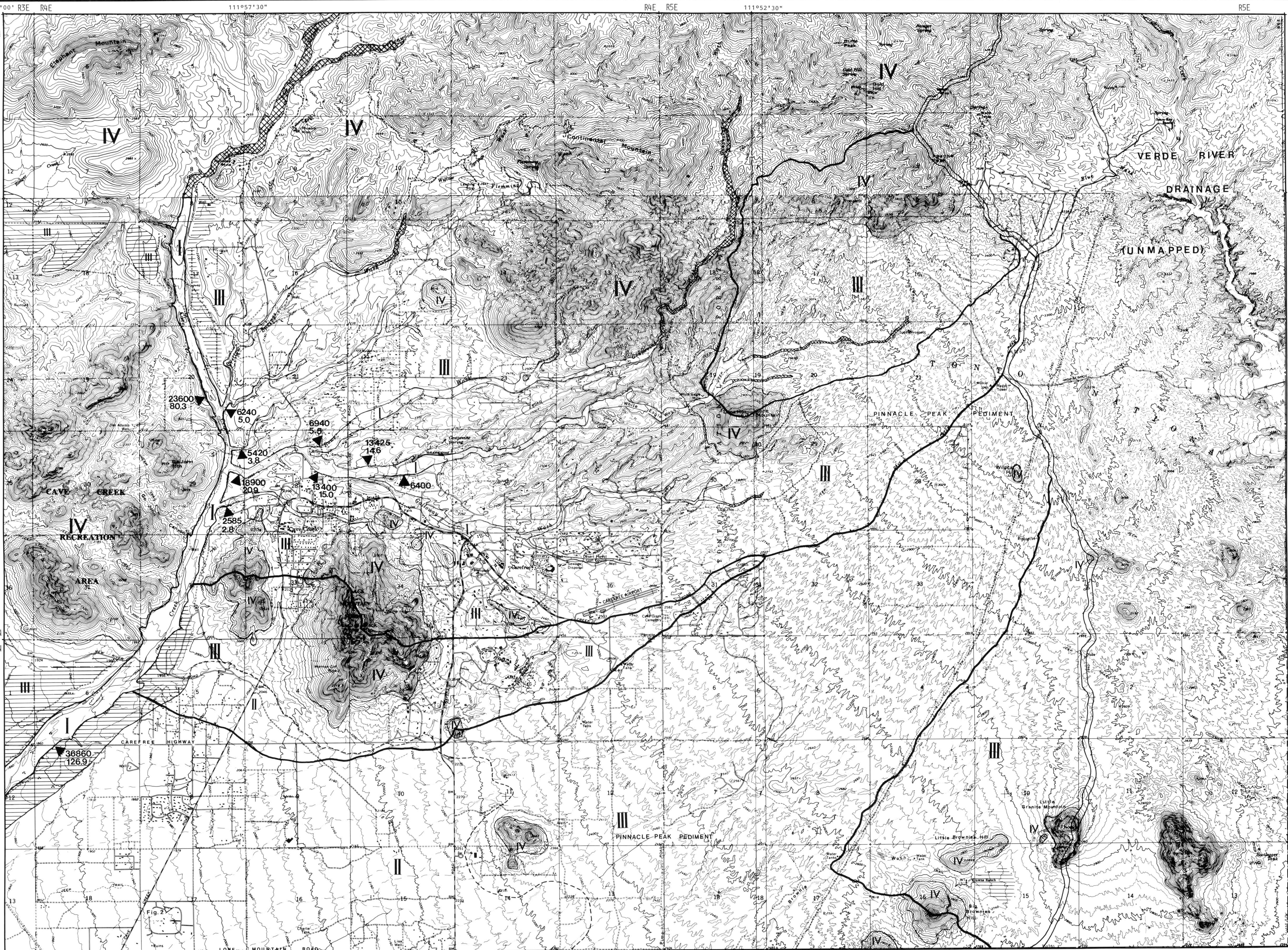
