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1974, pp. 351-354. https://doi.org/10.56577/FFC-25.351

in:

Ghost Ranch, Siemers, C. T.; Woodward, L. A.; Callender, J. F.; [eds.], New Mexico Geological Society 25 th Annual Fall Field Conference Guidebook, 404 p. https://doi.org/10.56577/FFC-25

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GENERAL GEOLOGY AND GROUND WATER CONDITIONS IN THE TRUCHAS-ESPANOLA-VELARDE AREA OF RIO ARRIBA COUNTY, NEW MEXICO

by
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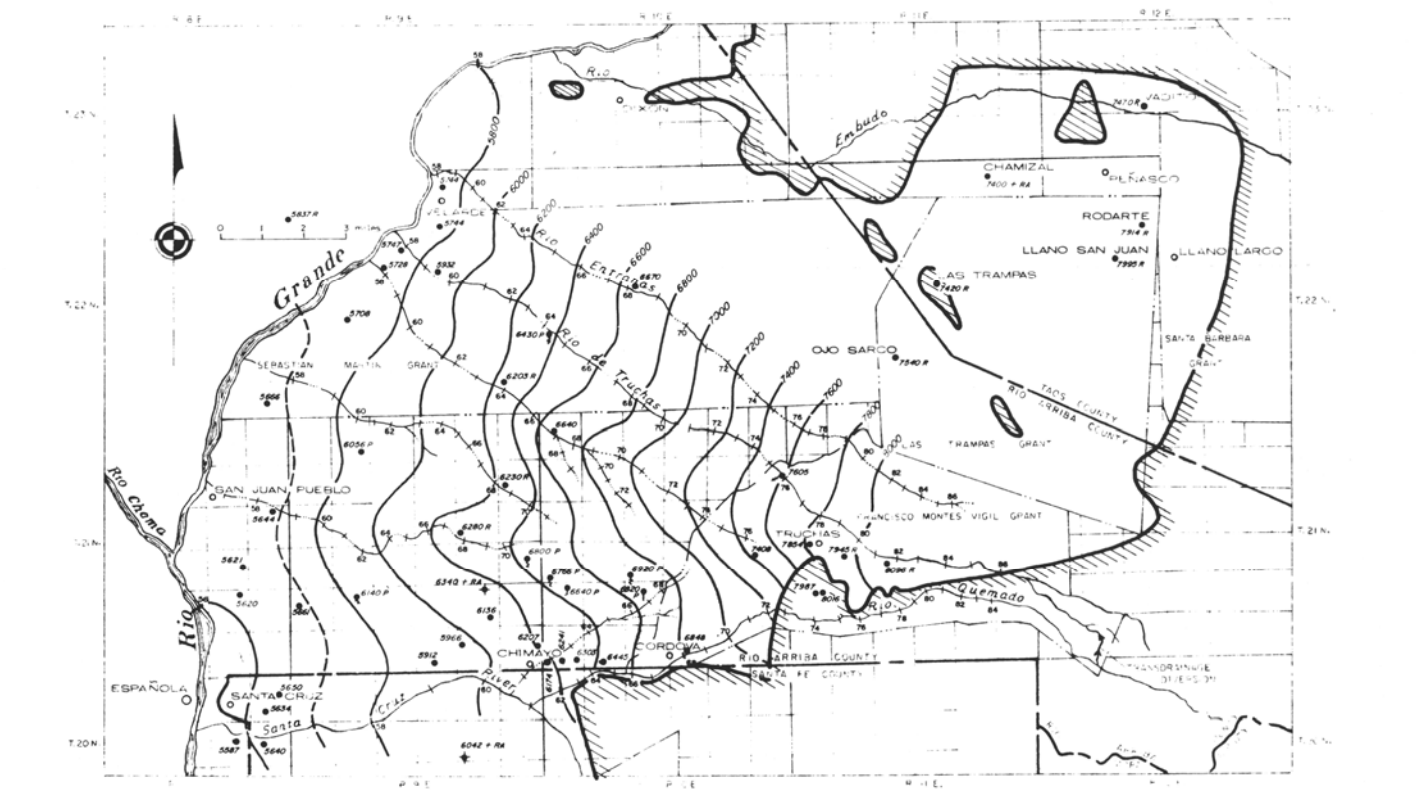
INTRODUCTION

This brief article is based on the research of geologic and hydrologic literature of the Truchas-Espanola-Velarde area and on data collected in the field during April-August 1970 as part of water-rights suit before the U.S. District Court. Fifty-four wells and springs were visited or noted in the 170 square mile area and a water-table map was constructed using measured or reported water levels (Fig. 1).

