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# HYDROLOGY OF THE ESTANCIA BASIN, CENTRAL NEW MEXICO

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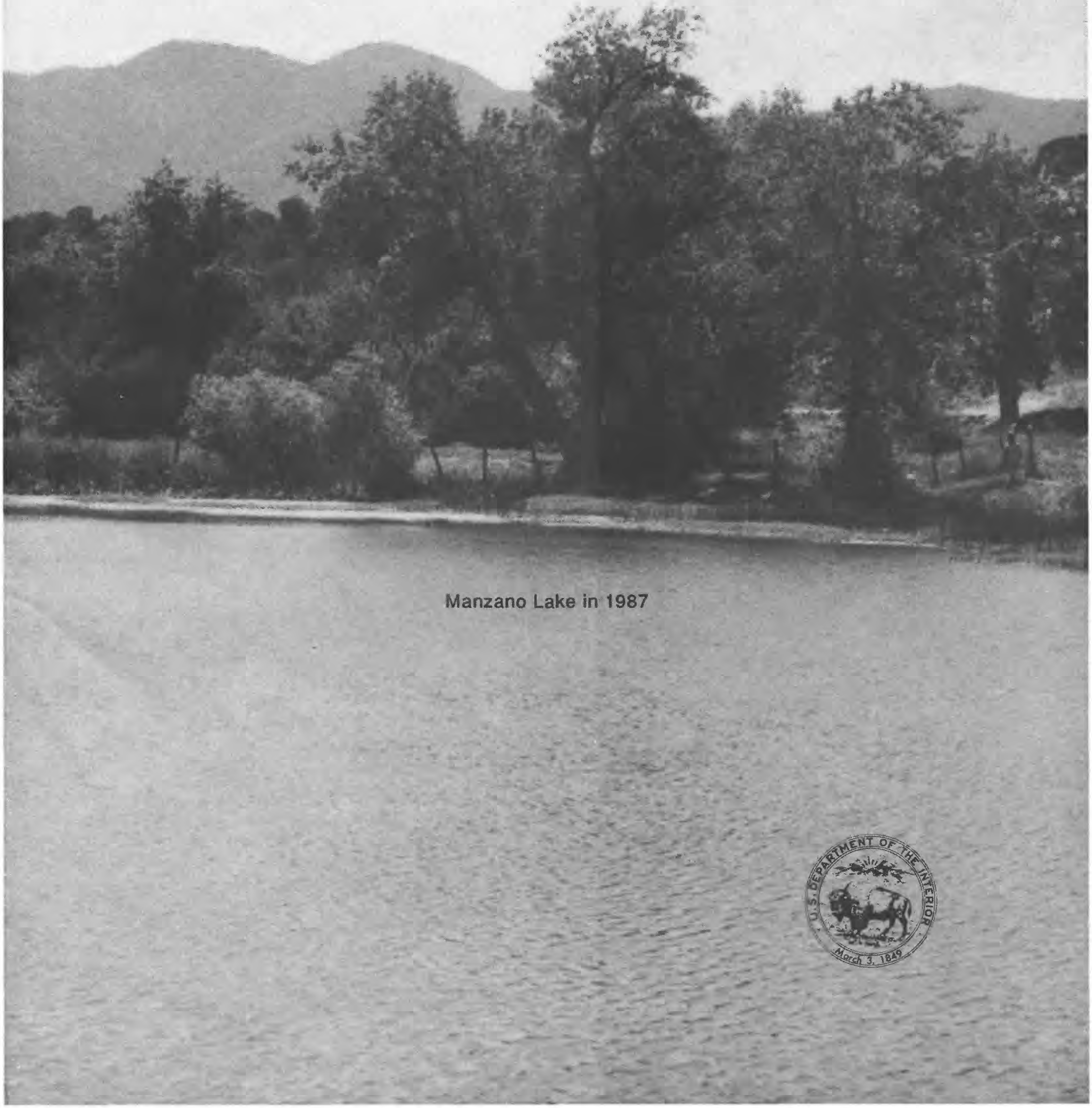
By
Robert R. White



Manzano Lake in 1987

U.S. DEPARTMENT OF THE INTERIOR

BRUCE BABBITT, *Secretary*

U.S. GEOLOGICAL SURVEY

Gordon P. Eaton, *Director*

For additional information
write to:

District Chief
U.S. Geological Survey
Water Resources Division
4501 Indian School Rd. NE, Suite 200
Albuquerque, New Mexico 87110

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[Plate is in pocket at back of report]



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## CONVERSION FACTORS AND VERTICAL DATUM

| Multiply | By | To obtain |
|---|---|---|
| inch | 2.540 | centimeter |
| foot | 0.3048 | meter |
| yard | 0.9144 | meter |
| mile | 1.609 | kilometer |
| acre | 4,047 | square meter |
| square mile | 2.590 | square kilometer |
| cubic foot per second | 0.02832 | cubic meter per second |
| acre-foot | 1,233 | cubic meter |
| gallon per minute | 0.06309 | liter per second |
| foot per day | 0.3048 | meter per day |
| foot per mile | 0.1894 | meter per kilometer |

Temperature can be converted to degrees Fahrenheit (°F) or degrees Celsius (°C) by the equations:

$$°F = 9/5\ (°C) + 32$$
$$°C = 5/9\ (°F - 32)$$

Sea level: In this report "sea level" refers to the National Geodetic Vertical Datum of 1929--a geodetic datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called Sea Level Datum of 1929.

# HYDROLOGY OF THE ESTANCIA BASIN, CENTRAL NEW MEXICO

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## ABSTRACT

The Estancia Basin of central New Mexico is a topographically closed basin that ranges in altitude from 6,000 feet to more than 10,000 feet above sea level. In the center of the basin a valley-fill aquifer of Quaternary age is as much as 400 feet thick. Limestone of the Madera Group of Pennsylvanian and Permian age crops out over most of the southwestern part of the basin.

Large-scale ground-water withdrawals for irrigation began about 1950. Between 1950 and 1985, water levels declined 50 to 60 feet in a number of places. From 1985 to the present (1989), however, a small rise in water level has been measured in a number of wells; this rise can be attributed to decreased ground-water withdrawals resulting from a government crop-reduction program and also to several years of heavy winter snowfall.

Continuous water-level recorders were placed on three wells from 1986 to 1988. Two of these wells showed short-term water-level changes characteristic of unconfined aquifers, whereas the other showed changes characteristic of confined aquifers. All three wells showed water-level changes caused by barometric-pressure changes.

Six series of miscellaneous measurements and two gain-and-loss (seepage) studies were made in streams in the southwestern part of the basin. These measurements showed an extreme variability in discharge under different climatic conditions.

The specific conductance of water in much of the southwestern part of the basin ranges from 350 to 550 microsiemens per centimeter at 25 degrees Celsius. East of State Highway 41 in the area of the salt lakes, water quality is highly dependent on depth in the aquifer. Specific-conductance values ranging from about 4,000 to 6,000 microsiemens were measured in water samples from wells in the center of the basin during this study, but previous studies have identified water samples having specific-conductance values of as much as 187,000 microsiemens.

A comparison of specific-conductance measurements and laboratory analyses of well water shows that water quality has changed in the past several decades. In many places, increases in specific conductance can be correlated with declines in water level.

# INTRODUCTION

The Estancia Basin covers about 2,000 square miles. The western boundary of the basin is the crest of the Manzano Mountains, the eastern boundary is in the Pedernal Hills, the northern boundary is the eroded edge of the Galisteo Creek drainage basin, and the southern boundary is the northern edge of Mesa de los Jumanos (fig. 1).

The term "Estancia Valley" locally refers to the farming and ranching area in the center of the Estancia topographic basin from north of Stanley to south of Willard, and excludes the Manzano Mountains and Pedernal Hills. When considering the entire topographic basin, the term "Estancia Basin" is used in this report. "Estancia Valley" is sometimes used when considering only the irrigated area in the center of the basin.

Water is the most valuable and limited resource in the Estancia Basin. Because of concern about future economic development in the area, the U.S. Geological Survey (USGS), in cooperation with the New Mexico State Engineer Office, conducted a study of the Estancia Basin to collect, compile, and analyze information on the water resources in the Estancia Basin.

## Purpose and Scope

This report presents results of a study of the water resources of the Estancia Basin, with an emphasis on ground-water conditions in irrigated areas. Considerable information was collected in the adjacent uplands; however, few data were collected in the area east of the salt lakes (Laguna del Perro, Salina Lake, and others).

Information was obtained on 284 wells in the study area. Data collected at wells included depth-to-water measurements and determination of the specific conductance of water samples. Water samples were collected from eight wells for laboratory analysis of inorganic chemical constituents.

Six series of measurements were made of stream discharge in the Manzano Mountains. In addition, gain-and-loss studies were conducted in Tajique Creek and Torreon Creek.

Field work began on this project in 1985; this primarily involved measurement of water levels in about 80 wells in the valley during February 1985. Full time field work began in 1986 and ended in mid-1988, except for additional water-level measurements made in February 1989.

## Location and Description of the Study Area

The Estancia Basin, located in central New Mexico, is a topographically closed basin that is bounded on the west by the drainage basin of the Rio Grande and on the east by the drainage basin of the Pecos River (fig. 1). The lowest point in the basin is at the salt lakes (from northeast of Estancia southward to Willard; pl. 1) at an altitude of about 6,000 feet; several peaks in the Manzano Mountains are more than 10,000 feet high (fig. 1).

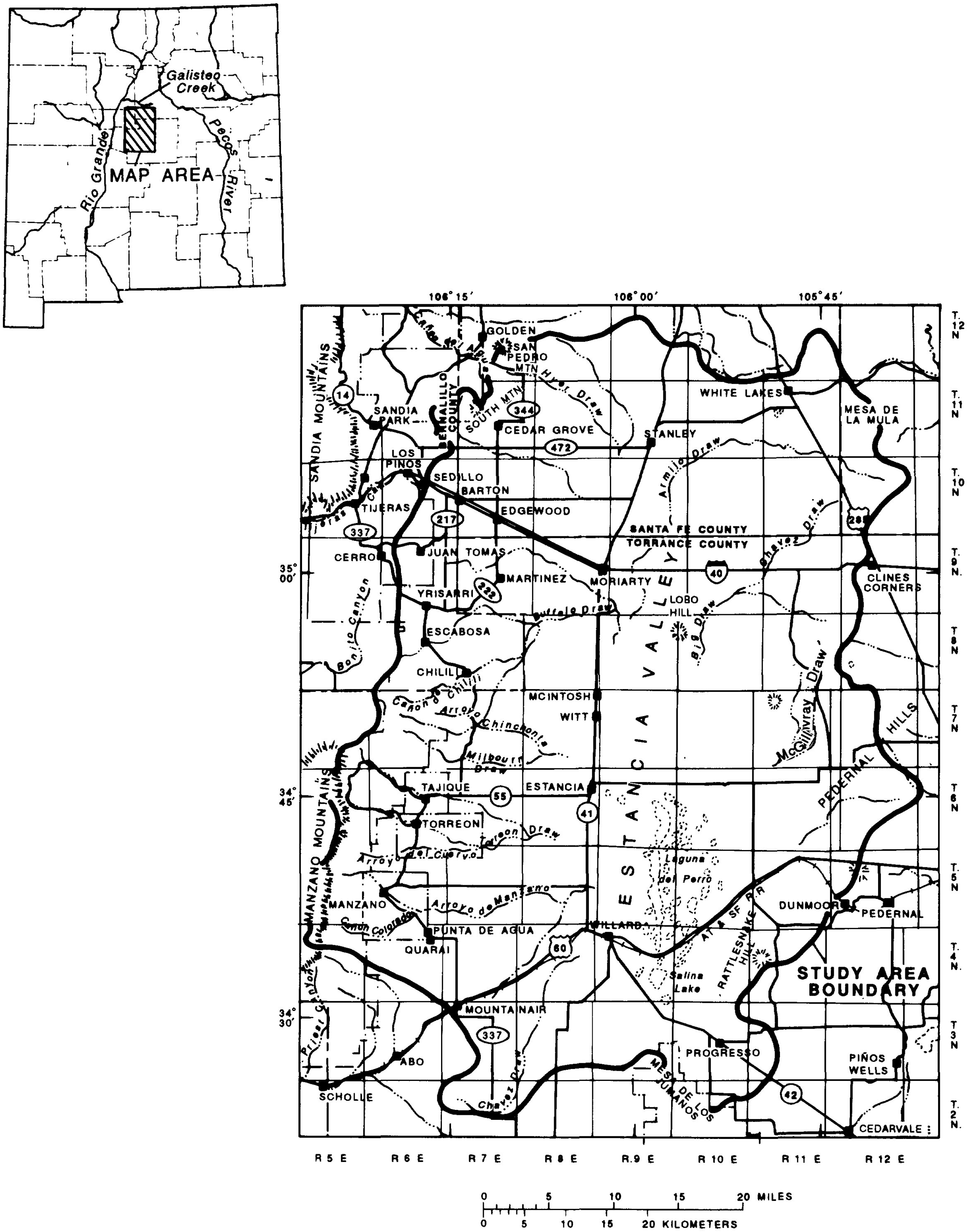


Figure 1.--Location of the study area.

The major communities (and 1984 population estimates) in the study area are Moriarty (1,399), Mountainair (926), and Estancia (792). Interstate Highway 40 passes through Moriarty, linking it with Albuquerque about 30 miles to the west. U.S. Highway 60 and the Santa Fe Railway cross the southern part of the Estancia Basin, passing through Willard and Mountainair. State Highway 337 and State Highway 41 are the principal north-south routes.

Farming and ranching are the principal occupations in the study area. There are 38,110 acres of potentially irrigable cropland in the Torrance County part of the Estancia Valley, although only 24,030 acres were actually irrigated in 1985 and only 17,030 acres were irrigated in 1986 (Lansford and others, 1987, p. 4-5). In 1985, 7,810 acres were irrigated in the Estancia Valley part of Santa Fe County (Wilson, 1986, p. 75).

## Climate

The average length of the growing season at Estancia is 131 days. In comparison, the average growing season at Albuquerque (west of the study area, about 1,000 feet lower in altitude) is 194 days, and the average at Santa Fe (north of the study area, about 1,000 feet higher) is 158 days. The median date of the last spring freeze at Estancia is May 22, and the median date of the first autumn freeze is September 30 (Gerhardt and others, 1986, p. 9).

Estancia has an average minimum temperature in January of 16.3 degrees Fahrenheit and an average maximum temperature in July of 88.8 degrees Fahrenheit. A summary of annual precipitation data from weather stations in and near the Estancia Valley is presented in table 1 (Kunkel, 1984) (all tables are in the back of the report).

## Well-Numbering System

The system of numbering wells in New Mexico is based on the common subdivision of public lands into sections (fig. 2). The well number, in addition to designating the well, locates its position to the nearest 10-acre tract in the land network. The number is divided by periods into four segments. The first segment denotes the township north or south of the New Mexico Base Line, the second denotes the range east or west of the New Mexico Principal Meridian, and the third denotes the section. The fourth segment of the number, which usually consists of three digits, denotes the 160-, 40-, and 10-acre tracts, respectively, in which the well is situated in the section. For this purpose, the section is divided into four quarters, numbered 1, 2, 3, and 4, for the northwest, northeast, southwest, and southeast quarters, respectively. The first digit of the fourth segment gives the quarter section, which is a tract of 160 acres. Similarly, the quarter section is divided into four 40-acre tracts numbered in the same manner, and the second digit denotes the 40-acre tract. Finally, the 40-acre tract is divided into four 10-acre tracts, and the third digit denotes the 10-acre tract. Thus, well 07N.08E.16.142 is in the NE 1/4 of the SE 1/4 of the NW 1/4 of section 16, Township 07 North, Range 08 East. Letters A and B are added to the last segment to designate the second and third wells in the same 10-acre tract. In previous years, the fourth segment was sometimes carried out to four or five digits, but this is no longer common practice. Some wells originally inventoried several decades ago are listed in this report with more than three digits in the fourth segment.

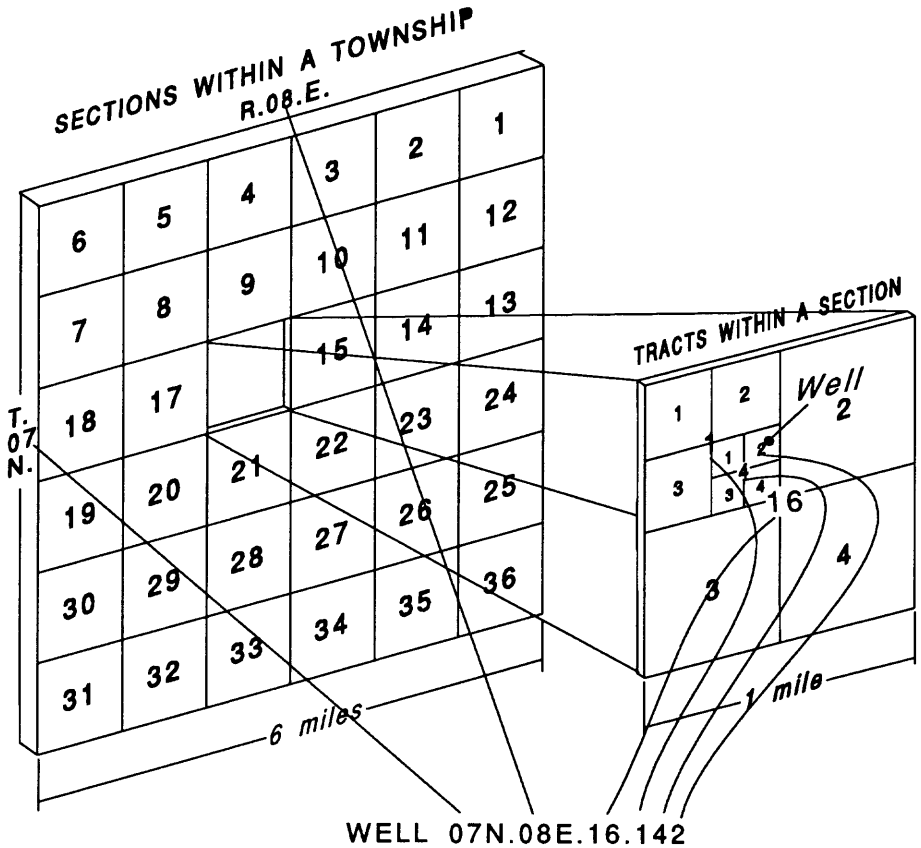


Figure 2.--System of numbering wells in New Mexico.

## Historical Background

As is true for all of New Mexico, the history of the Estancia Basin is intimately tied to the availability of water. Long before the arrival of Spanish settlers, American Indians were living in the foothills of the Manzano Mountains at locations that had dependable water supplies. Spanish explorers who visited the Estancia Basin in 1581-82 with the Chamuscado-Rodriguez expedition reported the existence of five pueblos, one of which contained 200 houses of two or three stories. A report of this expedition stated that "Back of the Sierra Morena [Manzano] we found some salines, which extend for five leagues and which produce the best salt in Christendom, just like salt derived from the sea" (Hammond and Rey, 1966, p. 107, 119).

A Franciscan priest, Fray Alonzo de Benavides, visited the area some time before 1630, and reported the following (Forrestal, 1954, p. 21):

> Leaving the Rio del Norte and traveling ten leagues east...we come to Chilili, the first pueblo of the Tompiras Nation. This nation extends in that direction more than fifteen leagues, and has fourteen or fifteen pueblos, with probably more than ten thousand inhabitants. It has six very good friaries and churches. The soil is not very fertile because of the frequent periods of cold weather and scarcity of water.

It was the scarcity of water, caused by a long drought, coupled with incessant warfare with nomadic tribes, that resulted in the abandonment of all the pueblo villages around the Manzano Mountains by the time of the Pueblo Revolt in 1680. Left abandoned were the three stone mission churches (Quarai and Abo (fig. 1) and Gran Quivira, 19 miles southeast of Mountainair) that are now included in Salinas National Monument, administered by the National Park Service.

The needs of the first homesteaders brought O.E. Meinzer to the Estancia Valley to conduct the first ground-water study of the area in 1909. Meinzer wrote (1911, p. 8) that great changes had taken place within the past decade, during which time two railroads had crossed the valley and "hundreds of homesteaders have come to take possession of the land, and eight villages have sprung up along the railways." Meinzer explained that "Insufficient rainfall during recent years has caused crop failures and has created an urgent demand for an investigation of the feasibility of irrigating with ground water."

The efforts to develop ground water for irrigation in the Estancia Valley at the time of Meinzer's 1911 report were generally unsuccessful "because of the poor efficiency of pumping equipment and because the attempts at development were restricted chiefly to the central part of the valley, where conditions were unfavorable for such development" (Smith, 1957, p. 53). A renewed interest in irrigation in the area in 1923 resulted in a number of studies by the New Mexico State Engineer Office, although these studies were ended for the most part by 1930 because of worsening economic conditions (New Mexico State Engineer, 1924, 1926, 1928; Bloodgood, 1930; Powell, 1930).

C.V. Theis, whose theoretical work would later revolutionize the science of hydrology, came to New Mexico in the early 1930's and began doing ground-water studies in various parts of the State. Theis (1934) wrote a short report on "a proposed colonization plan" for the Estancia Valley, in which he suggested that 100 families could settle on 80-acre tracts in the valley, build houses, and drill irrigation wells to provide a viable economic base for the area. He mentioned that land could be bought for $10.00 per acre. This plan never materialized.

Interest again revived in irrigation in 1940, leading to the establishment of an observation-well program in 1941 (Smith, 1957, p. 53). This observation-well program is still in effect as a joint effort by the New Mexico State Engineer Office and the USGS. Some of the information collected during that program is shown on well hydrographs in this report.

The USGS's presence in this area preceded the beginning of O.E. Meinzer's work. In 1880, the USGS employed Colonel Charles Potter to conduct a study of mining in New Mexico. His work took him east of the Sandia Mountains, and he was murdered somewhere north of the village of Tijeras (fig. 1). Most of the bandits involved in the murder were lynched by vigilantes. Although the gang leader survived a gunfight with Sheriff Pat Garrett and spent several years in prison, he was killed by Santa Fe County deputies in 1887 (White, 1987).

## Acknowledgments

The author would like to express appreciation to Kim Frazier and Jim Everheart of the New Mexico State Engineer Office in Albuquerque. Thanks are due to Bill Neish, Torrance County Extension Agent, and Zada Autry, the Extension office secretary, for answering questions about the study area.

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The author is grateful to Scott Thistlethwaite for valuable assistance in field work and in updating the National Water Information System (NWIS) data base. Rick Dulas (Texas A&M University) offered many helpful suggestions.

## GEOLOGIC UNITS AND THEIR WATER-YIELDING CHARACTERISTICS

Geologic units in the Estancia Basin range in age from Precambrian to Quaternary. A generalized geologic map of the study area, modified from Dane and Bachman (1965), is shown in figure 3.

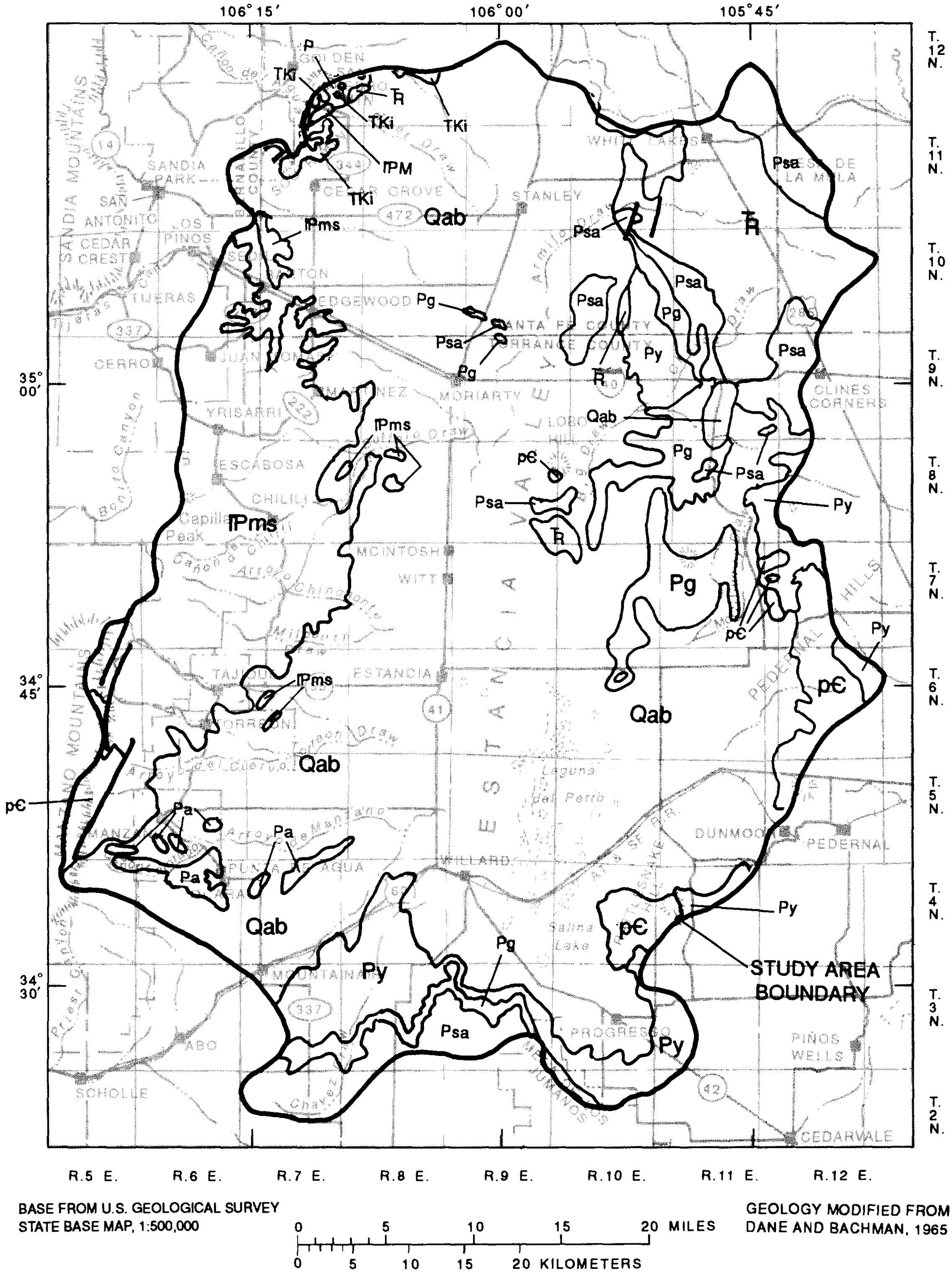



Figure 3.--Generalized geology of the study area.

## EXPLANATION

| | |
|---|---|
| Qab | ALLUVIUM AND BOLSON DEPOSTS--Alluvium, lake and dune deposits, and recent stream deposits; yields 500-1,000 gallons per minute to wells |
| TKi | INTRUSIVE ROCKS OF VARIOUS AGES |
| TR | ROCKS OF TRIASSIC AGE--Includes Chinle Formation and Santa Rosa Sandstone |
| P | ROCKS OF PERMIAN AGE |
| Psa | SAN ANDRES LIMESTONE--Limestone containing numerous solution channels, some beds of gypsum, sandstone, and siltstone. About 200 feet thick in some areas |
| Pg | GLORIETA SANDSTONE--White to yellow sandstone, 150-280 feet thick; yields as much as 1,000 gallons per minute to wells |
| Py | YESO FORMATION--Contains beds of sandstone, limestone, siltstone, and gypsum, 600-1,000 feet thick |
| Pa | ABO FORMATION--Predominantly sandstone and shale, 700-900 feet thick; yields a few gallons per minute to wells |
| IPms | SANDIA FORMATION AND MADERA GROUP--Sandia Formation consists of 10-200 feet of interbedded shale, limestone, and sandstone; Madera Group consists of 630-830 feet of limestone, shale, siltstone, sandstone, and conglomerate; yields 5-1,000 gallons per minute to wells |
| IPM | ROCKS OF PENNSYLVANIAN AND MISSISSIPPIAN AGE |
| p€ | ROCKS OF PRECAMBRIAN AGE |
| — | FAULT |

## Precambrian Rocks

Igneous and metamorphic rocks of Precambrian age are exposed at the western margin of the Estancia topographic basin in the Manzano and Sandia Mountains and at Monte Largo (just west of South Mountain), along the eastern edge of the basin in the Pedernal Hills, and in the eastern part of the basin at Lobo Hill (fig. 1). No wells inventoried for this study withdraw water from the Precambrian.

