56-53

UN2

# POSSIBILITIES OF IRRIGATION IN THE CAPULIN AREA, COLFAX AND UNION COUNTIES, NEW MEXICO

By

E. H. Herrick
U.S. Geological Survey

1951

(Released to the open file in 1957.)

As of 1951 a few irrigation wells had been completed in the vicinity of Capulin in northwestern Union County, one of which was reported to yield 2,000 gallons a minute. (See table 1.) The yield from these wells is such that some consideration has been given to expanding irrigation in the area. In order to obtain information on this development and to determine the possibilities of developing additional irrigation supplies in the basin, the writer, as part of the program of studies of ground waters of New Mexico in cooperation with the State Engineer, made a reconnaissance of the area from July 10 to 14, 1951.

Land in the Capulin basin is flat to gently rolling and contains many small lakes and poorly drained depressions. The only perennial stream in the area is along the east side, where springs in secs. 11 and 12, T. 29 N., R. 28 E., provide a perennial source of water for an unnamed stream which flows northeastward out of the basin (see map). Capulin Mountain, an extinct and almost perfectly circular volcano about 3 miles north of Capulin, is the most notable topographic feature in the area.

The part of the Capulin basin in the eastern part of Colfax County, south of the King Ranch and northeast of Cunico, is underlain largely by sheetlike alluvium which extends eastward into Union County in the

TABLE 1

RECORD OF WELLS IN THE VICINITY OF CAPULIN, UNION COUNTY, NEW MEXICO

(For record of wells in Colfax County, see Griggs, 1948)

| Location | Owner | Year completed | Depth of well (ft) | Water level: Depth below land surface datum (ft) | Water level: Date of measurement | Principal water-bearing bed: Depth to top of bed (ft) | Principal water-bearing bed: Character of material | Principal water-bearing bed: Geologic age | Method of lift* | Use of water/ |
|---|---|---|---|---|---|---|---|---|---|---|
| T. 28 N., R. 28 E. | | | | | | | | | | |
| sec. 3 | | - | 35 | - | - | - | Sand | Quaternary | - | - |
| sec. 7 | | - | 95 | - | - | 22 | Limestone and shale | Cretaceous | - | - |
| SE¼ sec. 9 | Mr. Leirer | - | 70 | 47± | - | - | Sand | Quaternary | - | - |
| T. 29 N., R. 27 E. | | | | | | | | | | |
| SW¼ sec. 13 | John King | - | 18 | 12.5 | 3-12-46 | - | do. | do. | W | S |
| T. 29 N., R. 28 E. | | | | | | | | | | |
| NW¼ sec. 11 | Jack Pruett | 1934? | - | 41.6 | 7-12-51 | - | - | - | EP | D,I,S |
| SE¼SW¼ sec. 17 | George Snead | 1949? | 41½ | 35.3 | 7-11-51 | 39½ | Volcanic cinders | Quaternary | GP | I |
| SW¼SW¼ sec. 17 | Dewey Munden | 1950 | 49 | 41.0 | do. | - | do. | do. | EP | D |
| SW¼SE¼ sec. 18 | S. Sandoval | - | 44 | 40.9 | do. | - | do. | do. | B | D |
| SE¼SW¼ sec. 18 | Carl Crist | 1949? | 34 | 29.6 | do. | 8 | do. | do. | GP | I,S |
| NE¼SW¼ sec. 18 | R. A. Pachta | 1948 | 48½ | 26.2 | 7-10-51 | 28½ | do. | do. | GP | I |
| NE¼ sec. 19 | Wm. Morris | 1950? | 62 | - | - | 45 | Lava | do. | - | D |
| sec. 22 | | - | 150± | - | - | - | do. | do. | - | - |
| sec. 26 | Mr. Pittard, Sr. | - | 190 | - | - | - | Lava? | do. | W | D,S |
| sec. 28 | Mr. Pittard, Jr. | - | 100 | 40* | - | - | Sand | do. | - | - |

* B, bucket; EP, electric pump; GP, gasoline pump; W, windmill.

/ D, domestic; I, irrigation; S, stock.

