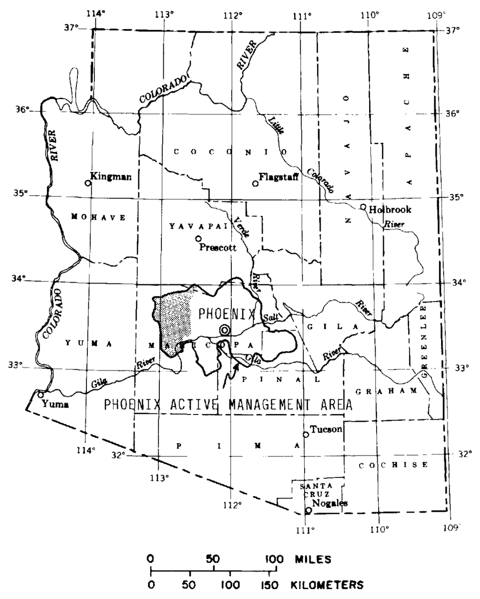


INDEX MAP SHOWING AREA OF REPORT (SHADED)

E X P L A N A T I O N

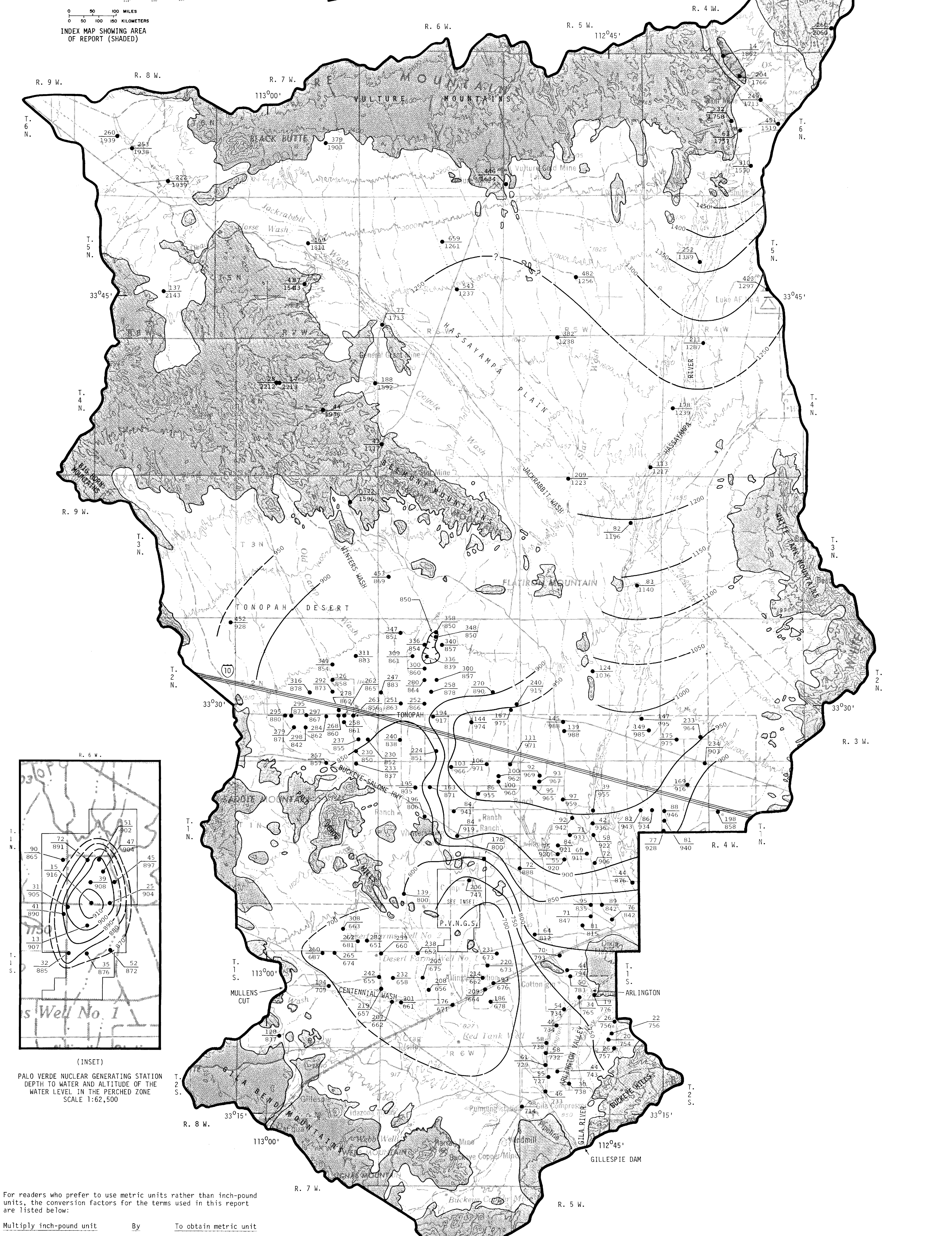
209/1223 ● WELL IN WHICH WATER LEVEL WAS MEASURED IN 1982--First number, 209, is depth to water in feet below land surface. Second number, 1223, is the altitude of the water level in feet above mean sea level

BEDROCK (VOLCANIC, GRANITIC, METAMORPHIC, OR SEDIMENTARY ROCK)--Water may occur in weathered or fractured zones, joint systems, or thin alluvium overlying consolidated rocks

WATER-BEARING UNITS (CLAY, SILT, SAND, GRAVEL, BASALT)