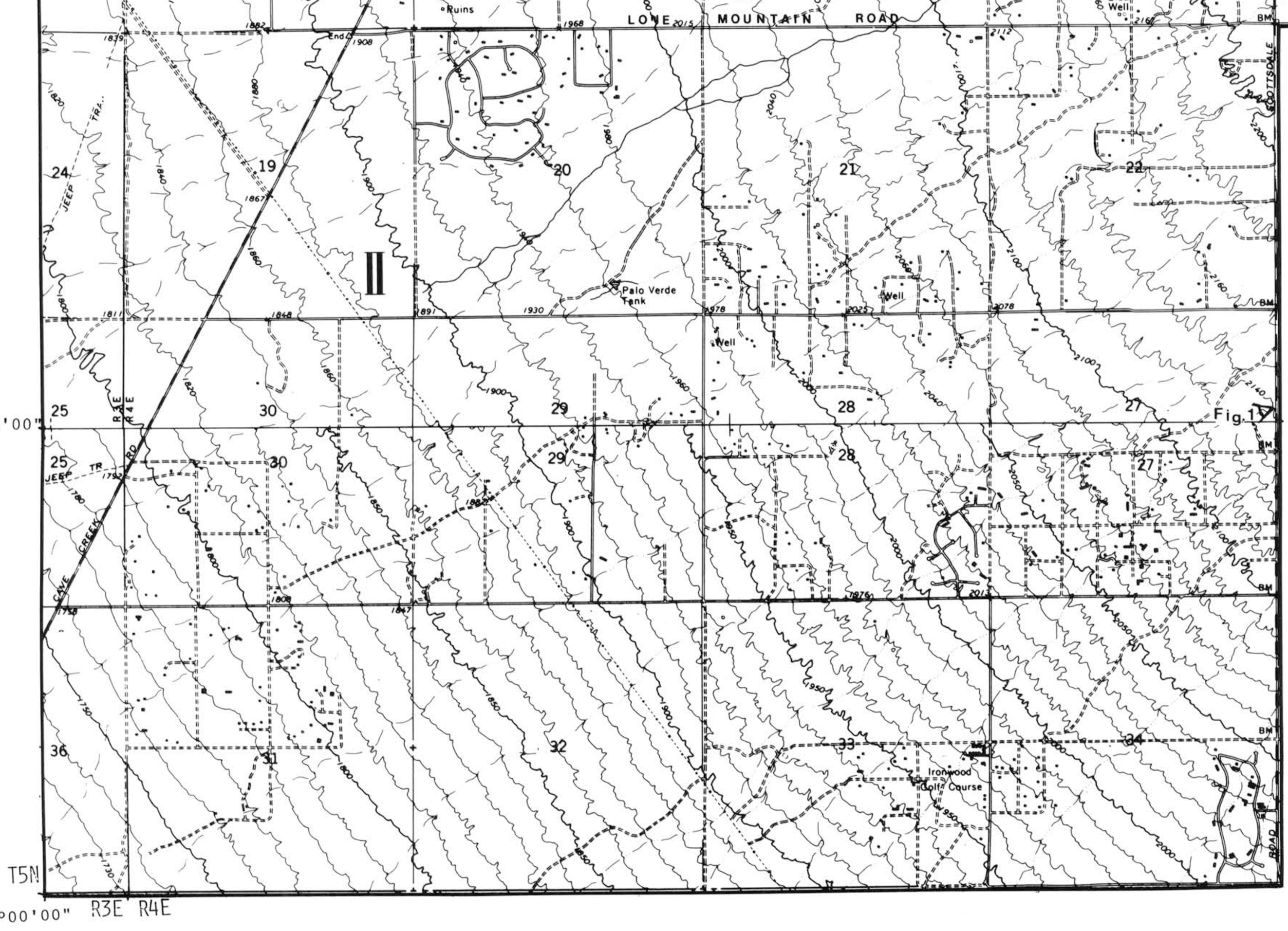




