EVALUATION OF A GROUND-WATER FLOW AND TRANSPORT MODEL OF THE UPPER COACHELLA VALLEY, CALIFORNIA

By Eric G. Reichard *and* J. Kevin Meadows

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CONVERSION FACTORS, ABBREVIATIONS, AND VERTICAL DATUM

Conversion Factors

Multiply	By	To obtain
acre	0.004047	square kilometer
acre-foot (acre-ft)	1,233	cubic meter
acre-foot per year (acre-ft/yr)	1,233	cubic meter per year
cubic foot per second (ft^3/s)	0.02832	cubic meter per second
foot (ft)	0.3048	meter
foot per day (ft/d)	0.3048	meter per day
foot per second (ft/s)	0.3048	meter per second
inch (in.)	25.40	millimeter
inch per year (in/yr)	25.40	millimeter per year
mile (mi)	1.609	kilometer
square mile (mi^2)	2.590	square kilometer

Temperature is given in degrees Fahrenheit (°F), which is converted to degrees Celsius (°C) by using the formula:

$$\text{Temp. °C} = (\text{temp. °F} - 32)/1.8.$$

Abbreviations and Acronyms Used

mg/L - milligram per liter

SUTRA - Saturated-Unsaturated TRAnsport--a computer program for simulating subsurface fluid movement and energy or solute transport

Vertical Datum

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

EVALUATION OF A GROUND-WATER FLOW AND TRANSPORT MODEL IN THE UPPER COACHELLA VALLEY, CALIFORNIA

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Abstract

A geohydrologic data base was compiled to evaluate the changes in ground-water conditions in the upper Coachella Valley, California, since 1978, when the results of a previous ground-water-model study were published. The compiled data were analyzed to improve understanding of the ground-water flow system and the effects on water quality of an existing artificial-recharge program. Analysis of well logs indicates that several zones of differing permeability can be correlated throughout the valley. Analysis of the water-quality data suggests that the artificial recharge of Colorado River water has caused increases in dissolved solids in some wells. Sparse data indicate that the recharged water moves much more rapidly through the uppermost part of the ground-water system than through deeper parts.

An evaluation of the existing ground-water simulation model of the upper Coachella Valley that was developed in the 1978 study yielded several conclusions. First, the 300- to 400-foot rise in water levels in the artificial-recharge area in 1985-86 significantly affected the ground-water flow system. Transmissivities in the model had to be increased to reflect the increase in saturated thickness. Storage-coefficient values in the model had to be increased from 0.02 (used in the previous study) to 0.10-0.15 to simulate the unconfined water-level response during this period. Second, stream-recharge and underflow rates from San Gorgonio Pass during 1979-86 seem to have been higher than the values estimated for previous studies. Conditions generally were wetter in 1979-86 than during the period in which the earlier estimates were made. Third, the flow system could be simulated more accurately if the model were extended to its true southeastern boundary, the Salton Sea. Finally, there are important vertical differences in transport of the artificially recharged water that the two-dimensional areal transport model cannot simulate.

The study results indicate several additional data-collection and modeling needs. The drilling of several sets of monitor wells perforated at different depths could help better define the three-dimensional flow system and water-quality differences. Additional data also are needed on underflow and stream recharge, evaporation rates and infiltration rates at the artificial-recharge facilities, and net pumpage. Three-dimensional flow and transport models are needed to evaluate the effects of ground-water development on water levels and water quality.

INTRODUCTION

The Coachella Valley in southern California is an arid basin facing continuing population growth and increases in ground-water demand. Since 1973, water from the Colorado River Aqueduct has been artificially recharged to the ground-water system in the upper Coachella Valley. Ground-water flow and transport models of the upper Coachella Valley are potentially useful for (1) simulating the effects of the existing artificial-recharge program on water levels and water quality; (2) predicting the effects on the ground-water system of alternative scenarios of future water development; (3) increasing understanding of the hydrogeologic system; and (4) providing a guide for data collection.

As a result of these considerations, the U.S. Geological Survey, in cooperation with the California Regional Water Quality Control Board, Colorado River Basin Region, conducted a study to evaluate the existing ground-water simulation model of the upper Coachella Valley and to identify future data-collection and modeling needs.

Purpose and Scope

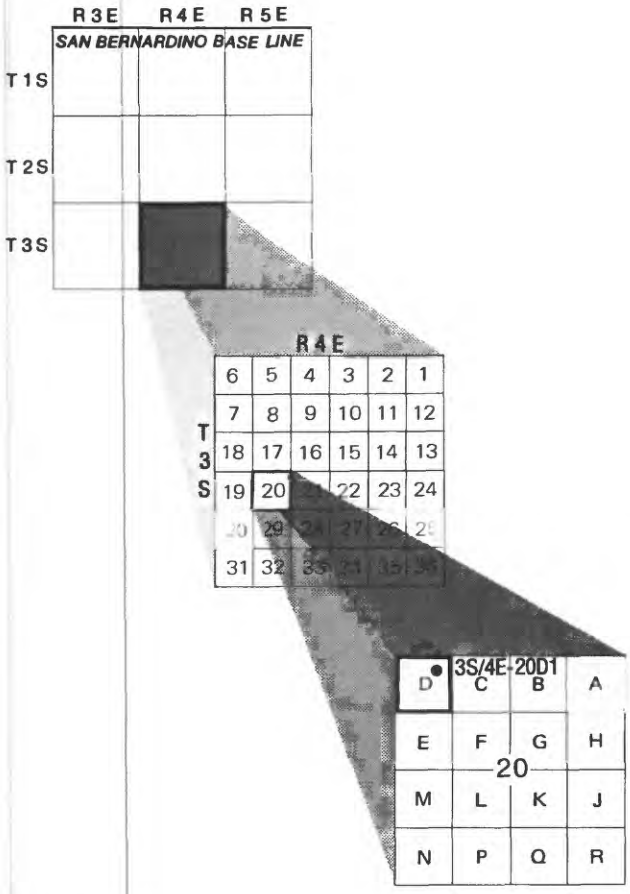
This report describes an evaluation of the existing ground-water simulation model of the upper Coachella Valley developed by Swain (1978). The evaluation consisted of several steps. First, an updated geohydrologic data base was compiled to evaluate changes in ground-water conditions since publication of the results of Swain's study. Second, the compiled data were analyzed to characterize the ground-water flow system and to quantify the effects on water quality of the artificial-recharge program during 1979-86. Third, the existing model was used to simulate ground-water flow and solute transport for the period 1979-86. The results of these simulations helped identify future modeling and data-collection needs for the valley.

Acknowledgments

The assistance of the Desert Water Agency and the Coachella Valley Water District in providing data for this study is greatly appreciated.

Well-Numbering System

Wells are numbered according to their location in the rectangular system for subdivision of public land. For example, in the well number 3S/4E-20D1, the part of the number preceding the slash indicates the township (T. 3 S.); the number following the slash indicates the range (R. 4 E.); the number following the hyphen indicates the section (sec. 20); and the letter following the section number indicates the 40-acre subdivision according to the lettered diagram below. The final digit is a serial number for wells in each 40-acre subdivision. The entire study area is south and east of the San Bernardino baseline and meridian. The diagram shows the location of a well with the well number 3S/4E-20D1.



DESCRIPTION OF STUDY AREA

Geographic Setting

The Coachella Valley is mostly in central Riverside County, extending into small parts of San Bernardino County on the north and San Diego and Imperial Counties on the south. The northwest-southeast-trending valley is about 65 mi long and includes about 440 mi^2. The valley is drained primarily by the Whitewater River system, which empties into the Salton Sea (fig. 1). Total drainage area of the Whitewater River is about 1,500 mi^2, and the altitude of the drainage basin ranges from more than 10,000 ft above sea level at the peaks of the San Bernardino and San Jacinto Mountains to more than 200 ft below sea level at the Salton Sea.

The models described in this report cover only that part of the upper Coachella Valley southwest of the Banning and San Andreas faults (see fig. 1). As defined in this report, the upper Coachella Valley extends from the San Gorgonio Pass southeastward to about 2 mi north of the city of Indio, and the lower Coachella Valley extends southeastward from the southern boundary of the modeled area to the Salton Sea.

Climate

Climate of the valley is typical of a desert environment. Average annual precipitation on the valley floor is less than 5 in., but in the mountains west and north of the valley it is as much as 40 in. Temperatures range from about 120°F in summer on the valley floor to below freezing in winter in the bordering mountains.

Geohydrology

Several reports on the geology of the Coachella Valley and aspects of its geohydrology have been published. Mendenhall (1909) provided a general description of the geology and water resources of the region. He showed that the source of recharge to the ground-water system is precipitation and mountain-front runoff rather than some distant source such as infiltration of water from the Colorado River, as was commonly believed at the time. Brown (1923) presented a qualitative overview of the geology and hydrology of the entire Salton Sea region. Huberty and others (1948) compiled a useful survey of water levels and water quality. Proctor (1968) described the lithology of the units in the surrounding mountains and the stratigraphy of the valley deposits, and provided a literature review of geologic studies of the entire Colorado Desert area. The most comprehensive summary of the hydrology of the Coachella Valley was completed by the California Department of Water Resources (1964). Loeltz and others (1975) provided a discussion of the regional geologic setting. The California Department of Water Resources (1979) compared water quality in wells of different depths in the Coachella Valley, focusing on the potential effects of poorly constructed or abandoned wells.

The Coachella Valley is part of the Salton Trough of the Basin and Range province. The Salton Trough, which is the landward extension of the Gulf of California, was formed in late Cenozoic time (Loeltz and others, 1975). Both Coachella Valley and Imperial Valley (south of the Salton Sea) drain into the lowest part of the trough, the Salton Sea.

The Coachella Valley is filled with as much as 12,000 ft of sediments (California Department of Water Resources, 1979). It is bounded by the pre-Tertiary igneous and metamorphic rocks of the San Bernardino and Little San Bernardino Mountains to the northeast and the San Jacinto and Santa Rosa Mountains to the southwest. The major faults in the Coachella Valley--the San Andreas, Banning, Garnet Hill, Mission Creek, and Indio Hills faults (see fig. 1)--are part of the San Andreas fault system.

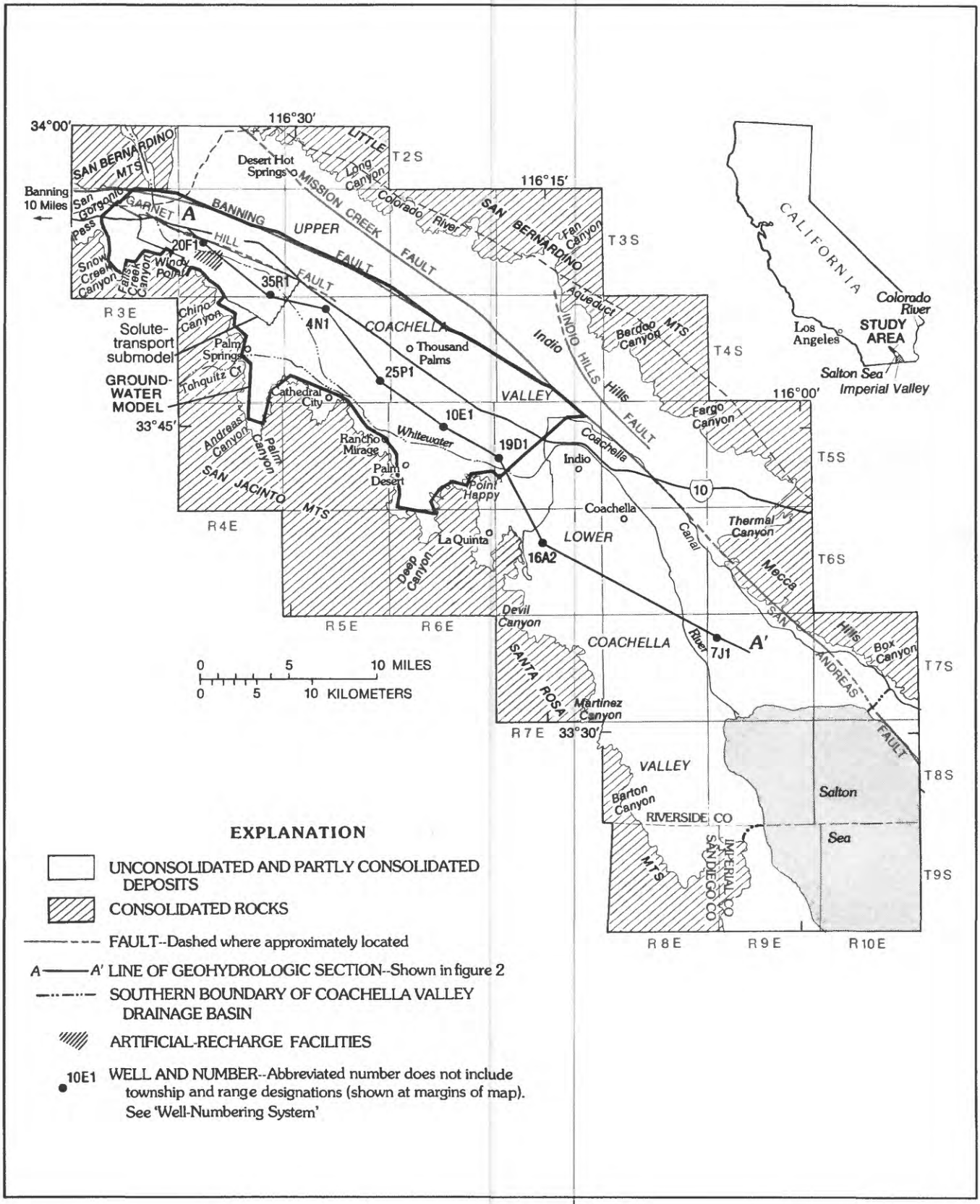


Figure 1. Study area and location of faults, geohydrologic section, and area of ground-water model.

These faults impede the flow of ground water in the valley (California Department of Water Resources, 1964).

As stated above, the models presented in this report cover only a part of the upper Coachella Valley. The modeled area is bounded on the southwest by the San Jacinto and Santa Rosa Mountains, on the northeast by the Banning and San Andreas faults, and on the northwest by the San Gorgonio Pass. The consolidated rocks of the San Jacinto and Santa Rosa Mountains act as barriers to flow of ground water. Ground water flows into the modeled area from the San Gorgonio Pass and, to a much lesser extent, across the Banning fault. The southeast boundary of the modeled area is a line extending from Point Happy to the San Andreas fault. This is the line that was chosen by Tyley (1974) and Swain (1978) to represent the boundary between the upper Coachella Valley, where ground-water levels historically were declining, and the lower Coachella Valley, where ground-water levels had been rising since completion of the Coachella Canal in 1949.

Tyley (1974) divided the geologic units in the modeled area into consolidated, semiconsolidated (partly consolidated), and unconsolidated deposits. The pre-Tertiary and Tertiary consolidated deposits, which are considered as rocks yielding no water to wells, form the basement of the modeled area and the adjacent San Jacinto and Santa Rosa Mountains. The Pliocene and Pleistocene partly consolidated deposits overlying the Tertiary deposits are exposed in the Indio Hills. The partly consolidated deposits yield little water. The Pleistocene and Holocene unconsolidated deposits are the main water-bearing units. The most significant water-bearing units are the Ocotillo Conglomerate, described by Dibblee (1954) as upper Pliocene or lower Pleistocene, the Cabezon Fanglomerate of Pleistocene age, and the Pleistocene and Holocene alluvium (California Department of Water Resources, 1964). The Ocotillo Conglomerate is described by the California Department of Water Resources (1964) as consisting of poorly consolidated sandstones and conglomerates with lenses of gray-green and red-brown silt and clay. The Cabezon Fanglomerate, considered correlative with the Ocotillo Conglomerate, was deposited at the base of the San Bernardino Mountains and is present in the northwestern part of the valley (California Department of Water Resources, 1964). This unit is described by Allen (1957) as a gray-to-tan poorly sorted conglomerate with abundant granitic boulders.

The total thickness of the water-bearing units--the Ocotillo Conglomerate, the Cabezon Fanglomerate, and the Pleistocene and Holocene alluvium--is estimated to be as much as 2,000 ft in the Coachella Valley (California Department of Water Resources, 1979). For modeling purposes, Tyley (1974) and Swain (1978) assumed the thickness of the active flow system in the water-bearing deposits to be about 1,000 ft. This assumption was based on the decreasing resistivity with increasing depth observed in geophysical logs and on the fact that maximum well depths in the Coachella Valley are 1,000 to 1,200 ft.

The water-bearing deposits in the modeled area are heterogeneous areally and vertically. A generalized geologic section of the Coachella Valley (fig. 2) shows electrical-resistivity logs in the unconsolidated deposits. Although the data are sparse and the correlations drawn are subjective, it appears that several layers of differing electrical resistivity in the unconsolidated deposits can be traced throughout the length of the valley. These layers may or may not be continuous. Low-resistivity units generally represent zones of lower permeability such as clay and silt. High-resistivity units generally represent zones of higher permeability such as sand and gravel. (It is not possible to distinguish between the Ocotillo Conglomerate, the Cabezon Fanglomerate, and the Pleistocene and Holocene alluvium in figure 2.) Two zones

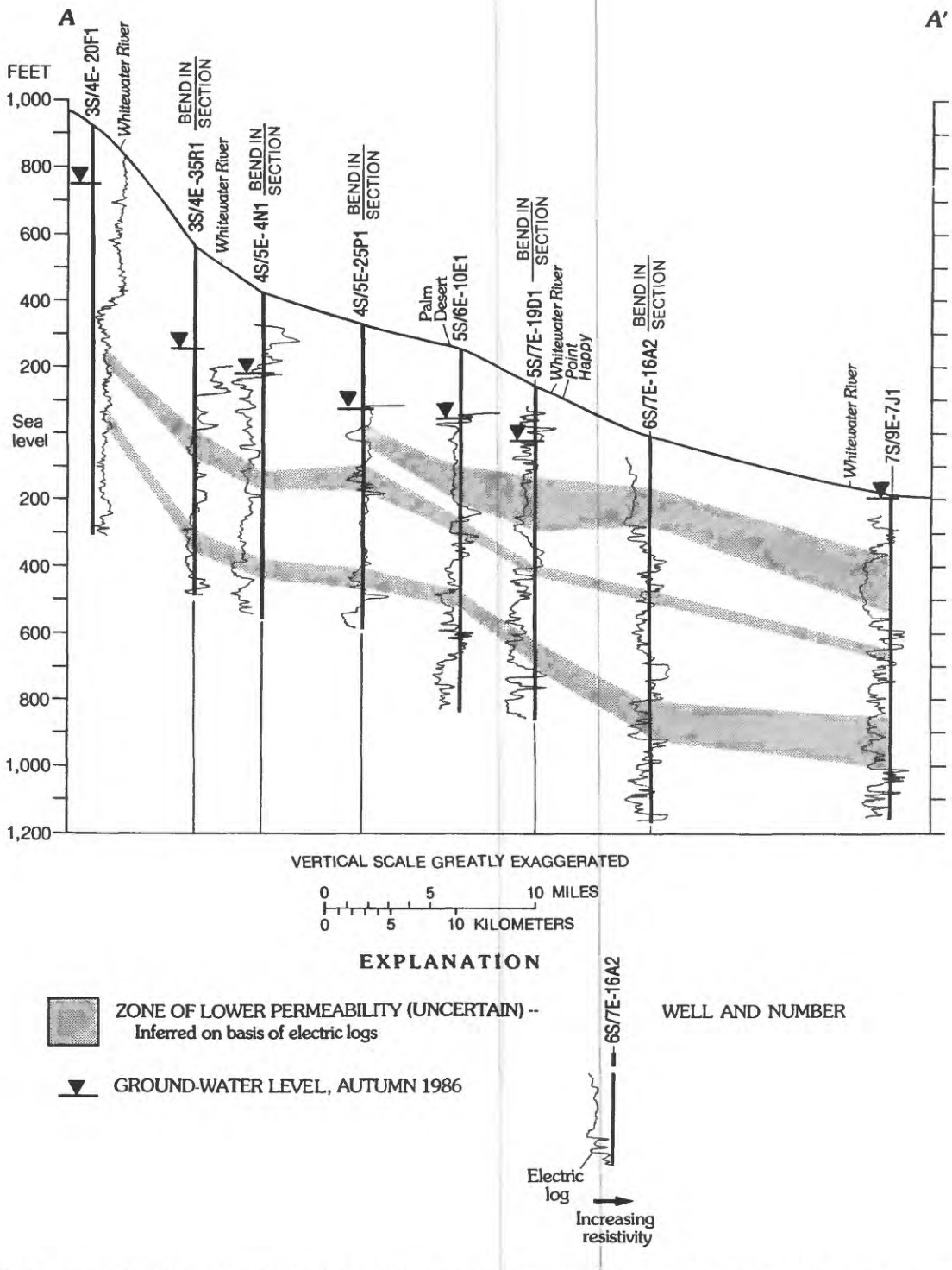


Figure 2. Generalized geohydrologic section of Coachella Valley, showing electrical-resistivity logs in the unconsolidated deposits.

of lower permeability were identified in the upper valley. A third zone of lower permeability is present near the middle of the section north of Palm Desert. These zones of lower permeability may impede vertical ground-water flow and chemical transport.

CHANGES IN GROUND-WATER CONDITIONS SINCE PREVIOUS (1978) MODEL STUDY

Hydrologic Data Base

In order to evaluate the changes in ground-water conditions in the Coachella Valley since the previous model study (Swain, 1978), it first was necessary to compile an updated hydrologic data base. The computerized data base includes digitized well locations, water levels, land-surface altitudes, perforated intervals, and pumping rates for about 600 wells. Location of the wells is shown in figure 3. Water-quality information for 38 wells and measured stream-flows and artificial-recharge quantities also are stored in the data base. Data on several other geohydrologic features, including surficial geology, streams, and recharge areas, have been digitized and incorporated into the data base. The computer data base allows easy interaction with ground-water simulation models and graphic packages. For example, water-level data can be extracted to produce contour maps and hydrographs. All wells in the data base are tabulated in appendix 1.

Additional information has been compiled and filed in the San Diego Office of the U.S. Geological Survey. This information includes well logs (about 220 drillers' logs and 35 geophysical logs), land use, population projections, flow in the Coachella Canal, and discharge permits.

Ground-Water Use

Estimated historical (1936-86) net ground-water pumpage for the upper Coachella Valley is shown in figure 4. Net pumpage is defined as the quantity of water actually removed from the ground-water system: that is, net pumpage equals gross pumpage minus nonused water that infiltrates back into the ground-water system. Values for 1936-73 were estimated by Tyley (1974) and Swain (1978). Values for 1979-86 were compiled in this study from gross-pumpage data provided by the Coachella Valley Water District and the Desert Water Agency. Net pumpage was assumed to be 65 percent of gross pumpage. This value (of 65 percent) was based on a study by the California Department of Water Resources (1987; 1988; written commun., 1989) and is subject to a great deal of uncertainty. As shown in figure 4, estimated annual net pumpage in the upper valley has increased more than 50 percent from 1979 to 1986 (from 63,000 acre-ft to 98,000 acre-ft). Gross pumpage for 1979-86 for all wells in the data base is tabulated in appendix 2.

Artificial Recharge

Since 1973, water from the Colorado River Aqueduct has been artificially recharged to the ground-water system through recharge facilities at the upper end of the valley (see fig. 1). The water is released to the Whitewater River, then diverted to recharge facilities that consist of approximately 700 acres of percolation ponds. The total volume of water diverted to the percolation ponds from 1973 to 1987 is about 960,000 acre-ft; of this total, about 650,000 acre-ft was diverted during 1985-87. During those 3 years, ground-water levels in the artificial-recharge area rose about 300 to 400 ft. No water was diverted to the recharge facilities from spring 1987 through autumn 1989. Annual quantities of Colorado River water released to the Whitewater River for artificial recharge are shown in figure 4 and listed in table 1.

Underflow and Recharge from Streams in Upper Coachella Valley

Estimates of long-term average annual underflow and recharge from streams (Swain, 1978) for the Coachella Valley are given in

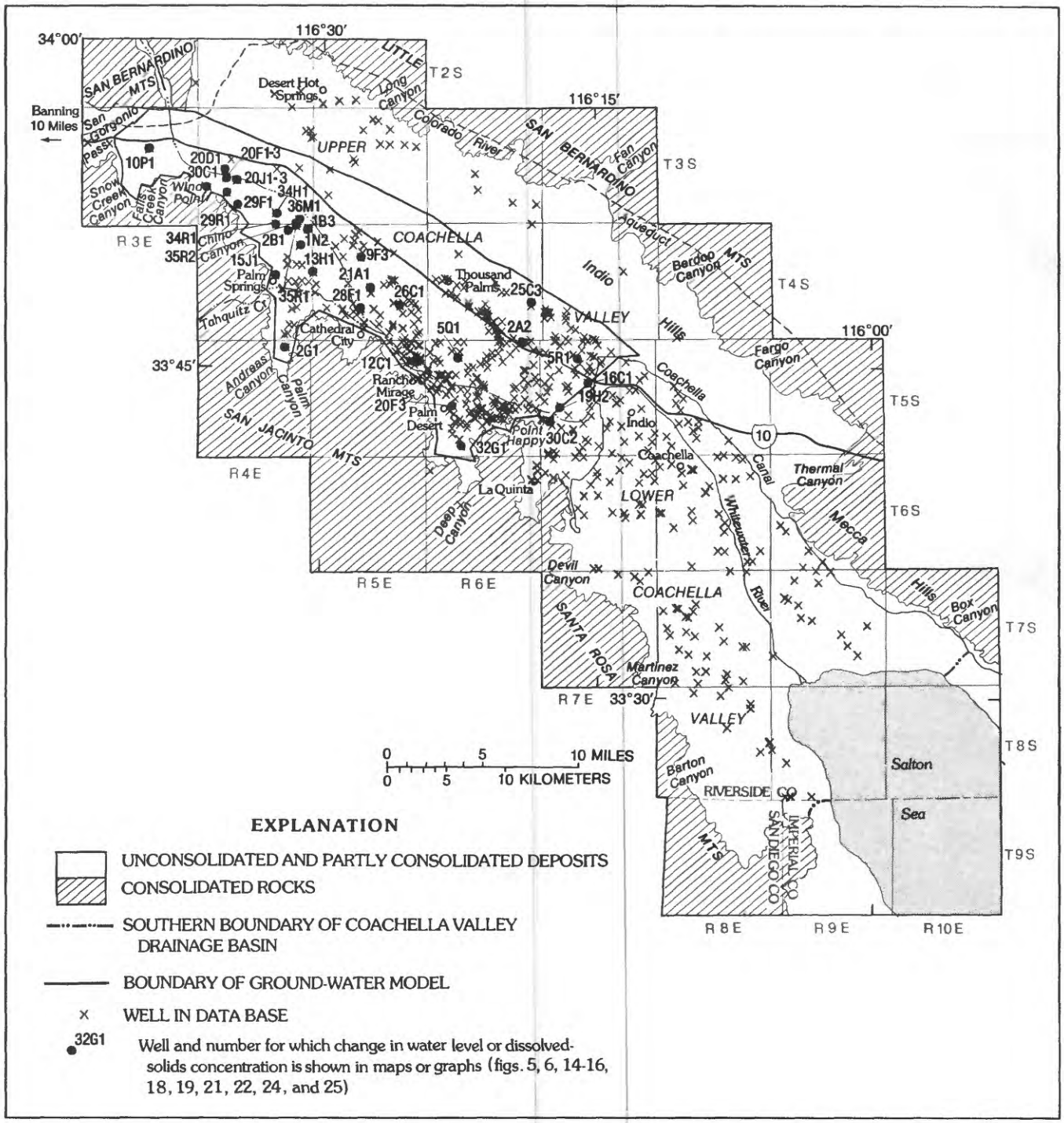


Figure 3. Location of wells in data base.

table 2. These rates, as discussed later, are smaller than the recharge rates for 1979-86. The estimated average rate of subsurface outflow from the upper valley to the lower valley, on the basis of the boundary fluxes computed by the simulations completed during this study, is about 7,000 acre-ft/yr.

Net flux in the upper valley during the simulation period, 1979-86, is shown in figure 4. Net flux equals the sum of artificial recharge, stream recharge, and underflow from San Gorgonio Pass and across the Banning fault, minus net pumpage and subsurface outflow to the lower valley.

Table 1. *Annual quantities and assumed dissolved-solids concentration of Colorado River water released to Whitewater River, 1973-87, and model-input values for artificial recharge, 1979-86*

[Assumed average dissolved-solids concentration based on measurements at Lake Havasu and Lake Mathews (Metropolitan Water District, oral commun., 1990). Acre-ft, acre-feet; mg/L, milligrams per liter; --, not applicable]

Calendar year	Water diverted (acre-ft)	Assumed average dissolved-solids concentration (mg/L)	Amount applied to Whitewater River channel (nodes 35, 38, 42, 50, 57, 68) (acre-ft)	Assumed evaporation (acre-ft)	Amount applied to recharge ponds (nodes 76, 77, 78, 84, 85, 86, 92, 93, 94) (acre-ft)
1973	7,000	No data	--	--	--
1974	15,000	710	--	--	--
1974	20,000	710	--	--	--
1976	13,000	710	--	--	--
1977	0	--	--	--	--
1978	0	--	--	--	--
1979	25,000	700	5,000	4,000	16,000
1980	26,000	700	5,200	4,000	16,800
1981	35,000	700	7,000	4,000	24,000
1982	27,000	690	5,400	4,000	17,600
1983	54,000	680	10,800	4,000	39,200
1984	84,000	620	16,800	4,000	63,200
1985	252,000	560	36,000	4,000	212,000
1986	298,000	530	36,000	4,000	258,000
1987	104,000	530	--	--	--

Table 2.--*Estimated long-term average rates of ground-water recharge in upper Coachella Valley*

[From Swain, 1978]

Source	Recharge, in acre-feet per year	Model nodes
San Gorgonio River and underflow	9,000	4,5,6
Whitewater River	12,000	35,38,42,50,57
Snow Creek	2,700	11,12,21,22
Falls Creek	950	
Chino Creek at Chino Canyon	2,000	107,117
Tahquitz Creek	2,300	126
Andreas Creek at Andreas Canyon	1,000	139
Palm Canyon	2,000	137,138,151,152
Deep Creek at Palm Desert	2,000	201,202,212,213
Total flow into Whitewater River subbasin except for flow from Garnet Hill subbasin	33,950	
Estimated flow across Banning fault into Garnet Hill subbasin	2,000	20,30,39,47, 55,62,73,82,90, 98,106,115,125, 136,150,164,174, 184,211,222,233, 241,248
Grand total (rounded)	36,000	

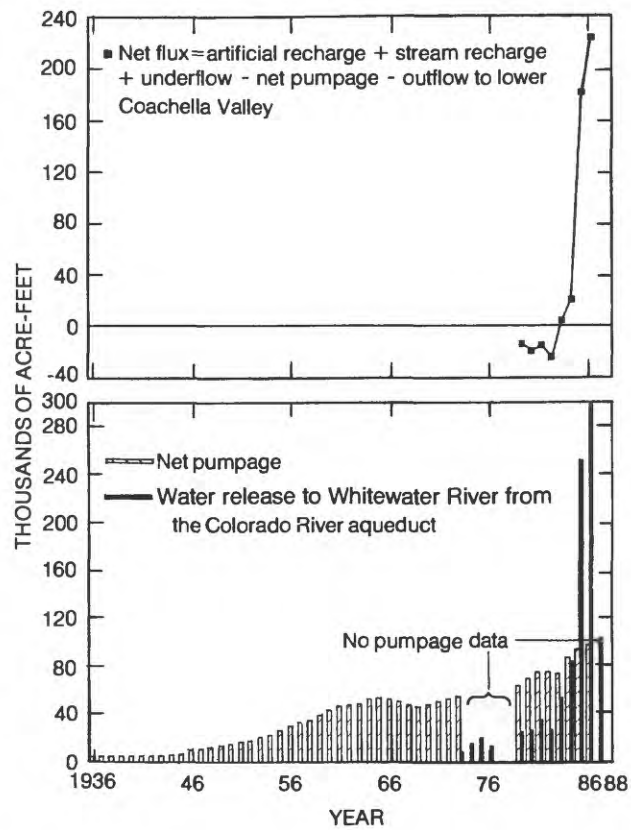


Figure 4. Net flux, net pumpage, and diversions to Whitewater River in the upper Coachella Valley, 1936-86.

Ground-Water Levels

Water-level hydrographs of selected wells in the upper valley are shown in figure 5, and water levels tabulated by well for autumn 1978 and autumn 1986 are given in appendixes 3 and 4, respectively. Water levels in the northern part of the upper valley (for example, wells [location shown in fig. 3] in townships 3S/3E, 3S/4E, 4S/4E, and 4S/5E) rose during 1979-86 as a result of the artificial-recharge program, increased underflow from San Gorgonio Pass, and increased mountain-front recharge. Water levels in the southern part of the upper valley (for example, wells in townships 5S/4E, 5S/6E and 5S/7E) generally declined during 1979-86. Note particularly that wells 5S/7E-16C1, -19H2, and -30C2 at the southern boundary of the model area have been declining at an average rate of 1 to 3 ft/yr. In the original modeling studies (Tyley, 1974; Swain, 1978), hydraulic heads in this area were assumed to be constant.

Regional Ground-Water Quality

A regional water-quality issue in the upper valley is the effect of the artificially recharged Colorado River water on the quality of the native ground water. The Colorado River water has a significantly higher dissolved-solids concentration (greater than 500 mg/L--see table 1) than the native water (about 200 mg/L). Dissolved-solids concentration of ground water near the artificial-recharge area generally has increased as a result of the artificial recharge (fig. 6). A map of dissolved-solids concentration of ground water sampled in autumn 1986 (fig. 7) shows that wells near each other may have markedly different dissolved-solids concentrations. As is discussed in more detail in the section, "Solute-Transport Simulations for 1979-86," these concentration differences may be due to vertical differences in solute-transport rates. Dissolved-solids concentrations tabulated by well are shown in appendix 5.

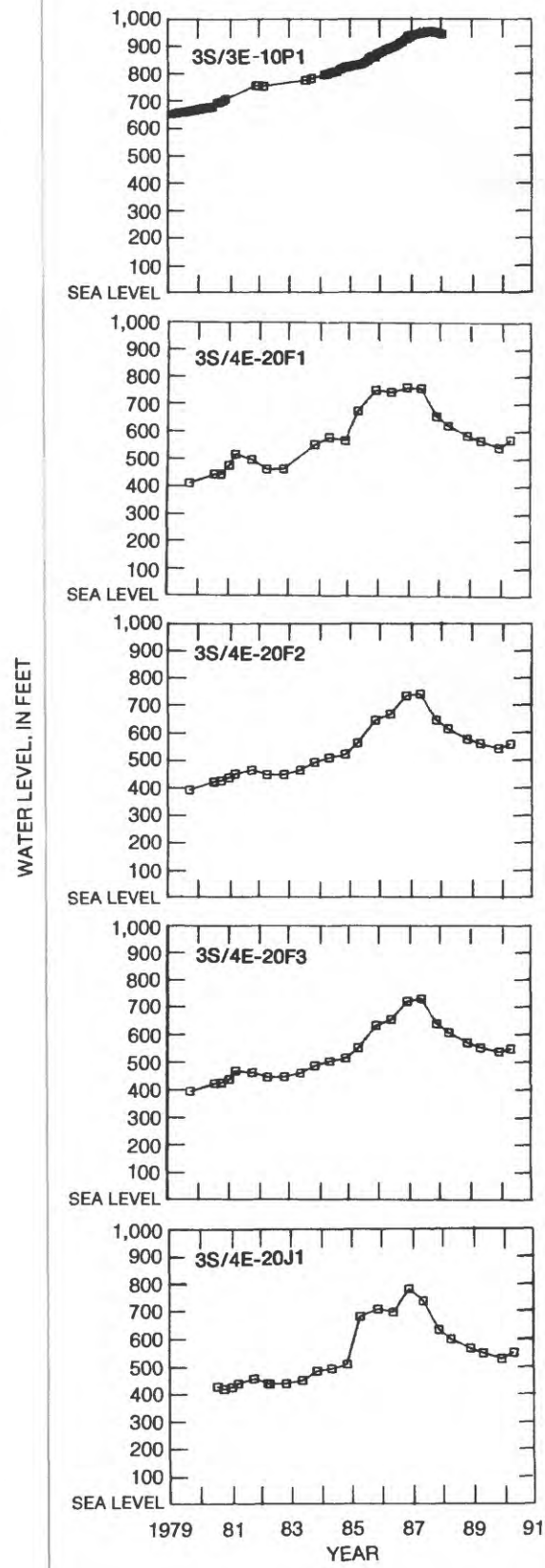


Figure 5. Water levels for selected wells in the upper Coachella Valley.

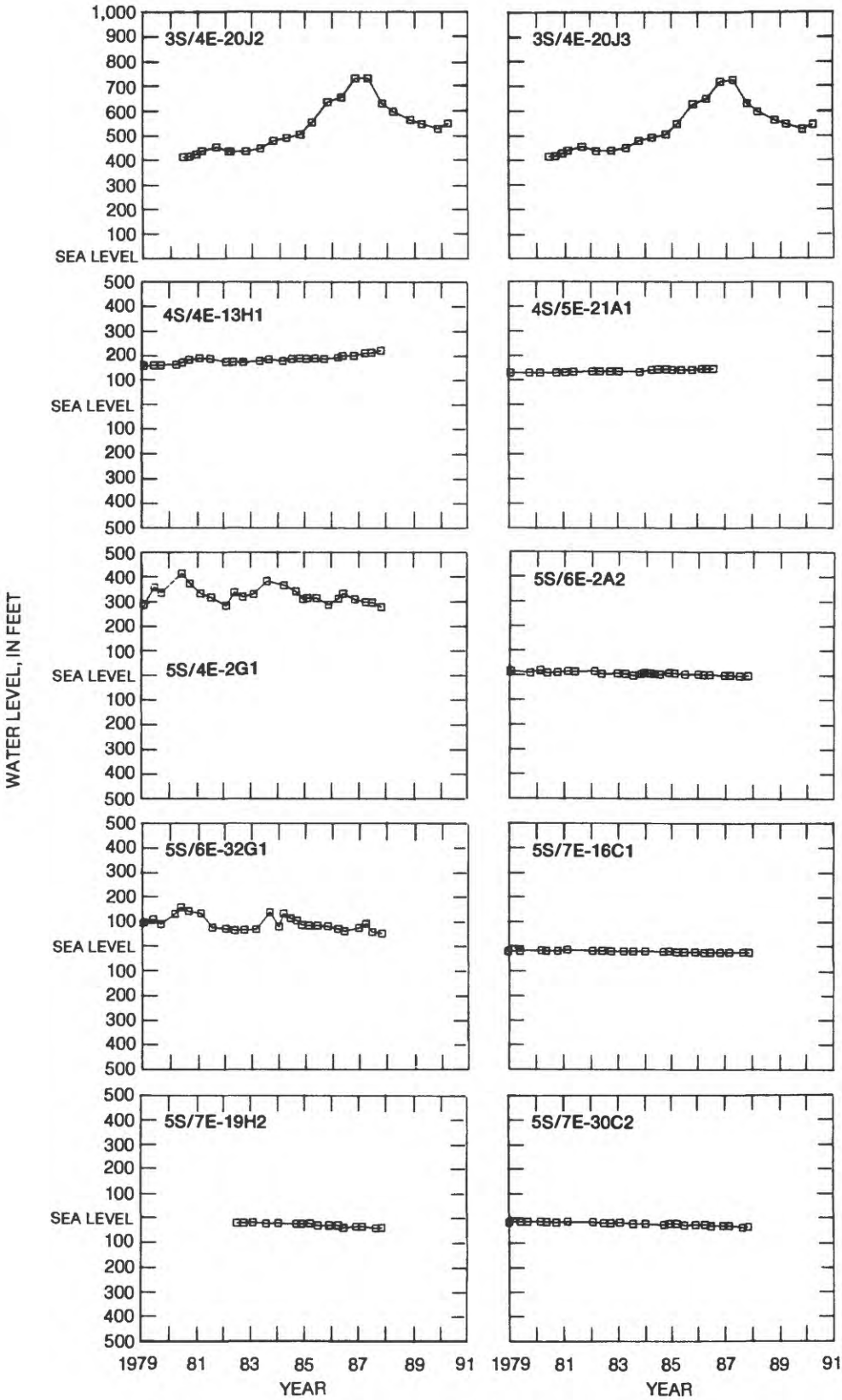


Figure 5. *Continued.*

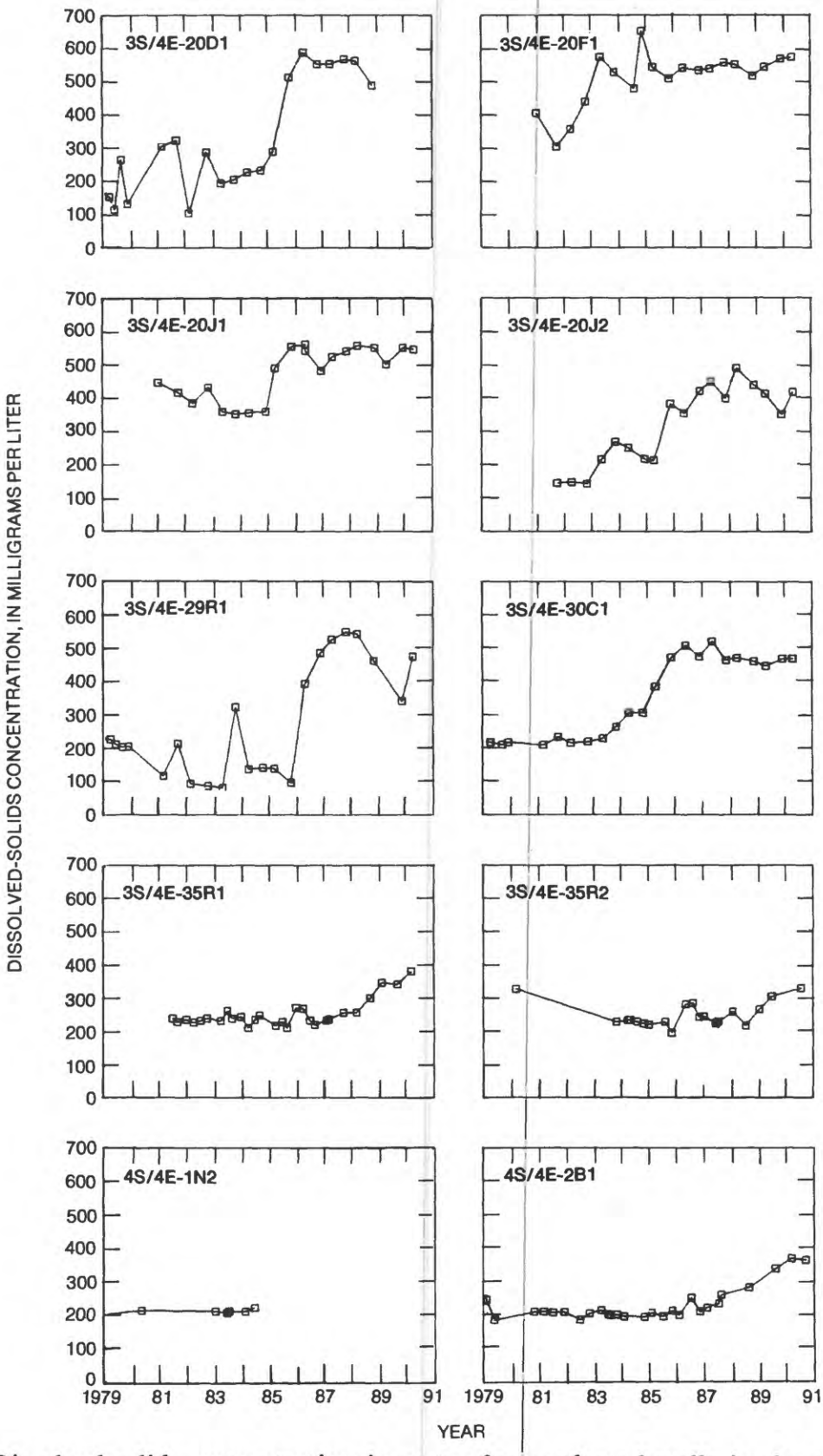


Figure 6. Dissolved-solids concentration in water from selected wells in the upper Coachella Valley.

