GROUND-WATER-QUALITY MONITORING NETWORK DESIGN FOR THE SAN JOAQUIN VALLEY GROUND-WATER BASIN, CALIFORNIA

By William E. Templin

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[Plates are in pocket]

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CONVERSION FACTORS

For readers who prefer to use the International System of Units (SI) rather than inch-pound units, the conversion factors for the terms used in this report are listed below.

Multiply	By	To Obtain
inches	25.40	millimeters
acre-ft (acre-feet)	0.001233	cubic hectometers
acre-ft/yr (acre-feet per year)	0.001233	cubic hectometers per year
miles	1.609	kilometers
mi^2 (square miles)	2.590	square kilometers
feet	0.3048	meters
ft/d (feet per day)	0.3048	meters per day
ft^3/s (cubic feet per second)	0.02832	cubic meters per second
µmho/cm (micromhos per centimeter)	1.0	microsiemens per centimeter
°F (degrees Fahrenheit)	°C = 5/9 (°F-32)	degrees Celsius

TRADE NAMES

Use of trade names in this report is for identification purposes only and does not imply endorsement by the U.S. Geological Survey.

ALTITUDE DATUM

National Geodetic Vertical Datum 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 "mean sea level."

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ABSTRACT

Ideal and actual ground-water-quality monitoring networks are proposed for the San Joaquin Valley basin in California. The ideal network, which comprises several subnetworks, provides direction in the development of an actual network of wells currently monitored by known operating agencies. The ideal network can serve as a basis for the future expansion of the actual network as more wells are included in the inventory of active monitoring networks. The management objectives of these networks are to develop a general baseline of ground-water quality, to identify temporal and spatial trends in ground-water quality, and to identify large-scale sources of contamination of ground water. The networks are based on an information structure that includes land use, surface and subsurface geology, ground-water levels, surface- and ground-water quality, possible sources of contamination, and active ground-water-quality monitoring networks. Development of the categories and subcategories of network objectives, which are needed to describe the quality of the ground water in the basin, makes clear the inadequacy of the currently operated networks. The expansion of ground-water-quality monitoring in the San Joaquin Valley, therefore, would be necessary to approximate adequately the ideal network.

INTRODUCTION

Since the early 1900's, researchers have been studying the ground water of the San Joaquin Valley basin, the first extensively documented study being Mendenhall (1908). Bertoldi (1979) included more than 500 bibliographic citations in his study of the ground water of the Central Valley, of which the San Joaquin Valley comprises about two-thirds (fig. 1). The present report cites 144 references actually used in this study. Many studies have made important contributions toward the design of a regional ground-water-quality monitoring network, but none of the reports deals with network design for the entire basin. The present report coordinates and consolidates the various general, regional, and local reports on geology, hydrology, land use, water quality, ground water, and network design.

In 1978 the U.S. Geological Survey began a series of studies in cooperation with the California State Water Resources Control Board to identify, inventory, and evaluate active networks in specific California ground-water basins. The ultimate objective of these studies was to integrate active monitoring networks to provide the best possible basinwide surveillance of ground-water quality at the lowest possible cost.

The present report outlines two networks designed for the San Joaquin basin. The first network represents an ideal compilation of sampling sites selected for optimal monitoring of regional ambient ground-water quality, regional effects of all known sources of contamination, and trends in regional ground-water quality. This "ideal" network is presented as a model or goal, which may need reassessment and modification during the network operation and evaluation stages. The second network is an attempt to approximate the ideal, using wells from active networks, supplemented in some cases with historically identified wells that are not currently known to be monitored.

A variety of factors were considered in network development, including the basin's known surface and subsurface characteristics, both natural and manmade, that might affect ground-water quality. Five stages of development were identified (fig. 2) to guide the network design and reevaluation process. This report discusses these factors and applies this information to the design of the ideal and actual monitoring networks. Knowledge of conditions and influences is, of course, incomplete, and in fact the purpose of the network is largely to obtain this knowledge. Network design, therefore, should be considered a continuous and cyclic process in which updating the information is crucial to the network's value as a valid scientific instrument.

Location

The San Joaquin Valley comprises the southern two-thirds of the Central Valley of California (fig. 1). The San Joaquin Valley ground-water basin, which is virtually coextensive with the flatlands of the valley, is bounded on the east by the Sierra Nevada; on the west by the Coast Ranges; on the south by the Tehachapi Mountains; and on the north by the Sacramento-San Joaquin River Delta area, roughly along the northern boundary of San Joaquin County. The basin is approximately 250 miles long, ranges in width from 30 miles near Stockton to about 70 miles near Tulare, and covers about 13,500 mi^2. The basin includes parts of San Joaquin, Alameda, Contra Costa, Stanislaus, Merced, Madera, Fresno, Kings, Tulare, and Kern Counties.

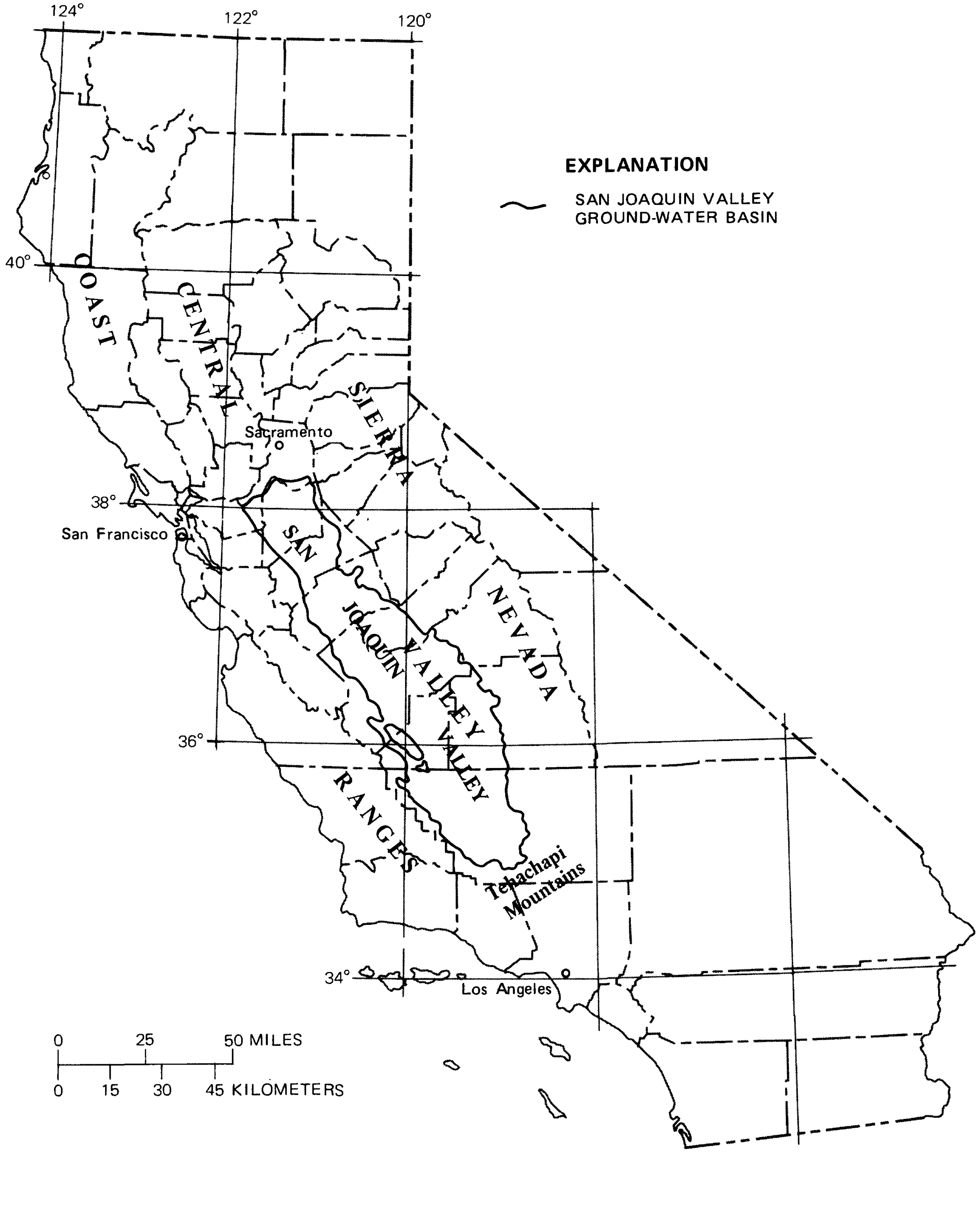


FIGURE 1. – Location of study area.

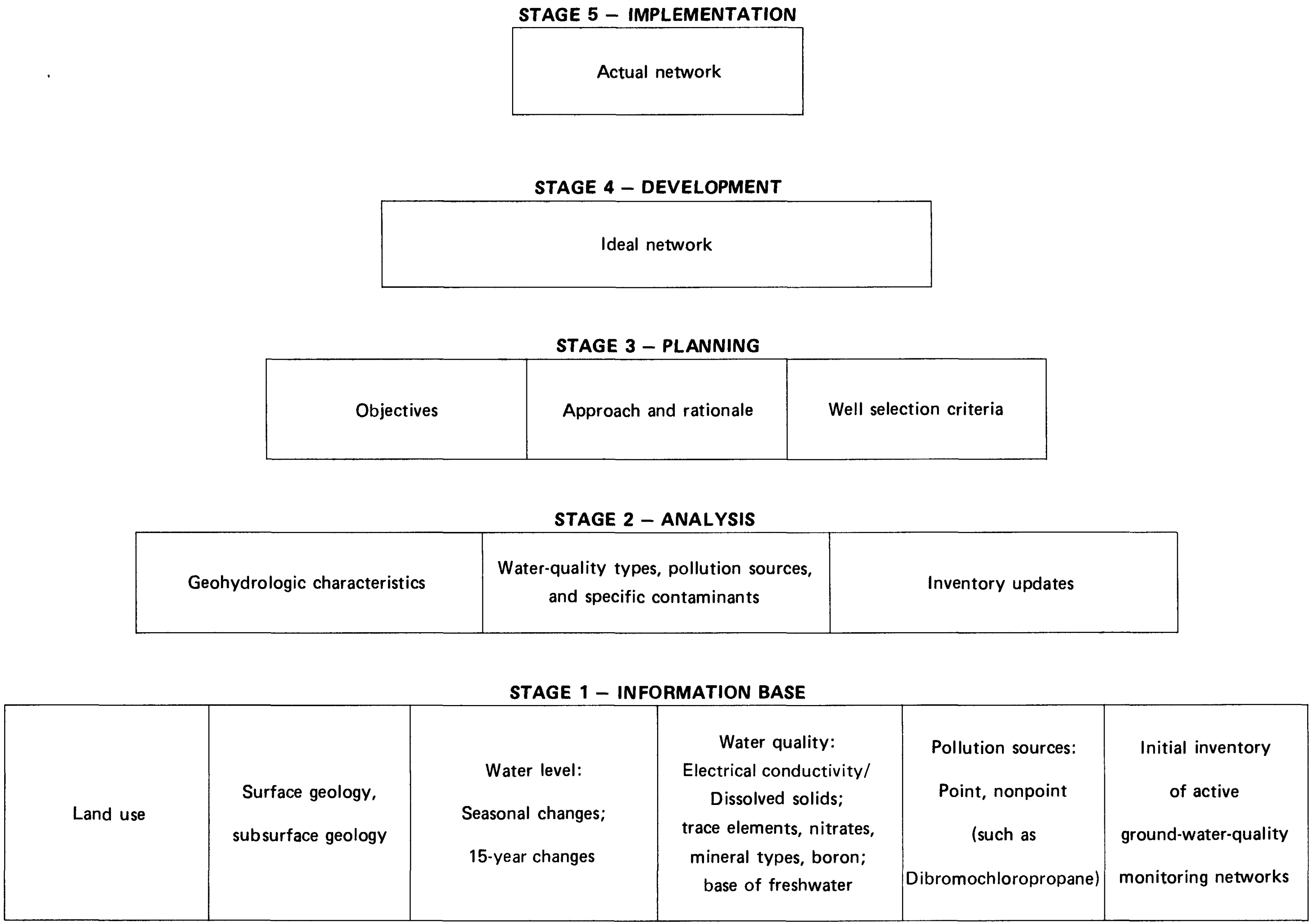
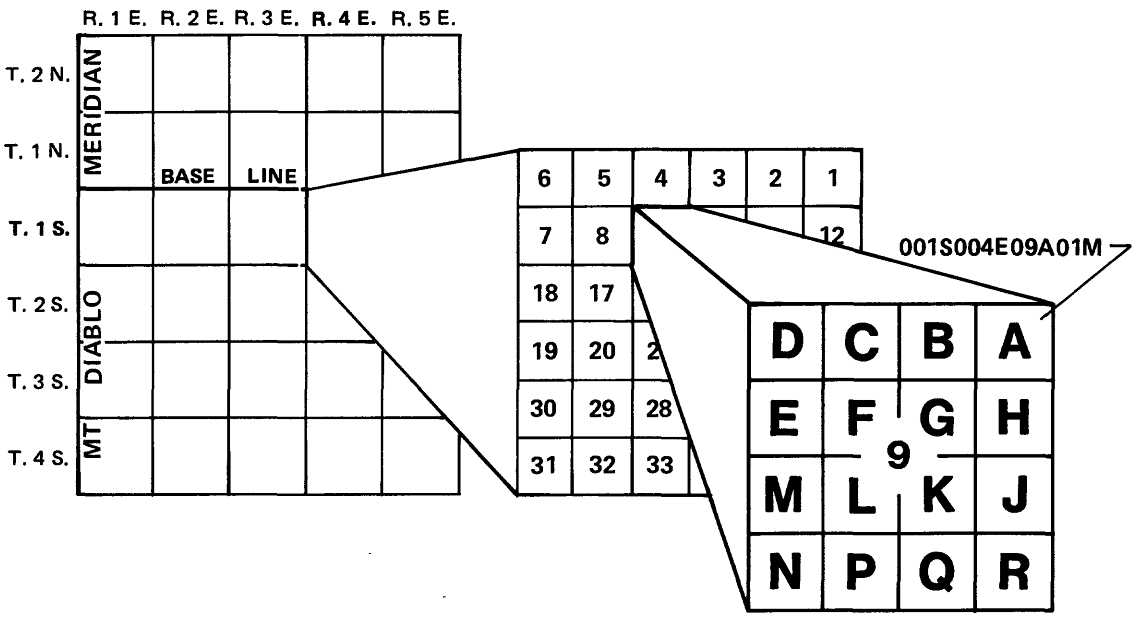


FIGURE 2. — Structural design of a regional ground-water-quality monitoring network.

Well-Numbering System

Wells are identified according to their location in the rectangular system for the subdivision of public lands. Identification consists of the township number, north or south; the range number, east or west; and the section number. Each section is further divided into sixteen 40-acre tracts lettered consecutively (omitting the letters I and O), beginning with A in the northeast corner of the section and progressing in a sinusoidal manner to R in the southeast corner. Within the 40-acre tract, wells are numbered sequentially in the order in which they are inventoried. The final letter of the identification signifies the base line and meridian to which the well location refers. All wells in the San Joaquin Valley ground-water basin refer to either the Mount Diablo or San Bernardino base line and meridian. Thus, the final letter in the official State well number of all wells in this report is either M (Mount Diablo) or S (San Bernardino). The derivation of well number 1S/4E-9A1M (001S004E09A01M in Survey format) is shown in the diagram of the well-numbering system.

The California Department of Water Resources has sole authority for assigning official State well numbers following these procedures. All individuals and agencies monitoring wells, therefore, are requested to locate accurately their wells on 7.5-minute U.S. Geological Survey quadrangle maps and send that location along with construction information, such as a completed driller's log, and any other local agency numbers to the nearest California Department of Water Resources office for official State well-number assignment. Care should be taken to be sure that locations and other information are correct. Confusion of wells in a local area is a common problem that can be avoided by this procedure.



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Castle Air Force Base
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Foster Farms
Fresno City Department of Public Works, Division of Solid Waste Management, Wastewater Management Division
Fresno County Department of Health
Fresno County Resource and Development Department
Kern County Water Agency
Kings County Water District
Madera County Department of Health
Merced County Department of Health, Division of Environmental Health
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North Kern Water Storage District
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San Joaquin Local Health District
Selma-Kingsburg-Fowler Sanitation District
Semitropic Water Storage District
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Tulare County Department of Public Works
Tulare Lake Drainage District
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APPROACH

Concepts of Regional Ground-Water-Quality Monitoring Network Design

As early as 1972, the U.S. Geological Survey was describing the design of ground-water monitoring networks in California (Dutcher, 1972). Dutcher recognized that ground water is not an isolated resource, that each ground-water basin should be considered separately, that the need for data is related to the stresses imposed on the system, and that the data collected should facilitate the construction of historical record and the evaluation of parameters computed from the data. He suggested that the data-collection program for each basin include the following:

1. A bibliography of pertinent geologic and hydrologic literature
2. A catalog of hydrologic data
3. A catalog of active and planned data collection of all relevant agencies
4. A catalog of probable stresses to ground-water basins
5. Design of a program for additional needed data collection.

Dutcher attempted to establish a method for planning data collection. He stated that the problem grew more complex as the number of design constraints increased and that, no matter how sophisticated the design, no data-collection program can be considered final. New tools and techniques create demands for new or different types of data, or they may solve problems using fewer data. An important factor in design, therefore, is a mechanism for periodic updating of the monitoring network. Dutcher identified many of the design problems that have recently been discussed in Everett and Schmidt (1978) and National Water Well Association (1981-83). The present report also takes account of these concepts and problems in its approach to designing a monitoring network that would identify and quantify the stresses on ground-water quality that are present in the San Joaquin Valley basin.

Methods

Prior Work

This project has been in progress since 1978. Phase 1 of the project, conducted between November 1978 and January 1979, was a preliminary inventory of ground-water-quality monitoring networks. The result was a tabulation of 24 networks active at that time. The information in the tables included the following:

1. Network identification number (sequential 1-24)
2. Townships in which wells were located
3. Number of wells in each network
4. Type of water-quality data monitored
5. Reason for monitoring
6. Monitoring agency (contact person, phone, and address)
7. Data-storage type and location
8. Anticipated duration, frequency, and analysis of samples.

Phase 2, conducted between February 1980 and February 1981, was a comprehensive, computer-generated catalog of the networks identified in phase 1, together with networks identified since phase 1's completion. The catalog (Glass and others, 1981) contained, as available, all or part of the following information for each well in each network:

1. Township-range-section (State well number)
2. Latitude and longitude
3. County
4. Responsible agency (California Department of Water Resources agency number)
5. Analyses performed
6. Responsible laboratory (California Department of Water Resources laboratory number)
7. Year of first sample and sample frequency
8. Data source (Geological Survey source-agency code number)
9. Data location (computer or office files)
10. Well information:
    a. Depth
    b. Perforated intervals
    c. Geohydrologic unit(s) tapped
    d. Location of seals (if present)
    e. Well classification (based on usefulness as a monitor well).

Present Work

The present report attempts to design an ideal network according to the principles set forth by Dutcher (1972); the suggestions of Moss (1979), Koryak (1980), Sanders (1980), and U.S. Geological Survey (1980c); and the requirements of the California State Water Resources Control Board and California Regional Water Quality Control Board, Central Valley Region. The ideal network ignores normal constraints, such as costs or drawbacks of existing wells, in order to design the best possible monitoring system. The design of the actual network derives from a comparison of this ideal network with the catalog of active networks compiled by Glass and others (1981). The selection criteria for the wells included location, construction, constituents currently sampled, and past and projected period of record. The differences between the ideal and actual networks become evident by comparing table 11 with table 12 and plate 11 with plate 12.

Monitoring networks change rapidly, for they are sensitive to changing scientific and managerial needs for data. Even over short time periods, networks are expanded, cut back, or terminated, and entirely new ones are developed. A valid inventory must be updated continually. During the 1-year hiatus between phases 1 and 2 of this project, the monitoring networks originally identified changed somewhat, so that the present report has had to reflect those changes to the extent allowable with information currently available.

Limitations

Virtually any network design has some shortcomings. Objectives of the individual active networks may not match those of the regional network, so that the type, amount, and quality of data may not be adequate. Some wells, for example, are monitored for compliance with issued permits and other legal requirements, and information such as well depth and construction is not available. For such wells, explicit requirements are limited in some cases to little more than the extent of monitoring. The importance of the monitoring to the sponsoring agency is commonly reflected in the qualifications of the individuals in charge and the analytical methods used. Information on well construction provided by drillers' logs is highly variable and subjective. The well-class entries of the tables presented in the phase 2 inventory (Glass and others, 1981) reflect the type and adequacy of information that was available on each well, but the quality of the drillers' logs could not always be determined and was not noted.

The sheer size of the San Joaquin Valley and the extensive development of its ground water create difficulties in identification of active networks as well as collection and reduction of data to computer-readable format. Information provided by some agencies, moreover, is sometimes inconsistent and contradictory. Lack of time for field verification of well location and construction may also result in reduced accuracy, even though attempts were made to provide the best information possible by repeated contacts with operating agencies for further clarification.

The San Joaquin Valley ground-water basin is by far the largest in California. The intensive agricultural and other land uses in the valley create a very complex and interrelated set of problems. By itself, the identification of present and potential water-quality problems is an enormous job that requires continuous updating. The size of the valley has led to the common practice of subdividing it into smaller study areas. Inconsistencies and inadequacies in the resultant information come to light when the various area reports are combined to form a complete picture. Furthermore, the boundaries of the subdivided areas have varied from study to study, and some areas are routinely studied more than others.

Finally, the assumption in the present report of comparability of data taken from various sources and from different time periods is questionable, and it should be tested statistically. Means are available to quantify the adequacy of data for different areas and variables (Moss, 1982), but funds and time for such quantitative analyses were not included in this first network-design effort. The networks that result from this effort should be reviewed and revised as funding becomes available. Uniform analytical methods and standards also need to be established and utilized.

GENERAL FEATURES

Physiography

The San Joaquin Valley is an elongated, southeast-trending, structural trough that lies between the westward-tilted Sierra Nevada and the Coast Ranges. The valley ends in the south at the Tehachapi Mountains and in the north at the delta of the San Joaquin and Sacramento Rivers. Altitudes in the valley range from near sea level in the north to about 1,700 feet above sea level near the apexes of some of the alluvial fans in the south. The basin includes the area between the foothills of the surrounding ranges and south of the northern boundary of San Joaquin County (California Department of Water Resources, 1975, p. 64).

Historically, the study area has been divided into three major subareas: the Delta basin, the San Joaquin basin, and the Tulare Lake basin. The California State Water Resources Control Board uses similar subdivisions. One of the problems in attempting to consolidate information from a variety of sources is that no two agencies use the same boundaries for the areas of their studies. The boundaries of the study area in this report are those of California Department of Water Resources (1975), which the California Department of Water Resources was using when this project began. To remain consistent with other phases of this project, the author has kept the same system of boundaries, even though the California Department of Water Resources has changed its own system.

The principal streams draining into the San Joaquin Valley ground-water basin include the Kings, Kaweah, Tule, and Kern Rivers, and the San Joaquin River and its tributaries, which include the Fresno, Chowchilla, Merced, Tuolumne, Stanislaus, and Mokelumne Rivers. All these streams drain primarily from the Sierra Nevada. The San Joaquin River and its tributaries flow north towards the Delta; the others drain into the Tulare Lake basin, a closed basin for surface runoff except during the wettest years. Many small, intermittent creeks drain from the Coast Ranges along the west side of the valley. The volume of water from the Coast Ranges is small compared to that from the Sierra Nevada. Creeks draining the Tehachapi Mountains and the Coast Ranges are intermittent.

According to Kuchler (1977), the natural vegetation of the San Joaquin Valley is predominantly California prairie grass (*Stripa*, spp.) and Tule marsh (*Scirpus*-*Typha* communities) and subordinately San Joaquin saltbrush (*Atriplex polycarpa*), Riparian forest (*Populus fremontii*), and valley oak savanna (*Quercus*-*Stipa* communities). Although most areas of the valley have undergone conversion to intensive agriculture, in some areas natural vegetation is still noticeable. Kuchler's portrayal of the natural vegetation may help in understanding historical conditions in the valley, especially surface-water distribution. Similarly, soil group areas (U.S. Department of Agriculture, 1973) may provide helpful clues to currently observed conditions of ground-water quality through their relations to their soil parent-material characteristics and the regional variations in vertical pollutant transport.

Land Use

According to Sgambat and others (1978, p. 183), the two primary purposes of monitoring regional and ambient conditions are (1) to provide information on the changes in character and usefulness of the subsurface reservoir and (2) to relate water quality to land use, so that a data base for planning decisions can be maintained and used. Anderson and others (1976, p. 4) stated, "There are different perspectives in the process of land-use classifications, and the process itself tends to be subjective, even when an objective numerical approach is used; therefore, there probably is no single ideal classification of land use and land cover, and it is unlikely that one could ever be developed."

The U.S. Geological Survey's land-use and land-cover map series, intended for use with remote-sensing data, are useful in designing ground-water-quality monitoring networks for regional areas. These maps are available for the entire San Joaquin Valley, some at a scale of 1:100,000 and others at a scale of 1:250,000. For the present report, copies of these maps were reduced to a common scale (1:500,000), combined, and generalized. The general land-use categories shown on the land-use map (pl. 1) meet two criteria: to show land uses that might significantly affect ground-water quality and to mark the boundaries of the land-use categories on the scale of the base map for this study (1:500,000) within the limitations of available drafting and publication methods. More detailed maps of land use (scale 1:24,000) are available for this area from the California Department of Water Resources; examples are shown in California Department of Water Resources (1970, p. 24-31; 1971a).

The selected land-use categories--urban, general agriculture, orchards and vineyards, confined feeding areas, rangeland, forest land, water, wetlands, and mining areas--were in some cases combined from more than one of the original classifications used by the Geological Survey (table 1). Aside from combining the categories, the only other major modification of the original was to enlarge the confined-feeding and mining areas enough to show at the map scale. The importance of the selected land-use categories is more obvious when they are compared with the information on other plates, such as geology, water levels, and locations of point and regional potential problem areas.

The major cities on the land-use map in the San Joaquin Valley (from north to south) are Stockton, Modesto, Merced, Madera, Fresno, Hanford, Visalia, and Bakersfield. These cities are the county seats for San Joaquin, Stanislaus, Merced, Madera, Fresno, Kings, Tulare, and Kern Counties, respectively. Other communities that show sizeable areas of urban development on the land-use map (pl. 1) are the Pittsburg-Antioch area in Alameda County; Lodi, Tracy, and the Lathrop-Manteca area in San Joaquin County; the Riverbank-Oakdale area and Turlock in Stanislaus County; Atwater and Los Banos in Merced County; Chowchilla in Madera County; Fowler, Selma, Kingsburg, Sanger, Reedley, and Coalinga in Fresno County; Dinuba, Tulare, Corcoran, and the Lindsay-Strathmore area of Tulare County; Lemoore in Kings County; and Delano, Wasco, Shafter, and Taft in Kern County.

TABLE 1. - Land-use and land-cover classification system for use with remote-sensing data

[Modified from Anderson and others, 1976]

Level 1	Level 2
1. Urban or built-up land.	11. Residential.
	12. Commercial and services.
	13. Industrial.
	14. Transportation, communications, and utilities.
	15. Industrial and commercial complexes.
	16. Mixed urban or built-up land.
	17. Other urban or built-up land.
2. Agricultural land.	21. Cropland and pasture.
	22. Orchards, groves, vineyards, nurseries, and ornamental horticultural areas.
	23. Confined-feeding operations.
	24. Other agricultural land.
3. Rangeland.	31. Herbaceous rangeland.
	32. Shrub and brush rangeland.
	33. Mixed rangeland.
4. Forest land.	41. Deciduous forest land.
	42. Evergreen forest land.
	43. Mixed forest land.
5. Water.	51. Streams and canals.
	52. Lakes.
	53. Reservoirs.
	54. Bays and estuaries.
6. Wetland.	61. Forested wetland.
	62. Nonforested wetland.
7. Barren land.	71. Dry salt flats.
	72. Beaches.
	73. Sandy areas other than beaches.
	74. Bare exposed rock.
	75. Strip mines, quarries, and gravel pits.
	76. Transitional areas.
	77. Mixed barren land.
8. Tundra.	81. Shrub and brush tundra.
	82. Herbaceous tundra.
	83. Bare ground tundra.
	84. Wet tundra.
	85. Mixed tundra.
9. Perennial snow or ice.	91. Perennial snowfields.
	92. Glaciers.

Water Supplies

The climate of the San Joaquin Valley is arid, characterized by hot summers and cool winters. The rainy season usually extends from October to April, but the strength and frequency of storms can have great annual variation. The remainder of the year constitutes most of the growing season, during which rainfall is scarce. According to Bertoldi (1979, p. 4), "The natural distribution of water in California is the root of all water problems within the San Joaquin Valley." Thomas and Phoenix (1976, p. E5) reported that most of the San Joaquin Valley ground-water basin has an average annual water deficiency of 20 to 40 inches. Supplemental water, therefore, is required to meet demand in the San Joaquin Valley. All sources of water are used in this area, including surface water, both natural and imported, and ground water. Because mean annual precipitation in the basin ranges from near 20 inches in the north to 5 inches in the south (Rantz, 1969), imported water and the related transport system play an important role in the water supplies of the basin.

Surface Water

Surface water accounts for about 60 percent of the annual water supply to the San Joaquin Valley and amounts to about 7.2 million acre-feet (San Joaquin Valley Interagency Drainage Program, 1979, p. 2.3). On the average, the surface-water supplies for the entire basin are made up of two-thirds natural runoff and one-third imported water. Agriculture accounts for more than 95 percent of the valley's water use (California Department of Water Resources, 1970b, p. 121). All the major streams entering the valley from the Sierra Nevada are controlled by retention reservoirs for the purposes of flood control, water supply, recreation, and sometimes hydroelectric generation. The two major sources of imported water are the Federal Central Valley Project (CVP) and the State Water Project (SWP) (California Department of Water Resources, 1974, p. 2-8). In the following summary of the larger water-importing facilities, each canal name is followed by the abbreviation of the project with which it is associated (CVP or SWP).

Imported water enters the southeast Delta area from the American River drainage east of Sacramento via the Folsom South Canal (CVP). During the winter and spring, Sacramento River water is helped to pass through the Delta via the Delta Cross Channel to the pumping plants of the Delta-Mendota Canal (CVP) and the California Aqueduct (CVP-SWP). The Delta-Mendota Canal delivers water to the San Luis Reservoir (CVP-SWP) west of Los Banos for release into the San Joaquin River, where it replaces the natural flows of the river diverted by the Madera Canal (CVP) and the Friant-Kern Canal (CVP) upstream at the Friant Dam. The Madera Canal carries water northwest into the Chowchilla River drainage, and the Friant-Kern Canal carries water south to the Bakersfield area. The California Aqueduct (CVP-SWP) also carries water south to the San Luis Reservoir during the winter and spring, where it is held until the summer and autumn for delivery farther south to the southern San Joaquin Valley and southern California (California Department of Water Resources, 1974, p. 2-11). For a more detailed review of water importation and distribution systems in the San Joaquin Valley, readers are referred to Nady and Larragueta (1983).

Ground Water

Ground water accounts for about 40 percent of the annual water supply to the San Joaquin Valley, which totals about 4.8 million acre-ft (San Joaquin Valley Interagency Drainage Program, 1979, p. 2.3). However, extractions of ground water increased from 3 million acre-ft in 1942 to at least 10 million acre-ft in 1966 (Ireland and others, 1982, p. 17). Ground-water pumpage steadily increased in the San Joaquin Valley from 9.5 million acre-ft in 1974 to 13 million acre-ft during the 1977 drought (Harris, 1977), but, since then, above-normal rainfall and surface-water availability have probably allowed ground-water use to decrease. Ground-water levels fluctuate seasonally and annually, depending respectively on agricultural use and annual rainfall. Of the 15 ground-water basins that California Department of Water Resources (1980c, p. 39) identified in the San Joaquin Valley (fig. 3), 8 were considered subject to critical conditions of overdraft: Eastern San Joaquin County, Chowchilla, Madera, Kings, Kaweah, Tulare Lake, Tule, and Kern County. According to California Department of Water Resources (1980c, p. 11), "A basin is subject to critical conditions of overdraft when continuation of present water management practices would probably result in significant adverse overdraft-related environmental, social, or economic impacts." This definition is paralegal and does not consider the hydraulic and hydrologic concepts of "capture" as defined and discussed by Theis (1938), Bredehoeft and Young (1970), and Bredehoeft and others (1982, p. 51-57).

In 1905-6, between 500 and 600 flowing wells and a somewhat greater number of pumping plants yielded about 300 ft^3/s (217,190 acre-ft/yr) (Mendenhall and others, 1916, p. 31). In the valley today, there are about 50,000 privately owned wells, and no public agency has basinwide authority to regulate ground-water pumping, according to the California Department of Water Resources (1980b, p. 7), which sums up the situation as follows:

> "Although the California Water Code gives State courts the power to restrict ground-water pumping anywhere in California to prevent damage to ground-water sources, to date no magistrate has exercised this power in the valley--largely because valley residents do not favor governmental restriction. Rather than promote legal restraints on ground-water pumping, valley growers have responded to the continuing overdraft by stepping up artificial-recharge efforts and calling for additional surface supplies. Currently, the amounts of water available for artificial recharge are limited, unless additional facilities to import surface supplies are developed. If nothing is done, and water demands continue to spiral, the average annual overdraft could reach 3.6 million acre-ft by the year 2000. Combined with rising energy costs, the lowered ground-water levels resulting from this large-scale overdrafting may eventually force many farming operations out of business."

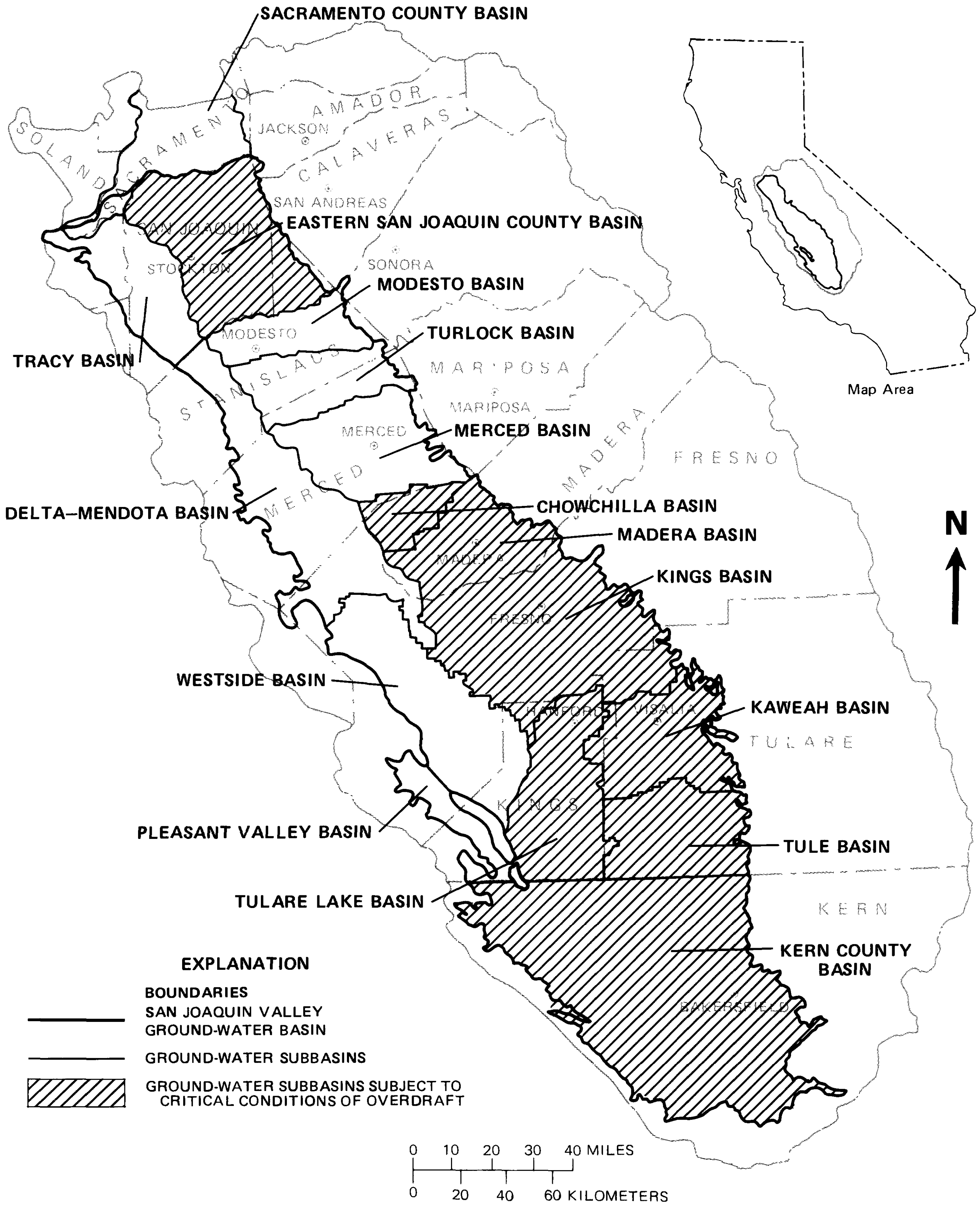


FIGURE 3. – Basins subject to critical conditions of overdraft (modified from California Department of Water Resources, 1980a, p. 39).

GEOHYDROLOGY

Geologic Units and Their Water-Bearing Character

Geologic units within the San Joaquin Valley ground-water basin can be divided into two general types, consolidated rocks and unconsolidated or semiconsolidated deposits. Consolidated rocks form the boundaries beneath and on the flanks of the productive ground-water reservoir in the unconsolidated deposits (Poland and Evenson, 1966, p. 241). The generalized geologic map (pl. 2) shows a distribution of the surface geologic units, by which one can see the complexity of the geologic environment in this basin. Compilation of the generalized stratigraphic units in the basin (table 2) indicates the vertical variation in geology and the water-bearing character of the various strata.

Geologic Structure

The conventional geographic divisions of the San Joaquin Valley are the Delta, the San Joaquin basin, and the Tulare Lake basin. Between the Delta and the San Joaquin basin, the division is usually made at the San Joaquin-Stanislaus County boundary, and between the San Joaquin and Tulare Lake basins the division is near the southernmost reach of the San Joaquin River, just north of Fresno. According to Mendenhall and others (1916, p. 21), the structural control of the drainage separation between the San Joaquin and Tulare Lake basins resulted from the growth of alluvial fans that dammed the valley. Subsequent studies have indicated that the Tulare Lake Bed (pl. 2) is probably the site of a structural downwarp and that active tectonic subsidence is the actual cause of the topographic depression of the Tulare Lake basin (Davis and Green, 1962, p. D89). Further division of the valley is usually made along political rather than structural boundaries, as are those currently used by the California Department of Water Resources (1980c).

The San Joaquin Valley is a structural downwarp between the tilted block of the Sierra Nevada on the east and the complexly folded and faulted Coast Ranges on the west (Davis and others, 1959, p. 2). The subsurface features of the San Joaquin Valley are intimately related to the geologic events in the adjoining mountains. The structurally downwarped geologic strata form a trough, which has filled with sediments to form the valley's aquifer systems. The generalized geologic sections (fig. 4) (Davis and others, 1959) indicate that the trough is asymmetrical. The axis of the trough is near the western edge of the basin, so that, although the thickness of the sediments is not fully known, the thickest parts probably lie nearer the western edge, as well.

TABLE 2.--Generalized Stratigraphic Units of the San Joaquin Valley Ground-Water Basin

[Geologic age after Page (1984, in press)]

Geologic age		Geologic unit (and map symbol on plate 2)	Thickness (feet)	General character	Water-bearing properties	Source
QUATERNARY	Holocene	Dune sand (Qs)	0-30	Well-sorted sand	Moderately permeable, above water table in most places	Davis and Hall (1958, p. 22); Page and LeBlanc (1969, p. 25)
QUATERNARY	Holocene	Alluvium and stream-channel deposits (Qr)	0-100, depth varies locally	Sand, silt, clay, and gravel	Highly to poorly permeable, varies locally	Page and LeBlanc (1969, p. 24); Page and Balding (1973, p. 13)
QUATERNARY	Holocene	Basin deposits (Qb)	0-50	Clay, silt, sand, and gravel	Moderately to poorly permeable	Hotchkiss and Balding (1971, p. 13)
TERTIARY AND QUATERNARY	Pliocene to Holocene	Lake deposits (QTl)	0-1,000	Silt, clay, and fine sand	Poorly permeable	Croft and Gordon (1968, p. 15)
TERTIARY AND QUATERNARY	Miocene to Holocene	Fan deposits (QTc)	0-1,000	Sand, silt, clay, and gravel	Highly to moderately permeable, major aquifers	Croft and Gordon (1968, p. 15)
TERTIARY AND QUATERNARY	Miocene to Holocene	Nonmarine terrace deposits (QTc)	0-120	Clay, silt, sand, and gravel	Highly permeable to permeable, generally above water table	Hotchkiss and Balding (1971, p. 13)
TERTIARY AND QUATERNARY	Miocene to Holocene	Pleistocene nonmarine deposits (QTc)	0-100	Clay, silt, sand, and gravel	Moderately to poorly permeable	Hotchkiss and Balding (1971, p. 13)
TERTIARY AND QUATERNARY	Miocene to Holocene	Pleistocene and Pliocene nonmarine deposits (QTc)	0-650	Poorly to well-sorted deposits of clay, silt, sand, and gravel	Highly permeable to impermeable	Hotchkiss and Balding (1971, p. 13)
TERTIARY	Miocene and Pliocene	Pliocene nonmarine deposits (Tcpm)	0-1,200	Unconsolidated and consolidated clay, silt, sand, and gravel	Highly permeable to impermeable, major aquifers	Hotchkiss and Balding (1971); Page and Balding (1973)
TERTIARY	Eocene, Oligocene, Miocene, and Pliocene	Tertiary marine rocks, undivided (Tm)	0-15,000	Consolidated and semiconsolidated sediments of marine origin	Generally low permeability, usually contain connate water	Wood and Davis (1959, p. 21 and pl. 1)

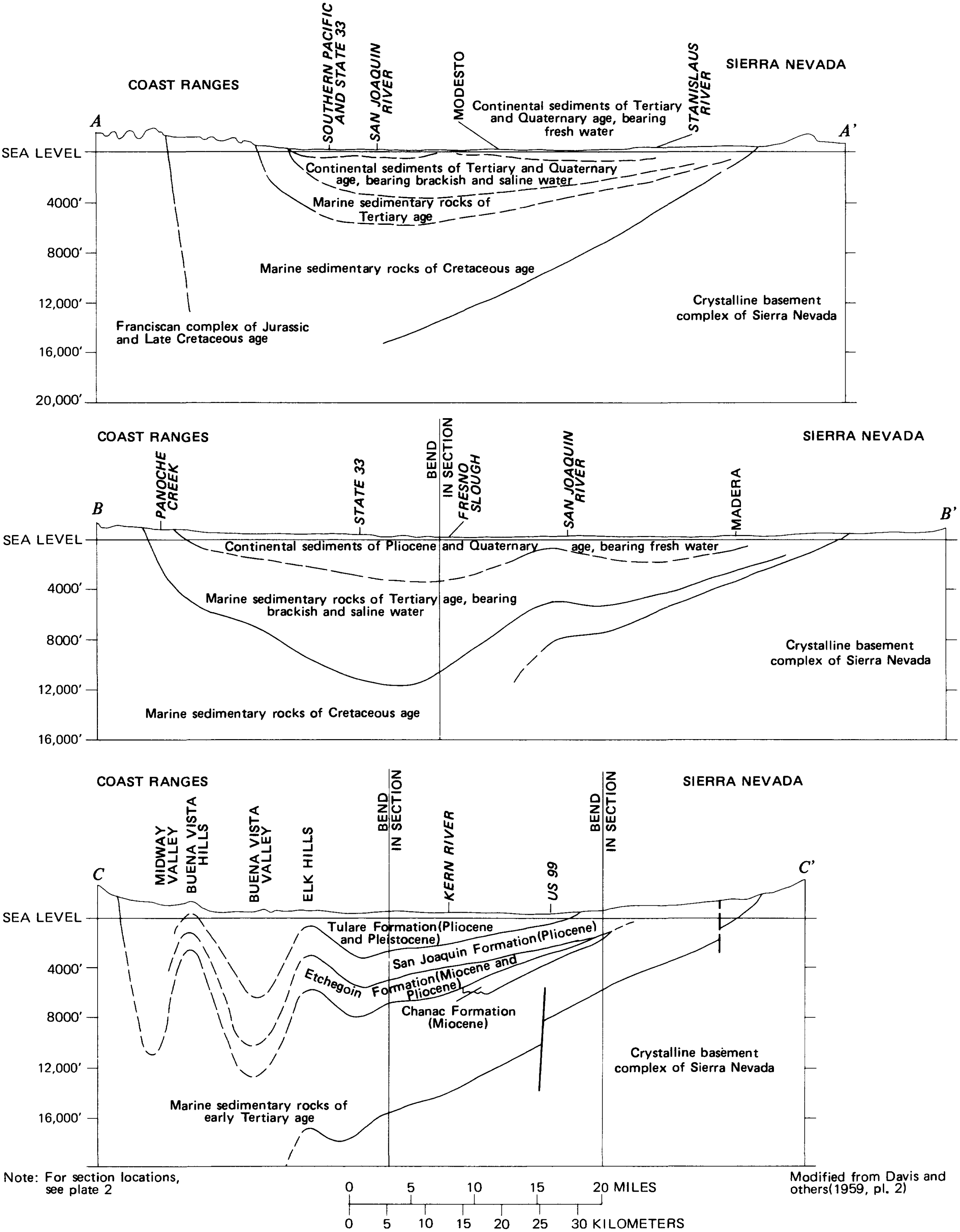


FIGURE 4. – Generalized geologic sections.

Arches (cross-valley anticlines), folds (anticline-syncline series trending in directions similar to the valley trough), and faults in the subsurface can also influence ground-water flow. Two arches (pl. 2) have been identified in the valley, the Stockton arch and the Bakersfield arch (Hackel, 1966, p. 224). In the vicinity of the Stockton arch, manmade disruptions of the normal ground-water flow paths overshadow any possible effects of the faulting or folding (California Department of Water Resources, 1967, p. 5). In the vicinity of the Bakersfield arch, however, three faults may affect ground-water movement (California Department of Water Resources, 1977a, p. 3). All the faults believed to restrict ground-water movement in the San Joaquin Valley are in Kern County (California Department of Water Resources, 1981b, p. 23) and are shown on plate 2. Ground-water movement is also restricted by three series of folds in Kern and southern Kings Counties (pl. 2). The generalized geologic sections (fig. 4) also give an overview of the variations in the subsurface geologic structure observed from the northern to the southern parts of the valley. Section C-C' (fig. 4) shows the folding along the west side and the faulting along the east side that have occurred in the southern part of the valley near Bakersfield. For more detailed discussion of the geomorphological history of the valley, the reader is referred to Hackel (1966) and Davis and others (1959). The sources listed in table 2 provide more detailed geologic sections. The inconsistencies of the stratigraphic nomenclature used by various authors of geologic reports for the valley are reflected in plate 2 and figures 4 and 5 of this report.

Ground Water

Occurrence

The heterogeneity of the sedimentary deposits in the San Joaquin Valley ground-water basin complicates the subsurface conditions. Croft's interpretation of conditions just south of Hanford (Croft, 1972, pl. 1) is an example of the interbedding of subsurface sediments (fig. 5). Local clay lenses, described by Page and LeBlanc (1969, p. 27) and Page and Balding (1973, p. 38), and the unknown integrity of confining beds also add to the complexity of the ground-water conditions within the basin.

The permeable subsurface of a ground-water basin is broadly divided into unsaturated and saturated zones. In the unsaturated zones, interstices between particles are occupied partly by water and partly by air, except during periods of recharge, when saturation may temporarily occur (Todd, 1980, p. 31). Water in these unsaturated zones can provide early warning of potential ground-water pollution from surface sources (Wilson, 1981, p. 32). Changes in the thickness of the unsaturated zone reflect the local response of a water table to recharge or discharge and the locations of confining layers.

