TEXAS WATER COMMISSION

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GROUND-WATER CONDITIONS IN THE VICINITY OF BURNET, TEXAS

By

J. Russell Mount, Geologist
Ground Water Division

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INTRODUCTION

Results of a special ground-water study made for the city of Burnet are presented in this report. The study was requested by the city to aid them in determining the dependability of Burnet's ground-water supply.

During 1956, the last year of the recent drought, one of the city's water-supply wells failed as a result of lowered water levels. However, the well was placed back in operation after the drought when water levels recovered as a result of normal or above normal rainfall. Because of the failure of this well, the future adequacy of ground water for meeting the city's increasing requirements under drought conditions was questioned.

In May 1961, officials of the city of Burnet requested the Texas Water Commission to assist them in determining the adequacy of ground-water supplies in the vicinity of Burnet. Because personnel were not immediately available to make a detailed investigation, the Commission agreed to make a special study in the vicinity of Burnet as a part of its present reconnaissance study of ground-water resources in the Colorado River Basin.

Data from the Burnet ground-water study and from earlier reconnaissance work would be compiled in a memorandum report that would be furnished the city for their use in evaluating the future adequacy of their ground-water supply. Prior to starting work in the area, it was suggested that the city employ a ground-water consultant to aid them in evaluating the data that would be collected by the Water Commission and to advise and assist them on additional work that might be required to properly determine the adequacy of the city's ground-water supply.

Basic data collected in the vicinity of Burnet, Texas, have been compiled and are presented in this report together with a discussion of ground-water conditions. Field work and data collected during this study also form an integral part of the Water Commission's reconnaissance study of ground-water resources in this portion of the Colorado River Basin.

The location and extent of the area studied, referred to as the Burnet area for discussion purposes, is shown on Plate 1. Field work in the Burnet area began in July 1961, and continued through August 1961. Measurements of water levels in selected wells and collection of pumpage and precipitation records continued through October 1961. Pumping tests of the city's wells, scheduled for a later time because of summer water demands, were conducted during the week ending November 4, 1961. The work performed during the field study consisted of inventorying wells, measuring spring and stream discharges, conducting pumping tests of wells, determining elevations of wells, springs, and stream beds, collecting precipitation and pumpage data, and mapping geology in the area of interest. The well inventory was made primarily to obtain water-level measurements, drillers' logs of wells, and water samples for chemical analysis. Chemical analyses of water samples were made by the Texas State Department of Health, in accordance with an agreement between them and the city of Burnet. Elevations for most of the wells within the city limits of Burnet were determined by field surveying, and elevations of wells, springs, and stream beds outside the city were determined with an aneroid barometer. The data collected during the study are presented in tables at the end of this report, and locations of the points where data were collected are shown on Plate 2, which is a base map of the Burnet area.

Published geologic maps by Paige (1912) and Barnes (1956b and 1958) are available for parts of the Burnet area. During the course of this study, rock units were mapped in those parts of the area where published maps of detailed geology were not available. No previous ground-water studies have been made in the area. However, a brief description of the city of Burnet's water supply is given in U. S. Geological Survey Water-Supply Paper 1069 (Sundstrom, et al., 1949), and information on one of the city's wells is included in a report by George (1942). Although Dr. V. E. Barnes' geological work in the Burnet area was not primarily concerned with the ground-water resources, his astute observations of ground-water conditions and his informative comments on the local geology have been beneficial in accomplishing the study.

ACKNOWLEDGEMENTS

Appreciation is expressed to Mayor Robert P. Miller, Jr. and to City Manager Fred Garrison for providing office space and pumpage and precipitation data; also for furnishing equipment and personnel for parts of the field studies. Mr. J. M. Wright, a local well driller, furnished drillers' logs, subsurface formation samples and information on ground-water conditions that were of value in the study. Aerial photographs, made available at the office of the Burnet Work Unit of the Soil Conservation Service, were of considerable value in the geologic mapping required for parts of the Burnet area. Appreciation is also expressed to local citizens for the cooperation and information they provided during the course of the study.

WELL-NUMBERING SYSTEM

The numbers assigned to wells and springs in this report conform to the statewide well-numbering system adopted by the Texas Water Commission. This system is based on division of the State into quadrangles formed by degrees of latitude and longitude, and repeated division of these quadrangles into smaller ones as shown below.

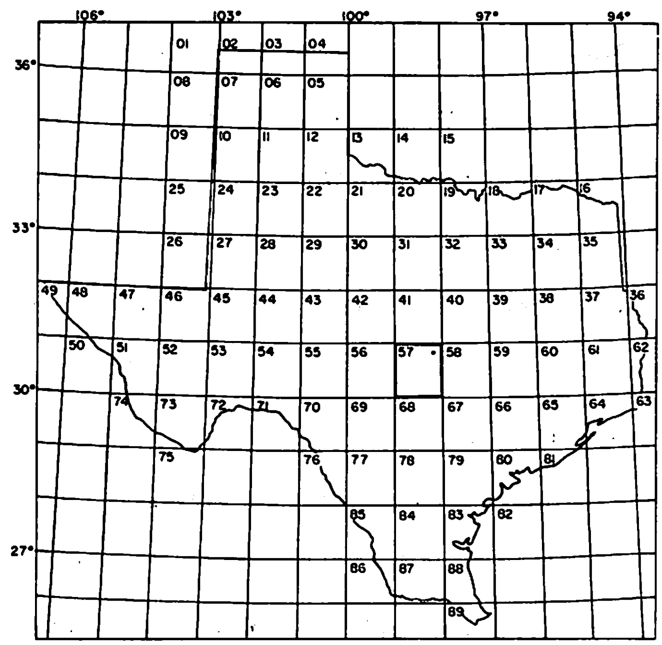
Location of Well 57-15-701

57 1-degree quadrangle

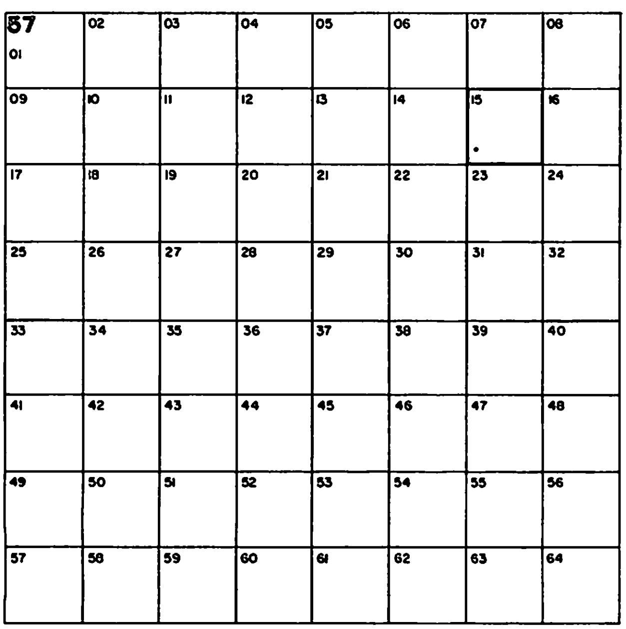
15 7 1/2 minute quadrangle

7 2 1/2 minute quadrangle

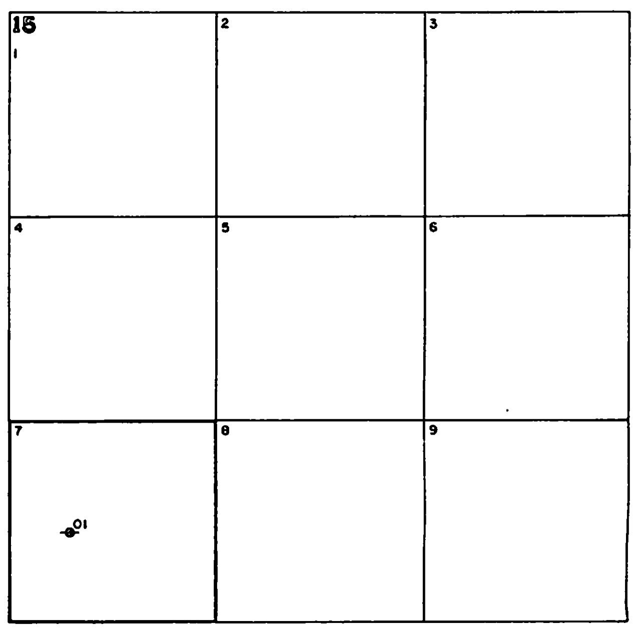
01 Well number within 2 1/2 minute quadrangle



1-degree Quadrangles



7 1/2-minute Quadrangles



2 1/2-minute Quadrangles

The largest quadrangle, a one-degree quadrangle, is divided into sixty-four 7-1/2 minute quadrangles, each of which is further divided into nine 2-1/2 minute quadrangles. Each one-degree quadrangle in the State has been assigned a number for identification. The 7-1/2 minute quadrangles are numbered consecutively from left to right beginning in the upper left hand corner of the one-degree quadrangle, and the 2-1/2 minute quadrangles within the 7-1/2 minute quadrangle are similarly numbered. The first two numbers of a well number identify the one-degree quadrangle; the third and fourth numbers identify the 7-1/2 minute quadrangle; the fifth number identifies the 2-1/2 minute quadrangle; and the last two numbers designate the order in which the well was inventoried within the 2-1/2 minute quadrangle.

The Burnet area lies entirely within one-degree quadrangle number 57, and the boundaries of this quadrangle are not shown on the illustrations in this report. However, the complete numbers of all wells and springs in this report begin with 57.

The points along the streams where flow measurements or observations were made do not conform to the statewide well-numbering system, but are numbered consecutively, and the numbers are preceded by the capital letter F.

GENERAL GEOLOGY AND PHYSIOGRAPHY

Geologic History

The Burnet area is located geologically on the northeast flank of a large domal feature called the Llano uplift which covers several counties. After the period of uplifting which occurred toward the end of Paleozoic time, the area was leveled by erosion and Paleozoic rocks near the center of the dome were removed, exposing rocks of Precambrian age. Cretaceous rocks were later deposited on this erosional surface. The incising of the Colorado River and its tributaries at a later date removed almost all of the Cretaceous rocks overlying the domal feature and exposed the Paleozoic and Precambrian rocks that appear at the surface in Llano uplift region. As a result of the erosion associated with development of the Colorado River drainage system, the Llano uplift now occupies a topographic basin with Cretaceous rocks exposed along the basin's rim.

Local Structure

Because the Burnet area is located on the northeast flank of the Llano uplift, the Paleozoic rocks in the area of study generally dip to the northeast. During the period of uplift, rocks were subjected to stresses, and in some places where stresses were severe enough to cause fractures, vertical movement of strata along the fracture planes resulted in numerous faults. The trend of faults in the Burnet area is northeast-southwest. Some faults are several miles in length, and they commonly reflect vertical displacements of more than 800 feet. Two important fault systems are shown on the geologic map (Plate 3). One system, located west of Burnet, crosses State Highway 29 near its intersection with Farm-to-Market Road 2341. The other system, located south of Burnet, crosses Hamilton Creek just north of its confluence with Delaware Creek.

The structure of the Cretaceous rocks is not related to structures of rocks underlying them, because the Llano uplift area was beveled by erosion before Cretaceous sediments were deposited. The only structural character exhibited by the Cretaceous rocks in the Burnet area is a gentle regional dip to the southeast. However, local changes in thickness of Cretaceous rocks are related to remnants of fault scarps on the eroded pre-Cretaceous surface.

Stratigraphy

Rocks of Precambrian age in the Burnet area are igneous and metamorphic whereas rocks of Paleozoic and Cretaceous age are sedimentary.

The stratigraphic units in the Burnet area and their water-bearing characteristics are briefly described in Table 1; the outcrop areas are shown on Plate 3. Names of stratigraphic units discussed in this report are based in part on work by Cloud and Barnes (1946).

Physiography

The Burnet area lies within two physiographic provinces: the topographic basin of the Llano uplift region, and the dissected uplands of Cretaceous rocks bordering the basin. Elevations range from approximately 1,100 feet to more than 1,600 feet above sea level. The western part of the Burnet area is underlain mostly by Paleozoic rocks, and generally features broad, low hills that are generally characteristic of the topographic basin of the Llano uplift region. The northern and eastern parts of the area are underlain by Cretaceous rocks and feature uplands with prominent ridges and steep slopes. The highest ridges are capped by limestones of the Fredericksburg group. Because geology is a controlling factor in physiographic development, a general idea of the topography in the Burnet area can be obtained by examining the geologic map shown on Plate 3. A more detailed illustration of topographic relief is provided by the 30-minute Burnet Quadrangle topographic sheet published in 1909 by the U. S. Geological Survey.

A major topographic divide occurs in the northeastern part of the Burnet area as shown on Plate 1. East of the divide the land is drained by streams of the Brazos River watershed. The portion of the Burnet area west of the divide is drained by tributaries of the Colorado River. The two principal tributaries of the Colorado River in the area of study are Hamilton Creek and Spring Creek.

PRINCIPAL WATER-BEARING UNITS

Principal water-bearing units in the Burnet area that may be of interest for development of a municipal water supply are the Hickory sandstone member of the Riley formation, the San Saba member of the Wilberns formation, the Gorman formation of the Ellenburger group, and the Hensell sand member of the Shingle Hills formation. Other water-bearing units serving as minor aquifers are described briefly in Table 1.

The two major fault systems shown on Plate 3 have a pronounced influence on the relative positions of rock units in the Burnet area. In order to facilitate discussion of some water-bearing units, the area has been separated into three subareas based on these fault systems and their inferred projections beneath overlying Cretaceous strata to the northeast. Plate 1 shows the locations of the three subareas, which are designated the Northwest, Central, and Southeast Subdivisions.

Hickory Sandstone Member of the Riley Formation

The Hickory sandstone is an important aquifer in the western part of the Llano region, where it supplies large quantities of water for municipal and irrigation use. However, in the Burnet area, water from this member is used only for domestic and stock purposes and the quantity of water that might be developed from the Hickory is unknown.

The thickness of the Hickory varies erratically throughout the Llano region because the sediments were deposited upon a rough Precambrian topography. Barnes (1956a) measured 340 feet of Hickory in the northwest part of the Burnet area. The Hickory formation is principally sandstone. Conglomeratic beds are encountered at the base of the Hickory and shale layers, which are common throughout the formation, are numerous in the upper part.

The Hickory is present at the ground surface throughout a large part of the Northwest Subdivision, but it is overlain by Cambrian and Cretaceous rocks in the eastern part of the subdivision. Although the Hickory is recharged in its outcrop area, the direction of ground-water movement is not known. Numerous seeps and small springs in the Hickory were observed in the general vicinity of well 57-14-601. Natural discharge from the Hickory may also occur in the seeps and springs along the fault system west of Burnet. Information on wells 57-14-601 and 57-14-908 and spring 57-14-903, all in the Northwest Subdivision, is given in Tables 2 and 3.

The Hickory sandstone occurs in the subsurface throughout the Central Subdivision of the Burnet area. The only information on the Hickory in this subdivision is from well 57-15-708, a test well drilled for the city of Burnet in 1956, and from well 57-15-739, which was drilled as an oil test in 1933.

The driller of the city test well reported that the top of the Hickory was encountered at a depth of 1,245 feet and that Precambrian rocks were encountered at a depth of 1,330 feet. According to the driller's log which is given in Table 4, the 85-foot thickness of the Hickory and its composition indicate that possibly only the upper part of the member is present at this site.

The city test well was completed at a depth of 1,330 feet, and casing was set to a depth of 50 feet. Although no record was made of the test performed on the completed well, it was reported that with the pump set at a depth of 455 feet the well yielded 100 gpm (gallons per minute) of saline water for a short time. A chemical analysis of this water is given in Table 3. The source of the highly mineralized water is not known.

