STATE OF SOUTH DAKOTA
Richard Kneip, Governor

SOUTH DAKOTA GEOLOGICAL SURVEY
Duncan J. McGregor, State Geologist

Information Pamphlet No. 2

MAJOR AQUIFERS IN CHARLES MIX AND DOUGLAS COUNTIES, SOUTH DAKOTA

by

Jack Kume
U.S. Geological Survey

Prepared in cooperation with the South Dakota Geological Survey, Counties of Charles Mix and Douglas, and Fort Randall Conservancy Sub-District

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INTRODUCTION

This Information Pamphlet is one of a series of preliminary reports on water-resources studies of South Dakota counties. It is designed to acquaint the reader with the general distribution, quantity, and quality of ground water available from the major aquifers in Charles Mix and Douglas Counties. A comprehensive report to be published later will contain the basic data collected during the study and much additional information on the hydrology and geology of the area.

Information in this report is based on data (fig. 1) collected by the United States Geological Survey and the South Dakota Geological Survey during the period 1966-70.

Copies of this publication and other county reports may be obtained from the South Dakota Geological Survey in Vermillion, South Dakota as they become available. Persons wishing additional information about the hydrology and geology may contact the U.S. Geological Survey or the South Dakota Geological Survey in Vermillion.

OCCURRENCE AND SOURCE OF GROUND WATER

MAJOR AQUIFERS IN UNCONSOLIDATED DEPOSITS

Ground-water sources include six major aquifers in unconsolidated deposits -- the Choteau, Corsica, Geddes, Greenwood, Delmont, and Tower aquifers (fig. 2). The unconsolidated deposits comprise preglacial stream sediments, glacial deposits, and postglacial alluvium. The Choteau aquifer is the largest; it underlies an area of 209,000 acres and contains about 2,200,000 acre-feet of water in transient storage. The Corsica, Geddes, Greenwood, Delmont, and Tower aquifers underlie a combined area of 138,000 acres, and contain about 1,300,000 acre-feet of water in transient storage. Minor unnamed aquifers in the unconsolidated deposits underlie a combined area of 88,800 acres. They consist of buried outwash lenses in stony clay, and contain about 350,000 acre-feet of water in transient storage.

The combined area underlain by aquifers in unconsolidated deposits is about 436,000 acres. Fifty-one percent of this area is underlain by more than 25 feet of saturated aquifer material.

MAJOR AQUIFERS IN BEDROCK

Ground-water sources also include three major artesian bedrock aquifers beneath the unconsolidated deposits -- the Niobrara aquifer, the Codell aquifer, and the Dakota aquifer.

The Niobrara aquifer, locally known as the "chalk rock," is the uppermost bedrock aquifer (fig. 3). It underlies the entire area except in the deeper parts of the major bedrock valleys where it has been removed by erosion. Depths to the top of the Niobrara range from 50 to 500 feet and its maximum known thickness is 164 feet. It supplies about 75 domestic or stock wells.

The Codell aquifer, locally known as the "sandrock" or the "soft-water sand," supplies more wells in the study area than any other aquifer. It has a maximum known thickness of 58 feet and depths to the top range from about 80 feet along the Missouri River to about 400 feet in the topographically high areas. Water is used extensively for domestic water supplies because it is soft.

The Dakota aquifer is the only bedrock aquifer in which flowing wells can be obtained. It is the largest and deepest aquifer, and underlies the entire area. The artesian head is sufficient to produce flowing wells in the topographically low areas (fig.4). The aquifer consists of layers of sandstone interbedded with shale and is locally known as the "artesian" or "hard-water sand." Depth to the top of the aquifer ranges from 465 feet in the Missouri River trench to more than 1,000 feet in the high areas. The known thickness of the Dakota ranges from 88 to 410 feet.

POTENTIAL FOR GROUND-WATER DEVELOPMENT

The Choteau, Greenwood, and Tower aquifers have the greatest potential for irrigation and other water-supply development. Estimated yields of wells penetrating these aquifers range from 250 to 1,000 gpm (gallons per minute) where the aquifers consist of at least 25 feet of saturated sand and gravel. (See fig. 2.) The Choteau aquifer has been the most extensively developed to date

Estimated yields of wells in the other major aquifers in the unconsolidated deposits range from about 50 to 500 gpm.

The Dakota artesian aquifer has the greatest potential of the aquifers in the bedrock for stock-well development because it underlies the entire area and can furnish flowing wells in many places. Unfortunately the water is of poor quality; therefore, domestic and municipal use is limited.

The Codell aquifer has the greatest potential for municipal and domestic water-supply development. It has been more extensively developed than the Dakota aquifer because it is much shallower and the quality of the water is better suited for domestic use.

