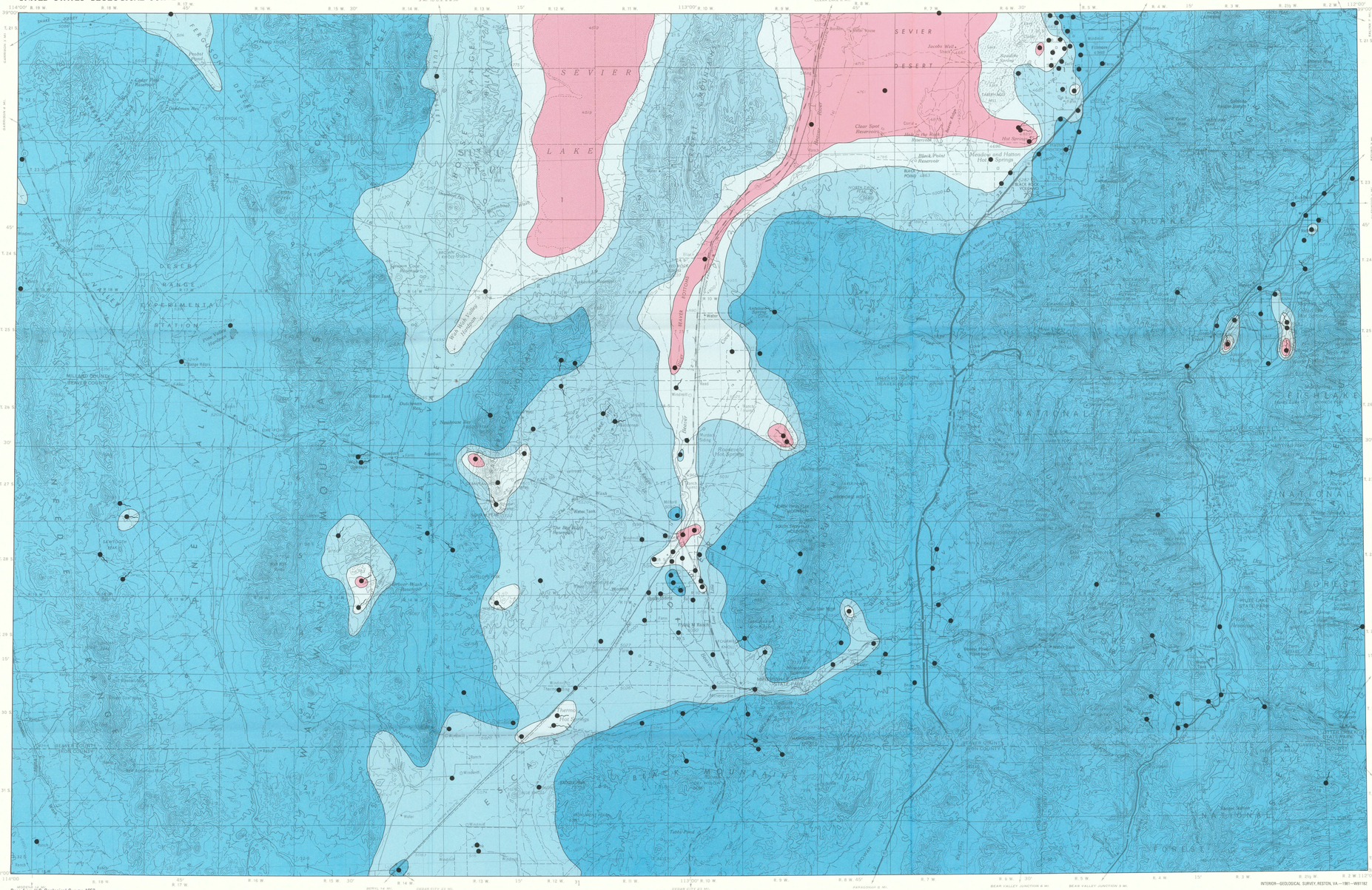
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

