*Water Science and Application 9*

# Groundwater Recharge in a Desert Environment:

## The Southwestern United States

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# Fundamental Concepts of Recharge in the Desert Southwest: A Regional Modeling Perspective

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Recharge in arid basins does not occur in all years or at all locations within a basin. In the desert Southwest potential evapotranspiration exceeds precipitation on an average annual basis and, in many basins, on an average monthly basis. Groundwater travel time from the surface to the water table and recharge to the water table vary temporally and spatially owing to variations in precipitation, air temperature, root zone and soil properties and thickness, faults and fractures, and hydrologic properties of geologic strata in the unsaturated zone. To highlight the fundamental concepts controlling recharge in the Southwest, and address the temporal and spatial variability of recharge, a basin characterization model was developed using a straightforward water balance approach to estimate potential recharge and runoff and allow for determination of the location of recharge within a basin. It provides a means for interbasin comparison of the mechanisms and processes that result in recharge and calculates the potential for recharge under current, wetter, and drier climates. Model estimates of recharge compare favorably with other methods estimating recharge in the Great Basin. Results indicate that net infiltration occurs in less than 5 percent of the area of a typical southwestern basin. Decadal-scale climatic cycles have substantially different influences over the extent of the Great Basin, with the southern portion receiving 220 percent higher recharge than the mean recharge during El Niño years in a positive phase of the Pacific Decadal Oscillation, whereas the northern portion receives only 48 percent higher recharge. In addition, climatic influences result in groundwater travel times that are expected to vary on timescales of days to centuries, making decadal-scale climate cycles significant for understanding recharge in arid lands.

## 1. INTRODUCTION

The purpose of this study was to develop a simple model for basin characterization that allows interbasin comparison of recharge mechanisms and the potential for recharge

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under current, wetter, and drier climates, and to highlight the fundamental concepts and mechanisms that control recharge in the deserts of the Southwestern United States (Southwest). The method developed allows analysis of climate change, as changes in precipitation and air temperature, to evaluate the potential for changes in groundwater recharge in the Great Basin and eventually in other areas in the Southwest. Without further refinements, this modeling approach primarily is intended to provide a means for hydrologically characterizing basins on a basin-wide or regional scale on the basis of fundamental concepts of recharge as they apply to southwestern desert environments. Estimates of recharge in basins of the Great Basin are presented for the purpose of illustrating the approach, evaluating relative proportions of recharge and runoff to describe the dominant mechanisms controlling recharge, and providing a comparison with other methods that have estimated recharge in the Great Basin. They are not relied on as accurate enough at this time to be used for assessment of water availability.

A basin characterization model (BCM) was developed for this study to determine the spatial and temporal variability of net infiltration (all terms are defined below), which is assumed to be equal to recharge because the model assumes steady state conditions and no lateral subsurface flow. The BCM uses a mathematical deterministic water-balance approach that includes the distribution of precipitation and the estimation of potential evapotranspiration, along with soil water storage and bedrock permeability. The BCM was used with available GIS data (digital elevation model, geology, soils, vegetation, precipitation, and air temperature maps), and GIS data that was developed for this study.

The BCM can be used to identify locations and climatic conditions that allow for excess water, quantifying the amount of water available either as runoff or as in-place recharge on a monthly basis, and allows inter-basin comparison of recharge mechanisms. The model does not distinguish between mountain front and stream channel recharge, which are referred to in this paper as runoff, nor does it explicitly define the percentage of runoff that becomes recharge. Because the accurate estimates of recharge cannot be calculated without further refinement to the BCM to estimate the partitioning of runoff, it calculates *potential* in-place recharge and *potential* runoff, and provides the distribution of both in a basin. These values can be combined using assumptions of the amount of runoff that results in recharge to estimate total potential recharge.

A simple calculation of travel time through the unsaturated zone can be estimated if steady state conditions are assumed and if unsaturated zone thickness and permeability data are available [*Flint et al.,* 2000]. The BCM can also be used to evaluate the potential for recharge under current, wetter, and drier climates, and is used to evaluate the role of decadal-scale climate cycles (El Niño/La Niña and the Pacific Decadal Oscillation) on recharge at a pixel scale (generally 30–270 meters) across the Southwest.

### *1.1 Terms and Concepts*

Because many terms related to infiltration and recharge often have different meanings to different researchers, the terms used in this paper are defined and are consistent with those in most current literature. Infiltration is the entry into the soil of water made available at the ground surface [*Freeze and Cherry,* 1979]. Net infiltration is the quantity of water that moves below the zone of surface evapotranspiration processes [*Flint et al.,* 2001]. Under steady state conditions, net infiltration is equal to recharge unless diverted to an area of flow from a spring and thus lost to evapotranspiration; even under this condition, one could argue that some recharge occurs, even if only to a small local or perched aquifer. Percolation (or drainage) is the process by which water moves downward through the unsaturated zone [*Flint et al.,* 2001]. Recharge is the entry into the saturated zone of water made available at the water table surface [*Freeze and Cherry,* 1979]. Discharge is the removal of water from the saturated zone across the water table surface [*Freeze and Cherry,* 1979].

Travel time in the unsaturated zone is the time it takes for water that has become net infiltration to recharge the water table (hours to millennia); it is controlled by net infiltration, the thickness of the unsaturated zone, and the effective porosity of subsurface flow paths [*Flint et al.,* 2000]. As climate changes, the travel time of infiltrating water through the unsaturated zone may vary; the spatial distribution of recharge also may vary. Recharge that occurs today is spatially variable owing to the thicknesses of soil and alluvium, the thickness of the unsaturated zone, and to the layering and properties of geologic and sediment strata. Recharge is temporally variable owing to changes in processes controlling net infiltration (primarily climate) for timescales of years to centuries.