The Niobrara aquifer, because of its generally poor quality of water, has very little potential for water-supply development except as a relatively shallow source of water for domestic and stock wells.

WATER QUALITY

Ground-water in the unconsolidated deposits ranges in quality from fresh (water containing less than 1,000 mg/l (milligrams per liter) total solids) to slightly saline, and is generally very hard. The Choteau aquifer contains very hard water of a sodium-sulfate type that is slightly saline; whereas, the Delmont aquifer contains very hard water of a calcium-sulfate type that is fresh. Water from the

other aquifers is fresh to slightly saline, very hard, and either a calcium-sulfate or sodium-sulfate type.

Ground-water in bedrock ranges from soft to very hard and is generally slightly saline. The Niobrara and Codell aquifers contain soft to moderately hard water of a sodium-bicarbonate-sulfate type that is slightly saline. The Dakota aquifer contains very hard (average hardness 990 mg/l) water of a calcium-sulfate type that is slightly saline.

WATER UTILIZATION

Ground water is used principally for domestic, stock, irrigation, and municipal water supplies and for recreation. The Choteau aquifer is the most widely used of the aquifers in unconsolidated deposits. It supplies water to 13 irrigation wells, 5 public-supply wells, and about 300 stock and domestic wells. The other aquifers in the unconsolidated deposits supply water to only a few stock and domestic wells. Seventy-seven percent of all domestic and stock wells and 80 percent of all public water-supply wells produce water from aquifers in the bedrock. The Codell aquifer is tapped by 650 domestic, stock, and municipal wells, more than any other aquifer. The Dakota aquifer, which supplies water to 340 stock, domestic, municipal, and recreation wells, ranks second.

RECOMMENDATIONS

The best possibilities for obtaining high-yield wells such as those generally needed for irrigation are in the areas shown on figure 2 where the aquifer thickness is greater than 25 feet. Before high-yield wells are constructed, it is desirable that a test well be drilled at the selected location to determine the thickness of the aquifer and provide samples for determining the grain size of the aquifer material. This information will help in the selection of the proper slot size and length of screen to be used. Pumping the test well shows the yield of the aquifer at that locality and provides a water sample for chemical-quality analysis. The type of soil and subsoil and the topography are also important in determining the suitability of the land for irrigation, and in selecting the most suitable irrigation system.

