DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

PREPARED IN COOPERATION WITH THE
ARIZONA WATER COMMISSION

WATER-RESOURCES INVESTIGATIONS
OPEN-FILE REPORT 80-441
SHEET 1 OF 2
GROUND-WATER CONDITIONS

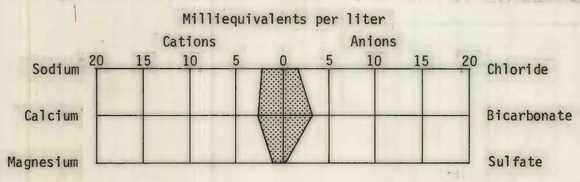
EXPLANATION

— — 4500 —?— WATER-LEVEL CONTOUR—Shows approximate altitude of the water level based on the assumption that the Blue and San Francisco Rivers are hydraulically connected with a large continuous ground-water system that is overlain in places by small discontinuous systems. Queried where uncertain. Contour interval 500 feet. Datum is mean sea level

2 ● 3540 / 20R / 100 / 343 / 0.8 WELL—First number, 3540, is altitude of the water level in feet above mean sea level. Second number, 20R, is depth to water in feet below land surface (R, depth to water reported). Third number, 100, is reported depth of well in feet. Fourth number, 343, is dissolved-solids concentration in milligrams per liter. Fifth number, 0.8, is fluoride concentration in milligrams per liter. Number, 2, next to symbol indicates number of wells at this location

● 4080 / 5 / 493 / 0.4 SPRING—First number, 4080, is altitude of the land surface in feet above mean sea level. Second number, 5, is estimated discharge of spring in gallons per minute. Third number, 493, is dissolved-solids concentration in milligrams per liter. Fourth number, 0.4, 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



CONVERSION FACTORS

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
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
acre	0.004047	square kilometer (km^2)
square mile (mi^2)	2.590	square kilometer (km^2)
acre-foot (acre-ft)	0.001233	cubic hectometer (hm^3)
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)
gallon per minute (gal/min)	0.06309	liter per second (L/s)

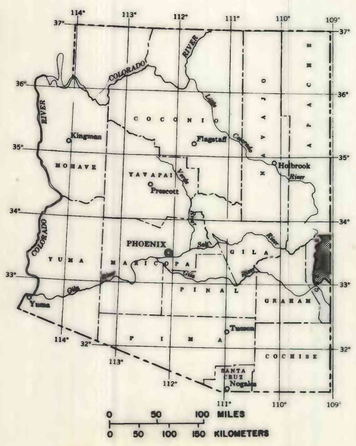


Figure 1.--Index map showing area of report (shaded).

INTRODUCTION

The San Francisco River area includes about 950 mi^2 in Greenlee County in east-central Arizona (fig. 1); most of the area is in the Apache National Forest. The most striking topographic features are the rock-walled canyons of the San Francisco and Blue Rivers and the outlying buttes, peaks, and mesas. The San Francisco River originates near Alpine about 4 mi north of the area, flows southeastward into New Mexico, and returns to Arizona about 20 mi northeast of Clifton; the river then flows southwestward to its confluence with the Blue River and continues to join the Gila River about 6 mi southwest of Clifton. The Blue River drains about two-thirds of the area. Altitude of the land surface ranges from 3,250 ft at the confluence of the San Francisco and Gila Rivers in the extreme southwest corner of the area to about 9,000 ft in the northern part.

Water-resources development has been slight compared with that in many areas in Arizona. In 1978 about 500 acre-ft of water was diverted from the San Francisco and Blue Rivers for irrigation of about 250 acres. The irrigated land consisted of scattered 2- to 25-acre parcels along the San Francisco and Blue Rivers. About 550 acre-ft of ground water was withdrawn from the shallow wells along the San Francisco River for municipal use at Clifton. Although the amount of ground water withdrawn annually in the San Francisco River area is not known, it probably does not exceed 600 acre-ft.

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 Arizona Water Commission, 222 North Central Avenue, Suite 850, Phoenix, and at U.S. Geological Survey offices in: Federal Building, 301 West Congress Street, Tucson, and Valley Center, Suite 1880, Phoenix. Material from which copies can be made at private expense is available at the Tucson and Phoenix offices of the U.S. Geological Survey.

GROUND WATER

About 20 wells were inventoried in 1978, and probably no more than 30 wells have been drilled in the 950-square-mile area. The depth to water was less than 30 ft in wells along the channels and flood plains of the San Francisco and Blue Rivers and 550 ft in a well in T. 1 N., R. 32 E. Although many springs are present in the area, many flow only in response to precipitation and snowmelt. The discharge of 12 springs was measured in 1978; 1 spring discharged about 200 gal/min, and the others discharged 100 gal/min or less. Most of the springs discharged into stream channels that contained flow for only a few hundred feet downstream from the spring.

Sufficient well and spring data are not available to determine whether the ground water comes from one continuous and (or) several discontinuous ground-water systems. Near the west boundary, most springs issue at the contact between two basalt flows or at the contact between a basalt flow and the underlying silt and clay deposits. These springs probably issue from small discontinuous ground-water systems in the fractured basaltic rocks. Wells near the Blue and San Francisco Rivers penetrate thin narrow alluvial deposits along the channels and flood plains of the rivers. The alluvial deposits and the underlying sedimentary and basaltic rocks are in hydraulic connection and may form a large continuous ground-water system. The water-level contours shown on sheet 1 are based on the assumption that the Blue and San Francisco Rivers are hydraulically connected with a large continuous ground-water system that is overlain in places by small discontinuous systems; however, only a few wells have been drilled on the outlying buttes, peaks, and mesas, and additional well data may require revision of the contours.

Water from wells and springs generally contained less than 500 mg/L (milligrams per liter) of dissolved solids; however, water from two wells near the State line contained 610 and 764 mg/L of dissolved solids, and water from one spring near Clifton contained 11,700 mg/L. Water from the spring was mainly a sodium and chloride type. The large amount of dissolved solids in the water from the spring precludes its use for most purposes. The recommended maximum contaminant level for dissolved solids in public water supplies is 500 mg/L, as proposed in the secondary drinking-water regulations of the U.S. Environmental Protection Agency (1977b, p. 17146) in accordance with provisions of the Safe Drinking Water Act (Public Law 93-523). 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 those contaminants in drinking water that have been shown to affect human health. Secondary drinking-water regulations apply to those contaminants that affect esthetic quality. 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.

Fluoride concentrations generally ranged from 0 to 0.9 mg/L; however, water from one spring near Clifton contained 3.6 mg/L of fluoride. The maximum contaminant level for fluoride 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 San Francisco River area the annual average maximum daily air temperature is about 72°F at Blue and about 82°F at Clifton, and the maximum contaminant level for fluoride is 1.6 and 1.4 mg/L, respectively.

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
CLIFTON 1:250,000, 1954-71 AND
SILVER CITY 1:250,000, 1954-70

MAPS SHOWING HYDROLOGIC CONDITIONS IN THE SAN FRANCISCO RIVER AREA, GREENLEE COUNTY, ARIZONA, 1978—A RECONNAISSANCE STUDY

BY
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