URBAN DRAINAGE CRITERIA

I. Introduction

This division contains guidelines for drainage system design and establishes a policy for recognized and established engineering design of storm drain facilities to protect the health, safety and welfare of the general public. Methods and processes included in this division are intended to serve as minimum standards. Recognized and established engineering practices and principles shall be followed in all engineering projects within NMSU boundaries. OFS Engineering shall determine the required parameters of any particular project or technical analysis and may require additional criteria should such be deemed to be in the best interest of the general public.

II. Hydrology Storm Definitions

a. *Initial and major design storm.* For the purposes of this division, every urban area has two separate and distinct storm events. One is the initial or ordinary storm system corresponding to a 10% chance (10-year, 24-hour) storm in any given year. The other is the major, or extraordinary, storm which corresponds to a one percent chance (100-year, 24-hour) storm in any given year. Since the effects and routing of storm waters for the major 1% chance, 24-hour storm may not be the same as for the initial 10% chance, 24-hour storm, all storm run-off drainage plans submitted for review and approval shall indicate the effects of the initial and the major storm.

i. *Initial* 10% chance, 24-hour *storm system.* The 10% chance storm drainage system shall be so designed as to provide protection against regularly occurring damage, to reduce street maintenance costs, and to provide orderly campus drainage ways.

ii. *Major 1*% chance, 24-hour *storm system.* The major storm drainage system shall be so designed as not to cause property damage or loss of life from the runoff expected in a major storm event. The anticipated effects of the 1% chance storm on the 10% chance storm drainage system shall be clearly identified in the drainage report.

iii. *Historic Flow.* The historic flow shall be defined as the peak flow rate of storm water that enters, crosses and/or exits a proposed development in its pre-developed and undisturbed condition for both the initial (10% chance) and major (1% chance) storm events. It shall be the responsibility of the consulting Engineer to show that peak flow and volume from a proposed development or construction project does not adversely affect or impact any upstream or downstream property, up to and including the next major drainage facility, drain and/or regional ponding area as determined by OFS Engineering. The development must not increase the peak, volume or change the location of the historic flow unless specifically allowed by OFS Engineering.

b. *Design storm frequencies.* The initial 10 year/10% chance and major 100 year/1% design storms shall apply to all land uses including but not limited to residential, general commercial, parks, roadways and, open channels.

c. *Runoff computation.* Total storm runoff shall be computed in accordance with the criteria set forth in this division. Runoff computations for both the 10% chance and 1% chance storm shall be submitted with the proposed storm drainage plan. The most recent official Federal (ACOE, FEMA, FIS, USDA, USGS, etc…) data and references must be used when analyzing flow that crosses any site.

d. *Major Arroyo Crossings* For purposes of this section, the term "major arroyo" shall mean any channel or waterway whose watershed exceeds 1.5 mi^2 and larger or a flow of 1000 cfs and larger in a 1% design storm whether such watershed is in its natural or unaltered state or has been altered by approved development, runoff diversions, or detention facilities.

i. Design Considerations:

a. The Consultant will be responsible for providing the engineering, design, flood mapping revisions and associated costs (if needed).

b. The consultant m u s t coordinate the design elements with OFS Engineering to ensure cohesion with NMSU master plan and NPDES-MS4 permit requirements.

III. **Runoff Analysis Method**

a. *Applicability.* This section sets forth the minimum design, technical criteria and specifications for the analysis and design of drainage systems. All construction plans, developments, paving projects, or any other commercial or residential construction submitted for approval by NMSU shall include storm drainage analysis and appropriate system design before any phase of construction will be permitted. Such analysis and design shall meet the criteria outlined in this article and must be approved by OFS Engineering before construction will be permitted.

b. *Development of less than three acres.* (0.00 to 2.99 Acres) Runoff analysis for developments of less than three acres can be based on general runoff coefficients for valley and/or mesa areas. The runoff coefficient is a value that is used to approximate the amount of runoff that a project will need to retain on site to maintain existing drainage characteristics. Drainage plans based on the Soil Conservation Service (SCS) method, in lieu of this simplified approach, will be acceptable. SCS submittals should include all supporting documentation, soils maps, CN tables, etc. Any site with a channelized flow crossing the site must use the SCS method. Developments within the 100 year flood plain must comply with Federal Emergency Management Agency (FEMA). Specific requirements shall be as follows

i. Identify area classification

a. Valley areas, land slope less than one percent.

b. Mesa areas, land slope greater than or equal to one percent.

ii. Runoff & Flow coefficients.

a. Valley areas runoff, 2.8 inches.
b. Mesa areas runoff, 2.0 inches.
c. Flow coefficient, 1.6 cfs/acre-in.
d.