Recharge is often discussed as dominant within one of the following basin locations: mountain block, diffuse, mountain front, stream channel, and playa lake. Mountain block recharge occurs directly into the underlying bedrock without runoff and is widely distributed in areas of higher mountainous terrain particularly where there is permeable bedrock. Diffuse recharge is areally distributed in alluvial valleys but away from the stream channels (similar to

**Table 1.** Total mean potential recharge (acre-feet/year) calculated for 258 basins in the Great Basin calculated using several methods of estimating recharge and potential in-place recharge and potential runoff calculated several ways using the basin characterization model.

| | | Mean potential recharge, in acre-feet per year, by method | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Basin Characterization Model — Mean year | | | Basin Characterization Model — Time series | | |
| Hydrographic area or subarea identifier* | Hydrographic area or subarea* | Maxey—Eakin method* | Chloride mass balance method* | Estimates using discharge measurements** | Water-balance model (Hevesi et al., 2003) | Water-balance model (Hevesi et al., 2002) | Potential in-place recharge | Potential runoff | Total potential recharge for mean year | Potential in-place recharge | Potential runoff | Total potential recharge for time series |
| 142 | Alkali Spring Valley | 100 | | | 141 | 3,544 | 9 | 0 | 9 | 221 | 82 | 229 |
| 230 | Amargosa Desert | 1,500 | | | 2,139 | 8,129 | 146 | 236 | 169 | 1,938 | 2,567 | 2,195 |
| 151 | Antelope Valley (Eureka and Nye) | | | | | | 4,880 | 1,087 | 4,988 | 4,060 | 1,682 | 4,228 |
| 57 | Antelope Valley (Humboldt System) | 11,000 | | | | | 2,091 | 2,289 | 2,320 | 1,848 | 2,988 | 2,147 |
| 93 | Antelope Valley (Lemmon Valley) | 300 | | | | | 1 | 947 | 95 | 1 | 1,308 | 131 |
| 186A | Antelope Valley (south) | | | | | | 1,193 | 486 | 1,242 | 977 | 624 | 1,039 |
| 186B | Antelope Valley (north) | | | | | | 3,574 | 1,202 | 3,694 | 2,897 | 1,341 | 3,031 |
| 186 | Antelope Valley (north and south) | 4,700 | | 16,824 | | | 4,767 | 1,688 | 4,936 | 3,874 | 1,965 | 4,071 |
| 106 | Antelope Valley (Walker System) | 18,000 | | | | | 5,045 | 75,829 | 12,627 | 4,678 | 82,497 | 12,928 |
| 283 | Beaver Valley | | | | | | 15,201 | 64,886 | 21,689 | 15,551 | 55,149 | 21,066 |
| 280 | Beryl-Enterprise Area | | | | | | 25,804 | 44,431 | 30,247 | 21,678 | 52,721 | 26,950 |
| 137A | Big Smoky Valley (north) | 12,000 | | | | | 2,544 | 2,628 | 2,807 | 3,686 | 3,742 | 4,060 |
| 215 | Black Mountains Area | 70 | | | | | 51 | 25 | 54 | 1,376 | 939 | 1,470 |
| 28 | Black Rock Desert | 14,000 | | | | | 3,963 | 18,836 | 5,847 | 6,055 | 30,586 | 9,113 |
| 275 | Blue Creek Valley | 14,000 | | | | | 2,279 | 59 | 2,285 | 3,051 | 138 | 3,065 |
| 61 | Boulder Flat | | | | | | 140 | 907 | 231 | 439 | 1,569 | 596 |
| 15 | Boulder Valley | 2,000 | | | | | 5,044 | 6,228 | 5,667 | 4,090 | 6,382 | 4,729 |
| 75 | Bradys Hot Springs Area | 160 | | | | | 812 | 542 | 866 | 1,088 | 1,290 | 1,216 |
| 129 | Buena Vista Valley | | | | | | 588 | 9,755 | 1,563 | 670 | 12,681 | 1,938 |
| 131 | Buffalo Valley | | | | | | 284 | 7,885 | 1,072 | 361 | 8,078 | 1,169 |
| 178A | Butte Valley (north) | | 2,400 | | | | 12,653 | 3,923 | 13,045 | 10,465 | 3,570 | 10,822 |
| 178B | Butte Valley (south) | | 1,200 | | | | 21,499 | 7,413 | 22,240 | 17,657 | 6,261 | 18,284 |
| 178 | Butte Valley (north and south) | 19,000 | | | | | 34,152 | 11,336 | 35,285 | 28,122 | 9,831 | 29,105 |
| 272 | Cache Valley | | | | | | 339,819 | 226,765 | 362,495 | 372,607 | 245,166 | 397,124 |
| 148 | Cactus Flat | 600 | | | 1,410 | 1,969 | 1,818 | 1,603 | 1,978 | 1,612 | 2,142 | 1,826 |
| 241 | California Valley | | | | 775 | 1,361 | 13 | 532 | 66 | 41 | 1,744 | 216 |
| 218 | California Wash | 60 | | | | | 23 | 1 | 23 | 639 | 130 | 652 |
| 55 | Carico Lake Valley | 4,300 | | | | | 1,826 | 4,080 | 2,234 | 1,435 | 3,582 | 1,793 |
| 101A,B | Carson Desert (Packard and Lahontan Valleys) | 1,300 | | | | | 752 | 1,412 | 893 | 1,821 | 2,218 | 2,043 |
| 105 | Carson Valley | 41,000 | | | | | 39,856 | 589,167 | 98,772 | 41,627 | 617,008 | 103,328 |
| 180 | Cave Valley | 14,000 | | | | | 9,350 | 9,135 | 10,264 | 8,479 | 9,009 | 9,380 |
| 282 | Cedar City Valley | | | | | | 3,275 | 29,899 | 6,265 | 2,696 | 27,149 | 5,411 |
| 264 | Cedar Valley | | | | | | 16,024 | 12,075 | 17,231 | 16,370 | 12,688 | 17,639 |
| 240 | Chicago Valley | | | | 569 | 903 | 11 | 57 | 17 | 80 | 873 | 167 |
| 102 | Churchill Valley | 1,300 | | | | | 6,470 | 10,420 | 7,512 | 6,718 | 14,298 | 8,148 |
| 143 | Clayton Valley | 1,500 | | | 1,051 | 14,347 | 524 | 306 | 555 | 1,300 | 1,190 | 1,419 |
| 204 | Clover Valley (Colorado System) | | | | | 14,512 | 17,614 | 16,274 | 12,367 | 20,215 | 14,389 | |

