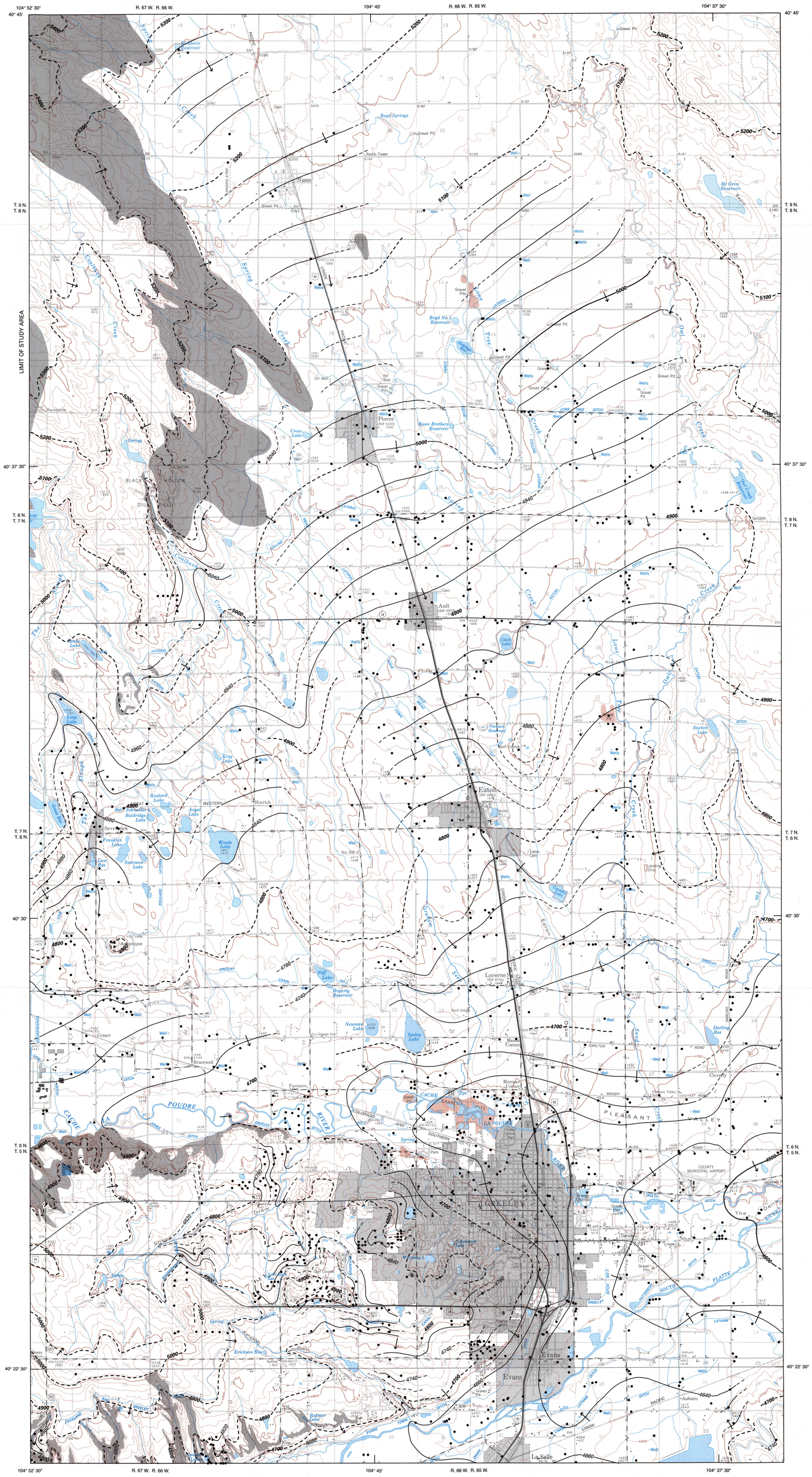
U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

Prepared in cooperation with the
COLORADO DEPARTMENT OF NATURAL RESOURCES,
DIVISION OF WATER RESOURCES, and the
COLORADO WATER CONSERVATION BOARD

HYDROLOGIC INVESTIGATIONS ATLAS HA–746A
Altitude of the water table—SHEET 3 of 5
Robson, S.G., and others, 2000, Geohydrology of the shallow aquifers in the Greeley–Nunn area, Colorado



EXPLANATION

Bedrock outcrop

4940 **Water-table contour—** Shows approximate altitude of water table in the shallow aquifers. Dashed where inferred. Arrow indicates general direction of ground-water movement. Contour interval 20 feet. Datum is sea level

Location of well or test hole with measured water level

HYDROLOGY

Water in the unconsolidated sediments is derived primarily from infiltration of precipitation; leakage from streams, canals, and ponds; and infiltration of irrigation water applied to lawns, gardens, and crops. Downward movement of the infiltrating water is hindered by less permeable underlying bedrock, and the water accumulates to form shallow aquifers with a water table in the unconsolidated sediments (fig. 2). However, the shallow aquifers may be intermittent in upland areas. During wet seasons, or periods of intensive irrigation, large rates of infiltration can cause the water table to rise, and aquifers can form in upland areas. During dry seasons or periods of drought, a lack of infiltration can cause the water table to decline, and the unconsolidated sediments in the upland areas may be drained. The larger stream valleys are the principal areas of ground-water discharge. Ground water also is discharged from the aquifers by evapotranspiration, withdrawal from wells, and discharge to springs.

