Appendix F3

Modified Maxey-Eakin Recharge Analysis

Appendix F3. Alternate Recharge Estimates

To incorporate site-specific recharge data and regional information for central New Mexico, Hydrosphere developed and ran a second set of calculations using the Maxey-Eakin model with a slight modification. Data were obtained from a comprehensive recent summary of recharge in the intermountain western United States by Stephens (1994), who summarizes the results of 17 field studies undertaken to quantify recharge rates in New Mexico, west Texas, Nevada, and eastern Washington, as well as mentioning results from other recharge studies conducted in arid lands across the globe (e.g., Darling et al., 1992). In compiling these comparative data, those data affected by recharge enhancing mechanisms (e.g., topography [McCord and Stephens, 1987]) or estimation techniques with unreasonably large uncertainties (Gee and Hillel, 1988) were eliminated from consideration. Data for sites comparable to those that occur across the Socorro-Sierra planning region were extracted from these studies.

While there is a huge amount of scatter in the data, a slight trend may be observed. In fact, a linear regression of the data may suggest a positive slope: increasing recharge with increasing precipitation. The slope of the line is roughly 3 percent, suggesting that on average, approximately 3 percent of precipitation ultimately replenishes underlying aquifers. Therefore, as a check on the Maxey-Eakin approach, the Maxey-Eakin equations (Section 5.11.1 of this report) were used with the specification that the percentage recharge is a constant 3.04 percent for all precipitation zones in the region.

The results of this application of the Maxey-Eakin model to estimate total recharge to the selected groundwater basins are presented in Table F3-1, along with the standard Maxey Eakin estimation presented in Section 5.11 of the main body of this report. In most cases, the two estimates are nearly identical, which should not be surprising, given that the vast majority of the basins considered for this study experience between 8 and 12 inches of precipitation annually, and the Maxey-Eakin r_i value for that range is 3 percent, equivalent to the estimated recharge percentage used in the modified approach. However, in basins that contain large percentages of higher elevations relative to the rest of the basin, the modified approach computes a significantly smaller recharge because the higher elevations are assigned the same recharge percentage as the low elevations (e.g., Las Animas Creek and Hot Springs Artesian Basins). In the Maxey-Eakin approach, the percentage of precipitation that recharges the aquifer in the higher elevations is much higher than in the lower elevations.

Table F3-1. Calculated Recharge to Groundwater Basins Outside the Rio Grande Valley in the Socorro-Sierra Water Planning Region

Basin	Area [a] (acres)	Volumetric Annual Recharge (ac-ft/yr)			
		Modified Maxey-Eakin		Maxey-Eakin	
		Total	Mountain Front	Total	Mountain Front
San Agustin, within planning region	240,100	7,585	67	7,620	201
Alamosa Creek, entire basin	163,109	2,143	93	2,331	325
Jornada del Muerto, entire basin	1,188,800	45,135	1,102	47,121	3,858
Tularosa, within planning region	780,000	22,761	150	21,805	526
Las Animas Creek	75,100	3,950	NC	17,200	NC
Hot Springs Artesian		6,829	NC	17,040	NC
Rio Grande Basin		NC	NC	63,800 [b]	NC
La Jencia Basin		NC	NC	20,000 [b]	NC

NC = Not calculated

[a] Portion of the basin that falls within the planning region
[b] SSPA (2002) estimate

To check the accuracy of the calculations, recharge to the Alamosa Creek Basin estimated by both this and the standard Maxey Eakin method was compared to field-measured data. At the hydrologic outlet to the basin, the total flow into the Monticello Box from Alamosa Creek and the Apache Warm Springs ranges between 6 and 8 cfs (Myers et al., 1994; Jeffrie, 2000), or from 4,344 to 5,791 acre feet per year (ac-ft/yr). The average annual recharge to the basin computed using the Maxey-Eakin models is on the same order of magnitude (roughly half [Table F3-1]) as the observed basin discharge. This is a reasonably close agreement given the approximation techniques used. More accurate recharge estimates would require local field studies.

References

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