750 — — ? — WATER-LEVEL CONTOUR--Shows altitude of the water level. Dashed where approximate. Queried where uncertain. Contour interval 50 feet on the map and 10 feet on the inset. Datum is mean sea level

PHOENIX ACTIVE MANAGEMENT AREA SUB-BASIN BOUNDARY



(INSET)

PALO VERDE NUCLEAR GENERATING STATION
DEPTH TO WATER AND ALTITUDE OF THE
WATER LEVEL IN THE PERCHED ZONE
SCALE 1:62,500

For readers who prefer to use metric units rather than inch-pound units, the conversion factors for the terms used in this report are listed below:

Multiply inch-pound unit	By	To obtain metric unit
inch	25.4	millimeter
foot	0.3048	meter
mile	1.609	kilometer
square mile	2.590	square kilometer
acre	0.4047	square hectometer
acre-foot	0.001233	cubic hectometer
gallons per minute	0.06309	liters per second

5 0 5 MILES
5 0 5 10 KILOMETERS

CONTOUR INTERVAL 200 FEET
WITH SUPPLEMENTARY CONTOURS AT 100-FOOT INTERVALS
DATUM IS MEAN SEA LEVEL
SCALE 1:125,000

INTRODUCTION

The Hassayampa sub-basin of the Phoenix Active Management Area (AMA), located about 50 miles west of Phoenix, includes approximately 1200 square miles in west-central Arizona. The sub-basin includes the Hassayampa Plain of the Hassayampa area as described by Sanger and Appel (1980), and the lower Hassayampa area as described by Stulik and Laney (1976). The sub-basin is an alluvial plain bounded on the north by the Vulture and Wickenburg Mountains, on the east by the White Tank Mountains, on the south by the Buckeye Hills and Gila Bend Mountains and on the west by the Belmont and Big Horn Mountains and the Palo Verde Hills.

The climate in the Hassayampa sub-basin is arid and average daily maximum air temperatures vary from 67°F in January to 107°F in July. Average daily minimum air temperatures vary from 34°F in January to 74°F in July. Extremes of 14°F in January and 120°F in July and August have been recorded. Precipitation is sparse; the area receives about seven inches of rain in normal years. The peak precipitation period occurs during July and August, and a secondary peak period occurs in February and March (Sellers and Hill, 1974, p. 516).

The Hassayampa sub-basin is drained by the Hassayampa River, Jackrabbit Wash, and Centennial Wash. The Hassayampa River enters the sub-basin from the north and continues about 40 miles south to its confluence with the Gila River east of Arlington. Jackrabbit Wash originates in the area on the west, north of the Belmont Mountains and continues southeast across the Hassayampa Plain to its confluence with the Hassayampa River. Centennial Wash enters the southwest portion of the lower Hassayampa area through Mullens Cut, and continues southeast to the Gila River. All three streams are ephemeral, flowing only after heavy rains.

Because of the ephemeral nature of the streams, the only dependable source of water for most of the sub-basin is groundwater. A small amount of surface water is delivered to the Arlington Valley by the Arlington Canal Company via 22 miles of unlined canal system that runs from near the confluence of the Hassayampa and Gila Rivers south and west to a point immediately north of Gillespie Dam. The surface water delivered to the area is flood water and agricultural irrigation tailwater from the Buckeye area and is used to supplement the groundwater supply in Arlington Valley. The amount of surface water available varies yearly, and delivery records do not exist. However, it is estimated that less than 5400 acre-feet of surface water is delivered yearly (University of Arizona, 1978, p. 149).

In the Hassayampa Plain, groundwater is used primarily for livestock watering and domestic supply. In 1982 no land was irrigated in this area, and total pumpage was estimated to be less than 500 acre-feet.

In the lower Hassayampa area nearly all of the groundwater pumped is used to irrigate crops. Extensive agricultural development in the lower Hassayampa area began in the early 1950's. By 1960 about 24,000 acres of land was under cultivation, and groundwater was the primary source of irrigation water (Stulik, 1974, p. 9). In 1982 about 22,500 acres of land was cultivated. Groundwater pumpage estimates for the lower Hassayampa area are not available prior to 1973. Pumpage estimates for the years 1973 through 1981 are included in the table on Sheet 2.

GROUNDWATER OCCURRENCE

Hassayampa Plain

Groundwater in the Hassayampa Plain occurs predominantly in the basin-fill sediments, locally in thin alluvium in stream channels that drain the mountains surrounding the area, and in the fractured and weathered volcanic, granitic, metamorphic and sedimentary rocks that comprise the mountains. The main water-bearing unit in the area consists of the basin-fill sediments. These deposits are comprised of gravel, sand, silt, and clay (Sanger and Appel, 1980), and range from a few tens of feet thick near the mountains to more than 800 feet thick near the center of the Hassayampa Plain. Groundwater in the basin-fill sediments occurs under unconfined, or water-table conditions. In the spring of 1982, the depth to water in the basin-fill sediments ranged from 77 feet below land surface near Jackrabbit Wash in the northwestern part of the plain to 659 feet below land surface in the north-central part. The sediments will yield a few tens to several hundreds of gallons per minute of water to properly constructed wells (Sanger and Appel, 1980).

Lower Hassayampa Area

In the lower Hassayampa area groundwater occurs regionally in the basin-fill sediments and locally in thin alluvium in stream channels that drain the mountains surrounding the area, and in fractured volcanic, granitic, metamorphic and sedimentary rocks that comprise the mountains. The basin-fill sediments which locally include the volcanic bedrock sequence, contain most of the recoverable groundwater in the lower Hassayampa area. Regional aquifer conditions in the basin-fill sediments are predominantly unconfined, or water table. Locally, groundwater occurs under confined, or artesian conditions, or is perched. Unconfined conditions predominate in the Tonopah Desert, along the Hassayampa River, along the Arlington Valley, and possibly, in parts of the area along Centennial Wash. Groundwater occurs under both confined and perched conditions in the area around the Palo Verde Nuclear Generating Station (PVNGS) site.