The well was capped upon completion of the test, and during the course of this study the depth to water in the well was measured periodically. These water-level measurements are given in Table 5.

Well 57-15-739 was drilled as an oil test in 1933 under the name C. C. Campen et al. #1 Atchison. The well is reported to have reached a total depth of 1,600 feet, but samples of cuttings from the well are available only to 1,300 feet. Examination of the cuttings, filed at the Well Sample Library of the Bureau of

Economic Geology, The University of Texas, shows that the top of the Hickory occurs at a depth of 1,145 feet in the well. The cuttings of Hickory from depths of 1,145 to 1,300 feet are composed of shale and fine sand. The well yielded 200 gpm to an irrigation pump, but failed during the recent drought and subsequently was plugged and abandoned. The depth to water and the source of the water produced are not known.

The rocks in the Southeastern Subdivision of the Burnet area dip more steeply to the northeast than in the other two subdivisions. The Hickory does not appear at the surface in this subdivision and the only information on it is from an irrigation test well, 57-23-403, located at the southeastern extremity of the Burnet area. Table 4 shows the depths and thicknesses of the stratigraphic units encountered in the well. The Hickory was encountered at a depth of 2,165 feet in this well and was found to be 305 feet thick (Barnes & Bell, unpublished manuscript). An electrical log was run on part of the well, and samples of drill cuttings collected from the well are in the files of the Well Sample Library of the Bureau of Economic Geology. Examination of the samples shows that the Hickory in this well is comprised of alternating layers of shale and medium-grained sand. The well failed to yield any significant quantities of water when it was completed and the well was plugged and abandoned. No information is available on the rate at which the well was pumped, the depth to water in the well, or the chemical quality of the water that was produced.

San Saba Member of the Wilberns Formation

The San Saba, which attains a thickness of approximately 300 feet in the Burnet area, is known to occur in the Central and Southeast Subdivisions. Except for about 50 feet of bedded argillaceous limestone at the base of the member, the San Saba is principally a dolomite. Only the dolomitic portion of the San Saba is known to produce water. The lower 75 feet of the dolomitic portion is vugular where this section is exposed in the outcrop area. Vugular zones also occur in the uppermost part of the San Saba. The areal pattern of the vugular zones and the extent of interconnection between these zones in the subsurface cannot be predicted.

The San Saba outcrops over a large part of the Central Subdivision. Dipping to the northeast, the San Saba passes into the subsurface immediately south and west of Burnet. Recharge is afforded by precipitation in the area of the outcrop. Available water-level data suggest that a water-level high is formed in the recharge area and that water in the San Saba moves generally to the northeast, east and southeast. Two major springs, 57-22-301 and 27-14-911, and several smaller springs and seeps discharge water from the San Saba. During the recent drought spring 57-14-911 continued to flow, but spring 57-22-301 ceased to flow and pumping from the spring was required to supply water for stock. Well 57-15-701, one of the two wells supplying the city of Burnet, probably obtains its water from porous zones in the San Saba. This well has been in service for approximately ten years and its normal pumping rate generally has been between 400 and 450 gpm. The well continued to supply the city during the recent drought and was the only well operating in 1956 and 1957 when the city's other well, which was screened in the Hensell, failed as a result of lowered water levels. Burnet municipal pumpage of ground water from 1947 through October 1961 is presented in Table 6 and on Plate 4. Pumpage at Burnet is generally higher during periods of low precipitation, especially during the summer months. The relationship of pumpage and precipitation for a short period of record is illustrated by the graphs on Plate 5.

Well 57-15-701 was pumped at higher rates when the well was first placed in service and during tests that were made October 31, and November 1, 1961. Pumping tests of this well are discussed on page 17. Periodic water-level measurements made in well 57-15-701 and in well 57-15-704, which penetrates the San Saba and deeper strata, are presented in Table 5.

A comparison of water-level elevations and chemical analyses of water from wells indicates that the San Saba dolomite may be hydraulically connected with overlying water-bearing materials. Although water from the San Saba has a high total hardness and in some instances contains objectionable quantities of nitrates, it generally is suitable for public supply. Analyses of water from the San Saba member are presented in Table 3.

In the Southeast Subdivision, the San Saba occurs only in the subsurface and at great depths. The top of the San Saba was encountered at a depth of 1,325 feet in a test well, 57-23-403, that was drilled to granite (Barnes and Bell, unpublished manuscript). This test well was abandoned because of insufficient water for irrigation. Porous zones in the San Saba are not indicated by the electrical log that is available for the well.

Gorman Formation of the Ellenburger Group

The Gorman formation occurs only in the Southeast Subdivision of the Burnet area, having been removed by erosion in the other subdivisions. Throughout the Southeast Subdivision almost all the Paleozoic rocks at the ground surface belong to the Gorman formation. Discussion of water-bearing properties of the Gorman is limited because of lack of information.

The base of the Gorman was encountered at a depth of 502 feet in well 57-23-403 (Barnes and Bell, unpublished manuscript). During field studies in the Burnet area, the Gorman was observed at the surface near the site of this well. Therefore, the thickness of the Gorman in the vicinity of the well is probably at least 502 feet. Its thickness may be greater downdip in the subsurface to the northeast, where its upper portion is not eroded but is contiguous with the overlying Honeycut formation. The Gorman is composed of limestone and dolomite, with limestone predominant over dolomite in the upper part of the formation (Cloud and Barnes, pp. 291-292). Longhorn Cavern, located approximately nine miles southwest of Burnet as shown on Plate 1, was formed by ground-water solution of a pure limestone that is present in the upper part of the Gorman (loc. cit.). The Gorman may also contain solution openings in the Burnet area and thus be a potential source of water for public supply. Wells 57-23-401 and

57-23-402, located in the extreme southeast part of the subdivision, obtain water from the Gorman for irrigation. Well 57-23-401 was reported to have pumped more than 500 gpm from porous zones in the formation. Both irrigation wells supplied water for irrigation during the recent drought. Other wells, including well 57-23-403, reportedly were drilled on the same property without finding water. Water-level measurements made in well 57-23-402 show that the water level rose more than 45 feet from 1953, in the early part of the drought, to 1961, after the drought. Measurements of water levels in wells 57-23-401 and 57-23-402 are included in Table 5. Plate 6 presents graphs of water levels in well 57-23-402 and yearly precipitation at Burnet for the period 1953 through 1960. Precipitation data are presented also in Table 7. Streamflow measurements, presented in Table 8, show that Hamilton Creek loses water to porous zones of the Gorman formation near the Texas Construction Materials' quarry about three miles south of Burnet. However, the direction of ground-water movement within the formation is not known.

A chemical analysis of water from well 57-23-401 indicates that water from the Gorman has a low content of nitrates and that it is suitable for public supply. This chemical analysis is included in Table 3.

Hensell Sand Member of the Shingle Hills Formation

The Hensell sand forms the basal part of the Cretaceous rocks in the Burnet area. It is composed of sand, conglomerate, silt, and clay, and is recognized by its red color. Its composition and thickness vary throughout the area. In the Burnet area the Hensell generally is thinner and less sandy to the west and northwest. Sand and conglomerate occur in basal portions of the member, and silt and clay are predominant near the top. The total thickness of the water-bearing sands in the Hensell is probably less than 30 feet in the Burnet area. Northwest of Burnet the Hensell occurs in the subsurface and is too thin to supply significant quantities of water. The outcrop areas of the Hensell are south and west of Burnet. The Hensell dips to the southeast, and extends from its outcrop areas into the subsurface beneath the overlying Glen Rose member of the Shingle Hills formation.

Although the Hensell is too thin to supply significant quantities of water in the area west and northwest of Burnet, it supplies all the domestic wells that were inventoried east of the city. The well with the highest known yield from the Hensell is used by the city of Burnet to furnish part of its public supply. This well, 57-15-702, is now pumped at a rate of 260 gpm, but during the recent drought it failed as a result of lowered water levels. A former irrigation well located northeast of Burnet, 57-15-706, also failed during the recent drought. The failure of these two wells indicates that the Hensell probably cannot be depended upon for large supplies of water during extended periods of drought. Frequent measurements of water levels that were made in two Hensell wells, 57-15-706 and 57-15-716, are presented in Table 5. Short pumping tests made of well 57-15-702 and of 57-15-705, a small-yield irrigation well just north of Burnet, are discussed in the following section on pumping tests.

Measurements of water levels in Hensell well 57-15-716 are presented together with municipal pumpage and precipitation on Plate 7. The water level in this well, which is located close to the city's two supply wells, declined during the dry month of August when the city wells were pumped almost continuously. The water level rose as pumping was reduced during the following months.

The Hensell is recharged by precipitation that falls in its outcrop area and possibly by movement of water from underlying and overlying water-bearing materials. The regional direction of ground-water movement in the Hensell is to the southeast.

Water from the Hensell is of suitable quality for public supply as shown by the chemical analyses in Table 3.

Pumping tests were conducted on three wells in the Burnet area to determine the wells' specific capacities and the coefficients of transmissibility of the aquifers supplying the wells. Basic data from tests of two of these wells are presented in Tables 9 through 14.

The specific capacity of a well is defined as the gallons per minute it will produce per foot of drawdown (gpm/ft.) after pumping at a constant rate for a given period of time. It is determined by dividing the pumping rate in gallons per minute by the number of feet the water level in the well was lowered due to pumping. It is a measure of the well's ability to supply water to the pump. The coefficient of transmissibility is defined as the rate at which water will move through a section of the aquifer having a width of one foot and a height equal to the saturated thickness of the aquifer when the hydraulic gradient is one foot per foot. It is expressed in gallons per day per foot (gpd/ft.) under a hydraulic gradient of unity. The coefficient of transmissibility, which is an index of the ability of the aquifer to transmit water, is computed by application of formulas involving pumping rate and rates of water-level changes which occur in the pumped well or in observation wells as a result of pumping or cessation of pumping.

The first test was made of well 57-15-701 in May 1961. This test was only of 30 minutes duration because the water requirements of the city at that time of the year limited the length of time that the municipal supply wells could be taken out of operation. At the beginning of the test, nearby municipal well 57-15-702 had not been operating since the previous day, and well 57-15-701 had been pumping continuously for several hours at a steady rate. Water levels in both wells were measured prior to starting the test. At the beginning of the test, pumping was stopped in well 57-15-701, and measurements of the depth to water were made at frequent intervals. The water-level measurements and time at which the measurements were taken were recorded and are presented for well

57-15-701 in Table 9. The data obtained from well 57-15-701 were used to compute the well's specific capacity and to obtain an approximate coefficient of transmissibility for the aquifer supplying the well. The well's specific capacity was found to be 74.6 gpm/ft. for a 30-minute recovery period, after pumping 440 gpm, and the coefficient of transmissibility for the aquifer supplying the well was 123,500 gpd/ft.

Water-level measurements in well 57-15-702 were made during the test to explore the possibility of hydraulic connection between the Hensell which supplies water to well 57-15-702 and the San Saba which supplies water to well 57-15-701. The data obtained were inconclusive because of the difficulty in making the measurements, but a slight water-level rise in well 57-15-702 indicated that a hydraulic connection might exist between the two aquifers. Water-level measurements made of well 57-15-702 during this test are not presented in this report.

A longer pumping test was suggested in order to more accurately determine transmissibility and to further investigate the possibility of interconnection between the aquifers supplying these two city wells. A longer test was planned for later in the year, following the summer months, when the demand for water would be low enough to allow well 57-15-701 to be taken out of operation. In the meantime other wells could be located which might be used for observation purposes to aid in determining aquifer characteristics and whether there is hydraulic connection between the two aquifers.

In the latter part of October the pump on well 57-15-701 was replaced with a higher capacity test pump. Subsequent testing included pumping the well at various rates to determine the well's performance and pumping the well at a constant rate for several hours to determine aquifer transmissibility. The rates of pumping and depths to water are presented in Table 9 and on Plate 8. In preparation for the test, provision was made to maintain pumping in well 57-15-702 at a steady rate for the duration of the test. Continuous water-level recorders were installed on nearby wells 57-15-704 and 57-15-716 to record water-level changes that might be caused by pumping. The graphs obtained from these recorders are filed at the office of the Texas Water Commission. Water-level measurements obtained from the graphs are given in Tables 10 and 11 and are plotted on Plate 8.

A deep-well current meter was installed in the pumped well prior to setting the test pump to determine the depths of the zones producing water while the well was being pumped. Vertical velocities of water in the well bore obtained from the current-meter survey are shown in Table 12. The measurements show that there was no vertical movement of water below a depth of 72 feet. Some of the variations in velocity measured at lesser depths probably reflect changes in well diameter. The depth to which the casing is set is not definitely known and caliper equipment was not available to measure the diameter of the well.

Frequent measurements of temperature and electrical conductivity were made on samples of water discharged from the pump during the test. The purpose of these measurements was to determine whether a change in water quality occurred when the well was pumped at high rates. The data from these measurements are presented in Table 13.

During the first part of the test, the well was pumped successively at rates of 725, 860, 1,000, 1,200 and 1,400 gallons per minute. Continuous pumping at each of these rates was maintained for a minimum period of 30 minutes, and depths to water were measured at frequent intervals throughout the test. Pumping rates of 725, 860, and 1,000 gallons per minute were measured with a 8"x6" pipe orifice and the higher pumping rates were measured with a 10"x8" pipe orifice. The drawdown measured at the various pumping rates indicated that flow measurements obtained with the two orifices were not comparable. Therefore, a check was made by pumping the well at about 1,020 gpm using the 10"x8" orifice and the drawdown measured in the well was compared with the drawdown measured in the well when it was pumped 1,000 gpm using the 8"x6" orifice. As shown by Plate 9, the one-half hour drawdown measured while using the 10"x8" orifice differed appreciably from that measured while using the 8"x6" orifice. From a comparison of the drawdowns shown by the data plotted on Plate 9, it appears that pumping rates measured with the 8"x6" orifice may be more reliable.

On the day following the well-performance tests discussed above, the well was pumped at approximately 800 gpm for eight hours. Water-level measurements were made at frequent intervals during the pumping period and during a four-hour period after pumping ceased. The pumping-test data for both days of the testing are given in Table 9 and are shown graphically on Plate 8.

Results of the pumping test show that initially the transmissibility of the aquifer is large, being on the order of 140,000 gpd/ft. However, the data from the latter portion of the pumping period indicates that the transmissibility becomes considerably lower with time. The decrease in transmissibility may result from a change in aquifer characteristics at some distance from the well or from dewatering part of the aquifer. A longer period of pumping would be required to determine the ultimate effect that the decreasing transmissibility would have on the availability of water to the well.

A graph from the continuous water-level recorder installed on well 57-15-716 shows that water levels in the observation well declined slightly during the test but did not fluctuate in response to pumping at well 57-15-701. This indicates that there is only a slight hydraulic connection between the aquifers supplying water to the two wells. A longer period of pumping might be necessary to cause significant effects on the water level in the observation well.

After the conclusion of the pumping test of well 57-15-701, pumping of well 57-15-702 was stopped, and measurements were made of the rising water levels during a four-hour period. The depths to water and times of measurement are given in Table 14. The data are not considered entirely reliable because of their erratic nature. It was not possible to obtain water-level measurements with a steel tape or electrical measuring device, so the depths to water were obtained with a mercury manometer used in conjunction with an airline installed in the well. Difficulties were encountered in that there was leakage in the airline and it was not possible to measure the mercury column accurately with available equipment. Analysis of the test data indicates that the well has a one-half hour specific capacity of 13.6 gpm/ft. while pumping at 260 gpm, and that the transmissibility of the Hensell sand in the immediate vicinity of the pumped well may be on the order of 70,000 to 90,000 gpd/ft. However, the latter portion of the recovery test data indicates that the transmissibility might become less with time.

