sand.....	65	540
Sand.....	18	375	Shale.....	18	558
Shale.....	45	420	Sand.....	38	596

**BISHOP**

Population in 1940: 1,329.

Source of information: W. L. Johnson, city secretary, July 1945.

Ownership: Municipal.

Source of supply: 2 wells at elevated tank in Bishop.

Well 1. Drilled about 1910; depth about 760 feet; diameter, 6 inches; pumped by air; yield, 75 gallons a minute.

Well 2. About 300 feet from well 1; drilled in 1939 by Layne-Texas Co.; depth, 782 feet; diameter, 8½ to 5½ inches; screen from 715 to 781 feet; deep-well turbine pump driven by 5-horsepower electric motor, pump lowered from 90 to 130 feet in 1941; static water level, 28 feet below land surface on June 30, 1939, and 36 feet below land surface in 1941; yield, 42 gallons a minute with draw-down of 38 feet on June 30, 1939; present yield, 100 gallons a minute.

Pumpage: Summer, 125,000 gallons a day; winter, 72,000 gallons a day.

Storage: Elevated tank, 50,000 gallons; ground reservoir, 65,000 gallons.

Number of customers: 355.

Treatment: Hypochlorination.

*Analyses*

[Collected July 1945. pH: Well 1, 8.0; well 2, 7.9. Analyzed by J. H. Rowley]

	Well 1		Well 2	
	Parts per million	Equivalents per million	Parts per million	Equivalents per million
Silica (SiO <sub>2</sub> ).....	10	-----	8.5	-----
Iron (Fe).....	.03	-----	.03	-----
Calcium (Ca).....	19	0.95	18	0.90
Magnesium (Mg).....	6.8	.56	6.2	.51
Sodium (Na).....	358	15.58	368	15.98
Potassium (K).....	17	.43	}	
Bicarbonate (HCO <sub>3</sub> ).....	311	5.11		
Sulfate (SO <sub>4</sub> ).....	192	4.00	188	5.14
Chloride (Cl).....	290	8.18	288	3.91
Fluoride (F).....	1.0	.05	.8	8.12
Nitrate (NO <sub>3</sub> ).....	11	.18	11	.04
Dissolved solids.....	1,060	-----	1,040	.18
Total hardness as CaCO <sub>3</sub> .....	76	-----	70	-----

*Driller's log well 2*

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Clay.....	12	12	Sand, hard layers.....	3	541
Sand and muck.....	4	16	Sand.....	11	552
Clay.....	9	25	Clay.....	28	580
Sand.....	10	35	Sand.....	14	594
Clay.....	288	323	Clay.....	10	604
Sand.....	9	332	Shale and clay.....	22	626
Clay.....	92	424	Shale.....	22	648
Sand.....	33	457	Shale and sand streaks.....	22	670
Clay.....	30	487	Shale.....	21	691
Hard sand.....	12	499	Shale and sand.....	22	713
Clay.....	35	534	Brown sand.....	45	758
Sand.....	4	538	Brown hard sand.....	22	780

**CORPUS CHRISTI**

Population in 1940: 57,301.

Source of information: John Cunningham, water superintendent, July 1945.

Ownership: Municipal.

Source of supply: Storage reservoir on Nueces River near Mathis; original capacity, 66,000 acre-feet. Water fed to low-water reservoir at Calallen by Nueces River. Filtration plant at Calallen; reservoir capacity, 175,000,000 gallons. Water pumped 16 miles to Corpus Christi; pumping capacity, 35 to 40 million gallons a day. Also supplies Naval Bases, Clarkwood, and Nueces Water Improvement District 1.

Storage: Elevated tank, 750,000 gallons; two ground reservoirs, 10,000,000 gallons each.

Treatment: Coagulation, sedimentation, aeration, rapid sand filtration, prechlorination and postchlorination.

*Average pumpage, in gallons a day*

	1937	1938	1939	1940
January.....	3,138,710	3,317,094	3,901,613	4,681,613
February.....	3,910,714	4,564,286	4,645,178	5,283,965
March.....	3,040,968	4,300,000	4,129,032	4,836,290
April.....	3,951,612	4,866,666	5,079,833	5,515,000
May.....	4,626,666	4,387,096	5,173,870	5,442,741
June.....	4,229,333	5,346,666	4,967,833	5,484,433
July.....	4,073,710	5,302,903	5,673,645	5,824,709
August.....	4,841,935	5,970,161	6,300,870	7,165,483
September.....	5,096,666	4,259,666	5,515,666	7,106,666
October.....	4,256,935	4,369,516	4,740,806	5,731,290
November.....	3,951,166	4,441,833	5,432,833	5,398,000
December.....	3,670,323	4,101,935	4,789,838	4,895,161
	1941	1942	1943	1944
January.....	5,110,000	7,162,096	10,268,870	10,707,967
February.....	5,920,000	8,060,714	11,816,785	12,219,896
March.....	4,679,000	7,094,193	10,172,903	10,693,258
April.....	6,070,000	8,844,333	11,963,000	13,125,266
May.....	6,010,000	8,533,225	12,190,322	14,763,064
June.....	7,079,333	10,827,166	11,699,666	18,243,766
July.....	7,806,451	9,550,483	11,467,741	19,885,193
August.....	9,952,903	11,185,806	12,419,032	22,545,000
September.....	10,445,666	11,116,500	11,518,333	17,702,933
October.....	7,577,096	10,874,193	9,753,548	16,357,741
November.....	7,672,833	10,879,677	10,394,666	71,636,033
December.....	6,870,000	10,190,967	10,601,290	14,455,967

*Analyses*

[Collected July 1945. pH: Raw water, 7.8; finished water, 7.3. Analyzed by J. H. Rowley]

	Raw water		Finished water	
	Parts per million	Equivalents per million	Parts per million	Equivalents per million
Silica (SiO <sub>2</sub> ).....	19		13	
Iron (Fe).....	.09		.05	
Calcium (Ca).....	56	2.80	39	1.95
Magnesium (Mg).....	6.5	.53	7.4	.61
Sodium (Na).....	56	2.42	59	2.55
Potassium (K).....	9.0	.23	9.6	.25
Bicarbonate (HCO <sub>3</sub> ).....	180	2.95	91	1.49
Sulfate (SO <sub>4</sub> ).....	43	.90	66	1.37
Chloride (Cl).....	74	2.09	88	2.48
Fluoride (F).....	.6	.03	.4	.02
Nitrate (NO <sub>3</sub> ).....	.4	.01	0	0
Dissolved solids.....	370		342	
Total hardness as CaCO <sub>3</sub> .....	166		128	



**PORT ARANSAS**

Population in 1940: 495.

Source of information: Boone Walker, manager, July 17, 1945.

Owner: Mustang Island Industries.

Source of supply: 36 wells, all 2-inch driven-well points, about 18 feet deep; wells are in 4 batteries of 9 wells each and each battery of wells is pumped by direct-suction pumps.

Pumpage: Unknown.

Storage: 3 wooden elevated tanks, about 3,000 gallons each.

Number of customers: About 300 during summer months.

Treatment: Hypochlorination.

*Analysis of composite sample*

[Collected July 17, 1945. pH is 7.8. Analyzed by J. H. Rowley]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> ).....	4.0	-----	Sulfate (SO <sub>4</sub> ).....	123	2.56
Iron (Fe).....	1.1	-----	Chloride (Cl).....	925	26.09
Calcium (Ca).....	106	5.29	Fluoride (F).....	.6	.03
Magnesium (Mg).....	69	5.67	Nitrate (NO <sub>3</sub> ).....	5.5	.09
Sodium (Na).....	498	21.66	Dissolved solids.....	1,930	-----
Potassium (K).....	44	1.13	Total hardness as CaCO <sub>3</sub> .....	548	-----
Bicarbonate (HCO <sub>3</sub> ).....	304	4.98			

**ROBSTOWN**

Population in 1940: 6,780.

Source of information: W. B. Messer, manager, July 18, 1945.

Owner: Nueces County Water Improvement District 3.

Source of supply: Nueces River: diversion plant about 5 miles north of Robstown; water fed by canal to filtration plant at Robstown.

Storage: Elevated tank, 100,000 gallons; ground reservoir, 7,000,000 gallons; treated ground storage, 150,000 gallons.

Number of customers: 1,960.

Treatment: Aeration, coagulation, sedimentation, rapid sand filtration, pre-chlorination, and postchlorination.

