TWO INTENSE LOCAL FLOODS IN NEW MEXICO

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Owing to the paucity of data concerning the areal pattern of local storms in the southwestern United States, even relatively meager information becomes of some value. Only at the Mexican Springs Experiment Station near Gallup, New Mexico, is there a sufficiently close network of raingages to provide adequate data of this type [see HARROLD and DICKSON 1944, of "References" at end of paper]. There are other smaller experimental watersheds maintained by the Soil Conservation Service and the Forest Service where gages will help provide such data, but even in those areas general field observations in the surrounding locality usually are necessary to provide a reasonably complete estimate of the depth-area pattern of local storms [LEOPOLD, 1942].

There is a need, therefore, of additional descriptions of local storms such as the two discussed here, despite the fact that the significance of such data is seriously reduced owing to the lack of measurements of rainfall at the storm centers.

Storm of June 10, 1914, near Hillsboro, New Mexico--A storm of high intensity occurred the night of June 10, 1914, at the headwaters of Trujillo and Percha Arroyos near Hillsboro, New Mexico. Striking evidence of the flood was still plainly visible in 1939, 25 years after the storm. Logs of large walnut trees uprooted by the flow were left high above the normal channel and boulders a cubic yard in volume were rolled along grades of 1.0 to 1.2 per cent [Soil Conservation Service, 1939]. Amounts of rainfall at surrounding stations are shown on Figure 1 and Table 1.

Table 1--Rainfall, June 10, 1914

Station	Rainfall	Remarks
	in	
Hermosa	1.30	Between 20^h00^m and 23^h45^m MST
Lake Valley	1.05	Between 21^h00^m and 23^h30^m
Diamond Ranch	1.48	During night
Mimbres	1.65	During June 10
Pinos Altos	1.18	During night
Ft. Bayard	0.10	Between 18^h30^m and 20^h00^m
Fluorine	0.14	
Glorieta Ranch	0.02	

According to the Weather Bureau account "it is probable . . . . that a much greater amount (than was measured by existing raingages) fell over the divide between Hillsboro and Mimbres at the headwater of the Rio Perches" [U.S. Weather Bureau 1914]. This is corroborated by field evidence of the flow in the normally dry washes. The flood in the Trujillo left high-water marks still visible in 1939, from which a peak-flow of 20,000 cfs from 22 square miles was estimated at Trujillo Park, 3-1/2 miles southwest of Hillsboro (point B in Figures 1 and 5). An equal flow was estimated downstream, just above the box in the Sibley Mountains (31 square miles, point C in Figures 1 and 5). Large logs jammed by this flow in the box canyon can be seen in Figure 2. Water abrasion to a height of seven feet can be noted on the upstream side of the walnut tree shown in Figure 3. Location of the photograph is shown by the letter A on Figure 1.

The watershed on which this flow developed is mountainous and the average gradient of the channel is three per cent. The soils in the upper watershed are brown to light brown and contain lime. The vegetation is piñon juniper association except for grassland in the valleys and Ponderosa pine association in the highest mountain areas.

The flood in the Rio Percha at the same time swept as a wall of water six feet deep through the town of Hillsboro, according to the Weather Bureau, and, owing to advance warning, only one life was lost [U.S. Weather Bureau, 1914]. Mr. NATIONS of Arrey told the writer that Mr. MURPHY'S body was found "hung in a tree near the box canyon some 50 feet out of the channel."

The available evidence allowed a rough estimate of the area of the storm. Approximately 600 sq. mi. received 1.5 inches or more, 1300 sq. mi. 1.0 inches or more. The center of the storm would have been 36 sq. mi. had it covered the watersheds of the upper Trujillo and Percha above the points where the peak discharges were estimated.

Only 24-hour (Northern Hemisphere) surface synoptic maps were available to study this storm. The local storm evidently was associated with flow of mT air from the south toward a weak wave developing in northern Colorado.

