Appendix G Design of Flow Control Structures

G.1 Design of Flow Control Structures

Flow control devices are orifices and weirs. The following formulas shall be used in computing maximum release rates from the designed structural BMP.

G.1.1 Circular Orifices

$$Q = CA(2gh)^{0.5}$$

where:

Q	=	orifice discharge (cfs)
C	=	discharge coefficient = 0.6
A	=	orifice cross-sectional area (ft^2) = 3.1416(D2/4)
g	=	gravitational acceleration (ft/s^2) = 32.2
h	=	hydraulic head above the center of the orifice (ft)

When h < D, the orifice shall be treated as a weir:

$$Q = CLH^{3/2}$$

where:

Q	=	flow through the weir (cfs)
C	=	3
L	=	diameter of orifice (ft)
H	=	hydraulic head above bottom of weir opening (ft)

G.1.2 Flow Under Gates

Flow under a vertical gate can be treated as a square orifice. For submerged conditions:

When outflow is not influenced by downstream water level:

$$Q = b \times a \times C \times \left[2g \times \left(\frac{H_0}{H_0 + H_i} \right) \right]^{0.5}$$

where:

Q	=	flow through the gate (cfs)
b	=	width of gate (ft)
a	=	gate opening height (ft)

C = discharge coefficient
G = 32.2 ft/s^2 (gravitational acceleration)

When outflow is influenced by downstream water level:

$$Q' = KQ$$

where:

Q = flow through the gate (cfs)
K = coefficient found in Figure G.1

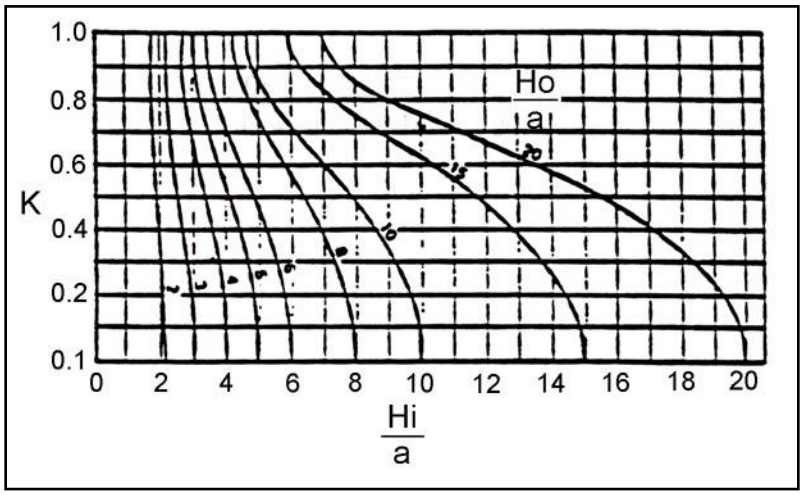

Figure G.1 Absolute downstream control of flow under gate.

G.1.3 Weirs

Rectangular:

$$Q = 3.33H^{1.5}(L - 0.2H)$$

60o V-notch:

$$Q = 1.43H^{2.5}$$

90o V-notch:

$$Q = 2.49H^{2.48}$$

where:

Q = low through the weir (cfs)
H = hydraulic head above the bottom of the weir (ft)
L = length of the weir crest (ft)