In areas directly underlain by bedrock aquifers (Robson and others, 1998), water may move between the shallow aquifers and the bedrock aquifers. Water generally moves downward from the shallow aquifers to the bedrock aquifers in upland areas and upward from bedrock aquifers to shallow aquifers in the larger stream valleys (Robson, 1989).

In most of the study area, water levels in the shallow aquifers have remained relatively constant over many decades (fig. 6). However, in some areas, water-level declines of 5 to 15 feet have occurred during a few dry periods when local precipitation or surface flow in streams and ditches was less than normal or when pumping from wells was greater than normal. Following these dry periods, the water levels commonly have recovered to near their long-term average. The appearance of the hydrographs can be affected by the frequency of the water-level measurements; biannual measurements in spring and fall sometimes produce a saw-toothed appearance, and single measurements every few years sometimes produce straight line segments or a blocky appearance to the hydrographs.

The well number shown on each hydrograph in figure 6 indicates the location of the well. For example, well number 8N/65W–34ABB is in Township 8 North, Range 65 West, section 34, in the northwest quarter of the northwest quarter of the northeast quarter of the section. The letter "A" indicates the northeast quarter, "B" indicates the northwest quarter, "C," if used in this example, would indicate the southwest quarter, and "D," if used, would indicate the southeast quarter. The first of the three letters indicates the largest quarterly division of the section; the following letters indicate progressively smaller quarterly divisions.

Altitude of the Water Table and Direction of Ground-Water Movement

The map of the water-table altitude (fig. 7) was prepared by hand contouring, and the geographic information system was used for plotting. Water-level measurements made in wells and test holes at various times by various individuals or agencies were hand contoured to better interpret the varied and inconsistent data values that sometimes resulted from inaccurate water-level measurements, unsaturated sediments, mislocated data points, or fluctuating water levels. Water-table contours generally were drawn using the preponderance of data in a local area and do not necessarily agree with each individual data value. Because water-level trends are minimal and measurements were made during all seasons over many years, the map (fig. 7) represents average water-level conditions in the aquifers. At any given time, however, the water level in a well could be higher or lower than indicated on the map due to local conditions and recent effects of weather, streamflow, and irrigation.

The water table in the shallow aquifers (fig. 7) ranges in altitude from about 5,400 feet in the northwest corner of the study area to about 4,600 feet in the South Platte River valley east of Greeley. The altitude of the water table shows water-level conditions primarily within unconsolidated sediments. However, where bedrock occurs at or near the land surface, the water table is defined by water-level conditions in the bedrock because at these locations, the bedrock aquifers generally are unconfined and have a water table similar to that in the unconsolidated sediments. The general altitude and configuration of the water table in both bedrock and unconsolidated sediments are similar to that of the land surface because depths to water are shallow in most areas. In areas where a ground-water supply has been developed, enough wells usually exist to provide water-level measurements adequate to define water-table contours at 20-foot intervals. In upland areas where unconsolidated sediments commonly are thin or sometimes unsaturated, few shallow wells exist, and water-level measurements are so sparse that the water table is contoured at 100-foot intervals. The locations of most of the upland 100-foot-interval contours and some of the 20-foot-interval contours are inferred from the altitude of the land surface and are shown in figure 7 as dashed lines. The thin unconsolidated sediments may be drained during dry periods in much of the area where contour lines are dashed.

Ground water flows from areas of high water-table altitude toward areas of low water-table altitude along paths that generally are perpendicular to the water-table contours, as shown by the arrows in figure 7. Ground water flows from upland areas toward stream valleys and, thence, down the valleys or down the paleovalleys. The larger stream valleys are principal areas of ground-water discharge. Ground water flows down the valley and toward the stream, where the water may seep into the stream. Thus, the Cache La Poudre River and the South Platte River are gaining streams through most of the study area. Most of the ground water in the study area that is not withdrawn by wells or consumed by evapotranspiration eventually flows to the South Platte River and leaves the area as streamflow, canal flow, or as underflow through the unconsolidated sediments of the South Platte River valley east of Greeley.

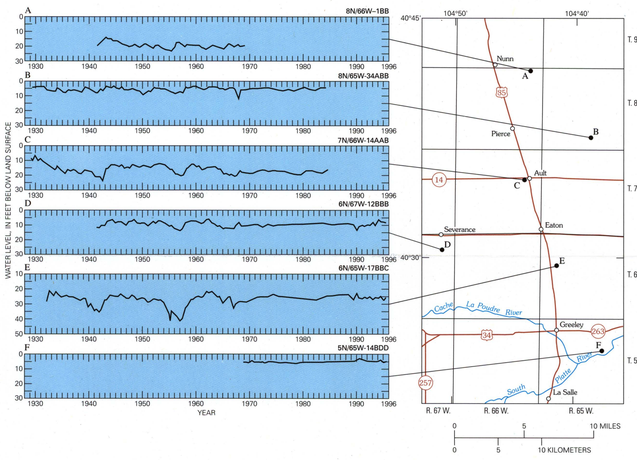


FIGURE 6—Water-level hydrographs for shallow wells.

FIGURE 7—Altitude of the water table and direction of ground-water movement.

Base from U.S. Geological Survey
1:50,000 Weld County

SCALE 1:50,000
1 1/2 0 1 2 3 4 MILES
1 .5 0 1 2 3 4 5 KILOMETERS

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

INTERIOR—GEOLOGICAL SURVEY, RESTON, VIRGINIA—2001

20% TOTAL RECOVERED FIBER

GEOHYDROLOGY OF THE SHALLOW AQUIFERS IN THE GREELEY–NUNN AREA, COLORADO

By
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2000