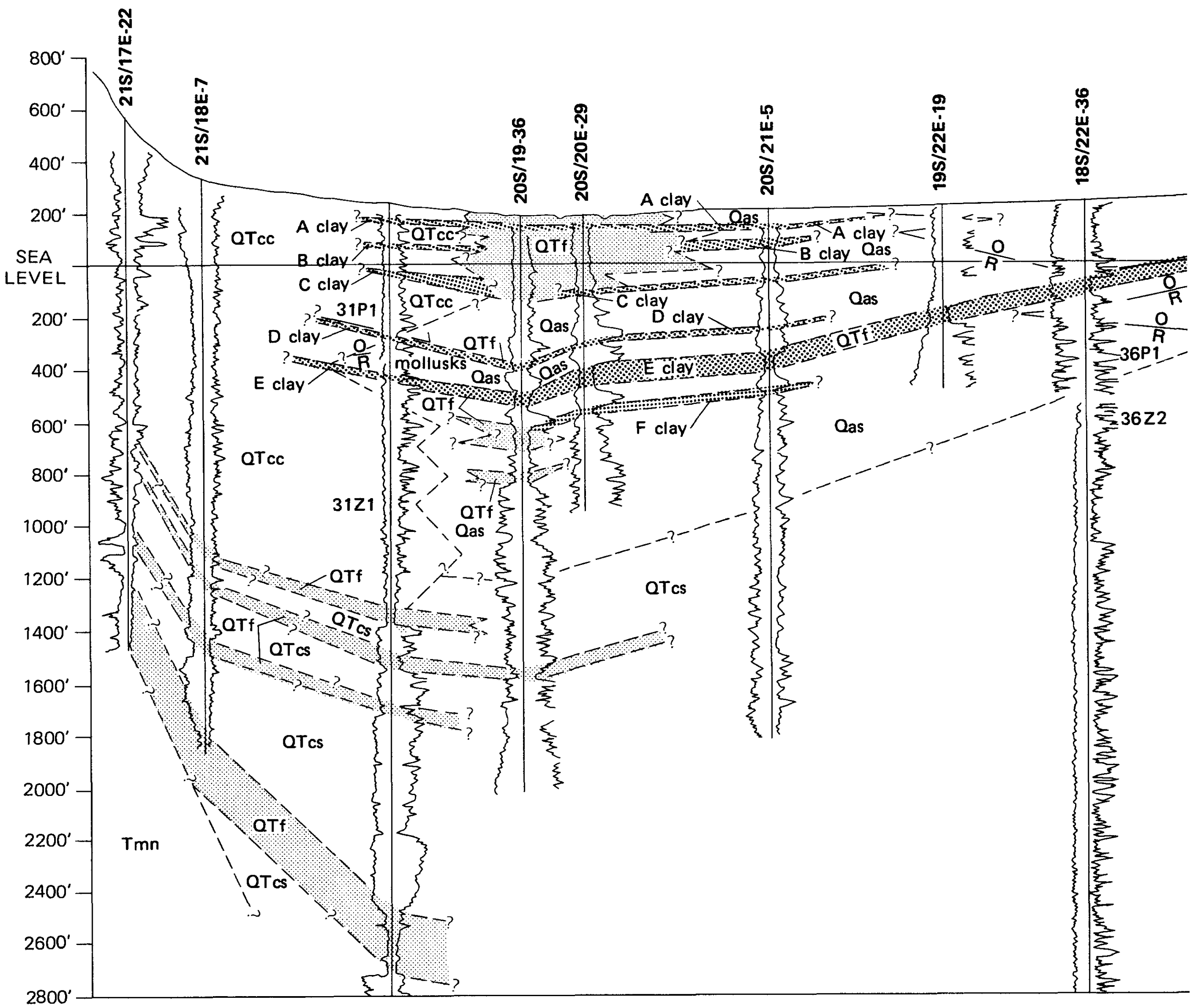
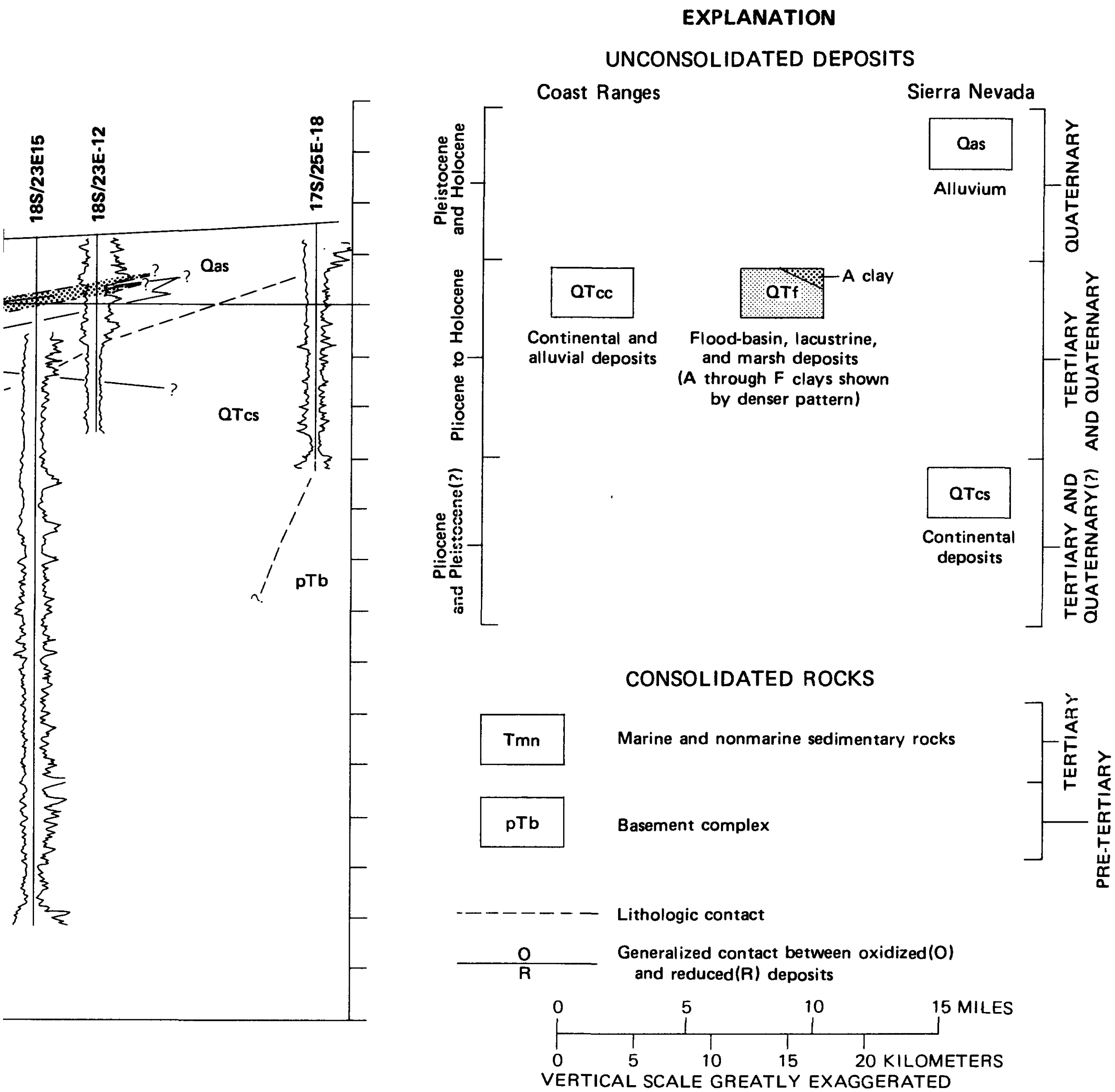


FIGURE 5. – Geologic section near Hanford,



California(modified from Croft, 1972, pl. 1).

In the saturated zone, perched aquifers are found regionally in the proximity of a shallow, fine-grained layer, which Croft (1972) called the A clay (Wilson and Schmidt, 1978, p. 138). Plates 3a, 3b, and 3c show the extent of the A clay, C clay, and E clay, respectively (Croft, 1972), and plate 4 shows the boundary of present and potential drainage problem areas in the San Joaquin Valley (California Department of Water Resources, 1977b). Perched or semiperched conditions may also exist locally in the vicinities of unmapped local clay lenses that create similar conditions. Perched zones are discussed in more detail in Piper and others (1939, p. 216), Croft and Gordon (1968, p. 22 and 36), Page and LeBlanc (1969, p. 28 and 41), Mitten and others (1970, p. 18 and 25), and Hotchkiss and Balding (1971, p. 47 and 69). Figure 5 shows the six confining layers suggested by Croft (1972, p. H17). In addition to the A clay, five other clay tongues (B through F) are shown. Croft did not map the B, D, and F clays because he felt that they were of limited extent and difficult to correlate consistently on electric logs. Within the boundaries of the various clay layers are semiconfined and confined aquifers that are a primary source of ground water. Outside these boundaries the aquifers are generally unconfined. The size of the San Joaquin Valley makes discussion of regional ground-water conditions difficult, as do the local variations of conditions caused by the differences in timing of sedimentary deposition. For discussions of the local occurrence of ground water in the basin, the reader is referred to the various area reports used as references throughout this report, especially in table 2. In the San Joaquin Valley, the approximate storage capacity of the underground reservoirs to a depth of 200 feet has been estimated as 100 million acre-ft (Davis and others, 1959, p. IV). The estimated storage to a depth of 1,000 feet is more than 570 million acre-ft, but the estimated usable storage capacity is about 80 million acre-ft because of limitations of water quality and cost of pumping (California Department of Water Resources, 1975, p. 65).

Recharge

The quality of water recharging the alluvial aquifers of the San Joaquin Valley is important to ground-water management and design of a water-quality monitoring network. According to Todd (1980, p. 16), "Principal sources of natural recharge include precipitation, streamflow, lakes, and reservoirs." Todd also identified two other types of recharge, incidental and artificial. Incidental recharge results from human activity not purposely related to artificial recharge of ground water. Examples of incidental recharge sources are irrigation, cesspools, septic tanks, leaky water mains, sewers, landfills, waste-disposal facilities, and canals. A variety of methods of intentional artificial recharge have been developed to augment the natural movement of surface water into underground formations, including water spreading, recharging through pits and wells, and pumping to induce recharge from surface-water bodies.

Recharge infiltration rates have been estimated for the San Joaquin Valley to range from less than 1.5 to about 3 ft/d by the California Region Framework Study Committee (1971, p. 205) and to range from 0.3 to 1.6 ft/d by Todd (1980, p. 461). These estimates diverge, but within a basin the size of the valley some areas are bound to be more receptive to recharge than others. In fact, Johnson and others (1968, p. A24) found that coefficients of vertical permeability (currently designated as hydraulic conductivity, K) for 205 samples from core holes ranged from 0.000009 to 49 ft/d in the Los Banos-Kettleman City area and for 138 samples ranged from 0.00003 to 87 ft/d in the Tulare-Wasco area.

Davis and others (1964, p. 27) delineated favorable areas for artificial recharge in the San Joaquin Valley, which include the larger alluvial fans in the vicinities of the Kern, San Joaquin, Kings, Merced, Tuolumne, and Stanislaus Rivers. They identified specific depth zones that might be more receptive, in the ranges of 10-50, 50-100, and 100-300 feet below land surface. Potential areas for artificial recharge in San Joaquin County are discussed in California Department of Water Resources (1967, p. 127) and Mitten (1982, p. 27). These areas are mainly located along the east side of the county in the vicinity of the Mokelumne and Calavaras Rivers. The average annual volume of intentional artificial recharge between 1966 and 1973 in the San Joaquin Valley was 1.3 million acre-ft (L. Dillingham, U.S. Bureau of Reclamation, oral commun., Sept. 1, 1982). Since 1973, those data are no longer being compiled (John Gostanian, California Department of Water Resources, oral commun., Sept. 1, 1982). However, the California Department of Water Resources (1977c, p. 10) found that much more emphasis should be given to the study and practice of artificial recharge in the San Joaquin Valley as well as to the quality and consistency of reporting methods.

Discharge

According to Davis and others (1964, p. 31), "Under natural conditions, ground-water discharge in the San Joaquin Valley occurred as seepage and evapotranspiration at the land surface near the low central part of the valley where it then moved toward areas of natural surface discharge." In the areas where ground water is shallow (pl. 4) evapotranspiration is still a source of ground-water discharge, but tile drains and dewatering wells are now used to help lower the water levels and provide artificial means of additional discharge (San Joaquin Valley Interagency Drainage Program, 1979, p. 3.4; and Page and Balding, 1973, p. 42). According to the California Department of Water Resources (1980b, p. 17), the streams in the Tulare subbasin lose water to rather than gain from the subsurface; consequently, seepage is not a significant source of ground-water discharge in that area. In the San Joaquin subbasin, however, considerable quantities of water probably seep into the San Joaquin River from the upper ground-water zone, especially during years of low streamflow (California Department of Water Resources, 1960, p. 41). Pumpage from wells is presently the chief form of ground-water discharge in the San Joaquin Valley. About 55 percent of the irrigation in the San Joaquin Valley currently is supplied from withdrawals of ground water, and nearly two-thirds of all ground-water withdrawals for the entire State occur in the San Joaquin Valley (Roots, 1978, p. 37). According to the California Department of Water Resources (1980a, p. 39), 8 of the 15 ground-water subareas identified in the San Joaquin Valley were subject to critical conditions of overdraft because of extensive pumping from wells (fig. 3).

Water Levels

Water levels and depths to ground water are very important to the design of ground-water-quality monitoring networks, for both conditions affect the quality of ground water. According to Schmidt (1977, p. 130), "Seasonal changes in quality have been documented for water from wells in areas of diffuse sources of pollution, such as agricultural-return flow and septic tanks. These changes are primarily due to significant changes in depth to water and vertical hydraulic-head gradient. Once the short-term and seasonal trends are established, the optimal sampling approach can be determined in order to establish long-term trends."

Many agencies measure water levels in the San Joaquin Valley. The California Department of Water Resources compiles the data and prepares the semiannual water-level maps for the area, which were used in plates 5a, 5b, and 5c. These maps are the best that are currently available, but their adequacy has been questioned in terms of the timing of seasonal measurements (A. K. Williamson, U.S. Geological Survey, Sacramento, Calif., oral commun., 1981) and the densities of the wells measured (John Gostanian, California Department of Water Resources, Fresno, Calif., oral commun., 1981). The questions arise because all wells in the valley do not reach their minimum and maximum water levels during the same months every year, as is observable in hydrographs from continuous water-level recorders available in Ireland and others (1982, p. 97-128); yet water levels are routinely measured during the same spring and autumn months semiannually. Also, for large areas, water levels are measured only during the spring, so that, during autumn periods of low water levels, wells are too sparse to contour the water levels accurately. Plate 5b shows the water levels measured in wells tapping the confined aquifer during the spring of 1980, whereas plate 5c shows only the levels for wells in the confined aquifer in Kern County because not enough wells are monitored in the autumn to construct a water-level contour map for the rest of the basin (mainly in the Westlands Water District, west of Fresno).

Depth to water

Depth to ground water in the San Joaquin Valley alluvial aquifers is important because of the potential for rapid influence on ground-water quality by man's activities at the land surface. The depth to ground water varies greatly within the San Joaquin Valley ground-water basin because depth to ground water is related to the local occurrence of various subsurface strata and surface topography. According to the California Region Framework Study Committee (1971, p. 205), "The minimum measured depth to ground water was 2 feet and the maximum was 842 feet." Plate 4 shows the boundary of the present and potential drainage problem areas where depth to the perched (shallow) water table ranges from 0 to 20 feet. Plates 5a and 5c show the water-level contours for the unconfined aquifer for the spring and autumn of 1980, respectively, to indicate some of the seasonal fluctuations in the valley during that year.

Depths to ground water in the unconfined aquifer can be obtained from plates 5a and 5c by subtracting the altitude of the water level from the altitude of the ground surface at the points where the water-level contours and the land-surface contours intersect. If the same process is used on the water-level contours of the confined aquifer (pl. 5b and in Kern County part of pl. 5c) the resultant depth is to the potentiometric surface in those wells and not the actual depth to the water in the confined aquifer. Maps showing the potentiometric surface are actually maps of the hydraulic head in confined aquifers (Freeze and Cherry, 1979, p. 49), and their contours are of an imaginary surface indicating the variation in head pressure within a confined aquifer. An important reason for mapping potentiometric surfaces is to determine direction of flow in ground water under confined conditions, provided that flow under those conditions occurs from high to low head. Depths to ground water for the San Joaquin Valley basin can also be obtained from periodically published maps showing lines of equal depth to water in wells. The most recent map of this type, which was published by the California Department of Water Resources (1981a) for spring 1981, shows depths within 5 feet of land surface near Gustine in Merced County and more than 700 feet below land surface south of the White Wolf fault (pl. 2) in Kern County.

Seasonal fluctuations

For the water levels of the San Joaquin Valley ground-water basin, the degree and timing of seasonal fluctuations vary, depending on the specific geographic area of concern, as is shown by the California Department of Water Resources (1980g, pl. 2). Davis and others (1959, p. 4) discussed seasonal and long-term trends in ground-water levels by dividing the San Joaquin Valley into eight geographic regions:

> "In the northeastern part of the valley * * * seasonal fluctuations of water level register a general rise of the water table owing to heavy applications of irrigation water in late spring and early summer and a decline in autumn as irrigation decreases. In the east-central part of the valley * * * substantial seasonal fluctuations of water level occur as the ground-water storage is replenished when surface water becomes available for recharge, and later is depleted by pumping. Long-term trends of water level generally agree with long-term trends in runoff. In the southeastern part of the valley * * * water levels fluctuate in response to ground-water withdrawals. The water table declines rapidly in late spring and summer and recovers as pumping ceases late in autumn. In recent years, imports of surface water through the Friant-Kern Canal have supplied additional recharge to the ground-water reservoirs locally and have caused a reduction in pumping draft, thereby reversing the trend toward depletion. In the alluvial fan of the Kern River * * * seasonal fluctuations of water level register changes in ground-water storage in response to variations in the runoff of the Kern River. In the southern fringe of the valley * * * withdrawals greatly exceed the total replenishment, and water levels have declined steadily as ground-water storage was depleted. Seasonal fluctuations in water level register variations in pumping demand, but the long-term water-level trend has been downward. The southwest part of the valley is a desert, largely uncultivated and used chiefly for grazing. The west-central part of the valley constitutes an area of heavy overdraft. Water levels in the confined aquifers have been drawn down rapidly in response to this heavy overdraft. The seasonal fluctuations register variations in pumping of ground water, but the year-to-year trends have been consistently downward. In the northwestern area * * * water levels stand near the land surface because surface water supplies are generally more than adequate. Both seasonal and long-term fluctuations are small." [Emphases added.]

Subsequent to Davis and others (1959), a series of area reports was written by various authors to cover the various regions in more detail, and more water distribution systems were installed to transport water into and out of the valley. The findings of these reports and the effects of the water-distribution systems are briefly addressed in the following section on historical trends.

Historical trends

Northeastern area.--Early historical trends of water levels in the northern part of the northeastern part of the San Joaquin Valley are discussed in Stearns and others (1930) and Piper and others (1939). A map showing lines of equal change in altitude of ground-water surface between autumn 1950 and autumn 1964 (California Department of Water Resources, 1967, p. 78) indicates that water levels decreased as much as 65 feet in a pumping depression east of Stockton; this depression was still present in 1980 (pl. 5a and 5c). During this period water levels generally declined in the whole eastern part of San Joaquin County. A similar map (pl. 6) by the California Department of Water Resources (1980h) shows the difference in water levels for most of the San Joaquin Valley ground-water basin between spring 1965 and spring 1980. Plate 6 also shows that water levels in the unconfined zone declined as much as 50 feet in an area southwest of Fresno and rose as much as 30 feet near Lindsay in eastern Tulare County. Changes in the confined zone ranging from a decline of 80 feet in north-central Kern County to a rise of 200 feet near Huron in southwestern Fresno County are also noticeable on plate 6. Page and Balding (1973, p. 42) agreed with Davis and others (1959) that ground water is seldom used for irrigation in the Stanislaus and Merced County parts of the northeastern part of the valley, except during dry years. Page and Balding (1973) also described the use of intentional dewatering to lower water levels in the unconfined water body. They mentioned a pumping depression that existed near El Nido, which also appears on the water level maps for spring and autumn of 1980 (pl. 5a and 5c) where subsidence due to ground-water withdrawal was reported. Water levels in the confined water body of this area fluctuate seasonally with heavy irrigation pumping during spring and summer and with decreased pumpage during autumn and winter.

An overview of the historical trends observed in the southern two-thirds of the San Joaquin Valley is presented in California Department of Water Resources (1980g, pl. 2), which shows water profiles in 1921, 1951, and 1979.

East central area.--Water-level hydrographs for the entire east-central part of the valley are presented in Roots (1978, pl. 17-34) with a map showing depth to ground water in spring of 1976. Mitten and others (1970, p. 25) described the water-level fluctuations in the Madera County part of the area as both seasonal and annual. The seasonal fluctuations were as great as 40 feet; annual fluctuations ranged from 14 to 30 feet. Since 1906, water levels had declined from 40 to 55 feet in some unconfined water bodies in the area. Page and LeBlanc (1969, p. 39 and 41) said that water levels in the Fresno area fluctuated seasonally from 3 to 44 feet in the unconfined water body, nearly parallel to confined water-body seasonal fluctuations. They mentioned that water-level fluctuations near Orange Cove had decreased since 1949, following an increase in surface-water deliveries, but the seasonal fluctuations in the perennial pumping depression near Fresno had increased from 6 feet prior to 1949 to 10 feet or more after 1949. Water levels for spring and autumn 1980 (pl. 5a and 5c) do not indicate much seasonal variation in the Fresno area, but plate 6 shows water-level declines of 10 to 15 feet in the same area between 1965 and 1980. Seasonal fluctuations between 30 and 70 feet for the confined water bodies in western Fresno County were described by Page and LeBlanc (1969, p. 41).

Southeastern area.--Croft and Gordon (1968) and Lofgren and Klausing (1969) mentioned that water levels vary greatly, depending on the areas of pumpage and applications of surface water from imported sources. Some wells in the unconfined water bodies have shown water-level fluctuations of up to 40 feet, whereas other wells in confined water bodies have had water-level fluctuations of more than 130 feet. Croft and Gordon (1968, pl. 11) and the water-level maps for 1980 included in the present report (pl. 5a and 5c) show pumping depressions northeast of Ivanhoe and southwest of Lindsay in Tulare County. Subsequent to the delivery of canal water to the area in 1951, rises in water levels approached 140 feet, and the cone of depression in the Lindsay area migrated westward from its former center (Croft and Gordon, 1968, p. 40). Greater differences were noted in the depth of water and the magnitude of seasonal water-level fluctuations in the confined aquifer system than in the semiconfined aquifer system, termed the "principal pumped zone" and the "shallow zone," respectively, by Hilton and others (1963, p. 89-105). Water-level fluctuations in the semiconfined "shallow zone" of this area were described as "considerably irregular." Their hydrographs for some wells showed very little change in 8 years and for others showed over 60 feet of change yearly. They mentioned that, prior to the importation of surface water, seasonal water-level fluctuations in the "principal pumped zone" ranged from static conditions to greater than 100 feet. They also reported that, as the importation of water via the Friant-Kern Canal began, the water level in some wells started to rise, while in others it continued to decline. A water-level mound that they identified just north of Delano was also present in 1980 (pl. 5a, 5b, and 5c), but between spring 1965 and spring 1980 a water-level decline of 20 feet was noted in that area (pl. 6). The area between Delano and Pixley has experienced up to 12 feet of subsidence due to water-level decline between 1926 and 1970 (Ireland and others, 1982, fig. 25).

Kern River fan area.--Dale and others (1966, p. 50-59), Core (1980, p. 20-23 and 25-31), and Arvin-Edison Water Storage District (1979, p. 15-19) reported that seasonal and annual fluctuations up to 80 feet are common in the Kern River fan area, and ground-water recharge operations are raising water levels in this area. Pumping depressions northwest of Oildale and west of Wasco, which were identified by Dale and others (1966, p. 59), are noticeable on the 1980 water-level maps (pl. 5a, 5b, and 5c).

Southern fringe area.--Wood and Dale (1964, p. 54-77), Lofgren (1975, p. D19-D24), and Arvin-Edison Water Storage District (1979) reported pumping depressions and seasonal water-level fluctuations of 13 to 25 feet in the Edison area. The Edison fault (pl. 2) creates an offset (vertical displacement) of about 300 feet in the surface of the main ground-water body and impedes southward movement of water. South of the White Wolf fault (pl. 2) seasonal water-level fluctuations of about 80 feet have been reported (Wood and Dale, 1964, p. 70-71). Hydrographs provided in a report by Arvin-Edison Water Storage District (1979, p. 18-19) confirm continued similar fluctuations in those two areas. Lofgren (1975, pl. 4) reported that between 1926 and 1970 land subsidence associated with water-level declines had ranged from 1 foot in the area south of Edison to 9 feet near Mettler. According to Ireland and others (1982, p. 13 and fig. 31) some residual compaction has continued, even though water levels have risen more than 150 feet. In the western part of the southern fringe area, two pumping depressions are shown by Wood and Dale (1964, pl. 5) that do not appear on the 1980 California Department of Water Resources water-level maps (pl. 5a, 5b, and 5c). One pumping depression does appear in Core (1980, pl. 2) near San Emigdio Creek (T32S/R26E); the minimum water surface of the depression is about 80 feet higher than in 1964. The California Aqueduct now runs through this area and probably influences the local ground-water levels. A map showing depths to water for most of the Kern County part of the San Joaquin Valley ground-water basin is included in Core (1980, pl. 1) and in the maps of the depths to ground water in the San Joaquin Valley done by the California Department of Water Resources in 1981; these maps are useful in establishing monitoring of ground-water quality in this area.

Southwestern area.--Ground-water level conditions are discussed in Wood and Davis (1959) and Core (1980), but the information on ground-water fluctuations is limited by the small number of wells in the area. Ground-water data for the Antelope Plain and Kettleman Plain areas are almost nonexistent; plates 5a, 5b, and 5c do not show water-level contours for much of these areas. Wood and Davis (1959, p. 29-47) provide the best available description of the trends and fluctuations for water levels in the area. They mentioned one pumping depression near the mouth of Antelope Valley (T26S/R18E). They also found that the ground-water gradients in the Antelope and McLure Valleys are about five times steeper than in the Kettleman Plain and the remainder of their study area between Avenal and McKittrick. Another pumping depression near the mouth of McLure Valley (T25S/R18E) probably prevented ground-water flow out of that valley. Water levels in that area were described as declining, and recovery in the nonpumping season was negligible. A pumping depression between Kettleman Plain and Antelope Plain near Devils Den (T25S/R19E) was expected to continue to control water-level conditions in that vicinity. Basing their judgment on data available since 1936, Wood and Davis (1959, p. 34) reported a marked decline of more than 100 feet in the water levels of the southern Kettleman Plain area. In central Kettleman Plain (T23S/R18E), declines of more than 40 feet between 1910 and 1928 were noted, and by 1955 recovery was about 10 feet short of the 1910 levels. South of Kettleman City near the Avenal Gap, the water quality was reportedly so poor that wells were not being used much, and water-level fluctuations were less than 2 feet.

West-central area.--Ground water in the Coalinga area (Pleasant Valley) is such poor quality that it is not used for human consumption and rarely for agriculture; consequently, water-level information is scarce. Davis and Poland (1957, p. 466) reported that ground water in the area occurs in an unconfined aquifer and that water levels had declined nearly 90 feet between 1905 and 1957. Ground water in the rest of this area is usually discussed in terms of upper and lower zones, separated by the Pleistocene Corcoran Clay Member of the Tulare Formation. According to Davis and Poland (1957, p. 433), "Water in the upper zone is in part confined and in part unconfined, but there is sufficient separation of aquifers within the upper zone that water stands at different levels in wells of different depth." They also reported that static water levels in wells tapping the lower part of the upper zone were from 10 to 115 feet deeper than the water table, and that heavy irrigation pumping near Five Points had caused a steep westward water-level gradient in the opposite direction from the slope of the regional water table. The lower zone supplies about three-fourths of the ground water for irrigation in this area (Bull and Miller, 1975, p. E19). An elongated pumping depression in the lower zone, mentioned by Davis and Poland (1957, p. 435), extends from north of Mendota to south of Huron and correlates well with the region of maximum (more than 28 feet) land subsidence that Ireland and others (1982, p. 8) have identified in the San Joaquin Valley. Importation of surface water in the late 1960's and 1970's significantly reduced the subsidence rate in this area, but the drought of 1976-77, attended by increased pumping, resulted in renewed subsidence (Ireland and others, 1982, p. 5).

Besides being the chief area of land subsidence in the San Joaquin Valley, the west-central area contains part of the present and potential drainage problem area, which extends throughout most of the length of the valley's axial trough (pl. 4). The complexity of the ground-water conditions in this area exemplifies some of the conditions that can be typical of areas in the San Joaquin Valley ground-water basin.

Northwestern area.--Ground-water level conditions in the area north of Union Island and west of Stockton in the Delta area are almost unknown. Wells are sparce, but Keeter (1980) included several in this area in her ground-water-quality sampling. The California Department of Water Resources (1967, p. 103-105) and Sorenson (1981) discussed the quality of ground water in this area of more than 500 mi^2, but water levels and subsurface confinement have apparently not been studied in much detail. Hotchkiss (1972) reported on the subsurface geology of the water-bearing deposits of the northern San Joaquin Valley, but his study went only as far north as Union Island. Hotchkiss and Balding (1971, p. 65-69) discussed the ground-water level conditions of three water-bearing zones between Tracy and Dos Palos in terms of relative depth: shallow, upper, and lower zones. In Hotchkiss and Balding's report, the contours of the depth to the shallow water-bearing zone look much like those in plate 4 of the present report, and water levels at that time were as shallow as 0.4 foot below land surface. The bottom of the shallow zone, between 5 and 25 feet below land surface, was used to approximate the top of the upper zone. Seasonal fluctuations of water levels in the upper zone were generally less than 20 feet. Low water levels are common during December in upper-zone wells of the rangeland-wetlands areas (pl. 1), where water is used by hunting clubs during waterfowl season, whereas lows in the lower zone are normally in August or September because of agricultural demand. Seasonal water-level fluctuations in the lower zones commonly exceed 60 feet but are usually about 20 feet. Long-term decline of water levels occurred prior to the completion of the Delta-Mendota Canal in 1951. Since then, pumping overdraft of the lower zone has reportedly ceased, and water levels in the upper zone rose as much as 50 feet by 1967. Water-level changes between measurements made in 1965 and 1980 are shown on plate 6. Water-level rises of up to 10 feet are indicated for this area. The California Department of Water Resources (1981a) reported that depths to water in this area range from 10 to 20 feet near the San Joaquin River on the east to more than 100 feet on the west near the California Aqueduct and the Delta-Mendota Canal.

Direction of Movement

The design of monitoring networks must be based on knowledge of the rate and direction of water movement (Pickering and Ficke, 1975). In laboratory tests of core-hole samples taken from sites in the Los Banos-Kettleman City and Tulare-Wasco areas, Johnson and others (1968, p. A24) determined values for coefficients of vertical and horizontal permeability (currently designated hydraulic conductivities, K). In the Los Banos-Kettleman City area, vertical hydraulic conductivities for 62 paired samples ranged from 0.00003 to 35 ft/d, and horizontal hydraulic conductivities ranged from 0.00003 to 44 ft/d. In the Tulare-Wasco area, vertical hydraulic conductivities for 138 samples ranged from 0.00003 to 87 ft/d, and horizontal hydraulic conductivities for 79 samples ranged from 0.00004 to 8.2 ft/d. The rate of ground-water movement is therefore very site specific. There are also other variables in contaminant movement because of dispersion diffusion, and concentration-gradient phenomena.

According to Davis and others (1959, p. 124), "Ground water moves in the direction of the hydraulic gradient, perpendicular to the water-level contours, from areas of recharge (indicated by ridges or mounds on the water surface) to areas of discharge (indicated by depressions in the water surface)." Review of the water-level maps provided in the Davis report and in the semiannual reports of the California Department of Water Resources (similar to plates 5a, 5b, and 5c) indicates the direction of movement that ground water in the San Joaquin Valley has taken historically. However, the rule that ground water moves parallel to the hydraulic gradient and perpendicular to the water-level contours holds true only in homogeneous, isotropic conditions (Fetter, 1981, p. 28), which is rarely the case, particularly for undisturbed, unconsolidated alluvial materials (Todd, 1980, p. 78) like those found in the San Joaquin ground-water basin. In the absence of more complete information, such rules are often used to provide "reasonable approximations."

The concept of potentiometric surfaces in confined aquifers presents a similar problem. The plotting of water levels in wells perforated only in confined aquifers shows hydraulic-head variations that can approximate the general flow of water in those aquifers, provided that flow occurs from high to low head. The concept is rigorously valid, however, only for horizontal flow in horizontal aquifers. If there are vertical components of flow, as there usually are, calculations and interpretations based on this type of potentiometric surface can be grossly misleading (Freeze and Cherry, 1979, p. 49). Although such simplifying assumptions do not exactly represent the real conditions in the system, they do represent the concept of the hydrologic process described in mathematical models (Londquist, 1981, p. 6), and they are firmly entrenched in usage.

Davis and others (1964, p. 15-17) presented a historical overview of the movement of ground water in the San Joaquin Valley. They stated in part:

> "Under natural conditions, the unconfined and semiconfined ground water in the San Joaquin Valley moved from recharge areas along the sides of the valley toward topographically low central areas where it was discharged at the land surface or was consumed by plants. * * * Little information is available on the hydraulic gradient in the principal confined aquifer during early development, but it is presumed that the water moved slowly toward the center of the valley and then northward in the direction of the Sacramento-San Joaquin Delta. The artesian head in the confined aquifer was sufficient to raise the water level above the land surface in wells tapping that aquifer beneath much of the central part of the valley. * * * Some water, therefore, must have moved upward through the confining clay bed in the central area. The diversion of surface water from the streams and the development of ground-water supplies for irrigation have lowered the water level, changed the hydraulic gradient, and in some places the direction of movement of the ground water. Water-level contours in the spring of 1952 show that ground water in the unconfined and semiconfined aquifers at that time was moving chiefly from areas irrigated by surface water to areas of discharge, chiefly areas of heavy irrigation pumpage, and to natural drains in the areas of heavy application of surface water. Movement of the water in the confined deposits was toward areas of heavy pumpage of ground water, which are now the principal zones of discharge."

Ground-water movement in the San Joaquin Valley is closely related to the pumping rates in the areas of primary use of ground water. The amount of annual ground-water pumpage required for agriculture depends on surface-water availability. Water levels also fluctuate seasonally, and their associated hydraulic gradients increase and decrease in response. In urban areas that consistently depend on ground water, water levels are probably more consistent.

The effects of stratigraphic folds and faults on water levels are in some cases apparent on the water-level maps (pl. 5a, 5b, and 5c). On plate 5a, the effects of the White Wolf fault are especially noticeable as an offset of about 100 feet in water levels southeast of Bakersfield. In other areas, the effects are not as obvious, because of either actual conditions or data inadequacies.

In design of the ideal ground-water-quality monitoring network, much more detail on the local movement of ground water is needed. The reader is referred to the various area reports, referenced throughout this report, to obtain the most detailed information now available on direction of ground-water movement. The interested reader may find, however, that details on direction and rate-of-movement information on ground water in the San Joaquin Valley varies significantly with the specific geographical area of interest. Regional information on this subject may soon improve with the completion of two ground-water models, one by the California Department of Water Resources (1980b) for the study area outside of San Joaquin County and one by the U.S. Geological Survey for the entire Central Valley (Bertoldi, 1979). Factors affecting movement of pollutants are discussed in detail by Wilson (1983) and in the list of references that he cites. Of special note is that specific pollutants may flow at a rate that is less than, equal to, or greater than the water-flow rate. Pollutant transport entails much more than ground-water movement alone, and this problem deserves closer study at the local level.

WATER QUALITY

Surface Water

Water in streams flowing from the Sierra Nevada, the Tehachapi Mountains, and the Coast Ranges differs markedly both in total concentration of dissolved matter and in the relative abundance of various constituents (Davis and others, 1959, p. 168). Davis and others (1959, p. 5) summarized the natural water quality of the streams that drain into the San Joaquin Valley ground-water basin as follows:

> "The streams of the east side of the valley drain areas of heavy precipitation in the Sierra Nevada, which are underlain by relatively insoluble igneous and metamorphic rocks of pre-Tertiary age. The waters, accordingly, are of low mineral content and are characteristically bicarbonate waters of the calcium or calcium-sodium type. By contrast, the streams of the south end and west side of the valley drain areas of low precipitation in the Coast

Ranges which are underlain chiefly by marine sediments of Tertiary and Cretaceous age and, in the north, by sedimentary, igneous, and metamorphic rocks of the Franciscan Formation [currently designated Franciscan Complex] of Jurassic to Late Cretaceous age. The stream waters have higher concentrations of mineral matter than do the streams of the Sierra Nevada. Streams that drain extensive areas of Tertiary sediments generally carry sulfate water of the calcium or sodium type. Streams that drain Cretaceous sediments and rocks of the Franciscan Formation generally carry bicarbonate water of intermediate cation composition."

Examples of the chemical quality of tributary streams and ground waters in the San Joaquin Valley, shown in figure 6 in pie diagrams taken from Davis and others (1959, plate 24) and on plates 7a, 7b, 7c, and 7d of the present report, indicate some of the water-quality variations in the basin. Imported water comes primarily from the Sacramento River drainage via the California Aqueduct and the Delta-Mendota Canal from a pumping plant north of Tracy. The quality of California Aqueduct water is sampled each month at numerous locations, and the results are published in the monthly State Water Project operation report (Groundwater Pollutant Study Review Committee, 1982, p. 3-11). Periodic sampling of the quality of both the imported water and the local sources of surface and ground water is important in detecting possible differences, especially where imported water may be of a lower quality than that of the ground-water body subject to incidental or intentional artificial recharge. Objectives for water-quality indicators and specific constituents in the inland surface waters are described in detail in the State Board's water-quality control-plan reports (California State Water Resources Control Board, 1975a, p. 1-4-1 to 1-4-17; 1975b, p. 1-4-5 to 1-4-11). A complete review of all the areas in the San Joaquin Valley where excessive concentrations of individual constituents exist for all possible uses of surface water is beyond the scope of the present report, but some of the areas discussed in the previously cited reports are reviewed.

In the northwestern part of the San Joaquin Valley near Antioch, surface waters are used during part of the year for municipal purposes, but during periods of low Delta outflow these supplies cannot be used because of saltwater "incursion" (California State Water Resources Control Board, 1975a, p. 1-5-54). Some point-source dischargers to surface water are of concern in this area (pl. 8), as are the potential problems that may be associated with the location of the discharge point of the San Luis Drain, which is planned to remove agricultural-return water from present and potential drainage problem areas (pl. 4).

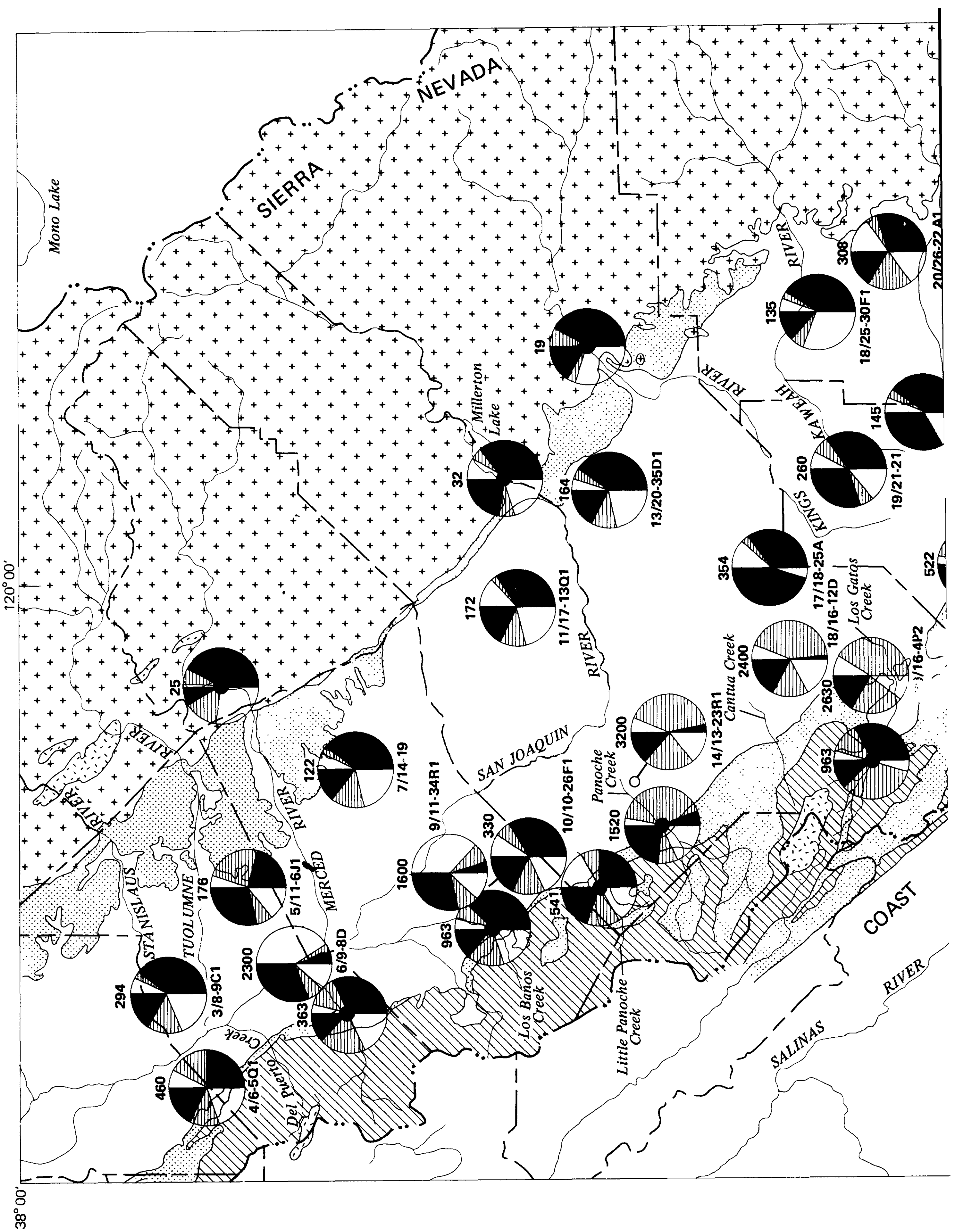
The water quality in the lower San Joaquin River ranks first on the list of severe pollution problems mentioned in California State Water Resources Control Board (1975a, p. 2-15-76). The problems in the San Joaquin River include high dissolved-solids concentrations, salinity, and agricultural-chemical content. Other low-quality surface waters listed in the report by the California State Water Resources Control Board (1975a) for the northern San Joaquin Valley are the Fourteen Mile Slough near Stockton and the Mokelumne River east of Lodi (locations on plate 8). The Fourteen Mile Slough is noted for its dissolved-oxygen and nutrients content from municipal dischargers in the area, and the Mokelumne River is noted for its pH and heavy-metal content from mine drainages in the vicinity of Lockeford and Clements.

For the Tulare Lake (southern) part of the San Joaquin Valley, the California State Water Resources Control Board (1975b, p. 2-15-175) ranked the Kaweah River below Terminus Dam (Lake Kaweah, pl. 8) high on the list of most polluted surface water because of excessive coliform bacteria from septic tanks. Sedimentation and turbidity in rivers of the southern Sierra Nevada, resulting from sluicing of silt from reservoirs, threatens the use of this water for municipal supplies, fish-spawning areas, and ground-water recharge. The streams with the most problems, in decreasing order of severity, are the Kings, Kern, Kaweah, and Tule Rivers. The lower reaches of the Kings River from Laton to the Tulare Lake bed are described as having water of poor quality because of high ground water, agricultural drainage, and low summer flows. Poso Creek, which is north of Oildale in Kern County, and some of the westside streams have historically high discharges of oilfield wastewater containing unacceptable levels of salinity and boron. Most of the lower reaches of the smaller creeks, sloughs, and bayous are described as recepticles for such sources of contamination as community wastewater, storm drainage, agricultural wastewater, and industrial wastewater (California State Water Resources Control Board, 1975b, p. 2-15-169 to 2-15-173).

Ground Water

The California Department of Water Resources (1965, pl. E-3) mapped ground-water types found in the San Joaquin Valley for most areas south of the Stanislaus River, and Sorenson (1981, figs. 2 and 3) mapped the area north of the Stanislaus River. Like the surface water, the ground water of the east side of the valley is characteristically bicarbonate water of the calcium, calcium-sodium, or calcium-magnesium type. Exceptions are sodium chloride water near Waterford in Stanislaus County and sulfate and chloride water north of Oildale in Kern County. On the west side of the valley is predominantly sulfate or chloride ground water of the sodium, magnesium, or calcium type.

Information on changes in ground-water types is not available for the entire valley. Since soil amendments and other agricultural chemicals have been applied in large quantities, sampling would be worthwhile to determine changes in water types and to distinguish water types in the various aquifers. In one 1,350 mi^2 area on the west side of Fresno County, Bertoldi (1971) constructed ionic concentration maps for the unconfined and confined aquifers based on water-quality data obtained in two different periods. The results of the study indicated that, except for some local decreases in sulfate concentrations in the unconfined aquifer and local increases in boron in both the unconfined and confined aquifers, general inorganic water quality remained the same in both aquifers. Fogelman (1982) attempted to separate by aquifer the wells for the San Joaquin Valley in the water-quality file of the Geological Survey, but he found that data were insufficient for mapping ground-water types. Determining which aquifer furnishes water to particular wells in the San Joaquin Valley can be a difficult and time-consuming task, as shown in Davis and Hall (1959, p. 31-34), and as became apparent during preparation of the 1980 inventory of active ground-water-quality monitoring networks presented in Glass and others (1981). Recently, it has been suggested that information in other computer files on ground-water quality, such as the California Department of Water Resources' WDIS file and the U.S. Environmental Protection Agency's STORET file, should be used to analyze trends in ground-water quality (T. J. Durbin, U.S. Geological Survey, Sacramento, Calif., written commun., 1982). The results' validity is of great concern, considering the limitations discussed earlier in this report and in Fogelman (1982, p. 4), but until such results are analyzed only speculations can be made.



Mono Lake
SIERRA
NEVADA
Millerton Lake
SAN JOAQUIN
RIVER
STANISLAUS
RIVER
TUOLUMNE
RIVER
MERCED
RIVER
Del Puerto
Creek
Los Banos Creek
Little Panoche Creek
Panoche Creek
Cantua Creek
Los Gatos Creek
KINGS
RIVER
KAWEAH
RIVER
COAST
SALINAS
RIVER
120°00'
38°00'
294
3/8-9C1
460
4/6-5Q1
2300
6/9-8D
363
176
5/11-6J1
25
122
7/14-19
1600
9/11-34R1
963
330
10/10-26F1
541
1520
3200
14/13-23R1
172
11/17-13Q1
32
164
13/20-35D1
19
354
17/18-25A
2400
18/16-12D
2630
963
260
19/21-21
145
135
18/25-30F1
308
522

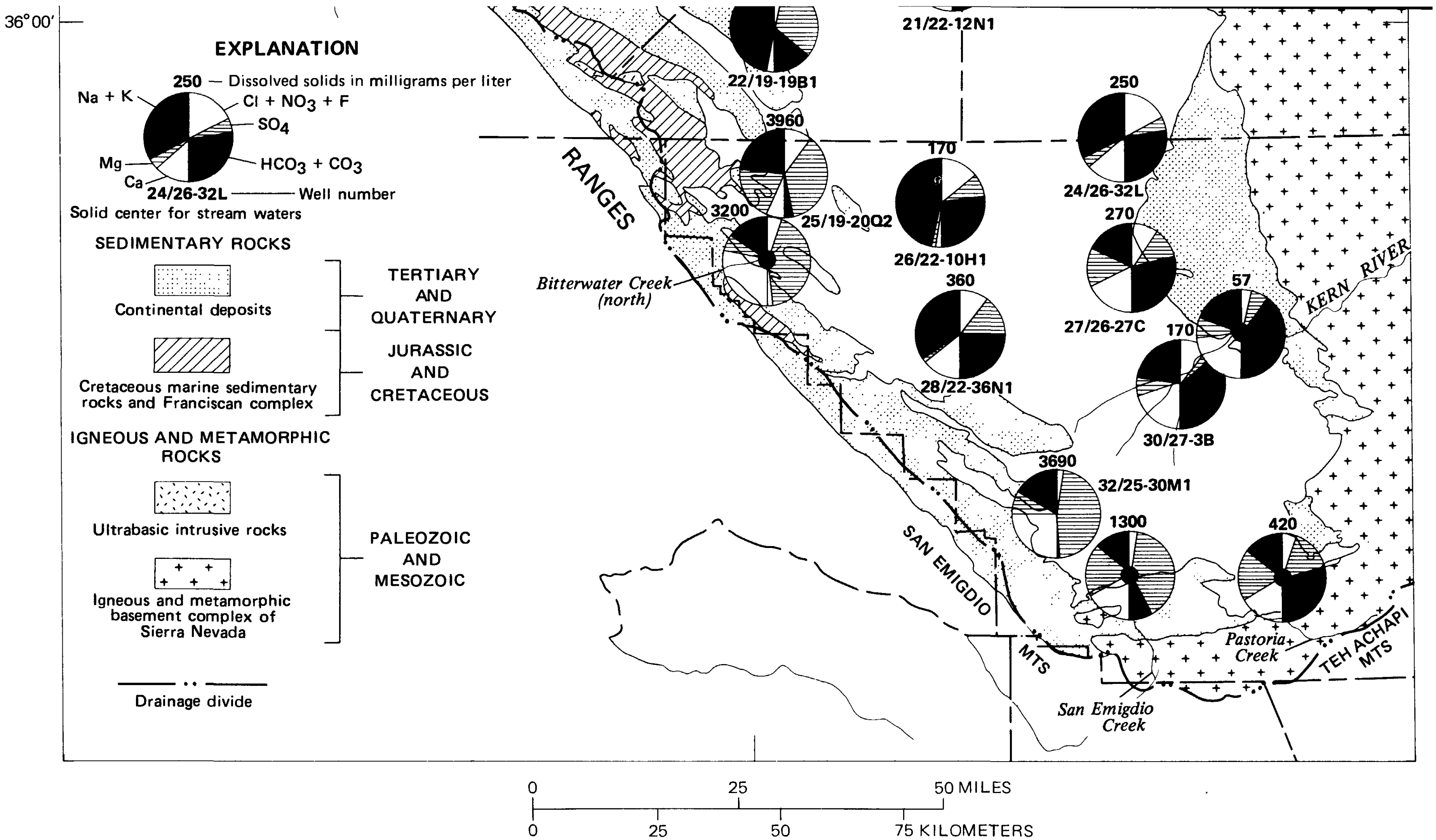


FIGURE 6. – General chemical quality of typical surface water tributary to and typical ground water in the San Joaquin Valley, California. (Modified from Davis and others, 1959, pl. 24)

Because of the size and complexity of the San Joaquin Valley, studies of ground-water quality have taken a piecemeal approach, but some reports do give information for major parts of the ground-water basin. In order to map the approximate base of fresh ground water (pl. 7a) for the valley south of Merced and a small area near Tracy (pl. 7a), Page (1973) used specific conductance of approximately 3,000 µmho/cm at 25°C as the maximum concentration in the fresh water, as did Olmsted and Davis (1961, p. 134). Along the west side of the valley, Hotchkiss and Balding (1971, pl. 3) also mapped parts of the approximate base of fresh ground water between Tracy and Dos Palos. There has been some speculation on the upward movement of the base of fresh ground water in certain areas of heavy pumpage. Wells in the valley generally do not pump from near the base of fresh ground water, so that little information has been compiled on the subject, but it is of current interest and may be studied in more detail in the near future (G. L. Bertoldi, U.S. Geological Survey, Sacramento, Calif., oral commun., 1982).

