# GROUND WATER

## VALLEY GROUND-WATER RESERVOIRS

Valley ground-water reservoirs, which consist of the saturated valley-fill deposits, are the chief developed source of ground water in the region. The occurrence and movement of water in the consolidated rocks surrounding the valleys are controlled largely by geologic structures such as faults, joints, and folds, and the resulting complex aquifer systems are difficult to delineate or exploit. Water from these aquifer systems discharges in springs and seeps and sustains the base flow of streams, or moves into the valley ground-water reservoirs as subsurface recharge. Most of the water that moves through the consolidated rocks ultimately discharges within the drainage basin in which it originates as precipitation, but some water may travel long distances in interbasin flow systems and discharge in a basin far removed from its place of origin. Development of ground water in some of the valley reservoirs has resulted in overdraft and long-term declines of water levels. Such areas in Nevada and Utah have been designated "critical ground-water areas" and further development is restricted or controlled by the State water administrators.

## GROUND-WATER DEVELOPMENT

Most of the valley ground-water reservoirs have undergone some degree of development by wells. At least 23 areas of ground-water development yielded more than 10,000 acre-feet to wells annually, and withdrawal by wells from all developed valley ground-water reservoirs totaled about 1 million acre-feet in 1965. Natural discharge from the valley ground-water reservoirs—exclusive of those in areas of upstream depletion (see runoff map, sheet 2) averages about 2.4 million acre-feet annually. The estimate (about 3 million acre-feet) for upstream depletions in the nominal water supply (sheet 1) includes natural ground-water discharge in the areas of upstream depletions.

*Estimated natural ground-water discharge, exclusive of areas of upstream depletion, and withdrawal by wells*

| Subregion | Discharge (Acre-feet per year) Natural discharge (Average) | Withdrawal by wells (1965) |
|---|---|---|
| Bear River | 40,000 | 175,000 |
| Great Salt Lake | 630,000 | 300,000 |
| Sevier Lake | 329,000 | 280,000 |
| Humboldt | 480,000 | 140,000 |
| Central Lahontan | 205,000 | 42,000 |
| Tonopah | 680,000 | 98,000 |
| Total (rounded) | 2,400,000 | 1,000,000 |

## GROUND-WATER STORAGE

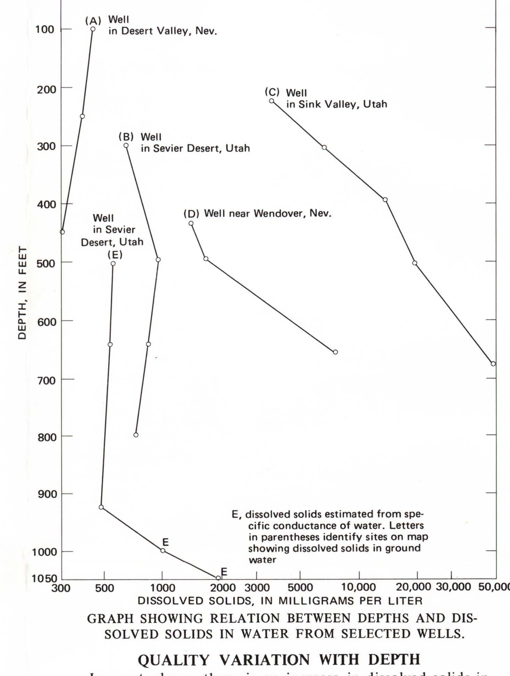
The estimated 190 million acre-feet of water stored in the upper 100 feet of saturated material in the valley ground-water reservoirs represents only a small fraction of the total ground-water storage in the region. The thickness of the saturated fill in most of the valleys exceeds 100 feet, and in some valleys it exceeds 1,000 feet. Moreover, large volumes of water are stored in the consolidated rocks of the region. Therefore, the 190 million acre-feet is the minimum volume of water that is economically recoverable from storage. Not all the ground water in storage is fresh, however; most of the valley reservoirs contain some saline water, especially those reservoirs near the major terminal lakes and sinks. Hence, full development of the valley ground-water reservoirs would require desalinization of some of the water.