**Table 1.** (continued).

| | | Mean potential recharge, in acre-feet per year, by method | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Basin Characterization Model — Mean year | | | Basin Characterization Model — Time series | | |
| Hydrographic area or subarea identifier* | Hydrographic area or subarea* | Maxey—Eakin method* | Chloride mass balance method* | Estimates using discharge measurements** | Water-balance model (Hevesi et al., 2003) | Water-balance model (Hevesi et al., 2002) | Potential in-place recharge | Potential runoff | Total potential recharge for mean year | Potential in-place recharge | Potential runoff | Total potential recharge for time series |
| 177 | Clover Valley (Independence Valley System) | 21,000 | | 58,802 | | | 8,065 | 38,353 | 11,900 | 8,223 | 36,675 | 11,890 |
| 64 | Clovers Area | | | | | | 2,250 | 5,458 | 2,796 | 2,493 | 6,088 | 3,102 |
| 171 | Coal Valley | 2,000 | | | 3,325 | | 3,575 | 2,643 | 3,839 | 2,740 | 3,701 | 3,110 |
| 100 | Cold Springs Valley | | | | | | 7 | 1,764 | 184 | 8 | 3,355 | 344 |
| 118 | Columbus Salt Marsh Valley | 700 | | | | | 633 | 420 | 675 | 983 | 1,207 | 1,104 |
| 2 | Continental Lake Valley | 11,000 | | | | | 643 | 4,364 | 1,079 | 1,233 | 7,889 | 2,022 |
| 126 | Cowkick Valley | | | | | | 290 | 91 | 300 | 442 | 352 | 477 |
| 210 | Coyote Spring Valley | 2,600 | | | | | 5,037 | 1,467 | 5,184 | 5,659 | 2,924 | 5,951 |
| 229 | Crater Flat | 220 | | | 268 | 1,424 | 29 | 9 | 30 | 782 | 382 | 820 |
| 54 | Crescent Valley | | | | | | 1,043 | 10,935 | 2,136 | 910 | 9,933 | 1,903 |
| 278 | Curlew Valley | 75,600 | | | | | 26,646 | 2,177 | 26,863 | 26,276 | 2,728 | 26,548 |
| 103A | Dayton Valley (Carson Plains) | | | | | | 5,522 | 14,372 | 6,959 | 7,090 | 19,847 | 9,074 |
| 103B | Dayton Valley (Stagecoach Valley) | | 320 | | | | 932 | 990 | 1,031 | 1,018 | 1,357 | 1,154 |
| 103 | Dayton Valley (Stagecoach Valley and Carson Plains) | 7,900 | | | | | 6,454 | 15,362 | 7,991 | 8,108 | 21,204 | 10,228 |
| 243 | Death Valley | 8,000 | | | 16,891 | 60,997 | 4,960 | 11,712 | 6,131 | 11,755 | 28,056 | 14,560 |
| 253 | Deep Creek Valley | 17,000 | | | | | 9,743 | 25,765 | 12,319 | 9,004 | 23,970 | 11,401 |
| 182 | Delamar Valley | 1,000 | | | | | 6,627 | 11,366 | 7,764 | 5,308 | 10,958 | 6,404 |
| 31 | Desert Valley | 5,000 | | | | | 1,218 | 12,203 | 2,438 | 1,292 | 15,250 | 2,817 |
| 153 | Diamond Valley | 21,000 | 10,500 | | | | 13,081 | 20,431 | 15,124 | 12,199 | 19,417 | 14,141 |
| 128 | Dixie Valley | 6,000 | | | | | 1,909 | 4,347 | 2,343 | 2,199 | 5,154 | 2,714 |
| 82 | Dodge Flat | 1,400 | | | | | 1,527 | 1,460 | 1,673 | 1,627 | 3,337 | 1,961 |
| 181 | Dry Lake Valley | 5,000 | | | | | 10,307 | 3,207 | 10,627 | 10,666 | 6,316 | 11,298 |
| 19 | Dry Valley (Black Rock Desert System) | 200 | | | | | 552 | 314 | 584 | 839 | 857 | 925 |
| 198 | Dry Valley Colorado System) | | | | | | 2,065 | 1,278 | 2,192 | 1,555 | 2,603 | 1,815 |
| 16 | Duck Lake Valley | 9,000 | 8,900 | | | | 16,185 | 11,988 | 17,384 | 16,060 | 20,458 | 18,106 |
| 259 | Dugway-Government Creek Valley | 7,000 | | | | | 4,489 | 17,112 | 6,200 | 3,714 | 14,735 | 5,187 |
| 104 | Eagle Valley Carson System) | 8,700 | | | | | 219 | 18,933 | 2,112 | 266 | 19,625 | 2,228 |
| 200 | Eagle Valley (Colorado System) | | | | | | 810 | 796 | 890 | 848 | 1,508 | 999 |
| 268 | East Shore Area | | | | | | 3,530 | 98,590 | 13,389 | 4,993 | 101,225 | 15,116 |
| 109 | East Walker Area | 31,000 | | | | | 21,032 | 84,308 | 29,463 | 19,215 | 92,571 | 28,472 |
| 127 | Eastgate Valley Area | | | | | | 1,032 | 1,319 | 1,164 | 1,194 | 1,707 | 1,364 |
| 133 | Edwards Creek Valley | 8,000 | | | | | 2,722 | 3,453 | 3,067 | 2,503 | 4,239 | 2,927 |
| 167 | Eldorado Valley | 1,100 | | | | | 1 | 112 | 12 | 933 | 1,384 | 1,072 |
| 49 | Elko Segment | | | | | | 244 | 3,823 | 626 | 340 | 4,909 | 831 |
| 158A | Emigrant Valley (Groom Lake Valley) | 3,200 | | | 5,739 | 12,910 | 2,279 | 1,409 | 2,420 | 3,655 | 4,574 | 4,112 |