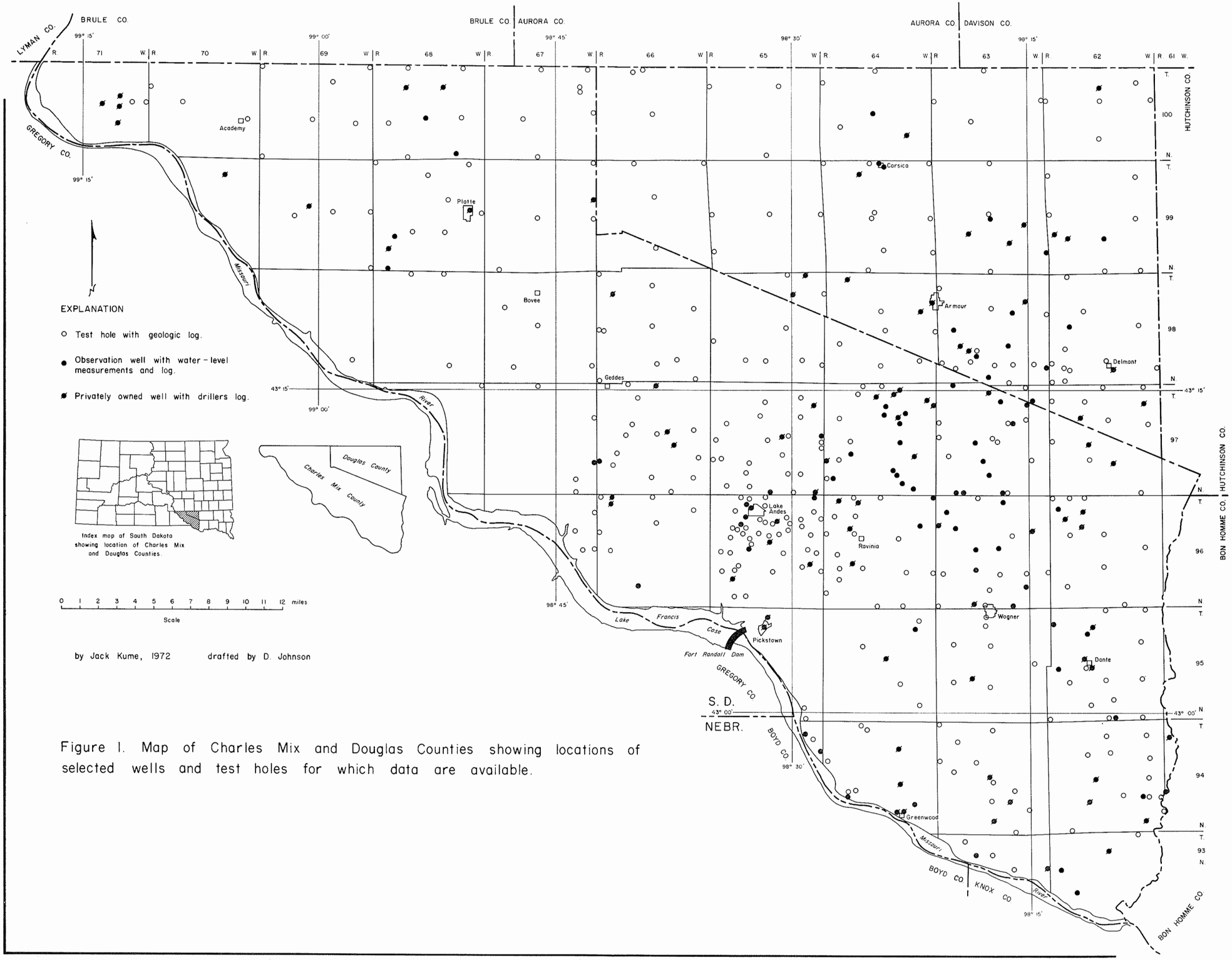

Figure 1. Map of Charles Mix and Douglas Counties showing locations of selected wells and test holes for which data are available.