*Estimated ground-water storage in the upper 100 feet of saturated valley-fill deposits*

| State | Assumed average specific yield (percent) | Area (acres) | Storage in upper 100 feet of saturation (1,000 acre-feet) |
|---|---|---|---|
| BEAR RIVER SUBREGION | | | |
| Idaho | 10 | 538,000 | 5,400 |
| Utah | 10 | 537,000 | 5,400 |
| Wyoming | 10 | 123,000 | 1,200 |
| Total | | | 12,000 |
| GREAT SALT LAKE SUBREGION | | | |
| Idaho | 10 | 108,000 | 1,100 |
| Nevada | 10 | 404,000 | 4,000 |
| Utah | 10 | 1,490,000 | 14,900 |
| | 5 | 5,980,000 | 29,900 |
| Total | | | 49,900 |
| SEVIER LAKE SUBREGION | | | |
| Utah | 10 | 1,670,000 | 16,700 |
| | 5 | 990,000 | 5,000 |
| Total | | | 21,700 |
| HUMBOLDT SUBREGION | | | |
| Nevada | 10 | 3,910,000 | 39,100 |
| | 5 | 908,000 | 4,500 |
| Total | | | 43,600 |
| CENTRAL LAHONTAN SUBREGION | | | |
| Nevada | 10 | 1,530,000 | 15,300 |
| | 5 | 166,000 | 830 |
| Total | | | 16,130 |
| TONOPAH SUBREGION | | | |
| Nevada | 10 | 5,060,000 | 50,600 |
| GREAT BASIN REGION | | | |
| Idaho | | 646,000 | 6,500 |
| Nevada | | 11,980,000 | 114,300 |