**Table 1.** (continued).

| | | Mean potential recharge, in acre-feet per year, by method | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Basin Characterization Model | | | | | |
| | | | | | | | Mean year | | | Time series | | |
| Hydrographic area or subarea identifier* | Hydrographic area or subarea* | Maxey—Eakin method* | Chloride mass balance method* | Estimates using discharge measurements** | Water-balance model (Hevesi et al., 2003) | Water-balance model (Hevesi et al., 2002) | Potential in-place recharge | Potential runoff | Total potential recharge for mean year | Potential in-place recharge | Potential runoff | Total potential recharge for time series |
| 158B | Emigrant Valley (Papoose Lake Valley) | 4 | | | | | 2 | 7 | 3 | 151 | 359 | 187 |
| 124 | Fairview Valley | 500 | | | | | 124 | 163 | 140 | 265 | 521 | 317 |
| 76 | Fernley Area | 600 | | | | | 888 | 647 | 953 | 1,307 | 2,001 | 1,507 |
| 77 | Fireball Valley | 200 | | | | | 1,239 | 968 | 1,336 | 1,213 | 1,563 | 1,369 |
| 117 | Fish Lake Valley | 33,000 | 26,800 | | | | 5,855 | 48,812 | 10,737 | 7,743 | 60,393 | 13,783 |
| 258 | Fish Springs Flat | 4,000 | | | | | 1,016 | 384 | 1,054 | 1,460 | 664 | 1,526 |
| 227A | Fortymile Canyon (Jackass Flat) | 900 | | | 1,583 | 1,665 | 857 | 535 | 910 | 2,524 | 2,535 | 2,778 |
| 227B | Fortymile Canyon (Buckboard Mesa) | 1,400 | | | 1,959 | 3,113 | 3,727 | 3,287 | 4,056 | 4,684 | 6,436 | 5,327 |
| 160 | Frenchman Flat | 100 | | | 1,903 | 5,683 | 537 | 396 | 576 | 4,299 | 2,207 | 4,520 |
| 122 | Gabbs Valley | 5,000 | 4,900 | | | | 1,023 | 1,238 | 1,147 | 2,195 | 2,367 | 2,431 |
| 172 | Garden Valley | 10,000 | | | 3,323 | | 16,542 | 14,325 | 17,974 | 13,866 | 16,939 | 15,559 |
| 120 | Garfield Flat | 300 | | | | | 1,371 | 1,257 | 1,497 | 1,382 | 2,265 | 1,609 |
| 216 | Garnet Valley | 400 | | | | | 288 | 60 | 294 | 989 | 109 | 1,000 |
| 147 | Gold Flat | 3,800 | | | 4,205 | 6,287 | 4,637 | 3,701 | 5,007 | 4,595 | 5,847 | 5,180 |
| 187 | Goshute Valley | 10,400 | | 40,911 | | | 25,210 | 9,048 | 26,115 | 22,410 | 9,498 | 23,360 |
| 23 | Granite Basin | 400 | | | | | 1 | 1,535 | 154 | 1 | 1,599 | 160 |
| 78 | Granite Springs Valley | 3,500 | | | | | 5,044 | 22,631 | 7,307 | 5,046 | 25,213 | 7,567 |
| 138 | Grass Valley | 13,000 | | | | | 6,891 | 11,266 | 8,018 | 5,030 | 10,926 | 6,123 |
| 71 | Grass Valley (Humboldt System) | 12,000 | | | | | 410 | 13,387 | 1,749 | 502 | 15,453 | 2,048 |
| 279 | Great Salt Lake | | | | | | 3 | 1,320 | 135 | 6 | 1,647 | 171 |
| 261B | Great Salt Lake Desert (east) | 4,500 | | | | | 54 | 0 | 54 | 106 | 0 | 106 |
| 261A | Great Salt Lake Desert (west) | 47,000 | | | | | 14,026 | 4,685 | 14,494 | 13,365 | 5,116 | 13,876 |
| 3 | Gridley Lake Valley | 4,500 | | | | | 933 | 1,666 | 1,099 | 2,588 | 5,981 | 3,186 |
| 251 | Grouse Creek Valley | 14,000 | | | | | 2,369 | 3,490 | 2,718 | 3,265 | 4,606 | 3,726 |
| 276 | Hansel and North Rozel Flat | 8,000 | | | | | 331 | 4 | 332 | 864 | 28 | 867 |
| 68 | Hardscrabble Area | 9,000 | | | | | 12,833 | 46,734 | 17,506 | 12,248 | 48,868 | 17,134 |
| 217 | Hidden Valley (north) | 400 | | | | | 188 | 6 | 188 | 566 | 57 | 571 |
| 166 | Hidden Valley (south) | | | | 23 | 28 | 0 | 0 | – | 169 | 63 | 175 |
| 25 | High Rock Lake Valley | 13,000 | | | | | 13,762 | 8,367 | 14,599 | 16,559 | 16,145 | 18,173 |
| 156 | Hot Creek Valley | 7,000 | | 5,756 | | | 4,512 | 1,805 | 4,692 | 5,380 | 4,034 | 5,783 |
| 24 | Hualapai Flat | 7,000 | | | | | 3,700 | 7,727 | 4,473 | 4,088 | 9,248 | 5,013 |
| 47 | Huntington Valley | | | | | | 34,668 | 59,713 | 40,639 | 29,248 | 52,667 | 34,514 |
| 113 | Huntoon Valley | 800 | | | | | 1,226 | 1,012 | 1,327 | 1,440 | 2,439 | 1,683 |
| 72 | Imlay Area | 4,000 | | | | | 226 | 6,056 | 831 | 462 | 10,260 | 1,488 |
| 188 | Independence Valley | 9,300 | | 50,065 | | | 22,907 | 8,347 | 23,742 | 20,525 | 8,863 | 21,411 |
| 161 | Indian Springs Valley | 10,000 | | | 4,591 | 18,978 | 6,912 | 3,904 | 7,302 | 9,966 | 7,901 | 10,756 |
| 135 | Ione Valley | 8,000 | | | | | 1,176 | 689 | 1,245 | 1,026 | 984 | 1,125 |
| 164A | Ivanpah Valley (north) | | | | 1,399 | 3,482 | 438 | 418 | 480 | 1,487 | 896 | 1,576 |
| 164B | Ivanpah Valley (south) | | | | 1,569 | 1,519 | 53 | 126 | 66 | 293 | 2,261 | 519 |
| 164 | Ivanpah Valley (North and South) | 1,500 | | | 2,968 | 5,001 | 491 | 545 | 546 | 1,779 | 3,158 | 2,095 |

