

22.3 Grading and Erosion Criteria

A. Slope Criteria

Earth slopes shall conform to the following criteria:

1. For slopes 3.0 feet high or less, maximum slope should not exceed 2:1 (horizontal to vertical)
2. For slopes greater than 3.0 feet high, maximum slope should not exceed 3:1 (horizontal to vertical) unless stabilized from slope failure through City Engineer approved means. Steeper slopes may be approved subject to a geotechnical recommendation and City concurrence.
3. All slopes shall be protected from erosion, especially when subjected to upland flows.

B. Grading near the Property Line

Particular attention must be given to grading (either cut or fill) near property lines. Care should be taken to ensure that existing foundations, retaining walls, stable slopes or other structures are not endangered and that the adjacent property is not damaged or its use constrained due to grading at or near the property line.

C. Grading In and Adjacent to Major Facilities

No grading, excavation, or fill may take place in or adjacent to any watercourse defined as a major facility (30 cfs for arroyos and 2 acre-ft for detention basins) without an approved grading and drainage plan.

Construction activities within major facilities shall provide for the safe passage of the 10-year design flow during the months of July, August and September.

D. Means of Erosion Control

The means of erosion control shall be specified on the grading plan. Steeper slopes require a larger diameter rock. Please refer to the table below for recommended erosion control. Recommendations are for slopes without upland flows:

3:1 and flatter-3/4" or larger rocks

2.5:1 to 3:1- 1.5" round or 3/4 inch crushed

2:1 to 2.5:1- 4" cobbles

1.5:1 to 2:0- 6" or larger rip-rap or 6" or larger angular stone

0.5:1 to 1.5:1- rock plating set into the soil

For slopes with upland flows, the velocity and flow rate should be considered when designing the erosion protection for the slope.

E. Levees and Berms

E.1 Definitions:

a. The DPM is adopting FEMA's definition of a levee, which is a man-made structure, usually an earthen embankment, designed and constructed in accordance with sound engineering practices to contain, control or divert the flow of water. Levees in general are used to contain flows from the river or major water course where the grade outside the levee is lower than the 100 year 6-hour water surface elevation.

b. A berm is a linear earth structure designed to direct or retain/detain storm water. The height is measured from the uphill side. See the section on Ponds for berms used to retain/ detain stormwater.

E.2 Design Criteria

All levees shall be designed to standards published by the Army Corp of Engineers and meet FEMA freeboard requirements.

Any berm whose purpose is to divert or convey runoff in a major arroyo shall be specially designed on a case-by-case basis and shall meet or exceed the guidelines listed herein.

E.2.1. Cross Section

- a) The top width should have a minimum width equal to the height of the berm. Construction and maintenance equipment should be considered when considering the top width.
- b) Berms are to be compacted to a minimum of 95% per ASTM D-1557.
- c) Berms 4 feet and higher must be provided with a structural keyway with bottom width equal to the top width and depth equal to at least one half the height, but not less than 3.0 feet and side slopes not steeper than 2:1 (horizontal to vertical)
- d) Unarmored faces of berms must have side slopes not steeper than 3:1 (horizontal to vertical).
- e) Safety issues should always be considered when designing slopes
- f) For high velocity flows:
 - a. For velocities 5 fps or greater an engineered means of erosion protection is required (bank protection)
 - b. Erosion protection may be required for velocities less than 5 fps.
 - c. Rip-rap protected side slopes shall not be steeper than 1.5:1 (horizontal to vertical).
 - d. Concrete faced berms may be used on side slopes greater than 1.5:1 (horizontal to vertical)

E.2.2 Freeboard

Berms must be provided with freeboard for the 100-year design flow based on the following guidelines:

- a. For flow depths less than 2.0 feet; minimum freeboard is 1.0 feet.
- b. For flow depths greater than 2.0 feet; minimum freeboard is 2.0 feet

E.2.3 Earthwork for Berms

All earthen berms shall be constructed of high quality fill material free of debris, organic matter, frozen matter and stone larger than 6 inches in any dimension. The key trench shall be scarified to a depth of 6 inches to ensure bonding with the fill material. Lifts shall not exceed 12 inches of loose material before compaction. The material in each lift shall contain optimum moisture content (-1% to +3%) and shall be compacted to at least 95% density as determined by ASTM D 1557.

E.2.4 Certification

All berms 4 feet and higher shall be inspected during construction and certified by a New Mexico Professional Engineer as to their substantial compliance to the (jurisdictional authority) approved plans and specifications.