DCM 6.5.0 - CHANNEL DROP STRUCTURES

The function of a drop structure is to reduce channel velocities by allowing for flatter upstream and downstream channel slopes. Two commonly used drop structures are shown in Figure 6-2 in Appendix ~~E~~ D of this manual.

The flow velocities in the upstream and downstream channels of the drop structure need to satisfy the permissible velocities allowed for channels. The design parameters for the sloping channel drop and the vertical channel drop are given below.

6.5.1 - Sloping Channel Drop

A. Approach Apron. A minimum ten (10) foot long riprap apron should be constructed immediately upstream of the drop to protect against the increasing velocities and turbulence which result as the water approaches the sloping portion of the drop structure. The same riprap and bedding design should be used as specified for the portion of the drop structure immediately downstream of the drop.

B. Chute. The chute shall have roughened faces and shall be no steeper than 2:1. The length, L, of the chute depends upon the hydraulic characteristics of the channel and drop. For a unit discharge, q, of 30 cubic feet per second per foot, L would be about 15 feet, that is, about ½ of the q value. The L should not be less than ten (10) feet, even for low q values.

C. Downstream Apron. The length of the downstream apron shall be sized according to Table 6-3 and shall be constructed of reinforced concrete or riprap depending on structural requirements.

Table 6-2
Minimum Roughness Coefficients of New or Altered Channels

Type of Channel and Description	Manning's Coefficients
1. Grass lined	
a. Bermuda (with regular mowing)	.040
b. St. Augustine (with regular mowing)	.045
c. Native grasses and vegetation not mowed regularly	.060
2. Concrete	
a. Concrete lined (rough finish)	.020
b. Concrete lined (smooth finish-culverts)	.015

c. Concrete rip-rap (exposed rubble)	.025
3. Gabion	.035
4. Rock-cut	.025
Source: 1. Chow, V.T. Open Channel Hydraulics. 1959. 2. WRC Engineering, Inc. Boulder County Storm Drainage Criteria Manual. 1984.	

Table 6-3
Length of Downstream Apron

Maximum Unit Discharge, q (cfs/ft)	Length of Downstream Apron, L_B (ft)
0-14	10
15	15
20	20
25	20
30	25

Source: City of Austin, Watershed Engineering Division.

6.5.2 - Vertical Channel Drops

The design criteria for the vertical channel drop is based upon the height of the drop and the normal depth and velocity of the approach and exit channels. The channel must be prismatic throughout, from the upstream channel through the drop to the downstream channel.

The steepest allowable sideslope for the riprap stilling basin is 4:1. The riprap should extend up the side slopes to a depth equal to one (1) foot above the normal depth projected upstream from the downstream channel. The maximum fall allowed at any one drop structure is four (4) feet from the upper channel bottom to the lower channel bottom.

A description of the drop structure and the design procedure, going from upstream to downstream, is given below and shown on Figure 6-2 in Appendix ~~E~~ D of this manual.

A. Approach Channel: The upstream and downstream channels will normally be grass-lined trapezoidal channels.

B. Approach Apron: A minimum ten (10) foot long riprap apron is provided upstream of the drop to protect against the increasing velocities and turbulence which result as the water approaches the vertical drop.

C. Downstream Apron: The riprap stilling basin is designed to force the hydraulic jump to occur within the basin and is designed for essentially zero scour.