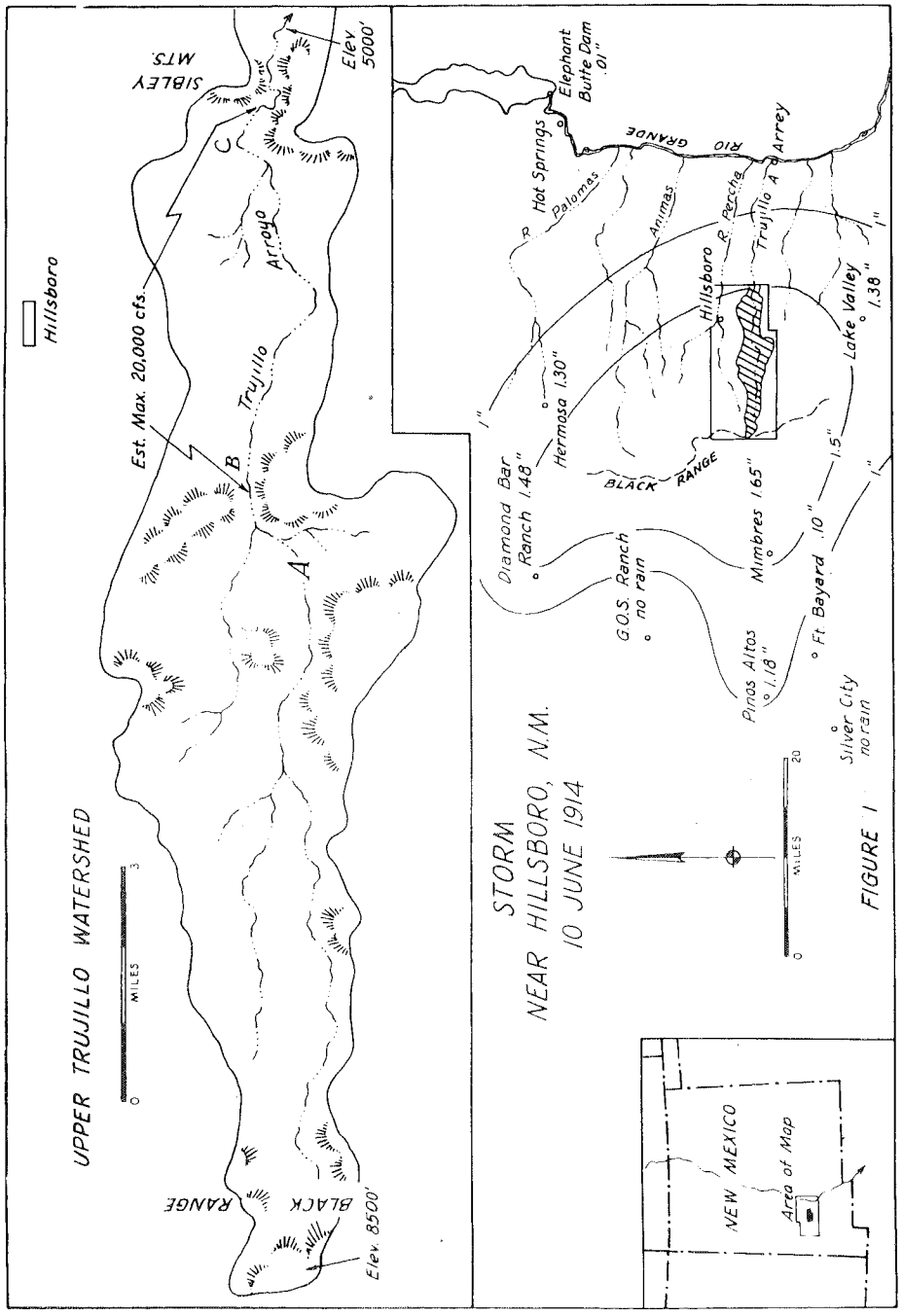
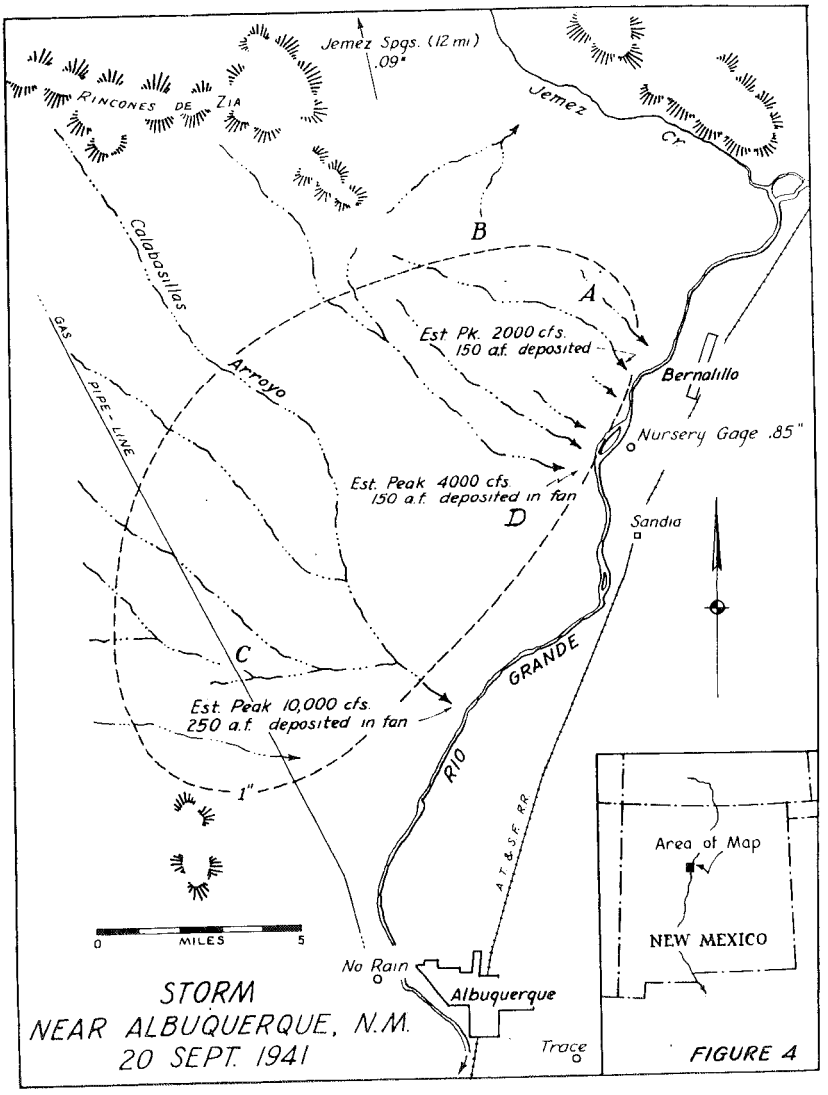