## Sandia Formation and Madera Group

The Sandia Formation, of Early and Middle Pennsylvanian age, consists of interbedded shale, limestone, and sandstone (fig. 3). The Sandia Formation was deposited on the eroded surface of Precambrian rocks, and the variable thickness of the Sandia (from less than 10 to more than 200 feet) is a result of the erosional relief of the Precambrian surface. Few, if any, wells withdraw water from the Sandia Formation because of its stratigraphic and topographic location. It crops out primarily near the summit of the steep western face of the Sandia and Manzano Mountains where wells are rarely drilled. Eastward, in the Estancia Basin, the Sandia Formation may exist at depths of 800 to 1,000 feet, but in this area domestic and stock wells may be completed at much shallower depths (Smith, 1957, p. 24).

A few springs discharge from only the Sandia Formation, but several discharge from both the Sandia Formation and the overlying Madera Group. One of these, Carlito Spring, a few miles west of the study area in Tijeras Canyon, discharges more than 250 gallons per minute (Titus, 1980, p. 11).

The Madera Group, of Middle and Late Pennsylvanian and Early Permian age, is exposed over most of the eastern slopes of the Sandia and Manzano Mountains. The Madera Group consists of three formations (in ascending order): the Los Moyos Limestone, the Wild Cow Formation, and the Bursum Formation. The Madera Group was formed by deposition in a shallow sea.

The lowermost formation in the Madera Group is the Los Moyos Limestone, which consists of 600 feet of cliff-forming layers of gray limestone, some beds of dark-colored shale, and minor amounts of siltstone, sandstone, and conglomerate. Above the Los Moyos is the Wild Cow Formation, consisting of layers of sandstone, conglomerate, siltstone, shale, and thin- to thick-bedded gray limestone (Myers, 1973; 1982). No data are available on the thickness of the Wild Cow Formation.

Although the Madera Group is predominantly Pennsylvanian in age, the uppermost unit, the Bursum Formation, is of Permian age. In the study area, the Bursum Formation is recognized only in the southern Manzano Mountains; elsewhere, the Permian Abo Formation overlies the Wild Cow Formation. The reason for this somewhat unusual stratigraphic nomenclature is that the top of the Bursum Formation is the highest marine limestone underlying the nonmarine Abo Formation and lithologic units are differentiated by rock type rather than by time boundaries. The Bursum Formation consists of red sandstone, red and green shale and siltstone, and gray limestone. Thickness ranges from less than 30 to more than 230 feet (Myers, 1982, p. 236-237).

The water-yielding properties of the Madera Group vary considerably in different areas of the Estancia Basin. An indication of the lithologic variability of this unit can be seen by examining the outcrops along New Mexico State Highway 337 southward from the community of Tijeras. When seen from a considerable distance, the Madera appears to be a massive, cliff-forming limestone sequence. However, a closer examination reveals that thick to thin limestone layers are interbedded with layers of shale, siltstone, sandstone, and conglomerate and that the cliffs are separated by weathered and eroded slopes formed on the softer sediments.

In addition to the lithologic variations, the water-yielding characteristics of the Madera Group are determined in great part by the extent of fracturing and faulting and the development of solution channels. In places where "secondary porosity" has not been developed by fracturing, faulting, or solution channel development, the Madera Group may yield very little water to wells. Near the community of Edgewood (fig. 1), in particular, obtaining sufficient quantities of water is often difficult even for domestic use, and most attempts at well drilling result in dry holes.

Titus (1980, p. 13) reported that the average yield from the Madera Group in the foothills of the Sandia and Manzano Mountains was 5 gallons per minute (measurements were made at 46 wells). Eastward, closer to the center of the Estancia Valley, some irrigation wells that withdrew water from the Madera yield several hundred gallons per minute. Further discussion about the characteristics of irrigation wells in the Madera is in the section on water-level changes.

An ánomalous, highly permeable zone exists in the Madera in the vicinity of Tps. 06 to 08 N., Rs. 07 and 08 E. (Titus, 1980, p. 13). Wells in this area may produce more than 1,000 gallons per minute. Carbon dioxide gas is found in the Madera Group in this area, which probably accounts for the large permeability (carbonic acid, formed when carbon dioxide gas dissolves in water, readily dissolves channels in limestone). Carbon dioxide is available in this area in sufficient quantity to have allowed commercial production before World War II (Talmage and Andreas, 1942).

## Abo Formation

The Abo Formation of Permian age crops out in the vicinity of Punta de Agua and nearby Quarai (fig. 1) and along the east-facing slopes of the southernmost Manzano Mountains. The total thickness of the Abo ranges from 700 to 900 feet; the lithology is predominantly sandstone and shale. The Abo is terrestrial in origin, as shown by its red color (iron oxide), mud cracks, current ripple marks, crossbedding, tracks of land vertebrates, plant impressions, and the lenticular character of the sandstone beds (Smith, 1957, p. 28).

The Abo Formation is not a productive aquifer in the southern Manzano Mountains. A number of wells drilled in the Abo, such as the public-supply well at Quarai (well 04N.06E.03.443, table 2), each yield a few gallons per minute, but supplies sufficient for municipal and irrigation use generally are not available.

## Yeso Formation

The Yeso Formation of Permian age is exposed over much of the southern and eastern parts of the Estancia topographic basin. The Yeso Formation crops out along the escarpment of Mesa de los Jumanos (the southern boundary of the basin; fig. 1), where it conformably overlies the Abo Formation. In the eastern part of the basin, the Yeso lies directly on the Precambrian rocks in the Pedernal Hills.

The Yeso Formation has considerable lithologic variability: it contains beds of sandstone, limestone, siltstone, and gypsum. The Yeso Formation is typically about 600 feet thick but may reach thicknesses of 1,000 feet (Smith, 1957, p. 30-31).

Under favorable conditions, the Yeso may yield large quantities of water. Smith (1957, p. 31-32) reported that two municipal wells drilled in the Yeso for the community of Mountainair (fig. 1) during the 1940's originally yielded about 500 gallons per minute each, but within a few years the yield had declined by half and new wells eventually had to be drilled. Despite occasional reports of large discharges from wells completed in fractured or cavernous parts of the Yeso, yields from wells completed in this formation typically do not exceed 15 gallons per minute.

## Glorieta Sandstone

The Glorieta Sandstone of Permian age crops out at the eastern side of the Estancia Valley and along the escarpment of Mesa de los Jumanos at the southern end of the valley. The Glorieta Sandstone ranges in thickness from 150 to 280 feet and consists of white to yellow sandstone that is of uniform grain size and is well cemented. In most places the Glorieta is highly permeable and well yields of more than 1,000 gallons per minute are possible.

Small outcrops of the Glorieta Sandstone are found about 4 miles north of Moriarty (fig. 3), and the Glorieta underlies the valley fill in much of the northern part of the Estancia Valley. Irrigation wells in this area usually withdraw water from both the Glorieta Sandstone and the valley fill.

## San Andres Limestone

The San Andres Limestone of Permian age forms the surface of Mesa de los Jumanos and crops out at a few places in the eastern part of the topographic basin, particularly in the vicinity of Clines Corners (fig. 3). The San Andres Limestone is about 200 feet thick on Mesa de los Jumanos and may be somewhat thicker at Clines Corners. The San Andres consists of limestone containing numerous solution channels and some beds of gypsum, sandstone, and siltstone. The San Andres appears to be above the water table everywhere in which it occurs in the study area, and no wells are known to withdraw water from it.

## Santa Rosa Sandstone and Chinle Formation

The Santa Rosa Sandstone and the Chinle Formation are not differentiated on the geologic map (fig. 3) but are shown together as Triassic rocks. They are exposed over a large area north and west of Clines Corners. Triassic rocks crop out in an area about 6 miles east of McIntosh and just west of the Estancia Basin between Cedar Crest and San Antonito (fig. 3). Smith (1957, p. 36-37) stated that in some places a red shale at the base of the Triassic rocks provides "geologic conditions favorable for the accumulation of potable perched ground water at appreciably shallower depths than are prevalent in underlying Permian aquifers."

## Valley Fill

Valley fill of Quaternary age in the Estancia Valley consists of alluvial material, lake and dune deposits, and recent stream deposits. The areal extent of the valley fill can be seen on the geologic map (fig. 3). The thickness of the valley fill is as great as 400 feet in the center of the valley, but the thickness decreases to a feather edge toward the margins of the valley. Test drilling during a preliminary study for siting the Superconducting Super Collider in the Estancia Valley (Johnpeer and others, 1987) indicates that the bedrock surface below the valley fill has a greater topographic relief than previously had been thought; in some places (particularly in the northeastern part of the valley), stream erosion formed valleys and ridges in the bedrock before the valley fill was deposited (John Hawley, New Mexico Bureau of Mines and Mineral Resources, oral commun., 1987).

The lower layers of the valley fill are composed of silt, sand, and gravel. Most of this material was probably derived from the Manzano Mountains, but there is some indication (Bachhuber, 1971, p. 25) that some of this alluvial material was deposited by a through-flowing river before tectonic activity made this a topographically closed basin.

In the first major geohydrologic study of the Estancia Valley, Meinzer (1911) recognized the existence of shore features at an approximate altitude of 6,200 feet. Meinzer attributed these features to a large Pleistocene lake almost 150 feet in depth that once covered part of the valley.

Bachhuber (1971) made an intensive study of the lake deposits. He felt that there was sufficient stratigraphic evidence to prove that the Estancia Valley had been completely filled by a lake during the Pleistocene. This lake would have overflowed a topographic sill at an altitude of 6,350 feet in an area 2 to 3 miles north of the community of Cedarvale in the southeastern part of the basin (fig. 3). If such a lake existed, it would have been about 285 feet deep, and the overflow would have flowed eastward to the Pecos River. However, some scientists have continued to claim that a lake could not have filled the basin to overflowing (John Hawley, oral commun., 1988), and Bachhuber (1986) now seems to have rejected the overflow theory as well.

In the center of the Estancia Basin are more than 50 salt lakes, such as Laguna del Perro, Salina Lake, and others that are unnamed (pl. 1). These lakes are typically 15- to 20-foot depressions bordered on the northeast side by dunes that may rise as much as 150 feet above the surface of the lakes. The dunes formed after the Pleistocene lake disappeared, during relatively dry climatic conditions when strong winds blew predominantly from the southwest. The conditions under which these dunes formed no longer exist, and the dunes are being slowly eroded. The salt lakes provide natural discharge points of ground water moving downgradient toward the south-central part of the basin.

Most of the irrigation wells in the Estancia Valley withdraw water from the valley fill. Successful wells can be completed virtually anywhere in the valley where the valley fill is saturated. The potential well yield is, however, dependent on saturated thickness and local variations in aquifer permeability.

The Cooperative Extension Service of New Mexico State University has conducted a number of tests of irrigation pump and motor efficiency in the Estancia Valley. In the most recent of their reports (Hohn and others, 1985), the average irrigation well yield was slightly greater than 500 gallons per minute. Of the 33 wells measured, 2 had yields exceeding 1,000 gallons per minute. The Cooperative Extension Service report does not identify wells by location or aquifer, but all of them are in the Estancia Valley and most of them withdraw water from the valley fill.

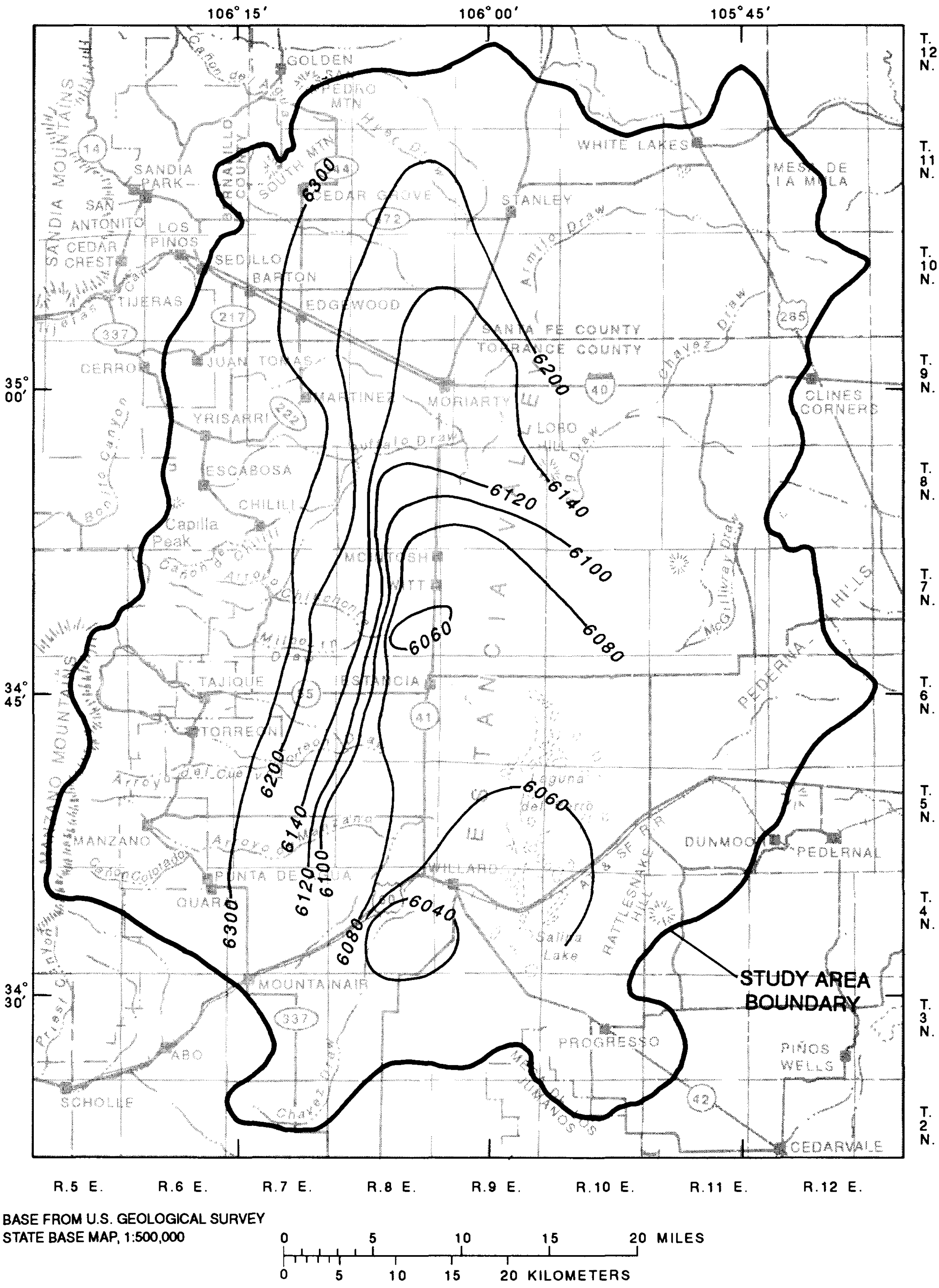
## GROUND-WATER MOVEMENT AND WATER-LEVEL CHANGES

### Water Movement

The Estancia Valley is situated in a topographically closed basin, and all water that falls as precipitation within the boundaries of the basin can leave the basin only as evaporation, sublimation (when part of the winter snow passes directly into the gaseous state without first melting), or transpiration from plants. Some of the water that falls as precipitation recharges the ground-water system and moves toward the south-central part of the basin, as shown in figure 4. The lowest part of the water table (indicated by the closed 6,040-foot contour) is in the area surrounding the community of Willard.

Ground water moves from upland areas downgradient toward the lower parts of the basin. Most ground water represents recharge from precipitation that falls in the Manzano Mountains because precipitation is greater in the Manzanos. The gradient of the water table is about 100 feet per mile in the foothills of the Manzanos (fig. 4). In the center of the valley, where the land-surface gradient is less than in the foothills, the water-table gradient is likewise smaller. The water table is generally a subdued reflection of the land surface. Just west of the road between McIntosh and Estancia, the water-table gradient is about 30 feet per mile; in the area of the salt lakes, the water-table gradient can be as little as about 2 feet per mile. An increase in the water-table gradient indicates an increase in the velocity of ground-water movement (if the permeability of the sediments is the same); thus figure 4 shows that ground-water movement is relatively rapid in the foothills of the Manzano Mountains and relatively slow in the area of the salt lakes in the south-central Estancia Valley.

Figure 4, which shows the altitude of the water table in the valley part of the Estancia Basin, was drawn using water levels (table 2) measured primarily in February 1985. However, additional measurements made through 1989 were used in some areas, particularly in areas where year-to-year variations are small. All measurements listed were made with a steel tape calibrated in hundredths of a foot. The measurements were referenced to a prescribed measuring point, such as the top of the casing or a hole in the pump base, but all water-level measurements that appear in table 2 have been adjusted to land-surface datum so that the values represent depth to water in feet below land surface.




EXPLANATION

6040 — WATER-LEVEL CONTOUR--Shows altitude of water table, in feet above sea level. Contour interval variable

Figure 4.--Altitude of the water table in the Estancia Basin, 1985.

## Water-Level Changes

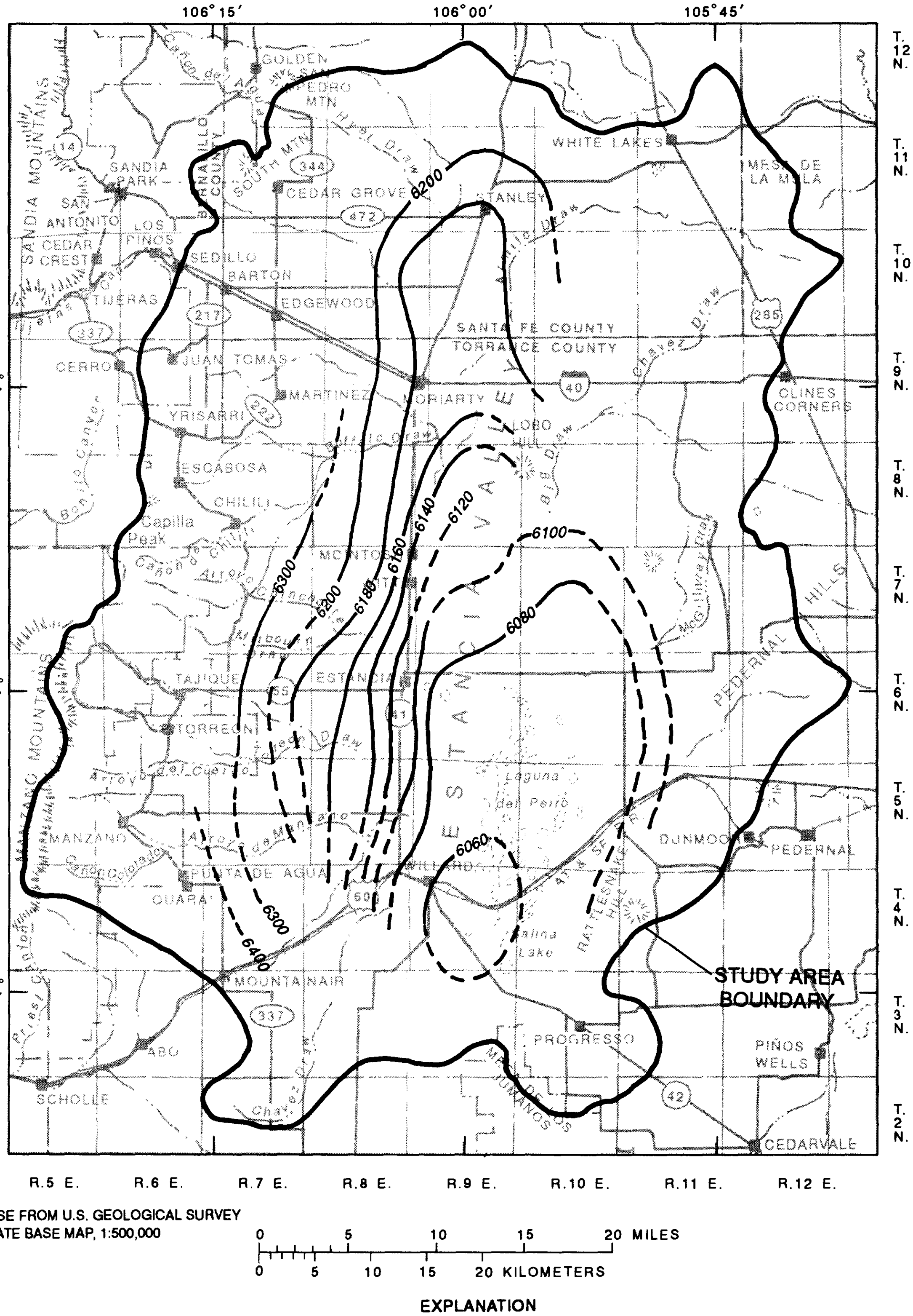
Water agencies in New Mexico have had an interest in water levels in the Estancia Valley for many years. Since 1941, the USGS, in cooperation with the New Mexico State Engineer office, has conducted a water-level-measurement program in the Estancia Valley that is still in operation. Measurements have been made quarterly, semiannually, or annually in both nonpumped and pumped wells. Currently, about a dozen wells are measured twice each year and about 80 wells are measured every 5 years. Only measurements in nonpumped wells are now made.

The water-level measurements from 1941 to the present have been entered into the NWIS data base, information on which is available from the USGS in Albuquerque. These measurements, repeated annually in the same wells whenever possible, provide a basis for determining long-term changes.

### Long-Term Changes

O.E. Meinzer made water-level measurements in the valley part of the Estancia Basin in the summer of 1909. Thus a comparison can be made between the 1985 water-table map (fig. 4) and a map of the water table under natural, undisturbed conditions before large-scale irrigation withdrawals. Meinzer conducted his study shortly after a number of stock and domestic wells had been completed by settlers in the valley. The 1909 water-table map (fig. 5) was compiled using measurements published by Meinzer (1911, p. 67-70). This map can be considered only an approximation because of the limitations of equipment and maps available to Meinzer (he measured depth to water with a knotted rope and located wells only to the closest quarter-section or section). Although a comparison of the 1909 and 1985 maps reveals a general decline in water level, the overall trend is very similar. The lowest contour shown on the 1909 map is 6,060 feet, and this contour is centered in the area of the southern salt lakes. The fact that, in comparison, the lowest contour on the 1985 map (6,040 feet) has shifted 4 to 5 miles westward suggests that ground-water withdrawals for irrigation southwest of Willard have caused a cone of depression to form in the water table in the area.

Water-level changes in the Estancia Basin from 1950 through 1985 are shown on plate 1. Although some measurements older than 1950 are available, many of them could not be used. Meinzer's 1909 measurements, for example, could not be related to existing wells (in addition to the limitations of his maps and equipment previously mentioned). Many of the wells measured in 1941, when the current program began, no longer exist. However, a sufficient number of the wells measured in 1950 still exist and could be measured in 1985 or later so that the changes for at least a 35-year period could be mapped. Because 1950 was the year in which large-scale irrigation began in the valley (Smith, 1957, p. 53), the changes from 1950 to 1985 are of particular interest.




EXPLANATION

6060 WATER-LEVEL CONTOUR--Shows altitude of water table, in feet above sea level. Contour interval variable (dashed line where approximate).

Figure 5.--Water-level contours in the Estancia Basin, 1909 (Compiled from measurements made by O.E. Meinzer).

Three large areas of decline are shown on plate 1: (1) a decline of 50 feet several miles north of Moriarty; (2) a decline of 60 feet between Moriarty and Estancia, centered on the highway between these two communities; and (3) a decline of 60 feet between Estancia and Willard, centered about 3 miles west of the highway between these communities. The three major areas of decline correspond to areas of substantial, long-term ground-water withdrawals for irrigation. Porosity and permeability variations in the aquifer may have affected the trend of decline.

The greatest decline shown on plate 1 (70 feet) is around well 06N.08E.03.221, about 2 miles northwest of Estancia. This large decline is an anomaly; the value given is based on measurements in only one well, and the cone of depression is probably of small areal extent. The decline has been confirmed by repeated measurements. The decline probably is due to greater-than-average ground-water withdrawals or smaller-than-average aquifer permeability in the area.

The trend of water-level decline shown on plate 1 from Stanley to south of Willard generally corresponds with the areas of ground-water withdrawals for irrigation. The average decline over the 35-year period is 1 to 2 feet per year in the area along Highway 41. West of the main centers of irrigation withdrawals, the decline is less, although so few 1950 measurements were available for wells that the contours could not be extended very far westward with any confidence.

East of the areas of greatest decline, the water-level decline has been a total of 5 to 10 feet during the 35-year period. This water-level decline in nonirrigated areas can be attributed to a broad cone of depression that has spread from the areas where irrigation wells are concentrated.

The effects of a substantial water-level decline are mostly economic because pumping costs increase as the depth to water increases. The decline in ground-water levels, however, has had some environmental impacts. Meinzer (1911, p. 39-40) noted the existence of shallow ground water in a narrow belt just west of what is now Highway 41 in the central and southern parts of the valley; the shallow water fed Antelope Springs (about 5 miles north of Estancia) and Estancia Spring (at the community of Estancia) (pl. 1). Long-time residents have stated that even as late as 1950 "marshy" areas existed south of Estancia in this belt. The decline in water level in the valley has dried up the natural springs along this belt and has killed some of the cottonwoods that once grew here when the ground water was at shallower depths.

Water-level records contained in the USGS NWIS data base were used to produce computer-generated hydrographs for wells in the Estancia Valley. These hydrographs are useful in determining the exact history of water-level changes in specific areas of the valley. The hydrographs are shown on plate 1, along with the location of the wells.

For consistency of presentation, the horizontal scale of all hydrographs shown on plate 1 is divided into years from 1940 through 1990. The vertical scale represents the water level in feet below land surface. The horizontal and vertical scales are consistent on all hydrographs so that direct comparisons may be made between hydrographs. The local well number is shown on each hydrograph.

Almost all measurements in the data base are plotted, including the pumping measurements that were sometimes made in the 1950's and 1960's. Measurements made when the pump is running usually can be recognized as a steep decline of 20 to 40 feet on the hydrograph, followed by recovery in the following measurement. When measurements are made twice per year, another trend of variation is shown on the hydrograph. Measurements made during the winter (usually January or February) provide water-level values that are considered "static"--that is, undisturbed by the effects of pumping. When measurements are made in the same well immediately after the irrigation season, the water level is often 5 to 10 feet lower than in the previous winter because of the residual effects of pumping. In the following winter, the water level usually will have recovered to within 1 to 2 feet of the previous winter measurement; the difference in the two measurements is an indication of the annual decline of the water level in that area.

Most of the hydrographs included on plate 1 show a general decline in water level from 1950 until 1987. From 1987 to 1989, the hydrographs for some wells in the valley show a definite upward trend (this is shown, in particular, on wells 05N.08E.10.333, 05N.08E.08.424, and 06N.08E.32.212). This upward trend was caused by two factors: (1) a decrease in irrigation withdrawals due to a government-sponsored crop-reduction program; and (2) several years of greater than normal snow accumulation and subsequent spring runoff.

Some wells, however, do not follow this pattern. During a 42-year record, well 07N.08E.16.142 has shown substantial changes in water level. This artesian well is in a confined layer in the Madera Group, and its large water-level changes are actually an indication of pressure changes in the confined layer. The artesian-pressure changes are primarily a result of fluctuations in recharge caused by climatic variations, although ground-water withdrawals in the area may also affect the water level. Drought conditions from 1950 to 1957 caused a water-level decline of about 90 feet, whereas greater than average rainfall beginning in 1958 resulted in a water-level rise of about 50 feet over a period of several years. Dry periods in the 1960's and 1970's also caused large water-level declines in this well. Well 07N.08E.16.231 (table 2), about 400 feet east of well 07N.08E.16.142, has shown similar water-level fluctuations (although records are available for only 4 years); this well began flowing at the surface in late 1987, an event sufficiently noteworthy that a photograph of it was featured in the December 10, 1987, issue of The Torrance County Citizen.