$A*F_c*R_c = Q$=flow rate
Impervious Area(acre)*Flow Coefficient (CFS/acre-in)*Runoff Coefficient (in)= Peak Flow Rate(CFS)

iii. Calculate impervious area of land to be developed. Impervious area includes the building, sidewalks, asphalt paving, etc. (Places where water cannot penetrate into the ground, including some desert landscaping.)
Calculate area in square feet.

iv. Find required storage volume by multiplying the impervious area (square feet) by the runoff coefficient (inches) and a conversion factor 1 foot /12 inches.

$A*C_R*CF = SV$=Storage Volume
Area(m^2)*Runoff Coefficient (mm)*Conversion Factor (1m/1,000mm) =Required Storage Volume (FT^3)

v. Indicate on the construction plans how the required storage volume will be controlled on site. Include details on the walls and berms that will control or direct runoff, asphalt and lots grade, and method of overflow of the storage area.

vi. Acceptable types of drainage structures are as follows

a. *Open ponding.* Open retention ponds are recommended in areas that have good percolation of water into the soil. Open ponds offer the maximum amount of storage for a given land area. The minimum depth shall be 18 inches, and the pond shall be located a minimum of 10 feet from any structures.

i. French drain. French drains are acceptable in areas that have poor percolation rates, i.e., clay. A French drain shall be used only to provide increased percolation rates for runoff. French drains must have an open pond above rock level with a minimum clearance of 12 inches between grate and top of rocks.

ii. Underground Storage. Underground storage is recommended in areas with good percolation and limited space. Credit is given for the open volume only; no credit is given for rock voids. No credit will be given for "rock ponds". Some acceptable products include, but are not limited to, perforated CMP, perforated HDPE, Rainstore©, infiltrator systems, etc. Designs must include a method to maintain the structures effectiveness.

c. *Development equal to or greater than three acres.* For development equal to or greater than three acres the following shall apply:

i. Runoff analysis for developments equal to or greater than 3.0 acres shall be based on the SCS method which is outlined in a publication entitled "Peak Rates of Discharge for Small Watersheds, Chapter 2 (revised 2/85 for New Mexico), Engineering Field Manual for Conservation Practices." This manual is specifically for the application of the NRCS procedure in New Mexico. NMSU requires the use of a modified S.C.S. Type II Storm with a minimum of 75% of rainfall occurring in a one-hour period. The following limitations apply to the NRCS method:

a. Minimum initial time, five (5) minutes. (Not T_c)

b. Time of concentration (Tc) is equal to the sum of initial time and gutter/pipe flow time. However, engineers must calculate the time of concentration. Time of concentration used shall be calculated value or six minutes, whichever is greater. All calculations must be included in the drainage report.

c. Overland flow portions of time of concentration are to be calculated for a maximum reach length of 500 feet.

d. Curve Numbers (CN's) shall be from USDA SCS, TR 55, 1986 or newer tables. CN's for residential or commercial/industrial uses shall be calculated using actual hydrologic conditions. CN's must be rounded to the nearest whole number.

ii. *Specific requirements.* The following criteria shall be utilized in the analysis of the drainage system:

a. Runoff analysis shall be based upon the proposed land use, and shall take into consideration all contributing runoff from areas outside of the study area. The analysis of storm runoff from undeveloped and existing developed areas lying outside of the study area shall be based upon present land use and topographic features.

b. The probable future flow pattern in undeveloped areas shall be based on existing natural topographic features (existing slopes, drainage ways, etc.).

c. Average land slope in both developed and undeveloped areas may be used in computing runoff. However, drainage patterns and slopes that have already been established shall be used in areas where available.

d. Flows and velocities which may occur at a design point when the upstream area has been fully developed shall be considered. Drainage ways, including the 10% chance and 1% chance systems shall be designed such that the increased flows and velocities, due to development, meet the guidelines for the 10% chance and 1% chance design storms.

e. Streets can be used as drainage ways for the 10% chance storm runoff. The primary use of streets shall be for the conveyance of traffic.

