UNITED STATES OF AMERICA

UNITED STATES

DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

CERTIFICATE OF EXACT COPY

Pursuant to 43 U. S. C. 1460, I hereby certify that the official records identified below are in the legal custody of the United States Geological Survey and attest that each annexed record is a true copy of a document comprising part of the official records of the United States Geological Survey: Water-Resources Inventory for 1966 Antelope Valley-East Kern Water Agency Area California; Open File Report 67-0020; 1967 edition; "*this report has been scanned and reproduced*".

IN TESTIMONY WHEREOF, I have hereunto subscribed my name and caused the seal of the Geological Survey, Department of the Interior to be affixed, the day and year written below.

SIGNATURE: ....Janis Wilson........................

TITLE: Business Partner Specialist...

OFFICE: ...United States Geological Survey..................................

PWS-0125-0001

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
Water Resources Division

WATER-RESOURCES INVENTORY FOR 1966

ANTELOPE VALLEY-EAST KERN WATER AGENCY AREA

CALIFORNIA

By

R. M. Bloyd, Jr.

Prepared in cooperation with the
Antelope Valley-East Kern Water Agency

67-20
OPEN-FILE REPORT

Menlo Park, California
November 14, 1967

PWS-0125-0002

CONTENTS

PWS-0125-0003

ILLUSTRATIONS

[1]All illustrations are at the end of the report. The page number given is that of the first principal reference to the illustration in the text.

WATER-RESOURCES INVENTORY FOR 1966

ANTELOPE VALLEY-EAST KERN WATER AGENCY AREA, CALIFORNIA

By R. M. Bloyd, Jr.

INTRODUCTION

To assist the Antelope Valley-East Kern Water Agency (AVEK) in its basin management program, the U.S. Geological Survey, Water Resources Division, in cooperation with the Agency, has established a basic water-data collection and analysis program. As part of that program, streamflow, precipitation, evaporation, and ground-water data will be collected on a continuing basis and analyzed annually y the U.S. Geological Survey. Also after collecting about 5 years f record, flood-frequency computations will be made, and refined stimates of average annual ground-water recharge will be computed. reliminary estimates of recharge have been made (Weir, Crippen, nd Dutcher, 1965).

PWS-0125-0005

Because the main ground-water reservoir in the AVEK area is not one large unit but 14 separate subunits (Bloyd, 1967), ground-water occurrence and movement in the reservoir are complicated. For example, some ground-water subunits contain poor quality water or have small quantities of water while adjacent subunits have an abundance of water of good quality. Therefore, enough measurements of ground-water levels will be made to prepare an annual water-level-contour map, to estimate annual changes in ground-water levels, and to estimate the annual depletion or addition to ground water in storage.

The AVEK area (fig. 1), which is a closed system, will probably have future ground-water quality deterioration due to increased salt concentrations caused in part by increased quantities of sewage effluent. If estimated population growth proves correct, the quantity of sewage requiring disposal will increase. Therefore, to insure the availability of data needed to identify, analyze, and solve future ground-water quality problems, ground-water samples will be collected and chemically analyzed by the U.S. Geological Survey. These samples will complement samples taken by the California Department of Water Resources.

The purpose of this first annual report to the Agency is to outline and discuss the basic water-data collection program, to present the results of the first year's work, and to outline work plans for the next fiscal year.

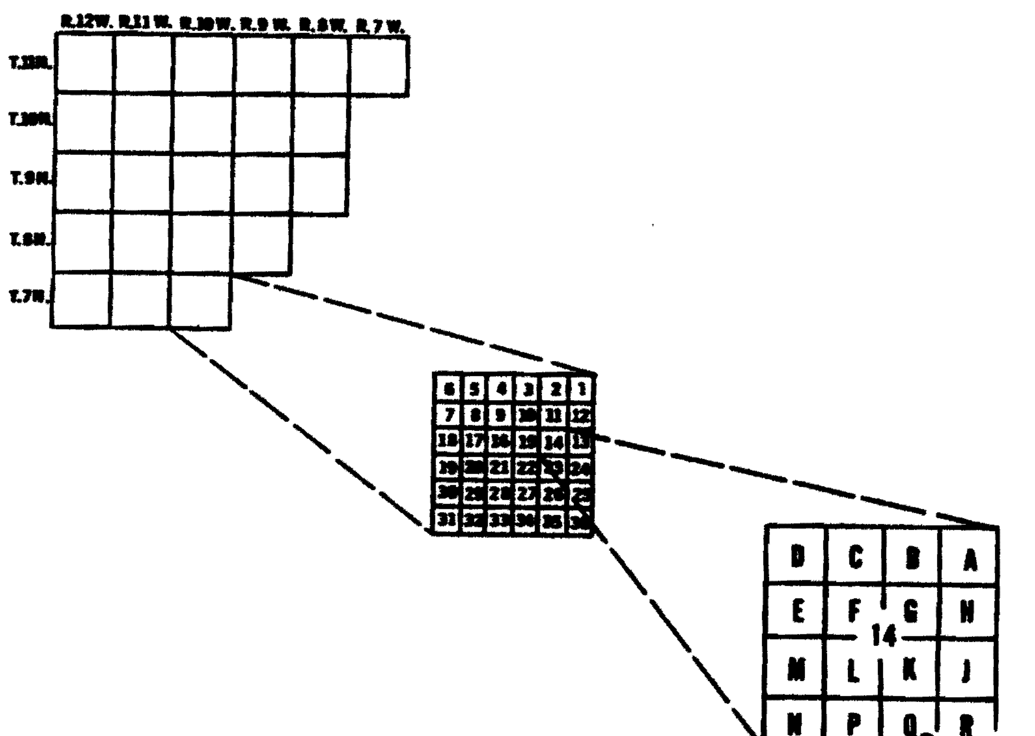
PWS-0125-0006

The work is being done by the U.S. Geological Survey, Water Resources Division, under the general direction of R. Stanley Lord, chief of the California district, and under the immediate supervision of L. C. Dutcher, chief of the Garden Grove subdistrict office.