The drought conditions of the 1950's, shown in dramatic fashion in the hydrograph for well 07N.08E.16.142, are shown in subtle changes in the hydrographs for a few other wells. Minor changes in the slope of the line during this period can be seen on the hydrographs for wells 06N.08E.03.221, 05N.08E.08.424, and 05N.08E.10.333, as well as a few others.

Wells 05N.10E.27.444 and 06N.10E.27.444, which are east of the salt lakes, have shown very little change in water level for a period of record of almost 50 years. These wells are almost 15 miles east of an area of major irrigation withdrawals and are not affected by cones of depression that have developed in the irrigated areas.

### Short-Term Fluctuations

In 1986, recorders were placed on three unused irrigation wells in the Estancia Valley to continuously monitor water-level changes. The recorders were removed in 1988, but these three wells have been included in the semiannual measurement program. The recorders were serviced every 1 to 2 months, during which a water-level measurement was made with a steel tape. These measurements were entered into the NWIS data base and are included in table 2 of this report. These measurements also were used to produce computer-generated hydrographs for the three wells.

Well 05N.08E.10.333 (fig. 6) is 6 miles south of Estancia and 2 miles west of State Highway 41. Numerous irrigation wells within a mile of this well are pumped during the growing season. The water-level response to withdrawals during the summer months indicates that this well is screened in an unconfined aquifer (in which water slowly drains toward the depression in the water table around pumped wells). The hydrograph shows that the water level declines slowly during the irrigation season and rises slowly after nearby wells have been shut off in late summer. During each winter for which measurements are shown in figure 6, the water level has risen slightly higher than in the previous year. This condition is caused by several years of greater-than-normal snowfall available to recharge the aquifer and by some decrease in ground-water withdrawals resulting from a government crop-reduction program, which began in the 1987 growing season.

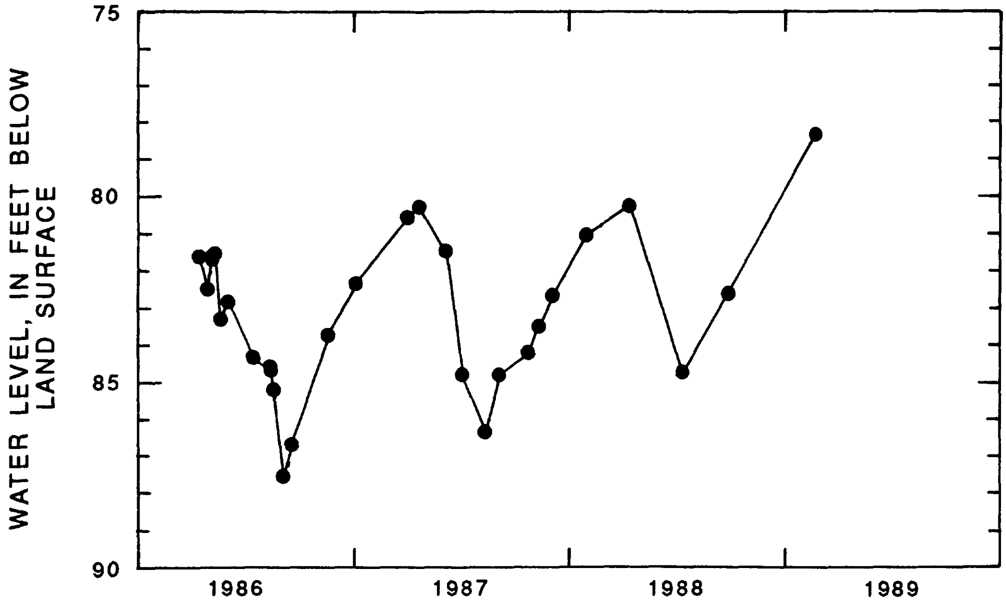



Figure 6.--Water level in well 05N.08E.10.333, 1986-89.

Well 07N.08E.25.121 (fig. 7), 3 miles north of Estancia, is screened in confined or semiconfined layers, and the water-level record consequently shows the rapid responses to pumping typical of an artesian aquifer. The depth to water in this well was 51.61 feet (table 2) when the recorder was installed on April 7, 1986. Within a few weeks the irrigation season began, and the water level in this well declined almost 15 feet; for the remainder of the summer, the depth to water ranged from 60 to 65 feet. When the irrigation season was over, the water level slowly rose to about 50 feet below land surface. Much of the land in this area was taken out of production for 1987, and the consequent decrease in ground-water withdrawals is reflected in a very stable water level in this well through the summer of 1987 (fig. 7).

The hydrograph for well 07N.08E.25.121 for 1986-89 was plotted using measurements made with a steel tape, generally every 1 to 2 months. Given that rapid water-level changes are typical of this well, figure 7 does not give a complete picture of the nature of the changes that are occurring. As a consequence, another hydrograph (fig. 8) was drawn for this well using data from the recorder chart for August 3-17, 1986. This hydrograph shows the rapid water-level changes typical of a confined (artesian) aquifer when nearby wells are pumped and then shut off. For example, the water level was rising in this well on August 5 and through the morning hours of the 6th, but just before noon the pump on an irrigation well in the area was turned on, causing a rapid decline in water level in the observation well. The pumped well remained on until 8 a.m. or 9 a.m. on the morning of August 9, and when it was shut off the water level in the observation well rose steadily until August 13, with a total rise of almost 8 feet. At midmorning on August 13, pumping began at another irrigation well in the area, and the water level in the observation well again began to decline. The pumped wells causing these declines may have been 1/2 mile or even 1 mile away.

Well 11N.09E.29.143 (fig. 9) is about 2 miles west of Stanley and is more than a mile north of the northernmost irrigation well currently being used in this area. The water-level trend in this well is typical of an unconfined aquifer; the hydrograph shows that slow changes occur in response to seasonal ground-water withdrawals.

Because of the distance of this observation well from the pumped wells, the water-level changes in well 11N.09E.29.143 are rather muted (the annual fluctuation is only about 1 foot) and show some delay in responding to irrigation withdrawals to the south (the water level begins to decline in this well 2 to 3 months after seasonal irrigation withdrawals begin). This well showed a slow decline of about 1 foot in water level from 1986 to 1989. This is in contrast with the southernmost of the observation wells (05N.08E.10.333), which showed a rise in water level during the same period (pl. 1). Well 05N.08E.10.333 is in an area that receives recharge derived from precipitation in the Manzano Mountains and is affected also by the reduction in irrigation pumpage that began in 1987; in contrast, well 11N.09E.29.143 is not hydraulically connected to either the Manzano or Sandia Mountains and is in an area in which no major reduction in irrigation withdrawals has occurred.

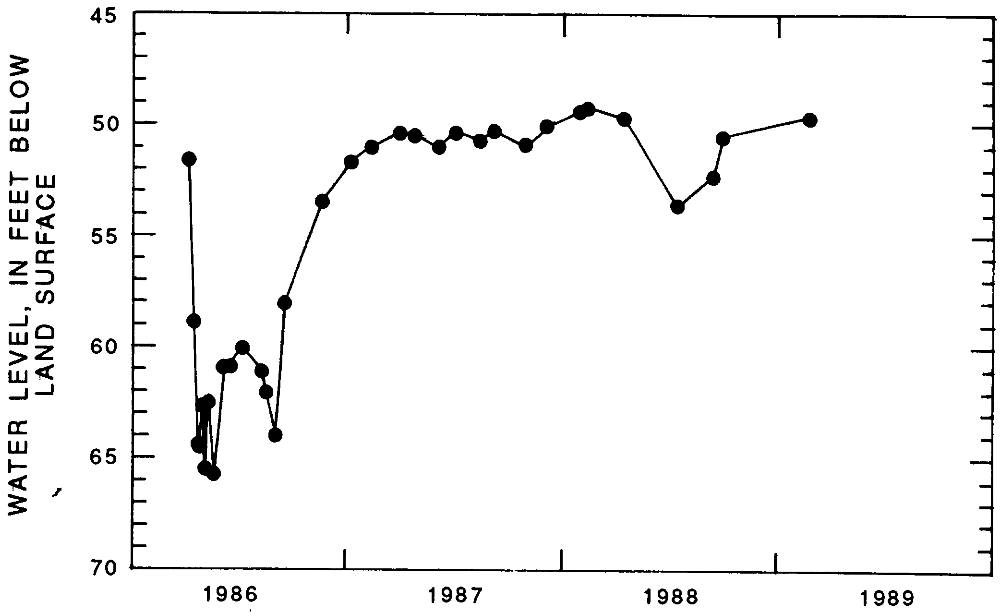



Figure 7.--Water level in well 07N.08E.25.121, 1986-89.

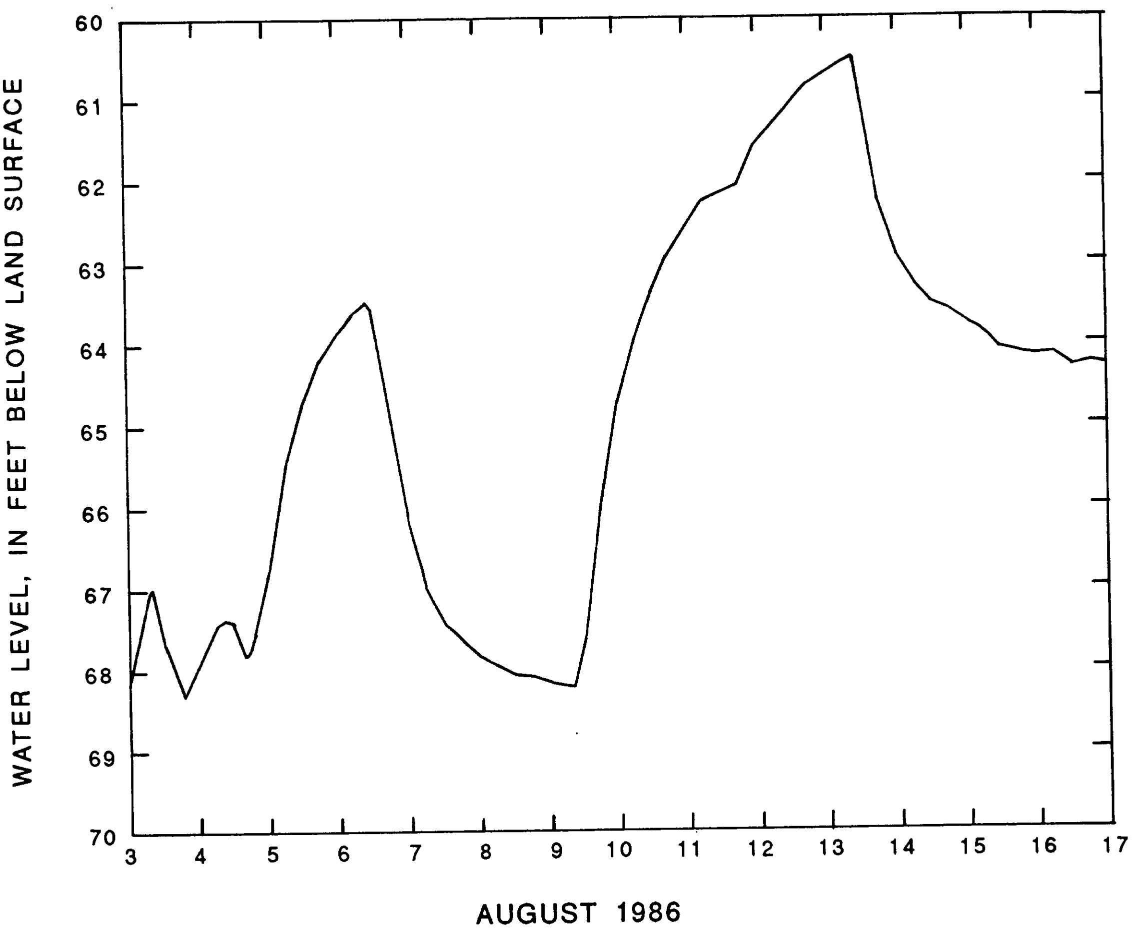



Figure 8.--Water level in well 07N.08E.25.121, August 3-17, 1986.

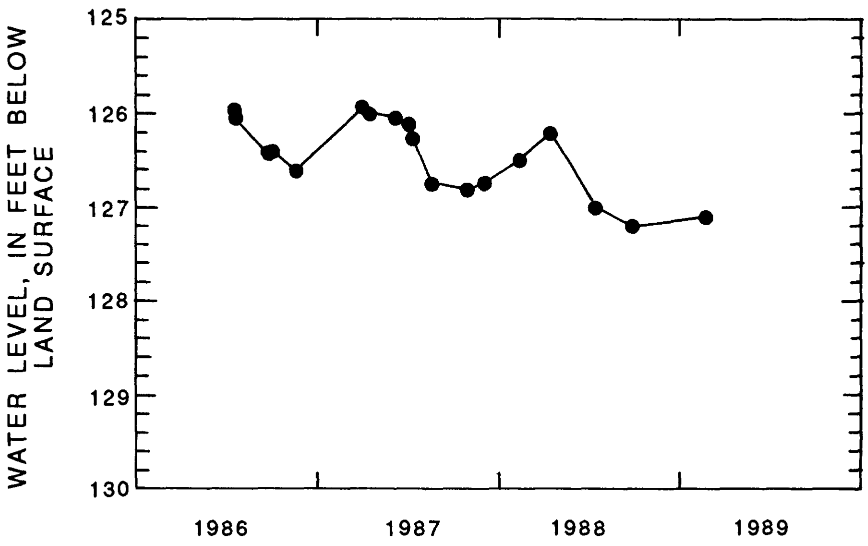



Figure 9.--Water level in well 11N.09E.29.143, 1986-89.

### Fluctuations Caused by Barometric-Pressure Changes

Each of the three observation wells equipped with recorders showed daily fluctuations in water level caused by barometric-pressure changes. An increase in barometric pressure resulted in a decline in water level; conversely, a decline in barometric pressure resulted in a rise in water level. The mechanism of these changes involves the very small elastic response of the aquifer to pressure changes, the even smaller compressibility of water, the well design, and the stratigraphy of the aquifer. A discussion of this phenomenon can be found in Ferris and others (1962, p. 83-85).

The water level in well 11N.09E.29.143 for July 7-8, 1987, is shown in figure 10. The barometric pressure at the well site (measured by a recording barograph installed in the well house) was converted from inches of mercury to feet of water so that the units would be consistent with the water-level measurements and was plotted at the top of figure 10 for comparison.

The barometric efficiency of a well (in percent) is defined as the change in water level divided by the change in barometric pressure, when both are expressed in the same units (White, 1971, p. 25). The three observation wells in the Estancia Valley that were examined for barometric effects showed an average barometric efficiency of 50 percent.

Water-level changes caused by barometric-pressure changes in wells in the Estancia Valley are small. The water-level change shown in figure 10 is only slightly more than 0.10 foot.

## SURFACE-WATER CONDITIONS

Surface-water measurements were made periodically in the Estancia Valley during 1985-87 to establish baseline data where little current information is available and to investigate the relation between surface water and ground water. All measurements were made in the streams on the east side of the Manzano Mountains.

The only continuous records of streamflow available for this area are for 1915 to 1919 (Neel, 1925, p. 77-86). These records show the extreme variability in flow in the streams on the east side of the Manzanos. For example, Cañon Colorado near Manzano (pl. 1) had a peak discharge of 1,220 cubic feet per second during a thunderstorm in July 1915 and had a discharge of 55 cubic feet per second during a period of snowmelt runoff in May 1916. However, except for 3 months, there was no streamflow whatsoever at this station during 1917 and 1918.

The only surface-water stations in the Estancia Basin at the time of this study are six crest-stage partial-record stations (Beal and Gold, 1987 [1988], p. 358-359). A crest-stage gage registers the peak stage occurring between inspections of the gage. A stage-discharge relation for each gage is developed from estimates of discharge made by indirect measurements of peak flow and from measurements of actual flow made using a current meter. The date of the maximum discharge is not always certain but is usually determined by comparison of weather records or by local inquiry. Only the maximum discharge for each year is published in annual surface-water data reports. The six crest-stage partial-record stations (pl. 1) in the Estancia Basin are:

Estancia Valley tributary at Cedar Grove,
Juan Tomas Canyon near Edgewood,
Osita Draw near Clines Corners,
Cañon de Torreon at Torreon,
Arroyo del Cuervo near Torreon, and
Big Draw near Mountainair.

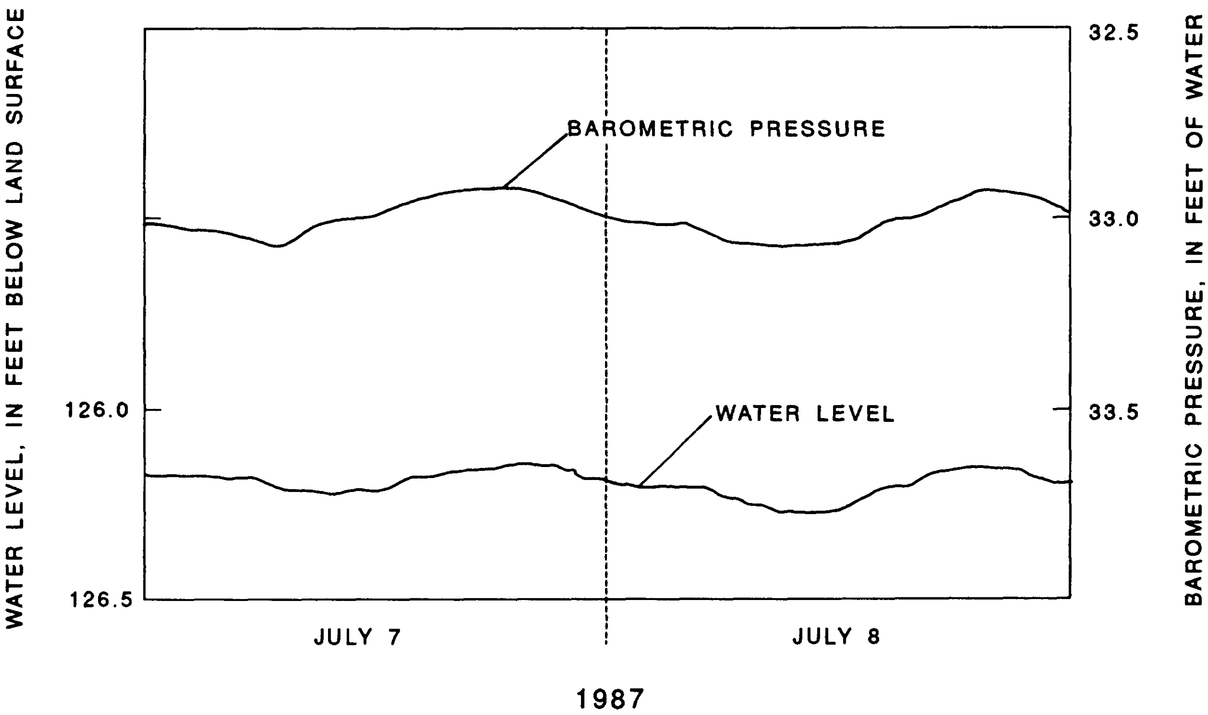



Figure 10.--Changes in water level in well 11N.09E.29.143 in response to barometric-pressure changes, July 7-8, 1987.

## Streamflow Measurements

From December 1985 to September 1987, six series of measurements were made in streams flowing eastward out of the Manzano Mountains (there is rarely any surface flow elsewhere in the basin). All measurements were made where the streams are crossed by State Highway 337, with the exception of the measurements made between Manzano Spring and Manzano Lake (pl. 1; Manzano Lake is approximately two-tenths mile east of the spring). State Highway 337 winds through the foothills of the Manzanos from one village to another. These villages (Chilili, Tajique, Torreon, and Manzano, among others) were originally established by American Indians and Spanish settlers along streams at the site of the largest dependable discharge in each stream. As a consequence, a series of measurements along State Highway 337 generally will provide the maximum discharge in each of the streams at any given time.

Most of these measurements were made by use of a current meter. At some locations, where discharge was small, a portable 3-inch modified Parshall flume was used to determine discharge. In a few instances, estimates of discharge were based on assessments of cross-sectional area and stream velocity.

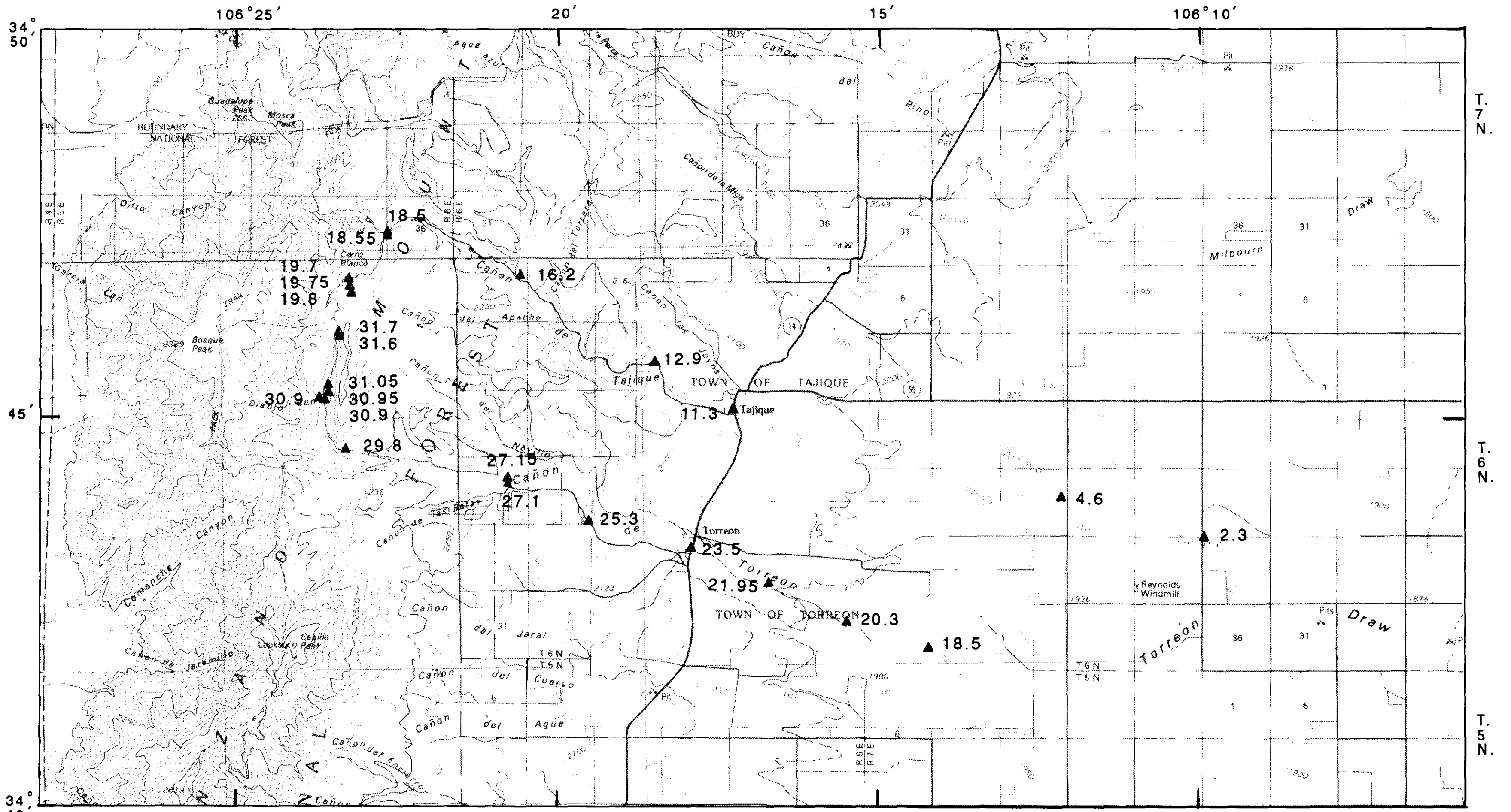
The 1985-87 measurements of instantaneous stream discharge, shown in table 3, demonstrate the extreme variability that was characteristic of the 1915-19 measurements. The winter of 1985-86 was quite dry, and the streamflow measurements made on March 26, 1986, at a time that generally is the middle of the snowmelt-runoff season, showed very little water in the stream channels in the Manzanos: the sum of all discharges measured on March 26, 1986, was 3.26 cubic feet per second.

In contrast, heavy snows fell in the Estancia Basin during the winter of 1986-87, and snowmelt runoff was large in volume and long in duration. A stream survey on April 2, 1987, showed the discharge in Cañon de Tajique (pl. 1) to be 23.1 cubic feet per second and the sum of all discharges recorded on that day to be 83.2 cubic feet per second. Local residents report that at one time during the snowmelt-runoff season in 1987 the discharge was much higher than measured on April 2, and for a week or more, several of the streams flowed over State Highway 41 and on to the salt lakes.

This variability of stream discharge through the seasons shows that the ground-water flow system that feeds the streams is shallow and is highly dependent on recharge from recent precipitation. Even Manzano Spring, which is considered a dependable source of water, responds rather quickly to recent weather conditions: for example, the discharge of Manzano Spring was 9.57 cubic feet per second on April 2, 1987, but had decreased to 1.80 cubic feet per second on June 17 and to 0.29 cubic foot per second on September 24 (table 3).

## Gain-and-Loss Measurements

Gain-and-loss measurements were made in Tajique Creek on May 28-29, 1985, and in Torreon Creek on July 8, 1987 (fig. 11). The purpose of these measurements was to determine the location where streamflow was increasing because of ground-water discharge or where streamflow was decreasing because of seepage into the ground. In practice, the measurements were made by locating the beginning of flow for each stream in the Manzano Mountains and then going downstream, making periodic measurements with a current meter or flume, until the flow ceased. (On USGS topographic maps, the Tajique drainage is labeled "Cañon de Tajique" west of State Highway 337 and "Arroyo de Tajique" east of that point, and the Torreon drainage is labeled "Cañon de Torreon" in the Manzano Mountains and "Torreon Draw" beginning at some indeterminate point downstream. For uniform presentation, the terms "Tajique Creek" and "Torreon Creek" will be used in discussing the gain-and-loss studies.)




Base from U.S. Geological Survey
Belen, New Mexico 1:100,000, 1979

0 1 2 3 4 MILES
0 1 2 3 4 KILOMETERS

EXPLANATION

18.5 ▲ SURFACE-WATER MEASURING SITE--Number by symbol is river mile, which is the distance in miles upstream from mouth of creek

Figure 11.--Locations of surface-water measuring sites on Tajique and Torreon Creeks, Estancia Basin.

The gain-and-loss measurements made along Tajique Creek on May 28-29, 1985, are shown in table 4. Locations of the measuring sites are shown in figure 11. The measurements are listed by river mile; river mile 0.0 is at the mouth of Tajique Creek, at its confluence with Torreon Creek. Flow began as a spring in the bed of a small tributary at an altitude of 7,800 feet. The stream discharge increased gradually for a distance of more than 8 river miles; the maximum discharge measured was 6.61 cubic feet per second at the village of Tajique, 50 yards upstream from the State Highway 337 crossing. The gradual increase in discharge indicates that ground water was moving into the channel and becoming surface flow. East of State Highway 337, problems in gaining access to the channel limited the number of measurements that could be made, but the stream appeared to be losing water throughout this reach. East of the highway, the water table becomes progressively deeper and, as a consequence, water infiltrates the bed of the channel. Although some of the streamflow in the lower reaches of Tajique Creek is lost to evapotranspiration, most of it likely recharges the aquifer.

The gain-and-loss measurements made along Torreon Creek on July 8, 1987, are shown in table 5. River mile designations for Torreon Creek were complicated by the fact that Torreon Draw actually extends to Laguna del Perro, although tracing the exact course of the stream on a map or on the ground is difficult (except in those rare instances when Torreon Creek has sufficient discharge to flow all the way to the lake). Torreon Draw as shown on the Mountainair NE quadrangle map (USGS 7.5-minute series) ends in T. 06 N., R. 08 E., sec. 35 at a point approximately 7 miles from Laguna del Perro; this point was designated as river mile 7.0 when determining distances for table 5.