Attempts to map the ranges of electrical conductivity of the ground water in the San Joaquin Valley have been made by the California Department of Water Resources (1965, pl. E-2; 1971b) and the California State Water Resources Control Board (1975b, p. 2-14-17), but success was limited by the sampling methods and the lack of separation of data by aquifer and adjustment for temperature that is a characteristic of specific conductance. On the east side of the valley, electrical conductivity values were commonly less than 500 µmho/cm, and on the west side values were usually more than 1,000 µmho/cm. Temperature and dissolved-solids content can also be important water-quality indicators. Ground-water temperature ranges from about 45°F to about 105°F in the San Joaquin Valley (California Department of Water Resources, 1975, p. 65), and dissolved-solids content ranges from 64 to 10,700 mg/L (California Region Framework Study Committee, 1971, p. 205). According to Davis and others (1959, p. 175), "The chief difference in quality between the unconfined and semiconfined waters and the underlying confined waters is that the confined waters generally contain less dissolved solids but have a higher percent sodium than the overlying waters." Davis and others (1959) noted, however, that such generalizations did not always hold true.

Locating areas that have high recorded levels of constituents of concern is important to design of a ground-water-quality network, specifically to individual well selection. Plates 7b, 7c, and 7d show maximum identified concentrations of trace elements, nitrates, and DBCP (dibromochloropropane) in the ground water of the San Joaquin Valley. Standards and maximum recorded trace-element concentrations are included in table 3 to complement the information provided on plate 7b. Analyzing ground-water samples for unexpected levels of trace elements may be a less expensive alternative to analyzing for a wide range of toxic chemicals that are associated with known concentrations from certain contaminant sources (K. D. Schmidt, ground-water consultant, Fresno, Calif., oral commun., January 21, 1983). Some of the nitrate extremes that the California Department of Water Resources (1970c) observed in San Joaquin Valley ground water between 1950 and 1969 are shown on plate 7c. California State Water Resources Control Board (1975b) has maps of the distribution of boron (p. 2-14-13), sulfate (p. 2-14-19), and chloride (p. 2-14-21) in the ground water of the Tulare Lake area. The California Department of Water Resources (1967, p. 110-111) reported saltwater intrusion in the valley west of Stockton; monitoring by the San Joaquin County Flood Control and Water Conservation District, however, had not substantiated that fact by 1979 (Howard Hitchcock, written commun., 1979), when monitoring was reduced to occasional sampling. Although some sampling is still done, funding of efforts to study this phenomenon has not continued (E. Franco, San Joaquin County Flood Control and Water Conservation District, oral commun., 1982).

TABLE 3. - Standards and maximum recorded trace-element concentrations, 1923-71

[Modified from California Department of Water Resources, 1973, p. 9. Units are in micrograms per liter]

Element	Drinking water standard	Irrigation tolerance limit	Tulare Lake Basin: Maximum concentration	Tulare Lake Basin: Drainage area	Tulare Lake Basin: Well number	San Joaquin River Basin: Maximum concentration	San Joaquin River Basin: Drainage area	San Joaquin River Basin: Well number
Aluminum	--	1,000	930	Westside	23S/21E-18D1	310	Eastside	11S/17E-25B1
Arsenic	50	1,000	1,100	Eastside	24S/24E-09F1	130	do.	05S/09E-09A1
Barium	1,000	--	700	do.	22S/28E/06C	8,000	do.	03S/12E-35C1
			700	do.	24S/25E-24P1			
Beryllium	--	500	4.3	Westside	31S/24E-13J3	--	--	--
Bismuth	--	--	--	--	--	16	Eastside	07S/15E-18K1
Bromine	--	--	90,000	Eastside	15S/17E-24J1	--	--	--
Cadmium	10	5	15	Westside	25S/19E-23B1	18	Westside	09S/09E-21F1
Cobalt	--	200	180	do.	31S/24E-24P2	56	Eastside	07S/13E-04P1
Chromium	50	500	50	Eastside	13S/19E-24K2	30	do.	05S/11E-07P1
Copper	1,000	200	1,000	Westside	24S/22E-35N1	200	do.	05S/17E-25J1
Iron, dissolved	--	--	7,330	Eastside	22S/24E-14N1	2,600	do.	06S/13E-06N1
Iron, total	300	--	82,800	do.	17S/19E-16H1	49,600	do.	04S/08E-02H1
Gallium	--	--	430	Westside	28S/22E-10R1	--	--	--
Germanium	--	--	15	Eastside	28S/27E-07C1	--	--	--
Iodine	--	--	3,000	Westside	27S/19E-28H2	1,030	Eastside	11S/14E-21N2
Lithium	--	5,000	400	do.	22S/15E-08A1	16	do.	06S/20E-10L1
			400	do.	22S/15E-08E1			
Manganese	50	2,000	3,900	Eastside	30S/25E-21L5	11,000	Eastside	12S/14E-35M2
Molybdenum	--	5	7,180	Westside	31S/24E-13P4	21	Westside	08S/09E-11H1
Nickel	--	500	37	do.	31S/24E-24P2	53	Eastside	06S/11E-27K1
Lead	50	5,000	20	Eastside	20S/29E/14R1	20	do.	01S/15E-06B1
			20	do.	11N/20W-24E1	20	do.	07S/15E-30E1
Selenium	10	50	10	do.	11N/20W-24E1	--	--	--
Strontium	--	--	660	do.	25S/25E-12E1	380	Westside	05S/08E-30Q1
Titanium	--	--	6.9	do.	15S/25E-03DS1	14.7	Eastside	05S/11E-29F1
Vanadium	--	10,000	100	Westside	31S/24E-13J4	60	do.	10S/13E-23M1
Zinc	5,000	5,000	7,000	Eastside	17S/27E-35P1	24,000	do.	10S/14E/31H1

To satisfy a requirement of the staff of the California State Water Resources Control Board for this project, staff of the California Regional Water Quality Control Board offices in Fresno and Sacramento provided the information (tables 4, 5, 6, and 7; pl. 8 and 9) that identifies some actual and potential point sources of contamination that have regional consequence and regional sources of possible contamination of ground water in the San Joaquin Valley. This project is the first attempt to identify and locate all sources in this way, so that additions, deletions, and revisions may be made as more information becomes available.

The California Department of Health Services and local health departments have been monitoring for DBCP (dibromochloropropane) in domestic ground-water supplies of the San Joaquin Valley since 1980; the results of this monitoring are shown on plate 7d. As an example of an approach (tables 8 and 9) that can be implemented for all regionally applied chemicals of concern for potential ground-water contamination, plate 10 shows areal application volumes of DBCP for comparison with locations of the pesticide found in ground-water supplies. This approach has the potential for preliminary prediction of the location of contaminated ground water, especially in conjunction with other information, such as soil types, surface and subsurface geology (pl. 2), ground-water levels (pl. 5a), and the chemistry of the contaminant.

A recent report on the ground-water quality in Kern County (Groundwater Pollutant Study Review Committee, 1982) contains maps showing concentrations of arsenic, boron, chloride, fluoride, nitrate, and total dissolved solids in the confined and unconfined aquifers. That report also includes a spatial problem-area map for three potentially hazardous organic compounds: DBCP, Aldicarb, and phenols. The report points out (p. 7-10) that because the present water-quality data were collected generally to serve some particular purpose of the collecting agency, the data base is inconsistent. Despite the inconsistencies, Kern County seems to have the best countywide data base and general understanding of its problems with ground-water quality, and its program could serve as a model for other counties in the San Joaquin Valley ground-water basin.

EXPLANATION OF CONTAMINANTS OF CONCERN IN TABLES 4-7

Abbreviation	Definition
Ag	Silver
As	Arsenic
B	Boron
Ba	Barium
BOD_5	Biochemical oxygen demand (5-day test)
Ca	Calcium
Cd	Cadmium
Cl	Chlorine
CO_3	Carbonate
COD	Chemical oxygen demand
Cr	Chromium
Cu	Copper
DS	Dissolved solids
DBCP	Dibromochloropropane
DD-Mixture	1,2-dichloropropane
EDB	Ethylene dibromide
Fe	Iron
HCO_3	Bicarbonate
Hg	Mercury
H_3PO_4	Phosphoric acid
H_2SO_4	Sulfuric acid
K	Potassium
Mg	Magnesium
N	Nitrogen
Na	Sodium
NaCl	Sodium chloride (table salt)
NH_3	Ammonia
NO_3	Nitrate
OC	Organochlorine pesticides
Pb	Lead
PCB's	Polychloronated biphenols
PCP	Pentachlorophenol
pH	Hydrogen ion activity
phenols	Various oil-refinery wastes
PO_4	Phosphates
S	Sulfur
Salts	NaCl and other salts
SC	Specific conductance (electrical conductivity adjusted to 25°C)
Se	Selenium
SO_4	Sulfates
Sr	Strontium
TCE	Trichloroethylene
VOC	Volatile organic chemicals
Zn	Zinc

TABLE 4. - Major point-source dischargers to land that are potentially significant to a regional ground-water-quality monitoring network: Industrial

[Modified from information provided by the California Regional Water Quality Control Board, Central Valley Region, Sacramento and Fresno offices. Revisions to this table are expected to be continuous with information improvements. Locations refer to Mount Diablo meridian]

Discharger	Location	Type of waste	Disposal method	Contaminants of concern
		SAN JOAQUIN COUNTY		
DuPont	2N/2E-15, 2N/2E-22	Freon, titanium dioxide, and other related production wastes	Unlined pond percolation and deep-well injection	Pb, NaCl, VOC
McCormick and Baxter	1N/6E-8	Wood treatment	Previously unlined, presently lined ponds	Creosote, As, Cu, oil, PCP, NH_3
Pacific Fibreboard	1N/6E-10	Paper production	Holding ponds	DS, Cl
El Dorado Chemical	1N/6E-12	Chemical	Concrete basin, lined ponds	Acids, alcohols, solvents
Amador Chemical	1N/7E-16	do.	Lined ponds	Acetone, solvents
Sharpe Army Depot	1S/6E-13, 1S/6E-23, 1S/6E-24	Domestic and industrial	Land disposal	TCE, As, radioactive substances
Occidental Chemical	1S/6E-36	Chemical	Present: underground injection; past: unlined ponds, ditches, and disposal pits	SO_4, pesticides (DBCP, EDB, and and a variety of others)
Holly Sugar Co.	2S/5E-10	Sugar plant	Land disposal	BOD_5, DS
Tracy Defense Depot	2S/5E-35	Industrial and military	Unlined burn pit, unused since 1970	Oils and unknown chemicals
Spreckels Sugar Co.	2S/7E-3	Sugar plant	Surface water	BOD_5, DS
		STANISLAUS COUNTY		
Riverbank Army Depot	2S/9E-25	Metal forming and finishing	Percolation ponds	H_2SO_4, H_3PO_4, S, SO_4, SC, DS, pH,
FMC Corp.	3S/9E-30	Alkali chemicals	Unlined ponds	Sr, Na, NO_3
Valley Wood Preservers	5S/10E-23, 5S/10E-24, 5S/10E-25, 5S/10E-26	Wood treatment (no longer in operation)	Land disposal	Cr, As, Cu, SO_4, and Cl

TABLE 4. - Major point-source dischargers to land that are potentially significant to a regional ground-water-quality monitoring network: Industrial--continued

Discharger	Location	Type of waste	Disposal method	Contaminants of concern
		MERCED COUNTY		
E. J. Gallo Hopeton Ranch	5S/13E-19	Winery wastewater	Irrigation	NO_3, DS
Livingston, City of	6S/11E-14, 6S/11E-23	Poultry processing	Irrigation	BOD_5, coliform, N
E. J. Gallo	6S/11E-30	Winery wastewater	do.	NO_3, DS
Rogers Foods, Inc. Universal	6S/12E-21	Onion, garlic processing	do.	BOD_5, N, DS
J. R. Wood, Inc.	6S/12E-35	Frozen food processing	Land disposal, evaporation pond	BOD_5, Na, N
Pacific Cordoba	7S/9E-19	Fruit, vegetable processing	Evaporation pond	Salts
Ragu Foods	7S/13E-23	Tomato processing	Land disposal	BOD_5, Na, N
California Canners and Growers	7S/14E-34, 7S/14E-35	Peach processing	Land disposal	BOD_5, Na
Oasis Foods	7S/15E-34	Fruit processing	Irrigation	BOD_5
H&R Meat Co.	8S/14E-13	Meat processing	Evaporation-percolation ponds	Salts
Tri-Valley Growers (Volta)	9S/9E-35	Tomato processing	Irrigation	BOD_5, Na, N
Union Chemical Co.	10S/12E-23	Agricultural chemicals	Evaporation pond	Pesticides
		MADERA COUNTY		
Paul Masson Vineyards	10S/17E-9	Winery wastewater	Irrigation	NO_3, DS
Bisceglia Brothers	11S/17E-26	do.	do.	NO_3, DS
United Vintners Wine Co.	11S/17E-27	do.	do.	NO_3, DS
Western Farm Service	11S/17E-34	Agricultural chemicals	Evaporation pond	Pesticides
		FRESNO COUNTY		
De Francesco and Sons, Inc.	12S/12E-34	Onion, garlic, beet processing	Land disposal	BOD_5, N
Guild Wine Co., Fresno Winery	13S/21E-32	Winery wastewater	Irrigation	NO_3, DS
E. J. Gallo Winery	13S/21E-33	do.	do.	do.
Thompson Hayward Agriculture and Nutrition Co.	13S/21E-35	Agricultural chemicals	Evaporation ponds	Pesticides
Spreckels Sugar Co.	14S/15E-3	Sugar-beet processing	Evaporation-percolation pond, irrigation	BOD_5, N

TABLE 4. - Major point-source dischargers to land that are potentially significant to a regional ground-water-quality monitoring network: Industrial--continued

Discharger	Location	Type of waste	Disposal method	Contaminants of concern
		FRESNO COUNTY--continued		
Seabrook Foods, Inc.	14S/15E-5, 14S/15E-6, 14S/15E-7, 14S/15E-8	Lima-bean processing	Irrigation	NO_3, DS
Fresno City Winery Waste Disposal Facility	14S/19E-22	Winery wastewater	Irrigation	NO_3, DS
O'Neill Meat Co.	14S/20E-2	Meat processing	Evaporation-percolation ponds, irrigation	Salts
FMC Corp.	14S/20E-14	Agricultural chemicals	Evaporation ponds	Pesticides
Wilbur Ellis Co.	14S/20E-24	do.	do.	do.
Purity Oil Sales, Inc.	14S/20E-25	Industrial chemicals	--	PCB's, heavy metals
Fresno Meat Packing Co.	14S/20E-28	Meat processing	Evaporation-percolation ponds, irrigation	Salts
Del Rey Cooperative Winery Association	14S/21E-33	Winery wastewater	Land disposal	NO_3, DS
Sun Maid Raisin Growers of California, Inc.	14S/21E-33	Raisin processing	do.	BOD_5, NO_3
Diamond Meat Co.	14S/22E-8	Meat, hide processing	Evaporation ponds, irrigation	Salts
Guild Wine Co., McCall Winery	14S/22E-17	Winery wastewater	Evaporation-percolation ponds	NO_3, DS
Nordman of California Distillery	14S/23E-34	Winery wastewater	Land disposal	NO_3, DS
Lion Packing Co.	15S/21E-26	Raisin processing	Irrigation	BOD_5, NO_3
Sperry New Holland	15S/21E-26	Industrial wastewater	Evaporation pond	Heavy metals
Mont LaSalle Vineyards, Mt. Tivy Winery	15S/23E-21	Winery wastewater	Land disposal	NO_3, DS
Bonner Packing Co.	15S/24E-11	Raisin processing	Irrigation	BOD_5, NO_3
Bell-Carter Olive Co.	15S/24E-23	Olive processing	Evaporation pond	BOD_5, salts
Sun Maid Distillery	15S/24E-25	Winery wastewater	Land disposal	NO_3, DS
Sun Maid Raisin	15S/24E-25	Raisin processing	do.	BOD_5, NO_3
Valley Nitrogen Products, Inc.	16S/17E-10	Agricultural chemicals	Evaporation pond	DS, N, radioactive substances
Vie Del Co. Winery	16S/20E-1	Winery wastewater	Land disposal	NO_3, DS
Selma Pressure Treating Co.	16S/22E-8	Industrial wastewater	Pipe leakage, spillage, runoff to land	Cu, As, Cr, phenols

TABLE 4. - Major point-source dischargers to land that are potentially significant to a regional ground-water-quality monitoring network: Industrial--continued

Discharger	Location	Type of waste	Disposal method	Contaminants of concern
		FRESNO COUNTY--continued		
Guardian Industries Corp.	16S/22E-16	Industrial wastewater	Evaporation-percolation ponds	DS
Vie Del Co.	16S/22E-16	Winery wastewater	Land disposal	NO_3, DS
Britz Fertilizer Co. Five Points Yard	17S/17E-28	Agricultural chemicals	Evaporation ponds	Pesticides
Nobel Vineyards, Inc.	26S/26E-9	Winery wastewater	Evaporation-percolation ponds	NO_3, DS
		KINGS COUNTY		
Central Coast Meats, Hanford Meat Packing	18S/22E-32	Meat processing	Irrigation	Salts
Liquid Chemical Corp.	19S/21E-13	Industrial wastewater	Evaporation ponds	Zn, Cu, Fe
Occidental Chemical Hanford Nitric Acid Plant	19S/21E-13	Fertilizer-plant water	Evaporation-percolation ponds	DS, N
Armstrong Rubber Co.	19S/21E-24	Industrial wastewater	Evaporation-percolation ponds, land disposal	DS
Carnation Co. Contadina Foods	19S/21E-25	Tomato processing	Irrigation	BOD_5, Na, N
		TULARE COUNTY		
California Growers Winery (Cutler Winery)	16S/25E-32	Winery wastewater	Irrigation	NO_3, DS
Lemon Cove Association Packing House	17S/26E-35	Citrus packing	Evaporation-percolation pond	Agricultural chemicals, fungicides, B, BOD_5
Woodlake Ranch, Inc.	17S/27E-31	Olive processing	Evaporation pond	BOD_5, salts
Malanco of California	18S/24E-30	Paper processing	Evaporation-percolation ponds	Heavy metals, DS
Southern California Edison	18S/25E-28	Wood-treatment processing	Leaking treatment tank	PCP, creosote, DD-Mixture
Sierra Wine Co. (Tulare Winery)	19S/24E-36	Winery wastewater	Irrigation	NO_3, DS
Lindsay, City of, Industrial Treatment Plant	19S/26E-33	Olive processing	Evaporation ponds	BOD_5, salts

TABLE 4. - Major point-source dischargers to land that are potentially significant to a regional ground-water-quality monitoring network: Industrial--continued

Discharger	Location	Type of waste	Disposal method	Contaminants of concern
		TULARE COUNTY--continued		
Tulare Meat Co.	20S/24E-23	Meat processing	Evaporation-percolation ponds, irrigation	Salts
Gilroy Foods, Inc.	20S/24E-35, 20S/24E-36	Onion, garlic processing	Evaporation-percolation ponds	BOD_5, N
Arden Farms Co.	21S/25E-30	Milk processing	Irrigation	BOD_5, N, DS
Tule River Cooperative Drier	21S/26E-20	Prune processing	Evaporation-percolation ponds	BOD_5
Sunkist Growers	22S/25E-6	Citrus processing	Irrigation	Agricultural chemicals, fungicides, B, BOD_5
Central Valley Citrus Packing Co.	23S/27E-3	Citrus packing	do.	do.
Terra Bella Citrus Association	23S/27E-3	Citrus processing	Land disposal	do.
Guild Wineries and Distillers (L. K. Marshall Winery)	24S/26E-34	Winery wastewater	Irrigation	NO_3, DS
Sierra Wine Co. (Delano Winery)	24S/26E-34	do.	do.	do.
		KERN COUNTY		
Perelli-Minetti and Sons	25S/25E-36	Winery wastewater	Evaporation-percolation ponds, land disposal	NO_3, DS
Delano Growers Cooperative	25S/26E-8	do.	Evaporation-percolation ponds	do.
Almaden Vineyard	26S/26E-30	do.	Land disposal	do.
Superior Farming Co.	27S/26E-20	Fruit processing	Irrigation	BOD_5, N, DS
Belridge Farms	28S/26E-15	Packing	Evaporation-percolation ponds, irrigation	BOD_5, N, DS
Bakersfield Ag-Chemical	28S/27E-32	Agricultural chemicals	Evaporation pond	Pesticides
Independent Valley Energy Co.	29S/27E-22, 29S/27E-23	Refinery	Injection well	Phenols, VOC, DS, oil and gas
San Joaquin Refining Co.	29S/27E-23	do.	Percolation sumps, irrigation	do.
Mohawk Petroleum Corp., Inc.	29S/27E-27	do.	Percolation sumps, injection well	do.
Lion Oil Co.	29S/27E-28	do.	Percolation sumps	do.
Sunland Refining Corp.	29S/27E-29	do.	do.	do.
IMC Carbon Products	29S/27E-33	do.	do.	VOC, DS

TABLE 4. - Major point-source dischargers to land that are potentially significant to a regional ground-water-quality monitoring network: Industrial--continued

Discharger	Location	Type of waste	Disposal method	Contaminants of concern
KERN COUNTY--continued				
Republic Carbon Products, Inc.	29S/27E-33	Industrial	Evaporation-percolation ponds	Heavy metals, VOC, DS
William Bolthouse Farms, Inc., Waste Treatment Facility	29S/28E-36	Carrot packing	do.	BOD_5, DS
Nalco Chemical Co.	30S/27E-15	Industrial wastes	Evaporation pond	Heavy metals, DS
Yurosek, Mike and Sons, Waste Treatment Facility	30S/28E-25	Carrot packing	Evaporation-	BOD_5, DS percolation ponds
Kein Valley Packing Co.	30S/28E-30	Meat processing	Irrigation	Salts
Kern County Refinery	30S/29E-30	Refinery	Percolation sumps	Phenols, VOC, DS, oil and gas
Lamont Winery, Inc.	31S/29E-2	Winery wastewater	Land disposal	NO_3, DS
Coastal Petroleum Refiners	32S/26E-2	Refinery	Irrigation	Phenols, VOC, DS, oil and gas

TABLE 5. - Major point-source dischargers to land that are potentially significant to a regional ground-water-quality monitoring network: Municipal and domestic

[Modified from information provided by the California Regional Water Quality Control Board, Central Valley Region, Sacramento and Fresno offices. Revisions to this table are expected to be continuous with information improvements. Explanation of abbreviations for dischargers: CSD, County Sanitation District; CWD, Community, County, or City Water District; PUD, Public Utilities District; SD, Sanitation District; STP, Sewage Treatment Plant; WD, Water District; and WTF, Water Treatment Facility. Locations refer to Mount Diablo meridian]

Discharger	Location	Wastewater type	Disposal method	Contaminants of concern
		SAN JOAQUIN COUNTY		
East Stockton	2N/7E-31, 1N/7E-5, 1N/7E-6	Domestic	Septic systems	NO_3, bacteria
Brentwood vicinity	1N/2E-13	do.	do.	NO_3
Stockton, City of	1N/6E-17	Domestic, industrial	Wastewater treatment plant	NO_3, bacteria, unknown industrial
		STANISLAUS COUNTY		
Modesto, City of	3S/9E-32	Domestic, cannery	--	NO_3, bacteria, unknown industrial
		MERCED COUNTY		
Snelling Community SD	5S/14E-4, 5S/14E-5, 5S/14E-8, 5S/14E-9	Domestic	Irrigation	BOD_5, coliform, N, DS
Hilmar CWD	6S/10E-23	do.	Land disposal	do.
Delhi WD	6S/11E-15	do.	Evaporation-percolation ponds	do.
Livingston, City of	6S/11E-22	do.	do.	do.
Winton SD	6S/12E-35	do.	Evaporation-percolation ponds, irrigation	do.
U.S. Air Force Castle AFB	6S/13E-28, 6S/13E-29, 6S/13E-30, 6S/13E-31, 6S/13E-32, 6S/13E-33	Domestic, industrial	do.	BOD_5, coliform, N, DS, TCE
Franklin CWD	7S/13E-14, 7S/13E-23	do.	Evaporation-percolation ponds	BOD_5, coliform, N, DS
Curtis, Robert, KOA	10S/9E-20	Domestic	do.	do.
Los Banos, City of	10S/11E-7, 10S/11E-8	Domestic, industrial	Land disposal, irrigation	do.
South Dos Palos, City of	11S/12E-15	Domestic	Evaporation-percolation ponds	do.

TABLE 5. - Major point-source dischargers to land that are potentially significant to a regional ground-water-quality monitoring network: Municipal and domestic--continued

Discharger	Location	Wastewater type	Disposal method	Contaminants of concern
		MADERA COUNTY		
Chowchilla, City of	9S/16E-31	Domestic, industrial	Evaporation-percolation ponds	BOD_5, coliform, N, DS
Madera, City of	11S/17E-30	do.	Evaporation-percolation ponds, irrigation	do.
		FRESNO COUNTY		
Firebaugh, City of	12S/14E-21, 12S/14E-33, 12S/14E-34	Domestic	Evaporation-percolation ponds	Cl, Na, Ca, Mg, K, NO_3, SO_4, SC, pH, alkalinity
Mendota, City of (STP)	13S/15E-29	Domestic, industrial	do.	COD, Cl, Na, Ca, Mg, NO_3, SO_4, PO_4, SC, alkalinity, pH
Bioley, City of	13S/18E-17	Domestic	do.	BOD_5, coliform, N, DS
Kerman, City of (STP)	14S/17E-13	do.	Irrigation	COD, Cl, Na, Ca, Mg, NO_3, SO_4, PO_4, SC, alkalinity, pH
Fresno, City of (STP)	14S/19E-21, 14S/19E-22, 14S/19E-27, 14S/19E-28	Domestic, industrial	Evaporation-percolation ponds, irrigation	Ca, Mg, Na, K, B, Cl, HCO_3, CO_3, SO_4, NO_3, SC, pH, hardness
Sanger, City of (STP)	14S/19E-25, 14S/19E-26	do.	Evaporation-percolation ponds	COD, Cl, Na, Ca, Mg, NO_3, SO_4, PO_4, SC, alkalinity, pH
Malaga CWD	14S/20E-25	Domestic	do.	do.
Tranquility, City of, PUD	15S/16E-4	do.	Irrigation	BOD_5, coliform, N, DS
San Joaquin, City of (STP)	15S/16E-27	do.	Evaporation-percolation ponds	do.
Parlier, City of (STP)	15S/21E-25, 15S/22E-30	do.	Irrigation	Cl, Na, Ca, Mg, K, NO_3, SO_4, SC, pH, alkalinity
Del Rey CSD	15S/22E-4	do.	Evaporation-percolation ponds, irrigation	Cl, Na, Ca, Mg, K, NO_3, SO_4, SC, pH, alkalinity
West Parlier CSD	15S/22E-27	do.	Evaporation-percolation ponds	BOD_5, coliform, N, DS
Orange Cove, City of (STP)	15S/24E-23	Domestic, industrial	Irrigation	COD, Cl, Na, Ca, Mg, NO_3, SO_4, PO_4, SC, alkalinity, pH
Caruthers, City of, CSD	16S/19E-13	Domestic	Evaporation-percolation ponds, irrigation	BOD_5, coliform, N, DS

TABLE 5. - Major point-source dischargers to land that are potentially significant to a regional ground-water-quality monitoring network: Municipal and domestic--continued

Discharger	Location	Wastewater type	Disposal method	Contaminants of concern
		FRESNO COUNTY--continued		
Selma-Kingsburg-Fowler CSD	16S/22E-21, 16S/22E-28	Domestic, industrial	Evaporation-percolation ponds, irrigation	COD, Cl, Na, Ca, Mg, NO_3, SO_4, PO_4, SC, alkalinity, pH
Riverdale PUD	17S/19E-13	Domestic	Evaporation-percolation ponds, irrigation	BOD_5, coliform, N, DS
Fresno County Industrial Farms	17S/20E-3	do.	Land disposal	do.
Laton CWD	17S/21E-17	do.	Evaporation-percolation ponds	do.
Blue Hills Service Co.	19S/16E-20	do.	Evaporation-percolation ponds	do.
Coalinga, City of	20S/15E-33	do.	Irrigation	COD, Cl, Na, Ca, Mg, NO_3, SO_4, PO_4, SC, alkalinity, pH
Huron, City of (STP)	20S/17E-1	do.	do.	BOD_5, coliform, N, DS
		KINGS COUNTY		
Lemoore, City of (STP)	19S/20E-15	Domestic, industrial	Irrigation	BOD_5, coliform, N, DS
Hanford, City of (STP)	19S/21E-12	Domestic	do.	do.
		TULARE COUNTY		
Sultana CSD	16S/24E-11, 16S/24E-14	Domestic, industrial	Subsurface leaching, land disposal	BOD_5, coliform, N, DS
New London CSD WTF	17S/23E-12	Domestic	Evaporation-percolation ponds	do.
Ivanhoe, City of, PUD	18S/26E-11	Domestic, industrial	Percolation basins	do.
Visalia, City of	19S/24E-16	Domestic, industrial	Percolation ponds, discharge to Mill Creek	do.
Farmsville, City of, WTF	19S/25E-12	Domestic	Evaporation-percolation ponds, irrigation	do.
Tulare, City of	20S/24E-16	Domestic, industrial	Evaporation-percolation ponds	do.
Strathmore, City of, PUD	20S/27E-30	do.	do.	do.
Tipton, City of, CSD	21S/24E-36	Domestic	Evaporation-percolation ponds, irrigation	do.

TABLE 5. - Major point-source dischargers to land that are potentially significant to a regional ground-water-quality monitoring network: Municipal and domestic--continued

Discharger	Location	Wastewater type	Disposal method	Contaminants of concern
		TULARE COUNTY--continued		
Woodville, City of, PUD	21S/26E-19	Domestic	Evaporation-percolation ponds	BOD_5, coliform, N, DS
Lakeshore Ltd.	21S/27E-33	do.	Subsurface leaching	do.
Porterville, City of, DPW, Porterville Airport Industrial Tract	22S/27E-9	Domestic, industrial	Irrigation	do.
Terra Bella, City of, Sewer Maintenance District	22S/27E-34	Domestic	Evaporation-percolation ponds, irrigation	do.
Richgrove CSD	24S/26E-36	do.	Septic tanks, leach fields	do.
		KERN COUNTY		
Delano, City of (STP)	25S/25E-7, 25S/25E-8, 25S/25E-9	Domestic	Irrigation	BOD_5, coliform, N, DS
Lost Hills SD	26S/21E-34	do.	Land disposal, seepage pits	do.
McFarland, City of (STP)	26S/25E-9	Domestic, industrial	Irrigation	do. do.
Five and Forty-six Property Owners	27S/21E-1	Domestic	Evaporation-percolation ponds	do.
Wasco PUD (STP)	27S/24E-9	Domestic, industrial	Irrigation	do.
Shafter, City of (STP)	28S/25E-28	do.	Evaporation-percolation ponds, irrigation	do.
Kern County Sheriff's Lerdo Facility	28S/27E-7	do.	Land disposal, irrigation	do.
Buttonwillow CWD (STP)	29S/23E-13	Domestic	Irrigation	do.
McKittrick Five Properties	29S/24E-16	do.	Evaporation-percolation ponds	do.
North of River SD 1 (STP)	29S/27E-15	do.	Land disposal	do.
Olcese WD WTF	29S/29E-3, 29S/29E-4	do.	Evaporation-percolation ponds, irrigation	do.
Bakersfield, City of, Plant 3	30S/27E-33	do.	Land disposal	do.
Mt. Vernon SD (STP)	30S/28E-3	do.	Irrigation	do.
Bakersfield, City of, Plants 1&2	30S/28E-3, 30S/28E-9	do.	do.	do.

TABLE 5. - Major point-source dischargers to land that are potentially significant to a regional ground-water-quality monitoring network: Municipal and domestic--continued

Discharger	Location	Wastewater type	Disposal method	Contaminants of concern
KERN COUNTY--continued				
Kern County Buena Vista Aquatic Recreation Area	31S/25E-13, 31S/25E-14, 31S/25E-15, 31S/25E-16, 31S/25E-23, 31S/25E-24	Domestic	Irrigation	BOD_5, coliform, N, DS
Lamont PUD	31S/28E-25	do.	Percolation basins, irrigation	do.
Arvin CSD	31S/29E-34	do.	Irrigation	do.

TABLE 6. - Major point-source dischargers to land that are potentially significant to a regional ground-water-quality monitoring network: Solid-waste disposal sites

[Modified from information provided by the California Regional Water Quality Control Board, Central Valley Region, Sacramento and Fresno offices. Revisions to this table are expected to be continuous with information improvements. Classification of disposal sites is based on the geologic and hydrologic features of the disposal area and capability of surface- and ground-water quality. Class I sites must have no possibility of contamination to usable water, and Class III sites may have wastes refined sufficiently to allow direct discharge to nearby water. Further description of these classifications can be found in Franks (1980) and Subchapter 15, Chapter 3, Title 23 of the California Administrative Code. Locations refer to Mount Diablo meridian unless otherwise noted]

Discharger	Location	Class of site	Contaminants of concern
	SAN JOAQUIN COUNTY		
Harney Lane	3N/8E-19, 3N/8E-20	II-2	SC, COD, Cl, hardness
Arcady Oil Co.	1N/5E-16, 1N/5E-21	III	Anticipated problems with oil and gas, salts, DS, heavy metals
French Camp	1N/6E-26, 1N/6E-27	III	Past problems with SC, COD, Cl, hardness
Austin Road	1N/7E-34	II-2	SC, COD, Cl, hardness
Foreward Inc.	1S/7E-3	II-1	Heavy metals, pesticides
Lawrence Livermore, Site No. 300	3S/4E-15, 3S/4E-16, 3S/4E-17, 3S/4E-20, 3S/4E-21, 3S/4E-22, 3S/4E-26, 3S/4E-27, 3S/4E-28, 3S/4E-29	II-1	Radioactive substances
Corral Hollow	3S/5E-18, 3S/5E-19	II-2	SC, COD, Cl, hardness
	STANISLAUS COUNTY		
Bonzi Landfill	4S/8E-12	II or III	SC, COD, alkalinity, Cl
Geer Road Landfill	4S/10E-3	II and III	SC, COD, Cl, Fe, hardness
	MADERA COUNTY		
Madera County, Fairmead	10S/16E-14	II	COD, N, DS, OC

TABLE 6. - Major point-source dischargers to land that are potentially significant to a regional ground-water-quality monitoring network: Solid-waste disposal sites--continued

Discharger	Location	Class of site	Contaminants of concern
FRESNO COUNTY			
Clovis, City of	11S/21E-29	II-1	VOC, heavy metals, DS
Volpa Brothers Rice Road Reclamation	12S/20E-15	II	COD, N, DS, OC
Mendota Disposal Site	13S/15E-29	II-2	do.
Fresno County, Kerman	14S/17E-14	II and III	do.
Solid Waste Industries Chateau Fresno	14S/19E-30	II	do.
Fresno, City of	14S/20E-19	II-2	do.
Orange Ave. Disposal Co.	14S/20E-26	II	do.
Gage, George	15S/20E-24	II	do.
Fresno County, Riverdale	15S/21E-36	II	do.
Southeast Regional Disposal Site	15S/22E-27	II and III	do.
Selma Scavenger Co.	15S/22E-34	II	do.
Chestnut Dump	16S/20E-12	II-2	do.
Environmental Disposal Service	19S/14E-36	I	VOC, heavy metals, DS
Standard Oil Co., Coalinga	20S/14E-23	II-1	do.
KINGS COUNTY			
U.S. Navy Lemoore Naval Air Station	19S/19E-20	II-2	COD, N, DS, OC
Kings County DPW, Hanford	19S/21E-1 (former site)	II-2	do.
Kings County DPW, Hanford	19S/22E-4 (present site)	II-2	do.
Kings Waste Disposal Co.	22S/18E-22	II-1	VOC, heavy metals, DS
Environmental Disposal Service, Kettleman Hills	22S/18E-34, 23S/18E-3	I	do.
Standard Oil of California, Kettleman North Dome	22S/18E-35	II-1	do.
TULARE COUNTY			
Tulare County, Woodlake	17S/26E-36	II-2	COD, N, DS, OC

TABLE 6. - Major point-source dischargers to land that are potentially significant to a regional ground-water-quality monitoring network: Solid-waste disposal sites--continued

Discharger	Location	Class of site	Contaminants of concern
		KERN COUNTY	
Kern County, Shafter-Wasco	28S/26E-8	II-2	COD, N, DS, OC
Getty Oil Co., Kern River	28S/28E-33	II-2	do.
Environmental Protection Corp., Eastside	28S/29E-30	II-1	VOC, heavy metals, DS
Bakersfield, City of	29S/28E-10, 29S/28E-11	II and III	COD, N, DS, OC
Liquid Waste Management, McKittrick	30S/22E-29	II-1	VOC, heavy metals, DS
Williams Brothers Engineering Co., Elk Hills North	30S/23E-27	II-1	do.
K&D Salvage Co.	30S/28E-5	II-2	COD, N, DS, OC
Environmental Protection Corp., Westside	31S/22E-25	II-1	VOC, heavy metals, DS
Williams Brothers Engineering Co., Elk Hills South	31S/24E-10	II-1	do.
Kern County, Arvin	31S/29E-31	II	COD, N, DS, OC
Chevron USA, Inc., Buena Vista	32S/23E-3	II-1	VOC, heavy metals, DS
Diversified Chemical Corp.	32S/23E-3	II-1	do.
Roy's Pumping Service	32S/28E-2	II-2	COD, N, DS, OC
Chevron USA, Inc., Kesto	[1]11N/23E-5	II-1	VOC, heavy metals, DS
Derrick Engineering Contractor, Maricopa	[1]11N/23E-8	II-1	do.

[1]San Bernardino meridian.

TABLE 7. - Major point-source dischargers to land that are potentially significant to a regional ground-water-quality monitoring network: Agricultural

[Modified from information provided by the California Regional Water Quality Control Board, Central Valley Region, Sacramento and Fresno offices. Revisions to this table are expected to be continuous with information improvements. Locations refer to Mount Diablo meridian]

Discharger	Location	Type of waste	Disposal method	Contaminants of concern
		MERCED COUNTY		
Kesterson Reservoir	8S/10E-5, 8S/10E-6, 8S/10E-7, 8S/10E-8, 8S/10E-9, 8S/10E-16, 8S/10E-17, 8S/10E-21	Agricultural drainage	Evaporation-percolation ponds	DS, Se
		KINGS COUNTY		
Fabry Farms	20S/20E-7, 20S/20E-18, 20S/19E-11, 20S/19E-12, 20S/19E-13, 20S/19E-14	Agricultural drainage	Evaporation-percolation ponds	DS
Tulare Lake Drainage District, Hacienda Evaporation Basin	Numerous sections in 24S/20E, 24S/21E, 24S/22E	do.	do.	DS
Tulare Lake Drainage District, South Evaporation Basin	24S/21E-36, 24S/22E-31	do.	do.	DS

Ideal Network

Management Objectives

The objectives of designing a ground-water-quality monitoring network for the San Joaquin Valley reflect management objectives for protecting and controlling ground-water quality. Some general ground-water management objectives have been identified to establish a base from which to develop general network objectives (tables 8 and 9). The first management objective is to determine the general ground-water-quality baseline (for example, mineral-water type) for each identifiable aquifer. The purpose of this baseline is to establish a set of ambient conditions for comparison with ground-water-quality conditions for the same area at a later time. The second management objective is to identify changes or trends in the quality of water from specific wells for use in detecting how changes in land use and management practices can affect the ground water. Comparison of changes in the analyses from a grid of wells may highlight trends that can provide feedback on man's regional activities. If the change is undesirable, corrective measures may be possible. Without well-planned monitoring networks, determining sources of contamination is much more difficult. The third management objective is to identify sources of contamination so that corrective action can be taken. From a regional perspective, the cumulative effects of a variety of contaminant sources in a particular area may become significant. Therefore, the first step in designing an ideal network might be to identify all such sources and their relation to natural conditions. Identification of sources should be ongoing or at least periodic, because land-use and management practices change continually.

TABLE 8. - A logical approach for identifying ground-water areas potentially influenced by regionally applied chemicals[1]

Step number	Action
1	Identify areas of recorded regional application of chemicals (DBCP, DD-Mixture, Aldicarb) from UC-Davis Department of Environmental Toxicology computer files of County Agricultural Commission Pesticide Use Reports.
2	Sample ground-water quality at various locations and depths, depending on the expected specific chemical densities (in relation to water density) and soil-infiltration rates.
3	Analyze results for correlations that may have transfer value for improving ability to predict ground-water contamination and for consideration by issuers of pesticide-use permits.

[1]In attempting to predict which chemicals might reach ground-water bodies, many other factors must also be considered, including method of chemical application, particular chemical species and potential for conversion to more or less soluble species, soil types and chemistry; subsurface geology, locations of saturated and unsaturated zones, and amounts of potential leaching water available at land surface. This approach is presented as a first step in determining areas to check for possible influences of regionally applied chemicals, using a large source of regional data.

TABLE 9. - General management and network objectives

[Source: J. P. Akers, U.S. Geological Survey, written commun., February 9, 1981]

I. Management objectives

   A. Determine general ground-water-quality baseline
   B. Identify change in quality (trends)
   C. Identify sources of contamination
      1. minimize contaminant buildups
      2. eliminate sources of contamination
      3. prevent additional contamination

II. Network objectives

   A. Optimize distribution of monitoring sites
      1. in each subbasin
      2. in each aquifer
   B. Establish a suite of constituents to monitor in each type of network
   C. Determine optimum sampling frequencies for each type of network
   C. Monitor known or anticipated:
      1. plumes of contaminants
      2. moving interfaces of ground-water-quality type

Network Objectives

According to Moss (1979, p. 1673), avoiding multifaceted network objectives may help prevent the establishment of irrationally designed networks. In this report, single, use-specific objectives are established for each network by separating the various objectives into individual categories (table 10) based on the concerns of the California State Water Resources Control Board and Regional Water Quality Control Board staffs. These categories were ranked in order of importance for distributing time and financial appropriations by future network implementors. The rankings in table 10 show how the staffs of the two boards view the topics. In time, these rankings may change, but certain general network objectives are established that are appropriate to all ground-water-quality monitoring networks. These objectives are summarized in table 9, and they are applied to each network in table 11. Because of the interrelations of the hydrologic system, the networks suggested in this report should be coordinated with networks that monitor ground-water levels, land use, precipitation, and surface-water discharge and quality.

Selection of Sites

In the past, the development of a consistent design approach and rationale of site selection for data-collection networks has been subjective, involving decisions on site density, location, sample frequency, and target constituents. More systematic design methods, based on rational criteria, are in development (Koryak, 1980; Moss, 1979; and Sanders, 1980). "The location of a permanent sampling station is probably the most critical design factor in a monitoring network which collects water-quality data," according to Sanders (1980, p. 110). He further stated, "If the samples collected are not representative of the water mass, the frequency of sampling, as well as the mode of data interpretation and presentation, becomes inconsequential." Site selection must depend on the objectives of the monitoring network, which must be analyzed separately (table 9) to determine logical sampling locations.

TABLE 10. - Priority ranking of ideal network categories

[Rank 1 has highest priority, and rank 7 has lowest]

Network category	Category priority		Subcategory priority		Network objectives
	State Board	Regional Board	State Board	Regional Board	
A. Regional ambient networks	1	1			A grid (evenly spaced or more dense in areas known to have complex quality conditions) to provide information on the general quality in the region. Should be sampled for general chemical, standard mineral, nutrient, and field parameters.
1. Perched or shallow zone			3	3	
2. Unsaturated or vadose zone			4	4	
3. Unconfined/semiconfined zone			1	1	
4. Confined zone			2	2	
5. Produced ground water			5	5	
B. Regional nonpoint problems	3	2			Monitor zones appropriate to problem.
1. Agricultural-return flow			2	2	Monitor perched and unconfined zones.
2. Regionally applied chemicals			1	1	DBCP, soil conditioners (sulfate, gypsum).
3. Refinery wastes			3	3	Phenols.
4. Oilfield brines			4	4	Specific conductance, chloride, sodium in perched and unconfined zones.
5. Saltwater and connate intrusion.			5	7	Specific conductance, chloride, sodium in confined zones.
6. Radioactive substances			6	6	Applied and natural.
7. Native substances			7	5	Nitrates, arsenic, boron.
C. Line sources	4	4			
1. Natural streams.					To determine areas and trends in natural recharge, influence of surface water quality from streams.
a. San Joaquin River			1	1	
b. South Fork Kings River			2	2	
c. Kern River			3	3	
2. Artificial channels.					To determine same as from natural streams.
a. California Aqueduct			6	6	
b. San Luis Drain			5	4	
c. Peripheral Canal			4	5	
D. Cumulative effects of point sources.	2	3			Monitor related chemicals.
1. Industrial and residential centers.			1	1	
2. Confined feeding areas			2	2	

Sanders (1980, p. 110) described three levels of location that are appropriate for consideration: macrolocation, microlocation, and representative location. Macrolocation is the location of wells within the basin relative to the need for information. Microlocation is the location relative to known dischargers or other unique features that may influence the sample. Representative location relates to the points at the site that need to be sampled--that is, the depth in or of the well or location of perforations opposite the aquifer zones being sampled. Representative location may also relate to the original objective of the network. A network monitoring the variation of water quality over a period of time should monitor the time-series variations during pumping, the variation between aquifers, and the variation within aquifers that the well taps (Schmidt, 1977, p. 131) to improve the network operator's knowledge of what these variations mean. If the objective is to monitor the quality of individual aquifers or specific depths, the representative location from which the water sample is taken may be of major importance. Where more than one aquifer is identified, the representative location dictates that a different well (or sampling point in a well specifically designed for that purpose) be sampled to characterize the quality of water in each zone suspected to have significantly different quality.

A prerequisite for wells included in the phase 2 inventory (Glass and others, 1981) was that they already were in an active monitoring program. Through budgetary necessity, regional ground-water monitoring networks generally have to rely on existing wells and measurements taken by ground-water users in the area (UNESCO, 1978, p. 340). As a result, networks commonly have used production wells often installed for obtaining the greatest volume of usable water. In such wells, casings are commonly perforated opposite many or most of the producing zones. Unless the objective of a monitoring network is to determine the quality of produced water, such wells are not selected as representative locations because of the composite sample of water that they supply. Existing wells must be carefully inspected for construction, present condition, and purpose of installation before they are chosen as sites in monitoring networks that may have incompatible objectives. The drawbacks of using unsuitable existing wells in monitoring ground-water quality are discussed further in the section of the present report, "Adequacy of Active Networks."

Moss (1979, p. 1674) stated, "It is a paradox of network design that the statistical parameters controlling the optimality of a network are frequently the unknowns that the network is being designed to estimate." The data that are collected may change the designer's perception of the hydrologic phenomena, and consequently network design should be reevaluated and updated periodically. Additionally, "regional network design is an endless job," as Moss (1979, p. 1676) mentioned, because of changes in the use of data to meet additional objectives, in the transfer of network-modification information from network operators to regional designers, and in the techniques of network-design evaluation.

The selection of sampling sites must be based on the needs of the specific sampling program (U.S. Geological Survey, 1980a, p. 2-88). Specific sampling programs in this report are described as network categories and subcategories from the list in table 10. The needs of the various categories of ground-water-quality monitoring networks are discussed in detail in California State Water Resources Control Board (1975b), discussed briefly in the following sections, and summarized in table 11. The approximate locations of ideal network sites are plotted on plate 11.

TABLE 11. - Ideal monitoring site locations and pertinent data

Network category and sub-category	Purpose[1]	Optimal distribution of sites	Proposed well depth	Aquifer to be monitored	Proposed suites of constituents	Proposed optimum sampling frequency	Well density[2] (number per township)			
							Ideal	Skeletal	Weight	Priority weighted skeletal
A1	Regional ambient baseline	Bound and grid based on plate 4	Less than 60 feet	Perched	Minerals, nutrients, pesticides	Semiannually	36	1	4	4
A2	do.	Grid over entire basin	Land surface to water table and below perched areas	Unsaturated	do.	do.	36	1	4	4
A3	do.	Grid over area, above A, C, or E clay boundaries (pl. 3a, 3b, 3c)	Variable with clay layer boundaries	Unconfined/ semiconfined	do.	do.	108	3	4	12
A4	do.	Grids below A, C, and E clays	Variable with clay depths	Confined	do.	do.	108	3	4	12
A5	do.	Grid over entire basin, where multiple zones are perforated	Representative of typical local production (composite nonqualifiable)	Composite	do.	do.	36	1	4	4
B1	Regional nonpoint problems: agricultural-return flow[3]	Bound and grid based on plate 4	Less than 100 feet	Unsaturated, unconfined/ semiconfined	Minerals, nutrients pesticides (DBCP[4], DD-Mixture, EDB[5]), and specific conductance	Monthly for 2 years, quarterly for 2 years, then semiannually	72	2	2.5	5
B2	Regional nonpoint problems: applied chemicals[6]	Within area each chemical has been applied (pl. 10)	Less than 200 feet	do.	Example: DBCP[4]	Monthly	72	2	2.5	5
B3, B4	Regional nonpoint problems: refinery wastes and oilfield brines[7]	Initially in areas delineated on plate 9	Land surface to bottom of usable aquifer depending on method of disposal	do.	Minerals, minor elements, other (phenols)	Quarterly	108	3	2.5	8
B5a	Regional nonpoint problems: Saltwater intrusion[8]	Delta saltwater intrusion areas	Determine depths where problem exists	Perched, unconfined/ semiconfined, confined	Minerals	Quarterly	108	3	2.5	8

See footnotes at end of table.