*Average pumpage, in gallons a day*

	1943	1944	1945		1943	1944	1945
January.....	405,000	462,000	583,000	July.....	680,000	776,000	-----
February.....	432,000	552,000	623,000	August.....	774,000	739,000	-----
March.....	535,000	597,000	700,000	September.....	580,000	567,000	-----
April.....	648,000	638,000	646,000	October.....	431,000	517,000	-----
May.....	678,000	546,000	741,000	November.....	453,000	543,000	-----
June.....	464,000	585,000	723,000	December.....	431,000	497,000	-----

*Analyses*

[Collection: July 1945. pH: Raw water, 7.9; finished water, 7.7. Analyzed by J. H. Rowley]

	Raw water		Finished water	
	Parts per million	Equivalents per million	Parts per million	Equivalents per million
Silica (SiO <sub>2</sub> ).....	16	-----	12	-----
Iron (Fe).....	.15	-----	1.15	-----
Calcium (Ca).....	62	3.09	67	3.34
Magnesium (Mg).....	7.2	.59	7.6	.62
Sodium (Na).....	45	1.97	47	2.05
Potassium (K).....	9.6	.25	9.5	.24
Bicarbonate (HCO <sub>3</sub> ).....	177	2.90	172	2.82
Sulfate (SO <sub>4</sub> ).....	44	.92	61	1.27
Chloride (Cl).....	73	2.06	76	2.14
Fluoride (F).....	.4	.02	.4	.02
Nitrate (NO <sub>3</sub> ).....	0	.00	0	.00
Dissolved solids.....	362	-----	379	-----
Total hardness as CaCO <sub>3</sub> .....	184	-----	198	-----

**REFUGIO COUNTY****AUSTWELL**

Population in 1940: 301.

Source of information: Mrs. Marie Bailey, city secretary, July 1945.

Ownership: Municipal.

Source of supply: Well, drilled in 1938 by C. E. Enton; depth, 361 feet; diameter, 6 inches; deep-well pump and electric motor; double-action cylinder; yield, 20 to 30 gallons a minute.

Storage: 13,500 gallons.

Number of customers: 60.

Treatment: None.

*Analysis*

[Collected July 1945. pH is 7.8. Analyzed by J. H. Rowley]

	Parts per million	Equivalents per million		Parts per million	Equivalents per million
Silica (SiO <sub>2</sub> ).....	12	-----	Sulfate (SO <sub>4</sub> ).....	89	1.85
Iron (Fe).....	.98	-----	Chloride (Cl).....	220	6.20
Calcium (Ca).....	36	1.80	Fluoride (F).....	.6	.03
Magnesium (Mg).....	18	1.48	Nitrate (NO <sub>3</sub> ).....	0	.00
Sodium (Na).....	248	10.80	Dissolved solids.....	833	-----
Potassium (K).....	9.9	.25	Total hardness as CaCO <sub>3</sub> .....	164	-----
Bicarbonate (HCO <sub>3</sub> ).....	381	6.25			

*Driller's log, well 1*

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Surface soil.....	4	4	Sand streaked, fine-grained and coarse-grained.....	10	245
Clay.....	66	70	Shale.....	19	264
Sand.....	5	75	Sand.....	14	278
Clay.....	49	124	Shale.....	26	304
Sand.....	22	146	Sand.....	9	313
Shale and sand.....	62	208	Shale.....	8	321
Sand.....	10	218	Sand and gravel.....	40	361
Shale.....	17	235			

## REFUGIO

Population in 1940: 4,077.

Source of information: I. C. Williams, water superintendent, July 1945.

Ownership: Municipal.

Source of supply: 2 wells.

Well 1. About a quarter of a mile northeast of the courthouse in Refugio; drilled in 1930 by Layne-Texas Co., original depth, 960 feet; underreamed and new screen installed in 1943; depth, 886 feet; diameter, 10 to 5½ inches; deep-well turbine pump and 30-horsepower electric motor, pump set at 119 feet; flowing well; pump yield, 330 gallons a minute with pumping level at 111 feet below land surface, after being repaired in 1943.

Well 2. About 140 feet from well 1; drilled in 1937 by Layne-Texas Co., depth, 875 feet; diameter, 13¾ to 6½ inches; deep-well turbine pump and 8-cylinder gasoline engine, pump set 100 feet; flowing well; pump yield, 660 gallons a minute with pumping level at 83 feet below land surface.

Pumpage: Summer, 400,000 gallons a day; winter, 200,000 gallons a day.

Storage: Elevated tank, 100,000 gallons; ground reservoir, 50,000 gallons.

Number of customers: 715.

Treatment: Chlorination.

## Analyses

[Collected July 1945. pH: Well 1, 8.1; well 2, 8.5. Analyzed by J. H. Rowley]

	Well 1		Well 2	
	Parts per million	Equivalents per million	Parts per million	Equivalents per million
Silica (SiO <sub>2</sub> ).....	13		16	
Iron (Fe).....	.12		.04	
Calcium (Ca).....	5.8	0.29	.59	0.29
Magnesium (Mg).....	2.7	.22	2.7	.22
Sodium (Na).....	371	16.11	365	15.88
Potassium (K).....	11	.28	7.2	.18
Bicarbonate (HCO <sub>3</sub> ).....	411	6.75	418	6.87
Sulfate (SO <sub>4</sub> ).....	57	1.19	53	1.10
Chloride (Cl).....	315	8.88	302	8.52
Fluoride (F).....	1.4	.07	1.4	.07
Nitrate (NO <sub>3</sub> ).....	.8	.01	.8	.01
Dissolved solids.....	994		963	
Total hardness as CaCO <sub>3</sub> .....	26		26	

## Driller's log; well 1

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Clay.....	58	58	Sand, hard.....	35	579
Sand.....	8	66	Shale.....	9	588
Shale.....	129	195	Sand.....	83	671
Sand.....	12	207	Shale and boulders.....	28	699
Shale.....	38	245	Sand.....	1	709
Sand.....	8	253	Rock.....	10	710
Rock.....	1	254	Sand.....	7	717
Sand.....	18	272	Rock.....	3	720
Shale.....	8	280	Sand.....	12	732
Sand.....	7	287	Rock.....	2	734
Shale.....	33	320	Shale, sticky.....	61	795
Sand.....	12	332	Sand, good.....	24	819
Shale.....	57	389	Shale.....	10	829
Sand.....	16	405	Sand, good.....	10	839
Shale.....	11	416	Rock.....	2	841
Sand.....	25	441	Shale.....	16	857
Shale.....	19	460	Sand, good.....	20	877
Sand.....	8	468	Shale.....	16	893
Shale.....	20	488	Rock sand.....	5	898
Sand.....	22	510	Shale.....	22	920
Shale.....	34	544			

## WOODSBORO

Population in 1940: 1,426.

Source of information: Edward Mason, water superintendent, July 1945.

Ownership: Municipal.

Source of supply: Well at elevated tank; drilled in 1935 by A. E. Fawcett, Jr.; depth, 203 feet (under-reamed and cased to 140 feet); diameter, 12 inches; deep-well turbine pump and 10-horsepower electric motor, pump set at 91 feet; static water level 32 feet below land surface on August 12, 1935; yield, 270 gallons a minute with drawdown of 40 feet on test, present yield, 250 gallons a minute.

Pumpage: Summer, 85,000 gallons a day; winter, 40,000 gallons a day.

Storage: Elevated tank, 75,000 gallons; ground storage, 50,000 gallons.

Customers: 270.

Treatment: None.

*Analysis*

[Collected July 1945. pH is 7.6. Analyzed by J. H. Rowley]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> )	12		Sulfate (SO <sub>4</sub> )	95	1.98
Iron (Fe)	.04		Chloride (Cl)	340	9.59
Calcium (Ca)	56	2.80	Fluoride (F)	.4	.02
Magnesium (Mg)	27	2.22	Nitrate (NO <sub>3</sub> )	.8	.01
Sodium (Na)	288	12.51	Dissolved solids	1,020	.01
Potassium (K)	13	.33	Total hardness as CaCO <sub>3</sub>	251	
Bicarbonate (HCO <sub>3</sub> )	382	6.26			

*Driller's log; well 1*

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Surface soil	2	2	Sand	35	140
Clay	28	30	Clay	12	152
Sand and clay	30	60	Sand and shale	35	187
Sand and hard streaks	35	95	Fine-grained sand	16	203
Dense clay	10	105			

## SAN PATRICIO COUNTY

## ARANSAS PASS

Population in 1940: 4,095.

Source of information: C. H. Cavitt, water superintendent, July 17, 1945.

Ownership: Municipal.

Source of supply: 10 wells at 2 well fields; well field No. 1 at elevated tank near center of city; well field No. 2 in south part of city about 1 mile from well field No. 1; all 7 wells in well field 1 center around the ground storage reservoir and elevated tank; wells 1, 2, 3, and 4 are about 200 feet from the nearest well; wells 5 and 6 are about 300 feet from the nearest well; and well 7 is about 500 feet from the nearest well.

Well field 1:

Well 1. Drilled about 1914; depth, 60 feet; diameter, 8 inches; deep-well cylinder and pump jack driven by 3-horsepower electric motor; static water level reported 27 feet below land surface.

Well 2. Drilled in 1930 by Marvin Baker; depth, 60 feet; diameter, 10 inches; deep-well cylinder and pump jack driven by 3-horsepower electric motor.

Well 3. Drilled in 1930 by Marvin Baker; depth, 60 feet; diameter, 8 inches; deep-well cylinder and pump jack driven by 3-horsepower electric motor.

Well 4. Drilled in 1932 by W. R. Erwin; depth, 60 feet; diameter, 12 inches; deep-well turbine pump driven by 2-horsepower electric motor; yield, 50 gallons a minute.