PWS-0125-0007

WELL-NUMBERING SYSTEM

Wells are numbered according to their location in the rectangular system for subdivision of public land. For example, in the well number 7N/10W-14Q1 that part of the number preceding the slash indicates the township (T. 7 N.); the number and letter following the slash indicates the range (R. 10 W.); the number following the hyphen indicates the section (sec. 14); the letter following the section number indicates the 40-acre subdivision of the section according to the lettered diagram below. The final digit is a serial number for wells in each 40-acre subdivision. The area covered by the report lies in the northwest quadrant of the San Bernardino base line and meridian and in the southeast quadrant of the Mount Diablo base line and meridian.



PWS-0125-0008

DATA COLLECTED DURING 1966-67

Records are available from 10 streamflow and 12 weather gages operated in the AVEK area by the U.S. Geological Survey and the U.S. Weather Bureau (fig. 2). Records are also available from gages operated by the Los Angeles County Flood Control District. Most of the Flood Control District's gages are in the mountain range bordering the AVEK area on the south and southwest. There are probably other precipitation gages in operation in the AVEK area for which records are not readily available. Therefore, in the event of heavy precipitation, the U.S. Geological Survey will canvass the AVEK area for any additional precipitation measurements.

Tabulated streamflow, precipitation, evaporation, and ground-water quality data will be presented initially in the next annual report to the Agency. No streamflow, precipitation, or evaporation data are presented in this report because computations by both the U.S. Geological Survey and the Los Angeles County Flood Control District for calendar year 1966 are not yet processed for publication. Many samples of ground water have been collected and analyzed for chemical quality in 1966-67 in the Edwards Air Force Base area and additional samples will be collected and analyzed during 1967 after an Agency-wide network of chemical-quality observation wells is established.

About 190 ground-water-level measurements were made by the U.S. Geological Survey in spring 1967 in an established network of observation wells in the AVEK area. About 80 additional measurements were made in spring 1967 by the California Department of Water Resour
The data have been analyzed and the results are presented in the following section of this report.

PWS-0125-0010

ANALYSIS OF GROUND-WATER DATA

A spring 1967 water-level-contour map has been prepared for the main aquifer in the AVEK area (figs. 3 and 4). Water-level measurements have also been made in several wells which penetrate only the shallow semiperched water body in Antelope Valley (Bloyd, 1967, fig. 10). However, no attempt was made to construct a water-level-contour map for the semiperched water body.

In the northern part of the Agency area the general movement of ground water is toward the central part of the Koehn subunit (fig. 3). In the Koehn subunit a large depression is centered in the northeast corner of T. 31 S., R. 37 E. and a smaller one is centered in the northern part of T. 30 S., R. 38 E. There are also pumping depressions in the Peerless, North Muroc, and Chaffee subunits. Ground water in the Willow Springs subunit generally moves southeastward toward an alluviated gap in the northeast part of T. 9 N., R. 13 W.

In the southern part of the Agency area, the pattern of ground-water movement is complex (fig. 4). Historically, ground-water generally moved toward Rogers Lake (fig. 2) where the water either continued to flow northward into the North Muroc subunit or discharged into the atmosphere by evapotranspiration.

PWS-0125-0011

In the Lancaster subunit, the largest subunit in the AVEK area, ground water generally moves toward two large pumping depressions. Both of these depressions, one centered in Tps. 7 and 8 N., R. 13 W. and the other centered in T. 7 N., R. 10 W., are in areas of large-scale pumping for irrigated agriculture. There is another smaller pumping depression in T. 9 N., R. 10 W. The broad ground-water mound oriented north-south in the center of the Lancaster subunit indicates that the historical movement of ground water from west to east has now been completely altered.

In the Buttes and Pearland subunits ground water generally moves toward the northwest. Ground water has probably always moved in this direction.

In the Neenach subunit ground water generally moves toward a pumping depression in the eastern part of the subunit.

In the West Antelope subunit ground-water movement is generally toward the south or toward the pumping depression in the western part of the subunit.

PWS-0125-0012

Figures 5 and 6 show contours of depth to ground water and average annual water-level decline for spring 1967 in the main aquifer. These contours are for ground water in the main aquifer and not for ground water in the shallow semiperched water body.

Water-level declines were computed by subtracting the spring 1967 water-level measurement from the most recent high-historical water-level measurement in the same well. The total decline or rise in water level was then divided by the number of years between the two measurements to get an average annual water-level decline figure. Henceforth, actual yearly decline figures should be available for all index wells.

In the northern part of the AVEK area depth to ground water ranges from less than 50 feet in T. 30 S., R. 38 E. to more than 500 feet in the center of the Peerless subunit and in the western part of the California City subunit (fig. 5).

In the central part of the Peerless subunit the water level is declining at a rate greater than 30 feet per year while in the central part of the Koehn subunit the water level is declining at a rate of from 2.5 feet per year to more than 10 feet per year. In parts of the North Muroc and Chaffee subunits water-level decline is between 2.5 and 5 feet per year. Elsewhere in the northern part of the AVEK area, ground-water levels are declining at a rate less than 2.5 feet per year.

PWS-0125-0013

In much of the southern part of the AVEK area water levels are declining at a rate greater than 5 feet per year (fig. 6). In almost every case, maximum water-level decline is occurring in areas where pumping depressions already exist. Therefore, existing pumping depressions will continue to expand.