TABLE 11. - Ideal monitoring site locations and pertinent data--continued

Network category and sub-category	Purpose[1]	Optimal distribution of sites	Proposed well depth	Aquifer to be monitored	Proposed suites of constituents	Proposed optimum sampling frequency	Well density[2] (number per township) Ideal	Skeletal	Weight	Priority weighted skeletal
B5b	Regional nonpoint problems: Connate intrusion[8]	Connate water areas west of Wasco (pl. 7a)	Lower zones of confined aquifer above and below E clay	Confined			36	1	2.5	3
B6	Regional nonpoint problems: radioactive substances	Grid over basin to maintain general surveillance (more dense in areas on plate 9)	Less than 200 feet and in expected contaminated zones	Unconfined/ semiconfined, confined	Gross alpha, gross beta, radium, as in EPA primary drinking water standards	Semiannually	72	2	2.5	5
B7	Regional nonpoint problems: native substances	Areas of known high natural concentrations	Zones of expected location	Unconfined/ semiconfined, confined	Nitrates, arsenic	Every 5 years	72	2	2.5	5
C1, C2	Line sources: natural streams and artificial channels (examples from table 4)	Corridor along both sides of potential line sources	Less than 400 feet	Unconfined/ semiconfined	Minerals, minor elements, supplemental minor elements, nutrients, pesticides	Semiannually	36	1	2.5	5
D1	Cumulative effects of point sources: urban and industrial centers (pl. 1)	Bound and grid areas from plate 1	To upper regions of first confined zone	Perched, unsaturated, unconfined/ semiconfined, confined	Minerals, Nitrogen, oil and grease, heavy metals, solvents, other	Quarterly	144	4	1	4
D2	Cumulative effects of point sources: confined feeding areas (pl. 1)	Bound and grid areas (Tulare County example)	Less than 400 feet	Unconfined/ semiconfined	Minerals, nutrients	Annually	36	1	1	1

[1]See table 4 for list of network categories.
[2]Weighting of priority was as follows: priority 1 = 4; priority 2 = 3; priority 3 = 2; priority 4 = 1. When priorities of the State Water Resources Control Board and Regional Water Quality Control Board differed, the priorities were averaged.
[3]After Tinlin (1976), p. 44-52.
[4]Dibromochloropropane.
[5]Ethylene dibromide.
[6]Example after California Department of Health Services Monitoring, Net 33, Basin 5-022, in Glass and others (1981).
[7]After Tinlin (1976), p. 3-11.
[8]After California Department of Water Resources (1967); California State Water Resources Control Board (1975b), basin 5d, p. 2-14-11; and Page (1973).

Regional ambient-conditions networks

To delineate regional ambient conditions adequately, the water-quality variations in the different depth zones must be considered in addition to the areal variations. In the present report, five types of regional ambient-conditions networks or zones (table 10) are considered: Perched or shallow, unsaturated, unconfined or semiconfined, confined, and produced or composite.

Perched or shallow zone.--The quality of water perched above shallow clay layers commonly influences the quality of water in lower zones. Personnel at the Fresno office of the Regional Water Quality Control Board (S. J. Green, written commun., December 16, 1982) have empirical evidence that water is cascading from the perched or shallow zone in some agricultural areas east of Buena Vista Lake and Lost Hills areas in Kern County (pl. 9) and may be affecting the quality of water in the lower zones. The boundary of the present and potential drainage problem areas (pl. 4) and the boundary of the A clay (plate 3a) may delineate the areal distribution for most of this network, but small areas of perched water have also been identified in association with clay lenses along the east side of the valley, as is discussed in the "Occurrence" section on ground water in the present report. For now, the boundary of the network approximates the boundaries of those areas delineated on plate 9. At least in the areas of existing empirical evidence, this network should monitor above the restricting layer, in the unsaturated zone, and in the saturated zones of the unconfined and confined zones to determine the amount of hydraulic connection between zones and to predict long-term consequences on the main producing zones. Wilson and Schmidt (1978, p. 138) concluded that monitoring of water from the perched zone can provide a good indication of the quality of irrigation-return water. Since 1959, the California Department of Water Resources (1982, p. 1) has monitored the quality of agricultural-return water from sumps in areas that use tile drains. Apparently, more data are needed on the effects of agricultural-return flows on the underlying ground water as well as the areal distribution of those effects, as is suggested in the agricultural-return-flow network discussed later in this report.

Vadose or unsaturated zone.--In the San Joaquin Valley, little monitoring has been done in the unsaturated zone except around some specific solid-waste disposal sites, such as the Southeast Regional Disposal Site in Fresno County. The term "vadose zone" is occasionally used interchangeably with "unsaturated zone," but according to Bouwer (1978) saturated regions are often present in some vadose zones. In any case, monitoring in these zones can provide an early warning of local subsurface-pollutant movement (Wilson, 1981, p. 32). Sgambat and others (1978, p. 190) discussed monitoring in shallow zones to predict the transport of surface applications (especially nitrates) to the underlying aquifers in unsewered, permeable areas. The California Department of Water Resources (1967, p. 44 and 70) stated that in the alluvial-fan areas of San Joaquin County water moves through this zone in less than 1 year, and they assumed that annual inputs at the surface can be considered annual inputs to the water-table aquifer. Other areas of known high permeability in the San Joaquin Valley are near Winton in Merced County and near Kingsburg in Fresno County. Monitoring the unsaturated zone provides local information on pollutant transport. Areas of higher permeabilities, which have more rapid pollutant transport, may be a higher short-term priority for monitoring. Pollutants take longer to reach ground water in less permeable areas, and they are more difficult to monitor (K. D. Schmidt, ground-water-quality consultant, Fresno, oral commun., January 20, 1983), but they may be no less a problem once they contaminate the ground water.

Unconfined or semiconfined zone.--This zone is commonly referred to as the water-table aquifer. In some areas of the San Joaquin Valley, especially on the east side, this zone is the major source of water, but in other areas, primarily on the west side, the quality of water in this zone precludes its use for many purposes. In both areas the quality of water in this zone is important for both its direct and indirect effects on usable ground water. Wells selected to monitor this zone on the west side of the valley are few, because ground water is not commonly used. Ideally, more wells should be drilled in this area in order to define the quality of water in this zone more precisely and to determine its effect on the lower zone. Although the lower zone is generally referred to as confined, producing and abandoned wells may transfer water between zones.

Confined zone.--The quality of water in confined zones in the San Joaquin Valley is commonly better than the quality of the overlying zones. The effects of heavy pumping from this zone, however, as well as the potential effect of the overlying and underlying zones, make the ambient quality of water in this zone an important factor. The largest horizontal boundary of this zone coincides with the boundary of the E clay (plate 3c).

Produced or composite ground-water quality.--In some areas of the valley, common practice among drillers has been to tap all the coarse-grained zones in wells that may be hundreds of feet deep and to perforate all zones expected to produce high volumes of usable water. These wells are not qualified for many network purposes because they produce composite samples from various aquifers. Such wells are not useful in ground-water-quality monitoring networks concerned with defining the water-quality in different aquifers, but they are useful in determining the quality of produced water used at the land surface (Welsh, 1974, p. 236). Pumping of these wells is typically heaviest during dry years, when surface water is less available for irrigation. Wells in this category commonly go unused for years, as do some wells in the confined-zone category, owing to the cost of pumped ground water compared to surface water. Monitoring networks in this category, therefore, should be flexible enough to sample economically during pumping periods and not during inactive periods, or else they should be funded to pay for the wells to be pumped during normally inactive periods for the sole purpose of sampling water quality.

Regional nonpoint-source problem networks

Seven subcategories were chosen as examples of possible entries into the category of regional nonpoint-source problem networks. The subcategories are not meant to be all inclusive, and subsequent iterations in network design may add or delete some of the categories discussed in the following sections.

Agricultural-return flow.--A major nonpoint-source problem in California is agricultural wastewater and irrigation return (Welsh, 1974, p. 236). The effects of applied surface and ground water and the resultant salt loading of the ground-water resource have long been a concern for the San Joaquin Valley (Jacobsen and Adams, 1971); detailed information on the subject is provided in California Department of Water Resources (1970a, p. 91-97) and California State Water Resources Control Board (1975a, p. 2-15-4 to 2-15-28 and 2-16-122 to 2-16-142; 1975b, p. 2-15-152). In the present report, the land-use map (pl. 1) indicates that most of the land is used for various agricultural purposes, such as cropland and pasture, orchards and vineyards, confined feeding areas, and rangeland. Many different single-purpose monitoring networks are needed to monitor the overall effects of agriculture on the quality of the ground water in the San Joaquin Valley--one for each agriculturally applied chemical, for example. However, the primary purpose of monitoring the effects of agricultural-return flow on ground water is probably to detect salinity trends. The network might include the region delineated on plate 4 as present and potential drainage-problem areas, located mainly in the trough of the valley, where natural drainage concentrates. The effects of agricultural-return flow are much more extensive, however. Sampling of ground water in most of the cropland, pasture, orchard, and vineyard areas can probably indicate effects of salt loading from applied irrigation water.

As Ayers and Coppock (1974, p. 15) suggested, this network can monitor drainage wells that pump out the salty, leachate, polluted upper layers of the water table (unconfined) aquifers. Sampling of the unsaturated zone, as suggested in Tinlin (1976, p. 43), in target locations typical of larger areas can also help to predict areas of ground-water contamination by agricultural-return flows. According to the San Joaquin Valley Interagency Drainage Program (1979, p. 61), the most abundant salt-producing ions found in agricultural-drainage water are sodium, calcium, magnesium, sulfate, chloride, and bicarbonate. Therefore, analysis of water in this network, as noted in table 11, should include these ions and specific conductance or total dissolved solids for comparison with similar ambient natural concentrations of the same constituents.

Other problems related to agricultural-return flow are discussed in the other subcategories of networks. Nitrates from fertilizers, sulfates from soil amendments, and pesticide residues could each require separate, single-purpose networks under the subcategory, "Regionally applied chemicals." Radioactive substances contained in soil amendments should be considered under the subcategory, "Radioactive substances." Monitoring of agricultural-return flow includes all of these concerns, as well as the effects on the streams and canals that remove water from this highly developed agricultural area--a further example of how complex and interrelated network design can become. A network to monitor agricultural-return flow may best be designed for the sole purpose of determining the areal extent and degree of salt loading, leaving the multitude of related concerns to other networks. Much work has been done on the relations of salt loading and ground-water quality in the San Joaquin Valley (California Department of Water Resources, 1970a), and this research should be used as background information in the operation of this network subcategory.

Regionally applied chemicals.--The design of an adequate monitoring network for regionally applied chemicals would require a thorough review of the chemicals applied in the San Joaquin Valley. An approach similar to the one previously mentioned in this report could be used as a first step in identifying which specific chemicals should be monitored in which areas of the valley. In addition to the nitrogen fertilizers and calcium sulfate (gypsum) soil amendments, monitoring of a multitude of applied pesticides and herbicides would probably be necessary. Concern may arise about many chemicals, as more information is gathered about their mobility, potential for ground-water contamination, and health hazards. Recently, DBCP (dibromochloropropane) use has created much concern because it was found to be more mobile than previously expected. Because of the currently extensive monitoring for DBCP (Glass and others, 1981, network 33 in the San Joaquin Valley basin), it is used as an example in this report (pl. 7d). Currently active studies in the Toxic Substances Control Program of the California State Water Resources Control Board should provide more information on specific chemicals. Among the chemicals of interest are DD-Mixture (1,2-dichloropropane), EDB (ethylene dibromide), Carbofuran, Atrazine, DBCP, and Aldicarb (D. R. Gilmore, California State Water Resources Control Board, oral commun., February 10, 1983).

The California Department of Food and Agriculture collects records of the pesticide-use permits issued by county agriculture commissions and of the volumes of chemicals applied by licensed operators in California. The University of California, Davis, Department of Environmental Toxicology maintains computer files of these data on applications of DBCP in the San Joaquin Valley for its "period of recorded legal use" (emphasis added) between 1971 and 1977. Based on these data, plate 10 shows the location and volumes of DBCP applications. Plate 7d shows where DBCP has been found, as of 1982, in action-level concentrations in the ground water of the San Joaquin Valley. Comparing the locations of use of specific chemicals with the locations of ground-water contamination can provide some information on where and under what conditions contamination may be expected.

For several reasons, however, conditions leading to potential contamination are difficult to assess. The computer data on the applications of pesticides are limited to the period of time since awareness of potential problems arose for each pesticide, not necessarily for its period of use. The data are also limited in that only licensed application firms are usually included in the permits on file with the California Department of Food and Agriculture (1980), and unlicensed applications are not recorded (Li and others, 1977, p. 15). The recording procedure is also limited in the accuracy with which data on areas of application are located. The accuracy of chemical-use locations depends on the concern at the time for potential adverse environmental impact of that chemical and on human error during site location and entry into computer files.

Millions of pounds of chemicals are used annually to control pests in California, but the movement and ultimate fate of many of these chemicals within the ecosystem are poorly understood (Li and others, 1977, p. 79). California is apparently not alone in its lack of understanding of the presence and effects of agricultural chemicals in ground water, as has been witnessed in the Aldicarb problems experienced in Suffolk County, New York (Baier and Moran, 1981). In the San Joaquin Valley, however, ground water in parts of Fresno and Kern counties has been sampled for Aldicarb with no evidence to date of concentrations as great as 1.0 µg/L--the suggested standard of the National Academy of Sciences is 7.0 µg/L (Groundwater Pollutant Study Review Committee, 1982, p. 4-26). Monitoring of pesticide contamination is presently marked with contradictions and uncertainties, so that much more research is needed in this controversial area.

The effects of soil amendments on changes in the water type in ground water of the San Joaquin Valley is another area in which further study is needed to meet the general network objective (table 9) of monitoring observed or anticipated moving interfaces of ground-water-quality types.

Refinery wastes.--The residual salts and phenols associated with certain oil-field and refinery wastewater-disposal techniques have been one of the major sources of ground-water degradation in the Tulare Lake Basin (California State Water Resources Control Board, 1975b, p. 2-14-56). The areas near West Bakersfield-Rosedale, Hanford, and Coalinga are of primary concern for known or suspected contamination of this sort in the San Joaquin Valley. Phenols, which are used for fungicide treatment in the citrus industry, in wood treatment, and in pesticides, may become a concern in Fresno and Tulare Counties. A preliminary network for monitoring phenols around the oil fields and refineries, delineated on plate 9, is desirable for better understanding of this situation.

Oilfield brines.--The brackish or saline water commonly produced in oil and gas operations strongly reflects the composition of connate water underlying much of the Tulare Lake basin (California State Water Resources Control Board, 1975b, p. 2-14-56), typically sodium chloride water with salinity concentrations ranging from 2,000 mg/L to several times that of seawater. Wastewater-disposal practices that degrade ground-water quality are being phased out, but the effects of past activities and the surveillance of current techniques dictate the need for a network to monitor associated changes in ground-water quality with time.

Saltwater and connate-water intrusion.--Intrusion of saltwater into the Delta has been a matter of concern for years, but to date little information is available to document the problem clearly. Considering the present and potential diversions of water from this area, monitoring the effects on ground water is of paramount importance. The best available data are included in California Department of Water Resources (1967) and Franco and others (1980), but beyond minimal sampling there is no active monitoring. The complex phenomenon of connate-water intrusion is described as "upconing" by Todd (1980, p. 502-505). In the Semitropic area of Kern County west of Wasco, connate-water intrusion has the potential for contamination of usable ground-water, and other areas of the Tulare Lake basin may have a similar potential problem (California State Water Resources Control Board, 1975b, p. 2-14-11). Delineations of the approximate base of fresh ground water by Page (1973), Hotchkiss and Balding (1971, plate 3), and Berkstresser (1973) are included in the present report as plate 7a. Comparison of plate 7a with water-level maps, similar to plates 5a, 5b, and 5c, for areas of heavy pumpage provides further information on specific areas of highest potential for this problem.

Radioactive substances.--Concentrations in ground water of native radioactive substances exceeding drinking-water standards have been reported in an area near Lathrop (Don Rothenbaum, California Regional Water Quality Control Board, Sacramento office, oral commun., 1982). Other potential areas of concern are near Corral Hollow Creek in San Joaquin County and near Helm in Fresno County. Further study should be undertaken to determine the distribution of native and imported sources of radioactive substances in the San Joaquin Valley, including substances applied as soil conditioners.

Native substances.--The distribution of naturally occurring levels of constituents that may have deleterious effects on ground-water quality has been discussed for areas in the San Joaquin Valley since the works of Mendenhall and others (1916). Some of the common native substances are the high sodium and potassium content in the alkali areas of the Tulare Lake bed and the concentrations of sulfate, chloride, boron, selenium, and arsenic along the west side of the valley. Because of the relation between the character of the water and the origin of the aquifer sediments, the distribution of water types provided in California Department of Water Resources (1965) and Sorenson (1981) are indicative of native anion and cation concentrations.

Skogerboe (1971, p. 12-13) mentioned that the major sources of nitrates in this area are the "natural nitrates in the soils and, to a lesser extent, applied fertilizers." High concentrations of native nitrates in ground water near the west-side tile drains and near Lindsay were noted during the present study (Lloyd Doneen, Ph.D., Professor emeritus, University of California, Davis, oral commun., 1982). Native nitrates have been found associated with Panoche, Oxalis, and Lost Hills soils from Tertiary marine parent material (see pl. 2, T15S/R12E), according to the California Department of Water Resources (1971c, p. 80-84).

Similar Tertiary marine parent materials elsewhere along the Coast Ranges may also be sources of native nitrates in quantities significant enough to influence ground-water quality, but a closer inspection of monitoring results is necessary to confirm this possibility. No published reference has been discovered for the Lindsay area native-nitrate conditions. The native concentrations of ground-water constituents are important in understanding the effects of man's surface and subsurface activities, so that, if there are no documents on the native nitrate or other constituents in the San Joaquin Valley basin, it may be advisable to determine their presence and location for reference purposes. Depending on the native substance under consideration, the regional ambient-conditions network proposed in the present report may help to develop such a reference.

Line sources

Sources of ground-water pollution can be classified as point, nonpoint, or line (Whitehead and Parliman, 1979, p. 13). In designing a monitoring network for regional ground-water quality, emphasis is placed on the broader effects of pollution sources, such as regional nonpoint-source problems, line sources, and cumulative effects of point sources. In the San Joaquin Valley, emphasis has in the past been placed on the quality of surface water or the quality of ground water, and less attention has been given to the relation of surface water to ground water. The line-source category emphasizes the relation between surface and ground water in the hydrologic system. Both natural drainages and artificial channels are line sources that may influence the quality of ground water. Specific examples of line sources that should be monitored for their effects on ground-water quality in the San Joaquin Valley are discussed in the following paragraphs.

Natural drainages.--All the natural drainages that flow into the valley influence the ground-water quality to one degree or another. Three of the larger streams were selected for this first attempt at network design because they are known to have problems that may significantly affect ground-water quality, not because they are the only streams that should be considered. A more thorough inventory of stream quality should be made and potential effects assessed for future expansion of this network subcategory.

The San Joaquin River, the main tributary to most of the ground-water basin, has been severely affected by diversions of water and return flows from irrigated agriculture and urban developments. An entire report could be written on the soils most susceptible to rapid percolation and the poorest reaches for water quality along the San Joaquin River and other drainages where ground water may be most severely affected. Such a study is beyond the scope of the present report; until more information is available, the proposed network includes all reaches of the San Joaquin River and some reaches of the lower Kings and Kern Rivers. Monitoring would determine areas of positive and negative influence on ground-water quality. Reaches of the lower Kings and Kern Rivers were identified for initial well selection based on information from the California State Water Resources Control Board (1975b, p. 2-15-169).

Artificial channels.--The California Aqueduct, the San Luis Drain, and the previously proposed Peripheral Canal were selected as the first three artificial channels for monitoring effects on ground-water quality. These three channels were included because of observed or expected effects. Such other channels as the Delta-Mendota Canal, San Luis Canal, and the Firebaugh Return Canal probably should be monitored as well, but further study is needed to determine which channels and reaches should be included.

Cumulative effects of point sources

The land-use map (pl. 1) and the map showing existing and potential point sources of possible ground-water contamination (pl. 8) were used to identify regions of possible cumulative effects of point sources. The present study is the first attempt to map all of the possible point sources for the entire San Joaquin Valley. Further studies similar to the one by Pfannkuch and Labno (1976) may result in the addition or deletion of sites. Unlike some regions where nonpoint sources historically have been monitored instead of point sources (Takasaki, 1977, p. 3), monitoring in the San Joaquin Valley has emphasized point sources and water pumped for domestic or agricultural purposes (Glass and others, 1981). The cumulative effects of point sources, however, have not been determined. Concern has been expressed (S. J. Green, California Regional Water Quality Control Board, Fresno Office, oral commun., 1982) that concentrated industrial-residential areas and confined-feeding areas may be having unknown effects on the ground water of the San Joaquin Valley. Networks to determine the regional effects of other point sources, such as disposal sites, mining areas, and exurban-growth areas also should be included in a future design.

Industrial and residential centers.--The largest industrial and residential areas in the San Joaquin Valley are near Stockton, Modesto, Fresno, and Bakersfield (pl. 1). The variety of potential contamination in these areas is probably the greatest of any known potential sources of ground-water degradation (Todd, 1980, p. 322). The large array of potential pollutants from urban runoff mentioned in California State Water Resources Control Board (1975b, p. 2-15-88) included pesticides, herbicides, oil and grease, heavy metals (particularly lead), rubber, dissolved minerals and nutrients, and organic matter. In cooperation with the U.S. Environmental Protection Agency, the Science and Education Administration--Water Management Research, and several local agencies, the U.S. Geological Survey is currently studying the effects of retention and recharge of urban storm runoff on the quality of ground water in the Fresno area. The results of that study can provide insight into the potential adverse effects of industrial-residential areas on the ground-water resources of the Central Valley (Richard Oltmann, U.S. Geological Survey, Sacramento, Calif., oral commun., 1982). Until these effects are more clearly defined, the suspected pollutants from domestic activities and point sources (tables 4, 5, 6, and 7; and pl. 8) should be monitored.

Confined-feeding areas.--The concentration of a large number of animals within a confined area can create a wasteload that overtaxes the natural assimilative capacity of the soil (Todd, 1980, p. 332). A single such area may have little regional effect, but the cumulative effect of many areas may be significant. Plate 1 shows that the highest concentration of confined-feeding areas in the valley is in Tulare County, but there are confined-feeding areas in all San Joaquin Valley counties. The feeding operations on plate 1 are large, specialized enterprises of livestock production, chiefly beef-cattle feedlots, dairy operations, poultry farms, and hog feedlots (Anderson and others, 1976, p. 14). The ideal ground-water-quality monitoring network provides information on the location and concentration of these and other point sources to determine maximum loading capacity without degradation of ground-water quality. Nitrate nitrogen is the most important persistent pollutant that may reach the water table from animal wastes, but salts, organic loads, and bacteria may also be transported (Todd, 1980, p. 332).

Actual Network

Summary of Active Networks

Between November 1978 and January 1979, 24 networks were identified for the phase 1 preliminary inventory of the active ground-water-quality monitoring networks in the San Joaquin Valley. Phase 2 provided a catalog of all networks previously identified as well as those identified since the end of phase 1. Between February 1980 and February 1981, Glass and others (1981) compiled computer-tabulated catalogs, which included more than 1,500 wells in 30 networks within the San Joaquin Valley ground-water basin, and provided the catalogs to the State Water Resources Control Board, as had been requested.

Active networks change rapidly. Between the end of phase 1 (January 1979) and the end of phase 2 (February 1981), 6 of the original 24 networks ceased operations; during the 1-year study for phase 2, 12 additional networks were identified. Since then, awareness of degradation of ground-water quality has increased, and Federal regulations like the Resource Conservation and Recovery Act (RCRA) of 1976 require monitoring programs for most point sources of contamination. Sanders (1981) discussed the general effects of RCRA, which for the San Joaquin Valley include starting many new ground-water-quality monitoring networks, concerning which little information was available for the present report. The inventory of active networks in Glass and others (1981), which was used in preparation of table 12 (given at end of this report), is already partly obsolete.

The main constituents monitored in the networks identified in Glass and others (1981) for the San Joaquin Valley ground-water basin were those required by the Safe Drinking Water Act. Irrigation and water-storage districts, however, were usually interested in a set of standard mineral constituents considered important for agricultural purposes. General chemical, bacterial, and standard mineral constituent analyses constituted the monitoring done by about 70 percent of the networks and more than 90 percent of the wells. The other constituents monitored in the networks included in the phase 2 inventory were usually specific contaminants related to particular point sources. For example, the California Department of Health Services monitors the extent of ground-water contamination from regional nonpoint applications of the agricultural pesticide DBCP (dibromochloropropane) (pl. 7d). Among the specific contaminants monitored by the point-source networks were the solvent, TCE (trichloroethylene); the wood-treating chemicals, creosote and PCP (pentachlorophenol); trace elements; and chlorides.

Adequacy of Active Networks

The catalog of active networks or parts of networks included in the phase 2 inventory (Glass and others, 1981) is incomplete because of (1) contradictory information provided by the operating agencies and (2) the time required to obtain, interpret, and qualify the information. The size and complexity of the basin also provided more work than was possible to complete in the time allotted to the project. The utility of the phase 2 inventory to the design phase was also limited by a recent increase in ground-water-quality monitoring networks and frequent changes in the number and location of wells of active networks. An adequate inventory of active networks requires continuous updating. The phase 2 inventory identified the tip of an iceberg of monitoring, the size of which is difficult to determine at this time.

The adequacy of each network to meet its monitoring objectives can be fully determined only through a study of each network and its resulting data. Generally, the networks meet their objectives--some better than others. The field of ground-water-quality monitoring is rapidly improving, but many network operators are not yet aware of these improvements or have not implemented the new methods. The inventoried networks can all be improved in certain areas of their operation, whether in well identification and qualification or in data handling.

Comparison of tables 11 and 12 and of plates 11 and 12 can give information on which to judge the adequacy of the active networks included in Glass and others (1981) to meet the goals set by the ideal networks.

The inventoried networks do not meet the requirements of the multiple-objective ideal network for the entire ground-water basin that the State and Regional Boards desire. The largest active network in the San Joaquin Valley is monitored by the California Department of Health Services to insure that the drinking water meets certain established standards. If the objective of that network were to identify trends in ground-water quality or differences in water quality with depth, it would not be met under current operation practices. The inventoried networks justify the statement currently made by most references on network design that the most important step in establishing a network is to establish the objectives of that network clearly. None of the objectives listed for the ideal network in table 10 are currently being met for the entire San Joaquin Valley ground-water basin. Even the type of monitoring done most extensively, quality of produced ground water, is not adequately monitored for all uses. Ideal locations and an initial regimen to meet the objectives of the various categories of networks proposed in table 10 adequately are given in table 11. As Henning and others (1983, p. 37) stated, "Slight modifications in data collection and analysis may provide management with the other valuable information with which to make operational and future planning decisions."

Selection of Wells

Wells were selected from the inventory of active ground-water-quality monitoring networks (Glass and others, 1981) to approximate the objectives suggested by the State and Regional Boards (table 10). In some areas where no inventoried wells were located but were needed, wells not known to be currently monitored were selected from the U.S. Geological Survey Ground Water Site Inventory file in WATSTORE; these wells are included in table 12 and located on plate 12. The purposes of this first actual network (pl. 12) are (1) to approximate the ideal network using active monitoring networks and (2) to provide guidance on how the actual network could be improved. Use of data that may have been collected from a number of different sources to meet a variety of different objectives may limit the reliability of the results. The actual network is a pioneering attempt at approximating the needed data-collection operation using a set of existing wells. Tests of the adequacy of the resulting network will have to wait until there are some data to analyze.

SUMMARY AND CONCLUSIONS

In the present report, ideal and actual ground-water-quality monitoring networks have been proposed for the San Joaquin Valley ground-water basin in California. An ideal network, comprising several subnetworks, was outlined in table 10 and discussed in more detail in the text, and sites were listed on table 11 and approximately located on plate 11. The ideal network was provided for direction in the development of an actual network and to serve as a basis for long-term expansion. The actual network was composed of currently monitored wells, but additional wells not known to be monitored were also included to provide guidance in selecting wells in areas that need expanded monitoring.

The report outlined the general physical features of the basin that influence ground-water quality, the relevant geology and hydrology, and the specific water conditions in various parts of the basin. The report also set forth management objectives for monitoring of ground-water quality in the valley: Development of a ground-water-quality baseline; identification of temporal and spatial trends in ground-water quality; and identification of large-scale sources of contamination of ground water.

The current level of ground-water-quality monitoring in the San Joaquin Valley needs expansion to meet its objectives. The present sampling activities and objectives for the many networks operated in the valley are not adequately monitored, coordinated, and evaluated. Standards are lacking that allow data collected for a specific purpose to be used for other purposes as well. Without a coordinated effort, the accountability of existing monitoring cannot be effectively evaluated and controlled to provide the best use of available funds.

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EXPLANATION OF TABLE 12

State well no: Wells are identified according to their location in the rectangular system for the subdivision of public land. The identification consists of the township number, north or south; the range number, east or west; and the section number. The section is further subdivided into sixteen 40-acre tracts lettered consecutively (excepting I and O), beginning with A in the northeast corner of the section and progressing in a sinusoidal manner to R in the southeast corner. Wells within the 40-acre tract are numbered sequentially. The base line and meridian are indicated by the final letter, as follows: M, Mount Diablo; and S, San Bernardino.

Lat: Latitude of the well location.

Long: Longitude of the well location.

Accuracy: Accuracy of the latitude and longitude location, as follows: S, ± 1 second; F, ± 5 seconds; T, ± 10 seconds; and M, ± 1 minute.

County: County in which well is located, as follows: 1, Alameda; 13, Contra Costa; 19, Fresno; 29, Kern; 31, Kings; 39, Madera; 47, Merced; 77, San Joaquin; 99, Stanislaus; 107, Tulare.

Agency DWR No: Number used by the California Department of Water Resources to identify agencies and firms that operate networks or analyze samples, as follows:

P: Private lab
1851: U.S. Agricultural Research Service
1893: Tulare Lake Drainage Dist.
2444: F.M.C. Corp.
2489: Fiberboard Corp.
2863: Tulare County
3858: Foster Farms
4203: Stockton, City of
4740: Southern California Edison Co.
5000: U.S. Geological Survey
5006: U.S. Air Force Environmental Health Lab
5050: California Dept. of Water Resources
5055: California Regional Water Quality Control Board
5060: California Dept. of Health Services
5110: San Joaquin County
5112: Fresno County
5127: Merced County
5129: Kings County Water Dist.
5133: Kern County Water Agency
5146: California Water Labs
5191: Agricultural Technical Services Co. Lab
5200: Fresno, City of
5521: Modesto Irrigation Dist.
5524: Turlock Irrigation Dist.
5615: North Kern Water Storage Dist.
5617: Semitropic Water Storage Dist.
5638: Alpaugh Irrigation Dist.
5640: Buena Vista Water Storage Dist.
5644: Arvin-Edison Water Storage Dist.
5649: Wheeler Ridge-Maricopa Water Storage Dist.

Agency DWR No--continued:

5701: California Water Service Co.
5802: Twining, Fresno Lab
5803: Hornkohl Lab
5806: B.C. Lab
5809: Stoner Lab
5810: Braun, Skaggs, and Kevorkian Lab
5819: Brown and Caldwell Lab
5882: Analytical Research Lab
6218: Stanislaus County
9484: Environmental Quality Analysis, San Francisco, Lab
9551: Morse Lab
9579: Witzke Lab
9597: Nelson Lab

Analysis type: Water-quality parameter-analysis code, as follows:

A: Physical
B: Common chemical
C: Trace elements
D: Pesticides
E: Nutrients
F: Sanitary
G: B and D
H: B and E
I: B and C
J: B and F
K: D and E
L: C, D, and E
M: All or most
N: B, C, and radioactivity
P: A, B, and C
Z: Other

Laboratory: Source of water-sample analysis (see Agency DWR no. for list of codes).

Frequency: Frequency of sample collection codes, as follows:

A: Annual
B: Bimonthly
C: Continuous
D: Daily
F: Semimonthly
I: Intermittent
M: Monthly
Ø: One time only
Q: Quarter annual
S: Semiannual
W: Weekly
2: Every 2 years
3: Every 3 years
4: Every 4 years
5: Every 5 years
X: Every 10 years
Z: Other

Year began: Year of first sample collection as part of the network inventoried by Glass and others (1981).

Data source: Code used by the U.S. Geological Survey to identify the agency that would be a source of the water-quality data collected, as follows:

CA001: California Dept. of Water Resources
CA020: Turlock Irrigation Dist.
CA026: Modesto Irrigation Dist.
CA036: Buena Vista Water Storage Dist.
CA066: Southern California Edison Co.
CA111: California Dept. of Health Services
CA116: California Regional Water Quality Control Board
CA154: Wheeler Ridge-Maricopa Water Storage Dist.
CA155: North Kern Water Storage Dist.
CA156: Tulare County Dept. of Public Works

EXPLANATION OF TABLE 12--Continued

Data Source--continued:

CA157: Alpaugh Irrigation Dist.
CA158: Tulare County Drainage Dist.
CA159: Kings County Water Dist.
CA160: Fresno County Resources Development Dept.
CA161: Fresno, City of, Wastewater Treatment Facility
CA162: Merced County Dept. of Health
CA163: San Joaquin County Flood Control and Water Conservation Dist.
CA166: Kern County Water Agency
CA174: Foster Farms
CA176: Pacific Fibreboard
CA177: Fresno County Dept. of Health
CA178: F.M.C. Corp.
CA179: Arvin-Edison Water Storage Dist.
CA241: California Water Service Co.
USAF: U.S. Air Force
USGS: U.S. Geological Survey
USSEA: U.S. Science and Education Administration, Agricultural Research Service

Data location:

Location

C: Cooperator's office
D: U.S. Geological Survey district office
R: U.S. Geological Survey project or field office
Z: Other

Format of storage

F: Office files
M: Machine readable (computerized)
P: Published
Z: Other

Well depth: Distance, in feet below land surface, to the bottom of well casing.

Perf interval: Distance, in feet below land surface, to first and last (if shown) openings in perforation intervals.

Geohydro unit: Geohydrologic unit codes used in WATSTORE (Rollo and others, 1979, p. F5-F10 and F42-F48) for the computer processing of ground-water data. The codes are based on the stratigraphic coding system proposed by the American Association of Petroleum Geologists.

EXPLANATION OF TABLE 12--Continued

Well seal: Distance, in feet below land surface, to approximate bottom of surface sanitary seal. Because of computer retrieval problems, entries in this column should be multiplied by 10. No entry means no seal is known to be present, except for well class 1, for which seal is less than 10 feet below land surface.

Well class: Each well from Glass and others (1981) was assigned to one of four classifications according to the availability of data concerning its construction and lithology. The classification of each well is based on the availability of five key items of information: (1) opening (perforated interval) records; (2) depth of well; (3) casing record; (4) sealing record; and (5) well logs. Each well is classified according to type and number of key items that are available for the well, as follows:

Class 1: All five key items are available and complete; if well seal is blank, seal is less than 10 feet below land surface.
Class 2: The opening record (1) is available, but one or more of the remaining key items may be lacking or incomplete.
Class 3: The opening record (1) is lacking, but one or more of the remaining key items is available.
Class 4: All five key items are lacking.

(NOTE: WHERE NO WELL CLASS EXISTS IN THE TABLE, THE WELLS ARE NOT KNOWN TO BE MONITORED AND ARE PLOTTED ON PLATE 11 AS SUGGESTED IDEAL ADDITIONS TO THE ACTUAL MONITORING WELL LIST.)

TABLE 12.--Actual Monitoring-Well Locations and Pertinant Data

A. Regional Ambient Networks

1. Perched or shallow zone

STATE WELL NO	LAT	LONG	ACCU-RACY	COUNTY	AGENCY DWR NO	ANAL-YSIS TYPE	LABORATORY	FREQ-UENCY	YEAR BEGAN	DATA SOURCE	DATA LOC-ATION	WELL DEPTH	PERF INTERVAL	GEOHYDRO UNIT	WELL SEAL	WELL CLASS
001N004E34H01M	375323	1213053	S	77	5050	B	5050	S	1977	CA001	C F	14	12- 14	111FLDB		2
001N004E35R01M	375300	1212955	S	77	5050	B	5050	S	1978	CA001	C F	12	10- 12	111FLDB		2
001N004E36K03M	375321	1212904	S	77	5050	B	5050	S	1975	CA001	C F	50		111FLDB		2
001N005E02F01M	375750	1212341	S	77	5050	B	5050	S	1975	CA001	C F	50		111FLDB		2
001N005E03Q01M	375723	1212437	S	77	5050	B	5050	S	1976	CA001	C F	12	10- 12	111FLDB		2
001N005E03R01M	375724	1212417	S	77	5050	B	5050	S	1978	CA001	C F		10- 12	111FLDB		2
001N005E10A01M	385720	1212419	S	77	5050	B	5050	S	1975	CA001	C F	30		111FLDB		2
001N005E10P01M	375641	1212433	S	77	5050	B	5050	S	1975	CA001	C F	30		111FLDB		2
001N005E10Q01M	375639	1212437	S	77	5050	B	5050	S	1977	CA001	C F	13	11- 13	111FLDB		2
001N005E15F01M	375612	1212448	S	77	5050	B	5050	S	1978	CA001	C F	12	10- 12	111FLDB		2
001N005E15L02M	375604	1212450	S	77	5050	B	5050	S	1975	CA001	C F	50		111FLDB		2
001N005E21E03M	375514	1212612	S	77	5050	B	5050	S	1978	CA001	C F	13	11- 13	111FLDB		2
001N005E21F01M	375519	1212604	S	77	5050	B	5050	S	1975	CA001	C F	30		111FLDB		2
001N005E21M02M	375505	1212606	S	77	5050	B	5050	S	1978	CA001	C F	13	11- 13	111FLDB		2
001N005E22E01M	375516	1212515	S	77	5050	B	5050	S	1978	CA001	C F	13	11- 13	111FLDB		2
001N005E29C02M	375436	1212702	S	77	5050	B	5050	S	1977	CA001	C F	10	8- 10	111FLDB		2
001N005E29F01M	375429	1212654	S	77	5050	B	5050	S	1977	CA001	C F	13	11- 13	111FLDB		2
001N005E30Q03M	375400	1212754	S	77	5050	B	5050	S	1975	CA001	C F	50		111FLDB		2
001N005E31D01M	375343	1212833	S	77	5050	B	5050	S	1979	CA001	C F	11	9- 11	111FLDB		2
001N005E31E01M	375337	1212830	S	77	5050	B	5050	S	1978	CA001	C F	11	9- 11	111FLDB		2
001N005E31P01M	375307	1212810	S	77	5050	B	5050	S	1977	CA001	C F	11	9- 11	111FLDB		2
001N005E36M01M	375327	1212301	S	77	5050	B	5050	S	1976	CA001	C F	12	10- 12	111FLDB		2
001N006E31L01M	375322	1212132	S	77	5050	B	5050	S	1976	CA001	C F	12	10- 12	111FLDB		2
001S004E02C01M	375248	1213029	S	77	5050	B	5050	S	1976	CA001	C F	12	10- 12	111FLDB		2
001S004E03K01M	375231	1213103	S	77	5050	B	5050	S	1978	CA001	C F	12	10- 12	111FLDB		2
001S004E03P02M	375216	1213134	S	77	5050	B	5050	S	1975	CA001	C F	30		111FLDB		2
001S004E04R01M	375211	1213148	S	77	5050	B	5050	S	1978	CA001	C F	12	10- 12	111FLDB		2
001S004E09A01M	375155	1213159	S	77	5050	B	5050	S	1976	CA001	C F	12	10- 12	111FLDB		2
001S004E09B01M	375159	1213217	S	77	5050	B	5050	S	1978	CA001	C F		10- 12	111FLDB		2
001S004E09C01M	375152	1213234	S	77	5050	B	5050	S	1975	CA001	C F	30		111FLDB		2
001S004E09N01M	375122	1213247	S	77	5050	B	5050	S	1978	CA001	C F			111FLDB		2
001S004E09N02M	375113	1213250	S	77	5050	B	5050	S	1978	CA001	C F	30		111FLDB		2
001S004E17A02M	375109	1213312	S	77	5050	B	5050	S	1977	CA001	C F	30		111FLDB		2
001S004E20K01M	374943	1213324	S	77	5050	B	5050	S	1977	CA001	C F	16	14- 16	111FLDB		2
001S004E21Q01M	374929	1213211	S	77	5050	B	5050	S	1976	CA001	C F	12	10- 12	111FLDB		2
001S005E06D01M	375253	1212835	S	77	5050	B	5050	S	1976	CA001	C F	11	9- 11	111FLDB		2
001S005E26E01M	374916	1212341	S	77	5050	B	5050	S	1978	CA001	C F	9	7- 9	111FLDB		2
001S006E05B01M	375253	1211958	S	77	5050	B	5050	S	1976	CA001	C F	12	10- 11	111FLDB		2
002N005E01C01M	380317	1212301	S	77	5050	B	5050	S	1976	CA001	C F	8	6- 8	111FLDB		2
002N005E02A01M	380327	1212318	S	77	5050	B	5050	S	1975	CA001	C F	48		111FLDB		2
002N005E02H02M	380311	1212326	S	77	5050	B	5050	S	1975	CA001	C F	48		111FLDB		2
002N005E02R02M	380237	1212315	S	77	5050	B	5050	S	1975	CA001	C F	46		111FLDB		2
002N005E02R03M	380248	1212338	S	77	5050	B	5050	X	1978	CA001	C F		10- 12	111FLDB		2
002N005E12M01M	380207	1212311	S	77	5050	B	5050	S	1976	CA001	C F	47		111FLDB		2
002N005E13D01M	380142	1212314	S	77	5050	B	5050	S	1975	CA001	C F	30		111FLDB		2
002N005E23R01M	375955	1212331	S	77	5050	B	5050	S	1976	CA001	C F	12	10- 12	111FLDB		2
002N005E24C02M	380043	1212243	S	77	5050	B	5050	S	1975	CA001	C F	50		111FLDB		2
002N005E24C03M	380048	1212248	S	77	5050	B	5050	S	1979	CA001	C F	22		111FLDB		2

TABLE 12.--Actual Monitoring-Well Locations and Pertinent Data--Continued

A. Regional Ambient Networks--continued

1. Perched or shallow zone--continued

STATE WELL NO	LAT	LONG	ACCU-RACY	COUNTY	AGENCY DWR NO	ANAL-YSIS TYPE	LABORATORY	FREQ-UENCY	YEAR BEGAN	DATA SOURCE	DATA LOC-ATION	WELL DEPTH	PERF INTERVAL	GEOHYDRO UNIT	WELL SEAL	WELL CLASS
002N005E24L01M	380018	1212247	S	77	5050	B	5050	S	1975	CA001	C F	9	7- 9	111FLDB		2
002N005E24N02M	380011	1212258	S	77	5050	B	5050	S	1975	CA001	C F	30		111FLDB		2
002N005E26H01M	375943	1212307	S	77	5050	B	5050	S	1978	CA001	C F	13	11- 13	111FLDB		2
002N005E26H02M	375937	1212324	S	77	5050	B	5050	S	1975	CA001	C F	30		111FLDB		2
002N005E26Q02M	375917	1212334	S	77	5050	B	5050	S	1977	CA001	C F	11	9-	111FLDB		2
002N005E26Q03M	375909	1212334	S	77	5050	B	5050	S	1975	CA001	C F	47		111FLDB		2
002N005E35B02M	375848	1212333	S	77	5050	B	5050	S	1975	CA001	C F	30		111FLDB		2
002N005E35K01M	375828	1212333	S	77	5050	B	5050	S	1977	CA001	C F	12	10- 12	111FLDB		2
002N005E35P01M	375814	1212349	S	77	5050	B	5050	S	1977	CA001	C F	12	10- 12	111FLDB		2
002N005E35Q02M	375815	1212330	S	77	5050	B	5050	S	1976	CA001	C F	30		111FLDB		2
003N005E03F02M	380819	1212454	S	77	5050	B	5050	S	1975	CA001	C F	30		111FLDB		2
003N005E10H02M	380743	1212438	S	77	5050	B	5050	S	1975	CA001	C F	30		111FLDB		2
003N005E14L01M	380626	1212410	S	77	5050	B	5050	S	1976	CA001	C F	12	10- 12	111FLDB		2
003N005E15C01M	380652	1212459	S	77	5050	B	5050	S	1977	CA001	C F	11	9- 11	111FLDB		2
003N005E15J01M	380628	1212426	S	77	5050	B	5050	S	1975	CA001	C F	30		111FLDB		2
003N005E23D01M	380553	1212405	S	77	5050	B	5050	S	1975	CA001	C F	30		111FLDB		2
003N005E23L01M	380531	1212354	S	77	5050	B	5050	S	1977	CA001	C F	30		111FLDB		2
003N005E26A01M	380510	1212322	S	77	5050	B	5050	S	1978	CA001	C F	27		111FLDB		2
003N005E26H01M	380449	1212324	S	77	5050	B	5050	S	1976	CA001	C F	30		111FLDB		2
003N005E26K01M	380448	1212343	S	77	5050	B	5050	S	1976	CA001	C F	21		111FLDB		2
003N005E26Q01M	380424	1212333	S	77	5050	B	5050	S	1978	CA001	C F	13	11- 13	111FLDB		2
003N005E36D01M	380415	1212320	S	77	5050	B	5050	S	1978	CA001	C F	9	7- 9	111FLDB		2
003N005E36E01M	380405	1212310	S	77	5050	B	5050	S	1978	CA001	C F	10	8- 10	111FLDB		2
003N005E36L01M	380355	1212257	S	77	5050	B	5050	S	1976	CA001	C F	10	8- 10	111FLDB		2
004N005E05C03M	381350	1212718	S	77	5050	B	5050	S	1978	CA001	C F	15	13- 14	111FLDB		2
004N005E05K02M	381333	1212714	S	77	5050	B	5050	S	1975	CA001	C F	30		111FLDB		2
004N005E08G01M	381254	1212712	S	77	5050	B	5050	S	1979	CA001	C F	14	13- 14	111FLDB		2
004N005E08P01M	381224	1212713	S	77	5050	B	5050	S	1979	CA001	C F	15	13- 15	111FLDB		2
004N005E17B02M	381212	1212700	S	77	5050	B	5060	S	1975	CA001	C F	30		111FLDB		2
004N005E17G01M	381200	1212659	S	77	5050	B	5050	S	1979	CA001	C F	11	9- 11	111FLDB		2
004N005E17L01M	381144	1212713	S	77	5050	B	5050	S	1977	CA001	C F	11	9- 10	111FLDB		2
004N005E20A01M	381115	1212648	S	77	5050	B	5050	S	1975	CA001	C F	30		111FLDB		2
004N005E20B01M	381126	1212715	S	77	5050	B	5050	S	1978	CA001	C F	12	10- 11	111FLDB		2
004N005E21L03M	381047	1212622	S	77	5050	B	5050	S	1975	CA001	C F	45		111FLDB		2
004N005E28C01M	381028	1212621	S	77	5050	B	5050	S	1975	CA001	C F	11	9- 11	111FLDB		2
004N005E28C02M	381022	1212620	S	77	5050	B	5050		1977	CA001	C F	11	9- 11	111FLDB		2
004N005E28F01M	381013	1212616	S	77	5050	B	5050	X	1978	CA001	C F	11	9- 11	111FLDB		2
004N005E28P01M	380954	1212609	S	77	5050	B	5050	S	1978	CA001	C F	12	10- 12	111FLDB		2
004N005E33A03M	380931	1212539	S	77	5050	B	5050	S	1979	CA001	C F	10	8- 10	111FLDB		2
004N005E33B02M	380930	1212600	S	77	5050	B	5050	S	1978	CA001	C F	11	9- 11	111FLDB		2
004N005E33B03M	380934	1212555	S	77	5050	B	5050	S	1975	CA001	C F	30		111FLDB		2
004N005E33H01M	380915	1212537	S	77	5050	B	5050	S	1976	CA001	C F	11	9- 11	111FLDB		2
004N005E33R02M	380847	1212538	S	77	5050	B	5050	S	1976	CA001	C F	12	10- 12	111FLDB		2
004N005E33R03M	380857	1212536	S	77	5050	B	5050	S	1975	CA001	C F	47		111FLDB		2
004N005E34M01M	380859	1212531	S	77	5050	B	5050	S	1978	CA001	C F	9	7- 9	111FLDB		2
004N005E34N02M	380847	1212517	S	77	5050	B	5050	S	1977	CA001	C F	12	10- 12	111FLDB		2
005N005E29F01M	381528	1212722	S	77	5050	B	5050	S	1978	CA001	C F			111FLDB		2
005N005E32C02M	381447	1212720	S	77	5050	B	5050	S	1975	CA001	C F	45		111FLDB		2
005N005E32Q02M	381406	1212712	S	77	5050	B	5050	S	1975	CA001	C F	30		111FLDB		2

TABLE 12.--Actual Monitoring-Well Locations and Pertinent Data--Continued

A. Regional Ambient Networks--continued

1. Perched or shallow zone--continued

STATE WELL NO	LAT	LONG	ACCU-RACY	COUNTY	AGENCY DWR NO	ANAL-YSIS TYPE	LABORATORY	FREQ-UENCY	YEAR BEGAN	DATA SOURCE	DATA LOC-ATION	WELL DEPTH	PERF INTERVAL	GEOHYDRO UNIT	WELL SEAL	WELL CLASS
025S021E11N01M	354542	1194117	S	29	5133	A	5133	S	1975	CA166	C F	20		111FLDB		2
025S021E24R01M	354327	1193910	S	29	5133	A	5133	S	1976	CA166	C F	20		111FLDB		3
025S021E25Q01M	354304	1193135	S	29	5133	A	5133	S	1977	CA166		10		111FLDB		2
025S022E14N01M	354446	1193441	S	29	5133	A	5133	S	1977	CA166	C F	15		111FLDB		2
025S022E16A01M	354539	1193550	S	29	5133	A	5133	S	1977	CA166	C F	14		111FLDB		2
025S022E21P01M	354356	1193631	S	29	5133	A	5133	S	1977	CA166	C F	14		111FLDB		2
025S022E26D01M	354353	1193442	S	29	5133	A	5133	S	1978	CA166	C F	15		111FLDB		2
025S022E32A01M	354301	1193655	S	29	5133	A	5133	S	1977	CA166	C F			111FLDB		3
025S022E32R02M	354209	1193655	S	29	5133	A	5133	S	1978	CA166	C F	16		111FLDB		2
025S022E34A01M	354301	1193445	S	29	5133	A	5133	S	1978	CA166	C F	15		111FLDB		2
026S022E20A01M	353932	1193655	S	29	5133	A	5133	S	1976	CA166	C F	31	31-	111FLDB		2
026S022E21N01M	353843	1193650	S	29	5133	A	5133	S	1976	CA166	C F	35		111FLDB		3
026S022E28R01M	353750	1193550	S	29	5133	A	5133	S	1976	CA166	C F	20		111FLDB		3
026S022E32N01M	353659	1193805	S	29	5133	A	5133	S	1977	CA166	C F	15		111FLDB		2
026S022E33R01M	353658	1193550	S	29	5133	A	5133	S	1977	CA166	C F	14		111FLDB		2
027S022E02N01M	353605	1193446	S	29	5133	A	5133	S	1977	CA166	C F	19		111FLDB		2
027S022E03P02M	353605	1193526	S	29	5133	A	5133	S	1979	CA166	C F	10		111FLDB		2
027S022E04D01M	353655	1193657	S	29	5133	A	5133	S	1977	CA166	C F	12		111FLDB		2
027S022E08A01M	353603	1193701	S	29	5133	A	5133	S	1979	CA166	C F	11		111FLDB		3
027S022E09R01M	353512	1193606	S	29	5133	A	5133	S	1977	CA166	C F	12	1- 12	111FLDB		2
027S022E10Q02M	353513	1193606	S	29	5133	A	5133	S	1977	CA166	C F					4
027S022E11L02M	353535	1193417	S	29	5133	A	5133	X	1976	CA166	C F	33		111FLDB		3
027S022E12A02M	353604	1193344	S	29	5133	A	5133	S	1976	CA166	C F	15		111FLDB		3
027S022E13R01M	353430	1193251	S	29	5133	A	5133	S	1976	CA166	C F	42		111FLDB		3
027S022E14B02M	353508	1193400	S	29	5133	A	5133	S	1976	CA166	C F	41		111FLDB		3
027S022E15A01M	353510	1193505	S	29	5133	A	5133	S	1977	CA166	C F	10		111FLDB		2
027S022E15N01M	353419	1193545	S	29	5133	A	5133	S	1979	CA166	C F	11		111FLDB		3
027S022E17B01M	353510	1193717	S	29	5133	A	5133	S	1979	CA166	C F	13		111FLDB		3
027S022E17P02M	353423	1193750	S	29	5133	A	5133	S	1979	CA166	C F	11		111FLDB		3
027S022E20A01M	353325	1193703	S	29	5133	A	5133	S	1977	CA166	C F	15		111FLDB		2
027S022E20P02M	353238	1193733	S	29	5133	A	5133	S	1976	CA166	C F	28		111FLDB		3
027S022E20Q01M	353327	1193720	S	29	5133	A	5133	S	1977	CA166	C F	11		111FLDB		3
027S022E20R02M	353329	1193703	S	29	5133	A	5133	S	1979	CA166	C F	8		111FLDB		3
027S023E19B02M	353412	1193158	S	29	5133	A	5133	S	1976	CA166	C F	17	7- 17	112CNTL		2
027S023E20J01M	353343	1193045	S	29	5133	A	5133	S	1976	CA166	C F	38		112CNTL		3
027S023E20R01M	353328	1193035	S	29	5133	A	5133	S	1980	CA166	C F					4
027S023E31A01M	353234	1193139	S	29	5133	A	5133	S	1979	CA166	C F	8		111FLDB		3
027S023E34C01M	353233	1192906	S	29	5133	A	5133	S	1976	CA166	C F	32		111FLDB		3
028S022E11P01M	352959	1193437	S	29	5133	A	5133	S	1980	CA166	C F					4
028S022E11P02M	352958	1193435	S	29	5133	A	5133	S	1980	CA166	C F					4
028S022E15N04M	352908	1193559	S	29	5133	A	5133	S	1977	CA166	C F	10		111FLDB		3
028S022E15N05M	352912	1193550	S	29	5133	A	5133	S	1977	CA166	C F	13		111FLDB		2
031S025E36H01M	351033	1191407	S	29	5133	A	5133	S	1977	CA166	C F					3
031S026E32N01M	351051	1191255	S	29	5133	A	5133	S	1976	CA166	C F	12	5- 12	111FLDB		2
031S028E05H01M	351536	1185906	S	29	5133	A	5133	S	1976	CA166	C F	10	5- 10	111ALVF		2
031S028E10D02M	351507	1185759	S	29	5133	A	5133	S	1976	CA166	C F	15	8- 15	111FLDB		2
031S028E28D02M	351229	1185903	S	29	5133	A	5133	S	1976	CA166	C F	13	7- 13	111ALVF		2
031S028E29R01M	351138	1185905	S	29	5133	A	5133	S	1976	CA166	C F	6	3- 6	111ALVF		2

TABLE 12.--Actual Monitoring-Well Locations and Pertinent Data--Continued

A. Regional Ambient Networks--continued

1. Perched or shallow zone--continued

STATE WELL NO	LAT	LONG	ACCU-RACY	COUNTY	AGENCY DWR NO	ANAL-YSIS TYPE	LABORATORY	FREQ-UENCY	YEAR BEGAN	DATA SOURCE	DATA LOC-ATION	WELL DEPTH	PERF INTERVAL		GEOHYDRO UNIT	WELL SEAL	WELL CLASS
031S028E30R01M	351140	1190010	S	29	5133	A	5133	S	1976	CA166	C F	18	12-	18	111ALVF		2
031S028E31N02M	351047	1190110	S	29	5133	A	5133	S	1976	CA166	C F	8	4-	8	111ALVF		2
032S027E02R01M	350955	1190220	S	29	5133	A	5133	S	1977	CA166	C F	13			111ALVF		3
032S027E06Q01M	351005	1190655	S	29	5133	A	5133	S	1976	CA166	C F	27			111FLDB		3
032S027E11B01M	350954	1190237	S	29	5133	A	5133	S	1976	CA166	C F	9	4-	9	111ALVF		2
032S027E14A02M	350904	1190224	S	29	5133	A	5133	S	1976	CA166	C F	10	5-	10	112LAKE		2
032S027E14R01M	350816	1190220	S	29	5133	A	5133	S	1976	CA166	C F	13	7-	13	112LAKE		2
032S027E15R01M	350816	1190322	S	29	5133	A	5133	S	1976	CA166	C F	14	7-	14	112LAKE		2
032S027E16R03M	350815	1190429	S	29	5133	A	5133	S	1977	CA166	C F						4
032S027E21N01M	350732	1190525	S	29	5133	A	5133	S	1976	CA166	C F	15	8-	15	112LAKE		2
032S028E06H01M	351033	1190010	S	29	5133	A	5133	S	1976	CA166	C F	16	9-	16	111ALVF		2
032S028E15N01M	350813	1185759	S	29	5133	A	5133	S	1976	CA166	Z F	14	7-	14	111FLDB		2
032S028E17D01M	350900	1190008	S	29	5133	A	5133	S	1976	CA166	C F	12	6-	12	111FLDB		2
032S028E18D01M	350904	1190114	S	29	5133	A	5133	S	1976	CA166	C F	6	3-	6	111ALVF		2
032S028E20A02M	350810	1185906	S	29	5133	A	5133	S	1976	CA166	C F	9	5-	9	111ALVF		2

A. Regional Ambient Networks--continued

2. Unsaturated or vadose zone

No monitoring of this zone was noted in Glass and others (1981) except as shown above in network A. 1. (above) and in network D. 1. (later in this table).

