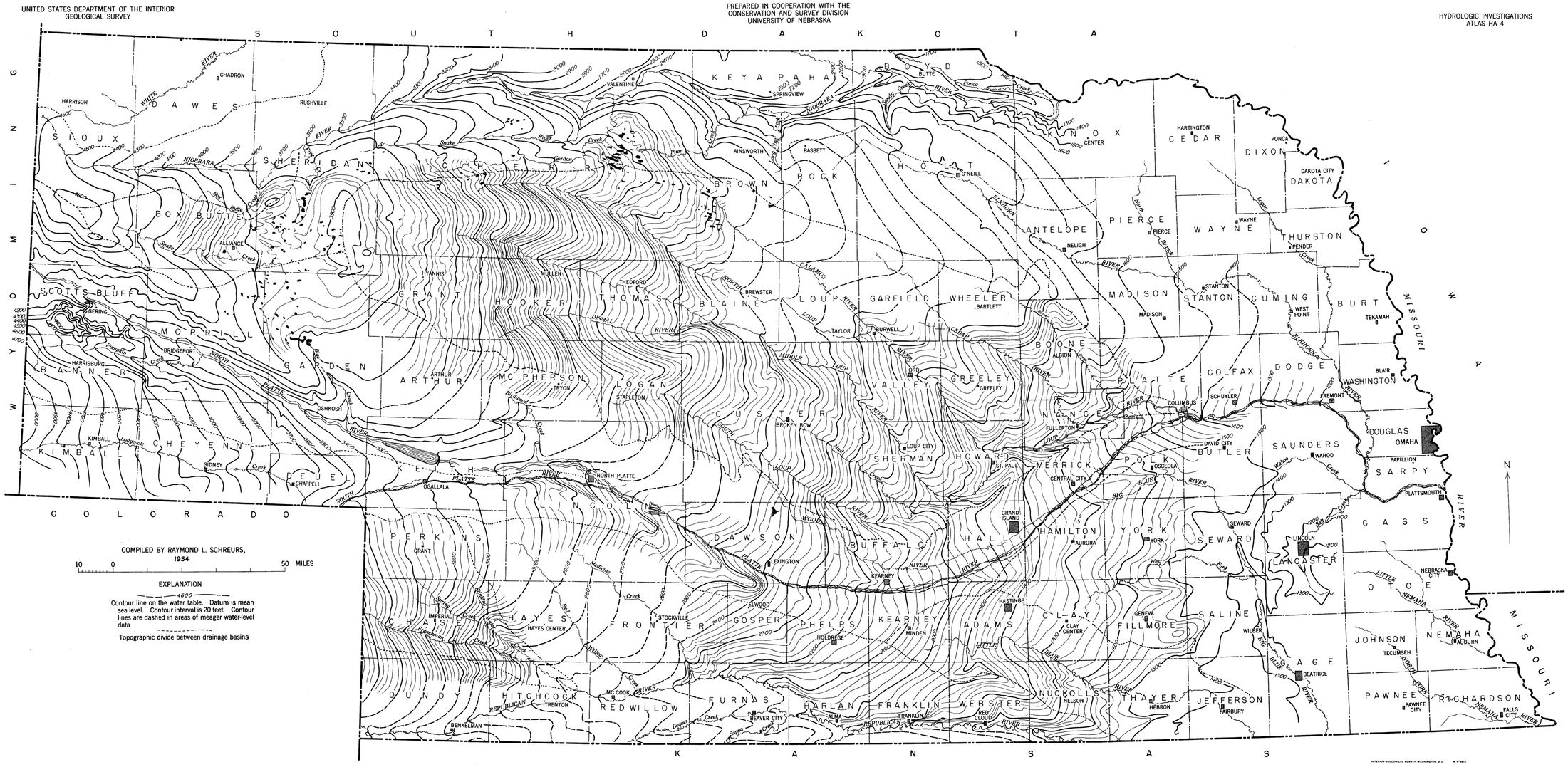
UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

PREPARED IN COOPERATION WITH THE
CONSERVATION AND SURVEY DIVISION
UNIVERSITY OF NEBRASKA

HYDROLOGIC INVESTIGATIONS
ATLAS HA 4



EXPLANATION

—4600— Contour line on the water table. Datum is mean sea level. Contour interval is 20 feet. Contour lines are dashed in areas of meager water-level data

