

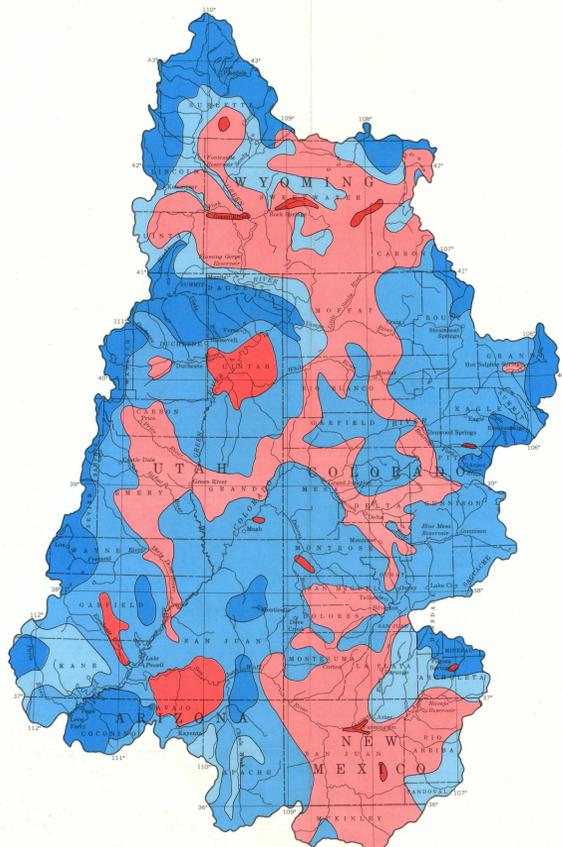
CHEMICAL QUALITY OF GROUND WATER

DISSOLVED SOLIDS
Most of the ground water in the basin contains moderate to large amounts of dissolved solids; fresh water occurs locally in deep bedrock aquifers. In general, shallow aquifers that have a high hydraulic conductivity, especially those in geohydrologic units 1 and 2, yield water with the smallest dissolved-solids content (less than 500 mg/l [milligrams per liter] in most areas). Deep bedrock aquifers in geohydrologic units 3 and 4 generally yield water with 500 to 3,000 mg/l of dissolved solids. Shale strata of geohydrologic unit 4, and deeply buried marine sedimentary rocks where ground water circulation is poor, yield water with the largest dissolved-solids content (more than 3,000 mg/l locally). Locally, however, oil tests have penetrated fresh-water aquifers (water containing less than 1,000 mg/l of dissolved solids) underlying saline-water aquifers at depths of several thousand feet.
The fresh-water aquifers apparently have good hydraulic connection with recharge areas on the flanks of the higher mountain ranges, and the fresh water moves rather freely from the recharge areas down into the aquifers. Such deep fresh-water aquifers are known to occur in the Weber Sandstone, Morgan Formation, Madison Limestone, and sandstone members of the Mancos Shale in the Uinta and Green River Basins and in the High Plateaus of Utah. (See Goode and Felts, 1962; Felts, 1966; and Welder, 1968.)

EXPLANATION
Areas where at least one aquifer should contain water with concentrations of dissolved solids greater than the limits shown below; other aquifers in the area probably would contain more highly mineralized water, based in part on geology.
Dissolved solids, in milligrams per liter

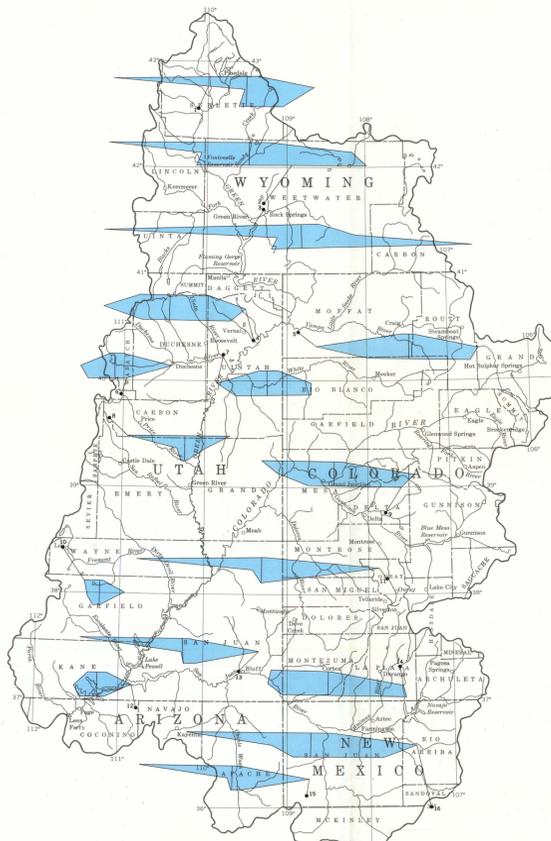
Less than 500	500 to 1000
Less than 100 in some mountainous areas	1000 to 2000
250 to 1000	More than 2000
500 to 1000	More than 2000 locally
1000 to 2000	More than 2000

Basin boundary



MAP SHOWING DISSOLVED-SOLIDS CONTENTS IN WATER FROM PRINCIPAL AQUIFERS

SELECTED CHEMICAL ANALYSES
Selected analyses of water from various aquifers indicate that the water is chiefly of the calcium bicarbonate or sodium bicarbonate type. However, a detailed study probably would show that ground water in the basin ranges considerably in type from place to place depending chiefly on the rock source and depth.



