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Peter W. Burck, Adam S. Belew, Jeff A. Fassett, Jesus J. Gallegos, Adam L. Lujan, Samuel B. MacKenzie, David E. Mattern, Wesley C. Myers, Brian A. Novosak, Charles L. Schaub, and Michael B. Shelley, [eds.]

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THE BLM HOMESTAKE WELL

PETER W. BURCK¹, ADAM S. BELEW¹, JEFF A. FASSETT¹, JESUS J. GALLEGOS¹,
ADAM L. LUJAN¹, SAMUEL B. MACKENZIE¹, DAVID E. MATTERN¹,
WESLEY C. MYERS¹, BRIAN A. NOVOSAK¹, CHARLES L. SCHAUB¹,
AND MICHAEL B. SHELLEY¹

¹U.S. Department of the Interior, Bureau of Land Management, Albuquerque, NM 87109; pburck@blm.gov

ABSTRACT—The Homestake Well, a flowing artesian well located in the Rio Puerco Valley of northwestern New Mexico, is within the San Juan structural basin of the Colorado Plateau. The well may be screened in the main body of the Late Cretaceous–age Gallup Sandstone or in another lower water-bearing zone, such as the sandstone from which Ojo del Padre Spring emanates at Guadalupe. The well is operated by the Bureau of Land Management to provide water for livestock, irrigation, wildlife, recreation, and domestic uses, and it helps the agency achieve its multiple use and sustainable yield mission. However, the well was drilled more than 50 years ago and may require maintenance or eventual replacement. Therefore, subject to funding availability, the agency plans to investigate how the artesian pressure in the source aquifer has changed over time.

WELL LOCATION

The Bureau of Land Management (BLM) Homestake Well is located 2.5 km (1.5 mi) southwest of the confluence of the Rio Puerco and Arroyo Chico in Sandoval County, New Mexico, at 35.573270 degrees north latitude, 107.204236 degrees west longitude (Figs. 1, 2). The U.S. Geological Survey (USGS) created a nationwide system to delineate and assign unit numbers to watersheds based on surface hydrologic features (USGS, 1987), as illustrated in Figure 3. According to the USGS, the well is within the Guadalupe Canon–Rio Puerco Subwatershed (12-digit hydrologic unit code = 130202040401) at a surface elevation of 1,879 m (6,165 ft; NAVD88).

WELL DETAILS

The BLM Homestake Well was drilled via cable tool in 1971 as a uranium exploration well by the Homestake Mining Company. The 0.15-m-diameter (6 in.) well is 183 m (602 ft) deep. No uranium was found, but artesian water was encountered. Ownership of the well was transferred from the Homestake Mining Company to the U.S. Department of the Interior. Unfortunately, the driller's log does not contain detailed geologic information for the well. Available information pertaining to formation hardness is included in Appendix 1. The water-bearing zones in the well are between 125.0 and 128.0 m (410 and 420 ft) and 142.6 and 143.0 m (468 and 469 ft) below land surface. According to the well record, a flow meter was used to estimate that 25% of the well flow is from the upper zone and 75% is from the lower zone. Initial well yield was about 1.514 m³/min (400 gallons per minute [gpm]) at a pressure of 655 kilopascals (95 pounds per square inch; Craig and Stone, 1983). Current well yield is reduced by a valve to approximately 0.757 m³/min (200 gpm).

In 1974, transmissivity was estimated at 36.2 m² per day (390 ft² per day) from the drawdown portion of a 4-hour constant rate aquifer test. Specific capacity was calculated at 0.029 m³/min per meter of drawdown (2.3 gpm per foot of

drawdown; Stone et al., 1983).

The well is connected to the nearly 161-km (100-mi) underground Cabezon water pipeline, which delivers water for livestock on about 20 grazing allotments and to a domestic water system (BLM, 2012). The pipeline is connected to more than 40 livestock troughs, 23 wildlife drinkers, and more than two dozen 12,000-gallon water storage tanks.

HISTORICAL WATER LEVELS

The USGS measured artesian pressure in the well from the early 1970s to early 1990s (Fig. 4). Well pressures declined during this period. No recent pressure measurements are available. Although the well is equipped with a pressure gage, the accuracy of the reading is unknown. Subject to availability of funding, the BLM plans to install a new pressure gauge and is evaluating the feasibility of monitoring pressure periodically in the future to determine if artesian pressure is changing over time.

WATER QUALITY

Chemical testing indicates the water is a sodium bicarbonate type, suggesting a deep groundwater source. According to Chapelle (2003), sodium bicarbonate type groundwater is often associated with sandstone aquifers. One mechanism for the formation of this type of groundwater is the dissolution of salts containing sodium coupled with feldspar cation exchange (e.g., Hanor and Wendeborn, 2023). In 1978, the water temperature was 17.5°C, and the specific conductance of the water was 490 micromhos at 25°C, indicating the water should be suitable for drinking water, livestock, and irrigated agriculture (Stone et al., 1983; USGS, 2016). Measurements taken between 1978 and 1987 indicate that pH ranged from 8.8 to 9.2 (standard units; USGS, 2016). The relatively high water quality in the well suggests that recharge areas are close and residence time is short (Stone, 1981). More water quality data is given in Appendix 2.