The pattern of gains and losses in Torreon Creek was similar to that found in Tajique Creek. Streamflow began high in the Manzano Mountains as springs in the channel, increased gradually as far east as State Highway 337, and then rather quickly infiltrated downstream from the highway. In this case, however, access to the channel was possible at the contact between the Madera Group and the valley fill. In the 1.55 miles between State Highway 337 and the formational contact, streamflow decreased by 1.16 cubic feet per second; in the 3.45 miles between the Madera/valley-fill contact and the point of no flow, an additional 1.03 cubic feet per second was lost.

## Recharge, Discharge, Evaporation, and Irrigation Withdrawals in the Estancia Basin

The continuous records of streamflow reported by Neel (1925, p. 77-86) provide an opportunity to estimate the total runoff, in acre-feet, flowing into the Estancia Valley from streams in the uplands (for 1916-18). The streams on which gages were placed were as follows: Cañon de Gallegos near Moriarty, Tajique Creek at Tajique, Torreon Creek near Torreon, Cañon Nuevo at Manzano, Arroyo del Ojo at Manzano (in the southwestern part of the town of Manzano), Arroyo de los Pino Reales at Manzano, and Cañon Colorado near Manzano (pl. 1). The total runoff for these streams was 35,300 acre-feet in 1916, 3,490 acre-feet in 1917, and 808 acre-feet in 1918 (if data had been recorded for Cañon de Chilili, the numbers would have been somewhat higher). The 1916-18 records show the same extreme variability of flow in these streams as do the miscellaneous measurements made in 1985-87 (table 3).

A detailed water budget has never been published for the Estancia Basin, owing to the difficulty of determining some of the components with any degree of confidence. However, some estimates have been made of various aspects of the water budget.

Smith (1957, p. 52) estimated that 50 inches per year of ground water evaporated from the playas (salt lakes); with a total playa-surface area of 12,000 acres, this would amount to an annual natural discharge from the basin of 50,000 acre-feet (not including some transpiration by vegetation on the surrounding uplands). Smith assumed that recharge would equal discharge in the basin, and with a basin area of about 2,000 square miles, he proposed an average rate of recharge from precipitation of 0.5 inch per year.

DeBrine (1971, p. 96) conducted an intensive study of a small area around the salt lakes; his work included the construction of evaporation pans. Relating his results to the entire basin, he calculated that between 27,000 and 36,000 acre-feet per year of ground water was discharged by evaporation.

Implicit in these estimates of evaporation are the assumptions that the hydrologic system is in equilibrium and that recharge equals discharge. This probably was a valid assumption in 1949 and 1950, when Smith (1957, p. 7) did his field work because large-scale irrigation withdrawals were just beginning. However, the water-level decline in most of the Estancia Valley during the past several decades shows that the hydrologic system is not in equilibrium: discharge, through both natural processes and irrigation withdrawals, has regularly exceeded recharge.

Irrigated acreage and irrigation withdrawals in New Mexico are closely monitored by the New Mexico State Engineer Office, the New Mexico Department of Agriculture, and the Agricultural Experiment Station at New Mexico State University. Smith (1957, p. 53) published data that revealed the growth of irrigated agriculture in the Estancia Valley after World War II:

| Year | Irrigated area (acres) | Water used (acre-feet) |
|---|---|---|
| 1944 | 200 | 200 |
| 1949 | 10,000 | 8,000 |
| 1954 | 23,000 | 33,000 |

Smith's designation of "water used" probably refers to total ground-water withdrawals for irrigation. More recent tabulations of irrigation statistics for the Estancia Valley differentiate between total withdrawals and depletions:

| Year | Irrigated area (acres) | Total withdrawals (acre-feet) | Depletions (acre-feet) |
|---|---|---|---|
| 1969 | 25,930 | -- | 32,420 |
| 1975 | 28,440 | 67,040 | 35,860 |
| 1980 | 34,360 | 69,090 | 47,090 |
| 1985 | 32,055 | 79,169 | 45,124 |

The numbers listed above were obtained from Sorensen (1977, 1982) and Wilson (1986). In some places, values for the Estancia Valley were calculated by adding ground-water withdrawals for Santa Fe County (most of these withdrawals are in the Estancia Valley part of the county) to the total withdrawals for Torrance County (all withdrawals in Torrance County for irrigated agriculture are from ground water). Where available, the few acres in the Bernalillo County part of the Estancia Valley are included in the totals given above. Depletions represent the amount of water actually lost by evapotranspiration.

## WATER QUALITY

The quality of water in the Estancia Basin shows great variation. In some places, fresh (see table next page) ground water is available that is suitable for any domestic, stock, irrigation, or municipal use. In other places in the valley, however, ground water has greater salinity than sea water.

### Specific-Conductance Measurements

Specific-conductance measurements were the primary means of assessing water quality during this study. Basically, the specific conductance of water is a measure of how easily an electric current passes through the water; specific conductance increases as the concentration of dissolved solids in the water increases. Although the relation between specific conductance (in microsiemens per centimeter at 25 degrees Celsius) and dissolved solids (in milligrams per liter) varies according to the magnitude and type of dissolved solids in the water, an estimate of the dissolved-solids concentration of a water sample can be made by multiplying the specific conductance by a factor of 0.65 to 0.70. The advantage of using specific conductance as an indicator of water quality is that specific conductance can be measured quickly in the field and the results are immediately available.

A general classification of water quality based on the dissolved-solids concentration and on the approximate equivalent specific conductance is given in the following table (Wilson and White, 1984, p. 30):

| Classification | Dissolved-solids concentration (milligrams per liter) | Equivalent specific conductance (microsiemens per centimeter at 5 degrees Celsius) (dissolved solids ÷ 0.65) |
|---|---|---|
| Fresh | Less than 1,000 | Less than 1,540 |
| Slightly saline | 1,000 to 3,000 | 1,540 to 4,620 |
| Moderately saline | 3,000 to 10,000 | 4,620 to 15,400 |
| Very saline | 10,000 to 35,000 | -- |
| Brine | More than 35,000 | -- |

The specific-conductance zones of ground water in the valley part of the Estancia Basin are shown in figure 12. The different patterns, representing ranges in specific conductance, were drawn from specific-conductance values given in table 2. Where sufficient information was not available to make a definitive determination of specific conductance for a particular area, that area was left blank on the map. However, some specific-conductance measurements can be found in table 2 for those areas left blank.

Wells in large areas in the western part of the Estancia Basin produce water having specific conductance less than 750 microsiemens (approximately equal to a dissolved-solids concentration of 500 milligrams per liter or less). Water of this quality is available in most places west of State Highway 41 from Moriarty to Willard. In a large area southwest of Estancia, ground water is available that has a specific conductance less than 750 microsiemens, generally ranging from 350 to 550 microsiemens (fig. 12); this water is of excellent quality and is suitable for almost any use. Likewise, in the northwestern part of the basin, ground water having a specific conductance less than 750 microsiemens is available; however, in this area, some wells yield water having a specific conductance exceeding 1,000 microsiemens. Ground water having a specific conductance exceeding 3,000 microsiemens can be found in a band along the north-south axis of the Estancia Valley centered approximately 5 miles east of State Highway 41 from north of Moriarty to near Willard.

## Water Quality in the Area of the Salt Lakes

Wide variations in specific conductance were measured near the salt lakes. Significantly different specific-conductance values were sometimes measured in adjacent wells. An example of this tendency was observed about 3 miles northeast of Willard in two wells that are only a few tens of feet apart. Well 05N.09E.33.221 produced water having a specific conductance of 900 microsiemens, whereas a sample from well 05N.09E.33.221A had a specific conductance of 2,500 microsiemens (table 2). Well 05N.09E.33.221 is about 40 feet deep, and well 05N.09E.33.221A, producing water that has almost three times the salinity of the well just to the north of it, is about 70 feet deep.

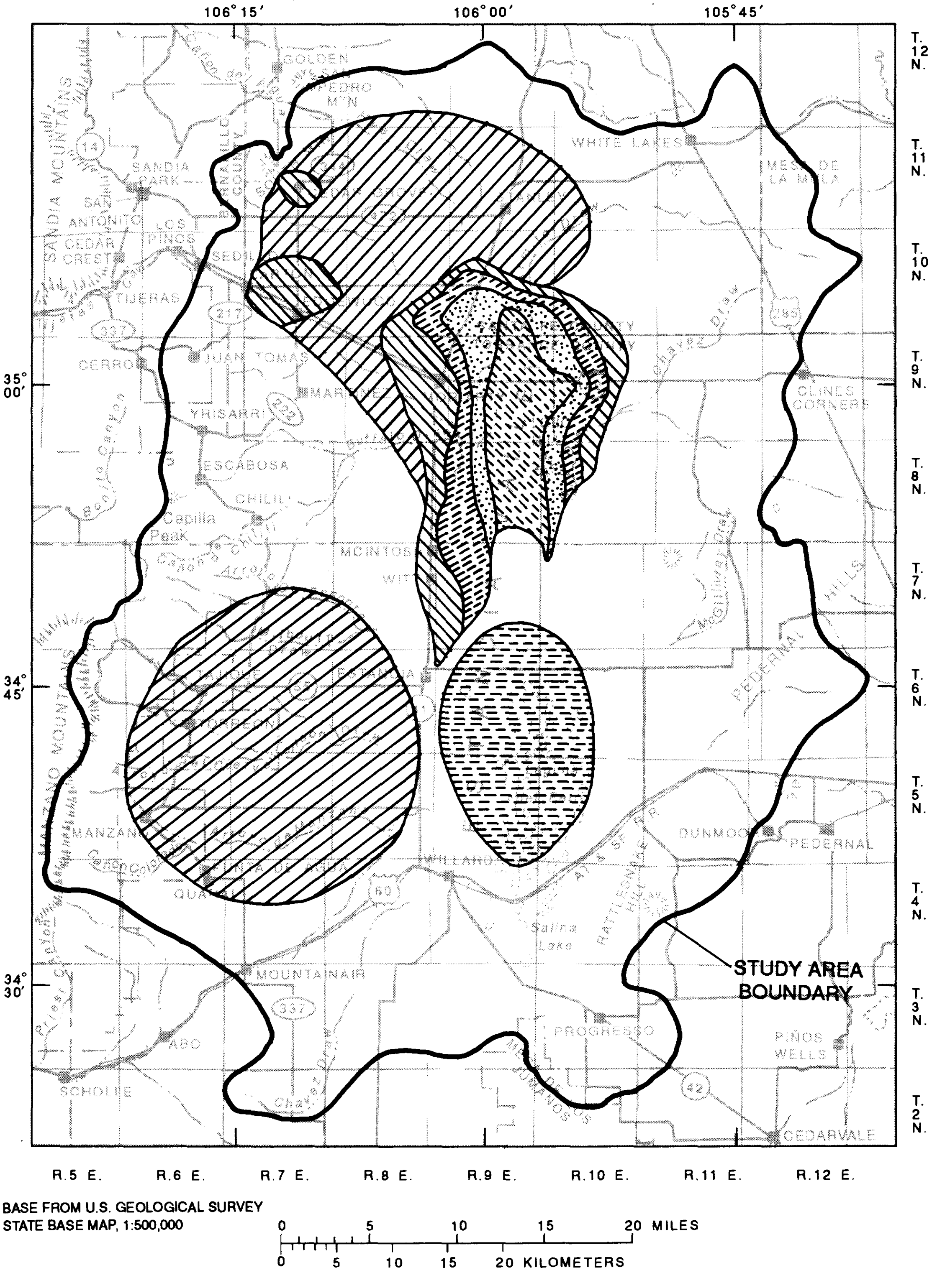
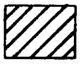
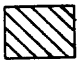


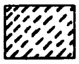

Figure 12.--Specific-conductance zones of ground water in the Estancia Basin, 1985-88.

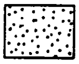
## EXPLANATION

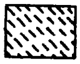
SPECIFIC CONDUCTANCE, IN MICROSIEMENS PER CENTIMETER AT 25 DEGREES CELSIUS--

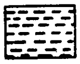

Less than 750--in the southwestern part of the valley, water in the area so designated is usually between 350 and 550


750-1,500


1,501-2,250


2,251-3,000


Greater than 3,000


Specific conductance variable, but generally greatest in magnitude near the surface. Measurements made during this study ranged from 856 to 4,860 in this area; some water samples from previous studies have exceeded 100,000

A similar situation was observed 1 to 2 miles southeast of Estancia. Water from well 06N.09E.19.111 had a specific conductance of 856 microsiemens, whereas water from well 06N.09E.18.311 had a specific conductance of 4,550 microsiemens (table 2); these wells are 0.5 mile apart. The depth and water level of these wells are not known.

An area immediately adjacent to the salt lakes, 3 to 4 miles southeast of Estancia, likewise showed considerable variation in water quality. Well 06N.09E.16.433, a stock well 27 feet deep, produced water having a specific conductance of 4,860 microsiemens (table 6). Well 06N.09E.15.433, a mile to the east of the previous well and only about 0.5 mile from the edge of the largest of the salt lakes, yielded water having a specific conductance of 2,050 microsiemens; this well was reported by the landowner to be 80 to 100 feet deep. The files of the USGS contain records of a test hole drilled to a depth of 78 feet in 1969; this test hole (listed in records as 06N.09E.16.300) may no longer exist, but a water sample taken at the time of drilling had a specific conductance of 1,390 microsiemens.

The information presented above indicates that although water quality varies considerably with depth in the area of the salt lakes, a definitive answer cannot be given as to the exact quality of water that could be expected at any given depth. Perhaps the only general statement that can be made is that immediately adjacent to the salt lakes, water at or near the water table will be of poor quality because of the concentration of salts by evaporation in the salt lakes. Analysis of water samples from different depths before the well was completed would increase the chances of obtaining the best available water. The clay layers deposited in the center of the valley by the Pleistocene lakes probably prevent any significant vertical mixing of water of different quality in different layers of the valley-fill aquifer.

Although the largest specific conductance measured during this study was 6,270 microsiemens in water from well 05N.10E.15.422 (table 2), the NWIS data base contains measurements from previous years exceeding 100,000 microsiemens in this area. These include 112,000 microsiemens in water from well 06N.09E.21.124, 137,000 microsiemens in water from well 06N.09E.24.333, and 187,000 microsiemens in water from well 06N.10E.06.331. This last measurement is more than three times the salinity of ocean water.

## Laboratory Analyses

In 1987, eight water samples were collected for laboratory analysis to determine the dissolved constituents in water in various places in the valley. Samples were collected from wells that were previously sampled at least once during the 1940's through the 1960's so changes in water quality could be determined. The location of wells from which water samples were collected for laboratory analysis is shown in figure 13. The analyses are listed in table 6 along with previous analyses.

The eight analyses are plotted on a trilinear (Piper) diagram (fig. 14). In figure 14, chemical concentrations have been converted from milligrams per liter to milliequivalents per liter and the points that are plotted indicate percentages of total cations or anions. Each well is plotted on each of the three parts of the diagram. Further information on the theory and construction of these trilinear diagrams can be found in Piper (1944) and Freeze and Cherry (1979).

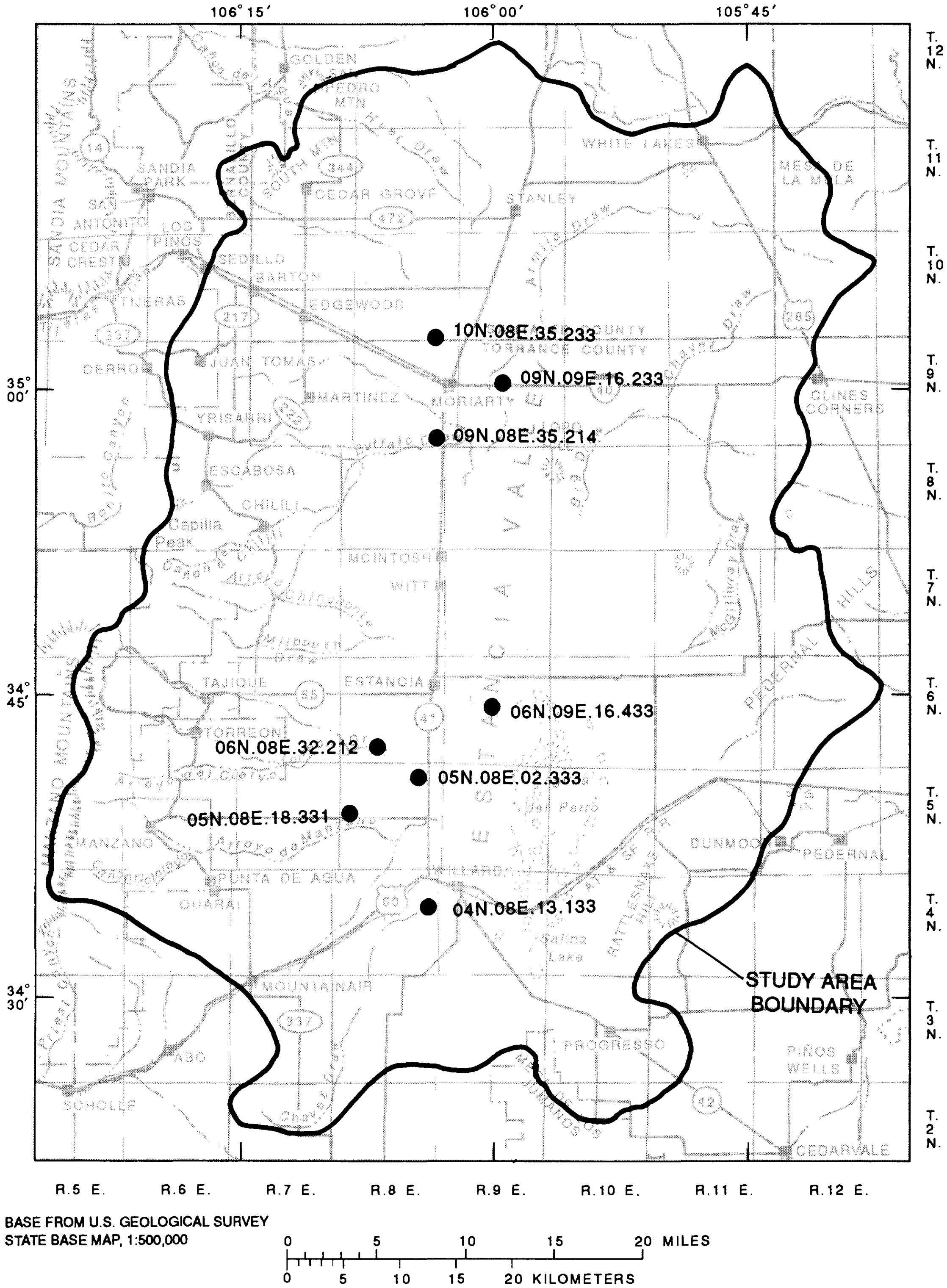
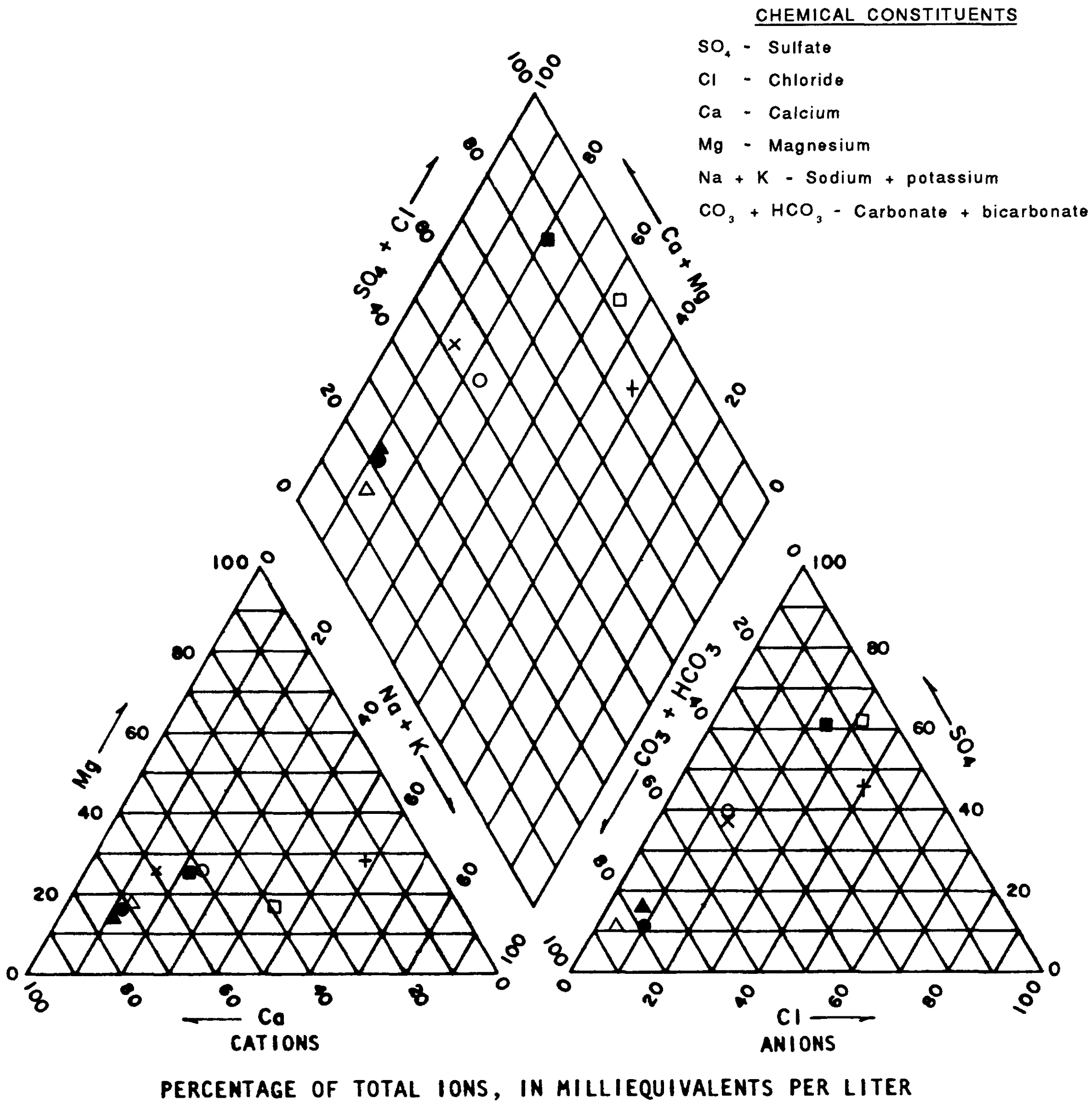



Figure 13.--Location of wells in the Estancia Basin from which water samples were collected in 1987 for laboratory analysis.




EXPLANATION

| | |
|---|---|
| o WELL 4N.8E.13.133 | + WELL 6N.9E.16.433 |
| ● WELL 5N.8E.18.331 | × WELL 9N.8E.35.214 |
| △ WELL 5N.8E.2.333 | □ WELL 9N.9E.16.233 |
| ▲ WELL 6N.8E.32.212 | ■ WELL 10N.8E.35.233 |

Figure 14.--Water samples collected in 1987 from wells in the Estancia Basin (locations of wells are shown in figure 13).

These eight wells are separated into three distinct groups in the triangle on the right in figure 14 (which shows the relative percentage of anions). Water from wells 05N.08E.02.333, 05N.08E.18.331, and 06N.08E.32.212 plots in the lower left of the triangle with 10 percent or less chloride (Cl), 10 to 20 percent sulfate ($SO_4$), and 75 to 85 percent carbonate plus bicarbonate ($CO_3 + HCO_3$). Water from these wells is low in dissolved solids (less than 400 milligrams per liter and generally less than 300 milligrams per liter), as shown in table 6. The large carbonate and bicarbonate concentrations and the small values of dissolved solids indicate that this water is derived from the Madera Group limestone or from valley fill that derives water from the Madera. A comparison of the well-location map (fig. 13) to the geologic map (fig. 3) and water-table altitude map (fig. 4) confirms this to be the case.

Water from wells 06N.09E.16.433, 09N.09E.16.233, and 10N.08E.35.233 plots in the upper right of the anion triangle in figure 14. Water from these wells contains 20 to 40 percent chloride, 45 to 65 percent sulfate, less than 20 percent carbonate plus bicarbonate, and as much as 1,200 milligrams per liter of sulfate. The 1987 analyses show dissolved-solids concentration ranging from 1,410 to 3,250 milligrams per liter (table 6). Well 06N.09E.16.433 is adjacent to the salt lakes, whereas wells 09N.09E.16.233 and 10N.08E.35.233 are near Moriarty in an area of slightly saline water.

Wells 04N.08E.13.133 and 09N.08E.35.214 plot midway between the other two groups in figure 14. These two wells yield water containing 10 to 20 percent chloride, 35 to 40 percent sulfate, and 45 to 50 percent carbonate plus bicarbonate.

Numerous historical analyses of water samples collected in the Estancia Basin are available in the files of the USGS. Many of the analyses were performed in the late 1940's and early 1950's and were published in Smith (1957). A computer-drawn plot of all available analyses was made to show the quantity of data available and the pattern of grouping of the analyses (fig. 15). Although the analyses are rather scattered on the anion triangle of figure 15, four groupings are discernible. Three of these match the three groups on the diagram of the 1987 analyses: (1) 80 to 90 percent carbonate plus bicarbonate; (2) 30 percent chloride, 60 percent sulfate, and 10 percent carbonate and bicarbonate; and (3) 20 percent chloride, 50 percent sulfate, and about 30 percent carbonate and bicarbonate. A fourth grouping visible in figure 15 is a group of analyses near the top of the anion triangle that contain about 90 percent sulfate. The water in the wells from which these samples were collected (located adjacent to and east of the salt lakes) generally contains a large dissolved-solids concentration. The cation triangle in figure 15 indicates that calcium and sodium plus potassium are the predominant cations in a majority of these samples.

## Water-Quality Changes

Maps showing the specific conductance of ground water in the Estancia Basin are included in this report (fig. 12) and in Smith (1957, pl. 3). However, the scale of these maps makes it difficult to detect any changes that may have occurred in the quality of ground water in the valley from the early 1950's to the late 1980's. Instead, wells were identified in which water-quality measurements were made a number of years apart. These measurements, compiled in table 7, consist of specific-conductance values taken primarily from the USGS NWIS data base and some additional data taken from USGS records of water analyses.

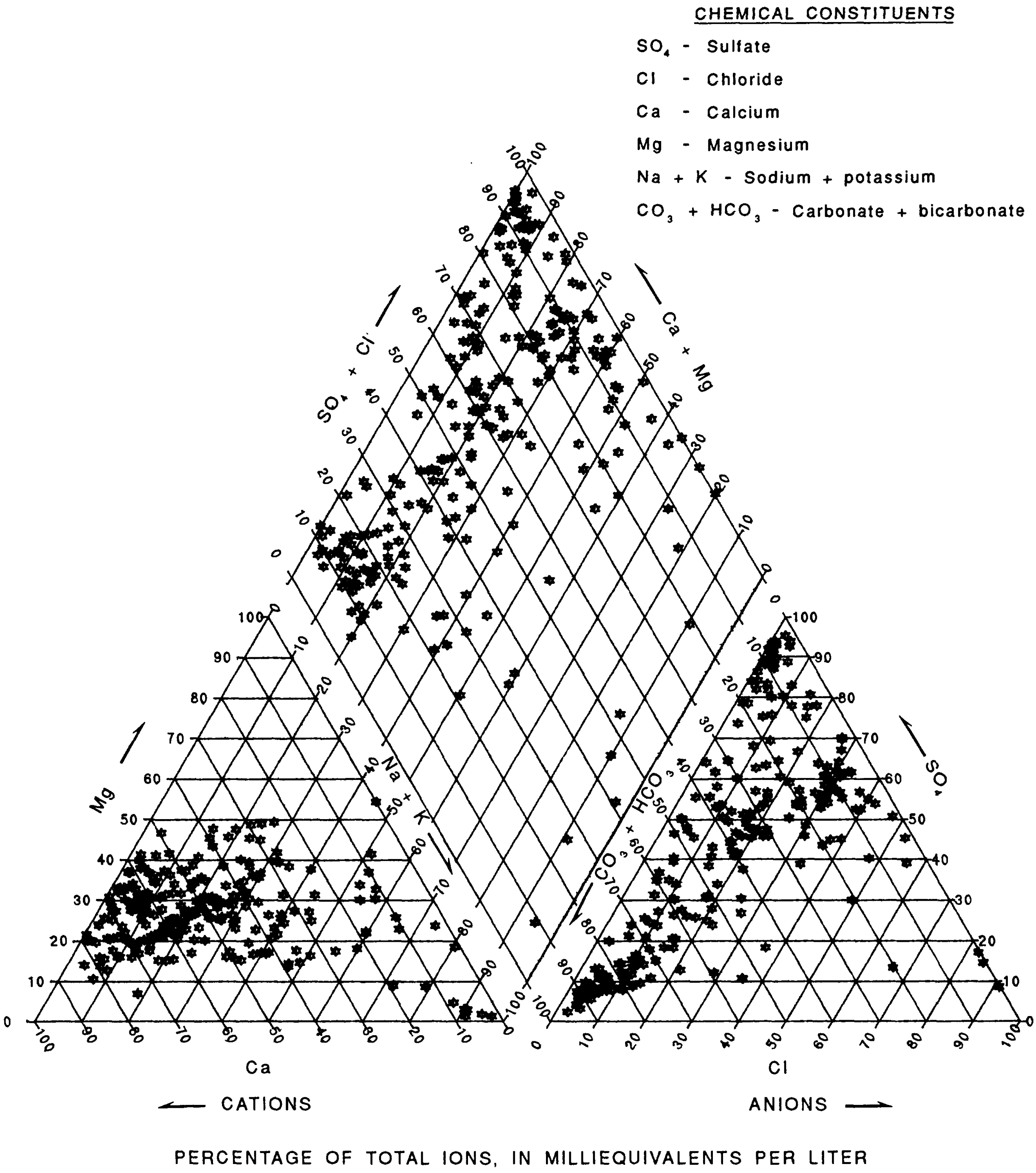



Figure 15.--All available water analyses for the Estancia Basin from U.S. Geological Survey files.

