



United States Department of the Interior

U. S. GEOLOGICAL SURVEY

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MEMORANDUM

To: Devin Galloway, WSFT-West Groundwater Specialist, Sacramento, CA
From: Keith J. Halford, Hydrologist, Nevada WSC, USGS
Subject: AQUIFER TEST—Analysis of *ER-5-5 main*, single-well aquifer test of basin fill, Frenchman Flat, Nevada National Security Site

A single-well aquifer test was conducted by Navarro-Intera, LLC (N-I) at Frenchman Flat on the Nevada National Security Site (NNSS) in southern Nevada (Figure 1). Transmissivity of rhyolitic lava-flow aquifers within the basin fill were estimated (Table 1). Well ER-5-5 main was pumped intermittently between April 27, 2013 and May 16, 2013. Transmissivity estimates from well ER-5-5 will constrain model forecasts of contaminant migration from the upgradient underground nuclear test MILK SHAKE, conducted in Emplacement Hole U-5k in 1968 (U.S. Department of Energy, 2011).

Site and Geology

The aquifer test occurred beneath Frenchman Flat in the southeast corner of NNSS where transport of radionuclides offsite is a concern (Laczniak and others, 1996). The well monitored during single-well aquifer testing at ER 5-5 main in Frenchman Flat is completed in older altered Tertiary alluvium. Well ER 5-5 is located in northern Frenchman Flat on the eastern edge of the NNSS (Figure 1). The borehole for well ER 5-5 main exclusively penetrates 1,090 ft of basin fill where the lower 160 ft were saturated (U.S. Department of Energy, 2013). A basalt lava-flow aquifer had been postulated and simulated at the target interval (~900-1,050 ft below ground surface) of well ER-5-5 site (U.S. Department of Energy, 2011). Undifferentiated basin fill with basalt rubble were encountered instead.