TABLE 12.--Actual Monitoring-Well Locations and Pertinent Data--Continued

A. Regional Ambient Networks--continued

3. Unconfined/semiconfined zone

STATE WELL NO	LAT	LONG	ACCU-RACY	COUNTY	AGENCY DWR NO	ANAL-YSIS TYPE	LABORATORY	FREQ-UENCY	YEAR BEGAN	DATA SOURCE	DATA LOC-ATION	WELL DEPTH	PERF INTERVAL	GEOHYDRO UNIT	WELL SEAL	WELL CLASS
003S010E25A01M	373901	1204843	S	99	3858	J	5146	A	1980	CA174	Z F	156	156-	112CNTL	15	1
015S022E27Q03M	363533	1193352	S	19	5112	B	5112	S	1975	CA160	C F	93	93-	111AVSN		1
015S022E27Q04M	363538	1193352	S	19	5112	B	5112	S	1979	CA160	C F	100	100-	111AVSN	2	1
015S022E31A01M	363517	1195650	S	29	5701	B	5701	Z	1969	CA241	Z F	280	150- 260	111ALVMY	6	2
015S022E32L01M	363451	1195618	S	19	5701	B	5701	Z	1964	CA241	Z F	288	288-	111ALVMY		2
016S022E05C01M	363425	1193621	S	19	5701	J	5701	Z	1962	CA241	Z F	208	208-	111AVSN		2
016S022E06G01M	363423	1193708	S	19	5701	J	5701	Z	1964	CA241	Z F	172	172-	111AVSN		1
016S022E07A01M	363339	1193635	S	19	5701	B	5701	Z	1963	CA241	Z F	228	228-	111ALVMY		2
016S022E30R01M	363014	1193644	S	19	5112	B	5112	S	1980	CA177	Z F	189	189-	111AVSN	2	1
016S022E32A01M	363012	1193540	S	19	5112	B	5112	S	1980	CA177	Z F	176	84- 176	111AVSN		1
016S023E23E01M	363139	1192627	M	107	5050	B	5050	Z	1978	CA001	C M					3
016S025E07R01M	363247	1191710	M	107	5060	J	5146	Z	1957	CA111	C M	333	173- 333	111ALVMO	6	1
016S025E08N01M	363242	1191653	M	107	5060	J	5806	Z	1964	CA111	C M	344	124- 340	111ALVMO	2	1
017S020E36R02M	362409	1194432	S	31	5050	B	5050	Z	1978	CA001	C M					3
017S021E36B01M	362457	1193834	S	31	5050	B	5050	Z	1978	CA001	C M					4
017S025E15H01M	362722	1191412	S	107	5050	B	5050	Z	1978	CA001	C M					3
018S024E06H01M	362339	1192409	S	107	5050	B	5050	Z	1978	CA001	C M	95	95-	111FLDB		2
019S019E25H02M	361458	1195118	S	31	5050	B	5050	Z	1978	CA001	C M	20	14- 20	112ALAEC		2
019S025E01P01M	361759	1191302	S	107	5050	B	5050	Z	1978	CA001	C M	76	76-	111AVSNY		1
020S020E19D01M	361049	1195101	S	31	5050	B	5050	Z	1978	CA001	C M	486		112ALAEC		3
020S021E03A01M	361328	1194027	S	31	5050	B	5050	Z	1978	CA001	C M	52		112ALAEC		3
021S018E34Q01M	360305	1200041	S	31	5050	B	5050	Z	1978	CA001	C M	350	350- 660	112ALAEC		2
021S022E22M01M	360505	1193511	S	31	5050	B	5050	Z	1978	CA001	C M	180	120- 180	112ALAEC		2
022S019E18P02M	360027	1195742	S	31	5050	B	5050	4	1980	USGS	C M	410	309- 329	112ALAEC		1
											R M		356- 377			
022S026E17C01M	360119	1191111	S	107	5050	B	5050	Z	1980	CA001	C M	403		111AVSN		3
023S027E27G01M	355402	1190222	S	107	5050	B	5050	Z	1978	CA001	C M	800	300- 800	112CNTL		2
024S025E20N01M	352301	1191748	S	107	5050	B	5050	Z	1978	CA001	C M					3
026S025E21Q01M	353856	1191650	S	29	5615	B	5806	Z	1953	CA155	Z F	905	345- 905	111ALVF		2
026S025E26N01M	353808	1191538	S	29	5615	B	5806	Z	1953	CA155	Z F	800	300- 800	111ALVF		2
026S025E30H01M	353824	1191906	S	29	5615	B	5806	Z	1953	CA155	Z F	800	340- 800	111ALVF		2
026S025E34R01M	353705	1191602	S	29	5615	B	5806	Z	1953	CA155	Z F	795	335- 795	111ALVF		2
026S025E36E01M	353738	1191445	S	29	5615	B	5806	Z	1953	CA155	Z F	808	340- 808	111ALVF		2
027S025E01N02M	353609	1191411	S	29	5615	J	5806	Z	1954	CA155	Z F	800	236- 800	112CNTL		2
027S025E01Q01M	353609	1191348	S	29	5615	B	5806	Z	1954	CA155	Z F	800	236- 800	112CNTL		2
027S025E16H01M	353455	1191638	S	29	5615	B	5806	Z	1954	CA155	Z F	808	343- 808	111ALVF		2
027S025E16Q01M	353434	1191652	S	29	5615	B	5806	Z	1954	CA155	Z F	809	345- 809	111ALVF		2
027S025E23A01M	353422	1191428	S	29	5615	B	5806	Z	1954	CA155	Z F	800	335- 800	111ALVF		2
027S026E07P01M	353518	1191300	S	29	5615	B	5806	Z	1954	CA155	Z F	906	336- 906	112CNTL		2
027S026E19L01M	353350	1191257	S	29	5615	B	5806	Z	1954	CA155	Z F	800	340- 800	112CNTL		2
027S026E30F01M	353309	1191258	S	29	5615	B	5806	Z	1954	CA155	Z F	700	292- 700	112CNTL		2
028S026E09D01M	353049	1191135	S	29	5615	B	5806	Z	1954	CA155	Z F	700	300- 700	112CNTL		2
028S026E21E01M	352845	1191117	S	29	5615	B	5806	Z	1954	CA155	Z F	700	292- 700	112CNTL		2
028S026E21G01M	352854	1191037	S	29	5615	B	5806	Z	1954	CA155	Z F	700	292- 700	112CNTL		2
028S026E21L01M	352837	1191055	S	29	5615	B	5806	Z	1954	CA155	Z F	700	292- 700	112CNTL		2
028S026E36D01M	352722	1190756	S	29	5615	B	5806	Z	1953	CA155	Z F	700	292- 700	112CNTL		2
028S026E36F01M	352708	1190749	S	29	5615	B	5806	Z	1954	CA155	Z F	700	292- 700	112CNTL		2

TABLE 12.--Actual Monitoring-Well Locations and Pertinent Data--Continued

A. Regional Ambient Networks

4. Confined zone

STATE WELL NO	LAT	LONG	ACCU-RACY	COUNTY	AGENCY DWR NO	ANAL-YSIS TYPE	LABORATORY	FREQ-UENCY	YEAR BEGAN	DATA SOURCE	DATA LOC-ATION	WELL DEPTH	PERF INTERVAL	GEOHYDRO UNIT	WELL SEAL	WELL CLASS
019S020E33A01M	361424	1194753	S	31	5050	B	5050	Z	1978	CA001	C M	525	485- 525	112ALAEC	36	1
020S020E28E02M	360937	1194851	S	31	5050	B	5050	Z	1978	CA001	C M	1320	1130- 1320	112ALBEC		2
021S021E26D01M	360446	1194041	S	31	5050	B	5050	Z	1978	CA001	C M	2001	945- 2001	112ALBEC		2
													2001-			
021S022E34A01M	360355	1193413	S	31	5050	B	5050	Z	1980	CA001	C M	1870	820- 1870	112ALBEC		2
024S025E03C01M	355234	1191525	S	107	5050	B	5050	Z	1978	CA001	C M					3
024S025E36J01M	354739	1191249	S	107	5050	B	5050	Z	1978	CA001	C M	1398	437- 587	112CNTL		2
													593- 1060			
													1068- 1398			
024S026E01A01M	355234	1190626	S	107	5050	B	5050	Z	1978	CA001	C M	1398	402- 1398	112CNTL		2
024S027E22C01M	355007	1190236	S	107	5050	B	5050	Z	1978	CA001	C M	1000	480- 1000	112CNTL		1

A. Regional Ambient Networks--continued

5. Produced ground water

STATE WELL NO	LAT	LONG	ACCU-RACY	COUNTY	AGENCY DWR NO	ANAL-YSIS TYPE	LABORATORY	FREQ-UENCY	YEAR BEGAN	DATA SOURCE	DATA LOC-ATION	WELL DEPTH	PERF INTERVAL	GEOHYDRO UNIT	WELL SEAL	WELL CLASS
002S005E21J01M	374436	1212458	S	77	5060	J	9597	Z	1953	CA111	C M	850	85- 90	112ALABE	14	1
													150- 250			
													330- 420			
													465- 835			
002S005E28L01M	374349	1212530	S	77	9597	J	9597	Z	1958	CA111	C M	930	132- 918	112ALABE	2	1
003S006E14A01M	374048	1211616	S	77	5060	J	9551	Z	1964	CA111	C M	420	96- 186	112ALABE	7	1
003S006E14A02M	374054	1211622	S	77	5060	J	9551	Z	1964	CA111	C M	389	110- 180	112ALABE	7	1
003S008E13F01M	374040	1210222	S	99	5521	B	5146	5	1949	CA026	C F	244	173- 244	112ALABE		2
003S008E13J01M	374024	1210149	S	99	5060	J	5146	Z	1969	CA111	C M	302	96- 278	112ALABE		2
003S008E24C02M	373951	1210239	S	99	5521	B	5146	5	1961	CA026	C F	372	152- 364	112ALABE		2
003S008E29K01M	373836	1210627	S	99	5521	B	5146	5	1954	CA026	C F	151	151-	112ALABE		2
003S009E19C01M	373957	1210117	S	99	5060	J	5146	Z	1966	CA111	C M	241	130- 136	112ALABE		2
													222- 230			
003S009E20C01M	373952	1210011	S	99	5060	J	9597	Z	1966	CA111	C M	204	116-	112ALABE		2
003S009E22N01M	373915	1205814	S	99	5060	D	9597	B	1979	CA111	C M	244	104- 232	112ALABE		2
003S009E26N01M	373822	1205715	S	99	5060	D	5146	B	1979	CA111	C M	235	102- 235	112ALABE	10	1
003S009E29B01M	373904	1205955	S	99	5060	J	5146	Z	1966	CA111	C M	260	160-	112ALABE	7	1
													210-			
003S009E32A01M	373815	1205941	S	99	5060	J	5146	Z	1966	CA111	C M	231	137-	112ALABE	15	1
													155- 195			
													195- 225			

TABLE 12.--Actual Monitoring-Well Locations and Pertinent Data--Continued

A. Regional Ambient Networks--continued

5. Produced ground water--continued

STATE WELL NO	LAT	LONG	ACCU-RACY	COUNTY	AGENCY DWR NO	ANAL-YSIS TYPE	LABORATORY	FREQ-UENCY	YEAR BEGAN	DATA SOURCE	DATA LOC-ATION	WELL DEPTH	PERF INTERVAL	GEOHYDRO UNIT	WELL SEAL	WELL CLASS
004S008E04G01M	373706	1210536	S	99	5521	B	5146	5	1953	CA026	C F	152	12- 152	112ALABE		2
004S008E27M01M	373328	1210445	S	99	5524	B	5146	Z	1965	CA020	C F	207		112ALABE		1
004S009E04K01M	373659	1205851	S	99	5060	J	5146	Z	1963	CA111	C M	192	68- 192	112ALABE		2
005S008E01R01M	373121	1210152	S	99	5524	B	5146	Z	1965	CA020	C F	266		112ALABE		1
005S008E02R01M	373129	1210302	S	99	5524	B	5146	X	1979	CA020	Z F	222		112ALABE		1
005S011E18Q01M	372934	1204752	S	99	5524	B	5146	Z	1979	CA020	C F	254	254-	112ALABE		1
006S009E12B01M	372601	1205534	S	99	5524	B	5146	Z	1965	CA020	C F	204	204-	112ALABE		1
006S010E11N01M	372508	1205050	S	47	5524	B	5146	Z	1979	CA020	C F	291	291-	112ALABE		1
006S011E03C01M	372647	1204503	S	47	5524	B	5146	X	1979	CA020	Z F	171	171-	112ALABE		2
006S011E04C01M	372642	1204615	S	47	5524	B	5146	X	1979	CA020	Z F			112ALABE		1
006S011E09C01M	372602	1204610	S	47	5524	B	5146	Z	1979	CA002	C F	172		112ALABE		1
006S011E09Q01M	372517	1204601	S	47	5524	B	5146	X	1979	CA020	Z F	91	91-	112ALABE		2
006S011E25F01M	372257	1204249	S	47	5060	D	5146	M	1979	CA111	C M	300	120- 295	112ALABE	7	1
006S011E25N01M	372231	1204306	S	47	5060	D	5146	M	1979	CA111	C M	180	68- 180	112ALABE		1
007S008E12D01M	372040	1210245	S	99	5050	B	5000	4	1980	USGS	R M	425	100- 240 290- 415	112ALABE		2
011N019W21F01S	350126	1185432	S	29	5644	B	5806	Z	1966	CA179	Z F	805	294- 498 504- 804	111ATSE 120CNNL		2
011N019W24H01S	350127	1185046	S	29	5644	B	5806	Z	1966	CA179	Z F	852	144- 846	111ATSE 120CNNL		2
011N020W17H01S	350231	1190144	S	29	5644	B	5806	Z	1966	CA179	Z F	1038	292- 1038	120CNNL		2
019S019E10E02M	361733	1195413	S	31	5050	B	5050	Z	1978	CA001	C M	582	315- 582	112ALABE		2
024S025E17P01M	355003	1191739	S	107	5050	B	5000	4	1980	USGS	R M	500	240- 500	112ALABE		2
030S028E19M01M	351810	1190109	S	29	5701	B	5701	7	1962	CA241	Z F	300	200- 300	112ALABE	5	2
030S028E20M01M	351807	1185953	S	29	5701	B	5701	Z	1964	CA241	Z F	415	217- 415	112ALABE	5	2
030S028E32B01M	351653	1185933	S	29	5050	B	5000	4	1980	USGS		441	108- 116 300- 308 346- 352	112ALABE		2
030S029E32P01M	351603	1185315	S	29	5644	B	5806	Z	1966	CA179	Z F	575	200- 575	112ALABE		2
030S029E34C01M	351655	1185107	S	29	5644	B	5806	Z	1966	CA179	Z F	400	208- 394	112ALABE		2
031S024E28B01M	351233	1192404	S	29	5649	B	5191	A	1976	CA154	Z F	402		112ALABE		3
031S029E01C01M	351600	1184855	S	29	5644	B	5806	X	1966	CA179	Z F	631	275- 631	112ALABE		2
031S029E01D01M	351601	1184922	S	29	5644	B	5806	X	1966	CA179	Z F	900	370- 894	112ALABE		2
031S029F02K01M	351535	1184945	S	29	5644	B	5806	A	1968	CA179	Z F	955	343- 949	112ALABE	3	1
031S029E05J01M	351524	1185234	S	29	5644	B	5806	Z	1966	CA179	Z F		158- 506	112ALABE		2
031S029E08H01M	351452	1185242	S	29	5644	B	5806	Z	1966	CA179	Z F	522	198- 521	112ALABE		2
031S029E09L01M	351442	1185209	S	29	5644	B	5806	Z	1966	CA179	Z F	506	186- 486	112ALABE	'	2
031S029E11B01M	351508	1184952	S	29	5644	B	5806	X	1966	CA179	Z F	1142	300- 540	112ALABE	2	1
031S029F16C01M	351414	1185208	S	29	5644	B	5806	A	1966	CA179	Z F	510	20- 268	112ALABE		2
031S029E23R01M	351250	1184931	S	29	5060	J	5803	Z	1974	CA111	C M	556	383-	112ALBEC		2
031S029E25K01M	351206	1184836	S	29	5644	B	5806	Z	1966	CA179	Z F	904	194- 344 350- 903	112ALABE		2
031S029E26E01M	351217	1185020	S	29	5060	J	5806	Z	1966	CA111	C M	898	154- 334 352- 892	112ALABE	9	1
031S029E36D01M	351139	1184921	S	29	5644	B	5806	Z	1966	CA179	Z F	900	206- 312 318- 894	112ALABE		2
032S028E13N01M	350812	1185538	S	29	5644	B	5806	A	1966	CA179	Z F	560	250- 560	112ALABE		2
032S028E22R02M	350721	1185710	S	29	5644	B	5806	Z	1966	CA179	Z F	998	319- 998	112ALABE		2

TABLE 12.--Actual Monitoring-Well Locations and Pertinent Data--Continued

A. Regional Ambient Networks--continued

5. Produced ground water--continued

STATE WELL NO	LAT	LONG	ACCU-RACY	COUNTY	AGENCY DWR NO	ANAL-YSIS TYPE	LABORATORY	FREQ-UENCY	YEAR BEGAN	DATA SOURCE	DATA LOC-ATION	WELL DEPTH	PERF INTERVAL	GEOHYDRO UNIT	WELL SEAL	WELL CLASS
032S028E23F01M	350754	1185627	S	29	5644	B	5806	X	1966	CA179	Z F	1002	252- 510 516- 1000	112ALABE		2
032S028E26A02M	350706	1185555	S	29	5644	B	5806	Z	1966	CA179	Z F	1000	150- 1000	112ALABE		2
032S028E26F01M	350701	1185639	S	29	5644	B	5806	Z	1966	CA179	Z F	1203	323- 502 508- 1203	112ALABE		2
032S028E27E01M	350654	1185745	S	29	5644	B	5806	Z	1966	CA179	Z F	1104	347- 1104	112ALABE	2	1
032S028E32R01M	350545	1185909	S	29	5644	B	5806	Z	1966	CA179	Z F	1003	402- 600 606- 1002	112ALABE		2
032S028E33J01M	350550	1185810	S	29	5644	B	5806	Z	1966	CA179	Z F	813	406- 502 508- 813	112ALABE		2
032S029E07R01M	350905	1185343	S	29	5644	B	5806	Z	1966	CA179	Z F		400- 1120	112ALABE		2
032S029E08R01M	350904	1185242	S	29	5644	B	5806	Z	1966	CA179	Z F	1001	200- 996	112ALABE		2
032S029E18P01M	350812	1185417	S	29	5644	B	5806	X	1966	CA179	Z F	800	172- 794	112ALABE		2
032S029E19B01M	350802	1185414	S	29	5644	B	5806	Z	1966	CA179	Z F	1004	302- 1004	112ALABE		2

B. Regional Nonpoint Problems

1. Agricultural return flow

STATE WELL NO	LAT	LONG	ACCU-RACY	COUNTY	AGENCY DWR NO	ANAL-YSIS TYPE	LABORATORY	FREQ-UENCY	YEAR BEGAN	DATA SOURCE	DATA LOC-ATION	WELL DEPTH	PERF INTERVAL	GEOHYDRO UNIT	WELL SEAL	WELL CLASS
002S004E16A01M	374551	1213150	S	77	5050	B	5050	2	1973	CA001	C M	66	56- 66	111ALCR	2	1
002S005E25D02M	374421	1212243	S	77	5050	B	5050	2	1969	CA001	C M	103	91- 103	112ALAEC		1
003S005E04H01M	374223	1212506	S	77	5000	B	5000	4	1980	USGS	R M C M	140	120- 140	112ALAEC		1
004S007E26D01M	373345	1211032	S	99	5060	J	9484	Z	1967	CA111	C M	168	146- 168	112ALAEC	11	1
008S009E08E01M	371523	1210028	S	47	5050	B	5000	4	1980	USGS	R M	60		112ALAEC		3
010S012E09P01M	370413	1203945	S	47	5050	B	5000	Z	1980	USGS	R M	180	7- 150	112ALAEC		2
012S014E28L04M	365124	1202649	S	19	5060	J	5802	Z	1977	CA111	C M		115-	112ALAEC		2
019S019E25H02M	361458	1195118	S	31	5050	B	5050	Z	1978	CA001	C M	20	14- 20	112ALAEC		2
020S021E03A01M	361328	1194027	S	31	5050	B	5050	Z	1978	CA001	C M	52		112ALAEC		3
021S022E22M01M	360505	1193511	S	31	5050	B	5050	Z	1978	CA001	C M	180	120- 180	112ALAEC		2
027S022E09D01M	353620	1193604	S	29	5640	B	5806	A	1950	CA036	Z F	400	100- 400	112ALAEC		2

TABLE 12.--Actual Monitoring-Well Locations and Pertinent Data--Continued

B. Regional Nonpoint Problems--continued

2. Applied chemicals: DBCP example

STATE WELL NO	LAT	LONG	ACCU-RACY	COUNTY	AGENCY DWR NO	ANAL-YSIS TYPE	LABORATORY	FREQ-UENCY	YEAR BEGAN	DATA SOURCE	DATA LOC-ATION	WELL DEPTH	PERF INTERVAL	GEOHYDRO UNIT	WELL SEAL	WELL CLASS
001S006E26L01M	374903	1211701	S	77	5060	D	9597	B	1979	CA111	C M	233	160- 185	111ALVF	5	1
													216- 231			
001S007E34L01M	374806	1211127	S	77	5060	D	5146	M	1979	CA111	C M	370	90- 150	111ALVF	6	1
													332- 365			
002N006E20J01M	380018	1211958	S	77	5060	D	9597	B	1979	CA111	C M	306	146- 306	112VCTR	8	1
														121LGUN		
002S009E04F01M	374730	1205926	S	77	5060	D	5146	B	1979	CA111	C M	154	154-	111AVSN		2
002S009E19R01M	374424	1210048	S	99	5060	D	9484	B	1979	CA111	C M	235		111AVSN		3
003N006E01L04M	380810	1211608	S	77	5060	D	5882	M	1979	CA001	C M	256	76-	112VCTR	7	1
														112CNTL		
003N006E01N03M	380753	1211624	S	77	5060	D	9597	B	1979	CA111	C M	210	70-	112VCTR	7	1
														112CNTL		
003N006E03Q01M	380757	1211804	S	77	5060	D	5882	B	1979	CA111	C M	520	170- 330	112CNTL	8	1
													340- 514			
003N006E10B02M	380738	1211819	S	77	5060	D	9597	B	1979	CA111	C M	506	158- 488	112CNTL	12	1
003N006E13H07M	380657	1211606	S	77	5060	D	5882	B	1979	CA111	C M	228	229-	112CNTL	8	3
003N006E13M02M	380630	1211631	S	77	5060	D	9597	M	1979	CA111	C M	498	73- 123	112CNTL	10	1
													148- 173			
													198- 223			
													223- 323			
													323- 348			
003N006E14L01M	380630	1211721	S	77	5060	D	9597	B	1979	CA111	C M	530	200- 250	112CNTL	10	1
													250- 450			
													450- 510			
003N007E05M06M	380806	1211430	S	77	5060	D	9597	M	1979	CA111	C M	460	460-	112CNTL		2
003S008E03M01M	374203	1210506	S	99	5060	D	9484	B	1979	CA111	C M	102		111AVSN		3
003S009E22N01M	373915	1205814	S	99	5060	D	9597	B	1979	CA111	C M	244	104- 232	112ALABE		2
003S009E26N01M	373822	1205715	S	99	5060	D	5146	B	1979	CA111	C M	235	102- 235	112ALABE	10	1
003S009E28C01M	373903	1205910	S	99	5060	D	9597	B	1979	CA111	C M	175	175-	112ALBEC		2
003S009E34A01M	373815	1205728	S	99	5060	D	5146	B	1979	CA111	C M	305	145- 305	112ALBEC		2
003S009E34L01M	373739	1205757	S	99	5060	D	5146	B	1979	CA111	C M					3
003S009E36L01M	373740	1205546	S	99	5060	D	5146	B	1979	CA111	C M	171				3
003S010E32D01M	373815	1205401	S	99	5060	D	5146	B	1979	CA111	C M	132	132-	111AVSN		2
003S011E28K01M	373834	1204545	S	99	5060	D	5146	B	1979	CA111	C M	290		111AVSN		3
														112CNTL		
004S009E03B01M	373724	1205752	S	99	5060	D	5146	M	1979	CA111	C M	57	57-	112ALAEC		2
004S009E03K01M	373704	1205753	S	99	5060	D	9484	B	1979	CA111	C M	100	100-	112ALAEC		2
004S009E06K01M	373659	1210104	S	99	5060	D	5146	B	1979	CA111	C M	140	110- 140	112ALAEC		2
004S009E08M01M	373557	1210026	S	99	5060	D	5146	B	1979	CA111	C M	100	100-	112ALAEC		1
004S009E09Q01M	373553	1205859	S	99	5060	D	9597	M	1979	CA111	C M	120	120-	112ALAEC		2
004S009E12E01M	373609	1205606	S	99	5060	D	5146	M	1979	CA111	C M	80	80-	112ALAEC	7	1
004S009F16D02M	373540	1205925	S	99	5060	D	5146	B	1979	CA111	C M	221	105-			2
005S011E05D01M	373202	1204724	S	99	5060	D	5146	B	1979	CA111	C M	300			5	1
006S010E22B01M	372403	1205121	S	47	5060	D	9579	B	1979	CA111	C M	217	100-		3	2
006S011E25E01M	372309	1204317	S	47	5060	D	5146	M	1979	CA111	C M	190	132-	112ALBEC		2
006S011E25F01M	372257	1204249	S	47	5060	D	5146	M	1979	CA111	C M	300	120- 295	112ALABE	7	1
006S011E25N01M	372231	1204306	S	47	5060	D	5146	M	1979	CA111	C M	180	68- 180	112ALABE		1
006S012E23N01M	372326	1203745	S	47	5060	D	5701	M	1979	CA111	C M			111ALVMO		4

TABLE 12.--Actual Monitoring-Well Locations and Pertinent Data--Continued

B. Regional Nonpoint Problems--continued

2. Applied chemicals: DBCP example--continued

STATE WELL NO	LAT	LONG	ACCU-RACY	COUNTY	AGENCY DWR NO	ANAL-YSIS TYPE	LABORATORY	FREQ-UENCY	YEAR BEGAN	DATA SOURCE	DATA LOC-ATION	WELL DEPTH	PERF INTERVAL	GEOHYDRO UNIT	WELL SEAL	WELL CLASS
006S012E23R03M	372327	1203650	S	47	5060	D	5802	B	1979	CA111	C M			111ALVMO		4
006S012E25D02M	372311	1203641	S	47	5060	D	5802	M	1980	CA111	C M	275	170- 195	111AVSN	5	1
													250- 265	112CNTL		
007S012E02G01M	372118	1203707	S	47	5060	D	5802	B	1979	CA111	C M	265	98-	111ALVMO		1
013S020E23Q01M	364654	1194533	M	19	5060	D	5802	M	1979	CA111	C M	213	208- 213	111AVSN		1
013S021E09R02M	364841	1194053	S	19	5060	D	5802	B	1980	CA111	C M	390	180- 390	111AVSN	5	1
013S021E17J01M	364758	1194153	M	19	5060	D	5146	M	1979	CA111	C M	172	172-	111AVSN		1
013S021E21P01M	364646	1194120	M	19	5060	D	5810	B	1979	CA111	C M	332	116- 123	111AVSN		1
													156- 161			
													215- 220			
014S020E13K01M	363738	1194431	S	19	5060	D	5146	M	1979	CA111	C M	120	120-	111AVSN		2
014S020E13R01M	363715	1194412	S	19	5060	D	5146	B	1980	CA111	C M	402	172-	111AVSN	5	2
014S021E07H02M	364353	1194316	S	19	5060	D	5802	B	1980	CA111	C M	380	180- 380	111AVSN	7	1
014S021E09R01M	364321	1194051	M	19	5060	D	5146	M	1979	CA111	C M	288	160- 260	111AVSN		1
014S021E10E01M	364351	1194037	M	19	5060	D	5146	M	1979	CA111	C M	120	120-	111AVSN		2
014S021E30P01M	364043	1194341	S	19	5060	D	5810	B	1980	CA111	C M		150-	111AVSN	6	2
014S022E23F01M	364200	1193305	S	19	5060	D	5802	M	1979	CA111	C M	186	85-	111AVSN		2
014S022E23M01M	364158	1193316	M	19	5060	D	5802	M	1979	CA111	C M	180	180-	111AVSN		2
015S022E05H01M	363923	1193546	S	19	5060	D	5810	B	1980	CA111	C M	308	136- 232	111AVSN	6	1
													260- 268			
													280- 308			
015S023E19E01M	363647	1193110	S	19	5060	D	5810	M	1980	CA111	C M	270	170- 270	111AVSN	5	1
015S023E26P01M	363525	1192625	S	19	5060	D	5810	B	1980	CA111	C M	216	216-	111AVSN		2
016S022E23K01M	363124	1193250	M	19	5060	D	5060	M	1979	CA111	C M	160	160-	111AVSN		2
016S022E26G01M	363054	1193238	M	19	5060	D	5802	M	1979	CA111	C M	140	140-	111AVSN		2
016S024E08Q01M	363250	1192243	M	107	5060	D	5806	M	1979	CA111	C M			111AVSN		3
016S024E17H01M	363229	1192239	S	107	5060	D	5806	M	1979	CA111	C M	90	90-	111AVSN		1
016S024E17N01M	363154	1192306	M	107	5060	D	5806	M	1979	CA111	C M	315	94- 107	111AVSN		2
													107- 190			
016S024E18A01M	363241	1192326	M	107	5060	D	5806	M	1979	CA111	C M	132	96- 128	111AVSN		1
022S026E03A02M	360303	1190836	S	107	5060	D	5810	B	1980	CA111	C M	400	90- 210	111AVSN	5	2
													270- 300	112CNTL		
													340- 400			
029S027E30H01M	352242	1190649	S	29	5060	D	5803	M	1979	CA111	C M	300	138- 300	111AVSNY	13	2
031S028E01Q02M	351512	1185517	S	29	5060	D	5806	B	1980	CA111	C M		400-	112ALBEC	10	2
031S029E07N01M	351420	1185448	S	29	5060	D	5806	B	1980	CA111	C M	750	400-	112ALBEC	10	2

TABLE 12.--Actual Monitoring-Well Locations and Pertinent Data--Continued

B. Regional Nonpoint Problems--continued

3. Refinery wastes

4. Oilfield brines

STATE WELL NO	LAT	LONG	ACCU-RACY	COUNTY	AGENCY DWR NO	ANAL-YSIS TYPE	LABORATORY	FREQ-UENCY	YEAR BEGAN	DATA SOURCE	DATA LOC-ATION	WELL DEPTH	PERF INTERVAL	GEOHYDRO UNIT	WELL SEAL	WELL CLASS
011N019W01H01S	350403	1185047	S	29	5644	B	5806	Z	1966	CA179	Z F	757	239- 752	111ATSE		2
011N020W01P01S	350355	1185813	S	29	5644	B	5806	Z	1966	CA179	Z F	598	250- 598	111ATSEY		2
012N019W27R01S	350522	1185253	S	29	5644	B	5806	Z	1966	CA179	Z F	1002	312- 1002	120CNNL		2
012N020W27P01S	350527	1190008	S	29	5644	B	5806	Z	1966	CA179	Z F					4
015S019E15C01M	363800	1195218	S	19	5112	B	5200	S	1978	CA160	Z F	187	187-	111ALVMO	2	1
019S021E01B01M	361848	1193836	S	31								500				
019S021E01B02M	361847	1193835	S	31								516				
020S015E32A01M	360903	1202128	S	19								399				
020S016E28F01M	360936	1201429	S	19								283				
020S016E28P01M	360914	1201426	S	19								1250				
020S017E30Q01M	360909	1200951	S	19								840				
020S017E31M01M	360840	1201037	S	19								2048	496-			
020S017E31Q01M	360818	1201006	S	19								2375	810-			
020S017E32R01M	360819	1200816	S	19								540	440-			
021S016E08E01M	360709	1201615	S	19	5050	B	5000	4	1980	USGS	R M	463	323- 463	111ALCR		2
021S016E12D01M	360723	1201157	S	19								200				
021S016E12D02M	360713	1201156	S	19								300				
021S016E12E01M	360702	1201156	S	19								495				
021S017E02G01M	360759	1200603	S	19								2025	450-			
021S017E14N01M	360541	1200630	S	19								273				
021S017E22G01M	360514	1200709	S	19								1707	555-			
028S028E35R01M	352646	1185518	S	29								1045				
028S028E36B01M	352724	1185431	S	29								400				
029S022E04R01M	352532	1193637	S	29								186				
029S023E21H01M	352328	1193009	S	29	5617	B	5806	A	1950	CA036	Z F					4
029S026E01R01M	352542	1190744	S	29								175				
029S026E13R01M	352355	1190747	S	29								515				
029S026E35P01M	352130	1190916	S	29								139				
029S027E10M01M	352448	1190410	S	29	5701	B	5701	Z	1964	CA241	Z F	400	250- 400	111AVSN	5	1
														112CNTL		
029S027E16D04M	352444	1190519	S	29	5701	B	5701	Z	1977	CA241	Z F	645	321- 625	112CNTL	28	1
029S027E23H01M	352327	1190232	S	29	5701	B	5701	Z	1970	CA241	Z F	525	190- 505	112CNTL	17	1
029S027E26J01M	352224	1190223	S	29	5701	B	5701	Z	1968	CA241	Z F	694	260- 674	112CNTL	7	1
029S028E16M01M	352416	1185853	S	29	5701	J	5701	3	1954	CA241	Z F	726	400- 696	112CNTL	4	1
029S028E19J02M	352321	1190022	S	29	5701	B	5701	Z	1950	CA241	Z F	600	200- 600	112CNTL	10	2
029S028E30Q02M	352148	1190028	S	29	5701	B	5701	Z	1951	CA241	Z F	600	168- 240	111AVSN	4	1
													264- 576	112CNTL		
029S028E32D01M	352200	1185959	S	29	5701	J	5701	3	1954	CA241	Z F	621	400- 450	111AVSN	5	1
													483- 605	112CNTL		
029S029E33F02M	352150	1185221	S	29	5644	B	5806	Z	1966	CA179	Z F	1957	1388- 1957	112ALVFO		1
030S023E01C03M	352116	1192727	S	29	5617	B	5806	A	1950	CA036	Z F	305		112ALAEC		3
030S024E14H01M	351906	1192137	S	29	5617	B	5806	A	1950	CA036	Z F	294	130- 230	112ALAEC		2
											Z F		130- 230	112ALAEC		
030S029E15K01M	351857	1185104	S	29	5644	B	5806	Z	1966	CA179	Z F	600	336- 600	112ALVFO		1
030S029E15L02M	351857	1185114	S	29	5644	B	5806	Z	1966	CA179	Z F	599	192- 599	112ALVFO		1
030S029E36B01M	351649	1184846	S	29	5644	B	5806	X	1966	CA179	Z F	620	390- 620	111AVSNY	3	1
030S029E36E01M	351641	1184918	S	29	5644	B	5806	Z	1966	CA179	Z F	890	378- 570	111AVSNY	3	1
													582- 884			
030S030E31D01M	351641	1184821	S	29	5644	B	5806	Z	1966	CA179	Z F	548	308- 548	111AVSNY		2
030S030E31M01M	351625	1184820	S	29	5644	B	5806	X	1966	CA179	Z F	625	283- 619	111AVSNY		2

TABLE 12.--Actual Monitoring-Well Locations and Pertinent Data--Continued

B. Regional Nonpoint Problems--continued

3. Refinery wastes--continued

4. Oilfield brines--continued

STATE WELL NO	LAT	LONG	ACCU-RACY	COUNTY	AGENCY DWR NO	ANAL-YSIS TYPE	LABORATORY	FREQ-UENCY	YEAR BEGAN	DATA SOURCE	DATA LOC-ATION	WELL DEPTH	PERF INTERVAL	GEOHYDRO UNIT	WELL SEAL	WELL CLASS
031S023E33N02M	351058	1191152	S	29								150				
031S024E28B01M	351233	1192404	S	29	5649	B	5191	A	1976	CA154	Z F	402		112ALABE		3
031S029E02M01M	351535	1185026	S	29	5644	B	5806	Z	1966	CA179	Z F	840	396- 840	112ALBEC	3	1
031S029E23L02M	351254	1185009	S	29	5644	B	5806	X	1966	CA179	Z F	1196	490- 1190	112ALBEC		1
031S029E35E01M	351115	1185019	S	29	5644	B	5806	X	1966	CA179	Z F	978	150- 300			2
													306- 972			
031S030E07D01M	351508	1184815	S	29	5644	B	5806	Z	1966	CA179	Z F	1277	541- 727		50	1
													739- 1257			
031S030E18Q01M	351336	1184745	S	29	5644	B	5806	Z	1966	CA179	Z F	600	250- 600	111AVSNY		2
031S030E30M01M	351206	1184818	S	29	5644	B	5806	X	1966	CA179	Z F	475	30- 384	111AVSNY		2
													375- 475			
032S024E24G01M	350800	1192101	S	29								701				
032S025E16P01M	350833	1191820	S	29								745				
032S025E35N01M	350545	1191555	S	29								800				
032S025E35N02M	350544	1191610	S	29								1661				
032S026E31P01M	350546	1191339	S	29								1505				
032S026E34R01M	350546	1191001	S	29								400				
032S027E35R01M	350546	1190230	S	29	5649	B	5191	A	1976	CA154	Z F	1314	647- 1314	112ALBEC		2
032S028E31R02M	350545	1190010	S	29	5644	B	5806	Z	1966	CA179	Z F	1196	498- 1196	112ALBEC	1	1
032S028E36Q01M	350535	1185506	S	29	5644	B	5806	X	1966	CA179	Z F	998	408- 992	111ATSEY		1
032S029E31H01M	350612	1185343	S	29	5644	B	5806	Z	1966	CA179	Z F	907	236- 907	111ATSE		2
032S029E34P01M	350535	1185059	S	29	5644	B	5806	Z	1966	CA179	Z F	998	276- 354	111ATSE		2
													360- 786	120CNNL		
													792- 997			

TABLE 12.--Actual Monitoring-Well Locations and Pertinent Data--Continued

B. Regional Nonpoint Problems--continued

5. Saltwater and connate intrusion

STATE WELL NO	LAT	LONG	ACCU-RACY	COUNTY	AGENCY DWR NO	ANAL-YSIS TYPE	LABORATORY	FREQ-UENCY	YEAR BEGAN	DATA SOURCE	DATA LOC-ATION	WELL DEPTH	PERF INTERVAL	GEOHYDRO UNIT	WELL SEAL	WELL CLASS
001N002E13F01M	375602	1214232	S	13	5060	J	9463	Z	1975	CA111	C M	135	60- 120	111ALCR	6	1
001N002E13H01M	375601	1214152	S	13	5060	B	5050	2	1974	CA001	C M	145	112- 142	111ALVF	5	2
001N003E17E01M	375600	1214026	S	13	5050	B	5050	2	1973	CA001	C M	123	113- 123	111ALCRY		2
001N004E03N01M	375732	1213145	S	77	5050	B	5050	2	1954	CA001	C M	168	168-	111FLDB		1
001N006E01J01M	375747	1211536	S	77	5701	B	5701	Z	1943	CA241	Z F	244	140- 185	111FLDB	10	1
													202- 208			
													217- 221			
													224- 232			
001N006E01M01M	375737	1211624	S	77	5701	B	5701	Z	1950	CA241	Z F	424	208- 424	111FLDB		2
001N006E02M01M	375746	1211722	S	77	5701	J	5701	Z	1954	CA241	Z F	451	356- 426	111FLDB	35	1
001N006E02Q01M	375733	1211647	S	77	5701	B	5701	Z	1960	CA241	Z F		252- 530	111FLDB	24	1
001N006E03C01M	375806	1211816	S	77	5701	B	5701	Z	1940	CA241	Z F	545	350- 545	111FLDB	22	1
001N006E04B01M	375859	1211901	S	77	5060	J	5701	Z	1945	CA111	C M	552	408- 552	111AVSN	15	2
001N006E04J01M	375737	1211848	S	77	5110	B	4203	S	1971	CA163	Z P	236	185- 236	111FLDB		2
001N006E06K01M	375742	1212125	F	77	5110	B	9597	S	1971	CA163	Z P			111FLDB		3
001N006E10Q06M	375643	1211808	S	77	5110	B	5819	S	1971	CA163	Z P	263	234- 259	111FLDB		2
001N006E10Q07M	375635	1211755	S	77	5110	B	5819	S	1971	CA163	Z P	652	233- 314	111FLDB		2
													343- 357			
													382- 386			
													402- 412			
001N006E11E02M	375704	1211721	S	77	5060	J	4203	Z	1976	CA111	C M			111AVSN		4
001N006E11K01M	375647	1211650	S	77	5701	B	5701	Z	1952	CA241	Z F	516	288- 516	111FLDB	28	1
001N006E12A01M	375717	1211541	S	77	5701	B	5701	Z	1959	CA241	Z F	540	200- 510	111FLDB		2
001N006E12F01M	375709	1211557	S	77	5701	B	5701	Z	1959	CA241	Z F	520	426- 438	111FLDB	4	1
													445- 450			
													475- 495			
001N006E12G01M	375705	1211544	S	77	5060	J	4203	Z	1999	CA111	C M	230	210- 230	111AVSN		2
001N006E12K03M	375654	1211549	S	77	5701	J	5701	Z	1947	CA241	Z F	408	192- 408	111FLDB		3
001N006E12N01M	375636	1211616	S	77	5701	B	5701	Z	1960	CA241	Z F	520	201- 500	111FLDB	9	1
001N006E13B03M	375621	1211540	S	77	5050	B	5050	Z	1970	CA001	C M	340	200- 230	112VCTR	5	1
													273- 283	112ARSC		
													320- 340	121LGUN		
001N006E13G02M	375607	1211547	S	77	5701	J	5701	Z	1953	CA241	Z F	504	216- 480	111FLDB		2
001N006E13J01M	375552	1211529	S	77	5701	B	5701	Z	1947	CA241	Z F	408	192- 408	111FLDB		2
001N006E22J01M	375507	1211735	S	77	5110	B	4203	S	1971	CA163	Z P	259	120- 124	111FLDB		2
													132- 134			
													202- 203			
													213- 215			
													217- 220			
001N006E35P02M	375307	1211704	S	77	5110	B	9597	S	1971	CA163	Z P	260		111AVSN		3
001N007E04F01M	375751	1211233	S	77	5060	J	5701	Z	1969	CA241	C M	535	210- 515	111FLDB	5	1
001N007E04G01M	375751	1211233	S	77	5060	J	5701	Z	1969	CA111	C M			111AVSN		4
001N007E05A01M	375808	1211323	S	77	5701	J	5701	Z	1954	CA241	Z F	427	196- 419	111FLDB	7	3
001N007E05N01M	375721	1211401	S	77	5701	B	5701	Z	1949	CA241	Z F	420	144- 408	111FLDB		2
001N007E07E01M	375707	1211521	S	77	5701	B	5701	Z	1944	CA241	Z F	250	140- 250	111FLDB		2
001N007E07F01M	375702	1211505	S	77	5060	B	4203	Z	1966	CA111	C M	418	260- 268	112VCTR	3	1
													275- 288	112ARSC		
													328- 332	121LGUN		
													358- 370			
													406- 414			

