TUCSON METROPOLITAN AREA

EASE OF EXCAVATION AND POTENTIAL ERODIBILITY

FLOOD HAZARDS

SLOPE RELIEF

by

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scale 1:120,000

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MAPS OF `EROSION SUSCEPTIBILITY/EASE OF EXCAVATION' WITHIN THE TUCSON 1 X 2 DEGREE QUADRANGLE, ARIZONA

Comments by Roger B. Morrison, December, 1982.

These comments pertain to two `EROSION SUSCEPTIBILITY/EASE OF EXCAVATION' maps that I prepared between 1975 and 1977 and am submitting to the Arizona Bureau of Geology and Mineral Technology, Tuscon, Arizona. I hope that these maps will be placed on open file at this Bureau, so that they will be available to the public. They are dual-purpose maps, that integrate information on surficial sediments, soil profiles, and bedrock within several meters of the landsurface. They are designed to be used by engineers, developers, resource managers, and planners.

One map, covering the entire Tucson 1 x 2 degree quadrangle at 1:250,000 scale, was prepared as part of a project to test the utility of Landsat-1 (ERTS-1) multispectral images to produce maps for practical geoscience applications. They were prepared by inspecting and interpreting many Landsat-1 images (bands 5, 6, and 7), from different orbital passes and times of year, of the same scenes. Map-unit boundaries were drawn on 1:250,000-scale enlargement prints of Landsat-1 images, on the basis of the clearest evidence of the boundaries from various images. This interpretation utilized information available from geologic and soil maps and my own limited field observations as purely secondary input; i.e., the Landsat-image enlargements were used only for plotting information that could be identified from Landsat images. Consequently, the accuracy of this map is constrained by the relatively poor ground resolution and stereovision capability of the Landsat-1 images; probably it is adequate for 1:500,000 scale.

The other map covers a 1,300 sq mi area around Tucson at 1:120,000 scale (the Tucson Metropolitan area and vicinity). Like the first map, it shows both (1) the susceptibility to erosion of the various types of earth materials within several meters of the landsurface (and hence on the potential magnitude of the modern problem of accelerated erosion), and (2) the ease of excavation of these near-surface materials for man's construction activities. This map is primarily photointerpretive, from high-quality high-altitude color airphotos taken from NASA's RB57 aircraft, but it has substantial ground control from my own field observations, hence it probably has accuracy suitable for publication at 1:150,000 scale.

These maps separate the exposed earth materials into four principal classes: readily, moderately, slightly, and least erodible or excavatible. These classes pertain to the predominant earth material in the map area, disregarding local inclusions of material with other erodibility characteristics. (Persons needing information on specific sites should consult more detailed, larger-scale maps of the pertinent parameters.)

Especially significant are the areas designated as `readily erodible' (map units 1a and 1b). These are predominantly alluvial soils of late Quaternary age that are unconsolidated or only slightly consolidated and relatively fine textured (mainly sand, silt,and some clay). These areas are chiefly in the the interiors of the intermontane basins, beyond the zones of gravel deposition near the mountains. They include not only the flood plains of the larger streams but also the lower parts of the piedmont alluvial plains (bajada toe slopes) where the flood plains of the desert washes spread out and coalesce. Thus, the interior lowlands of the larger intermontane basins have extensive areas of readily erodible materials, commonly miles wide.

Moderately and slightly erodible/excavatible materials are chiefly alluvial deposits whose erodibility is lessened because of (1) coarse particle size (boulder to pebble gravel) and/or (2) strong soil development (clay and/or calcium carbonate accunmulation), and/or (3) weak to moderate induration of sediment below the soil profile. These materials occur chiefly on the intermediate and upper parts of the piedmont alluvial slopes of the intermontane basins. Slightly erodible (class 3) materials tend to occur closer to the mountains than the moderately erodibile (class 2) materials, because here the geomorphic surfaces generally are older, soil development stronger, and particle size coarser. Small class 2 and 3 areas occur within the mountains, and some class 2 areas in the interiors of the intermontane basins.

EXPLANATION for map of FLOOD HAZARDS of the TUCSON METROPOLITAN AREA
(Prepared by Roger B. Morrison, 1975-77)

83-46

Map unit symbol	Degree of flood hazard	Remarks
1	Most severe	Lower portions of flood plains of Santa Cruz River and major washes. Whole area is liable to inundation by "100-year recurrence-interval" floods, and most of it will be inundated by 50-year floods. Estimated flood magnitudes of Santa Cruz River at Tucson gaging station for 10-yr, 20-yr, and 50-yr recurrence intervals are respectively 14,500, 20,300 and 27,600 cubic feet per second (USGS Water-Supply Paper 1939-A, 1970).
2	Moderate to locally severe	Higher parts of flood plains of Santa Cruz River and major washes. Liable to inundation by floods of more than 100-yr recurrence-interval magnitude (or by 100-yr floods if artificial or natural changes, e.g., aggradation) reduce the carrying capacity of the present stream channel. Greatest hazard generally is along boundary with class 1 areas.
3	Moderate to severe	Lowlands of Avra-Altar Valley, subject to very extensive sheet inundation (at times covering >90% of the area) from severe rainstorms such as that of Labor Day 1970. Few well-defined natural drainage channels. 1/
4	Locally moderate to severe along side-wash channels	Lower terraces and small alluvial fans bordering along main streams. Generally not liable to inundation by at least 200-yr recurrence-interval floods of main streams but liable to local flooding and debris deposition along side-wash channels, which may in places shift position from time to time
5	Moderate to locally severe along channels	Relative narrow flood plains of moderate-sized washes. Subject to occasional to frequent inundation from flash floods.
6	Moderate to severe; channels are liable to shift position.	Broad gently sloping lowlands with poorly defined shifting drainage channels. Subject to extensive sheet inundation (40% to 90% of area) from flash floods.1/
7	Highly variable; severe to slight	Gently sloping bajadas, generally with <5 ft local relief; 10% to 50% of area is subject to moderate to locally severe sheet flooding after heavy torrential rainstorms.1/
8	Slight to none, except along drainage channels shown	Well-drained higher areas (hills, mountains, and bajadas (piedmont alluvial slopes) with 5 to >1000 ft of local relief. Flood hazard is slight to nil (<10% of area is liable to inundation) except along channels shown; however, unusually heavy rainstorms may cause brief shallow sheetfloods anywhere in area and local debris deposition below steep slopes.

Natural drainage channels that are likely to flow at least several cubic feet a second after heavy rainstorms

Drainage channels, artificially controlled

Reservoir or stock tank

X — Mine dumps; tailings ponds

1/ Boundaries shown disregard artificial embankments, levees, and channelization.

Tucson Metropolitan Area — Relief-Dissection -Slope Map

Scale 1:120,000

Explanation

Map unit	Local relief/ dissection limits	Slope limits	Remarks
1	0-1.5m (0-5ft)	$<1^{\circ}$ *	Nearly level, gently sloping or gently undulating flood plains and bajada toe slopes.
2	1.5-5m (5-16ft)	$\sim 1^{\circ}$ *	Slightly dissected bajadas.
3	5-20m (16-65ft)	$<4^{\circ}$ *	Moderately dissected bajadas, lower hills.
4	20-100m (65-330ft)	Generally $<40^{\circ}$, locally to 90°	Deeply dissected bajadas, higher hills and lower mountains.
5	>100m (330ft)	Commonly $>35^{\circ}$, locally to 90°	Higher mountains with very steep slopes.

* Except for banks of modern arroyos, which commonly have steep slopes, up to vertical.