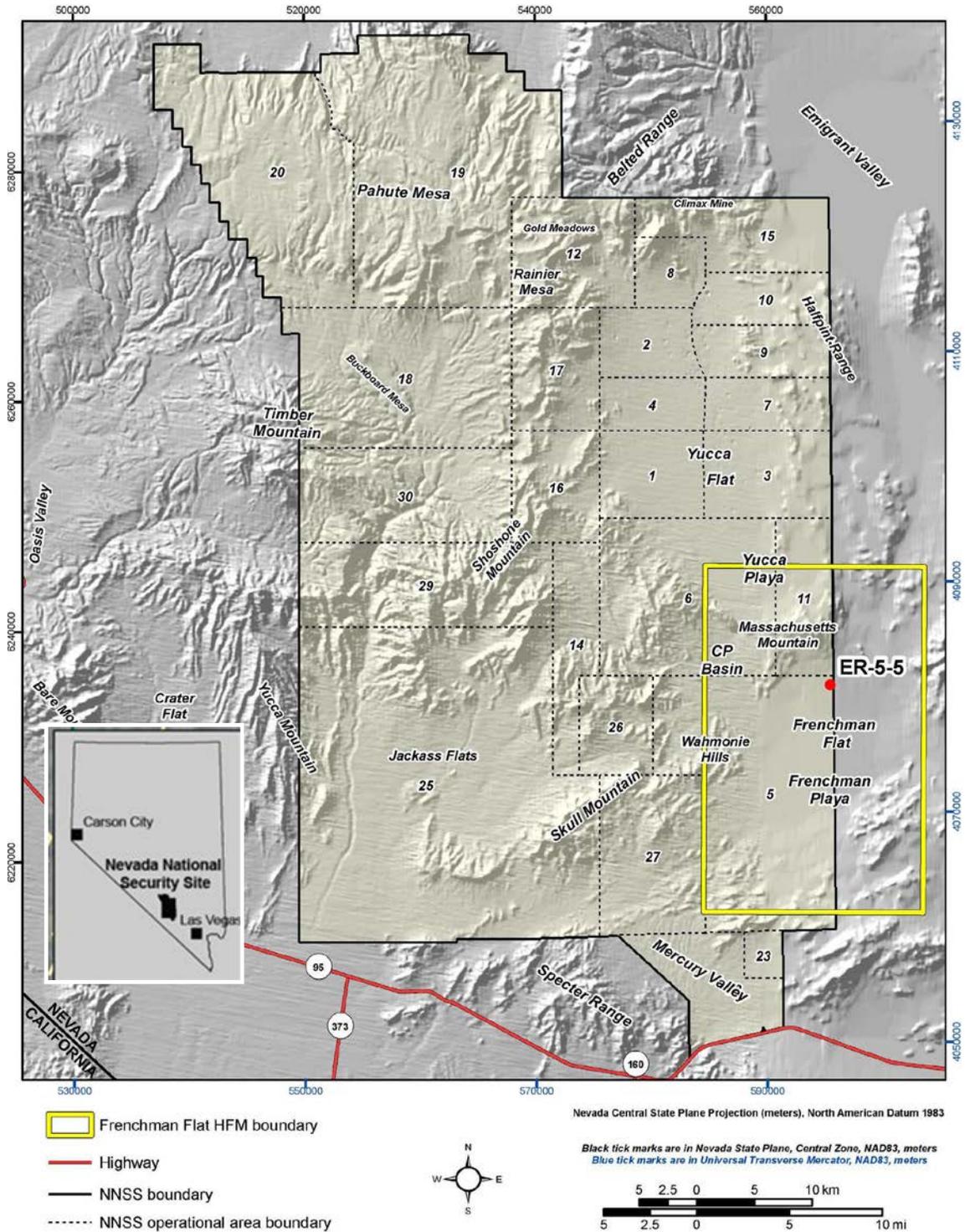


Figure 1.—Location of well ER-5-5, Frenchman Flat, Nevada National Security Site.

Table 1.—Well location and construction data for wells ER-5-5 main and ER-5-5 main piezometer, Frenchman Flat, Nevada National Security Site.

[Latitude and longitude are in degrees, minutes, and seconds and referenced to North American Datum of 1927 (NAD 27); ft amsl, feet above North American Vertical Datum of 1929 (NGVD 29); ft bgs, feet below ground surface.]

Map Identifier	SITE IDENTIFIER	Latitude	Longitude	Ground surface elevation, ft amsl	Depth to Static Water Level, ft bgs	Diameter Screen, in inches	Top Screen, ft bgs	Bottom Screen, ft bgs
ER-5-5 main	N/A	N36°52'12"	W115°55'49"	3,337	930	6 5/8	913	1,038
ER-5-5 piezometer	365212115554901	N36°52'12"	W115°55'49"	3,337	930	2 3/8	925	1,045

Pumping and Drawdowns

The screened interval of ER-5-5 main produces water from undifferentiated basin fill. The constant-rate test lasted about 78 hours and was conducted from 5/13/2013 09:50 to 5/16/2013 15:30. Discharge during the constant-rate test averaged 100 gal/min with a total groundwater withdrawal of about 0.5 million gallons. Total withdrawal during the period of well development and testing was about 1.4 million gallons (Figure 2).

Water levels were measured at well ER-5-5 piezometer so drawdowns could be estimated (Figure 2). Drawdowns were estimated as the change from initial water level without further corrections. Thermal expansion did not occur because water temperature fluctuated less than 0.2°C during the period of well development and testing. Barometric and earth tide fluctuations were much smaller than observed changes in the water levels resulting from pumping (Figure 2).

Analysis

A transmissivity of 400 ft²/d was estimated for geohydrologic units penetrated by the ER-5-5 borehole. This value was estimated by modeling water–level changes with superimposed Theis solutions (Halford and others, 2012). All pumping changes were simulated between April 27 and May 16, 2013. Calibration was limited to the period between May 7 and May 20, 2013 (Figure 3) because pumping was steady relative to initial well development prior to May 4, 2013 (Figure 2). A storage coefficient could not be estimated and was assigned. A value of 0.15 was assumed because the aquifer is unconfined.