The basin-fill sediments in the lower Hassayampa area are divided into three major units and include the upper, middle, and lower alluvium (U.S. Bureau of Reclamation, 1976, v. 1, p. 60-62). The upper alluvium is unsaturated in most of the area; it contains groundwater only in the areas along the Hassayampa and Gila Rivers and in the perched aquifer at the PVNGS site. The middle and lower alluvium, and locally the volcanic and sedimentary bedrock, are the main water-bearing units that comprise the regional aquifer. The geology and hydrology of the lower Hassayampa area were further defined during siting studies for the PVNGS (Fugro, 1980, p. 6-22). Fugro's studies indicate that the upper alluvium is 30 to 60 feet thick and consists of silty sands and gravelly sands with discontinuous lenses of clay and silty clay. The middle alluvium is 230 to 300 feet thick and is predominantly clay and silty clay interbedded with discontinuous lenses of clayey silt, clayey sand and silty sand. Locally, the middle alluvium includes the Palo Verde clay, which is described by Fugro (1980, p. 10) as a massive clay layer that varies from 80 to 136 feet thick. The Palo Verde clay is significant hydrologically because it acts as the confining unit to the regional aquifer in the area of the Palo Verde Hills. Fugro's studies of the PVNGS site indicate that the Palo Verde clay is present south of the Buckeye-Salome Highway, from Winters Wash east to Arlington. Although the Palo Verde clay has been traced to the southern boundary of the PVNGS site - approximately the southern boundary of Section 3, Township 1 South, Range 6 West - the southern extent of the Palo Verde clay in the area along Centennial Wash has not been determined. Drillers logs from the area along Centennial Wash indicate that significant clay deposits are present. Thus, the Palo Verde clay may extend into parts of the area along Centennial Wash; and although groundwater under confined aquifer conditions has not been reported, it may be present.

The middle alluvium also acts as a perching layer at the PVNGS site, where a perched aquifer was identified during Fugro's studies (1980, p. 20). The perched aquifer exists locally in the upper alluvium and the upper part of the middle alluvium. Its areal extent generally corresponds with the extent of a previously irrigated area in Section 34, Township 1 North, Range 6 West and Section 3 of Township 1 South, Range 6 West. In 1982 depth to water in the perched aquifer ranged from about 13 feet below land surface to 90 feet below land surface (see inset). The perched aquifer probably was formed when excess irrigation water percolated through the highly permeable upper alluvium to the upper part of the middle alluvium. The middle alluvium is much less permeable than the upper alluvium and impedes downward movement of the irrigation water. The maximum saturated thickness of the perched aquifer was about 25 to 30 feet in 1976 (Fugro, 1980, p. 26). Irrigation ceased at the PVNGS site in September 1975 and since then the water levels in the perched aquifer have been declining. The declines are a result of dewatering for the PVNGS construction (Fugro, 1980, p. 27), and leakage into the middle alluvium.

The lower alluvium consists of less than 100 to more than 1,000 feet of unconsolidated silty sand, sand and gravelly sand, and locally, moderately to well consolidated alluvial fan deposits (Fugro, 1980, p. 17). Most of the large diameter highly productive wells in the area are completed in the lower alluvium or in the underlying volcanic and sedimentary deposits.

Bedrock in the lower Hassayampa area consists of granitic and metamorphic rocks (basement complex), and locally consists of interbedded volcanic and sedimentary deposits that unconformably overlie the basement complex. The volcanic and sedimentary deposits are water bearing, and consist of complex interbedded sequences of fractured basalt, tuffs, tuffaceous sandstones, and coarse-grained sandstone (Fugro, 1980, p. 17) and are considered part of the regional aquifer. These deposits have been recognized at the PVNGS site and the area along Centennial Wash. The maximum known thickness of these deposits exceeds 1,400 feet at the PVNGS site. Several wells in the area around the PVNGS site completed in these deposits produce more than 1,000 gallons per minute of water. The granitic and metamorphic basement is generally non-water bearing.

In the spring of 1982, depth to water in the regional aquifer system in the lower Hassayampa area ranged from 19 feet below land surface near Arlington to 453 feet below land surface north of Tonopah. The total thickness of the basin-fill sediments and volcanic bedrock that comprise the regional aquifer system in the area ranges from a few feet near the mountains to more than 1,200 feet in the central part of the Tonopah Desert and Centennial Wash. The sediments yield a few tens to more than 2,000 gallons per minute of water to properly constructed wells.

BASE FROM U.S. GEOLOGICAL SURVEY
PHOENIX, AZ., 1954, REV. 1969, 1:250,000
PRESCOTT, AZ., 1954, REV. 1970, 1:250,000

DEPTH TO WATER AND ALTITUDE OF THE WATER LEVEL, 1982

These hydrologic maps are available upon request from the Department of Water Resources, Basic Data Unit, 2810 South 24th Street, Suite 122, Phoenix, Arizona, 85034. The hydrologic data on which these maps are based are available, for the most part, in computer-printout form and may be consulted at the Department of Water Resources and at the U.S. Geological Survey offices located at: Federal Building, 301 West Congress Street, Tucson, and Valley Center, 241 North Central Avenue, Suite 1880, Phoenix, Arizona.