GEOGRAPHY

The triangular-shaped Truchas-Espanola-Velarde area is bounded on the south by the Santa Cruz River and its main tributary the Rio Quemado, on the north by Rio (Cañada de las) Entranas, and on the west by the master stream of the area, the Rio Grande. The southern one-third of the area drains to the Rio Grande by the perennial Santa Cruz River and Rio Quemado and their tributaries; the remaining northern two-thirds of the area drains to the Rio Grande by westward- and northwestward-trending intermittent streams named, from south to north, Arroyos de Chinguague and del Palacio, Cañada Ancha, Rio de Truchas, and Rio Entranas. Only Rio de Truchas becomes perennial in its upper reach.

The Truchas-Espanola-Velarde area is a dissected piedmont plain which rises gently eastward from an altitude of approx-



CONFIGURATION OF THE WATER TABLE, TRUCHAS-ESPANOLA-VELARDE AREA, RIO ARRIBA COUNTY, NEW MEXICO

R.L.BORTON, STATE ENGINEER OFFICE, 1973

EXPLANATION

- 7644 — WELL WITH WATER-LEVEL ALTITUDE IN FEET ABOVE MEAN SEA LEVEL: A, ARTESIAN; P, PERCHED; R, REPORTED.
- 7152 — SPRING WITH ALTITUDE IN FEET ABOVE MEAN SEA LEVEL: P, PERCHED.
- 5800 — WATER-LEVEL CONTOUR IN FEET ABOVE MEAN SEA LEVEL, CONTOUR INTERVAL 200 FEET. ADDITIONAL 5700-FOOT CONTOUR IS DASHED.
- GEOLOGIC CONTACT OF CENOZOIC ROCKS (OPEN AREA) AND PRE-CENOZOIC ROCKS (HACHURED).
- ARROYO CHANNEL OR STREAM COURSE. TICKS REPRESENT ALTITUDE OF CHANNEL OR WATER SURFACE IN 100'S OF FEET ABOVE MEAN SEA LEVEL, VALUES OF EVEN 100'S GIVEN.

Figure 1.

Table 1. Records of selected wells and springs in the Truchas-Espanola-Velarde area, Rio Arriba County, New Mexico. Well-numbering system is that used by the U.S. Geological Survey and the New Mexico State Engineer Office; "proj." refers to locations projected into unsurveyed land-grant areas. Land surface altitudes, in feet above sea level, at wells was determined from topographic maps. Water-level altitudes are in feet above sea level; R, reported; P, perched; A, artesian. Use symbols: D, domestic; I, irrigated; n, none; S, stock; PS, public supply; OT, oil test.