Topographic divide between drainage basins

This map is based on ground-water investigations made in cooperation with the Conservation and Survey Division of the University of Nebraska and as part of the program of the Department of the Interior for development of the Missouri River basin. The cooperative ground-water investigations have been in progress in Nebraska since 1930. More than 2,600 test holes (total footage, 360,000 feet) in eastern and south-central Nebraska and in small areas elsewhere in the State have revealed subsurface geologic conditions and have yielded information on the thickness of the water-bearing material and the position of the water table. About three-fourths of the State has been covered by either detailed or reconnaissance studies made as part of the program for development of the Missouri River basin. The water-table contours shown on this map are based on information that was obtained during these investigations but has not yet been released in published form. The sources of the information on which the map is based are as follows:

Babcock, H. M., and Visher, F. N., 1951, Ground-water conditions in the Dutch Flats area, Scotts Bluff and Sioux Counties, Nebr.: U. S. Geol. Survey Circ. 126.

Bach, W. K., Cronin, J. G., and Brown, D. W., 1948, Map of the Platte-Republican divide area, Nebraska, showing contours on the water table and depth to water below land surface. [In the open files of the U. S. Geol. Survey.]

Brown, D. W., 1954?, Ground-water resources of the Middle Loup Division of the lower Platte River basin, Nebraska: U. S. Geol. Survey Water-Supply Paper 1358. [In press.]

Cady, R. C., and Scherer, O. J., 1946 [1947], Geology and ground-water resources of Box Butte County, Nebr.: U. S. Geol. Survey Water-Supply Paper 969.

Cronin, J. G., and Newport, T. G., 1951, Map showing contour of the water table in Valentine National Wildlife Refuge and Ainsworth area, Nebraska. [In the open files of the U. S. Geol. Survey.]

Nace, R. L., 1953, Ground water for irrigation in Box Butte County, Nebr.: U. S. Geol. Survey Circ. 166.

Reed, E. C., 1944, Ground-water survey of area north of O'Neill, Holt County, Nebr.: Nebraska Water-Survey Paper 2.

Waite, H. A., and others, 1948, Ground-water hydrology of the Republican and Frenchman River valleys in Nebraska: U. S. Geol. Survey Circ. 19.

———1949, Geology and ground-water hydrology of the lower Platte River valley, Nebraska: U. S. Geol. Survey Circ. 20.

Wenzel, L. K., and Waite, H. A., 1941, Ground water in Keith County, Nebr.: U. S. Geol. Survey Water-Supply Paper 848.

Wenzel, L. K., Cady, R. C., and Waite, H. A., 1946, Geology and ground-water resources of Scotts Bluff County, Nebr.: U. S. Geol. Survey Water-Supply Paper 943.

Additional information in the files of the U. S. Geological Survey and the Conservation and Survey Division, University of Nebraska, Lincoln, Nebr., and from topographic maps of the U. S. Geological Survey.

Nebraska is near the center of the United States and is a part of the Great Plains province. Its extreme length is about 430 miles and its maximum width about 210 miles; the area is about 77,000 square miles. The surface slopes gradually from the west and north to the southeast at an average of 10 feet per mile. The highest point is in western Banner County at an altitude of 5,340 feet; the point of lowest altitude is 825 feet in the southeastern corner of the State. All the drainage reaches the Missouri River, which flows southward along the eastern border of the State. The principal tributaries of the Missouri River in Nebraska are the Niobrara, Platte, Republican, Big and Little Blue, and Nemaha and Little Nemaha Rivers. The drainage basin of the Platte River and its tributaries is about 40,000 square miles, or a little more than half the area of Nebraska. The headwaters of the Loup and Elkhorn Rivers, tributaries of the Platte, are in the Sandhills region, a topographic unit that comprises about 20,000 square miles and is dotted by hundreds of small lakes. Precipitation, the original source of all recharge to ground water, is progressively greater in an eastward direction. The average annual precipitation is a little less than 16 inches in southern Sioux County and is a little more than 34 inches in the southeastern corner of the State.

