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WATER-BEARING CHARACTERISTICS OF THE ROCKS OF
EASTERN COLFAr AND WESTERN UNION COUNTIES,
NEW MEXICO

By

GEORGE A. DINWIDDIE AND JAMES B. COOPER

U.S. Geological Survey

INTRODUCTION

The eastern part of Colfax County and the western
part of Union County is predominantly a plains area
studded with lava-capped mesas and volcanic cones. It
contains some of the most interesting topographic and
geologic features in New Mexico—one of which, Capulin
Mountain, a near-perfect cinder cone, was designated a
National Monument in 1916.

The principal structural feature of the area is the north-
est-trending Sierra Grande arch that underlies the north-
west part of Union County and continues southwestward
through eastern Colfax County. In southeastern Colfax
County, the Precambrian surface is about 4,900 feet above
sea level; east of the axis of the arch the beds slope gra-
dually to the southeast and near the New Mexico-Oklahoma
State line the Precambrian surface is near sea level. West
of the arch the beds slope gently to the northwest towards
the axis of the Raton structural basin, about 20 miles west
of Raton in Colfax County (Foster and Stipp, 1961).

The rocks that crop out in eastern Colfax and western
Union Counties range in age from Triassic to Quaternary;
most of them will yield water to wells. Rocks older than
Triassic are not exposed in the area. Several oil test wells
in eastern Union County have penetrated these rocks,
which include all of the Paleozoic systems except the
Silurian and Devonian, and have reached the Precambrian
surface. No water wells in eastern Colfax or western Union
Counties are known to tap water in rocks older than
Triassic and nothing is known of the quantity or quality
of the water that may be present in them. The principal
aquifer is the Dakota Sandstone of Cretaceous age.

The following discussion is of general Ethology, the
known water-bearing characteristics, and the present and
potential utilization of ground water from the stratigraphic
units that crop out in the plains. The formations are de-
scribed in order from oldest to youngest.

DOCKUM GROUP

The oldest rocks that crop out in the plains are strata
in the Dockum Group of Late Triassic age. In Union
County nearly all exposures are restricted to the drainage
area of the Cimarron River. Here the Baldy Hill Forma-
tion, the Travesser Formation, the Sloan Canyon Forma-

1 Publication authorized by the Director, U.S. Geological Survey.
The Greenhorn Limestone of Late Cretaceous age conformably overlies the Graneros Shale and crops out at many places in the plains area of eastern Colfax and western Union Counties. The Greenhorn consists of thin beds of gray to black lime-manye places in the plains of Colfax and Union Counties. mmany are of adequate nor acceptable for domestic use. The Dakota Sandstone and the underlying Purgatoire Formation, both of Early Cretaceous age, are widespread in the plains area of eastern Colfax and western Union Counties. Because of their lithologic similarity it is most difficulty to differentiate two formations everywhere. In this report the name Dakota Sandstone applies to all the sandstone, and minor amounts of shale, between the Morrison Formation and the overlying Graneros Shale. The Dakota crops out along the Canadian River in the southern part of Colfax County, in the Cimarron River valley of Union County, and in large areas of the plains of both counties. The upper part of the Dakota is a lenticular to parallel-bedded gray shale, shaly sandstone, and sandstone. The lower part is dark-gray shale with light-colored to white sandstone at the base. In the plains area the Dakota ranges in thickness up to 300 feet.

The Dakota Sandstone is the principal aquifer in the plains area of eastern Colfax and western Union Counties. It yields adequate quantities of water to stock and domestic wells and where present, the lower sandstone unit may yield 500 gpm (gallons per minute) or more to wells. The chemical quality of the water is variable, but generally is suitable for stock and irrigation use; in places it is undesirable for domestic use.

GRANEROS SHALE

The Graneros Shale of Early and Late Cretaceous age conformably overlies the Dakota Sandstone and crops out principally in Tps. 23 and 24 N., Rs. 23, 24, and 25 E., Colfax County and in many localities in the uplands of western Union County. It consists mainly of fossiliferous dark-gray to black, fissile shale, but in places it contains thin (less than 1 foot) beds of limestone. The Graneros ranges in thickness up to 170 feet in the plains area. In the southern part of Colfax County the Graneros yields generally less than 5 gpm to a few stock wells; it is not known to yield water to wells in Union County. The quantity and quality of water from the Graneros generally are neither adequate nor acceptable for domestic use.