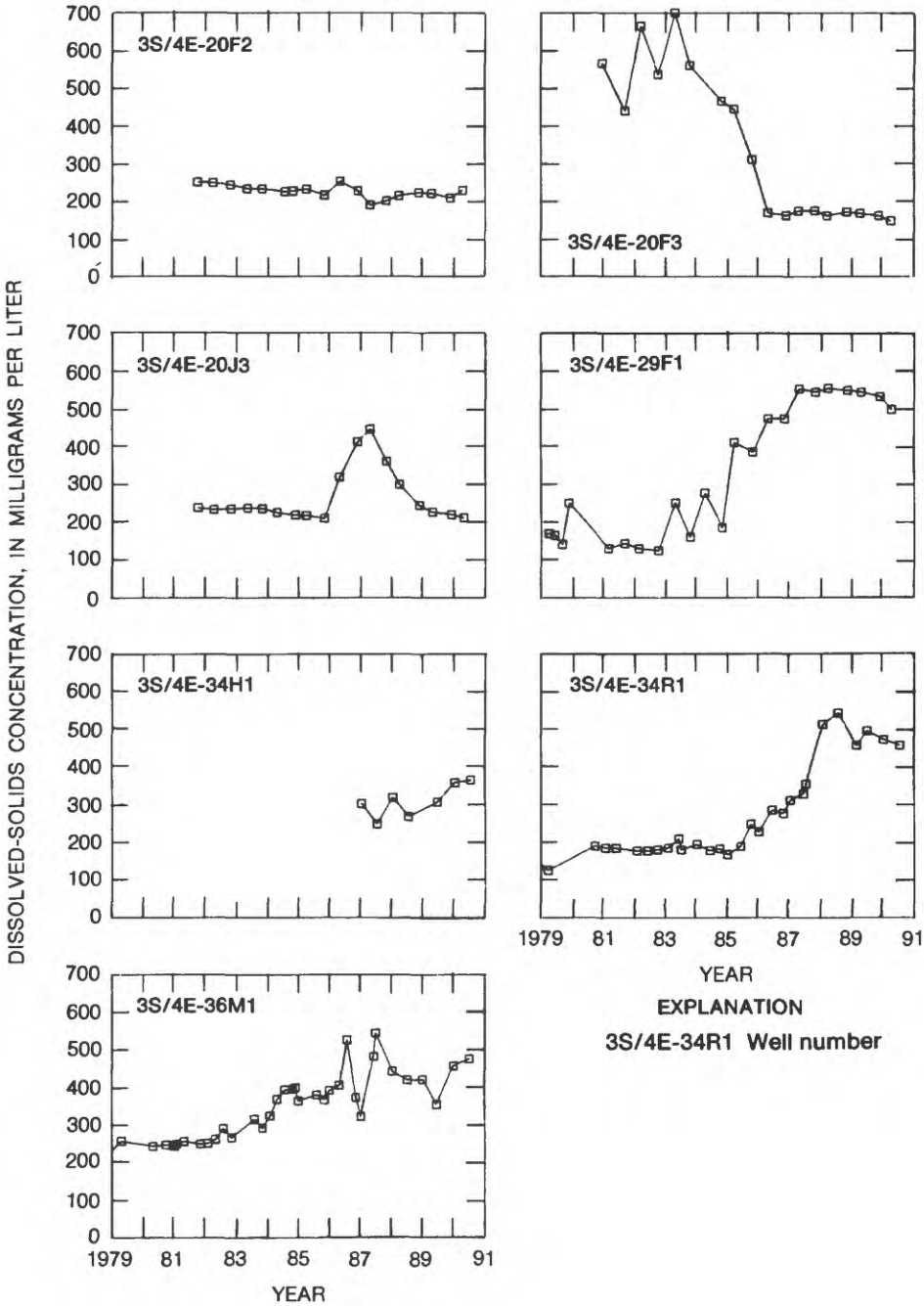


Figure 6. *Continued.*

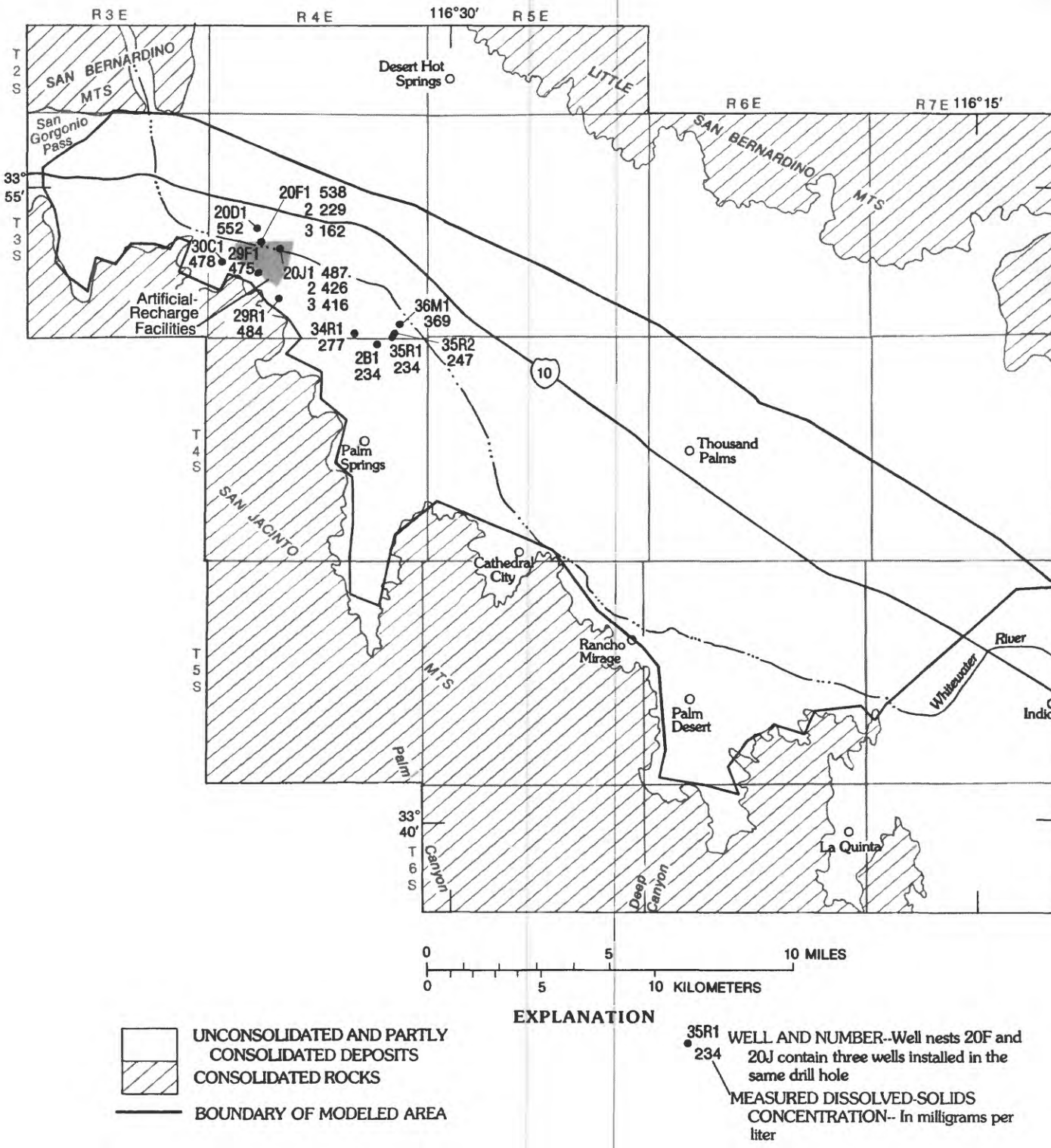


Figure 7. Dissolved-solids concentration in water from selected wells near the artificial-recharge area, autumn 1986.

EVALUATION OF EXISTING MODEL

Description of Model

Swain (1978) developed two-dimensional finite-element models of ground-water flow and transport for the upper Coachella Valley. The flow model was based on an analog model of the same area (Tyley, 1974). An outline of the area modeled is shown in figure 1. The flow model consisted of 209 isoparametric quadrilateral elements ranging in area from 0.14 to 3.6 mi^2. Swain (1978) completed steady-state and transient calibrations of the flow model. In the steady-state calibration, recharge and transmissivity values were adjusted until simulated water levels reasonably matched measured water levels in 1936, when hydrologic conditions were assumed to be in equilibrium. In the transient calibration, storage-coefficient values were adjusted until simulated water levels reasonably matched measured water levels for the period 1936-68. The flow model was further tested by comparing simulated and measured water levels for the period 1968-74. A finer mesh (312 elements, with areas ranging from 0.015 to 0.2 mi^2) was used to model solute transport in the artificial-recharge area. Temporal water-quality data were not available for use in calibrating the transport model.

Swain used his flow and transport models to evaluate the potential effects of a proposed artificial-recharge program. Water levels and dissolved-solids concentrations were simulated using estimated rates of artificial recharge and pumpage for three time periods: 1974-80, 1981-90, and 1991-2000.

In the discussion that follows, Swain's (1978) flow model, hereafter referred to as "the existing model," is evaluated for the purposes of determining the benefits of additional modeling effort and data collection. Some changes to the existing model were necessary for the analysis; however, constructing a new model was not an objective of the study.

Conversion of Existing Model to the Computer Code SUTRA

The first step in evaluating the existing model (Swain, 1978) was to retrieve the original computer program and input files and recreate some of the original simulations. Second, in the interest of utilizing a well-documented model in current (1991) common use, the original input files were converted for use with SUTRA (Voss, 1984), a two-dimensional areal simulation computer code for ground-water flow and solute transport developed by the U.S. Geological Survey.

The mesh used for the SUTRA model, shown in figure 8, contains 255 nodes and 209 elements. The mesh is exactly the same as that used in the existing model except that nodes located on the sides of elements were eliminated. Pumpage and recharge rates assigned to side nodes in the existing model were distributed to surrounding nodes in SUTRA. Because SUTRA assigns storage properties and thickness by node and the existing model assigned them by element, the nodal values for these parameters in SUTRA were estimated as the mean of the elemental values assigned in the existing model. No other changes were required, other than renumbering of nodes.

As written, SUTRA deals with specific storage, which is a function of matrix (rock) compressibility, fluid compressibility, and porosity. Of these terms, only porosity is allowed to vary spatially in the code. In the Coachella Valley, it is necessary to simulate spatially varying aquifer storage properties. In addition, when solving the two-dimensional ground-water flow equation for a confined aquifer it is useful to input the aquifer storage coefficient directly rather than compute it as a function of its components. To address these two needs, SUTRA was modified to allow an aquifer storage coefficient to be directly input for each node. The storage-coefficient values then are converted to specific

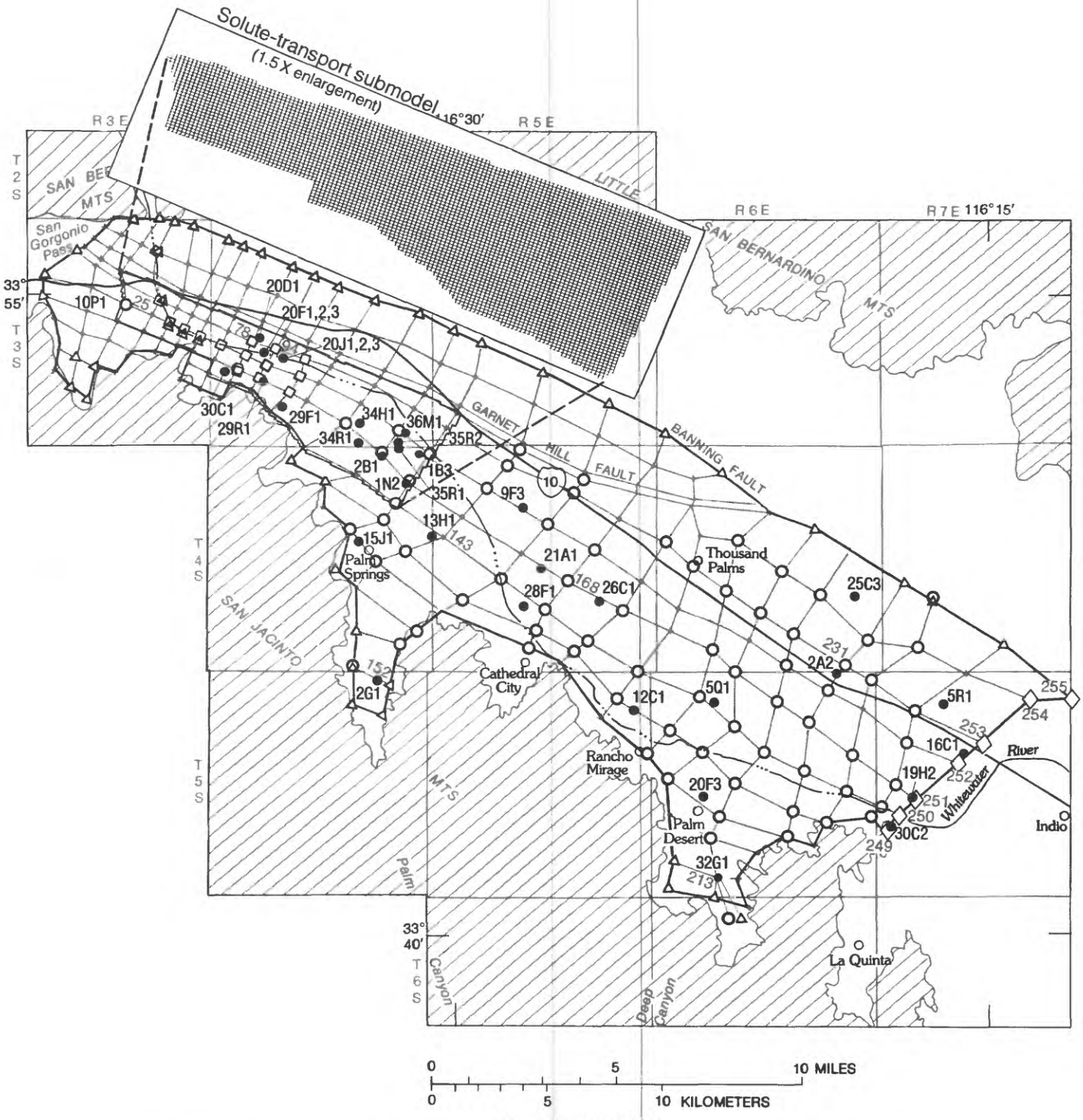


Figure 8. Model mesh, source/sink nodes, boundary conditions, and monitoring-well locations for the SUTRA model, and location of solute-transport submodel.

storage by dividing the storage coefficients by aquifer thickness. The specific changes made to the SUTRA code are discussed in appendix 6.

Hydrogeologic Parameters Used in Existing Model

Tyley (1974) established a preliminary transmissivity distribution for the upper Coachella Valley on the basis of drillers' logs and specific-capacity tests. These preliminary values then were revised and separated into aquifer saturated thickness and hydraulic conductivity as part of the steady-state model calibrations of both Tyley (1974) and Swain (1978). These values are shown in figures 9 and 10. The hydraulic-conductivity values were not modified in this study. As is discussed below, the saturated thickness values in the artificial-recharge area were increased to reflect the effects of rising water levels.

Tyley (1974) derived a preliminary distribution for storage coefficient that was based on a qualitative analysis of the depositional system of the valley. Swain (1978) modified this distribution in the course of transient-model calibration. The storage-coefficient distribution used by Swain (1978) is shown in figure 11. As is discussed below, this distribution was modified in the modeling for this study.

Reproduction, Using SUTRA, of Previous Existing-Model Simulations

To test the success of the conversion of the existing two-dimensional flow model to a two-dimensional SUTRA code, several of the scenarios described by Swain (1978) were simulated. A plot of steady-state (1936) water levels simulated by SUTRA is shown in figure 12. The discontinuity of the water-level contours reflects the barrier effect of the Garnet Hill fault. These results closely match the map of 1936 water levels (assumed to represent steady-state conditions) presented by Tyley (1974, fig. 9). Simulated water-level changes for 1974-80, with artificial recharge, as simulated by SUTRA (fig. 13), closely match those of Swain (1978, fig. 19).

New Transient Simulations for 1979-86

After the existing model was converted to SUTRA and tested, the model was used to simulate the period 1979-86. In the 1980's, the volume of artificial recharge greatly increased (see table 1 and fig. 4). Applying the SUTRA model to this more recent time period provides a means for testing several assumptions implicit in the existing model and for improving understanding of the geohydrologic system in the upper valley.

The following changes were made to the existing-model inputs. The 1979-86 net pumpage and artificial-recharge values were input into the SUTRA model. Twenty percent of the water diverted from the Colorado River Aqueduct (see table 1), up to a maximum of 50 ft^3/s, was assumed to recharge in the Whitewater River channel upstream of the recharge facilities. On the basis of the area of the artificial-recharge facilities (700 acres), and an estimated evaporation rate of 66 to 72 in/yr (see Hely and Peck, 1964, pl. 6), 4,000 acre-ft/yr of the water diverted to the recharge facilities was assumed to evaporate. This value probably is an overestimate for evaporation in the years 1979-84, when the recharge facilities covered a smaller area and when most recharge took place during cooler, winter months. Artificial recharge is input as a source term lagged 3 months from the beginning of the year. This lag period was chosen on the basis of an analysis of hydrographs of wells in the artificial-recharge area. Initially, the only other change made to the existing model was to modify the southeastern boundary conditions. Because water levels are slowly declining in that part of the valley, the constant-head boundary used in the existing

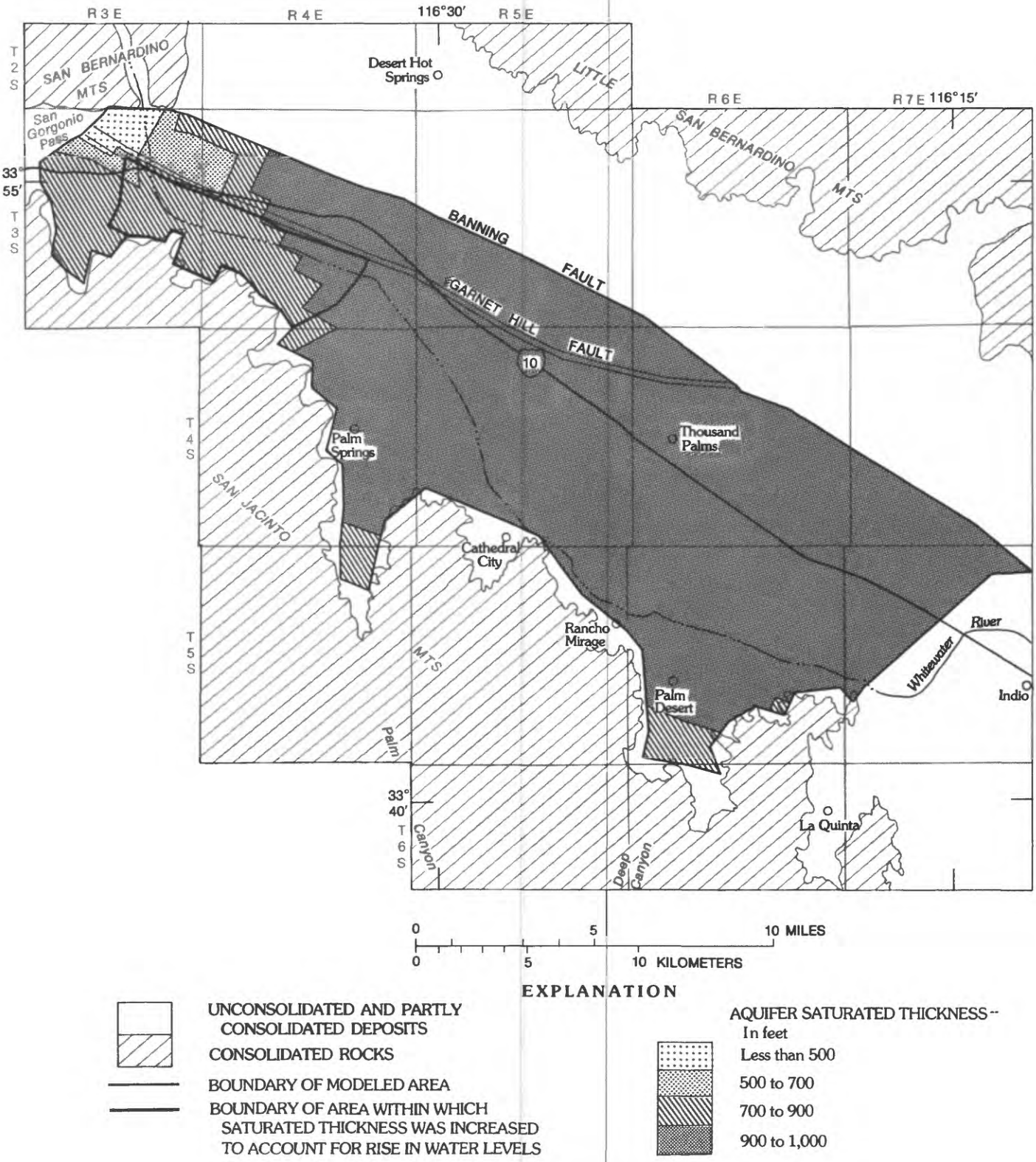


Figure 9. Aquifer saturated thickness in the model area.

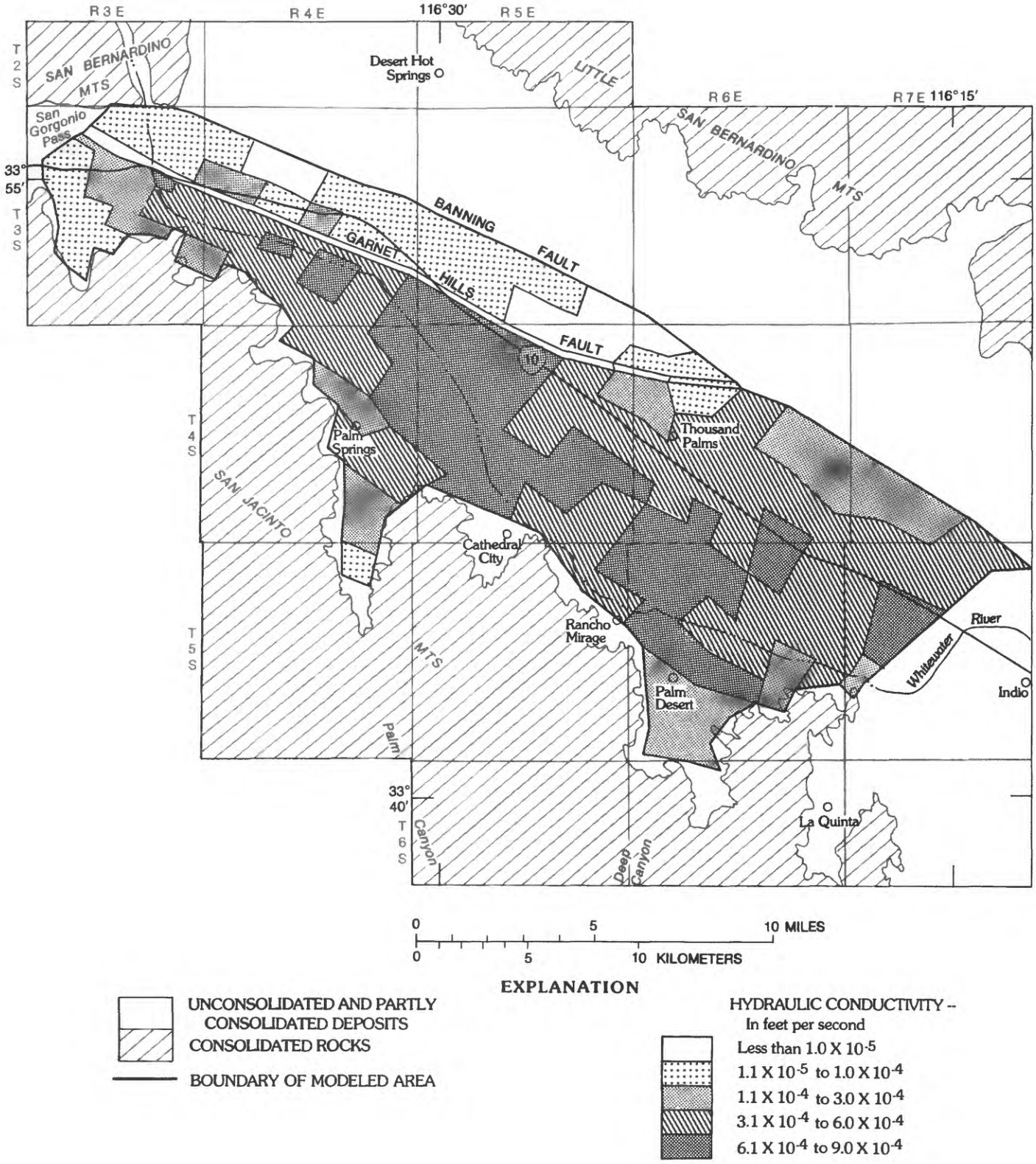


Figure 10. Hydraulic conductivity in the model area.

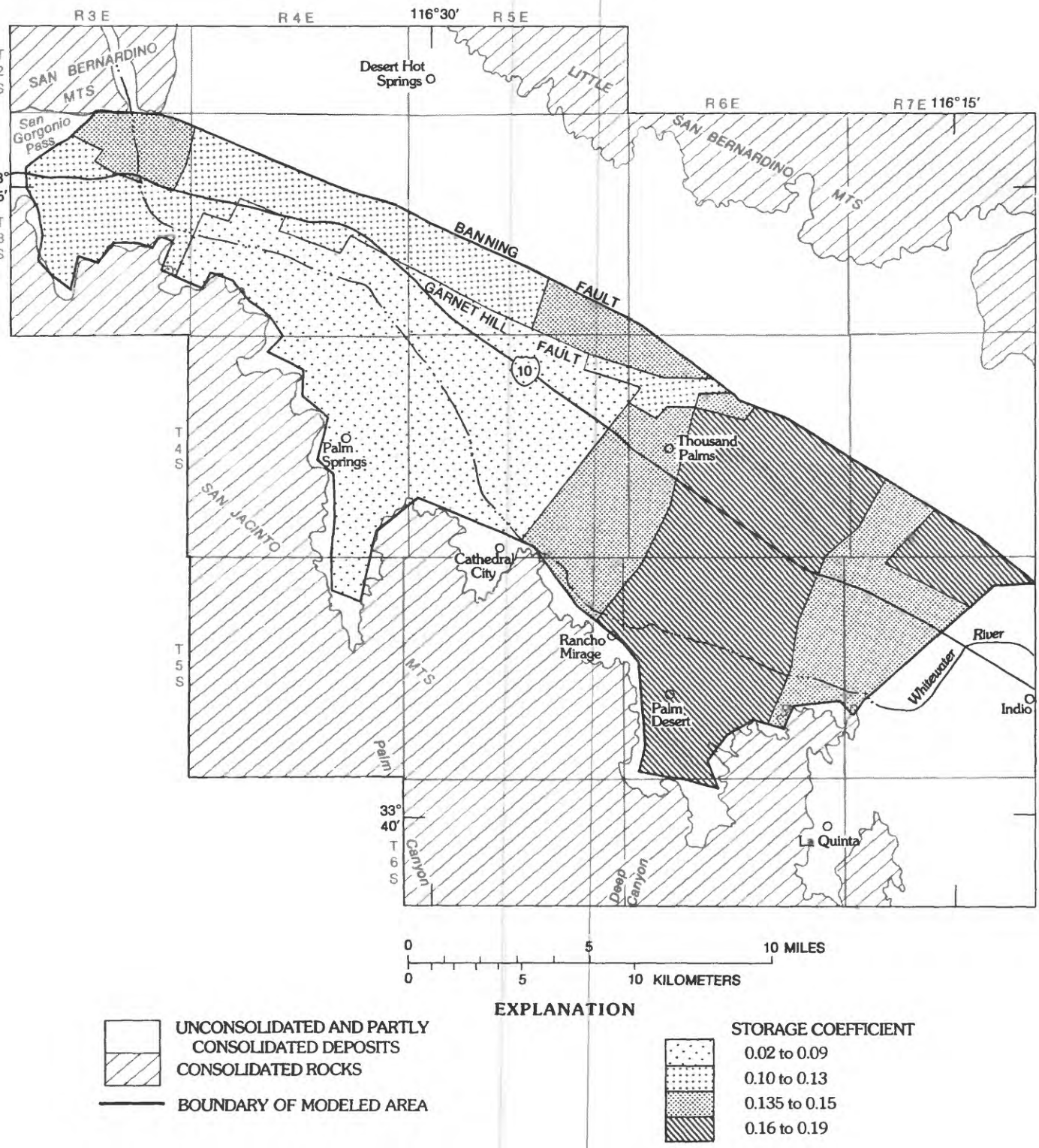


Figure 11. Storage-coefficient distribution used in existing model.

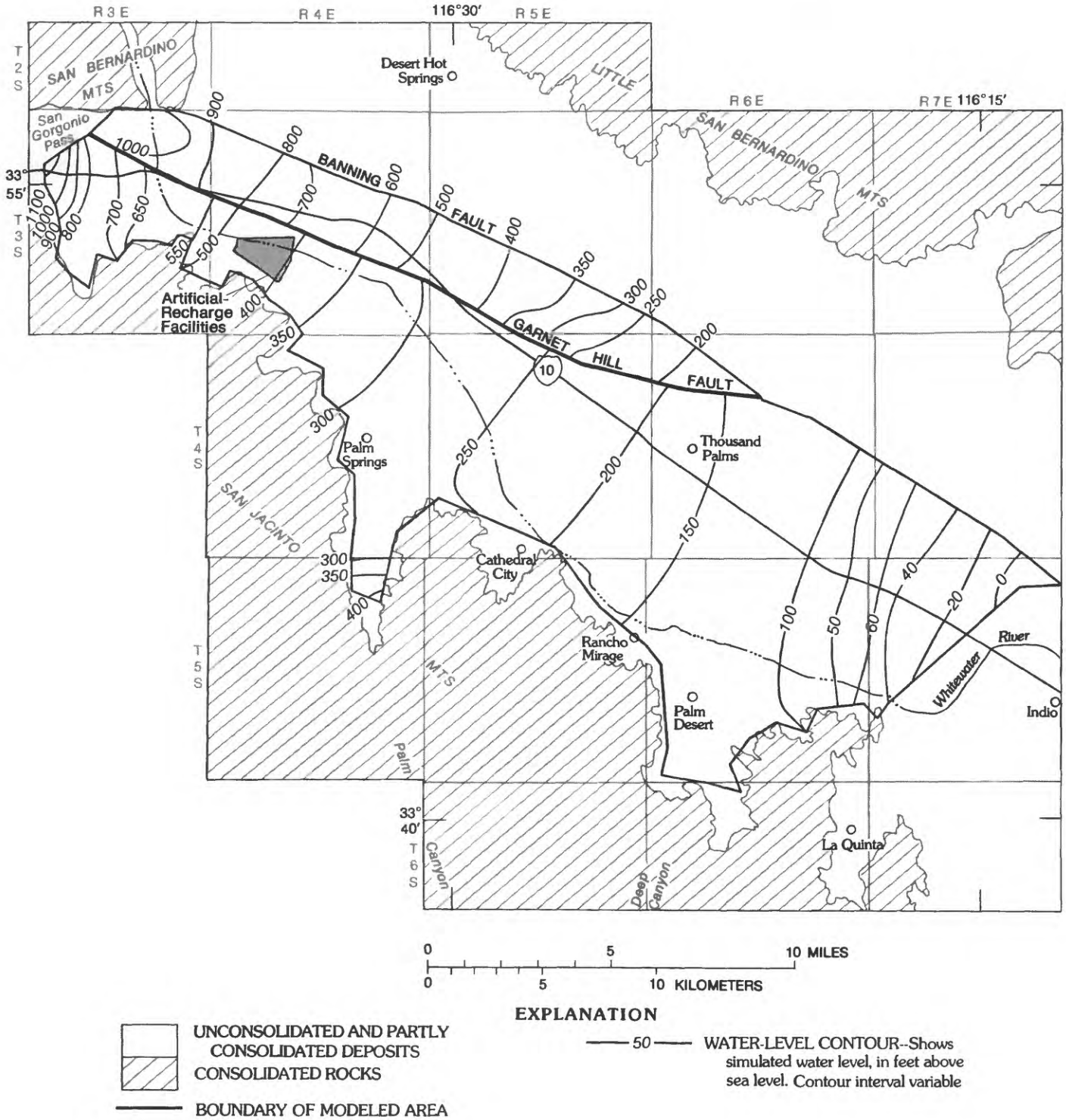


Figure 12. Simulated steady-state (1936) water levels using SUTRA model.

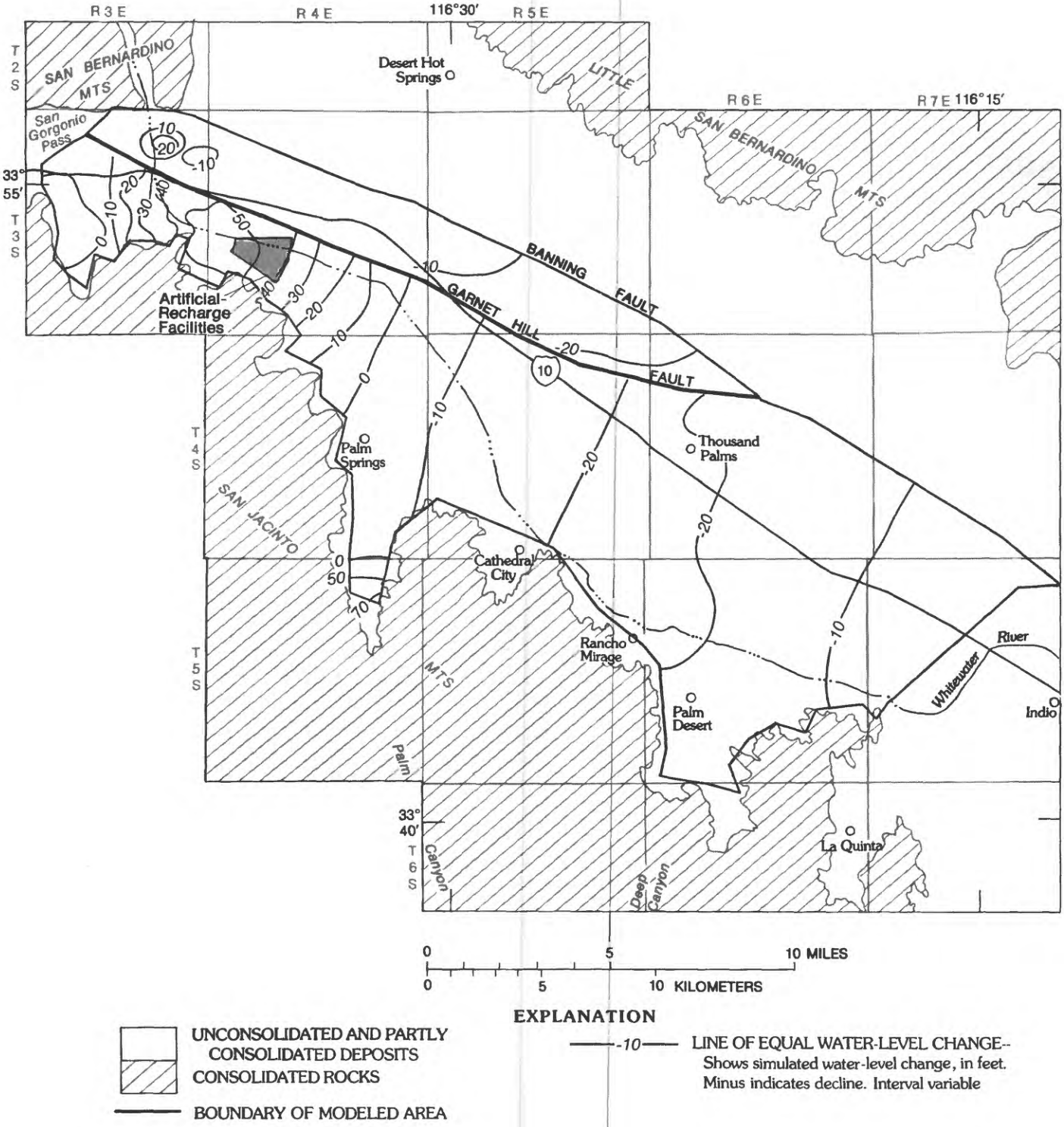


Figure 13. Simulated water-level change, 1974-80, using SUTRA model.

model is no longer valid, and it was replaced by a specified-head boundary. The heads specified for each year of the 8-year simulation period for the six nodes at the southeast end of the model are given in appendix 7. These heads were based on water levels measured at wells 5S/7E-16C1, -19H2, and -30C2 (see fig. 5). The initial head conditions for the 1979-86 simulation were generated from the 1974-80 SUTRA simulation with artificial recharge described in the previous section. The SUTRA "unit 55" input file containing these initial head values is shown in appendix 8.

For the 1979-86 simulation, simulated and measured water levels for selected wells are shown in figure 14. Simulated water levels for three wells, 3S/3E-10P1, 5S/4E-2G1, and 5S/6E-32G1, are less than measured water levels for the entire model period. The reasons for this underestimation are discussed below. The simulated water levels for other wells correlate reasonably well with measured water levels for the period 1979-84. The simulated rise in water levels in 1985 and 1986, however, is significantly larger than the measured rise (see wells 3S/4E-20D1 and -20F1, for example). There are three possible factors that may contribute to this divergence between model simulations and measured values: Transmissivity is underestimated, artificial-recharge rates are overestimated, or the storage coefficient is underestimated.

The 300- to 400-foot rise in water levels in the artificial-recharge area in 1985 and 1986 is a significant fraction of the assumed initial saturated thickness of the aquifer (see fig. 9). SUTRA, when used areally, cannot simulate conditions of varying saturated thickness. For this study, a simplified method of incorporating the effects of increased saturated thickness was employed. The saturated thickness for all model nodes in the artificial-recharge area was increased 350 ft from values previously used in the model (see fig. 9). Clearly this overestimates saturated thickness prior to 1985; however, it grossly approximates the increased transmissivity during the years with the highest recharge rates. Simulated and measured 1979-86 water levels for the same wells when the effects of increased transmissivity (an increase in saturated thickness) are considered are shown in figure 15. The simulated water-level rise in the artificial-recharge area in 1985 and 1986 still is much larger than the measured rise. Water levels are relatively insensitive to transmissivity values in this area.

Model simulations indicate that assumed artificial-recharge rates would have to be reduced to 150,000 acre-ft/yr in 1985 and 1986 to produce simulated water levels that reasonably match measured levels (see fig. 16), This implies recharge rates that are 60,000 to 100,000 acre-ft/yr lower than the rates given in table 1. However, it is unlikely that the artificial-recharge rates in table 1 are greatly overestimated. The amount of Colorado River water released into the Whitewater River is gaged, and local officials report that no water was "wasted" downstream of the ponds. Although evaporation rates are uncertain, it is not likely that 1985-86 evaporation was significantly higher than the 4,000 acre-ft/yr value used in the model.

The average infiltration rates implied by the assumed artificial-recharge quantities given in table 1 are consistent with sparse available data. For example, the recharge of 258,000 acre-ft over a 700-acre area in 1986 implies an average infiltration rate of about 1 ft/d. This is consistent with recent data collected by the Coachella Valley Water District (Levy, 1988) that indicate that the infiltration rate at a recharge pond declines from an initial value of about 20 ft/d to a long-term value of about 0.6 ft/d.

Much of the difference between simulated and measured water levels in 1985 and 1986 in the artificial-recharge area likely is due to the storage-coefficient value of 0.02 assumed in that area (see fig. 11). Storage-coefficient values

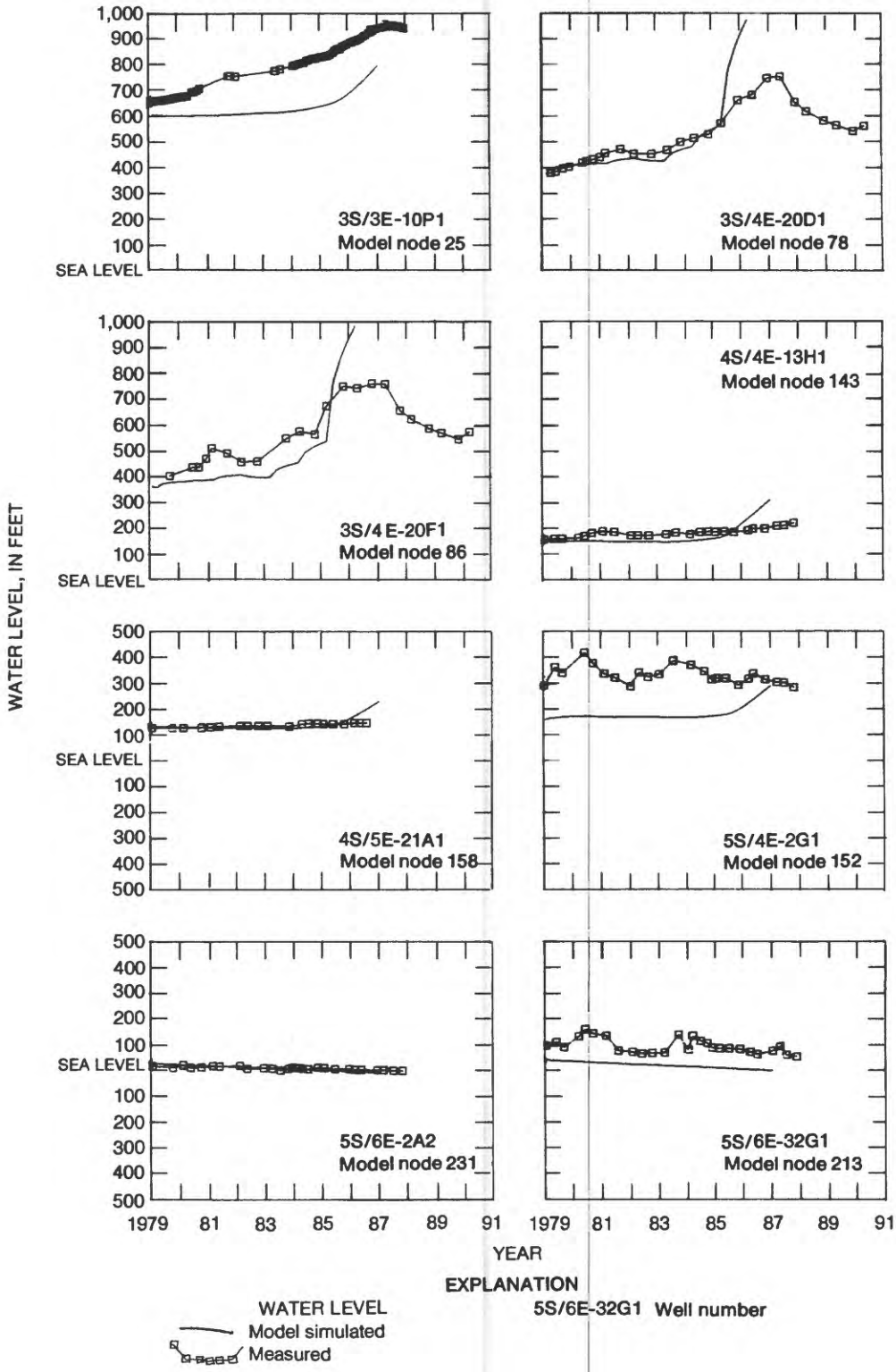


Figure 14. Simulated water levels, 1979-86, using all parameters from existing model, and measured water levels at selected wells.