Location No.	Owner/Name	Depth (ft.)	Land-Surface Altitude (ft.)	Water-level Altitude (ft.)	Measurement	Use, Remarks
20.8.1.243	Trujillo	118	5740	5650	5/28/70	D
20.8.1.342	Terazon		5648	5634	5/28/70	D
20.8.11.241	Martinez	105	5660	5587	5/28/70	D
20.8.12.143	Branch	78	5710	5640	5/28/70	D
20.9.11.333	Castle-Wigzell No. 1 Fed-Kelly	2703	6042	6042+RA	1961	OT, abd. 1961, artesian flows below 405'
21.8.13.211	San Juan Pueblo		5830	5644	5/26/70	S
21.8.23.244	BIA		5691	5621	4/3/70	S
21.8.26.2214	Espanola Rodeo		5680	5620	5/28/70	PS
21.9.5.4234	Kelly		6180	6056P	2/24/70	S, D
21.9.12.310	Kelly	700	6880	6230R	8/ /67	S
21.9.14.331	Kelly	560	6800	6280R	8/ /67	S
21.9.26.210	Elliott No. 1 Elliott	1685	6340	6340+RA	1931	OT, abd. 1937, 200 gpm flow rept.
21.9.24.233			6800	6800P		Spring
21.9.26.441	BLM	300	6230	6136	2/26/70	S
21.9.29.213	Kelly		6140	6140P		S, spring in Arroyo del Llano
21.9.30.134	San Juan Pueblo		5850	5661	4/9/70	S
21.9.34.342	Martinez		5950	5912	5/27/72	D
21.9.35.131	Martinez		6050	5996	5/27/70	D
21.9.36.422	Hodnett		6220	6207	5/27/70	D, S
21.10.6.141	Jaramillo	140	6720	6640	2/18/70	S
21.10.12.2444			7605	7605	11/10/72	S, spring in Rio de Truchas
21.10.19.343			6766	6766P		Spring
21.10.21.330			6920	6920P		3 springs in area
21.10.24.131	Medart	386	7715	7408	5/25/70	D
21.10.28.123			6820	6820P		Spring (El Ojo Negro)
21.10.30.213			6640	6640P		Spring
21.10.31.342	Ortega		6280	6241	5/27/70	D
21.10.31.441	Archuleta		6355	6303	5/27/70	D
21.10.31.333			6200	6174	5/27/70	I, N
21.10.32.344	Lopez		6540	6445	2/26/70	D
21.10.34.413	Roybal	50	6860	6848	5/21/70	D
21.11.19.211	Martinez	285	8040	7854	5/26/70	D
21.11.19.223	Truchas MDWCA	247	8070			PS
21.11.20.143	Law	290	8155	7945R	2/ /71	D
21.11.21.320	Samora	280	8340	8096R	9/ /72	D
21.11.30.232	Sandoval	105	8080	7987	5/25/70	D
21.11.30.232	Sandoval	105	8090	8016	5/25/70	D
22.8.36.4113	Highway Dept.	108	5750	5666	11/ /62	D
22.9.3.243	Bustos	90	5820	5744	5/26/70	D
22.9.7.111	Rio Salado Acres, Inc.	1037	6795	5837R	1964	S
22.9.9.444	Velarde Elem. Sch.		5830	5747	2/25/70	PS
22.9.15.412	Soil Cons. Serv.		5980	5932	2/25/70	S, D
22.9.16.141			5790	5728	5/27/70	D
22.9.20.322	Jackson Sawmill		5805	5708	5/28/70	D
22.9.36.110	BLM	363	6470	6203R	1970	S
22.10.16.343	BLM		6841	6670	2/25/70	S
22.10.30.122			6430	6430P	2/23/70	Spring in Rio de Truchas
22.11.2.232	Chamizal MDWCA	150	7400	7400+R		PS, flows 20 gpm
22.11.22.proj.	Trampas MDWCA	70	7420	7420R	1962	PS
22.11.28.proj.	Ojo Sarco MDWCA	140	7680	7540R	1972	PS
22.12.5.414	Penasco MDWCA	140	7730	7725R	1953	PS
22.12.9.proj.	Rodarte MDWCA	140	7920	7914R	1953	PS
22.12.17.proj.	Llano San Juan MDWCA	300	8075	7995R	1955	PS
23.12.33.121	Vadito MDWCA	158	7480	7470R	1960	PS

imately 5,500 feet near the Rio Grande. The southeastern part of the area, in the vicinity of Truchas, consists of an elevated dissected plain (El Llano de Abeyta) which slopes gently northwestward. The southern edge of a western extension of the plain (Mesa de la Ceja) rises about 1,000 feet above Chimayo in the Santa Cruz Valley where its base is marked by spectacular badlands; eastward, the high plain merges into foothills which rapidly give way to the rugged Sangre de Cristo Mountains with crest altitudes near 12,000 feet. Below timberline, at about 11,000 feet, zones of fir, spruce, aspen, ponder-

osa pine, pinon and juniper occur in descending order until, at the lowest altitudes along the Rio Grande and Santa Cruz Valleys, vegetation is reduced to scattered junipers, range grasses, and cactus. Cottonwoods and river willows thrive along the perennial watercourses; thick bosques of these water-loving trees border the Rio Grande.

Precipitation in the area varies from about 10 inches annually on the western low plains to more than 30 inches in the high mountain on the east. The village of Truchas, at an altitude of about 8,000 feet, receives an average of nearly 16 inches annually.

The population of the Truchas-Espanola-Velarde area is concentrated in the valleys of the Rio Grande, from Espanola to Velarde, and the Santa Cruz River and the lower parts of its tributaries from its junction with the Rio Grande to Cordova. Truchas, on the southeast lip of the elevated plain occupying the eastern part of the area, is the only village located away from the two streams. The economy of the area is based principally on agriculture; innumerable small farms and orchards along the Rio Grande and Santa Cruz River are irrigated with surface water diverted from these streams.

GENERAL GEOLOGY

The Truchas-Espanola-Velarde area is located in the northeastern part of Espanola basin on the eastern flank of the Rio Grande depression, which extends from southern Colorado through central New Mexico nearly to Texas. The northeasternmost part of the area lies in a sub-basin called the Penasco embayment, open to the west, bordered on the north by the Picuris prong of Precambrian metamorphics and granites, on the east by Pennsylvanian sedimentary rocks, and on the south by Precambrian granite. The contact between the older rocks of the uplifted Sangre de Cristo and Picuris Mountains and the much younger rocks of the Penasco embayment and Rio Grande depression is difficult to observe and interpret; in some exposures it appears to be marked by a zone of high-angle normal step faulting, and at other localities moderately-dipping younger basin rocks are seen to rest unconformably upon the older basement rocks.