MAP SHOWING ANALYSES OF WATER FROM SELECTED WELLS AND SPRINGS

EXPLANATION
Well or spring and number

Sodium (Na)	Chloride (Cl)
Potassium (K)	Bicarbonate (HCO ₃)
Calcium (Ca)	Sulfate (SO ₄)
Magnesium (Mg)	

Cations Anions

Concentration, in milliequivalents per liter

Map No.	Water-bearing formation	Depth to water-bearing zone (feet)	Dissolved solids (milligrams per liter)
1	Wasatch Formation	790	446
2	Alluvium	59	1,180
3	Wasatch Formation	190	1,340
4	Phosphoria Formation	4,266	731
5	Weber Sandstone	30	667
6	North Hole Formation	1,825	310
7	Weber Sandstone	1,500	448
8	Mancos Shale (Ferron Sandstone Member)	3,865	311
9	Mancos Shale	Spring	734
10	Volcanic rocks	220	173
11	Dakota Sandstone	562	698
12	Wasatch Sandstone	1,000	223
13	Glen Canyon Group	835	401
14	Meuserie Group	2,875	786
15	Mendoc Formation and Point Lockout Sandstone	1,448	452
16	San Jose Formation	Spring	960

SALINE GROUND WATER
Saline ground water is an important resource in the basin. Slightly to moderately saline water containing 1,000 to about 10,000 mg/l of dissolved solids constitutes an important segment of the total water resource in the Upper Colorado River basin. In some areas this water is the only source of supply and in a large part of the basin it is in relatively shallow aquifers that have moderate to high hydraulic conductivity. Continued rapid advancements in the field of demineralization of water should eventually make withdrawal and use of some of this water economically feasible. The largest quantities of near-surface saline water are in the Wyoming Basin and Navajo sections of the Upper Colorado River basin.

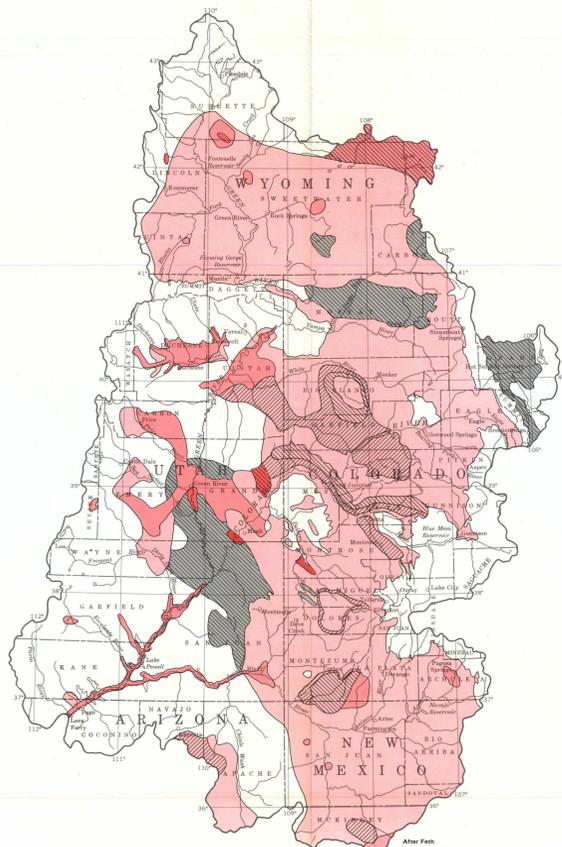
SALINE WATER RESOURCES
Areas where large volumes of mineralized water are stored; unshaded areas do not contain large volumes of mineralized water.
Dissolved solids, in milligrams per liter

1000 to 2000
3000 to 10,000
10,000 to 25,000
More than 25,000

Inferred to contain mineralized water by analogy with other areas where geologic and hydrologic conditions are comparable.