The water level in observation well 57-15-716 continued to decline slowly after pumping from well 57-15-702 ceased. This indicates that the sands of the Hensell supplying water to the two wells may have only a slight hydraulic connection. Observation well 52-15-716, an abandoned domestic well, is completed at a depth of 57 feet, whereas well 57-15-702 reportedly encountered its most productive sand between depths of 64 and 74 feet.

In August 1961, a short pumping test was made of well 57-15-705, which produces water from sands of the Hensell a short distance north of Burnet. Although data collected during this test are reliable, the results of the test are generally inconclusive. The transmissibility of the aquifer is apparently low, being on the order of 1,000 gpd/ft. or less, and the specific capacity of the well was about one gpm/ft. after one-half hour of pumping at 47 gpm. Because of the short test period and the nature of the results, the test data are not given in this report.

OBSERVATIONS OF STREAMFLOW

A Price-type current meter was used to measure streamflow at various points along Delaware and Hamilton Creeks. It had not rained for several weeks prior to the time of these measurements. Therefore, the observed changes in streamflow reflect the amounts of ground water received by the stream or the amounts of surface water lost to the water-bearing rocks in the area. The measurements and observations of streamflow are given in Table 8. Locations of the points at which the measurements and observations were made are shown on Plate 2.

Measurements of Delaware Creek showed that springs are present along Delaware Creek between Delaware Spring (57-22-301) and the confluence of Delaware and Hamilton Creeks.

Observations along Hamilton Creek revealed that springs discharge into Hamilton Creek, and that Hamilton Creek recharges the Gorman formation.

SUMMARY

Aquifers in the Burnet area that were found to have some indications of potential for supplying water for public supply purposes are the San Saba, Gorman, Hensell, and Hickory. However, locations at which adequate water supplies possibly can be developed from these formations cannot be predicted from data now available. Additional information such as that obtained from a program of test drilling will be needed.

Wells and springs with the largest yields in the Burnet area discharge water from the San Saba. Water in the San Saba is encountered mostly in cavities. Locations of the cavities cannot be predicted and can be found only by test drilling. Chemical quality of the water from the San Saba is suitable for most uses. The water generally has a high total hardness, and in some cases its content of nitrates exceeds the limit recommended for public consumption.

The Gorman formation also contains water in cavities. Two irrigation wells located about four miles south of Burnet obtain water from porous zones in the formation. The Gorman is present at the ground surface in an area south of Burnet. Test drilling would be required to locate porous zones capable of supplying large-yield wells.

The Hensell sand supplies water to most of the wells in the eastern part of the Burnet area, but is generally too thin to sustain large-yield wells for long periods of time. A public supply well at Burnet has the largest yield of all wells completed in the Hensell in this area. Failure of this well during the recent drought, as a result of lowered water levels, indicates that the Hensell does not contain a large quantity of water in storage. Therefore, the ability of the aquifer to supply water on a continuous basis depends on the adequacy of recharge. The quality of the water from the Hensell is similar to that from the San Saba.

The Hickory supplies water only to small domestic wells in the Burnet area. In an area about five miles northwest of Burnet, water from the Hickory is of

good chemical quality. Although the thickness of the Hickory in this area is known to be as much as 340 feet, no information is available on its water-bearing properties. At Burnet, and in the area generally to the south and southwest, the Hickory occurs at depths of several hundred feet. A test well at Burnet drilled by the city through the Hickory failed to produce a significant quantity of water. However, the slight thickness of Hickory encountered and its composition indicate that only the upper part of the member is present at this site. Additional test drilling would be required to determine whether the full section of Hickory is present in other localities near Burnet. Testing also would be required to determine the water-bearing properties of the Hickory and the chemical quality of its water. Limited information available on the Hickory in the area southeast of Burnet indicates that, because of faulting, the Hickory probably occurs at depths greater than 2,000 feet.

Pumping tests conducted on the two city supply wells show that the transmissibilities of the Hensell and San Saba aquifers probably are high in the vicinity of these wells, but that the transmissibilities may become less with time if the wells are pumped at steady rates. Further investigations may be necessary to determine the effect that changing hydraulic characteristics may have on the availability of water.

REFERENCES CITED

Barnes, V. E., 1956a, Lead deposits in the upper Cambrian of central Texas: Univ. Texas Bur. Econ. Geology Rept. of Inv. 26, 68 p.

________1956b, Resume of geology of eastern Llano uplift and road logs for first part of San Angelo Geological Society field trip, in San Angelo Geol. Soc. Guidebook, Four Provinces Field Trip, March 16-17, 1956: part I, p. 1-32.

________1958, Field excursion eastern Llano region: Univ. Texas Bur. Econ. Geology Guidebook No. 1, 31 p.

Barnes, V. E., and Bell, W. C.: Manuscript on the Cambrian rocks of central Texas, in preparation for publication by Univ. Texas Bur. Econ. Geology.

Cloud, P. E., Jr., and Barnes, V. E., 1946, The Ellenburger group of central Texas: Univ. Texas Pub. 4621, 473 p. [1948].

George, W. O., 1942, Ground water in the vicinity of Burnet and Bertram, Burnet County, Texas: U. S. Geol. Survey open-file report (available at Austin, Texas), 12 p.

Paige, Sidney, 1912, Description of the Llano and Burnet quadrangles: U. S. Geol. Survey Geol. Atlas, Folio 183.

Sundstrom, R. W., Broadhurst, W. L., & Dwyer, B. C., 1949, Public water supplies in central & north central Texas: U. S. Geol. Survey Water-Supply Paper 1069, 128 p.

TABLES OF BASIC DATA

Table 1.--Stratigraphic units in the Burnet area

System	Series and group		Formation	Member	Approximate thickness (ft.)	Description of rocks	Water-bearing characteristics
Cretaceous	Comanche series	Fredericksburg group	Edwards limestone		100±	Hard, massive limestone.	No water supply.
			Comanche Peak limestone		40- 50	Nodular limestone.	Do.
			Walnut clay		10- 15	Yellow sandy clay.	Do.
		Trinity group	Shingle Hills	Glen Rose limestone	0-250	Alternating layers of hard limestone and sandy clay.	Yields water in large seepage areas on hill-slopes.
				Hensell sand	0-74+	Fine red silt and clay, with occasional layers of sand and conglomerate.	Supplies domestic wells east of Burnet; occasionally may yield over 100 gpm.
Ordovician	Ellenburger group		Honeycut		0-?	Bedded limestone and dolomite.	Mostly unknown in area; may supply water for domestic wells.
			Gorman		500	Massive, cherty limestone and dolomite.	Yields over 500 gpm to irrigation wells.
			Tanyard	Staendebach	450	Cherty dolomite.	Unknown in area.
				Threadgill	90	Non-cherty, coarse-grained dolomite and fine-grained limestone.	Mostly unknown; supplies water to small springs.
Cambrian			Wilberns	San Saba	300	Tan to rose, vugular dolomite, cherty in middle part; limestone in lower 50 feet.	Vugular protions may yield over 400 gpm.
				Point Peak	125	Olive-green shale, siltstone and limestone.	No water supply.
				Morgan Creek limestone	135	Glauconitic limestone.	Do.
				Welge sandstone	15	Medium-grained sandstone.	Yields small amounts of water to domestic wells.
			Riley	Lion Mountain sandstone	55	Glauconitic sandstone and limestone.	Do.
				Cap Mountain limestone	300	Glauconitic limestone.	No water supply.
				Hickory sandstone	80-350	Sandstone and shale, conglomeratic at base.	Yields small amounts of water to domestic wells; potential for large development is unknown.
Precambrian						Igneous and metamorphic rocks.	Fractures yield very small amounts of water to domestic wells.

Table 2.--Records of wells and springs in the Burnet area

Method of lift and type of power: T, turbine; C, cylinder; S, submergible; J, jet; Cf, centrifugal; E, electric; W, wind; G, gasoline.
Use of water: D, domestic; S, stock; Irr, irrigation; PS, public supply; Ind, industrial; N, none.

Well or spring	Owner	Elevation of land surface (ft.)	Depth of well (ft.)	Casing		Water-bearing unit	Water level			Water temperature (°F)	Method of lift	Use of water	Remarks
				Diameter (in.)	Depth (ft.)		Depth below land surface (ft.)	Elevation (ft.)	Date of measurement				
*57-14-601	Allen McReynolds	1,370	208	8	14	Hickory	27.07	1,343	8-30-61	70	C,W	S	Natural seepage in area.
57-14-801	W. M. Hanszen	1,235	--	--	--	Threadgill	flows	1,235	--	68.5	(Spring)	do	Known as Buzzard Roost Spring. Estimated flow 10 gpm. Located on fault.
*57-14-901	Morgan Wright	1,456	300	7	15	San Saba	163.60	1,292	8- 1-61	70.5	S,E	D	Water in porous zone where rock changes color from pink to tan.
*57-14-902	W. M. Hanszen	1,285	--	--	--	Threadgill	flows	1,285	--	69.5	(Spring)	D,S	Water from joint in rock. Estimated flow 40 gpm. Flow ceased in 1956.
57-14-903	F. L. Parks	1,252	--	--	--	Staendebach and Hickory	do	1,252	--	--	do	S	Known as Four-mile Spring. Ceased flow in 1956. Estimated flow 5 gpm. Located on fault.
*57-14-904	do	1,342	140	8	--	Threadgill?	73.12	1,269	8-23-61	72	J,E	D,S	Reported weak supply. Reported water level 97 ft. in 1956.
57-14-906	C. V. McKnight	1,600±	420	--	--	--	--	--	--	--	N	N	No water supply obtained. Bottom of hole in white limestone.
*57-14-908	Jeff Hodge	1,306	25	30	--	Hickory	13.47	1,293	8-24-61	70.5	Cf,E	S	Dug well. Weak supply.
*57-14-909	Edgar Shelburn	1,401	170	6	170	Glen Rose?	149	1,252	8-22-61	69.5	C,E	D,S	Water from fine red silt.
57-14-910	do	1,430	300+	do	--	do	175.72	1,254	do	--	N	N	Weak supply.
57-14-911	W. M. Hanszen	1,200	--	--	--	San Saba	flows	1,200	8-16-61	--	(Spring)	S	Known as Big Spring. Measured flow 435 gpm. Flowed during drought.
*57-14-912	Mrs. C. C. Husted	1,328	225	8	--	do	33.47	1,295	8-17-61	70	J,E	S	Water reported from fine sand at 141-143 ft. Pumped 175 gpm when completed.
57-15-401	L. T. Rettmann	1,377	160	6	160	Hensell	125.06	1,252	8-28-61	--	S,E	D	
57-15-501	Willie Spiekermann	1,423	215	do	215	do	193 (reported)	1,230	1956	--	C,G	D,S	Reported pumping rate 22 gpm. Reported drilling time 1-1/2 days.
R *57-15-701	City of Burnet	1,293.17	168	18	--	San Saba	26.46	1,266.71	5-31-61	68.5	T,E	PS	Drilled as oil test.
R *57-15-702	do	1,293.41	74	12	74	Hensell	26.79	1,266.62	do	do	do	do	Pumps 260 gpm. Failed in 1956.
R *57-15-703	Mrs. R. S. Bowden	1,319.13	112	8	112	do	53.72	1,265.41	8- 1-61	do	do	Irr	Reported yield 100 gpm.

See footnotes at end of table.

Table 2.--Records of wells and springs in the Burnet area--continued

	Well or spring	Owner	Elevation of land surface (ft.)	Depth of well (ft.)	Casing		Water-bearing unit	Water level			Water temperature (°F)	Method of lift	Use of water	Remarks
					Diameter (in.)	Depth (ft.)		Depth below land surface (ft.)	Elevation (ft.)	Date of measurement				
WL+R	57-15-704	City of Burnet	1,278.77	800±	10	30	San Saba	11.55	1,267.22	8-22-61	--	N	N	Drilled for municipal supply. Drilling tools lost in hole.
R	~~57-15-705~~	~~Mrs. R. S. Bowden~~	~~1,317.78~~	~~178~~	~~8~~	--	~~Hensell~~	~~53.96~~	~~1,263.82~~	~~8- 1-61~~	~~69~~	~~T,E~~	~~Irr.~~	
R+WL	57-15-706	do	1,337.47	100	do	100	do	73.43	1,264.04	8- 2-61	--	N	N	Failed in 1956. Previously used for irrigation.
R-707														
R+WL	*57-15-708	City of Burnet	1,277.08	1,330	12	50	San Saba	9.75	1,267.33	8-22-61	--	do	do	Reported drawdown 455 ft. after pumping 100 gpm for 15 minutes. 1/
R	57-15-709	Dr. Joe Sheppard	1,266-1,270	--	--	--	Threadgill?	flows	1,266-1,270	--	--	(Spring)	do	Water from seeps in draw.
R	*57-15-710	A. M. Gibbs	1,270.45	96	5	92	San Saba	6.79	1,263.66	8- 3-61	68.5	S,E	D	Tested at 317 gpm. Water reported from cavity at 92-96 feet.
*711-R														
R	57-15-712	Maude Daugherty	1,353	160	6	160	Hensell	111.44	1,242	8-15-61	--	N	N	Abandoned domestic well.
R	*57-15-713	Dr. Sam Paschall	--	100	do	100	do	--	--	--	70	J,E	D	Irrigates 2 lawns. Operated continuously during summer months.
R	*57-15-714	Edward Verlander	1,318.03	206	7	--	San Saba	53.88	1,264.15	8- 2-61	70	do	do	Water reported from cavity at 194-206 ft.
R	57-15-715	Otto Kusler	1,335	124	do	16	do	40.42	1,295	8-15-61	69	S,E	do	Bailed 40 gpm when completed.
R+WL	57-15-716	Anna Cheatham	1,296.14	47	6	47	Hensell	31.20	1,264.94	8-11-61	--	N	N	
R	57-15-717	Andrew Miller	1,294.35	340	8	--	San Saba	31.79	1,262.56	8-15-61	--	J,E	D	Not used.
R	57-15-718	Alma Cotham	1,317.53	365	6	--	do	55.59	1,261.94	do	70	C,E	do	
R	57-15-719	John Kincheloe	1,301.10	50	36	10	Hensell	34.9	1,266.2	8-14-61	--	N	N	Dug well. Formerly used for irrigation.
R	57-15-720	W. D. Corder	1,324.72	110	6	110	do	60.15	1,264.57	do	--	do	do	Abandoned domestic well.
721-R 722-R														
R	57-15-723	W. Landon Proffitt	1,312.13	90	do	90	do	47.67	1,264.46	8-15-61	69	S,E	D	
R	*57-15-724	Jordan Everett	1,334.72	155	do	1.5	Hensell?	54.2	1,280.5	do	69.5	C,E	do	Irrigates 2 lawns.
R	*57-15-725	D. E. Manning	1,323.38	270	8	--	San Saba?	42.9	do	do	70.5	J,E	do	
R	57-15-726	Cal Spivey	1,313.95	52	6	52	Hensell	37.66	1,276.29	8-14-61	--	N	N	Abandoned domestic well.
R	57-15-727	John Pogue	1,289.72	81	do	--	San Saba?	21.23	1,268.49	do	69	J,E	D,S	
R-728														
R	57-15-729	Pete Elliott	1,291.20	67	5.5	67	Hensell	28.29	1,262.91	8-15-61	--	N	N	

730-R
* See footnotes at end of table.