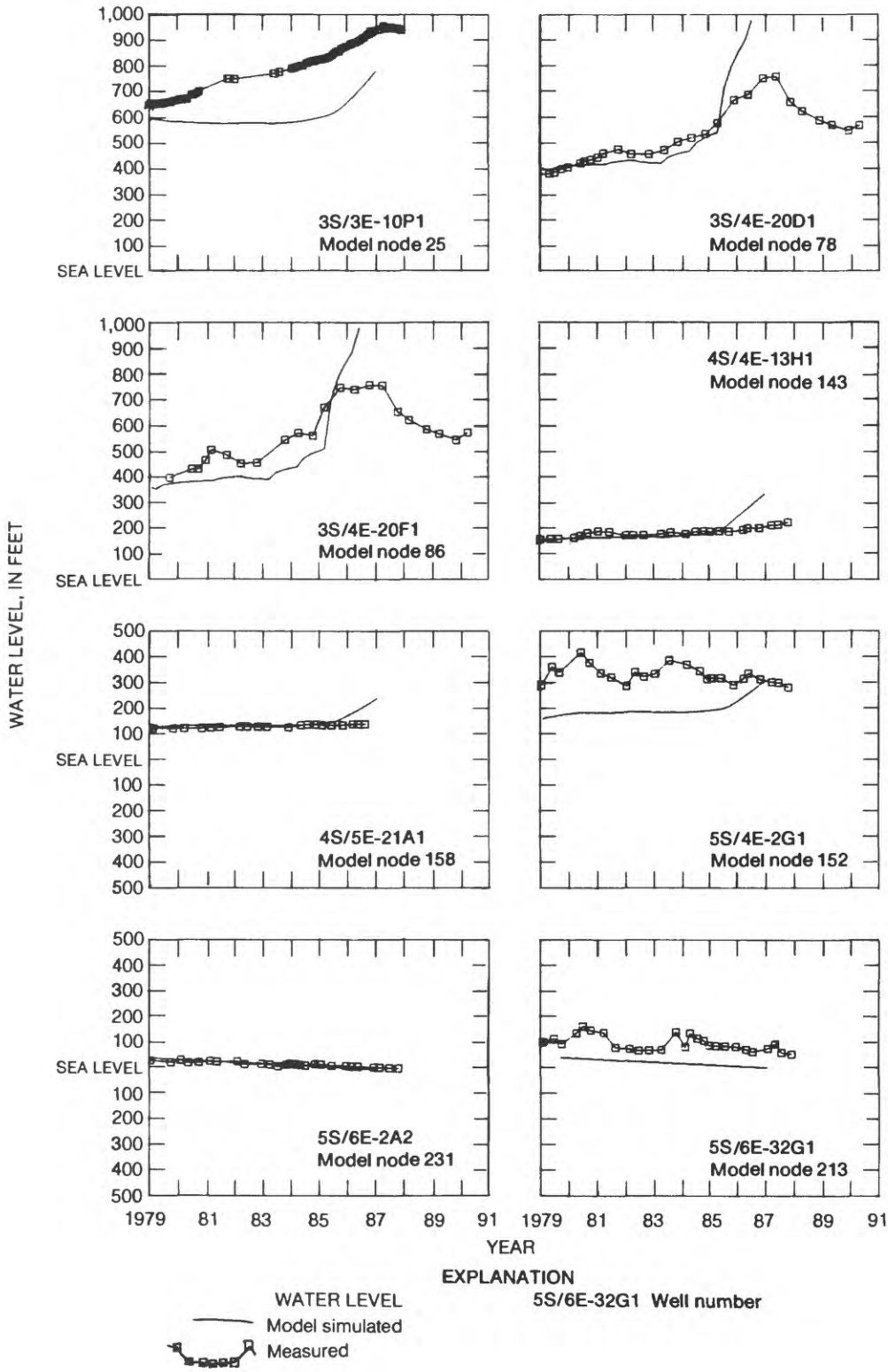


Figure 15. Simulated water levels, 1979-86, using all parameters from existing model, except assuming 350-foot increase in saturated thickness of aquifer in the artificial-recharge area, and measured water levels at selected wells.

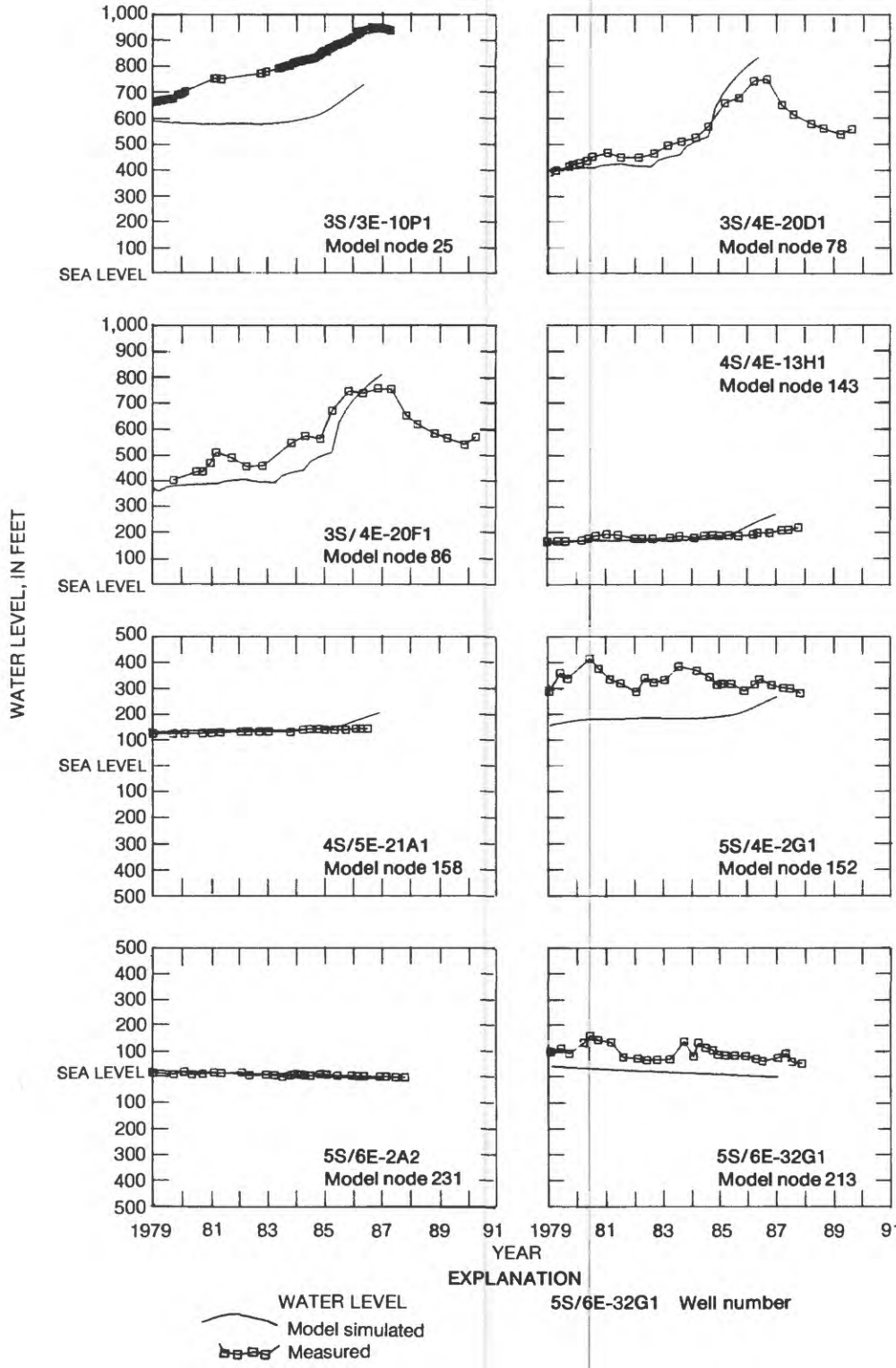


Figure 16. Simulated water levels, 1979-86, using all parameters from existing model, except assuming 350-foot increase in saturated thickness of aquifer in the artificial-recharge area and assuming a maximum of 150,000 acre-feet per year of artificial recharge, and measured water levels at selected wells.

were adjusted upward in this area to 0.10-0.15. These adjusted values were more consistent with the values in the rest of the model (0.10-0.19). The revised storage-coefficient distribution is shown in figure 17. The SUTRA "unit 5" input file for the 1979-86 simulation using this revised distribution is given in appendix 9. Simulated and measured water levels are shown in figures 18 and 19. The match in the artificial-recharge area for the high-recharge years, 1985 and 1986, is much better than that using the previous storage-coefficient distribution (see fig. 15). Note, however, that the previous storage-coefficient distribution yields a slightly better match for the years 1979-84. This illustrates the limitations of modeling a complicated hydrogeologic system (see fig. 2) with a two-dimensional model. During the period of the original model calibration and during the first years of this model application, the water levels in wells in the artificial-recharge area showed a semiconfined response, with a storage-coefficient value of approximately 0.02. However, the change in hydrologic conditions in 1985 and 1986 caused a significant change in aquifer characteristics. As much as 400 ft of previously unsaturated deposits became saturated. Water levels during that period showed an unconfined response, with storage-coefficient values of 0.10-0.15.

Model simulations carried out for this study end in 1986, because pumpage data were not available for later years. Water levels during the period 1987-89 generally declined because, as described earlier, no artificial recharge occurred from spring 1987 through autumn 1989. When such pumpage data become available, the simulation could be extended to include this period. The match between simulated and measured water-level declines for 1987-89 using the revised storage-coefficient distribution then could be evaluated.

The remainder of this report deals only with model simulations using the revised storage-coefficient distribution, because the main emphasis is on the effects of the large recharge volumes. It is recognized that this distribution yields a poorer match of simulated and measured water levels than the previous storage-coefficient distribution for 1979-84. As is discussed below, there are several other important disparities between simulated and measured water levels.

As shown in figures 18 and 19, the simulated water levels southeast of San Gorgonio Pass (see wells 3S/3E-10P1 and 3S/4E-20D1 and -20F1 for the period 1979-85) and in Palm and Deep Canyons (see wells 5S/4E-2G1 and 5S/6E-32G1) are too low. This seems to suggest that recharge from streams and underflow from San Gorgonio Pass in the 1980's has been greater than quantities assumed in the studies of Tyley (1974) and Swain (1978) (see table 1). Graphs of cumulative flow and cumulative departure from mean flow for several streams in the Coachella Valley (fig. 20) show that conditions during the mid-1970's to the mid-1980's were considerably wetter than those in the late 1960's and early 1970's when Tyley's and Swain's studies were carried out. Years 1980 and 1983 were particularly wet.

The underestimation of water levels by the model southeast of San Gorgonio Pass suggests that artificial recharge, at least during 1979-85, had a greater effect on water levels in that area than was calculated using the model. This indicates that the spatial distribution of artificial recharge used in the model may be incorrect.

Solute-Transport Simulations for 1979-86

The effect on water quality of the artificial-recharge water of higher dissolved-solids concentration was simulated with SUTRA using a smaller solute-transport submodel (see fig. 8). The model mesh contains 4,742 nodes and 4,552 elements with dimensions of 300 by 400 ft. The nodes on the northwest and southeast boundaries of the submodel were set as time-varying specified-head boundaries on the

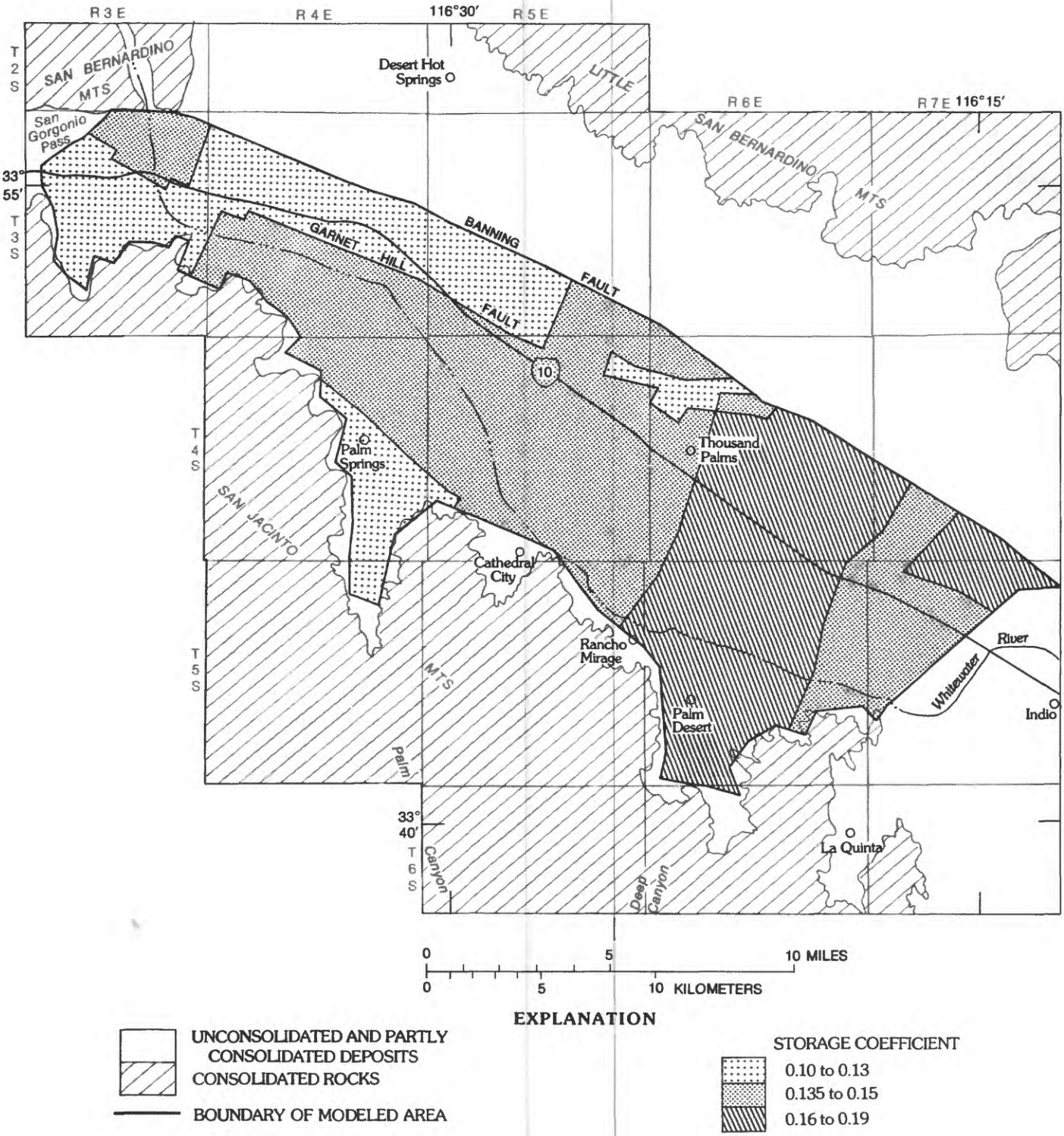


Figure 17. Revised storage-coefficient distribution used in SUTRA model.

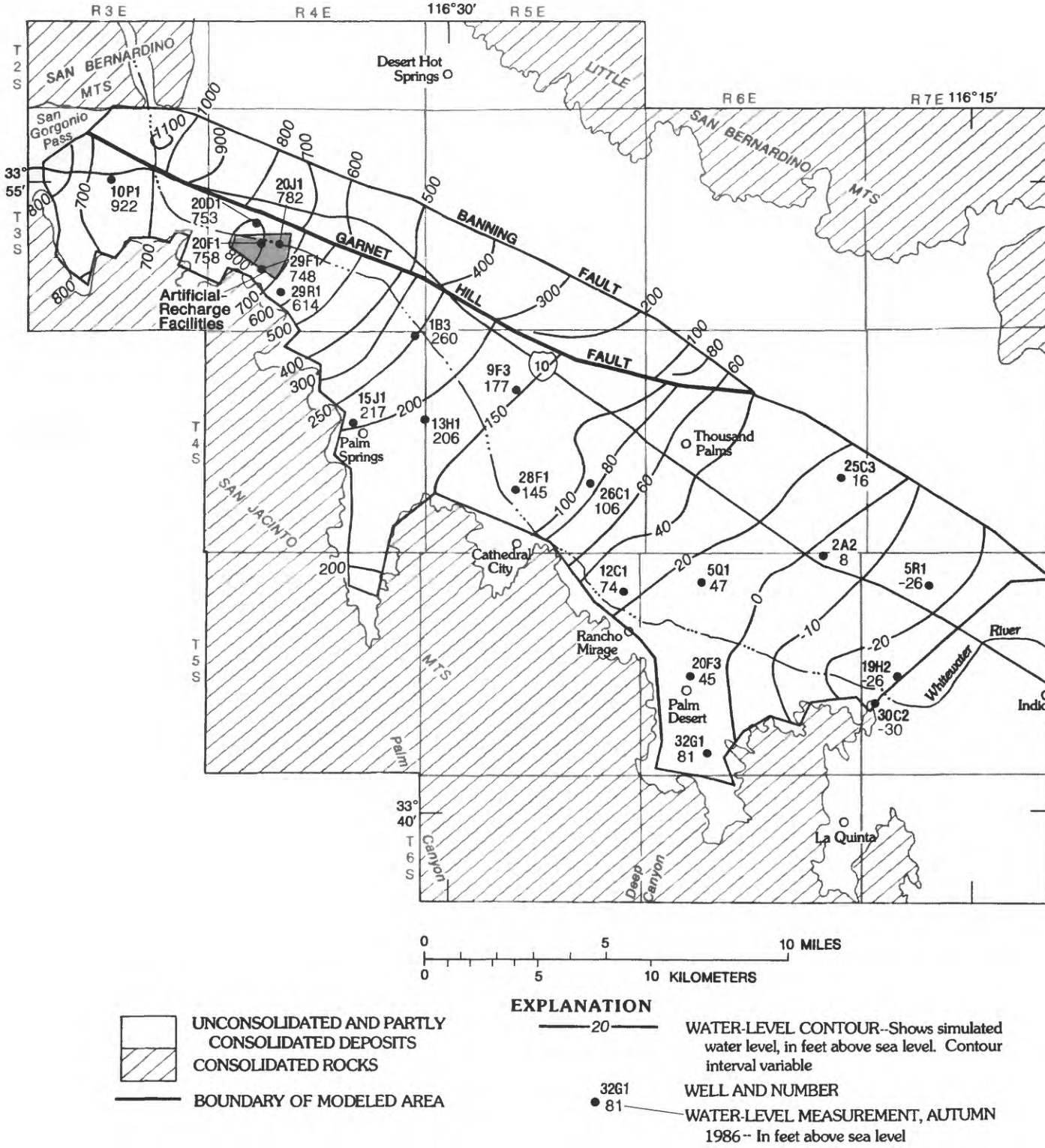


Figure 18. Simulated water levels, with revised storage-coefficient distribution used in SUTRA model, and measured water levels, autumn 1986.

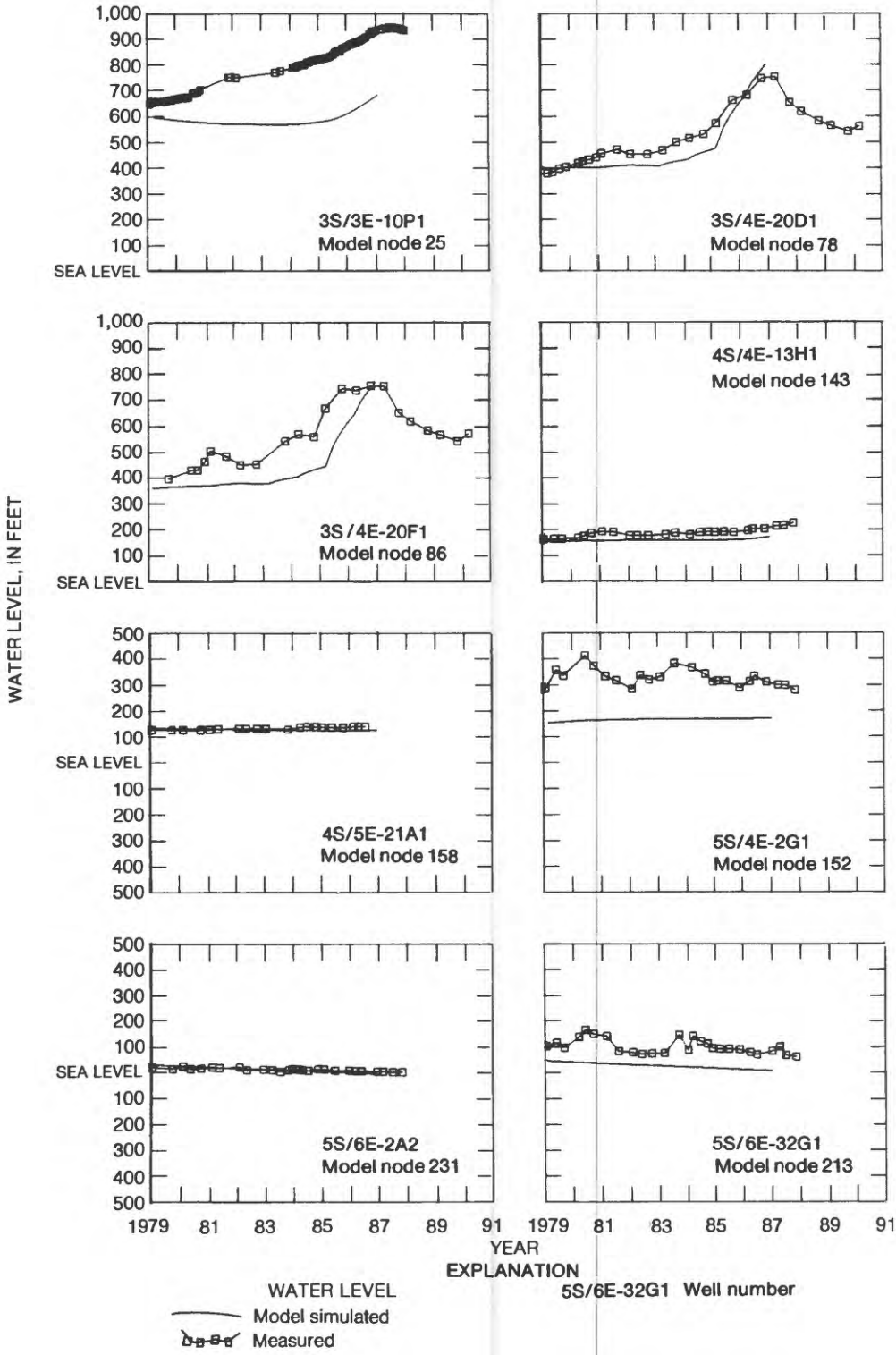


Figure 19. Simulated water levels, 1979-86, with revised storage-coefficient distribution used in SUTRA model, and measured water levels at selected wells.

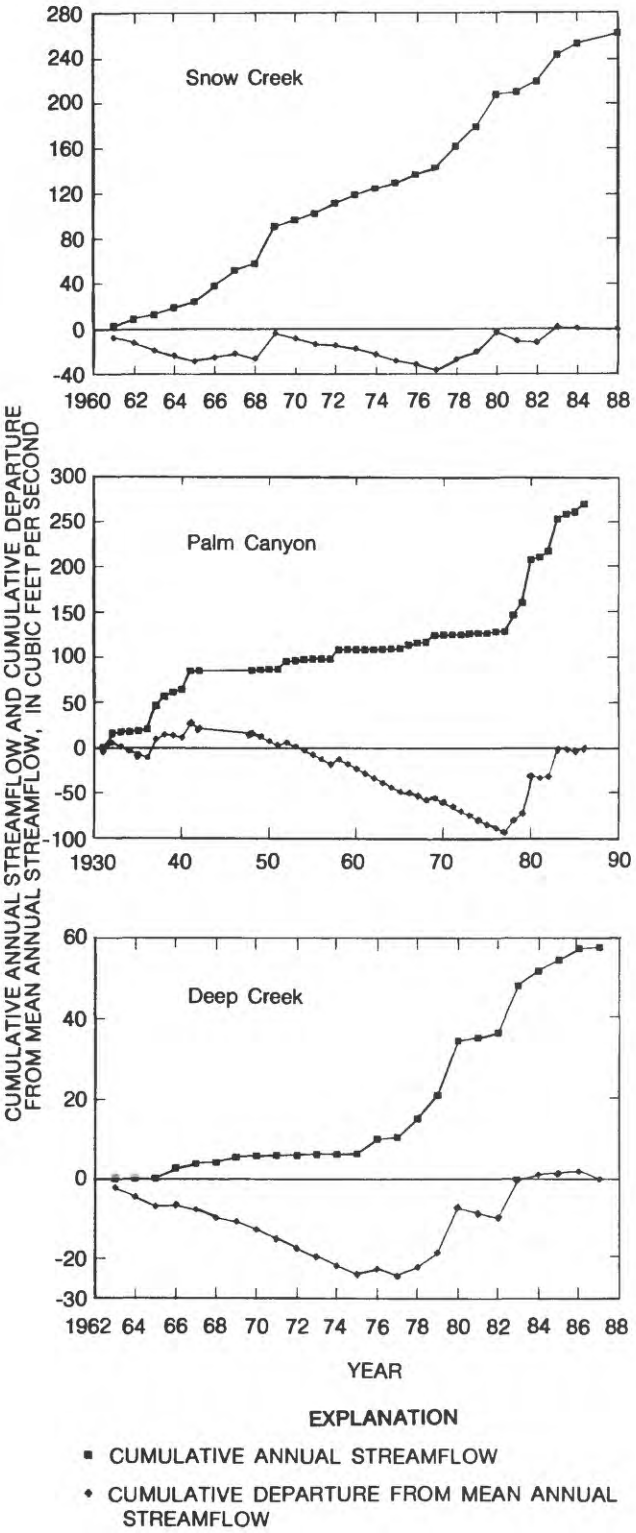


Figure 20. Cumulative annual flow and cumulative departure from mean annual flow for three Coachella Valley streams.

basis of results from the flow model just described. The northeast and southwest boundaries were set as no-flow boundaries. Specifying the northeast boundary, the Banning fault, as a no-flow boundary does not account for the outflow of artificial-recharge water that occurs across the fault. The boundary condition was chosen for reasons of numerical stability in the simulation. Submodel simulations were carried out in which this northeast boundary was set as a time-varying specified-head boundary rather than a no-flow boundary. The concentrations that were produced by these simulations were similar to the concentrations obtained using a no-flow boundary, except that numerical instabilities led to unreasonable computed concentration values near that boundary. The parameter values and source-sink rates from the flow model were used. Stresses from the flow model had to be distributed among nodes representing the same area in the submodel. Assuming no chemical reactions, SUTRA can be used to solve the two-dimensional advection dispersion equation (see Konikow and Bredehoeft, 1978, p. 5-6). Swain's (1978) values for porosity (0.25), longitudinal dispersivity (100 ft), and transverse dispersivity (33 ft) were used.

The solute-transport submodel was used to simulate the increase in dissolved solids resulting from artificial recharge during 1979-86. Initial dissolved-solids concentration in ground water was assumed to be 200 mg/L. Simulated and measured dissolved-solids concentrations at selected wells are shown in figures 21 and 22. The perforated intervals of these wells are shown in figure 23 superimposed on geologic section *B-B'* (line of section is shown in fig. 21).

As shown in figures 21 and 22, the model poorly simulates changes in dissolved-solids concentration. The high-dissolved-solids recharge water is moving much faster than is simulated by the model. For example, dissolved-solids concentration clearly increased in wells

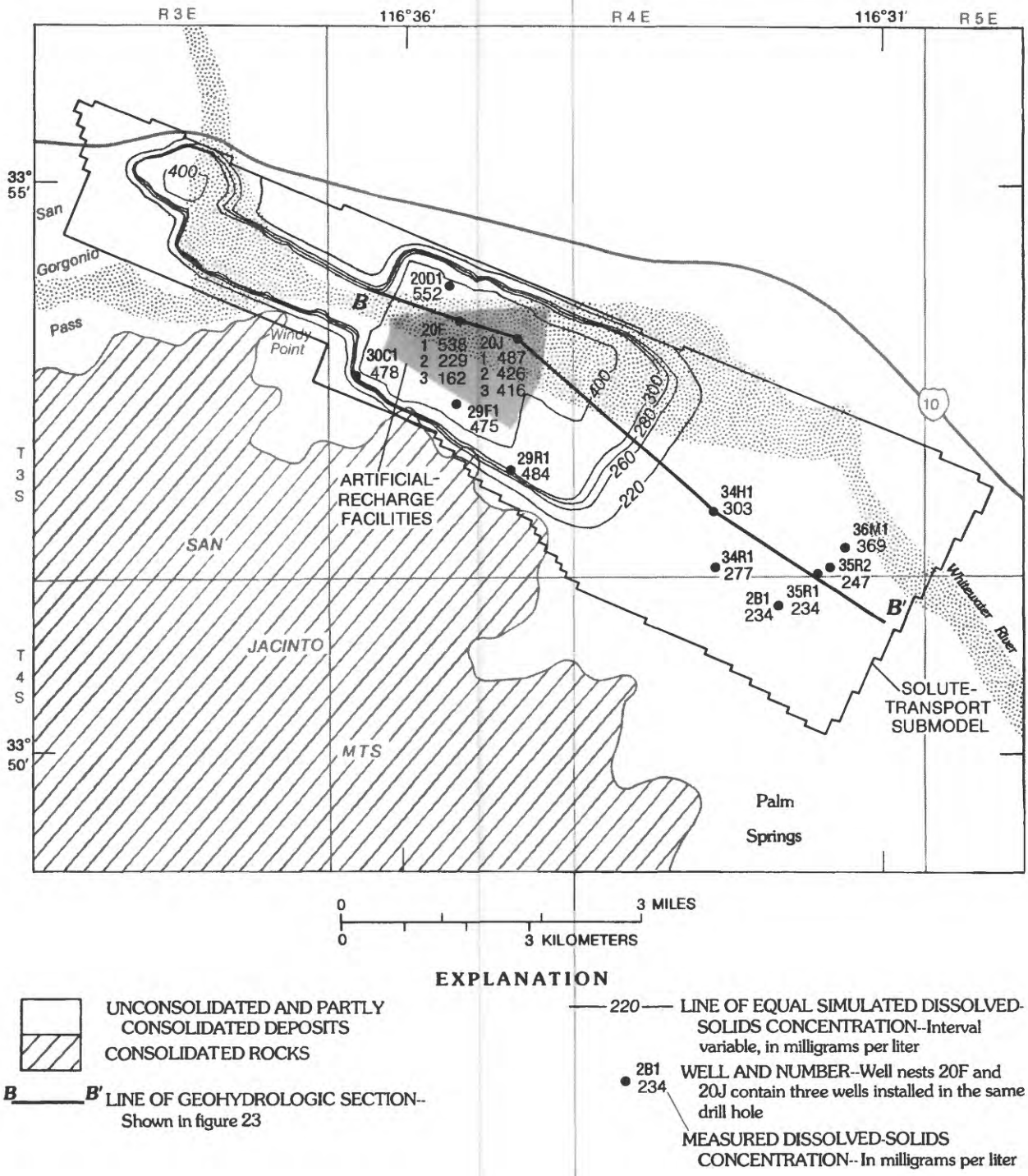


Figure 21. Simulated and measured dissolved-solids concentration, autumn 1986, for base-case simulation using the solute-transport submodel.

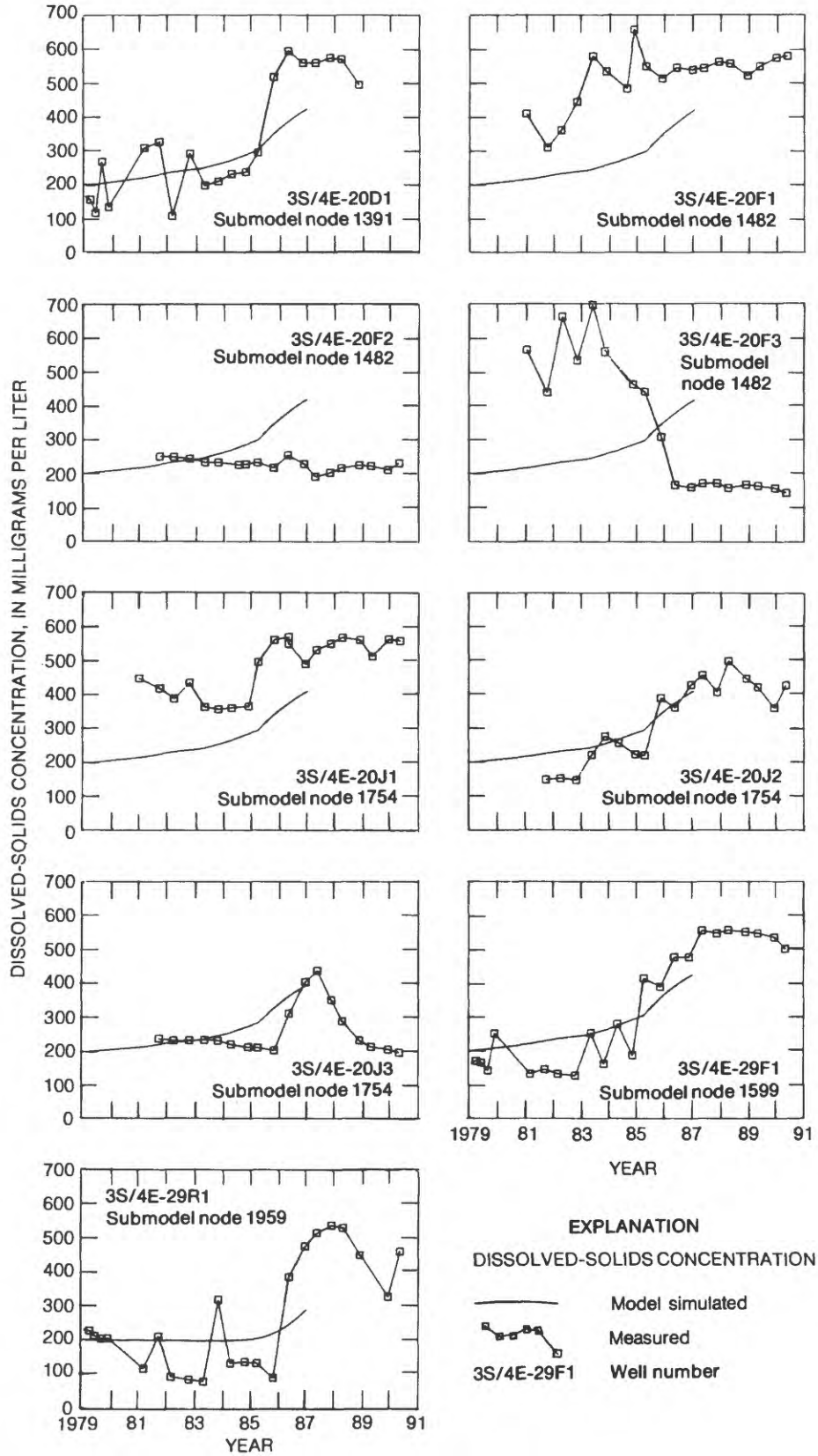


Figure 22. Simulated dissolved-solids concentration, 1979-86, for base-case simulation, and measured dissolved-solids concentration in water from selected wells--*Continued on page 34.*

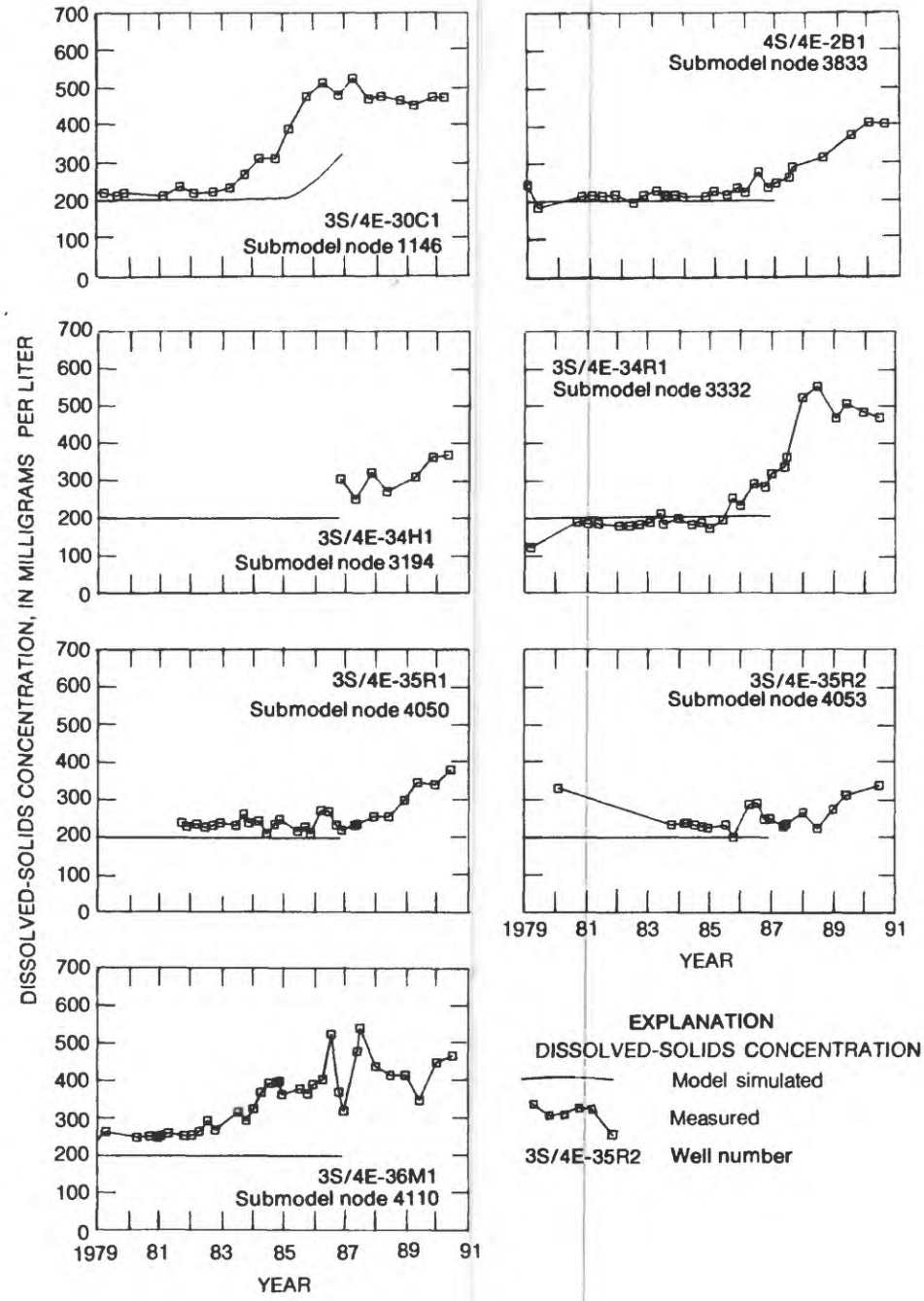


Figure 22. Simulated dissolved-solids concentration, 1979-86, for base-case simulation, and measured dissolved-solids concentration in water from selected wells--*Continued*.

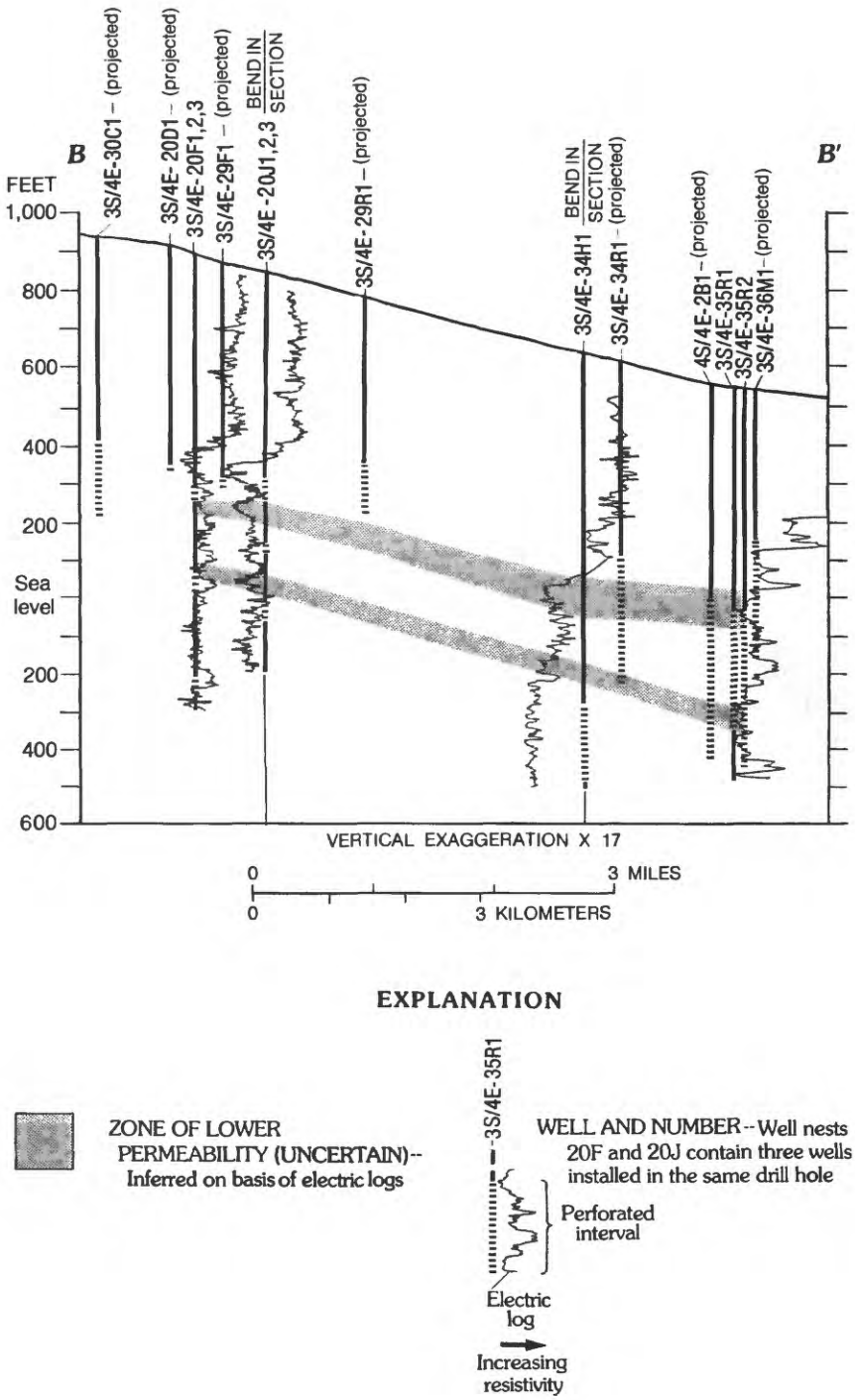


Figure 23. Generalized geohydrologic section showing perforated intervals of wells near the artificial-recharge area.