MISCELLANEOUS INVESTIGATIONS SERIES
MAP I–1374



Base from U.S. Geological Survey, 1953
Revised 1973

SCALE 1:250 000

5 0 5 10 15 MILES

5 0 5 10 15 KILOMETERS

CONTOUR INTERVAL 200 FEET
WITH SUPPLEMENTARY CONTOURS AT 100 FOOT INTERVALS
NATIONAL GEODETIC VERTICAL DATUM OF 1929

1981 MAGNETIC DECLINATION FOR THIS SHEET VARIES FROM 15°00' EASTERLY FOR THE CENTER OF THE WEST EDGE TO 14°30' EASTERLY FOR THE CENTER OF THE EAST EDGE. MEAN ANNUAL CHANGE IS 0°9'30" WESTERLY

INTERIOR—GEOLOGICAL SURVEY, RESTON, VA.—1981—W81182

MAP SHOWING GENERAL CHEMICAL QUALITY OF GROUND WATER IN THE RICHFIELD QUADRANGLE, UTAH

By
Don Price

1981

EXPLANATION

The concentrations of dissolved solids in water from most springs and water wells less than 1,000 feet deep should be within the ranges shown.

DISSOLVED-SOLIDS CONCENTRATION, IN MILLIGRAMS PER LITER

100–500
Locally less than 100

500–1000

1000–3000

3000–10,000
Locally more than 10,000

DATA SITE USED FOR CONTROL

Well ● Spring ~

This is one of a series of maps that describe the geology and related natural resources of the Richfield 2° Quadrangle, Utah. The purpose of this map is to show the general chemical quality of ground water by ranges of dissolved-solids concentrations. The water quality varies considerably with depth in some areas; thus, the actual concentrations of dissolved solids of water in some aquifers locally may be somewhat larger or smaller than shown depending on the depth of those aquifers. This map is intended only for general planning purposes. Detailed site-specific information about the chemical quality of ground water in most parts of the map area can be gained only by special on-site investigation.

Data used to compile this map were collected by the U.S. Geological Survey in cooperation with the Utah Department of Natural Resources, Division of Water Rights. Most of those data are in the files of the U.S. Geological Survey, Salt Lake City, Utah, or in the following reports: Carpenter and Young (1963), Mower (1963, 1978), Sandberg (1963), and Mower and Cordova (1974). In those areas where little or no ground-water quality data are available, ranges of dissolved solids are inferred on the basis of such factors as geology (Stokes, 1964), known or inferred conditions of ground-water occurrence, and the general chemical quality of surface water during low-flow (base-flow) periods (Price, 1980).

For additional information about the chemical quality of ground water in various parts of the Richfield 2° Quadrangle, the reader is referred to the following reports: Meinzer (1911), Snyder (1963), Mower (1965, 1978), Young and Carpenter (1965), Hood and Rush (1965), Sandberg (1966), Handy, Mower, and Sandberg (1969), Mower and Cordova (1974), and Stephens (1974, 1976).

GROUND-WATER QUALITY

Ground water in the Richfield 2° Quadrangle ranges from fresh to briny according to the following classification commonly used by the U.S. Geological Survey:

Classification	Dissolved-solids concentration (milligrams per liter)
Fresh	Less than 1,000
Slightly saline	1,000–3,000
Moderately saline	3,000–10,000
Very saline	10,000–35,000
Briny	More than 35,000

Valley fill

The valleys of the Richfield 2° Quadrangle are underlain by unconsolidated and semiconsolidated sedimentary fill, that consists chiefly of clay, silt, sand, and gravel of Tertiary and Quaternary age. The maximum saturated thickness of the fill ranges from less than 100 feet in some parts of the Sevier River valley to more than 1,000 feet in broad valleys such as the Escalante Desert.

Water in the fill that underlies the Sevier River valley generally is fresh and in most places contains less than 500 mg/L (milligrams per liter) of dissolved solids. Local exceptions are in the immediate vicinity of such thermal springs as Monroe, Joseph, and Red Hill Hot Springs. Those springs discharge slightly to moderately saline water at the land surface and also probably discharge similar water to the fill in the subsurface. There also may be some local occurrences of saline water in the valley fill near Richfield, where the salt-bearing Arapien Formation of Jurassic age occurs in close proximity to the fill as noted by Price (1981) in the adjacent Redmond 1:24,000 Quadrangle.

Water in the fill that underlies most of Beaver Valley and eastern Pavant Valley near Fillmore generally is fresh and in most places contains less than 500 mg/L of dissolved solids. This also appears to be true of Pine Valley and the upstream reaches of Snake and Wah Wah Valleys, although confirmation data for these areas are sparse.