Water from well 04N.08E.13.133, about 2 miles southwest of Willard, had a specific conductance of 640 microsiemens in 1950 and 728 microsiemens in 1987 (table 6). This represents an apparent 14-percent increase, although the variations sometimes seen in repeated samplings of wells may account for some of the difference.

Information on seven wells located between Willard and Estancia appears in table 7. Some of these wells have shown no changes, and others have shown increases.

Water from well 05N.08E.02.311 showed essentially no change in specific conductance from 1966 to 1986, and water from well 05N.08E.02.333 showed no significant change from 1950 to 1987 (table 7). These wells are 1.0 mile west of State Highway 41, and the fact that no change in water quality has occurred suggests that there has been little or no westward movement of inferior-quality water from the vicinity of the salt lakes.

Water from well 05N.08E.08.424 had a specific conductance of 351 microsiemens in 1950 and 525 microsiemens in 1986, an increase of 50 percent. Water from well 05N.08E.18.312 had a specific conductance of 368 microsiemens in 1950 and 460 microsiemens in 1986, an increase of 25 percent. Although the percentage increases are large, the water is still of excellent quality and is suitable for most uses. The cause of these increases appears to be associated with the decline in water level in the aquifer. As can be seen on plate 1, these two wells are in the area of greatest water-level decline in the part of the valley between Willard and Estancia; the decline has been from 50 to more than 60 feet (a hydrograph for well 05N.08E.08.424 is shown on pl. 1). The most likely explanation for this specific-conductance change is that the water becomes more highly mineralized with depth, and as the upper layers of the aquifer are dewatered, a greater proportion of the inferior water is withdrawn during pumping.

Water samples from well 05N.08E.18.331 had specific-conductance values of 220 microsiemens on June 27, 1966; 375 microsiemens on May 7, 1986; and 439 microsiemens on September 4, 1987 (table 7). The 1966 value of 220 microsiemens is so much less than would be expected for ground water in this area that meter error is suspected and no conclusions will be drawn regarding any possible long-term changes. However, the 1986 and 1987 values demonstrate the short-term variations possible when samples are collected under different pumping conditions, such as different amounts of well drawdown and different pumping durations.

The four specific-conductance measurements that are available for well 06N.08E.32.212 indicate no significant change since 1950. The water level in this well has declined about 50 feet since the 1940's (pl. 1). Water-quality changes measured in wells 05N.08E.08.424 and 05N.08E.18.312 are greater, but the quality of water in these two wells is now similar to that in well 06N.08E.32.212 where measurements were begun in 1950.

Well 06N.09E.16.433 is immediately adjacent to one of the salt lakes east of Estancia. Specific-conductance measurements in 1968, 1986, and 1987 show virtually no change. Likewise, the laboratory analyses of 1968 and 1987 show all constituents to be practically the same (table 6). This well is 27 feet deep, thus the measurements give an indication of water quality very close to the water table. This well is 4 to 5 miles east of a major area of irrigation withdrawals, and although water levels have declined somewhat at this well, the stress on the aquifer is relatively small, which probably accounts for the lack of any change in water quality.

Three of the wells in table 7 are between Estancia and Moriarty, and all three wells show substantial increases in specific conductance. Specific conductance in water from well 07N.09E.18.211 changed from 647 microsiemens in 1965 to 1,200 microsiemens in 1986, an increase of 85 percent, and water from well 08N.09E.07.211 changed from 981 microsiemens in 1950 to 1,700 microsiemens in 1986, an increase of 73 percent. Water from well 09N.08E.35.214 had a specific conductance of 821 to 824 microsiemens from 1948 to 1950 that rose to 1,120 microsiemens in 1987, an increase of 36 percent. These three wells are in an area of 40- to 60-foot water-level declines (pl. 1), but they are also on the margins of the body of high-salinity water that is found along the north-south axis of the valley (fig. 13). The increase in specific conductance in water from these wells seems to be related to the decline in water level and to the presence of inferior-quality water at depth, as seems to be the situation in several wells south of Estancia. Consideration also needs to be given to the possibility that water having large values of specific conductance is moving westward into this area in response to long-term irrigation withdrawals.

Well 09N.09E.16.233 is a stock well about 3 miles east of Moriarty, and well 09N.10E.18.233 supplies a motel about 7 miles east of Moriarty. Water from both wells has had a slight increase in specific conductance since 1950 (table 7). Although water levels have declined in this area, these wells were originally located where the aquifer contains slightly saline water (1,000 to 3,000 microsiemens); thus, any water that may have moved into the area in response to pumping stresses is little worse than the water originally there.

In the irrigated area north of Moriarty, substantial changes in water quality have taken place. The progressive change can be seen in water from well 10N.08E.25.3111, which had specific-conductance values of 1,390 in 1950; 1,760 in 1966; and 2,400 microsiemens in 1986 and 1987 (table 7). The specific conductance of water from well 10N.08E.35.233 was 1,350 microsiemens in 1948 and as much as 2,150 microsiemens in 1987. The only other well in this area for which long-term measurements are available is 10N.08E.36.1112, from which water was withdrawn having a specific conductance of 1,260 microsiemens in 1948 and 1,900 microsiemens in 1986.

The three wells listed above are in an area in which water levels have declined about 50 feet since 1950 (pl. 1). A hydrograph for well 10N.08E.25.3111 is shown on plate 1. Most of the irrigation wells in this area are perforated in both the valley fill and underlying Glorieta Sandstone. The Glorieta Sandstone in this area contains water of inferior quality, and as the upper layers of the valley fill have been dewatered by irrigation withdrawals during the past several decades, a progressively larger proportion of Glorieta water has been withdrawn, thus accounting for the progressive increase in salinity of the water used for irrigation. A well driller in Stanley (Larry Dennisson, oral commun., 1987) stated that when he drills a small-capacity well (domestic or stock well) in the area, he makes certain that the bottom of the well is in the valley fill. His own domestic well is 290 feet deep (well 11N.09E.27.312, table 2) at a location where the top of the Glorieta is at 330 feet; as a consequence, the specific conductance of his well water is 610 microsiemens, which is considerably less than that of water in the irrigation wells nearby that penetrate the Glorieta.

The specific-conductance measurements shown in table 7 for well 10N.08E.35.233 for 1986 and 1987 are of particular interest. Water from this well measured 1,850 microsiemens on May 14, 1986; 2,000 microsiemens on August 13, 1986; 1,750 microsiemens on April 14, 1987; and 2,150 microsiemens on August 12, 1987. In both years, the summer measurements were considerably larger than the spring measurements. This appears to be related to the situation described in the previous paragraph. The length of time a well has been pumped and the consequent drawdown of the water level determine to a great extent the relative amount of water withdrawn from each of the formations perforated by the well. The phenomenon of variations in water quality in a given well during the pumping season was observed in a number of wells in the valley, although nowhere else to this extent.

Three other wells are shown in table 7 (11N.07E.21.144, 11N.07E.22.11134, and 12N.07E.34.224). In each case, the specific conductance of water from these wells improved slightly. These wells are on the northwestern side of the valley near the foothills, far from the centers of irrigation withdrawals. The small variations in quality shown in table 7 might reflect small variations in the quality of recharge from the mountains or, to some extent, might result from small meter variations.

## SUMMARY AND CONCLUSIONS

The Estancia Basin is a topographically closed basin. All ground water moves toward the Willard area, where the water table (and land surface) is at the lowest altitude.

Ground-water levels have generally declined in the Estancia Valley from north of Stanley to south of Willard. The average water-level decline from 1950 to 1985 was 1 to 2 feet per year in the area along and just to the east of Highway 41. There were three areas of particularly large decline from 1950 to 1985: (1) a decline of 50 feet several miles north of Moriarty; (2) a decline of 60 feet between Moriarty and Estancia, centered on State Highway 41 between these two communities; and (3) a decline of 60 feet between Estancia and Willard, centered about 3 miles west of State Highway 41 between these communities. From early 1986 to early 1989, some wells in the valley showed a gradual rise of several feet in static water level; this rise was caused by several years of especially heavy winter snowfall (with consequent recharge to the aquifer) and by decreased ground-water withdrawals resulting from the most recent government crop-reduction program.

Water-level recorders were in place on three observation wells in the Estancia Valley from 1986 to 1988. In response to irrigation withdrawals in nearby wells, two of the observation wells showed the gradual changes that are characteristic of water-table (unconfined) aquifers, whereas the third well showed the rapid changes (as much as about 15 feet during the irrigation season) of artesian (confined) aquifers. All three observation wells showed daily water-level changes in response to barometric-pressure changes. These daily water-level changes were generally about 0.10 foot.

Discharge was measured in the streams flowing eastward out of the Manzano Mountains. The variability of stream discharge through the seasons shows that the ground-water flow system that feeds the stream is shallow and is highly dependent on recharge from recent precipitation.

The quality of ground water in the area of the salt lakes is highly dependent on the depth of the well. In wells immediately adjacent to the salt lakes, water at or near the water table will be of poor quality because of the concentration of salts by evaporation in the salt lakes; otherwise, a definitive answer cannot be given as to the exact quality of water that could be expected at any given depth. Analysis of water samples from different depths before a well is completed would increase the chances of obtaining the best available water.

Three areas in which water quality has changed during the past several decades are also areas having water-level declines of 50 to 60 feet. West of State Highway 41 between Willard and Estancia, water from some wells has shown an increase in specific conductance, probably because water of slightly inferior quality is being withdrawn from deeper layers of the aquifer (the upper layers have been dewatered); however, water in this area is still of excellent quality. South of Moriarty, water from some wells has shown substantial increases in specific conductance; the exact cause is not known, but it may be related to inferior-quality water either at depth or moving into the area from the east. North of Moriarty is an area in which the quality of irrigation well water has deteriorated as the valley fill has been partially dewatered and an increased percentage of water from the underlying Glorieta Sandstone has been withdrawn.

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Table 1.--Summary of annual precipitation data from weather stations in and near the Estancia Valley

[From Kunkel, 1984]

| Station | Period of record | Mean | Annual precipitation (inches) High | Year | Low | Year |
|---|---|---|---|---|---|---|
| Estancia | 1937-83 | 11.78 | 23.63 | 1941 | 4.87 | 1956 |
| McIntosh 4NW | 1931-76 | 12.70 | 22.30 | 1941 | 4.07 | 1956 |
| Mountainair | 1931-83 | 13.67 | 27.00 | 1941 | 6.82 | 1934 |
| Pedernal 4E | 1931-83 | 10.93 | 17.48 | 1972 | 3.82 | 1964 |
| Progresso | 1931-83 | 13.47 | 30.74 | 1941 | 5.13 | 1945 |
| Stanley 1NNE | 1954-83 | 11.14 | 17.73 | 1969 | 4.65 | 1956 |
| Albuquerque | 1931-83 | 8.29 | 15.88 | 1941 | 4.06 | 1956 |

Table 2.--Well data for the Estancia Basin, 1985-89

[Local well number: well location is given by township, range, and section. See introduction of this report for explanation of this system. Primary use of water: A, air conditioning; C, commercial; H, house; I, irrigation; P, public; R, reported; S, stock; T, testhole; U, unused; Z, other. Water-quality parameter code: these five-digit codes, which uniquely identify a specific constituent, are used to store data in the National Water-Data Storage and Retrieval System (WATSTORE): 00095, specific conductance, in microsiemens per centimeter at 25 degrees Celsius; 00010, water temperature, in degrees Celsius; 00400, pH, in standard units. -- indicates no data]

| Local well number | Latitude | Longitude | Altitude of land surface (feet above sea level) | Primary use of water | Depth of well (feet) | Water-level measurement date | Water level (feet below land surface) | Water-quality measurement date | Water-quality parameter code | Water-quality value |
|---|---|---|---|---|---|---|---|---|---|---|
| 04N.06E.03.443 | 34°35'42" | 106°17'49" | 6,650 | P | 98 | 02-21-85 | 23.55 | 07-14-86 | 00095 | 370 |
| 04N.07E.08.4441 | 34°34'53" | 106°13'39" | 6,430 | I | -- | 02-21-85 | 83.62 | -- | -- | -- |
| 04N.07E.23.3132 | 34°33'23" | 106°11'19" | 6,363 | A | -- | 02-21-85 | 126.46 | -- | -- | -- |
| 04N.08E.11.433 | 34°39'26" | 106°04'23" | 6,148 | I | 160 | 02-21-85 | 112.92 | -- | -- | -- |
| | | | | | | 08-09-85 | 120.23 | -- | -- | -- |
| 04N.08E.12.143 | 34°35'20" | 106°03'39" | 6,128 | I | -- | 10-08-86 | 95.80 | -- | -- | -- |
| 04N.08E.12.333 | 34°34'53" | 106°03'54" | 6,137 | U | 272 | -- | -- | 08-26-86 | 00010 | 16.3 |
| | | | | | | -- | -- | 08-26-86 | 00095 | 925 |
| 04N.08E.13.133 | 34°34'28" | 106°03'54" | 6,153 | I | 197 | -- | -- | 09-08-87 | 00010 | 15.5 |
| | | | | | | -- | -- | 09-08-87 | 00095 | 728 |
| 04N.08E.14.233 | 34°34'24" | 106°04'29" | 6,155 | U | -- | 02-21-85 | 121.51 | -- | -- | -- |
| 04N.08E.24.133 | 34°33'38" | 106°03'52" | 6,148 | I | -- | 02-21-85 | 114.07 | -- | -- | -- |
| 04N.09E.04.211 | 34°36'31" | 106°00'15" | 6,079 | U | -- | 05-13-86 | 38.80 | -- | -- | -- |
| 04N.09E.06.443 | 34°35'47" | 106°01'58" | 6,097 | P | -- | -- | -- | 07-14-86 | 00095 | 650 |
| 04N.09E.07.334 | 34°34'53" | 106°02'36" | 6,118 | I | 163 | 02-21-85 | 80.06 | -- | -- | -- |
| | | | | | | 10-08-86 | 83.86 | -- | -- | -- |
| | | | | | | 04-01-87 | 80.35 | -- | -- | -- |
| | | | | | | 08-11-87 | 87.11 | -- | -- | -- |
| | | | | | | 01-28-88 | 80.79 | -- | -- | -- |
| | | | | | | 08-11-88 | 93.91 | -- | -- | -- |

Table 2.--Well data for the Estancia Basin, 1985-89--Continued

| Local well number | Latitude | Longitude | Altitude of land surface (feet above sea level) | Primary use of water | Depth of well (feet) | Water-level measurement date | Water level (feet below land surface) | Water-quality measurement date | Water-quality parameter code | Water-quality value |
|---|---|---|---|---|---|---|---|---|---|---|
| 04N.09E.07.334 | 34°34'53" | 106°02'36" | 6,118 | I | 163 | 02-21-89 | 79.91 | -- | -- | -- |
| 04N.09E.09.444 | 34°34'57" | 105°59'45" | 6,078 | S | -- | -- | -- | 08-12-86 | 00095 | 1,950 |
| 04N.09E.10.433 | 34°34'55" | 105°59'12" | 6,064 | S | -- | -- | -- | 08-12-86 | 00095 | 1,250 |
| 04N.09E.18.111 | 34°34'52" | 106°02'49" | 6,123 | I | -- | 08-26-86 | 89.41 | -- | -- | -- |
| | | | | | | 10-08-86 | 88.68 | -- | -- | -- |
| 04N.09E.18.311 | 34°34'27" | 106°02'52" | 6,123 | U | -- | 10-08-86 | 90.88 | -- | -- | -- |
| | | | | | | 04-01-87 | 87.57 | -- | -- | -- |
| 05N.06E.14.444 | 34°39'06" | 106°16'13" | -- | I | 148 | 02-21-85 | 107.09 | -- | -- | -- |
| 05N.07E.11.411 | 34°40'22" | 106°10'28" | 6,260 | I | 275 | 07-12-88 | 131.12 | -- | -- | -- |
| 05N.07E.13.211 | 34°39'59" | 106°09'18" | 6,245 | I | -- | 05-07-86 | 127.56 | -- | -- | -- |
| 05N.07E.14.444 | 34°39'12" | 106°09'58" | 6,242 | I | -- | -- | -- | 05-07-86 | 00010 | 16.5 |
| | | | | | | -- | -- | 05-07-86 | 00095 | 350 |
| 05N.07E.29.433 | 34°37'23" | 106°13'36" | 6,332 | I | -- | 02-21-85 | 33.60 | -- | -- | -- |
| 05N.08E.02.311 | 34°41'18" | 106°04'41" | 6,137 | I | -- | -- | -- | 05-21-86 | 00010 | 16 |
| | | | | | | -- | -- | 05-21-86 | 00095 | 420 |
| 05N.08E.02.333 | 34°40'54" | 106°04'41" | 6,136 | I | 150 | -- | -- | 05-21-86 | 00010 | 16 |
| | | | | | | -- | -- | 05-21-86 | 00095 | 390 |
| | | | | | | -- | -- | 09-04-87 | 00010 | 14 |
| | | | | | | -- | -- | 09-04-87 | 00095 | 432 |
| 05N.08E.05.331 | 34°41'04" | 106°07'51" | 6,216 | U | -- | 02-21-85 | 116.76 | -- | -- | -- |
| | | | | | | 04-30-86 | 116.56 | -- | -- | -- |
| 05N.08E.07.413 | 34°40'15" | 106°08'22" | 6,234 | I | 201 | 02-21-85 | 130.22 | -- | -- | -- |
| | | | | | | 04-30-86 | 129.85 | -- | -- | -- |
| 05N.08E.08.424 | 34°40'18" | 106°06'49" | 6,218 | I | -- | 02-21-85 | 126.21 | 09-04-86 | 00010 | 15 |
| | | | | | | 01-15-86 | 127.13 | 09-04-86 | 00095 | 525 |
| | | | | | | 09-17-86 | 129.74 | -- | -- | -- |
| | | | | | | 04-01-87 | 124.75 | -- | -- | -- |
| | | | | | | 09-04-87 | 128.35 | -- | -- | -- |
| | | | | | | 01-28-88 | 123.85 | -- | -- | -- |
| | | | | | | 08-11-88 | 127.52 | -- | -- | -- |

Table 2.--Well data for the Estancia Basin, 1985-89--Continued

| Local well number | Latitude | Longitude | Altitude of land surface (feet above sea level) | Primary use of water | Depth of well (feet) | Water-level measurement date | Water level (feet below land surface) | Water-quality measurement date | Water-quality parameter code | Water-quality value |
|---|---|---|---|---|---|---|---|---|---|---|
| 05N.08E.08.424 | 34°40'18" | 106°06'49" | 6,218 | I | -- | 02-21-89 | 121.43 | -- | -- | -- |
| 05N.08E.10.113 | 34°40'39" | 106°05'46" | 6,165 | I | 200 | 02-21-85 | 82.39 | -- | -- | -- |
| 05N.08E.10.331 | 34°40'11" | 106°05'44" | 6,165 | I | 176 | -- | -- | 08-19-86 | 00010 | 15.5 |
| | | | | | | -- | -- | 08-19-86 | 00095 | 470 |
| | | | | | | -- | -- | 08-26-86 | 00010 | 15 |
| | | | | | | -- | -- | 08-26-86 | 00095 | 460 |
| 05N.08E.10.333 | 34°40'05" | 106°05'42" | 6,163 | U | 132 | 02-21-85 | 79.96 | -- | -- | -- |
| | | | | | | 04-17-86 | 81.64 | -- | -- | -- |
| | | | | | | 04-29-86 | 82.47 | -- | -- | -- |
| | | | | | | 05-05-86 | 81.70 | -- | -- | -- |
| | | | | | | 05-07-86 | 81.59 | -- | -- | -- |
| | | | | | | 05-12-86 | 81.51 | -- | -- | -- |
| | | | | | | 05-21-86 | 83.33 | -- | -- | -- |
| | | | | | | 06-04-86 | 82.82 | -- | -- | -- |
| | | | | | | 07-14-86 | 84.29 | -- | -- | -- |
| | | | | | | 08-12-86 | 84.66 | -- | -- | -- |
| | | | | | | 08-14-86 | 84.56 | - | -- | -- |
| | | | | | | 08-19-86 | 85.17 | -- | -- | -- |
| | | | | | | 09-04-86 | 87.54 | -- | -- | -- |
| | | | | | | 09-17-86 | 86.66 | -- | -- | -- |
| | | | | | | 11-18-86 | 83.72 | -- | -- | -- |
| | | | | | | 01-05-87 | 82.34 | -- | -- | -- |
| | | | | | | 04-01-87 | 80.55 | -- | -- | -- |
| | | | | | | 04-21-87 | 80.23 | -- | -- | -- |
| | | | | | | 06-03-87 | 81.45 | -- | -- | -- |
| | | | | | | 07-02-87 | 84.75 | -- | -- | -- |
| | | | | | | 08-11-87 | 86.33 | -- | -- | -- |
| | | | | | | 09-04-87 | 84.80 | -- | -- | -- |

Table 2.--Well data for the Estancia Basin, 1985-89--Continued

| Local well number | Latitude | Longitude | Altitude of land surface (feet above sea level) | Primary use of water | Depth of well (feet) | Water-level measurement date | Water level (feet below land surface) | Water-quality measurement date | Water-quality parameter code | Water-quality value |
|---|---|---|---|---|---|---|---|---|---|---|
| 05N.08E.10.333 | 34°40'05" | 106°05'42" | 6,163 | U | 132 | 10-27-87 | 84.15 | – | – | – |
| | | | | | | 11-10-87 | 83.48 | – | – | – |
| | | | | | | 12-02-87 | 82.65 | – | – | – |
| | | | | | | 01-28-88 | 81.02 | – | – | – |
| | | | | | | 04-12-88 | 80.21 | – | – | – |
| | | | | | | 07-12-88 | 84.84 | – | – | – |
| | | | | | | 09-27-88 | 82.62 | – | – | – |
| | | | | | | 02-21-89 | 78.25 | – | – | – |
| 05N.08E.14.111 | 34°40'00" | 106°04'40" | 6,138 | I | 200 | 05-05-86 | 66.80 | – | – | – |
| 05N.08E.14.222 | 34°40'00" | 106°03'43" | 6,110 | H | 150 | 00-00-85 | 32 | 05-05-86 | 00095 | 590 |
| 05N.08E.14.311 | 34°39'34" | 106°04'40" | 6,141 | U | 200 | 05-05-86 | 60.60 | – | – | – |
| 05N.08E.15.211 | 34°40'01" | 106°05'12" | 6,148 | I | – | 05-05-86 | 71.75 | – | – | – |
| 05N.08E.15.313 | 34°39'26" | 106°05'44" | 6,168 | U | 225 | 05-12-86 | 79.80 | – | – | – |
| 05N.08E.16.111 | 34°40'00" | 106°06'43" | 6,202 | U | 200 | 02-21-85 | 118.38 | – | – | – |
| | | | | | | 08-28-86 | 123.39 | – | – | – |
| 05N.08E.17.113 | 34°39'54" | 106°07'43" | 6,202 | I | – | 02-21-85 | 106.27 | – | – | – |
| 05N.08E.18.312 | 34°39'34" | 106°08'38" | 6,205 | I | 159 | 02-21-85 | 93.80 | 05-07-86 | 00010 | 16 |
| | | | | | | – | – | 05-07-86 | 00095 | 460 |
| 05N.08E.18.331 | 34°39'22" | 106°08'53" | 6,198 | I | 150 | 02-21-85 | 79.00 | 05-07-86 | 00010 | 15.5 |
| | | | | | | – | – | 05-07-86 | 00095 | 375 |
| | | | | | | – | – | 09-04-87 | 00010 | 14 |
| | | | | | | – | – | 09-04-87 | 00095 | 439 |
| 05N.08E.21.111 | 34°39'06" | 106°06'47" | 6,187 | I | – | 02-21-85 | 88.52 | – | – | – |
| 05N.08E.21.441 | 34°38'28" | 106°05'57" | 6,170 | I | – | 02-21-85 | 65.34 | – | – | – |
| | | | | | | 05-21-86 | 65.15 | – | – | – |
| 05N.08E.22.211 | 34°39'06" | 106°05'13" | 6,150 | S | – | 05-05-86 | 65.94 | – | – | – |
| 05N.08E.23.121 | 34°39'07" | 106°04'23" | 6,133 | U | – | 05-12-86 | 55.15 | – | – | – |
| 05N.08E.24.213 | 34°39'00" | 106°03'08" | 6,111 | U | – | 05-12-86 | 53.90 | – | – | – |
| 05N.08E.24.311 | 34°38'42" | 106°03'38" | 6,119 | I | 150 | 02-21-85 | 41.69 | – | – | – |

