37. MOVEMENT OF PERCHED GROUND WATER IN ALLUVIUM NEAR LOS ALAMOS, NEW MEXICO

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The infiltration and underground movement of snowmelt water in Mortandad Canyon near Los Alamos, N. Mex., were studied from March through June 1961. Mortandad Canyon is one of the deep, steep-walled easterly draining canyons that dissect the Pajarito Plateau. The part of the canyon studied has a drainage area of about 2 square miles and heads at an altitude of about 7,350 feet on the central part of the plateau, where the annual precipitation is about 17.5 inches.

The Bandelier Tuff of Pleistocene age caps the Pajarito Plateau and rests on the Santa Fe Group of middle(?) Miocene to Pleistocene(?) age. The principal ground-water body is in the Santa Fe Group about 960 feet beneath the canyon floor. However, a small body of perched ground water, which was the subject of investigation, occurs in alluvium resting on the Bandelier in the bottom of Mortandad Canyon. In the western part of the canyon the alluvium is 40 to 80 feet wide and 20 to 30 feet thick, whereas in the eastern part of the canyon the alluvium is 600 to 700 feet wide and be as much as 100 feet thick.

ie water in the alluvium was monitored by means of holes drilled in seven lines across Mortandad Canyon. At each line (fig. 37.1), 1 observation well and several 2-inch-diameter access tubes were constructed with plastic pipe. Water levels were measured periodically in the observation wells, and the moisture content of the alluvium and underlying tuff was determined by using a neutron-scattering moisture probe in the access tubes.

The source of recharge to the alluvium in Mortandad Canyon is local precipitation. In 1961 about one-fourth of the annual precipitation occurred in the winter, and a snowpack 1 to 2 feet deep accumulated in the deep, narrow western part of the canyon. Some diurnal melting occurred in January, February, and March, and the melt water infiltrated the soil and alluvium. As the length of the daily melting period increased in April, the thin alluvium in the upper part of the canyon became saturated to the level of the stream channel, and surface flow began because the alluvium was unable to absorb and transmit all the snowmelt water.

Infiltration occurred at the front of the surface m and in the channel upstream from the front; ever, the front of the stream advanced eastward

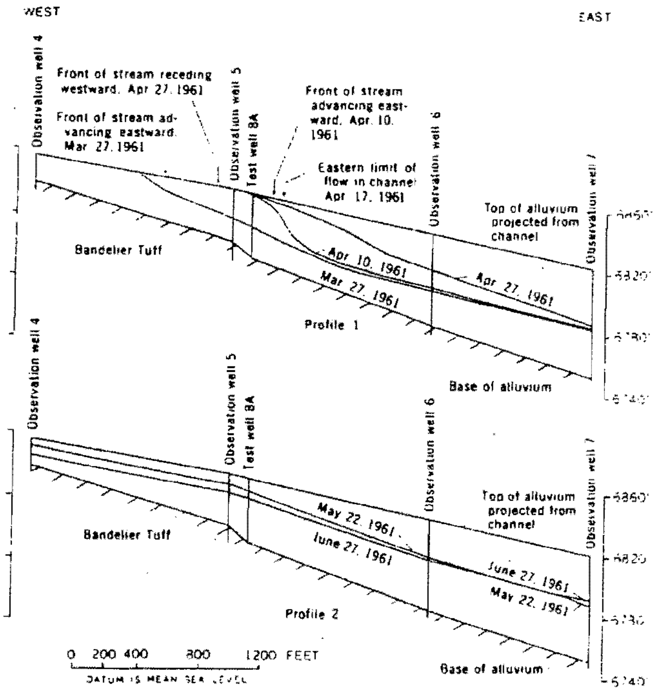

Figure 37.1.—Longitudinal profiles showing base and top of alluvium and water levels in alluvium in part of Mortandad Canyon.

more rapidly than did the front of the zone of complete saturation in the alluvium, as shown by the fact that the front of the stream passed test well 8a (fig. 37.2) almost 2 weeks before the water level in the well indicated that the alluvium was saturated to stream level.

Between observation wells 4 and 6, where the canyon widens, the alluvium thickens and consists of an upper unit of coarse, loose sand and an underlying unit of sandy clay. In this reach the part of the ground-water body in the coarse sand beneath the channel formed a mound with a steep eastward-sloping front. This happened because the coarse sand absorbed water from the stream and transmitted it downward at a faster rate than the sandy clay absorbed the water and transmitted it laterally. Water filtering downward in the coarse sand beneath the eastern part of the stream was accreted to the front of the ground-water mound, causing the front of the ground-water mound in the coarse sand to advance eastward faster than the movement of the ground-water body as a whole.