| Utah | | 10,700,000 | 71,900 |
| Wyoming | | 123,000 | 1,200 |
| Total (rounded) | | | 190,000 |

## QUALITY OF GROUND WATER

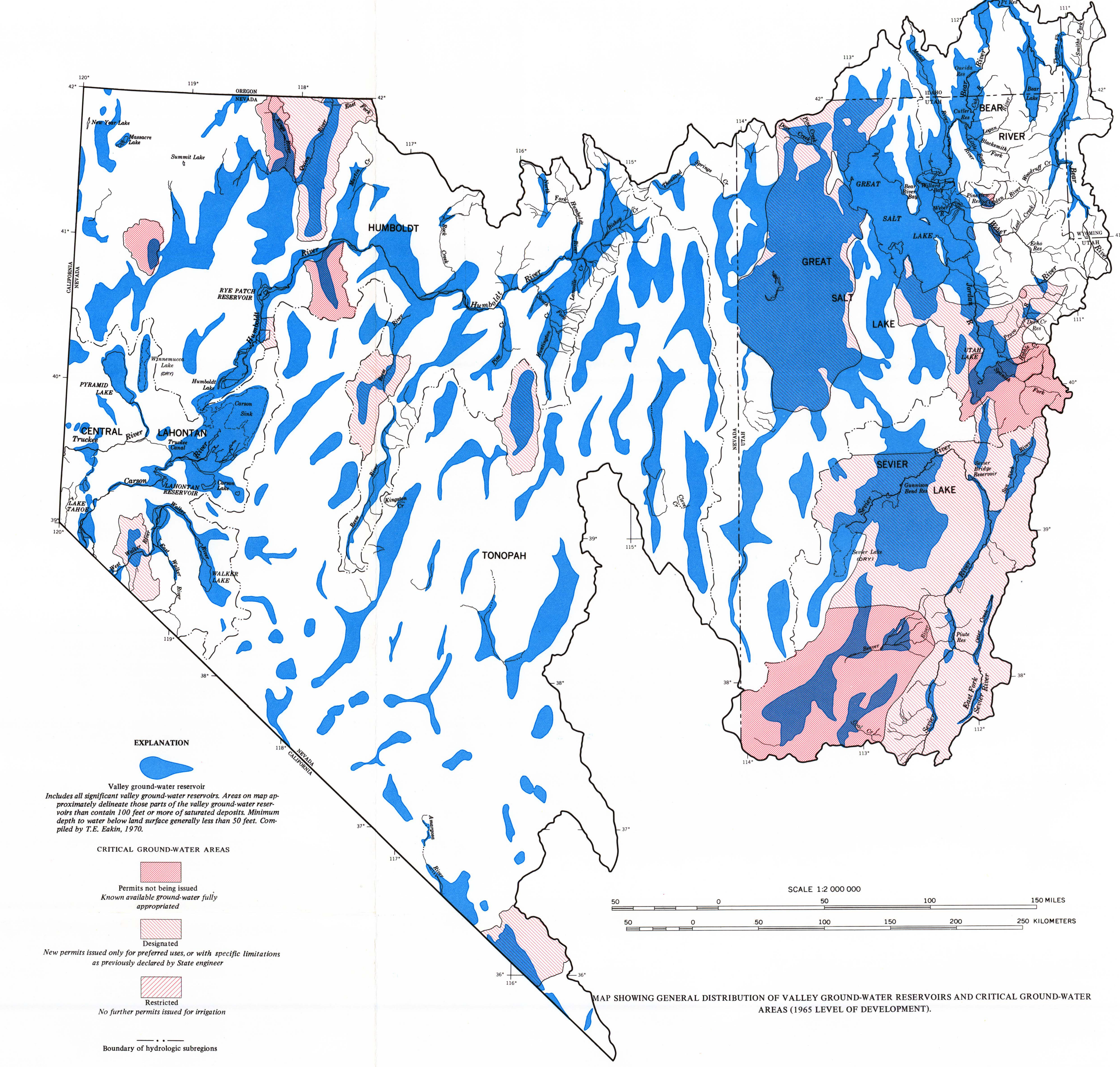
The general suitability of water for most uses is closely related to the dissolved-solids content of the water, although concentrations of individual materials in the water can limit its usefulness for some purposes. For domestic use, the U.S. Public Health Service (1962) recommends water with a maximum dissolved-solids content of 500 mg/l (milligrams per liter), but waters containing up to 1,000 mg/l are generally used for domestic supplies where better water is not available. The combination of dissolved-solids content and SAR (sodium-adsorption ratio) is often used to evaluate the suitability of the water for irrigation use. The larger the dissolved-solids content and SAR of the water, the less suitable the water is likely to be for irrigation. However, these factors must be considered in conjunction with soil types and drainage conditions, as well as the presence of substances, such as boron, that are toxic to certain plants.