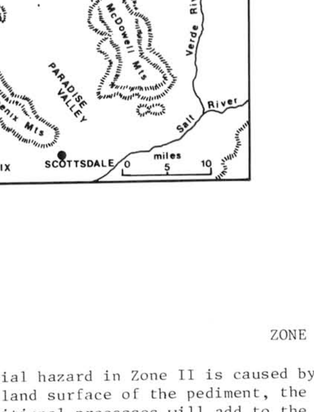
Base map from U.S.G.S. topographical maps, 1:24,000 Series; Cave Creek (1965); Currys Corner (1964); Humboldt Mountain (1964); New River Mesa (1964); Wildcat Hill (1965).

SCALE 1:24 000

CONTOUR INTERVAL 10, 20, 40 FEET

ROAD CLASSIFICATION

Heavy-duty — Light-duty
Medium-duty — Unimproved dirt



RECONNAISSANCE ENVIRONMENTAL GEOLOGY OF THE TONTO FOOTHILLS, SCOTTSDALE

MARICOPA COUNTY, ARIZONA

by Troy L. Péwé, Ray Kenny and Jim Bales

1985

UTM GRID AND 1965 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

FLOODING

Prepared in cooperation with
Department of Geology, Arizona State University
Long Range Planning Department, City of Scottsdale
Arizona State Land Department

INTRODUCTION*

As incongruous as it may appear, flooding is a major hazard in desert areas and probably is the major geologic hazard in the Tonto Foothills area. The principle potential flood hazard in the area is along the major drainage, Cave Creek and its tributaries. It must be emphasized that the flood hazard along the small washes on the pediment, and alluvial slopes and plains, although generally overlooked, also constitutes a serious problem.

The washes, either in defined channels or in poorly defined low-bank channels are normally dry and can carry essentially only small flows. The flow from a 100-year magnitude event would result in sheet flow out of low-bank channels and a high velocity flow in the confined channels. The typical flood is one of rapid rise in water surface, short period of peak flow, and a gradual decline in water surface. Such are referred to as flash floods. As is common in the desert, the lack of continuous vegetation cover, the absence of an organic layer, and the presence of caliche just below the surface all tend to reduce effective water-surface infiltrationrate and contribute to rapid run off.

The zones of potential flood hazard on the map are based on the source of flooding, frequency of flooding and degree of hazard related to physical features such as land forms and drainage patterns. The zones in general re-present potential flood hazard areas having similar characteristics. Zone I is the flood plain of Cave Creek and its major tributaries. Zone II is the slightly dissected alluvial plain or valley bottom away from the mountains. Zone III is the dissected lower slopes and pediment surfaces with rather well defined channels, and Zone IV represents flood runoff on steep hills and mountains.

ZONE I

This area is inundated by 100-year flood magnitudes or greater along Cave Creek and its major tributaries. It includes the main creek channel and most of the present flood plain. The velocity of the flow would be high and the land adjacent would be subject to lateral erosion as well as shifting and migrating of creek channels. The depth of flow on the floodplain, outside of the channel, will be more than 1 foot and locally as much as 5 feet.

Obstructions or channel modifications would cause changes in the flooded area, and would also change either erosion or depositional environment, or both, for that stretch. Erosional or depositional changes would generally occur downstream from the point of a new obstruction or modification, which could include a new bridge, large fallen trees, or a large load of trash deposited in the channel area.

The peak discharge of the 100-year flood from Cave Creek and its major tributaries at the west edge of the map area below Carefree Highway is 36,860 cubic feet per second (cfs) (see map). One-half mile below the confluence with Rowe Wash, the 100-year flow is about 35,000 cfs.