Water in the fill that underlies most of the Escalante Desert generally contains 500 to 1,000 mg/L of dissolved solids. Locally the dissolved-solids concentrations may be less than 500 mg/L (as near Lund and Milford). In other places, the dissolved-solids concentrations may exceed 1,000 mg/L (as in the vicinity of Thermo) or exceed 3,000 mg/L (as at Roosevelt Hot Springs and the intensively pumped area near Milford).

Water in the fill that underlies the Beaver River valley downstream from Milford, the Sevier Desert, and the Sevier Lake bed generally is slightly to moderately saline. Locally, this salinity may be related to mineral springs such as Roosevelt, Meadow, and Hatton Hot Springs. The near-surface deposits that underlie the Sevier Lake bed contain very saline and briny water due to evaporites in the lakebed deposits. However, there may be water of better quality in some of the deeper strata, as indicated by Whelan (1969, p. 11). Some of the deeper strata beneath the Sevier Desert probably also contain very saline and briny water, as indicated by the Utah Emergency Relief Administration Range Inventory (1936, p. 55, 65).

Consolidated rocks

Consolidated rocks, ranging in age from Precambrian to Tertiary, form the mountains and extend beneath the younger fill of the valleys in the Richfield 2° Quadrangle. Those rocks consist largely of limestone, intrusive and extrusive igneous rocks, sandstone, and conglomerate. Water moves through the consolidated rocks chiefly in complex systems of faults, fractures, joints, lava-interflow zones, and solution cavities. The chemical quality of the water varies greatly depending on the rock types through which it flows and on the distance and depth to which it circulates between recharge and discharge areas.

Chemical analyses of springs and baseflow of streams indicate that most of the shallow circulating water in the higher parts (generally above the 6,000-foot level) of most mountain ranges is fresh, with dissolved-solids concentrations generally less than 500 mg/L and locally less than 100 mg/L. Exceptions are in the Wah Wah and San Francisco Mountains where there are local occurrences of slightly to moderately saline water, apparently related to igneous activity and associated mineralization. Water in the rocks that form the southern end of the House Range and Cricket Mountains (which border Sevier Lake) is inferred to contain at least 500 mg/L of dissolved solids. The concentrations could be even greater than 1,000 mg/L considering that normal annual precipitation in those areas is only about 8 inches (U.S. Weather Bureau, 1963) and therfore the supply of fresh recharge water is meager.

The water discharging from thermal springs in the Richfield 2° Quadrangle owes its thermal character and salinity at least partly to deep circulation in fault zones in the consolidated rocks. (See Mundorff, 1970, p. 40–43, and Milligan and others, 1966, p. 37–40.) Dissolved-solids concentrations of most of the water ranges from about 1,500 to 8,000 mg/L (Mundorff, 1970, table 1). It is probable that saline water, whether or not thermal, also occurs at many other places in the consolidated rocks where those rocks extend beneath the valley fill. At such great depths in the map area, water moves very slowly (except along major fault or solution zones in carbonate rocks), and, thus, has ample time to dissolve mineral constituents from the rocks. It is possible, however, that water in extensive fault zones in carbonate rocks, even at great depths beneath the fill, is of better chemical quality than some of the water in the fill. For example, an oil-test well in the SE¼NW¼SE¼ sec. 32, T. 24 S., R. 19 W., produced water with only 225 mg/L of dissolved solids from consolidated rocks of Devonian age at depths of greater than 6,000 feet (Gates and Kruer, 1981, table 10). This is at least 5,000 feet lower than the level of the adjacent valley floor.

Chemical composition

Chemical composition of the ground water in the Richfield 2° Quadrangle varies considerably and is related largely to geologic sources and concentration of dissolved solids. Principal ions in the freshest waters generally are calcium, magnesium, and bicarbonate. Principal ions in the more saline waters commonly are sodium, sulfate, and chloride. Most of the thermal springs in the area yield water in which sodium is the principal cation and chloride is the principal anion (Mundorff, 1970, table 1).

REFERENCES CITED

Carpenter, C. H., and Young, R. A., 1963, Ground-water data, central Sevier Valley, parts of Sanpete, Sevier, and Piute Counties, Utah: U.S. Geological Survey open-file report (published as Utah Basic-Data Report 3), 34 p.