3S/4E-34R1 and -36M1 during the model-simulation period.

Examination of figure 23, along with the measured water-quality data, yields a possible explanation for this faster-than-expected rise in dissolved-solids concentration at some downgradient wells and for the differences in water-quality responses among wells in the same area. The suggested explanation is that the recharge water is moving much more rapidly through the uppermost part of the ground-water system than through deeper parts.

In the artificial-recharge area, all the shallow wells--those with perforations above the uppermost zone of lower permeability in figure 23--show significant increases in dissolved-solids concentration. The two multilevel well nests (3S/4E-20F and -20J) provide information on the vertical differences in water quality in the artificial-recharge area. Each nest consists of three wells installed in the same drill hole. Dissolved-solids concentration of water from well 3S/4E-20F1 perforated at a shallow depth in nest 3S/4E-20F rose in response to the artificial recharge. The other two wells (3S/4E-20F2 and -20F3), perforated at greater depths, seem to show no concentration increase. The initially high dissolved-solids concentration in well 3S/4E-20F3 may be due to a different source, such as residual drilling mud, because these two wells were not fully developed until 1986. The dissolved-solids concentration of water from three wells in nest 3S/4E-20J increased during 1983-87; however, the concentration increase took longer to reach wells at greater depths, and the increase diminished in magnitude with depth.

Wells 3S/4E-34H1, -34R1, -35R1, -35R2, -36M1, and 4S/4E-2B1 are downgradient from the artificial-recharge area. Water from wells 3S/4E-34R1 and -36M1, which have the shallowest perforations, had the most rapid rise in dissolved-solids concentration. Water from wells 3S/4E-35R1, -35R2, and 4S/4E-2B1, which have slightly deeper perforations, had a more delayed water-quality response. Water from well 3S/4E-34H1, which has the deepest perforations, had a water-quality response similar to those of 3S/4E-35R1 and -35R2, although well 3S/4E-34H1 is about a mile closer to the recharge area. Any analysis of water quality at these six downgradient wells is complicated by the fact that they all are pumped wells. Water-quality differences among these wells may be due partly to differences in pumping rates (see appendix 2).

The sparse water-quality data suggest that transport occurs in the upper part of the aquifer at rates much higher than those predicted by the solute-transport submodel, which is a two-dimensional areal model that assumes complete mixing through the entire depth of the aquifer. The existing model, however, can be used as a tool to qualitatively demonstrate the transport effects of a much more permeable upper zone. A second transport simulation was completed in which it was assumed that all flow occurs in the upper 20 percent of the aquifer. In model input, all thicknesses were divided by 5 and all conductivities were multiplied by 5 to maintain the same transmissivity. Storage-coefficient values were not affected (see appendix 6).

Measured dissolved-solids concentrations and those simulated when it is assumed that all transport occurs in the upper (20 percent) part of the aquifer are shown in figures 24 and 25. For several wells, this assumption seems to yield model results closer to measured values than those simulated under the assumption of complete mixing through the entire depth of the aquifer (see figs. 21 and 22). This is particularly true for the shallow wells in the artificial-recharge area. For downgradient wells (3S/4E-34H1, -34R1, -35R1, -35R2, -36M1, and 4S/4E-2B1), there is a divergence between simulated and measured dissolved-solids concentrations

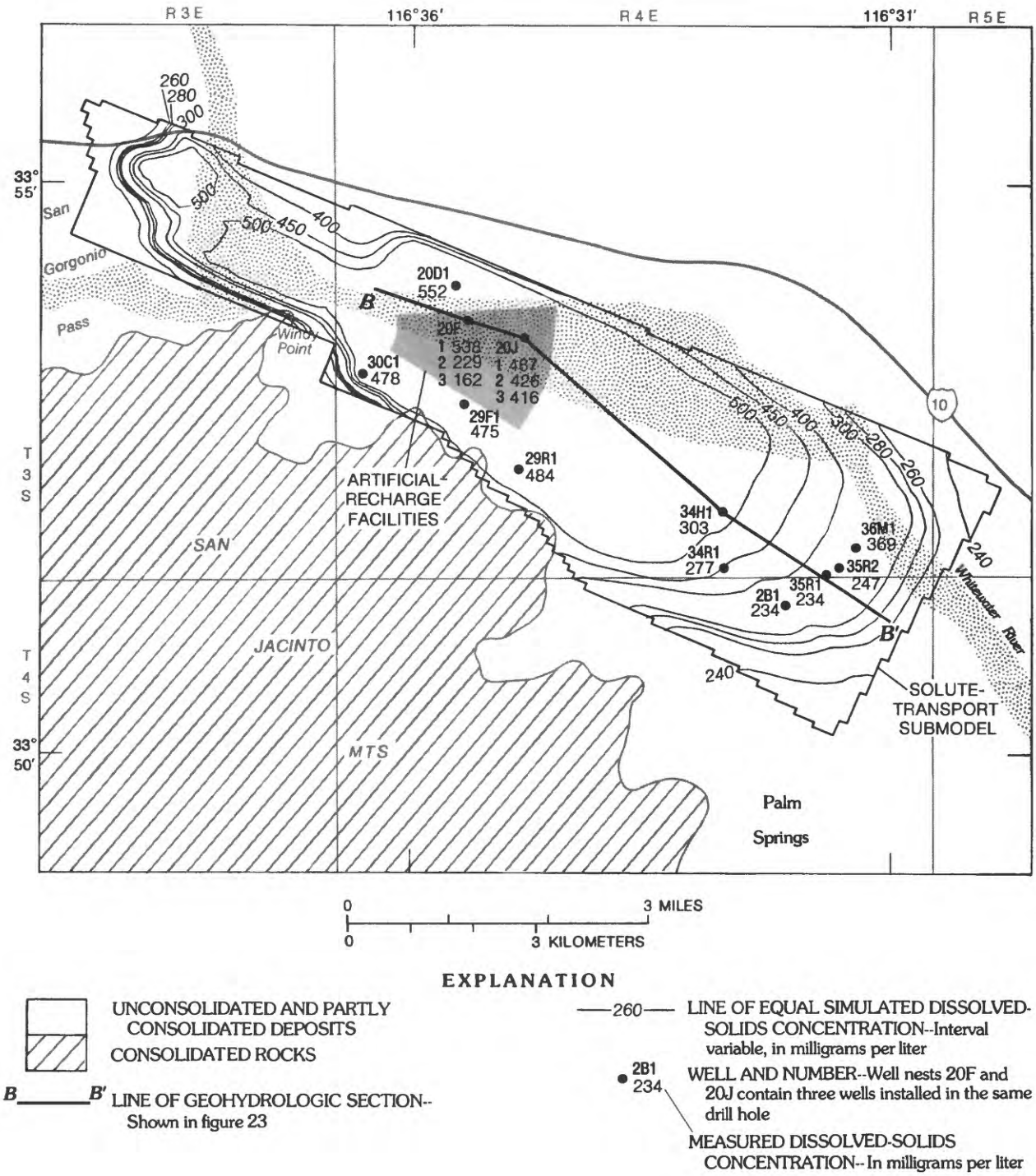


Figure 24. Simulated dissolved-solids concentration, assuming that all transport occurs in the upper 20 percent of the aquifer, and measured dissolved-solids concentration, autumn 1986.

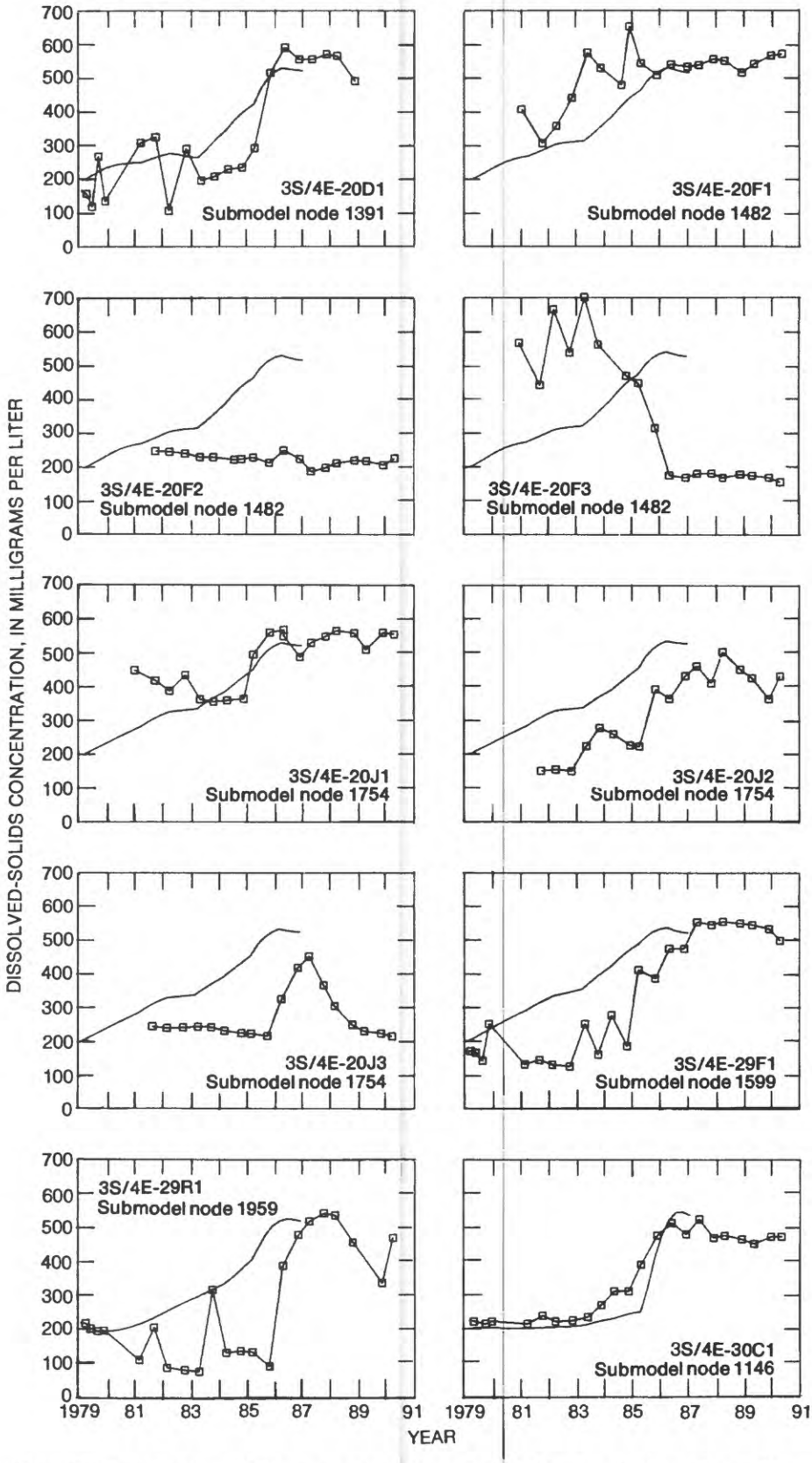


Figure 25. Simulated dissolved-solids concentration, 1979-86, assuming that all transport occurs in the upper 20 percent of the aquifer, and measured dissolved-solids concentration at selected wells.

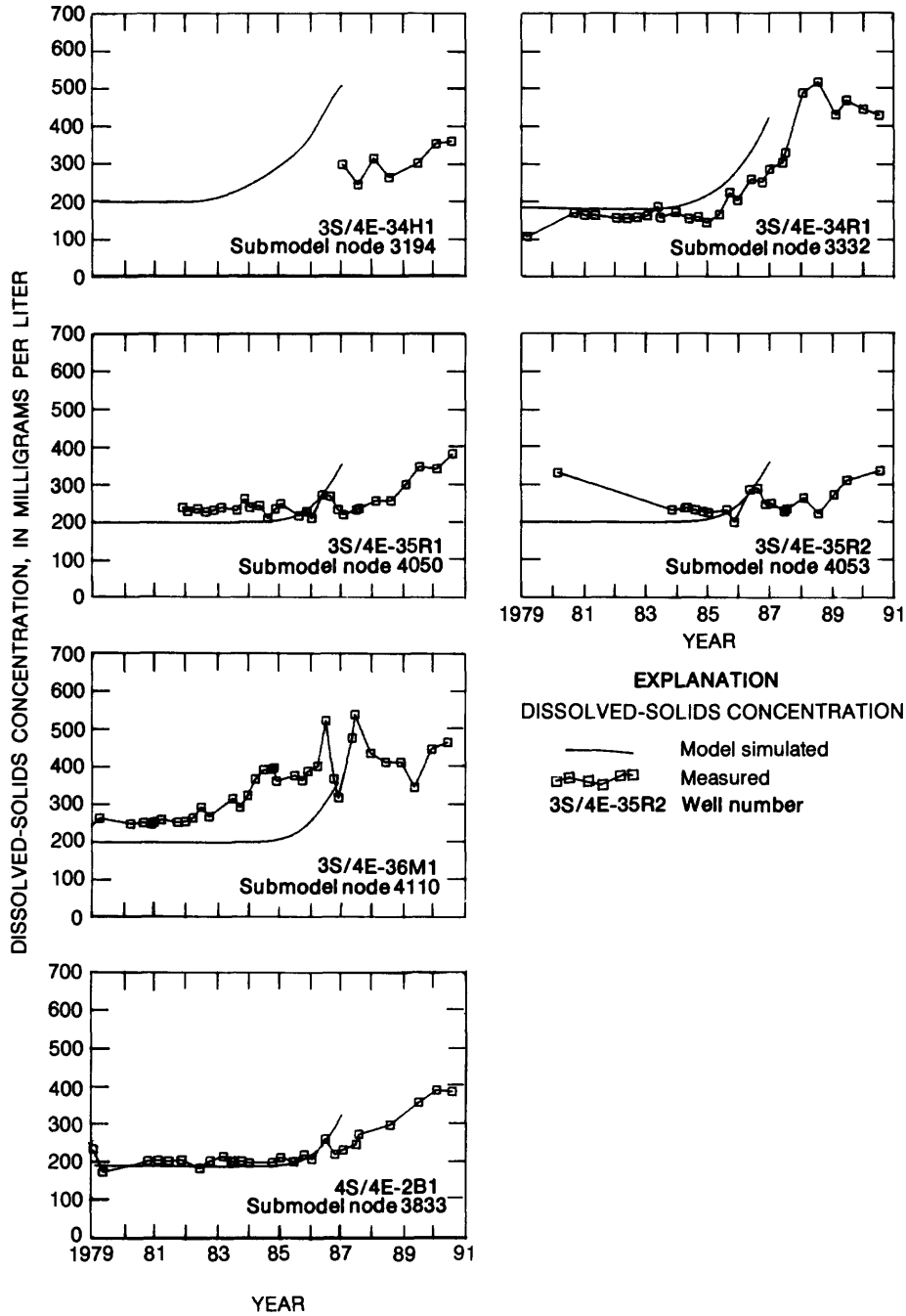


Figure 25. *Continued.*

that correlates with the depth of the top of perforations. For example, the model overestimates the arrival time of the high dissolved-solids water at well 3S/4E-36M1, which is the shallowest of the downgradient wells, and underestimates the arrival time for all the deeper downgradient wells. The deeper the top of the perforations, the larger the underestimation error.

Although no quantitative conclusions can be drawn from the transport simulations, the results suggest that there are significant vertical differences in transport rates: Most of the artificial-recharge water appears to flow through the upper, more permeable part of the aquifer. To test this finding would require additional water-quality sampling and water-level measuring at multiple depths, as well as cross-sectional and (or) three-dimensional flow and transport modeling.

CONCLUSIONS

Model Evaluation

Several conclusions can be drawn from the model evaluation:

I. General Conclusions--

(1) Even extensively calibrated models may yield inaccurate results when used to simulate time periods in which stress conditions were significantly different from those of the calibration period.

(2) Vertical differences in solute-transport rates are likely to be very important, even when flow is adequately simulated with an areal two-dimensional model.

II. Specific Conclusions--

(1) The large rise in water levels in 1985-86 had a significant effect on the ground-water flow system. Saturated thickness in the artificial-recharge area increased by as much as 400 ft, causing an increase in transmissivity and a change in the storage coefficient.

(2) Extending the model to the true southeastern boundary of the flow system, the Salton Sea, would enable adequate simulation of the flow system. The assumed constant-head boundary at the southeastern end of the upper Coachella Valley is no longer appropriate. The specified-head boundary used for the retrospective 1979-86 simulations in this study is not appropriate for any predictive model simulations.

(3) Revised estimates for several components of the upper-valley water budget could allow more accurate analysis of the effects of future water development. In particular, the rates of recharge from the streams flowing out of the San Jacinto Mountains and underflow from the San Gorgonio Pass during 1979-86 seem to have been higher than the estimates used in previous studies.

(4) There is uncertainty about the factor to use to convert gross pumpage to net pumpage. The appropriate value to use in the Coachella Valley could be determined through additional study.

(5) The monthly water budget of the artificial-recharge ponds would need to be documented to enable determination of the actual amount of diverted water that recharges the ground-water system.

(6) Important vertical differences in transport are inadequately simulated by the areal two-dimensional solute-transport submodel. In particular, solutes may be moving much more rapidly in the uppermost part of the ground-water system relative to deeper parts.

Future Data Collection

Additional data would add to the understanding of the three-dimensional flow system of the entire Coachella Valley. The drilling of several sets of nested wells would allow for measurement of dissolved-solids concentrations and water levels at varying depths. Such additional data would be most useful for the following areas:

- upgradient of the artificial-recharge area
- just downgradient of the artificial-recharge area
- at the base of Palm Canyon
- at the base of Deep Canyon
- at the lower end of the existing-model area (northwest of Indio)
- in the lower valley
- on both sides of major faults in the valley

Aquifer tests at wells in these areas would improve understanding of three-dimensional geohydrologic properties in the valley.

Existing water-quality data in the valley are sparse. A water-quality monitoring network could provide information on: (1) regional water-quality trends, (2) the effects of identified potential contamination sources on ground-water quality, and (3) vertical water-quality differences. The multilevel sampling of newly drilled test holes, along with regular water-quality sampling of a number of existing wells, could provide valuable information.

Future Modeling

A basinwide multilayer flow model and a set of submodels of chemical transport would be useful in evaluating the three-dimensional effects of ground-water development on water levels and water quality. A basinwide flow model would include both the upper and lower valleys. The modeling of the upper valley could be based, in part, on the model evaluated in this report, but it could be enhanced in several ways. First, it could incorporate vertical differences in the ground-water flow system. Second, it could allow simulation of unconfined conditions, where transmissivity is a function of water level. Third, the model parameters--storage coefficient, hydraulic conductivity, aquifer thickness, dispersivity, and porosity--could be reestimated in light of the results of this report and the analysis of new and preexisting data. Fourth, the assumed basin water budget could be revised on the basis of the results of this report and extended from two dimensions to three. As described above, refined estimates of stream recharge, artificial recharge, and return flow from pumpage would allow more accurate model simulations.

Extending the model to the basin's true southeastern boundary, the Salton Sea, could aid in understanding the valleywide hydrologic system. The lower valley traditionally has been described as a multiaquifer system consisting of an upper "perched" zone, a confining layer of fine-textured lake deposits, an upper aquifer, a confining unit, and a lower aquifer. Most production is from the lower aquifer. The existing data base of well logs, water-level measurements, and water quality is inadequate to determine the areal extent of hydraulically distinguishable layers. In addition, the water budget in the lower valley has not been defined adequately. Estimates of inflow from the various ungaged streams and of the large amount of irrigation water that is recharging the system are needed to accurately model the movement of ground water in the lower valley.

A second important modeling need is the development of a new transport model (or models). A new generalized regional transport model could help provide a greater understanding of regional water-quality trends. Regional water-quality issues include the effects of the artificially recharged Colorado River water in the upper valley, potential nonpoint agricultural contaminant sources in the lower valley, and "natural" geochemical changes in the ground

water as it moves through the valley. As indicated in this report, the existing two-dimensional model of the upper valley has proved helpful in analyzing the potential areal movement of the artificial-recharge water, but it cannot simulate the vertical differences in solute transport.

Several possible modeling approaches are available to address vertical differences in the movement of chemicals. One approach is to use cross-sectional models that can simulate chemical transport along ground-water flow lines. A cross-sectional model in the artificial-recharge area could be particularly helpful in testing the hypothesis that the high-dissolved-solids water is moving more rapidly in the upper part of the ground-water system.

A second, more computationally intensive approach is to use actual three-dimensional or layered models. Simulations carried out as part of this study indicate that cell size must be quite small (several hundred feet per side) to accurately model advective-dispersive transport. Areally extensive three-dimensional modeling may therefore be computationally infeasible.

A third approach to transport modeling is to focus strictly on advective transport. This could be done by linking a particle-tracking algorithm with a three-dimensional flow model (see, for example, Pollock, 1989). Given that advection is likely to be the dominant transport process and that dispersion is very difficult to quantify, such an approach seems potentially useful in the Coachella Valley.

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Appendix 1: *List and description of wells in data base*

[Remarks: L, water-level well; P, well with 1979-86 pumpage data; Q, water-quality well; U, sampled by U.S. Geological Survey; --, no data]

Well number	Perforated interval (depth, in feet below land surface)	Land-surface altitude (feet above or below (-) sea level)	Latitude	Longitude	Remarks	Closest model node for pumped wells (in model area only)
2S/3E-25K1	--	2,140	33°58′04" N	116°37′10" W	L	
2S/4E-25N1	320-370	1,099	33°57′42" N	116°31′22" W	L	
2S/4E-34A1	380-610	1,180	33°57′34" N	116°32′49" W	L	
2S/4E-35Q1	185-380	1,044	33°56′59" N	116°31′53" W	L	
2S/5E-31L1	220-285	984	33°57′08" N	116°30′09" W	L	
2S/5E-32E6	110-180	1,060	33°57′15" N	116°29′15" W	L	
2S/5E-33E5	261-281	1,240	33°57′17" N	116°28′21" W	L	
3S/2E-23B1	--	1,510	33°54′11" N	116°44′34" W	L	
3S/3E-07M1	330-455	1,472	33°55′22" N	116°43′06" W	L	
3S/3E-08M1	225-553	1,350	33°55′19" N	116°41′54" W	L	
3S/3E-10P1	476-776	1,170	33°55′06" N	116°39′41" W	LPQ	25
3S/3E-10P2	306-906	1,170	33°55′06" N	116°39′42" W	LP	25
3S/4E-12B1	180-220	885	33°55′53" N	116°30′51" W	L	
3S/4E-12B2	270-500	885	33°55′55" N	116°30′51" W	LP	
3S/4E-12C1	200-480	890	33°55′54" N	116°31′06" W	LP	
3S/4E-12H1	122-147 172-192	848	33°55′34" N	116°30′48" W	L	
3S/4E-12H2	350-750	842	33°55′36" N	116°30′42" W	L	
3S/4E-13N1	216-254	713	33°54′13" N	116°31′28" W	L	
3S/4E-17K1	340-375	901	33°54′36" N	116°35′13" W	L	
3S/4E-20D1	560-580	910	33°54′07" N	116°35′34" W	LQU	
3S/4E-20F1	600-640	890	33°53′47" N	116°35′27" W	LQU	
3S/4E-20F2	850-890	890	33°53′47" N	116°35′27" W	LQU	
3S/4E-20F3	1,100-1,140	890	33°53′47" N	116°35′27" W	LQU	
3S/4E-20J1	550-590	840	33°53′39" N	116°34′53" W	LQU	
3S/4E-20J2	690-730	840	33°53′39" N	116°34′53" W	LQU	
3S/4E-20J3	850-890	840	33°53′39" N	116°34′53" W	LQU	
3S/4E-22A1	180-185 218-230	711	33°54′09" N	116°32′43" W	L	
3S/4E-29F1	550-570	865	33°53′05" N	116°35′28" W	LQU	
3S/4E-29R1	431-551	777	33°52′30" N	116°34′53" W	LQU	
3S/4E-30C1	530-726	944	33°53′20" N	116°36′32" W	LPQU	76
3S/4E-32B2	475-611	791	33°52′20" N	116°35′09" W	L	
3S/4E-34H1	900-1,100	617	33°52′09" N	116°32′46" W	LPQ	109
3S/4E-34R1	506-830	610	33°51′39" N	116°32′46" W	LPQ	119
3S/4E-35R1	600-900	555	33°51′34" N	116°31′39" W	LPQ	120
3S/4E-35R2	600-1,000	555	33°51′41" N	116°31′39" W	LPQ	120
3S/4E-36M1	403-703	545	33°51′52" N	116°31′29" W	LPQ	120
3S/5E-03L1	225-370	1,165	33°56′21" N	116°27′08" W	L	
3S/5E-03R1	145-240	1,055	33°55′57" N	116°26′29" W	L	
3S/5E-04H1	244-355	1,160	33°56′25" N	116°27′26" W	L	
3S/5E-09C1	262-334	1,020	33°55′55" N	116°27′58" W	L	
3S/5E-10L2	190-260	925	33°55′18" N	116°27′03" W	L	
3S/5E-10R1	177-207	960	33°55′15" N	116°26′31" W	L	
3S/5E-11Q1	170-236	1,075	33°55′15" N	116°25′42" W	L	
3S/5E-12P1	304-379	1,165	33°55′10" N	116°25′03" W	L	
3S/5E-16M1	162-200	780	33°54′27" N	116°28′24" W	L	
3S/5E-17J1	182-405	787	33°54′36" N	116°28′30" W	L	
3S/5E-19B1	51-83	689	33°54′08" N	116°29′48" W	L	
3S/5E-30G1	344-644	590	33°53′00" N	116°29′53" W	L	
3S/6E-21F2	342-430	1,070	33°53′54" N	116°21′49" W	L	

Appendix 1: *List and description of wells in data base*--Continued

Well number	Perforated interval (depth, in feet below land surface)	Land-surface altitude (feet above or below (-) sea level)	Latitude	Longitude	Remarks	Closest model node for pumped wells (in model area only)
3S/6E-25Q1	371-511	955	33°52′31" N	116°18′27" W	L	
3S/6E-26P1	204-310	960	33°52′35" N	116°19′46" W	L	
3S/6E-28A1	250-332	1,000	33°53′10" N	116°21′40" W	L	
3S/6E-36P1	--	772	33°51′38" N	116°18′43" W	L	
4S/4E-01B1	--	510	33°51′27" N	116°30′59" W	P	131
4S/4E-01B2	--	510	33°51′26" N	116°30′59" W	P	131
4S/4E-01B3	400-700	510	33°51′28" N	116°31′01" W	L	
4S/4E-01N2	525-800	500	33°50′42" N	116°31′26" W	LPQ	130
4S/4E-02B1	570-1,003	565	33°51′22" N	116°32′07" W	LPQ	119
4S/4E-11K1	--	493	33°50′09" N	116°32′08" W	LPQ	128
4S/4E-11Q1	302-402	470	33°49′49" N	116°32′08" W	LPQ	128
4S/4E-11Q2	535-948	468	33°49′51" N	116°32′08" W	LPQ	128
4S/4E-11R1	526-700	458	33°49′50" N	116°31′38" W	LPQ	128
4S/4E-13C1	512-912	450	33°49′48" N	116°31′21" W	LPQ	129
4S/4E-13H1	400-500	418	33°49′28" N	116°30′42" W	L	
4S/4E-13P1	345-365 398-408	410	33°49′06" N	116°31′22" W	L	
4S/4E-13Q1	--	400	33°49′03" N	116°30′59" W	PQ	142
4S/4E-14Q1	622-830 850-958	425	33°49′05" N	116°32′07" W	LPQ	141
4S/4E-14R1	560-800	408	33°49′03" N	116°31′42" W	LPQ	142
4S/4E-15J1	164-344 415-435	453	33°49′20" N	116°32′48" W	L	
4S/4E-23D1	190-408	435	33°48′45" N	116°32′24" W	LPQ	141
4S/4E-23E1	240-472	435	33°48′42" N	116°32′28" W	LPQ	141
4S/4E-24D1	580-980	398	33°48′46" N	116°31′32" W	LPQ	141
4S/4E-24H1	600-1,000	390	33°48′34" N	116°30′38" W	LPQ	142
4S/4E-26A1	450-780	428	33°47′54" N	116°31′39" W	LPQ	154
4S/4E-26G1	450-800	440	33°47′48" N	116°31′54" W	LPQ	154
4S/4E-35A1	--	510	33°47′06" N	116°31′46" W	P	153
4S/4E-35B1	--	510	33°47′06" N	116°32′02" W	P	153
4S/4E-35K1	435-600	554	33°46′42" N	116°32′08" W	L	
4S/4E-35L1	--	540	33°46′40" N	116°32′18" W	P	138
4S/5E-03P1	288-600	380	33°50′51" N	116°27′11" W	LP	161
4S/5E-04E2	--	435	33°51′11" N	116°28′25" W	L	146
4S/5E-04F1	276-576	430	33°51′17" N	116°28′14" W	LP	147
4S/5E-04N1	520-690 790-810 860-890	425	33°50′54" N	116°28′28" W	LP	146
4S/5E-05K1	408-748	446	33°51′00" N	116°29′02" W	LP	145
4S/5E-08A1	368-1,100	420	33°50′41" N	116°28′32" W	LP	145
4S/5E-08D1	500-900	441	33°50′39" N	116°29′30" W	L	145
4S/5E-08L1	--	415	33°50′11" N	116°29′05" W	LP	145
4S/5E-09B1	398-806	405	33°50′40" N	116°27′58" W	LP	146
4S/5E-09F1	227-616	397	33°50′21" N	116°28′02" W	L	
4S/5E-09F3	410-670	397	33°50′08" N	116°28′06" W	LP	159
4S/5E-11E1	172-607	327	33°50′20" N	116°26′18" W	LP	160
4S/5E-14N1	330-640 715-780	340	33°49′06" N	116°26′16" W	LP	169
4S/5E-15R1	243-507	345	33°49′03" N	116°26′25" W	LP	169
4S/5E-15R2	400-560	346	33°49′08" N	116°26′25" W	LP	169

Appendix 1: *List and description of wells in data base*--Continued

Well number	Perforated interval (depth, in feet below land surface)	Land-surface altitude (feet above or below (-) sea level)	Latitude	Longitude	Remarks	Closest model node for pumped wells (in model area only)
4S/5E-17Q1	600-720 745-795 815-895 920-1,000	360	33°48′ 58" N	116°28′ 47" W		
4S/5E-19D1	340-440	393	33°51′ 52" N	116°31′ 32" W	LPQ	142
4S/5E-21A1	--	357	33°48′ 46" N	116°27′ 35" W	L	
4S/5E-21J2	440-470 680-1,000	348	33°48′ 31" N	116°27′ 34" W	LP	168
4S/5E-22A1	--	347	33°48′ 56" N	116°26′ 31" W	L	
4S/5E-22B1	--	352	33°48′ 54" N	116°26′ 52" W	LP	168
4S/5E-23R1	--	330	33°48′ 11" N	116°25′ 29" W		
4S/5E-24E1	600-1,000	400	33°48′ 31" N	116°31′ 37" W		
4S/5E-25D1	540-850	325	33°48′ 03" N	116°25′ 08" W	LP	178
4S/5E-25F1	--	325	33°47′ 46" N	116°24′ 58" W	LP	178
4S/5E-25P1	500-740 790-840	320	33°47′ 20" N	116°24′ 58" W	L	178
4S/5E-26A1	1,050-1,400	330	33°48′ 05" N	116°25′ 22" W	LP	178
4S/5E-26B1	1,050-1,360	340	33°48′ 04" N	116°25′ 48" W	LP	178
4S/5E-26C1	430-500 660-880	342	33°47′ 56" N	116°25′ 59" W	LP	178
4S/5E-26D1	769-1,385	345	33°48′ 04" N	116°26′ 21" W	LP	168
4S/5E-26H1	816-1,360	340	33°47′ 40" N	116°25′ 22" W	LP	178
4S/5E-26K1	400-820	340	33°47′ 36" N	116°25′ 50" W	LP	178
4S/5E-27E1	344-392	313	33°47′ 48" N	116°27′ 25" W	L	167
4S/5E-27E2	456-835	315	33°47′ 48" N	116°27′ 25" W	LP	167
4S/5E-27L1	--	300	33°47′ 32" N	116°27′ 35" W	P	167
4S/5E-28F1	500-925	322	33°47′ 49" N	116°28′ 07" W	LP	167
4S/5E-28F2	500-925	312	33°47′ 41" N	116°28′ 08" W	LP	166
4S/5E-28M1	--	310	33°47′ 33" N	116°28′ 21" W	P	166
4S/5E-29A1	600-1,000	327	33°48′ 03" N	116°28′ 33" W	LPQ	157
4S/5E-29F1	100-407	338	33°47′ 50" N	116°29′ 07" W	L	
4S/5E-29F2	--	330	33°47′ 45" N	116°29′ 08" W	P	156
4S/5E-29H1	590-990	320	33°47′ 41" N	116°28′ 32" W	LPQ	166
4S/5E-29K1	--	325	33°47′ 32" N	116°28′ 59" W	LP	156
4S/5E-30C1	300-440	357	33°47′ 51" N	116°30′ 00" W	LPQ	156
4S/5E-33B1	268-288	302	33°47′ 09" N	116°27′ 56" W	L	
4S/5E-33B4	429-843	291	33°47′ 12" N	116°27′ 57" W	LPQ	166
4S/5E-33G1	172-436	294	33°46′ 57" N	116°27′ 57" W	LQ	
4S/5E-34C1	240-500	290	33°47′ 07" N	116°27′ 08" W	LP	176
4S/5E-34J1	240-500	272	33°46′ 44" N	116°26′ 34" W	LP	176
4S/5E-35D2	215-407	268	33°47′ 06" N	116°26′ 22" W	L	
4S/5E-35E1	--	268	33°46′ 59" N	116°26′ 22" W	LP	177
4S/5E-35G3	--	262	33°46′ 55" N	116°25′ 48" W	L	
4S/5E-35G4	600-1,000	262	33°46′ 55" N	116°25′ 50" W	LP	177
4S/5E-35Q1	171-518	250	33°46′ 23" N	116°25′ 50" W	LP	186
4S/5E-35Q2	340-600	255	33°46′ 29" N	116°25′ 42" W	LP	187
4S/5E-36D1	470-492 658-678	320	33°47′ 07" N	116°25′ 13" W	L	
4S/5E-36L1	408-840	300	33°46′ 46" N	116°24′ 54" W	LP	187
4S/5E-36L2	252-650	300	33°46′ 40" N	116°24′ 58" W	LP	187
4S/5E-36M1	315-627	257	33°51′ 52" N	116°31′ 32" W	LP	187
4S/6E-08L1	--	378	33°50′ 17" N	116°22′ 44" W	L	
4S/6E-17R1	166-817	215	33°49′ 02" N	116°22′ 23" W	LP	192
4S/6E-18P1	216-454	232	33°49′ 08" N	116°24′ 00" W	LP	180

Appendix 1: *List and description of wells in data base*--Continued

Well number	Perforated interval (depth, in feet below land surface)	Land-surface altitude (feet above or below (-) sea level)	Latitude	Longitude	Remarks	Closest model node for pumped wells (in model area only)
4S/6E-18Q2	125-255	242	33°49′ 10" N	116°23′ 31" W	LP	190
4S/6E-18Q5	480-560	240	33°49′ 10" N	116°23′ 29" W	L	
	610-640					
	670-700					
	780-830					
	930-990					
4S/6E-18R1	479-518	240	33°49′ 09" N	116°23′ 20" W	LP	190
4S/6E-19J2	171-500	212	33°48′ 31" N	116°23′ 28" W	L	
4S/6E-20A1	178-844	205	33°48′ 46" N	116°22′ 28" W	L	
4S/6E-20C1	--	220	33°48′ 53" N	116°22′ 50" W	P	190
4S/6E-20L1	530-900	198	33°48′ 21" N	116°22′ 51" W	LP	200
4S/6E-20M1	460-960	205	33°48′ 31" N	116°23′ 10" W	LP	190
4S/6E-22C1	208-211	218	33°48′ 59" N	116°20′ 45" W	LP	210
	272-304					
4S/6E-22C2	189-213	219	33°48′ 59" N	116°20′ 41" W	L	
	233-305					
4S/6E-22J1	--	230	33°48′ 32" N	116°20′ 08" W	L	
4S/6E-22K1	150-495	215	33°48′ 33" N	116°20′ 23" W	L	
4S/6E-25C2	540-700	193	33°47′ 55" N	116°18′ 47" W	LP	232
4S/6E-25C3	540-700	199	33°48′ 06" N	116°18′ 46" W	LP	221
4S/6E-25J2	110-340	158	33°47′ 39" N	116°18′ 03" W	LP	232
4S/6E-25R1	110-340	150	33°47′ 22" N	116°18′ 03" W	LP	232
4S/6E-27N1	506-563	165	33°47′ 27" N	116°21′ 06" W	L	
4S/6E-28A2	180-750	175	33°48′ 01" N	116°21′ 18" W	L	
4S/6E-28E1	106-452	177	33°47′ 53" N	116°22′ 12" W	LP	200
4S/6E-28E3	460-880	177	33°47′ 55" N	116°22′ 10" W	LP	200
4S/6E-28G2	106-822	168	33°47′ 41" N	116°21′ 29" W	LP	209
4S/6E-28H1	192-980	167	33°47′ 43" N	116°21′ 12" W	LP	209
4S/6E-28J2	--	166	33°47′ 28" N	116°21′ 21" W	L	
4S/6E-28J3	157-600	164	33°47′ 29" N	116°21′ 11" W	LP	209
4S/6E-28J7	500-680	165	33°47′ 34" N	116°21′ 10" W	LP	209
	730-780					
	810-880					
	900-1,080					
4S/6E-28K4	496-796	168	33°47′ 40" N	116°21′ 39" W	LP	209
4S/6E-29A1	178-844	179	33°48′ 05" N	116°22′ 13" W	L	
4S/6E-34A1	300-1,015	158	33°47′ 13" N	116°20′ 22" W	LP	220
4S/6E-34C1	108-495	163	33°47′ 13" N	116°20′ 49" W	P	220
4S/6E-34D1	--	162	33°47′ 13" N	116°21′ 08" W	L	
4S/6E-34D2	312-880	162	33°47′ 09" N	116°20′ 56" W	LP	220
4S/6E-34F1	--	161	33°46′ 59" N	116°20′ 39" W	L	
4S/6E-34K1	--	158	33°46′ 47" N	116°20′ 23" W	LP	220
4S/6E-34K2	716-1,150	161	33°46′ 41" N	116°20′ 36" W	LP	219
4S/6E-34L1	168-805	165	33°46′ 47" N	116°20′ 44" W	LP	219
4S/6E-34M1	450-1,000	165	33°46′ 47" N	116°21′ 06" W	LP	219
4S/6E-34Q1	171-602	168	33°46′ 33" N	116°20′ 36" W	L	
4S/6E-35P1	500-600	150	33°46′ 27" N	116°19′ 45" W	L	
4S/7E-14E1	382-520	1,100	33°49′ 28" N	116°13′ 42" W	L	
4S/7E-29E1	330-700	118	33°47′ 41" N	116°16′ 49" W	LP	241
4S/7E-29M1	570-680	107	33°47′ 27" N	116°16′ 52" W	LP	241
4S/7E-29N2	118-263	103	33°47′ 16" N	116°16′ 52" W	LP	240
4S/7E-30E3	180-360	161	33°47′ 47" N	116°17′ 59" W	LP	232
4S/7E-30L1	200-568	150	33°47′ 37" N	116°17′ 44" W	LP	232
4S/7E-30M1	--	158	33°47′ 37" N	116°17′ 58" W	L	

Appendix 1: *List and description of wells in data base*--Continued

Well number	Perforated interval (depth, in feet below land surface)	Land-surface altitude (feet above or below (-) sea level)	Latitude	Longitude	Remarks	Closest model node for pumped wells (in model area only)
4S/7E-30M2	--	148	33°47′38" N	116°17′51" W	LP	232
4S/7E-30M6	--	150	33°47′32" N	116°17′49" W	LP	232
4S/7E-30P1	148-360	140	33°47′24" N	116°17′41" W	LP	232
4S/7E-31Q3	236-356 590-710	97	33°46′32" N	116°17′26" W	LP	240
4S/7E-32F2	--	80	33°46′55" N	116°16′34" W	P	240
4S/7E-32G2	280-320 380-400	73	33°46′50" N	116°16′20" W	L	
4S/7E-32N2	195-462	73	33°46′25" N	116°16′54" W	LP	240
4S/7E-33N1	100-412	54	33°46′31" N	116°15′51" W	L	
4S/7E-33Q1	240-460	48	33°46′24" N	116°15′22" W	L	
4S/8E-31R2	--	280	33°46′27" N	116°10′47" W	L	
5S/4E-02G1	300-500	580	33°46′05" N	116°32′14" W	L	
5S/5E-01B1	420-800	247	33°46′10" N	116°24′54" W	LP	187
5S/5E-01C1	216-350	244	33°46′09" N	116°24′59" W	L	
5S/5E-01D2	--	250	33°46′16" N	116°25′22" W	L	
5S/5E-01D3	--	250	33°46′14" N	116°25′21" W	LP	187
5S/5E-01L5	500-740	242	33°45′43" N	116°25′10" W	LP	187
5S/5E-01M4	150-502	250	33°45′54" N	116°25′26" W	LP	186
5S/5E-01N1	--	235	33°45′29" N	116°25′19" W	LP	186
5S/5E-01P1	108-192	240	33°45′41" N	116°25′01" W	L	
5S/5E-01Q2	400-835	235	33°45′37" N	116°24′51" W	LP	186
5S/5E-01Q3	400-820	235	33°45′32" N	116°24′51" W	LP	186
5S/5E-02A1	--	249	33°46′14" N	116°25′37" W	LP	186
5S/5E-02B1	450-600	252	33°46′18" N	116°25′54" W	LP	186
5S/5E-02F2	250-495	242	33°45′56" N	116°26′05" W	L	186
5S/5E-02H1	--	249	33°45′56" N	116°26′51" W	LP	186
5S/5E-02L1	130-140 200-220	252	33°45′52" N	116°26′14" W	L	
5S/5E-02Q1	220-450	239	33°45′40" N	116°25′47" W	LP	186
5S/5E-03A1	110-130 238-320	260	33°46′20" N	116°26′35" W	L	
5S/5E-11A1	--	234	33°45′20" N	116°25′40" W	L	
5S/5E-11A3	250-440	239	33°45′26" N	116°25′32" W	LP	186
5S/5E-12B3	410-800	230	33°45′27" N	116°24′54" W	LP	186
5S/5E-12C1	163-503	233	33°45′24" N	116°25′01" W	L	
5S/5E-12C2	--	230	33°45′16" N	116°25′11" W	L	
5S/5E-12D1	125-360	239	33°45′26" N	116°25′25" W	LP	186
5S/5E-12D2	278-498	236	33°45′24" N	116°25′24" W	LP	186
5S/5E-12H2	432-590	220	33°45′07" N	116°24′27" W	L	
5S/5E-12J1	400-880	221	33°45′00" N	116°24′27" W	LP	196
5S/5E-12L2	208-461	240	33°44′38" N	116°25′15" W	LP	195
5S/5E-12Q1	--	235	33°44′46" N	116°24′51" W	LP	195
5S/6E-01C1	126-1,250	125	33°46′21" N	116°18′47" W	LP	231
5S/6E-01D2	410-440 510-626 678-716 774-801 840-902 920-980	132	33°46′19" N	116°19′05" W	LP	231
5S/6E-01J1	500-730	112	33°45′47" N	116°18′20" W	LP	239
5S/6E-01J2	320-620	116	33°45′49" N	116°18′19" W	LP	239
5S/6E-01K2	481-601	120	33°45′55" N	116°18′40" W	LP	239
5S/6E-02A1	200-618	140	33°46′18" N	116°19′14" W	L	