TABLE 12.--Actual Monitoring-Well Locations and Pertinent Data--Continued

B. Regional Nonpoint Problems--continued

5. Saltwater and connate intrusion--continued

STATE WELL NO	LAT	LONG	ACCU-RACY	COUNTY	AGENCY DWR NO	ANAL-YSIS TYPE	LABORATORY	FREQ-UENCY	YEAR BEGAN	DATA SOURCE	DATA LOC-ATION	WELL DEPTH	PERF INTERVAL		GEOHYDRO UNIT	WELL SEAL	WELL CLASS
001N007E08F02M	375703	1211356	S	77	5701	B	5701	Z	1966	CA241	Z F	552	240-	528	111FLDB	7	1
001N007E08H02M	375701	1211321	S	77	5701	B	5701	Z	1962	CA241	Z F	527	275-	507	111FLDB	10	1
001N007E08P01M	375632	1211341	S	77	5701	B	5701	Z	1967	CA241	Z F	522	210-	498	111FLDB	8	1
001N007E16M01M	375555	1211254	S	77	5701	J	5701	Z	1964	CA241	Z F	560	208-	540	111FLDB		2
001N007E17D01M	375620	1211407	S	77	5701	J	5701	Z	1967	CA241	Z F	530	199-	506	111FLDB	7	1
001N007E17D02M	375618	1211406	S	77	5701	J	5701	Z	1967	CA241	Z F	528	197-	522	111FLDB	7	1
001N007E17P01M	375539	1211400	S	77	5050	B	5050	2	1969	CA001	C M	100	100-		112VCTR	10	1
001N007E18B01M	375621	1211440	S	77	5701	J	5701	Z	1959	CA241	Z F	570	222-	366	111FLDB		2
													390-	550			
001N007E18D01M	375624	1211519	S	77	5701	B	5701	Z	1956	CA241	Z F	450	209-	426	111FLDB		2
001N007E18E02M	375614	1211522	S	77	5701	J	5701	Z	1955	CA241	Z F	500	210-	480	111FLDB	7	1
001N007E18E03M	375614	1211522	S	77	5701	B	5701	Z	1965	CA241	Z F	509	214-	505	111FLDB	8	1
001N007E18L01M	375601	1211458	S	77	5701	B	5701	Z	1958	CA241	Z F	510	205-	485	111FLDB		2
001N007E26H03M	375422	1210953	S	77	5050	B	5050	2	1970	CA001	C M	160	160-		112VCTR		1
															121LGUN		
															112ARSC		
001N007E30E01M	375431	1211521	S	77	5701	B	5701	Z	1941	CA241	Z F	315	148-	156	111FLDB		2
													170-	180			
													290-	306			
001N008E10C01M	375718	1210505	S	77	5050	B	5050	2	1970	CA001	C M	204	204-		111AVSN		2
001N008E15J01M	375602	1210431	S	77	5050	B	5050	2	1959	CA001	C M	164	154-	164	111AVSN		1
001N009E16F01M	375622	1205932	S	77	5050	B	5050	2	1969	CA001	C M	212	194-	208	111AVSN		2
															121LGUN		
001N009E26A01M	375453	1205650	S	77	5050	B	5050	2	1970	CA001	C M	260	228-	252	111AVSN		2
001S003E03M01M	375228	1213820	S	13	5050	B	5050	2	1974	CA001	C M	185	165-	185	111ALVF		2
001S003E15A01M	375106	1213722	S	13	5050	B	5050	2	1973	CA001	C M	45	35-	45	112PLSC		2
001S006E02D04M	375258	1211727	S	77	5050	B	5050	2	1970	CA001	C M	248	220-	244	111AVSN	3	1
001S006E25M02M	374909	1211559	S	77	5110	B	9597	S	1971	CA163	Z P	250	142-	166	111ALVF	8	1
													238-	250			
001S006E26H01M	374909	1211630	S	77	5110	B	9597	S	1971	CA163	Z P	228	208-	222	111ALVF	3	1
001S006E26L01M	374903	1211701	S	77	5060	D	9597	B	1979	CA111	C M	233	160-	185	111ALVF	5	1
													216-	231			
001S006E35D01M	374830	1211711	S	77	5110	B	9597	S	1971	CA163	Z P	170	150-	166	111ALVF	3	1
001S006E35E04M	374824	1211710	S	77	5110	B	9597	S	1971	CA163	Z P	194	130-	137	111ALVF		1
													140-	147			
													159-	167			
													170-	183			
001S006E36B01M	374838	1211537	S	77	5110	B	9597	S	1971	CA163	Z P	210	110-	210	111FLDB		2
001S006E36G01M	374821	1211537	S	77	5110	B	9597	S	1971	CA163	Z P	210	120-	140	111ALVF	5	1
													160-	180			
													180-	210			
001S007E21G01M	375004	1211219	S	77	5000	B	5000	2	1969	CA001	R M	85			111ALVF		1
											C M						
001S007E32H02M	374830	1211258	S	77	5060	J	5060	Z	1965	CA111	C M	176	120-	130	112VCTR	3	1
													140-	152	112ARSC		
													163-	171	121LGUN		
001S007E32P01M	374803	1211332	S	77	5060	J	5060	Z	1950	CA111	C M	100			112VCTR		2
001S007E33L01M	374815	1211225	S	77	5060	J	5146	Z	1974	CA111	C M	162	118-	154	112VCTR		2
															121LGUN		
															112ARSC		

TABLE 12.--Actual Monitoring-Well Locations and Pertinent Data--Continued

B. Regional Nonpoint Problems--continued

5. Saltwater and connate intrusion--continued

STATE WELL NO	LAT	LONG	ACCU-RACY	COUNTY	AGENCY DWR NO	ANAL-YSIS TYPE	LABORATORY	FREQ-UENCY	YEAR BEGAN	DATA SOURCE	DATA LOC-ATION	WELL DEPTH	PERF INTERVAL	GEOHYDRO UNIT	WELL SEAL	WELL CLASS
001S007E34L01M	374806	1211127	S	77	5060	D	5146	M	1979	CA111	C M	370	90- 150	111ALVF	6	1
													332- 365			
001S008E13M01M	375053	1210306	S	77	5050	B	5050	2	1970	CA001	C M	120	120-	111AVSN		2
001S008E16R01M	375031	1210530	S	77	5050	B	5050	2	1969	CA001	C M	138	138-	111AVSN		2
001S009E11J01M	375142	1205640	S	77	5050	B	5050	2	1970	CA001	C M	164	164-	111AVSN		2
														121LGUN		
001S009E16P02M	375035	1205934	S	77	5050	B	5050	2	1969	CA001	C M	116	116-	111AVSN		2
001S009E33P01M	374756	1205917	S	77	5050	B	5050	2	1972	CA001	C M	152	152-	111AVSN		2
002N001E07R02M	380140	1215355	S	13	5000	Z	5000	S	1972	USGS	R M	134		110ALVM		3
002N001E07R03M	380141	1215406	S	13	5000	Z	5000	S	1974	USGS	R M	132		110ALVM		3
002N001E07R04M	380141	1215400	S	13	5000	Z	5000	S	1974	USGS	R M	156				3
002N001E17K01M	380107	1215302	S	13	5000	Z	5000	S	1974	USGS	R M	190		110ALVM		3
002N001E18D01M	380129	1215439	S	13	5000	Z	5000	S	1974	USGS	R F	125		110ALVM		3
											R M					
002N001E22C01M	380044	1215103	S	13	5000	Z	5000	S	1974	USGS	R M	160	118- 158	110ALVM		2
													140- 155			
002N001E24E03M	380024	1214908	S	13	5000	Z	5000	S	1977	USGS	R M	130		110ALVM		3
002N001W04Q01M	380239	1215838	S	13	5000	Z	5000	S	1974	USGS	R M	62	22- 37	110ALVM		2
													42- 62			
002N001W09D01M	380226	1215912	S	13	5000	Z	5000	S	1974	USGS	R M	152	74- 152			2
002N001W09D02M	380221	1215908	S	13	5000	Z	5000	S	1974	USGS	R M	141				3
002N001W10C01M	380216	1215738	S	13	5000	Z	5000	S	1974	USGS	R M	80	60- 80	110ALVM		1
002N001W12P04M	380141	1215525	S	13	5000	Z	5000	S	1974	USGS	R M	132		110ALVM		3
002N002E17N01M	380048	1214707	S	13	5000	Z	5000	S	1974	USGS	R M	500		110ALVM		3
002N002E17R03M	380048	1214609	S	13	5000	Z	5000	S	1976	USGS	R M	102	62- 92	110ALVM	2	1
													92- 102			
002N002E18M01M	380102	1214808	S	13	5000	Z	5000	S	1974	USGS	R M	176		110ALVM		3
002N002E19F01M	380019	1214734	S	13	5000	Z	5000	S	1976	USGS	R M	190	49- 87	110ALVM		1
													113- 150			
													168- 178			
002N002E19G01M	380025	1214711	S	13	5000	Z	5000	S	1974	USGS	R M	140	54- 128	110ALVM		1
002N002E19G02M	380024	1214715	S	13	5000		5000	S	1975	USGS	R M					4
002N002E20A01M	380043	1214612	S	13	5000	B	5000	Z	1957	CA001	R M	78	42- 75	110ALVM		1
002N002E20F01M	380019	1214646	S	13	5000	Z	5000	S	1974	USGS	R M	93		110ALVM		3
002N002E20J01M	380012	1214611	S	13	5000	Z	5000	S	1974	USGS	R M	95		110ALVM		3
002N002E21K01M	380017	1214559	S	13	5000	Z	5000	S	1975	USGS	R M	120	104-	110ALVM		1
002N002E21L01M	380016	1214545	S	13	5000	Z	5000	S	1976	USGS	R M	140	124-	110ALVM		2
002N002E22F01M	380020	1214439	S	13	5000	Z	5000	S	1973	USGS	R M	66		110ALVM		3
002N002E22L01M	380017	1214432	S	13	5000	Z	5000	S	1975	USGS	R M	63		110ALVM		3
002N002W13B03M	380124	1220142	S	13	5000	Z	5000	S	1975	USGS	R M	201	88- 144	110ALVM		2
002N002W13B04M	380124	1220147	S	13	5000	Z	5000	S	1976	USGS	R M	200	128- 140	110ALVM	12	1
													162- 175			
002N002W13B05M	380123	1220154	S	13	5000	Z	5000	S	1974	USGS	R M	326	198- 205	110ALVM	14	1
													242- 247			
													290- 300			
002N002W13P01M	380049	1220153	S	13	5000	Z	5000	S	1973	USGS	R M	139		110ALVM		3
002N002W14P02M	380045	1220317	S	13	5000	Z	5000	S	1974	USGS	R M	420	80- 160	110ALVM	5	1
													170- 190			
													200- 220			
													280- 300			
													310- 330			

TABLE 12.--Actual Monitoring-Well Locations and Pertinent Data--Continued

B. Regional Nonpoint Problems--continued

5. Saltwater and connate intrusion--continued

STATE WELL NO	LAT	LONG	ACCU-RACY	COUNTY	AGENCY DWR NO	ANAL-YSIS TYPE	LABORATORY	FREQ-UENCY	YEAR BEGAN	DATA SOURCE	DATA LOC-ATION	WELL DEPTH	PERF INTERVAL		GEOHYDRO UNIT	WELL SEAL	WELL CLASS
002N006E04E01M	380308	1211940	S	77	5110	B	9597	S	1971	CA163	Z P						4
002N006E07P01M	380153	1212128	S	77	5050	B	5050	2	1970	CA001	C M	236			112VCTR		1
															112ARSC		
															121LGUN		
002N006E08C01M	380230	1212038	S	77	5110	B	9597	S	1971	CA163	Z P	114	114-		112VCTR		1
002N006E09F01M	380211	1211919	S	77	5060	J	9597	Z	1978	CA111	C M	570	297-	337	112VCTR	6	1
													337-	455	112ARSC		
													455-	495	121LGUN		
													495-	530			
													530-	540			
002N006E09J01M	380203	1211855	S	77	5060	B	4203	Z	1966	CA111	Z P	284	138-	145	111FLDB	3	1
											C M		175-	180			
													195-	205			
													234-	239			
													242-	244			
002N006E09K01M	380202	1211901	S	77	5060	J	4203	Z	1966	CA111	C M	262	163-	178	112VCTR	3	1
													192-	205	112ARSC		
													248-	255	121LGUN		
002N006E15D02M	380141	1211830	S	77	5060	J	4203	Z	1976	CA111	C M	600	280-	300	111FLDB	8	1
													300-	330			
													330-	350			
													350-	380			
													380-	460			
002N006E15F01M	380118	1211814	S	77	5060	J	4203	Z	1972	CA111	C M	435	190-	230	112VCTR	10	1
													230-	275	112ARSC		
													275-	285	121LGUN		
													285-	382			
													382-	422			
002N006E16B01M	380133	1211915	S	77	5060	J	4203	Z	1966	CA111	C M	238	164-	238	112VCTR	3	1
															121LGUN		
															112ARSC		
002N006E16C02M	380130	1211931	S	77	5050	B	5050	2	1969	CA001	C M	104	104-		112VCTR		1
															112ARSC		
002N006E16D03M	380127	1211945	S	77	5060	J	9597	Z	1971	CA111	C M	190	190-		112VCTR		2
															121LGUN		
002N006E16E01M	380124	1211947	S	77	5060	J	9597	Z	1954	CA111	C M	424	240-		112VCTR		2
															121LGUN		
002N006E16H01M	380123	1211900	F	77	5060	J	4203	Z	1966	CA111	C M	250	175-	200	112VCTR	5	1
													226-	230	121LGUN		
													232-	235			
													242-	248			
002N006E16Q01M	380056	1211900	S	77	5060	J	4203	Z	1966	CA111	C M	410	168-	212	112ARSC	3	1
													352-	376	121LGUN		
													396-	406			
002N006E16R02M	380101	1211849	S	77	5060	J	4203	A	1966	CA111	C M	304	237-	304	111FLDB	3	1

TABLE 12.--Actual Monitoring-Well Locations and Pertinent Data--Continued

B. Regional Nonpoint Problems--continued

5. Saltwater and connate intrusion--continued

STATE WELL NO	LAT	LONG	ACCU-RACY	COUNTY	AGENCY DWR NO	ANAL-YSIS TYPE	LABORATORY	FREQ-UENCY	YEAR BEGAN	DATA SOURCE	DATA LOC-ATION	WELL DEPTH	PERF INTERVAL	GEOHYDRO UNIT	WELL SEAL	WELL CLASS
002N006E17J01M	380107	1211952	S	77	5110	J	4203	Z	1957	CA111	Z P	268	170- 174	111FLDB		1
											C M		182- 184	112VCTR		
													192- 236	112ARSC		
														121LGUN		
002N006E19L01M	380017	1212142	F	77	5110	B	9597	S	1971	CA163	Z P	252	100- 106	111FLDB		1
													166- 170			
													187- 192			
													210- 217			
002N006E19P01M	380011	1212136	S	77	5110	B	9597	S	1971	CA163	Z P	292	108- 122	111FLDB		2
002N006E19P02M	380004	1212132	S	77	5110	B	9597	S	1971	CA163	Z P	256	124- 130	111FLDB		2
													162- 170			
													184- 190			
002N006E20A01M	380043	1211956	S	77	5060	J	4203	Z	1958	CA111	C M			112VCTR		4
002N006E20F01M	380031	1212035	S	77	5110	B	4203	S	1971	CA163	Z F	252	85- 90	111FLDB		2
													115- 128			
													150- 155			
													215- 225			
													235- 245			
002N006E20L01M	380011	1212030	S	77	5110	B	9597	S	1971	CA163	Z P	332	272- 328	112VCTR	3	1
														121LGUN		
002N006E20M02M	380019	1212055	S	77	5110	J	4203	Z	1974	CA111	Z P	355	295- 315	111FLDB	5	1
													333- 353			
002N006E21C01M	380041	1211922	S	77	5060	J	9597	Z	1971	CA111	C M	200	160-	112VCTR		2
														121LGUN		
002N006E21C02M	380040	1211922	S	77	5110	B	9597	S	1971	CA163	Z P	256	256-	111FLDB		2
														112ARSC		
														112VCTR		
														121LGUN		
002N006E21F01M	380026	1211914	S	77	5060	J	9597	Z	1971	CA111	C M	224	180-	112VCTR	2	1
														121LGUN		
002N006E21F02M	380033	1211922	S	77	5110	B	9597	S	1971	CA163	Z P	266	210- 262	112VCTR	4	1
														121LGUN		
002N006E21K01M	380014	1211905	S	77	5060	J	5701	Z	1959	CA111	C M					4
002N006E22B01M	380045	1211812	S	77	5701	B	5701	Z	1959	CA241	Z F	520	150- 495	111FLDB	7	1
002N006E22D01M	380042	1211830	S	77	5060	J	4203	Z	1966	CA111	C M	344	200- 212	112VCTR	4	1
													314- 326	112ARSC		
														121LGUN		

TABLE 12.--Actual Monitoring-Well Locations and Pertinent Data--Continued

B. Regional Nonpoint Problems--continued

5. Saltwater and connate intrusion--continued

STATE WELL NO	LAT	LONG	ACCU-RACY	COUNTY	AGENCY DWR NO	ANAL-YSIS TYPE	LABORATORY	FREQ-UENCY	YEAR BEGAN	DATA SOURCE	DATA LOC-ATION	WELL DEPTH	PERF INTERVAL	GEOHYDRO UNIT	WELL SEAL	WELL CLASS
002N006E22E01M	380032	1211836	S	77	5701	J	5701	Z	1961	CA241	Z F	100	171- 178	111FLDB	2	1
													190- 219			
													236- 248			
002N006E22G01M	380029	1211811	S	77	5701	B	5701	Z	1961	CA241	Z F	512	170- 490	111FLDB	8	1
002N006E22G02M	380035	1211757	S	77	5701	J	5701	Z	1974	CA241	Z F	514	254- 514	111FLDB	5	1
002N006E22Q01M	380016	1211801	S	77	5701	B	5701	Z	1960	CA241	Z F	520	200- 500	111FLDB	9	1
002N006E22Q02M	380001	1211758	S	77	5701	J	5701	Z	1961	CA241	Z F	520	184- 286	111FLDB	7	1
													310- 396			
													444- 500			
002N006E25N01M	375906	1211618	S	77	5701	J	5701	Z	1949	CA241	Z F	408		111FLDB		3
002N006E26L01M	375926	1211719	S	77	5701	J	5701	Z	1969	CA241	Z F	545	200- 298	111FLDB	5	1
													310- 346			
													353- 395			
													400- 525			
002N006E27B01M	375942	1211817	S	77	5701	B	5701	Z	1960	CA241	Z F	540	188- 520	111ALVF	9	1
002N006E27H01M	375942	1211748	S	77	5701	J	5701	Z	1967	CA241	Z F	520	195- 301	111FLDB		3
													308- 500			
002N006E27K01M	375927	1211806	S	77	5701	B	5701	Z	1968	CA241	Z F	510	175- 490	111FLDB	9	2
002N006E27K02M	375927	1211806	S	77	5701	B	5701	Z	1972	CA241	Z F	502	185- 485	111FLDB	5	1
002N006E27L01M	375919	1211824	S	77	5701	J	5701	Z	1957	CA241	Z F	519	195- 240	111FLDB	8	1
													261- 345			
													369- 495			
002N006E27P01M	375913	1211819	S	77	5701	J	5701	Z	1953	CA241	Z F	503		111FLDB		3
002N006E30B01M	375953	1212124	S	77	5110	B	9597	S	1971	CA163	Z P	188	156- 174	111FLDB		2
002N006E33B01M	375854	1211909	S	77	5701	J	5701	Z	1958	CA241	Z F	504	170- 480	111FLDB	7	1
002N006E33F01M	375852	1211928	S	77	5701	B	5701	Z	1952	CA241	Z F	480	144- 216	111FLDR	6	1
													240- 456			
002N006E33G01M	375842	1211905	S	77	5701	B	5701	Z	1950	CA241	Z F	400	200- 400	111FLDB	9	1
002N006E33K01M	375830	1211900	S	77	5701	J	5701	Z	1956	CA241	Z F	552	350- 535	111FLDB	8	1
002N006E33M03M	375840	1211919	S	77	5060	J	5709	Z	1947	CA111	C M					4
002N006E33N01M	375824	1211934	S	77	5060	J	5701	Z	1949	CA111	C M					4
002N006E34B01M	375901	1211741	S	77	5701	B	5701	Z	1950	CA241	Z F	400	200- 400	111FLDB	9	1
002N006E34C01M	375902	1211812	S	77	5701	B	5701	Z	1947	CA241	Z F	408	204- 408	111FLDB		2
002N006E34K02M	375829	1211759	S	77	5701	J	5701	Z	1964	CA241	Z F	548	196- 353	111FLDB	7	1
													356- 528			
002N006E34L01M	375837	1211815	S	77	5060	J	5701	Z	1970	CA111	C M	274				3
002N006E34Q01M	375814	1211747	S	77	5701	B	5701	Z	1950	CA241	Z F	400	200- 400	111FLDB		2
002N006E35B01M	375900	1211655	S	77	5701	B	5701	Z	1974	CA241	Z F	500	200- 480	111FLDB	5	2
002N006E35D02M	375901	1211725		77	5060	J	4203	Z	1976	CA111	C M	264	192- 260	112VCTR		1
														121LGUN		
002N006E36A01M	375905	1211532	S	77	5701	B	5701	Z	1947	CA241	Z F	408	192- 408	111FLDB		2
002N006E36F01M	375847	1211606	S	77	5701	B	5701	Z	1974	CA241	Z F	518	242- 498	111FLDB	5	1
002N006E36G01M	375849	1211543	S	77	5701	J	5701	Z	1973	CA241	Z F	580	200- 560		6	1
002N006E36N03M	375828	1211615	S	77	5701	J	5701	Z	1957	CA241	Z F	514	202- 490	111FLDB	9	1
002N006E36R03M	375821	1211532	S	77	5701	J	5701	Z	1946	CA241	Z F	264	144- 264	111FLDB	9	1

TABLE 12.--Actual Monitoring-Well Locations and Pertinent Data--Continued

B. Regional Nonpoint Problems--continued

5. Saltwater and connate intrusion--continued

STATE WELL NO	LAT	LONG	ACCU-RACY	COUNTY	AGENCY DWR NO	ANAL-YSIS TYPE	LABORATORY	FREQ-UENCY	YEAR BEGAN	DATA SOURCE	DATA LOC-ATION	WELL DEPTH	PERF INTERVAL	GEOHYDRO UNIT	WELL SEAL	WELL CLASS
002N007E07G01M	380154	1211453	S	77	5050	B	5050	Z	1970	CA001	C M	212	212-	112VCTR 112ARSC 121LGUN		1
002N007E12J02M	380210	1210859	S	77	5050	B	5050	2	1971	CA001	C M	204	204-	112VCTR 121LGUN 112ARSC		1
002N007E20E04M	380034	1211410	S	77	5050	B	5050	2	1969	CA001	C M	140	140-	112VCTR 112ARSC		2
002N007E25M01M	375929	1210947	S	77	5050	B	5050	2	1970	CA001	C M	298	298-	112VCTR 112ARSC 121LGUN		1
002N007E30K01M	375928	1211452	S	77	5701	B	5701	Z	1977	CA241	Z F	508	298- 488	111FLDB	5	1
002N008E13G01M	380136	1210253	S	77	5050	B	5050	2	1970	CA001	C M	200	200-	121LGUN	5	1
002N008E15K01M	380120	1210453	S	77	5060	J	9597	Z	1975	CA111	C M	476	476-	112VCTR 112ARSC 121LGUN	14	1
002N008E15K03M	380124	1210450	S	77	5060	J	9597	Z	1977	CA111	C M	368	368-	112VCTR 121LGUN 112ARSC	16	1
002N008E15L01M	380118	1210520	S	77	5060	J	9597	Z	1977	CA111	C M	619	619-	112VCTR 112ARSC 121MRTN 121LGUN	10	1
002N008E15N03M	380108	1210528	S	77	5060	J	9597	Z	1976	CA111	C M	646	448- 554 556- 640	112VCTR 121LGUN	14	1
002N008E16L01M	380113	1210628	S	77	5060	J	9597	Z	1975	CA111	C M	270	190- 270	111AVSNY	18	1
002N008E21J01M	380027	1210540	S	77	5050	B	5050	2	1969	CA001	C M	370		111AVSNY	15	2
002S004E16A01M	374551	1213150	S	77	5050	B	5050	2	1973	CA001	C M	66	56- 66	111ALCR	2	1
002S005E20R01M	374425	1212615	S	77	5060	J	9597	Z	1974	CA111	C M	1200	366-	112ALBEC	19	1
002S005E21D01M	374509	1212600	S	77	5060	J	9597	Z	1964	CA111	C M	1148	337-	112ALBEC		1
002S005E21J01M	374436	1212458	S	77	5060	J	9597	Z	1953	CA111	C M	850	85- 90 150- 250 330- 420 465- 835	112ALABE	14	1
002S005E21Q01M	374431	1212512	S	77	5060	J	9597	Z	1950	CA111	C M	800	127-	112ALABE	12	2
002S005E22D01M	374513	1212454	S	77	5060	J	9597	Z	1974	CA111	C M					4
002S005E25D02M	374421	1212243	S	77	5050	B	5050	2	1969	CA001	C M	103	91- 103	112ALAEC		1
002S005E28A02M	374418	1212506	S	77	5060	J	9597	Z	1950	CA111	C M	200	120- 197	112ALAEC		2
002S005E28E01M	374406	1212600	S	77	5060	J	9597	Z	1972	CA111	C M	755	230-	112ALARE	40	2
002S005E28L01M	374349	1212530	S	77	9597	J	9597	Z	1958	CA111	C M	930	132- 918	112ALABE	2	1
002S005E29A01M	374415	1212604	S	77	5060	J	9597	Z	1953	CA111	C M	190		112ALAEC	9	3
002S006E20L01M	374445	1212004	S	77												
002S006E20L02M	374445	1212000	S	77								657	592- 652			
002S006E32D01M	374328	1212030	S	77								680				
002S007E04F01M	374737	1211221	S	77	5060	J	5146	Z	1965	CA111	C M	120	120-	111ALVM	3	1
002S007E05A01M	374743	1211302	S	77	5060	J	5146	Z	1950	CA111	C M	243	243-	112ALBEC		2
002S007E05A02M	374743	1211303	S	77	5060	J	5146	Z	1950	CA111	C M	325		112ALBEC		2
002S007E05B01M	374739	1211315	S	77	5060	J	5146	Z	1965	CA111	C M	100	100-	112ALABE		2

TABLE 12.--Actual Monitoring-Well Locations and Pertinent Data--Continued

B. Regional Nonpoint Problems--continued

5. Saltwater and connate intrusion--continued

STATE WELL NO	LAT	LONG	ACCU-RACY	COUNTY	AGENCY DWR NO	ANAL-YSIS TYPE	LABORATORY	FREQ-UENCY	YEAR BEGAN	DATA SOURCE	DATA LOC-ATION	WELL DEPTH	PERF INTERVAL	GEOHYDRO UNIT	WELL SEAL	WELL CLASS
002S007E07Q01M	374611	1211414	S	77	5050	B	5050	2	1965	CA001	C M	127	54- 122	112ALAEC		2
002S007E24R02M	374424	1210833	S	77	5050	B	5050	2	1970	CA001	C M	98	98-	111AVSN		2
002S007E30H01M	374356	1211405	S	77								205	85- 157		2	
													157- 205			
002S007E34R02M	374251	1211055	S	77								260	80- 260		2	
002S008E02C01M	374749	1210350	S	77	5050	B	5050	2	1970	CA001	C M	76	76-	111AVSN		2
002S008E19H01M	374448	1210731	S	77	5060	J	4156	Z	1972	CA111	C M	312	78- 138	111AVSN	7	1
													138- 246			
													294- 312			
002S008E19R02M	374427	1210728	S	77	5060	J	4156	Z	1970	CA111	C M	254	55- 63	111AVSN	2	1
													92- 108			
													204- 252			
002S008E20J02M	374444	1210622	S	77	5050	B	5050	2	1972	CA001	C M	140	182- 310	111AVSN		2
002S008E20N01M	374435	1210720	S	77	5060	J	4156	Z	1951	CA111	C M	165	165-	111AVSN		2
002S008E29D01M	374419	1210722	S	77	5060	J	4156	Z	1951	CA111	C M	109	109-	111AVSN		2
002S008E30B01M	374414	1210757	S	77	5060	J	5146	Z	1951	CA111	C M	136	136-	111AVSN		1
002S008E30H01M	374448	1210737	S	77	5060	J	5146	Z	1972	CA111	C M	338	84- 278	111AVSN	5	1
													278- 338			
002S009E04B01M	374753	1205805	S	77	5060	J	5146	Z	1967	CA111	C M	293	281- 293	111AVSN		2
002S009E04C01M	374747	1205926	S	77	5060	J	5146	Z	1950	CA111	C M	105	80-	111AVSN		2
002S009E04E01M	374736	1205931	S	77	5060	J	5146	Z	1978	CA111	C M	255	190- 230	111ALVM	5	1
002S009E12R01M	374610	1205528	S	77	5050	B	5050	2	1970	CA001	C M	280	280-	111AVSN		2
002S009E15P01M	374523	1205816	S	77	5050	B	5050	2	1969	CA001	C M	133	133-	111AVSN		1
002S009E19B02M	374517	1210115	S	77	5050	B	5050	2	1971	CA001	C M	193	175- 190	111AVSN		2
003N006E13A04M	380645	1211550	S	77	5050	B	5050	2	1970	CA001	C M	161	161-	112VCTR		1
														112ARSC		
														121LGUN		
003N006E15Q05M	380605	1211817	S	77	5110	B	9597	S	1971	CA163	Z P	140	140-	112VCTR		2
														121LGUN		
														112ARSC		
003N006E17H03M	380634	1212001	S	77	5050	B	5050	2	1969	CA001	C M	78	78-	112VCTR		1
003N007E16C06M	380657	1211257	S	77	5050	B	5050	2	1971	CA001	C M	170		112VCTR		3
														121LGUN		
003N008E20P01M	380531	1210730	S	77	5050	B	5050	2	1970	CA001	C M	184	184-	121LGUN		1
003N009E06N01M	380808	1210158	S	77	5050	B	5050	2	1970	CA001	C M	334	344-	121LGUN		1
														121MRTN		
003S005E12J02M	374111	1212139	S	77	5050	B	5050	2	1970	CA001	C M	224	224-	112ALAEC		1
003S006E04N01M	374148	1211910	S	77								600	206-			
003S006E05R01M	374151	1211930	S	77								775	252-			
003S006E08R01M	374155	1211926	S	77								808	154- 803			
003S006E09J02M	374110	1211824	S	77		B			1959			800	167- 790		2	
003S006E10K01M	374113	1211744	S	77								800	167-			
003S006E14A01M	374048	1211616	S	77	5060	J	9551	Z	1964	CA111	C M	420	96- 186	112ALABE	7	1
003S006E14A02M	374054	1211622	S	77	5060	J	9551	Z	1964	CA111	C M	389	110- 180	112ALABE	7	1
003S006E14M01M	374019	1211708	S	77		B			1953			1055	150-			
003S006E15N02M	374012	1211814	S	77								4194				
003S006E16L01M	374018	1211850	S	77		B			1959			811	262-			
003S006E16M01M	374058	1211924	S	77								718	102-			
003S006E16R01M	374010	1211824	S	77								4188				

TABLE 12.--Actual Monitoring-Well Locations and Pertinent Data--Continued

B. Regional Nonpoint Problems--continued

5. Saltwater and connate intrusion--continued

STATE WELL NO	LAT	LONG	ACCU-RACY	COUNTY	AGENCY DWR NO	ANAL-YSIS TYPE	LABORATORY	FREQ-UENCY	YEAR BEGAN	DATA SOURCE	DATA LOC-ATION	WELL DEPTH	PERF INTERVAL	GEOHYDRO UNIT	WELL SEAL	WI CI
003S006E17K01M	374015	1211937	S	77	5050	B	5000	4	1980	USGS	R M	156		112ALAEC		
003S007E04K01M	374205	1211201	S	77								280	70- 280		2	
003S007E09P01M	374059	1211222	S	99								276				
003S007E13A01M	374040	1210837	S	99	5050	B	5000	4	1980	USGS	R M	198		111AVSN		
003S007E18F01M	374042	1211439	S	77								204	108- 204		5	
004N005E24J03M	381045	1212217	S	77	5050	B	5050	2	1971	CA001	C M	72		111ALVF		
004N006E12C06M	381254	1211620	S	77	5050	B	5050	2	1970	CA001	C M	138	138-	112VCTR		
														121LGUN		
														112ARSC		
004N006E16R07M	381127	1211913	S	77	5050	B	5050	2	1969	CA001	C M	117	117-	112VCTR		
														112ARSC		
														121LGUN		
004N006E34E05M	380920	1211840	S	77	5110	B	9597	S	1971	CA163	Z P	224	84- 85	111ALVF	5	
													133- 134			
													164- 165			
													193- 200			
													215- 219			
004N007E12P04M	381220	1210939	S	77	5050	B	5050	2	1970	CA001	C M	188	188-	112VCTR	5	
														121LGUN		
														112ARSC		
004N007E15E01M	381149	1211221	S	77	5050	B	5050	2	1969	CA001	C M	216	216-	112VCTR		
														112ARSC		
														121LGUN		
004N007E29E02M	381008	1211430	S	77	5050	B	5050	2	1971	CA001	C M	185	185-	112VCTR		
														121LGUN		
														112ARSC		
004N008E22K02M	381057	1210457	S	77	5050	B	5050	2	1969	CA001	C M	204	204-	112VCTR		
														112ARSC		
														121LGUN		
004N008E29E04M	381018	1210755	S	77	5050	B	5050	2	1971	CA001	C M	216	216-	112VCTR		
														121LGUN		
														112ARSC		
004N009E17E02M	381210	1210102	S	77	5050	B	5050	2	1970	CA001	C M	156	156-	112VCTR		
														112ARSC		
														121LGUN		
004S006E09D01M	373547	1211922	S	77	5050	B	5050	2	1969	CA001	C M	141	131- 141	112ALAEC		
005N006E36C03M	381441	1211629	S	77	5050	B	5050	2	1979	CA001	C M	520	160- 180	121LGUN		
													460- 580			
005N008E26P01M	381509	1210420	S	77	5050	B	5050	2	1971	CA001	C M	268	268-	112ARSC		
														121LGUN		
009S011E34R01M	370600	1204436	S	47		B			1952			225				
009S012E05P01M	371018	1204051	S	47								800	260-			
010S011E07G01M	370424	1204804	S	47								6000				
010S011E17P01M	370327	1204720	S	47								480				
010S012E09P01M	370413	1203945	S	47	5050	B	5000	Z	1980	USGS	R M	180	7- 150	112ALAEC		

TABLE 12.--Actual Monitoring-Well Locations and Pertinent Data--Continued

B. Regional Nonpoint Problems--continued

5. Saltwater and connate intrusion--continued

STATE WELL NO	LAT	LONG	ACCU-RACY	COUNTY	AGENCY DWR NO	ANAL-YSIS TYPE	LABORATORY	FREQ-UENCY	YEAR BEGAN	DATA SOURCE	DATA LOC-ATION	WELL DEPTH	PERF INTERVAL	GEOHYDRO UNIT	WELL SEAL	WELL CLASS
010S013E23M01M	370242	1203128	S	39		B			1965			460	250-			
010S013E26K01M	370158	1203051	S	39		B			1965			519	279-			
010S014E29C01M	370223	1202752	S	39							D F	600				
010S014E34E01M	370114	1202608	S	39		B			1965			900	307-			
011S012E07E02M	365925	1204220	S	47								488	388-			
011S012E11J01M	365909	1203710	S	47								627				
011S013E34N01M	365526	1203226	S	19								590				
011S014E07N02M	365856	1202924	S	39		B			1966			800	232-			
011S015E33P04M	365530	1202022		39								756				
011S015E35P01M	365533	1201813	S	39	5050	B	5000	4	1980	USGS	R M					4
012S013E10G01M	365416	1203155	S	19								1218				
012S013E19K01M	365210	1203516	S	19								1250	400-			
012S014E14A01M	365340	1202358		39								405				
012S014E28L04M	365124	1202649	S	19	5060	J	5802	Z	1977	CA111	C M		115-	112ALAEC		2
012S015E08F01M	365409	1202114	S	39								720	224-			
012S016E31A01M	365045	1201518	S	39		B			1966			340	160-			
013S011E13N01M	364734	1204339	S	19								800				
013S011E23E01M	364708	1204434	S	19								1823				
013S012E16N01M	364743	1204023	S	19								845				
013S012E22F01M	364709	1203850	S	19								1250				
013S013E14N01M	364734	1203144	S	19								1432	497-			
013S014E15R01M	364823	1202538	S	19								603	20-			
013S015E15G01M	364800	1201910		39								384				
013S015E19Q01M	364647	1202219	S	19	5112	B	5112	S	1978	CA160	C F	213	96- 115 135- 159 169- 213	112ALAEC	5	1
013S015E24E01M	364718	1201727		39								5530				
013S016E19J01M	364658	1201530	S	39								352				
013S016E20M01M	364704	1201519		39								4517				
013S017E22B01M	364734	1200601	S	19	5050	B	5000	4	1980	USGS	R M	90		111ALVMO		3
013S017E32J02M	364512	1200711	M	19								280				
014S012E14P01M	364224	1203801	S	19								1580	600-			
014S012E21B01M	364223	1203956	S	19								340	240-			
014S012E23A01M	364210	1203716	S	19								1026	593-			
014S012E23H01M	364156	1203715	S	19								2065	695-			
014S014E10N01M	364314	1202619	S	19								1463	540-			
014S014E13E03M	364257	1202409	S	19								499	312-			
014S015E16D01M	364309	1202100	S	19								762				
014S015E19N01M	364128	1202311	S	19								1033	581-			
014S016E16R01M	364221	1201235	M	19								500				
014S017E09A01M	364357	1200610	M	19								264				
014S017E12J01M	364331	1200302	M	19	5060	J	5146	Z	1974	CA111	C M			111ALVMO		4
014S017E12R01M	364318	1200302	M	19	5060	J	5146	Z	1971	CA111	C M			111ALVMO		4

TABLE 12.--Actual Monitoring-Well Locations and Pertinent Data--Continued

B. Regional Nonpoint Problems--continued

5. Saltwater and connate intrusion--continued

STATE WELL NO	LAT	LONG	ACCU-RACY	COUNTY	AGENCY DWR NO	ANAL-YSIS TYPE	LABORATORY	FREQ-UENCY	YEAR BEGAN	DATA SOURCE	DATA LOC-ATION	WELL DEPTH	PERF INTERVAL	GEOHYDRO UNIT	WELL SEAL	WELL CLASS
015S012E12E01M	363828	1203713	S	19								2106	863-			
015S012E15A02M	363759	1203825	S	19								810				
015S012E23Q01M	363623	1203736	S	19								850				
015S013E16N01M	363710	1203401	S	19								1911	696-			
015S013E22N01M	363616	1203257	S	19								1838				
020S016E04G01M	361307	1201411	S	19								1989	809-			
020S016E22J01M	361022	1201237	S	19								1730				
020S017E27B01M	361000	1200637	S	19								2041	558-			
021S016E01P02M	360725	1201140	S	19								1128	643-			
021S016E08E01M	360709	1201615	S	19	5050	B	5000	4	1980	USGS	R M	463	323- 463	111ALCR		2
021S017E14A01M	360631	1200534	S	19								2105	730-			
021S017E22G01M	360514	1200709	S	19								1707	555-			
021S018E32C01M	360356	1200253	S	31								1970	650-			
022S018E04B01M	360304	1200144	S	31								1700	520-			
022S019E18P02M	360027	1195742	S	31	5050	B	5050	4	1980	USGS	C M	410	309- 329	112ALAEC		1
											R M		356- 377			
023S018E29E02M	355408	1200317	S	31								364				
024S021E36B01M	354810	1193905	S	31												
024S022E17Q01M	355017	1193643	S	31								2200				
024S022E17R01M	355016	1193637	S	31								1400				
024S023E03D01M	355228	1192843	S	107	5050	B	5000	4	1980	USGS	R M	1240	796- 1240	112ALBEC	35	1
025S021E20F01M	354425	1194356	S	29								1254				
026S021E25F01M	353833	1193948	S	29								396				
026S022E32J01M	353726	1193707	S	29								750				
026S023E29K01M	353817	1193100	S	29								708				
027S021E03A01M	353656	1194123	S	29								300				
027S022E09D01M	353620	1193604	S	29	5640	B	5806	A	1950	CA036	Z F	400	100- 400	112ALAEC		2
027S022E16B01M	353510	1193619	S	29								808	180-			
027S023E01R05M	353607	1192617	S	29								1160	1008-			
028S022E04A01M	353141	1193603	S	29	5617	B	5806	A	1950	CA036	Z F	426	216- 426	112ALAEC		2
											Z F		216- 426	112ALAEC		
028S022E09R01M	353000	1193613	S	29	5617	B	5806	A	1956	CA036	Z F	700	396- 522	112ALBEC	41	1
											Z F		396- 522	112ALBEC		
028S023E16C01M	352948	1193027	S	29		B		O	1961	USGS		754				
028S023E16K01M	352935	1192947	S	29								550				
029S023E16K01M	352406	1193034	S	29								670				
029S023E21H01M	352328	1193009	S	29	5617	B	5806	A	1950	CA036	Z F					4
											Z F					
029S024E32G01M	352141	1192503	S	29								678				
030S024E04C06M	352112	1192410	S	29								800	758-			
031S024E22B01M	351331	1192308	S	29								500				
031S024E28B01M	351233	1192404	S	29	5649	B	5191	A	1976	CA154	Z F	402		112ALABE		3

TABLE 12.--Actual Monitoring-Well Locations and Pertinent Data--Continued

B. Regional Nonpoint Problems--continued

6. Radioactive substances

STATE WELL NO	LAT	LONG	ACCU-RACY	COUNTY	AGENCY DWR NO	ANAL-YSIS TYPE	LABORATORY	FREQ-UENCY	YEAR BEGAN	DATA SOURCE	DATA LOC-ATION	WELL DEPTH	PERF INTERVAL	GEOHYDRO UNIT	WELL SEAL	WELL CLASS
001S006E02D04M	375258	1211727	S	77	5050	B	5050	2	1970	CA001	C M	248	220- 244	111AVSN	3	1
001S006E05B01M	375253	1211958	S	77	5050	B	5050	S	1976	CA001	C F	12	10- 11	111FLDB		2
001S006E25M02M	374909	1211559	S	77	5110	B	9597	S	1971	CA163	Z P	250	142- 166	111ALVF	8	1
													238- 250			
001S006E26H01M	374909	1211630	S	77	5110	B	9597	S	1971	CA163	Z P	228	208- 222	111ALVF	3	1
001S006E26L01M	374903	1211701	S	77	5060	D	9597	B	1979	CA111	C M	233	160- 185	111ALVF	5	1
													216- 231			
001S006E35D01M	374830	1211711	S	77	5110	B	9597	S	1971	CA163	Z P	170	150- 166	111ALVF	3	1
001S006E35E04M	374824	1211710	S	77	5110	B	9597	S	1971	CA163	Z P	194	130- 137	111ALVF		1
													140- 147			
													159- 167			
													170- 183			
001S006E36B01M	374838	1211537	S	77	5110	B	9597	S	1971	CA163	Z P	210	110- 210	111FLDB		2
001S006E36G01M	374821	1211537	S	77	5110	B	9597	S	1971	CA163	Z P	210	120- 140	111ALVF	5	1
													160- 180			
													180- 210			
001S007E21G01M	375004	1211219	S	77	5000	B	5000	2	1969	CA001	R M	85		111ALVF		1
											C M					
001S007E29F01M	374910	1211341	S	77	5060	J	5146	Z	1975	CA111	C M	365		112VCTR	6	3
														112ARSC		
														121LGUN		
001S007E32H02M	374830	1211258	S	77	5060	J	5060	Z	1965	CA111	C M	176	120- 130	112VCTR	3	1
													140- 152	112ARSC		
													163- 171	121LGUN		
001S007E32P01M	374803	1211332	S	77	5060	J	5060	Z	1950	CA111	C M	100		112VCTR		2
001S007E33L01M	374815	1211225	S	77	5060	J	5146	Z	1974	CA111	C M	162	118- 154	112VCTR		2
														121LGUN		
														112ARSC		
001S007E34L01M	374806	1211127	S	77	5060	D	5146	M	1979	CA111	C M	370	90- 150	111ALVF	6	1
													332- 365			
002S007E04F01M	374737	1211221	S	77	5060	J	5146	Z	1965	CA111	C M	120	120-	111ALVM	3	1
002S007E05A01M	374743	1211302	S	77	5060	J	5146	Z	1950	CA111	C M	243	243-	112ALBEC		2
002S007E05A02M	374743	1211303	S	77	5060	J	5146	Z	1950	CA111	C M	325		112ALBEC		2
002S007E05B01M	374739	1211315	S	77	5060	J	5146	Z	1965	CA111	C M	100	100-	112ALABE		2
002S007E07Q01M	374611	1211414	S	77	5050	B	5050	2	1965	CA001	C M	127	54- 122	112ALAEC		2
002S007E24R02M	374424	1210833	S	77	5050	B	5050	2	1970	CA001	C M	98	98-	111AVSN		2
003S005E04H01M	374223	1212506	S	77	5000	B	5000	4	1980	USGS	R M	140	120- 140	112ALAEC		1
											C M					
003S005E12J02M	374111	1212139	S	77	5050	B	5050	2	1970	CA001	C M	224	224-	112ALAEC		1
013S015E19Q01M	364647	1202219	S	19	5112	B	5112	S	1978	CA160	C F	213	96- 115	112ALAEC	5	1
													135- 159			
													169- 213			
013S015E29C01M	364634	1202140	S	19	5122	B	5112	S	1974	CA160	C F	50	10- 50	112ALAEC		2
013S017E22B01M	364734	1200601	S	19	5050	B	5000	4	1980	USGS	R M	90		111ALVMO		3

TABLE 12.--Actual Monitoring-Well Locations and Pertinent Data--Continued

B. Regional Nonpoint Problems--continued

6. Radioactive substances--continued

STATE WELL NO	LAT	LONG	ACCU-RACY	COUNTY	AGENCY DWR NO	ANAL-YSIS TYPE	LABORATORY	FREQ-UENCY	YEAR BEGAN	DATA SOURCE	DATA LOC-ATION	WELL DEPTH	PERF INTERVAL		GEOHYDRO UNIT	WELL SEAL	WELL CLASS
013S020E03C01M	365008	1194650	M	19	5060	J	5802	Z	1974	CA111	C M	168			111ALVMO		3
013S020E07C01M	364911	1194951	M	19	5060	J	5806	Z	1973	CA111	C M	150	150-		111ALVMO	9	1
013S020E07F01M	364902	1195000	M	19	5060	J	5806	Z	1973	CA111	C M	148	148-		111ALVMO		2
013S020E08C01M	364910	1194847	M	19	5060	J	5806	Z	1973	CA111	C M	152	152-		111ALVMO		1
013S020E08L01M	364842	1194856	M	19	5060	J	5806	Z	1973	CA111	C M	289	150-	285	111ALVMO		2
013S020E08P01M	364840	1194851	M	19	5060	J	5806	Z	1973	CA111	C M	168	168-		111ALVMO		1
013S020E09F02M	364900	1194742	M	19	5060	J	5146	Z	1973	CA111	C M	136	136-		111ALVMO		1
013S020E09Q01M	364829	1194731	M	19	5060	J	5802	Z	1974	CA111	C M	124	124-		111ALVMO		1
013S020E11C01M	364907	1194540	M	19	5060	J	5146	Z	1972	CA111	C M	144	144-		111ALVMO		1
013S020E13E01M	364807	1194505	S	19	1851	B	1851	M	1971	USSEA	Z F	400	170-	400	111AVSN	5	1
013S020E13H01M	364803	1194410	M	19	5060	J	5810	Z	1971	CA111	C M	294	207-		111ALVMO		1
013S020E14M01M	364801	1194550	M	19	5060	J	5802	Z	1971	CA111	C M	302	187-	192	111ALVMO		1
013S020E15L01M	364758	1194638	M	19	5060	J	5810	Z	1971	CA111	C M	264	205-	214	111ALVMO		1
013S020E16L01M	364757	1194752	M	19	5060	J	5146	Z	1973	CA111	C M	135	135-		111ALVMO		2
013S020E17A01M	364821	1194822	M	19	5060	J	5146	Z	1971	CA111	C M	72	72-		111ALVMO		1
013S020E17F01M	364802	1194851	M	19	5060	J	5810	Z	1971	CA111	C M	257	205-	210	111ALVMO		1
													252-	257			
013S020E17G01M	364811	1194832	M	19	5060	J	5146	Z	1971	CA111	C M		115-		111ALVMO		2
013S020E17J01M	364759	1194821	M	19	5060	J	5146	Z	1973	CA111	C M	142	142-		111ALVMO		1
013S020E17R01M	364736	1194822	M	19	5060	J	5146	Z	1973	CA111	C M	130	130-		111ALVMO		1
013S020E19C01M	364724	1194947	M	19	5060	J	5810	Z	1971	CA111	C M	312	312-		111ALVMO		1
013S020E20E01M	364710	1194901	M	19	5060	J	5802	Z	1971	CA111	C M	296	140-	180	111ALVMO		1
													250-	283			
013S020E21E01M	364711	1194802	M	19	5060	J	5146	Z	1973	CA111	C M	154	154-		111ALVMO		1
013S020E23B01M	364733	1194521	M	19	5060	J	5810	Z	1971	CA111	C M	268	195-	208	111ALVMO		1
013S020E23J01M	364707	1194502	M	19	5060	J	5810	Z	1971	CA111	C M	280	184-	190	111ALVMO		1
													261-	267			
013S020E23Q01M	364654	1194533	M	19	5060	D	5802	M	1979	CA111	C M	213	208-	213	111AVSN		1
013S020E24J02M	364711	1194409	S	19	1851	B	1851	M	1971	USSEA	Z F	304	148-	304	111AVSN	5	1
013S020E24R01M	364657	1194411	M	19	5060	J	5146	Z	1973	CA111	C M	185	185-		111ALVMO		1
013S020E25E01M	364622	1194447	M	19	5060	J	5146	Z	1973	CA111	C M	296	154-	294	111ALVMO	12	1
013S020E25E02M	364630	1194500	M	19	5060	J	5146	Z	1972	CA111	C M	96	96-		111ALVMO		1
013S020E25M01M	364606	1194455	M	19	5060	J	5146	Z	1973	CA111	C M	154	154-		111ALVMO		2
013S020E26C01M	364630	1194535	M	19	5060	J	5146	Z	1973	CA111	C M	137	137-		111ALVMO		1
013S020E26D01M	364641	1194602	M	19	5060	J	5810	Z	1971	CA111	C M		243-	249	111ALVMO		2
013S020E26Q01M	364552	1194532	M	19	5060	J	5146	Z	1973	CA111	C M	132	132-		111ALVMO		2
013S020E27J01M	364614	1194606	M	19	5060	J	5802	Z	1971	CA111	C M	168	168-		111ALVMO		1
013S020E28R01M	364558	1194722	M	19	5060	J	5802	Z	1971	CA111	C M	271	238-	244	111ALVMO		1
013S020E32D01M	364542	1194913	M	19	5060	J	5802	Z	1971	CA111	C M		200-	206	111ALVMO		2
013S020E34B01M	364550	1194636	M	19	5060	J	5802	Z	1971	CA111	C M	170	170-		111ALVMO		1
013S020E35H02M	364529	1194510	M	19	5060	J	5802	Z	1971	CA111	C M	334	180-	186	111ALVMO		1
													235-	241			
013S020E36D01M	364551	1194502	M	19	5060	J	5146	Z	1973	CA111	C M	175	175-		111ALVMO		1
014S017E12J01M	364331	1200302	M	19	5060	J	5146	Z	1974	CA111	C M				111ALVMO		4
014S017E12P01M	364318	1200302	M	19	5060	J	5146	Z	1971	CA111	C M				111ALVMO		4
014S018E07N01M	364314	1200258	M	19	5060	J	5146	Z	1971	CA111	C M	216	216-		111ALVMO		2