Table 2.--Records of wells and springs in the Burnet area--continued

R-733
R-734

Well or spring	Owner	Elevation of land surface (ft.)	Depth of well (ft.)	Casing: Diameter (in.)	Casing: Depth (ft.)	Water-bearing unit	Water level: Depth below land surface (ft.)	Water level: Elevation (ft.)	Water level: Date of measurement	Water temperature (°F)	Method of lift	Use of water	Remarks
57-15-731	Chas. Schnabel	1,285.37	80	4	--	San Saba	22.80	1,262.57	8-15-61	--	N	N	Abandoned domestic well.
57-15-732	Mrs. S. H. Orand	1,274.47	75	--	--	Hensell	27.76	1,246.71	do	--	do	do	Abandoned domestic well. Reported completed in sand.
57-15-735	F. H. Hammond	1,267.38	85	6	--	do	23.91	1,243.47	do	69	J,E	D	Reported completed in sand. Irrigates lawn.
*57-15-736	E. B. Kinsey	1,263.07	80	do	--	do	20.76	1,242.31	8-17-61	68.5	do	do	Irrigates lawn.
57-15-737	Leslie Fry	1,346	120	8	120	Glen Rose	87.90	1,258	8-22-61	--	C,E	D,S	
57-15-738	do	1,357	114	6	--	do	76	1,281	do	--	C,W	S	Reported drilling time 10 hrs. Reported water level more than 100 feet in 1956.
57-15-739	John Pogue	1,268	1,600	--	--	--	--	--	--	--	N	N	Abandoned oil test, formerly used for irrigation. Reported yield 200 gpm. Failed in drought. Samples of cuttings of incomplete section on file at Well Sample Library of the Bureau of Economic Geology, The University of Texas. Top of Hickory sandstone at a depth of 1,145 feet.
57-15-801	J. W. Boss	1,450	329	6	329	Hensell	266.76	1,183	8-24-61	--	S,E	D,S	
57-15-802	Gene Germany	1,409	240	do	--	do	187.56	1,221	do	--	C,E	do	Walnut clay at surface.
57-15-803	A. L. Warren	1,478	250	do	250	do	228	1,250	8-28-61	--	do	do	
57-15-804	State Highway Dept.	1,496	349	--	340	do	300 (reported)	1,196	1953	--	S,E	D,Ind	Pumps 10 gpm continuously. Used for lawn irrigation and road maintenance.
57-22-202	Donald Duncan	1,390	--	--	--	San Saba	flows	1,390	8-14-61	--	(Spring)	S	Located at head of Peter Creek.
57-22-203	W. M. Hanszen	1,368	240	10	6	do	12.55	1,355	8-16-61	--	C,W	do	Deepened from 80 ft. in 1956 becauseof water-level decline.
57-22-204	H. B. Siler	1,374	65	--	--	do	6 (reported)	1,368	1960	68.5	J,E	D,S	Did not fail in drought.
57-22-205		1,345	300	--	--	do	140	1,205	8-17-61	72.5	C,E	S	
*57-22-206	Donald Duncan	1,406	100	6	6	do	29.18	1,377	8-16-61	69.5	do	D,S	Deepened from 50 ft. in drought because of water-level decline. Weak supply.

See footnotes at end of table.

Table 2.--Records of wells and springs in the Burnet area--continued

Well or spring	Owner	Elevation of land surface (ft.)	Depth of well (ft.)	Casing: Diameter (in.)	Casing: Depth (ft.)	Water-bearing unit	Water level: Depth below land surface (ft.)	Water level: Elevation (ft.)	Water level: Date of measurement	Water temperature (°F)	Method of lift	Use of water	Remarks
*57-22-301	Mrs. Ralph Trussell	1,231	--	--	--	San Saba	flows	1,231	--	70	(Spring)	S	Known as Delaware Spring. Flow ceased in 1956, but could be pumped. Measured flow 311 gpm in 1961.
57-22-302	Donald Duncan	1,267	50	7	10	do	21.14	1,246	8-14-61	--	N	N	Recently drilled - to be used as stock well.
57-22-303	do	1,276	60	--	--	do	25.24	1,251	do	--	C,G	S	
57-22-305	W. M. Hanszen	1,312	25	7	--	do	5.20	1,307	8-16-61	--	N	N	Abandoned domestic well.
*57-23-101	Jerome Felps	1,221	88	8	12	Honeycut?	18.00	1,203	7-26-61	69.5	J,E	D,S	Drawdown 2.2 ft. after pumping 10 gpm for 1/2 hour.
57-23-102	do	1,209	--	--	--	do	flows	1,209	do	--	(Spring)	S,Irr	Known as Felps Spring. Measured flow 401 gpm.
*57-23-103	Jettie Felps	1,202	--	--	--	do	do	1,202	do	69	do	S	Known as Horseshoe Spring. Estimated flow 10 gpm.
57-23-104	Texas Construction Materials Company	1,130	75	--	--	San Saba	6	1,124	8- 8-61	--	N	N	Core hole in bottom of quarry.
57-23-105	Tom O'Donnell	1,251	84	6	65	do	24.82	1,226	8-18-61	68	J,E	S,D	Supplies local airport.
57-23-106	Houston Clinton	--	248	8	30	Welge	20 (reported)	--	1960	--	S,E	S	Water from sand at 220-248 feet. Tested at 119 gpm when completed.
*57-23-201	T. C. Warren	1,358	206	6	206	Hensell	148.26	1,210	8-29-61	70	C,E	D,S	Well did not penetrate to base of water bearing sand.
*57-23-202	V. E. Lewis	1,307	108	do	--	do	86.98	1,220	8-24-61	70.5	C,W	D	
*57-23-401	Houston Clinton	1,160	240	12	40	Gorman	42.25	1,118	8-15-61	--	T,E	Irr,S	Not used. Reported yield more than 500 gpm. [1]
57-23-402	do	1,177	200	do	20	do	62.43	1,115	8-22-61	--	do	do	Not used.
57-23-403	do	1,200±	2,491	--	--	--	--	--	--	--	N	N	Drilled for irrigation. Electric log in files of Texas Water Commission. Cuttings on file at Well Sample Library of the Bureau of Economic Geology, The University of Texas. [1]

* See Table 3 for chemical analysis of the water.

[1] See Table 4 for log of well.

Table 3.--Chemical analyses of water from wells and springs in the Burnet area

(Analyses are in parts per million except specific conductance and pH)

Well or spring	Owner	Depth of well (ft.)	Date of collection	Analyst[1]	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na+K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids[2]	Total hardness as $CaCO_3$	Specific conductance (micromhos at 25° C.)	pH
57-14-601	Allen McReynolds	208	8-30-61	USGS	13.0	0.01	102	34	13	436	12	35	0.3	4.0	451	394	755	6.8
57-14-901	Morgan Wright	300	8- 1-61	TSDH	13.0	0.46	88	47	30	445	16	47	0.2	29	528	410	880	7.3
57-14-902	W. M. Hanszen	--	8-16-61	TSDH	10.8	0.05	94	49	8	497	14	12	0.1	11	467	440	778	7.1
57-14-904	F. L. Parks	140	8-23-61	TSDH	14.0	0.74	72	43	18	400	17	20	0.4	21	422	360	703	7.1
57-14-908	Jeff Hodge	25	8-23-61	TSDH	22.0	0.34	80	18	16	351	14	8	0.4	3	345	275	575	6.8
57-14-909	Edgar Shelburn	170	8-22-61	TSDH	16.4	0.23	72	40	23	366	57	17	0.5	1.2	421	345	701	7.1
57-14-912	Mrs. C. C. Husted	225	8-18-61	TSDH	13.0	0.07	96	48	35	501	14	38	0.2	21	536	440	894	7.0
57-15-701	City of Burnet	168	5- -53	TSDH	32	0.04	94	41	7	--	28	39	0.1	4.4	465	405	775	8.2
Do.	do	do	7- -59	TSDH	--	0.02	110	32	15	--	13	33	0.1	22	485	410	809	7.0
Do.	do	do	11-16-60	TSDH	--	0.02	96	36	18	415	15	31	0.1	21	432	390	720	7.0
Do.	do	do	8- 3-61	TSDH	11.8	0.10	94	32	21	405	38	32	0.1	14	465	369	775	7.4
57-15-702	do	74	1-15-46	USGS	9.6	0.39	97	32	17.8	408	17	31	0.0	19	439	374	762	7.8
Do.	do	do	12- -50	TSDH	14	0.03	93	35	32	--	23	36	0.2	12	470	376	--	7.2
Do.	do	do	7- 9-59	TSDH	--	0.02	90	26	19	318	28	40	0.1	27	443	335	738	7.1
Do.	do	do	8-17-61	TSDH	12.4	0.03	90	28	24	332	33	39	0.2	29	434	340	723	7.0
57-15-703	Mrs. R. S. Bowden	112	8- 1-61	TSDH	12.2	0.07	88	37	21	411	18	31	0.3	20	468	372	780	7.2
57-15-708	City of Burnet	1,330	12- -56	TSDH	--	4.4	110	45	465	386	70	832	0.4	4.2	1,920	463	1,600	6.9
57-15-710	A. M. Gibbs	96	8- 3-61	TSDH	13.6	0.09	127	41	39	454	45	60	0.2	67	672	487	1,120	7.2
57-15-713	Dr. Sam Paschall	100	8- 2-61	TSDH	13.0	0.05	90	25	23	350	20	37	0.2	24	447	330	745	7.4
57-15-714	Edward Verlander	206	8- 2-61	TSDH	13.0	0.04	111	36	28	412	29	45	0.2	63	564	429	940	7.7
57-15-724	Jordan Everett	155	8-25-61	TSDH	8.8	0.06	120	60	22	543	25	44	0.1	74	688	550	1,146	6.9
57-15-725	D. E. Manning	270	8-25-61	TSDH	11.8	0.04	112	31	9	483	13	13	0.1	8	455	410	758	6.9
57-15-736	E. B. Kinsey	80	8-31-61	TSDH	14.0	0.11	140	48	56	479	54	87	0.1	95	774	550	1,290	7.0
57-22-206	Donald Duncan	100	8-14-61	TSDH	13.4	0.41	142	83	34	379	83	91	0.1	336	965	700	1,608	7.3
57-22-301	Mrs. Ralph Trussell	--	8-11-61	TSDH	9.6	0.03	90	49	7	486	14	10	0.1	11	456	430	760	7.4
57-23-101	Jerome Felps	88	7-26-61	TSDH	13.0	0.12	129	62	42	383	48	91	0.2	168	828	580	1,380	7.9
57-23-103	Jettie Felps	--	7-26-61	TSDH	10.6	0.12	96	43	21	454	15	30	0.1	21	504	418	840	7.3
57-23-201	T. C. Warren	206	8-24-61	USGS	15	--	80	32	27	388	18	28	0.3	15	410	331	697	7.1
57-23-202	V. E. Lewis	108	8-24-61	USGS	9.9	--	90	31	29	406	14	26	0.4	37	452	352	743	7.2
57-23-401	Houston Clinton	240	10- 1-53	USGS	13	--	82	44	17	449	15	25	0.4	5.6	428	386	764	7.6

[1] Agency conducting analysis: USGS, United States Geological Survey; TSDH, Texas State Department of Health.

[2] Dissolved solids determined from residue after evaporation in USGS analyses, and from specific conductance in TSDH analyses.

Table 4.--Logs of wells in the Burnet area

Description	Thickness (ft.)	Depth (ft.)

Well 57-15-708

Owner: City of Burnet. Driller: J. M. Wright, Burnet.

Description	Thickness (ft.)	Depth (ft.)
Soil and gravel	25	0-25
Ellenburger lime	770	25-795
(Porous zone, little water)	(?)	(100)
(Porous zone, little water)	(?)	(400)
Welge sand	25	795-820
Lime	425	820-1,245
Tight sand and green shale	85	1,245-1,330
Granite	--	1,330

Well 57-23-401

Owner: Houston Clinton. Driller: J. M. Wright, Burnet.

Description	Thickness (ft.)	Depth (ft.)
Soft lime	6	0-6
Lime, hard	54	6-60
Break -- got drilling water	4	60-65
Ellenburger limestone -- hard from 65 to 195 feet; very porous from 195 to 235 feet and no cuttings recovered; very hard from 235 to 240 feet. Main water from 195 to 235 feet.	175	65-240

Table 4.--Logs of wells in the Burnet area--continued

Well 57-23-403

(Murchison Ranch water well)

Owner: Houston Clinton Data from unpublished manuscript by Barnes and Bell.

Stratigraphic unit	Thickness (ft.)	Depth (ft.)
Gorman formation	257+	245-502
Tanyard formation	823	502-1,325
Staendebach member	433	502-935
Threadgill member	390	935-1,325
Wilberns formation	487	1,325-1,812
San Saba member	280	1,325-1,605
Dolomitic facies	240	1,325-1,565
Calcitic facies	40	1,565-1,605
Point Peak member	65	1,605-1,670
Morgan Creek limestone member	130	1,670-1,800
Welge sandstone member	12	1,800-1,812
Riley formation	658	1,812-2,470
Lion Mountain sandstone member	53	1,812-1,865
Cap Mountain limestone member	300	1,865-2,165
Hickory sandstone member	305	2,165-2,470
Precambrian; Town Mountain granite	21+	2,470-2,491

Note: Samples of cuttings from this well are on file at the Well Sample Library of the Bureau of Economic Geology, The University of Texas. An electrical log of this well is on file at the office of the Texas Water Commission, Austin.

Table 5.--Water levels in selected wells in the Burnet area

Date	Time	Depth to water (ft.)	Date	Time	Depth to water (ft.)

Well 57-15-701

Owner: City of Burnet

Date	Time	Depth to water (ft.)	Date	Time	Depth to water (ft.)
4- 3-51	--	a/ 35	8-25-61	2:30 p. m.	b/ 36.26
1956	--	a/ 90	8-28-61	10:30 a. m.	b/ 35.84
5-31-61	1:00 p. m.	b/ 32.95	8-28-61	4:30 p. m.	b/ 36.28
5-31-61	2:00 p. m.	27.06	8-29-61	4:00 a. m.	29.98
8-18-61	1:00 p. m.	b/ 35.07	8-29-61	11:59 a. m.	b/ 36.04
8-22-61	4:00 p. m.	b/ 36.05	8-30-61	11:10 a. m.	b/ 35.46
8-23-61	4:00 p. m.	b/ 35.86	8-31-61	11:00 a. m.	b/ 35.53
8-24-61	4:30 p. m.	b/ 36.08			

Measurements for October 30 and 31 and for November 1 are given in Table 9.

a/ Reported water level

b/ Well pumping at time of measurement

Well 57-15-704

Owner: City of Burnet

Date	Time	Depth to water (ft.)	Date	Time	Depth to water (ft.)
4-12-61	--	7.69	8- 9-61	1:00 p. m.	12.07
4-20-61	--	8.02	8-11-61	4:30 p. m.	12.09
5-31-61	--	9.49	8-15-61	3:20 p. m.	11.31
7-24-61	5:00 p. m.	10.37	8-18-61	3:00 p. m.	11.48
7-26-61	10:00 a. m.	10.51	8-22-61	5:00 p. m.	11.55
7-26-61	5:00 p. m.	10.46	8-25-61	2:30 p. m.	11.73
7-27-61	12:30 p. m.	10.53	8-28-61	11:00 a. m.	11.85
7-28-61	10:00 a. m.	10.56	8-28-61	4:30 p. m.	11.81
7-31-61	12:30 p. m.	10.67	8-31-61	11:00 a. m.	11.89
8- 1-61	11:00 a. m.	10.69	9- 7-61	5:00 p. m.	11.99
8- 2-61	5:00 p. m.	10.76	9-13-61	--	11.77
8- 3-61	6:00 a. m.	10.74	9-25-61	--	11.91
8- 5-61	2:00 p. m.	10.85	10-25-61	--	12.25
8- 7-61	6:30 p. m.	10.95	10-30-61	--	12.12

Measurements for October 31 and November 1 are given in Table 10.