The younger rocks filling the Rio Grande depression vary greatly in their attitude and degree of deformation but in general they dip moderately to the northwest, gradually lessening away from the mountains, and are broken by numerous normal strike faults of short length and moderate displacement. Gravity investigations in the Albuquerque and Santa Fe areas indicate that sedimentary rocks filling the Rio Grande depression may be 10,000-15,000 feet thick; preliminary gravity studies in the Truchas-Espanola-Velarde area indicate a maximum thickness of about 12,000 feet in the vicinity of Espanola.

The rocks of the Truchas-Espanola-Velarde area are predominantly those of the Tesuque Formation of the Santa Fe Group, Miocene to Pliocene in age, which is well exposed in the badlands north of Chimayo and in the deep canyons in the central part of the area. The Tesuque Formation has an overall banded, pinkish gray-tan appearance and is composed mainly of arkosic, silty sandstone and mudstone with occasional thin conglomerate or ash beds. Consolidation and cementation vary greatly laterally and vertically. Bedding is commonly irregular, lithologic units are discontinuous, and sorting is poor, typical of alluvial fan deposits. In the basal portion of the Tesuque Formation near Chamizal and Vadito, in the northeastern part of the Peňasco embayment, is a 200-1,200 foot thick sequence of volcanic breccia, basal conglomerate, water-laid tuff, gravels, and thin basalt flows called the Picuris Tuff. Small exposures of similar rock assemblages, called the Bishop's Lodge Member are exposed near the mountain front in the lower part of the Tesuque south of Chimayo and in the Santa Fe area.

Although the Precambrian and Pennsylvanian rocks exposed along the eastern margin of the depression have been downfaulted to as much as 12,000 feet below land surface in the southeast part of the Tesuque-Espanola-Velarde area, it is possible that this interval may contain not only the alluvial sediments of the Tesuque Formation but an unknown thickness of continental sediments of the Galisteo Formation of Eocene age. Galisteo-type lithology was not encountered in either of two oil tests drilled near Chimayo, both of which bottomed in Pennsylvanian rocks.

Unconformably overlying the Tesuque is the Ancha Formation, a very poorly consolidated alluvial deposit of gravel and boulders which caps the high dissected plain of the eastern part of the Tesuque-Espanola-Velarde area. The thickness of the formation, more than 300 feet near the mountain front, gradually decreases westward; it has been completely removed by erosion over the western half of the area. Recent alluvium composed of silt, fine sand, and gravel lenses occupies all of the stream and arroyo channels in the area, the thickest and most extensive being that in the valleys of the Rio Grande and the lower Santa Cruz River.

GROUND WATER

The main aquifers in the Truchas-Espanola-Velarde area are the Tesuque Formation and the alluvium in the major stream channels; aquifers also exist as joints, fractures, and solution openings in the Pennsylvanian and Precambrian rocks of the Sangre de Cristo and Picuris Mountains, but these sources of ground water are very limited and relatively unused. Ground water which occurs in sands and gravels of the Tesuque is usually found under water-table or unconfined conditions; depth to water varies from approximately 100 feet in the low plains and terraces of the west and south to more than 650 feet on the elevated plains of the central and eastern parts of the area. Ground-water movement is westward towards the Rio Grande from the principal area of recharge near the mountains. Configuration of the water-table contours shows mounding of the water table below many of the intermittent streams in the central part of the area, Canada Ancha and Arroyo de Chinguague in particular, which indicates stream loss during times of flood or snow melt. This is probably the most important type of recharge to the ground-water reservoir. The accompanying water-table map (Fig. 1) indicates that groundwater in the alluvium and the Tesuque is intimately related to surface water along the valleys of the Rio Grande and the Santa Cruz River. Perched water bodies which occur in the area are known mainly by the presence of small springs and seeps which issue from the face of the south escarpment of the high plain (Mesa de la Ceja) north of Cordova and Chimayo. Artesian or confined ground-water conditions were encountered in two oil tests located northwest and southwest of Chimayo, one of which is reported to have flowed 200 gpm.

Ground water in the Truchas-Espanola-Velarde area is used

primarily for stock and domestic purposes and is obtained from shallow hand-dug or small-diameter drilled wells of small or moderate capacity. However, the town of Espanola has deeper, large-diameter, gravel-packed wells which produce as much as 250 gpm with a specific capacity of 1.5 gpm per foot of drawdown. Groundwater from the alluvium or Tesuque Formation commonly has a high calcium-magnesium hardness and concentrations of iron or nitrate which exceed Public Health Service standards for domestic use are not uncommon in local areas.

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