Example 1. Design of a New Pond

Given: Drainage area, DA = 100 acres, watershed slope-steep, curve number (RCN) = 75, 10 percent chance (10-year), 24-hour precipitation P = 5.4 inches, storm distribution = Type II, required detention time T = 24 hours.

Determine: (a) Maximum required principal spillway discharge Q_o
(b) Minimum required detention storage V_s

Procedure:

1. Determine volume of runoff from P = 5.4 inches and RCN = 75. Exhibit 2-7A EFM: V_r = 2.77 inches. Use 2.8 inches.

2. Enter TSC-NE-ENG-225, sheet 3, (Exhibit 2-14), EFM with DA = 100 acres, RCN = 75 and V_r = 2.8 inches to obtain peak runoff rate Q_i = (90 cfs/inch of runoff)(V_r) = (90 x 2.8) = 250 cfs

3. $Q_i/DA = 250/100 = 2.5$ cfs/acre

4. Enter Exhibit 11-10, sheet 2 of 2 with V_r = 2.8 inches and Q_i/DA = 2.5 cfs/acre to obtain $Q_o/Q_i = 0.031$

5. The maximum required principal spillway discharge $Q_o = 0.031 \times Q_i = 0.031 \times 250 = 7.8$ cfs

6. $Q_o/DA = 7.8/100 = 0.08$ cfs/acre

7. From Exhibit 11-4, sheet 1 of 3, page 11-55a, with Q_o/DA = .08 cfs/acre, determine that Table B is appropriate.

8. Enter Table B with V_r = 2.8 inches and Q_o/DA = 0.08 to obtain V_s = 2.0 inches.

9. Minimum required detention storage in acre ft. = 2.0 inches $\times \frac{100 \text{ acres}}{12 \text{ in/ft}}$ = 17 AF

Example 2. Analysis of Existing Pond

Given: Drainage area = 75 acres, RCN = 85, slope-moderate, 10-year 24 hr precipitation, P = 6.0 inches, Type II storm distribution, Available storage V_S = 17.5 acre-ft. Principal spillway discharge, Q_o = 18 cfs.

Determine: Whether the sedimentation pond has a principal spillway that is small enough and sufficient detention storage to meet the 10-hour detention time requirement.

Procedure: Check principal spillway discharge:

1. V_r = 4.3 inches (Exhibit 2-7A EFM)

2. Enter - TSC-NE-ENG-225, Sheet 2 of 3 (Exhibit 2-14), EFM with DA = 75 acres, RCN = 85, and V_r = 4.3 inches to obtain peak rate of runoff Q_i = (58 cfs/inch)(V_r) = 58 x 4.3 = 250 cfs

3. Q_i/DA = 250/75 = 3.3 cfs/acre

4. Enter Exhibit 11-10, sheet 1 of 2 with V_r = 4.3 inches and Q_i/DA = 3.3 cfs/acre to obtain Q_o/Q_i = 0.084.

5. Maximum Q_o = 0.084 x Q_i = (0.084)(250) = 21 cfs
   Since the actual principal spillway discharge (18 cfs) is less than the maximum (21 cfs), the principal spillway is small enough to provide the required detention time.

Now check to see if there is sufficient detention storage using the actual principal spillway discharge.

6. Q_o/DA = 18 cfs/75 acres = 0.24 cfs/acre

7. Since Q_o/DA < 0.47 cfs/acre, use Table B (Exhibit 11-4, Sheet 3 of 3).

8. For V_r = 4.3 inches and Q_o/DA = 0.24 cfs/acre, V_S = 2.6 inches.

9. The required detention storage in acre feet is 2.6 inches
   $\times \frac{75 \text{ acres}}{12 \text{ in/ft}}$ = 16 acre feet

10. Since the available storage (17.5 acre feet) is larger than the required storage (V_S = 16 acre feet), the pond has sufficient detention storage. Note: Either a principal spillway that is too large or insufficient detention storage would disqualify this pond from meeting the detention time requirement.