Well 5. Drilled in 1930 by Marvin Baker; depth, 60 feet; diameter, 10 inches; deep-well cylinder and pump jack driven by 10-horsepower electric motor.

Well 6. Drilled in 1933 by Marvin Baker; depth, 60 feet; diameter, 8 inches; deep-well turbine pump driven by 2-horsepower electric motor; yield, 50 gallons a minute.

Well 7. Drilled in 1940 by Marvin Baker; depth, 60 feet; diameter, 8 inches; deep-well turbine pump driven by 5-horsepower electric motor.

Well field No. 2:

Well 1. Drilled in 1940 by Lloyd Richardson; depth, 60 feet; diameter, 10 inches; deep-well turbine pump driven by 2-horsepower electric motor; static water level, 6 feet below land surface; yield, 50 gallons a minute.

Well 2. About 500 feet from well 1; drilled in 1940 by Lloyd Richardson; depth, 60 feet; diameter, 10 inches; deep-well turbine pump driven by 2-horsepower electric motor.

Well 3. About 700 feet from well 2; drilled in 1941 by Marvin Baker; depth, 60 feet; diameter, 8 inches; deep-well turbine pump driven by 3-horsepower electric motor.

Pumpage (estimated): 200,000 gallons a day.

Storage: Elevated tank, 60,000 gallons; concrete ground reservoir, 84,000 gallons; wood ground tank, 18,000 gallons.

Number of customers: 900.

Treatment: None.

### Analyses

[Collected July 1945. pH: Wells 1, 2, and 3, in well field 2, 7.8; well 6, in well field 1, 7.4. Analyzed by J. H. Rowley]

	Wells 1, 2 and 3		Well 6	
	Parts per million	Equivalents per million	Parts per million	Equivalents per million
Silica (SiO <sub>2</sub> )	37	-----	21	-----
Iron (Fe)	1.0	-----	40	-----
Calcium (Ca)	53	2.65	65	3.24
Magnesium (Mg)	4.0	.33	15	1.23
Sodium (Na)	56	2.45	124	5.40
Potassium (K)	4.9	.13	8.7	.22
Bicarbonate (HCO <sub>3</sub> )	199	3.26	280	4.59
Sulfate (SO <sub>4</sub> )	4.2	.09	3.5	.07
Chloride (Cl)	78	2.20	192	5.42
Fluoride (F)	0	.00	.2	.01
Nitrate (NO <sub>3</sub> )	.8	.01	.2	.00
Dissolved solids	337	-----	593	-----
Total hardness as CaCO <sub>3</sub>	156	-----	234	-----

## MATHIS

Population in 1940: 1,950.

Source of information: E. T. Gidlett, water superintendent, July 1945.

Ownership: Municipal.

Source of supply: 2 wells.

Well 1. At water tank; drilled in 1939; depth, 319; deep-well turbine pump; yield, 280 gallons per minute.

Well 2. At water tank one block from well 1; drilled in 1943 by A. H. Masiran; depth, 480 feet; drilled to 617 feet and plugged back to 480; yield, 280 gallons per minute.

Pumpage: No record, automatic control.

Storage: Elevated tank 100,000; ground storage, 50,000 gallons.

Number of customers: 591.

Treatment: None.

## Analyses

[Collected July 1945. pH: Well 1, 8.0; well 2, 7.8. Analyzed by J. H. Rowley]

	Well 1		Well 2	
	Parts per million	Equivalents per million	Parts per million	Equivalents per million
Silica (SiO <sub>2</sub> )	13		14	
Iron (Fe)	.61		.22	
Calcium (Ca)	27	1.35	18	0.90
Magnesium (Mg)	8.7	.72	6.7	.55
Sodium (Na)	347	15.10	358	15.57
Potassium (K)	9.9	.25	11	.28
Bicarbonate (HCO <sub>3</sub> )	351	5.75	345	5.66
Sulfate (SO <sub>4</sub> )	43	0.90	33	.69
Chloride (Cl)	378	10.66	385	10.86
Fluoride (F)	1.0	.05	1.0	.05
Nitrate (NO <sub>3</sub> )	2.8	.05	2.2	.04
Dissolved solids	1,000		999	
Total hardness as CaCO <sub>3</sub>	116		86	

## ODEM

Population in 1940: 1,147.

Source of information: Walter Heinsholm, water superintendent, July 1945.

Ownership: Municipal.

Source of supply: 3 wells.

Well 1. At elevated tank; used as stand-by; drilled about 1930; depth, about 125 feet; diameter, 6 inches; deep-well cylinder and pump jack driven by electric motor; yield, 20 gallons a minute.

Well 2. At elevated tank, drilled in 1936 by Layne-Texas Co.; depth, 126 feet; diameter, 10 inches; deep-well turbine pump driven by 7½-horsepower electric motor; pump set at 87 feet; static water level, 60 feet below land surface; yield, 60 gallons a minute.

Well 3. One-half mile north of Odem; drilled in 1940 by Masarin and Vickers; depth, 133 feet; diameter, 8 inches; deep-well turbine pump driven by 5-horsepower electric motor; yield, 20 gallons a minute.

Pumpage: Maximum 60,000 gallons a day; average 40,000 gallons a day.

Storage: Elevated tank, 50,000 gallons; ground reservoir, 100,000 gallons.

Number of customers: 211.

Treatment: Aeration, sedimentation, and chlorination.

*Analysis, well 2*

[Collected July 1945. pH is 7.7. Analyzed by J. H. Rowley]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> ).....	55		Sulfate (SO <sub>4</sub> ).....	58	1.21
Iron (Fe).....	16		Chloride (Cl).....	1,310	36.95
Calcium (Ca).....	119	5.94	Fluoride (F).....	.8	.04
Magnesium (Mg).....	50	4.11	Nitrate (NO <sub>3</sub> ).....	2.8	.05
Sodium (Na).....	829	36.03	Dissolved solids.....	2,700	
Potassium (K).....	21	.54	Total hardness as CaCO <sub>3</sub> .....	530	
Bicarbonate (HCO <sub>3</sub> ).....	510	8.37			

**SINTON**

Population in 1940: 3,770.

Source of information: J. P. Hall, water superintendent, July 19, 1945.

Ownership: Municipal.

Source of supply: 5 wells.

Well 1. At fire station; drilled about 1912; depth, 936 feet; diameter, 4 inches; flows 50 gallons a minute.

Well 2. In city park, drilled in 1922; depth, 936 feet; diameter, 6 inches; flows 15 gallons a minute. (Flowed 50 gallons a minute before well 8 was drilled.)

Well 5. About 300 feet north of city park; drilled in 1939 by Layne-Texas Co.; depth, 473 feet; diameter, 13½ to 8½ inches; deep-well turbine pump driven by 15-horsepower electric motor; static water level 18 feet below land surface on November 11, 1939; pumping level, 54 feet below land surface when pumped 405 gallons a minute, November 11, 1939.

Well 6. In city park; drilled in 1937 by E. T. Ellwood; depth, 906 feet; diameter, 6 inches; flowed 100 gallons a minute in 1937 and 60 gallons a minute in 1945.

Well 8. In city park; drilled in 1941 by Layne-Texas Co.; depth, 940 feet; diameter, 8 inches; flowed 110 gallons a minute when drilled and 100 gallons a minute in 1945.

Pumpage: Summer, 250,000 gallons a day; winter, 200,000 gallons a day.

Storage: Elevated tank, 75,000 gallons; ground reservoir, 116,000 gallons; ground reservoir, 56,000 gallons.

Number of customers: 675.

Treatment: None.

*Analyses*

[Collected July 1945. pH: well 1, 7.7; well 2, 7.9; well 5, 7.5, well 8, 8.0. Analyzed by J. H. Rowley]

	Well 1		Well 2	
	Parts per million	Equiva- lents per million	Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> ).....	15		10	
Iron (Fe).....	.07		.11	
Calcium (Ca).....	8.6	0.43	13	0.65
Magnesium (Mg).....	2.0	.16	2.5	.21
Sodium (Na).....	663	28.82	804	34.94
Potassium (K).....	16	.41	14	.36
Bicarbonate (HCO <sub>3</sub> ).....	350	5.74	374	6.14
Sulfate (SO <sub>4</sub> ).....	.4	.01	.4	.01
Chloride (Cl).....	850	23.97	1,060	29.90
Fluoride (F).....	1.0	.05	1.2	.06
Nitrate (NO <sub>3</sub> ).....	2.8	.05	3.2	.05
Dissolved solids.....	1,730		2,090	
Total hardness as CaCO <sub>3</sub> .....	50		61	