TABLE 12.--Actual Monitoring-Well Locations and Pertinent Data--Continued

B. Regional Nonpoint Problems--continued

6. Radioactive substances--continued

STATE WELL NO	LAT	LONG	ACCU-RACY	COUNTY	AGENCY DWR NO	ANAL-YSIS TYPE	LABORATOR	FREQ-UENCY	YEAR BEGAN	DATA SOURCE	DATA LOC-ATION	WELL DEPTH	PERF INTERVAL	GEOHYDRO UNIT	WELL SEAL	WELL CLASS
014S018E24A01M	364208	1195708	S	19	5112	B	5200	S	1978	CA160	Z F	172	172-	111ALVMO	2	1
014S018E25A01M	364128	1195708	S	19	5112	B	5200	S	1978	CA160	Z F	120	120-	111ALVMO		1
014S018E26C01M	364128	1195849	S	19	5112	B	5200	S	1978	CA160	Z F	208	208-	111ALVMO		3
014S018E26N01M	364047	1195831	S	19	5112	B	5200	Z	1978	CA160	Z F	116		111ALVMO		1
014S018E35N01M	363945	1200048	S	19	5112	B	5200	S	1978	CA160	Z F			111ALVMO		4
014S018E36G01M	364018	1195734	S	19	5112	B	5200	S	1978	CA160	Z F			111ALVMO		4
014S019E10Q02M	364320	1195318	S	19	5112	B	5200	S	1978	CA160	Z F	200	200-	111ALVMO		2
014S019E15R01M	364235	1195252	S	19	5112	B	5200	S	1978	CA160	Z F	80		111ALVMO		3
014S019E16C01M	364314	1195424	S	19	5112	B	5200	S	1978	CA160	Z F			111ALVMO		4
014S019E18D01M	364405	1195703	S	19	5112	B	5200	S	1978	CA160	Z F	180	180-	111ALVMO		2
014S019E19F01M	364155	1195605	M	19	5112	B	5200	S	1978	CA160	Z F	237	237-	111ALVMO		2
014S019E20A01M	364209	1195512	S	19	5200	B	5200	S	1977	CA161	Z F	210	160- 210	111AVSN	5	1
014S019E20J01M	364144	1195511	S	19	5200	B	5200	S	1977	CA161	Z F	250	200- 250	111AVSN	5	1
014S019E20K03M	364156	1195528	S	19	5200	B		S	1975	CA161	Z F	250	200- 250	111AVSN	5	1
014S019E20R01M	364144	1195458	S	19	5200	B	5200	S	1975	CA161	Z F		170- 220	111AVSN	5	1
014S019E21D01M	364210	1195442	S	19	5200	B	5200	S	1975	CA161	Z F	240	190- 240	111AVSN	5	1
014S019E21F01M	364158	1195425	S	77	5200	B	5200	S	1975	CA161	Z F	250	200- 250	111AVSN	5	1
014S019E21G01M	364158	1195423	S	19	5200	B	5200	S	1975	CA161	Z F	220	170- 220	111AVSN	5	1
014S019E21H01M	364157	1195407	S	19	5200	B	5200	S	1975	CA161	Z F	200	150- 200	111AVSN	5	1
014S019E21J01M	364156	1195357	S	19	5200	B	5200	S	1975	CA161	Z F	250	200- 250	111AVSN	5	1
014S019E21L01M	364156	1195425	S	19	5200	B	5200	S	1975	CA161	Z F	253	203- 253	111AVSN	6	1
014S019E21R01M	364143	1195407	S	19	5200	B	5200	S	1975	CA161	Z F	240	160- 240	111AVSN	5	1
014S019E22C02M	364211	1195334	S	19	5200	B	5200	S	1975	CA161	Z F	210	160- 210	111AVSN	6	1
014S019E22E01M	364157	1195336	S	19	5200	B	5200	S	1975	CA161	Z F	120	70- 120	111AVSN	5	1
014S019E22E02M	364158	1195350	S	77	5200	B	5200	S	1975	CA161	Z F	250	170- 220	111AVSN	5	1
014S019E22F01M	364157	1195320	S	19	5200	B	5200	S	1977	CA161	Z F	220	170- 220	111AVSN	5	1
014S019E22L01M	364144	1195335	S	19	5200	B	5200	S	1975	CA161	Z F	220	170- 220	111AVSN	5	1
014S019E22M01M	364156	1195350	S	19	5200	B	5200	S	1975	CA161	Z F	233	183- 233	111AVSN	5	1
014S019E22R02M	364157	1195250	S	19	5112	B	5200	S	1978	CA160	Z F	160		111ALVMO		3
014S019E25C01M	364118	1195051	M	19	5112	B	5200	S	1978	CA160	Z F	130	130-	111ALVMO		2
014S019E26M01M	364052	1195244	S	19	5112	B	5200	S	1978	CA160	Z F	75		111ALVMO		3
014S019E27L01M	364104	1195321	S	19	5200	B	5200	S	1975	CA161	Z F	250	200- 250	111AVSN	5	1
014S019E27R01M	364046	1195225	S	19	5112	B	5200	S	1978	CA160	Z F	96		111ALVMO		3
014S019E28A02M	364129	1195353	S	19	5200	B	5200	S	1975	CA161	Z F	220	170- 220	111AVSN	6	1
014S019E28J01M	364104	1195353	S	19	5200	B	5200	S	1975	CA161	Z F	210		111AVSN	6	1
014S019E28P01M	364132	1195303	M	19	5112	B	5200	S	1978	CA160	Z F	270	270-	111ALVMO		2
014S019E29B01M	364127	1195527	S	19	5200	B	5200	S	1977	CA161	Z F	250	200- 250	111AVSN	6	1
014S019E29H01M	364044	1195436	M	19	5112	B	5200	S	1978	CA160	Z F	120		111ALVMO		3
014S019E30A01M	364120	1195546	M	19	5112	B	5200	S	1978	CA160	Z F	106	106-	111ALVMO		2
014S019E31A01M	364036	1195538	M	19	5112	B	5200	S	1978	CA160	Z F					4
014S019E32B01M	364036	1195451	M	19	5112	B	5200	S	1978	CA160	Z F	200		111ALVMO		3
014S019E33C01M	364035	1195411	M	19	5112	B	5200	S	1978	CA160	Z F	180		111ALVMO		3
014S019E34F01M	364020	1195301	M	19	5112	B	5200	S	1978	CA160	Z F					4
014S019E36C01M	364037	1195110	S	19	5112	B	5200	S	1978	CA160	Z F	58	58-	111ALVMO		1

TABLE 12.--Actual Monitoring-Well Locations and Pertinent Data--Continued

B. Regional Nonpoint Problems--continued

6. Radioactive substances--continued

STATE WELL NO	LAT	LONG	ACCU-RACY	COUNTY	AGENCY DWR NO	ANAL-YSIS TYPE	LABORATORY	FREQ-UENCY	YEAR BEGAN	DATA SOURCE	DATA LOC-ATION	WELL DEPTH	PERF INTERVAL		GEOHYDRO UNIT	WELL SEAL	WELL CLASS
014S020E01J01M	364424	1194408	M	19	5060	J	5810	Z	1971	CA111	C M	350	240-	248	111ALVMO		1
													335-	343			
014S020E03C02M	364458	1194650	M	19	5060	J	5802	Z	1971	CA111	C M	233	202-	211	111ALVMO		1
014S020E03M01M	364423	1194702	M	19	5060	J	5810	Z	1971	CA111	C M	420	138-	145	111ALVMO		1
													214-	220			
													284-	290			
014S020E11F01M	364344	1194540	M	19	5060	J	5802	Z	1971	CA111	C M	250	196-	203	111ALVMO		1
014S020E13K01M	363738	1194431	S	19	5060	D	5146	M	1979	CA111	C M	120	120-		111AVSN		2
014S020E13R01M	363715	1194412	S	19	5060	D	5146	B	1980	CA111	C M	402	172-		111AVSN	5	2
014S020E14Q01M	364236	1194522	M	19	5060	J	5146	Z	1978	CA111	C M	167	167-		111ALVMO		2
014S020E16A01M	364314	1194727	M	19	5060	J	5802	Z	1971	CA111	C M	262	226-	231	111ALVMO		1
014S020E19H01M	364209	1194939	S	19	5200	B	5200	M	1975	CA161	Z F						4
014S020E19H02M	364158	1194936	S	19	5200	B	5200	M	1975	CA161	Z M						4
014S020E19J01M	364156	1194947	S	19	5200	B	5200	M	1975	CA161	Z F						4
014S020E19J02M	364149	1194936	S	19	5200	B	5200	M	1975	CA161							4
014S020E24K01M	364152	1194427	M	19	5060	J	5146	Z	1973	CA111	C M	168	168-		111ALVMO		1
014S020E36A01M	364040	1194418	M	19	5060	J	5060	Z	1971	CA111	C M	348	152-	348	111ALVMO	6	1
015S018E02F02M	363922	1195845	S	19	5112	B	5200	S	1978	CA160	Z F	315	315-		111ALVMO	2	1
015S018E10J01M	363826	1195918	S	19	5112	B	5200	S	1978	CA160	Z F	454	250-	448	111ALVMO		2
015S018E11J02M	363826	1195812	S	19	5112	B	5200	S	1978	CA160	Z F	324	114-	140	111ALVMO		2
													220-	306			
015S018E12B01M	363852	1195707	M	19	5112	B	5200	S	1978	CA160	Z F	125			111ALVMO		3
015S018E13A03M	363759	1195709	S	19	5112	B	5200	S	1978	CA160	Z F	214	214-		111ALVMO		2
015S018E14A01M	363758	1195812	S	19	5112	B	5200	S	1978	CA160	Z F	324	198-	315	111ALVMO		2
015S018E14M01M	363733	1195901	S	19	5112	B	5200	S	1978	CA160	Z F				111ALVMO		4
015S019E03J01M	363921	1195227	M	19	5112	B	5200	S	1978	CA160	Z F	248	248-		111ALVMO		2
015S019E04L01M	363911	1195401	M	19	5112	B	5200	S	1978	CA160	Z F	175			111ALVMO		3
015S019E05L01M	363919	1195506	M	19	5112	B	5200	S	1978	CA160	Z F						4
015S019E06L01M	363920	1195608	M	19	5112	B	5200	S	1978	CA160	Z F	200			111ALVMO		3
015S019E07Q01M	363802	1195600	M	19	5112	B	5200	S	1978	CA160	Z F	112	112-		111ALVMO		2
015S019E08A01M	363853	1195457	S	19	5112	B	5200	S	1978	CA160	Z F	175			111ALVMO		3
015S019E10P03M	363814	1195320	S	19	5112	B	5200	S	1978	CA160	Z F	192	174-	192	111ALVMO	2	1
015S019E11F02M	363837	1195217	S	19	5112	B	5200	S	1978	CA160	Z F	132	132-		111ALVMO	4	1
015S019E15C01M	363800	1195218	S	19	5112	B	5200	S	1978	CA160	Z F	187	187-		111ALVMO	2	1
016S020E18G01M	363224	1194948	M	19	5060	J	5806	Z	1974	CA111	C M	420	420-		111ALVMO		2
017S020E36R02M	362409	1194432	S	31	5050	B	5050	Z	1978	CA001	C M						3
019S019E10E02M	361733	1195413	S	31	5050	B	5050	Z	1978	CA001	C M	582	315-	582	112ALARE		2
019S019E25H02M	**361459**	**1195056**	**S**	**31**								20					
019S020E33A01M	361424	1194753	S	31	5050	B	5050	Z	1978	CA001	C M	525	485-	525	112ALAEC	36	1

TABLE 12.--Actual Monitoring-Well Locations and Pertinent Data--Continued

B. Regional Nonpoint Problems--continued

7. Native Substances

a. Nitrates

STATE WELL NO	LAT	LONG	ACCU-RACY	COUNTY	AGENCY DWR NO	ANAL-YSIS TYPE	LABORATORY	FREQ-UENCY	YEAR BEGAN	DATA SOURCE	DATA LOC-ATION	WELL DEPTH	PERF INTERVAL		GEOHYDRO UNIT	WELL SEAL	WELL CLASS
010S011E21J01M	370257	1204549	S	47								65					
010S012E09P01M	370413	1203945	S	47	5050	B	5000	Z	1980	USGS	R M	180	7-	150	112ALAEC		2
010S012E21B01M	370310	1203944	S	47								116	80-				
010S013E22A01M	370304	1203140	S	39								200	75-				
011S012E22R01M	365712	1203807	S	19								20					
011S013E22C01M	365754	1203217	S	19								139					
012S012E14N02M	365250	1203804	S	19								20					
012S013E21E01M	365204	1203335	S	19								15					
012S014E21M01M	365222	1202703		39								188	66-				
012S014E28L04M	365124	1202649	S	19	5060	J	5802	Z	1977	CA111	C M		115-		112ALAEC		2
013S013E15A01M	364825	1203146	S	19								21					
013S013E15M02M	364800	1203250	S	19								111					
013S014E21N05M	364642	1202728	S	19								30					
014S014E22N03M	364129	1202626	S	19								20	5-				
019S026E15B01M	361558	1190826	S	107								145					
021S027E21R01M	360452	1190310	S	107								132					
021S027E35F01M	360344	1190138	S	107	5060	J	5802	Z	1974	CA111	C M	587	160-	195	111AVSN		1
													200-	250	112CNTL		
													265-	300			
													385-	587			

b. Arsenic

STATE WELL NO	LAT	LONG	ACCU-RACY	COUNTY	AGENCY DWR NO	ANAL-YSIS TYPE	LABORATORY	FREQ-UENCY	YEAR BEGAN	DATA SOURCE	DATA LOC-ATION	WELL DEPTH	PERF INTERVAL		GEOHYDRO UNIT	WELL SEAL	WELL CLASS
018S021E25A01M	362023	1193807	S	31								510					
018S021E32J01M	361906	1194223	S	31	5060	J	5803	Z	1955	CA111	C M	332	162-	186	112ALAEC	5	1
													210-	258			
													282-	330			
018S021E32R01M	361853	1194223	S	31	5060	J	5803	Z	1961	CA111	C M	203	123-	203	112ALAEC		2
018S021E36D01M	361933	1193907	S	31								465					
018S022E21C01M	362128	1193531	S	31								173					
018S022E30E01M	362018	1193759	S	31								504					
019S021E12B02M	361756	1193829	S	31								391					
019S021E21B01M	361601	1194135	S	31								404					
019S022E21C01M	361600	1193526	S	31								436					
020S021E03A01M	361328	1194027	S	31	5050	B	5050	Z	1978	CA001	C M	52			112ALAEC		3
020S021E16L01M	361125	1194153	S	31								1208					
020S021E21F01M	361035	1194153	S	31								1208					
020S022E15C01M	361152	1180553	S	31								1198					
021S022E22M01M	360505	1193511	S	31	5050	B	5050	Z	1978	CA001	C M	180	120-	180	112ALAEC		2
021S022E22R02M	360502	1193413	S	31								1500					
021S022E34A01M	360355	1193413	S	31	5050	B	5050	Z	1980	CA001	C M	1870	820-	1870	112ALBEC		2
021S023E05E01M	360805	1193053	S	107	5050	B	5050	Z	1978	CA001	C M	228	228-		112ALAEC		1
021S023E22J02M	360508	1192748	S	107								435					
021S024E26C01M	360449	1192043	S	107	5050	B	5050	Z	1978	CA001	C M				112ALAEC		3
027S022E09D01M	353620	1193604	S	29	5640	B	5806	A	1950	CA036	Z F	400	100-	400	112ALAEC		2
028S022E10R01M	353001	1193455	S	29	5640	B	5806	A	1950	CA036	Z F	260			112ALAEC		3

TABLE 12.--Actual Monitoring-Well Locations and Pertinent Data--Continued

B. Regional Nonpoint Problems--continued

7. Native substances--continued

c. Boron

STATE WELL NO	LAT	LONG	ACCU-RACY	COUNTY	AGENCY DWR NO	ANAL-YSIS TYPE	LABORATORY	FREQ-UENCY	YEAR BEGAN	DATA SOURCE	DATA LOC-ATION	WELL DEPTH	PERF INTERVAL		GEOHYDRO UNIT	WELL SEAL	WELL CLASS
022S023E15F02M	360053	1192820	S	107								480					
022S024E22A01M	360021	1192118	S	107								256					
024S023E22K01M	354915	1192747	S	107								723					
024S024E16B01M	355056	1192258	S	107								600					
025S022E11G01M	354610	1193406	S	29								600					
026S022E35E01M	353728	1193444	S	29								396					
029S029E31H01M	352144	1185345	S	29	5644	B	5806	A	1966	CA179	Z F	798			112ALVFO		3
030S026E22P01M	351747	1191020	S	29								400	275-				
030S026E31P01M	351603	1191335	S	29													
030S029E15K01M	351857	1185104	S	29	5644	B	5806	Z	1966	CA179	Z F	600	336-	600	112ALVFO		1
030S029E15L02M	351857	1185114	S	29	5644	B	5806	Z	1966	CA179	Z F	599	192-	599	112ALVFO		1
031S026E32C01M	351149	1191236	S	29								410					

TABLE 12.--Actual Monitoring-Well Locations and Pertinent Data--Continued

C. Line Sources

1. Natural streams

a. San Joaquin River

STATE WELL NO	LAT	LONG	ACCU-RACY	COUNTY	AGENCY DWR NO	ANAL-YSIS TYPE	LABORATORY	FREQ-UENCY	YEAR BEGAN	DATA SOURCE	DATA LOC-ATION	WELL DEPTH	PERF INTERVAL	GEOHYDRO UNIT	WELL SEAL	WELL CLASS
001N005E02F01M	375750	1212341	S	77	5050	B	5050	S	1975	CA001	C F	50		111FLDB		2
001N006E06K01M	375742	1212125	F	77	5110	B	9597	S	1971	CA163	Z P			111FLDB		3
001N006E22J01M	375507	1211735	S	77	5110	B	4203	S	1971	CA163	Z P	259	120- 124	111FLDB		2
001N006E31L01M	375322	1212132	S	77	5050	B	5050	S	1976	CA001	C F	12	10- 12	111FLDB		2
001N006E35P02M	375307	1211704	S	77	5110	B	9597	S	1971	CA163	Z P	260		111AVSN		3
001S006E05B01M	375253	1211958	S	77	5050	B	5050	S	1976	CA001	C F	12	10- 11	111FLDB		2
001S006E25M02M	374909	1211559	S	77	5110	B	9597	S	1971	CA163	Z P	250	142- 166 238- 250	111ALVF	8	1
001S006E26H01M	374909	1211630	S	77	5110	B	9597	S	1971	CA163	Z P	228	208- 222	111ALVF	3	1
001S006E26L01M	374903	1211701	S	77	5060	D	9597	B	1979	CA111	C M	233	160- 185 216- 231	111ALVF	5	1
001S006E35D01M	374830	1211711	S	77	5110	B	9597	S	1971	CA163	Z P	170	150- 166	111ALVF	3	1
001S006E35E04M	374824	1211710	S	77	5110	B	9597	S	1971	CA163	Z P	194	130- 137 140- 147 159- 167 170- 183	111ALVF		1
002N005E23R01M	375955	1212331	S	77	5050	B	5050	S	1976	CA001	C F	12	10- 12	111FLDB		2
002N005E26H01M	375943	1212307	S	77	5050	B	5050	S	1978	CA001	C F	13	11- 13	111FLDB		2
002N005E26H02M	375937	1212324	S	77	5050	B	5050	S	1975	CA001	C F	30		111FLDB		2
002N005E26Q02M	375917	1212334	S	77	5050	B	5050	S	1977	CA001	C F	11	9-	111FLDB		2
002N005E26Q03M	375909	1212334	S	77	5050	B	5050	S	1975	CA001	C F	47		111FLDB		2
002N005E35B02M	375848	1212333	S	77	5050	B	5050	S	1975	CA001	C F	30		111FLDB		2
002N005E35K01M	375828	1212333	S	77	5050	B	5050	S	1977	CA001	C F	12	10- 12	111FLDB		2
002N005E35P01M	375814	1212349	S	77	5050	B	5050	S	1977	CA001	C F	12	10- 12	111FLDB		2
002N005E35Q02M	375815	1212330	S	77	5050	B	5050	S	1976	CA001	C F	30		111FLDB		2
003S006E14A01M	374048	1211616	S	77	5060	J	9551	Z	1964	CA111	C M	420	96- 186	112ALABE	7	1
003S006E14A02M	374054	1211622	S	77	5060	J	9551	Z	1964	CA111	C M	389	110- 180	112ALABE	7	1
004S007E26D01M	373345	1211032	S	99	5060	J	9484	Z	1967	CA111	C M	168	146- 168	112ALAEC	11	1
007S010E24A01M	371853	1204857	S	47	3858	J	5146	A	1980	CA174	Z F	136	35- 80	112ALAEC		2
007S010E24H02M	371837	1204903	S	47	3858	J	5146	A	1980	CA174	Z F	84	55- 80	112ALAEC		2
012S014E28L04M	365124	1202649	S	19	5060	J	5802	Z	1977	CA111	C M		115-	112ALAEC		2
013S015E19Q01M	364647	1202219	S	19	5112	B	5112	S	1978	CA160	C F	213	96- 115 135- 159 169- 213	112ALAEC	5	1
013S015E29C01M	364634	1202140	S	19	5122	B	5112	S	1974	CA160	C F	50	10- 50	112ALAEC		2
013S017E22B01M	364734	1200601	S	19	5050	B	5000	4	1980	USGS	R M	90		111ALVMO		3
013S020E03C01M	365008	1194650	M	19	5060	J	5802	Z	1974	CA111	C M	168		111ALVMO		3

TABLE 12.--Actual Monitoring-Well Locations and Pertinent Data--Continued

C. Line Sources--continued

1. Natural Streams--continued

b. South Fork Kings River

STATE WELL NO	LAT	LONG	ACCU-RACY	COUNTY	AGENCY DWR NO	ANAL-YSIS TYPE	LABORATORY	FREQ-UENCY	YEAR BEGAN	DATA SOURCE	DATA LOC-ATION	WELL DEPTH	PERF INTERVAL	GEOHYDRO UNIT	WELL SEAL	WELL CLASS
017S020E36R02M	362409	1194432	S	31	5050	B	5050	Z	1978	CA001	C M					3
017S021E36B01M	362457	1193834	S	31	5050	B	5050	Z	1978	CA001	C M					4
019S019E10E02M	361733	1195413	S	31	5050	B	5050	Z	1978	CA001	C M	582	315- 582	112ALABE		2
019S019E25H02M	361459	1195056	S	31								20				
019S020E33A01M	361424	1194753	S	31	5050	B	5050	Z	1978	CA001	C M	525	485- 525	112ALAEC	36	1
020S020E19D01M	361049	1195101	S	31	5050	B	5050	Z	1978	CA001	C M	486		112ALAEC		3
020S020E28E02M	360937	1194851	S	31	5050	B	5050	Z	1978	CA001	C M	1320	1130- 1320	112ALBEC		2

c. Kern River

STATE WELL NO	LAT	LONG	ACCU-RACY	COUNTY	AGENCY DWR NO	ANAL-YSIS TYPE	LABORATORY	FREQ-UENCY	YEAR BEGAN	DATA SOURCE	DATA LOC-ATION	WELL DEPTH	PERF INTERVAL	GEOHYDRO UNIT	WELL SEAL	WELL CLASS
029S027E12E01M	352524	1190208	S	29	5060	J	5803	Z	1973	CA111	C M	722	290- 697	111ALVMO		2
029S027E12Q01M	352447	1190145	S	29	5060	J	5803	Z	1973	CA111	C M	620	192- 620	111ALVMO		2
029S027E24D02M	352257	1190206	S	29	5701	B	5701	Z	1962	CA241	Z F	660	265- 640	112CNTL	7	1
029S027E24L01M	352316	1190158	S	29	5701	B	5701	Z	1949	CA241	Z F	300	77- 285	111AVSN		2
														112CNTL		
029S027E24N01M	352310	1190158	S	29	5701	B	5701	Z	1964	CA241	Z F	768	250- 748	112CNTL	7	1
029S028E19J02M	352321	1190022	S	29	5701	B	5701	Z	1950	CA241	Z F	600	200- 600	112CNTL	10	2
029S028E19L01M	352318	1190047	S	29	5701	J	5701	3	1957	CA241	Z F	616	256- 592	111AVSNY		2
														112CNTL		

2. Artificial channels

a. California Aqueduct

STATE WELL NO	LAT	LONG	ACCU-RACY	COUNTY	AGENCY DWR NO	ANAL-YSIS TYPE	LABORATORY	FREQ-UENCY	YEAR BEGAN	DATA SOURCE	DATA LOC-ATION	WELL DEPTH	PERF INTERVAL	GEOHYDRO UNIT	WELL SEAL	WELL CLASS
021S018E34Q01M	360305	1200041	S	31	5050	B	5050	Z	1978	CA001	C M	350	350- 660	112ALAEC		2
022S019E18P02M	360027	1195742	S	31	5050	B	5050	4	1980	USGS	C M	410	309- 329	112ALAEC		1
											R M		356- 377			

TABLE 12.--Actual Monitoring-Well Locations and Pertinent Data--Continued

C. Line Sources--continued

2. Artificial channels--continued

b. San Luis Drain

STATE WELL NO	LAT	LONG	ACCU-RACY	COUNTY	AGENCY DWR NO	ANAL-YSIS TYPE	LABORATORY	FREQ-UENCY	YEAR BEGAN	DATA SOURCE	DATA LOC-ATION	WELL DEPTH	PERF INTERVAL	GEOHYDRO UNIT	WELL SEAL	WELL CLASS
008S010E21L04M	371314	1205232	S	47		B			1952			260				
008S010E22R01M	371300	1205106	S	47								12				
008S010E27A01M	371258	1205108	S	47								50				
008S010E35C01M	371154	1205032	S	47								54	51-			
009S010E02R01M	371027	1204956	S	47								12				
009S011E20A01M	370833	1204643	S	47								17				
009S011E32J01M	370622	1204645	S	47								12				
010S011E21J01M	370257	1204549	S	47								65				
011S011E12D01M	365948	1204332	S	47								75				
011S012E22R01M	365712	1203807	S	19								20				
012S013E09B01M	365437	1203302	S	19								151				
012S013E11R01M	365424	1203047	S	19								50				
012S014E28J02M	365129	1202607		39								144	104-			
012S014E29H01M	365135	1202714	S	19								192				
013S014E02M01M	364939	1202510	S	19								208	75-			
013S014E03M01M	364938	1202605	S	19								20				
013S015E29C01M	364634	1202140	S	19	5122	B	5112	S	1974	CA160	C F	50	10- 50	112ALAEC		2

TABLE 12.--Actual Monitoring-Well Locations and Pertinent Data--Continued

TABLE 12.--Actual Monitoring-Well Locations and Pertinent Data--Continued

C. Line Sources--continued

2. Artificial channels--continued

c. Peripheral Canal

STATE WELL NO	LAT	LONG	ACCU-RACY	COUNTY	AGENCY DWR NO	ANAL-YSIS TYPE	LABORATORY	FREQ-UENCY	YEAR BEGAN	DATA SOURCE	DATA LOC-ATION	WELL DEPTH	PERF INTERVAL		GEOHYDRO UNIT	WELL SEAL	WELL CLASS
001N004E34H01M	375323	1213053	S	77	5050	B	5050	S	1977	CA001	C F	14	12-	14	111FLDB		2
001N004E35R01M	375300	1212955	S	77	5050	B	5050	S	1978	CA001	C F	12	10-	12	111FLDB		2
001N004E36K03M	375321	1212904	S	77	5050	B	5050	S	1975	CA001	C F	50			111FLDB		2
001N005E02F01M	375750	1212341	S	77	5050	B	5050	S	1975	CA001	C F	50			111FLDB		2
001N005E03Q01M	375723	1212437	S	77	5050	B	5050	S	1976	CA001	C F	12	10-	12	111FLDB		2
001N005E03R01M	375724	1212417	S	77	5050	B	5050	S	1978	CA001	C F		10-	12	111FLDB		2
001N005E10A01M	385720	1212419	S	77	5050	B	5050	S	1975	CA001	C F	30			111FLDB		2
001N005E10P01M	375641	1212433	S	77	5050	B	5050	S	1975	CA001	C F	30			111FLDB		2
001N005E10Q01M	375639	1212437	S	77	5050	B	5050	S	1977	CA001	C F	13	11-	13	111FLDB		2
001N005E15F01M	375612	1212448	S	77	5050	B	5050	S	1978	CA001	C F	12	10-	12	111FLDB		2
001N005E15L02M	375604	1212450	S	77	5050	B	5050	S	1975	CA001	C F	50			111FLDB		2
001N005E21E03M	375514	1212612	S	77	5050	B	5050	S	1978	CA001	C F	13	11-	13	111FLDB		2
001N005E21F01M	375519	1212604	S	77	5050	B	5050	S	1975	CA001	C F	30			111FLDB		2
001N005E21M02M	375505	1212606	S	77	5050	B	5050	S	1978	CA001	C F	13	11-	13	111FLDB		2
001N005E22E01M	375516	1212515	S	77	5050	B	5050	S	1978	CA001	C F	13	11-	13	111FLDB		2
001N005E29C02M	375436	1212702	S	77	5050	B	5050	S	1977	CA001	C F	10	8-	10	111FLDB		2
001N005E29F01M	375429	1212654	S	77	5050	B	5050	S	1977	CA001	C F	13	11-	13	111FLDB		2
001N005E30Q03M	375400	1212754	S	77	5050	B	5050	S	1975	CA001	C F	50			111FLDB		2
001N005E31D01M	375343	1212833	S	77	5050	B	5050	S	1979	CA001	C F	11	9-	11	111FLDB		2
001N005E31E01M	375337	1212830	S	77	5050	B	5050	S	1978	CA001	C F	11	9-	11	111FLDB		2
001N005E31P01M	375307	1212810	S	77	5050	B	5050	S	1977	CA001	C F	11	9-	11	111FLDB		2
001N005E36M01M	375327	1212301	S	77	5050	B	5050	S	1976	CA001	C F	12	10-	12	111FLDB		2
001N006E31L01M	375322	1212132	S	77	5050	B	5050	S	1976	CA001	C F	12	10-	12	111FLDB		2
001S004E02C01M	375248	1213029	S	77	5050	B	5050	S	1976	CA001	C F	12	10-	12	111FLDB		2
001S004E03K01M	375231	1213103	S	77	5050	B	5050	S	1978	CA001	C F	12	10-	12	111FLDB		2
001S004E03P02M	375216	1213134	S	77	5050	B	5050	S	1975	CA001	C F	30			111FLDB		2
001S004E04R01M	375211	1213148	S	77	5050	B	5050	S	1978	CA001	C F	12	10-	12	111FLDB		2
001S004E09A01M	375155	1213159	S	77	5050	B	5050	S	1976	CA001	C F	12	10-	12	111FLDB		2
001S004E09B01M	375159	1213217	S	77	5050	B	5050	S	1978	CA001	C F		10-	12	111FLDB		2
001S004E09C01M	375152	1213234	S	77	5050	B	5050	S	1975	CA001	C F	30			111FLDB		2
001S004E09N01M	375122	1213247	S	77	5050	B	5050	S	1978	CA001	C F				111FLDB		2
001S004E09N02M	375113	1213250	S	77	5050	B	5050	S	1978	CA001	C F	30			111FLDB		2
001S004E17A02M	375109	1213312	S	77	5050	B	5050	S	1977	CA001	C F	30			111FLDB		2
001S004E20K01M	374943	1213324	S	77	5050	B	5050	S	1977	CA001	C F	16	14-	16	111FLDB		2
001S004E21Q01M	374929	1213211	S	77	5050	B	5050	S	1976	CA001	C F	12	10-	12	111FLDB		2
001S005E06D01M	375253	1212835	S	77	5050	B	5050	S	1976	CA001	C F	11	9-	11	111FLDB		2
001S005E26E01M	374916	1212341	S	77	5050	B	5050	S	1978	CA001	C F	9	7-	9	111FLDB		2
001S006E05B01M	375253	1211958	S	77	5050	B	5050	S	1976	CA001	C F	12	10-	11	111FLDB		2
002N005E01C01M	380317	1212301	S	77	5050	B	5050	S	1976	CA001	C F	8	6-	8	111FLDB		2
002N005E02A01M	380327	1212318	S	77	5050	B	5050	S	1975	CA001	C F	48			111FLDB		2
002N005E02H02M	380311	1212326	S	77	5050	B	5050	S	1975	CA001	C F	48			111FLDB		2
002N005E02R02M	380237	1212315	S	77	5050	B	5050	S	1975	CA001	C F	46			111FLDB		2
002N005E02R03M	380248	1212338	S	77	5050	B	5050	X	1978	CA001	C F		10-	12	111FLDB		2
002N005E12M01M	380207	1212311	S	77	5050	B	5050	S	1976	CA001	C F	47			111FLDB		2
002N005E13D01M	380142	1212314	S	77	5050	B	5050	S	1975	CA001	C F	30			111FLDB		2
002N005E23R01M	375955	1212331	S	77	5050	B	5050	S	1976	CA001	C F	12	10-	12	111FLDB		2
002N005E24C02M	380043	1212243	S	77	5050	B	5050	S	1975	CA001	C F	50			111FLDB		2
002N005E24C03M	380048	1212248	S	77	5050	B	5050	S	1979	CA001	C F	22			111FLDB		2

TABLE 12.--Actual Monitoring-Well Locations and Pertinent Data--Continued

C. Line Sources--continued

2. Artificial channels--continued

c. Peripheral Canal--continued

STATE WELL NO	LAT	LONG	ACCU-RACY	COUNTY	AGENCY DWR NO	ANAL-YSIS TYPE	LABORATORY	FREQ-UENCY	YEAR BEGAN	DATA SOURCE	DATA LOC-ATION	WELL DEPTH	PERF INTERVAL	GEOHYDRO UNIT	WELL SEAL	WELL CLASS
002N005E24L01M	380018	1212247	S	77	5050	B	5050	S	1975	CA001	C F	9	7- 9	111FLDB		2
002N005E24N02M	380011	1212258	S	77	5050	B	5050	S	1975	CA001	C F	30		111FLDB		2
002N005E26H01M	375943	1212307	S	77	5050	B	5050	S	1978	CA001	C F	13	11- 13	111FLDB		2
002N005E26H02M	375937	1212324	S	77	5050	B	5050	S	1975	CA001	C F	30		111FLDB		2
002N005E26Q02M	375917	1212334	S	77	5050	B	5050	S	1977	CA001	C F	11	9-	111FLDB		2
002N005E26Q03M	375909	1212334	S	77	5050	B	5050	S	1975	CA001	C F	47		111FLDB		2
002N005E35H02M	375848	1212333	S	77	5050	B	5050	S	1975	CA001	C F	30		111FLDB		2
002N005E35K01M	375828	1212333	S	77	5050	B	5050	S	1977	CA001	C F	12	10- 12	111FLDB		2
002N005E35P01M	375814	1212349	S	77	5050	B	5050	S	1977	CA001	C F	12	10- 12	111FLDB		2
002N005E35Q02M	375815	1212330	S	77	5050	B	5050	S	1976	CA001	C F	30		111FLDB		2
003N005E03F02M	380819	1212454	S	77	5050	B	5050	S	1975	CA001	C F	30		111FLDB		2
003N005E10H02M	380743	1212438	S	77	5050	B	5050	S	1975	CA001	C F	30		111FLDB		2
003N005E14L01M	380626	1212410	S	77	5050	B	5050	S	1976	CA001	C F	12	10- 12	111FLDB		2
003N005E15C01M	380652	1212459	S	77	5050	B	5050	S	1977	CA001	C F	11	9- 11	111FLDB		2
003N005E15J01M	380628	1212426	S	77	5050	B	5050	S	1975	CA001	C F	30		111FLDB		2
003N005E23D01M	380553	1212405	S	77	5050	B	5050	S	1975	CA001	C F	30		111FLDB		2
003N005E23L01M	380531	1212354	S	77	5050	B	5050	S	1977	CA001	C F	30		111FLDB		2
003N005E26A01M	380510	1212322	S	77	5050	B	5050	S	1978	CA001	C F	27		111FLDB		2
003N005E26H01M	380449	1212324	S	77	5050	B	5050	S	1976	CA001	C F	30		111FLDB		2
003N005E26K01M	380448	1212343	S	77	5050	B	5050	S	1976	CA001	C F	21		111FLDB		2
003N005E26Q01M	380424	1212333	S	77	5050	B	5050	S	1978	CA001	C F	13	11- 13	111FLDB		2
003N005E36D01M	380415	1212320	S	77	5050	B	5050	S	1978	CA001	C F	9	7- 9	111FLDB		2
003N005E36E01M	380405	1212310	S	77	5050	B	5050	S	1978	CA001	C F	10	8- 10	111FLDB		2
003N005E36L01M	380355	1212257	S	77	5050	B	5050	S	1976	CA001	C F	10	8- 10	111FLDB		2
004N005E05C03M	381350	1212718	S	77	5050	B	5050	S	1978	CA001	C F	15	13- 14	111FLDB		2
004N005E05K02M	381333	1212714	S	77	5050	B	5050	S	1975	CA001	C F	30		111FLDB		2
004N005E08G01M	381254	1212712	S	77	5050	B	5050	S	1979	CA001	C F	14	13- 14	111FLDB		2
004N005E08P01M	381224	1212713	S	77	5050	B	5050	S	1979	CA001	C F	15	13- 15	111FLDB		2
004N005E17B02M	381212	1212700	S	77	5050	B	5060	S	1975	CA001	C F	30		111FLDB		2
004N005E17G01M	381200	1212659	S	77	5050	B	5050	S	1979	CA001	C F	11	9- 11	111FLDB		2
004N005E17L01M	381144	1212713	S	77	5050	B	5050	S	1977	CA001	C F	11	9- 10	111FLDB		2
004N005E20A01M	381115	1212648	S	77	5050	B	5050	S	1975	CA001	C F	30		111FLDB		2
004N005E20B01M	381126	1212715	S	77	5050	B	5050	S	1978	CA001	C F	12	10- 11	111FLDB		2
004N005E21L03M	381047	1212622	S	77	5050	B	5050	S	1975	CA001	C F	45		111FLDB		2
004N005E28C01M	381028	1212621	S	77	5050	B	5050	S	1975	CA001	C F	11	9- 11	111FLDB		2
004N005E28C02M	381022	1212620	S	77	5050	B	5050		1977	CA001	C F	11	9- 11	111FLDB		2
004N005E28F01M	381013	1212616	S	77	5050	B	5050	X	1978	CA001	C F	11	9- 11	111FLDB		2
004N005E28P01M	380954	1212609	S	77	5050	B	5050	S	1978	CA001	C F	12	10- 12	111FLDB		2
004N005E33A03M	380931	1212539	S	77	5050	B	5050	S	1979	CA001	C F	10	8- 10	111FLDB		2
004N005E33B02M	380930	1212600	S	77	5050	B	5050	S	1978	CA001	C F	11	9- 11	111FLDB		2
004N005E33B03M	380934	1212555	S	77	5050	B	5050	S	1975	CA001	C F	30		111FLDB		2
004N005E33H01M	380915	1212537	S	77	5050	B	5050	S	1976	CA001	C F	11	9- 11	111FLDB		2
004N005E33R02M	380847	1212538	S	77	5050	B	5050	S	1976	CA001	C F	12	10- 12	111FLDB		2
004N005E33R03M	380857	1212536	S	77	5050	B	5050	S	1975	CA001	C F	47		111FLDB		2
004N005E34M01M	380859	1212531	S	77	5050	B	5050	S	1978	CA001	C F	9	7- 9	111FLDB		2
004N005E34N02M	380847	1212517	S	77	5050	B	5050	S	1977	CA001	C F	12	10- 12	111FLDB		2
005N005E29F01M	381528	1212722	S	77	5050	B	5050	S	1978	CA001	C F			111FLDB		2
005N005E32C02M	381447	1212720	S	77	5050	B	5050	S	1975	CA001	C F	45		111FLDB		2
005N005E32Q02M	381406	1212712	S	77	5050	B	5050	S	1975	CA001	C F	30		111FLDB		2

TABLE 12.--Actual Monitoring-Well Locations and Pertinent Data--Continued

D. Cumulative Effects of Point Sources

1. Industrial and residential centers

STATE WELL NO	LAT	LONG	ACCU-RACY	COUNTY	AGENCY DWR NO	ANAL-YSIS TYPE	LABORATORY	FREQ-UENCY	YEAR BEGAN	DATA SOURCE	DATA LOC-ATION	WELL DEPTH	PERF INTERVAL		GEOHYDRO UNIT	WELL SEAL	WELL CLASS
001N006E02Q01M	375733	1211647	S	77	5701	B	5701	Z	1960	CA241	Z F		252-	530	111FLDB	24	1
001N006E11K01M	375647	1211650	S	77	5701	B	5701	Z	1952	CA241	Z F	516	288-	516	111FLDB	28	1
001N006E12G10M	375719	1211556	S	77	5701	B	5701	Z	1955	CA241	Z F	500	195-	230	111FLDB	5	1
													325-	330			
													355-	365			
													406-	410			
													420-	435			
001N006E13G02M	375607	1211547	S	77	5701	J	5701	Z	1953	CA241	Z F	504	216-	480	111FLDB		2
001N006E22J01M	375507	1211735	S	77	5110	B	4203	S	1971	CA163	Z P	259	120-	124	111FLDB		2
													132-	134			
													202-	203			
													213-	215			
													217-	220			
001N007E04F01M	375751	1211233	S	77	5060	J	5701	Z	1969	CA241	C M	535	210-	515	111FLDB	5	1
001N007E08H02M	375701	1211321	S	77	5701	B	5701	Z	1962	CA241	Z F	527	275-	507	111FLDB	10	1
001N007E16M01M	375555	1211254	S	77	5701	J	5701	Z	1968	CA241	Z F	560	208-	540	111FLDB		2
001N007E26H03M	375422	1210953	S	77	5050	B	5050	2	1970	CA001	C M	160	160-		112VCTR		1
															121LGUN		
															112ARSC		
002N001E07R02M	380140	1215355	S	13	5000	Z	5000	S	1972	USGS	R M	134			110ALVM		3
002N001E07R03M	380141	1215406	S	13	5000	Z	5000	S	1974	USGS	R M	132			110ALVM		3
002N001E07R04M	380141	1215400	S	13	5000	Z	5000	S	1974	USGS	R M	156					3
002N001E17K01M	380107	1215302	S	13	5000	Z	5000	S	1974	USGS	R M	190			110ALVM		3
002N001E18D01M	380129	1215439	S	13	5000	Z	5000	S	1974	USGS	R F	125			110ALVM		3
											R M						
002N001E22C01M	380044	1215103	S	13	5000	Z	5000	S	1974	USGS	R M	160	118-	158	110ALVM		2
													140-	155			
002N001E24E03M	380024	1214908	S	13	5000	Z	5000	S	1977	USGS	R M	130			110ALVM		3
002N002E17R03M	380048	1214609	S	13	5000	Z	5000	S	1976	USGS	R M	102	62-	92	110ALVM	2	1
													92-	102			
002N002E19F01M	380019	1214734	S	13	5000	Z	5000	S	1976	USGS	R M	190	49-	87	110ALVM		1
													113-	150			
													168-	178			
002N002E20A01M	380043	1214612	S	13	5000	B	5000	Z	1957	CA001	R M	78	42-	75	110ALVM		1
002N002E21K01M	380017	1214559	S	13	5000	Z	5000	S	1975	USGS	R M	120	104-		110ALVM		1
002N002E22F01M	380020	1214439	S	13	5000	Z	5000	S	1973	USGS	R M	66			110ALVM		3
002N006E07P01M	380153	1212128	S	77	5050	B	5050	2	1970	CA001	C M	236			112VCTR		1
															121LGUN		
															112ARSC		
002N006E09F01M	380211	1211919	S	77	5060	J	9597	Z	1978	CA111	C M	570	297-	337	112VCTR	6	1
													337-	455	112ARSC		
													455-	495	121LGUN		
													495-	530			
													530-	540			
002N006E15F01M	380118	1211814	S	77	5060	J	4203	Z	1972	CA111	C M	435	190-	230	112VCTR	10	1
													230-	275	112ARSC		
													275-	285	121LGUN		
													285-	382			
													382-	422			

TABLE 12.--Actual Monitoring-Well Locations and Pertinent Data--Continued

D. Cumulative Effects of Point Sources--continued

1. Industrial and residential centers--continued

STATE WELL NO	LAT	LONG	ACCU-RACY	COUNTY	AGENCY DWR NO	ANAL-YSIS TYPE	LABORATORY	FREQ-UENCY	YEAR BEGAN	DATA SOURCE	DATA LOC-ATION	WELL DEPTH	PERF INTERVAL	GEOHYDRO UNIT	WELL SEAL	WELL CLASS
002N006E16C02M	380130	1211931	S	77	5050	B	5050	2	1969	CA001	C M	104	104-	112VCTR 112ARSC		1
002N006E16H01M	380123	1211900	F	77	5060	J	4203	Z	1966	CA111	C M	250	175- 200 226- 230 232- 235 242- 248	112VCTR 121LGUN	5	1
002N006E16R02M	380101	1211849	S	77	5060	J	4203	A	1966	CA111	C M	304	237- 304	111FLDB	3	1
002N006E21F01M	380026	1211914	S	77	5060	J	9597	Z	1971	CA111	C M	224	180-	112VCTR 121LGUN	2	1
002N006E36F01M	375847	1211606	S	77	5701	B	5701	Z	1974	CA241	Z F	518	242- 498	111FLDB	5	1
002N006E36G01M	375849	1211543	S	77	5701	J	5701	Z	1973	CA241	Z F	580	200- 560		6	1
002N006E36N03M	375828	1211615	S	77	5701	J	5701	Z	1957	CA241	Z F	514	202- 490	111FLDB	9	1
002N006E36R03M	375821	1211532	S	77	5701	J	5701	Z	1946	CA241	Z F	264	144- 264	111FLDB	9	1
002S005E20R01M	374425	1212615	S	77	5060	J	9597	Z	1974	CA111	C M	1200	366-	112ALBEC	19	1
002S005E21D01M	374509	1212600	S	77	5060	J	9597	Z	1964	CA111	C M	1148	337-	112ALBEC		1
002S005E21J01M	374436	1212458	S	77	5060	J	9597	Z	1953	CA111	C M	850	85- 90 150- 250 330- 420 465- 835	112ALABE	14	1
002S005E25D02M	374421	1212243	S	77	5050	B	5050	2	1969	CA001	C M	103	91- 103	112ALAEC		1
002S005E28L01M	374349	1212530	S	77	9597	J	9597	Z	1958	CA111	C M	930	132- 918	112ALABE	2	1
002S007E04F01M	374737	1211221	S	77	5060	J	5146	Z	1965	CA111	C M	120	120-	111ALVM	3	1
002S007E07Q01M	374611	1211414	S	77	5050	B	5050	2	1965	CA001	C M	127	54- 122	112ALAEC		2
002S007E24R02M	374424	1210833	S	77	5050	B	5050	2	1970	CA001	C M	98	98-	111AVSN		2
003N006E15Q05M	380605	1211817	S	77	5110	B	9597	S	1971	CA163	Z P	140	140-	112VCTR 121LGUN 112ARSC		2
003S009E02P01M	374159	1205654	S	99	5521	B	5146	5	1947	CA026	C F	141		111AVSN		1
003S009E16K01M	374027	1205901	S	99	5060	J	9484	Z	1963	CA111	C M	305	92- 305	111AVSN		1
003S009E21H01M	373948	1205837	S	99	5060	J	5146	Z	1971	CA111	C M	242	104- 194	111AVSN		1
003S009E22F01M	373938	1205757	S	99	5060	J	5819	Z	1963	CA111	C M	212	212-	111AVSN		1
003S009E24F01M	373938	1205548	S	99	5060	J	9597	Z	1975	CA111	C M	220	124- 216	111AVSN	5	1
003S009E26N01M	373822	1205715	S	99	5060	D	5146	B	1979	CA111	C M	235	102- 235	112ALABE	10	1
003S009E30Q01M	373827	1210106	S	99	5060	J	5146	Z	1963	CA111	C M	206	97- 206	111AVSN		1
003S009E36D01M	373804	1205545	S	99	5060	J	5146	Z	1971	CA111	C M	176	156- 172	111AVSN	3	1
004N006E12C06M	381254	1211620	S	77	5050	B	5050	2	1970	CA001	C M	138	138-	112VCTR 112ARSC 121LGUN		1
004N006E16R07M	381127	1211913	S	77	5050	B	5050	2	1969	CA001	C M	117	117-	112VCTR 121LGUN 112ARSC		1
004N006E34E05M	380920	1211840	S	77	5110	B	9597	S	1971	CA163	Z P	224	84- 85 133- 134 164- 165 193- 200 215- 219	111ALVF	5	1