Table 2.--Well data for the Estancia Basin, 1985-89--Continued

| Local well number | Latitude | Longitude | Altitude of land surface (feet above sea level) | Primary use of water | Depth of well (feet) | Water-level measurement date | Water level (feet below land surface) | Water-quality measurement date | Water-quality parameter code | Water-quality value |
|---|---|---|---|---|---|---|---|---|---|---|
| 05N.08E.25.111 | 34°38'16" | 106°03'38" | 6,117 | I | -- | 05-12-86 | 42.12 | -- | -- | -- |
| | | | | | | 05-13-86 | 45.53 | -- | -- | -- |
| 05N.08E.35.444 | 34°36'33" | 106°03'40" | 6,122 | I | 200 | 04-13-86 | 90 | 04-13-86 | 00010 | 15 |
| | | | | | | -- | -- | 04-13-86 | 00095 | 500 |
| 05N.09E.06.311 | 34°41'18" | 106°02'33" | 6,102 | U | -- | 05-03-85 | 27.90 | -- | -- | -- |
| | | | | | | 08-28-86 | 28.60 | -- | -- | -- |
| 05N.09E.29.111 | 34°38'13" | 106°01'28" | 6,093 | S | 80 | -- | -- | 05-13-86 | 00010 | 17 |
| | | | | | | -- | -- | 05-13-86 | 00095 | 600 |
| 05N.09E.32.211 | 34°37'25" | 106°00'58" | 6,082 | H | -- | -- | -- | 05-13-86 | 00095 | 650 |
| 05N.09E.33.221 | 34°37'23" | 105°59'41" | 6,068 | S | 40 | 05-13-86 | 23.82 | 05-13-86 | 00010 | 15.5 |
| | | | | | | -- | -- | 05-13-86 | 00095 | 900 |
| 05N.09E.33.221A | 34°37'23" | 105°59'41" | 6,068 | S | 70 | 05-13-86 | 23.10 | 04-13-86 | 00095 | 2,500 |
| 05N.10E.15.422 | 34°39'34" | 105°52'05" | 6,108 | H | 50 | -- | -- | 07-22-87 | 00095 | 6,270 |
| 05N.10E.27.444 | 34°37'08" | 105°52'26" | 6,105 | I | -- | 02-22-85 | 43.33 | -- | -- | -- |
| 06N.07E.10.233 | 34°45'42" | 106°11'28" | 6,405 | S | -- | 05-21-87 | 103.47 | -- | -- | -- |
| 06N.07E.10.4133 | 34°45'28" | 106°11'33" | 6,420 | I | -- | 02-22-85 | 122.55 | -- | -- | -- |
| 06N.07E.14.424 | 34°44'37" | 106°09'59" | 6,338 | S | -- | 05-21-87 | 185.8 | 05-21-87 | 00010 | 15.5 |
| | | | | | | -- | -- | 05-21-87 | 00095 | 480 |
| 06N.07E.25.411 | 34°43'04" | 106°09'27" | 6,240 | I | -- | 02-22-85 | 92.30 | -- | -- | -- |
| 06N.08E.01.411 | 34°46'29" | 106°03'01" | 6,110 | I | 312 | 04-22-86 | 33.83 | -- | -- | -- |
| 06N.08E.01.412 | 34°46'31" | 106°02'58" | 6,109 | S | -- | 04-22-86 | 36.15 | 04-22-86 | 00010 | 15.5 |
| | | | | | | -- | -- | 04-22-86 | 00095 | 1,450 |
| 06N.08E.02.343 | 34°46'07" | 106°04'25" | 6,135 | I | -- | 04-24-86 | 61.71 | -- | -- | -- |
| 06N.08E.03.221 | 34°46'58" | 106°04'51" | 6,151 | U | -- | 02-22-85 | 90.94 | -- | -- | -- |
| | | | | | | 04-18-86 | 90.86 | -- | -- | -- |
| 06N.08E.03.221A | 34°46'58" | 106°04'56" | 6,156 | U | -- | 04-18-86 | 95.54 | -- | -- | -- |
| 06N.08E.05.321 | 34°46'30" | 106°07'28" | 6,295 | I | -- | 04-18-86 | 128.22 | -- | -- | -- |
| 06N.08E.06.113 | 34°46'50" | 106°08'51" | 6,333 | I | -- | 05-21-87 | 165.70 | -- | -- | -- |

Table 2.--Well data for the Estancia Basin, 1985-89--Continued

| Local well number | Latitude | Longitude | Altitude of land surface (feet above sea level) | Primary use of water | Depth of well (feet) | Water-level measurement date | Water level (feet below land surface) | Water-quality measurement date | Water-quality parameter code | Water-quality value |
|---|---|---|---|---|---|---|---|---|---|---|
| 06N.08E.08.321 | 34°45'40" | 106°07'35" | 6,260 | U | -- | 04-25-86 | 122.86 | -- | -- | -- |
| 06N.08E.10.111 | 34°46'05" | 106°05'43" | 6,204 | I | -- | 04-24-86 | 118.53 | -- | -- | -- |
| 06N.08E.10.333 | 34°45'15" | 106°05'48" | 6,188 | I | -- | 02-22-85 | 104.98 | -- | -- | -- |
| | | | | | | 04-25-86 | 108.27 | -- | -- | -- |
| 06N.08E.11.321 | 34°45'39" | 106°04'18" | 6,141 | P | -- | -- | -- | 07-08-86 | 00010 | 14 |
| | | | | | | -- | -- | 07-08-86 | 00095 | 478 |
| 06N.08E.11.444 | 34°45'22" | 106°03'46" | 6,119 | P | -- | -- | -- | 07-08-86 | 00010 | 14 |
| | | | | | | -- | -- | 07-08-86 | 00095 | 525 |
| 06N.08E.21.232 | 34°44'05" | 106°06'07" | 6,207 | I | -- | 04-30-86 | 107.32 | -- | -- | -- |
| 06N.08E.23.433 | 34°43'31" | 106°04'02" | 6,122 | U | -- | 04-30-86 | 32.00 | -- | -- | -- |
| 06N.08E.27.313 | 34°42'53" | 106°05'44" | 6,172 | I | 140 | 04-30-86 | 76.73 | -- | -- | -- |
| 06N.08E.32.212 | 34°42'34" | 106°07'08" | 6,174 | I | 209 | 02-22-85 | 77.98 | 04-30-86 | 00010 | 15 |
| | | | | | | 01-15-86 | 79.29 | 04-30-86 | 00095 | 425 |
| | | | | | | 09-04-86 | 83.51 | 09-01-87 | 00010 | 14.5 |
| | | | | | | 03-31-87 | 78.44 | 09-01-87 | 00095 | 504 |
| | | | | | | 09-08-87 | 82.21 | -- | -- | -- |
| | | | | | | 01-28-88 | 78.16 | -- | -- | -- |
| | | | | | | 08-11-88 | 82.46 | -- | -- | -- |
| | | | | | | 02-21-89 | 77.08 | -- | -- | -- |
| 06N.08E.33.133 | 34°42'13" | 106°06'47" | 6,176 | I | -- | -- | -- | 04-30-86 | 00010 | 15.5 |
| | | | | | | -- | -- | 04-30-86 | 00095 | 510 |
| | | | | | | -- | -- | 09-04-86 | 00010 | 15 |
| | | | | | | -- | -- | 09-04-86 | 00095 | 550 |
| 06N.09E.02.433 | 34°46'12" | 105°57'48" | 6,086 | H | -- | -- | -- | 08-26-86 | 00095 | 2,500 |
| 06N.09E.08.222 | 34°46'05" | 106°00'32" | 6,091 | U | -- | 08-26-86 | 15.31 | -- | -- | -- |
| 06N.09E.11.211 | 34°46'05" | 105°57'45" | 6,086 | I | 140 | 02-22-85 | 15.58 | -- | -- | -- |
| | | | | | | 08-08-85 | 24.22 | -- | -- | -- |
| | | | | | | 01-15-86 | 14.99 | -- | -- | -- |
| | | | | | | 08-26-86 | 16.06 | -- | -- | -- |
| | | | | | | 03-31-87 | 14.13 | -- | -- | -- |

Table 2.--Well data for the Estancia Basin, 1985-89--Continued

| Local well number | Latitude | Longitude | Altitude of land surface (feet above sea level) | Primary use of water | Depth of well (feet) | Water-level measurement date | Water level (feet below land surface) | Water-quality measurement date | Water-quality parameter code | Water-quality value |
|---|---|---|---|---|---|---|---|---|---|---|
| 06N.09E.11.211 | 34°46'05" | 105°57'45" | 6,086 | I | 140 | 08-11-87 | 14.89 | – | – | – |
| | | | | | | 01-28-88 | 13.95 | – | – | – |
| | | | | | | 08-11-88 | 15.05 | – | – | – |
| | | | | | | 02-21-89 | 13.82 | – | – | – |
| 06N.09E.15.433 | 34°44'23" | 105°58'53" | 6,085 | S | 80-100 R | – | – | 09-11-86 | 00010 | 14.5 |
| | | | | | | – | – | 09-11-86 | 00095 | 2,050 |
| | | | | | | – | – | 09-11-86 | 00010 | 14.5 |
| | | | | | | – | – | 09-11-86 | 00095 | 4,850 |
| 06N.09E.16.433 | 34°44'23" | 105°59'57" | 6,083 | S | 27 | – | – | 11-18-87 | 00010 | 12.5 |
| | | | | | | – | – | 11-18-87 | 00095 | 4,860 |
| 06N.09E.18.311 | 34°44'47" | 106°02'33" | 6,094 | S | – | – | – | 09-11-86 | 00010 | 13 |
| | | | | | | – | – | 09-11-86 | 00095 | 4,550 |
| 06N.09E.19.111 | 34°44'20" | 106°02'32" | 6,094 | S | – | – | – | 09-09-87 | 00010 | 14 |
| | | | | | | – | – | 09-09-87 | 00095 | 856 |
| 06N.09E.27.221 | 34°43'29" | 105°58'38" | 6,085 | H | – | – | – | 05-03-85 | 00095 | 2,400 |
| 06N.09E.33.333 | 34°41'48" | 106°00'27" | 6,084 | S | – | 05-03-85 | 19.95 | – | – | – |
| 06N.10E.05.312A | 34°46'20" | 105°55'13" | 6,090 | I | – | 02-22-85 | 17.45 | – | – | – |
| 06N.10E.07.112 | 34°46'03" | 105°56'07" | 6,080 | S | – | 02-22-85 | 13.44 | – | – | – |
| 06N.10E.08.112 | 34°46'05" | 105°55'02" | 6,088 | I | 169 | 09-11-86 | 15.09 | – | – | – |
| 06N.10E.12.3442 | 34°45'08" | 105°51'05" | – | I | – | 02-22-85 | 39.70 | – | – | – |
| 06N.10E.27.444 | 34°42'42" | 105°52'08" | 6,100 | I | – | 07-12-88 | 26.65 | 07-12-88 | 00010 | 13 |
| | | | | | | – | – | 07-12-88 | 00095 | 3,760 |
| 06N.11E.08.211 | 34°45'51" | 105°48'57" | 6,150 | I | – | 02-22-85 | 74.09 | – | – | – |
| 06N.11E.10.211 | 34°45'51" | 105°46'50" | 6,240 | I | – | 02-22-85 | 78.98 | – | – | – |
| 07N.07E.01.233 | 34°51'45" | 106°09'22" | 6,418 | I | 200 | 02-21-85 | 124.25 | – | – | – |
| 07N.07E.13.4312 | 34°49'45" | 106°09'13" | 6,390 | U | – | 02-21-85 | 110.32 | – | – | – |
| | | | | | | 08-08-85 | 110.36 | – | – | – |
| | | | | | | 01-15-86 | 110.31 | – | – | – |
| | | | | | | 08-14-86 | 110.28 | – | – | – |
| | | | | | | 03-31-87 | 110.29 | – | – | – |

## Table 2.--Well data for the Estancia Basin, 1985-89--Continued

| Local well number | Latitude | Longitude | Altitude of land surface (feet above sea level) | Primary use of water | Depth of well (feet) | Water-level measurement date | Water level (feet below land surface) | Water-quality measurement date | Water-quality parameter code | Water-quality value |
|---|---|---|---|---|---|---|---|---|---|---|
| 07N.07E.17.4444 | 34°49'35" | 106°13'10" | 6,615 | I | 280 | 09-01-87 | 110.29 | – | – | – |
| | 02-21-85 | 218.80 | – | – | – | | | | | |
| 07N.08E.02.242 | 34°51'59" | 106°03'39" | 6,155 | I | – | – | – | 07-30-86 | 00010 | 16.5 |
| | | | | | | – | – | 07-30-86 | 00095 | 1,200 |
| 07N.08E.06.212 | 34°52'14" | 106°08'11" | 6,340 | I | – | 02-20-85 | 151.57 | – | – | – |
| 07N.08E.09.313 | 34°50'44" | 106°06'48" | 6,278 | U | – | 02-04-86 | 86.38 | – | – | – |
| 07N.08E.09.431 | 34°50'39" | 106°06'17" | 6,261 | I | 127 | 02-21-85 | 76.94 | – | – | – |
| 07N.08E.12.311 | 34°50'55" | 106°03'37" | 6,148 | I | – | 02-04-86 | 94.85 | – | – | – |
| 07N.08E.13.212 | 34°50'25" | 106°02'55" | – | – | – | 02-21-85 | 72.69 | – | – | – |
| 07N.08E.14.212 | 34°50'25" | 106°04'00" | 6,150 | I | – | 04-04-86 | 91.42 | – | – | – |
| 07N.08E.16.142 | 34°50'14" | 106°06'20" | 6,254 | I | 200 | 04-04-86 | 13.20 | – | – | – |
| | | | | | | 09-01-87 | 9.41 | – | – | – |
| | | | | | | 01-28-88 | 3.04 | – | – | – |
| | | | | | | 08-12-88 | 4.63 | – | – | – |
| | | | | | | 02-21-89 | 4.73 | – | – | – |
| 07N.08E.16.231 | 34°50'12" | 106°06'15" | 6,252 | I | 250 | 04-04-86 | 22.86 | – | – | – |
| | | | | | | 09-01-87 | 0.68 | – | – | – |
| | | | | | | 12-10-87 | Flowing | – | – | – |
| | | | | | | 01-28-88 | Flowing | – | – | – |
| | | | | | | 08-12-88 | 1.41 | – | – | – |
| | | | | | | 02-21-89 | 1.86 | – | – | – |
| 07N.08E.16.242 | 34°50'12" | 106°05'47" | 6,242 | I | – | 04-04-86 | 115.90 | – | – | – |
| 07N.08E.16.441 | 34°49'48" | 106°06'00" | 6,233 | I | 356 | 04-04-86 | 83.02 | – | – | – |
| 07N.08E.20.3343 | 34°48'45" | 106°07'41" | 6,310 | I | 170 | 02-21-85 | 151.92 | – | – | – |
| | | | | | | 02-04-86 | 148.46 | – | – | – |
| 07N.08E.24.313 | 34°49'02" | 106°03'37" | 6,138 | I | – | – | – | 07-30-86 | 00010 | 14.5 |
| | | | | | | – | – | 07-30-86 | 00095 | 800 |
| 07N.08E.25.121 | 34°48'43" | 106°03'22" | 6,131 | U | 200 | 02-21-85 | 48.55 | – | – | – |
| | | | | | | 04-07-86 | 51.61 | – | – | – |
| | | | | | | 04-18-86 | 58.91 | – | – | – |

Table 2.--Well data for the Estancia Basin, 1985-89--Continued

| Local well number | Latitude | Longitude | Altitude of land surface (feet above sea level) | Primary use of water | Depth of well (feet) | Water-level measurement date | Water level (feet below land surface) | Water-quality measurement date | Water-quality parameter code | Water-quality value |
|---|---|---|---|---|---|---|---|---|---|---|
| 07N.08E.25.121 | 34°48'43" | 106°03'22" | 6,131 | U | 200 | 04-24-86 | 64.37 | -- | -- | -- |
| | | | | | | 04-29-86 | 64.50 | -- | -- | -- |
| | | | | | | 05-05-86 | 62.70 | -- | -- | -- |
| | | | | | | 05-07-86 | 65.49 | -- | -- | -- |
| | | | | | | 05-12-86 | 62.47 | -- | -- | -- |
| | | | | | | 05-21-86 | 65.71 | -- | -- | -- |
| | | | | | | 06-06-86 | 60.95 | -- | -- | -- |
| | | | | | | 06-18-86 | 60.84 | -- | -- | -- |
| | | | | | | 07-08-86 | 60.00 | -- | -- | -- |
| | | | | | | 08-12-86 | 61.08 | -- | -- | -- |
| | | | | | | 08-19-86 | 62.01 | -- | -- | -- |
| | | | | | | 09-04-86 | 63.99 | -- | -- | -- |
| | | | | | | 09-17-86 | 58.04 | -- | -- | -- |
| | | | | | | 11-18-86 | 53.46 | -- | -- | -- |
| | | | | | | 01-05-87 | 51.67 | -- | -- | -- |
| | | | | | | 02-10-87 | 50.99 | -- | -- | -- |
| | | | | | | 03-31-87 | 50.34 | -- | -- | -- |
| | | | | | | 04-21-87 | 50.42 | -- | -- | -- |
| | | | | | | 06-03-87 | 51.00 | -- | -- | -- |
| | | | | | | 07-02-87 | 50.31 | -- | -- | -- |
| | | | | | | 08-11-87 | 50.70 | -- | -- | -- |
| | | | | | | 09-04-87 | 50.25 | -- | -- | -- |
| | | | | | | 10-27-87 | 50.92 | -- | -- | -- |
| | | | | | | 12-02-87 | 50.04 | -- | -- | -- |
| | | | | | | 01-28-88 | 49.33 | -- | -- | -- |
| | | | | | | 02-09-88 | 49.16 | -- | -- | -- |
| | | | | | | 04-12-88 | 49.66 | -- | -- | -- |
| | | | | | | 07-12-88 | 53.61 | -- | -- | -- |
| | | | | | | 09-12-88 | 52.22 | -- | -- | -- |

Table 2.--Well data for the Estancia Basin, 1985-89--Continued

| Local well number | Latitude | Longitude | Altitude of land surface (feet above sea level) | Primary use of water | Depth of well (feet) | Water-level measurement date | Water level (feet below land surface) | Water-quality measurement date | Water-quality parameter code | Water-quality value |
|---|---|---|---|---|---|---|---|---|---|---|
| 07N.08E.25.121 | 34°48'43" | 106°03'22" | 6,131 | U | 200 | 09-27-88 | 50.47 | – | – | – |
| | | | | | | 02-21-89 | 49.65 | – | – | – |
| 07N.08E.25.212 | 34°48'43" | 106°02'50" | 6,120 | S | – | – | – | 04-07-86 | 00010 | 16 |
| | | | | | | – | – | 04-07-86 | 00095 | 640 |
| 07N.08E.26.221 | 34°48'43" | 106°03'51" | 6,139 | I | 250 | 04-07-86 | 70.11 | 07-30-86 | 00010 | 17 |
| | | | | | | – | – | 07-30-86 | 00095 | 600 |
| 07N.08E.33.424 | 34°47'14" | 106°05'47" | 6,202 | U | – | 04-10-86 | 77.19 | – | – | – |
| 07N.08E.33.444 | 34°47'02" | 106°05'51" | 6,203 | S | – | – | – | 04-18-86 | 00010 | 15 |
| | | | | | | – | – | 04-18-86 | 00095 | 710 |
| 07N.08E.35.124 | 34°47'42" | 106°04'10" | 6,145 | U | – | 09-17-86 | 57.82 | – | – | – |
| 07N.08E.36.211 | 34°47'51" | 106°03'05" | 6,120 | I | – | – | – | 04-10-86 | 00010 | 15 |
| | | | | | | – | – | 04-10-86 | 00095 | 850 |
| 07N.08E.36.233 | 34°47'28" | 106°03'06" | 6,118 | I | – | 04-10-86 | 50.07 | – | – | – |
| 07N.08E.36.343 | 34°47'02" | 106°03'18" | 6,122 | S | – | 04-18-86 | 37.09 | 04-10-86 | 00010 | 14 |
| | | | | | | – | – | 04-10-86 | 00095 | 525 |
| 07N.08E.36.434 | 34°47'02" | 106°02'56" | 6,116 | I | – | 04-10-86 | 37.21 | – | – | – |
| 07N.09E.02.222 | 34°51'54" | 105°57'23" | 6,151 | U | 90 | 02-21-85 | 69.71 | – | – | – |
| 07N.09E.05.111 | 34°52'12" | 106°01'33" | 6,133 | S | 414 | 02-21-85 | 65.10 | – | – | – |
| 07N.09E.05.323 | 34°51'32" | 106°01'18" | 6,137 | I | – | – | – | 08-28-86 | 00010 | 15 |
| | | | | | | – | – | 08-28-86 | 00095 | 1,900 |
| 07N.09E.05.412 | 34°51'46" | 106°00'51" | 6,128 | I | – | 03-27-86 | 68.96 | 08-28-86 | 00010 | 15 |
| | | | | | | – | – | 08-28-86 | 00095 | 1,900. |
| 07N.09E.06.211 | 34°52'12" | 106°02'04" | 6,134 | I | – | – | – | 07-30-86 | 00010 | 14 |
| | | | | | | – | – | 07-30-86 | 00095 | 1,800 |
| 07N.09E.06.334 | 34°51'22" | 106°02'24" | 6,132 | U | – | 03-27-86 | 69.59 | – | – | – |
| | | | | | | 08-28-86 | 95.10 | – | – | – |
| 07N.09E.17.221 | 34°50'11" | 106°00'49" | 6,133 | I | – | 02-21-85 | 44.42 | – | – | – |
| 07N.09E.18.211 | 34°50'23" | 106°02'04" | 6,122 | – | 370 | – | – | 03-27-86 | 00010 | 15.5 |

## Table 2.--Well data for the Estancia Basin, 1985-89--Continued

| Local well number | Latitude | Longitude | Altitude of land surface (feet above sea level) | Primary use of water | Depth of well (feet) | Water-level measurement date | Water level (feet below land surface) | Water-quality measurement date | Water-quality parameter code | Water-quality value |
|---|---|---|---|---|---|---|---|---|---|---|
| 07N.09E.18.211 | 34°50'23" | 106°02'04" | 6,122 | – | 370 | – | – | 03-27-86 | 00095 | 1,200 |
| 07N.09E.18.211A | 34°50'25" | 106°02'03" | 6,122 | – | 60 | – | – | 03-27-86 | 00010 | 15 |
| | | | | | | – | – | 03-27-86 | 00095 | 1,300 |
| 07N.09E.20.133 | 34°49'13" | 106°01'25" | 6,109 | S | 33 | 04-04-86 | 30.74 | – | – | – |
| 07N.09E.31.333 | 34°47'01" | 106°02'33" | 6,109 | S | – | 04-10-86 | 32.04 | – | – | – |
| 07N.10E.08.122 | 34°51'08" | 105°54'55" | 6,145 | I | – | 02-21-85 | 68.18 | – | – | – |
| 08N.08E.06.4322 | 34°56'35" | 106°08'05" | 6,380 | I | – | 02-20-85 | 88.57 | – | – | – |
| 08N.08E.09.413 | 34°55'52" | 106°06'14" | 6,334 | I | – | 02-09-88 | 107.62 | – | – | – |
| 08N.08E.09.4323 | 34°55'40" | 106°06'06" | 6,339 | I | – | 02-20-85 | 127.69 | – | – | – |
| | | | | | | 01-28-86 | 124.68 | – | – | – |
| 08N.08E.11.111 | 34°56'28" | 106°04'42" | 6,238 | I | 280 | 02-20-85 | 139.77 | – | – | – |
| | | | | | | 01-28-86 | 140.44 | – | – | – |
| 08N.08E.12.212 | 34°56'26" | 106°02'55" | 6,199 | I | 180 | 02-20-85 | 98.37 | – | – | – |
| 08N.08E.23.211 | 34°54'39" | 106°04'09" | 6,215 | I | – | 01-28-86 | 134.00 | – | – | – |
| 08N.08E.28.311A | 34°53'24" | 106°06'48" | 6,310 | I | 275 | 01-28-86 | 131.90 | – | – | – |
| 08N.08E.28.4131 | 34°53'23" | 106°06'14" | 6,283 | I | 350 | 02-20-85 | 133.70 | – | – | – |
| 08N.08E.35.322 | 34°52'27" | 106°04'21" | 6,237 | I | 228 | 02-20-85 | 109.01 | – | – | – |
| | | | | | | 08-08-85 | 115.14 | – | – | – |
| | | | | | | 01-14-86 | 105.72 | – | – | – |
| | | | | | | 08-14-86 | 108.03 | – | – | – |
| | | | | | | 03-31-87 | 102.25 | – | – | – |
| | | | | | | 08-18-87 | 101.94 | – | – | – |
| | | | | | | 02-09-88 | 98.98 | – | – | – |
| | | | | | | 08-12-88 | 100.29 | – | – | – |
| | | | | | | 02-21-89 | 96.20 | – | – | – |
| 08N.09E.05.333 | 34°56'31" | 106°01'30" | 6,166 | H | – | – | – | 01-30-86 | 00095 | 1,760 |
| 08N.09E.07.141 | 34°56'16" | 106°02'18" | 6,178 | I | – | – | – | 07-30-86 | 00010 | 17 |
| | | | | | | – | – | 07-30-86 | 00095 | 1,800 |

## Table 2.--Well data for the Estancia Basin, 1985-89--Continued

| Local well number | Latitude | Longitude | Altitude of land surface (feet above sea level) | Primary use of water | Depth of well (feet) | Water-level measurement date | Water level (feet below land surface) | Water-quality measurement date | Water-quality parameter code | Water-quality value |
|---|---|---|---|---|---|---|---|---|---|---|
| 08N.09E.07.211 | 34°56'28" | 106°02'02" | 6,180 | I | 300 | 01-30-86 | 104.20 | 07-30-86 | 00010 | 14.5 |
| | | | | | | – | – | 07-30-86 | 00095 | 1,700 |
| 08N.09E.18.311 | 34°55'09" | 106°02'34" | 6,168 | I | – | – | – | 09-04-86 | 00010 | 16 |
| | | | | | | – | – | 09-04-86 | 00095 | 850 |
| 08N.09E.18.321 | 34°55'09" | 106°02'13" | 6,164 | I | – | – | – | 09-04-86 | 00010 | 15 |
| | | | | | | – | – | 09-04-86 | 00095 | 2,300 |
| 08N.09E.18.412 | 34°55'09" | 106°01'50" | 6,158 | I | – | – | – | 09-04-86 | 00010 | 14 |
| | | | | | | – | – | 09-04-86 | 00095 | 2,100 |
| 08N.09E.19.241 | 34°54'26" | 106°01'41" | 6,152 | I | – | – | – | 09-04-86 | 00010 | 15 |
| | | | | | | – | – | 09-04-86 | 00095 | 2,150 |
| 08N.09E.30.1111 | 34°53'52" | 106°02'35" | 6,153 | I | 200 | 02-20-85 | 84.09 | 08-30-86 | 00010 | 16 |
| | | | | | | 01-30-86 | 86.65 | 08-30-86 | 00095 | 1,800 |
| 08N.09E.30.131 | 34°53'38" | 106°02'35" | 6,152 | I | – | – | – | 09-04-86 | 00010 | 16 |
| | | | | | | – | – | 09-04-86 | 00095 | 1,800 |
| 08N.09E.30.212 | 34°53'52" | 106°01'55" | 6,148 | I | – | – | – | 09-04-86 | 00010 | 15 |
| | | | | | | – | – | 09-04-86 | 00095 | 1,425 |
| 08N.10E.09.134 | 34°56'07" | 105°53'16" | 6,385 | S | – | 09-18-86 | 255.70 | 09-18-86 | 00010 | 17.5 |
| | | | | | | – | – | 09-18-86 | 00095 | 1,200 |
| 09N.07E.21.341 | 34°59'07" | 106°12'07" | 6,750 | H | 80 | – | – | 07-16-87 | 00095 | 1,180 |
| 09N.08E.01.133 | 35°02'02" | 106°02'56" | 6,238 | U | – | 05-14-86 | 67.86 | – | – | – |
| | | | | | | 08-13-86 | 68.72 | – | – | – |
| | | | | | | 04-14-87 | 69.18 | – | – | – |
| 09N.08E.02.313 | 35°01'52" | 106°04'00" | 6,242 | I | – | 05-14-86 | 127.74 | – | – | – |
| 09N.08E.07.222 | 35°01'32" | 106°07'14" | 6,403 | H | 140 | 01-27-86 | 104.73 | – | – | – |
| 09N.08E.07.242 | 35°01'14" | 106°07'19" | 6,403 | H | – | – | – | 05-20-86 | 00095 | 400 |