	Well 5		Well 8	
	Parts per million	Equivalents per million	Parts per million	Equivalents per million
Silica (SiO <sub>2</sub> ).....	10		8.0	
Iron (Fe).....	.02		.08	
Calcium (Ca).....	5.5	0.27	18	0.90
Magnesium (Mg).....	1.7	.14	3.9	.32
Sodium (Na).....	356	15.47	902	43.12
Potassium (K).....	5.4	.14	16	.41
Bicarbonate (HCO <sub>3</sub> ).....	374	6.13	420	6.89
Sulfate (SO <sub>4</sub> ).....	48	1.00	.2	.00
Chloride (Cl).....	312	8.80	1,340	37.79
Fluoride (F).....	1.0	.05	1.4	.07
Nitrate (NO <sub>3</sub> ).....	2.2	.04	0	.00
Dissolved solids.....	943		2,500	
Total hardness as CaCO <sub>3</sub> .....	28		82	

*Drillers' logs*

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
<b>Well 5</b>					
Sandy clay.....	9	9	Sandy shale.....	13	200
Muddy sand.....	13	22	Sand.....	6	206
Caliche.....	9	31	Shale.....	27	233
Sand.....	5	36	Sand.....	8	241
Caliche.....	3	39	Tough shale.....	46	287
Rock.....	3	42	Sandy shale.....	53	340
Shale.....	9	51	Shale break.....	2	342
Rock.....	2	53	Sand.....	3	345
Caliche.....	5	58	Shale.....	7	352
Sand.....	9	67	Shale and sand breaks.....	5	357
Shale break.....	2	69	Sticky shale.....	12	369
Sand and shale breaks.....	11	80	Shale, sand breaks.....	6	375
Hard layer.....	2	82	Shale.....	14	389
Shale and sand layers.....	13	95	Sandy shale.....	8	397
Caliche.....	28	123	Sandy shale.....	8	405
Blue shale.....	11	134	Sand.....	8	413
Sand.....	8	142	Shale.....	24	437
Shale.....	3	145	Sand.....	10	447
Sand.....	16	161	Shale break.....	2	449
Shale.....	9	170	Sand.....	7	456
Sand.....	17	187	Hard shale.....	10	466
<b>Well 8</b>					
Clay.....	8	8	Rock.....	1	434
Sand.....	10	18	Hard shale.....	7	441
Clay and caliche.....	30	48	Sand.....	42	483
Sandy shale.....	90	138	Shale.....	32	515
Caliche.....	8	146	Sand.....	21	536
Shale.....	95	241	Shale.....	29	565
Fine sand.....	15	256	Sand.....	22	587
Tough shale.....	38	294	Hard shale.....	125	712
Rock.....	1	295	Sand.....	14	726
Hard shale.....	80	375	Tough shale.....	181	907
Sand.....	15	390	Sand.....	33	940
Shale.....	15	405	Shale.....	12	952
Sand.....	10	415			
Hard sand.....	18	433			

**TAFT**

Population in 1940: 2,686.

Source of information: C. R. Brock, operator, July 1945.

Owner: Central Power and Light Co.



Source of supply: 4 wells at company plant.

Well 2. Depth about 220 feet; deep-well turbine pump and electric motor; yield, 285 gallons a minute, February 16, 1942.

Well 6. Depth about 200 feet; deep-well turbine pump and electric motor; yield reported, 300 gallons a minute.

Well 7. Depth about 200 feet; deep-well turbine pump and electric motor; yield reported, 300 gallons a minute.

Well 9. Drilled in 1944 by Layne-Texas Co., Ltd.; depth, 216 feet; diameter, 24 to 16 inches; screens from 158 to 188 feet and 206 to 216 feet; deep-well turbine pump and 30-horsepower electric motor; static water level, 70 feet below land surface on November 7, 1944; pumping level, 156 feet when pumping 260 gallons a minute.

Pumpage: Averages 601,000 gallons a day in January 1945; 763,000 gallons a day in June 1945.

Storage: Elevated tank, 100,000 gallons; ground reservoir, 140,000 gallons.

Number of customers: 776.

Treatment: Aeration and chlorination.

### Analyses

[Collected July 1945. pH: Well 7, 7.7; well 9, 7.8. Analyzed by J. H. Rowley]

	Well 7		Well 9	
	Parts per million	Equivalents per million	Parts per million	Equivalents per million
Silica (SiO <sub>2</sub> )	16		16	
Iron (Fe)	.05		.02	
Calcium (Ca)	21	1.05	17	0.85
Magnesium (Mg)	8.4	.69	7.6	.62
Sodium (Na)	531	23.10	490	21.30
Potassium (K)	7.7	.20	8.8	.23
Bicarbonate (HCO <sub>3</sub> )	394	6.47	437	7.17
Sulfate (SO <sub>4</sub> )	113	2.35	66	1.37
Chloride (Cl)	570	16.08	508	14.33
Fluoride (F)	1.8	.09	1.8	.09
Nitrate (NO <sub>3</sub> )	2.8	.05	2.2	.04
Dissolved solids	1,470		1,330	
Total hardness as CaCO <sub>3</sub>	97		85	

### Driller's log, well 9

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	5	5	Sand	7	116
Clay	10	15	Clay	5	121
Sand	10	25	Sand (broken)	66	187
Sandy clay	7	32	Sand and lime	6	193
Sandy clay and clay	47	79	Shale	7	200
Sand	14	93	Sand (broken)	16	216
Clay	16	109	Shale	5	221

## STARR COUNTY

### RIO GRANDE CITY

Population in 1940: 2,500.

Source of information: superintendent, Central Power and Light Co., August 9, 1945.

Owner: Central Power and Light Co.

Source of supply: Rio Grande; pumping plant five blocks east and one block south of post office.

Storage: Elevated tank, 50,000 gallons; ground storage, 500,000 gallons.

Number of customers: 617.

Treatment: Aeration, coagulation, sedimentation, rapid sand filtration, and chlorination.

*Average pumpage, in gallons a day*

	1940	1941	1942	1943	1944	1945
January .....	174,000	222,000	253,000	386,000	155,000	173,000
February .....	233,000	198,000	251,000	343,000	207,000	207,000
March .....	290,000	201,000	364,000	371,000	220,000	205,000
April .....	344,000	297,000	389,000	393,000	231,000	307,000
May .....	385,000	307,000	415,000	383,000	217,000	322,000
June .....	343,000	310,000	342,000	317,000	208,000	333,000
July .....	333,000	350,000	350,000	318,000	179,000	-----
August .....	333,000	473,000	417,000	345,000	195,000	-----
September .....	316,000	360,000	393,000	287,000	186,000	-----
October .....	262,000	318,000	376,000	213,000	167,000	-----
November .....	224,000	238,000	365,000	161,000	151,000	-----
December .....	229,000	245,000	378,000	227,000	185,000	-----

*Analyses*

[Collected August 9, 1945. pH of finished water, 7.7 Analyzed by C. B. Cibulka]

	Finished water		Raw water	
	Parts per million	Equivalents per million	Parts per million	Equivalents per million
Silica (SiO <sub>2</sub> ) .....	17	-----	-----	-----
Iron (Fe) .....	.21	-----	-----	-----
Calcium (Ca) .....	86	4.29	82	4.09
Magnesium (Mg) .....	18	1.48	19	1.56
Sodium (Na) .....	90	3.92	91	3.94
Potassium (K) .....	12	.31		
Bicarbonate (HCO <sub>3</sub> ) .....	128	2.10	144	2.36
Sulfate (SO <sub>4</sub> ) .....	217	4.52	191	3.98
Chloride (Cl) .....	118	3.33	114	3.22
Fluoride (F) .....	.6	.03	-----	-----
Nitrate (NO <sub>3</sub> ) .....	1.2	.02	2	.03
Dissolved solids .....	648	-----	654	-----
Total hardness as CaCO <sub>3</sub> .....	288	-----	282	-----

**ROMA**

Population in 1940: 1,414.

Source of information: E. Ramirez, water superintendent, Aug. 9, 1945.

Ownership: Municipal.

Source of supply: Rio Grande; pumping plant, one block east and two blocks south of post office.

*Average pumpage, in gallons a day*

	1941	1942	1943	1944	1945
January .....	-----	25,580	25,322	37,400	46,700
February .....	-----	27,392	41,428	46,800	46,700
March .....	20,967	43,233	49,100	54,400	80,200
April .....	32,700	43,400	55,300	73,400	74,900
May .....	24,677	46,161	71,100	63,000	92,300
June .....	26,700	53,633	61,300	67,700	1,087,000
July .....	29,064	45,700	61,800	78,000	-----
August .....	36,290	45,354	55,100	72,100	-----
September .....	27,566	34,900	51,400	59,900	-----
October .....	31,548	36,967	37,200	63,900	-----
November .....	28,733	40,800	34,300	51,300	-----
December .....	24,419	35,600	26,600	42,500	-----

Storage: Elevated tank, 60,000 gallons; concrete ground storage reservoir, 15,000 gallons.

Number of customers: 298 (also supplies the communities of La Saenz, Escobores, and San Pedro, Mexico).

Treatment: Coagulation, sedimentation, and chlorination.

