

**U.S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
NEW YORK CONSERVATION PRACTICE GUIDELINE**

ESTIMATING RUNOFF

REFERENCE

Engineering Field Handbook – Chapter 2 - Estimating Runoff and Peak Discharges

Chapter 2 – Worksheet 1, Page 2-90

Chapter 2 – Worksheet 2, Page 2-91

National Engineering Handbook, Section 4, Hydrology,

Chapter 8 – Land Use and Treatment Classes

Chapter 9 – Hydrologic Soil –Cover Complexes

Current Soil Survey Information for the project County.

USGS Topographic Map(s) of the site.

Aerial Photo Map(s) of the site.

LIMITATIONS:

EFH –Chapter 2 - Estimating Runoff procedure is for small rural watersheds of 1-2000 acres. For other situations, the use Technical Reference 55 - Urban Hydrology for Small Watersheds. (“TR-55”) or Technical Reference 20 - Watershed Drainage Network Simulation (“TR-20”) may be required. Note the additional limitations to this procedure as found in EFH-2, Page 2-7.

PROCEDURE FOR ESTIMATING RUNOFF AND PEAK DISCHARGE

The following procedure uses the EFH Chapter 2. For more complex watersheds, you may also need to refer to the NEH Sections 4, 8, and/or 9.

WORKSHEET 1: RUNOFF CURVE NUMBER (CN)

1. Determine total drainage area (DA) for the practice being designed. Determine drainage areas in acres from USGS map, photographs or field observations. Record on Worksheet 1.
2. Determine all the Soil Types (by name) of the drainage area. Use the Soil Survey for the county the drainage is located in. Determine the Hydrologic Soil Group for each soil. Refer to Table 2-1, pages 2-42 through 2-83 for U.S. Soils and Table NY-2-1 pages. 2-41.1-2-41.3 for Soil Series used in New York. Record data in the first column of the worksheet.
3. Determine the Land Use, Treatment and/or Cover Description for each soil type (by name) and hydrologic group from aerial photos, soils photo maps and/or field visit. Cover Description includes the cover type, treatment and hydrologic condition. (Refer to Table 2-3 a, b, c, d, e, pg. 2-85 – N2-88(1). Record the Curve Number (CN) in the next column.
4. Determine the area in acres (or percent) of watershed for each soil type/cover description combination, (columns 1 and 2) and record that information in the column 4.
5. Column 5 is the Product of CN x area. Multiply the two numbers and record in this column.
6. Add the figures for Area (column 4) and Product (column 5) and record in the space at the bottom of each column.

- At the bottom of the worksheet for CN (weighted), divide the Product total by the Area total (column 5/4). Round the result to the next whole number. This result is the Curve Number for the design watershed and will be used on Worksheet 2.

WORKSHEET 2: TIME OF CONCENTRATION AND PEAK DISCHARGE

Estimating time of concentration:

- Determine rainfall distribution type, Figure 2-1, Page 2-15. Record on Worksheet 2.
Type II Rainfall distribution is normally used in upstate NY.
Type III Rainfall distribution is used in Southeast New York and Long Island.
- Record on Worksheet 2. Record the total drainage area from Worksheet 1 on Worksheet 2.
- Record the Weighted Runoff Curve Number from Worksheet 1 on Worksheet 2.
- Determine average watershed slope from the USGS topographic map, soils map, field measurements or refer to method shown on pg. 2-5, Eq. 2-6. Average several random slopes in the watershed. Record as 'slope percent' on Worksheet 2.
- Determine watershed flow length as described on pg. 2-5 and pg. N2-5(1) and record on Worksheet 2.
- Using flow length, watershed slope, and runoff curve number; determine the Time of Concentration (T_c) from Figure 2-27, pg. 2-41 of Chapter 2 of the EFH. Time of Concentration may also be computed by using the T_c equation shown on Worksheet 2, and on pg. 2-5. Note that $T_{c \text{ min}} = 0.1$ hours, and $T_{c \text{ max}} = 10$ hours.

Estimating peak discharge:

- Select storm frequency for which peak discharge to be determined. Consult appropriate conservation practice standard for criteria on storm frequency to be used. Record on Worksheet 2.
- Obtain the 24-hour rainfall (P), for the location of the design drainage area. Use figure 2-2 through 2-25, pgs. 2-16 to 2-39 or use NY Amendment NY-1, pgs. 2-14.1 to 2-14.4 and record on Worksheet 2.
- Determine Initial Abstraction, (I_a) from Chapter 2, Page 2-89. Use Weighted Runoff Curve Number and then select I_a from Table 2-4. Record on Worksheet 2.
- Compute Initial Abstraction divided by Rainfall, (I_a/P), ratios for each desired storm frequency. Record I_a/P on Worksheet 2. Note that the allowable range of I_a/P is 0.1 to 0.5. If the computed ratio is outside this range then the limiting value should be used.
- Determine Unit Peak Discharge, (q_u) by using Time of Concentration, T_c and the I_a/P ratio. Using the appropriate Exhibit 2 chart for the correct Type rainfall distribution, pgs. 2-11 to 2-14, follow the line representing your I_a/P ratio until it intersects your T_c . Record on Worksheet 2.
- Determine runoff (Q) for each storm frequency desired. Using the Rainfall, (P) and the Weighted Runoff Curve Number, (RCN), enter Figure 2-26, pg. 2-40 Table 2-2, pg. 2-84 or Table 2-2a, pgs. N2-84 (1 through 13) and obtain the runoff depth. Record on Worksheet 2.

13. Compute Peak Discharge (q_p) by multiplying the Unit Peak Discharge (q_u) times the Drainage Area in Acres (A) times the Runoff (R) in inches.

$$q_p = q_u * A * R$$

14. If pond and swamp areas are spread throughout the watershed and are not considered in the time of concentration computation, (see # 6), then an adjustment is needed for pond and swamp areas. Enter Table 2-5 on pg. N2-6 (1) with the percentage of pond and swamp area and obtain a peak adjustment factor. Multiply this peak adjustment factor times the peak discharge to obtain the corrected peak discharge.