DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

PREPARED IN COOPERATION WITH THE
ARIZONA WATER COMMISSION

WATER-RESOURCES INVESTIGATIONS
OPEN-FILE REPORT 80-726
SHEET 2 OF 2

SPECIFIC CONDUCTANCE AND ARSENIC AND FLUORIDE CONCENTRATIONS

Maximum and minimum concentrations of selected chemical constituents in ground water in the upper Verde River area

[Analytical results in milligrams per liter except as indicated. Some of the values in the table are not included on the map; complete chemical analyses are available in the files of the U.S. Geological Survey]

Value	Alluvium	Basalt	Verde Formation	Coconino Sandstone	Supai Formation	Redwall Limestone	Martin Formation	Igneous rocks
Dissolved solids								
Maximum	3,790	3,180	90,300	316	411	503	1,480	669
Minimum	134	111	211	143	152	180	207	325
Sulfate								
Maximum	1,900	590	59,800	5.4	81	100	37	200
Minimum	4	7.5	<1.0	.2	<1.0	2.5	5.4	33
Fluoride								
Maximum	.8	1.5	3.4	.5	.6	1.6	.4	.3
Minimum	.1	.1	.0	.0	.0	.1	.1	.2
Arsenic, in micrograms per liter								
Maximum	30	14	130	6	35	15	6	1
Minimum	11	14	1	3	3	4	6	0

EXPLANATION

APPROXIMATE RELATION OF SPECIFIC CONDUCTANCE TO DISSOLVED SOLIDS

SPECIFIC CONDUCTANCE, IN MICROMHOS PER CENTIMETER AT 25°C	DISSOLVED SOLIDS, IN MILLIGRAMS PER LITER
Less than 810	Less than 500
810 to 1,610	500 to 1,000
1,610 to 2,420	1,000 to 1,500
2,420 to 3,220	1,500 to 2,000
More than 3,220	More than 2,000
Insufficient data	Insufficient data

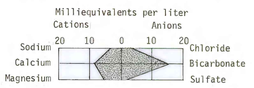
Tv 1250 / 62 / 0.5 — WELL THAT PENETRATES THE REGIONAL AQUIFER—First entry, Tv, is principal geologic formation from which the well obtains its water (see composite stratigraphic column for explanation of letter symbol); queried where uncertain. Second entry, 1250, is specific conductance in micromhos per centimeter at 25°C (specific conductance is an indication of the dissolved-solids concentration in water). Third entry, 62, is arsenic concentration in micrograms per liter. Fourth entry, 0.5, is fluoride concentration in milligrams per liter

pC 580 / 0.0 / 0.3 — WELL THAT PENETRATES AN AQUIFER OTHER THAN THE REGIONAL AQUIFER—First entry, pC, is principal geologic formation from which the well obtains its water (see composite stratigraphic column for explanation of letter symbol). Second entry, 580, is specific conductance in micromhos per centimeter at 25°C (specific conductance is an indication of the dissolved-solids concentration in water). Third entry, 0.0, is arsenic concentration in micrograms per liter. Fourth entry, 0.3, is fluoride concentration in milligrams per liter

Pc 236 / 0.2 — SPRING THAT ISSUES FROM THE REGIONAL AQUIFER—First entry, Pc, is geologic formation from which the spring issues (see composite stratigraphic column for explanation of letter symbol); queried where uncertain. Second entry, 236, is specific conductance in micromhos per centimeter at 25°C (specific conductance is an indication of the dissolved-solids concentration in water). Third entry, 0.2, is fluoride concentration in milligrams per liter

pC 990 / 1 / 0.3 — SPRING THAT ISSUES FROM AN AQUIFER OTHER THAN THE REGIONAL AQUIFER—First entry, pC, is geologic formation from which the spring issues (see composite stratigraphic column for explanation of letter symbol). Second entry, 990, is specific conductance in micromhos per centimeter at 25°C (specific conductance is an indication of the dissolved-solids concentration in water). Third entry, 1, is arsenic concentration in micrograms per liter. Fourth entry, 0.3, is fluoride concentration in milligrams per liter

CHEMICAL-QUALITY DIAGRAM—Shows major chemical constituents in milliequivalents per liter. The diagrams are in a variety of shapes and sizes, which provides a means of comparing, correlating, and characterizing types of water



DS=3180 — DISSOLVED SOLIDS—Number, 3180, is dissolved solids in milligrams per liter

