DECONVOLUTION

Example 8.8

Beginning at 10:00 a.m. on October 18, rain fell for 2 hours on the 182 km^2 watershed above a stream gaging station. The flows recorded in column 2 of the following table were observed. The discharge in the stream prior to the storm was 15 m^3/s. Develop a unit hydrograph (U.H.).

Solution A constant base flow is assumed equal to the 15 m^3/s flow prior to the storm. The runoff hydrograph in column 4 is the gaged flow less base flow. The direct runoff volume V_R is determined as the area under the runoff hydrograph. The Q_t in column 4 of the table sum to 2,529 m^3/s. V_R is approximated as

$$V_R = \sum (Q_t \Delta t) = \Delta t \sum Q_t = (1 \text{ hr})(2{,}529 \text{ m}^3/\text{s})(3{,}600 \text{ s/hr}) = 9{,}104{,}400 \text{ m}^3$$

which is converted to an equivalent depth covering the 182 km^2 watershed.

$$V_R = \frac{9{,}104{,}400 \text{ m}^3}{182{,}000{,}000 \text{ m}^2} = 0.05002 \text{ m} = 5.00 \text{ cm}$$

The unit hydrograph flows in column 5 are obtained by scaling the flows in column 4.

$$Q_{1.0\text{ cm}} = Q_{5.00\text{ cm}}\left(\frac{1.0 \text{ cm}}{5.00 \text{ cm}}\right)$$

Clock time (hrs) (1)	Gaged flows (m^3/s) (2)	Base flow (m^3/s) (3)	Direct Runoff flows (m^3/s) (4)	U.H. flows (m^3/s)/cm (5)	U.H. time (hours) (6)
10:00	15	15	0	0.0	0
11:00	178	15	163	32.6	1
12:00	431	15	416	83.2	2
13:00	562	15	547	109.4	3
14:00	503	15	488	97.6	4
15:00	347	15	332	66.4	5
16:00	245	15	230	46.0	6
17:00	169	15	154	30.8	7
18:00	104	15	89	17.8	8
19:00	75	15	60	12.0	9
20:00	52	15	37	7.4	10
21:00	28	15	13	2.6	11
22:00	15	15	0	0.0	12
23:00	15	15	0		

Wurbs & James, WRE, Prentice-Hall 2002