### Analyses

[Collected Aug. 9, 1945. pH of finished water, 7.7. Analyzed by J. H. Rowley]

	Finished water		Raw water	
	Parts per million	Equivalents per million	Parts per million	Equivalents per million
Silica (SiO <sub>2</sub> ).....	14			
Iron (Fe).....	83	.36		
Calcium (Ca).....	21	4.14	82	4.09
Magnesium (Mg).....	109	1.73	22	1.81
Sodium (Na).....	11	4.74	114	4.96
Potassium (K).....	120	.28		
Bicarbonate (HCO <sub>3</sub> ).....	233	1.97	114	1.87
Sulfate (SO <sub>4</sub> ).....	143	4.85	228	4.75
Chloride (Cl).....	.8	4.03	150	4.23
Fluoride (F).....	.2	.04		
Nitrate (NO <sub>3</sub> ).....		.00	8	.01
Dissolved solids.....	701		725	
Total hardness as CaCO <sub>3</sub> .....	294		295	

## UVALDE COUNTY

### SABINAL

Population in 1940: 1,768.

Source of information: Mrs. R. B. C. Ware, city secretary, Nov. 2, 1945.

Ownership: Municipal.

Source of supply: 2 wells.

Well 1. At elevated tank; drilled in 1923 by Trim & Son; drilled to 2,800 feet and plugged back to 1,476 feet; diameter, 10 to 6 inches; deep-well turbine pump and electric motor; static water level, 230 feet below land surface in 1929; yield, 250 gallons a minute.

Well 2. Drilled in 1923 by Trim & Son; depth, 1,493 feet; diameter, 10 to 8 inches; cased to 930 feet; deep-well turbine pump and 40-horsepower electric motor; static water level, 214 feet below land surface; yield, 335 gallons a minute.

Pumpage: No record.

Storage: Elevated tank, 100,000 gallons.

Number of customers: 450.

Treatment: Chlorination.

*Analyses*

Collected Nov. 2, 1945. pH: Well 1, 7.6; well 2, 7.1. Analyzed by C. B. Cibulka and J. H. Rowley]

	Well 1		Well 2	
	Parts per million	Equivalents per million	Parts per million	Equivalents per million
Silica (SiO <sub>2</sub> )	2.8		14	
Iron (Fe)	.16		.12	
Calcium (Ca)	58	2.89	88	4.39
Magnesium (Mg)	72	5.92	29	2.38
Sodium (Na)	148	6.43	17	.75
Potassium (K)	21	.54	9.5	.24
Bicarbonate (HCO <sub>3</sub> )	45	.74	254	4.16
Sulfate (SO <sub>4</sub> )	608	12.66	142	2.96
Chloride (Cl)	82	2.31	20	.56
Fluoride (F)	1.4	.07	.6	.03
Nitrate (NO <sub>3</sub> )	0	.00	3.0	.05
Dissolved solids	1,020		470	
Total hardness as CaCO <sub>3</sub>	440		338	

Drillers' log: No log available; top of Edwards limestone reported by Trim & Son to be 930 feet below the land surface.

**UVALDE**

Population in 1940: 6,679.

Source of information: R. W. Evans, city secretary, Nov. 1, 1945.

Ownership: Municipal.

Source of supply: 3 wells.

Well 1. Dug and drilled about 1910; well consists of a large pit dug to about 50 feet in depth and cemented on four sides, then drilled to 375 feet; diameter of drilled well 10 inches; two horizontal centrifugal pumps mounted in the pit and driven by electric motors; yield, 750 gallons a minute each; static water level, 36 feet below land surface.

Well 2. Drilled in 1938 by H. Crawford and John Roberts; depth, 478 feet; diameter, 12½ inches; deep-well turbine pump and 60-horsepower electric motor; static water level, 36 feet below land surface; yield, 1,100 gallons a minute with a drawdown of about 15 feet.

Well 3. Drilled in 1942 by Henry Rosenow; depth 400 feet; diameter, 12½ inches; deep-well turbine pump and 60-horsepower electric motor; yield, 1,100 gallons a minute.

Storage: Elevated tank, 150,000 gallons; standpipe in North Uvalde, 100,000 gallons.

Number of customers: 1,688.

Treatment: None.

*Average pumpage,<sup>1</sup> in gallons a day*

	1942	1943		1942	1943
January	392,000	498,000	July	810,000	1,430,000
February	478,000	722,000	August	1,300,000	1,890,000
March	465,000	875,000	September	738,000	1,430,000
April	872,000	942,000	October	650,000	458,000
May	552,000	1,070,000	November	667,000	656,000
June	1,135,000	913,000	December	516,000	522,000

<sup>1</sup> Average in gallons a day for year 1944 is 910,000; that for 1945 is 926,000.

*Analysis, well 3*

[Collected November 2, 1945. pH is 7.0. Analyzed by J. H. Rowley and C. B. Cibulka]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> ).....	11	-----	Sulfate (SO <sub>4</sub> ).....	19	0.40
Iron (Fe).....	.08	-----	Chloride (Cl).....	24	.69
Calcium (Ca).....	74	3.69	Fluoride (F).....	.4	.02
Magnesium (Mg).....	9.5	.78	Nitrate (NO <sub>3</sub> ).....	4.1	.07
Sodium (Na).....	24	1.06	Dissolved solids.....	319	-----
Potassium (K).....	7.0	.18	Total hardness as CaCO <sub>3</sub> .....	224	-----
Bicarbonate (HCO <sub>3</sub> ).....	277	4.54			

*Driller's log, well 2*

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Clay and soil.....	30	30	Limestone.....	89	165
Gravel.....	28	58	Clay.....	95	260
Clay.....	18	76	Limestone.....	218	478

**VICTORIA COUNTY****VICTORIA**

Population in 1940: 11,566.

Source of information: F. B. Lowry, city engineer, Apr. 20, 1945.

Ownership: Municipal.

Source of supply: 6 wells.

Well 5. About 400 feet northeast of pump station; drilled in 1934 by Southern Engine & Pump Co.; depth, 612 feet; diameter, 12½ to 10 inches; screen from 562 to 606 feet and gun-perforated from 509 to 538 feet; deep-well turbine pump and 10-horsepower electric motor; flows; pump yield reported 402 gallons a minute after 24 hours' pumping in October 1942; temperature, 77° F.

Well 6. About 300 feet northeast of pump station; drilled in 1938; depth, 365 feet; diameter, 16 to 8½ inches; screens at 158 to 180, 204 to 222, 258 to 314, and 326 to 346 feet, underreamed and gravel-walled; deep-well turbine pump and electric motor; static water level, 1 foot below land surface; yield, 500 gallons a minute with draw-down at 78 feet after 5 hours' pumping; temperature, 74° F; water turbid and well unused.

Well 7. About 300 feet northwest of pump station; drilled in 1940 by A. E. Fawcett, Jr.; depth, 412 feet; diameter, 16 to 10 inches, screen from 364 to 410 feet; deep-well turbine pump and 40-horsepower electric motor, pump set at 100 feet; flows 50 gallons a minute at ground level; pump yield, 1,000 gallons a minute with draw-down of 90 feet in 1940; yield, 731 gallons a minute after 24 hours' pumping in October, 1942; temperature, 73° F.

Well 8. About 200 feet east of pump station; drilled in 1941 by A. H. Masiran; depth, 414 feet; diameter, 10¾ to 8 inches; screen from 374 to 413 feet; deep-well turbine pump and electric motor; flows; pump yield 525 gallons a minute with draw-down of 62 feet when drilled; yield, 430 gallons a minute after 24 hours' pumping in October 1942; temperature, 75° F.

Well 9. About 200 feet northwest of pump station; drilled in 1941 by Layne-Texas Co., Ltd.; depth, 604 feet; diameter, 13 to 10 $\frac{3}{4}$  inches, screens at 475 to 527 and 554 to 600 feet; deep-well turbine pump and 20-horsepower electric motor; pump set at 100 feet; flows; pump yield, 525 gallons a minute with draw-down of 100 feet when drilled; yield, 603 gallons a minute after 24 hours' pumping in October 1942; temperature, 75° F.

Well 10. One block west of city limits on east Pine Street, drilled in 1942 by Layne-Texas Co., Ltd., depth, 1504 feet (plugged back to 1,012 feet); diameter, 16 to 8 $\frac{3}{4}$  inches; screen from 804 to 991 feet, underreamed and gravel-walled; deep-well turbine pump and 125-horsepower electric motor; static water level 21 feet below land surface on September 2, 1942; yield, 1,000 gallons a minute with draw-down of 201 feet after 39 hours' pumping; pumps directly into water mains; temperature, 82 $\frac{1}{2}$ ° F.

Pumpage: No record.

Storage: 2 elevated tanks, 500,000 and 300,000 gallons; concrete ground reservoir, 1,000,000 gallons.

Number of customers: 3,305.

Treatment: Aeration.

