Example 8.2

Estimate the 25-year recurrence interval peak discharge for the watershed in Fig. 8.4 that is located in Dallas County, Texas. The watershed has an area A of 620 hectares (1,530 ac) and a runoff coefficient C of 0.60.

Solution In Example 8.1, the t_L was estimated to be 1.8 hours using Eq. 8.3, which can be transformed to a t_C of 3.0 hours using Eq. 8.7. The rainfall duration t is set equal to the t_C of 3.0 hours or 180 minutes. Eq. 7.50 and Table 7.6 are used to determine the rainfall intensity for a 25-year recurrence interval.

$$i = \frac{a}{(t+b)^c} = \frac{90}{(180+8.7)^{0.774}} = 1.56 \text{ in./hr } (3.96 \text{ cm/hr})$$

The rational formula is applied alternatively with metric and English units.

$$Q_p = CiA \text{ (conversion factors)}$$

$$Q_p = 0.60(3.96 \text{ cm/hr})(620 \text{ ha})\left(\frac{\text{m}}{100 \text{ cm}}\right)\left(\frac{10{,}000 \text{ m}^2}{\text{ha}}\right)\left(\frac{\text{hr}}{3{,}600 \text{ s}}\right) = 41 \text{ m}^3/\text{s}$$

$$Q_p = 0.60(1.56 \text{ in./hr})(1{,}530 \text{ ac})\left(\frac{\text{ft}}{12 \text{ in.}}\right)\left(\frac{43{,}560 \text{ ft}^2}{\text{acre}}\right)\left(\frac{\text{hr}}{3{,}600 \text{ s}}\right) = 1{,}400 \text{ ft}^3/\text{s}$$

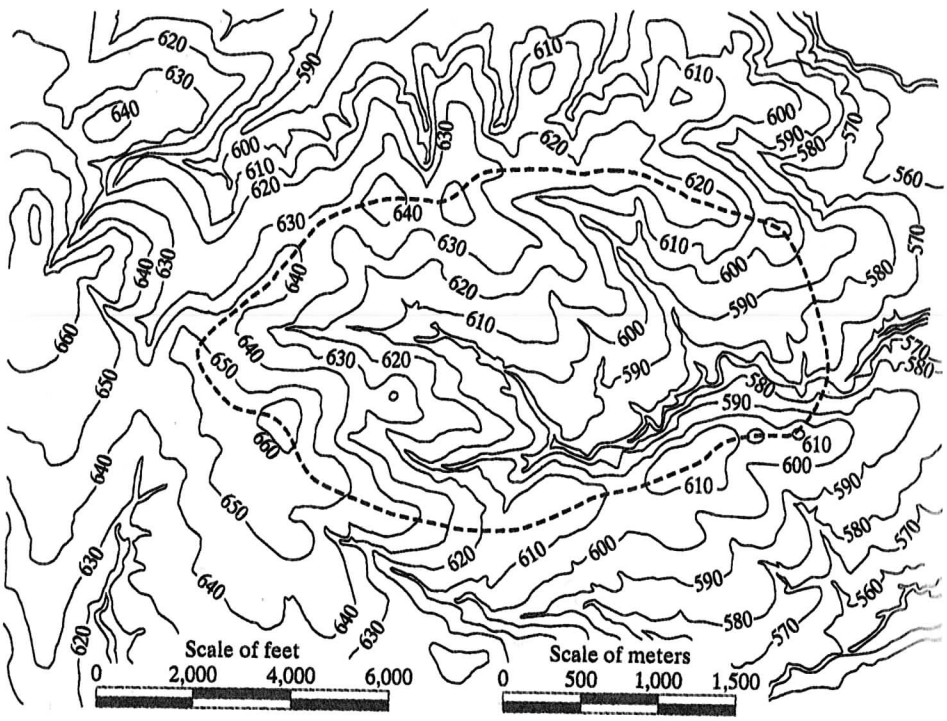

Figure 8.4 The watershed is delineated on a contour map (contour interval = 10 ft).

Eq. 8.3:

$$t_L = \frac{l^{0.8}(1{,}000 - 9CN)^{0.7}}{1{,}900\, CN^{0.7} y^{0.5}}$$

where
t_L in h
l in feet
CN (from CN Method)
y in % (average slope of watershed)

Eq. 8.7:

$$t_C = \frac{5}{3} t_L$$

TABLE 7.6 COEFFICIENTS FOR EQ. 7.50 FOR FOUR TEXAS COUNTIES

T	Brazos			Dallas			El Paso			Harris		
years	a	b	c	a	b	c	a	b	c	a	b	c
2	65	8.0	0.806	54	8.3	0.791	24	9.5	0.797	68	7.9	0.800
5	76	8.5	0.785	68	8.7	0.782	34	12.0	0.802	70	7.7	0.749
10	80	8.5	0.763	78	8.7	0.777	42	12.0	0.795	81	7.7	0.753
25	89	8.5	0.754	90	8.7	0.774	60	12.0	0.843	81	7.7	0.724
50	98	8.5	0.745	101	8.7	0.771	90	12.0	0.900	91	7.7	0.728
100	96	8.0	0.730	106	8.3	0.762	65	9.5	0.825	91	7.9	0.706

$$i = \frac{a}{(t+b)^c} \qquad \text{Eq. (7.50)}$$

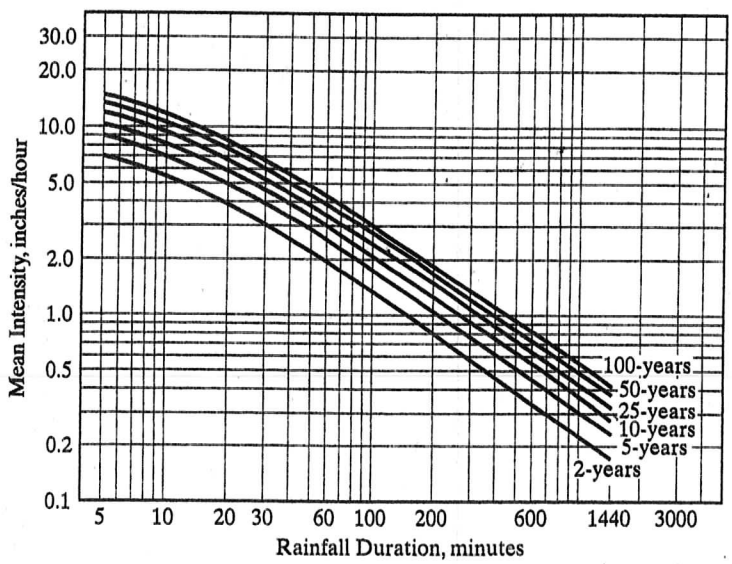

Figure 7.12 Rainfall IDF curves for Dallas County, Texas.

SOURCE: Wurbs & James, 2002