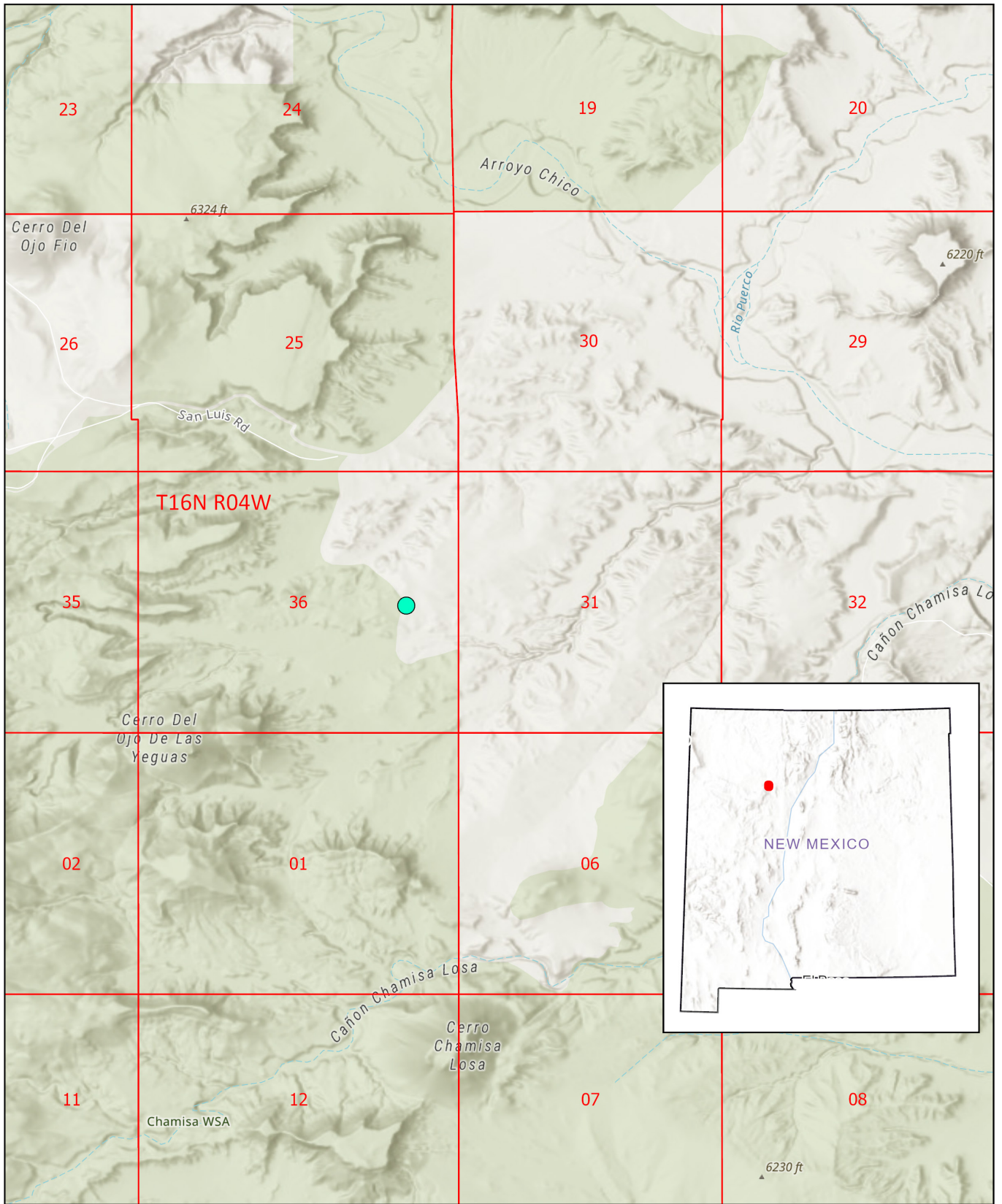


FIGURE 1. Map showing the location of the BLM Homestake Well.



FIGURE 2. The BLM Homestake Well.



FIGURE 3. Example of U.S. Geological Survey Hydrologic Unit Codes (HUCs).