(feet are in decimals & fractions)

gpm Capulin, by Herrick...2

vicinity of and south of Capulin. The exact extent of the alluvium is difficult to determine because of the mantle of soil, but it probably covers an area of at least 75 square miles in the two counties. To the west the alluvium pinches out against the Niobrara and Pierre formations of Cretaceous age. On the south the alluvium is bounded by lava flows of Quaternary age and the Dakota sandstone of Cretaceous age. To the east the alluvium is bounded by the lavas of the Sierra Grande and on the north it is bounded by lava-capped mesas and by the volcanic rocks of Capulin Mountain.

The alluvium consists of silty clay, sand, and fine gravel. Its thickness ranges from zero to as much as 100 feet. In places the fill rests directly on lava, cinders, and scoria, but over much of the area it probably rests on shale and sandstone beds of Cretaceous age.

In T. 29 N., R. 27 E., in eastern Colfax County, nearly all the wells investigated by Griggs* obtain water from the alluvium at depths to 70 feet. A well in the SE¼ sec. 36 is 140 feet deep and obtains water from the Dakota sandstone, as do many of the wells in T. 28 N., R. 27 E., to the south. Several wells in the latter township obtain water from the Greenhorn limestone, and only a few obtain water from the alluvium.

A study of the distribution of the wells and the elevations of the water levels in these two townships indicates that there are two bodies

---

* Griggs, R. L., 1948, Geology and ground-water resources of the eastern part of Colfax County, New Mexico: ~~State Bureau of Mines and Mineral Resources Ground-Water Rept. 1.~~ N. Mex. School Mines, State Bur. Mines and Mineral Resources Ground-Water Rept. 1.

of ground water, one in the Dakota sandstone and one in the alluvium. The water in the alluvium in T. 29 N., R. 27 E., possibly may be discharging into ponds where it is evaporated. Griggs determined that the alluvium in the vicinity of a well in sec. 13, T. 29 N., R. 27 E., is not highly permeable. ~~Though~~ This well had a yield of only 6 gallons a minute per foot of drawdown, but it did not fully penetrate the aquifer. Therefore, it probably cannot be used as a criterion to indicate whether wells can be developed in the alluvium in T. 29 N., R. 27 E., which would yield water in a sufficient amount to irrigate more than a few acres.

In the southern part of T. 28 N., R. 27 E., a saturated lens of alluvium, smaller than the area of water-bearing alluvium to the north, overlies the Graneros shale but no wells with high yields are known to be developed in the alluvium. In the remainder of the area in Tps. 28 and 29 N., R. 27 E., most of the wells are finished in the Dakota sandstone and Greenhorn limestone, but none of these wells are known to have high yields.

In T. 28 N., R. 28 E., south of Capulin, a dry well drilled in sec. 7(?) is reported to have penetrated 1 foot of soil, 21 feet of sand containing some boulders, and more than 60 feet of shale to a total depth of ~~95~~ 85 feet. The well cuttings at this abandoned well site were examined and proved to be largely fossiliferous limestone and calcareous shale, probably of the Greenhorn limestone. About 2 miles east of this well, in the SE¼ sec. 9, a well owned by a Mr. Leirer is reported to have been completed entirely in sand at a depth of 70 feet. The well is reported to be "strong." A well about 1 mile north of the Leirer well was dug to a depth of 35 feet in ~~x~~ sand and also is reported to

be "strong." In sec. 28, T. 29 N., R. 28 E., a well was completed at a depth of 100 feet in sand. Black shale reportedly was encountered below the sand. The yield of the well was reported to be more than was needed for stock and domestic use. All the domestic and stock wells which obtain water from this sand are reported to yield dependable supplies, although some of the wells occasionally sand up. At least one rancher in this area has contemplated irrigation. It appears possible that properly constructed wells developed in this body of sand, which extends in a southeasterly direction through T. 28 N., R. 28 E., might supply sufficient water for irrigation on a small scale, although it is likely that development on a large scale would deplete the water stored in the aquifer. An aquifer test on one of the wells producing from this sand in the north-central part of T. 28 N., R. 28 E., would aid in determining the permeability of the sand and the possibilities of developing irrigation wells in the area.