Areas where depth to ground water is greater than 300 feet and where the water table is also declining at a rate greater than 5 feet per year are shaded in figures 5 and 6. If this trend continues, and economic pumping limits are reeched, parts of the AVEK area will have to be supplied with supplemental water. Also, because geophysical data and geologic well logs suggest shallow bedrock in parts of the shaded areas in T. 7 N., R. 10 W., and in T. 8 N., R. 14 W., there may be only limited water available in these areas. To keep AVEK apprised of the water-level conditions in these shaded areas, many additional water-level measurements will be made in these areas in winter 1967-68

PWS-0125-0014

PROPOSED DIGITAL-COMPUTER PROGRAM

With increased population in the area, AVEK will probably have increasingly complex hydrologic problems to solve. Therefore, plans have been made to computerize the basic water data analysis program to enable the Geological Survey to supply AVEK with a more flexible and productive analysis program. A summary of the proposed digital computer program follows.

Because input data to a computer must be supplied in a form which the computer can use, a grid or nodal network has been established (figs. 3A and 4A). The spacing of the initial grid network and lines is 3' longitude and 3' latitude. However, the grid is designed so it can be expanded in the future by at least 6' latitude and longitude on all sides without changing any original nodal point numbers.

PWS-0125-0015

For each nodal point there is a nodal area, which is the "area of influence" of the nodal point. Thus, a data value inserted into the computer for one nodal point would actually apply to the whole nodal area rather than to just the nodal point. Ideally, for each nodal point there would be an assigned index well and the "area of influence" for the index well and nodal point would be a rectangle, 3' latitude by 3' longitude. However, in some places an index well had to be assigned to more than one nodal point and in other places a nodal point had to be eliminated from consideration because there was no nearby index well. Therefore, nodal areas vary considerably.

During the past year a network of index wells was established, and each of these wells was assigned to specific nodal points. Some of the criteria used in selecting index wells were whether or not:

1. A geologic log was available for the well.

2. The perforated interval of the well casing was known.

3. The well is unused (making it possible to get more meaningful water-level measurements more conveniently).

4. The well was measurable.

Wells measured as part of the proposed digital computer program are shown in figures 3 and 4.

PWS-0125-0016

Input data to the computer will include index-well data such as location of well by latitude and longitude, water-level measurements in the well, and land-surface altitude at the well site. Estimates of coefficients of storage and transmissibility, ground-water pumpage, recharge, and other ground-water inflow and outflow parameters can also be input data. Geologic and hydrologic boundary conditions of the ground-water reservoir in the AVEK area would also be input data. A typical boundary condition would be a fault which acts as a barrier to ground-water movement. The boundaries of the subunits in the AVEK area have already been defined (Bloyd, 1967).

Output data will include the altitude of the water level, the annual change in the altitude of the water level, and the depth to water below land-surface datum in each index well. Other output data can be estimates of the rate of accretion to ground-water storage or coefficients of storage and transmissibility.

The output data from the computerized data analysis program will provide data that will be useful if a hydrologic model of the Lancaster subunit is eventually constructed. The construction of the model of the Lancaster subunit will require a more complex digital computer program and will be described in a later report.

PWS-0125-0017

WORK PLANS FOR 1967-68

Streamflow, precipitation, and evaporation data will continue to be collected by the U.S. Geological Survey. However, no flood-frequency analysis will be possible for about five years.

A network of chemical-quality observation wells will be established and ground-water quality samples will be collected and analyzed during summer 1967.

Ground-water level measurements will be made in the established network of observation wells. Also, an intensive ground-water level measuring program will be conducted in that part of the AVEK area where depth to ground water is greater than 300 feet and where the water table is declining at a rate greater than 5 feet per year (figs. 5 and 6).

Insofar as computer facilities and funds are available, a digital computer program will be implemented.

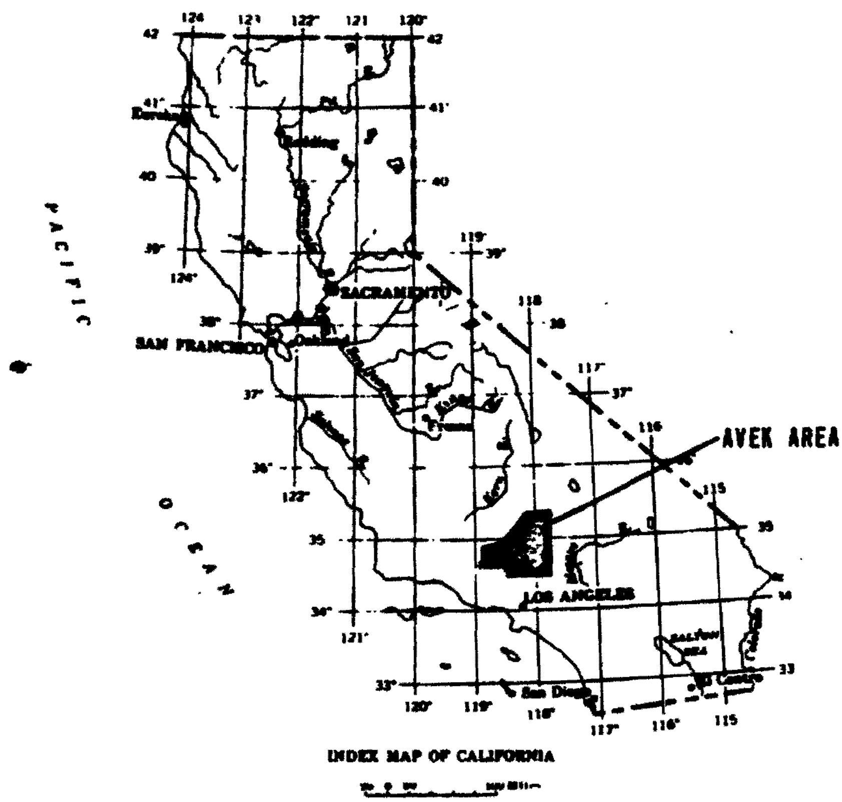
PWS-0125-0018

REFERENCES

Bloyd, R. M., Jr., 1967, Water resources of the Antelope Valley-East Kern Water Agency area, California: U.S. Geol. Survey open-file rept., 135 p.