MAPS SHOWING GROUNDWATER CONDITIONS IN THE HASSAYAMPA SUB-BASIN OF THE PHOENIX ACTIVE MANAGEMENT AREA, MARICOPA AND YAVAPAI COUNTIES, ARIZONA--1982

BY

M. R. LONG

EXPLANATION

+1 ● WELL IN WHICH WATER LEVEL WAS MEASURED IN 1978 AND 1982--Number, is the difference in feet between the 1978 and 1982 measurements

-5 ● WELL IN WHICH WATER LEVEL WAS MEASURED IN 1970 AND 1982--Number, -5, is the difference in feet between the 1970 and 1982 measurements

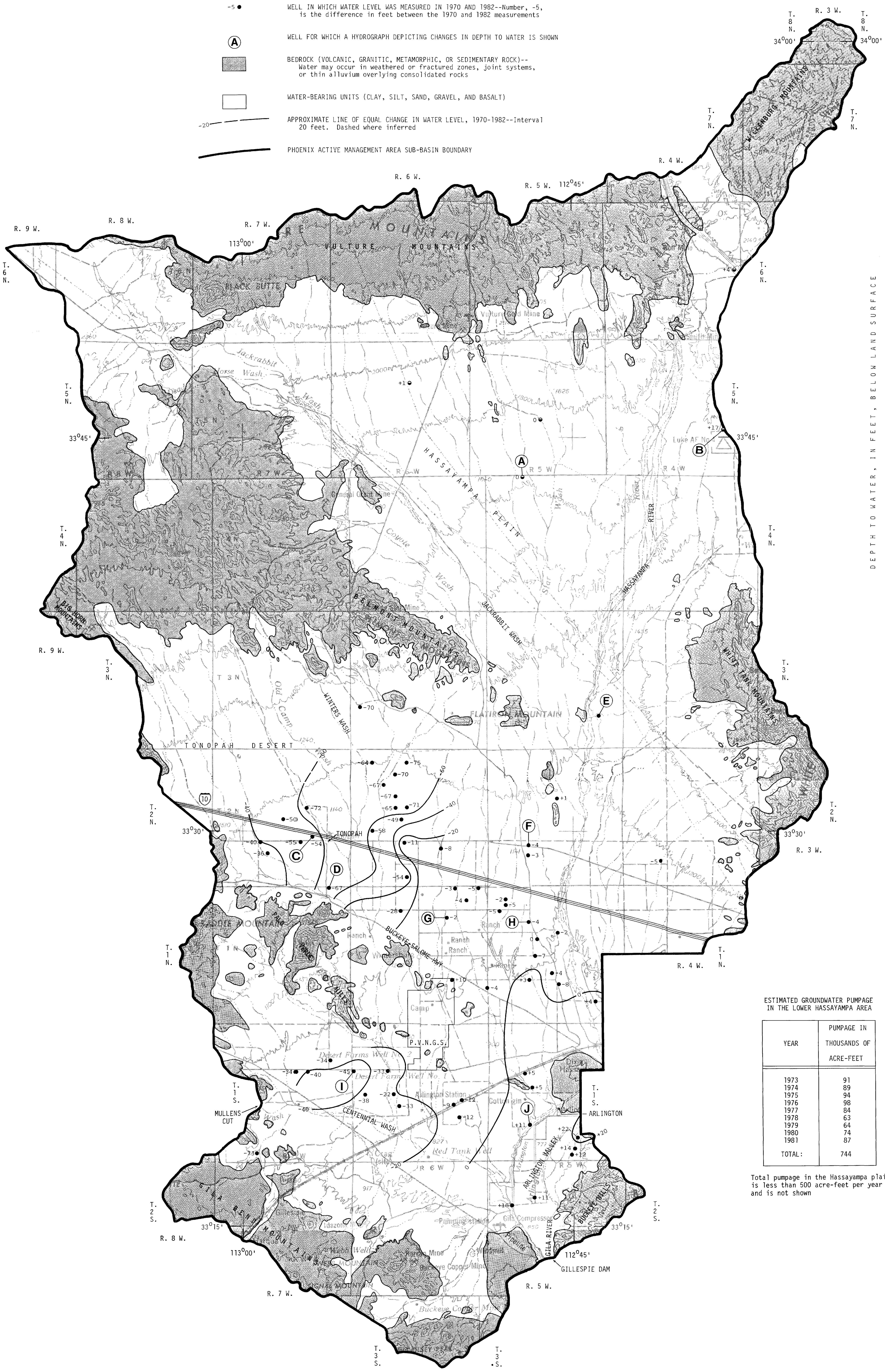
(A) WELL FOR WHICH A HYDROGRAPH DEPICTING CHANGES IN DEPTH TO WATER IS SHOWN

BEDROCK (VOLCANIC, GRANITIC, METAMORPHIC, OR SEDIMENTARY ROCK)--Water may occur in weathered or fractured zones, joint systems, or thin alluvium overlying consolidated rocks

WATER-BEARING UNITS (CLAY, SILT, SAND, GRAVEL, AND BASALT)

-20 APPROXIMATE LINE OF EQUAL CHANGE IN WATER LEVEL, 1970-1982--Interval 20 feet. Dashed where inferred