**Table 1.** (continued).

| Hydrographic area or subarea identifier* | Hydrographic area or subarea* | Mean potential recharge, in acre-feet per year, by method: Maxey—Eakin method* | Chloride mass balance method* | Estimates using discharge measurements** | Water-balance model (Hevesi et al., 2003) | Water-balance model (Hevesi et al., 2002) | Basin Characterization Model — Mean year: Potential in-place recharge | Mean year: Potential runoff | Mean year: Total potential recharge for mean year | Time series: Potential in-place recharge | Time series: Potential runoff | Time series: Total potential recharge for time series |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 174 | Jakes Valley | | | 38,203 | | | 10,761 | 2,131 | 10,974 | 8,082 | 2,280 | 8,310 |
| 165 | Jean Lake Valley | 100 | | | 73 | 217 | 0 | 28 | 3 | 167 | 276 | 195 |
| 132 | Jersey Valley | 800 | | | | | 557 | 955 | 652 | 677 | 1,366 | 813 |
| 206 | Kane Springs Valley | | | | | | 4,579 | 8,416 | 5,421 | 5,262 | 10,659 | 6,328 |
| 157 | Kawich Valley | 3,500 | | | 3,688 | 6,563 | 3,788 | 3,008 | 4,089 | 3,454 | 5,143 | 3,968 |
| 66 | Kelly Creek Area | | | | | | 3,730 | 5,497 | 4,279 | 3,408 | 6,654 | 4,073 |
| 30A | Kings River Valley (Rio King Subarea) | | | | | | 8,386 | 21,333 | 10,520 | 7,698 | 24,428 | 10,141 |
| 30B | Kings River Valley (Sodhouse Subarea) | | | | | | 26 | 23 | 28 | 109 | 62 | 116 |
| 30 | Kings River Valley (Rio King and Sodhouse subareas) | 15,000 | | | | | 8,412 | 21,357 | 10,547 | 7,808 | 24,490 | 10,257 |
| 139 | Kobeh Valley | | | | | | 7,793 | 5,852 | 8,378 | 5,942 | 5,413 | 6,483 |
| 79 | Kumiva Valley | 1,000 | | | | | 36 | 11,208 | 1,157 | 31 | 10,742 | 1,105 |
| 183 | Lake Valley | 13,000 | | | | | 13,213 | 15,049 | 14,718 | 10,858 | 14,946 | 12,353 |
| 45 | Lamoille Valley | | | | | | 20 | 62,875 | 6,308 | 21 | 69,928 | 7,014 |
| 212 | Las Vegas Valley | | 28,000 | | 15,147 | | 28,072 | 21,349 | 30,207 | 33,697 | 28,483 | 36,545 |
| 285 | Leamington Canyon | | | | | | 3,786 | 31,981 | 6,984 | 4,388 | 38,152 | 8,203 |
| 92A | Lemmon Valley (west) | | | | | | 8 | 3,787 | 386 | 9 | 5,521 | 561 |
| 92B | Lemmon Valley (east) | | | | | | 7 | 1,906 | 197 | 99 | 3,519 | 451 |
| 92 | Lemmon Valley (east and west) | 1,500 | | | | | 14 | 5,693 | 584 | 108 | 9,040 | 1,012 |
| 144 | Lida Valley | | | | 610 | 11,335 | 50 | 6 | 50 | 406 | 118 | 418 |
| 150 | Little Fish Lake Valley | 11,000 | | 9,628 | | | 3,501 | 2,996 | 3,801 | 3,010 | 3,131 | 3,324 |
| 67 | Little Humboldt Valley | 24,000 | | | | | 26,022 | 58,057 | 31,828 | 25,338 | 64,651 | 31,803 |
| 155A | Little Smoky Valley (north) | | | | | | 7,881 | 1,466 | 8,028 | 6,122 | 1,561 | 6,278 |
| 155B | Little Smoky Valley (central) | | | | | | 391 | 93 | 400 | 317 | 167 | 334 |
| 155C | Little Smoky Valley (south) | | | | | | 1,889 | 567 | 1,946 | 1,542 | 963 | 1,638 |
| 155 | Little Smoky Valley (north, central and south) | 5,400 | | 12,681 | | | 10,161 | 2,126 | 10,374 | 7,981 | 2,692 | 8,250 |
| 9 | Long Valley | 6,000 | | | | | 5,908 | 5,164 | 6,424 | 5,913 | 7,486 | 6,662 |
| 175 | Long Valley (Colorado System) | 10,000 | | 47,740 | | | 15,875 | 4,139 | 16,289 | 13,186 | 3,495 | 13,536 |
| 73A | Lovelock Valley (Oreana Subarea) | | | | | | 39 | 1,672 | 206 | 95 | 2,542 | 349 |
| 73B | Lovelock Valley (Upper and Lower Valley subareas) | | | | | | 1,732 | 2,826 | 2,015 | 2,290 | 5,810 | 2,871 |
| 73 | Lovelock Valley (Orena, and Upper and Lower Valley subareas) | 3,200 | | | | | 1,771 | 4,498 | 2,220 | 2,385 | 8,352 | 3,220 |
| 242 | Lower Amargosa Valley | | | | 767 | 1,475 | 17 | 26 | 20 | 590 | 1,420 | 732 |
| 205 | Lower Meadow Valley Wash | | | | | | 10,883 | 8,004 | 11,683 | 18,126 | 19,659 | 20,092 |
| 220 | Lower Moapa Valley | 40 | | | | | 0 | 0 | - | 128 | 193 | 147 |
| 59 | Lower Reese River Valley | | | | | | 354 | 5,804 | 935 | 445 | 5,995 | 1,044 |