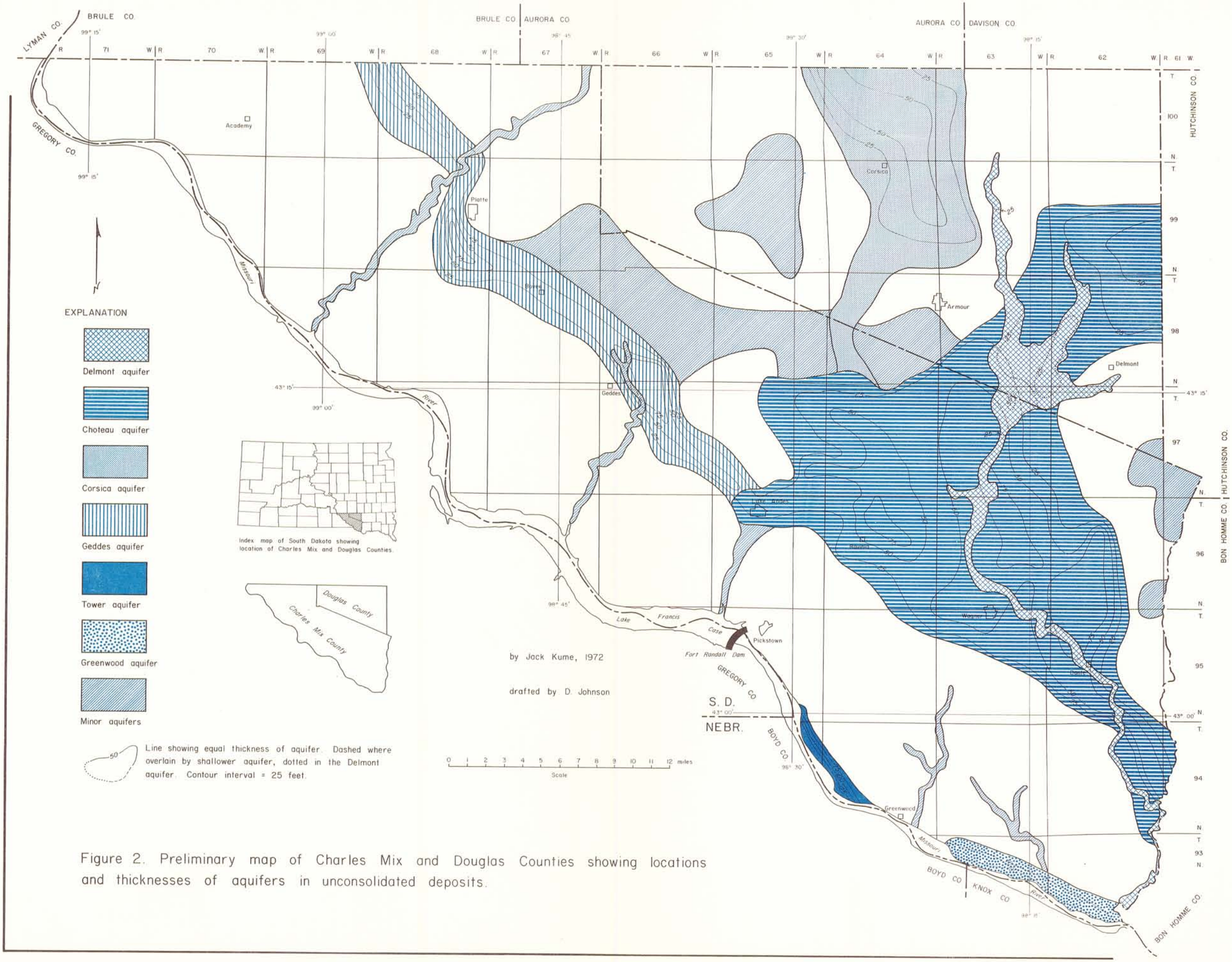

Figure 2. Preliminary map of Charles Mix and Douglas Counties showing locations and thicknesses of aquifers in unconsolidated deposits.

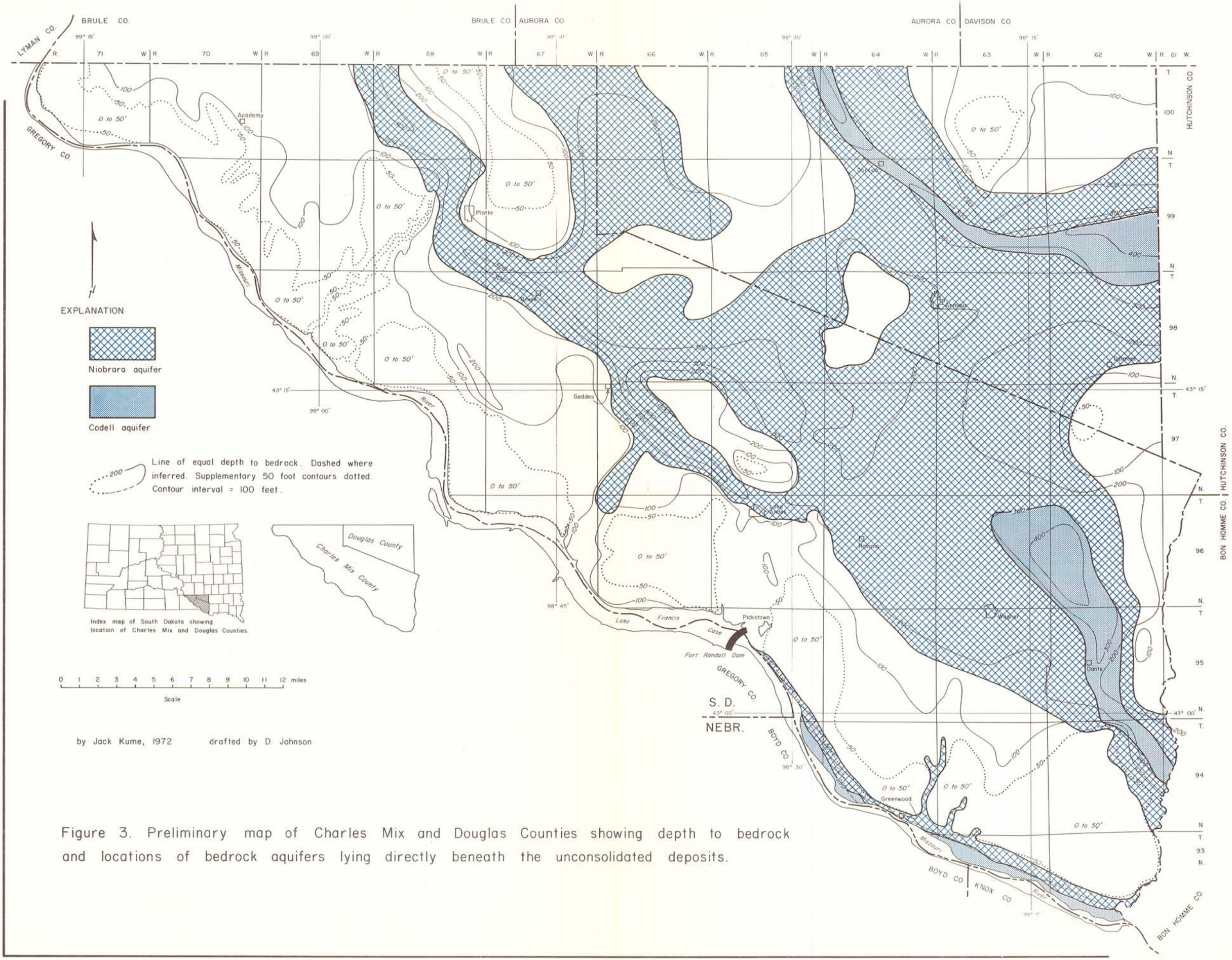

Figure 3. Preliminary map of Charles Mix and Douglas Counties showing depth to bedrock and locations of bedrock aquifers lying directly beneath the unconsolidated deposits.