Well 57-15-706

Owner: Mrs. R. S. Bowden

Date	Time	Depth to water (ft.)	Date	Time	Depth to water (ft.)
4-12-61		70.66	8-28-61		75.49
8- 2-61		73.43	8-31-61		75.78
8- 5-61		73.60	9- 6-61		75.92
8-11-61		74.23	9-13-61		75.95
8-15-61		74.53	9-25-61		75.81
8-22-61		74.89	10-25-61		75.72
8-25-61		75.26	11- 3-61		76.04

Table 5.--Water levels in selected wells in the Burnet area--continued

Well 57-15-708

Owner: City of Burnet

Date	Time	Depth to water (ft.)	Date	Time	Depth to water (ft.)
5-31-61	5:00 p. m.	8.54	8-15-61	3:20 p. m.	9.53
7-24-61	10:00 a. m.	8.86	8-18-61	3:00 p. m.	9.57
7-26-61	5:00 p. m.	9.02	8-22-61	5:00 p. m.	9.75
7-27-61	12:30 p. m.	8.98	8-25-61	2:30 p. m.	9.78
7-28-61	10:00 a. m.	8.95	8-28-61	4:30 p. m.	9.90
7-31-61	12:30 p. m.	9.11	8-28-61	11:00 a. m.	9.83
8- 1-61	11:00 a. m.	9.10	8-31-61	11:00 a. m.	9.84
8- 2-61	5:00 p. m.	9.23	9- 7-61	5:00 p. m.	10.00
8- 3-61	6:00 a. m.	9.07	9-13-61	--	9.01
8- 5-61	2:00 p. m.	9.25	9-25-61	--	9.64
8- 7-61	6:30 p. m.	9.36	10-25-61	--	9.78
8- 9-61	1:00 p. m.	9.35	10-30-61	--	9.76
8-11-61	4:30 p. m.	9.46			

Well 57-15-716

Owner: Anna Cheatham

Date	Time	Depth to water (ft.)	Date	Time	Depth to water (ft.)
8-11-61	4:50 p. m.	31.20	9-17-61	1:00 p. m.	32.61
8-15-61	3:05 p. m.	31.62	9-18-61	1:00 p. m.	32.48
8-16-61	12:01 p. m.	31.76	9-19-61	1:00 p. m.	32.40
8-17-61	1:00 p. m.	31.88	9-20-61	--	32.31
8-18-61	1:00 p. m.	32.02	9-21-61	1:00 p. m.	32.33
8-22-61	4:00 p. m.	32.79	9-22-61	1:00 p. m.	32.35
8-23-61	4:00 p. m.	32.52	9-23-61	1:00 p. m.	32.36
8-24-61	4:30 p. m.	32.61	9-24-61	1:00 p. m.	32.40
8-25-61	2:30 p. m.	32.65	9-25-61	2:00 p. m.	32.45
8-28-61	10:30 a. m.	32.91	9-26-61	1:00 p. m.	32.48
8-28-61	4:30 p. m.	32.91	9-27-61	1:00 p. m.	32.55
8-29-61	4:00 a. m.	33.00	9-28-61	1:00 p. m.	32.60
8-29-61	12:00 a. m.	33.02	9-29-61	1:00 p. m.	32.57
8-30-61	11:20 a. m.	33.05	9-30-61	1:00 p. m.	32.60
9- 6-61	5:10 p. m.	33.14	10- 1-61	11:00 a. m.	32.62
9- 7-61	5:55 p. m.	33.10	10- 2-61	1:00 p. m.	32.61
9- 8-61	1:00 p. m.	33.15	10- 3-61	1:00 p. m.	32.71
9- 9-61	1:00 p. m.	33.16	10- 4-61	1:00 p. m.	32.78
9-10-61	1:00 p. m.	33.11	10- 5-61	1:00 p. m.	32.83
9-11-61	1:00 p. m.	33.05	10- 6-61	1:00 p. m.	32.89
9-12-61	1:00 p. m.	32.98	10- 7-61	1:00 p. m.	32.94
9-13-61	11:17 a. m.	32.98	10- 8-61	1:00 p. m.	32.94
9-14-61	1:00 p. m.	32.90	10- 9-61	1:00 p. m.	32.93
9-15-61	1:00 p. m.	32.81	10-19-61	--	32.07
9-16-61	1:00 p. m.	32.71	10-25-61	--	32.21

(continued on next page)

Table 5.--Water levels in selected wells in the Burnet area--continued

Date	Time	Depth to water (ft.)	Date	Time	Depth to water (ft.)

Well 57-15-716--continued

10-30-61	9:00 p. m.	32.17	10-31-61	4:00 p. m.	32.24
10-31-61	8:55 a. m.	32.24			

Additional measurements for October 30 and 31 and for November 1, 2 and 3 are given in Table 11.

Well 57-23-401

Owner: Houston Clinton

10- 1-53		a/ 90	7-26-61		42.28
12-30-57		46.03	8-15-61		43.25
1-13-61		33.47			

a/ Reported water level

Well 57-23-402

Owner: Houston Clinton

10- 1-53		98.84	8-28-61		62.90
12-30-57		65.79	8-31-61		63.02
1-13-61		52.52	9- 7-61		63.37
7-26-61		61.52	9-13-61		63.57
7-31-61		61.07	9-25-61		63.86
8- 5-61		61.34	10-19-61		66.84
8-15-61		62.09	10-25-61		66.76
8-22-61		62.43	11- 3-61		66.72

Table 6.--Monthly municipal pumpage, city of Burnet

(Pumpage in thousands of gallons)

	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961
Jan.	2,712	2,746	3,293	3,503	5,865	5,146	4,464	4,185	4,634	4,874	3,894	3,886	5,177	3,782	3,968
Feb.	2,346	2,064	3,248	2,940	5,460	4,727	4,133	5,852	4,016	3,987	3,620	3,528	3,836	3,393	3,640
Mar.	2,564	2,293	3,478	4,111	6,180	4,867	5,177	5,828	4,904	6,461	4,177	3,844	4,929	4,371	4,805
Apr.	2,879	2,675	3,515	4,400	6,169	4,605	5,820	6,690	7,860	7,801	4,253	4,170	4,830	6,030	7,950
May	3,478	3,325	4,960	4,836	4,868	5,580	6,677	6,169	--	8,819	4,583	5,487	7,161	7,688	10,106
June	5,062	5,370	5,796	4,956	--	7,967	11,983	--	7,974	13,607	6,005	8,400	8,205	11,627	8,100
July	5,525	5,270	6,190	8,432	--	11,067	11,210	15,841	10,850	--	13,774	12,431	6,417	11,162	8,246
Aug.	4,443	5,902	6,303	8,776	12,503	13,547	9,817	11,477	10,137	--	14,346	13,082	10,633	11,060	14,855
Sept.	4,748	4,924	4,320	5,649	8,683	7,680	6,268	11,757	8,970	11,470	7,067	5,730	7,380	9,373	7,014
Oct.	4,285	4,684	3,286	6,299	7,155	6,417	4,867	7,471	7,533	7,037	4,484	5,115	4,712	--	5,277
Nov.	3,084	3,645	3,340	5,433	5,226	5,118	4,028	4,920	5,970	4,122	3,906	5,790	4,050	4,316	--
Dec.	2,516	3,540	3,320	4,898	5,456	4,340	4,325	5,115	4,774	4,345	3,844	5,301	3,565	3,794	--

Table 7.--Precipitation at Burnet

Annual precipitation for period of record

Year	Inches
1952	26.75
1953	30.25
1954	13.00
1955	25.42
1956	17.94
1957	49.35
1958	32.70
1959	45.35
1960	29.33

Monthly precipitation for 1961 period of record

Month	Inches
Jan.	1.69
Feb.	3.43
Mar.	0.96
Apr.	0.18
May	1.21
June	4.64
July	3.06
Aug.	0.07
Sept.	5.31
Oct.	2.64

Table 8.--Streamflow observations in the Burnet area

Number	Date	Location	Flow		Elevation (ft.)	Remarks
			(cfs)*	(gpm)		
F-1	Aug. 5, 1961	Hamilton Creek, at Texas Construction Materials' quarry	0.95	427	1,162	Measured at toe of mill pond dam.
F-2	Aug. 10, 1961	Hamilton Creek, east of Texas Construction Materials' quarry	0.74	332	1,172	Stream crosses fault. Flow goes underground in fault zones and in porous zones upstream from faults.
F-3	do	do	0.78	350	1,177	
F-4	do	do	0.23	103	1,190	
F-5	do	Hamilton Creek, northeast of Texas Construction Materials' quarry	0.21	94	1,182	
F-6	do	Delaware Creek, south of Texas Construction Materials' quarry	1.72	772	1,160	
F-8	Aug. 30, 1961	Hamilton Creek	0	0	1,232	Standing water. No seepage from bank.
F-9	Aug. 15, 1961	do	0.1	45	1,266	Estimated flow over concrete ford.
F-9	Aug. 30, 1961	do	0	0	do	No flow. Water stands 0.15 feet below concrete ford.
F-10	do	do	0	0	1,262	Standing water. No seepage from bank.
F-11	Aug. 11, 1961	do	less than 1	less than 1	1,217	Seepage from bank. (Honeycut formation). Flow increasing downstream.
F-12	do	Springs at head of Delaware Creek	0.69	310	1,231	See 57-22-301 in Table 2.

*Cubic feet per second

Table 9.--Pumping test data for well 57-15-701

Date	Time	Depth to water (ft.)	Pumping rate (gpm)	Remarks
		Pumping test of May 31, 1961		
5-31-61	11:30 a. m.	33.3	440	Pumping rate measured with recording flow meter at treatment plant.
Do.	1:45 p. m.	33.35		
Do.	1:48:00	--		Pumping stopped.
Do.	1:49:15	28.7		
Do.	1:49:45	28.35		
Do.	1:50:30	28.15		
Do.	1:51:00	28.05		
Do.	1:51:30	27.97		
Do.	1:53:45	27.87		
Do.	1:55:40	27.78		
Do.	1:58:10	27.71		
Do.	2:00:30	27.65		
Do.	2:02:30	27.61		
Do.	2:05:30	27.57		
Do.	2:08:15	27.53		
Do.	2:11:30	27.51		
Do.	2:13:30	27.49		
Do.	2:16:30	27.46		
Do.	2:17	--		Pumping started.
		Pumping test from October 30 through November 1, 1961 (Water-level measurements are referenced to base of test pump.)		
10-30-61	10:15 a. m.	29.15		
Do.	1:40 p. m.	29.15		
Do.	2:20	29.15		
Do.	5:40	29.16		
Do.	8:30	29.19		
10-31-61	11:35 a. m.	29.25		
Do.	11:50	29.25		
Do.	12:48 p. m.	29.25		
Do.	12:55	29.23		
Do.	1:15	29.24		
Do.	1:20	--		Pumping started.
Do.	1:22	39.26	722	Pumping rate during this portion of test measured with 8" x 6" pipe orifice.
Do.	1:23	39.44		
Do.	1:24	39.64	722	
Do.	1:25	39.77		
Do.	1:26	39.84		
Do.	1:27	39.95		

(Continued on next page)

Table 9.--Pumping test data for well 57-15-701--continued

Date	Time	Depth to water (ft.)	Pumping rate (gpm)	Remarks
	Pumping test from October 30 through November 1, 1961--continued			
	(Water-level measurements are referenced to base of test pump.)			
10-31-61	1:28 p. m.	40.03		
Do.	1:29	40.12	722	
Do.	1:30	40.18		
Do.	1:31	40.21		
Do.	1:32	40.28		
Do.	1:33	40.34		
Do.	1:34	40.40		
Do.	1:35	40.42		
Do.	1:36	40.47		
Do.	1:37	40.50		
Do.	1:38	40.53		
Do.	1:39	40.58		
Do.	1:40	40.58		
Do.	1:41	40.63	726	
Do.	1:42	40.64		
Do.	1:43	40.65		
Do.	1:45	40.68	730	
Do.	1:49	40.84		
Do.	1:50	--	869	Increased pumping speed.
Do.	1:51	43.08	866	
Do.	1:52	43.69		
Do.	1:53	44.14		
Do.	1:54	44.42		
Do.	1:55	44.54	858	
Do.	1:56	44.64		
Do.	1:57	44.72		
Do.	1:58	44.75	858	
Do.	1:59	44.75		
Do.	2:00	44.84		
Do.	2:01	44.91		
Do.	2:03	45.63	860	
Do.	2:04	45.30	860	
Do.	2:05	45.28		
Do.	2:14	46.07		Shifted measuring point on pump base. Effective increase in depth to water is 0.4 feet.
Do.	2:17	46.19		
Do.	2:21	46.17	860	
Do.	2:25	46.25	860	
Do.	2:29	46.20		
Do.	2:30	--		Increased pumping speed.
Do.	2:33	52.58	1,010	
Do.	2:35	52.00		
Do.	2:37	52.02	1,007	
Do.	2:41	52.06	1,007	

(Continued on next page)

Table 9.--Pumping test data for well 57-15-701--continued

Date	Time	Depth to water (ft.)	Pumping rate (gpm)	Remarks
Pumping test from October 30 through November 1, 1961--continued				
(Water-level measurements are referenced to base of test pump.)				
10-31-61	2:47 p. m.	50.45		
Do.	2:49	52.30		
Do.	2:51	52.43		
Do.	2:54	52.40		
Do.	2:57	52.55		
Do.	2:59	52.54		
Do.	3:00	--		Pumping stopped.
Do.	3:01	33.26		
Do.	3:02	32.16		
Do.	3:03	31.67		
Do.	3:05	31.21		
Do.	3:07	30.96		
Do.	3:09	30.76		
Do.	3:11	30.65		
Do.	3:13	30.56		
Do.	3:15	30.49		
Do.	3:20	30.37		
Do.	3:25	30.28		
Do.	3:26	30.28		
Do.	3:29	30.20		
Do.	3:30	30.16		
Do.	3:37	30.13		
Do.	3:39	30.11		
Do.	3:40	--		Pumping started.
Do.	3:41	46.48		
Do.	3:42	50.55		
Do.	3:43	51.57	1,212	Pumping rate during this portion of test measured with 10" x 8" pipe orifice.
Do.	3:44	52.48		
Do.	3:45	52.97		
Do.	3:46	53.28	1,203	
Do.	3:47	53.45		
Do.	3:48	53.65		
Do.	3:49	53.77		
Do.	3:50	53.88		
Do.	3:51	54.00		
Do.	3:53	54.21		
Do.	3:55	54.33	1,203	
Do.	3:57	54.44		
Do.	4:00	54.68		
Do.	4:02	54.71		
Do.	4:05	54.81	1,203	
Do.	4:09	54.95		

(Continued on next page)

Date	Time	Depth to water (ft.)	Pumping rate (gpm)	Remarks
Pumping test from October 30 through November 1, 1961--continued				
(Water-level measurements are referenced to base of test pump.)				
10-31-61	4:10 p. m.	--		Increased pumping speed.
Do.	4:11	58.75		
Do.	4:12	59.23	1,412	
Do.	4:13	59.83		
Do.	4:14	61.53		
Do.	4:15	61.69	1,395	
Do.	4:16	61.84		
Do.	4:18	62.28	1,387	
Do.	4:19	62.50		
Do.	4:20	62.68		
Do.	4:22	62.54	1,387	
Do.	4:25	64.54		
Do.	4:27	64.83		
Do.	4:28	64.88	1,378	
Do.	4:30	64.96		Pumping air and water.
Do.	4:33	65.09	1,370	
Do.	4:35	65.10	1,378	
Do.	4:38	65.11	1,370	
Do.	4:40	--		Pumping stopped.
Do.	4:41	43.48		
Do.	4:42	34.52		
Do.	4:43	33.33		
Do.	4:44	32.70		
Do.	4:45	32.24		
Do.	4:46	32.08		
Do.	4:48	31.72		
Do.	4:50	31.49		
Do.	4:55	31.09		
Do.	5:00	30.90		
Do.	5:05	30.78		
Do.	5:11	30.64		
Do.	9:52	29.72		
Do.	10:05	29.70		
Do.	10:13	29.75		
Do.	10:15	--		Pumping started.
Do.	10:16	43.64	1,032	Pumping rate during this portion of test measured with 10" x 8" pipe orifice.
Do.	10:17	43.94		
Do.	10:19	46.25		
Do.	10:20	46.59		
Do.	10:21	46.80		
Do.	10:22	46.94		
Do.	10:23	47.06		
Do.	10:25	46.05	1,010	