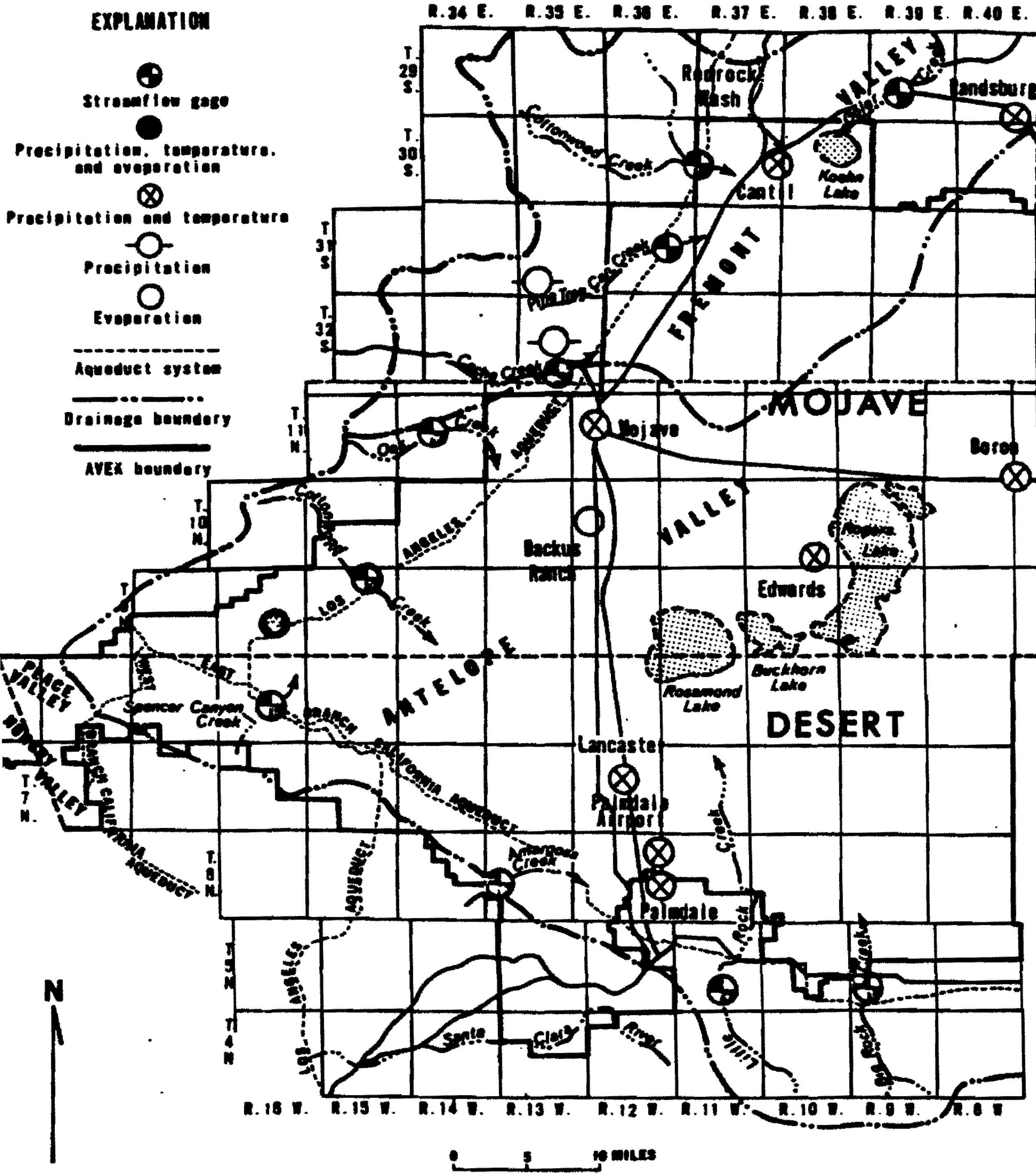
Weir, J. E., Jr., Crippen, J. R., and Dutcher, L. C., 1965, A progress report and proposed test-well drilling program for the water-resources investigation of the Antelope Valley-East Kern Water Agency area, California: U.S. Geol. Survey open-file rept., 121 p.