Table 2.--Well data for the Estancia Basin, 1985-89--Continued

| Local well number | Latitude | Longitude | Altitude of land surface (feet above sea level) | Primary use of water | Depth of well (feet) | Water-level measurement date | Water level (feet below land surface) | Water-quality measurement date | Water-quality parameter code | Water-quality value |
|---|---|---|---|---|---|---|---|---|---|---|
| 09N.08E.10.133 | 35°01'13" | 106°05'04" | 6,266 | I | -- | 05-14-86 | 147.25 | 05-28-86 | 00010 | 16 |
| | | | | | | -- | -- | 05-28-86 | 00095 | 1,350 |
| 09N.08E.11.233 | 35°01'13" | 106°03'30" | 6,240 | I | -- | 05-20-86 | 90.10 | -- | -- | -- |
| 09N.08E.11.411 | 35°01'05" | 106°03'30" | 6,238 | S | -- | -- | -- | 05-20-86 | 00010 | 16 |
| | | | | | | -- | -- | 05-20-86 | 00095 | 1,150 |
| 09N.08E.13.322 | 35°00'12" | 106°02'28" | 6,219 | I | -- | 05-22-86 | 68.40 | 05-22-86 | 00010 | 13.5 |
| | | | | | | -- | -- | 05-22-86 | 00095 | 1,000 |
| 09N.08E.14.242 | 35°00'28" | 106°03'00" | 6,224 | P | 340 | -- | -- | 07-08-86 | 00010 | 14.5 |
| | | | | | | -- | -- | 07-08-86 | 00095 | 1,200 |
| 09N.08E.14.311 | 35°00'10" | 106°03'19" | -- | -- | -- | 02-20-85 | 96.47 | -- | -- | -- |
| 09N.08E.20.133A | 34°59'28" | 106°07'12" | 6,358 | H | -- | 01-27-86 | 92.85 | -- | -- | -- |
| 09N.08E.23.214 | 34°59'39" | 106°03'15" | 6,227 | P | -- | -- | -- | 07-08-86 | 00010 | 14.5 |
| | | | | | | -- | -- | 07-08-86 | 00095 | 1,200 |
| 09N.08E.24.332 | 34°59'05" | 106°02'43" | 6,205 | U | -- | 02-20-85 | 78.26 | -- | -- | -- |
| | | | | | | 08-08-85 | 81.48 | -- | -- | -- |
| | | | | | | 01-14-86 | 79.56 | -- | -- | -- |
| | | | | | | 08-14-86 | 80.01 | -- | -- | -- |
| | | | | | | 03-31-87 | 79.48 | -- | -- | -- |
| | | | | | | 08-18-87 | 80.45 | -- | -- | -- |
| | | | | | | 02-09-88 | 80.82 | -- | -- | -- |
| | | | | | | 08-12-88 | 85.77 | -- | -- | -- |
| | | | | | | 02-21-89 | 81.68 | -- | -- | -- |
| 09N.08E.27.434 | 34°58'05" | 106°04'24" | 6,246 | I | -- | 02-20-85 | 128.76 | -- | -- | -- |
| | | | | | | 01-27-86 | 130.85 | -- | -- | -- |
| 09N.08E.35.214 | 34°57'55" | 106°03'18" | 6,218 | I | 194 | -- | -- | 09-09-87 | 00010 | 14 |
| | | | | | | -- | -- | 09-09-87 | 00095 | 1,120 |
| 09N.09E.03.244 | 35°02'05" | 105°56'41" | 6,195 | U | -- | 10-28-86 | 19.97 | -- | -- | -- |
| 09N.09E.08.142 | 35°01'18" | 106°00'22" | 6,206 | H | 102 | -- | -- | 10-27-86 | 00095 | 2,600 |
| 09N.09E.10.121 | 35°01'33" | 105°58'24" | 6,205 | S | -- | -- | -- | 10-28-86 | 00010 | 21.5 |
| | | | | | | -- | -- | 10-28-86 | 00095 | 6,100 |

Table 2.--Well data for the Estancia Basin, 1985-89--Continued

| Local well number | Latitude | Longitude | Altitude of land surface (feet above sea level) | Primary use of water | Depth of well (feet) | Water-level measure-ment date | Water level (feet below land surface) | Water-quality measure-ment date | Water-quality parameter code | Water-quality value |
|---|---|---|---|---|---|---|---|---|---|---|
| 09N.09E.11.222 | 35°01'35" | 105°56'38" | 6,229 | H | 150 | -- | -- | 10-28-86 | 00095 | 3,000 |
| 09N.09E.11.341 | 35°00'55" | 105°57'22" | 6,220 | I | 260 | 02-19-85 | 82.10 | 10-27-86 | 00010 | 14.5 |
| | | | | | | -- | -- | 10-27-86 | 00095 | 3,200 |
| | | | | | | -- | -- | 09-01-87 | 00095 | 3,160 |
| 09N.09E.14.122 | 35°00'43" | 105°57'10" | 6,220 | I | 250 | -- | -- | 09-04-87 | 00010 | 14 |
| | | | | | | -- | -- | 09-04-87 | 00095 | 3,930 |
| 09N.09E.16.233 | 35°00'20" | 105°59'15" | 6,194 | S | 75 | 06-19-86 | 59.42 | 10-27-86 | 00010 | 14.5 |
| | | | | | | 09-04-87 | 60.54 | 10-27-86 | 00095 | 3,400 |
| | | | | | | 09-16-87 | 60.43 | 09-16-87 | 00010 | 17 |
| | | | | | | -- | -- | 09-16-87 | 00095 | 3,380 |
| 09N.09E.17.133 | 35°00'19" | 106°00'45" | 6,201 | H | 120 | -- | -- | 10-27-86 | 00095 | 2,400 |
| 09N.09E.17.243 | 35°00'22" | 106°00'00" | 6,176 | H | 60 | -- | -- | 10-27-86 | 00095 | 3,100 |
| 09N.09E.24.111 | 34°59'49" | 105°56'38" | 6,242 | U | -- | 06-19-86 | 102.37 | -- | -- | -- |
| 09N.09E.25.244 | 34°58'35" | 105°55'42" | 6,285 | I | -- | 02-20-85 | 148.83 | -- | -- | -- |
| | | | | | | 09-18-86 | 149.44 | -- | -- | -- |
| 09N.09E.25.433 | 34°58'08" | 105°56'05" | 6,265 | H | 180 | -- | -- | 09-18-86 | 00095 | 2,300 |
| 09N.09E.28.243 | 34°58'33" | 105°58'56" | 6,180 | Z | -- | 02-20-85 | 42.28 | -- | -- | -- |
| | | | | | | 06-19-86 | 43.85 | -- | -- | -- |
| 09N.10E.18.233 | 35°00'22" | 105°55'00" | 6,222 | C | 460 | -- | -- | 09-18-86 | 00095 | 3,500 |
| 09N.10E.32.324 | 34°57'34" | 105°54'01" | 6,328 | H | 240 | -- | -- | 09-18-86 | 00095 | 850 |
| 09N.10E.32.422 | 34°57'40" | 105°53'28" | 6,320 | S | -- | -- | -- | 09-18-86 | 00010 | 15 |
| | | | | | | -- | -- | 09-18-86 | 00095 | 1,200 |
| 10N.07E.03.333 | 35°06'52" | 106°11'24" | 6,580 | H | 500 | -- | -- | 10-09-86 | 00095 | 850 |
| 10N.07E.03.444 | 35°06'49" | 106°10'27" | 6,540 | H | 287 | 05-09-85 | 156.46 | 05-09-85 | 00010 | 13 |
| | | | | | | -- | -- | 05-09-85 | 00095 | 450 |
| | | | | | | -- | -- | 05-09-85 | 00400 | 7.7 |
| 10N.07E.11.111 | 35°06'45" | 106°10'21" | 6,530 | U | 154 | 05-09-85 | 151.28 | -- | -- | -- |
| | | | | | | 04-01-88 | 152.64 | -- | -- | -- |
| 10N.07E.12.434 | 35°05'58" | 106°08'35" | 6,450 | H | -- | -- | -- | 09-03-86 | 00095 | 725 |

Table 2.--Well data for the Estancia Basin, 1985-89--Continued

| Local well number | Latitude | Longitude | Altitude of land surface (feet above sea level) | Primary use of water | Depth of well (feet) | Water-level measurement date | Water level (feet below land surface) | Water-quality measurement date | Water-quality parameter code | Water-quality value |
|---|---|---|---|---|---|---|---|---|---|---|
| 10N.07E.15.334A | 35°05'05" | 106°11'18" | 6,555 | H | 365 | 04-30-85 | 257.24 | 04-30-85 | 00010 | 14 |
| | | | | | | -- | -- | 04-30-85 | 00095 | 1,000 |
| | | | | | | -- | -- | 04-30-85 | 00400 | 6.4 |
| 10N.07E.16.443 | 35°05'06" | 106°11'42" | 6,582 | P | -- | -- | -- | 06-02-86 | 00095 | 850 |
| 10N.07E.17.234 | 35°05'33" | 106°12'53" | 6,595 | H | 480 | 05-01-85 | 286.15 | 05-01-85 | 00010 | 14 |
| | | | | | | -- | -- | 05-01-85 | 00095 | 520 |
| | | | | | | -- | -- | 05-01-85 | 00400 | 7.1 |
| 10N.07E.17.234A | 35°05'31" | 106°12'52" | 6,590 | H | 493 | -- | -- | 05-01-85 | 00010 | 16.5 |
| | | | | | | -- | -- | 05-01-85 | 00095 | 1,180 |
| | | | | | | -- | -- | 05-01-85 | 00400 | 6.3 |
| 10N.07E.17.241 | 35°05'35" | 106°12'45" | 6,597 | H | 420 | 05-03-85 | 295.30 | 05-03-85 | 00010 | 16.5 |
| | | | | | | -- | -- | 05-03-85 | 00095 | 510 |
| | | | | | | -- | -- | 05-03-85 | 00400 | 7 |
| 10N.07E.17.243 | 35°05'28" | 106°12'39" | 6,582 | H | 520 | 05-03-85 | 300.13 | 05-03-85 | 00010 | 16 |
| | | | | | | -- | -- | 05-03-85 | 00095 | 725 |
| | | | | | 520 | -- | -- | 05-03-85 | 00400 | 6.9 |
| 10N.07E.17.244 | 35°05'32" | 106°12'35" | 6,579 | H | 420 | -- | -- | 05-01-85 | 00010 | 10.5 |
| | | | | | | -- | -- | 05-01-85 | 00095 | 1,000 |
| | | | | | | -- | -- | 05-01-85 | 00400 | 6.4 |
| 10N.07E.17.422 | 35°05'23" | 106°12'38" | 6,594 | H | 540 | -- | -- | 05-03-85 | 00010 | 14 |
| | | | | | | -- | -- | 05-03-85 | 00095 | 1,280 |
| | | | | | | -- | -- | 05-03-85 | 00400 | 6.3 |
| 10N.07E.17.431 | 35°05'13" | 106°12'56" | 6,645 | H | 510 | -- | -- | 05-01-85 | 00010 | 12.5 |
| | | | | | | -- | -- | 05-01-85 | 00095 | 1,030 |
| | | | | | | -- | -- | 05-01-85 | 00400 | 6.7 |
| 10N.07E.17.441 | 35°05'09" | 106°12'41" | 6,625 | H | 400 | -- | -- | 05-01-85 | 00010 | 14.5 |
| | | | | | | -- | -- | 05-01-85 | 00095 | 1,150 |
| | | | | | | -- | -- | 05-01-85 | 00400 | 6.3 |
| 10N.07E.19.412 | 35°04'23" | 106°13'53" | 6,696 | U | 450 | 05-07-85 | 387.20 | -- | -- | -- |
| 10N.07E.19.412A | 35°04'35" | 106°13'56" | 6,687 | H | 460 | -- | -- | 05-07-85 | 00010 | 14 |

## Table 2.--Well data for the Estancia Basin, 1985-89--Continued

| Local well number | Latitude | Longitude | Altitude of land surface (feet above sea level) | Primary use of water | Depth of well (feet) | Water-level measurement date | Water level (feet below land surface) | Water-quality measurement date | Water-quality parameter code | Water-quality value |
|---|---|---|---|---|---|---|---|---|---|---|
| 10N.07E.19.412A | 35°04'35" | 106°13'56" | 6,687 | H | 460 | – | – | 05-07-85 | 00095 | 1,350 |
| | | | | | | – | – | 05-07-85 | 00400 | 6.4 |
| 10N.07E.20.121 | 35°04'57" | 106°13'18" | 6,662 | H | 435 | 05-06-85 | 357.90 | 05-02-85 | 00010 | 15 |
| | | | | | | – | – | 05-02-85 | 00095 | 650 |
| | | | | | | – | – | 05-02-85 | 00400 | 7.1 |
| 10N.07E.21.112 | 35°04'58" | 106°12'22" | 6,640 | H | 380 | – | – | 05-09-85 | 00010 | 16.5 |
| | | | | | | – | – | 05-09-85 | 00095 | 1,130 |
| | | | | | | – | – | 05-09-85 | 00400 | 6.4 |
| 10N.07E.21.221 | 35°04'58" | 106°11'40" | 6,590 | H | 380 | 05-09-85 | 300.49 | 05-09-85 | 00010 | 15.5 |
| | | | | | | – | – | 05-09-85 | 00095 | 980 |
| | | | | | | – | – | 05-09-85 | 00400 | 6.6 |
| 10N.07E.22.322 | 35°04'34" | 106°10'56" | 6,590 | H | 450 | 05-06-85 | 290.29 | 05-06-85 | 00010 | 15.5 |
| | | | | | | – | – | 05-06-85 | 00095 | 800 |
| | | | | | | – | – | 05-06-85 | 00400 | 6.6 |
| | | | | | | – | – | 06-02-86 | 00010 | 18 |
| | | | | | | – | – | 06-02-86 | 00095 | 770 |
| 10N.07E.22.411 | 35°04'35" | 106°10'55" | 6,592 | P | – | 06-02-86 | 281.65 | – | – | – |
| 10N.07E.24.132 | 35°04'46" | 106°09'09" | 6,450 | I | 238 | 05-07-85 | 131.64 | 05-07-85 | 00010 | 14.5 |
| | | | | | | – | – | 05-07-85 | 00095 | 830 |
| | | | | | | – | – | 05-07-85 | 00400 | 7.1 |
| 10N.07E.24.224 | 35°04'36" | 106°08'19" | 6,428 | I | 264 | 05-08-85 | 141.00 | – | – | – |
| 10N.08E.01.442 | 35°06'56" | 106°01'58" | 6,288 | U | – | 06-30-86 | 141.70 | – | – | – |
| 10N.08E.03.241 | 35°07'26" | 106°04'18" | 6,334 | I | – | – | – | 06-23-86 | 00010 | 16.5 |
| | | | | | | – | – | 06-23-86 | 00095 | 350 |
| 10N.08E.03.244 | 35°07'13" | 106°04'02" | 6,319 | I | – | 06-30-86 | 173.80 | – | – | – |
| | | | | | | 04-01-88 | 175.49 | – | – | – |
| 10N.08E.04.244 | 35°07'14" | 106°05'08" | 6,358 | I | – | – | – | 06-30-86 | 00010 | 16.5 |
| | | | | | | – | – | 06-30-86 | 00095 | 370 |
| 10N.08E.05.144 | 35°07'16" | 106°06'42" | 6,390 | U | – | 07-02-86 | 161.50 | – | – | – |
| 10N.08E.06.222 | 35°07'37" | 106°07'15" | 6,450 | H | – | – | – | 07-02-86 | 00095 | 350 |

Table 2.--Well data for the Estancia Basin, 1985-89--Continued

| Local well number | Latitude | Longitude | Altitude of land surface (feet above sea level) | Primary use of water | Depth of well (feet) | Water-level measurement date | Water level (feet below land surface) | Water-quality measurement date | Water-quality parameter code | Water-quality value |
|---|---|---|---|---|---|---|---|---|---|---|
| 10N.08E.07.413 | 35°06'08" | 106°07'38" | 6,437 | S | 180 | 09-03-86 | 168.00 | -- | -- | -- |
| 10N.08E.11.332A | 35°06'07" | 106°03'54" | 6,308 | I | -- | 06-23-86 | 157.72 | -- | -- | -- |
| | | | | | | 07-09-87 | 159.35 | -- | -- | -- |
| | | | | | | 02-09-88 | 160.20 | -- | -- | -- |
| 10N.08E.12.413 | 35°06'11" | 106°02'25" | 6,285 | I | -- | -- | -- | 06-23-86 | 00010 | 17 |
| | | | | | | -- | -- | 06-23-86 | 00095 | 530 |
| 10N.08E.13.1332 | 35°05'34" | 106°02'53" | 6,274 | I | 513 | 02-19-85 | 137.65 | 05-28-86 | 00010 | 17.5 |
| | | | | | | 01-14-86 | 134.58 | 05-28-86 | 00095 | 810 |
| | | | | | | 08-13-86 | 146.65 | -- | -- | -- |
| | | | | | | 04-01-87 | 134.72 | -- | -- | -- |
| | | | | | | 08-18-87 | 141.46 | -- | -- | -- |
| | | | | | | 02-09-88 | 134.59 | -- | -- | -- |
| | | | | | | 02-21-89 | 137.07 | -- | -- | -- |
| 10N.08E.13.3231 | 35°05'20" | 106°02'40" | 6,262 | I | -- | -- | -- | 05-28-86 | 00010 | 17.5 |
| | | | | | | -- | -- | 05-28-86 | 00095 | 1,150 |
| 10N.08E.14.231 | 35°05'41" | 106°03'28" | 6,289 | I | -- | 05-28-86 | 153.45 | -- | -- | -- |
| 10N.08E.14.424 | 35°05'18" | 106°03'00" | 6,258 | I | -- | -- | -- | 05-28-86 | 00010 | 17 |
| | | | | | | -- | -- | 05-28-86 | 00095 | 900 |
| 10N.08E.14.433 | 35°05'03" | 106°03'29" | 6,260 | I | -- | 04-14-87 | 121.17 | 05-28-86 | 00010 | 18 |
| | | | | | | -- | -- | 05-28-86 | 00095 | 495 |
| 10N.08E.20.231 | 35°04'45" | 106°06'40" | 6,349 | I | -- | 09-03-86 | 195.50 | 09-03-86 | 00010 | 15 |
| | | | | | | -- | -- | 09-03-86 | 00095 | 450 |
| 10N.08E.20.444 | 35°04'10" | 106°06'15" | 6,325 | H | -- | -- | -- | 09-03-86 | 00010 | 15.5 |
| | | | | | | -- | -- | 09-03-86 | 00095 | 440 |
| 10N.08E.21.221 | 35°05'01" | 106°05'19" | 6,318 | U | 270 | 02-19-85 | 158.55 | -- | -- | -- |
| 10N.08E.22.322 | 35°04'33" | 106°04'34" | 6,295 | S | -- | 09-03-86 | 143.10 | 09-03-86 | 00010 | 15.5 |
| | | | | | | -- | -- | 09-03-86 | 00095 | 375 |
| 10N.08E.23.111 | 35°05'02" | 106°04'02" | 6,270 | I | -- | -- | -- | 09-03-86 | 00010 | 17.5 |
| | | | | | | -- | -- | 09-03-86 | 00095 | 510 |
| 10N.08E.24.114 | 35°04'49" | 106°02'43" | 6,253 | I | -- | -- | -- | 05-28-86 | 00010 | 19.5 |

Table 2.--Well data for the Estancia Basin, 1985-89--Continued

| Local well number | Latitude | Longitude | Altitude of land surface (feet above sea level) | Primary use of water | Depth of well (feet) | Water-level measurement date | Water level (feet below land surface) | Water-quality measurement date | Water-quality parameter code | Water-quality value |
|---|---|---|---|---|---|---|---|---|---|---|
| 10N.08E.24.114 | 35°04'49" | 106°02'43" | 6,253 | I | -- | -- | -- | 05-28-86 | 00095 | 1,580 |
| 10N.08E.25.3111 | 35°03'43" | 106°02'57" | 6,261 | I | 238 | 02-19-85 | 124.84 | 08-13-86 | 00010 | 15 |
| | | | | | | -- | -- | 08-13-86 | 00095 | 2,400 |
| | | | | | | -- | -- | 04-14-87 | 00010 | 13.5 |
| | | | | | | -- | -- | 04-14-87 | 00095 | 2,400 |
| 10N.08E.25.312 | 35°03'40" | 106°02'43" | 6,265 | -- | -- | -- | -- | 05-28-86 | 00010 | 15 |
| | | | | | | -- | -- | 05-28-86 | 00095 | 2,150 |
| 10N.08E.27.432 | 35°03'32" | 106°04'18" | 6,253 | I | -- | -- | -- | 09-10-86 | 00010 | 15.5 |
| | | | | | | -- | -- | 09-10-86 | 00095 | 1,550 |
| 10N.08E.33.133 | 35°02'58" | 106°06'08" | 6,322 | I | -- | -- | -- | 05-14-86 | 00010 | 18 |
| | | | | | | -- | -- | 05-14-86 | 00095 | 900 |
| 10N.08E.33.431 | 35°02'36" | 106°05'33" | 6,294 | I | -- | -- | -- | 05-14-86 | 00010 | 17 |
| | | | | | | -- | -- | 05-14-86 | 00095 | 950 |
| 10N.08E.35.233 | 35°02'55" | 106°03'27" | 6,250 | I | 270 | -- | -- | 05-14-86 | 00010 | 14.5 |
| | | | | | | -- | -- | 05-14-86 | 00095 | 1,850 |
| | | | | | | -- | -- | 08-13-86 | 00010 | 13.5 |
| | | | | | | -- | -- | 08-13-86 | 00095 | 2,000 |
| | | | | | | -- | -- | 04-14-87 | 00010 | 14 |
| | | | | | | -- | -- | 04-14-87 | 00095 | 1,750 |
| | | | | | | -- | -- | 08-12-87 | 00010 | 14 |
| | | | | | | -- | -- | 08-12-87 | 00095 | 2,150 |
| 10N.08E.35.312 | 35°02'52" | 106°03'48" | 6,255 | I | -- | -- | -- | 05-14-86 | 00010 | 16 |
| | | | | | | -- | -- | 05-14-86 | 00095 | 1,400 |
| | | | | | | -- | -- | 04-14-87 | 00010 | 15.5 |
| | | | | | | -- | -- | 04-14-87 | 00095 | 1,450 |
| 10N.08E.35.33112 | 35°02'30" | 106°03'54" | 6,250 | I | 188 | 02-19-85 | 115.24 | -- | -- | -- |
| 10N.08E.35.413 | 35°02'42" | 106°03'27" | 6,245 | I | -- | -- | -- | 05-14-86 | 00010 | 15 |
| | | | | | | -- | -- | 05-14-86 | 00095 | 1,700 |
| | | | | | | -- | -- | 08-13-86 | 00010 | 14 |

Table 2.--Well data for the Estancia Basin, 1985-89--Continued

| Local well number | Latitude | Longitude | Altitude of land surface (feet above sea level) | Primary use of water | Depth of well (feet) | Water-level measurement date | Water level (feet below land surface) | Water-quality measurement date | Water-quality parameter code | Water-quality value |
|---|---|---|---|---|---|---|---|---|---|---|
| 10N.08E.35.413 | 35°02'42" | 106°03'27" | 6,245 | I | -- | -- | -- | 08-13-86 | 00095 | 1,850 |
| | | | | | | -- | -- | 04-14-87 | 00010 | 14 |
| | | | | | | -- | -- | 04-14-87 | 00095 | 1,750 |
| 10N.08E.36.1112 | 35°03'17" | 106°02'52" | 6,222 | I | 231 | -- | -- | 08-13-86 | 00010 | 14 |
| | | | | | | -- | -- | 08-13-86 | 00095 | 1,900 |
| 10N.09E.01.331 | 35°06'58" | 105°56'37" | 6,294 | S | -- | 07-21-86 | 66.98 | -- | -- | -- |
| 10N.09E.03.313 | 35°07'05" | 105°58'38" | 6,270 | S | -- | 07-21-86 | 127.24 | 07-21-86 | 00010 | 15 |
| | | | | | | -- | -- | 07-21-86 | 00095 | 430 |
| 10N.09E.05.1113 | 35°07'37" | 106°00'48" | 6,260 | I | 325 | 02-19-85 | 123.35 | -- | -- | -- |
| 10N.09E.07.143 | 35°06'24" | 106°01'36" | 6,260 | I | -- | -- | -- | 06-23-86 | 00010 | 17.5 |
| | | | | | | -- | -- | 06-23-86 | 00095 | 710 |
| 10N.09E.07.323 | 35°06'13" | 106°01'38" | 6,267 | U | -- | 06-23-86 | 133.95 | -- | -- | -- |
| | | | | | | 04-14-87 | 128.42 | -- | -- | -- |
| 10N.09E.07.341 | 35°06'05" | 106°01'38" | 6,258 | I | -- | -- | -- | 06-23-86 | 00010 | 19 |
| | | | | | | -- | -- | 06-23-86 | 00095 | 1,500 |
| 10N.09E.08.111 | 35°06'43" | 106°00'50" | 6,255 | I | -- | 04-14-87 | 116.51 | 07-18-86 | 00010 | 15 |
| | | | | | | -- | -- | 07-18-86 | 00095 | 625 |
| 10N.09E.10.222 | 35°06'45" | 105°57'43" | 6,292 | S | -- | -- | -- | 07-21-86 | 00095 | 500 |
| 10N.09E.10.311 | 35°06'22" | 105°58'35" | 6,262 | S | -- | -- | -- | 07-16-86 | 00010 | 14.5 |
| | | | | | | -- | -- | 07-16-86 | 00095 | 420 |
| 10N.09E.19.121 | 35°05'01" | 106°01'33" | 6,243 | I | -- | 05-28-86 | 117.13 | -- | -- | -- |
| 10N.09E.20.214 | 35°04'50" | 106°00'05" | 6,220 | I | -- | -- | -- | 06-23-86 | 00095 | 2,980 |
| 10N.09E.21.343 | 35°04'13" | 105°59'30" | 6,212 | I | -- | -- | -- | 05-22-86 | 00010 | 16 |
| | | | | | | -- | -- | 05-22-86 | 00095 | 2,700 |
| 10N.09E.22.1311 | 35°04'51" | 105°58'41" | 6,240 | I | 500 | -- | -- | 06-18-86 | 00010 | 16.5 |
| | | | | | | -- | -- | 06-18-86 | 00095 | 1,300 |

Table 2.--Well data for the Estancia Basin, 1985-89--Continued

| Local well number | Latitude | Longitude | Altitude of land surface (feet above sea level) | Primary use of water | Depth of well (feet) | Water-level measurement date | Water level (feet below land surface) | Water-quality measurement date | Water-quality parameter code | Water-quality value |
|---|---|---|---|---|---|---|---|---|---|---|
| 10N.09E.26.211 | 35°04'10" | 105°57'06" | 6,234 | H | – | – | – | 05-22-86 | 00095 | 2,350 |
| 10N.09E.26.2223 | 35°04'07" | 105°56'41" | 6,232 | I | – | 02-19-85 | 97.37 | 05-22-86 | 00010 | 17.5 |
| | | | | | | 04-21-87 | 92.07 | 05-22-86 | 00095 | 2,450 |
| 10N.09E.26.442 | 35°03'29" | 105°56'42" | 6,220 | I | 120 | 04-21-87 | 86.89 | – | – | – |
| 10N.09E.26.442A | 35°03'30" | 105°56'39" | 6,220 | H | – | – | – | 04-21-87 | 00095 | 2,900 |
| 10N.09E.28.131 | 35°03'56" | 105°59'45" | 6,225 | U | – | 07-16-86 | 97.80 | – | – | – |
| 10N.09E.28.231 | 35°03'53" | 105°59'14" | 6,220 | I | – | – | – | 07-16-86 | 00010 | 15.5 |
| | | | | | | – | – | 07-16-86 | 00095 | 3,200 |
| 10N.09E.29.1334 | 35°03'45" | 106°00'46" | 6,244 | I | 140 | 02-19-85 | 105.32 | – | – | – |
| | | | | | | 08-08-85 | 112.90 | – | – | – |
| | | | | | | 01-14-86 | 105.70 | – | – | – |
| | | | | | | 08-13-86 | 115.62 | – | – | – |
| | | | | | | 04-01-87 | 104.12 | – | – | – |
| | | | | | | 08-18-87 | 111.28 | – | – | – |
| | | | | | | 02-09-88 | 104.51 | – | – | – |
| | | | | | | 02-21-89 | 105.50 | – | – | – |
| 10N.09E.30.424 | 35°03'37" | 106°00'54" | 6,275 | I | – | – | – | 08-13-86 | 00010 | 16 |
| | | | | | | – | – | 08-13-86 | 00095 | 2,700 |
| 10N.09E.32.211 | 35°03'18" | 106°00'14" | 6,265 | H | – | – | – | 05-20-86 | 00095 | 2,500 |
| 10N.09E.33.11213 | 35°03'18" | 105°59'38" | 6,240 | I | 200 | 02-19-85 | 103.85 | 05-20-86 | 00010 | 15.5 |
| | | | | | | – | – | 05-20-86 | 00095 | 2,650 |
| | | | | | | – | – | 10-28-86 | 00010 | 15 |
| | | | | | | – | – | 10-28-86 | 00095 | 2,900 |
| 10N.09E.35.244 | 35°02'56" | 105°56'40" | 6,210 | S | 150 | – | – | 04-21-87 | 00010 | 14 |
| | | | | | | – | – | 04-21-87 | 00095 | 2,900 |
| 11N.07E.02.444 | 35°12'01" | 106°09'22" | 6,763 | H | – | – | – | 10-09-86 | 00095 | 480 |
| 11N.07E.13.122 | 35°11'03" | 106°08'52" | 6,634 | U | – | 08-18-87 | 360 | – | – | – |
| 11N.07E.13.131 | 35°10'54" | 106°09'14" | 6,685 | H | 318 | – | – | 10-09-86 | 00095 | 385 |
| 11N.07E.15.333 | 35°10'17" | 106°11'23" | 6,810 | H | – | – | – | 10-02-86 | 00095 | 1,100 |
| 11N.07E.22.11134 | 35°10'11" | 106°11'26" | 6,780 | T | 610 | – | – | 10-09-86 | 00095 | 850 |