(Continued on next page)

Table 9.--Pumping test data for well 57-15-701--continued

Date	Time		Depth to water (ft.)	Pumping rate (gpm)	Remarks
					Pumping test from October 30 through November 1, 1961--continued (Water-level measurements are referenced to base of test pump.)
10-31-61	10:26	p. m.	47.37		
Do.	10:27		47.47		
Do.	10:29		47.56	995	
Do.	10:31		47.68		
Do.	10:33		--	1,024	
Do.	10:34		47.81	1,016	
Do.	10:37		47.91		
Do.	10:40		48.02	1,024	
Do.	10:42		48.08		
Do.	10:45		48.21		
Do.	10:46		48.25		
Do.	10:47		--	1,016	
Do.	10:48		48.29		
Do.	10:50		48.34		
Do.	10:55		48.39		Increased pumping rate to check deep-well current meter.
11- 1-61	8:34	a. m.	29.64		Bottom of strainer on pump intake pipe at depth of 57 feet.
Do.	8:47		29.64		
Do.	9:09		29.63		
Do.	9:10		--		Pumping started.
Do.	9:11		42.04		Pumping rate during this portion of test measured with 8" x 6" pipe orifice.
Do.	9:12		42.59		
Do.	9:13		42.88		
Do.	9:14		43.02		
Do.	9:15		43.13		
Do.	9:16		43.24	801	
Do.	9:18		43.44		
Do.	9:19		43.53		
Do.	9:20		43.60		
Do.	9:22		43.75		
Do.	9:25		43.90		
Do.	9:30		44.07	801	
Do.	9:35		44.18		
Do.	9:40		44.25	801	
Do.	9:45		44.38	801	
Do.	9:46		44.40		
Do.	9:49		44.42	801	
Do.	9:50		44.44		
Do.	9:52		44.49		
Do.	9:55		44.52	801	

(Continued on next page)

Table 9.--Pumping test data for well 57-15-701--continued

Date	Time		Depth to water (ft.)	Pumping rate (gpm)	Remarks
Pumping test from October 30 through November 1, 1961--continued					
(Water-level measurements are referenced to base of test pump.)					
11- 1-61	10:00	a. m.	44.59	801	
Do.	10:05		44.60	801	
Do.	10:10		44.66		
Do.	10:12		44.68		
Do.	10:15		44.70	801	
Do.	10:20		44.80		
Do.	10:25		44.85	801	
Do.	10:30		44.85	801	
Do.	10:35		44.94	801	
Do.	10:40		44.96	805	
Do.	10:45		44.99	801	
Do.	10:50		45.01		
Do.	11:00		45.11	801	
Do.	11:10		45.20	801	
Do.	11:20		45.25	798	
Do.	11:30		45.45	801	
Do.	11:40		45.45	801	
Do.	11:50		45.44	801	
Do.	12:00		45.47	801	
Do.	12:10	p. m.	45.55	798	
Do.	12:20		45.68	801	
Do.	12:30		45.75	798	
Do.	12:45		45.69	798	
Do.	1:00		45.79	798	
Do.	1:15		45.71	795	
Do.	1:20		45.76		
Do.	1:30		45.86	795	
Do.	1:45		45.94	795	
Do.	2:00		45.95	795	
Do.	2:15		46.09	795	
Do.	2:30		46.26	795	
Do.	2:46		46.31	791	
Do.	3:00		46.34	791	
Do.	3:15		46.39	791	
Do.	3:30		46.37	791	
Do.	3:45		46.45	791	
Do.	4:00		46.55	791	
Do.	4:15		46.59	788	
Do.	4:30		46.62	788	
Do.	4:45		46.67	788	
Do.	5:00		46.74	791	
Do.	5:09		46.77	788	
Do.	5:10		--		Pumping stopped.
Do.	5:11		34.84		

(Continued on next page)

Table 9.--Pumping test data for well 57-15-701--continued

Date	Time	Depth to water (ft.)	Pumping rate (gpm)	Remarks
Pumping test from October 30 through November 1, 1961--continued				
(Water-level measurements are referenced to base of test pump.)				
11- 1-61	5:12 p. m.	33.85		
Do.	5:13	33.42		
Do.	5:14	33.13		
Do.	5:15	32.92		
Do.	5:16	32.80		
Do.	5:17	32.65		
Do.	5:18	32.56		
Do.	5:19	32.50		
Do.	5:21	32.35		
Do.	5:23	32.28		
Do.	5:26	32.10		
Do.	5:31	31.93		
Do.	5:35	31.87		
Do.	5:40	31.72		
Do.	5:46	31.65		
Do.	5:51	31.58		
Do.	5:55	31.50		
Do.	6:00	31.45		
Do.	6:08	31.33		
Do.	6:18	31.22		
Do.	6:25	31.15		
Do.	6:35	31.10		
Do.	6:45	31.01		
Do.	7:00	30.95		
Do.	7:18	30.88		
Do.	7:30	30.83		
Do.	7:45	30.74		
Do.	8:00	30.66		
Do.	8:15	30.66		
Do.	8:22	30.69		
Do.	8:26	30.64		
Do.	8:30	30.63		
Do.	8:45	30.59		
Do.	9:00	30.53		
Do.	9:10	30.52		

Table 10.--Water levels in pumping test observation well 57-15-704

(Measurements were obtained from water-level recorder chart and referenced to top of casing, which is 0.7 feet above land surface.)

Date	Time	Depth to water (ft.)	Date	Time	Depth to water (ft.)
10-31-61	8:30 a. m.	12.70	11- 1-61	11:00 p. m.	12.58
Do.	9:00	12.71	do	12:00	12.57
Do.	10:00	12.71	11- 2-61	1:00 a. m.	12.56
Do.	11:00	12.71	do	1:30	12.55
Do.	12:15 p. m.	12.67	do	2:00	12.57
Do.	1:00	12.66	do	3:00	12.58
Do.	2:00	12.65	do	4:00	12.58
Do.	3:00	12.65	do	5:00	12.59
Do.	4:00	12.67	do	6:00	12.62
Do.	5:10	12;69	do	7:00	12.63
Do.	6:00	12.69	do	8:00	12.64
Do.	7:00	12.69	do	9:00	12.64
Do.	8:00	12.69	do	10:09	12.64
Do.	9:00	12.69	do	11:00	12.63
Do.	10:00	12.69	do	12:00	12.60
Do.	11:00	12.68	do	1:00 p. m.	12.58
Do.	12:00	12.68	do	2:00	12.57
11- 1-61	1:00 a. m.	12.68	do	3:00	12.58
Do.	2:00	12.68	do	4:00	12.60
Do.	3:00	12.67	do	5:00	12.62
Do.	4:00	12.67	do	6:00	12.65
Do.	5:00	12.66	do	7:00	12.68
Do.	6:00	12.65	do	8:00	12.70
Do.	7:00	12.65	do	9:00	12.70
Do.	8:00	12.65	do	10:00	12.70
Do.	8:30	12.64	do	11:00	12.70
Do.	9:00	12.63	do	12:00	12.69
Do.	10:00	12:62	11- 3-61	1:00 a. m.	12.67
Do.	11:00	12.61	do	2:00	12.67
Do.	12:00	12.60	do	3:00	12.69
Do.	1:00 p. m.	12.59	do	4:00	12.73
Do.	2:00	12.58	do	5:00	12.76
Do.	3:00	12.58	do	6:00	12.78
Do.	4:00	12.59	do	7:00	12.79
Do.	5:00	12.60	do	8:00	12.80
Do.	6:00	12.61	do	9:00	12.83
Do.	7:00	12.61	do	10:00	12.83
Do.	8:00	12.61	do	11:00	12.81
Do.	9:00	12.60	do	11:37	12.79
Do.	10:00	12.59			

Table 11.--Water levels in pumping test observation well 57-15-716

(Measurements were obtained from water-level recorder chart and referenced to top of concrete foundation, which is at land surface.)

Date	Time	Depth to water (ft.)	Date	Time	Depth to water (ft.)
10-30-61	4:35 p. m.	32.14	11- 1-61	2:35 p. m.	32.35
Do.	9:00 p. m.	32.17	do	10:00 p. m.	32.40
10-31-61	8:35 a. m.	32.24	11- 2-61	1:00 a. m.	32.40
Do.	12:00 a. m.	32.24	do	5:00 a. m.	32.45
Do.	4:00 p. m.	32.24	do	1:02 p. m.	32.50
Do.	5:15 p. m.	32.26	do	3:00 p. m.	32.55
11- 1-61	5:00 a. m.	32.28	do	4:37 p. m.	32.60
Do.	8:40 a. m.	32.35	11- 3-61	9:57 a. m.	32.70

Table 12.--Water velocity in well 57-15-701

(Measurements were obtained with deep-well current meter during test of November 1, 1961)

Depth of measurement (ft.)	Velocity (fps)*	Pumping rate (gpm)	Depth of measurement (ft.)	Velocity (fps)*	Pumping rate (gpm)
51	0.06	495	62	0.08	800
53	0.06	495	62.5	0.09	800
55	0.07	495	63	0.09	800
56	0.07	495	64	0.06	800
57	0.08	495	65	0.06	800
58	0.07	495	66	0.06	800
59	0.07	490	67	0.07	800
60	0.07	490	68	0.06	800
61	0.04	480	69	0.04	800
59.6	0.16	800	70	0.03	800
60	0.15	800	71	0.03	800
60.5	0.13	800	72	0.04	800
61	0.10	800	73	0.00	800
61.5	0.08	800			

*Feet per second

Table 13.--Conductivity of water from well 57-15-701

Time	Pumping rate (gpm)	Conductivity (micromhos/cm.)*	Water temperature during measurement (°F)	Water temperature at well (°F)
		October 31, 1961		
1:53 p. m.	725	710	71.5	70
1:58	860	710	71.0	70
2:15	860	720	71.0	70
2:30	860	710	71.0	70
2:35	1,010	710	70.5	70
2:45	1,010	710	71.0	70
3:00	1,010	710	71.0	70
3:45	1,220	720	71.0	70
4:05	1,220	715	70.5	70
4:15	1,420	710	70.5	70
4:30	1,350+	705	70.0	70
		November 1, 1961		
12:01 p. m.	800	735	73.0	70

*Conductivity measured at temperature indicated

Table 14.--Pumping test data for well 57-15-702

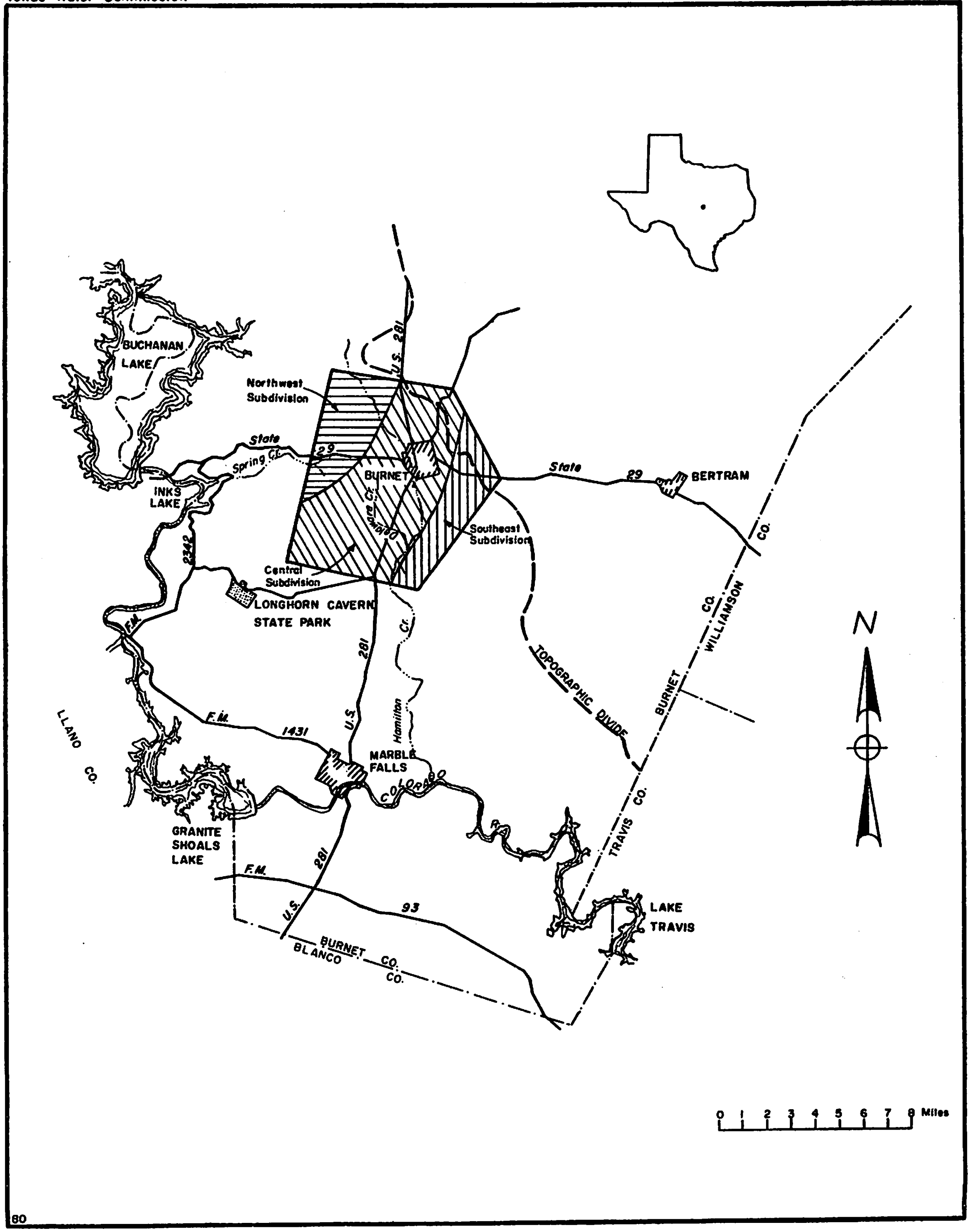
(Well had been pumped continuously at 260 gpm since Oct. 30, 1961. Measurements were made with mercury manometer installed on air line.)