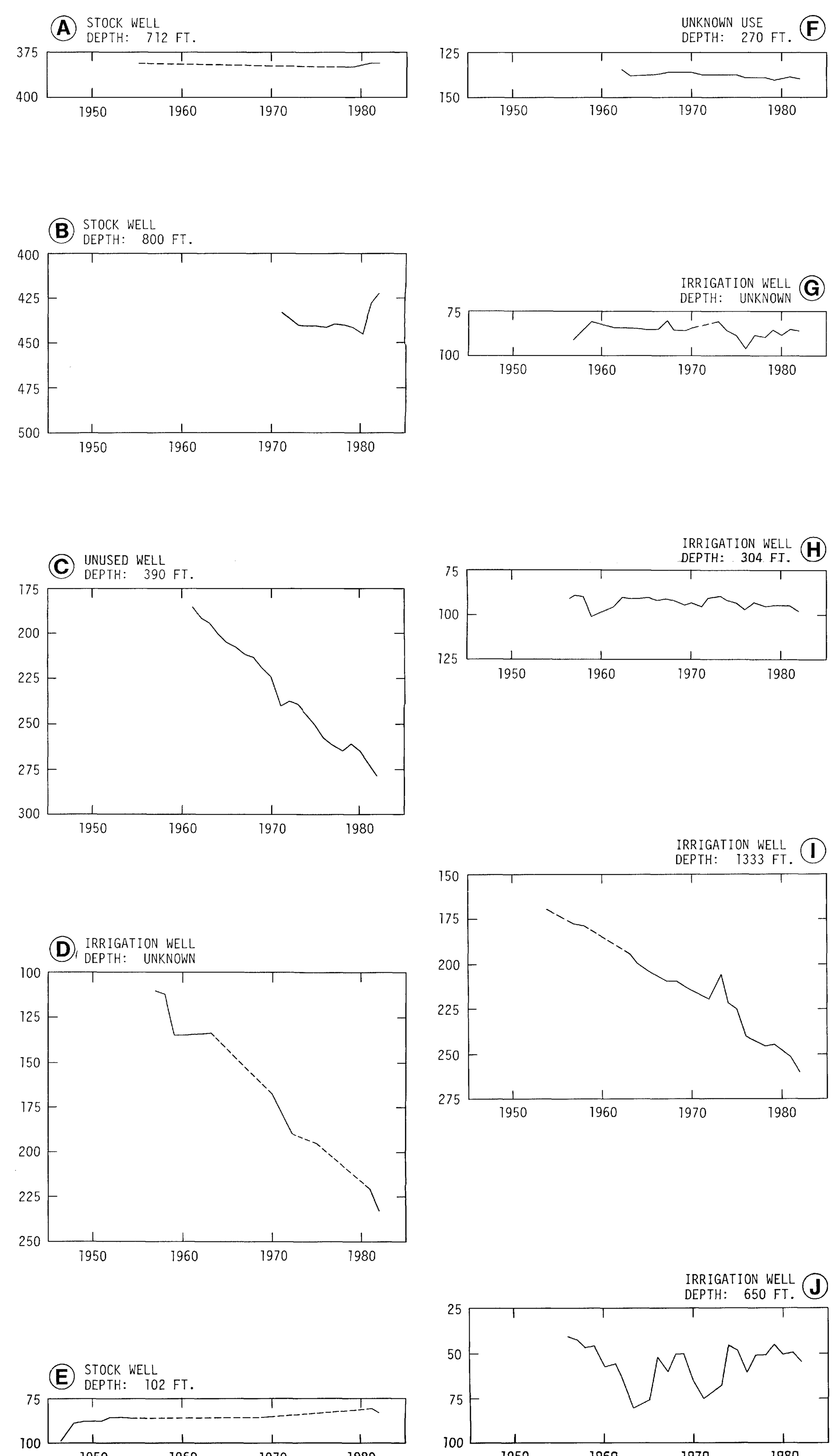
PHOENIX ACTIVE MANAGEMENT AREA SUB-BASIN BOUNDARY



5 0 5 MILES
5 0 5 10 KILOMETERS

CONTOUR INTERVAL 200 FEET
WITH SUPPLEMENTARY CONTOURS AT 100-FOOT INTERVALS
DATUM IS MEAN SEA LEVEL
SCALE 1:125,000

HYDROGRAPHS OF THE WATER LEVEL IN SELECTED WELLS SHOWN ON THE MAP
(Dashed line indicates inferred water level.)



ESTIMATED GROUNDWATER PUMPAGE IN THE LOWER HASSAYAMPA AREA

YEAR	PUMPAGE IN THOUSANDS OF ACRE-FEET
1973	91
1974	89
1975	94
1976	98
1977	84
1978	63
1979	64
1980	74
1981	87
TOTAL:	744

Total pumpage in the Hassayampa plain is less than 500 acre-feet per year and is not shown

CHANGE IN WATER LEVEL

Hassayampa Plain

Water-level changes in the Hassayampa Plain between 1978 and 1982 vary from no change in the central portion of the plain to 17 feet of rise east of the Hassayampa River in Section 24, Township 5 North, Range 4 West. Water-level data prior to 1978 are sparse; available data indicate water levels have changed little since the mid-1950's (see Hydrograph A), probably because groundwater use has not changed significantly since that time.

The water-level rise in the eastern part of the area that has occurred since 1980 (see Hydrograph B) is not fully understood. It is probable that the water-level rise can be attributed to reduced pumpage in the nearby Salt River Valley during the 1978 thru 1980 period, and recharge from the Hassayampa River.