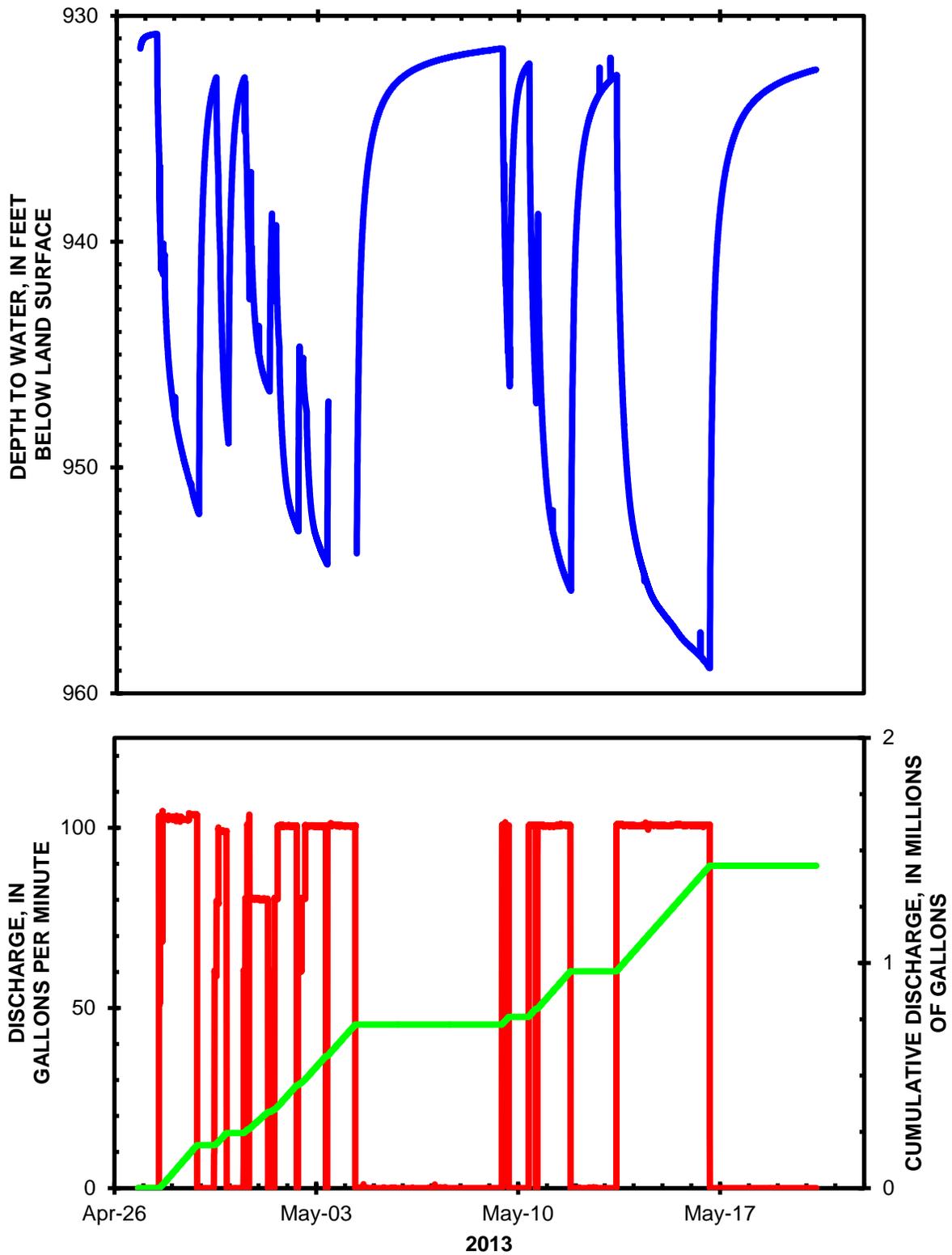


Figure 2.—Water-level changes in well ER-5-5 piezometer and pumping rates and cumulative discharge from well ER-5-5 main during well development and aquifer testing, April-May, 2013.