Table 2.--Well data for the Estancia Basin, 1985-89--Continued

| Local well number | Latitude | Longitude | Altitude of land surface (feet above sea level) | Primary use of water | Depth of well (feet) | Water-level measurement date | Water level (feet below land surface) | Water-quality measurement date | Water-quality parameter code | Water-quality value |
|---|---|---|---|---|---|---|---|---|---|---|
| 11N.07E.23.214 | 35°10'05" | 106°09'37" | 6,662 | H | -- | -- | -- | 10-02-86 | 00095 | 470 |
| 11N.07E.24.224 | 35°04'54" | 106°08'20" | 6,465 | H | 180 | 05-07-85 | 172.00 | 05-08-85 | 00010 | 17.5 |
| | | | | | | -- | -- | 05-08-85 | 00095 | 825 |
| | | | | | | -- | -- | 05-08-85 | 00400 | 6.6 |
| 11N.07E.33.424 | 35°07'54" | 106°11'32" | 6,635 | U | -- | 07-02-86 | 266.15 | -- | -- | -- |
| 11N.07E.34.111 | 35°08'29" | 106°11'26" | 6,625 | H | 375 | -- | -- | 05-10-85 | 00010 | 15 |
| | | | | | | -- | -- | 05-10-85 | 00095 | 600 |
| | | | | | | -- | -- | 05-10-85 | 00400 | 7.1 |
| | | | | | | -- | -- | 07-02-86 | 00095 | 550 |
| 11N.08E.17.134 | 35°10'48" | 106°07'03" | 6,524 | S | -- | -- | -- | 07-18-86 | 00010 | 15.5 |
| | | | | | | -- | -- | 07-18-86 | 00095 | 380 |
| 11N.08E.27.2124 | 35°09'18" | 106°04'19" | 6,332 | I | -- | 04-01-88 | 158.41 | -- | -- | -- |
| 11N.08E.30.211 | 35°09'23" | 106°07'45" | 6,523 | -- | -- | 07-18-86 | 255.72 | 07-18-86 | 00010 | 15.5 |
| | | | | | | -- | -- | 07-18-86 | 00095 | 390 |
| 11N.08E.33.444 | 35°07'40" | 106°05'07" | 6,354 | I | -- | 06-30-86 | 211.60 | -- | -- | -- |
| 11N.09E.14.34434 | 35°10'17" | 105°57'12" | 6,403 | I | 430 | 02-19-85 | 169.56 | -- | -- | -- |
| 11N.09E.15.433 | 35°10'17" | 105°58'11" | -- | U | 100 | 03-30-88 | 74.91 | -- | -- | -- |
| 11N.09E.27.312 | 35°08'55" | 105°58'27" | 6,340 | H | 290 | -- | -- | 10-27-87 | 00095 | 610 |
| 11N.09E.29.143 | 35°08'59" | 106°00'29" | 6,274 | U | -- | 07-16-86 | 125.96 | -- | -- | -- |
| | | | | | | 07-18-86 | 126.04 | -- | -- | -- |
| | | | | | | 09-22-86 | 126.43 | -- | -- | -- |
| | | | | | | 09-23-86 | 126.40 | -- | -- | -- |
| | | | | | | 10-02-86 | 126.40 | -- | -- | -- |
| | | | | | | 11-18-86 | 126.61 | -- | -- | -- |
| | | | | | | 04-01-87 | 125.93 | -- | -- | -- |
| | | | | | | 04-14-87 | 126.00 | -- | -- | -- |
| | | | | | | 06-03-87 | 126.04 | -- | -- | -- |
| | | | | | | 07-02-87 | 126.11 | -- | -- | -- |
| | | | | | | 07-09-87 | 126.26 | -- | -- | -- |
| | | | | | | 08-18-87 | 126.74 | -- | -- | -- |

Table 2.--Well data for the Estancia Basin, 1985-89--Concluded

| Local well number | Latitude | Longitude | Altitude of land surface (feet above sea level) | Primary use of water | Depth of well (feet) | Water-level measurement date | Water level (feet below land surface) | Water-quality measurement date | Water-quality parameter code | Water-quality value |
|---|---|---|---|---|---|---|---|---|---|---|
| 11N.09E.29.143 | 35°08'59" | 106°00'29" | 6,274 | U | -- | 10-27-87 | 126.81 | -- | -- | -- |
| | | | | | | 12-02-87 | 126.74 | -- | -- | -- |
| | | | | | | 02-09-88 | 126.50 | -- | -- | -- |
| | | | | | | 04-12-88 | 126.20 | -- | -- | -- |
| | | | | | | 07-12-88 | 126.97 | -- | -- | -- |
| | | | | | | 09-27-88 | 127.22 | -- | -- | -- |
| | | | | | | 02-21-89 | 127.14 | -- | -- | -- |
| 11N.09E.31.132 | 35°08'18" | 106°01'38" | 6,275 | I | -- | -- | -- | 09-22-86 | 00010 | 15.5 |
| | | | | | | -- | -- | 09-22-86 | 00095 | 775 |
| 11N.09E.31.234 | 35°08'11" | 106°01'07" | 6,269 | I | -- | -- | -- | 07-18-86 | 00010 | 16.5 |
| | | | | | | -- | -- | 07-18-86 | 00095 | 650 |
| 11N.09E.32.441 | 35°07'52" | 106°00'01" | 6,270 | I | -- | -- | -- | 07-18-86 | 00010 | 15.5 |
| | | | | | | -- | -- | 07-18-86 | 00095 | 600 |
| 11N.09E.35.2221 | 35°08'32" | 105°56'44" | 6,338 | I | 306 | 03-30-88 | 156.10 | -- | -- | -- |
| 11N.10E.16.311 | 35°10'44" | 105°53'24" | 6,554 | I | -- | 03-30-88 | 287.98 | -- | -- | -- |
| 11N.11E.32.22221 | 35°08'31" | 105°47'12" | 6,757 | S | -- | 03-30-88 | 55.58 | -- | -- | -- |
| 12N.08E.35.4433 | 35°12'55" | 106°03'12" | 6,435 | U | 271 | 03-30-88 | 246.50 | -- | -- | -- |
| 12N.09E.26.1232 | 35°14'27" | 105°57'16" | 6,552 | S | -- | 03-30-88 | 55.39 | -- | -- | -- |

Table 3.--Stream and spring discharge on the east side of the Manzano Mountains, 1985-87

[HW, highway; est, discharge was estimated at that site; --, no data]

| Stream or spring | Discharge (cubic feet per second) | | | | | |
|---|---|---|---|---|---|---|
| | Dec 4, 1985 | Mar 26, 1986 | Oct 23, 1986 | Apr 2, 1987 | June 16-17, 1987 | Sept 24, 1987 |
| Arroyo de Yrisarri at junction of HW 337 and HW 222 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cañada de Escabosa at HW 337 | 0 | 0 | 0 | 0.05 | 0.06 | 0.01 est |
| Cañon de Chilili at HW 337 | 0.50 | 0.44 | 0.18 | 10.9 | 5.17 | 0.61 |
| Cañada de la Perra at HW 337 | 0 | 0 | 0 | 1.26 | 0.84 | 0 |
| Cañon de Tajique at HW 337 | 0.24 | 0.26 | 0.15 | 23.1 | 4.55 | 0.29 |
| Cañon de Torreon at HW 337 | 0 | 0.1 est | 0.43 | 20.5 | 5.29 | 0.51 |
| Arroyo del Cuervo at HW 337 | 0 | 0 | 0 | 0 | 0.13 | 0 |
| Arroyo de Manzano at HW 337 | 0 | 0 | 0 | 6.53 | 0.20 | 0 |
| Manzano Spring, between spring and lake | 0.47 | 2.46 | 1.51 | 9.57 | 1.80 | 0.29 |
| Cañon de los Pino Reales at HW 337 | -- | -- | 0 | 3.0 est | 0.01 est | 0 |
| Cañon del Chato at HW 337 | -- | -- | 0 | 2.0 est | 0 | 0 |
| Cañon Colorado at El Gato at HW 337 | -- | -- | 0 | 6.0 est | 0.73 | 0.2 est |
| Cañon Sapato near Punta de Agua at HW 337 | -- | -- | 0.08 | 0.29 | 0.11 | 0.11 |
| Total | 1.21 | 3.26 | 2.35 | 83.2 | 18.9 | 2.02 |

Table 4.--Gain-and-loss measurements, Tajique Creek, May 28-29, 1985

[Locations shown in fig. 11. µS/cm, microsiemens per centimeter at 25 degrees Celsius; lat, latitude; long, longitude; --, no data]

| River mile[1] | Stream | Location | Altitude (feet above sea level) | Date | Time | Specific conductance (µS/cm) | Discharge (cubic feet per second) Main stream | Tributary | Indicated gain or loss between measurement sites on main stream |
|---|---|---|---|---|---|---|---|---|---|
| 19.8 | Tajique | Lat 34°46'42", long 106°23'27" | 7,800 | May 28 | 1300 | -- | 0 | -- | -- |
| 19.75 | Unnamed tributary | Lat 34°46'42", long 106°23'27" | 7,800 | May 28 | 1300 | 440 | -- | 0.34 | -- |
| 19.7 | Tajique | Lat 34°46'42", long 106°23'24" | 7,770 | May 28 | 1335 | 460 | 1.59 | -- | +1.25 |
| 18.55 | Tajique | Lat 34°47'22", long 106°22'42", 30 yards upstream from mouth of Fourth of July Creek | 7,500 | May 28 | 1425 | 400 | 1.86 | -- | +0.27 |
| 18.5 | Fourth of July | Lat 34°47'24", long 106°22'42", 30 yards upstream from mouth | 7,500 | May 28 | 1507 | 450 | | 0.78 | -- |
| 16.2 | Tajique | Lat 34°46'53", long 106°20'38", at Forest Road 321 crossing | 7,130 | May 28 | 1555 | 420 | 3.83 | -- | +1.19 |
| 12.9 | Tajique | Lat 34°45'44", long 106°18'29", at Forest Road 55 crossing 1.6 miles west of State Highway 337 | 6,779 | May 29 | 1200 | 410 | 6.30 | -- | +2.47 |
| 11.3 | Tajique | Lat 34°45'15", long 106°17'15", 50 yards upstream from State Highway 337 crossing, at village of Tajique | 6,650 | May 29 | 1330 | 390 | 6.61 | -- | +0.31 |
| 4.6 | Tajique | Lat 34°43'58", long 106°12'03", at farm road crossing at the western edge of sec. 22, T. 6 N., R. 7 E. | 6,338 | May 29 | 1455 | 350 | 3.72 | -- | -2.89 |
| 2.3 | Tajique | Lat 34°43'32", long 106°09'57", at farm road crossing at the eastern edge of sec. 23, T. 6 N., R. 7 E. | 6,254 | May 29 | -- | -- | 0 | -- | -3.72 |

[1]River mile 0.0 is at mouth of Tajique Creek at its confluence with Torreon Creek.

Table 5.--Gain-and-loss measurements, Torreon Creek, July 8, 1987

[Locations shown in fig. 11. μS/cm, microsiemens per centimeter at 25 degrees Celsius; lat, latitude; long, longitude; --, no data; est, estimated]

| River mile[1] | Stream | Location | Altitude (feet above sea level) | Time | Water temperature (degrees Celsius) | Specific conductance (uS/cm) | Discharge (cubic feet per second): Main stream | Discharge: Tributary | Discharge: Indicated gain or loss between measurement sites on main stream |
|---|---|---|---|---|---|---|---|---|---|
| 31.7 | Torreon | Lat 34°46'03", long 106°23'30" | 7,900 | | | | 0 | -- | -- |
| 31.6 | Torreon | Lat 34°45'58", long 106°23'28" | 7,890 | 1120 | 10 | 650 | 0.07 | | +0.07 |
| 31.05 | Torreon | Lat 34°45'30", long 106°23'32" | 7,735 | | | | 0.01 est | | -0.06 |
| 30.95 | Torreon | Lat 34°45'26", long 106°23'34" | 7,720 | | | | 0 | | -0.01 |
| 30.9 | Torreon | Lat 34°45'23", long 106°23'37" | 7,705 | | | | 0 | | |
| 30.9 | Unnamed tributary | Lat 34°45'22", long 106°23'39", at road crossing, 50 yards upstream from mouth | 7,700 | 1145 | 11 | 550 | -- | 0.17 | -- |
| 29.8 | Torreon | Lat 34°44'35", long 106°23'22", at loop road crossing | 7,480 | 1206 | 12.5 | 440 | 0.48 | -- | +0.31 |
| 27.15 | Torreon | Lat 34°44'13", long 106°20'44", at loop road crossing | 7,040 | 1320 | 17.5 | 425 | 1.08 | -- | +0.60 |
| 27.1 | Las Palas | Lat 34°44'06", long 106°20'44", 20 yards upstream from loop road crossing | 7,030 | 1330 | 24 | 305 | -- | 0.19 | -- |
| 25.3 | Torreon | Lat 34°43'39", long 106°19'27" | 6,835 | 1345 | 19 | 460 | 2.21 | -- | +0.94 |
| 23.5 | Torreon | Lat 34°43'22", long 106°17'54", 50 yards upstream from State Highway 337; small agricultural diversions about 200 yards upstream, estimated 0.1 to 0.2 cubic foot per second | 6,678 | 1420 | 19.5 | 630 | 2.19 | -- | -0.02 |
| 21.95 | Torreon | Lat 34°42'50", long 106°16'40", 100 yards upstream from where the Madera Group outcrop disappears under alluvium | 6,575 | 1520 | -- | 530 | 1.03 | -- | -1.16 |
| 20.3 | Torreon | Lat 34°42'23", long 106°15'23" | 6,480 | 1608 | 29 | 500 | 0.21 | -- | -0.82 |
| 18.5 | Torreon | Lat 34°42'02", long 106°14'09" | 6,397 | | -- | -- | 0 | -- | -0.21 |

[1]River miles determined from location of river mile 7.0, which is about 7 miles west of Laguna del Perro.

Table 6.--Laboratory analyses of water samples from wells in the Estancia Basin

[µS/cm, microsiemens per centimeter at 25 degrees Celsius; deg C, degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter; wat wh fet fld, water, whole, fixed endpoint titration, field; wat wh it fld, water, whole, incremental titration, field; wat dis it fld, water, dissolved, incremental titration, field; --, no data; <, less than]

| Local well number | Date | Specific conductance (µS/cm) | pH (standard units) | Temperature water (deg C) | Hardness, total (mg/L as $CaCO_3$) | Hardness, noncarbonate (mg/L as $CaCO_3$) | Alkalinity (mg/L as $CaCO_3$) | Solids, sum of constituents, dissolved (mg/L) |
|---|---|---|---|---|---|---|---|---|
| 04N.08E.13.133 | 08-31-50 | 640 | -- | -- | -- | 0 | 180 | -- |
| | 09-08-87 | 728 | 8.06 | 15.5 | 290 | 120 | 171 | 454 |
| 05N.08E.02.333 | 08-30-50 | 414 | -- | -- | 230 | 30 | 197 | 249 |
| | 09-04-87 | 432 | 7.77 | 14 | 200 | 9 | 192 | 263 |
| 05N.08E.18.331 | 06-27-66 | 220 | -- | 14 | -- | 0 | -- | -- |
| | 09-04-87 | 439 | 7.61 | 14 | 200 | 32 | 171 | 261 |
| 06N.08E.32.212 | 08-29-50 | 500 | -- | -- | -- | 0 | 213 | -- |
| | 01-05-66 | 570 | 7.90 | 15 | 300 | 86 | 213 | 382 |
| | 09-01-87 | 504 | 7.35 | 14.5 | 230 | 55 | 180 | 292 |
| 06N.09E.16.433 | 02-20-68 | 4,860 | 7.70 | -- | 1,200 | 820 | 427 | 3,330 |
| | 11-18-87 | 4,860 | 7.95 | 12.5 | 1,000 | 630 | 424 | 3,250 |
| 09N.08E.35.214 | 05-22-48 | 823 | 7.60 | -- | 410 | 99 | 312 | 556 |
| | 05-30-50 | 824 | -- | -- | -- | 0 | 295 | -- |
| | 08-17-50 | 821 | -- | -- | -- | 0 | 287 | -- |
| | 09-09-87 | 1,120 | 7.46 | 14 | 540 | 250 | 287 | 711 |
| 09N.09E.16.233 | 07-03-50 | 3,160 | -- | -- | 1,100 | 990 | 148 | 2,300 |
| | 09-16-87 | 3,380 | 7.58 | 17 | 970 | 830 | 140 | 2,320 |
| 10N.08E.35.233 | 08-11-48 | 1,350 | -- | 14 | 610 | 370 | 238 | 916 |
| | 08-30-50 | 1,360 | -- | -- | -- | 0 | 233 | -- |
| | 08-12-87 | 2,150 | 7.20 | 14 | 880 | 710 | 173 | 1,410 |

## Table 6.--Laboratory analyses of water samples from wells in the Estancia Basin--Continued

| Local well number | Solids, residue at 180 deg C, dis-solved (mg/L) | Solids, dis-solved (tons per acre-foot) | Calcium, dis-solved (mg/L as Ca) | Magne-sium, dis-solved (mg/L as Mg) | Sodium, dis-solved (mg/L as Na) | Sodium + potas-sium, dis-solved (mg/L as Na) | Potas-sium, dis-solved (mg/L as K) | Bicar-bonate wat wh fet fld (mg/L as $HCO_3$) |
|---|---|---|---|---|---|---|---|---|
| 04N.08E.13.133 | -- | -- | -- | -- | -- | -- | -- | 220 |
| | -- | 0.62 | 76 | 24 | 42 | -- | 1.9 | -- |
| 05N.08E.02.333 | -- | 0.34 | 71 | 12 | -- | 0 | -- | 240 |
| | -- | 0.36 | 64 | 10 | 14 | -- | 1.0 | -- |
| 05N.08E.18.331 | -- | -- | -- | -- | -- | -- | -- | -- |
| | -- | 0.35 | 66 | 9.2 | 12 | -- | 1.6 | -- |
| 06N.08E.32.212 | -- | -- | -- | -- | -- | -- | -- | 260 |
| | 384 | 0.52 | 98 | 13 | 15 | -- | -- | 260 |
| | -- | 0.40 | 79 | 9.0 | 13 | -- | 1.4 | -- |
| 06N.09E.16.433 | 3,290 | 4.47 | 170 | 200 | 670 | -- | 16 | 520 |
| | -- | 4.41 | 140 | 170 | 650 | -- | 16 | -- |
| 09N.08E.35.214 | -- | 0.76 | 110 | 33 | -- | 43 | -- | 380 |
| | -- | -- | -- | -- | -- | -- | -- | 360 |
| | -- | -- | -- | -- | -- | -- | -- | 350 |
| | -- | 0.97 | 150 | 39 | 40 | -- | 3.4 | -- |
| | -- | -- | -- | -- | -- | -- | -- | 360 |
| | -- | -- | -- | -- | -- | -- | -- | 350 |
| | -- | 0.97 | 150 | 39 | 40 | -- | 3.4 | -- |
| 09N.09E.16.233 | -- | 3.13 | 330 | 75 | -- | 320 | -- | 180 |
| | -- | 3.15 | 270 | 71 | 350 | -- | 6.3 | -- |
| 10N.08E.35.233 | -- | 1.25 | 160 | 50 | -- | 69 | -- | 290 |
| | -- | -- | -- | -- | -- | -- | -- | 280 |
| | -- | 1.92 | 240 | 69 | 110 | -- | 4.2 | -- |

## Table 6.--Laboratory analyses of water samples from wells in the Estancia Basin--Continued

| Local well number | Bicarbonate wat wh it fld (mg/L as $HCO_3$) | Bicarbonate wat dis it fld (mg/L as $HCO_3$) | Carbonate wat wh fet fld (mg/L as $CO_3$) | Carbonate wat wh it fld (mg/L as $CO_3$) | Sulfate, dissolved (mg/L as $SO_4$) | Chloride, dissolved (mg/L as Cl) | Fluoride, dissolved (mg/L as F) | Silica, dissolved (mg/L as $SiO_2$) |
|---|---|---|---|---|---|---|---|---|
| 04N.08E.13.133 | -- | -- | 0 | -- | -- | 21 | -- | -- |
| | 210 | -- | -- | 0 | 140 | 35 | 0.80 | 23 |
| 05N.08E.02.333 | -- | -- | 0 | -- | 19 | 5.0 | 0.60 | 22 |
| | 237 | -- | -- | 0 | 25 | 6.7 | 0.70 | 23 |
| 05N.08E.18.331 | -- | -- | -- | -- | -- | 9.9 | -- | -- |
| | 210 | -- | -- | 0 | 25 | 15 | 0.20 | 19 |
| 06N.08E.32.212 | -- | -- | 0 | -- | -- | 9.0 | -- | -- |
| | -- | -- | 0 | -- | 76 | 20 | -- | 23 |
| | 232 | -- | -- | 0 | 36 | 12 | 0.30 | 20 |
| 06N.09E.16.433 | -- | -- | 0 | -- | 1,200 | 770 | 1.1 | 31 |
| | -- | 531 | -- | -- | 1,200 | 780 | 1.1 | 28 |
| 09N.08E.35.214 | -- | -- | 0 | -- | 97 | 54 | 0.50 | 32 |
| | -- | -- | 0 | -- | -- | 38 | -- | -- |
| | -- | -- | 0 | -- | -- | 40 | -- | -- |
| | 354 | -- | -- | 0 | 210 | 63 | 0.40 | 27 |
| | -- | -- | 0 | -- | -- | 38 | -- | -- |
| | -- | -- | 0 | -- | -- | 40 | -- | -- |
| | 354 | -- | -- | 0 | 210 | 63 | 0.40 | 27 |
| 09N.09E.16.233 | -- | -- | 0 | -- | 1,100 | 390 | 1.6 | 19 |
| | 172 | -- | -- | 0 | 1,100 | 410 | 1.4 | 21 |
| 10N.08E.35.233 | -- | -- | 0 | -- | 370 | 92 | 0.60 | 26 |
| | -- | -- | 0 | -- | -- | 97 | -- | -- |
| | 216 | -- | -- | 0 | 650 | 190 | 0.50 | 22 |

Table 6.--Laboratory analyses of water samples from wells in the Estancia Basin--Concluded

| Local well number | Nitrogen nitrate, dissolved (mg/L as N) | Nitrogen nitrate, dissolved (mg/L as $NO_3$) | Nitrogen $NO_2+NO_3$, dissolved (mg/L as N) | Boron, dissolved (µg/L as B) | Iron, dissolved (µg/L as Fe) | Manganese, dissolved (µg/L as Mn) | Depth of well, total feet |
|---|---|---|---|---|---|---|---|
| 04N.08E.13.133 | -- | -- | -- | -- | -- | -- | 197 |
| | -- | -- | 1.90 | 70 | <3 | <1 | 197 |
| 05N.08E.02.333 | 0.410 | 1.8 | -- | -- | -- | -- | 150 |
| | -- | -- | 0.780 | 30 | <3 | 1 | 150 |
| 05N.08E.18.331 | -- | -- | -- | -- | -- | -- | 150 |
| | -- | -- | 2.30 | 20 | <3 | 1 | 150 |
| 06N.08E.32.212 | -- | -- | -- | -- | -- | -- | 209 |
| | 2.10 | 9.3 | -- | 70 | -- | -- | 209 |
| | -- | -- | 3.00 | 30 | <3 | <1 | 209 |
| 06N.09E.16.433 | 2.50 | 11 | -- | 380 | 0 | -- | 27 |
| | -- | -- | 1.30 | 390 | 10 | 70 | 27 |
| 09N.08E.35.214 | 1.50 | 6.6 | -- | -- | -- | -- | 194 |
| | -- | -- | -- | -- | -- | -- | 194 |
| | -- | -- | -- | -- | -- | -- | 194 |
| | -- | -- | 1.40 | 70 | <3 | <1 | 194 |
| | -- | -- | -- | -- | -- | -- | 194 |
| | -- | -- | -- | -- | -- | -- | 194 |
| | -- | -- | 1.40 | 70 | <3 | <1 | 194 |
| 09N.09E.16.233 | 0.360 | 1.6 | -- | -- | -- | -- | 75 |
| | -- | -- | 0.490 | 310 | 20 | 20 | 75 |
| 10N.08E.35.233 | 0.560 | 2.5 | -- | -- | -- | -- | 270 |
| | -- | -- | -- | -- | -- | -- | 270 |
| | -- | -- | 4.30 | 100 | 30 | <10 | 270 |

Table 7.--Specific-conductance values in water samples from selected wells in the Estancia Basin, 1940's-1980's

[μS/cm, microsiemens per centimeter at 25 degrees Celsius]

| Local well number | Date measured | Specific conductance (μS/cm) |
|---|---|---|
| 05N.08E.02.311 | 05-21-66 | 477 |
| | 05-21-86 | 420 |
| 05N.08E.02.333 | 08-30-50 | 414 |
| | 05-21-86 | 390 |
| | 09-04-87 | 432 |
| 05N.08E.08.424 | 08-16-50 | 351 |
| | 09-04-86 | 525 |
| 05N.08E.18.312 | 08-29-50 | 368 |
| | 05-07-86 | 460 |
| 05N.08E.18.331 | 06-27-66 | 220 |
| | 05-07-86 | 375 |
| | 09-04-87 | 439 |
| 06N.08E.32.212 | 08-29-50 | 500 |
| | 01-05-66 | 570 |
| | 04-30-86 | 425 |
| | 09-01-87 | 504 |
| 06N.09E.16.433 | 02-20-68 | 4,860 |
| | 09-11-86 | 4,850 |
| | 11-18-87 | 4,860 |
| 07N.09E.18.211 | 11-19-65 | 647 |
| | 03-27-86 | 1,200 |
| 08N.09E.07.211 | 08-22-50 | 981 |
| | 07-30-86 | 1,700 |
| 09N.08E.35.214 | 05-22-48 | 823 |
| | 05-30-50 | 824 |
| | 08-17-50 | 821 |
| | 09-09-87 | 1,120 |
| 09N.09E.16.233 | 07-03-50 | 3,160 |
| | 10-27-86 | 3,400 |
| | 09-16-87 | 3,380 |
| 09N.10E.18.233 | 09-27-50 | 3,350 |
| | 09-18-86 | 3,500 |
| 10N.07E.12.434 | 12-08-65 | 766 |
| | 09-03-86 | 725 |
| 10N.08E.25.3111 | 08-29-50 | 1,390 |
| | 06-13-66 | 1,760 |
| | 08-13-86 | 2,400 |
| | 04-14-87 | 2,400 |

Table 7.--Specific-conductance values in water samples from selected wells in the Estancia Valley, 1940's-1980's--Concluded

| Local well number | Date measured | Specific conductance (µS/cm) |
|---|---|---|
| 10N.08E.35.233 | 08-11-48 | 1,350 |
| | 08-30-50 | 1,360 |
| | 05-14-86 | 1,850 |
| | 08-13-86 | 2,000 |
| | 04-14-87 | 1,750 |
| | 08-12-87 | 2,150 |
| 10N.08E.36.1112 | 03-07-48 | 1,260 |
| | 08-13-86 | 1,900 |
| 11N.07E.21.144 | 07-02-62 | 515 |
| | 08-21-84 | 500 |
| 11N.07E.22.11134 | 03-09-77 | 960 |
| | 09-24-84 | 850 |
| | 10-09-86 | 850 |
| 12N.07E.34.224 | 06-17-76 | 540 |
| | 09-24-84 | 500 |



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