Tips for Determining Preliminary Intake Spacing and Drainage Areas

If the majority of a drainage area is pavement (Figure 1), the following instructions will help determine the preliminary spacing of intakes.

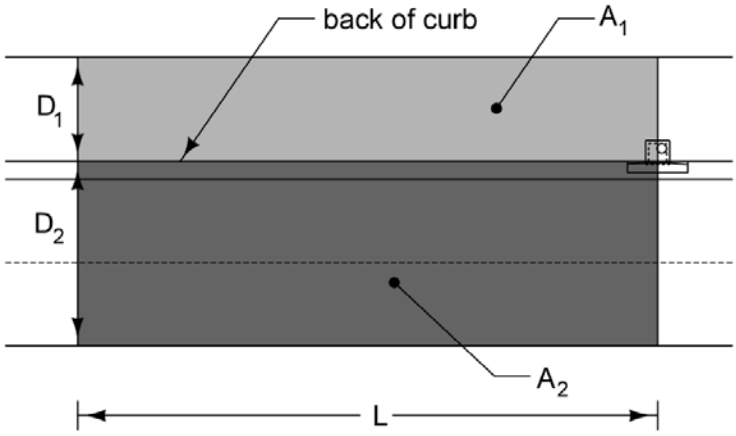

Figure 1: Drainage area.

1. Calculate maximum allowable Q based on maximum allowable width of spread:

$$Q = \frac{K_u}{n} S_x^{1.67} T^{2.67} \sqrt{S_L} \quad \text{(Equation 3)}$$

where:

Q = gutter flow rate, ft^3/s (m^3/s).
K_u = empirical coefficient equal to 0.56 (0.3~~-~~76 for metric units).
n = Manning's roughness coefficient. See Table 6, Section 4A-5.
S_x = gutter cross slope, ft/ft (m/m).
T = maximum allowable spread, ft (m). See Table 1.
S_L = longitudinal gutter slope, ft/ft (m/m).

2. Estimate Intensity (I). Assume a T_c = 5 minutes. Use Table 2 or Table 3 of Section 4A-5 to find the corresponding intensity value (I) for the appropriate Region.

3. Calculate the preliminary intake spacing (L):

$$L = \frac{43{,}560 \times Q}{I(C_1D_1 + C_2D_2)} \text{ (English units)} \qquad L = \frac{3{,}600{,}000 \times Q}{I(C_1D_1 + C_2D_2)} \text{ (metric units)}$$

where:

L, D_1, and D_2 are in feet (meters) and I is in in/hr (mm/hr)

The equations for L are derived as follows:

$$A_1 = \frac{D_1 \times L}{43{,}560} \text{ and } A_2 = \frac{D_2 \times L}{43{,}560} \text{ (English units, where } A_1 \text{ and } A_2 \text{ are in acres)}$$

$A_1 = \frac{D_1 \times L}{3{,}600{,}000}$ and $A_2 = \frac{D_2 \times L}{3{,}600{,}000}$ (metric units, where A_1 and A_2 are in hectares)

For the composite area $C = \frac{C_1A_1 + C_2A_2}{A_1 + A_2}$

where:

C_1 and C_2 are the imperviousness coefficients for areas A_1 and A_2. See Table 1, Section 4A-5.

From the Rational equation:

$$Q = CIA = \frac{C_1A_1 + C_2A_2}{A_1 + A_2} \times I \times (A_1 + A_2) = [C_1 \frac{D_1 \times L}{43{,}560} + C_2 \frac{D_2 \times L}{43{,}560}]I$$

$$= \frac{(C_1D_1 + C_2D_2) \times LI}{43{,}560} \text{ (English units)}$$

$$Q = [C_1 \frac{D_1 \times L}{3{,}600{,}000} + C_2 \frac{D_2 \times L}{3{,}600{,}000}]I = \frac{(C_1D_1 + C_2D_2) \times LI}{3{,}600{,}000} \text{ (metric units)}$$

Solving for L:

$L = \frac{43{,}560 \times Q}{I(C_1D_1 + C_2D_2)}$ (English units) $L = \frac{3{,}600{,}000 \times Q}{I(C_1D_1 + C_2D_2)}$ (metric units)

where:

L, D_1, and D_2 are in feet (meters) and I is in in/hr (mm/hr)