Test made on November 2, 1961

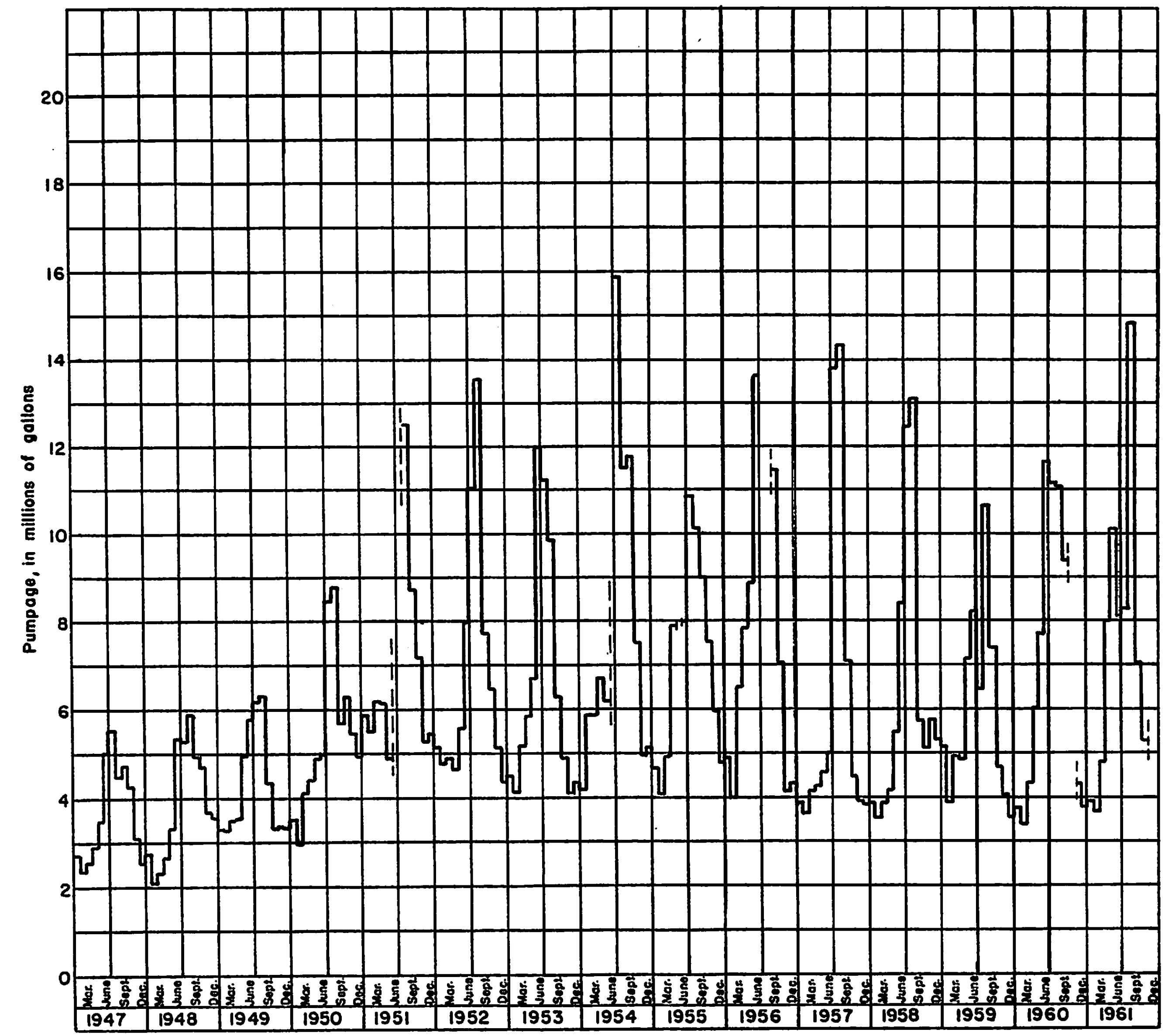
Time	Depth to water (ft.)	Time	Depth to water (ft.)
3:55 p. m.	a/ 55.03	5:40 p. m.	32.84
4:32	a/ 54.08	5:48	32.79
4:46	a/ 54.76	6:03	32.76
4:50	Pumping stopped	6:12	32.76
4:51	33.53	6:22	32.57
4:53	35.16	6:31	32.49
4:54	33.39	6:45	32.44
4:55	33.53	7:00	32.16
4:57	33.53	7:01	32.30
4:59	33.39	7:15	32.19
5:00	33.31	7:35	32.08
5:02	33.31	7:50	32.00
5:08	33.25	8:05	31.84
5:12	33.12	8:20	31.78
5:15	33.06	8:34	31.65
5:20	35.70	8:44	31.59
5:25	35.70	8:50	31.43

a/ Pumping level

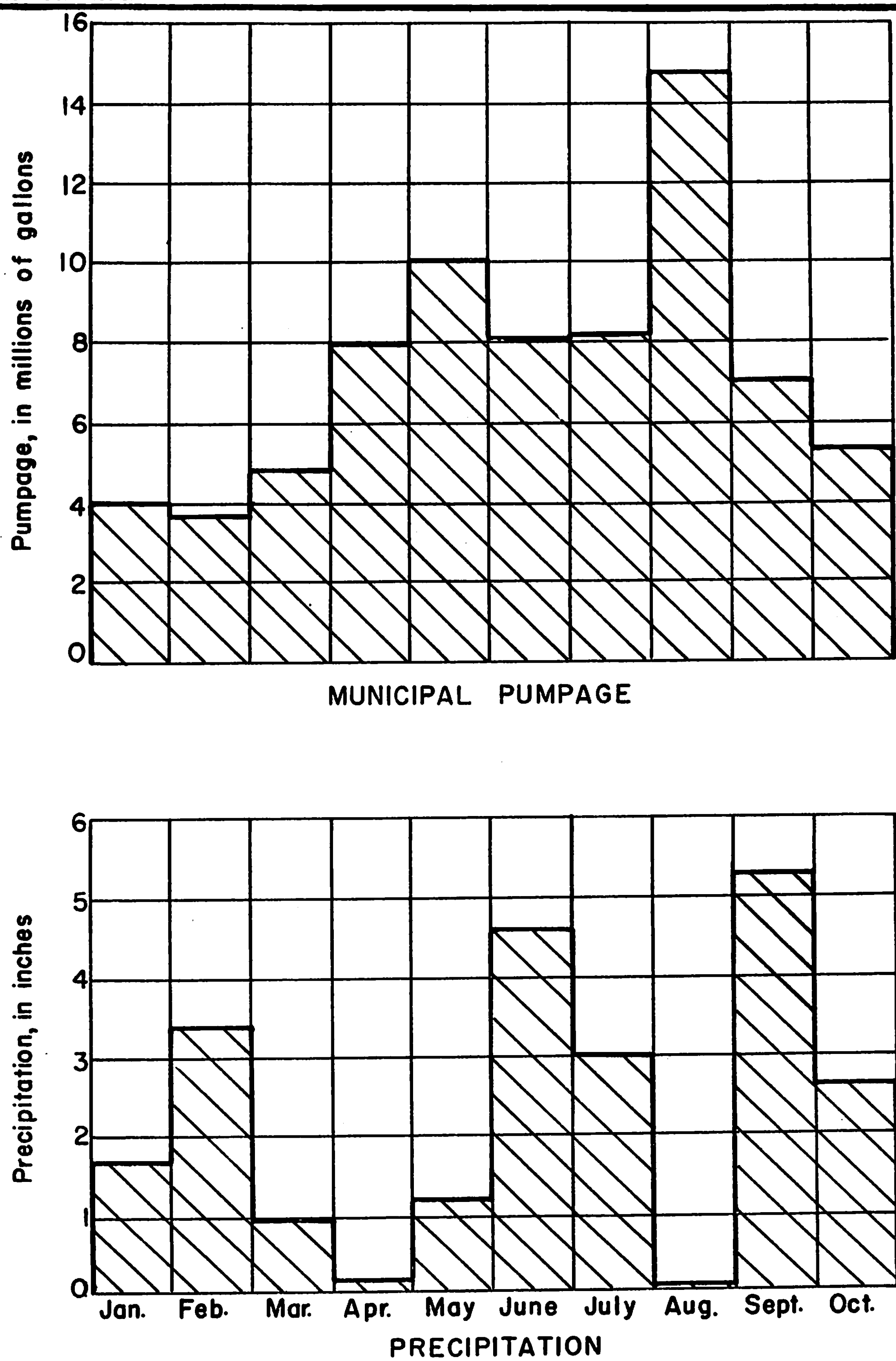
ILLUSTRATIONS



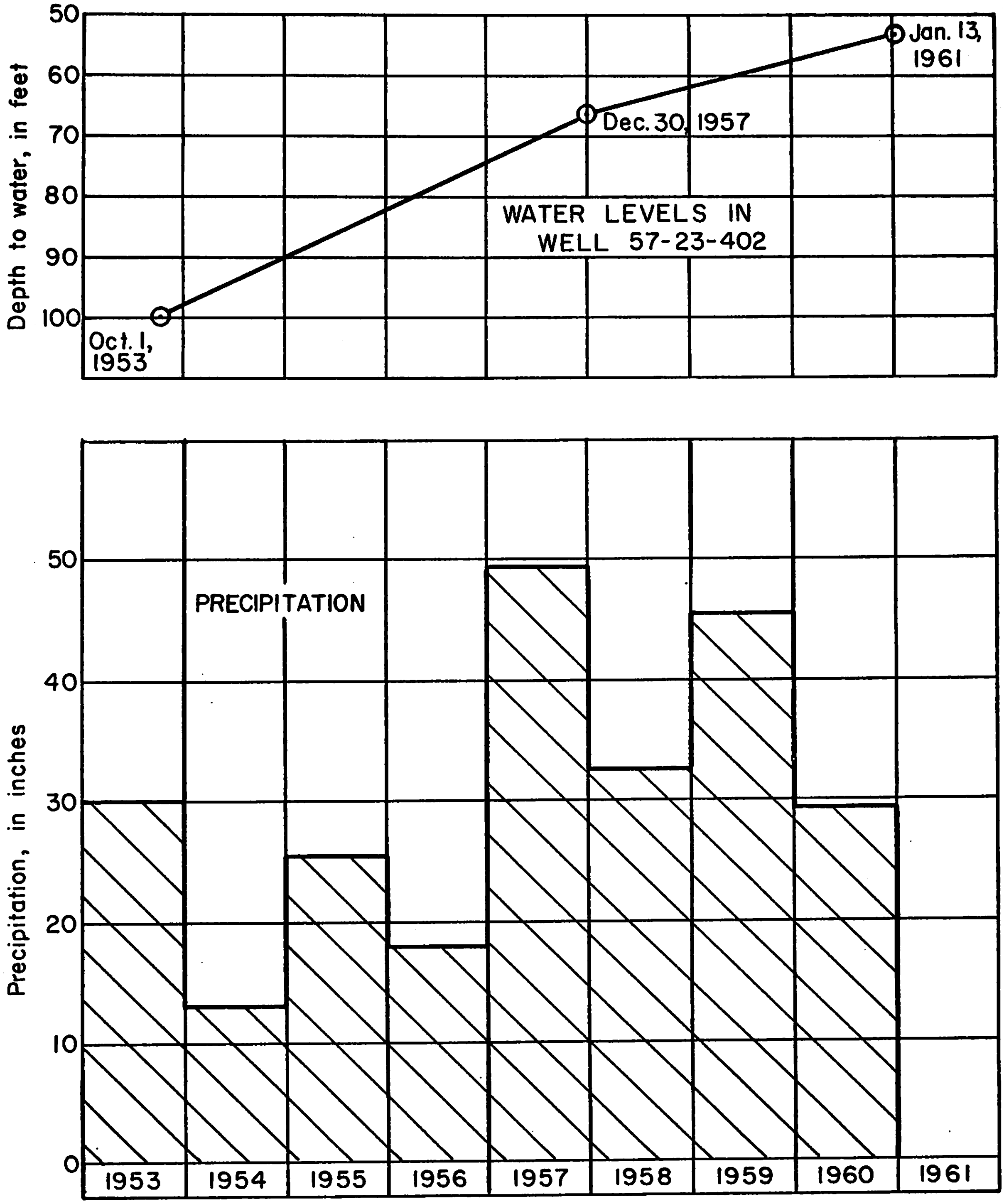
INDEX MAP OF PART OF BURNET COUNTY SHOWING LOCATION AND SUBDIVISIONS OF BURNET AREA OF STUDY