### Analyses

[Collected Apr. 20, 1945. pH: Well 5, 7.0; well 6, 7.2; wells 7 and 8, 7.4; wells 9 and 10, 7.5. Analyzed by J. H. Rowley]

	Well 5		Well 6		Well 7	
	Parts per million	Equivalents per million	Parts per million	Equivalents per million	Parts per million	Equivalents per million
Silica (SiO <sub>2</sub> )	21		26		28	
Iron (Fe)	4.7		3.0		1.2	
Calcium (Ca)	34	1.70	36	1.80	37	1.85
Magnesium (Mg)	11	.90	11	.90	12	.99
Sodium (Na)	146	6.36	152	6.59	128	5.57
Potassium (K)	7.9	.20	6.4	.16	5.8	.15
Bicarbonate (HCO <sub>3</sub> )	402	6.59	386	6.33	360	5.90
Sulfate (SO <sub>4</sub> )	14	.29	10	.21	3	.06
Chloride (Cl)	80	2.26	102	2.88	91	2.57
Fluoride (F)	.4	.02	.6	.03	.06	.03
Nitrate (NO <sub>3</sub> )	0	.00	0	.00	0	.00
Dissolved solids	517		537		484	
Total hardness as CaCO <sub>3</sub>	130		135		142	

	Well 8		Well 9		Well 10	
	Parts per million	Equivalents per million	Parts per million	Equivalents per million	Parts per million	Equivalents per million
Silica (SiO <sub>2</sub> )	26		18		23	
Iron (Fe)	7.9		2.3		.97	
Calcium (Ca)	36	1.80	29	1.45	18	0.90
Magnesium (Mg)	12	.99	10	.82	6.9	.57
Sodium (Na)	134	5.82	150	6.51	221	9.60
Potassium (K)	3.9	.10	5.9	.15	6.6	.17
Bicarbonate (HCO <sub>3</sub> )	366	6.00	359	5.88	348	5.70
Sulfate (SO <sub>4</sub> )	3	.06	15	.31	37	.77
Chloride (Cl)	93	2.62	96	2.71	163	4.74
Fluoride (F)	.6	.03	.6	.03	.6	.03
Nitrate (NO <sub>3</sub> )	0	.00	0	.00	0	.00
Dissolved solids	497		504		656	
Total hardness as CaCO <sub>3</sub>	140		114		74	

*Driller's log*

	Thickness ft. (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
<b>Well 7</b>					
Surface.....	17	17	Hard lime.....	37	229
Sand—lime streaks.....	31	48	Sand and boulders.....	2	231
Coarse sand.....	12	60	Hard lime.....	51	282
Gravel.....	42	102	Sand, loose.....	13	295
Shale and sand.....	13	115	Shale and lime.....	7	302
Hard sand rock.....	10	125	Hard sand.....	15	317
Shale—lime streaks.....	6	141	Sand.....	7	324
Shale and boulders.....	7	148	Shale, sticky.....	17	341
Gumbo.....	39	187	Hard sand rock.....	21	362
Shale and boulders.....	5	192	Pink gumbo.....	14	376
Rock, hard.....	2	194	Sand.....	36	412

**Well 8**

Soil.....	6	6	Shale.....	5	236
Clay.....	18	24	Sand.....	3	239
Sand and gravel.....	70	94	Shale, sticky.....	29	268
Clay and gravel.....	5	99	Sand.....	4	272
Sand rock.....	2	101	Shale.....	8	280
Sand and boulders.....	25	126	Sand.....	12	292
Sand and shale streaks.....	18	144	Shale.....	4	296
Sand and boulders.....	24	168	Sand and shale streaks.....	30	326
Shale.....	3	171	Shale.....	10	336
Sand.....	5	176	Hard sand and boulders.....	24	360
Shale.....	11	187	Shale, pink sticky.....	14	374
Sand.....	6	193	Sand and boulders.....	37	411
Shale, sticky.....	23	216	Shale.....	3	414
Sand.....	15	231			

**WEBB COUNTY****LAREDO**

Population in 1940: 39,274.

Source of information: H. T. Ellsworth, district manager, and E. J. Hood, water plant superintendent, July 29, 1944.

Owner: Central Power & Light Co.

Source of supply: Rio Grande.

Storage: 2 concrete reservoirs, 2,000,000 and 2,200,000 gallons.

Number of customers: 5,700.

Treatment: Aeration, coagulation, sedimentation, rapid sand filtration, pre-chlorination, and postchlorination.

*Average pumpage, in thousands of gallons a day*

1940	1941	1942	1943	1944 (6 months)
2,600	2,650	3,279	4,208	4,410

*Maximum pumpage in thousands of gallons a day*

1940	1941	1942	1943	1944 (6 months)
-----	-----	5,407	6,901	6,756

*Analysis of finished water*

[Collected July 29, 1944. pH is 7.7. Analyzed by J. H. Rowley]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SO <sub>2</sub> ).....	16	-----	Sulfate (SO <sub>4</sub> ).....	322	6.70
Iron (Fe).....	10	-----	Chloride (Cl).....	293	8.26
Calcium (Ca).....	102	5.09	Fluoride (F).....	.8	.04
Magnesium (Mg).....	36	2.96	Nitrate (NO <sub>3</sub> ).....	2.8	.05
Sodium (Na) + Potassium (K).....	207	9.00	Dissolved solids.....	1,040	-----
Bicarbonate (HCO <sub>3</sub> ).....	122	2.00	Total hardness as CaCO <sub>3</sub> .....	402	-----



*Monthly averages of finished water at Laredo, in parts per million except pH*

[Analyses by Central Power and Light Co.]

	Magnesium (Mg)			Sulfate (SO <sub>4</sub> )			Chloride (Cl)			Hardness as CaCO <sub>3</sub>			pH		
	1941	1942	1943	1941	1942	1943	1941	1942	1943	1941	1942	1943	1941	1942	1943
January.....	-----	46	39	-----	575	420	280	525	290	-----	675	560	8.2	8.1	7.8
February.....	-----	53	42	-----	600	430	245	550	320	-----	650	600	8.3	8.0	7.8
March.....	-----	50	32	-----	500	330	280	500	280	-----	600	470	8.3	8.0	7.8
April.....	-----	45	28	-----	400	260	245	430	225	-----	470	390	8.2	7.9	7.8
May.....	-----	30	30	-----	340	280	330	330	280	-----	390	450	8.1	7.8	7.8
June.....	-----	26	18	-----	350	240	235	240	160	-----	360	350	8.2	7.7	7.8
July.....	-----	22	7	-----	380	220	330	205	130	-----	460	310	8.2	7.7	7.7
August.....	17	20	16	310	270	230	220	190	154	-----	350	340	8.3	7.7	7.7
September.....	12	8	20	240	140	215	190	64	205	-----	340	410	8.3	7.8	7.7
October.....	19	16	18	360	190	205	165	115	200	-----	220	330	8.3	7.7	7.7
November.....	40	31	25	330	330	215	380	220	300	-----	700	350	8.3	7.8	8.0
December.....	55	32	33	640	380	280	600	240	290	-----	525	590	8.3	8.3	7.9
Average.....	-----	31.6	25.7	-----	362	277	274	301	236	-----	424	430	8.2	7.9	7.8

## WILLACY COUNTY

## LYFORD

Population in 1940: 891.

Source of information: W. A. Comp, water superintendent, August 8, 1945.

Ownership: Municipal.

Source of supply: Well 0.4 mile north of railroad depot and east of highway; drilled in 1908 by Layne-Texas Co. for irrigation purpose; depth, 1,935 feet; diameter, 10 to 8 inches; screens reported at 1,200 feet and near bottom; rotary pump and 15-horsepower electric motor; small flow 1 foot above land surface after pump has been shut down 10 to 12 hours; temperature, 92° F.

Pumpage (estimated): Maximum, 75,000 gallons; average, 50,000 gallons a day.

Storage: Elevated tank, 60,000 gallons.

Number of customers: 130.

Treatment: None.

## Analysis

[Collected August 8, 1945. Analyzed by C. B. Cibulka]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> )			Sulfate (SO <sub>4</sub> )	1,580	32.89
Iron (Fe)			Chloride (Cl)	685	19.32
Calcium (Ca)	106	5.29	Fluoride (F)		
Magnesium (Mg)	28	2.30	Nitrate (NO <sub>3</sub> )		.01
Sodium and Potassium (Na+K)	1,070	46.52	Dissolved solids	3,530	
Bicarbonate (HCO <sub>3</sub> )	115	1.89	Total hardness as CaCO <sub>3</sub>	380	

## RAYMONDVILLE

Population in 1940: 4,050.

Source of information: Bill Schupp, city manager, August 10, 1945.

Ownership: Municipal.

Source of supply: Canal from Rio Grande. Formerly supplied from well drilled in 1928 by Layne-Texas Company; depth, 1,416 feet; cased to 1,360 feet, diameter, 12 to 8½ inches; static water level reported, 10 feet below land surface on June 25, 1928; yield, 325 gallons a minute with drawdown of 31 feet.

Pumpage: Maximum, 900,000 gallons a day.

Storage: Elevated tank, 75,000 gallons; ground reservoir, 250,000 gallons.

Number of customers: 1,260.

Treatment: Coagulation, sedimentation, rapid sand filtration, prechlorination, and postchlorination.

