

10/15/2024

HAM-275-11.46 Downstream CB Sta 436+50 – PID 121506

Time of Concentration

a) Overland Flow

$$t_o = \frac{1.8(1.1-C)(L)^{1/2}}{S^{1/3}}$$

C – Coefficient of Runoff

0.4

L – Length, feet

300

Upstream Elevation, ft

781

Downstream Elevation, ft

757

S – Slope, percent

8

$$t_o = 10.9 \text{ minutes}$$

b) Shallow Concentrated Flow

$$t_s = \frac{L}{60V}$$

k – Coefficient,

L&D Table 1101-1

0.305

L – Length, feet

395

Upstream Elevation, ft

757

Downstream Elevation, ft

729

S – Slope, Percent

7.1

V – Velocity, fps (V = 3.281k*S^{1/2})

2.666

$$t_s = 2.5 \text{ minutes}$$

c) Open Channel Flow

$$t_d = \frac{L}{60V}$$

k – Coefficient,

L&D Table 1101-1

0.305

L – Length, ft

1770

Upstream Elevation, ft

729

Downstream Elevation, ft

619

S – Slope, Percent

6.2

V – Velocity, fps (V = 3.281k*S^{1/2})

2.492

$$t_d = 11.8 \text{ minutes}$$

$$\text{Time of Concentration} = t_o + t_s + t_d = 25 \text{ minutes}$$

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Peak Discharge-Rational Method

Rational Method:

$$Q_p = CiA$$

Q_p – Peak Discharge, cfs

C – Coefficient of Runoff

i – Rainfall Intensity, in/hr

A – Watershed Area, acres

Select an Area for IDF Curve, L&D Figure 1101-2:

☐ Ohio Map

☐ Area A

☐ Area B

☒ Area C

☐ Area D

Calculate Rainfall Intensity for selected area:

C	.4
i_2 , in/hr	2.5
i_5 , in/hr	3.02
i_{10} , in/hr	3.42
i_{25} , in/hr	3.94
i_{50} , in/hr	4.3
i_{100} , in/hr	4.62
A, acres	29.5

Calculate Flowrates:

Q_2 , cfs	29.5
Q_5 , cfs	35.6
Q_{10} , cfs	40.4
Q_{25} , cfs	46.5
Q_{50} , cfs	50.7
Q_{100} , cfs	54.5

Design Storm Frequency = 50 year, $Q_{50} = 50.7$ cfs

Per TMS – ADT = (INTERSTATE). Per L&D Volume 2, Section 1004.2, design storm is 50 year