The southeastern part of T. 29 N., R. 28 E., is underlain by lava of the Sierra Grande. Little is known of the water-bearing properties of this lava. Parts of it probably are quite permeable, but the zone of saturation appears to be at considerable depth. A well drilled in sec. 22 is reported to have passed through 150 feet of lava; the character of the rocks underlying the lava could not be determined. In sec. 21, about 1.5 miles west of the above well, a hole was drilled to a depth of more than 100 feet in clay without encountering water; the hole was abandoned.

In the vicinity of Capulin in T. 29 N., R. 28 E., the alluvium narrows to less than 0.5 mile in width and is underlain by a bed of

volcanic cinders and scoria at least 30 feet thick in places. It is from these cinders that three irrigation wells and several domestic wells obtain their water. This volcanic material is similar in appearance to the cinders and scoria that form many of the recent volcanic cones of the region. The cinders have been covered by alluvium, which is as much as 40 feet thick in places in this area. Although several wells close to U.S. Highway 87 in the vicinity of Capulin reach the cinders at depths ranging from 8 to 40 feet, only one well is known to penetrate the bed completely. A well drilled recently for William Morris just south of Highway 87 in Capulin penetrated 26 feet of silt and sand, 19 feet of cinders, and 17 feet of hard lava rock. The cinders contain no water at this point, as they lie above the water table. The well is reported to have been pumped at the rate of 30 gallons a minute, obtaining water from fractures in the lava beds.

The wells producing from the cinders north of Capulin are capable of very high yields. Measurements made of the water level in the irrigation well owned by R. A. Pachta, in the SW¼ SW¼ sec. 18, indicated a drawdown of 1.3 feet at the end of 8 hours of pumping at the rate of 1,280 gallons a minute. The specific capacity is approximately 1,000 gallons a minute per foot of drawdown. During the same period, the drawdown in the Crist well, about 200 yards to the south, was 0.07 foot. There was no measurable effect on the water level in the Snead well, which is about 0.9 mile east of the Pachta well. Although Mr. Pachta normally pumps the well at the rate of 1,250-1,300 gallons a minute, the well is capable of yielding as much as 1,700 gallons a minute. Mr. Crist's well is dug 34 feet deep and is finished in cinders. The well normally has about 5 feet of water in it. Mr. Crist

reports that he can pump the well at the rate of 900 gallons a minute without seriously drawing down the water level, but that the pump breaks suction if he pumps more than 1,000 gallons a minute. The Snead well, in the SW¼ sec. 17, also is a dug well, 41.5 feet deep. It normally contains about 6 feet of water and is reported to yield 700 gallons a minute. It is believed that the lower capacities of the Crist and Snead wells are due to the shallow depths of the shafts. Properly constructed wells at these sites, finished at depths farther below the water table in the cinder bed, should -- on the basis of the performance of the Pachta well -- be capable of yielding at least 1,000 gallons a minute.

The cinder bed in which the Pachta, Crist, and Snead wells are finished appears to be more or less ~~xxxxxxxxx~~ evenly distributed north of Capulin and to extend from at least 0.5 mile west of Capulin to about 1 mile east of the village. The volcanic material is at least 30 feet thick in places and is covered by alluvium and soil ranging from a few feet to 40 feet in thickness. The cinders were not found exposed at the surface in the ~~xxx~~ area immediately north of Capulin. Although the exact limits of the cinder bed have not been determined, it appears that the bed extends only a short distance west of the Pachta well and only a short distance east of the Snead well. This assumption is based on the fact that no wells east of the Snead well are known to penetrate cinders, ~~xxxxxxx~~ although several wells have penetrated lava which probably is older than the cinders. All the wells immediately west of the Pachta well are completed in the alluvium. The character of the

rocks underlying the alluvium is not known, but the alluvium here is believed to be underlain with rocks of Cretaceous age.