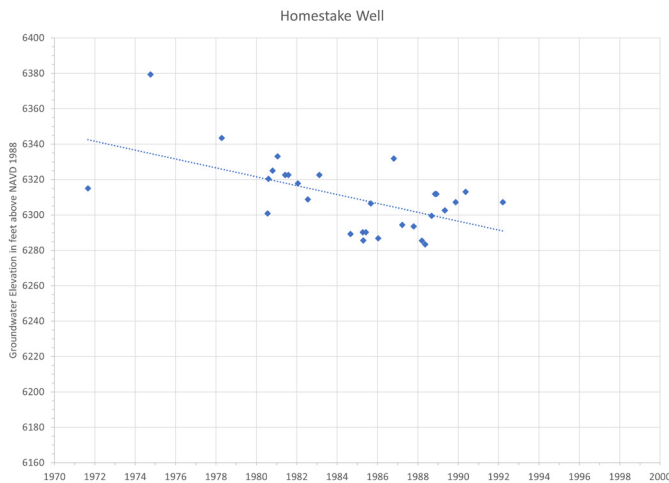


FIGURE 4. Homestake Well groundwater elevation in feet above NAVD 1988 (USGS National Water Information System, 2016). Land surface elevation is 1,879 m (6,165 ft). Groundwater in the source aquifer(s) is under artesian pressure. All data are approved by the USGS Director. Note the downward trend between 1972 and 1992.

HYDROGEOLOGY

The Homestake Well lies in the southeastern portion of the San Juan Basin (Stone, 1981; Kernodle et al., 1989). Near the well, exposed Late Cretaceous strata dip gently ($<3^\circ$) to the northwest (D. Koning, written comm., 2024). The well appears to be screened primarily in the Gallup Sandstone, a major artesian aquifer in the San Juan Basin (West, 1958; Stone, 1981; Molenaar et al., 1996), but it may be screened in a lower water-bearing zone corresponding to the Ojo del Padre Spring sandstone (D. Koning, written comm., 2024). The Gallup Sandstone is a nearshore sandstone confined by marine shale above and below. Its thickness ranges from roughly 25 m (90 ft) northeast of Grants to approximately 200 m (700 ft) northeast of Gallup (Stone and Mizell, 1978; Stone, 1981). In the Gallup-Grants area, the formation comprises seven tongues of progradational, marine (beach) sandstone and lesser fluvial sandstone (Molenaar, 1973; Campbell, 1979; Stone, 1981; Molenaar, 1983). But in the Rio Puerco Valley near the ghost town of Guadalupe, only a single 18-m-thick (59 ft) tongue is observed (Nummedal and Molenaar, 1995; Koning, 2024). The Gallup Sandstone grades laterally seaward into marine mudstones of the Mancos Shale and landward into nonmarine deposits of the Crevasse Canyon Formation (Molenaar, 1983). The formation is underlain by the Mancos Shale and overlain by the Crevasse Canyon Formation to the southwest (near Grants and I-40), but near the Homestake Well, the Crevasse Canyon Formation is missing, and the Mulatto Sandstone directly overlies the Gallup Sandstone (Stone, 1981; Molenaar, 1983; Kernodle et al., 1989; Nummedal and Molenaar, 1995; Koning, 2024). The Gallup Sandstone is a submature to mature lithic arkose (Folk's 1974 classification; Stone, 1979). Porosity in the Gallup Sandstone ranges from 4 to 9 percent (Stone, 1981).

In the southern portion of the San Juan Basin, groundwater flow direction within the Gallup Sandstone aquifer is from the southwest to the northeast but may turn southeasterly near the Rio Puerco (Stone, 1981). Based on this flow direction and topographic consideration, recharge areas appear to be in outcrop areas to the south and southwest of the well and probably include Mount Taylor and Mesa Chivato (Stone, 1981; Kernodle et al., 1989).

WATER PERMIT

In 1982, the BLM filed a declaration with the New Mexico Office of the State Engineer (NMOSE) for 323 acre-ft per annum of water from the well. For NMOSE administrative purposes, the well is located within the Rio Puerco subbasin of the Rio Grande Underground Water Basin, and its NMOSE point of diversion number is RG-38718.

FUTURE WORK

Because the BLM Homestake Well is more than 50 years old, it may require maintenance or replacement. Subject to funding availability, the BLM plans to determine the current

artesian pressure in the well and to make periodic pressure measurements in the future to evaluate pressure trends. The BLM is also investigating whether a well casing inspection is feasible.

SUMMARY

The BLM Homestake Well serves an important function by providing water through a nearly 161-km (100-mi) pipeline for domestic, livestock, wildlife, and other uses in a rural part of the state. Because no detailed geologic well log has been found, there is uncertainty regarding the formation(s) that provide water to the well. The source of water to the well may be the main body of the Gallup Sandstone or a lower zone corresponding to the Ojo del Padre Spring near Guadalupe ghost town (D, Koning, written comm., 2024). The BLM is seeking funding to determine the current artesian pressure in the aquifer at the location of the well and to evaluate the condition of the well casing.

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Appendices can be found at

<https://nmgs.nmt.edu/repository/index.cfm?rid=2024002>