**Table 1.** (continued).

| Hydrographic area or subarea identifier* | Hydrographic area or subarea* | Mean potential recharge, in acre-feet per year, by method | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Basin Characterization Model — Mean year | | | Basin Characterization Model — Time series | | |
| | | Maxey—Eakin method* | Chloride mass balance method* | Estimates using discharge measurements** | Water-balance model (Hevesi et al., 2003) | Water-balance model (Hevesi et al., 2002) | Potential in-place recharge | Potential runoff | Total potential recharge for mean year | Potential in-place recharge | Potential runoff | Total potential recharge for time series |
| 51 | Maggie Creek Area | | | | | | 695 | 8,759 | 1,571 | 1,748 | 10,529 | 2,801 |
| 273 | Malad-Lower Bear River Area | | | | | | 81,639 | 43,703 | 86,010 | 84,159 | 44,066 | 88,566 |
| 52 | Marys Creek Area | | | | | | 35 | 17 | 37 | 154 | 228 | 176 |
| 42 | Marys River Area | | | | | | 19,014 | 36,806 | 22,694 | 18,977 | 43,651 | 23,342 |
| 108 | Mason Valley | 2,000 | | | | | 1,438 | 19,162 | 3,354 | 1,635 | 19,694 | 3,604 |
| 8 | Massacre Lake Valley | | | | | | 1,086 | 247 | 1,110 | 2,613 | 1,829 | 2,796 |
| 225 | Mercury Valley | 250 | | | 359 | 2,256 | 75 | 243 | 99 | 751 | 1,165 | 867 |
| 163 | Mesquite Valley | 1,500 | 1,600 | | 3,470 | 6,696 | 1,370 | 582 | 1,428 | 4,328 | 2,492 | 4,577 |
| 58 | Middle Reese River Valley | 7,000 | | | | | 1,065 | 1,119 | 1,177 | 1,045 | 1,274 | 1,173 |
| 284 | Milford Area | | | | | | 1,509 | 6,091 | 2,118 | 1,734 | 6,919 | 2,426 |
| 140A | Monitor Valley (north) | | | | | | 8,536 | 15,375 | 10,074 | 6,981 | 12,882 | 8,269 |
| 140B | Monitor Valley (south) | | | | | | 13,827 | 22,150 | 16,042 | 10,260 | 17,665 | 12,026 |
| 136 | Monte Cristo Valley | 500 | | | | | 190 | 1,179 | 308 | 399 | 1,756 | 575 |
| 12 | Mosquito Valley | 700 | | | | | 6 | 1 | 6 | 185 | 106 | 196 |
| 26 | Mud Meadows | 8,000 | | | | | 3,439 | 3,346 | 3,774 | 4,590 | 4,711 | 5,061 |
| 219 | Muddy River Springs Area | | | | | | 12 | 0 | 12 | 207 | 1 | 207 |
| 154 | Newark Valley | 17,500 | | 49,092 | | | 16,721 | 17,077 | 18,428 | 13,852 | 15,380 | 15,390 |
| 44 | North Fork Area | | | | | | 7,189 | 34,246 | 10,614 | 17,330 | 49,380 | 22,268 |
| 137B | Northern Big Smoky Valley | 65,000 | | | | | 25,680 | 70,153 | 32,695 | 20,720 | 62,976 | 27,018 |
| 266 | Northern Juab Valley | | | | | | 12,996 | 24,774 | 15,474 | 12,878 | 27,698 | 15,648 |
| 228 | Oasis Valley | 1,000 | | | 2,209 | 4,698 | 2,445 | 744 | 2,519 | 5,512 | 3,919 | 5,903 |
| 209 | Pahranagat Valley | 1,800 | | | 4,046 | | 6,620 | 4,234 | 7,043 | 6,665 | 5,211 | 7,186 |
| 208 | Pahroc Valley | 2,200 | | | | | 4,275 | 1,564 | 4,432 | 4,531 | 3,015 | 4,832 |
| 162 | Pahrump Valley | | | | 11,759 | 28,437 | 20,976 | 17,319 | 22,708 | 23,716 | 25,591 | 26,275 |
| 203 | Panaca Valley | | | | | | 4,535 | 2,059 | 4,741 | 4,506 | 4,779 | 4,984 |
| 69 | Paradise Valley | 10,000 | | | | | 2,902 | 63,905 | 9,293 | 2,971 | 70,503 | 10,022 |
| 260B | Park Valley (east) | | | | | | 256 | 10,171 | 1,273 | 317 | 10,772 | 1,394 |
| 260A | Park Valley (west) | | | | | | 319 | 1,736 | 493 | 585 | 1,923 | 777 |
| 260 | Park Valley (east and west) | 24,000 | | | | | 575 | 11,907 | 1,765 | 902 | 12,696 | 2,171 |
| 281 | Parowan Valley | | | | | | 6,718 | 24,701 | 9,188 | 5,368 | 24,572 | 7,825 |
| 202 | Patterson Valley | 8,000 | | | | | 6,201 | 4,427 | 6,643 | 6,046 | 7,132 | 6,759 |
| 286 | Pavant Valley | | | | | | 20,068 | 56,338 | 25,701 | 19,957 | 64,934 | 26,450 |
| 170 | Penoyer Valley | 4,300 | 3,200 | | 5,160 | | 3,797 | 2,551 | 4,052 | 3,828 | 4,460 | 4,275 |
| 191 | Pilot Creek Valley | 2,400 | | | | | 2,239 | 2,778 | 2,517 | 2,871 | 3,187 | 3,189 |
| 252 | Pilot Valley | 3,400 | | | | | 613 | 2,543 | 867 | 837 | 2,551 | 1,092 |
| 29 | Pine Forest Valley | 10,000 | | | | | 5,493 | 15,310 | 7,024 | 5,452 | 23,193 | 7,771 |
| 255 | Pine Valley (Great Salt Lake Desert System) | 21,000 | | | | | 14,027 | 18,308 | 15,858 | 11,982 | 16,365 | 13,619 |
| 53 | Pine Valley (Humboldt System) | 46,000 | | | | | 16,331 | 27,297 | 19,060 | 13,026 | 23,031 | 15,330 |
| 130 | Pleasant Valley (Dixie Valley System)6 | 3,000 | | | | | 601 | 3,188 | 920 | 801 | 4,544 | 1,25 |

**Table 1.** (continued).

| | | Mean potential recharge, in acre-feet per year, by method | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Basin Characterization Model | | | | | |
| | | | | | | | Mean year | | | Time series | | |
| Hydrographic area or subarea identifier* | Hydrographic area or subarea* | Maxey—Eakin method* | Chloride mass balance method* | Estimates using discharge measurements** | Water-balance model (Hevesi et al., 2003) | Water-balance model (Hevesi et al., 2002) | Potential in-place recharge | Potential runoff | Total potential recharge for mean year | Potential in-place recharge | Potential runoff | Total potential recharge for time series |
| 88 | Pleasant Valley | 10,000 | | | | | 746 | 27,585 | 3,505 | 663 | 28,877 | 3,550 |
| | (Truckee System) | | | | | | 7,766 | 102 | 7,777 | 8,008 | 121 | 8,020 |
| 274 | Pocatello Valley | | | | | | | | | | | |
| 277 | Promontory Mountains Area | | | | | | 1,888 | 490 | 1,937 | 3,373 | 954 | 3,468 |
| 65 | Pumpernickel Valley | | | | | | 101 | 2,591 | 360 | 321 | 3,754 | 697 |
| 81 | Pyramid Lake Valley | 6,600 | | | | | 9,830 | 9,656 | 10,796 | 11,443 | 16,877 | 13,130 |
| 33A | Quinn River Valley (Orovada Subarea) | | | | | | 8,128 | 68,406 | 14,969 | 7,865 | 73,280 | 15,193 |
| 33B,C | Quinn River Valley (McDermitt and Oregon Canyon) | | | | | | 40,294 | 103,185 | 50,612 | 35,080 | 103,920 | 45,472 |
| 33 | Quinn River Valley (Orovada, McDermitt, and Oregon Canyon subareas) | 73,000 | | | | | 48,422 | 171,590 | 65,581 | 42,945 | 177,200 | 60,665 |
| 173A | Railroad Valley (south) | | 4,900 | | 4,135 | | 1,853 | 892 | 1,942 | 2,682 | 2,539 | 2,936 |
| 173B | Railroad Valley (north) | | 24,800 | 61,083 | | | 57,421 | 39,280 | 61,349 | 46,876 | 38,659 | 50,742 |
| 173 | Railroad Valley (north and south) | 52,000 | | | | | 59,274 | 40,172 | 63,291 | 49,558 | 41,199 | 53,678 |
| 141 | Ralston Valley | 5,000 | | | | | 3,708 | 3,683 | 4,076 | 4,028 | 5,410 | 4,568 |
| 123 | Rawhide Flats | 150 | | | | | 144 | 42 | 149 | 394 | 179 | 412 |
| 119 | Rhodes Salt Marsh Valley4 | 500 | | | | | 318 | 882 | 406 | 756 | 1,880 | 94 |
| 62 | Rock Creek Valley | | | | | | 442 | 849 | 527 | 921 | 1,581 | 1,079 |
| 226 | Rock Valley | 30 | | | 352 | 532 | 0 | 0 | – | 324 | 110 | 335 |
| 199 | Rose Valley | | | | | | 48 | 4 | 48 | 38 | 52 | 43 |
| 176 | Ruby Valley | 68,000 | | 145,636 | | | 35,382 | 88,306 | 44,212 | 29,133 | 82,288 | 37,362 |
| 263 | Rush Valley | 34,000 | | | | | 33,806 | 42,371 | 38,043 | 31,493 | 40,184 | 35,511 |
| 267 | Salt Lake Valley | | | | | | 28,193 | 182,454 | 46,439 | 29,827 | 184,549 | 48,282 |
| 22 | San Emidio Desert | 2,100 | | | | | 3,862 | 9,961 | 4,858 | 3,747 | 11,559 | 4,903 |
| 20 | Sano Valley | 4 | | | | | 37 | 2 | 37 | 87 | 54 | 93 |
| 146 | Sarcobatus Flat | 1,200 | | | 2,466 | 7,315 | 1,230 | 707 | 1,301 | 2,532 | 2,398 | 2,772 |
| 287 | Sevier Desert | | | | | | 17,238 | 30,771 | 20,316 | 17,924 | 33,064 | 21,230 |
| 245 | Shadow Valley | | | | 1,731 | 3,634 | 89 | 145 | 104 | 528 | 1,506 | 679 |
| 32 | Silver State Valley | 1,400 | | | | | 52 | 634 | 115 | 183 | 2,344 | 418 |
| 271 | Sink Valley | 1,000 | | | | | 99 | 0 | 99 | 154 | 5 | 154 |
| 270 | Skull Valley | | | | | | 16,969 | 44,502 | 21,419 | 14,624 | 39,740 | 18,598 |
| 134 | Smith Creek Valley | 12,000 | | | | | 3,279 | 2,935 | 3,572 | 3,738 | 4,550 | 4,193 |
| 107 | Smith Valley | 17,000 | | | | | 11,313 | 87,974 | 20,111 | 10,359 | 94,692 | 19,828 |
| 21 | Smoke Creek Desert | 13,000 | | | | | 14,993 | 14,351 | 16,428 | 18,729 | 25,829 | 21,311 |
| 254 | Snake Valley | 100,000 | | | | | 80,079 | 126,490 | 92,728 | 69,738 | 122,176 | 81,955 |
| 121A,C | Soda Spring Valley (east and central) | | | | | | 242 | 1,483 | 390 | 598 | 4,188 | 1,017 |
| 121B | Soda Spring Valley (west) | | | | | | 257 | 871 | 344 | 367 | 1,108 | 478 |
| 121 | Soda Spring Valley (east, central, and west) | 700 | | | | | 499 | 2,354 | 735 | 965 | 5,297 | 1,494 |