Appendix 1: *List and description of wells in data base*--Continued

Well number	Perforated interval (depth, in feet below land surface)	Land-surface altitude (feet above or below (-) sea level)	Latitude	Longitude	Remarks	Closest model node for pumped wells (in model area only)
5S/6E-02A2	450-650	140	33°46′ 15" N	116°19′ 17" W	L	
5S/6E-02D1	350-1,250	155	33°46′ 15" N	116°20′ 08" W	LP	230
5S/6E-02G1	470-600	140	33°46′ 02" N	116°19′ 37" W	LP	230
	670-690					
	710-770					
	890-1,000					
5S/6E-02M1	665-1,305	170	33°45′ 44" N	116°19′ 57" W	LP	230
5S/6E-03A1	520-560	164	33°46′ 21" N	116°20′ 28" W	LP	219
	610-680					
	780-826					
	906-980					
5S/6E-03B1	480-1,040	170	33°46′ 19" N	116°20′ 35" W	L	
5S/6E-03H1	520-1,100	195	33°46′ 05" N	116°20′ 30" W	LP	219
5S/6E-03K1	710-770	230	33°45′ 47" N	116°20′ 36" W	LP	218
	800-860					
	910-990					
	1,020-1,090					
5S/6E-03L1	--	240	33°45′ 48" N	116°20′ 55" W	LP	218
5S/6E-03N1	750-950	260	33°45′ 39" N	116°21′ 14" W	LP	218
5S/6E-03P1	570-970	260	33°45′ 35" N	116°20′ 55" W	LP	218
5S/6E-05A1	520-1,220	282	33°46′ 18" N	116°22′ 29" W	LP	207
5S/6E-05B1	850-1,045	285	33°46′ 18" N	116°22′ 51" W	LP	198
5S/6E-05K1	1,036-1,300	260	33°45′ 52" N	116°22′ 42" W	LP	197
5S/6E-05M1	540-1,040	262	33°45′ 54" N	116°23′ 09" W	LP	197
5S/6E-05Q1	525-730	250	33°45′ 36" N	116°22′ 45" W	LP	197
	800-890					
	1,020-1,135					
5S/6E-06B3	455-890	290	33°46′ 17" N	116°23′ 47" W	LP	197
5S/6E-06C1	--	285	33°46′ 14" N	116°24′ 22" W	LP	187
5S/6E-06C2	--	284	33°46′ 14" N	116°24′ 22" W	LP	187
5S/6E-06M1	420-820	233	33°45′ 50" N	116°24′ 21" W	LP	187
5S/6E-06M2	420-1,000	230	33°45′ 50" N	116°24′ 21" W	LP	187
5S/6E-06Q1	668-1,202	220	33°45′ 31" N	116°23′ 53" W	LP	197
5S/6E-07B1	--	215	33°45′ 22" N	116°23′ 47" W	LP	196
5S/6E-07C2	320-500	220	33°45′ 27" N	116°24′ 09" W	LP	196
5S/6E-07J1	460-560	210	33°44′ 50" N	116°23′ 38" W	LP	196
5S/6E-07M1	--	220	33°44′ 38" N	116°24′ 30" W	LP	195
5S/6E-07N1	144-200	220	33°44′ 47" N	116°24′ 24" W	LP	196
5S/6E-07Q2	300-500	210	33°44′ 48" N	116°23′ 46" W	L	
5S/6E-07Q3	380-500	210	33°44′ 47" N	116°23′ 53" W	L	
5S/6E-07R1	364-604	206	33°44′ 25" N	116°23′ 46" W	LP	205
5S/6E-08M2	280-520	205	33°44′ 50" N	116°23′ 21" W	LP	205
5S/6E-08M3	650-920	205	33°44′ 38" N	116°23′ 32" W	LP	205
5S/6E-08N2	450-780	210	33°44′ 36" N	116°23′ 24" W	LP	205
5S/6E-08N3	390-690	200	33°44′ 47" N	116°23′ 19" W	LP	205
5S/6E-08P1	--	200	33°44′ 48" N	116°22′ 55" W	L	
5S/6E-08Q1	--	195	33°44′ 20" N	116°23′ 08" W	LP	205
5S/6E-09B1	--	262	33°45′ 17" N	116°21′ 34" W	LP	218
5S/6E-09E1	550-580	285	33°45′ 09" N	116°22′ 13" W	L	
	630-730					
5S/6E-09F1	450-490	280	33°45′ 08" N	116°21′ 58" W	L	
	530-670					
	770-830					
5S/6E-09M1	--	200	33°44′ 54" N	116°22′ 14" W		

Appendix 1: *List and description of wells in data base*--Continued

Well number	Perforated interval (depth, in feet below land surface)	Land-surface altitude (feet above or below (-) sea level)	Latitude	Longitude	Remarks	Closest model node for pumped wells (in model area only)
5S/6E-09Q1	740-1,010	200	33°44′ 39" N	116°21′ 48" W	LP	217
5S/6E-10D1	530-1,030	260	33°45′ 24" N	116°21′ 15" W	LP	218
5S/6E-10D2	--	260	33°45′ 24" N	116°20′ 21" W	LP	229
5S/6E-10E1	480-670 820-925	265	33°44′ 54" N	116°22′ 14" W	LP	218
5S/6E-12G1	192-272 472-604	121	33°45′ 15" N	116°18′ 39" W	L	
5S/6E-12M1	140-650	158	33°45′ 00" N	116°19′ 11" W	LP	237
5S/6E-12M2	200-500	150	33°45′ 00" N	116°19′ 05" W	LP	237
5S/6E-12N1	470-946	178	33°44′ 36" N	116°19′ 11" W	LP	237
5S/6E-12Q1	--	160	33°44′ 41" N	116°18′ 34" W	LP	237
5S/6E-12Q2	--	160	33°44′ 41" N	116°18′ 34" W	LP	237
5S/6E-13B1	302-310	145	33°44′ 28" N	116°18′ 30" W	LP	237
5S/6E-13D1	518-566 614-878	169	33°44′ 25" N	116°18′ 59" W	LP	237
5S/6E-13M1	339-369 387-400 517-626 740-900	197	33°44′ 08" N	116°19′ 10" W	LP	237
5S/6E-13R1	470-650	150	33°43′ 49" N	116°18′ 20" W	LP	244
5S/6E-14G1	520-600 630-670	206	33°44′ 10" N	116°19′ 44" W	LP	228
5S/6E-14G2	--	210	33°44′ 14" N	116°19′ 38" W	LP	237
5S/6E-14Q1	440-600 706-810	158	33°43′ 45" N	116°19′ 43" W	LP	228
5S/6E-16A1	360-560	181	33°44′ 22" N	116°21′ 23" W	LP	217
5S/6E-16A2	445-530 730-965	190	33°44′ 22" N	116°21′ 34" W	LP	217
5S/6E-16C1	--	200	33°44′ 28" N	116°22′ 00" W	LP	217
5S/6E-16H1	336-552	165	33°44′ 14" N	116°21′ 21" W	LP	217
5S/6E-16K1	302-366	165	33°44′ 03" N	116°21′ 44" W	LP	216
5S/6E-16M1	350-500	179	33°44′ 04" N	116°22′ 17" W	LP	216
5S/6E-16N2	564-904	180	33°43′ 44" N	116°22′ 18" W	LP	216
5S/6E-16Q1	156-300	165	33°43′ 51" N	116°21′ 40" W	LP	216
5S/6E-16Q2	242-354	165	33°43′ 48" N	116°21′ 47" W	LP	216
5S/6E-17F1	290-590	198	33°44′ 13" N	116°23′ 09" W	LP	205
5S/6E-17G2	550-890	195	33°44′ 10" N	116°22′ 40" W	LP	205
5S/6E-17M2	376-700	195	33°44′ 04" N	116°23′ 19" W	LP	205
5S/6E-17P2	420-700	190	33°43′ 44" N	116°22′ 58" W	LP	216
5S/6E-18C2	300-650	220	33°44′ 23" N	116°24′ 09" W	LP	195
5S/6E-18C3	--	200	33°44′ 13" N	116°24′ 16" W	LP	204
5S/6E-18G1	377-497	200	33°44′ 11" N	116°23′ 54" W	LP	204
5S/6E-18L2	317-509	198	33°44′ 02" N	116°23′ 58" W	LP	204
5S/6E-18R1	296-450	193	33°43′ 55" N	116°23′ 27" W	L	
5S/6E-18R2	425-800	193	33°43′ 55" N	116°23′ 27" W	LP	204
5S/6E-20A1	435-522	200	33°43′ 30" N	116°22′ 23" W	LP	216
5S/6E-20F2	420-497	210	33°43′ 10" N	116°23′ 16" W	LP	215
5S/6E-20F3	625-925	210	33°43′ 23" N	116°23′ 04" W	LP	215
5S/6E-20P1	300-588	267	33°43′ 02" N	116°23′ 02" W	LP	215
5S/6E-21G1	167-237	210	33°43′ 18" N	116°21′ 42" W	LP	216
5S/6E-21G3	195-500	195	33°43′ 24" N	116°21′ 45" W	LP	216
5S/6E-21H3	210-550	200	33°43′ 17" N	116°21′ 33" W	LP	216
5S/6E-21H5	400-600	200	33°43′ 18" N	116°21′ 27" W	LP	216
5S/6E-21J1	172-278	200	33°43′ 14" N	116°21′ 33" W	LP	216

Appendix 1: *List and description of wells in data base*--Continued

Well number	Perforated interval (depth, in feet below land surface)	Land-surface altitude (feet above or below (-) sea level)	Latitude	Longitude	Remarks	Closest model node for pumped wells (in model area only)
5S/6E-21L1	250-578	240	33°43′ 08" N	116°22′ 05" W	L	
5S/6E-21N1	200-243	248	33°43′ 03" N	116°22′ 11" W	L	
5S/6E-21N2	400-820	248	33°43′ 04" N	116°22′ 10" W	LP	215
5S/6E-21P1	212-433	260	33°42′ 52" N	116°21′ 57" W	LP	215
5S/6E-21Q3	350-700	240	33°42′ 59" N	116°21′ 43" W	LP	215
5S/6E-21R1	250-480	217	33°42′ 59" N	116°21′ 30" W	LP	226
5S/6E-22B1	350-390	160	33°43′ 33" N	116°20′ 47" W	LP	227
	416-452					
	468-502					
5S/6E-22B2	548-704	150	33°43′ 42" N	116°20′ 43" W	LP	228
	752-872					
5S/6E-22C1	183-510	160	33°43′ 38" N	116°20′ 54" W		
5S/6E-22G2	288-474	165	33°43′ 24" N	116°20′ 47" W	LP	227
5S/6E-22H1	291-507	150	33°43′ 26" N	116°20′ 25" W	LP	227
5S/6E-22H2	772-855	150	33°43′ 25" N	116°20′ 20" W	LP	227
5S/6E-22J1	342-372	175	33°43′ 05" N	116°20′ 31" W	LP	227
	388-392					
	416-518					
	524-554					
5S/6E-22M1	222-260	200	33°43′ 06" N	116°21′ 13" W	LP	227
	287-340					
5S/6E-22P1	254-292	198	33°42′ 59" N	116°21′ 02" W	LP	227
	305-370					
5S/6E-22P2	264-370	205	33°42′ 52" N	116°20′ 56" W	LP	227
5S/6E-23E2	374-383	144	33°43′ 21" N	116°20′ 15" W	LP	227
	400-413					
	482-509					
5S/6E-23E3	275-420	140	33°43′ 22" N	116°20′ 10" W	LP	227
5S/6E-23F1	778-794	140	33°43′ 23" N	116°19′ 51" W	LP	228
5S/6E-23H1		125	33°43′ 22" N	116°19′ 29" W	L	236
5S/6E-23K2	476-492	135	33°43′ 13" N	116°19′ 40" W	LP	235
5S/6E-23L1	110-168	129	33°43′ 15" N	116°19′ 59" W	LP	227
	280-352					
	355-426					
5S/6E-23L3	255-312	130	33°43′ 12" N	116°19′ 57" W	L	
5S/6E-23M1	384-480	160	33°43′ 07" N	116°20′ 15" W	LP	227
	576-776					
5S/6E-23N1	504-577	160	33°43′ 01" N	116°20′ 03" W	LP	227
5S/6E-24D1	--	160	33°43′ 41" N	116°19′ 09" W	LP	236
5S/6E-24F1	440-690	155	33°43′ 29" N	116°18′ 55" W	LP	236
5S/6E-24G1	480-680	110	33°43′ 18" N	116°18′ 32" W	LP	243
	810-930					
5S/6E-24M1	396-564	115	33°43′ 13" N	116°18′ 59" W	LP	236
	604-628					
	668-778					
5S/6E-24R1	--	94	33°43′ 02" N	116°18′ 25" W	L	
5S/6E-25A1	400-656	91	33°42′ 45" N	116°18′ 11" W	LP	242
5S/6E-25A2	430-650	80	33°42′ 47" N	116°18′ 17" W	LP	242
5S/6E-27A1	458-596	160	33°42′ 45" N	116°20′ 17" W	LP	227
5S/6E-27A2	322-482	170	33°42′ 48" N	116°20′ 25" W	LP	227
5S/6E-27B2	178-298	200	33°42′ 50" N	116°20′ 37" W	LP	227
5S/6E-27C1	138-292	204	33°42′ 49" N	116°20′ 50" W	LP	227
5S/6E-27C2	--	211	33°42′ 49" N	116°21′ 02" W	LP	226
5S/6E-27D1	266-392	225	33°42′ 44" N	116°21′ 12" W	LP	226

Appendix 1: *List and description of wells in data base*--Continued

Well number	Perforated interval (depth, in feet below land surface)	Land-surface altitude (feet above or below (-) sea level)	Latitude	Longitude	Remarks	Closest model node for pumped wells (in model area only)
5S/6E-27D2	170-370	230	33°42′ 39" N	116°21′ 15" W	LP	226
5S/6E-28C1	204-252	262	33°42′ 50" N	116°21′ 52" W	L	
5S/6E-28C2	410-680	262	33°42′ 49" N	116°21′ 52" W	LP	215
5S/6E-28E1	247-346	332	33°42′ 25" N	116°22′ 19" W	L	
5S/6E-28E2	320-470	310	33°42′ 35" N	116°22′ 19" W	LP	215
5S/6E-28H1	194-373	260	33°42′ 29" N	116°21′ 29" W	LP	226
5S/6E-29B1	351-615	290	33°42′ 48" N	116°22′ 43" W	LP	215
5S/6E-29C1	243-531	337	33°42′ 41" N	116°23′ 01" W	L	
5S/6E-29C2	530-670	337	33°42′ 40" N	116°23′ 01" W	LP	214
5S/6E-29H1	--	320	33°42′ 34" N	116°22′ 42" W	LP	214
5S/6E-29M1	457-723	405	33°42′ 23" N	116°23′ 10" W	LP	214
5S/6E-29P1	500-700	454	33°42′ 07" N	116°23′ 08" W	LP	214
5S/6E-32B1	450-700	440	33°41′ 53" N	116°22′ 44" W	LP	213
5S/6E-32B2	460-700	440	33°41′ 53" N	116°22′ 44" W	LP	213
5S/6E-32B3	460-652	440	33°41′ 53" N	116°22′ 44" W	LP	213
5S/6E-32G1	459-736	455	33°41′ 33" N	116°22′ 38" W	L	
5S/7E-03K1	580-740	44	33°45′ 50" N	116°14′ 24" W	L	
5S/7E-04A1	147-367	47	33°46′ 22" N	116°15′ 14" W	L	
5S/7E-04C1	520-800	50	33°46′ 19" N	116°15′ 42" W	L	
5S/7E-04D1	100-370	58	33°46′ 19" N	116°15′ 56" W	L	
5S/7E-04H1	570-840	42	33°46′ 08" N	116°15′ 07" W	L	
5S/7E-04M1	192-678	51	33°45′ 55" N	116°16′ 01" W	L	
5S/7E-04N1	147-411	51	33°45′ 36" N	116°15′ 20" W	L	
5S/7E-04Q1	123-363	38	33°45′ 36" N	116°15′ 20" W	L	
5S/7E-04Q3	240-320	40	33°45′ 39" N	116°15′ 31" W	L	
5S/7E-05C1	260-400	69	33°46′ 19" N	116°16′ 45" W	L	
5S/7E-05K1	--	61	33°45′ 43" N	116°16′ 28" W	LP	246
5S/7E-05R1	230-350	59	33°45′ 33" N	116°16′ 15" W	L	
5S/7E-06B1	168-180 280-303	92	33°46′ 21" N	116°17′ 25" W	LP	240
5S/7E-06B3	300-660	90	33°46′ 19" N	116°17′ 30" W	LP	239
5S/7E-06H1	400-480	82	33°46′ 06" N	116°17′ 12" W	L	
5S/7E-06M1	195-363 555-651	103	33°45′ 48" N	116°18′ 00" W	LP	239
5S/7E-07F1	147-459	102	33°45′ 15" N	116°17′ 51" W	LP	245
5S/7E-07J1	147-363	100	33°45′ 01" N	116°17′ 15" W	LP	246
5S/7E-07P1	144-450	101	33°44′ 42" N	116°17′ 44" W	LP	245
5S/7E-08A2	286-650	55	33°45′ 18" N	116°16′ 07" W	L	
5S/7E-08G1	--	85	33°45′ 06" N	116°16′ 24" W	L	
5S/7E-08Q1	203-654	54	33°44′ 49" N	116°16′ 20" W	L	
5S/7E-09F1	130-310	39	33°45′ 11" N	116°15′ 34" W	L	
5S/7E-09K1	147-387	33	33°44′ 55" N	116°15′ 27" W	L	
5S/7E-09L2	147-319	41	33°44′ 56" N	116°15′ 42" W	L	
5S/7E-10D2	200-530	32	33°45′ 23" N	116°14′ 54" W	L	
5S/7E-10E1	70-360	28	33°45′ 17" N	116°14′ 58" W	L	
5S/7E-11C1	323-443	29	33°45′ 22" N	116°13′ 35" W	L	
5S/7E-12P1	280-400	3	33°44′ 44" N	116°12′ 34" W	L	
5S/7E-13D1	580-583 980-1,022	-11	33°44′ 32" N	116°12′ 51" W	L	
5S/7E-14J2	232-350	-12	33°44′ 05" N	116°13′ 04" W	L	
5S/7E-14K1	264-411	-5	33°44′ 05" N	116°13′ 23" W	L	
5S/7E-15Q1	264-464	5	33°43′ 52" N	116°14′ 19" W	L	
5S/7E-16C1	147-355	37	33°44′ 25" N	116°15′ 41" W	L	
5S/7E-16K2	200-415	27	33°44′ 10" N	116°15′ 26" W	LP	

Appendix 1: *List and description of wells in data base*--Continued

Well number	Perforated interval (depth, in feet below land surface)	Land-surface altitude (feet above or below (-) sea level)	Latitude	Longitude	Remarks	Closest model node for pumped wells (in model area only)
5S/7E-17E1	459-603	82	33°44′ 13" N	116°16′ 52" W	L	
5S/7E-17F1	200-720	80	33°44′ 18" N	116°16′ 46" W	L	
5S/7E-17L1	212-600	67	33°44′ 03" N	116°16′ 45" W	L	
5S/7E-18D1	160-200	129	33°44′ 25" N	116°18′ 04" W	L	
5S/7E-18F1	--	112	33°44′ 15" N	116°17′ 48" W	LP	244
5S/7E-18M2	168-264	127	33°44′ 01" N	116°17′ 55" W	L	
5S/7E-19D1	440-650 710-770 840-920	140	33°43′ 37" N	116°18′ 33" W	LP	244
5S/7E-19H2	460-660	104	33°43′ 22" N	116°17′ 11" W	L	
5S/7E-20P2	150-350	75	33°42′ 58" N	116°16′ 44" W	L	
5S/7E-21F2	82-614	28	33°43′ 22" N	116°15′ 34" W	L	
5S/7E-21Q1	--	40	33°42′ 55" N	116°15′ 30" W	L	
5S/7E-22H2	506-1,100	5	33°43′ 31" N	116°14′ 06" W	L	
5S/7E-23D2	483-882	0	33°43′ 39" N	116°13′ 54" W	L	
5S/7E-24M4	250-660	-17	33°43′ 14" N	116°12′ 44" W	L	
5S/7E-25R1	--	-30	33°42′ 07" N	116°12′ 14" W	L	
5S/7E-26E3	515-1,110	5	33°42′ 27" N	116°13′ 50" W	L	
5S/7E-27B1	236-500	16	33°42′ 40" N	116°14′ 28" W	L	
5S/7E-27L1	516-600	20	33°42′ 22" N	116°14′ 38" W	L	
5S/7E-28E1	128-198	46	33°42′ 35" N	116°15′ 56" W	LP	
5S/7E-29K1	--	60	33°42′ 19" N	116°16′ 28" W	L	
5S/7E-30C2	115-235 427-489	73	33°42′ 42" N	116°17′ 46" W	L	
5S/7E-30F1	77-84 104-126 140-144 180-192	66	33°42′ 30" N	116°17′ 40" W	L	
5S/7E-30F2	--	67	33°42′ 30" N	116°17′ 40" W	L	
5S/7E-30J1	500-900	68	33°42′ 23" N	116°17′ 08" W	LP	
5S/7E-31N1	110-772	49	33°41′ 09" N	116°17′ 53" W	LP	
5S/7E-31P1	110-680	55	33°41′ 15" N	116°17′ 51" W	LP	
5S/7E-31Q1	--	57	33°41′ 18" N	116°17′ 34" W	L	
5S/7E-31Q2	380-420 760-920	60	33°41′ 12" N	116°17′ 25" W	LP	
5S/7E-32R1	180-500	40	33°41′ 18" N	116°16′ 09" W	L	
5S/7E-33D2	398-518	43	33°41′ 52" N	116°15′ 49" W	L	
5S/7E-33F2	400-540	40	33°41′ 45" N	116°15′ 40" W	L	
5S/7E-33J1	500-650	35	33°41′ 32" N	116°15′ 05" W	L	
5S/7E-33M1	388-517	40	33°41′ 30" N	116°15′ 58" W	L	
5S/7E-34Q2	188-550	5	33°41′ 13" N	116°14′ 22" W	L	
5S/7E-35F2	510-800	-5	33°41′ 45" N	116°13′ 40" W	L	
5S/7E-36D1	152-756	-21	33°41′ 59" N	116°12′ 53" W	L	
5S/7E-36G1	125-345	-32	33°41′ 44" N	116°12′ 10" W	L	
5S/7E-36Q1	147-375	-34	33°41′ 20" N	116°12′ 22" W	L	
5S/8E-17N1	278-398	30	33°43′ 56" N	116°10′ 45" W	L	
5S/8E-18H1	300-500	-25	33°44′ 15" N	116°10′ 59" W	L	
5S/8E-19H2	402-690	0	33°43′ 29" N	116°10′ 51" W	L	
5S/8E-20C2	278-438	-20	33°43′ 41" N	116°10′ 27" W	L	
5S/8E-20M1	400-450	-10	33°43′ 10" N	116°10′ 36" W	L	
5S/8E-28M1	388-460	-15	33°42′ 39" N	116°09′ 37" W	L	
5S/8E-28M2	208-268	-40	33°42′ 23" N	116°09′ 38" W	L	
5S/8E-29E2	--	-30	33°42′ 33" N	116°10′ 42" W	L	
5S/8E-29G1	230-278	-28	33°42′ 38" N	116°10′ 11" W	L	

Appendix 1: *List and description of wells in data base*--Continued

Well number	Perforated interval (depth, in feet below land surface)	Land-surface altitude (feet above or below (-) sea level)	Latitude	Longitude	Remarks	Closest model node for pumped wells (in model area only)
5S/8E-29R1	400-592	-50	33°42′ 14" N	116°09′ 55" W	L	
5S/8E-31C3	513-818	-40	33°41′ 59" N	116°11′ 22" W	L	
5S/8E-31J1	240-302	-52	33°41′ 32" N	116°11′ 05" W	L	
5S/8E-33D1	521-810	-55	33°41′ 54" N	116°09′ 44" W	L	
5S/8E-34G1	490-789	25	33°41′ 46" N	116°07′ 58" W	L	
6S/6E-01G1	205-296	50	33°40′ 41" N	116°18′ 30" W	L	
6S/6E-01Q1	--	55	33°40′ 25" N	116°18′ 27" W	LP	
6S/6E-06M1	264-364	940	33°40′ 27" N	116°24′ 21" W	L	
6S/6E-12F1	--	118	33°40′ 00" N	116°18′ 46" W	LP	
6S/6E-12G1	--	90	33°40′ 00" N	116°18′ 27" W	LP	
6S/6E-17K1	480-580	975	33°38′ 52" N	116°22′ 41" W	L	
6S/7E-01H1	525-595	-45	33°40′ 53" N	116°12′ 00" W	L	
6S/7E-01P1	--	-50	33°40′ 16" N	116°12′ 38" W	L	
6S/7E-01Q1	460-500	-50	33°40′ 18" N	116°12′ 11" W	L	
6S/7E-02D2	--	-7	33°41′ 01" N	116°13′ 51" W	L	
6S/7E-02G1	160-363	-11	33°40′ 47" N	116°13′ 25" W	L	
6S/7E-02N1	426-570	-10	33°40′ 27" N	116°13′ 57" W	L	
6S/7E-04D2	472-592	-32	33°41′ 03" N	116°15′ 56" W	L	
6S/7E-04R1	--	10	33°40′ 21" N	116°15′ 10" W	L	
6S/7E-05B1	368-560	38	33°41′ 03" N	116°16′ 23" W	L	
6S/7E-06B1	580-800	48	33°40′ 57" N	116°17′ 35" W	LP	
6S/7E-06N1	--	58	33°40′ 21" N	116°18′ 24" W	LP	
6S/7E-07B1	200-480	50	33°40′ 06" N	116°17′ 35" W	L	
6S/7E-08D2	316-476	31	33°40′ 13" N	116°16′ 54" W	L	
6S/7E-09A1	--	8	33°40′ 08" N	116°15′ 10" W	L	
6S/7E-09L2	225-300	9	33°39′ 47" N	116°15′ 32" W	L	
6S/7E-10G1	100-360	-15	33°39′ 53" N	116°14′ 28" W	L	
6S/7E-12E1	120-600	-45	33°39′ 51" N	116°12′ 52" W	L	
6S/7E-12H3	290-350	-70	33°39′ 56" N	116°12′ 24" W	L	
6S/7E-13M2	146-386	-56	33°38′ 53" N	116°12′ 53" W	LP	
6S/7E-13M4	480-600	-56	33°38′ 51" N	116°12′ 42" W	LP	
6S/7E-16A2	350-530 650-800	-5	33°39′ 17" N	116°15′ 07" W	L	
6S/7E-16D1	420-510 550-700 1,040-1,110	7	33°39′ 17" N	116°15′ 54" W	LP	
6S/7E-17R1	--	-5	33°38′ 43" N	116°16′ 16" W	L	
6S/7E-21D1	550-610 670-800 800-1,020	-10	33°38′ 24" N	116°15′ 54" W	LP	
6S/7E-22B1	1,088-1,365	-42	33°38′ 30" N	116°14′ 21" W	L	
6S/7E-23D3	380-600	-52	33°38′ 29" N	116°13′ 42" W	L	
6S/7E-23F1	312-375	-55	33°38′ 17" N	116°13′ 38" W	L	
6S/7E-24D5	--	-63	33°38′ 24" N	116°12′ 47" W	L	
6S/7E-33Q1	--	90	33°35′ 59" N	116°15′ 22" W	L	
6S/7E-33R1	--	70	33°35′ 59" N	116°15′ 07" W	L	
6S/7E-33R2	--	80	33°35′ 58" N	116°15′ 07" W	L	
6S/7E-33R3	--	75	33°35′ 58" N	116°15′ 07" W	L	
6S/8E-02D1	292-760	9	33°41′ 00" N	116°07′ 35" W	L	
6S/8E-02F1	540-1,015	5	33°40′ 54" N	116°07′ 13" W	L	
6S/8E-03C1	508-1,140	-69	33°41′ 06" N	116°08′ 15" W	L	
6S/8E-03D1	--	-84	33°41′ 01" N	116°08′ 37" W	L	
6S/8E-05P1	216-264	-75	33°40′ 17" N	116°10′ 33" W	L	
6S/8E-05R1	206-640	-80	33°40′ 27" N	116°10′ 02" W	LP	

Appendix 1: *List and description of wells in data base*--Continued

Well number	Perforated interval (depth, in feet below land surface)	Land-surface altitude (feet above or below (-) sea level)	Latitude	Longitude	Remarks	Closest model node for pumped wells (in model area only)
6S/8E-05R2	540-750	-82	33°40′ 26" N	116°09′ 54" W	LP	
6S/8E-05R3	520-650	-80	33°40′ 28" N	116°10′ 00" W	LP	
6S/8E-06G3	200-260	-62	33°40′ 42" N	116°11′ 06" W	L	
6S/8E-06M1	--	-55	33°40′ 35" N	116°11′ 45" W	L	
6S/8E-08L1	--	-85	33°39′ 43" N	116°10′ 27" W	L	
6S/8E-09K2	468-548	-98	33°39′ 41" N	116°09′ 01" W	L	
6S/8E-09Q2	620-1,025	-102	33°39′ 24" N	116°09′ 14" W	L	
6S/8E-09Q4	580-680	-102	33°39′ 25" N	116°09′ 15" W	L	
6S/8E-10F1	506-583	-99	33°40′ 01" N	116°08′ 17" W	L	
6S/8E-11A1	400-842	-25	33°40′ 08" N	116°06′ 48" W	L	
6S/8E-11E1	--	-100	33°40′ 01" N	116°07′ 35" W	L	
6S/8E-17R1	470-550	-109	33°38′ 34" N	116°10′ 01" W	L	
6S/8E-19D1	1,196-1,413	-85	33°38′ 29" N	116°11′ 47" W	L	
6S/8E-19D2	450-570	-87	33°38′ 29" N	116°11′ 39" W	L	
6S/8E-19R1	--	-105	33°37′ 49" N	116°10′ 59" W	L	
6S/8E-20H1	430-670	-117	33°38′ 09" N	116°09′ 57" W	LP	
6S/8E-22D2	500-680 900-1,100	-120	33°38′ 25" N	116°08′ 31" W	LP	
6S/8E-22K1	500-1,030	-128	33°38′ 02" N	116°08′ 12" W	L	
6S/8E-25P1	478-658	-140	33°36′ 46" N	116°06′ 16" W	L	
6S/8E-27C1	670-1,070	-135	33°37′ 38" N	116°08′ 14" W	L	
6S/8E-27N1	312-438	-145	33°36′ 46" N	116°08′ 36" W	L	
6S/8E-32R1	--	-140	33°36′ 05" N	116°10′ 02" W	L	
6S/8E-34C1	447-545	-146	33°36′ 44" N	116°08′ 13" W	L	
6S/8E-35J1	514-564	-155	33°36′ 16" N	116°06′ 58" W	L	
6S/8E-36M1	1,540-1,880	-155	33°36′ 17" N	116°06′ 42" W	L	
6S/9E-19L1	430-730	-35	33°37′ 54" N	116°05′ 10" W	L	
6S/9E-30A1	220-355	-51	33°37′ 38" N	116°04′ 53" W	L	
6S/9E-32A1	218-598	20	33°36′ 45" N	116°03′ 39" W	L	
6S/9E-32Q1	244-284	-100	33°36′ 00" N	116°03′ 57" W	L	
6S/9E-33K1	240-402	40	33°36′ 14" N	116°02′ 53" W	L	
7S/7E-01C1	240-380	-112	33°35′ 49" N	116°12′ 24" W	L	
7S/7E-01M1	--	-111	33°35′ 25" N	116°12′ 52" W	L	
7S/7E-02H1	278-326	-105	33°35′ 37" N	116°13′ 10" W	L	
7S/7E-03A1	250-452	-72	33°35′ 44" N	116°14′ 03" W	L	
7S/8E-02B1	520-575	-161	33°35′ 50" N	116°07′ 02" W	L	
7S/8E-03A1	400-500	-159	33°35′ 52" N	116°07′ 55" W	L	
7S/8E-07R1	--	-90	33°34′ 09" N	116°10′ 53" W	L	
7S/8E-08N1	300-360	-92	33°34′ 09" N	116°10′ 46" W	L	
7S/8E-09M1	540-600	-147	33°34′ 21" N	116°09′ 48" W	L	
7S/8E-15P1	310-1,060	-140	33°33′ 17" N	116°08′ 32" W	L	
7S/8E-17A1	800-1,100	-118	33°34′ 01" N	116°09′ 58" W	L	
7S/8E-17F1	265-325	-79	33°33′ 47" N	116°10′ 22" W	L	
7S/8E-17G1	400-750	-78	33°33′ 44" N	116°10′ 14" W	LP	
7S/8E-18C1	--	-73	33°34′ 03" N	116°11′ 36" W	L	
7S/8E-18Q1	300-500	2	33°33′ 16" N	116°11′ 23" W	L	
7S/8E-19G1	--	7	33°32′ 56" N	116°11′ 14" W	L	
7S/8E-20B1	210-501	-2	33°33′ 04" N	116°10′ 20" W	L	
7S/8E-20H1	260-486	-22	33°32′ 53" N	116°09′ 52" W	L	
7S/8E-22K1	446-775	-124	33°32′ 39" N	116°08′ 17" W	L	
7S/8E-23Q1	316-416	-181	33°32′ 24" N	116°07′ 03" W	L	
7S/8E-23Q2	365-425	-171	33°32′ 24" N	116°07′ 15" W	L	
7S/8E-28G1	195-295	-16	33°31′ 59" N	116°09′ 14" W	L	
7S/8E-29D1	360-650	95	33°32′ 16" N	116°10′ 45" W	L	

Appendix 1: *List and description of wells in data base*--Continued

Well number	Perforated interval (depth, in feet below land surface)	Land-surface altitude (feet above or below (-) sea level)	Latitude	Longitude	Remarks	Closest model node for pumped wells (in model area only)
7S/8E-29G1	--	80	33°32′ 03" N	116°10′ 14" W	L	
7S/8E-31R1	--	24	33°30′ 46" N	116°10′ 58" W	L	
7S/8E-33B1	243-522	21	33°31′ 18" N	116°09′ 17" W	L	
7S/8E-33E1	318-702	75	33°31′ 17" N	116°09′ 49" W	L	
7S/8E-33N2	--	75	33°30′ 45" N	116°09′ 43" W	L	
7S/8E-34G1	--	-92	33°31′ 10" N	116°08′ 07" W	L	
7S/8E-34K1	300-895	-84	33°30′ 55" N	116°08′ 12" W	L	
7S/8E-35K1	--	-161	33°30′ 52" N	116°07′ 14" W	L	
7S/9E-03D1	320-600	31	33°35′ 48" N	116°02′ 27" W	L	
7S/9E-04C1	300-600	-42	33°35′ 50" N	116°03′ 15" W	L	
7S/9E-04K1	300-600	-65	33°35′ 17" N	116°03′ 06" W	L	
7S/9E-05M1	460-940	-152	33°35′ 24" N	116°04′ 26" W	L	
7S/9E-07H2	451-566	-188	33°34′ 37" N	116°04′ 57" W	L	
7S/9E-07J1	410-470 500-570 830-870	-185	33°34′ 31" N	116°04′ 46" W	LP	
7S/9E-08P1	430-590	-180	33°34′ 16" N	116°04′ 13" W	LP	
7S/9E-13N1	90-306	-101	33°33′ 19" N	116°00′ 28" W	L	
7S/9E-16M2	530-590	-186	33°33′ 34" N	116°03′ 29" W	L	
7S/9E-17K1	420-570 590-620 830-900	-195	33°33′ 41" N	116°04′ 05" W	LP	
7S/9E-22G2	560-620	-173	33°32′ 56" N	116°01′ 52" W	L	
7S/9E-23N1	530-560	-187	33°32′ 25" N	116°01′ 31" W	LP	
7S/9E-26G2	336-432	-205	33°31′ 59" N	116°01′ 00" W	L	
7S/9E-30M1	--	-213	33°31′ 58" N	116°05′ 37" W	L	
7S/10E-27A1	--	34	33°32′ 18" N	115°55′ 24" W	L	
8S/8E-03B1	485-680	-100	33°30′ 34" N	116°08′ 02" W	L	
8S/8E-03L1	402-618	-59	33°30′ 11" N	116°08′ 29" W	L	
8S/8E-05H1	250-560	9	33°30′ 19" N	116°09′ 58" W	L	
8S/8E-11A4	300-380	-157	33°29′ 48" N	116°06′ 50" W	L	
8S/8E-11H1	560-876	-166	33°29′ 36" N	116°06′ 51" W	L	
8S/8E-15G1	--	55	33°28′ 43" N	116°08′ 09" W	L	
8S/8E-24A1	800-900	-155	33°28′ 04" N	116°05′ 48" W	L	
8S/8E-24A2	--	-154	33°28′ 01" N	116°05′ 51" W	L	
8S/8E-24J1	216-312	-148	33°27′ 43" N	116°05′ 41" W	L	
8S/8E-24L1	--	-110	33°27′ 37" N	116°06′ 19" W	L	
8S/9E-30A1	315-595	-152	33°27′ 08" N	116°04′ 54" W	L	
8S/9E-31Q1	230-350	-6	33°25′ 35" N	116°04′ 59" W	LP	
8S/9E-31R1	182-278	-17	33°25′ 35" N	116°04′ 41" W	LP	
8S/9E-31R2	180-348	-18	33°25′ 36" N	116°04′ 44" W	LP	
8S/9E-33N1	--	-133	33°25′ 36" N	116°03′ 33" W	L	

Appendix 2: *Gross pumpage for January-June and July-December, 1979-86, for wells in data base*

[Pumpage, in acre-feet per year. *, no pumpage data (July-December 1986); pumpage assumed to equal January-June 1986 pumpage for model]

Well number	1979 Jan.-June	1979 July-Dec.	1980 Jan.-June	1980 July-Dec.	1981 Jan.-June	1981 July-Dec.	1982 Jan.-June	1982 July-Dec.	1983 Jan.-June	1983 July-Dec.	1984 Jan.-June	1984 July-Dec.	1985 Jan.-June	1985 July-Dec.	1986 Jan.-June	1986 July-Dec.
3S/3E-10P1	15	10	10	216	216	157	157	0	0	20	20	0	0	44	44	*
3S/3E-10P2	0	60	60	107	107	108	108	105	105	104	104	110	110	109	109	*
3S/4E-12B2	15	15	162	162	249	249	292	292	230	230	516	516	814	814	661	661
3S/4E-12C1	1,001	1,001	945	945	1,173	1,173	1,010	1,010	1,212	1,212	1,399	1,399	1,334	1,334	1,498	1,498
3S/4E-30C1	156	160	160	196	196	177	177	140	140	170	170	159	159	187	187	*
3S/4E-34H1	0	0	0	0	0	0	0	0	0	0	0	0	0	857	857	*
3S/4E-34R1	566	257	257	411	411	471	471	759	759	63	63	8	8	1,120	1,120	*
3S/4E-35R1	0	0	0	0	0	2,468	2,468	2,511	2,511	2,183	2,183	3,811	3,811	3,599	3,599	*
3S/4E-35R2	0	0	0	0	0	0	0	0	0	899	899	2,952	2,952	1,227	1,227	*
3S/4E-36M1	236	484	484	520	520	412	412	55	55	0	0	262	262	156	156	*
4S/4E-01B1	201	663	663	814	814	144	144	169	169	828	828	1,152	1,152	1,012	1,012	*
4S/4E-01B2	847	455	455	123	123	698	698	732	732	372	372	167	167	455	455	*
4S/4E-01N2	338	1,362	1,362	1,279	1,279	1,207	1,207	1,208	1,208	11	11	0	0	0	0	*
4S/4E-02B1	3,276	4,398	4,398	4,006	4,006	3,984	3,984	3,155	3,155	3,888	3,888	3,696	3,696	2,576	2,576	*
4S/4E-11K1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	*
4S/4E-11Q1	908	1,106	1,106	555	555	980	980	533	533	517	517	183	183	352	352	*
4S/4E-11Q2	2,095	1,106	1,106	2,223	2,223	1,819	1,819	1,433	1,433	932	932	1,068	1,068	846	846	*
4S/4E-11R1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	*
4S/4E-13C1	2,113	2,225	2,225	2,364	2,364	2,661	2,661	2,033	2,033	2,904	2,904	1,472	1,472	2,488	2,488	*
4S/4E-13Q1	50	44	44	62	62	58	58	51	51	52	52	49	49	47	47	*
4S/4E-14Q1	893	1,145	1,145	1,267	1,267	1,377	1,377	935	935	959	959	1,495	1,495	1,346	1,346	*
4S/4E-14R1	0	2	2	1,071	1,071	1,244	1,244	1,103	1,103	228	228	114	114	1,696	1,696	*
4S/4E-23D1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*
4S/4E-23E1	673	1,286	1,286	366	366	0	0	1,675	1,675	1,025	1,025	1,880	1,880	1,868	1,868	*
4S/4E-24D1	1,942	3,239	3,239	1,828	1,828	1,669	1,669	1,930	1,930	3,750	3,750	2,900	2,900	3,074	3,074	*
4S/4E-24H1	0	0	0	0	0	0	0	1,307	1,307	2,417	2,417	3,500	3,500	3,768	3,768	*
4S/4E-26A1	2,585	1,935	1,935	2,842	2,842	2,487	2,487	2,404	2,404	2,523	2,523	2,739	2,739	1,713	1,713	*
4S/4E-26G1	2,982	1,520	1,520	3,163	3,163	2,627	2,627	3,105	3,105	2,922	2,922	3,009	3,009	3,953	3,953	*
4S/4E-35A1	273	343	343	337	337	384	384	348	348	366	366	564	564	588	588	*
4S/4E-35B1	993	1,115	1,115	878	878	774	774	877	877	959	959	873	873	611	611	*
4S/4E-35L1	940	641	641	943	943	802	802	810	810	1,042	1,042	956	956	900	900	*
4S/5E-03P1	257	257	182	182	285	285	117	117	114	114	187	187	175	175	194	194
4S/5E-04F1	1,596	1,596	1,596	1,596	1,514	1,514	1,870	1,870	1,575	1,575	1,145	1,145	1,658	1,658	1,056	1,056
4S/5E-04N1	0	0	0	0	0	0	47	47	88	88	717	717	575	575	958	958
4S/5E-05K1	621	621	310	310	211	211	172	172	397	397	475	475	741	741	627	627
4S/5E-08A1	0	0	141	141	78	78	75	75	89	89	1,014	1,014	1,159	1,159	1,065	1,065
4S/5E-08L1	0	0	0	0	0	0	0	0	0	0	124	124	437	437	228	228
4S/5E-09B1	510	510	754	754	1,254	1,254	1,426	1,426	1,098	1,098	1,138	1,138	964	964	0	0
4S/5E-09F3	0	0	0	0	0	0	0	0	0	0	0	0	915	915	1,889	1,889
4S/5E-11E1	194	194	64	64	137	137	150	150	97	97	137	137	135	135	171	171
4S/5E-14N1	136	136	153	153	188	188	180	180	155	155	166	166	167	167	292	292