## Analysis

[Collected: Well, March 23, 1937; canal, August 8, 1945. pH: Well, 8.2; canal, 7.8. Well sample analyzed by State Health Department; canal sample analyzed by C. B. Cibulka]

	Well	Canal (Finished Water)	
	Parts per million	Parts per million	Equivalents per million
Silica (SiO <sub>2</sub> )		17	
Iron (Fe)	.14	.11	
Calcium	43	78	3.89
Magnesium (Mg)	22	19	1.56
Sodium (Na)		103	4.47
Potassium (K)		9.9	.25
Bicarbonate (HCO <sub>3</sub> )		99	1.62
Sulfate (SO <sub>4</sub> )	1,167	226	4.71
Chloride (Cl)	56	135	3.81
Fluoride (F)	2.25	.6	.03
Nitrate (NO <sub>3</sub> )		0	.00
Dissolved solids	2,781	659	
Total hardness as CaCO <sub>3</sub>	284	272	

*Driller's log, well*

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Sand.....	84	84	Sand.....	8	686
Clay.....	59	143	Gumbo.....	144	830
Sand.....	78	221	Clay and sand.....	21	851
Clay.....	51	272	Sand rock.....	1	852
Sand.....	39	311	Clay and gravel.....	20	872
Clay.....	25	336	Sand rock.....	2	874
Sand.....	26	362	Clay.....	42	916
Clay.....	24	386	Clay and gravel.....	23	939
Sandy clay.....	35	421	Packsand.....	4	943
Sand.....	15	436	Clay.....	35	978
Clay.....	16	452	Packsand.....	7	985
Sand and clay layers.....	24	476	Clay.....	41	1,026
Gumbo.....	30	506	Gumbo.....	15	1,041
Sand.....	16	522	Sand.....	14	1,055
Clay.....	8	530	Clay.....	26	1,081
Sand.....	16	546	Sand.....	15	1,096
Sand rock.....	1	547	Sand rock.....	1	1,097
Clay.....	36	583	Clay.....	16	1,113
Sand.....	18	601	Sandy clay.....	87	1,200
Clay.....	15	616	Packsand.....	10	1,210
Sand.....	40	656	Clay.....	94	1,304
Clay.....	22	678	Sandy clay.....	12	1,416

**WILSON COUNTY****FLORESVILLE**

Population in 1940: 1,708.

Source of information: Tom Johnson, water superintendent, July 29, 1944.

Ownership: Municipal.

Source of supply: Well 2 blocks west and 2 blocks south of courthouse; drilled in 1925 by San Antonio Public Service Co.; depth, 1,523 feet (reported no water below 850 feet); diameter, 8 inches; flows 375 gallons a minute, temperature, 91° F.

Pumpage (flow): Average, 300,000 gallons a day.

Storage: 4 concrete basins, 160,000 gallons, elevated tank, 75,000 gallons.

Number of customers: 525.

Treatment: Aeration, coagulation, hypochlorination, and sedimentation.

*Analysis*

[Collected July 29, 1944. pH is 7.6. Analyzed by J. H. Rowley]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> ).....	15	-----	Sulfate (SO <sub>4</sub> ).....	16	.33
Iron (Fe).....	.05	-----	Chloride (Cl).....	22	.62
Calcium (Ca).....	26	1.30	Fluoride (F).....	.2	.01
Magnesium (Mg).....	11	.90	Nitrate (NO <sub>3</sub> ).....	0	.00
Sodium (Na).....	100	4.33	Dissolved solids.....	412	-----
Potassium (K).....	9.1	.23	Total hardness as CaCO <sub>3</sub> .....	110	-----
Bicarbonate (HCO <sub>3</sub> ).....	354	5.80			

**POTH**

Population in 1940: 509.

Source of information: E. J. Koserak, city secretary, July 29, 1944.

Ownership: Municipal.

Source of supply: Well drilled in 1936; depth, 2,032 feet; diameter, 7 to 4½ inches; casing perforated from 1,779 to 2,032 feet; flows 390 gallons a minute, shut-in pressure 12 pounds when drilled; temperature, 115° F.

Storage: Elevated tank, 50,000 gallons.

Number of customers: 147.

Treatment: None.

*Average pumpage, in gallons a day*

	1941	1942	1943	1944
January.....	18,000	29,000	37,000	31,000
February.....	15,000	40,000	60,000	34,000
March.....	28,000	32,000	53,000	31,000
April.....	15,500	49,000	46,000	55,000
May.....	18,000	28,000	48,000	58,000
June.....	21,000	70,000	38,000	-----
July.....	43,000	62,000	66,000	-----
August.....	55,000	72,000	78,000	-----
September.....	70,000	37,000	67,000	-----
October.....	33,000	37,000	39,000	-----
November.....	34,000	37,000	27,000	-----
December.....	25,000	40,000	28,000	-----

*Analysis*

[Collected July 29, 1944. pH is 8.2. Analyzed by J. H. Rowley]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> ).....	21	-----	Sulfate (SO <sub>4</sub> ).....	32	0.67
Iron (Fe).....	.03	-----	Chloride (Cl).....	38	1.07
Calcium (Ca).....	6.0	0.30	Fluoride (F).....	6	.03
Magnesium (Mg).....	1.9	.16	Nitrate (NO <sub>3</sub> ).....	0	.00
Sodium (Na).....	215	9.34	Dissolved solids.....	567	-----
Potassium (K).....	4.0	.10	Total hardness as CaCO <sub>3</sub> .....	23	-----
Bicarbonate (HCO <sub>3</sub> ).....	495	8.13			

*Driller's log*

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Sand, shale, gumbo, and boulders.....	650	650	Fine sand and shale (Carrizo sand).....	140	1,770
Sandy shale (Weches green- sand).....	192	842	Soft sand.....	230	2,000
Sandy shale and boulders Queen City sand).....	788	1,630	Soft sandy shale (Wilcox group).....	32	2,032

**SASPAMCO**

Population in 1940: 200.

Source of information: Wilson County report, July 29, 1944.

Owner: San Antonio Sewer & Pipe Co.

Source of supply: Well drilled in 1915; depth, 600 feet; diameter, 10 inches; reported water level, 135 feet below land surface; draw-down, 175 feet after pumping 33 gallons a minute for 24 hours.

Pumpage: Unknown.

Storage: Elevated tank, 10,000 gallons.

Number of customers: Unknown.

Treatment: None.

*Analysis*

[Collected July 29, 1944. pH is 7.9. Analyzed by J. H. Rowley]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> ).....	12		Sulfate (SO <sub>4</sub> ).....	290	6.04
Iron (Fe).....	.10		Chloride (Cl).....	137	3.86
Calcium (Ca).....	42	2.10	Fluoride (F).....	.2	.01
Magnesium (Mg).....	21	1.73	Nitrate (NO <sub>3</sub> ).....	.8	.01
Sodium (Na).....	265	11.52	Dissolved solids.....	940	
Potassium (K).....			Total hardness as CaCO <sub>3</sub> .....	192	
Bicarbonate (HCO <sub>3</sub> ).....	331	5.43			

**STOCKDALE**

Population in 1940: 926.

Source of information: John E. Wheeler, water superintendent, July 28, 1944.

Ownership: Municipal.

Source of supply: Well (city well No. 2); drilled in 1935 by Kelly Construction Co.; depth, 315 feet; diameter, 8 to 6 inches; deep-well turbine pump and 10-horsepower electric motor; reported water level, 55 feet below land surface when drilled; draw-down, 50 feet after pumping 124 gallons a minute for 80 hours; yield, 93 gallons a minute in 1940.

Pumpage: Maximum, 100,000 gallons a day.

Storage: Elevated tank, 50,000 gallons.

Number of customers: 150.

Treatment: None.

*Analysis*

[Collected July 28, 1944. pH is 7.7. Analyzed by J. H. Rowley]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> ).....	21		Sulfate (SO <sub>4</sub> ).....	126	2.62
Iron (Fe).....	2.8		Chloride (Cl).....	54	1.52
Calcium (Ca).....	67	3.34	Fluoride (F).....	.1	.01
Magnesium (Mg).....	26	2.14	Nitrate (NO <sub>3</sub> ).....	.8	.01
Sodium (Na).....	53	2.30	Dissolved solids.....	483	
Potassium (K).....	12	.31	Total hardness as CaCO <sub>3</sub> .....	274	
Bicarbonate (HCO <sub>3</sub> ).....	240	3.93			

**ZAPATA COUNTY****ZAPATA**

Population in 1940: 700.

Source of information: R. San Miguel, Jr., owner, August 9, 1945.

Owner: R. San Miguel, Jr.

Source of supply: Rio Grande pumping plant, two blocks west and two blocks south of courthouse.

Pumpage (estimated): 40,000 to 50,000 gallons a day.

Storage: Elevated wood tank, 5,000 gallons; concrete ground reservoir, about 50,000 gallons.

Number of customers: 125.

Treatment: Coagulation, sedimentation, filtration, and chlorination.