Lower Hassayampa Area

The water-level changes depicted on the map for the lower Hassayampa area are differences between 1970 and 1982 water-level data. The water-level changes in the basin-fill sediments recorded for that period range from 75 feet of decline in the Tonopah Desert to 22 feet of rise in the Arlington Valley. Water-level declines have occurred in the Tonopah Desert since the late 1950's and early 1960's (see Hydrographs C and D). The decline in this area is associated with a large cone of depression in the west half of Township 2 North, Range 6 West and Township 2 North, Range 7 West (see Sheet 1). Water levels in the area near the Hassayampa River and in the east half of Township 2 North, Range 6 West, have changed very little by comparison (see Hydrographs E, F, G and H). The reason that water levels have not changed in this area is that this part of the area has not been developed for agriculture, and groundwater use has been limited.

Significant water-level declines have also occurred in the area along Centennial Wash. In Township 1 South, Range 6 West and Township 1 South, Range 7 West water levels have declined as much as 45 feet since 1970, and as much as 90 feet since the early 1950's (see Hydrograph I). This area is highly developed for agriculture, and water for irrigation is supplied solely from groundwater pumpage.

The PVNGS site was previously an agricultural area and water-level declines of as much as 17 feet were reported between 1970 and 1975 (Stulik and Laney, 1975). However, since construction of the PVNGS began in 1976, much of the area has not been irrigated and most of the agricultural pumpage has ceased. The reduction in pumpage has resulted in water-level rises of about 20 feet in the three years between 1976 and 1979 (Fugro, 1980, p. 24), and the water level in a well in Section 34, Township 1 North, Range 6 West rose about 30 feet between 1976 and 1980 (Fugro, 1980, Appendix A, Fig. 8).

Water-level rises also have been recorded in the Arlington Valley. Although the Arlington Valley is an agricultural area, water levels historically have not declined significantly because of the availability of imported surface water, recharge from the Gila River during flow events, and underflow of the Gila River from the west Salt River Valley. Water levels in wells in this area respond quickly to flow events in the Gila River. During the years 1978 through 1980 several major flow events occurred in the Gila River and water-levels rose accordingly (see Hydrograph J).

BASE FROM U.S. GEOLOGICAL SURVEY
PHOENIX, AZ., 1954, REV. 1969, 1:250,000
PRESCOTT, AZ., 1954, REV. 1970, 1:250,000

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CHANGE IN WATER LEVEL AND HYDROGRAPHS OF SELECTED WELLS

MAPS SHOWING GROUNDWATER CONDITIONS IN THE HASSAYAMPA SUB-BASIN OF THE PHOENIX ACTIVE MANAGEMENT AREA, MARICOPA AND YAVAPAI COUNTIES, ARIZONA--1982

BY

M. R. LONG

EXPLANATION

470/4.0 ● WELL FOR WHICH A WATER SAMPLE WAS COLLECTED IN 1981-82--First number, 470, is specific conductance in micromhos per centimeter at 25°C (specific conductance is an indication of the dissolved-solids concentration in water). Asterisk after number indicates water sample collected in year other than 1981-82. Second number, 4.0, is the fluoride concentration in milligrams per liter

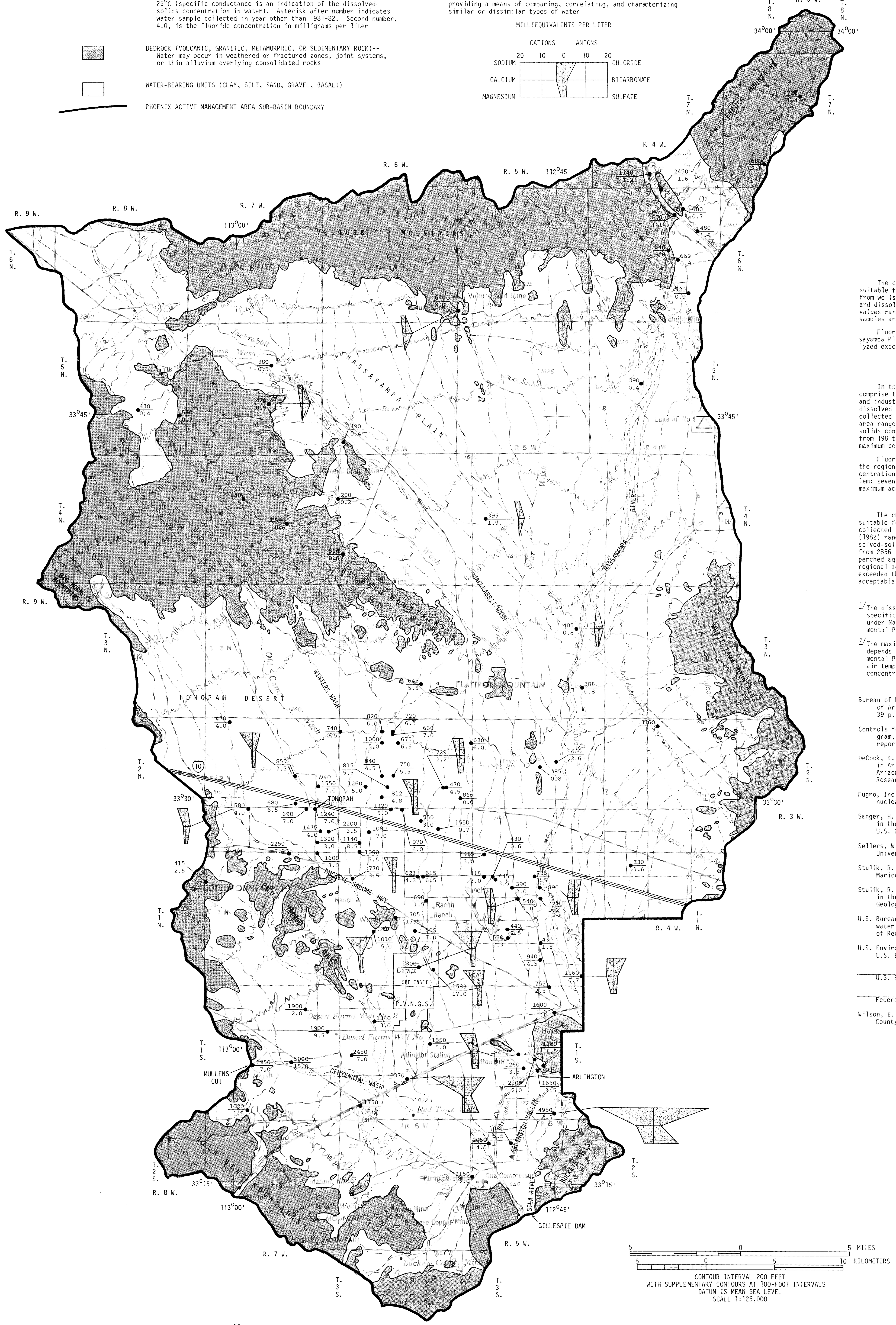
BEDROCK (VOLCANIC, GRANITIC, METAMORPHIC, OR SEDIMENTARY ROCK)--Water may occur in weathered or fractured zones, joint systems, or thin alluvium overlying consolidated rocks