PWS-0125-0019



INDEX MAP OF CALIFORNIA

SHOWING AREA DESCRIBED IN THIS REPORT



MAP OF THE AVEK AREA SHOWING LOCATION OF STREAMFLOW GAGES AND WEATHER GAGES

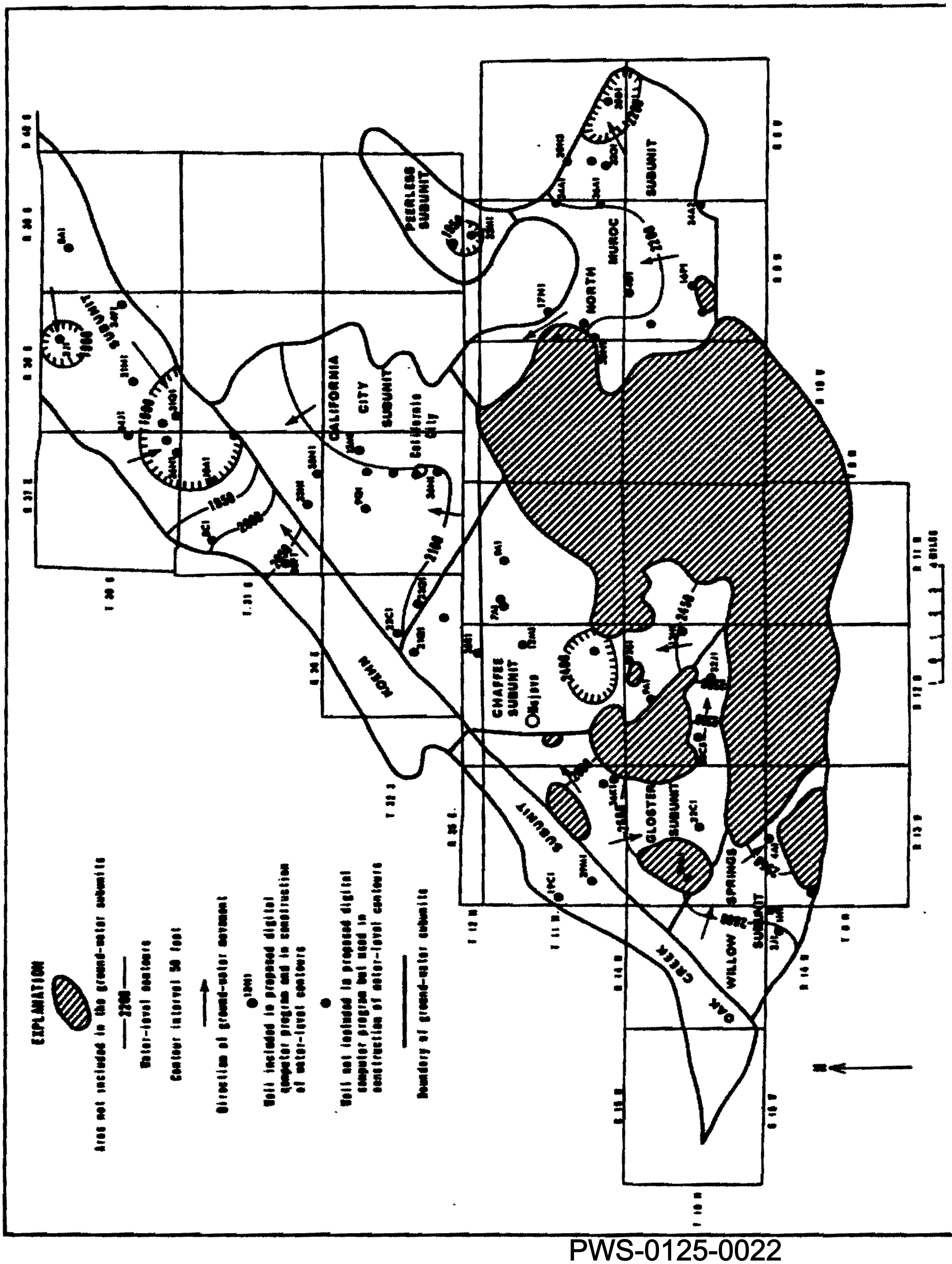
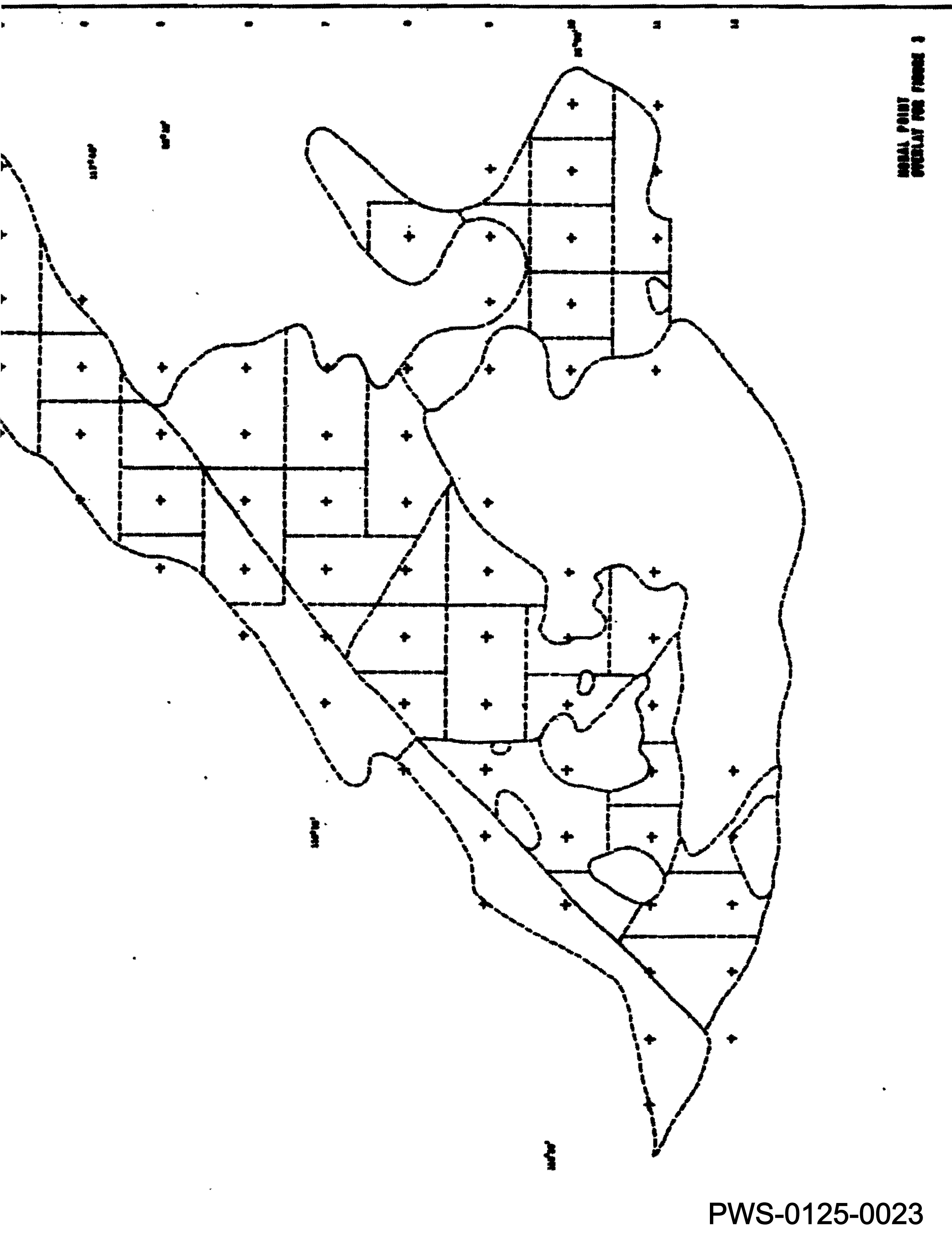
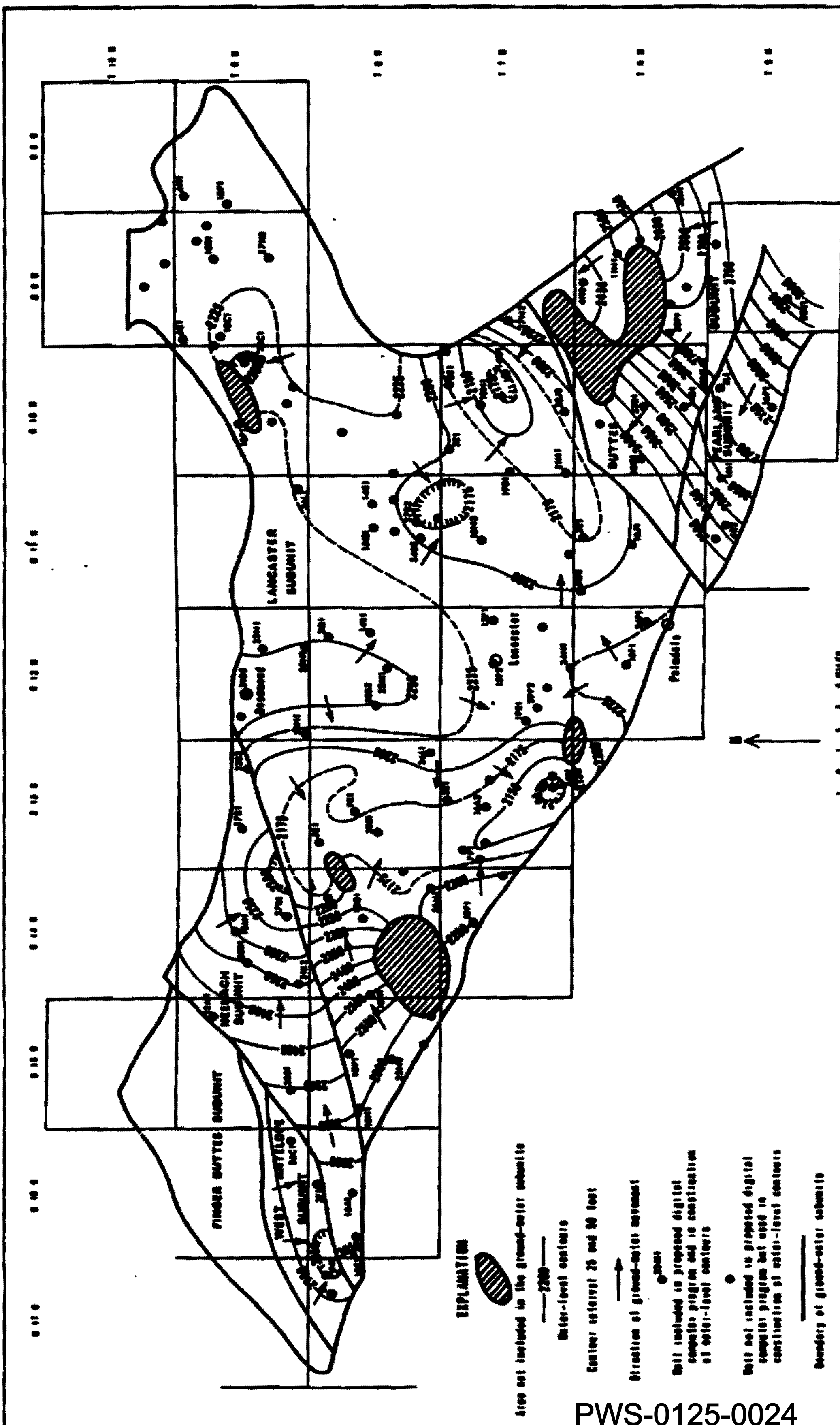