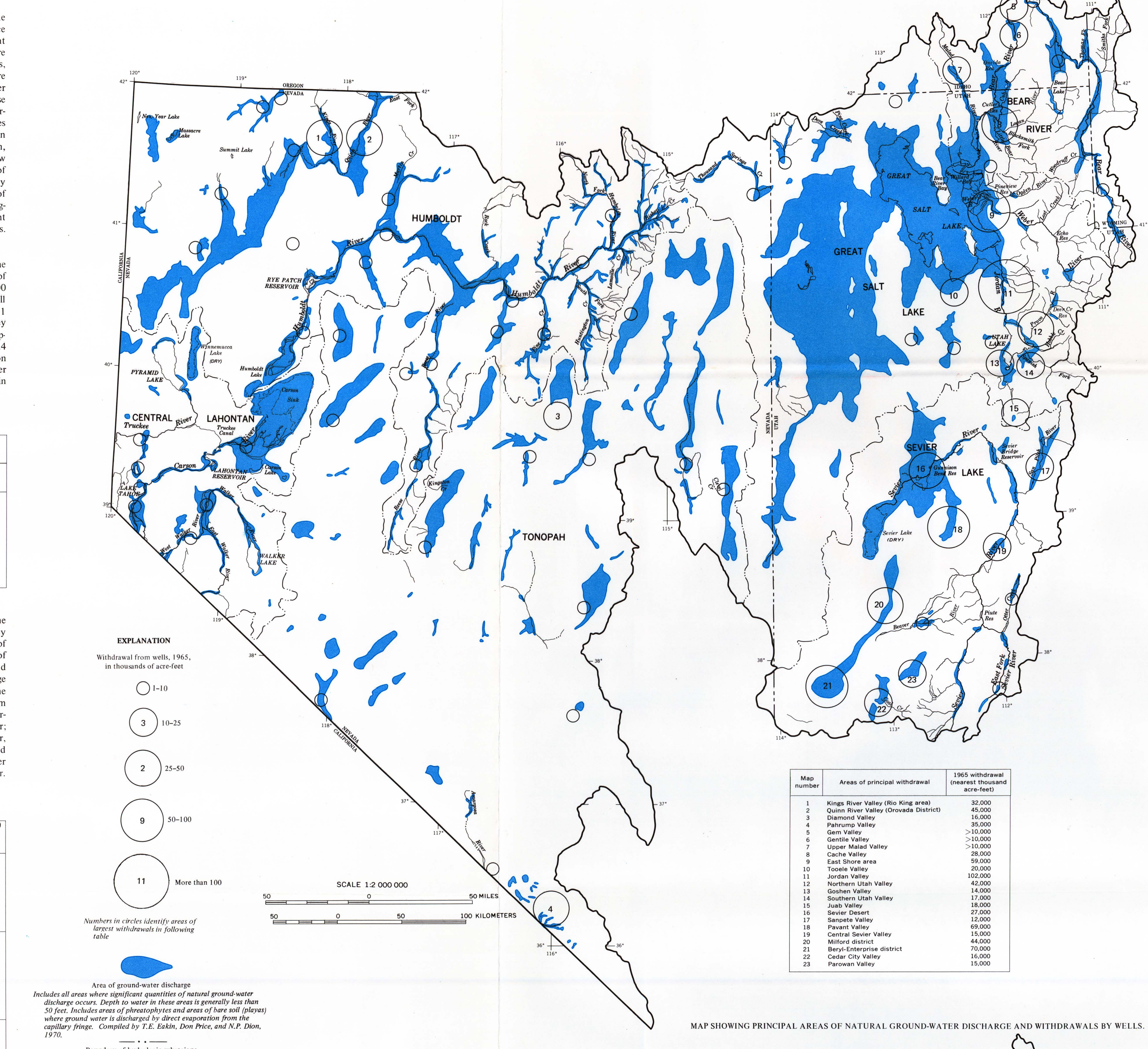

GRAPH SHOWING RELATION BETWEEN DEPTHS AND DISSOLVED SOLIDS IN WATER FROM SELECTED WELLS.

## QUALITY VARIATION WITH DEPTH

In most places, there is an increase in dissolved solids in ground water with increasing depth. In some parts of the region, however, shallow ground water is more highly mineralized than deeper ground water. This condition commonly occurs in and near terminal sinks of topographically closed valleys where deep, relatively fresh water moves upward under artesian pressure into shallower aquifers and dissolves minerals along its upward course. In these terminal areas, the mineral content of shallow ground water is concentrated by evapotranspiration.