Appendix 2: *Gross pumpage for January-June and July-December, 1979-86, for wells in data base*--Continued

Well number	1979 Jan.-June	1979 July-Dec.	1980 Jan.-June	1980 July-Dec.	1981 Jan.-June	1981 July-Dec.	1982 Jan.-June	1982 July-Dec.	1983 Jan.-June	1983 July-Dec.	1984 Jan.-June	1984 July-Dec.	1985 Jan.-June	1985 July-Dec.	1986 Jan.-June	1986 July-Dec.
4S/5E-15R1	14	14	19	19	13	13	13	13	18	18	19	19	14	14	21	21
4S/5E-15R2	8	8	1	1	2	2	1	1	15	15	11	11	28	28	41	41
4S/5E-19D1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*
4S/5E-21J2	131	131	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4S/5E-22B1	0	0	0	0	0	0	0	0	0	0	37	37	560	560	759	759
4S/5E-25D1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	966	966
4S/5E-25F1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	602	602
4S/5E-26A1	310	310	724	724	984	984	1,609	1,609	1,332	1,332	821	821	1,147	1,147	1,342	1,342
4S/5E-26B1	169	169	1,402	1,402	1,605	1,605	1,891	1,891	2,305	2,305	2,324	2,324	1,886	1,886	1,145	1,145
4S/5E-26C1	1,110	1,110	601	601	1,175	1,175	844	844	834	834	1,069	1,069	786	786	794	794
4S/5E-26D1	1,515	1,515	1,286	1,286	1,812	1,812	1,380	1,380	1,083	1,083	1,261	1,261	1,022	1,022	1,614	1,614
4S/5E-26H1	1,611	1,611	786	786	730	730	593	593	2,050	2,050	2,375	2,375	2,358	2,358	2,182	2,182
4S/5E-26K1	511	511	648	648	670	670	911	911	673	673	678	678	784	784	713	713
4S/5E-27E2	0	0	982	982	1,981	1,981	2,214	2,214	1,606	1,606	1,490	1,490	1,761	1,761	1,510	1,510
4S/5E-27L1	420	420	420	420	389	389	398	398	291	291	388	388	388	388	388	388
4S/5E-28F1	1,630	1,630	1,302	1,302	2,272	2,272	1,128	1,128	1,006	1,006	1,160	1,160	1,279	1,279	1,431	1,431
4S/5E-28F2	2,060	2,060	2,344	2,344	1,632	1,632	141	141	1,074	1,074	2,214	2,214	1,517	1,517	1,179	1,179
4S/5E-28M1	308	1,058	1,058	1,247	1,247	1,036	1,036	1,015	1,015	1,177	1,177	1,419	1,419	1,391	1,391	*
4S/5E-29A1	2,483	2,918	2,918	2,685	2,685	2,120	2,120	1,936	1,936	1,673	1,673	1,574	1,574	1,419	1,419	*
4S/5E-29F2	273	85	85	54	54	265	265	0	0	0	0	8	8	17	17	*
4S/5E-29H1	2,984	2,789	2,789	3,327	3,327	2,222	2,222	1,496	1,496	2,530	2,530	2,191	2,191	2,470	2,470	*
4S/5E-29K1	177	147	147	262	262	148	148	137	137	77	77	51	51	72	72	*
4S/5E-30C1	265	28	28	0	0	0	0	45	45	156	156	204	204	209	209	*
4S/5E-33B4	148	63	63	19	19	1,726	1,726	1,281	1,281	455	455	117	117	23	23	*
4S/5E-34C1	214	214	215	215	204	204	203	203	232	232	252	252	291	291	272	272
4S/5E-34J1	177	177	166	166	193	193	202	202	252	252	24	24	248	248	244	244
4S/5E-35E1	378	378	378	378	301	301	207	207	0	0	121	121	36	36	31	31
4S/5E-35G4	619	619	540	540	405	405	332	332	408	408	396	396	371	371	83	83
4S/5E-35Q1	0	0	0	0	0	0	0	0	0	0	2	2	46	46	0	0
4S/5E-35Q2	597	597	583	583	813	813	740	740	785	785	808	808	721	721	760	760
4S/5E-36L1	1,002	1.002	1,074	1,074	993	993	1,036	1,036	1,052	1,052	902	902	739	739	661	661
4S/5E-36L2	779	779	623	623	338	338	718	718	621	621	988	988	1,147	1,147	1,125	1,125
4S/5E-36M1	1,161	1.161	794	794	919	919	773	773	866	866	523	523	576	576	968	968
4S/6E-17R1	107	107	32	32	192	192	3	3	0	0	0	0	0	0	0	0
4S/6E-18P1	242	242	176	176	0	0	0	0	0	0	0	0	0	0	0	0
4S/6E-18Q2	72	72	30	30	53	53	10	10	0	0	0	0	0	0	0	0
4S/6E-18R1	141	141	120	120	108	108	64	64	0	0	0	0	0	0	0	0
4S/6E-20C1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4S/6E-20L1	555	555	626	626	637	637	613	613	601	601	723	723	694	694	740	740
4S/6E-20M1	160	160	0	0	581	581	314	314	525	525	628	628	1,229	1,229	983	983
4S/6E-22C1	36	36	43	43	65	65	55	55	77	77	95	95	115	115	152	152
4S/6E-25C2	438	438	433	433	445	445	427	427	271	271	621	621	732	732	961	961

Appendix 2: *Gross pumpage for January-June and July-December, 1979-86, for wells in data base*--Continued

Well number	1979 Jan.-June	1979 July-Dec.	1980 Jan.-June	1980 July-Dec.	1981 Jan.-June	1981 July-Dec.	1982 Jan.-June	1982 July-Dec.	1983 Jan.-June	1983 July-Dec.	1984 Jan.-June	1984 July-Dec.	1985 Jan.-June	1985 July-Dec.	1986 Jan.-June	1986 July-Dec.
4S/6E-25C3	452	452	2,740	2,740	482	482	368	368	79	79	262	262	215	215	414	414
4S/6E-25J2	0	0	0	0	0	0	269	269	0	0	391	391	391	391	392	392
4S/6E-25R1	0	0	0	0	0	0	90	90	0	0	391	391	391	391	392	392
4S/6E-28E1	0	0	0	0	6	6	252	252	372	372	519	519	585	585	517	517
4S/6E-28E3	72	72	0	0	0	0	0	0	0	0	0	0	0	0	126	126
4S/6E-28G2	131	131	155	155	134	134	48	48	3	3	3	3	0	0	0	0
4S/6E-28H1	152	152	169	169	409	409	110	110	0	0	0	0	0	0	0	0
4S/6E-28J3	61	61	61	61	198	198	201	201	8	8	35	35	70	70	29	29
4S/6E-28J7	511	511	690	690	519	519	233	233	0	0	0	0	0	0	0	0
4S/6E-28K4	0	0	0	0	8	8	581	581	527	527	572	572	29	29	308	308
4S/6E-34A1	201	201	132	132	196	196	79	79	0	0	0	0	0	0	0	0
4S/6E-34C1	0	0	0	0	0	0	107	107	0	0	0	0	0	0	0	0
4S/6E-34D2	761	761	618	618	405	405	389	389	0	0	0	0	0	0	0	0
4S/6E-34K1	292	292	310	310	360	360	341	341	0	0	0	0	0	0	0	0
4S/6E-34K2	858	858	541	541	613	613	384	384	0	0	0	0	0	0	0	0
4S/6E-34L1	1,438	1,438	810	810	275	275	603	603	762	762	762	762	314	314	10	10
4S/6E-34M1	585	585	271	271	457	457	413	413	447	447	478	478	20	20	0	0
4S/7E-29E1	858	858	742	742	1,254	1,254	776	776	1,099	1,099	1,001	1,001	1,061	1,061	1,200	1,200
4S/7E-29M1	0	0	283	283	7	7	680	680	902	902	412	412	275	275	467	467
4S/7E-29N2	434	434	21	21	0	0	0	0	0	0	411	411	270	270	491	491
4S/7E-30E3	270	270	270	270	332	332	399	399	57	57	0	0	0	0	0	0
4S/7E-30L1	0	0	0	0	0	0	0	0	0	0	539	539	538	538	538	538
4S/7E-30M2	978	978	747	747	161	161	349	349	4	4	0	0	0	0	0	0
4S/7E-30M6	0	0	0	0	0	0	0	0	0	0	91	91	122	122	173	173
4S/7E-30P1	0	0	0	0	0	0	90	90	0	0	539	539	538	538	538	538
4S/7E-31Q3	718	718	831	831	329	329	146	146	180	180	130	130	120	120	120	120
4S/7E-32F2	96	96	96	96	75	75	75	75	0	0	75	75	75	75	75	75
4S/7E-32N2	127	127	148	148	166	166	186	186	166	166	186	186	242	242	330	330
5S/5E-01B1	945	945	1,161	1,161	755	755	790	790	611	611	813	813	854	854	811	811
5S/5E-01D3	437	437	425	425	580	580	402	402	301	301	372	372	433	433	383	383
5S/5E-01L5	799	799	1,294	1,294	1,449	1,449	1,937	1,937	1,864	1,864	2,130	2,130	1,995	1,995	343	343
5S/5E-01M4	0	0	0	0	0	0	0	0	23	23	0	0	0	0	0	0
5S/5E-01N1	29	29	33	33	33	33	36	36	37	37	48	48	48	48	45	45
5S/5E-01Q2	1,379	1,379	142	142	40	40	192	192	194	194	163	163	506	506	110	110
5S/5E-01Q3	0	0	375	375	1,315	1,315	622	622	899	899	1,059	1,059	882	882	941	941
5S/5E-02A1	0	0	0	0	699	699	431	431	573	573	283	283	517	517	553	553
5S/5E-02B1	0	0	0	0	93	93	87	87	1,155	1,155	1,436	1,436	1,702	1,702	1,934	1,934
5S/5E-02H1	0	0	0	0	0	0	860	860	403	403	1,004	1,004	714	714	514	514
5S/5E-02Q1	189	189	53	53	39	39	21	21	0	0	0	0	0	0	0	0
5S/5E-11A3	504	504	287	287	419	419	370	370	396	396	267	267	279	279	251	251
5S/5E-12B3	864	864	925	925	819	819	611	611	454	454	790	790	821	821	811	811
5S/5E-12D1	6	6	0	0	0	0	53	53	5	5	2	2	17	17	32	32

Appendix 2: *Gross pumpage for January-June and July-December, 1979-86, for wells in data base*--Continued

Well number	1979 Jan.-June	1979 July-Dec.	1980 Jan.-June	1980 July-Dec.	1981 Jan.-June	1981 July-Dec.	1982 Jan.-June	1982 July-Dec.	1983 Jan.-June	1983 July-Dec.	1984 Jan.-June	1984 July-Dec.	1985 Jan.-June	1985 July-Dec.	1986 Jan.-June	1986 July-Dec.
5S/5E-12D2	181	181	332	332	355	355	229	229	213	213	332	332	456	456	406	406
5S/5E-12J1	2,213	2,213	1,860	1,860	2,301	2,301	2,246	2,246	2,539	2,539	2,720	2,720	2,215	2,215	725	725
5S/5E-12L2	17	17	209	209	32	32	1	1	12	12	6	6	284	284	243	243
5S/5E-12Q1	5	5	40	40	66	66	0	0	0	0	0	0	0	0	0	0
5S/6E-01C1	237	237	237	237	0	0	0	0	0	0	0	0	0	0	0	0
5S/6E-01D2	692	692	234	234	615	615	408	408	12	12	3	3	0	0	0	0
5S/6E-01J1	181	181	149	149	184	184	107	107	74	74	78	78	71	71	76	76
5S/6E-01J2	144	144	38	38	117	117	75	75	51	51	50	50	50	50	43	43
5S/6E-01K2	12	12	26	26	133	133	90	90	77	77	69	69	76	76	55	55
5S/6E-02D1	0	0	0	0	0	0	0	0	0	0	0	0	473	473	480	480
5S/6E-02G1	0	0	0	0	0	0	0	0	0	0	0	0	994	994	2,075	2,075
5S/6E-02M1	0	0	0	0	0	0	0	0	0	0	1,022	1,022	1,640	1,640	1,396	1,396
5S/6E-03A1	519	519	360	360	403	403	306	306	353	353	382	382	76	76	0	0
5S/6E-03H1	6	6	600	600	862	862	733	733	616	616	677	677	470	470	625	625
5S/6E-03K1	778	778	906	906	615	615	179	179	586	586	86	86	436	436	392	392
5S/6E-03L1	0	0	0	0	0	0	0	0	0	0	1,463	1,463	1,285	1,285	1,139	1,139
5S/6E-03N1	0	0	0	0	0	0	0	0	0	0	767	767	344	344	119	119
5S/6E-03P1	0	0	0	0	0	0	0	0	0	0	794	794	1,671	1,671	1,759	1,759
5S/6E-05A1	1,237	1,237	781	781	953	953	850	850	707	707	836	836	889	889	835	835
5S/6E-05B1	192	192	45	45	97	97	50	50	83	83	14	14	53	53	72	72
5S/6E-05K1	767	767	2,764	2,764	1,469	1,469	1,444	1,444	1,497	1,497	1,338	1,338	988	988	831	831
5S/6E-05M1	0	0	619	619	836	836	814	814	879	879	830	830	721	721	598	598
5S/6E-05Q1	1,463	1,463	1,051	1,051	1,311	1,311	1,569	1,569	674	674	785	785	305	305	224	224
5S/6E-06B3	0	0	0	0	0	0	0	0	0	0	0	0	956	956	1,044	1,044
5S/6E-06C1	0	0	0	0	0	0	0	0	0	0	704	704	634	634	5	5
5S/6E-06C2	0	0	0	0	0	0	0	0	0	0	380	380	208	208	1,209	1,209
5S/6E-06M1	400	400	439	439	1,042	1,042	902	902	705	705	879	879	830	830	829	829
5S/6E-06M2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,960	1,960
5S/6E-06Q1	462	462	560	560	440	440	1,110	1,110	800	800	812	812	904	904	1,184	1,184
5S/6E-07B1	0	0	0	0	0	0	0	0	0	0	139	139	363	363	297	297
5S/6E-07C2	140	140	113	113	183	183	164	164	174	174	164	164	174	174	185	185
5S/6E-07J1	126	126	126	126	256	256	109	109	86	86	89	89	87	87	62	62
5S/6E-07M1	0	0	140	140	227	227	84	84	88	88	97	97	133	133	139	139
5S/6E-07N1	140	140	26	26	102	102	89	89	164	164	120	120	47	47	33	33
5S/6E-07R1	0	0	1,146	1,146	409	409	244	244	266	266	236	236	238	238	417	417
5S/6E-08M2	583	583	629	629	361	361	0	0	14	14	0	0	0	0	0	0
5S/6E-08M3	0	0	1,261	1,261	1,377	1,377	1,331	1,331	1,456	1,456	1,480	1,480	1,045	1,045	1,052	1,052
5S/6E-08N2	266	266	672	672	759	759	687	687	1,151	1,151	971	971	1,124	1,124	1,659	1,659
5S/6E-08N3	0	0	0	0	177	177	946	946	967	967	777	777	806	806	988	988
5S/6E-08Q1	265	265	330	330	360	360	576	576	419	419	646	646	900	900	974	974
5S/6E-09B1	0	0	0	0	0	0	0	0	0	0	845	845	1,707	1,707	1,439	1,439
5S/6E-09Q1	0	0	0	0	0	0	0	0	0	0	0	0	1,067	1,067	2,003	2,003

Appendix 2: *Gross pumpage for January-June and July-December, 1979-86, for wells in data base*--Continued

Well number	1979 Jan.-June	1979 July-Dec.	1980 Jan.-June	1980 July-Dec.	1981 Jan.-June	1981 July-Dec.	1982 Jan.-June	1982 July-Dec.	1983 Jan.-June	1983 July-Dec.	1984 Jan.-June	1984 July-Dec.	1985 Jan.-June	1985 July-Dec.	1986 Jan.-June	1986 July-Dec.
5S/6E-10D1	0	0	0	0	0	0	179	179	987	987	1.266	1,266	1,208	1,208	1,144	1,144
5S/6E-10D2	0	0	0	0	0	0	60	60	241	241	586	586	943	943	954	954
5S/6E-10E1	0	0	0	0	0	0	0	0	142	142	2,475	2,475	2,184	2,184	2,782	2,782
5S/6E-12M1	0	0	450	450	315	315	210	210	172	172	307	307	344	344	366	366
5S/6E-12M2	0	0	450	450	115	115	889	889	1,163	1,163	1,074	1,074	957	957	583	583
5S/6E-12N1	0	0	0	0	5	5	940	940	1,138	1,138	1,883	1,883	1,823	1,823	1,663	1,663
5S/6E-12Q1	0	0	0	0	0	0	0	0	0	0	780	780	608	608	154	154
5S/6E-12Q2	0	0	0	0	0	0	0	0	0	0	96	96	349	349	537	537
5S/6E-13B1	348	348	419	419	166	166	561	561	559	559	621	621	601	601	587	587
5S/6E-13D1	397	397	48	48	399	399	290	290	250	250	268	268	189	189	115	115
5S/6E-13M1	696	696	611	611	683	683	552	552	815	815	951	951	1,225	1,225	1,037	1,037
5S/6E-13R1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,383	1,383
5S/6E-14G1	0	0	0	0	477	477	990	990	1,407	1.407	1,580	1,580	1,311	1,311	1,349	1,349
5S/6E-14G2	0	0	0	0	0	0	0	0	0	0	447	447	1,075	1,075	1,237	1,237
5S/6E-14Q1	1,266	1,266	871	871	123	123	0	0	0	0	0	0	0	0	0	0
5S/6E-16A1	211	211	123	123	36	36	0	0	0	0	0	0	0	0	0	0
5S/6E-16A2	673	673	1.705	1,705	2,078	2,078	1,677	1,677	1,573	1,573	2.091	2,091	2,465	2,465	2,325	2,325
5S/6E-16C1	250	250	170	170	398	398	405	405	455	455	396	396	474	474	460	460
5S/6E-16H1	141	141	80	80	1	1	0	0	0	0	0	0	0	0	0	0
5S/6E-16K1	287	287	235	235	267	267	232	232	195	195	220	220	250	250	234	234
5S/6E-16M1	101	101	88	88	126	126	120	120	125	125	141	141	125	125	127	127
5S/6E-16N2	750	750	963	963	1,249	1,249	1,529	1,529	1,458	1.458	1,352	1,352	1,311	1,311	1,275	1,275
5S/6E-16Q1	48	48	48	48	0	0	53	53	0	0	0	0	8	8	10	10
5S/6E-16Q2	445	445	237	237	33	33	26	26	19	19	92	92	22	22	24	24
5S/6E-17F1	0	0	475	475	663	663	512	512	534	534	624	624	581	581	541	541
5S/6E-17G2	0	0	0	0	941	941	983	983	1,129	1.129	1.507	1,507	1,491	1,491	1,770	1,770
5S/6E-17M2	376	376	300	300	375	375	378	378	360	360	371	371	156	156	539	539
5S/6E-17P2	303	303	288	288	354	354	340	340	258	258	325	325	337	337	359	359
5S/6E-18C2	488	488	603	603	549	549	593	593	221	221	603	603	369	369	201	201
5S/6E-18C3	570	570	469	469	459	459	504	504	711	711	557	557	799	799	596	596
5S/6E-18G1	79	79	72	72	75	75	67	67	66	66	62	62	92	92	58	58
5S/6E-18L2	59	59	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5S/6E-18R2	926	926	1.589	1,589	1,897	1,897	2.256	2,256	2.691	2.691	2.506	2,506	2,309	2,309	1,832	1,832
5S/6E-20A1	54	54	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5S/6E-20F2	0	0	0	0	0	0	15	15	20	20	0	0	0	0	0	0
5S/6E-20F3	317	317	398	398	403	403	181	181	119	119	299	299	474	474	504	504
5S/6E-20P1	1,177	1.177	844	844	8	8	1	1	0	0	0	0	0	0	0	0
5S/6E-21G1	133	133	140	140	47	47	0	0	0	0	0	0	0	0	0	0
5S/6E-21G3	209	209	213	213	414	414	320	320	222	222	241	241	161	161	83	83
5S/6E-21H3	155	155	212	212	191	191	136	136	145	145	161	161	147	147	158	158
5S/6E-21H5	3	3	73	73	69	69	139	139	56	56	19	19	11	11	10	10
5S/6E-21J1	280	280	218	218	210	210	88	88	0	0	0	0	0	0	0	0

Appendix 2: *Gross pumpage for January-June and July-December, 1979-86, for wells in data base*--Continued

Well number	1979 Jan.-June	1979 July-Dec.	1980 Jan.-June	1980 July-Dec.	1981 Jan.-June	1981 July-Dec.	1982 Jan.-June	1982 July-Dec.	1983 Jan.-June	1983 July-Dec.	1984 Jan.-June	1984 July-Dec.	1985 Jan.-June	1985 July-Dec.	1986 Jan.-June	1986 July-Dec.
5S/6E-21N2	3,260	3,260	2,937	2,937	3,620	3,620	3,276	3,276	2,833	2,833	2,726	2,726	2,875	2,875	2,211	2,211
5S/6E-21P1	486	486	479	479	69	69	1	1	0	0	0	0	0	0	0	0
5S/6E-21Q3	1,174	1,174	1,271	1,271	1,099	1,099	1,527	1,527	860	860	1,461	1,461	647	647	816	816
5S/6E-21R1	110	110	110	110	127	127	115	115	130	130	173	173	120	120	185	185
5S/6E-22B1	355	355	377	377	190	190	196	196	187	187	160	160	204	204	410	410
5S/6E-22B2	0	0	545	545	1,389	1,389	2,182	2,182	2,494	2,494	2,823	2,823	2,501	2,501	2,293	2,293
5S/6E-22G2	37	37	685	685	499	499	268	268	277	277	350	350	248	248	312	312
5S/6E-22H1	63	63	20	20	118	118	283	283	209	209	568	568	224	224	206	206
5S/6E-22H2	0	0	92	92	114	114	286	286	222	222	227	227	349	349	259	259
5S/6E-22J1	173	173	173	173	107	107	87	87	93	93	83	83	83	83	76	76
5S/6E-22M1	0	0	0	0	0	0	320	320	0	0	319	319	317	317	319	319
5S/6E-22P1	444	444	141	141	413	413	0	0	0	0	0	0	0	0	0	0
5S/6E-22P2	37	37	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5S/6E-23E2	0	0	0	0	0	0	64	64	52	52	60	60	51	51	26	26
5S/6E-23E3	0	0	0	0	0	0	0	0	0	0	0	0	76	76	264	264
5S/6E-23F1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2
5S/6E-23K2	828	828	729	729	676	676	495	495	941	941	829	829	1,025	1,025	1,001	1,001
5S/6E-23L1	94	94	85	85	94	94	89	89	62	62	62	62	72	72	83	83
5S/6E-23M1	304	304	95	95	614	614	591	591	762	762	704	704	662	662	749	749
5S/6E-23N1	102	102	30	30	58	58	47	47	52	52	65	65	64	64	75	75
5S/6E-24D1	0	0	0	0	0	0	0	0	0	0	0	0	138	138	1,571	1,571
5S/6E-24F1	0	0	0	0	0	0	0	0	0	0	0	0	236	236	760	760
5S/6E-24G1	922	922	319	319	238	238	92	92	3	3	32	32	265	265	1	1
5S/6E-24M1	21	21	1,337	1337	1,805	1,805	1,505	1,505	1,155	1,155	1,059	1,059	1,711	1,711	1,543	1,543
5S/6E-25A1	31	31	24	24	202	202	256	256	63	63	212	212	124	124	115	115
5S/6E-25A2	161	161	338	338	74	74	48	48	23	23	5	5	153	153	206	206
5S/6E-27A1	538	538	601	601	626	626	439	439	399	399	320	320	350	350	538	538
5S/6E-27A2	154	154	198	198	157	157	129	129	151	151	164	164	198	198	152	152
5S/6E-27B2	100	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5S/6E-27C1	0	0	19	19	89	89	23	23	19	19	6	6	7	7	17	17
5S/6E-27C2	784	784	561	561	166	166	602	602	361	361	160	160	134	134	131	131
5S/6E-27D1	100	100	446	446	543	543	654	654	449	449	407	407	556	556	421	421
5S/6E-27D2	83	83	245	245	612	612	513	513	421	421	675	675	631	631	657	657
5S/6E-28C2	732	732	686	686	933	933	927	927	263	263	0	0	53	53	0	0
5S/6E-28E2	0	0	0	0	0	0	158	158	769	769	987	987	1,019	1,019	1,162	1,162
5S/6E-28H1	104	104	1,013	1,013	452	452	269	269	328	328	61	61	32	32	224	224
5S/6E-29B1	509	509	478	478	460	460	482	482	511	511	569	569	592	592	525	525
5S/6E-29C2	879	879	849	849	810	810	534	534	679	679	52	52	1,208	1,208	538	538
5S/6E-29H1	479	479	443	443	423	423	456	456	418	418	481	481	446	446	474	474
5S/6E-29M1	390	390	144	144	187	187	2	2	1	1	0	0	0	0	0	0
5S/6E-29P1	0	0	0	0	422	422	21	21	0	0	0	0	0	0	0	0
5S/6E-32B1	626	626	888	888	1,083	1,083	964	964	1,046	1,046	1,191	1,191	1,236	1,236	981	981

Appendix 2: *Gross pumpage for January-June and July-December, 1979-86, for wells in data base*--Continued

Well number	1979 Jan.-June	1979 July-Dec.	1980 Jan.-June	1980 July-Dec.	1981 Jan.-June	1981 July-Dec.	1982 Jan.-June	1982 July-Dec.	1983 Jan.-June	1983 July-Dec.	1984 Jan.-June	1984 July-Dec.	1985 Jan.-June	1985 July-Dec.	1986 Jan.-June	1986 July-Dec.
5S/6E-32B2	1,049	1,049	1,163	1,163	1,021	1,021	681	681	852	852	727	727	832	832	808	808
5S/6E-32B3	31	31	82	82	5	5	11	11	30	30	38	38	57	57	86	86
5S/7E-05K1	401	401	360	360	261	261	313	313	237	237	231	231	237	237	13	13
5S/7E-06B1	333	333	269	269	168	168	121	121	170	170	130	130	120	120	120	120
5S/7E-06B3	0	0	0	0	0	0	190	190	0	0	100	100	120	120	120	120
5S/7E-06M1	46	46	60	60	43	43	165	165	111	111	139	139	192	192	205	205
5S/7E-07F1	768	768	554	554	551	551	383	383	565	565	636	636	422	422	371	371
5S/7E-07J1	46	46	46	46	0	0	0	0	0	0	0	0	0	0	0	0
5S/7E-07P1	161	161	167	167	205	205	147	147	162	162	351	351	255	255	108	108
5S/7E-16K2	75	75	92	92	113	113	103	103	89	89	87	87	90	90	97	97
5S/7E-18F1	0	0	199	199	145	145	171	171	189	189	234	234	292	292	282	282
5S/7E-19D1	0	0	0	0	0	0	0	0	0	0	0	0	394	394	1,877	1,877
5S/7E-28E1	0	0	0	0	1	1	17	17	0	0	0	0	0	0	1	1
5S/7E-30J1	272	272	284	284	307	307	362	362	289	289	353	353	363	363	426	426
5S/7E-31N1	0	0	250	250	502	502	243	243	194	194	55	55	51	51	20	20
5S/7E-31P1	0	0	905	905	247	247	0	0	0	0	0	0	0	0	0	0
5S/7E-31Q2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	98	98
6S/6E-01Q1	0	0	0	0	0	0	0	0	0	0	0	0	240	240	425	425
6S/6E-12F1	0	0	0	0	0	0	0	0	0	0	0	0	20	20	13	13
6S/6E-12G1	0	0	0	0	0	0	0	0	0	0	0	0	187	187	255	255
6S/7E-06B1	0	0	0	0	0	0	567	567	766	766	1,074	1,074	1,223	1,223	817	817
6S/7E-06N1	0	0	0	0	0	0	0	0	0	0	0	0	124	124	220	220
6S/7E-13M2	0	0	0	0	1	1	2	2	0	0	0	0	0	0	0	0
6S/7E-13M4	158	158	147	147	149	149	141	141	153	153	167	167	172	172	176	176
6S/7E-16D1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	240	240
6S/7E-21D1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3
6S/8E-05R1	12	12	5	5	5	5	2	2	2	2	4	4	2	2	0	0
6S/8E-05R2	89	89	80	80	98	98	102	102	114	114	127	127	102	102	71	71
6S/8E-05R3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4
6S/8E-20H1	0	0	0	0	16	16	110	110	81	81	13	13	0	0	105	105
6S/8E-22D2	168	168	146	146	198	198	103	103	130	130	224	224	0	0	171	171
7S/8E-17G1	17	17	19	19	25	25	23	23	24	24	28	28	0	0	33	33
7S/9E-07J1	0	0	0	0	0	0	0	0	0	0	4	4	3	3	70	70
7S/9E-08P1	0	0	140	140	321	321	320	320	307	307	336	336	378	378	338	338
7S/9E-17K1	513	513	540	540	756	756	733	733	815	815	831	831	0	0	928	928
7S/9E-23N1	135	135	104	104	5	5	4	4	1	1	0	0	0	0	0	0
8S/9E-31Q1	595	595	571	571	652	652	625	625	679	679	699	699	0	0	728	728
8S/9E-31R1	174	174	47	47	107	107	30	30	47	47	65	65	0	0	77	77
8S/9E-31R2	24	24	10	10	29	29	10	10	4	4	0	0	0	0	0	0

Appendix 3: *Ground-water levels, autumn 1978*

[Altitude of water level in feet above or below (-) sea level]

Well number	Perforated interval (depth, in feet below land surface)	Date	Altitude of water level
2S/3E-25K1	--	09/78	1,994
2S/4E-34A1	380-610	09/78	760
2S/4E-35Q1	185-380	09/78	748
2S/5E-31L1	220-285	09/78	748
2S/5E-32E6	110-180	09/78	1,107
2S/5E-33E5	261-281	09/78	1,071
3S/2E-23B1	--	09/78	1,220
3S/3E-08M1	225-553	09/78	1,128
3S/3E-10P1	476-776	10/78	648
3S/3E-10P2	306-906	09/78	656
3S/4E-12B1	180-220	10/78	743
3S/4E-12B2	270-500	10/78	747
3S/4E-12C1	200-480	10/78	743
3S/4E-12H1	122-147	10/78	747
	172-192		
3S/4E-13N1	216-254	09/78	485
3S/4E-17K1	340-375	09/78	564
3S/4E-20D1	560-580	10/78	372
3S/4E-22A1	180-185	09/78	546
	218-230		
3S/4E-29F1	550-570	10/78	375
3S/4E-29R1	431-551	10/78	276
3S/4E-30C1	530-726	10/78	392
3S/4E-34R1	506-830	10/78	196
3S/5E-03L1	225-370	09/78	945
3S/5E-03R1	145-240	09/78	905
3S/5E-04H1	244-355	09/78	914
3S/5E-09C1	262-334	09/78	756
3S/5E-10L2	190-260	10/78	750
3S/5E-10R1	177-207	09/78	861
3S/5E-11Q1	170-236	09/78	882
3S/5E-12P1	304-379	09/78	859
3S/5E-17J1	182-405	10/78	740
3S/5E-19B1	51-83	09/78	692
3S/5E-30G1	344-644	09/78	387
3S/6E-25Q1	371-511	09/78	728
3S/6E-26P1	204-310	09/78	711
3S/6E-28A1	250-332	09/78	745
3S/6E-36P1	--	09/78	689
4S/4E-01B3	400-700	10/78	160
4S/4E-01N2	525-800	09/78	175
4S/4E-11R1	526-700	10/78	166
4S/4E-13H1	400-500	09/78	163
4S/4E-13P1	345-365	09/78	170
	398-408		
4S/4E-15J1	164-344	09/78	167
	415-435		
4S/4E-23E1	240-472	10/78	175
4S/4E-26A1	450-780	10/78	148
4S/4E-35K1	435-600	09/78	229
4S/5E-04F1	276-576	10/78	156
4S/5E-05K1	408-748	10/78	163
4S/5E-09B1	398-806	10/78	160
4S/5E-09F1	227-616	10/78	149
4S/5E-11E1	172-607	10/78	122
4S/5E-19D1	240-440	10/78	161
4S/5E-21A1	--	10/78	127
4S/5E-21J2	440-470	10/78	128
	680-1,000		
4S/5E-22A1	--	09/78	123
4S/5E-27E1	344-392	10/78	118
4S/5E-29K1	--	09/78	134
4S/5E-30C1	300-440	09/78	141
4S/5E-33B1	268-288	10/78	118
4S/5E-35D2	215-407	09/78	94
4S/5E-35G3	--	10/78	84
4S/5E-35G4	600-1,000	10/78	83
4S/5E-36D1	470-492	09/78	88
	658-678		
4S/5E-36M1	315-627	10/78	86
4S/6E-08L1	--	09/78	83
4S/6E-17R1	166-817	10/78	75
4S/6E-18P1	216-454	10/78	84
4S/6E-18Q2	125-255	10/78	86
4S/6E-18R1	479-518	10/78	83
4S/6E-19J2	171-500	09/78	85
4S/6E-20M1	460-960	10/78	76
4S/6E-22C1	208-211	10/78	61
	272-304		
4S/6E-22C2	189-213	10/78	67
	233-305		
4S/6E-22J1	--	09/78	69
4S/6E-22K1	150-495	09/78	80
4S/6E-27N1	506-563	09/78	46
4S/6E-28A2	180-750	10/78	61
4S/6E-28J2	--	09/78	57
4S/6E-29A1	178-844	09/78	70
4S/6E-34D1	--	10/78	46
4S/6E-34F1	--	10/78	81
4S/6E-34Q1	171-602	09/78	92
4S/7E-14E1	382-520	09/78	726
4S/7E-30M1	--	11/78	30
4S/7E-31Q3	236-356	09/78	10
	590-710		

Appendix 3: *Ground-water levels, autumn 1978*--Continued

Well number	Perforated interval (depth, in feet below land surface)	Date	Altitude of water level
4S/7E-32N2	195-462	10/78	2
4S/7E-33N1	100-412	09/78	4
5S/5E-01D2	--	09/78	82
5S/5E-01L5	500-740	10/78	72
5S/5E-01P1	108-192	10/78	75
5S/5E-02F2	250-495	10/78	73
5S/5E-02L1	130-140	09/78	82
	200-220		
5S/5E-02Q1	220-450	09/78	71
5S/5E-03A1	110-130	09/78	88
	238-320		
5S/5E-11A1	--	10/78	56
5S/5E-12C1	162-503	10/78	78
5S/5E-12C2	--	09/78	64
5S/5E-12D1	125-360	09/78	73
5S/5E-12H2	432-590	10/78	57
5S/5E-12J1	400-880	10/78	46
5S/5E-12L2	208-461	10/78	70
5S/5E-12Q1	--	10/78	68
5S/6E-02A1	200-618	10/78	38
5S/6E-02A2	450-650	10/78	21
5S/6E-06Q1	668-1,202	11/78	61
5S/6E-07J1	460-560	10/78	59
5S/6E-07Q2	300-500	10/78	55
5S/6E-07Q3	380-500	10/78	57
5S/6E-08N2	450-780	09/78	65
5S/6E-12G1	192-272	10/78	8
	472-604		
5S/6E-13D1	518-566	10/78	3
	614-878		
5S/6E-14Q1	440-600	11/78	22
	706-810		
5S/6E-16A1	360-560	11/78	40
5S/6E-16A2	445-530	10/78	47
	730-965		
5S/6E-16H1	336-552	10/78	33
5S/6E-16M1	350-500	09/78	42
5S/6E-18L2	317-509	11/78	44
5S/6E-18R1	296-450	10/78	43
5S/6E-18R2	425-800	10/78	41
5S/6E-20P1	300-588	11/78	37
5S/6E-21L1	250-578	10/78	45
5S/6E-21N2	400-820	11/78	45
5S/6E-21Q3	350-700	11/78	46
5S/6E-22B1	350-390	9/78	26
	416-452		
	468-502		
5S/6E-22P1	254-292	11/78	34
	305-370		
5S/6E-22P2	264-370	11/78	47
5S/6E-23L3	255-312	11/78	23
5S/6E-23M1	384-480	11/78	32
	576-776		
5S/6E-24G1	480-680	11/78	6
	810-930		
5S/6E-25A1	400-656	09/78	5
5S/6E-27C1	138-292	10/78	46
5S/6E-27C2	--	11/78	46
5S/6E-28C1	204-252	11/78	47
5S/6E-28C2	410-680	11/78	48
5S/6E-28E1	247-346	09/78	45
5S/6E-29B1	351-615	09/78	47
5S/6E-29C1	243-531	10/78	29
5S/6E-29C2	530-670	10/78	38
5S/6E-29M1	457-723	11/78	49
5S/6E-29P1	500-700	10/78	43
5S/6E-32G1	459-736	10/78	120
5S/7E-04A1	147-367	09/78	-3
5S/7E-04D1	100-370	09/78	0
5S/7E-04M1	192-678	09/78	-3
5S/7E-05K1	--	10/78	-9
5S/7E-06B1	168-180	10/78	8
	280-303		
5S/7E-06H1	400-480	09/78	-2
5S/7E-06M1	195-363	10/78	11
	555-651		
5S/7E-07F1	147-459	09/78	14
5S/7E-07J1	147-363	09/78	-14
5S/7E-07P1	144-450	10/78	3
5S/7E-08G1	--	11/78	-2
5S/7E-08Q1	203-654	09/78	-13
5S/7E-09F1	130-310	09/78	-16
5S/7E-10E1	70-360	09/78	-18
5S/7E-11C1	323-433	09/78	-12
5S/7E-12P1	280-400	09/78	-28
5S/7E-13D1	580-583	09/78	-30
	980-1,020		
5S/7E-14J2	232-350	09/78	-27
5S/7E-14K1	264-411	09/78	-29
5S/7E-15Q1	264-464	09/78	-24
5S/7E-16C1	147-355	10/78	-11
5S/7E-16K2	200-415	10/78	-18
5S/7E-18D1	160-200	09/78	9
5S/7E-18M2	168-264	10/78	4
5S/7E-22H2	506-1,100	10/78	-42

Appendix 3: *Ground-water levels, autumn 1978*--Continued

Well number	Perforated interval (depth, in feet below land surface)	Date	Altitude of water level
5S/7E-27B1	236-500	10/78	-29
5S/7E-27L1	516-600	09/78	-44
5S/7E-28E1	128-198	10/78	-20
5S/7E-30C2	115-235	09/78	-14
	427-489		
5S/7E-30F1	77-84	10/78	-17
	104-126		
	140-144		
5S/7E-30F2	--	10/78	-15
5S/7E-30J1	500-900	10/78	-22
5S/7E-31N1	110-772	11/78	-28
5S/7E-31P1	110-680	11/78	-19
5S/7E-33D2	398-518	09/78	-37
5S/7E-33F2	400-540	09/78	-28
5S/7E-33M1	388-517	10/78	-35
5S/7E-36D1	152-756	09/78	-45
5S/7E-36G1	125-345	09/78	-45
5S/7E-36Q1	147-375	10/78	-49
5S/8E-17N1	278-398	10/78	-32
5S/8E-19H2	402-690	10/78	-66
5S/8E-20C2	278-438	10/78	-53
5S/8E-20M1	400-450	10/78	-59
5S/8E-28M1	388-460	10/78	-27
5S/8E-28M2	208-268	10/78	14
5S/8E-29G1	230-278	10/78	0
5S/8E-29R1	400-592	10/78	29
5S/8E-31J1	240-302	10/78	-63
5S/8E-34G1	--	10/78	-100
6S/6E-01G1	205-296	10/78	-38
6S/6E-01Q1	--	10/78	-28
6S/6E-12G1	--	10/78	-38
6S/6E-17K1	480-580	09/78	794
6S/7E-01H1	525-595	10/78	-70
6S/7E-01P1	--	10/78	-56
6S/7E-02G1	160-363	10/78	-33
6S/7E-07B1	200-480	10/78	-128
6S/7E-09L2	225-300	10/78	-23
6S/7E-10G1	100-360	10/78	-27
6S/7E-12E1	120-600	10/78	-54
6S/7E-13M2	146-386	10/78	-65
6S/7E-13M4	480-600	10/78	-75
6S/7E-17R1	--	10/78	-57
6S/7E-22B1	1,088-1,365	10/78	-57
6S/7E-23D3	380-600	10/78	-75
6S/7E-23F1	312-375	10/78	-76
6S/8E-02D1	292-760	10/78	-95
6S/8E-02F1	540-1,015	10/78	-100
6S/8E-03C1	508-1,140	10/78	-84
6S/8E-05P1	216-264	10/78	-83
6S/8E-05R1	206-640	10/78	-86
6S/8E-05R2	540-750	10/78	-88
6S/8E-06G3	200-260	10/78	-72
6S/8E-09K2	468-548	10/78	-98
6S/8E-09Q4	580-680	10/78	-98
6S/8E-10F1	506-583	10/78	-99
6S/8E-17R1	470-550	10/78	-98
6S/8E-19D1	1,196-1,413	10/78	-75
6S/8E-19D2	450-570	10/78	-94
6S/8E-19R1	000-350	10/78	-75
6S/8E-22D2	500-680	10/78	-118
	900-1,100		
6S/8E-22K1	500-1,030	10/78	-134
6S/8E-25P1	478-658	10/78	-159
6S/8E-27C1	670-1,070	10/78	-121
6S/8E-27N1	312-438	10/78	-138
6S/8E-32R1	000-1,400	10/78	-101
6S/8E-34C1	447-545	10/78	-135
6S/8E-35J1	514-564	10/78	-149
6S/8E-36M1	1,540-1,880	10/78	-144
6S/9E-30A1	220-355	10/78	-104
6S/9E-32A1	218-598	10/78	-185
6S/9E-32Q1	244-284	10/78	-175
6S/9E-33K1	240-402	10/78	-169
7S/7E-03A1	250-452	09/78	-90
7S/8E-02B1	520-575	10/78	-155
7S/8E-03A1	400-500	10/78	-149
7S/8E-07R1	--	10/78	-129
7S/8E-09M1	540-600	10/78	-124
7S/8E-17A1	800-1,100	10/78	-126
7S/8E-17F1	265-325	10/78	-122
7S/8E-17G1	400-750	10/78	-122
7S/8E-18C1	--	10/78	-120
7S/8E-20B1	210-501	10/78	-131
7S/8E-22K1	446-775	10/78	-136
7S/8E-23Q1	316-416	10/78	-165
7S/8E-23Q2	365-425	10/78	-165
7S/8E-28G1	195-295	09/78	-130
7S/8E-29G1	--	09/78	-129
7S/8E-33B1	343-522	09/78	-139
7S/8E-33E1	318-702	09/78	-117
7S/8E-34G1	--	09/78	-134
7S/8E-34K1	300-895	09/78	-141
7S/8E-35K1	--	09/78	-140
7S/9E-03D1	320-600	10/78	-175
7S/9E-04C1	300-600	10/78	-169
7S/9E-05M1	460-940	10/78	-196