GREENHORN LIMESTONE

The Greenhorn Limestone of Late Cretaceous age conformably overlies the Graneros Shale and crops out in many places in the plains of Colfax and Union Counties. The Greenhorn consists of thin beds of gray to black limestone that weathers to a light tan, and dark-gray to black calcareous shale. The formation is seldom more than 50 feet in thickness. The Greenhorn probably will yield small quantities of water through fractures at places where it is saturated. A few wells in the plains area obtain small yields from the Greenhorn near the outcrop of the formation. The water from most of the wells in the Greenhorn is of fair quality, though it is hard.

CARLILE SHALE

The Carlile Shale of Late Cretaceous age conformably overlies the Greenhorn Limestone and crops out at many places in the northeast corner of Colfax County and the northwest corner of Union County. The Carlile mainly consists of dark-gray to black shale that contains some thin beds of limestone and a few thin beds of silty sandstone. The formation ranges in thickness up to 200 feet in the plains area. It is not considered as an aquifer, although it is possible that at places permeable beds in the upper part of the formation might yield some water to a well.

GOGALLALA FORMATION

The Ogallala Formation of Pliocene age occurs as irregularly shaped outliers, some of which cover as much as 10 to 15 square miles in parts of the plains area of Colfax and Union Counties. In much of the area it is covered by lava flows. The Ogallala is a heterogeneous deposit of sand, silt, and clay that contains some gravel and boulders near

[In this article there is no mention of the Trinidad Sandstone, Vermejo Formation, and the Raton Formation as potential aquifers. It is believed that the reason for this is that this account is limited to the plains of eastern Colfax County and western Union County. In addition, there is a lack of well data in the high mesas.—Ed.]
the base. The thickness of the Ogallala in the plains area ranges up to nearly 300 feet; it is thickest where it fills ancient valleys cut in the underlying bedrock. Water of good chemical quality is yielded to wells from the Ogallala. The yield is variable and is dependent upon the thickness and type of saturated material, which in turn is dependent upon the topography of the surface upon which the Ogallala was deposited. A well at the Capulin Mountain National Monument penetrated the Ogallala Formation from 671 to 680 feet beneath basaltic cinders and yields more than 40 gpm.

**VOLCANIC ROCKS**

Lava fields and flows of Tertiary and Quaternary age cover many hundreds of square miles in the plains area of eastern Colfax and western Union Counties. They are prominent as caps on mesas and as flows in the valleys. The volcanic rocks mainly consist of basalt but there are also some rhyolitic to latitic tuffs and flows. They lie above the water table in many localities; however, many springs issue from the bases of the basalt flows as water percolates downward through joints and fractures. The village of Branson, Colorado, about one mile north of the New Mexico State line north of Folsom, is supplied by water from several springs located in T. 32 N., R. 28 E., Union County. These springs yield about 50 gpm from basaltic lava flows which cap a large mesa in this area. Near Capulin yields of 1,000 gpm or more are obtained from shallow wells that tap water in cinders. This area is presently being investigated as a possible source of municipal supply for the city of Raton. Water in the lava and associated alluvium generally is of good chemical quality.

**ALLUVIUM**

Alluvium of Quaternary age occurs in the plains area as stream-channel deposits, as wind-blown silt and clay deposits, and as an areal deposit in the Capulin basin in Tps. 28 and 29 N., Rs. 26 to 28 E., south and west of Capulin. The alluvium consists of clay, silt, sand, and gravel that generally are not consolidated. It yields adequate quantities of water to domestic and stock wells in many stream valleys. In the Capulin basin the alluvium is as much as 100 feet thick and may yield 100 to 300 gpm to wells. The chemical quality is generally satisfactory for stock, domestic, and irrigation uses.

**PEDIMENT GRAVELS**

Pediment gravels of Quaternary age occur as veneers on remnants of pediments. They are present at many places in Colfax County and are particularly noticeable near Springer and Maxwell. The gravels consist of sand and gravel, clay and silt. Water-saturated zones in the gravel generally are not thick enough to yield more than a few gallons per minute. The pediment gravels are not considered to be an aquifer in eastern Colfax and western Union Counties.
Dakota Sandstone, Morrison Formation, and sandstones of the Dockum Group locally yield water that is undesirable for domestic use.

Adequate quantities of ground water are available for stock and domestic use throughout eastern Colfax and western Union Counties. Water wells range in depth from less than 10 feet to about 700 feet. A few wells near Springer flow; elsewhere water levels range from a few feet to more than 600 feet below the land surface. Most of the water is used on ranches; only minor amounts are utilized for public supply. Large yields are not common and are known to be obtained only from volcanic cinders and alluvium near Capulin.

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