Depth, in feet below land surface, to shallowest zone that contains mineralized water

Less than 500
500 to 1000
More than 1000



MAP SHOWING AREAS OF LARGE QUANTITIES OF SALINE GROUND WATER

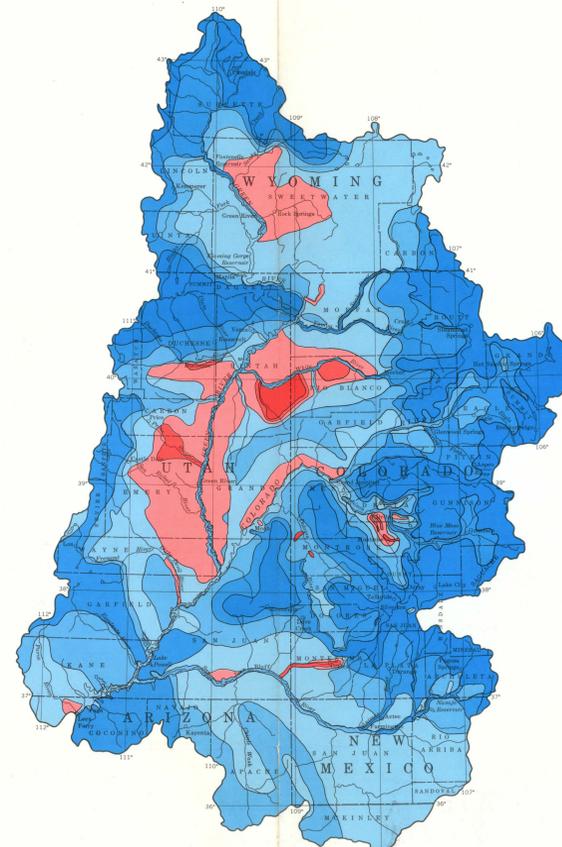
CHEMICAL QUALITY OF SURFACE WATER

DISSOLVED SOLIDS
Streams with headwaters in areas underlain by rocks of geohydrologic unit 4 contribute the largest amount of dissolved solids to the Colorado River. The headwaters of most of the streams in the basin generally contain water with less than 100 mg/l of dissolved solids. Those streams which head in the higher mountain areas underlain by resistant rocks of geohydrologic units 1 and 2 generally maintain a relatively low dissolved-solids content (less than 500 mg/l) even in their lower reaches. The smaller tributary streams that head in areas underlain by less resistant shale strata of geohydrologic unit 4 dissolve minerals rapidly and contain water with 500 to 2,000 mg/l of dissolved solids. Thus they contribute to the mineral gain in the Colorado River and its main tributaries.
Return irrigation flow and inflow of saline ground water rising along faults also contribute heavily to the mineral content of the streams.

EXPLANATION
Weighted-average concentration of dissolved solids, in milligrams per liter

Less than 50
50 to 100
100 to 250
250 to 500
500 to 1000
1000 to 2000
2000 to 3000
More than 3000

In areas of few or no sampling sites, the weighted-average concentrations of dissolved solids were estimated from data observed in adjacent areas of similar geology and topography. Data from these areas of few or no sampling sites should be used with discretion.



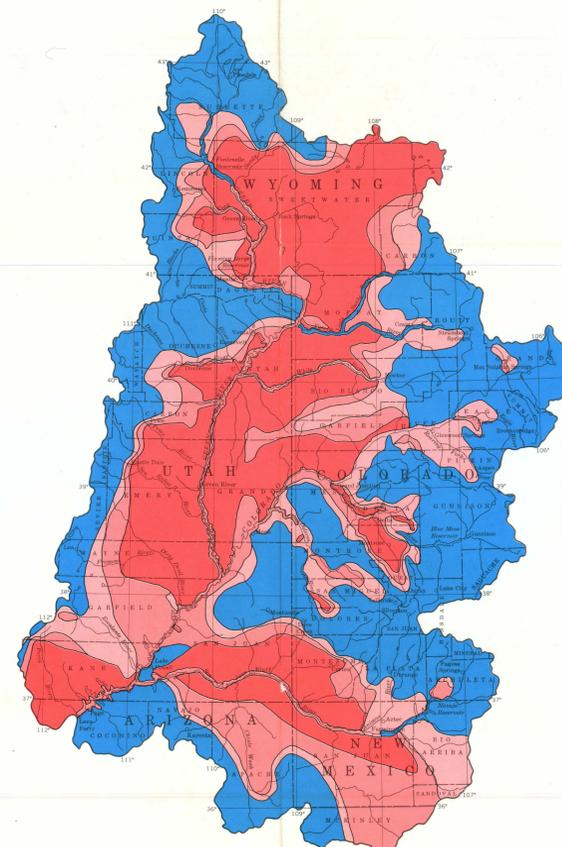
MAP SHOWING WEIGHTED-AVERAGE CONCENTRATION OF DISSOLVED SOLIDS

SULFATE
One of the principal dissolved constituents is sulfate which is dissolved chiefly from the shale strata and exceeds 250 mg/l in many areas.

EXPLANATION
Weighted-average concentration of sulfate, in milligrams per liter

Less than 50
50 to 100
100 to 250
250 to 500
More than 500

In areas of few or no sampling sites, the weighted-average concentrations of sulfate were estimated from data observed in adjacent areas of similar geology and topography. Data from these areas of few or no sampling sites should be used with discretion.



MAP SHOWING WEIGHTED-AVERAGE CONCENTRATION OF SULFATE

SELECTED HYDROLOGIC DATA IN THE UPPER COLORADO RIVER BASIN

By
Don Price and K. M. Waddell