*Analyses*

[Collected August 9, 1945. pH of finished water is 7.7. Analyzed by C. B. Cibulka]

	Finished water		Raw water	
	Parts per million	Equivalents per million	Parts per million	Equivalents per million
Silica (SiO <sub>2</sub> ).....	15			
Iron (Fe).....	63			
Calcium (Ca).....	82	4.09	84	4.19
Magnesium (Mg).....	19	1.56	21	1.73
Sodium (Na).....	104	4.50	106	4.60
Potassium (K).....	7.7	.20		
Bicarbonate (HCO <sub>3</sub> ).....	102	1.67	132	2.17
Sulfate (SO <sub>4</sub> ).....	231	4.81	208	4.33
Chloride (Cl).....	136	3.84	142	4.00
Fluoride (F).....		.03		
Nitrate (NO <sub>3</sub> ).....	.6	.00	1.5	.02
Dissolved solids.....	675		758	
Total hardness as CaCO <sub>3</sub> .....	282		296	

**ZAVALA COUNTY****CRYSTAL CITY**

Population in 1940: 6,529.

Source of information: L. L. Williams, city manager, May 10, 1945.

Ownership: Municipal.

Source of supply: 2 wells.

Well 1. Plugged and abandoned.

Well 2. Drilled in 1927 by Floyd Trimm; depth, 1,050 feet; diameter, 12 inches; deep-well submersible pump and 50-horsepower electric motor; yield, 800 gallons a minute; temperature, 88° F.

Well 3. At pump station; drilled in 1941; depth, 990 feet; diameter, 12½ to 8 inches; liner perforated between 755 and 990 feet; deep-well turbine pump and electric motor; static water level reported 80 feet below land surface when drilled; yield, 800 gallons a minute with draw-down of 14 feet; temperature, 88° F.

Pumpage: Maximum, 1,000,000 gallons; minimum, 500,000 gallons, average 750,000 gallons a day.

Storage: Elevated tank, 50,000 gallons; concrete ground reservoir, 50,000 gallons.

Number of customers: 1,208.

Treatment: Occasional chlorination.

*Analyses*

[Collected January 9, 1945. pH of well 2 is 7.5. Analyzed by State Health Department]

	Well 2		Well 3	
	Parts per million	Equivalents per million	Parts per million	Equivalents per million
Silica (SiO <sub>2</sub> ).....	19		20	
Iron (Fe).....	28		.45	
Calcium (Ca).....	64	3.19	64	3.19
Magnesium (Mg).....	19	1.56	19	1.56
Sodium (Na).....	61	2.66	60	2.61
Potassium (K).....				
Bicarbonate (HCO <sub>3</sub> ).....	296	4.85	293	4.80
Sulfate (SO <sub>4</sub> ).....	64	1.33	64	1.33
Chloride (Cl).....	43	1.21	43	1.21
Fluoride (F).....	.2	.01	.2	.01
Nitrate (NO <sub>3</sub> ).....	.4	.01	.4	.01
Dissolved solids.....	420		430	
Total hardness as CaCO <sub>3</sub> .....	238		238	

*Driller's log, well 3*

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil.....	4	4	Brown shale.....	50	500
Yellow sand.....	76	80	Blue shale.....	45	545
Blue gumbo.....	25	105	Sand.....	10	555
Brown shale.....	10	115	Blue shale.....	45	600
Blue shale.....	65	180	Light shale.....	20	620
Brown shale.....	65	245	Brown shale.....	110	730
Sand-water.....	10	255	Light shale.....	25	755
Brown shale.....	35	290	Sand.....	15	770
Sand-water.....	25	315	Gumbo.....	15	785
Brown shale and coal.....	15	330	Sand.....	110	895
Sand.....	10	340	Gumbo.....	10	905
Shale.....	90	430	Sand.....	85	990
Sandy shale.....	20	450			

**LA PRYOR**

Population in 1940: 500.

Source of information: R. K. Miller, owner, May 9, 1945.

Owner: R. K. Miller.

Source of supply: Well purchased from Central Power & Light Co.; drilled in 1927; depth, 520 feet; diameter, 10 to 6½ inches; perforated casing from 460 to 520 feet; deep-well turbine pump and 7½-horsepower electric motor; static water level, 129.3 feet below land surface on Jan. 28, 1930, and reported 130 feet on May 9, 1945; yield, 50 gallons a minute; temperature, 78° F.

Pumpage (estimated): Average, 30,000 gallons a day.

Storage: Elevated tank, 22,000 gallons.

Number of customers: 124.

Treatment: None.

*Analysis*

[Collected May 9, 1945. pH is 7.1. Analyzed by J. H. Rowley]

	Parts per million	Equiva- lents per million		Parts per million	Equiva- lents per million
Silica (SiO <sub>2</sub> ).....	18	-----	Sulfate (SO <sub>4</sub> ).....	21	0.44
Iron (Fe).....	.03	-----	Chloride (Cl).....	15	.42
Calcium (Ca).....	85	4.24	Fluoride (F).....	.4	.02
Magnesium (Mg).....	14	1.15	Nitrate (NO <sub>3</sub> ).....	.2	.00
Sodium (Na).....	3.0	.13	Dissolved solids.....	303	-----
Potassium (K).....			Total hardness as CaCO <sub>3</sub> .....	270	-----
Bicarbonate (HCO <sub>3</sub> ).....	283	4.64			

# INDEX

	Page		Page
Agua Dulce.....	87	Fowlerton.....	84
Alamo.....	62	Freer.....	51-52
Alamo Heights.....	24-25		
Alice.....	72-74	Geologic structure.....	4
Aransas Pass.....	93-94	George West.....	84
Aquifers in the area.....	4	Gillett.....	76
Asherton.....	46-47	Goliad.....	56
Austin chalk.....	7	Goliad sand.....	4, 7, 8
Austwell.....	91	Gonzales.....	57
		Ground water, chemical character of.....	13
Balcones fault zone, relation to ground-water occurrence.....	4	occurrence of.....	4-8
Bandera.....	21	Harlingen.....	38-39
Beaumont clay, sands of.....	4, 8	Hebronville.....	70-72
Beeville.....	21-23	Hondo.....	86-87
Benavides.....	50		
Big Wells.....	47	Jourdanton.....	18-19
Bishop.....	88		
Boerne.....	79	Karnes City.....	76-77
Brackettville.....	80	Kenedy.....	77-78
Brownsville.....	37	Kingsville.....	80-82
Brundage.....	48	Kyle.....	60
Buda.....	59-60		
		La Feria.....	39
Campbellton.....	17	La Pryor.....	112
Carrizo sand.....	4, 5, 6, 7	Laredo.....	104-106
Carrizo Springs.....	48-49	Lissie formation.....	4, 8
Catahoula tuff.....	7	Lockhart.....	31-32
Catarina.....	49	Los Fresnos.....	40
Christine.....	17-18	Luling.....	32-33
Combes.....	38	Lyford.....	107
Corpus Christi.....	88-89	Lytton Springs.....	33
Cotulla.....	82-83		
Coughran.....	18	McAllen.....	65-66
Crystal City.....	111-112	McMahan.....	35
Cuero.....	42-45	Marion.....	58
		Martindale.....	34
Dale.....	30	Mathis.....	95
Devine.....	86	Maxwell.....	34-35
Dilley.....	53-54	Mercedes.....	66
Donna.....	62-63	Mineral constituents in solution.....	9-12
		Mission.....	67
Eagle Pass.....	85	Mount Selman formation.....	4, 6, 7
Ed Couch.....	63		
Edinburg.....	63-64	New Braunfels.....	41-42
Edwards limestone.....	4, 5, 6	Nixon.....	57
Elsa.....	64-65	Nordheim.....	45
		North Pleasanton.....	19-20
Falfurrias.....	28-30		
Falls City.....	75-76	Oakville sandstone.....	4, 8
Fentress.....	31	Odem.....	95-96
Floresville.....	108	Orange Grove.....	74



	Page		Page
Pearsall.....	54-55	Seadrift.....	37
Pettus.....	23-24	Seguin.....	59
Pharr.....	67-68	Sinton.....	96-97
Pleasanton.....	20	Stockdale.....	110
Port Aransas.....	90	Surface water, chemical character of.....	13-15
Port Isabel.....	40		
Port Lavaca.....	36	Taft.....	97-98
Poteet.....	20-21	Three Rivers.....	85
Poth.....	108-109	Trinity group.....	5
Premont.....	75		
		Uhland.....	35-36
Raymondville.....	107-108	Uvalde.....	101-102
Refugio.....	92		
Rio Grande City.....	98-99	Victoria.....	102-104
Rio Hondo.....	40-41		
Robstown.....	90-91	Waelder.....	58
Rockport.....	16-17	Water quality, standards of.....	12
Roma.....	99-100	Water supplies, sources of.....	5-8
Runge.....	78-79	Water-bearing formations.....	5-8
		Weslaco.....	69
Sabinal.....	100-101	Woodsboro.....	93
San Antonio.....	25-28		
San Benito.....	41	Yegua formation.....	7
San Diego.....	52-53	Yorktown.....	46
San Juan.....	68-69		
San Marcos.....	61	Zapata.....	110-111
Saspmaco.....	109-110		