If the surficial unconsolidated deposits of Quaternary age were removed from Nebraska the surface rocks in the State would be sedimentary strata of Pennsylvanian to Tertiary age. Rocks of Pennsylvanian and Permian age would be exposed in the southeastern corner. Bordering this area on the northwest would be a 100-mile-wide band of rocks of Cretaceous age; rocks of this age would be exposed also in the Republican River valley, the lower Niobrara River valley, and the extreme northwestern part of the State. Rocks of Tertiary (Oligocene, Miocene, and Pliocene) age would be exposed in the remainder of the State. The rocks of Pennsylvanian and Permian age yield only small quantities of ground water. The sandstones in the Dakota formation, which are the only important water-bearing rocks of Cretaceous age, are the source of supply for many wells in parts of eastern Nebraska. The rocks of Oligocene and Miocene age are the principal source of water in the northwestern part, and the Ogallala formation of Pliocene age is an important aquifer in the central and southwestern parts of the State. The unconsolidated deposits of Quaternary age that overlie the bedrock surface are composed of the following: glacial drift; water-laid silt, sand, and gravel; and wind-deposited silt and sand. The glacial drift is restricted to the eastern fourth of the State and, because ground water is discontinuous in this material, the water-table contour lines on the map were not extended through this area. The water-laid sand and gravel occur in sheetlike deposits ranging in thickness from less than a foot to as much as 250 feet; the greater thicknesses occur in buried valleys in central Nebraska. In many places the deposits of sand and gravel are below the water table and yield abundant supplies of water. The wind-deposited silt (loess) mantles older deposits throughout much of the area; the thicker deposits generally occur along the Missouri River and in the south-central part of the State. In the sand-dune area of west-central Nebraska (known as the Sandhills region) is stored hundreds of millions of acre-feet of water. Except in small areas, the water table in the eastern two-thirds of Nebraska is in the deposits of Quaternary age, whereas in the remainder of the State it generally is in rocks of Tertiary age.

The configuration of the water table is similar to that of the land surface, but the water table generally is smoother and the relief is less. Because all points on a contour line have the same altitude, there is no difference in hydraulic pressure along the line; and as the maximum difference of pressure occurs at a right angle to a contour line, the water moves down gradient at a right angle to the line. Therefore, in addition to showing the configuration of the water table, this map shows the direction of ground-water flow in Nebraska. Ground water moves toward points of discharge such as streams, lakes, wells, and areas of shallow water table where evaporation and transpiration by plants take place. The depth to water can be determined by using the water-table contour map in conjunction with topographic maps.

In general, the ground-water divides between streams, as indicated by the map, coincide with surface or topographic divides (shown by dashed lines), but the following exceptions are worthy of mention: in Lincoln, Dawson, Buffalo, Gosper, Phelps, Kearney, and Adams Counties the ground-water divides on the north and south sides of the Platte River are closer to the river than are the topographic divides, but in Cheyenne and southern Garden Counties the topographic divides are nearer the North Platte River than are the ground-water divides.

A change in geologic conditions in McPherson, Hooker, and Cherry Counties may account for the close spacing of the water-table contour lines in that part of the State; it is possible that the formations of Miocene age pinch out in this area. The close spacing of water-table contour lines generally indicates low permeability and wide spacing indicates high permeability.

Some concern has been expressed that large withdrawals of ground water for irrigation in Box Butte County would deplete the surface flow of the North Platte River. Study of the water-table contour map shows that excessive pumping might have some effect on the flow of Blue Creek, a tributary of the North Platte River, but probably a greater effect on the flow of Pine Creek, a tributary of the Niobrara River.

The map shows a mounding of the water table along the south side of the Platte River between North Platte and Lexington which probably is caused by seepage from the system of canals and reservoirs present in the area, and from irrigated fields.

Another feature shown by the map is the relation of the Republican, Platte, and Niobrara Rivers to the water table. The 3,300-foot contour line crosses the three streams at points on a north-south line. West of this line the North Platte River is entrenched below the regional water table, whereas east of this line the Platte River flows at an altitude above that of the Niobrara and Republican Rivers at points directly north and south. This indicates that the Platte River in central Nebraska is flowing down the side slope of a ground-water mound having a crest 300 to 500 feet higher than the level of the Republican and Niobrara Rivers at points directly north and south.

CONFIGURATION OF THE WATER TABLE IN NEBRASKA