The cinders are very permeable. Recharge to the cinder bed is in part from the alluvium, but probably a very important part of the recharge to the area comes from the slopes of Capulin Mountain. It is known that this mountain receives a relatively large amount of precipitation in its upper reaches and in the crater at its top, although no records are available. Much of this water probably moves readily through the permeable material of the cone and finds its way into the cinders and alluvium about the base. Precipitation at the village of Capulin, 3 miles south of the mountain, has been recorded by the Weather Bureau for the past 24 years. Normal annual precipitation at the village of Capulin is 15.35 inches. Two springs which feed a northward-flowing stream in secs. 11 and 12, T. 29 N., R. 28 E., are believed to derive their flow from the water body in the cinders of the Capulin area. The spring in the NW¼ sec. 12 discharged an estimated 450 gallons a minute in July 1951 from the openings between loose blocks at the end of a lava flow; and the other spring, in sec. 11, discharged an estimated 90 gallons a minute from similar openings farther up the lava flow. The water discharged by the springs is considerably less mineralized that that pumped from the Pachta well (table 2), which may indicate that this water is derived almost entirely from the slopes of Capulin Mountain.

In July 1951 the water level in the Pachta well was approximately 2 feet higher than the reported level at the time the well was completed in 1948. This probably was due largely to the fact that rainfall in 1949 and 1950, as recorded at the Capulin station, was more than 4 inches above normal.

TABLE 2

CHEMICAL ANALYSES OF WATER FROM A WELL AND SPRING IN THE VICINITY OF CAPULIN, UNION COUNTY, NEW MEXICO

(Units in parts per million.)

| Laboratory Number | 16.943 | 16,942 |
|---|---|---|
| Date of collection | 7-11-51 | 8-4-51 |
| Silica ($SiO_2$) | 28 | 28 |
| Calcium (Ca) | 36 | 50 |
| Magnesium (Mg) | 20 | 42 |
| Sodium and potassium (Na+K) | 27 | 77 |
| Bicarbonate ($HCO_3$) | 221 | 313 |
| Sulfate ($SO_4$) | 27 | 155 |
| Chloride (Cl) | 10 | 29 |
| Fluoride (F) | .6 | .6 |
| Nitrate ($NO_3$) | 7.4 | 4.6 |
| Dissolved solids | | |
| Sum | 265 | 540 |
| Hardness as $CaCO_3$ | 172 | 298 |
| Non-carbonate | 0 | 41 |
| Specific conductance (micromhos at 25°C) | 426 | 847 |
| Percent sodium | 26 | 36 |

Lab. No. 16.943 - Spring; 4 miles E. of Capulin and 1.5 mile N. of Highway 64. Spring; NW¼NW¼ sec. 12, T. 29 N., R. 28 E. Point of collection, spring pool; owner, Milton Bennett; WBF, lava & talus; flow 450 gpm; reported permanent; temp. 54°F.

Lab. No. 16.942 - Drilled well; NE¼SW¼ sec. 18, T. 29 N., R. 28 E; depth 48.5 ft. diam.; 14 in. cased; 48 ft. date collected 10-7-48; point of collection discharge pipe; owner, R. A. Pachta, Des Moines, N. Mex.; WBF cinders, 28.5 to 48.5 ft.; water level 26.2 ft. below LSD; yield 1,244 gpm, pumping meas.; temp. 51°F.

style inconsistent

Mr. Pachta and Mr. Snead were irrigating about 50 acres each in July 1951, but both intended to irrigate larger areas in ensuing years. Mr. Crist was not yet irrigating in July 1951. If these three wells were pumped simultaneously, as they might be throughout much of July and August, a total of about 1,250,000 gallons of water would be pumped in an 8-hour period every day. It is possible that as much as 50 percent of the pumped water would percolate back into the alluvium and eventually into the cinders. It seems likely, however, that this amount of withdrawal would lower the level of the water table appreciably in this small area, though information is inadequate to determine the amount of lowering.

In summary, analyses of samples of water from two wells in the area indicate that the water is satisfactory for irrigation. It appears that the most favorable locality for the development of irrigation is in the vicinity of the three irrigation wells to the north of Capulin in the cinder aquifer. Unless water must be transported a considerable distance, an area of less than 2 square miles is suitable for irrigation from wells drilled in this cinder bed as it has been defined. Another area of possible development of irrigation is in T. 28 N., R. 28 E., south of Capulin, where beds of saturated sand in the alluvium may yield water in sufficient quantities for irrigation on a small scale. Further study would be needed to learn more definitely the extent to which irrigation is feasible in the Capulin basin.