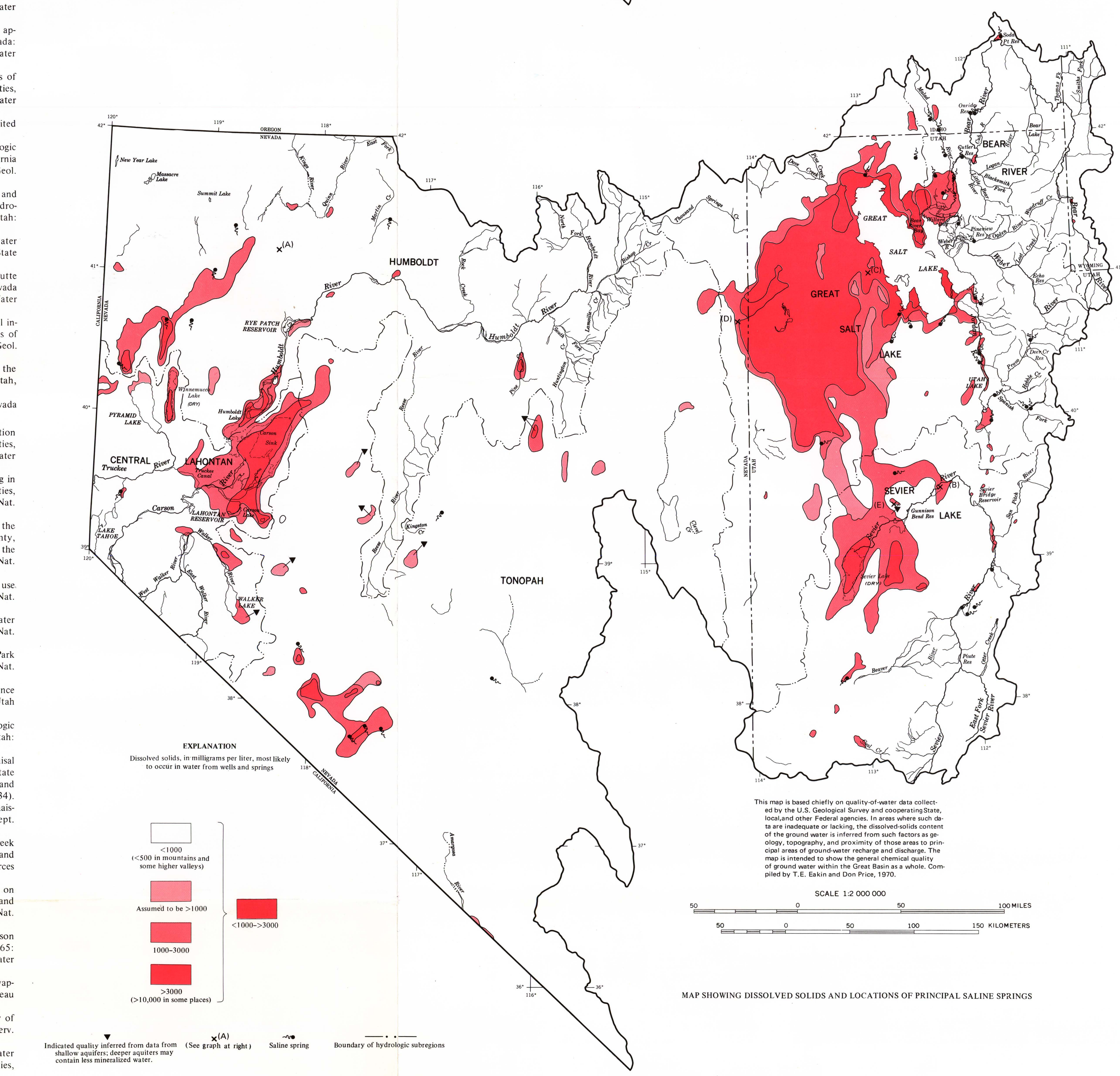



MAP SHOWING GENERAL DISTRIBUTION OF VALLEY GROUND-WATER RESERVOIRS AND CRITICAL GROUND-WATER AREAS (1965 LEVEL OF DEVELOPMENT).

