SURFACE-WATER RESOURCES AND BASIN WATER BUDGET FOR SPRING VALLEY, WHITE PINE AND LINCOLN COUNTIES, NEVADA

For
THE LAS VEGAS VALLEY WATER DISTRICT, LAS VEGAS, NEVADA

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By

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Table 25. --Standard format and values for altitude-area-precipitation-recharge efficiency compared to values used for this study.

Altitude, in feet	Area, in acres, rounded[1]	Precipitation, in inches per year		Recharge efficiency, in percent	
		Hardman map[2]	This Study[3]	Maxey-Eakin[4]	This Study
>9,000 9,000 – 13,000[a]	62,000	> 20 (21)	21.3	25	25
8,000 – 9,000	92,500	15 – 20 (17.5)	17.3	15	14
7,000 – 8,000	181,000	12 - 15 (13.5)	14.5	7	8
6,000 – 7,000	382,000	8 – 12 (10)	11.6	3	5
5,000 – 6,000[b]	349,000	< 8 (6)	8.8	0	2

1. Areas differ from Rush and Kazmi (1965) due to map scale and rounding; total acreage listed in Table 24 is more precise and was used for calculation.
2. Rush and Kazmi (1965, Table 6, p. 21; based on Hardman, 1936). Mean precipitation rate for altitude-precipitation interval in parenthesis.
3. Mean precipitation rate for the altitude interval.
4. Efficiency coefficients as reported in: Maxey and Eakin (1949); Rush and Kazmi (1965); and Eakin (1966).

a. This interval commonly reported as a single interval (> 9,000 ft, abmsl).
b. Minimum altitude in basin is ~ 5,550 ft abmsl. Mean altitude below 6,000 ft used to estimate recharge is ~ 5,800 ft, which equals a precipitation rate 9.7 inches and a recharge efficiency of 3 percent. Interval is reported in Rush and Kazmi (1965) as; < 6,000 ft abmsl.

The standard efficiency factors are those of Maxey and Eakin (1949), listed in Table 25 and are normally used in conjunction with the "Hardman map". The recharge efficiency however is a function of the precipitation rate (Eakin, 1966 p. p. 260-262) and thus the Maxey-Eakin efficiencies, which are non-unique, can be used with other precipitation maps. Donovan and Katzer (2000) working in Las Vegas Valley modified the form of the Maxey-Eakin precipitation-efficiency relationship, which is a "stepped" relationship (one rate per ~ 4 inch precipitation interval), into an equation wherein each value of precipitation used has a calculated efficiency rate.

The recharge efficiency is calculated using the recharge efficiency curve equation described in Donovan and Katzer (2000) for Las Vegas Valley. The equation was developed to minimize manual calculation errors and the calculated recharge efficiency is the same, for each of the standard Maxey-Eakin precipitation intervals. The recharge efficiency equation, $\mathbf{R_e = 0.05 (P)^{2.75}}$, is for the interval between 8 and 20 inches of precipitation, < 8 inches $R_e = 0$, > 20 inches $R_e = 0.25$, where P is precipitation in feet. When this equation is used with a specific precipitation map each interval of precipitation is calculated. When used with the altitude-area-precipitation tables the recharge for each altitude interval is calculated. A minor variant of this equation is to assume recharge occurs in areas where the precipitation rate is less than 8 inches, which commonly occurs below 6,000 ft, but not in Spring Valley. The smallest precipitation rate considered "effective" (ie. a percentage becomes recharge) in Spring Valley is 9.6 inches per year at an altitude of 5,775 ft above mean sea level.

The Maxey and Eakin (1949) recharge efficiencies (0, 3, 7, 15 and 25 percent) listed in Table 25 are for irregular precipitation intervals (contours of 8, 12, 15 and 20 inches) of precipitation as defined on the Hardman maps (1936, and 1965). The contours of more recent precipitation maps are usually regular (i.e. 1 inch, 2 inch or 4 inch intervals).