The area on Cave Creek floodplain covered by the 100-year flood downstream from its junction with Rowe Wash has been defined by the U.S. Corps of Engineers (1964). Upstream from Rowe Wash, the area of Cave Creek and its major tributaries south of 33"52'30" N. Lat. and west of 111° 52'30" W. Long. that is covered by the 100-year flood was estimated by the U.S. Geological Survey (Hjalmarson, 1978). The cross hatched area of Zone I extending upstream from these earlier works, was compiled by the present authors from field observations and interpretations from aerial photographs and topographic maps. The discharge figures on the map are from U.S. Department of Housing and Urban Development (1979).

ZONE II

This zone has a high probability of flooding (1) along any of the small, shallow channels in this area of a slightly dissected alluvial plain, and (2) from overland flow or sheetflow less than 2 feet deep on the generally flat surfaces between the small channels. Streams debouching from steeper ground onto Zone II areas can transport large quantitites of mud, sand, gravel, and debris. This sediment will be deposited where the velocity of flow slows. There is a high probability that such flood sediments will be deposited in, and adjacent to buildings, pools, or walls within Zone II. Erosion is generally not a problem within Zone II.

The potential flood hazard for a specific point in Zone II is very difficult to estimate, and is generally underestimated, because a specific drainage area cannot be easily determined. Most channels in Zone II are less than 3 feet deep and divide or split, which invalidates normal procedures for determination of the area of a watershed, upon which the calculation of precise precipitation volumes depend.

A further difficulty concerns the movement of a channel across the land surface. Comparison of aerial photo-graphs and topographic maps which had been prepared about 10 years apart reveal many channel changes; also branching or joining points had changed location.

Any evaluation of flood-hazard potential must consider site evaluation, the cross-sectional configuration, the gradient of the terrain, the distance from the site to adjacent defined washes, the location and estimate of over-flow upstream, and although rarely applicable here, how long since the soil was saturated.

ZONE III

The greatest potential hazard in Zone II is caused by flooding in the confined channels between the defined ridges of the dissected land surface of the pediment, the alluvial slopes, and the creek terraces. Within this zone, both erosional and depositional processes will add to the potential hazard. Scour and bank erosion have occurred along many of the channels and along the incised short segments of floodplains found in this zone. Deposition has occurred where the short floodplain segments are being built or are aggrading. The depth of flooding generally does not exceed 10 feet and will depend upon the amount of erosion or deposition that occurs during the flood flow. Occasionally debris jams occur at natural channel constrictions, or at man-made obstructions, and there the depth of floodwaters will increase on the upflow side. The hazard potential in the larger washes of Zone III is very similar to that for Zone I; however, the channels in Zone III are not as wide nor have they achieved the degree of near-permanence by being entrenched as Cave Creek or its major tributaries. The narrow channels can only be clearly depicted on very large scale maps. There has been less changing locations of channels in Zone III than in Zone II. The areas shown in the cross hatched pattern are susceptible to flooding from local sheet flow.

ZONE IV

The high potential flood hazard in Zone IV exists within the strongly confined or well defined channels of the steep slopes of hills and mountains. Sudden flooding and high velocity of flow are common. There is low potential flood hazard on the well drained mountain slopes of this zone, however sheetflow down the slopes may occur and be the initiating factor for other geologic hazards such as landslides, boulder rolling, or debris flows. Debris flows would generally be confined to the ill-defined minor channels which are tributary to the major mountain channels. See Plate 2 for information on the other geologic hazards.

*This map involves a general evaluation on a broad scale and does not preclude the necessity of a specific site investigation.