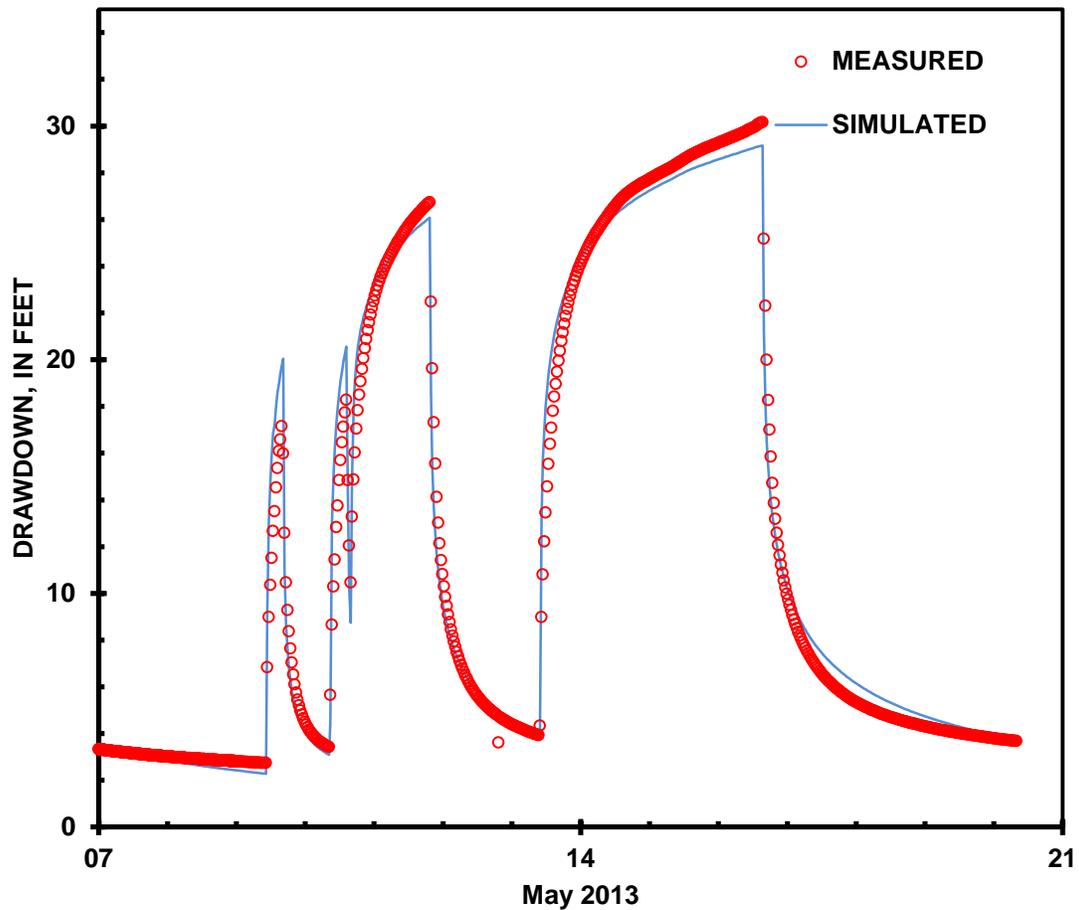
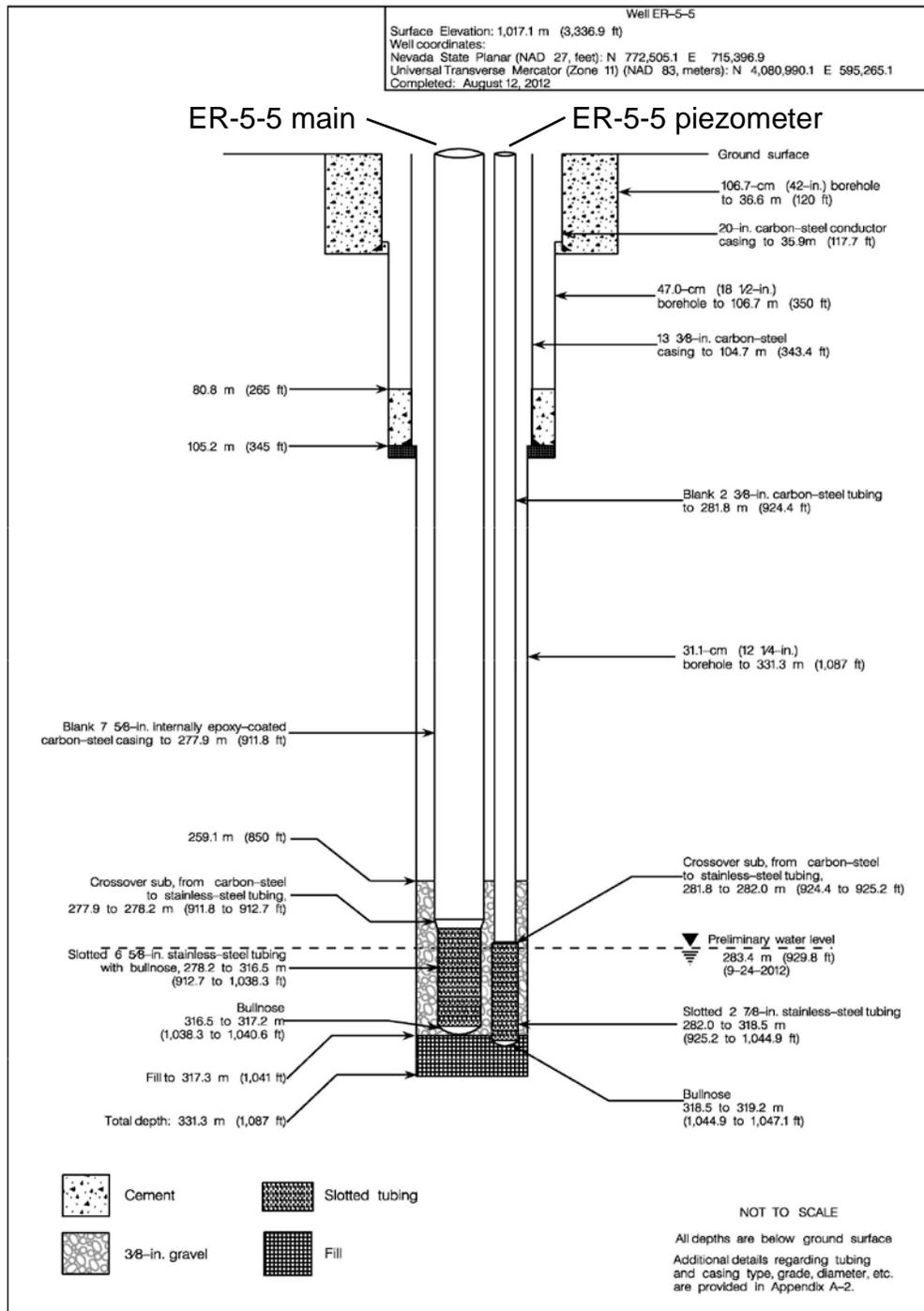