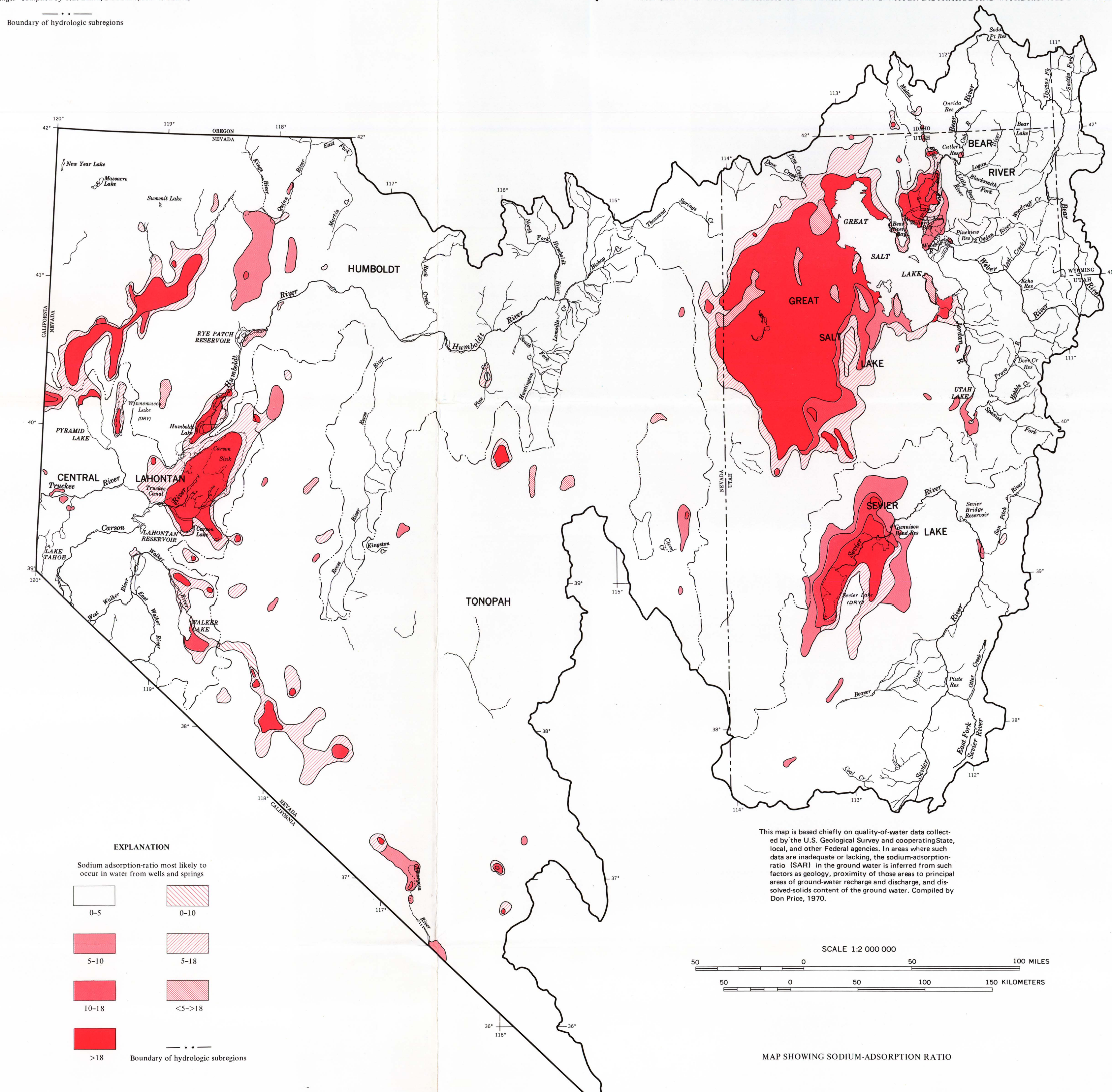



| Map number | Areas of principal withdrawal | 1965 withdrawal (nearest thousand acre-feet) |
|---|---|---|
| 1 | Kings River Valley (Rio King area) | 32,000 |
| 2 | Quinn River Valley (Orovada District) | 45,000 |
| 3 | Diamond Valley | 16,000 |
| 4 | Pahrump Valley | 35,000 |
| 5 | Gem Valley | >10,000 |
| 6 | Gentile Valley | >10,000 |
| 7 | Upper Malad Valley | >10,000 |
| 8 | Cache Valley | 28,000 |
| 9 | East Shore area | 59,000 |
| 10 | Tooele Valley | 20,000 |
| 11 | Jordan Valley | 102,000 |
| 12 | Northern Utah Valley | 42,000 |
| 13 | Goshen Valley | 14,000 |
| 14 | Southern Utah Valley | 17,000 |
| 15 | Juab Valley | 18,000 |
| 16 | Sevier Desert | 27,000 |
| 17 | Sanpete Valley | 12,000 |
| 18 | Pavant Valley | 69,000 |
| 19 | Central Sevier Valley | 15,000 |
| 20 | Milford district | 44,000 |
| 21 | Beryl-Enterprise district | 70,000 |
| 22 | Cedar City Valley | 16,000 |
| 23 | Parowan Valley | 15,000 |

MAP SHOWING PRINCIPAL AREAS OF NATURAL GROUND-WATER DISCHARGE AND WITHDRAWALS BY WELLS.




MAP SHOWING DISSOLVED SOLIDS AND LOCATIONS OF PRINCIPAL SALINE SPRINGS




MAP SHOWING SODIUM-ADSORPTION RATIO

## SELECTED REFERENCES

The following list of reports is not a complete bibliography of the hydrology of the Great Basin Region. It includes only the most recent areal reports of the more heavily developed areas and selected technical reports of local and regional interest. Many published and unpublished basic-data reports and some technical reports have been omitted. More complete information on published and unpublished hydrologic data in all or specific parts of the region can be obtained from the district offices of the U.S. Geological Survey in Carson City, Nev.; Salt Lake City, Utah; Boise, Idaho; and Cheyenne, Wyo.

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INTERIOR—GEOLOGICAL SURVEY, RESTON, VIRGINIA—1974

# WATER IN THE GREAT BASIN REGION; IDAHO, NEVADA, UTAH, AND WYOMING

By
Don Price, T. E. Eakin, and others
1974