f. On-site retention or detention is required for all sites. Detention Ponds must detain the 1%chance rainfall allowing the predeveloped flow or less to flow off the development. An approved routing system must be used to route the hydrograph through the detention pond(s). Detention pond storage volumes shall be calculated for the ten (10% chance) and 100-year (1% chance) storms by flood routing using a hydrographic method (HEC-1, HEC-HMS, SCS Hydro, TRSS, or generally recognized method) or by the FAA method. The changing of a natural drainage way location will not be approved unless such change is shown to be without unreasonable hazard and liability, substantiated by thorough analysis and investigation of all affected down stream facilities. This includes impacts to buildings, public and private infrastructure, habitats and, open space. The use of detention facilities may not be acceptable where outfall is into another storage facility. When the peak flow and total volume into the storage facilities is greater than the pre-development peak flow and total volume, a detailed hydrologic analysis of both facilities must be provided to OFS Engineering for review. These facilities may be sensitive to increased volumes of runoff as opposed to increase rates of flow. Such facilities require approval of OFS Engineering.

g. The planning and design of drainage systems shall be such that problems are not transferred from one location to another. Outfall points shall be designed in such a manner that will not cause increased flooding and/or erosion downstream. Irrigation canals

shall not be used as outfall points unless such is shown to be without hazard substantiated by thorough hydrologic and hydraulic analysis. Approval for use of irrigation canals for drainage shall be obtained in writing from the controlling agency and shall be submitted to the city as part of the drainage study.

h. Dedicated drainage easements or rights-of-way are required for drainage ways, and these shall be designated on all drainage drawings. Drainage rights-of-way shall have a minimum clear bottom width of 10 feet of clear unobstructed space with a design that facilitates cleaning using available equipment.

i. Approval will not be made for any construction which will encroach on any drainage easement or impair surface or subsurface drainage.

IV. Specific Analysis Requirements

a. *Requirements for storm drainage reports and construction plans.* All drainage reports shall be prepared by a professional engineer, registered in the State of New Mexico, and shall comply with the minimum requirements and specifications set forth in this section. Review schedules will be as outlined in the NMSU Design Guidelines. However, reports involving large developments and complex structures will require more review time. The engineer should be aware that whenever unusual or serious drainage problems are anticipated in conjunction with a proposed development, additional analysis and information beyond the minimum requirements outlined in this section may be required. The following specifications and criteria shall be used:

i. *Master drainage study:*

a. The purpose of the master drainage study is to identify major drainage ways, ponding areas, locations of culverts, bridges, open channels and drainage basins which are contributory to the proposed study area. In addition, the ability of downstream drainage facilities to pass the developed runoff from the proposed development must be analyzed in the master drainage study. The master drainage study shall contain a general outline of the proposed drainage routing plans for the development. The report shall include but not be limited to the following information and calculations:

i. Calculations for peak flow from all upstream off-site tributary areas.

ii. Calculations for peak flow within the proposed development for all drainage basins larger than 5 acres.

iii. Preliminary analysis of the one percent (1%) and ten percent (10%) chance storm floodplain and major drainage ways.

iv. Closed subbasin analysis including identification of water into or out of subbasin.

v. Discussion and analysis of downstream drainage facilities.

vi. Discussion of drainage problems and solutions which are anticipated within the proposed development.

vii. The report shall be printed and bound on 8 ½ by 11-inch paper.

viii. All drainage studies/reports must include a table of pertinent values in the body of the report. The values shall include, at a minimum, flow depth for all flow paths, peak velocity, T_c, freeboard for channels (not including streets), flow (Q), CN numbers, and volumes of runoff for basins. Drainage studies shall include maps showing both flow and volume into and out of basin(s) and proposed development.

ix. Flows may need to be routed to a historic point of convergence for both the pre and post condition.

a. Drawings for the master drainage study shall include, but not be limited to, the following:

i. Any and all floodplains and floodways must be identified. A copy of the applicable FEMA floodplain map is required indicating limits of current study.

ii. Existing topography, one (1) foot contour interval minimum.

iii. Location and size of existing and proposed open channels, storm drains, detention/retention areas, SCS soils map, and all other drainage structures.

iv. Identification of all drainage basins in the development.

v. Location of all streets larger than residential classification.

vi. Identification of all drainage basins tributary to the proposed development.

vii. Basin maps may be scaled as small as 1"=400' (1:4800). Orthophoto maps at a scale of one inch equals 200 feet are preferred**.** Basin maps shall have each basin name, Area (acres), 10% & 1% peak flows (CFS) into and out of the basin (shown at the location of concentration) and, clearly indicated flow paths. Maps of a scale 1"=2000' may be used for undeveloped, offsite basins greater than 1 square mile.