WATER-BEARING UNITS (CLAY, SILT, SAND, GRAVEL, BASALT)

PHOENIX ACTIVE MANAGEMENT AREA SUB-BASIN BOUNDARY

CHEMICAL QUALITY DIAGRAM--Shows major constituents in milliequivalents per liter. The diagrams are in a variety of shapes and sizes, providing a means of comparing, correlating, and characterizing similar or dissimilar types of water

MILLIEQUIVALENTS PER LITER
CATIONS
ANIONS
20 10 0 10 20
SODIUM
CALCIUM
MAGNESIUM
CHLORIDE
BICARBONATE
SULFATE

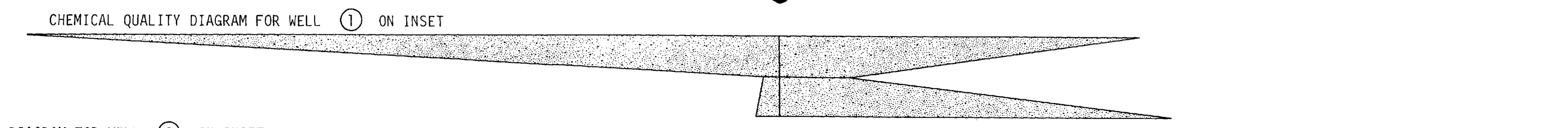


5 0 5 MILES

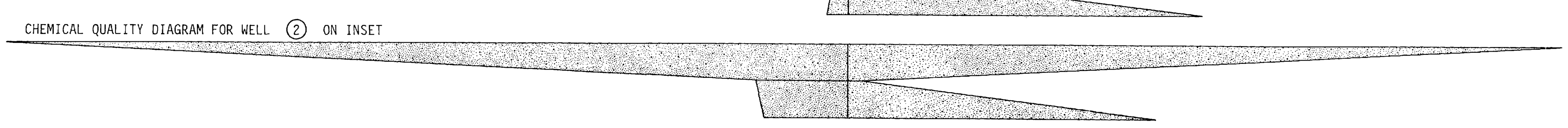
5 0 5 10 KILOMETERS

CONTOUR INTERVAL 200 FEET
WITH SUPPLEMENTARY CONTOURS AT 100-FOOT INTERVALS
DATUM IS MEAN SEA LEVEL
SCALE 1:125,000

CHEMICAL QUALITY DIAGRAM FOR WELL ① ON INSET



CHEMICAL QUALITY DIAGRAM FOR WELL ② ON INSET



GROUNDWATER QUALITY

Hassayampa Plain

The chemical quality of groundwater in the Hassayampa Plain is generally suitable for most uses. Specific conductance values for water samples collected from wells in the area range from 200 to 2450 micromhos per centimeter at 25°C, and dissolved-solids concentrations estimated from the specific conductance values ranged from 120 to 1470 milligrams per liter (mg/L). Two of the 22 samples analyzed exceeded the maximum contaminant level for dissolved solids[1/].

Fluoride concentrations in the groundwater samples collected in the Hassayampa Plain area ranged from 0.2 to 3.0 mg/L. Seven of the 22 samples analyzed exceeded the maximum acceptable fluoride concentration of 1.4 mg/L[2/].

Lower Hassayampa Area

Regional Aquifer System

In the lower Hassayampa area, groundwater in the basin-fill sediments that comprise the regional aquifer system is generally suitable for most agricultural and industrial uses. Domestic users should be aware of high concentrations of dissolved solids and fluoride. Specific conductance values of water samples collected from wells in the regional aquifer system in the lower Hassayampa area ranged from 330 to 5000 micromhos per centimeter at 25°C, and dissolved-solids concentrations estimated from the specific conductance values range from 198 to 3000 mg/L. Forty-three of the 85 samples analyzed exceeded the maximum contaminant level for dissolved solids.

Fluoride concentrations in the groundwater samples collected from wells in the regional aquifer system ranged from 0.6 to 17.5 mg/L. High fluoride concentrations in groundwater in the lower Hassayampa area are a widespread problem; seventy-two of the 85 samples of the groundwater collected exceeded the maximum acceptable fluoride concentration of 1.4 mg/L.