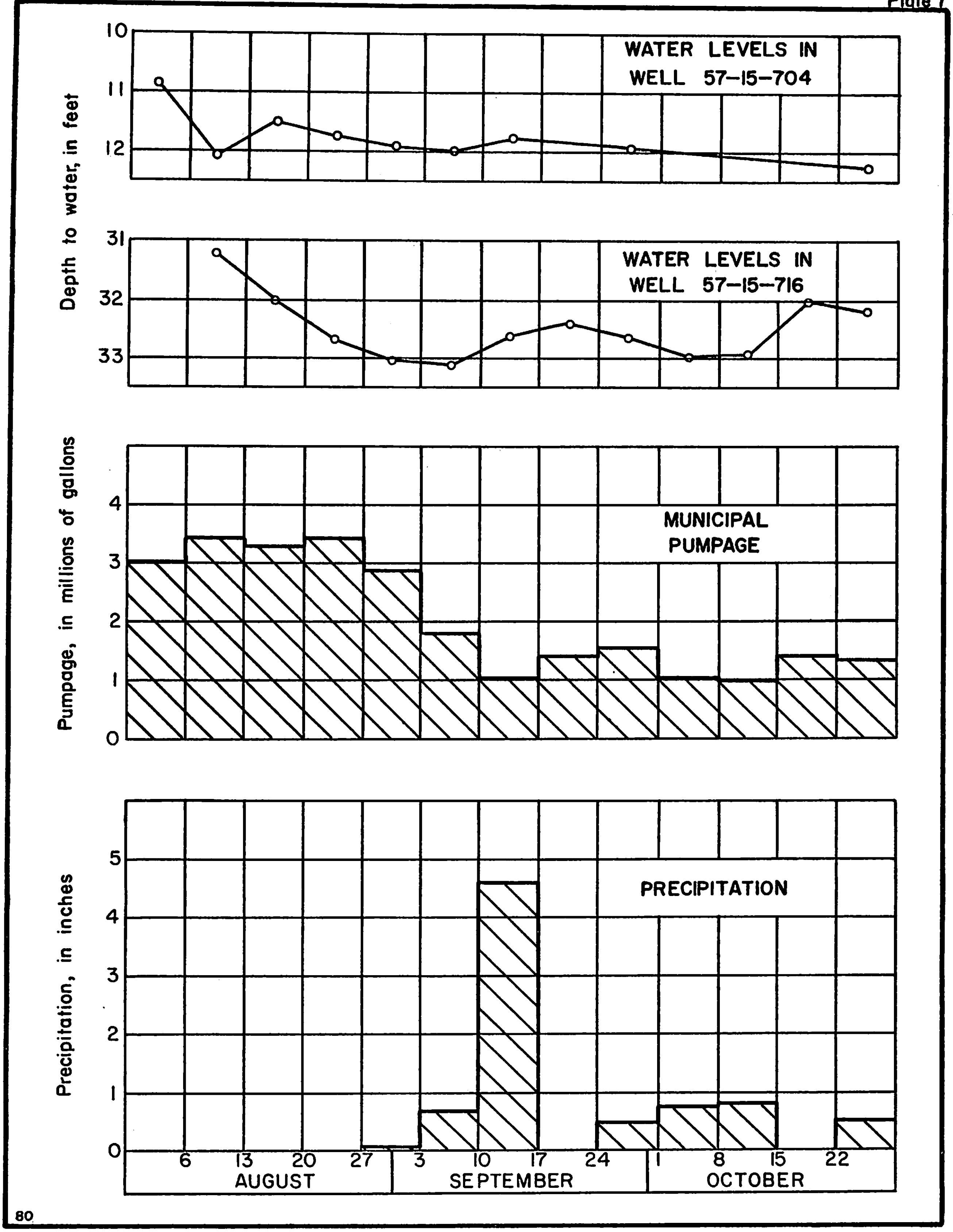
MONTHLY MUNICIPAL PUMPAGE, CITY OF BURNET, JAN. 1947 – OCT. 1961



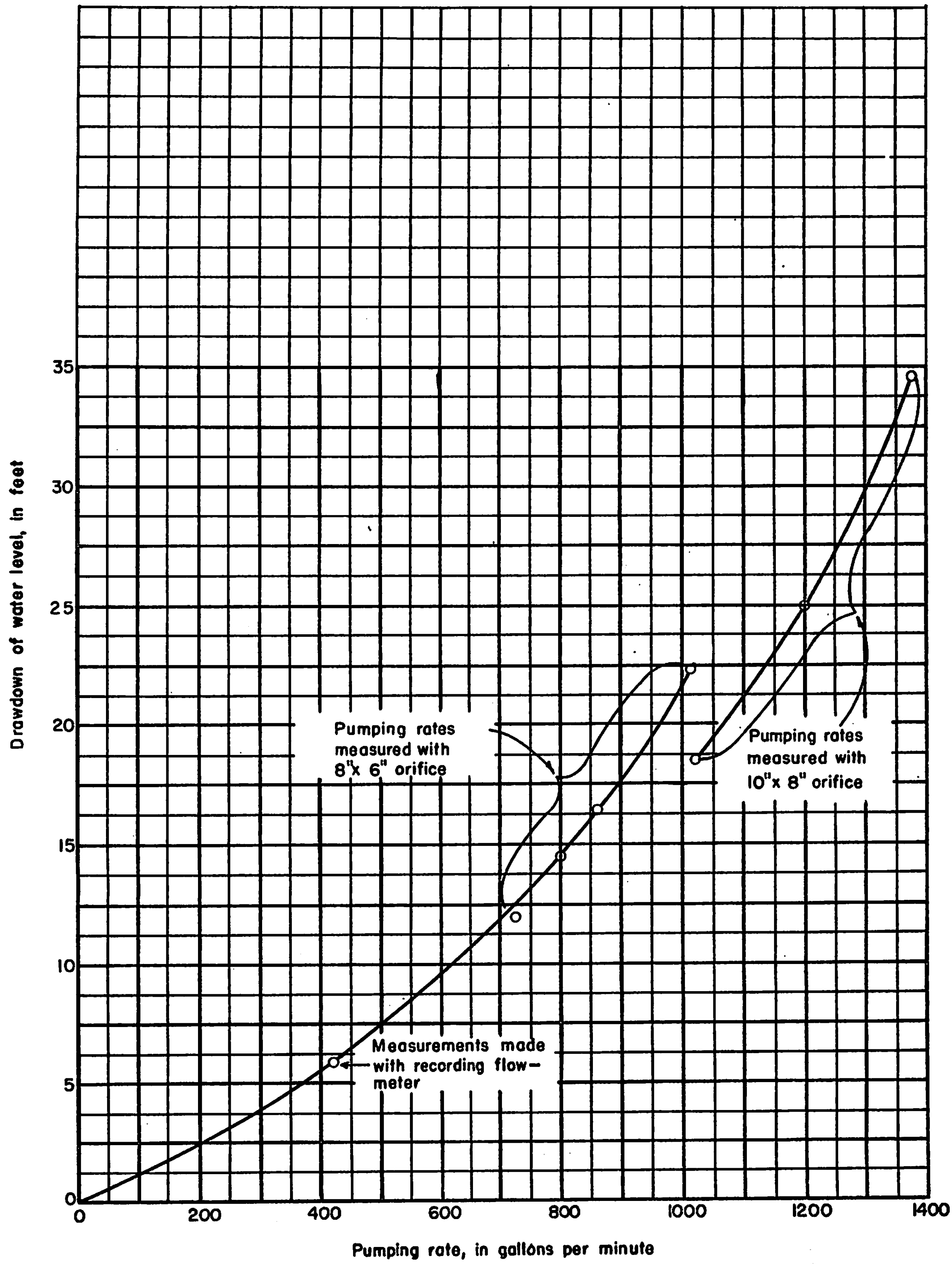
MONTHLY MUNICIPAL PUMPAGE AND PRECIPITATION AT BURNET, JAN.–OCT., 1961



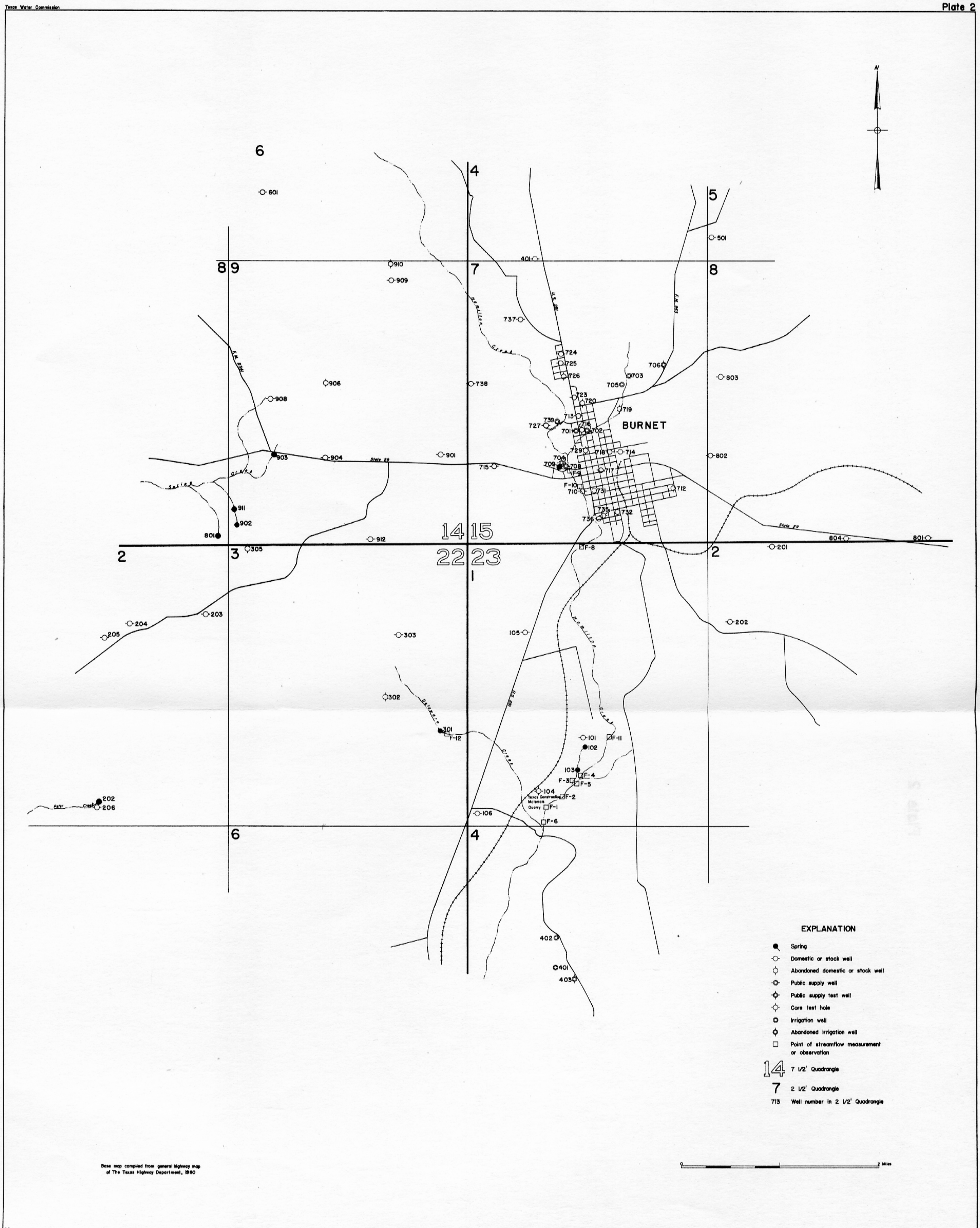
WATER LEVELS IN WELL 57-23-402 AND ANNUAL PRECIPITATION AT BURNET, 1953-60



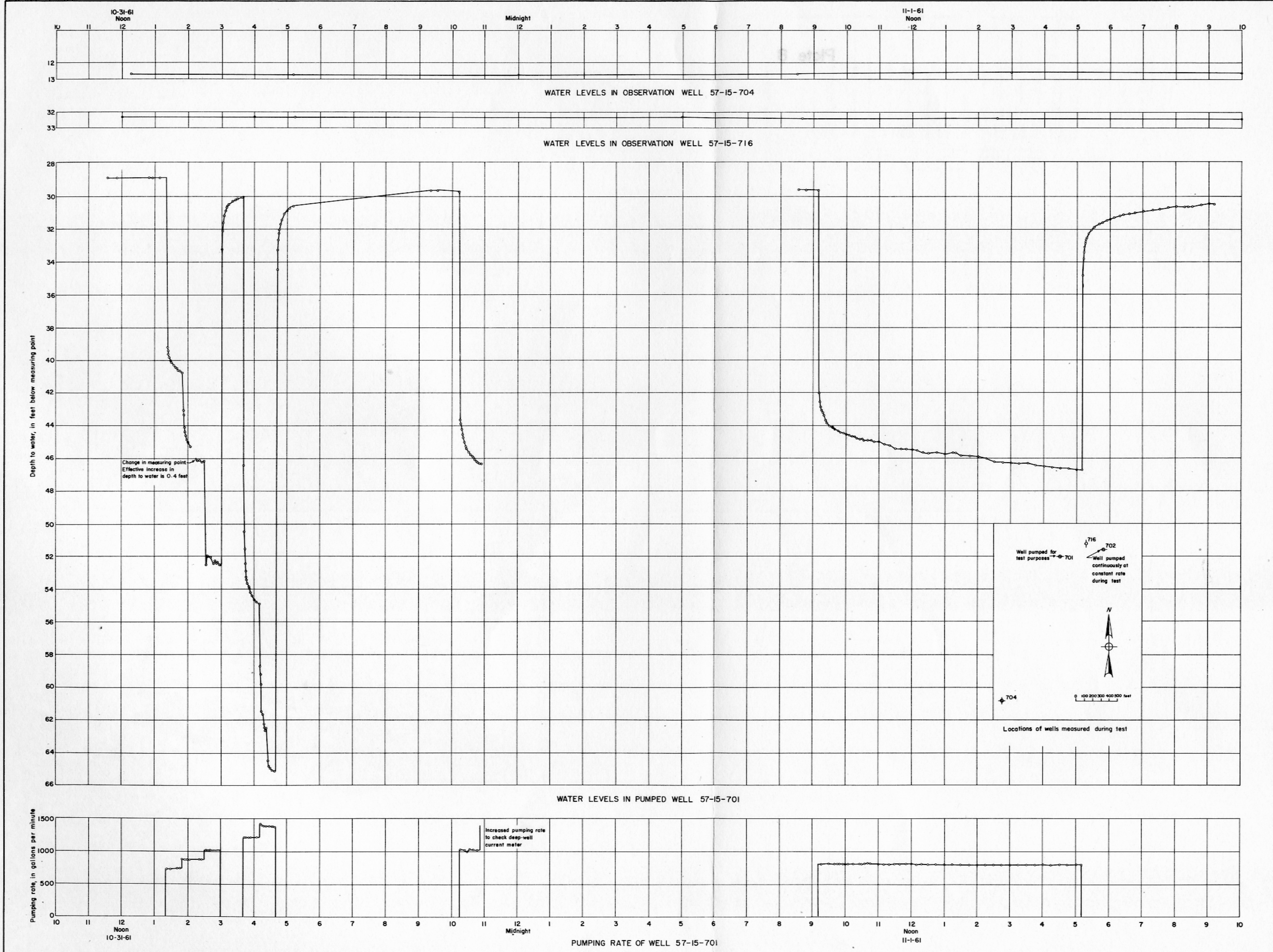
WATER LEVELS, WEEKLY MUNICIPAL PUMPAGE, AND WEEKLY PRECIPITATION AT BURNET, AUG.-OCT., 1961



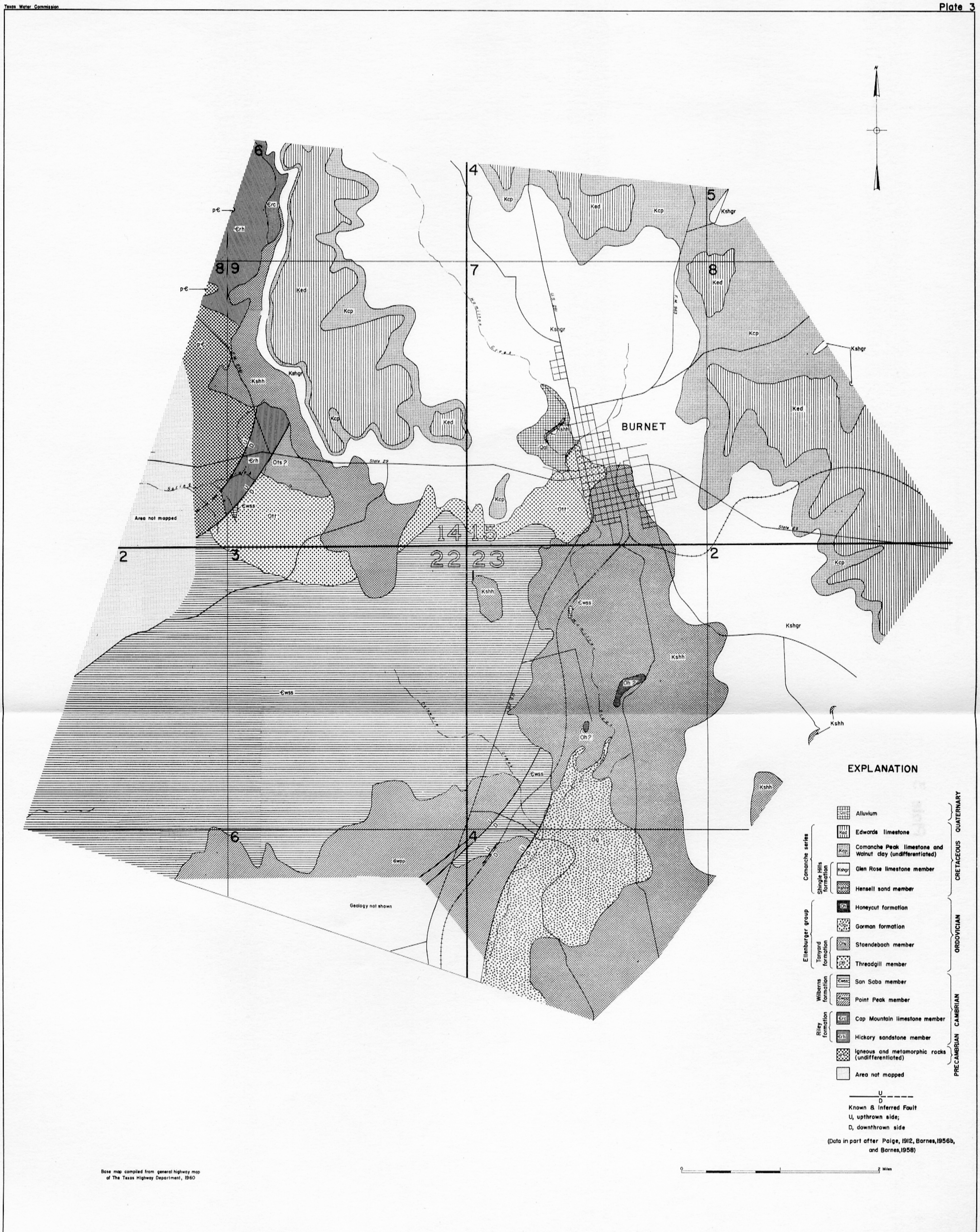
AVERAGE ONE-HALF HOUR DRAWDOWN IN WELL 57-15-701



MAP OF BURNET AREA, SHOWING LOCATIONS OF DATA POINTS



PUMPING TEST OF WELL 57-15-701



GEOLOGIC MAP OF THE BURNET AREA