**Table 1.** (continued).

| | | Mean potential recharge, in acre-feet per year, by method | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Basin Characterization Model | | | | | |
| | | | | | | | Mean year | | | Time series | | |
| Hydrographic area or subarea identifier* | Hydrographic area or subarea* | Maxey—Eakin method* | Chloride mass balance method* | Estimates using discharge measurements** | Water-balance model (Hevesi et al., 2003) | Water-balance model (Hevesi et al., 2002) | Potential in-place recharge | Potential runoff | Total potential recharge for mean year | Potential in-place recharge | Potential runoff | Total potential recharge for time series |
| 46 | South Fork Area | | | | | | 8 | 59,056 | 5,914 | 8 | 55,920 | 5,600 |
| 85 | Spanish Springs Valley | 600 | | | | | 695 | 474 | 743 | 991 | 1,685 | 1,159 |
| 201 | Spring Valley (Colorado System) | 10,000 | | | | | 9,549 | 13,249 | 10,874 | 7,486 | 14,436 | 8,930 |
| 184 | Spring Valley (Great Salt Lake Desert System) | 75,000 | 61,600 | 103,569 | | | 57,629 | 93,577 | 66,987 | 48,116 | 80,635 | 56,179 |
| 43 | Starr Valley Area | | | | | | 2,905 | 84,762 | 11,381 | 2,986 | 82,405 | 11,226 |
| 179 | Steptoe Valley | 85,000 | | 131,469 | | | 104,285 | 71,344 | 111,419 | 88,282 | 61,094 | 94,391 |
| 152 | Stevens Basin | | | | | | 1,390 | 10 | 1,391 | 1,055 | 113 | 1,067 |
| 125 | Stingaree Valley | | | | | | 9 | 13 | 10 | 90 | 73 | 97 |
| 149 | Stone Cabin Valley | 5,000 | | | | | 2,843 | 1,628 | 3,006 | 3,673 | 3,139 | 3,987 |
| 145 | Stonewall Flat | 100 | | | 1,241 | 3,393 | 65 | 6 | 65 | 540 | 110 | 551 |
| 27 | Summit Lake Valley | 4,200 | | | | | 1,000 | 1,072 | 1,107 | 1,248 | 2,204 | 1,469 |
| 86 | Sun Valley | 50 | | | | | 5,657 | 36,757 | 9,333 | 6,260 | 40,549 | 10,315 |
| 50 | Susie Creek Area | | | | | | 178 | 1,684 | 346 | 525 | 2,907 | 816 |
| 7 | Swan Lake Valley | | | | | | 514 | 248 | 539 | 2,697 | 1,688 | 2,866 |
| 114 | Teels Marsh Valley | 1,300 | | | | | 1,284 | 1,887 | 1,473 | 2,035 | 3,527 | 2,387 |
| 48 | Tenmile Creek Area | | | | | | 3,608 | 17,122 | 5,320 | 2,954 | 16,702 | 4,624 |
| 189A | Thousand Springs Valley (Herrell Siding-Brush Creek subarea) | | | | | | 1,192 | 5,092 | 1,701 | 1,197 | 5,707 | 1,768 |
| 189B | Thousand Springs Valley (Toano-Rock Spring subarea) | | | | | | 2,206 | 4,322 | 2,638 | 3,505 | 5,960 | 4,101 |
| 189C | Thousand Springs Valley (Rocky Butte subarea) | | | | | | 1,728 | 0 | 1,728 | 3,160 | 74 | 3,167 |
| 189D | Thousand Springs Valley (Montello-Crittenden Creek subarea) | | | | | | 7,573 | 358 | 7,609 | 10,436 | 1,462 | 10,582 |
| 189 | Thousand Springs Valley (Herrell Siding-Brush Creeak, Toano-Rock Spring Rocky Butte and Montello-Crittenden Creek subareas) | 12,000 | | | | | 12,699 | 9,772 | 13,676 | 18,299 | 13,202 | 19,619 |
| 168 | Three Lakes Valley (north) | 2,000 | | | 1,490 | 9,031 | 1,317 | 472 | 1,364 | 2,182 | 903 | 2,272 |
| 211 | Three Lakes Valley (south) | 6,000 | | | 1,298 | 7,335 | 2,725 | 1,773 | 2,903 | 3,631 | 1,981 | 3,830 |
| 169A | Tikapoo Valley (north) | | | | 3,971 | 13,767 | 3,028 | 947 | 3,123 | 3,756 | 2,050 | 3,961 |
| 169B | Tikapoo Valley (south) | | | | 2,295 | 10,819 | 1,230 | 263 | 1,256 | 2,419 | 581 | 2,477 |
| 169 | Tikapoo Valley (north and south) | 6,000 | | | 6,266 | 24,586 | | | – | | | – |
| 185 | Tippett Valley | 6,900 | | 12,389 | | | 9,364 | 3,534 | 9,717 | 7,367 | 2,918 | 7,659 |
| 137A | Tonopah Flat | 12,000 | | | | | 2,544 | 2,628 | 2,807 | 3,686 | 3,742 | 4,060 |
| 262 | Tooele Valley | | | | | | 23,941 | 24,445 | 26,386 | 23,885 | 23,766 | 26,262 |
| 83 | Tracy Segment | 6,000 | | | | | 9,768 | 6,750 | 10,443 | 10,613 | 14,424 | 12,056 |
| 87 | Truckee Meadows | 27,000 | | | | | 1,983 | 15,837 | 3,566 | 2,013 | 17,699 | 3,783 |