TABLE 12.--Actual Monitoring-Well Locations and Pertinent Data--Continued

D. Cumulative Effects of Point Sources--continued

1. Industrial and residential centers--continued

STATE WELL NO	LAT	LONG	ACCU-RACY	COUNTY	AGENCY DWR NO	ANAL-YSIS TYPE	LABORATORY	FREQ-UENCY	YEAR BEGAN	DATA SOURCE	DATA LOC-ATION	WELL DEPTH	PERF INTERVAL	GEOHYDRO UNIT	WELL SEAL	WELL CLASS
004S009E02N01M	373646	1205710	S	99	5060	J	5146	Z	1974	CA111	C M	147	87- 147	112ALAEC		1
004S009E06H01M	373710	1210041	S	99	5060	J	9484	Z	1963	CA111	C M	138		112ALAEC		1
004S009E09B02M	373628	1205853	S	99	5060	J	5146	Z	1953	CA111	C M	94	94-	112ALAEC		1
004S009E09D01M	373628	1205929	S	99	5060	J	5146	Z	1963	CA111	C M	80	80-	111AVSN		1
004S009E16D02M	373540	1205925	S	99	5060	D	5146	B	1979	CA111	C M	221	105-			2
004S009E22C01M	373442	1205757	S	99	5524	B	5146	Z	1965	CA020	C F	150	150-	112ALAEC		1
005S010E14E01M	373000	1205037	S	99	5060	J	9485	Z	1959	CA111	C M	384	203- 384	112ALBEC	8	1
005S010E15N01M	373707	1205157	S	99	5524	B	5146	X	1979	CA020	Z F	102		112ALAEC		1
005S010E22G01M	372921	1205109	S	99	5060	J	9485	Z	1957	CA111	C M	420	286-	112ALBEC		2
007S012E02G01M	372118	1203707	S	47	5060	D	5802	B	1979	CA111	C M	265	98-	111ALVMO		1
007S013E06G01M	372120	1203457	S	47	5006	M	5006	A	1978	CA179	Z F	285	285-	111ALVMO		2
007S013E24M01M	371829	1203008	S	47								294	102- 294	111ALVMO		
007S013E24Q01M	371815	1202929	S	47								148		111ALVMO		
007S014E16P02M	371914	1202637	S	47								120		111ALVMO		
007S014E19B02M	371852	1202828	S	47								98		111ALVMO		
007S014E21A01M	371857	1202605	S	47								72		111ALVMO		
013S019E15C01M	364822	1195302	M	19								101				
013S019E16K02M	364755	1195353	M	19								165				
013S019E21G01M	364718	1195357	M	19								116				
013S019E22G01M	364717	1195251	M	19								125				
013S020E07C01M	364911	1194951	M	19	5060	J	5806	Z	1973	CA111	C M	150	150-	111ALVMO	9	1
013S020E13H01M	364803	1194410	M	19	5060	J	5810	Z	1971	CA111	C M	294	207-	111ALVMO		1
013S020E15L01M	364758	1194638	M	19	5060	J	5810	Z	1971	CA111	C M	264	205- 214	111ALVMO		1
013S020E21E01M	364711	1194802	M	19	5060	J	5146	Z	1973	CA111	C M	154	154-	111ALVMO		1
013S020E36D01M	364551	1194502	M	19	5060	J	5146	Z	1973	CA111	C M	175	175-	111ALVMO		1
013S021E07G02M	364902	1194317	M	19	5060	J	5810	Z	1972	CA111	C M	108	108-	111ALVMO		1
013S021E16Q01M	364746	1194118	M	19	5060	J	5146	Z	1973	CA111	C M	267	144- 160	111ALVMO		1
													190- 205			
													222- 226			
													241- 256			
013S021E21P01M	364646	1194120	M	19	5060	D	5810	B	1979	CA111	C M	332	116- 123	111AVSN		1
													156- 161			
													215- 220			
013S021E30P01M	364555	1194338	M	19	5060	J	5802	Z	1971	CA111	C M	280	150- 158	111ALVMO		1
													171- 178			
													259- 266			
014S020E01J01M	364424	1194408	M	19	5060	J	5810	Z	1971	CA111	C M	350	240- 248	111ALVMO		1
													335- 343			
014S020E16A01M	364314	1194727	M	19	5060	J	5802	Z	1971	CA111	C M	262	226- 231	111ALVMO		1
014S020E36A01M	364040	1194418	M	19	5060	J	5060	Z	1971	CA111	C M	348	152- 348	111ALVMO	6	1
018S021E16A01M	362208	1194120	S	31								64				
018S021E16J01M	362147	1194130	S	31								356				
018S021E22N01M	362049	1194115	S	31								120				
018S021E22R01M	362044	1194015	S	31								52				
018S021E32J01M	361906	1194223	S	31	5060	J	5803	Z	1955	CA111	C M	332	162- 186	112ALAEC	5	1
													210- 258			
													282- 330			
018S021E32R01M	361853	1194223	S	31	5060	J	5803	Z	1961	CA111	C M	203	123- 203	112ALAEC		2

TABLE 12.--Actual Monitoring-Well Locations and Pertinent Data--Continued

D. Cumulative Effects of Point Sources--continued

1. Industrial and residential centers--continued

STATE WELL NO	LAT	LONG	ACCU-RACY	COUNTY	AGENCY DWR NO	ANAL-YSIS TYPE	LABORATORY	FREQ-UENCY	YEAR BEGAN	DATA SOURCE	DATA LOC-ATION	WELL DEPTH	PERF INTERVAL	GEOHYDRO UNIT	WELL SEAL	WELL CLASS
018S024E06H01M	362339	1192409	S	107	5050	B	5050	Z	1978	CA001	C M	95	95-	111FLDB		2
018S024E25L01M	362004	1191932	S	107	5701	B	5701	Z	1972	CA241	Z F	310	150- 290	111ALVMY	5	1
018S024E27R02M	361951	1192046	S	107	5701	B	5701	Z	1973	CA241	Z F	305	175- 295	111ALVMY	5	1
018S024E35N01M	361858	1192037	S	107	5701	B	5701	Z	1973	CA241	Z F	320	190- 310	111ALVMY	5	1
018S024E36C01M	361936	1191929	S	107	5701	B	5701	Z	1964	CA241	Z F	392	269- 277	111ALVMY	6	1
													321- 325			
													329- 355			
													365- 373			
018S024E36K01M	361910	1191918	S	107	5701	J	5701	Z	1959	CA241	Z F	260	153- 174	111AVSNY		1
018S024E36N01M	361856	1191950	S	107	5701	B	5701	Z	1975	CA241	Z F	296	96- 192	111ALVMY	6	2
													216- 276			
018S025E19N01M	362052	1191835	S	107	5701	J	5701	Z	1946	CA241	Z F	167	167-	111AVSNY		1
018S025E19Q01M	362042	1191801	S	107	5701	B	5701	Z	1958	CA241	Z F	270	245- 257	111ALVMY	5	1
018S025E27P01M	361958	1191519	S	107	5701	J	5701	Z	1960	CA241	Z F	320	78- 82	111AVSNY	5	1
													86- 104			
													192- 200			
													290- 300			
018S025E28D01M	362018	1191636	S	107	5701	B	5701	Z	1961	CA241	Z F	290	198- 215	111ALVMY	5	1
													255- 275			
018S025E28L01M	361953	1191624	S	107	5701	B	5701	Z	1968	CA241	Z F	350	130- 330	111ALVMY	5	1
018S025E28M09M	361957	1191638	S	107	4740	Z	5809	M	1976	CA066	Z F	158	62- 158	111AVSNY		2
														112ALVMO		
018S025E28M13M	361957	1191634	S	107	4740	Z	5809	M	1977	CA066	Z F	141	63- 141	111AVSNY		2
														112ALVMO		
019S025E01P01M	361759	1191302	S	107	5050	B	5050	Z	1978	CA001	C M	76	76-	111AVSNY		1
019S025E06M01M	361808	1191831	S	107	5701	B	5701	Z	1968	CA241	Z F	212	212-	111ALVMY	4	1
019S025E07A01M	361758	1191747	S	107	1061	B	5701	Z	1970	CA241	Z F	272	120- 250	111ALVMY	8	1
019S025E19E02M	361556	1191843	S	107	5701	B	5701	Z	1975	CA241	Z F	194	194-	111ALVMY		2
019S025E19E03M	361556	1191843	S	107	5701	B	5701	Z	1975	CA241	Z F	230	230-	111ALVMY		2
020S024E15G01M	360255	1192101	S	107								470				
021S027E21R01M	360452	1190310	S	107								132				
021S027E25M01M	360414	1190049	S	107								380				
021S027E35F01M	360344	1190138	S	107	5060	J	5802	Z	1974	CA111	C M	587	160- 195	111AVSN		1
													200- 250	112CNTL		
													265- 300			
													385- 587			
021S028E30P01M	360410	1185926	S	107								227				
021S028E31H01M	360344	1185905	S	107								105				
021S028E31Q01M	360315	1185924	S	107								175				
029S027E09H01M	352522	1190427	S	29	5701	B	5701	Z	1961	CA241	Z F	400	200- 400	111AVSN	5	1
														112CNTL		
029S027E12E01M	352524	1190208	S	29	5060	J	5803	Z	1973	CA111	C M	722	290- 697	111ALVMO		2
029S027E12Q01M	352447	1190145	S	29	5060	J	5803	Z	1973	CA111	C M	620	192- 620	111ALVMO		2

TABLE 12.--Actual Monitoring-Well Locations and Pertinent Data--Continued

D. Cumulative Effects of Point Sources--continued

1. Industrial and residential centers--continued

STATE WELL NO	LAT	LONG	ACCU-RACY	COUNTY	AGENCY DWR NO	ANAL-YSIS TYPE	LABORATORY	FREQ-UENCY	YEAR BEGAN	DATA SOURCE	DATA LOC-ATION	WELL DEPTH	PERF INTERVAL	GEOHYDRO UNIT	WELL SEAL	WELL CLASS
029S027E16D04M	352444	1190519	S	29	5701	B	5701	Z	1977	CA241	Z F	645	321- 625	112CNTL	28	1
029S027E24D02M	352257	1190206	S	29	5701	B	5701	Z	1962	CA241	Z F	660	265- 640	112CNTL	7	1
029S027E24L01M	352316	1190158	S	29	5701	B	5701	Z	1949	CA241	Z F	300	77- 285	111AVSN		2
														112CNTL		
029S027E25B02M	352257	1190138	S	29	5701	J	5701	3	1958	CA241	Z F	605	220- 585	111AVSNY	7	1
														111AVSN		
029S027E36H01M	352151	1190119	S	29	5701	J	5701	Z	1952	CA241	Z F	569	144- 569	111AVSNY	4	1
														112CNTL		
029S028E16E01M	352427	1185902	S	29	5701	J	5701	3	1954	CA241	Z F	783	461- 773	112CNTL	7	1
029S028E16K01M	352418	1185819	S	29	5060	J	5701	Z	1999	CA111	C M	808	500- 784	112CNTL	7	1
029S028E16M01M	352416	1185853	S	29	5701	J	5701	3	1954	CA241	Z F	726	400- 696	112CNTL	4	1
029S028E16Q01M	352357	1185829	S	29	5701	J	5701	3	1955	CA241	Z F	750	400- 740	112CNTL	7	1
029S028E16R01M	352409	1185810	S	29	5701	J	5701	3	1956	CA241	Z F	820	520- 792	112CNTL	9	1
029S028E21M01M	352323	1185856	S	29	5701	J	5701	3	1948	CA241	Z F		400- 553	112CNTL		2
													565- 580			
029S028E30Q02M	352148	1190028	S	29	5701	B	5701	Z	1951	CA241	Z F	600	168- 240	111AVSN	4	1
													264- 576	112CNTL		
030S027E02F01M	352054	1190255	S	29	5701	B	5701	Z	1954	CA241	Z F	480	116- 456	111AVSN	5	1
030S027E11R01M	351934	1190231	S	29	5701	B	5701	Z	1964	CA241	Z F	400	100- 400	111AVSN	3	1
030S027E23C04M	351835	1190305	S	29	5701	B	5701	Z	1966	CA241	Z F	630	208- 610	111AVSN	9	1
														112CNTL		
030S028E05E01M	352051	1190000	S	29	5050	J	5701	3	1948	CA241	Z F	600	200- 600	111AVSN	20	1
											R P			112CNTL		
030S028E18B01M	351929	1190030	S	29	5701	J	5701	3	1954	CA241	Z F	600	216- 576	111AVSNY	9	1

TABLE 12.--Actual Monitoring-Well Locations and Pertinent Data--Continued

D. Cumulative Effects of Point Sources--continued

2. Confined-feeding areas

STATE WELL NO	LAT	LONG	ACCU-RACY	COUNTY	AGENCY DWR NO	ANAL-YSIS TYPE	LABORATORY	FREQ-UENCY	YEAR BEGAN	DATA SOURCE	DATA LOC-ATION	WELL DEPTH	PERF INTERVAL	GEOHYDRO UNIT	WELL SEAL	WELL CLASS
006S010E01D01M	372643	1204946	S	47	5524	B	5146	Z	1979	CA020	C F	112		112ALAEC		1
006S010E17H01M	372454	1205314	S	47								60	42-			
006S010E22B01M	372403	1205121	S	47	5060	D	9579	B	1979	CA111	C M	217	100-		3	2
006S010E26D01M	372316	1205058	S	47								106				
006S010E32D01M	372220	1205400	S	47								100				
007S011E04M01M	372059	1204637	S	47								87				
007S011E14G01M	371928	1204339	S	47								108				
007S011E21D01M	371855	1204638	S	47								78	68-			
007S011E33E01M	371655	1204636	S	47								56				
007S012E02G01M	372118	1203707	S	47	5060	D	5802	B	1979	CA111	C M	265	98-	111ALVMO		1
007S012E08E01M	372031	1204104	S	47								76				
007S012E14U01M	371907	1203705	S	47								72		111ALVMO		
007S012E22H02M	371835	1203810	S	47								176	5- 25 109- 125 148- 164 167- 171	111ALVMO		
007S012E29K01M	371736	1204031	S	47								117	88-			
011S010E02N02M	365955	1205114	S	47								17				
011S010E06Q02M	365957	1205500	S	47								93				
011S010E07H02M	365952	1205456	S	47								85				
011S010E16L01M	365830	1205254	S	47		B			1949			300	250-			
011S010E24N01M	365719	1205009	S	47								126				
014S017E01E01M	364445	1200358	M	19								164				
014S017E06D01M	364452	1200903	M	19								165				
014S017E12J01M	364331	1200302	M	19	5060	J	5146	Z	1974	CA111	C M			111ALVMO		4
014S017E12R01M	364318	1200302	M	19	5060	J	5146	Z	1971	CA111	C M			111ALVMO		4
014S017E15N01M	364236	1200555	M	19								133				
014S017E21A01M	364220	1200613	M	19								120				
014S017E27H01M	364114	1200508	M	19								151				
015S019E07Q01M	363802	1195600	M	19	5112	B	5200	S	1978	CA160	Z F	112	112-	111ALVMO		2
015S019E11F02M	363837	1195217	S	19	5112	B	5200	S	1978	CA160	Z F	132	132-	111ALVMO	4	1
015S019E17R01M	363712	1195437	M	19								118				
015S019E21E01M	363653	1195435	M	19								120				
015S019E29A01M	363612	1195443	M	19								166				
015S019E35L01M	363458	1195158	M	19								150				
017S019E04A01M	362903	1195403	M	19								168				
017S019E12C01M	362824	1195118	M	19								80				
017S019E19C01M	362637	1195628	M	19								45				
017S019E24B01M	362649	1195118	S	19								100				
017S019E28F01M	362532	1195433	M	19								100				
017S019E34B01M	362445	1195308	M	19								52				
017S020E01C01M	362918	1194501	M	19								67				
017S020E09K02M	362809	1194803	S	19								107				
017S020E16M01M	362658	1194831	S	19								132				
017S020E27D01M	362554	1194738	S	19								89				
017S020E30F02M	362539	1195018	S	19								42				
017S020E36R02M	362409	1194432	S	31	5050	B	5050	Z	1978	CA001	C M					3

TABLE 12.--Actual Monitoring-Well Locations and Pertinent Data--Continued

D. Cumulative Effects of Point Sources--continued

2. Confined-feeding areas--continued

STATE WELL NO	LAT	LONG	ACCU-RACY	COUNTY	AGENCY DWR NO	ANAL-YSIS TYPE	LABORATORY	FREQ-UENCY	YEAR BEGAN	DATA SOURCE	DATA LOC-ATION	WELL DEPTH	PERF INTERVAL	GEOHYDRO UNIT	WELL SEAL	WELL CLASS
018S022E10K01M	362244	1193416	S	31								60				
018S022E21G01M	362112	1193523	S	31								105				
018S022E29Q01M	361947	1193626	S	31								83				
018S022E35L01M	361911	1193326	S	31								128				
018S023E14H01M	362202	1192621	S	107								92				
018S023E15A01M	362219	1192725	S	107								85				
018S023E33E01M	361925	1192925	S	31								110				
018S024E06H01M	362339	1192409	S	107	5050	B	5050	Z	1978	CA001	C M	95	95-	111FLDB		2
018S024E12A01M	362310	1191836	S	107								100				
018S024E22C01M	362126	1192111	S	107								125				
018S024E25L01M	362004	1191932	S	107	5701	B	5701	Z	1972	CA241	Z F	310	150- 290	111ALVMY	5	1
018S024E27R02M	361951	1192046	S	107	5701	B	5701	Z	1973	CA241	Z F	305	175- 295	111ALVMY	5	1
018S024E32C01M	361940	1192347	S	107								123				
018S024E35C02M	361937	1192024	S	107	5701	B	5701	Z	1966	CA241	Z F	113	113-	111ALVMY		2
019S023E02N01M	361803	1192711	S	107								169				
019S023E08A01M	361750	1192924	S	31								147				
019S023E16C01M	361653	1192854	S	31								180				
019S023E30J01M	361450	1193033	S	107								145				
019S023E35H01M	361404	1192616	S	107								132				
019S025E01P01M	361759	1191302	S	107	5050	B	5050	Z	1978	CA001	C M	76	76-	111AVSNY		1
019S025E06H03M	361821	1191759	S	107	5701	B	5701	Z	1976	CA241	Z F	300	150- 280	111ALVMY	5	2
019S025E19E02M	361556	1191843	S	107	5701	B	5701	Z	1975	CA241	Z F	194	194-	111ALVMY		2
019S025E22R01M	361523	1191438	S	107								156				
019S025E31J01M	361354	1191734	S	107								122				
019S025E35D02M	361425	1191417	S	107								100				
020S023E01D01M	361335	1192602	S	107								152				
020S023E06R01M	361257	1193032	S	107								150				
020S023E15C01M	361149	1192800	S	107								132				
020S023E29N01M	360919	1193029	S	107								165				
020S023E35K01M	360843	1192635	S	107								169				
020S024E05Q01M	361244	1192330	S	107								144				
020S024E20J01M	361030	1192300	S	107								110				
020S025E01D01M	355309	1191304	S	107								120				
020S025E36B01M	361334	1191759	S	107								182				
021S024E04J01M	360753	1192230	S	107								155				
021S024E16N01M	360553	1192332	S	107								93				
021S024E26C01M	360449	1192043	S	107	5050	B	5050	Z	1978	CA001	C M			112ALAEC		3
021S024E29A01M	360441	1192333	S	107								150				
021S024E36A02M	360345	1191909	S	107								200				
021S025E26C01M	360403	1191418	S	107								170				
021S025E30F01M	360436	1191846	S	107								203				
022S025E02D01M	360303	1191435	S	107								178				
022S025E06F01M	360252	1191851	S	107								183				
022S025E18J02M	360049	1191808	S	107								123				
022S025E22D01M	360016	1191541	S	107								248				

APPENDIX A. - Actual monitoring-well locations and pertinent data

[Index to table 12]

Well No.	Networks	Well No.	Networks
001N002E13F01M	B.5	001N007E05A01M	B.5
13H01M	B.5	05N01M	B.5
001N003E17E01M	B.5	07E01M	B.5
001N004E03N01M	B.4	07F01M	B.5
34H01M	A.1;C.2c	08F02M	B.5
35R01M	A.1;C.2c	08H02M	B.5;D.1
36K03M	A.1;C.2c	08P01M	B.5
001N005E02F01M	A.1;C.1a 2c	16M01M	B.5;D.1
03Q01M	A.1;C.2c	17D01M	B.5
03R01M	A.1;C.2c	17D02M	B.5
10A01M	A.1;C.2c	17P01M	B.5
10P01M	A.1;C.2c	18B01M	B.5
10Q01M	A.1;C.2c	18D01M	B.5
15F01M	A.1;C.2c	18E02M	B.5
15L02M	A.1;C.2c	18E03M	B.5
21E03M	A.1;C.2c	18L01M	B.5
21F01M	A.1;C.2c	26H03M	B.5;D.1
21M02M	A.1;C.2c	30E01M	B.5
22E01M	A.1;C.2c	001N008E10C01M	B.5
29C02M	A.1;C.2c	15J01M	B.5
29F01M	A.1;C.2c	001N009E16F01M	B.5
30Q03M	A.1;C.2c	26A01M	B.5
31D01M	A.1;C.2c	001S003E03M01M	B.5
31E01M	A.1;C.2c	15A01M	B.5
31P01M	A.1;C.2c	001S004E02C01M	A.1;C.2c
36M01M	A.1;C.2c	03K01M	A.1;C.2c
001N006E01M10M	B.5	03P02M	A.1;C.2c
02M01M	B.5	04R01M	A.1;C.2c
02Q01M	B.5;D.1	09A01M	A.1;C.2c
03C01M	B.5	09B01M	A.1;C.2c
04B01M	B.5	09C01M	A.1;C.2c
04J01M	B.5	09N01M	A.1;C.2c
06K01M	B.5;C.1a	09N02M	A.1;C.2c
10Q06M	B.5	17A02M	A.1;C.2c
10Q07M	B.5	20K01M	A.1;C.2c
11E02M	B.5	21Q01M	A.1;C.2c
11K01M	B.5;D.1	001S005E06D01M	A.1;C.2c
12A01M	B.5	26E01M	A.1;C.2c
12F01M	B.5	001S006E02D04M	B.5,6
12G01M	B.5	05B01M	A.1;B.6;C.1a,2c
12G10M	D.1	25M02M	B.5,6;C.1a
12K03M	B.5	26H01M	B.5,6
12N01M	B.5	26L01M	B.2,5,6;C.1a
13B03M	B.5	35D01M	B.5,6;C.1a
13G02M	B.5;D.1	35E04M	B.5,6;C.1a
13J01M	B.5	36B01M	B.5,6
22J01M	B.5;C.1a;D.1	36G01M	B.5,6
31L01M	A.1;C.1a;2c	001S007E21G01M	B.5,6
35P02M	B.5;C.1a	29F01M	B.6
001N007E04F01M	B.5;D.1	32H02M	B.5,6
04G01M	B.5	32P01M	B.5,6

Well No.	Networks	Well No.	Networks
001S007E33L01M	B.5,6	002N006E04E01M	B.5
34L01M	B.2,5,6	07P01M	B.5;D.1
001S008E13M01M	B.5	08C01M	B.5
16R01M	B.5	09F01M	B.5;D.1
001S009E11J01M	B.5	09J01M	B.5
16P02M	B.5	09K01M	B.5
33P01M	B.5	15D02M	B.5
002N001E07R02M	B.5;D.1	15F01M	B.5;D.1
07R03M	B.5;D.1	16B01M	B.5
07R04M	B.5;D.1	16C02M	B.5;D.1
17K01M	B.5;D.1	16D03M	B.5
18D01M	B.5;D.1	16E01M	B.5
22C01M	B.5;D.1	16H01M	B.5;D.1
24E03M	B.5;D.1	16Q01M	B.5
002N001W04Q01M	B.5	16R02M	B.5;D.1
09D01M	B.5	17J01M	B.5
09D02M	B.5	19L01M	B.5
10C01M	B.5	19P01M	B.5
12P04M	B.5	19P02M	B.5
002N002E17N01M	B.5	20A01M	B.5
17R03M	B.5;D.1	20F01M	B.5
18M01M	B.5	20J01M	B.2
19F01M	B.5;D.1	20L01M	B.5
19G01M	B.5	20M02M	B.5
19G02M	B.5	21C01M	B.5
20A01M	B.5;D.1	21C02M	B.5
20F01M	B.5	21F01M	B.5;D.1
20J01M	B.5	21F02M	B.5
21K01M	B.5;D.1	21K01M	B.5
21L01M	B.5	22B01M	B.5
22F01M	B.5;D.1	22D01M	B.5
22L01M	B.5	22E01M	B.5
002N002W13B03M	B.5	22G01M	B.5
13B04M	B.5	22G02M	B.5
13B05M	B.5	22Q01M	B.5
13P01M	B.5	22Q02M	B.5
14P02M	B.5	25N01M	B.5
002N005E01C01M	A.1;C.2c	26L01M	B.5
02A01M	A.1;C.2c	27B01M	B.5
02H02M	A.1;C.2c	27H01M	B.5
02R02M	A.1;C.2c	27K01M	B.5
02R03M	A.1;C.2c	27K02M	B.5
12M01M	A.1;C.2c	27L01M	B.5
13D01M	A.1;C.2c	27P01M	B.5
23R01M	A.1;C.1a,2c	30B01M	B.5
24C02M	A.1;C.2c	33B01M	B.5
24C03M	A.1;C.2c	33F01M	B.5
24L01M	A.1;C.2c	33G01M	B.5
24N02M	A.1;C.2c	33K01M	B.5
26H01M	A.1;C.1a,2c	33M03M	B.5
26H02M	A.1;C.1a,2c	33N01M	B.5
26Q02M	A.1;C.1a,2c	34B01M	B.5
26Q03M	A.1;C.1a,2c	34C01M	B.5
35B02M	A.1;C.1a,2c	34K02M	B.5
35K01M	A.1;C.1a,2c	34L01M	B.5
35P01M	A.1;C.1a,2c	34Q01M	B.5
35Q02M	A.1;C.1a,2c	35B01M	B.5

Well No.	Networks
002N006E35D02M	B.5
36A01M	B.5
36F01M	B.5;D.1
36G01M	B.5;D.1
36N03M	B.5;D.1
36R03M	B.5;D.1
002N007E07Q01M	B.5
12J02M	B.5
20E04M	B.5
25M01M	B.5
30K01M	B.5
002N008E13G01M	B.5
15K01M	B.5
15K03M	B.5
15L01M	B.5
15N03M	B.5
16L01M	B.5
21J01M	B.5
002S004E16A01M	B.2,5
002S005E20R01M	B.5;D.1
21J01M	A.5;B.5;D.1
21Q01M	B.5
22D01M	B.5
25D02M	B.1,5;D.1
28A02M	B.5
28E01M	B.5
28L01M	A.5;B.5;D.1
29A01M	B.5
002S006E20L01M[1]	B.5
20L02M[1]	B.5
32D01M[1]	B.5
002S007E04F01M	B.5,6;D.1
05A01M	B.5,6
05A02M	B.5,6
05B01M	B.5,6
07Q01M	B.5,6;D.1
24R02M	B.5,6;D.1
30H01M[1]	B.5
34R02M[1]	B.5
002S008E02C01M	B.5
19H01M	B.5
19R02M	B.5
20J02M	B.5
20N01M	B.5
29D01M	B.5
30B01M	B.5
30H01M	B.5
002S009E04B01M	B.5
04C01M	B.5
04E01M	B.5
04F01M	B.2
12R01M	B.5
15P01M	B.5
19B02M	B.5
19R01M	B.2
003N005E03F02M	A.1;C.2c
10H02M	A.1;C.2c
003N005E14L01M	A.1;C.2c
15C01M	A.1;C.2c
15J01M	A.1;C.2c
23D01M	A.1;C.2c
23L01M	A.1;C.2c
26A01M	A.1;C.2c
26H01M	A.1;C.2c
26K01M	A.1;C.2c
26Q01M	A.1;C.2c
36D01M	A.1;C.2c
36E01M	A.1;C.2c
36L01M	A.1;C.2c
003N006E01L04M	B.2
01N03M	B.2
03Q01M	B.2
10B02M	B.2
13A04M	B.5
13B07M	B.2
13M02M	B.2
14L01M	B.2
15Q05M	B.5;D.1
17H03M	B.5
003N007E05M06M	B.2
16C06M	B.5
003N008E20P01M	B.5
003N009E06N01M	B.5
003S005E04H01M	B.1,6
12J02M	B.5,6
003S006E04N01M[1]	B.5
05R01M[1]	B.5
08R01M[1]	B.5
09J02M[1]	B.5
10K01M[1]	B.5
14A01M	A.5;B.5;C.1a
14A02M	A.5;B.5;C.1a
14M01M[1]	B.5
15N02M[1]	B.5
16L01M[1]	B.5
16M01M[1]	B.5
16R01M[1]	B.5
17K01M	B.5
003S007E04K01M[1]	B.5
09P01M[1]	B.5
13A01M	B.5
18F01M[1]	B.5
003S008E03M01M	B.2
13F01M	A.5
13J01M	A.5
24C02M	A.5
29K01M	A.5
003S009E02P01M	D.1
16K01M	D.1
19C01M	A.5
20C01M	A.5
21H01M	D.1
22F01M	D.1
22N01M	A.5;B.2

Well No.	Networks	Well No.	Networks
003S009E24F01M	D.1	004S009E09Q01M	B.2
26N01M	A.5;B.2;D.1	12E01M	B.2
28C01M	B.2	16D02M	B.2;D.1
29B01M	A.5	22C01M	D.1
30Q01M	D.1	005N005E29F01M	A.1;C.2c
32A01M	A.5	32C02M	A.1;C.2c
34A01M	B.2	32Q02M	A.1;C.2c
34L01M	B.2	005S008E01R01M	A.5
36D01M	D.1	02R01M	A.5
36L01M	B.2	005S010E14E01M	D.1
003S010E25A01M	A.3	15N01M	D.1
32D01M	B.2	22G01M	D.1
003S011E28K01M	B.2	005S011E05D01M	B.2
004N005E05C03M	A.1;C.2c	18Q01M	A.5
05K02M	A.1;C.2c	006S009E12B01M	A.5
08G01M	A.1;C.2c	006S010E01D01M	D.2
08P01M	A.1;C.2c	11N01M	A.5
17B02M	A.1;C.2c	17H01M[1]	D.2
17G01M	A.1;C.2c	22B01M	B.2;D.2
17L01M	A.1;C.2c	26D01M[1]	D.2
20A01M	A.1;C.2c	32D01M[1]	D.2
20B01M	A.1;C.2c	006S011E03C01M	A.5
21L03M	A.1;C.2c	04C01M	A.5
24J03M	B.5	09C01M	A.5
28C01M	A.1;C.2c	09Q01M	A.5
28C02M	A.1;C.2c	25E01M	B.2
28F01M	A.1;C.2c	25F01M	A.5;B.2
28P01M	A.1;C.2c	25N01M	A.5;B.2
33A03M	A.1;C.2c	006S012E23N01M	B.2
33B02M	A.1;C.2c	23R03M	B.2
33B03M	A.1;C.2c	25D02M	B.2
33H01M	A.1;C.2c	007S008E12D01M	A.5
33R02M	A.1;C.2c	007S010E24A01M	C.1a
33R03M	A.1;C.2c	24H02M	C.1a
34M01M	A.1;C.2c	007S011E04M01M[1]	D.2
34N02M	A.1;C.2c	14G01M[1]	D.2
004N006E12C06M	B.5;D.1	21D01M[1]	D.2
16R07M	B.5;D.1	33E01M[1]	D.2
34E05M	B.5;D.1	007S012E02G01M	B.2;D.1,2
004N007E12P04M	B.5	08E01M[1]	D.2
15E01M	B.5	14Q01M[1]	D.2
29E02M	B.5	22H02M[1]	D.2
004N007E26D01M	B.1	29K01M[1]	D.2
004N008E22K02M	B.5	007S013E06G01M	D.1
29E04M	B.5	24M01M[1]	D.1
004S007E26D01M	C.1a	24Q01M[1]	D.1
004S008E04G01M	A.5	007S014E16P02M[1]	D.1
27M01M	A.5	19B02M[1]	D.1
004S009E02N01M	D.1	21A01M[1]	D.1
03B01M	B.2	008S009E08E01M	B.1
03K01M	B.2	008S010E21L04M[1]	C.2b
04K01M	A.5	22R01M[1]	C.2b
06H01M	D.1	27A01M[1]	C.2b
06K01M	B.2	35C01M[1]	C.2b
08M01M	B.2	009S010E02R01M[1]	C.2b
09B02M	D.1	009S011E20A01M[1]	C.2b
09D01M	D.1	32J01M[1]	C.2b

Well No.	Networks	Well No.	Networks
010S011E21J01M[1]	B.7;C.2b	009S011E29C01M	B.6;C.1a,2b
010S012E09P01M	B.1,7a	013S016E19J01M[1]	B.5
21B01M[1]	B.7a	20M01M[1]	B.5
010S013E22A01M[1]	B.7a	013S017E22B01M	B.5 6;C.1a
010S013E23M01M[1]	B.5	32J02M[1]	B.5
26K01M[1]	B.5	013S019E15C01M[1]	D.1
010S014E29C01M[1]	B.5	16K02M[1]	D.1
34E01M[1]	B.5	21G01M[1]	D.1
011N019W01H01S	B.3,4	22G01M[1]	D.1
21F01S	A.5	013S020E03C01M	B.6;C.1a
24H01S	A.5	07C01M	B.6;D.1
011N020W01P01S	B.3,4	07F01M	B.6
17H01S	A.5	08C01M	B.6
011S010E02N02M[1]	D.2	08L01M	B.6
06Q02M[1]	D.2	08P01M	B.6
07B02M[1]	D.2	09F02M	B.6
16L01M[1]	D.2	09Q01M	B.6
24N01M[1]	D.2	11C01M	B.6
011S011E12D01M[1]	C.2b	13E01M	B.6
011S012E07E02M[1]	B.5	13H01M	B.6;D.1
11J01M[1]	B.5	14M01M	B.6
22R01M[1]	B.7a;C.2b	15L01M	B.6;D.1
011S013E22C01M[1]	B.7a	16L01M	B.6
34N01M[1]	B.5	17A01M	B.6
011S014E07N02M[1]	B.5	17F01M	B.6
011S015E33P04M[1]	B.5	17G01M	B.6
35P01M	B.5	17J01M	B.6
012N019W27R01S	B.3,4	17R01M	B.6
012N020W27P01S	B.3,4	19C01M	B.6
012S012E14N02M[1]	B.7a	20E01M	B.6
012S013E09B01M[1]	C.2b	21E01M	B.6;D.1
10G01M	B.5	23B01M	B.6
11B01M[1]	C.2b	23J01M	B.6
19K01M[1]	B.5	23Q01M	B.2
21E01M[1]	B.7a	24J02M	B.6
012S014E14A01M[1]	B.5	24R01M	B.6
21M01M[1]	B.7a	25E01M	B.6
28J02M[1]	C.2b	25E02M	B.6
28L04M	B.1,5,7a;C.1a	25M01M	B.6
29H01M[1]	C.2b	26C01M	B.6
012S015E08F01M	B.5	26D01M	B.6
012S016E31A01M[1]	B.5	26Q01M	B.6
013S011E13N01M[1]	B.5	27J01M	B.6
23E01M[1]	B.5	28R01M	B.6
013S012E16N01M[1]	B.5	32D01M	B.6
22F01M[1]	B.5	34B01M	B.6
013S013E14N01M[1]	B.5	35H01M	B.6
013S013E15A01M[1]	B.7a	35H02M	B.6
15M02M[1]	B.7a	36D01M	B.6;D.1
013S014E02M01M[1]	C.2b	013S021E07G02M	D.1
03M01M[1]	C.2b	09R02M	B.2
15B01M[1]	B.5	16Q01M	D.1
21N05M[1]	B.7a	17J01M	B.2
22N03M[1]	B.7a	21P01M	B.2;D.1
013S015E15G01M[1]	B.5	30P01M	D.1
19Q01M	B.5,6;C.1a	014S012E14P01M[1]	B.5
24E01M[1]	B.5	21B01M[1]	B.5

Well No.	Networks	Well No.	Networks
014S012E23A01M[1]	B.5	014S019E33C01M	B.6
23H01M[1]	B.5	34F01M	B.6
014S014E10N01M[1]	B.5	36C01M	B.6
13E03M[1]	B.5	014S020E01J01M	B.6;D.1
014S015E16D01M[1]	B.5	03C02M	B.6
19N01M[1]	B.5	03M01M	B.6
014S016E16R01M[1]	B.5	11F01M	B.6
014S017E01E01M[1]	D.2	13K01M	B.2,6
06D01M[1]	D.2	13R01M	B.2,6
09A01M[1]	B.5	14Q01M	B.6
12J01M	B.5,6;D.2	16A01M	B.6;D.1
12R01M	B.5,6;D.2	19H01M	B.6
15N01M[1]	D.2	19H02M	B.6
21A01M[1]	D.2	19J01M	B.6
27H01M[1]	D.2	19J02M	B.6
014S018E07N01M	B.6	24K01M	B.6
24A01M	B.6	36A01M	B.6;D.1
25A01M	B.6	014S021E07H02M	B.2
26C01M	B.6	09R01M	B.2
26N01M	B.6	10E01M	B.2
35N01M	B.6	30P01M	B.2
36G01M	B.6	014S022E23F01M	B.2
014S019E10Q02M	B.6	23M01M	B.2
15R01M	B.6	015S018E02F02M	B.6
16C01M	B.6	10J01M	B.6
18D01M	B.6	11J02M	B.6
19F01M	B.6	12B01M	B.6
20A01M	B.6	13A03M	B.6
20J01M	B.6	14A01M	B.6
20K03M	B.6	14M01M	B.6
20R01M	B.6	015S019E03J01M	B.6
21D01M	B.6	04L01M	B.6
21F01M	B.6	05L01M	B.6
21G01M	B.6	06L01M	B.6
21H01M	B.6	07Q01M	B.6;D.2
21J01M	B.6	08A01M	B.6
21L01M	B.6	10P03M	B.6
21R01M	B.6	11F02M	B.6;D.2
22C02M	B.6	15C01M	B.3,4,6
22E01M	B.6	17R01M[1]	D.2
22E02M	B.6	21E01M[1]	D.2
22F01M	B.6	29A01M[1]	D.2
22L01M	B.6	35L01M[1]	D.2
22M01M	B.6	015S022E05H01M	B.2
22R02M	B.6	27Q03M	A.3
25C01M	B.6	27Q04M	A.3
26M01M	B.6	31A01M	A.3
27L01M	B.6	32L01M	A.3
27R01M	B.6	015S012E12E01M[1]	B.5
28A02M	B.6	15A02M[1]	B.5
28J01M	B.6	23Q01M[1]	B.5
28P01M	B.6	015S013E16N01M[1]	B.5
29B01M	B.6	22N01M[1]	B.5
29R01M	B.6	015S023E19E01M	B.2
30A01M	B.6	26P01M	B.2
31A01M	B.6	016S020E18G01M	B.6
32B01M	B.6	016S022E05C01M	A.3

Well No.	Networks	Well No.	Networks
016S022E06G01M	A.3	018S025E28D01M	D.1
07A01M	A.3	28L01M	D.1
23K01M	B.2	28M09M	D.1
26G01M	B.2	28M13M	D.1
30R01M	A.3	019S019E10E02M	A.5;C.1b
016S023E23E01M	A.3	25H02M[1]	A.3;B.1,6; C.1b
016S024E08Q01M	B.2	019S020E33A01M	A.4;B.6;C.1b
17H01M	B.2	019S021E01B01M[1]	B.3,4
17N01M	B.2	01B02M[1]	B.3,4
18A01M	B.2	12B01M[1]	B.7b
016S025E07R01M	A.3	21B01M[1]	B.7b
08N01M	A.3	019S022E21C01M[1]	B.7b
017S019E04A01M[1]	D.2	019S023E02N01M[1]	D.2
12C01M[1]	D.2	08A01M[1]	D.2
19C01M[1]	D.2	16C01M[1]	D.2
24B01M[1]	D.2	30J01M[1]	D.2
28F01M[1]	D.2	35H01M[1]	D.2
34B01M[1]	D.2	019S025E01P01M	A.3;D.1,2
017S020E01C01M[1]	D.2	06H03M	D.2
09K02M[1]	D.2	06M01M	D.1
16M01M[1]	D.2	07A01M	D.1
27D01M[1]	D.2	19E02M	D.1,2
30F02M[1]	D.2	19E03M	D.1
36R02M	A.3;C.1b;D.2	22R01M[1]	D.2
017S021E36B01M	A.3;C.1b	31J01M[1]	D.2
017S025E15H01M	A.3	35D02M[1]	D.2
018S021E16A01M[1]	D.1	019S026E15B01M[1]	B.7a
16J01M[1]	D.1	020S015E32A01M[1]	B.3,4
22N01M[1]	D.1	020S016E04G01M[1]	B.5
22R01M[1]	D.1	22J01M[1]	B.5
25A01M[1]	B.7b	28F01M[1]	B.3,4
32J01M	B.7b;D.1	28P01M[1]	B.3,4
32R01M	B.7b;D.1	020S017E27B01M[1]	B.5
36D01M[1]	B.7b	30Q01M[1]	B.3,4
018S022E10K01M[1]	D.2	31M01M[1]	B.3,4
21C01M[1]	B.7b	31Q01M[1]	B.3,4
21G01M[1]	D.2	32R01M[1]	B.3,4
29Q01M[1]	D.2	020S020E19D01M	A.3;C.1b
30E01M[1]	B.7b	28E02M	A.4;C.1b
35L01M[1]	D.2	020S021E03A01M	A.3;B.1,7b
018S023E14H01M[1]	D.2	16L01M	B.7b
15A01M[1]	D.2	21F01M[1]	B.7b
33E01M[1]	D.2	020S022E15C01M[1]	B.7b
018S024E06H01M	A.3;D.1,2	020S023E01D01M[1]	D.2
12A01M[1]	D.2	06R01M[1]	D.2
22C01M[1]	D.2	15C01M[1]	D.2
25L01M	D.1,2	29N01M[1]	D.2
27R02M	D.1,2	35K01M[1]	D.2
32C01M[1]	D.2	020S024E05Q01M[1]	D.2
35C02M	D.2	15G01M[1]	D.1
35N01M	D.1	20J01M[1]	D.2
36C01M	D.1	020S025E01D01M[1]	D.2
36K01M	D.1	36B01M[1]	D.2
36N01M	D.1	021S016E08E01M	B.3,4
018S025E19N01M	D.1	12D01M[1]	B.3,4
19Q01M	D.1	12D02M[1]	B.3,4
27P01M	D.1		

Well No.	Networks	Well No.	Networks
021S016E12E01M[1]	B.3,4	025S022E16A01M	A.1
021S017E02G01M[1]	B.3,4	21P01M	A.1
14A01M[1]	B.5	26D01M	A.1
14N01M[1]	B.3,4	32A01M	A.1
22G01M[1]	B.3,4,5	32R02M	A.1
021S018E32C01M[1]	B.5	34A01M	A.1
021S018E34Q01M	A.3;C.2a	026S021E25F01M[1]	B.5
021S021E26D01M	A.3	026S022E20A01M	A.1
021S022E22M01M	A.3;B.1,7b	21N01M	A.1
22R02M	B.7b	28R01M	A.1
34A01M	B.7b	32J01M[1]	B.5
021S022E34A01M	A.4	32N01M	A.1
021S023E05E01M	B.7b	33R01M	A.1
22J02M[1]	B.7b	35E01M[1]	B.7c
021S024E04J01M[1]	D.2	026S023E29K01M[1]	B.5
16N01M[1]	D.2	026S025E21Q01M	A.3
26C01M	B.7b;D.2	26N01M	A.3
29A01M[1]	D.2	30H01M	A.3
36A02M[1]	D.2	34R01M	A.3
021S025E26C01M[1]	D.2	36E01M	A.3
30F01M[1]	D.2	027S021E03A01M[1]	B.5
021S027E21R01M[1]	D.1	027S022E02N01M	A.1
25M01M[1]	D.1	03P02M	A.1
35F01M	B.7a;D.1	04D01M	A.1
021S028E30P01M[1]	D.1	08A01M	A.1
31H01M[1]	D.1	09D01M	B.1,5,7b
31Q01M[1]	D.1	09R01M	A.1
022S018E04B01M	B.5	10Q02M	A.1
022S019E18P02M	A.3;B.5;C.2a	11L02M	A.1
022S023E15F02M[1]	B.7c	12A02M	A.1
022S024E22A01M[1]	B.7c	13R01M	A.1
022S025E02D01M[1]	D.2	14B02M	A.1
06F01M[1]	D.2	15A01M	A.1
18J02M[1]	D.2	15N01M	A.1
22D01M[1]	D.2	16B01M[1]	B.5
022S026E03A02M	B.2	17B01M	A.1
17C01M	A.3	17P02M	A.1
023S018E29E02M[1]	B.5	20A01M	A.1
023S027E27G01M	A.3	20P02M	A.1
024S021E36B01M[1]	B.5	20Q01M	A.1
024S022E17Q01M[1]	B.5	20R02M	A.1
17R01M[1]	B.5	027S023E01R05M[1]	B.5
024S023E03D01M	B.5	19B02M	A.1
22K01M[1]	B.7c	20J01M	A.1
024S024E16B01M[1]	B.7c	20R01M	A.1
024S025E03C01M	A.4	31A01M	A.1
17P01M	A.5	34C01M	A.1
20N01M	A.3	027S025E01N02M	A.3
36J01M	A.4	01Q01M	A.3
024S026E01A01M	A.4	16H01M	A.3
024S027E22C01M	A.4	16Q01M	A.3
025S021E11N01M	A.1	23A01M	A.3
20F01M[1]	B.5	027S026E07P01M	A.3
24R01M	A.1	19L01M	A.3
25Q01M	A.1	30F01M	A.3
025S022E11G01M[1]	B.7c	028S022E04A01M	B.5
14N01M	A.1	09R01M	B.5

APPENDIX A.--Continued

Well No.	Networks	Well No.	Networks
028S022E10R01M	B.7b	030S028E19M01M	A.5
11P01M	A.1	20M01M	A.5
11P02M	A.1	32B01M	A.5
15N04M	A.1	030S029E15K01M	B.3,4,7c
15N05M	A.1	15L02M	B.3,4,7c
028S023E16C01M[1]	B.5	32P01M	A.5
16K01M[1]	B.5	34C01M	A.5
028S026E09D01M	A.3	36B01M	B.3,4
21E01M	A.3	36E01M	B.3,4
21G01M	A.3	030S030E31D01M	B.3,4
21L01M	A.3	31M01M	B.3,4
36D01M	A.3	031S023E33N02M	B.3,4
36F01M	A.3	031S024E22B01M[1]	B.5
028S028E35R01M[1]	B.3,4	28B01M	A.5;B.3,4
36B01M[1]	B.3,4	031S025E36H01M	A.1
029S022E04R01M[1]	B.3,4	031S026E32C01M[1]	B.7c
029S023E16K01M[1]	B.5	32N01M	A.1
21H01M	B.3,4,5	031S028E01Q02M	B.2
029S024E32G01M[1]	B.5	05H01M	A.1
029S026E01R01M[1]	B.3,4	10D02M	A.1
13R01M[1]	B.3,4	28D02M	A.1
35P01M[1]	B.3,4	29R01M	A.1
029S027E09H01M	D.1	30R01M	A.1
10M01M	B.3,4	31N02M	A.1
12E01M	C.1c;D.1	031S029E01C01M	A.5
12Q01M	C.1c;D.1	01D01M	A.5
16D04M	B.3,4;D.1	02K01M	A.5
23H01M	B.3,4	02M01M	B.3,4
24D02M	C.1c;D.1	05J01M	A.5
24L01M	C.1c;D.1	07N01M	B.2
24N01M	C.1c	08H01M	A.5
25B02M	D.1	09L01M	A.5
26J01M	B.3,4	11B01M	A.5
36H01M	D.1	16C01M	A.5
029S028E16E01M	D.1	23L02M	B.3,4
16K01M	D.1	23R01M	A.5
16M01M	B.3,4;D.1	25K01M	A.5
16Q01M	D.1	26E01M	A.5
16R01M	D.1	35E01M	B.3,4
19J02M	B.3,4;C.1c	36D01M	A.5
19L01M	C.1c	031S030E07D01M	B.3,4
21M01M	D.1	18Q01M	B.3,4
30H01M	B.2	30M01M	B.3,4
30Q02M	B.3,4;D.1	032S024E24G01M[1]	B.3,4
32D01M	B.3,4	032S025E16P01M[1]	B.3,4
029S029E31H01M	B.7c	35N01M[1]	B.3,4
33F02M	B.3,4	35N02M[1]	B.3,4
030S023E01C03M	B.3,4	032S026E31P01M[1]	B.3,4
030S024E04C06M[1]	B.5	34R01M[1]	B.3,4
14H01M	B.3,4	032S027E02R01M	A.1
030S026E22P01M[1]	B.7c	06Q01M	A.1
31P01M[1]	B.7c	11B01M	A.1
030S027E02F01M	D.1	14A02M	A.1
11R01M	D.1	14R01M	A.1
23C04M	D.1	15R01M	A.1
030S028E05E01M	D.1	16R03M	A.1
18B01M	D.1	21N01M	A.1

Well No.	Networks	Well No.	Networks
032S027E35R01M	B.3,4	032S028E27E01M	A.5
032S028E06H01M	A.1	31R02M	B.3,4
13N01M	A.5	32R01M	A.5
15N01M	A.1	33J01M	A.5
17D01M	A.1	36Q01M	B.3,4
18D01M	A.1	032S029E07R01M	A.5
20A02M	A.1	08R01M	A.5
22R02M	A.5	18P01M	A.5
23F01M	A.5	19B01M	A.5
26A02M	A.5	31H01M	B.3,4
26F01M	A.5	34P01M	B.3,4

[1]Not listed in Glass and others (1981).