Appendix 3: *Ground-water levels, autumn 1978*--Continued

Well number	Perforated interval (depth, in feet below land surface)	Date	Altitude of water level
7S/9E-07H2	451-566	10/78	-183
7S/9E-08P1	430-590	10/78	-192
7S/9E-13N1	90-306	10/78	-144
7S/9E-16M2	530-590	10/78	-199
7S/9E-17K1	420-570	10/78	-190
	590-620		
	830-900		
7S/9E-22G2	560-620	10/78	-201
7S/9E-23N1	530-560	10/78	-207
7S/9E-26G2	336-432	10/78	-188
7S/10E-27A1	--	10/78	-18
8S/8E-03B1	485-680	09/78	-142
8S/8E-03L1	402-618	09/78	-139
8S/8E-11A4	300-380	09/78	-153
8S/8E-11H1	560-876	09/78	-156
8S/8E-24A1	800-900	09/78	-162
8S/8E-24A2	--	09/78	-162
8S/8E-24J1	216-312	09/78	-169
8S/8E-24L1	--	09/78	-164
8S/9E-30A1	315-595	09/78	-168
8S/9E-31Q1	230-350	10/78	-195
8S/9E-31R1	182-278	10/78	-186
8S/9E-31R2	180-348	10/78	-181
8S/9E-33N1	--	09/78	-172

Appendix 4: *Ground-water levels, autumn 1986*

[Altitude of water level in feet above or below (-) sea level]

Well number	Perforated interval (depth, in feet below land surface)	Date	Altitude of water level
2S/5E-32E6	110-180	10/86	1,010
2S/5E-33E5	261-281	10/86	1,110
3S/3E-10P1	476-776	10/86	922
3S/4E-20D1	560-580	11/86	753
3S/4E-20F1	600-640	11/86	758
3S/4E-20F2	850-890	11/86	739
3S/4E-20F3	1,100-1,140	11/86	728
3S/4E-20J1	550-590	11/86	782
3S/4E-20J2	690-730	11/86	736
3S/4E-20J3	850-890	11/86	721
3S/4E-29F1	550-570	11/86	748
3S/4E-29R1	431-551	11/86	614
3S/4E-32B2	475-611	10/86	605
3S/4E-35R1	600-900	11/86	267
3S/4E-35R2	600-1,000	10/86	285
3S/5E-10L2	190-260	10/86	752
3S/5E-10R1	177-207	10/86	894
3S/5E-11Q1	170-236	12/86	872
3S/5E-12P1	304-379	10/86	860
3S/6E-21F2	342-430	10/86	755
3S/6E-36P1	--	10/86	690
4S/4E-01B3	400-700	10/86	260
4S/4E-02B1	570-1,003	10/86	278
4S/4E-13H1	400-500	10/86	206
4S/4E-13P1	345-365	10/86	204
	98-408		
4S/4E-15J1	164-344	10/86	217
	415-435		
4S/5E-03P1	288-600	10/86	176
4S/5E-04F1	276-576	10/86	196
4S/5E-04N1	520-690	09/86	188
	780-810		
	860-890		
4S/5E-08A1	368-1,100	11/86	182
4S/5E-09F1	227-616	10/86	175
4S/5E-09F3	410-670	10/86	177
4S/5E-11E1	172-607	10/86	151
4S/5E-14N1	330-640	10/86	129
	715-780		
4S/5E-15R1	243-507	10/86	130
4S/5E-15R2	400-560	10/86	139
4S/5E-21J2	440-470	11/86	145
	680-1,000		
4S/5E-22A1	--	10/86	135
4S/5E-22B1	--	10/86	137
4S/5E-25D1	540-850	11/86	102
4S/5E-25P1	500-740	11/86	84
	790-840		
4S/5E-26A1	1,050-1,400	11/86	95
4S/5E-26B1	1,050-1,360	11/86	107
4S/5E-26C1	430-500	11/86	106
	660-880		
4S/5E-26D1	769-1,385	11/86	111
4S/5E-26H1	816-1,360	11/86	101
4S/5E-26K1	400-820	11/86	105
4S/5E-27E1	344-392	11/86	129
4S/5E-27E2	456-835	11/86	132
4S/5E-28F1	500-925	11/86	145
4S/5E-28F2	500-925	11/86	135
4S/5E-29F1	100-407	11/86	167
4S/5E-29K1	--	11/86	155
4S/5E-30C1	300-440	11/86	175
4S/5E-34C1	240-500	11/86	119
4S/5E-34J1	240-500	11/86	106
4S/5E-35E1	--	11/86	95
4S/5E-36D1	470-492	11/86	88
	658-678		
4S/5E-36L1	408-840	11/86	96
4S/5E-36L2	252-650	11/86	70
4S/6E-25C2	540-700	10/86	23
4S/6E-25C3	540-700	10/86	16
4S/6E-35P1	500-600	10/86	13
4S/7E-29E1	330-700	12/86	-5
4S/7E-29M1	570-680	12/86	-15
4S/7E-29N2	118-263	10/86	2
4S/7E-30E3	180-360	10/86	30
4S/7E-30M1	--	10/86	14
4S/7E-30M2	--	10/86	11
4S/7E-30M6	--	10/86	13
4S/7E-31Q3	236-356	10/86	-2
	590-710		
4S/7E-32G2	280-320	10/86	-5
	380-400		
4S/7E-32N2	195-462	10/86	-7
4S/7E-33N1	100-412	10/86	-2
4S/7E-33Q1	240-460	10/86	-14
5S/4E-02G1	300-500	10/86	316
5S/5E-01C1	216-350	11/86	74
5S/5E-01D3	--	11/86	82
5S/5E-01L5	500-740	11/86	69

Appendix 4: *Ground-water levels, autumn 1986*--Continued

Well number	Perforated interval (depth, in feet below land surface)	Date	Altitude of water level
5S/5E-01M4	150-502	11/86	72
5S/5E-01N1	--	11/86	72
5S/5E-01P1	108-192	11/86	67
5S/5E-01Q2	400-835	11/86	64
5S/5E-01Q3	400-820	11/86	60
5S/5E-02A1	--	11/86	82
5S/5E-02B1	450-600	11/86	81
5S/5E-02F2	250-495	11/86	73
5S/5E-02L1	130-140	11/86	83
	200-220		
5S/5E-11A1	--	11/86	64
5S/5E-11A3	250-440	11/86	69
5S/5E-12B3	410-800	11/86	56
5S/5E-12C1	163-503	11/86	74
5S/5E-12D1	125-360	11/86	65
5S/5E-12D2	278-498	11/86	58
5S/5E-12H2	432-590	11/86	52
5S/5E-12J1	400-880	11/86	50
5S/5E-12L2	208-461	11/86	68
5S/5E-12Q1	--	11/86	54
5S/6E-01C1	126-1,250	10/86	14
5S/6E-01D2	410-440	10/86	11
	510-626		
	678-716		
	774-801		
	840-902		
	920-980		
5S/6E-01J1	500-730	10/86	-8
5S/6E-01J2	320-620	10/86	-2
5S/6E-01K2	481-601	10/86	1
5S/6E-02A2	450-650	12/86	8
5S/6E-02G1	470-600	12/86	-1
	670-690		
	710-770		
	890-1,000		
5S/6E-03P1	570-970	12/86	30
5S/6E-05A1	520-1,220	12/86	54
5S/6E-05B1	850-1,045	12/86	55
5S/6E-05K1	1,036-1,300	12/86	62
5S/6E-05M1	540-1,040	12/86	55
5S/6E-05Q1	525-730	11/86	47
	800-890		
	1,020-1,135		
5S/6E-06B3	455-890	12/86	71
5S/6E-06C1	--	11/86	74
5S/6E-06C2	--	11/86	77
5S/6E-06Q1	668-1,202	10/86	51
5S/6E-07B1	--	10/86	50
5S/6E-07C2	320-500	12/86	54
5S/6E-07J1	460-560	11/86	47
5S/6E-07M1	--	12/86	56
5S/6E-07N1	144-200	10/86	52
5S/6E-07Q2	300-500	10/86	49
5S/6E-07Q3	380-500	10/86	46
5S/6E-07R1	364-604	10/86	51
5S/6E-08M2	280-520	11/86	54
5S/6E-08M3	650-920	11/86	41
5S/6E-08N2	450-780	12/86	52
5S/6E-08N3	390-690	11/86	44
5S/6E-08P1	--	12/86	49
5S/6E-08Q1	--	12/86	43
5S/6E-09B1	--	12/86	63
5S/6E-09Q1	740-1,010	12/86	31
5S/6E-10D1	530-1,030	12/86	92
5S/6E-10D2	--	12/86	52
5S/6E-10E1	480-670	12/86	53
	820-925		
5S/6E-12G1	192-272	10/86	0
	472-604		
5S/6E-12M1	140-650	10/86	15
5S/6E-12M2	200-500	10/86	-4
5S/6E-12N1	470-946	10/86	-7
5S/6E-12Q1	--	10/86	12
5S/6E-12Q2	--	10/86	10
5S/6E-13B1	--	10/86	-11
5S/6E-13D1	518-566	10/86	-10
	614-878		
5S/6E-13M1	339-369	10/86	-7
	387-400		
	517-626		
	740-900		
5S/6E-14G1	520-600	10/86	-2
	630-670		
5S/6E-14G2	--	10/86	-1
5S/6E-14Q1	440-600	10/86	0
	706-810		
5S/6E-16A1	360-560	12/86	23
5S/6E-16A2	445-530	12/86	33
	730-965		
5S/6E-16H1	336-552	12/86	29
5S/6E-16K1	302-366	12/86	25
5S/6E-16M1	350-500	12/86	29
5S/6E-16N2	564-904	12/86	23
5S/6E-16Q1	156-300	12/86	22
5S/6E-16Q2	242-354	12/86	15
5S/6E-17F1	290-590	12/86	42

Appendix 4: *Ground-water levels, autumn 1986*--Continued

Well number	Perforated interval (depth, in feet below land surface)	Date	Altitude of water level
5S/6E-17G2	550-890	12/86	32
5S/6E-17M2	376-700	12/86	35
5S/6E-17P2	420-700	12/86	36
5S/6E-18C2	300-650	12/86	51
5S/6E-18C3	--	12/86	37
5S/6E-18G1	377-497	12/86	32
5S/6E-18L2	317-509	12/86	34
5S/6E-18R1	296-450	12/86	30
5S/6E-18R2	425-800	12/86	29
5S/6E-20A1	435-522	12/86	28
5S/6E-20F3	628-925	12/86	45
5S/6E-20P1	300-588	12/86	31
5S/6E-21G1	167-237	12/86	30
5S/6E-21G3	195-500	12/86	17
5S/6E-21H3	210-550	12/86	23
5S/6E-21H5	400-600	12/86	29
5S/6E-21J1	172-278	12/86	19
5S/6E-21N2	400-820	12/86	36
5S/6E-21P1	212-433	12/86	26
5S/6E-21Q3	350-700	12/86	28
5S/6E-21R1	250-480	12/86	28
5S/6E-22B1	350-390	12/86	15
	416-452		
	468-502		
5S/6E-22B2	548-704	12/86	18
	752-872		
5S/6E-22G2	288-474	12/86	19
5S/6E-22H2	772-855	12/86	25
5S/6E-22J1	342-372	12/86	32
	388-392		
	416-518		
	524-554		
5S/6E-22M1	222-260	12/86	26
	287-340		
5S/6E-23E2	374-383	12/86	-1
	400-413		
	482-509		
5S/6E-23E3	275-420	12/86	22
5S/6E-23F1	778-794	12/86	19
5S/6E-23K2	476-492	12/86	7
5S/6E-23L1	110-168	12/86	7
	280-352		
	355-426		
5S/6E-23L3	255-312	12/86	4
5S/6E-23M1	384-480	12/86	25
	576-776		
5S/6E-23N1	504-577	12/86	31
5S/6E-24D1	--	12/86	-14
5S/6E-24F1	440-690	12/86	2
5S/6E-24G1	480-680	12/86	-13
	810-930		
5S/6E-24M1	396-564	12/86	-10
	604-628		
	668-778		
5S/6E-24R1	--	12/86	-14
5S/6E-25A1	400-656	12/86	-8
5S/6E-25A2	430-650	12/86	-28
5S/6E-27C1	138-292	12/86	42
5S/6E-27C2	--	12/86	32
5S/6E-27D1	266-392	12/86	32
5S/6E-27D2	170-370	12/86	23
5S/6E-28C1	204-252	12/86	29
5S/6E-28C2	410-680	12/86	28
5S/6E-28E2	320-470	12/86	38
5S/6E-28H1	194-373	12/86	47
5S/6E-29B1	351-615	12/86	16
5S/6E-29C1	243-531	12/86	29
5S/6E-29C2	530-670	12/86	29
5S/6E-29H1	--	12/86	36
5S/6E-29M1	457-723	12/86	34
5S/6E-29P1	500-700	12/86	31
5S/6E-32B1	450-700	12/86	50
5S/6E-32B2	460-700	12/86	43
5S/6E-32B3	460-652	12/86	39
5S/6E-32G1	459-736	12/86	81
5S/7E-03K1	580-740	10/86	-51
5S/7E-04A1	147-367	10/86	-8
5S/7E-04C1	520-800	10/86	-13
5S/7E-04D1	100-370	10/86	-8
5S/7E-04H1	570-840	10/86	-41
5S/7E-04M1	192-678	10/86	-10
5S/7E-04N1	147-411	10/86	-16
5S/7E-04Q1	123-363	10/86	-16
5S/7E-04Q3	240-320	10/86	-24
5S/7E-05C1	260-400	10/86	-6
5S/7E-05K1	--	10/86	-18
5S/7E-05R1	230-350	10/86	-26
5S/7E-06B1	168-180	10/86	2
	280-303		
5S/7E-06B3	300-660	10/86	-8
5S/7E-06H1	400-480	10/86	-9
5S/7E-06M1	195-363	10/86	-3
	555-651		
5S/7E-07F1	147-459	12/86	-7

Appendix 4: *Ground-water levels, autumn 1986*--Continued

Well number	Perforated interval (depth, in feet below land surface)	Date	Altitude of water level
5S/7E-07P1	144-450	12/86	-10
5S/7E-08A2	286-650	10/86	-26
5S/7E-08G1	--	12/86	-10
5S/7E-08Q1	203-654	12/86	-16
5S/7E-09F1	130-310	10/86	-17
5S/7E-09K1	147-387	10/86	-22
5S/7E-09L2	147-319	10/86	-16
5S/7E-10D2	200-530	10/86	-20
5S/7E-10E1	70-360	10/86	-22
5S/7E-16C1	147-355	10/86	-21
5S/7E-16K2	200-415	10/86	-26
5S/7E-17E1	459-603	12/86	-23
5S/7E-17L1	212-600	12/86	-29
5S/7E-18D1	160-200	12/86	-11
5S/7E-18F1	--	12/86	-8
5S/7E-18M2	168-264	12/86	-18
5S/7E-19D1	440-650	12/86	-18
	710-770		
	840-920		
5S/7E-19H2	460-660	12/86	-26
5S/7E-20P2	150-350	12/86	-14
5S/7E-21F2	82-614	10/86	-36
5S/7E-21Q1	--	10/86	-44
5S/7E-22H2	506-1,100	10/86	-66
5S/7E-23D2	483-882	10/86	-68
5S/7E-24M4	250-660	10/86	-64
5S/7E-26E3	515-1,110	10/86	-78
5S/7E-27B1	236-500	12/86	-33
5S/7E-28E1	128-198	12/86	-31
5S/7E-29K1	--	12/86	-39
5S/7E-30C2	115-235	12/86	-30
	427-489		
5S/7E-30J1	500-900	12/86	-38
6S/6E-06M1	264-364	12/86	772
6S/6E-17K1	480-580	12/86	764
6S/8E-05R2	540-750	10/86	-92
6S/8E-05R3	520-650	10/86	-99
6S/8E-22K1	500-1,030	11/86	-123
6S/8E-25P1	478-658	10/86	-155
6S/8E-34C1	447-545	11/86	-137
6S/8E-35J1	514-564	11/86	-147
6S/9E-33K1	240-402	10/86	-157
7S/7E-01C1	240-380	12/86	-112
7S/7E-03A1	250-452	10/86	-104
7S/8E-02B1	520-575	10/86	-157
7S/8E-03A1	400-500	10/86	-154
7S/8E-07R1	--	10/86	-134
7S/8E-08N1	300-360	10/86	-132
7S/8E-09M1	540-600	10/86	-134
7S/8E-17A1	800-1,100	10/86	-140
7S/8E-17F1	265-325	10/86	-138
7S/8E-17G1	400-750	10/86	-136
7S/8E-18C1	--	10/86	-132
7S/8E-18Q1	300-500	10/86	-146
7S/8E-19G1	--	10/86	-206
7S/8E-20B1	210-501	10/86	-145
7S/8E-20H1	260-486	10/86	-134
7S/8E-22K1	446-775	10/86	-152
7S/8E-23Q2	365-425	10/86	-188
7S/8E-28G1	195-295	10/86	-149
7S/8E-29D1	360-650	10/86	-128
7S/8E-29G1	--	10/86	-146
7S/8E-31R1	--	10/86	-51
7S/8E-33B1	243-522	10/86	-148
7S/8E-33E1	318-702	10/86	-142
7S/8E-33N2	--	10/86	-157
7S/8E-34G1	--	10/86	-150
7S/8E-34K1	300-895	10/86	-158
7S/8E-35K1	--	10/86	-144
7S/9E-03D1	320-600	10/86	-180
7S/9E-04C1	300-600	10/86	-165
7S/9E-04K1	300-600	10/86	-174
7S/9E-05M1	460-940	10/86	-181
7S/9E-07H2	451-566	10/86	-188
7S/9E-07J1	410-470	10/86	-189
	500-570		
	830-870		
7S/9E-08P1	430-590	10/86	-205
7S/9E-13N1	90-306	10/86	-149
7S/9E-16M2	530-590	10/86	-213
7S/9E-17K1	420-570	10/86	-211
	590-620		
	830-900		
7S/9E-22G2	560-620	10/86	-203
7S/9E-23N1	530-560	10/86	-215
7S/9E-26G2	336-432	10/86	-200
7S/9E-30M1	--	10/86	-203
7S/10E-27A1	--	10/86	-16
8S/8E-03B1	485-680	10/86	-166
8S/8E-03L1	402-618	10/86	-163
8S/8E-05H1	250-560	10/86	-236
8S/8E-11A4	300-380	10/86	-176
8S/8E-11H1	560-876	10/86	-176
8S/8E-15G1	--	10/86	-77

Appendix 5: *Dissolved-solids concentration in water from selected wells*

[mg/L, milligrams per liter; --, no data]

Well number	Land-surface altitude (feet above or below (-) sea level)	Perforated interval (depth, in feet below land surface)	Date	Dis-solved-solids concen-tration (mg/L)
3S/3E-10P1	1,170	476-776	04/74	265
			07/74	296
3S/4E-20D1	910	560-580	06/77	369
			10/77	240
			04/79	157
			06/79	119
			09/79	268
			12/79	136
			03/81	307
			10/81	325
			03/82	108
			11/82	290
			05/83	196
			11/83	208
			04/84	229
			10/84	234
			04/85	291
			11/85	513
			05/86	588
			11/86	552
			04/87	552
			11/87	567
			03/88	562
			11/88	488
3S/4E-20F1	890	600-640	01/81	409
			10/81	310
			04/82	361
			10/82	444
			05/83	578
			11/83	533
			07/84	483
			11/84	656
			04/85	547
			11/85	513
			05/86	545
			05/86	544
			12/86	538
			04/87	543
			11/87	561
			03/88	556
			11/88	521
			04/89	547
			11/89	573
			04/90	577
3S/4E-20F2	890	850-890	10/81	249
			04/82	248
			10/82	243
			05/83	233
			11/83	233
			07/84	226
			11/84	228
			04/85	233
			11/85	217
			05/86	254
			12/86	229
			04/87	192
3S/4E-20F2--Continued			11/87	204
			03/88	218
			11/88	226
			04/89	224
			11/89	213
			04/90	233
3S/4E-20F3	890	1,100-1,140	01/81	564
			10/81	439
			04/82	662
			10/82	534
			05/83	697
			11/83	557
			11/84	464
			04/85	442
			11/85	310
			05/86	170
			05/86	169
			12/86	162
			04/87	174
			11/87	175
			03/88	161
			11/88	171
			04/89	167
			11/89	161
			04/90	147
3S/4E-20J1	840	550-590	01/81	448
			10/81	418
			04/82	388
			10/82	434
			05/83	363
			11/83	356
			04/84	360
			12/84	365
			04/85	495
			11/85	560
			05/86	567
			05/86	548
			12/86	487
			04/87	530
			11/87	548
			03/88	565
			11/88	558
			04/89	509
			11/89	559
			04/90	555
3S/4E-20J2	840	690-730	10/81	149
			04/82	153
			10/82	148
			05/83	221
			11/83	275
			04/84	256
			12/84	222
			04/85	219
			11/85	387
			05/86	359
			12/86	426
			04/87	455

Appendix 5: *Dissolved-solids concentration in water from selected wells*--Continued

Well number	Land-surface altitude (feet above or below (-) sea level)	Perforated interval (depth, in feet below land surface)	Date	Dis-solved-solids concen-tration (mg/L)
3S/4E-20J2--Continued			11/87	405
			03/88	496
			11/88	445
			04/89	419
			11/89	357
			04/90	424
3S/4E-20J3	840	850-890	10/81	242
			04/82	237
			10/82	239
			05/83	241
			11/83	240
			04/84	229
			12/84	222
			04/85	221
			11/85	214
			05/86	322
			12/86	416
			04/87	449
			11/87	364
			03/88	302
			11/88	247
			04/89	229
			11/89	223
			04/90	214
3S/4E-29F1	865	550-570	06/77	133
			12/77	120
			04/79	170
			06/79	165
			09/79	141
			12/79	250
			03/81	131
			09/81	145
			03/82	131
			11/82	126
			05/83	251
			11/83	161
			04/84	277
			11/84	186
			04/85	411
			11/85	386
			05/86	474
			11/86	475
			04/87	553
			11/87	545
			03/88	554
			11/88	549
			04/89	545
			11/89	533
			04/90	499
3S/4E-29R1	777	431-551	06/77	228
			12/77	244
			04/79	226
			06/79	211
			09/79	203
			12/79	205
			03/81	117
			09/81	213
			03/82	95
3S/4E-29R1--Continued			11/82	87
			05/83	83
			11/83	322
			04/84	138
			10/84	142
			04/85	140
			11/85	97
			05/86	393
			12/86	484
			04/87	524
			11/87	547
			03/88	541
			11/88	461
			11/89	341
			04/90	475
3S/4E-30C1	944	530-726	11/61	197
			11/62	289
			11/63	234
			12/64	307
			12/66	254
			11/70	152
			03/71	185
			06/71	182
			11/71	230
			05/72	206
			11/72	261
			09/73	232
			12/77	242
			11/78	222
			04/79	220
			09/79	212
			12/79	220
			03/81	212
			09/81	236
			03/82	219
			11/82	222
			05/83	232
			11/83	268
			04/84	309
			10/84	310
			04/85	387
			11/85	474
			05/86	511
			11/86	478
			04/87	523
			11/87	468
			03/88	475
			11/88	464
			04/89	451
			11/89	472
			04/90	473
3S/4E-34H1	617	900-1,100	01/87	303
			07/87	250
			01/88	319
			07/88	270
			06/89	307
			01/90	360
			07/90	366

Appendix 5: *Dissolved-solids concentration in water from selected wells*--Continued

Well number	Land-surface altitude (feet above or below (-) sea level)	Perforated interval (depth, in feet below land surface)	Date	Dis-solved-solids concen-tration (mg/L)
3S/4E-34R1	610	506-830	02/73	180
			09/73	182
			05/74	197
			07/74	258
			09/74	116
			08/76	163
			06/78	180
			04/79	123
			10/80	188
			02/81	183
			06/81	182
			02/82	176
			06/82	176
			10/82	179
			02/83	184
			06/83	208
			07/83	179
			01/84	194
			06/84	177
			10/84	183
			01/85	167
			06/85	189
			10/85	247
			01/86	227
			06/86	285
			10/86	277
			01/87	311
			06/87	328
			07/87	355
			01/88	513
			07/88	543
			02/89	457
			06/89	496
			01/90	473
			07/90	458
3S/4E-35R1	555	600-900	11/81	240
			01/82	230
			05/82	236
			08/82	227
			11/82	232
			02/83	240
			08/83	232
			11/83	262
			01/84	240
			05/84	244
			08/84	211
			11/84	236
			01/85	249
			08/85	218
			11/85	230
			01/86	211
			05/86	272
			08/86	270
			11/86	234
			01/87	220
			06/87	234
			07/87	237
3S/4E-35R1--Continued			01/88	258
			07/88	258
			01/89	301
			06/89	348
			01/90	342
			07/90	382
3S/4E-35R2	555	600-1,000	03/80	330
			11/83	232
			04/84	237
			05/84	237
			08/84	232
			11/84	228
			01/85	225
			08/85	232
			11/85	200
			05/86	286
			08/86	290
			11/86	247
			01/87	249
			06/87	228
			07/87	234
			01/88	264
			07/88	223
			01/89	273
			06/89	311
			07/90	336
3S/4E-36M1	545	403-703	09/73	190
			05/74	194
			07/74	315
			05/75	175
			10/75	198
			05/76	244
			08/76	201
			11/77	209
			06/78	193
			05/79	262
			05/80	248
			10/80	251
			01/81	248
			02/81	252
			05/81	260
			11/81	252
			02/82	254
			05/82	264
			08/82	293
			11/82	268
			08/83	316
			11/83	292
			02/84	325
			05/84	368
			08/84	392
			11/84	395
			12/84	398
			01/85	362
			08/85	378
			11/85	365
			01/86	389

Appendix 5: *Dissolved-solids concentration in water from selected wells*--Continued

Well number	Land-surface altitude (feet above or below (-) sea level)	Perforated interval (depth, in feet below land surface)	Date	Dis-solved-solids concen-tration (mg/L)
3S/4E-36M1--Continued			05/86	403
			08/86	523
			11/86	369
			01/87	318
			06/87	477
			07/87	540
			01/88	437
			07/88	414
			01/89	415
			06/89	348
			01/90	450
			07/90	468
4S/4E-1N2	500	525-800	05/73	213
			09/73	266
			05/74	226
			08/74	271
			09/74	234
			05/75	214
			10/75	185
			05/76	196
			09/76	176
			01/78	198
			05/80	218
			01/83	214
			06/83	209
			07/83	214
			02/84	212
			06/84	225
4S/4E-2B1	565	570-1,003	01/73	229
			05/74	218
			06/74	253
			09/74	203
			05/75	193
			10/75	196
			05/76	202
			08/76	196
			09/76	182
			05/77	189
			11/77	206
			06/78	217
			10/78	206
			01/79	242
			05/79	182
			10/80	212
			02/81	215
			06/81	212
			11/81	216
			06/82	194
			10/82	214
			03/83	226
			06/83	215
			07/83	212
			10/83	214
			01/84	210
			10/84	211
			01/85	225
			06/85	214
4S/4E-2B1--Continued			10/85	233
			01/86	221
			06/86	274
			10/86	234
			01/87	246
			06/87	260
			07/87	287
			07/88	313
			06/89	372
			01/90	406
			07/90	402
4S/4E-11K1	493	--	05/73	314
			01/78	267
			01/81	260
4S/4E-11Q1	470	302-402	05/73	332
			09/73	276
			09/74	234
			05/75	251
			07/75	327
			09/76	289
			05/77	305
			11/77	259
			06/78	289
			10/78	295
			05/79	308
			05/80	308
			08/80	362
			10/80	302
			08/81	332
			11/81	324
			01/82	318
			05/82	305
			10/82	310
			02/83	310
			06/83	262
			07/83	324
			10/83	321
			01/84	353
			06/84	285
			10/84	384
			01/85	343
			06/85	380
			10/85	339
			01/86	266
			06/86	323
			10/86	233
			01/87	252
			06/87	224
			07/87	230
			01/88	187
			05/88	230
			07/88	215
			11/88	213
4S/4E-11Q2	468	535-948	05/73	170
			09/73	149
			05/74	160
			06/74	208

Appendix 5: *Dissolved-solids concentration in water from selected wells*--Continued

Well number	Land-surface altitude (feet above or below (-) sea level)	Perforated interval (depth, in feet below land surface)	Date	Dis-solved-solids concen-tration (mg/L)
4S/4E-11Q2--Continued			09/74	192
			05/75	164
			05/76	148
			08/76	165
			09/76	159
			05/77	143
			11/77	193
			06/78	170
			01/79	164
			05/79	211
			10/80	170
			02/81	164
			01/82	153
			02/83	152
			01/84	149
			01/85	149
			01/86	126
			01/87	147
			06/87	159
			07/87	156
			01/88	128
			07/88	156
4S/4E-11R1	458	526-700	09/73	145
			01/78	192
			01/81	188
			01/84	177
			01/85	182
4S/4E-13C1	450	512-912	07/75	183
			10/75	181
			06/78	176
			10/78	170
			05/79	178
			02/81	182
			06/81	182
			01/82	177
			01/84	179
			01/85	178
			06/85	196
			07/85	241
			01/86	153
			06/87	160
			07/87	151
			01/88	142
			07/88	163
4S/4E-13Q1	400		01/88	314
			05/88	342
			07/88	313
4S/4E-14Q1	425	622-830	11/88	275
		850-958	09/74	182
			05/75	161
			10/75	174
			11/77	178
			01/78	201
			06/78	158
			11/78	198
			10/80	196
			01/81	170
			06/81	154
4S/4E-14Q1--Continued			11/81	150
			02/82	194
			06/82	153
			10/82	179
			02/83	176
			06/83	155
			07/83	155
			10/83	173
			11/83	149
			01/84	183
			06/84	193
			10/84	213
			01/85	196
			06/85	171
			10/85	166
			01/86	209
			06/86	198
			10/86	172
			01/87	172
			06/87	177
			07/87	170
			01/88	175
			07/88	198
4S/4E-14R1	408	560-800	05/73	183
			09/73	197
			07/74	270
			01/78	204
			10/80	200
			01/81	170
			06/81	194
			11/81	192
			02/82	183
			06/82	194
			10/82	197
			01/83	185
			06/83	155
			07/83	155
			10/83	149
			01/84	147
			06/84	176
			10/84	192
			01/85	180
			06/85	205
			10/85	214
			01/86	116
			06/86	241
			10/86	221
			06/87	204
			07/87	186
4S/4E-23D1	435	190-408	08/74	287
			02/79	104
			02/81	104
			11/81	111
			01/82	106
			01/84	113
			01/85	95
			06/87	210
			07/87	245

Appendix 5: *Dissolved-solids concentration in water from selected wells*--Continued

Well number	Land-surface altitude (feet above or below (-) sea level)	Perforated interval (depth, in feet below land surface)	Date	Dis-solved-solids concen-tration (mg/L)
4S/4E-23D1--Continued			01/88	253
			11/88	350
4S/4E-23E1	435	240-472	08/76	135
			06/79	86
			09/80	94
			02/81	85
			05/81	85
			07/82	71
			09/82	83
			01/83	83
			04/83	89
			07/83	95
			09/83	88
			01/84	78
			09/84	86
			01/85	68
			02/86	77
			04/86	112
			07/86	134
			09/86	126
			01/87	129
			02/87	75
			06/87	126
			07/87	137
			10/87	140
4S/4E-24D1	398	580-980	12/73	115
			07/75	108
			10/75	125
			05/76	123
			07/77	161
			11/77	155
			06/78	143
			10/78	116
			05/79	154
			10/80	128
			03/81	129
			06/81	125
			11/81	132
			02/82	117
			06/82	124
			01/83	143
			06/83	119
			07/83	125
			10/83	128
			02/84	125
			06/84	127
			10/84	135
			01/85	124
			06/85	132
			10/85	135
			06/86	157
			10/86	135
			01/87	129
			06/87	130
			07/87	138
			01/88	131
			07/88	181
4S/4E-24H1	390	600-1,000	03/81	197

Well number	Land-surface altitude (feet above or below (-) sea level)	Perforated interval (depth, in feet below land surface)	Date	Dis-solved-solids concen-tration (mg/L)
4S/4E-24H1--Continued			08/83	238
			11/83	262
			04/84	235
			05/84	266
			08/84	235
			11/84	247
			01/85	236
			03/85	252
			08/85	229
			11/85	251
			01/86	256
			05/86	263
			08/86	263
			11/86	215
			01/87	209
			06/87	189
			07/87	203
4S/4E-26A1	428	450-780	05/73	296
			09/73	198
			05/74	255
			06/74	303
			09/74	317
			05/75	261
			05/76	263
			08/76	231
			09/76	263
			05/77	259
			11/77	330
			06/78	260
			10/78	285
			01/79	284
			05/79	311
			10/80	302
			02/81	314
			05/81	295
			11/81	300
			01/82	300
			05/82	294
			08/82	310
			11/82	304
			08/83	298
			11/83	298
			01/84	300
			05/84	303
			08/84	295
			11/84	315
			01/85	312
			08/85	325
			11/86	338
			01/87	337
			06/87	334
			07/87	342
			07/88	350
4S/4E-26G1	440	450-800	05/73	276
			09/73	265
			05/74	246
			07/74	364
			09/74	260

Appendix 5: *Dissolved-solids concentration in water from selected wells*--Continued

Well number	Land-surface altitude (feet above or below (-) sea level)	Perforated interval (depth, in feet below land surface)	Date	Dis-solved-solids concen-tration (mg/L)
4S/4E-26G1--Continued			05/75	261
			10/75	266
			05/76	260
			09/76	259
			05/77	287
			04/78	258
			06/78	295
			10/78	282
			05/79	331
			03/81	284
			08/82	310
			11/82	292
			02/83	308
			08/83	292
			01/84	328
			05/84	297
			08/84	281
			11/84	295
			01/85	308
			08/85	280
			11/85	313
			01/86	294
			05/86	366
			08/86	365
			06/87	292
			07/87	330
4S/5E-19D1	393	340-440	09/64	269
			10/65	274
			09/66	219
			05/69	290
			11/71	217
			05/72	157
			07/74	317
			09/74	216
			05/75	193
			01/78	207
			01/81	212
			05/81	188
			11/81	180
			01/82	170
			04/82	189
			06/82	194
			10/82	202
			02/83	220
			06/83	203
			07/83	202
			01/84	177
			06/84	148
			10/84	159
			01/85	160
			10/85	246
			10/86	282
			06/87	298
			07/87	321
			01/88	296
			05/88	330
			07/88	321

Well number	Land-surface altitude (feet above or below (-) sea level)	Perforated interval (depth, in feet below land surface)	Date	Dis-solved-solids concen-tration (mg/L)
4S/5E-19D1--Continued			11/88	294
4S/5E-29A1	327	600-1,000	07/74	235
			05/77	160
			11/77	206
			04/78	150
			06/78	194
			10/78	176
			05/79	204
			08/79	158
			10/80	171
			01/81	176
			06/81	173
			11/81	174
			02/82	174
			03/82	182
			06/82	190
			10/82	173
			02/83	164
			06/83	173
			07/83	171
			10/83	178
			02/84	176
			06/84	174
			10/84	176
			01/85	170
			06/85	173
			10/85	186
			01/86	189
			06/86	214
			10/86	178
			01/87	167
			06/87	157
			07/87	171
			01/88	153
			07/88	186
4S/5E-29H1	320	590-990	07/74	216
			11/77	218
			04/78	204
			06/78	220
			10/78	217
			05/79	209
			08/79	197
			10/80	206
			03/81	212
			06/81	206
			11/81	210
			02/82	195
			06/82	214
			10/82	202
			06/83	203
			07/83	202
			08/83	208
			10/83	208
			01/84	207
			06/84	207
			10/84	202
			06/85	205
			10/85	216

Appendix 5: *Dissolved-solids concentration in water from selected wells*--Continued

Well number	Land-surface altitude (feet above or below (-) sea level)	Perforated interval (depth, in feet below land surface)	Date	Dis-solved-solids concen-tration (mg/L)
4S/5E-29H1--Continued			01/86	215
			06/86	247
			10/86	215
			01/87	221
			06/87	210
			07/87	208
			01/88	163
			07/88	222
4S/5E-30C1	357	300-440	01/88	253
			05/88	294
			07/88	208
			11/88	269
4S/5E-33B4	291	429-843	05/73	274
			09/73	252
			05/74	250
			06/74	268
			11/74	270
			05/77	262
			07/77	279
			11/77	287
			06/78	246
			10/78	172
			05/79	290
			08/79	262
			06/80	269
			02/81	273
			06/81	266
			11/81	252
			01/82	250
4S/5E-33B4--Continued			04/82	264
			06/82	273
			08/82	250
			10/82	244
			02/83	248
			04/83	244
			08/83	268
			10/83	268
			01/84	224
			04/84	265
			08/84	272
			10/84	288
			01/85	266
			08/85	263
			10/85	305
			01/86	282
			04/86	279
			08/86	355
			10/86	287
			01/87	277
			06/87	282
			07/87	286
			01/88	262
			07/88	322
			11/88	296
4S/5E-33G1	294	172-436	01/88	320
			05/88	358
			07/88	345
			11/88	342

Appendix 6: *Modifications to SUTRA to allow input of spatially varying aquifer-storage coefficient*

As written, SUTRA computes a specific storage term as a function of its components: Matrix compressibility and porosity and fluid compressibility (see Voss, 1984, eq. 2.18). Because matrix compressibility is not allowed to vary spatially in the model code, it is not possible to simulate spatially varying aquifer-storage properties. To address this limitation, and to allow direct input of aquifer-storage coefficients for areal models, SUTRA was modified to allow an aquifer-storage coefficient to be read in for each node. Once read in, the storage coefficient is converted to the specific storage term used by SUTRA by dividing the storage coefficient by the aquifer thickness at that node. The simple modifications to the SUTRA code are described below:

Input Data Set 4

The dummy variable JSTOR is read in in I5 format. The revised data set 4 is:

VARIABLE	FORMAT
IUNSAT	I5
ISSFLO	I5
ISSTRA	I5
IREAD	I5
ISTOR	I5
JSTOR	I5

JSTOR is set to 1 to read in SOP for every node. It is to be 0 otherwise.

Input Data Set 14A

The variable STORFAC, a scale factor for the storage coefficient, is read in in G10.0 format. The revised data set 14A is:

VARIABLE	FORMAT
	5X
SCALX	G10.0
SCALY	G10.0
SCALTH	G10.0
PORFAC	G10.0
STORFAC	G10.0

Input Data Set 14B

The variable SOP (II), scaled aquifer storage coefficient is read in in G10.0 format for each of NN nodes. The revised data set 14B is:

VARIABLE	FORMAT
II	I5
X(II)	G10.0
Y(II)	G10.0
THICK(II)	G10.0
POR(II)	G10.0
SOP(II)	G10.0

The modifications to the following three subroutines are transparent in that a standard input file can be read in and the modifications will be bypassed (JSTOR, STORFAC, and SOP (II) are all taken to be 0). Conversely, a modified input file can be run with the original code (values for the three new variables will not be read in).

These modifications apply when SUTRA is used to simulate areal flow and transport problems. Values for fluid density, viscosity, gravity vector components, and the fluid coefficient of density change with concentration and must be set to the values shown in the example of Rocky Mountain Arsenal study area in Denver, Colorado (Voss, 1984, p. 192), to obtain results in terms of hydraulic head.

Subroutine V12842d

--Line A881 replaces A880. JSTOR is included in the common block CONTRL:

```
COMMON/CONTRL/ GNU,UP,DTMULT,DTMAX,ME,ISSFLO,ISSTRA,ITCYC,          A870....
1  NPCYC,NUCYC,NPRINT,IREAD,ISTORE,NOUMAT,IUNSAT,JSTOR              A881....
```

--Line A1871 replaces A1870. JSTOR is read in. If JSTOR = 1, SOP will be read in for each node. If not, SUTRA operates in the normal manner:

```
READ(5,200) IUNSAT,ISSFLO,ISSTRA,IREAD,ISTORE,JSTOR                 A1871...
```

Subroutine Sutra2d

--Line B251 replaces B250. JSTOR is included in common block CONTRL:

```
COMMON/CONTRL/ GNU,UP,DTMULT,DTMAX,ME,ISSFLO,ISSTRA,ITCYC,          B240....
1  NPCYC,NUCYC,NPRINT,IREAD,ISTORE,NOUMAT,IUNSAT,JSTOR              B251....
```

Subroutine Indat122d

--Line C191 replaces C190. JSTOR is included in common block CONTRL.

```
COMMON/CONTRL/ GNU,UP,DTMULT,DTMAX,ME,ISSFLO,ISSTRA,ITCYC,          C180....
1  NPCYC,NUCYC,NPRINT,IREAD,ISTORE,NOUMAT,IUNSAT,JSTOR              C191....
```

--Lines C2641 and C2651 replace C2640 and 2650. STORFAC is read in along with the other nodal scaling factors (Data set 14A).

```
C.....INPUT DATASETS 14A AND 14B: NODEWISE DATA                     C2630...
   READ(5,330) SCALX,SCALY,SCALTH,PORFAC,STORFAC                    C2641...
 330 FORMAT(5X,5G10.0)                                              C2651...
```

- Lines C2661, C2671, and C2681 replace C2660, C2670, and C2680.
SOP (II) is read in for each node II along with the other nodal parameters (Data set 14B).

```
    DO 455 I=1,NN                                                   C2661...
   READ(5,400) II,X(II),Y(II), THICK(II),POR(II),SOP(II)            C2671...
 400 FORMAT(I5,5G10.0)                                              C2681...
```

-Lines C2731 to C2735 and Line C2741 are inserted.