SELECTED REFERENCES

Hjalmarson, H.J., 1978, Delineation of flood hazards in the Cave Creek Quadrangle, Maricopa County, Arizona: U.S. Geological Survey Map I-843-B, 1:24,000, 1 sheet.
Kenny, Ray, 1985, Flooding: in Péwé, Troy L., 1985, Geologic Hazards of Arizona: in Reynolds, S., and Jenny, J., eds., 1985, Summary of Arizona Geology: Arizona Geological Society, in press.
Rhoads, B.L., and Graf, W.L., 1983, Public policy for land-use planning near desert mountains: Center for Southwest Studies, A.S.U., Tempe, AZ., 72 p.
U.S. Army Corps of Engineers, 1964, Flood-plain information study for Maricopa County, Arizona, volume II, Cave Creek report: Corps of Engineers, U.S. Army Engineers District, Los Angeles, CA., 24 p.
U.S. Department of Housing and Urban Development, 1979, Flood insurance study, unincorporated areas of Maricopa County, Arizona: USDHD, Washington, D.C., 35 p.

EXPLANATION

I	Extent of inundation from the 100-year flood-flow along Cave Creek and major tributaries. Open pattern indicates flood outlines previously published. Cross-hatched pattern indicates areas where potential flood hazard is based on geologic evidences noted by the authors from field observations and interpretation of aerial photographs and topographic maps.
II	High probability of flooding along small, shallow channels or by sheet flow over slightly dissected alluvial plains. High probability of deposition of mud, sand, gravel and debris from floodwaters.
III	Flooding generally confined to defined channels of washes cut into pediment and the thin alluvial pediment cover or into poorly to well-indurated alluvium of slopes. Cross-hatched pattern areas susceptible to flooding by local sheetflow.
IV	Steep mountainous terrain with high potential flood hazard in strongly defined channels. Some effects of floodflow may trigger landslides.

MAP SYMBOLS

▲ 2740 3.1	Apex of triangle points to location of design point. Upper number is flow in cubic feet per second in the 100-year flood. Lower figure is area of watershed (in square miles) upstream from design point.
═	Boundary between Verde and Salt River watersheds.
━	Boundary between minor watersheds.
◁	Location and orientation of illustration.

Figure 1 - Looking downstream along a small unnamed wash in Zone II. The channel is about 12 ft (3.7 m) wide, and the banks are from 1 to 1.5 ft (0.3 to 0.5 m) high. The capacity of the channel is about 10 % of the potential peak discharge of the 100 year flood. The hydraulic characteristics and general appearance of many small washes in Zone II are similar to those of the wash in the photograph. Floodwater may spread over the adjoining land as much as 2 ft (0.6 m) deep and as much as 100 ft (30 m) from the channels (from Hjalmarson, 1978).

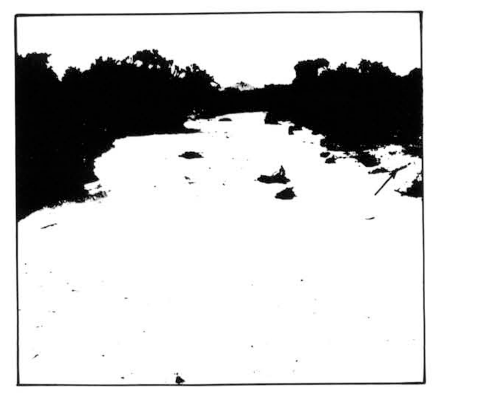


Figure 2 - Looking downstream and west along one of the large washes in Zone II. Channel is about 40 ft (12 m) wide and has a 3 ft (0.9 m) high bank on the south and a 1 ft (0.3 m) high bank on the north. The capacity of the channel is a small fraction of the potential 100 year flood. Land adjacent to large washes is susceptible to inundation, erosion, and deposition of sediment. Floodwater can spread out from the washes to depths of more than 3 ft (0.9 m). The floodflow on land adjacent to the channels generally is less than 2 ft (0.6 m) deep; the floodflow in the channels may be as much as 5 ft (1.5 m) deep, and velocities may be more than 10 ft/s (3.0 m/s). The small manmade mound of sediment indicated by the arrow in the right foreground of the photograph is adjacent to a subdivision lot to the north (from, Hjalmarson, 1978).