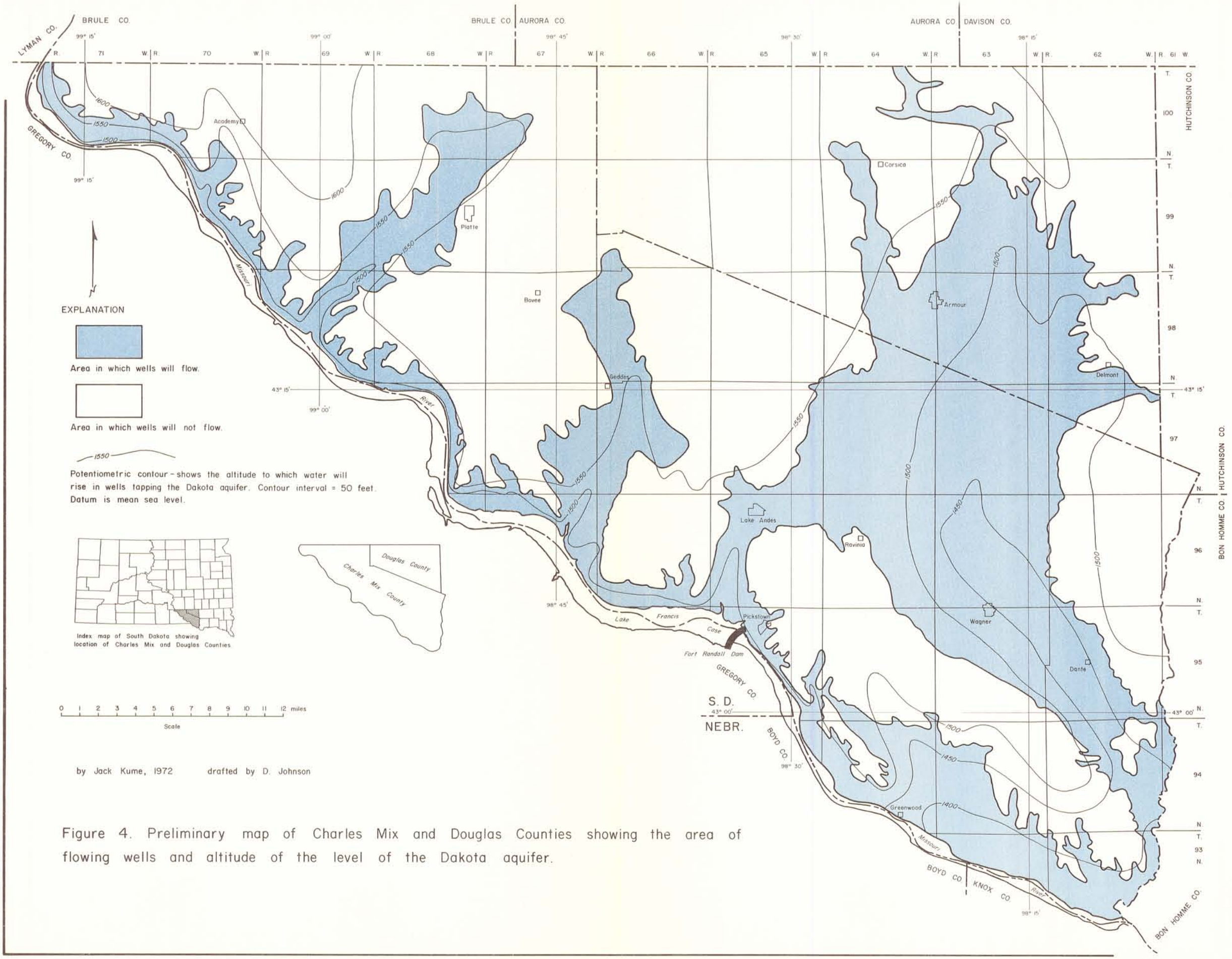

Figure 4. Preliminary map of Charles Mix and Douglas Counties showing the area of flowing wells and altitude of the level of the Dakota aquifer.