Figure 3.—Measured and simulated drawdown in well ER-5-5 piezometer May 7, 2013 and May 20, 2013.

References

- Halford, K., Garcia, C.A., Fenelon, J., and Mirus, B., 2012, Advanced methods for modeling water-levels and estimating drawdowns with SeriesSEE, an Excel add-In, U.S. Geological Survey Techniques and Methods 4-F4, 28 p. <http://pubs.usgs.gov/tm/tm4-F4/>
- Laczniak, R.J., Cole, J.C., Sawyer, D.A., and Trudeau, D.A., 1996, Summary of hydrogeologic controls on ground-water flow at the Nevada Test Site: U.S. Geological Survey Water-Resources Investigations Report 96-4109, 59 p. <http://pubs.er.usgs.gov/publication/wri964109>
- U.S. Department of Energy, 2011. Corrective Action Decision Document/Corrective Action Plan for Corrective Action Unit 98: Frenchman Flat Nevada National Security Site, Nevada, DOE/NV--1455. Las Vegas, NV.
- U.S. Department of Energy, 2013, Completion Report for Model Evaluation Well ER-5-5 Corrective Action Unit 98: Frenchman Flat: U.S. Department of Energy Report DOE/NV--1496.

Appendix A. Construction diagram well ER-5-5



As-built diagram of the well completion for well ER-5-5 (U.S. Department of Energy, 2013).