--If JSTOR =1, storage coefficient is converted to specific storage by dividing by thickness and multiplying by STORFAC. Otherwise the read-in value of SOP is ignored and SOP is computed as a function of porosity and fluid and matrix compressibility.

```
C     SET SPECIFIC PRESSURE STORATIVITY, SOP.                          C2730...
      IF(JSTOR.NE.1) GO TO 450                                         C2731...
C     COMPUTE SPECIFIC STORAGE FROM AQUIFER STORAGE COEFF.             C2732...
      SOP(II)=SOP(II)/THICK(II)                                        C2733...
      SOP(II)=SOP(II)*STORFAC                                          C2734...
      GO TO 455                                                        C2735...
  450 SOP(II)=(1.D0-POR(II))*COMPMA+POR(II)*COMPFL                     C2740...
  455 CONTINUE                                                         C2741...
```

-Lines C2751, C2791, C2801, C2811, C2812, C2831, and C2841 replace C2750, C2790, C2800, C2810, C2830, and C2840.

--Scale factor (STORFAC) and nodal values for storage coefficient (SOP) are printed out along with the other nodal parameters.

```
  460 IF(KNODAL.EQ.0) WRITE(6,469) SCALX,SCALY,SCALTH,PORFAC,STORFAC   C2751...
  469 FORMAT(1H1////11X,' N O D E  I N F O R M A T I O N' //16X,       C2760...
    1  ' PRINTOUT OF NODE COORDINATES, THICKNESSES AND POROSITIES ',   C2770...
    2  ' CANCELED.' //16X,' SCALE FACTORS :' /33X,1PD15.4,5X,' X-SCALE' /  C2780...
    1  33X,1PD15.4,5X,' Y-SCALE' /33X,1PD15.4,5X,' THICKNESS FACTOR' /  C2790...
    2  33X,1PD15.4,5X,' POROSITY FACTOR' /33X,1PD15.4,5X,              C2791...
    3  ' STORAGE FACTOR' )                                             C2801...
      IF(KNODAL.EQ.+1) WRITE(6,470) (I,X(I),Y(I),THICK(I),POR(I),SOP(I), C2811...
    1 I=1,NN)                                                          C2812...
  470 FORMAT(1H1//11X,' N O D E  I N F O R M A T I O N' //13X,         C2820...
    1  ' NODE' ,7X,' X' ,16X,' Y' ,17X,' THICKNESS' ,6X,' POROSITY' ,10X,' SOP' ,  C2831...
    2  //(11X,I6,3(3X,1PD14.5),6X,0PF8.5),3X,1PD14.5)                  C2841...
```

Appendix 7: *Specified-head values used for southeast boundary of model*

[Heads in feet above sea level]

Model node	Specified heads								
	1978	1979	1980	1981	1982	1983	1984	1985	1986
249	-14	-16	-18	-20	-22	-24	-26	-28	-30
250	-14	-16	-18	-20	-22	-24	-26	-28	-30
251	-3	-6	-9	-12	-14	-17	-20	-23	-26
252	-11	-12	-14	-15	-16	-17	-18	-20	-21
253	-11	-12	-14	-15	-16	-17	-18	-20	-21
254	-20	-21	-22	-24	-25	-26	-28	-29	-30
255	-20	-21	-22	-24	-24	-26	-28	-29	-30

Appendix 8: *SUTRA unit 55 input file for simulation shown in figures 14-16, 18, and 19*

[See Voss (1984) for explanation of SUTRA input format]

7.3092485325546D+02	7.0985899300306D+02	7.5947662928802D+02	9.0355513146015D+02
9.1414202838240D+02	7.5135094740934D+02	7.2642196442595D+02	1.0215110599278D+03
1.0280367664628D+03	1.0309778003080D+03	7.9447895312718D+02	7.0988839112659D+02
6.7551634832975D+02	6.5822353333552D+02	6.6485228566834D+02	6.8586759783335D+02
6.8236787299960D+02	1.0242472371306D+03	1.0298200956512D+03	1.0404959569667D+03
8.6644150841152D+02	6.7785048055671D+02	6.2023543530216D+02	6.0008339113558D+02
5.9637445003192D+02	6.0827924715137D+02	6.2560919271569D+02	1.0279101909645D+03
1.0312493844393D+03	1.0261322763394D+03	6.3387464504295D+02	5.8030887660840D+02
5.6534177715512D+02	5.5870359083219D+02	5.5598494955718D+02	5.6366801332397D+02
9.9593743165737D+02	1.0585613610923D+03	9.8347073323853D+02	5.5502119933749D+02
5.4566659125671D+02	5.4400946289647D+02	5.4030695526537D+02	5.4172629843688D+02
9.1833117613636D+02	9.4151969915621D+02	9.7160375021260D+02	5.4254000363596D+02
5.2774788420714D+02	5.2443561250320D+02	5.2126415252395D+02	5.1908197561392D+02
8.5134581066725D+02	8.6177690499184D+02	8.7578455283921D+02	4.9668735466222D+02
5.0128811115803D+02	4.9926721345866D+02	4.9786948363961D+02	8.3065185155742D+02
8.3465026835037D+02	8.4987093124908D+02	4.7168548249930D+02	4.6095537366492D+02
4.4968207470205D+02	4.5598837068753D+02	4.5840329767371D+02	4.5955956093108D+02
4.5598632116355D+02	4.5236051598971D+02	8.1284513319495D+02	8.1634947682564D+02
8.4396565008153D+02	4.3671469692823D+02	4.1258028188337D+02	4.1414677652447D+02
4.1859699001020D+02	4.1228747295351D+02	4.0838635537657D+02	7.8995408021504D+02
7.8548933338340D+02	7.8436902327703D+02	3.7290844534780D+02	3.7439875016622D+02
3.7387415953172D+02	3.7165153368524D+02	3.7041036467841D+02	7.1908339747009D+02
7.1808530705512D+02	6.9157991905751D+02	3.2725652825799D+02	3.2404685057230D+02
3.2517824360614D+02	3.3137274015248D+02	3.3263903435967D+02	6.3120746158595D+02
6.2726915866372D+02	6.1499238897673D+02	2.9693965610796D+02	2.9860571436783D+02
2.9695600682998D+02	2.9389089520781D+02	2.9307271026353D+02	6.0273638425061D+02
6.0129662453105D+02	5.9714688841844D+02	2.6707917726512D+02	2.6681492177270D+02
2.5333316720213D+02	2.5190601202937D+02	2.4805023346848D+02	2.4545321966019D+02
5.2887000808955D+02	5.2784711098947D+02	5.1569297350584D+02	2.0628712346115D+02
2.2598315210225D+02	2.0905805549056D+02	2.0422328066654D+02	2.0454508798768D+02
2.0569554437494D+02	2.0424672044664D+02	4.4424687660599D+02	4.6342531173271D+02
4.6996256369580D+02	1.6924167316439D+02	1.7888488684181D+02	1.6890318373982D+02
1.7558462703218D+02	1.7965634458356D+02	1.8407410595728D+02	1.8667273624421D+02
1.8591504748528D+02	4.0026843083948D+02	4.1660831755988D+02	4.3016815598030D+02
2.0946709273917D+02	1.5034019854309D+02	1.5263296360193D+02	1.6004991723578D+02
1.5662605956894D+02	1.5764687493828D+02	1.5609186980912D+02	1.5757591866173D+02
1.5739247388343D+02	1.5631070736762D+02	1.5468066032123D+02	2.8355381497802D+02
3.5476363889643D+02	3.6802803644395D+02	2.2549846109497D+02	1.5775197289566D+02
1.4051783151041D+02	1.3510790274199D+02	1.4388153411659D+02	1.3992665768102D+02
1.3456818721185D+02	1.3486544112832D+02	1.3631637226744D+02	1.3609116421867D+02
1.3552493643174D+02	1.6422256848469D+02	2.5145618769252D+02	2.8247787219170D+02
1.1726918808057D+02	1.1687151675557D+02	1.1802690526583D+02	1.1582481859778D+02
1.1454219934325D+02	1.1632941240120D+02	1.1822336661968D+02	1.3771874236294D+02
1.5971412324223D+02	1.9356574470382D+02	9.6373129136533D+01	9.5767139413962D+01
9.3823126850431D+01	9.2697072592709D+01	9.3326114969678D+01	9.3267348204016D+01
9.3105357632458D+01	9.7259199037020D+01	1.1112029932173D+02	9.9337026562304D+01
6.2588260713489D+01	6.2706484423383D+01	6.5348342324987D+01	7.1783671575515D+01
7.7002283542440D+01	7.9136048812587D+01	8.1875495589795D+01	7.0182175441146D+01
6.4310503682001D+01	6.9567042477375D+01	5.1601559873885D+01	5.3532558759397D+01
5.6283464010878D+01	6.1350950845334D+01	6.2527580116289D+01	6.5922968627814D+01
4.8175855890521D+01	4.8164279136752D+01	4.3664821992153D+01	4.7808882127584D+01
4.7299956508256D+01	4.6958785034038D+01	5.5160921541586D+01	5.6456767669702D+01
5.5551462324414D+01	5.9020202930374D+01	6.1036384994262D+01	4.6323080604772D+01

4.6416563676416D+01	4.0634621667843D+01	3.6941064839752D+01	3.7265755189505D+01
4.0994262554444D+01	4.3664400429114D+01	4.4608203720932D+01	4.5552149115976D+01
4.8862272077292D+01	5.1247760449877D+01	4.5906821042814D+01	4.4460649518241D+01
3.6085420260682D+01	2.8744393940544D+01	2.8235776955295D+01	3.3414227316017D+01
3.7353584218654D+01	3.6146514810369D+01	3.6352799272966D+01	3.2311447235571D+01
3.4072086299846D+01	2.7044969876938D+01	2.4487171085308D+01	2.4131098019584D+01
2.5177194246082D+01	2.8157292686757D+01	2.9452373376748D+01	2.1930580048160D+01
2.4713197997854D+01	2.0765027493446D+01	2.2528679746854D+01	2.0753084551694D+01
1.7003914233003D+01	1.6329511627487D+01	7.6492221299874D+00	-9.1682785810257D-01
2.2633467346254D+01	3.1963439423736D+01	2.0990636710470D+01	9.0252694465452D+00
4.0282847083805D+00	-7.8933466533485D+00	-2.0270212367722D+00	
200.	200.	200.	200.
200.	200.	200.	200.
200.	200.	200.	200.

Appendix 8: *SUTRA unit 55 input file for simulation shown in figures 14-16, 18, and 19*--Continued

200.	200.	200.	200.
200.	200.	200.	200.
200.	200.	200.	200.
200.	200.	200.	200.
200.	200.	200.	200.
200.	200.	200.	200.
200.	200.	200.	200.
200.	200.	200.	200.
200.	200.	200.	200.
200.	200.	200.	200.
200.	200.	200.	200.
200.	200.	200.	200.
200.	200.	200.	200.
200.	200.	200.	200.
200.	200.	200.	200.
200.	200.	200.	200.
200.	200.	200.	200.
200.	200.	200.	200.
200.	200.	200.	200.
200.	200.	200.	200.
200.	200.	200.	200.
200.	200.	200.	200.
200.	200.	200.	200.
200.	200.	200.	200.
200.	200.	200.	

Appendix 9: *SUTRA unit 5 input file for simulation shown in figures 18 and 19*

[See Voss, 1984, and appendix 6 for explanation of SUTRA input format]

```
SUTRA SOLUTE TRANSPORT coachella add 350 ft thick in AR area COACHELLA VALLEY --1979-86 verif. runs
.65 RETURN, QUARTERLY STRESS CHANGES 10 TIME STEPS/QUARTER, set s to .15 in PS region, .1 IN plm
CAN.,
 255      209      40       0        7        00       127      0    9    99
 0        +0       +0       +01      +01      1
 0.00000  1.00E+02
 320      7.88940E05  2.524608E+08   1        1.0      3.15576+10  1    01
 319      1        0        0        +1       +1       001      1
 01
 0.000E00 0001.0   0.0      1.0E00   0.00     0.00     1.000
 0.0E0    0.0E0    0.0E0    0001.0
 NONE
 0.0E-9   0.0E-9   0.0E-9   0.0E-9
 00.0     00.0     1.0
 NODE     100.0    100.0    1.00     1.       1.
 1        142.     470.     700.     0.250    0.130
 2        137.     499.     725.     0.250    0.130
 3        110.     538.     750.     0.250    0.130
 4        79.0     558.     750.     0.250    0.130
 5        66.0     582.     725.     0.250    0.130
 6        100.     635.     600.     0.250    0.130
 7        110.     645.     400.     0.250    0.130
 8        115.     663.     250.     0.250    0.140
 9        124.     683.     200.     0.250    0.150
 10       129.     702.     200.     0.250    0.150
 11       175.     457.     700.     0.250    0.130
 12       165.     500.     725.     0.250    0.130
 13       156.     535.     750.     0.250    0.130
 14       149.     567.     750.     0.250    0.130
 15       142.     602.     737.     0.250    0.130
 16       134.     632.     612.     0.250    0.130
 17       138.     643.     400.     0.250    0.130
 18       142.     661.     250.     0.250    0.140
 19       150.     682.     200.     0.250    0.150
 20       157.     710.     200.     0.250    0.150
 21       200.     452.     700.     0.250    0.130
 22       193.     500.     733.     0.250    0.130
 23       195.     541.     1100.    0.250    0.130
 24       196.     571.     1100.    0.250    0.130
 25       194.     597.     1100.    0.250    0.130
 26       182.     623.     1037.    0.250    0.130
 27       172.     638.     912.     0.250    0.135
 28       176.     657.     425.     0.250    0.145
 29       181.     682.     350.     0.250    0.150
 30       190.     724.     350.     0.250    0.150
 31       222.     505.     750.     0.250    0.130
 32       233.     541.     1100.    0.250    0.130
 33       234.     573.     1100.    0.250    0.130
 34       237.     598.     1100.    0.250    0.130
 35       240.     621.     1100.    0.250    0.130
 36       220.     644.     1087.    0.250    0.135
 37       213.     654.     662.     0.250    0.145
 38       205.     681.     600.     0.250    0.150
```

39	210.	727.	600.	0.250	0.150
40	262.	552.	1100.	0.250	0.130
41	263.	574.	1100.	0.250	0.130
42	263.	600.	1100.	0.250	0.130
43	264.	623.	1100.	0.250	0.130
44	264.	640.	1062.	0.250	0.130
45	261.	650.	637.	0.250	0.140
46	252.	685.	650.	0.250	0.150
47	238.	738.	700.	0.250	0.150
48	283.	557.	1100.	0.250	0.130
49	284.	576.	1100.	0.250	0.130
50	286.	601.	1112.	0.250	0.130
51	287.	623.	1125.	0.250	0.130
52	288.	642.	1062.	0.250	0.130
53	288.	651.	600.	0.250	0.127
54	288.	688.	625.	0.250	0.125
55	290.	740.	700.	0.250	0.125
56	308.	577.	1117.	0.250	0.130
57	310.	601.	1137.	0.250	0.130
58	310.	623.	1150.	0.250	0.130
59	311.	642.	1100.	0.250	0.130
60	311.	651.	662.	0.250	0.115
61	312.	689.	675.	0.250	0.100
62	316.	742.	725.	0.250	0.100
63	310.	557.	1075.	0.250	0.130
64	310.	530.	1050.	0.250	0.130
65	342.	530.	1050.	0.250	0.150
66	342.	556.	1075.	0.250	0.150
67	342.	577.	1125.	0.250	0.150
68	343.	600.	1150.	0.250	0.150
69	343.	623.	1150.	0.250	0.150
70	344.	643.	1125.	0.250	0.102
71	344.	652.	762.	0.250	0.115
72	343.	692.	825.	0.250	0.100
73	343.	744.	875.	0.250	0.100
74	375.	532.	1050.	0.250	0.150
75	376.	557.	1100.	0.250	0.150
76	377.	578.	1150.	0.250	0.150
77	378.	601.	1175.	0.250	0.150
78	380.	623.	1187.	0.250	0.150
79	381.	647.	1200.	0.250	0.150
80	381.	656.	875.	0.250	0.100
81	385.	698.	950.	0.250	0.100
82	387.	744.	0.100E+04	0.250	0.100
83	409.	558.	1150.	0.250	0.150
84	411.	580.	1175.	0.250	0.150
85	412.	602.	1212.	0.250	0.150
86	415.	627.	1237.	0.250	0.150
87	417.	648.	1250.	0.250	0.150
88	417.	657.	912.	0.250	0.100
89	420.	698.	962.	0.250	0.100
90	425.	742.	0.100E+04	0.250	0.100
91	444.	543.	1150.	0.250	0.150
92	458.	582.	1175.	0.250	0.150
93	462.	608.	1225.	0.250	0.150

94	457.	634.	1262.	0.250	0.150
95	455.	650.	1287.	0.250	0.150
96	452.	658.	962.	0.250	0.100
97	456.	694.	987.	0.250	0.100
98	461.	744.	0.100E+04	0.250	0.100
99	477.	537.	1175.	0.250	0.150
100	485.	581.	1200.	0.250	0.150
101	490.	611.	1250.	0.250	0.150
102	496.	638.	1300.	0.250	0.150
103	498.	652.	1337.	0.250	0.150
104	499.	660.	0.100E+04	0.250	0.100
105	504.	702.	0.100E+04	0.250	0.100
106	508.	751.	0.100E+04	0.250	0.100
107	498.	492.	850.	0.250	0.150
108	508.	520.	1217.	0.250	0.150
109	548.	574.	1250.	0.250	0.150
110	556.	608.	1300.	0.250	0.150
111	563.	640.	1337.	0.250	0.150
112	566.	655.	0.135E+04	0.250	0.150
113	566.	663.	0.100E+04	0.250	0.100
114	571.	711.	0.100E+04	0.250	0.100
115	578.	762.	0.100E+04	0.250	0.100
116	570.	455.	850.	0.250	0.100
117	557.	488.	900.	0.250	0.150
118	594.	514.	937.	0.250	0.150
119	613.	556.	962.	0.250	0.150
120	621.	596.	987.	0.250	0.150
121	628.	632.	0.100E+04	0.250	0.150
122	634.	660.	0.100E+04	0.250	0.150
123	633.	669.	0.100E+04	0.250	0.100
124	633.	706.	0.100E+04	0.250	0.100
125	633.	757.	0.100E+04	0.250	0.100
126	625.	378.	900.	0.350	0.100
127	618.	441.	917.	0.317	0.100
128	656.	471.	962.	0.300	0.150
129	660.	500.	0.100E+04	0.300	0.150
130	664.	533.	0.100E+04	0.275	0.150
131	672.	584.	0.100E+04	0.250	0.150
132	677.	627.	0.100E+04	0.250	0.150
133	685.	655.	0.100E+04	0.250	0.150
134	685.	663.	0.100E+04	0.250	0.100
135	686.	709.	0.100E+04	0.250	0.100
136	675.	757.	0.100E+04	0.250	0.100
137	722.	216.	750.	0.200	0.100
138	702.	267.	800.	0.200	0.100
139	685.	315.	925.	0.200	0.100
140	657.	368.	967.	0.300	0.100
141	667.	416.	975.	0.350	0.100
142	698.	446.	0.100E+04	0.350	0.150
143	740.	486.	0.100E+04	0.350	0.150
144	750.	521.	0.100E+04	0.300	0.150
145	767.	573.	0.100E+04	0.250	0.150
146	779.	614.	0.100E+04	0.250	0.150
147	790.	643.	0.100E+04	0.250	0.150

148	786.	651.	0.100E+04	0.250	0.100
149	776.	710.	0.100E+04	0.250	0.112
150	770.	760.	0.100E+04	0.250	0.125
151	770.	220.	750.	0.200	0.100
152	760.	265.	800.	0.200	0.100
153	748.	324.	925.	0.200	0.100
154	760.	348.	0.100E+04	0.275	0.100
155	780.	390.	933.	0.350	0.100
156	802.	417.	950.	0.350	0.150
57	838.	466.	0.100E+04	0.350	0.150
158	851.	507.	0.100E+04	0.300	0.150
159	867.	563.	0.100E+04	0.250	0.150
160	883.	622.	0.100E+04	0.250	0.150
161	888.	642.	0.100E+04	0.250	0.150
162	881.	651.	0.100E+04	0.237	0.150
163	878.	704.	0.100E+04	0.225	0.137
164	874.	752.	0.100E+04	0.225	0.150
165	914.	395.	850.	0.350	0.150
166	914.	420.	925.	0.350	0.150
167	914.	453.	0.100E+04	0.350	0.150
168	926.	500.	0.100E+04	0.312	0.150
169	941.	557.	0.100E+04	0.275	0.150
170	955.	612.	0.100E+04	0.275	0.150
171	964.	657.	0.100E+04	0.250	0.150
172	957.	665.	0.100E+04	0.212	0.115
173	967.	700.	0.100E+04	0.200	0.150
174	965.	750.	0.100E+04	0.200	0.150
175	965.	392.	900.	0.350	0.150
176	975.	417.	950.	0.350	0.150
177	986.	437.	0.100E+04	0.337	0.150
178	0.101E+04	500.	0.100E+04	0.312	0.150
179	0.102E+04	544.	0.100E+04	0.300	0.150
180	0.103E+04	606.	0.100E+04	0.300	0.150
181	0.104E+04	673.	0.100E+04	0.260	0.126
182	0.104E+04	682.	0.100E+04	0.200	0.120
183	0.103E+04	706.	0.100E+04	0.200	0.150
184	0.106E+04	728.	0.100E+04	0.200	0.150
185	0.105E+04	345.	925.	0.375	0.150
186	0.106E+04	379.	962.	0.375	0.150
187	0.107E+04	427.	0.100E+04	0.362	0.150
188	0.109E+04	500.	0.100E+04	0.337	0.150
189	0.108E+04	533.	0.100E+04	0.312	0.150
190	0.108E+04	595.	0.100E+04	0.287	0.150
191	0.107E+04	635.	0.100E+04	0.283	0.150
192	0.112E+04	654.	0.100E+04	0.287	0.170
193	0.115E+04	714.	0.100E+04	0.267	0.140
194	0.113E+04	716.	0.100E+04	0.200	0.115
195	0.113E+04	327.	975.	0.400	0.170
196	0.114E+04	372.	987.	0.400	0.170
197	0.116E+04	432.	0.100E+04	0.387	0.170
198	0.115E+04	498.	0.100E+04	0.362	0.170
199	0.115E+04	536.	0.100E+04	0.325	0.170
200	0.114E+04	582.	0.100E+04	0.287	0.170
201	0.124E+04	164.	750.	0.200	0.190

202	0.123E+04	204.	800.	0.200	0.190
203	0.119E+04	264.	900.	0.200	0.190
204	0.117E+04	306.	983.	0.300	0.190
205	0.120E+04	363.	0.100E+04	0.362	0.190
206	0.123E+04	415.	0.100E+04	0.362	0.190
207	0.119E+04	483.	0.100E+04	0.350	0.190
208	0.119E+04	534.	0.100E+04	0.337	0.190
209	0.119E+04	573.	0.100E+04	0.312	0.190
210	0.120E+04	642.	0.100E+04	0.300	0.190
211	0.121E+04	715.	0.100E+04	0.300	0.190
212	0.130E+04	182.	750.	0.200	0.190
213	0.129E+04	212.	800.	0.200	0.190
214	0.126E+04	256.	900.	0.200	0.190
215	0.126E+04	290.	975.	0.225	0.190
216	0.126E+04	342.	0.100E+04	0.300	0.190
217	0.128E+04	398.	0.100E+04	0.350	0.190
218	0.127E+04	470.	0.100E+04	0.350	0.190
219	0.126E+04	522.	0.100E+04	0.337	0.190
220	0.125E+04	567.	0.100E+04	0.312	0.190
221	0.126E+04	634.	0.100E+04	0.300	0.190
222	0.127E+04	707.	0.100E+04	0.300	0.190
223	0.136E+04	188.	750	0.200	0.190
224	0.132E+04	216.	800.	0.200	0.190
225	0.133E+04	265.	900.	0.200	0.190
226	0.136E+04	302.	900.	0.233	0.177
227	0.135E+04	337.	937.	0.300	0.170
228	0.134E+04	397.	0.100E+04	0.350	0.170
229	0.132E+04	459.	0.100E+04	0.350	0.170
230	0.133E+04	514.	0.100E+04	0.325	0.170
231	0.133E+04	557.	0.100E+04	0.300	0.170
232	0.135E+04	603.	0.100E+04	0.300	0.170
233	0.136E+04	698.	0.100E+04	0.300	0.170
234	0.140E+04	307.	750.	0.300	0.150
235	0.140E+04	343.	917.	0.333	0.150
236	0.141E+04	396.	0.100E+04	0.350	0.150
237	0.139E+04	447.	0.100E+04	0.362	0.150
238	0.138E+04	510.	0.100E+04	0.362	0.150
239	0.137E+04	553.	0.100E+04	0.350	0.150
240	0.141E+04	622.	0.100E+04	0.350	0.150
241	0.141E+04	690.	0.100E+04	0.350	0.150
242	0.146E+04	380.	0.100E+04	0.300	0.150
243	0.146E+04	396.	0.100E+04	0.312	0.150
244	0.147E+04	433.	0.100E+04	0.362	0.150
245	0.146E+04	493.	0.100E+04	0.400	0.150
246	0.145E+04	540.	0.100E+04	0.387	0.150
247	0.149E+04	616.	0.100E+04	0.375	0.160
248	0.153E+04	678.	0.100E+04	0.375	0.170
249	0.148E+04	367.	0.100E+04	0.250	0.150
250	0.149E+04	395.	0.100E+04	0.275	0.150
251	0.150E+04	427.	0.100E+04	0.350	0.150
252	0.154E+04	500.	0.100E+04	0.400	0.150
253	0.156E+04	539.	0.100E+04	0.375	0.150

254	0.159E+04	623.	0.100E+04	0.350	0.170	
255	0.165E+04	648.	0.100E+04	0.350	0.190	
ELEMENT	1.0	1.0	1.	100.	100.	30.
1	0.51E-04	0.51E-04	1.0	1.0	1.0	1.0
2	0.48E-04	0.48E-04	1.0	1.0	1.0	1.0
3	0.81E-04	0.81E-04	1.0	1.0	1.0	1.0
4	0.25E-04	0.25E-04	1.0	1.0	1.0	1.0
5	0.73E-04	0.73E-04	1.0	1.0	1.0	1.0
6	0.16E-03	0.16E-03	1.0	1.0	1.0	1.0
7	0.50E-06	0.50E-06	1.0	1.0	1.0	1.0
8	0.46E-04	0.46E-04	1.0	1.0	1.0	1.0
9	0.46E-04	0.46E-04	1.0	1.0	1.0	1.0
10	0.47E-04	0.47E-04	1.0	1.0	1.0	1.0
11	0.54E-04	0.54E-04	1.0	1.0	1.0	1.0
12	0.10E-03	0.10E-03	1.0	1.0	1.0	1.0
13	0.13E-03	0.13E-03	1.0	1.0	1.0	1.0
14	0.11E-03	0.11E-03	1.0	1.0	1.0	1.0
15	0.18E-03	0.18E-03	1.0	1.0	1.0	1.0
16	0.50E-06	0.50E-06	1.0	1.0	1.0	1.0
17	0.46E-04	0.46E-04	1.0	1.0	1.0	1.0
18	0.46E-04	0.46E-04	1.0	1.0	1.0	1.0
19	0.89E-04	0.89E-04	1.0	1.0	1.0	1.0
20	0.13E-03	0.13E-03	1.0	1.0	1.0	1.0
21	0.30E-03	0.30E-03	1.0	1.0	1.0	1.0
22	0.20E-03	0.20E-03	1.0	1.0	1.0	1.0
23	0.15E-03	0.15E-03	1.0	1.0	1.0	1.0
24	0.30E-06	0.30E-06	1.0	1.0	1.0	1.0
25	0.18E-04	0.18E-04	1.0	1.0	1.0	1.0
26	0.44E-04	0.44E-04	1.0	1.0	1.0	1.0
27	0.29E-03	0.29E-03	1.0	1.0	1.0	1.0
28	0.42E-03	0.42E-03	1.0	1.0	1.0	1.0
29	0.54E-03	0.54E-03	1.0	1.0	1.0	1.0
30	0.78E-03	0.78E-03	1.0	1.0	1.0	1.0
31	0.30E-06	0.30E-06	1.0	1.0	1.0	1.0
32	0.58E-04	0.58E-04	1.0	1.0	1.0	1.0
33	0.73E-04	0.73E-04	1.0	1.0	1.0	1.0
34	0.15E-03	0.15E-03	1.0	1.0	1.0	1.0
35	0.57E-03	0.57E-03	1.0	1.0	1.0	1.0
36	0.57E-03	0.57E-03	1.0	1.0	1.0	1.0
37	0.57E-03	0.57E-03	1.0	1.0	1.0	1.0
38	0.40E-06	0.40E-06	1.0	1.0	1.0	1.0
39	0.49E-04	0.49E-04	1.0	1.0	1.0	1.0
40	0.42E-04	0.42E-04	1.0	1.0	1.0	1.0
41	0.57E-03	0.57E-03	1.0	1.0	1.0	1.0
42	0.51E-03	0.51E-03	1.0	1.0	1.0	1.0
43	0.56E-03	0.56E-03	1.0	1.0	1.0	1.0
44	0.30E-06	0.30E-06	1.0	1.0	1.0	1.0
45	0.13E-03	0.13E-03	1.0	1.0	1.0	1.0
46	0.58E-04	0.58E-04	1.0	1.0	1.0	1.0
47	0.14E-03	0.14E-03	1.0	1.0	1.0	1.0
48	0.24E-03	0.24E-03	1.0	1.0	1.0	1.0
49	0.42E-03	0.42E-03	1.0	1.0	1.0	1.0

50	0.40E-03	0.40E-03	1.0	1.0	1.0	1.0
51	0.41E-03	0.41E-03	1.0	1.0	1.0	1.0
52	0.30E-06	0.30E-06	1.0	1.0	1.0	1.0
53	0.24E-03	0.24E-03	1.0	1.0	1.0	1.0
54	0.79E-04	0.79E-04	1.0	1.0	1.0	1.0
55	0.13E-03	0.13E-03	1.0	1.0	1.0	1.0
56	0.20E-03	0.20E-03	1.0	1.0	1.0	1.0
57	0.42E-03	0.42E-03	1.0	1.0	1.0	1.0
58	0.47E-03	0.47E-03	1.0	1.0	1.0	1.0
59	0.50E-03	0.50E-03	1.0	1.0	1.0	1.0
60	0.40E-06	0.40E-06	1.0	1.0	1.0	1.0
61	0.20E-03	0.20E-03	1.0	1.0	1.0	1.0
62	0.81E-05	0.81E-05	1.0	1.0	1.0	1.0
63	0.55E-03	0.55E-03	1.0	1.0	1.0	1.0
64	0.59E-03	0.59E-03	1.0	1.0	1.0	1.0
65	0.52E-03	0.52E-03	1.0	1.0	1.0	1.0
66	0.57E-03	0.57E-03	1.0	1.0	1.0	1.0
67	0.40E-06	0.40E-06	1.0	1.0	1.0	1.0
68	0.56E-04	0.56E-04	1.0	1.0	1.0	1.0
69	0.48E-05	0.48E-05	1.0	1.0	1.0	1.0
70	0.51E-03	0.51E-03	1.0	1.0	1.0	1.0
71	0.58E-03	0.58E-03	1.0	1.0	1.0	1.0
72	0.63E-03	0.63E-03	1.0	1.0	1.0	1.0
73	0.57E-03	0.57E-03	1.0	1.0	1.0	1.0
74	0.40E-06	0.40E-06	1.0	1.0	1.0	1.0
75	0.38E-04	0.38E-04	1.0	1.0	1.0	1.0
76	0.68E-05	0.68E-05	1.0	1.0	1.0	1.0
77	0.58E-03	0.58E-03	1.0	1.0	1.0	1.0
78	0.53E-03	0.53E-03	1.0	1.0	1.0	1.0
79	0.50E-03	0.50E-03	1.0	1.0	1.0	1.0
80	0.54E-03	0.54E-03	1.0	1.0	1.0	1.0
81	0.40E-06	0.40E-06	1.0	1.0	1.0	1.0
82	0.12E-03	0.12E-03	1.0	1.0	1.0	1.0
83	0.53E-04	0.53E-04	1.0	1.0	1.0	1.0
84	0.56E-03	0.56E-03	1.0	1.0	1.0	1.0
85	0.63E-03	0.63E-03	1.0	1.0	1.0	1.0
86	0.69E-03	0.69E-03	1.0	1.0	1.0	1.0
87	0.53E-03	0.53E-03	1.0	1.0	1.0	1.0
88	0.40E-06	0.40E-06	1.0	1.0	1.0	1.0
89	0.38E-04	0.38E-04	1.0	1.0	1.0	1.0
90	0.22E-04	0.22E-04	1.0	1.0	1.0	1.0
91	0.32E-03	0.32E-03	1.0	1.0	1.0	1.0
92	0.43E-03	0.43E-03	1.0	1.0	1.0	1.0
93	0.51E-03	0.51E-03	1.0	1.0	1.0	1.0
94	0.52E-03	0.52E-03	1.0	1.0	1.0	1.0
95	0.50E-03	0.50E-03	1.0	1.0	1.0	1.0
96	0.40E-06	0.40E-06	1.0	1.0	1.0	1.0
97	0.17E-04	0.17E-04	1.0	1.0	1.0	1.0
98	0.34E-04	0.34E-04	1.0	1.0	1.0	1.0
99	0.27E-03	0.27E-03	1.0	1.0	1.0	1.0
100	0.40E-03	0.40E-03	1.0	1.0	1.0	1.0
101	0.60E-03	0.60E-03	1.0	1.0	1.0	1.0

102	0.74E-03	0.74E-03	1.0	1.0	1.0	1.0
103	0.74E-03	0.74E-03	1.0	1.0	1.0	1.0
104	0.62E-03	0.62E-03	1.0	1.0	1.0	1.0
105	0.30E-06	0.30E-06	1.0	1.0	1.0	1.0
106	0.15E-04	0.15E-04	1.0	1.0	1.0	1.0
107	0.35E-04	0.35E-04	1.0	1.0	1.0	1.0
108	0.32E-03	0.32E-03	1.0	1.0	1.0	1.0
109	0.23E-03	0.23E-03	1.0	1.0	1.0	1.0
110	0.63E-03	0.63E-03	1.0	1.0	1.0	1.0
111	0.72E-03	0.72E-03	1.0	1.0	1.0	1.0
112	0.81E-03	0.81E-03	1.0	1.0	1.0	1.0
113	0.77E-03	0.77E-03	1.0	1.0	1.0	1.0
114	0.64E-03	0.64E-03	1.0	1.0	1.0	1.0
115	0.30E-06	0.30E-06	1.0	1.0	1.0	1.0
116	0.18E-04	0.18E-04	1.0	1.0	1.0	1.0
117	0.35E-04	0.35E-04	1.0	1.0	1.0	1.0
118	0.40E-04	0.40E-04	1.0	1.0	1.0	1.0
119	0.18E-03	0.18E-03	1.0	1.0	1.0	1.0
120	0.27E-03	0.27E-03	1.0	1.0	1.0	1.0
121	0.35E-03	0.35E-03	1.0	1.0	1.0	1.0
122	0.52E-03	0.52E-03	1.0	1.0	1.0	1.0
123	0.65E-03	0.65E-03	1.0	1.0	1.0	1.0
124	0.77E-03	0.77E-03	1.0	1.0	1.0	1.0
125	0.79E-03	0.79E-03	1.0	1.0	1.0	1.0
126	0.76E-03	0.76E-03	1.0	1.0	1.0	1.0
127	0.78E-03	0.78E-03	1.0	1.0	1.0	1.0
128	0.22E-05	0.22E-05	1.0	1.0	1.0	1.0
129	0.80E-05	0.80E-05	1.0	1.0	1.0	1.0
130	0.16E-04	0.16E-04	1.0	1.0	1.0	1.0
131	0.75E-03	0.75E-03	1.0	1.0	1.0	1.0
132	0.79E-03	0.79E-03	1.0	1.0	1.0	1.0
133	0.87E-03	0.87E-03	1.0	1.0	1.0	1.0
134	0.52E-03	0.52E-03	1.0	1.0	1.0	1.0
135	0.46E-03	0.46E-03	1.0	1.0	1.0	1.0
136	0.32E-03	0.32E-03	1.0	1.0	1.0	1.0
137	0.63E-05	0.63E-05	1.0	1.0	1.0	1.0
138	0.98E-05	0.98E-05	1.0	1.0	1.0	1.0
139	0.98E-05	0.98E-05	1.0	1.0	1.0	1.0
140	0.47E-03	0.47E-03	1.0	1.0	1.0	1.0
141	0.52E-03	0.52E-03	1.0	1.0	1.0	1.0
142	0.62E-03	0.62E-03	1.0	1.0	1.0	1.0
143	0.64E-03	0.64E-03	1.0	1.0	1.0	1.0
144	0.46E-03	0.46E-03	1.0	1.0	1.0	1.0
145	0.11E-03	0.11E-03	1.0	1.0	1.0	1.0
146	0.92E-05	0.92E-05	1.0	1.0	1.0	1.0
147	0.16E-04	0.16E-04	1.0	1.0	1.0	1.0
148	0.84E-05	0.84E-05	1.0	1.0	1.0	1.0
149	0.38E-03	0.38E-03	1.0	1.0	1.0	1.0
150	0.42E-03	0.42E-03	1.0	1.0	1.0	1.0
151	0.56E-03	0.56E-03	1.0	1.0	1.0	1.0
152	0.62E-03	0.62E-03	1.0	1.0	1.0	1.0
153	0.44E-03	0.44E-03	1.0	1.0	1.0	1.0

154	0.16E-03	0.16E-03	1.0	1.0	1.0	1.0
155	0.93E-04	0.93E-04	1.0	1.0	1.0	1.0
156	0.31E-04	0.31E-04	1.0	1.0	1.0	1.0
157	0.24E-04	0.24E-04	1.0	1.0	1.0	1.0
158	0.45E-03	0.45E-03	1.0	1.0	1.0	1.0
159	0.81E-03	0.81E-03	1.0	1.0	1.0	1.0
160	0.83E-03	0.83E-03	1.0	1.0	1.0	1.0
161	0.58E-03	0.58E-03	1.0	1.0	1.0	1.0
162	0.46E-03	0.46E-03	1.0	1.0	1.0	1.0
163	0.32E-03	0.32E-03	1.0	1.0	1.0	1.0
164	0.79E-03	0.79E-03	1.0	1.0	1.0	1.0
165	0.77E-03	0.77E-03	1.0	1.0	1.0	1.0
166	0.67E-03	0.67E-03	1.0	1.0	1.0	1.0
167	0.68E-03	0.68E-03	1.0	1.0	1.0	1.0
168	0.48E-03	0.48E-03	1.0	1.0	1.0	1.0
169	0.31E-03	0.31E-03	1.0	1.0	1.0	1.0
170	0.37E-03	0.37E-03	1.0	1.0	1.0	1.0
171	0.20E-03	0.20E-03	1.0	1.0	1.0	1.0
172	0.27E-03	0.27E-03	1.0	1.0	1.0	1.0
173	0.22E-03	0.22E-03	1.0	1.0	1.0	1.0
174	0.61E-03	0.61E-03	1.0	1.0	1.0	1.0
175	0.59E-03	0.59E-03	1.0	1.0	1.0	1.0
176	0.62E-03	0.62E-03	1.0	1.0	1.0	1.0
177	0.49E-03	0.49E-03	1.0	1.0	1.0	1.0
178	0.46E-03	0.46E-03	1.0	1.0	1.0	1.0
179	0.32E-03	0.32E-03	1.0	1.0	1.0	1.0
180	0.21E-03	0.21E-03	1.0	1.0	1.0	1.0
181	0.20E-03	0.20E-03	1.0	1.0	1.0	1.0
182	0.27E-03	0.27E-03	1.0	1.0	1.0	1.0
183	0.29E-03	0.29E-03	1.0	1.0	1.0	1.0
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185	0.35E-03	0.35E-03	1.0	1.0	1.0	1.0
186	0.46E-03	0.46E-03	1.0	1.0	1.0	1.0
187	0.61E-03	0.61E-03	1.0	1.0	1.0	1.0
188	0.73E-03	0.73E-03	1.0	1.0	1.0	1.0
189	0.43E-03	0.43E-03	1.0	1.0	1.0	1.0
190	0.20E-03	0.20E-03	1.0	1.0	1.0	1.0
191	0.27E-03	0.27E-03	1.0	1.0	1.0	1.0
192	0.22E-03	0.22E-03	1.0	1.0	1.0	1.0
193	0.32E-03	0.32E-03	1.0	1.0	1.0	1.0
194	0.46E-03	0.46E-03	1.0	1.0	1.0	1.0
195	0.56E-03	0.56E-03	1.0	1.0	1.0	1.0
196	0.44E-03	0.44E-03	1.0	1.0	1.0	1.0
197	0.21E-03	0.21E-03	1.0	1.0	1.0	1.0
198	0.32E-03	0.32E-03	1.0	1.0	1.0	1.0
199	0.37E-03	0.37E-03	1.0	1.0	1.0	1.0
200	0.57E-03	0.57E-03	1.0	1.0	1.0	1.0
201	0.48E-03	0.48E-03	1.0	1.0	1.0	1.0
202	0.45E-03	0.45E-03	1.0	1.0	1.0	1.0
203	0.22E-03	0.22E-03	1.0	1.0	1.0	1.0
204	0.22E-03	0.22E-03	1.0	1.0	1.0	1.0
205	0.27E-03	0.27E-03	1.0	1.0	1.0	1.0

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206      0.64E-03  0.64E-03  1.0      1.0      1.0      1.0
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208      0.53E-03  0.53E-03  1.0      1.0      1.0      1.0
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4	5.52	200.	San Gorgonio
5	4.14	200.	San Gorgonio
6	2.76	200.	San Gorgonio
11	1.86	200.	Snow ck
21	1.86	200.	Snow ck
12	0.655	200.	Falls ck
22	0.655	200.	Falls ck
20	0.167	200.	Banning fault
30	0.167	200.	Banning fault
-35			AR +WW Rv. above bridge
-38			AR+WW riv below bridge
39	0.167	200.	Banning fault
-42			AR + WW riv below bridge
47	0.167	200.	Banning fault
-50			AR + WW riv below bridge
55	0.690E-01	200.	Banning fault
-57			AR + WW riv below bridge
62	0.690E-01	200.	Banning fault
-68			AR + WW river
73	0.690E-01	200.	Banning fault
-76			AR
-77			AR
-78			AR
82	0.442E-01	200.	Banning fault
-84			AR
-85			AR
-86			AR
-92			AR
-93			AR

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-94                                     AR
90          0.414E-01   200.            Banning fault
98          0.290E-01   200.            Banning fault
106         0.138       200.            Banning fault
115         0.842E-01   200.            Banning fault
107         1.38        200.            Chino
117         1.38        200.            Chino
125         0.483E-01   200.            Banning fault
126         3.17        200.            Tahquitz
136         0.483E-01   200.            Banning fault
139         1.38        200.            Andreas
150         0.103       200.            Banning fault
137         1.03        200.            Palm Canyon
151         1.03        200.            Palm Canyon
152         0.35        200.            Palm Canyon
164         0.241       200.            Banning fault
174         0.152       200.            Banning fault
184         0.124       200.            Banning fault
211         0.166       200.            Banning fault
201         0.46        200.            Deep ck
202         0.46        200.            Deep ck
212         0.46        200.            Deep ck
222         0.193       200.            Banning fault
233         0.117       200.            Banning fault
248         0.166       200.            Banning fault

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