Problem 4A-5_4, Determining Peak Flow Values

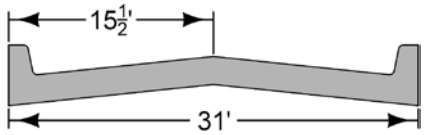
Determine the peak flow for a 10-year recurrence interval for an intake located on a Primary Highway with a 31 ft back-to-back pavement (two 12 ft. lanes with 3 ½ ft curb and gutter section using 6" curbs).

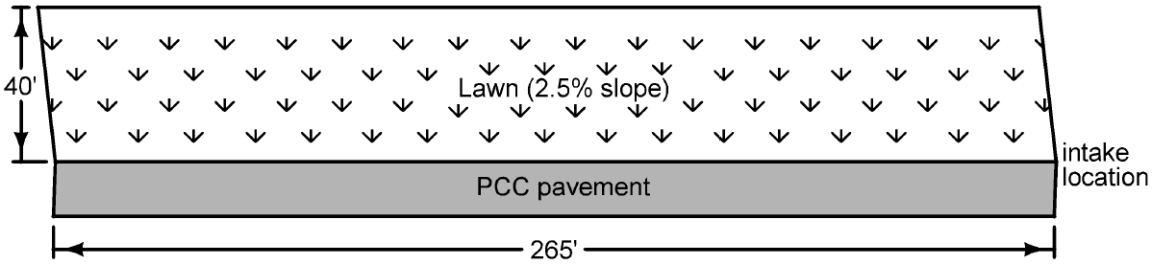
Location: Jewel, Iowa.

Drainage area consists of the following:

Lawn, 2.5% slope Bermuda grass (no buildings, driveways, or sidewalk areas)
- A = 0.25 Acres (approximately 40' × 265')
- C = 0.25 for a 10-year recurrence interval
- Average Slope of Surface, S = 2.5%
- T_c and I have already been determined to be:
- T_c = 7 min. When calculating T_c, time runoff is in the gutter was assumed to be negligible.
- I = 6.79 in/hr for a 10 year recurrence interval

Pavement:
- A = 0.09 acres of new PCC (15 ½ ft × 265 ft). Runoff flows from crown to gutter.
- C = 0.95 for a 10 year recurrence interval
- Pavement Cross Slope, S_x = 2.0%
- Gutter Cross Slope, S_w = 2.0%
- Length in Gutter = 265 ft.
- Longitudinal Slope, S_L = 1.5%
- Manning's Coefficient, n = 0.016
- T_c and I have already been determined to be:
- T_c = 5 min. Actual T_c was determined to be less than 5 min.; however, to determine I, a minimum T_c of 5 min. is required.
- I = 8.10 in/hr for a 10 year recurrence interval





Jewel is located in Section Code 5 (see Table 2 of Section 4A-5 for English units).

1) Lawn

Calculate peak flow using Equation 4A-5_1:

$$Q = CIA = 0.25 \times 6.79 \times 0.25 = 0.42 \text{ ft}^3/\text{s}.$$

2) Paved area.

Calculate peak flow using Equation 4A-5_1:

$$Q = CIA = 0.95 \times 8.10 \times 0.09 = 0.69 \text{ ft}^3/\text{s}$$

3) Combined area.

To calculate peak flow for the combination of the lawn and the paved area, use the flowpath associated with the longest T_c. In this situation, the lawn has the longest T_c (7 min). Use Equation 4A5-2 to calculate a weighted C value.

$$C = \frac{(0.25 \times 0.25) + (0.95 \times 0.09)}{0.25 + 0.09} = 0.44$$

Calculate the peak flow for the combined area (T_c = 7 min., so I = 6.79 in/hr):

$$Q = CIA = 0.44 \times 6.79 \times (0.25 + 0.09) = 1.02 \text{ ft}^3/\text{s}.$$

The combined area produces the largest peak flow. Use this value when determining the final size of the intake.