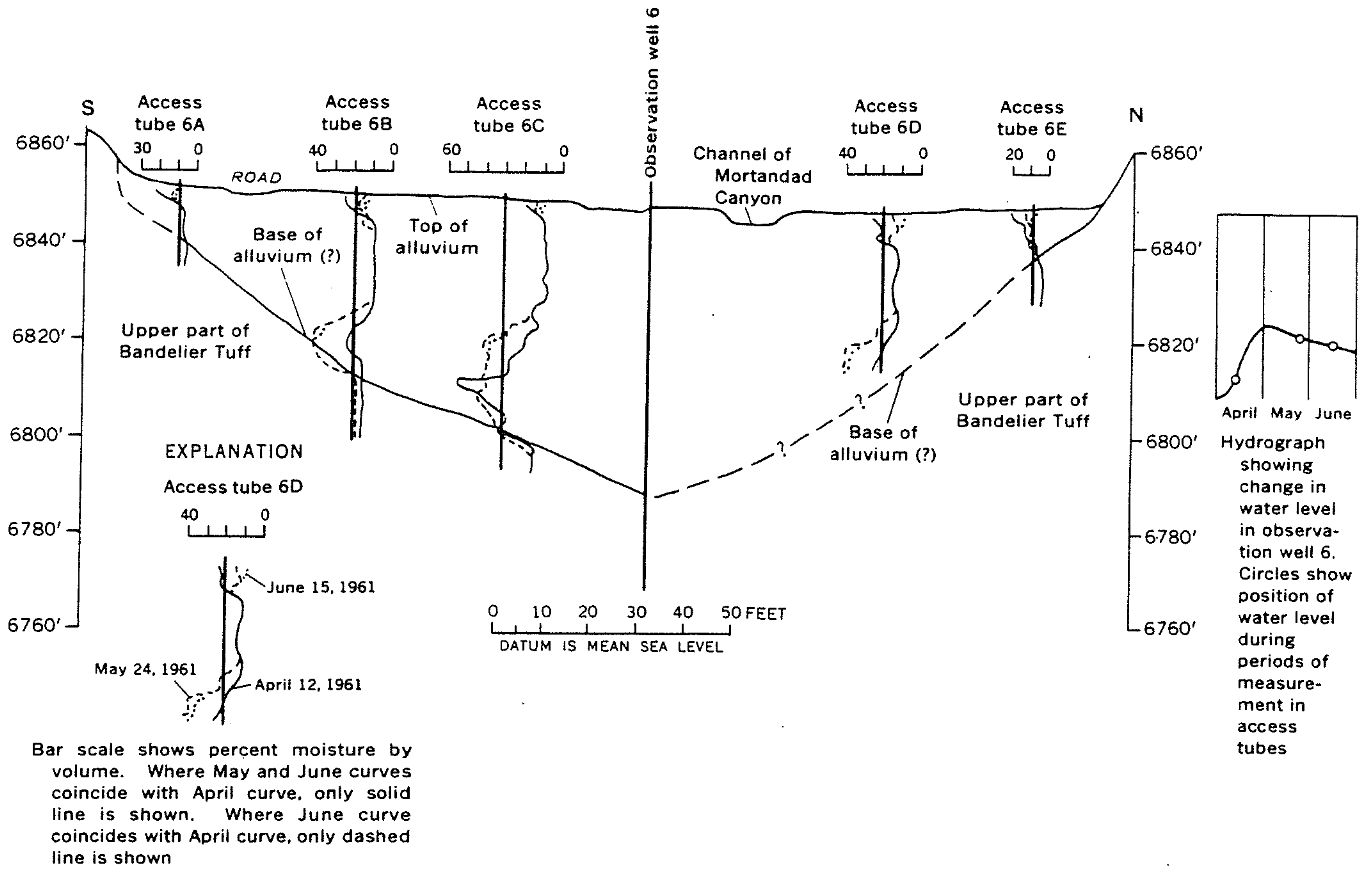

FIGURE 37.2.—Profile across Mortandad Canyon showing water levels and moisture content of alluvium and Bandelier Tuff in the spring of 1961.

Late in April the front of the stream receded upstream as the snowpack in the upper part of the canyon was depleted. The front of the ground-water mound began to decay and flatten because it no longer received recharge directly from the stream (water level for April 27, 1961, on profile 1, fig. 37.1). Subsequent changes of the water levels resulted from continued lateral subsurface drainage of ground water from the upper part of the canyon to the lower part (profile 2, fig. 37.1).

The moisture content of the Bandelier Tuff immediately beneath the alluvium increased slightly. The highest recorded moisture content was 19 percent by volume (access tube 6B, fig. 37.2); this is probably less than the minimum value necessary for significant amounts of water to be transmitted through the tuff. Perched water was not found in the Bandelier Tuff or in the Santa Fe Group above the principal zone of saturation at test well 8, indicating that little or no water is moving downward from the alluvium to the main aquifer in the part of the canyon studied.

The phenomenon of the building of a ground-water mound during infiltration and the different rates of movement of the resulting water strata probably occurs elsewhere. This possibility should be considered in other infiltration investigations, especially in the interpretation of rates of water movement, use of tracers, and studies of chemical quality of water.