Figure 1.--Map of northeastern New Mexico showing the location of Capulin Mountain National Monument.

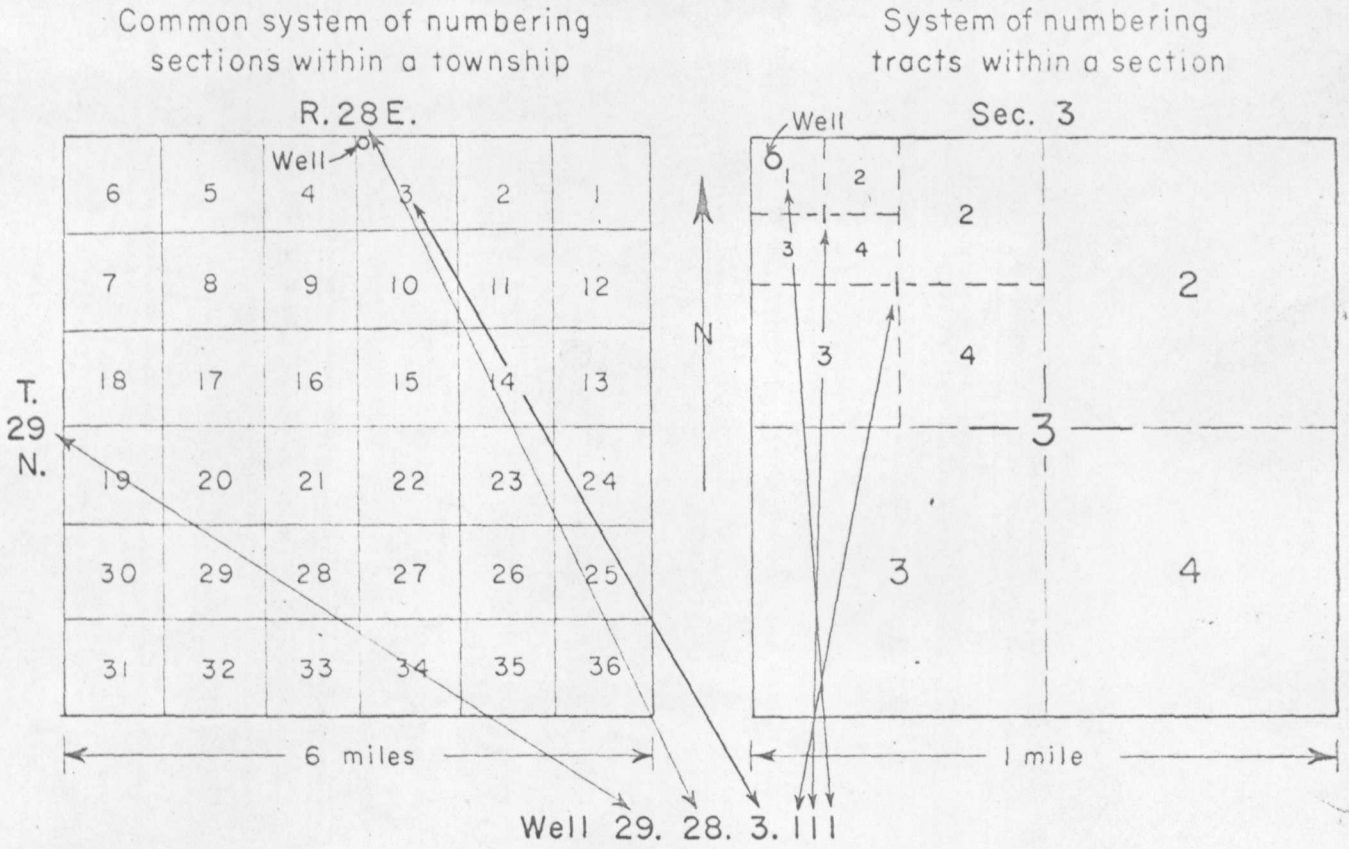
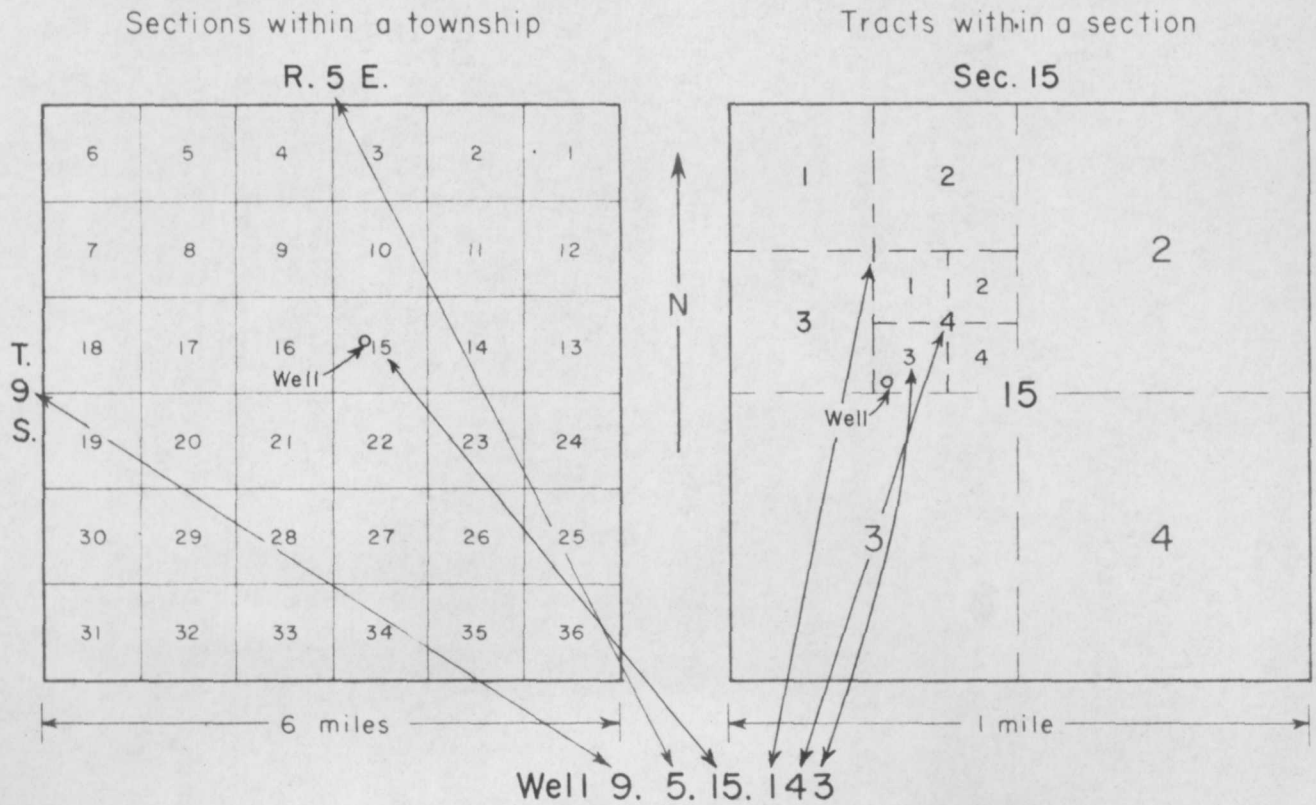