ARBITRARY BOUNDARY OF GROUND-WATER AREA

Chemical Quality of Ground Water

The U.S. Environmental Protection Agency (1977a, b) has established national regulations and guidelines for the quality of water provided by public water systems. The regulations are either primary or secondary. Primary drinking-water regulations govern contaminants in drinking water that have been shown to affect human health, such as fluoride and arsenic. Secondary drinking-water regulations apply to those contaminants that affect esthetic quality, such as dissolved solids, sodium, magnesium, sulfate, and chloride. The primary regulations are enforceable either by the Environmental Protection Agency or by the States; in contrast, the secondary regulations are not Federally enforceable. The secondary regulations are intended as guidelines for the States. The regulations express limits as "maximum contaminant levels," where contaminant means any physical, chemical, biological, or radiological substance or matter in water. The maximum contaminant level for dissolved solids in public water supplies is 500 mg/L (milligrams per liter), as proposed in the secondary drinking-water regulations of the U.S. Environmental Protection Agency (1977b, p. 17146).

In most of the upper Verde River area the ground water contains less than 500 mg/L of dissolved solids and is suitable for most uses (see accompanying table). In places, however, the water is highly mineralized. Specific conductance, which is shown on the map, varies with the concentration of ions in solution and is an indication of the dissolved-solids concentration in the water. The dissolved-solids values may be estimated by multiplying the specific conductance by 0.6.

The chemical quality of ground water in the regional aquifer is nonuniform areally and stratigraphically. In the northern and eastern parts of the area most wells and springs obtain their water from the Coconino Sandstone or underlying units. The water generally contains 250 to 500 mg/L of dissolved solids—mainly calcium, magnesium, and bicarbonate. Water from one well near Sedona, however, contains 1,480 mg/L of dissolved solids; most of the water is probably from the Martin Formation. Water from a few wells northwest of Sedona contains more than 500 mg/L of dissolved solids. In the southwestern part of the area most wells obtain their water from the Verde Formation. The chemical quality of water in the Verde varies greatly owing to the difference in lithology and the poor hydraulic connection between the beds that make up the formation. Near Cottonwood, Page Springs, and Rimrock, water from most wells that tap the Verde contains less than 500 mg/L of dissolved solids—mainly calcium, magnesium, and bicarbonate. Near Cornville and Camp Verde, however, water from several wells contains 500 to 2,000 mg/L of dissolved solids, and water from a few wells contains more than 2,000 mg/L of dissolved solids; water from one well that penetrates the Verde contains 90,300 mg/L of dissolved solids and 59,800 mg/L of sulfate. The maximum contaminant level recommended for sulfate by secondary regulations is 250 mg/L (U.S. Environmental Protection Agency, 1977b, p. 17146). In the Verde Formation water that contains more than 1,000 mg/L of dissolved solids generally contains a predominance of sodium, magnesium, and sulfate owing to solution of salts, one of which is gypsum.

Fluoride concentrations generally are less than the maximum contaminant level, which in public water supplies differs according to the annual average maximum daily air temperature (Bureau of Water Quality Control, 1978, p. 6). The amount of water consumed by humans, and therefore the amount of fluoride ingested, depends partly on air temperature. In the area between Perkinsville and Camp Verde the annual average maximum daily air temperature is about 77°F, and the maximum contaminant level for fluoride is 1.6 mg/L. In other parts of the area the annual average maximum daily air temperature is about 64°F, and the maximum contaminant level for fluoride is 1.8 mg/L. Water from some wells near Cornville and Camp Verde contains more than 50 µg/L (micrograms per liter) of arsenic, which is the maximum contaminant level in public water supplies (U.S. Environmental Protection Agency, 1976, p. 14).

SELECTED REFERENCES

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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

BASE FROM U.S. GEOLOGICAL SURVEY
FLAGSTAFF 1:250,000, 1954,
HOLBROOK 1:250,000, 1954,
PRESCOTT 1:250,000, 1954, AND
WILLIAMS 1:250,000. 1956

SPECIFIC CONDUCTANCE AND ARSENIC AND FLUORIDE CONCENTRATIONS

MAPS SHOWING GROUND-WATER CONDITIONS IN THE UPPER VERDE RIVER AREA, YAVAPAI AND COCONINO COUNTIES, ARIZONA—1978

BY

GARY W. LEVINGS AND LARRY J. MANN