**Table 1.** (continued).

| | | Mean potential recharge, in acre-feet per year, by method | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Basin Characterization Model | | | | | |
| | | | | | | | Mean year | | | Time series | | |
| Hydrographic area or subarea identifier* | Hydrographic area or subarea* | Maxey—Eakin method* | Chloride mass balance method* | Estimates using discharge measurements** | Water-balance model (Hevesi et al., 2003) | Water-balance model (Hevesi et al., 2002) | Potential in-place recharge | Potential runoff | Total potential recharge for mean year | Potential in-place recharge | Potential runoff | Total potential recharge for time series |
| 221 | Tule Desert | 2,100 | | | | | 1,319 | 1,512 | 1,470 | 4,126 | 3,456 | 4,472 |
| 257 | Tule Valley | 7,600 | | | | | 6,206 | 2,992 | 6,505 | 5,559 | 2,736 | 5,833 |
| 56 | Upper Reese River Valley | 37,000 | 30,000 | | | | 13,529 | 30,683 | 16,598 | 12,137 | 29,699 | 15,107 |
| 265A | Utah Valley Area (Goshen Valley) | | | | | | 1,561 | 2,526 | 1,814 | 2,056 | 3,630 | 2,419 |
| 265C | Utah Valley Area (north) | | | | | | 42,897 | 76,850 | 50,582 | 45,816 | 78,973 | 53,714 |
| 265B | Utah Valley Area (south) | | | | | | 62,634 | 85,648 | 71,199 | 63,401 | 94,892 | 72,890 |
| 244 | Valjean Valley | | | | 671 | 820 | 2 | 533 | 56 | 77 | 1,921 | 269 |
| 222 | Virgin River Valley | | | | | | 16,014 | 23,837 | 18,398 | 29,392 | 30,078 | 32,400 |
| 4 | Virgin Valley | 7,000 | | | | | 615 | 615 | 676 | 2,377 | 1,561 | 2,533 |
| 256 | Wah Wah Valley | 7,000 | | | | | 5,869 | 1,886 | 6,057 | 5,186 | 2,319 | 5,418 |
| 110A | Walker Lake Valley (Schurz Subarea) | | | | | | 351 | 13,684 | 1,720 | 897 | 10,780 | 1,975 |
| 110B | Walker Lake Valley (Lake Subarea) | | | | | | 487 | 35,034 | 3,991 | 560 | 32,806 | 3,841 |
| 110C | Walker Lake Valley (Whiskey Flat-Hawthorne Subarea) | | | | | | 4,599 | 54,355 | 10,035 | 4,096 | 53,332 | 9,429 |
| 110 | Walker Lake Valley | 6,500 | | | | | 5,438 | 103,074 | 15,745 | 5,553 | 96,918 | 15,245 |
| 84 | Warm Springs Area | 6,000 | | | | | 3,446 | 7,044 | 4,150 | 3,738 | 12,722 | 5,010 |
| 269 | West Shore Area | 600 | | | | | 53 | 1 | 53 | 188 | 6 | 189 |
| 60 | Whirlwind Valley | | | | | | 119 | 55 | 125 | 169 | 104 | 179 |
| 74 | White Plains | 3 | | | | | 13 | 0 | 13 | 212 | 80 | 220 |
| 207 | White River Valley | | | | | | 33,443 | 14,818 | 34,925 | 29,192 | 15,673 | 30,759 |
| 63 | Willow Creek Valley | | | | | | 2,629 | 5,052 | 3,134 | 4,189 | 6,954 | 4,885 |
| 80 | Winnemucca Lake Valley | 2,900 | | | | | 4,099 | 9,894 | 5,088 | 4,292 | 11,791 | 5,471 |
| 70 | Winnemucca Segment | | | | | | 622 | 7,321 | 1,354 | 990 | 8,478 | 1,838 |
| 159 | Yucca Flat | 700 | | | 1,557 | 2,815 | 874 | 1,732 | 1,047 | 1,677 | 3,002 | 1,977 |
| | | | Total potential Great Basin recharge | | | | 2,406,022 | 4,828,227 | 2,888,844 | 2,428,874 | 5,239,825 | 2,952,856 |

*Harrill and Prudic (1998)
** Nichols (2000)

the basin boundaries primarily occur along the drainage divides, and the divides tend to have higher elevations (thus higher precipitation and lower air temperature) and thinner soils relative to the soils in the central part of each basin.

### *3.1 Evaluation of Recharge Processes*

Results of the mean monthly calculations indicate that there is 2.41 million acre-feet/year of potential in-place recharge in the Great Basin and 4.83 million acre-feet/year of potential runoff, or a total potential recharge of 7.24 million acre-feet/year. Results of the 34-year time series calculations indicate that there is slightly more recharge when water can be carried over between months: 2.43 million acre-feet/year of potential in-place recharge, and 5.24 million acre-feet/year of potential runoff, or a total potential recharge of 7.67 million acre-feet/year. Although the amount of recharge that occurs as a result of runoff is not known, based on analyses performed by *David Prudic* [*U.S. Geological Survey, personal communication,* 2001] and *Hevesi et al.* [2003], it was assumed that about 10 percent of