Gates, J. S., and Kruer, S. A., 1981, Hydrologic reconnaissance of the southern Great Salt Lake Desert and summary of the hydrology of west-central Utah: Utah Department of Natural Resources Technical Publication 71, 55 p.

Handy, A. H., Mower, R. W., and Sandberg, G. W., 1969, Changes in chemical quality of ground water in three areas in the Great Basin, Utah: U.S. Geological Survey Professional Paper 650–D, p. D228–D234.

Hood, J. W., and Rush, F. E., 1965, Water-resources appraisal of the Snake Valley area, Utah and Nevada: Utah State Engineer Technical Publication 14, 43 p. (Also published as Nevada Department of Conservation and Natural Resources Reconnaissance Report 34.)

Meinzer, O. E., 1911, Ground water in Juab, Millard, and Iron Counties, Utah: U.S. Geological Survey Water-Supply Paper 227, 162 p.

Milligan, C. H., Marsell, R. E., and Bagley, J. M., 1966, Mineralized springs in Utah and their effects on manageable water supplies: Utah State University Water Research Laboratory Report WC 23–6, 50 p.

Mower, R. W., 1963, Selected hydrologic data, Pavant Valley, Millard County, Utah: U.S. Geological Survey open-file report (published as Utah Basic-Data Report 5), 20 p.

_____ 1965, Ground-water resources of Pavant Valley, Utah: U.S. Geological Survey Water-Supply Paper 1794, 78 p.

_____ 1978, Hydrology of the Beaver Valley area, Beaver County, Utah, with emphasis on ground water: Utah Department of Natural Resources Technical Publication 63, 90 p.

Mower, R. W., and Cordova, R. M., 1974, Water resources of the Milford area, Utah, with emphasis on ground water: Utah Department of Natural Resources Technical Publication 43, 106 p.

Mundorff, J. C., 1970, Major thermal springs of Utah: Utah Geological and Mineralogical Survey Water-Resources Bulletin 13, 60 p.

Price, Don, 1980, Map showing general chemical quality of surface water in the Richfield Quadrangle, Utah: U.S. Geological Survey Miscellaneous Investigation Map I–1234, scale 1:250,000.

_____ 1981, Summary appraisal of water resources in the Redmond Quadrangle, Sanpete and Sevier Counties, Utah: U.S. Geological Survey Miscellaneous Investigations Map I–1304–B, scale 1:24,000.

Sandberg, G. W., 1963, Ground-water data, Beaver, Escalante, Cedar City, and Parowan Valleys, parts of Washington, Iron, Beaver, and Millard Counties, Utah: U.S. Geological Survey open-file report (published as Utah Basic-Data Report 6), 26 p.

_____ 1966, Ground-water resources of selected basins in southwestern Utah: Utah State Engineer Technical Publication 13, 46 p.

Snyder, C. T., 1963, Hydrology of stock-water development on the public domain of western Utah: U.S. Geological Survey Water-Supply Paper 1475–N, p. 487–536.

Stephens, J. C., 1974, Hydrologic reconnaissance of the Wah Wah Valley drainage basin, Millard and Beaver Counties, Utah: Utah Department of Natural Resources Technical Publication 47, 53 p.

_____ 1976, Hydrologic reconnaissance of the Pine Valley drainage basin, Millard, Beaver, and Iron Counties, Utah: Utah Department of Natural Resources Technical Publication 51, 38 p.

Stokes, W. L., ed., 1964, Geologic map of Utah: University of Utah, scale 1:250,000.

U.S. Weather Bureau [1963], Normal annual and May-September precipitation (1931–60) for the State of Utah: Map of Utah, scale 1:500,000.

Utah Emergency Relief Administration, 1936, Range improvement program: Utah Emergency Relief Administration Duplicated Report 117.

Whelan, J. A., 1969, Subsurface brines and soluble salts of subsurface sediments, Sevier Lake, Millard County, Utah: Utah Geological and Mineralogical Survey Special Studies Report 30.

Young, R. A., and Carpenter, C. H., 1965, Ground-water conditions and storage in the central Sevier Valley, Utah: U.S. Geological Survey Water-Supply Paper 1787, 95 p.

For sale by Branch of Distribution, U.S. Geological Survey, Box 25286, Federal Center, Denver, CO 80225