Perched Aquifer

The chemical quality of the perched groundwater at the PVNGS site is unsuitable for most uses. The specific conductance values of water samples collected from the perched aquifer by Controls for Environmental Pollution (1982) range from 4,760 to 31,650 micromhos per centimeter at 25°C, and dissolved-solids concentrations estimated from specific conductance values ranged from 2856 to 18,990 mg/L. Fluoride concentrations in the groundwater from the perched aquifer are similar to the concentrations in the groundwater from the regional aquifer and ranged from 3.4 to 23 mg/L. All of the samples taken exceeded the maximum contaminant level for dissolved solids and the maximum acceptable fluoride concentration.

NOTES

1/ The dissolved-solids concentration may be approximated by multiplying the specific conductance value by 0.6. The maximum contaminant level allowable under National Secondary Drinking Water regulations is 500 mg/L (U.S. Environmental Protection Agency, 1977b, p. 17146).

2/ The maximum acceptable concentration of fluoride in public water supplies depends on the annual average of maximum daily air temperatures (U.S. Environmental Protection Agency, 1977a, p. 67). The annual average maximum daily air temperature in this area is about 86°F and the maximum acceptable fluoride concentration is 1.4 mg/L.

SELECTED REFERENCES

Bureau of Water Quality Control, 1978, Drinking water regulations for the State of Arizona: Arizona Department of Health Services duplicated report, 39 p.

Controls for Environmental Pollution, Inc., 1982, Environmental control program, perched groundwater and regional groundwater analyses summary report 1976 thru 1981: unpublished report, 238 p.

DeCook, K. J., Emel, J. L., and Mack, S. F., 1980, Water service organizations in Arizona--a report to the Arizona Water Commission and the Central Arizona Water Conservation District (revised): Tucson, Water Resources Research Center unpublished report, 201 p.

Fugro, Inc., 1980, Operational ground-water monitoring program--Palo Verde nuclear generating station: unpublished report, 57 p.

Sanger, H. W., and Appel, C. L., 1980, Maps showing ground-water conditions in the Hassayampa Area, Maricopa and Yavapai counties, Arizona-1978: U.S. Geological Survey Open-File Report 80-584, maps.

Sellers, W. D., and Hill, R. H., eds., 1974, Arizona climate 1931-1972: Tucson, University of Arizona Press, 616 p.

Stulik, R. S., 1974, Ground-water conditions in the lower Hassayampa area, Maricopa County, Arizona: Arizona Water Commission Bulletin 8, 51 p.

Stulik, R. S., and Laney, R. L., 1976, Maps showing ground-water conditions in the lower Hassayampa area, Maricopa County, Arizona-1975: U.S. Geological Survey Water-Resources Investigations 76-35, maps.

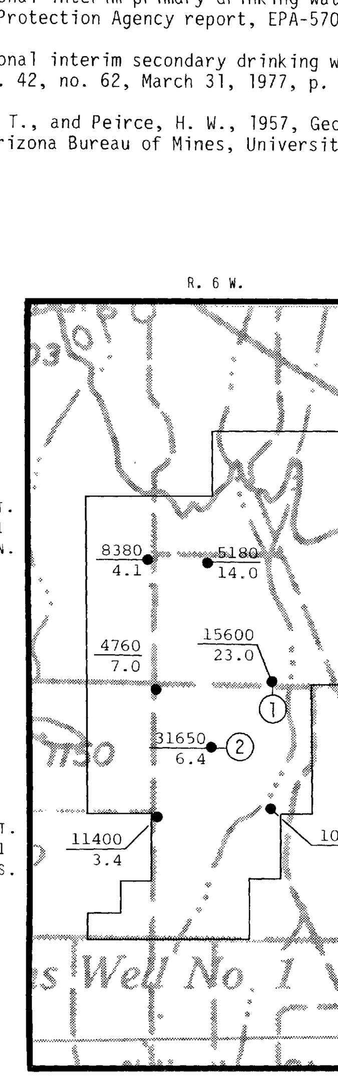
U.S. Bureau of Reclamation, 1976, Central Arizona Project-Geology and groundwater resources report, Maricopa and Pinal Counties, Arizona: U.S. Bureau of Reclamation duplicated report, v. 1, 115 p., 73 figs; v. 2, 110 figs.

U.S. Environmental Protection Agency, 1976 [1978], Quality criteria for water: U.S. Environmental Protection Agency publication, 256 p.

______ 1977a, National interim primary drinking water regulations: U.S. Environmental Protection Agency report, EPA-570/9-76-003, 159 p.

______ 1977b, National interim secondary drinking water regulations: Federal Register, v. 42, no. 62, March 31, 1977, p. 17143-17147.

Wilson, E. D., Moore, R. T., and Peirce, H. W., 1957, Geologic map of Maricopa County, Arizona: Arizona Bureau of Mines, University of Arizona.



(INSET)

PALO VERDE NUCLEAR GENERATING STATION
CHEMICAL QUALITY OF WATER
IN THE PERCHED AQUIFER
SCALE 1:62,500

BASE FROM U.S. GEOLOGICAL SURVEY
PHOENIX, AZ., 1954, REV. 1969, 1:250,000
PRESCOTT, AZ., 1954, REV. 1970, 1:250,000

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CHEMICAL QUALITY OF WATER

MAPS SHOWING GROUNDWATER CONDITIONS IN THE HASSAYAMPA SUB-BASIN OF THE PHOENIX ACTIVE MANAGEMENT AREA, MARICOPA AND YAVAPAI COUNTIES, ARIZONA--1981-82

BY

M. R. LONG