EXPLANATION
Area not included in the ground-water subunits
2200
Water-level contours
Contour interval 50 feet
Direction of ground-water movement
Well included in proposed digital computer program and in construction of water-level contours
Well not included in proposed digital computer program but used in construction of water-level contours
Boundary of ground-water subunits
PEERLESS SUBUNIT
NORTH MUROC SUBUNIT
CALIFORNIA CITY SUBUNIT
California City
CHAFFEE SUBUNIT
Mojave
GLOSTER SUBUNIT
WILLOW SPRINGS SUBUNIT
OAK CREEK SUBUNIT
2100
2450
1950
2000
N

FIGURE 3A

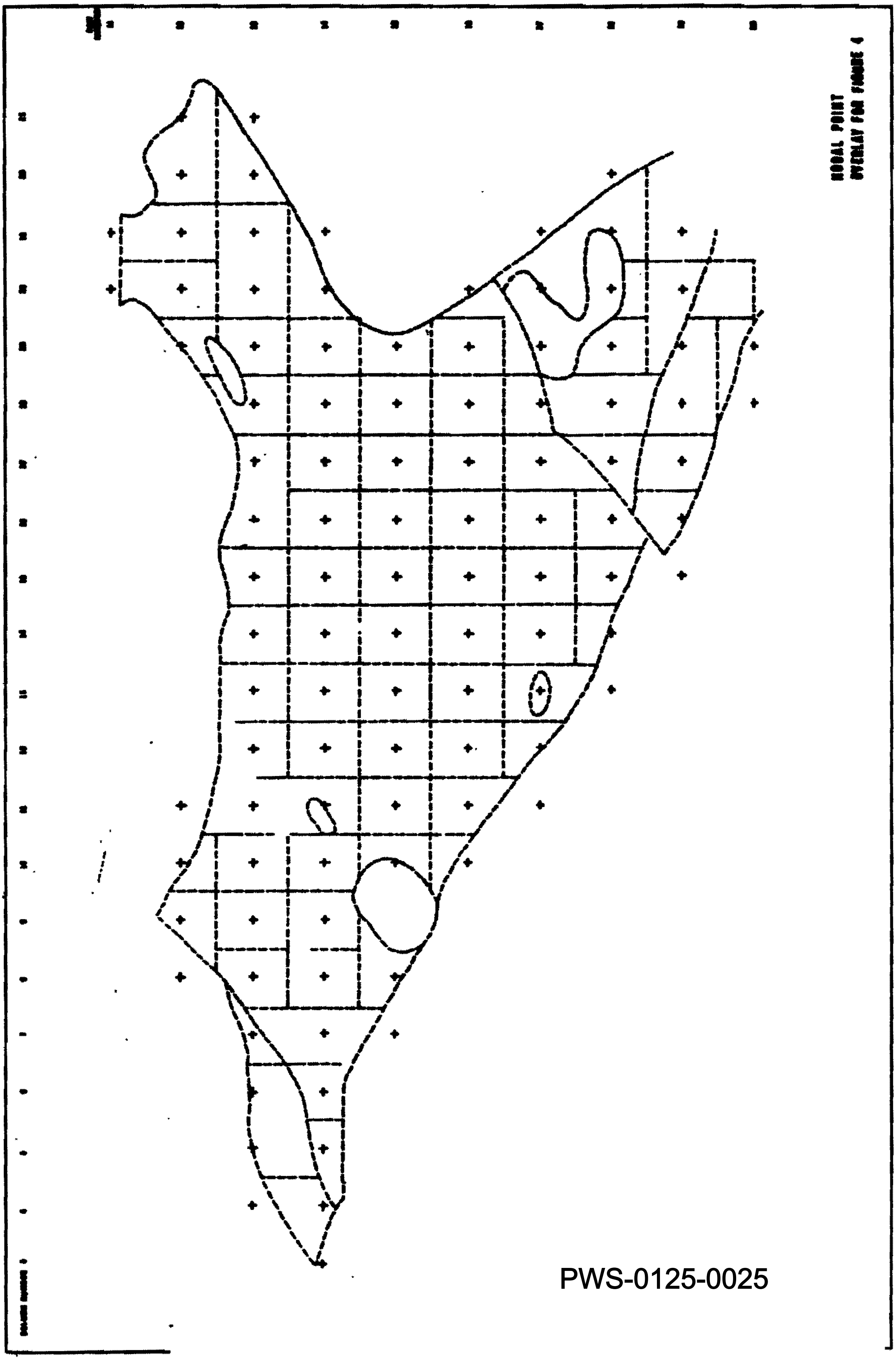


PWS-0125-0023

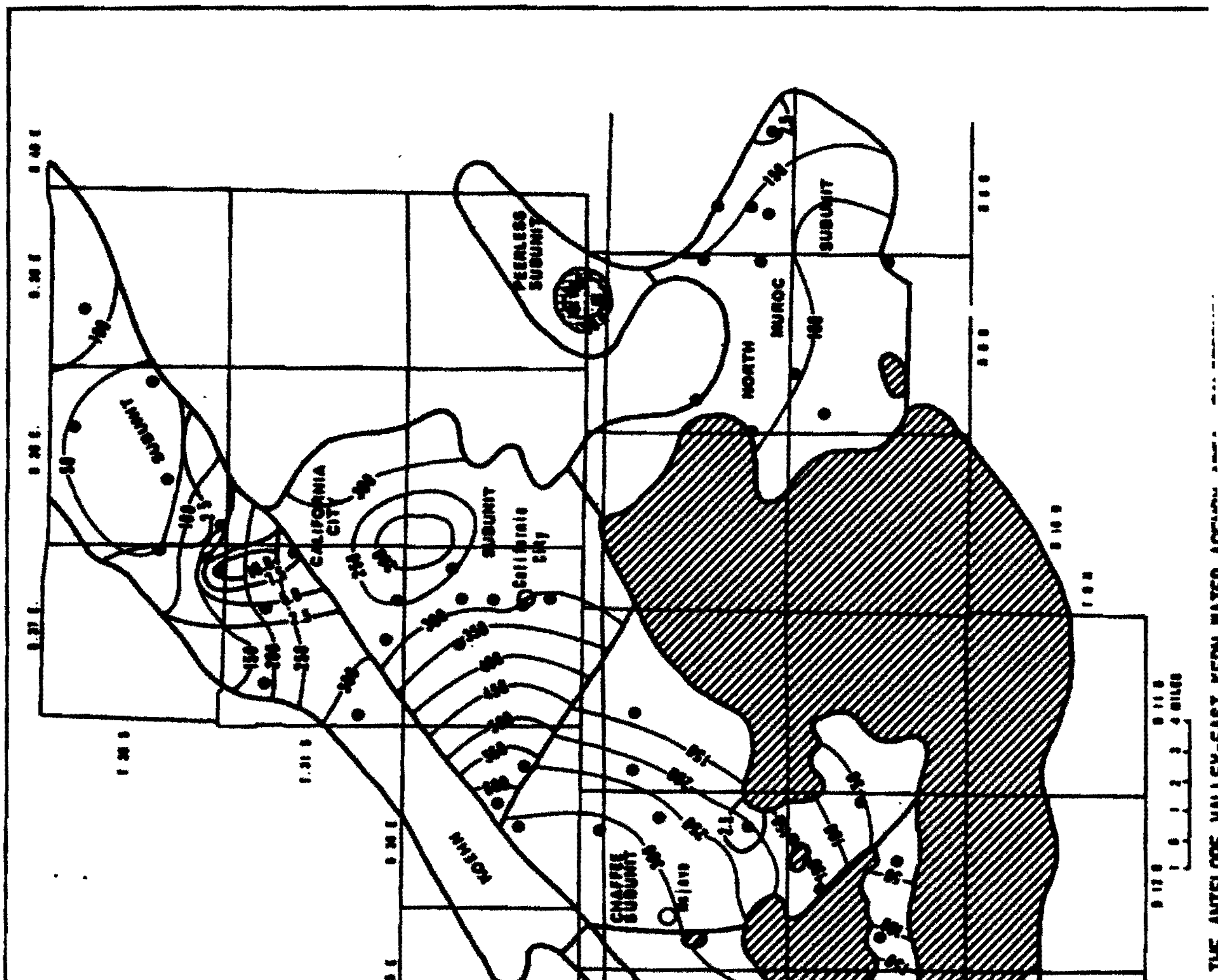


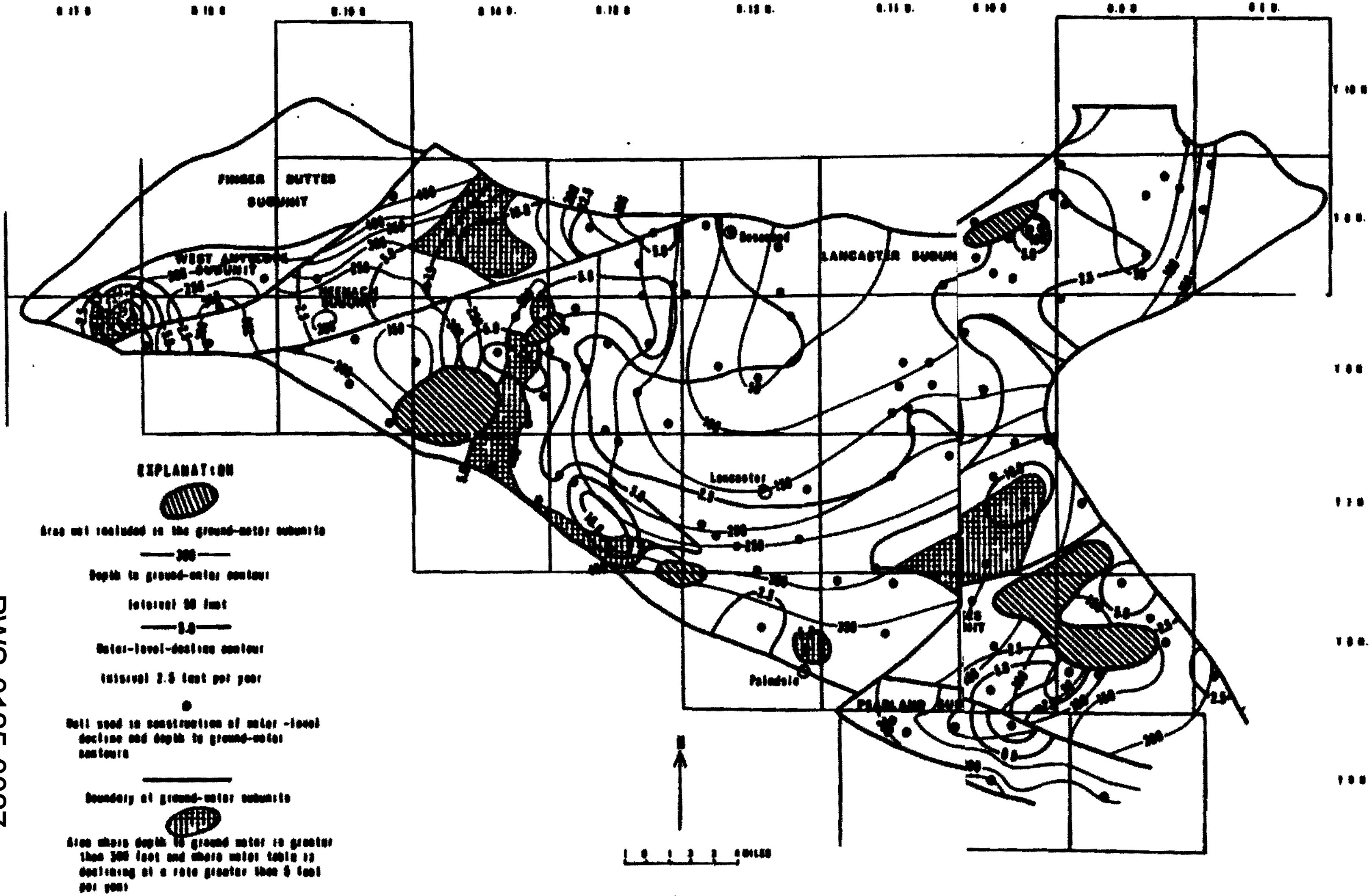
MAP OF THE SOUTHERN PART OF THE ANTELOPE VALLEY-EAST KERN WATER AGENCY AREA, CALIFORNIA

PWS-0125-0024



PWS-0125-0025


EXPLANATION
Area not included in the ground-water subunits
Depth to ground-water contour
Interval 50 feet
Water-level-decline contour
Interval 2.5 feet per year
Well used in construction of water-level decline and depth to ground-water contours
Boundary of ground-water subunits
Area where depth to ground water is greater than 300 feet and where water table is declining at a rate greater than 5 feet per year
PEERLESS SUBUNIT
NORTH MUROC SUBUNIT
CALIFORNIA CITY SUBUNIT
California City
CHAFFEE SUBUNIT
Mojave
GLOSTER SUBUNIT
WILLOW SPRINGS SUBUNIT
OAK CREEK SUBUNIT



MAP OF THE SOUTHERN PART OF THE ANTELOPE VALLEY-EAST KERN WATER AGENCY AREA.IFORNIA
SHOWING DEPTH TO GROUND WATER, SPRING 1967, AND AVERAGE ANNUAL WATER-LEVEL DECL

Base from U.S. Geological Survey and Army Map Service topographic quadrangles

PWS-0125-0027

Antelope Valley