FIGURE 1

Fig. 2--Log jam caused by flood of June 1914 in Sibley Mt. box of Trujillo Arroyo, N. M.

Fig. 3--Water abrasion on walnut tree in wide channel of Trujillo Arroyo, N. M.



Storm of September 20, 1941, near Albuquerque, New Mexico--Between 14^h00^m and 17^h00^m MST, September 20, 1941, a severe thunderstorm occurred a few miles northwest of the city of Albuquerque, New Mexico. The center of the storm moved northeastward over the Llano de Albuquerque, a broad mesa separating the Rio Grande from the Rio Puerco Watershed to the west.

During the two days prior to September 20 there was a flow of mT air west from the Gulf of Mexico and then northward into New Mexico under the influence of a high-pressure cell over the northeastern States. At the time of the local storm near Albuquerque a cold front extended from Phoenix to Denver, then northward through Minnesota. The cold front strengthened the flow of mT air into New Mexico and was preceded by local thunderstorms scattered over the State. The radiosonde record of Albuquerque at 09^h00^m LST September 20, showed prominent convective instability and relative humidities over 85 per cent at most levels up to 17,000 feet above mean sea-level.

A field investigation was made September 23, as soon as road conditions permitted. The only raingages in the area were located near the perimeter of the storm. Albuquerque No. 1 reported no rain eight miles southeast of the center of the storm. An intensity gage at the Soil Conservation Nursery south of Bernalillo was near the edge of the storm and recorded 0.69 inch in 30 minutes and a total of 0.85 inch in 110 minutes. Inspection of water collected in tin cans and other containers showed 1.5 to 2.5 inches of water at the location indicated by A in Figure 4, west of Bernalillo. The same type of evidence, augmented by reports of men working on the Bernalillo-Cuba Highway, indicated that the rain decreased rapidly west of the divide labeled B. There were no indications of appreciable flow in tributaries of the Rio Puerco.