Figure 2.--System of numbering wells in New Mexico

System of numbering wells in New Mexico

All wells referred to in this atlas are identified by a location number used by the Geological Survey for numbering water wells in New Mexico. The location number is a description of the geographic location of the well, based on the system of public land surveys. It indicates the location of the well to the nearest 10-acre tract, when the well can be located that accurately. The location number consists of a series of numbers corresponding to the township, range, section, and tract within a section, in that order, as illustrated below. If a well has not been located closely enough to be placed within a tract smaller than 160 acres within a section, a zero is used for that part of the number. All wells in the area covered by this report are south of the New Mexico Base Line and most are east of the New Mexico Principal Meridian. Those wells west of the meridian are identified by the letter W following the Range number. Springs are identified by the letter S preceeding the Range number.



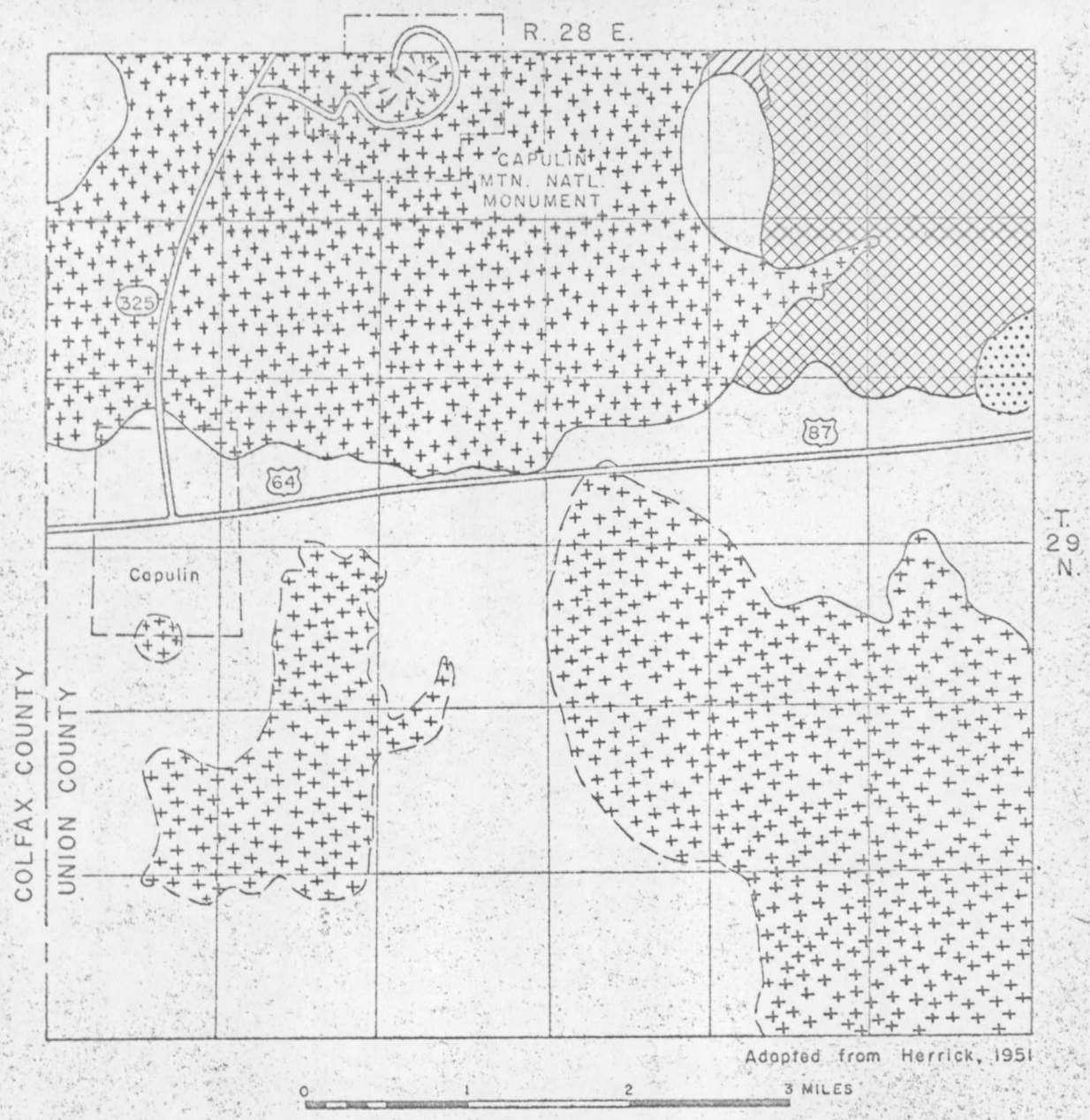



Figure 4.—Generalized areal geology in the vicinity of Capulin Mountain National Monument, N. Mex.

EXPLANATION

QUATERNARY
- Alluvium

TERTIARY
- Volcanic rocks
- Ogallala formation

CRETACEOUS
- Upper Cretaceous: Undifferentiated rocks
- Lower Cretaceous: Dakota sandstone and Purgatoire formation