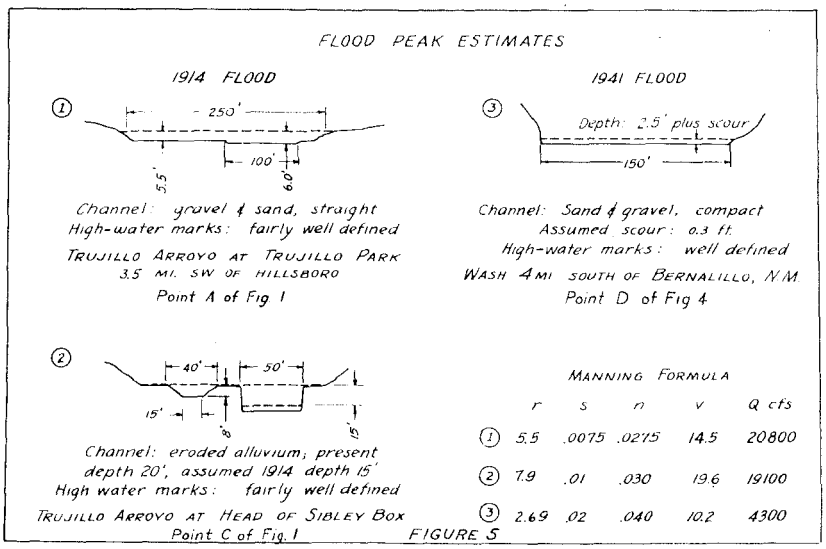


FIGURE 5

Totals of rainfall for the day showed that there were scattered storms in the State, but the stations closest to the center of this particular thunderstorm recorded the following:

Table 2--Totals of rainfall, September 20, 1941

Station	Rainfall
Los Lunas	None
San Fidel	0.20 inch
Laguna	None
Albuquerque No. 1	None
Bernalillo	0.85 inch
Jemez Springs	0.09 inch
Lee Ranch	None

Although no large amounts of rain were recorded by gages, the flash flows in the ephemeral washes draining the mesa indicated an exceptional rainfall. High-water marks and the character

of the channels and material deposited allowed a rough estimate of the peak flows. At the mouth of Calabasillas Arroyo (see Fig. 4) the peak must have been of the order of 10,000 cfs contributed from only a portion of the total drainage area of 85 sq. mi. A primary gas main feeding the city of Albuquerque was washed out by a tributary of this arroyo at a point indicated by C on Figure 4.

Local testimony indicated that a similar flash flow occurred in Calabasillas Arroyo in 1904.

Estimates of the peak flow of other arroyos are shown in Figure 4. The area on which these discharges originated is a mesa whose top slopes southeast at an average rate of 22 feet per mile. The soil is sandy loam and the upper 20 feet of the old pediment surface consists of poorly consolidated gravels and sands containing considerable amounts of caliche [Soil Conservation Service, 1939].

At the mouth of Calabasillas Arroyo an estimated 250 acre-feet of sediment, primarily sand, were deposited as a fan which forced the flow of the Rio Grande into a narrow channel against the east bank of the main flood plain. The total contribution of sediment must have been even larger because much was carried downstream by the combined flow of the arroyo and the Rio Grande. The depth of deposition was nine feet in places. Some large boulders were deposited in the fan. One, estimated weight 1,400 pounds, was deposited 700 feet from the mouth of the arroyo and five feet above the normal streambed.

The data roughly delineate the area of most intense rain. The dotted line in Figure 4 is the writer's estimate of the area, 110 sq. mi., which received more than one inch of rainfall.

I am indebted to HERBERT W. YEO, formerly State Engineer of New Mexico, for checking my field estimates of flow with his own notes and for furnishing the data on deposition of sediment. The Soil Conservation Service kindly allowed the use of the photographs.

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