A Report to Congress

# Water Resources of the Basin and Range Carbonate-Rock Aquifer System, White Pine County, Nevada, and Adjacent Areas in Nevada and Utah—Draft Report

U.S. Department of the Interior
U.S. Geological Survey

In contrast to Steptoe Valley, pre-development discharge annually exceeds the relatively low annual recharge in White River Valley by more than 40,000 acre-ft, indicating that water lost from evapotranspiration on the valley floor must be supported, in part, by subsurface inflow from adjacent valleys. The deficit of ground water in Whiter River Valley is balanced by inter-basin flow from Steptoe Valley to the northeast, Jakes Valley to the north, and Cave Valley to the east. Estimates of the magnitude of inter-basin flow differ from previous estimates for some hydrographic area boundaries. The largest differences are for estimated outflow from southern Steptoe Valley, where previous investigations proposed zero outflow, and for southern Spring Valley. The estimated 29,000 acre-ft/ yr of ground-water flow from southern Spring Valley to Snake Valley is about twice the highest previous estimate.
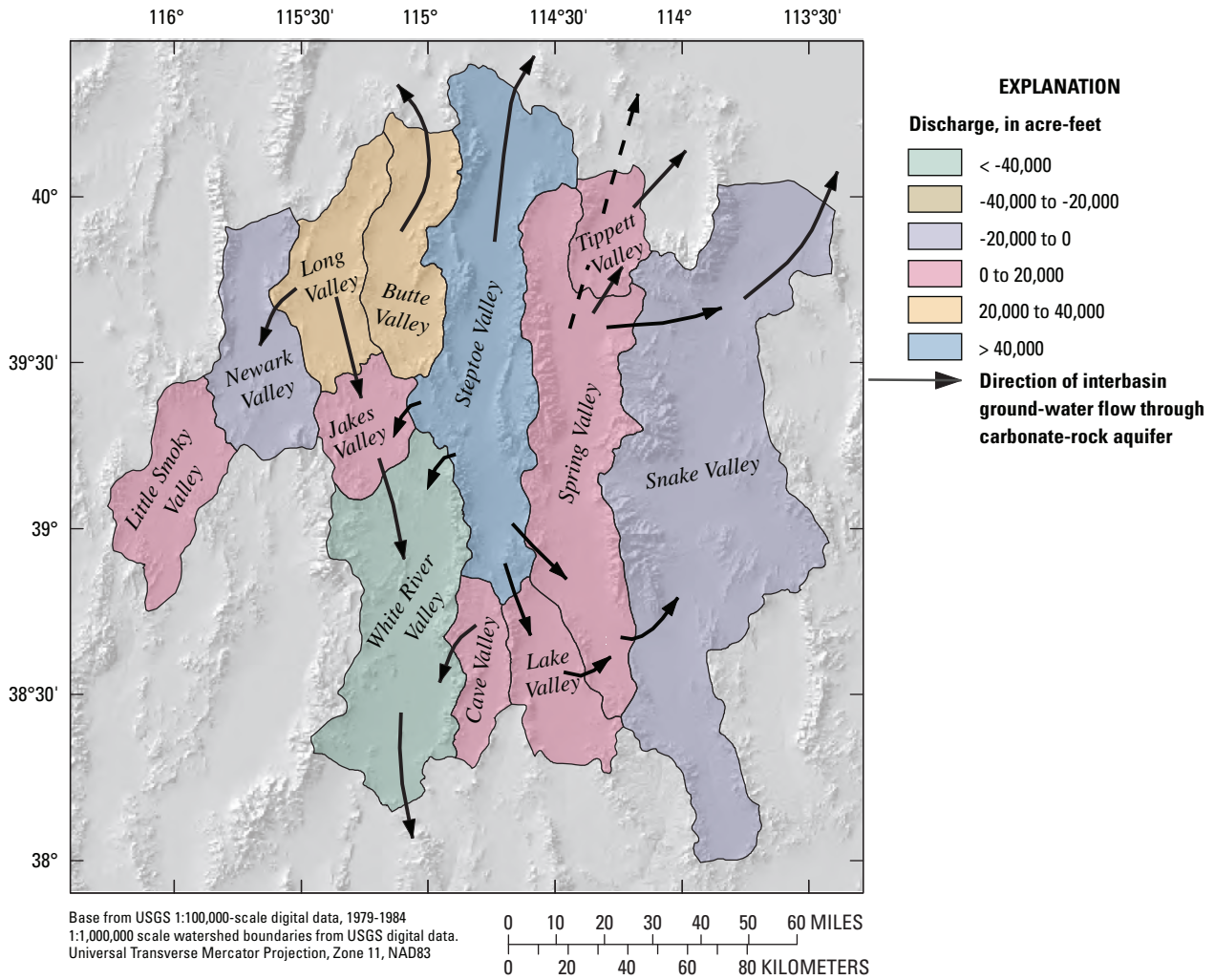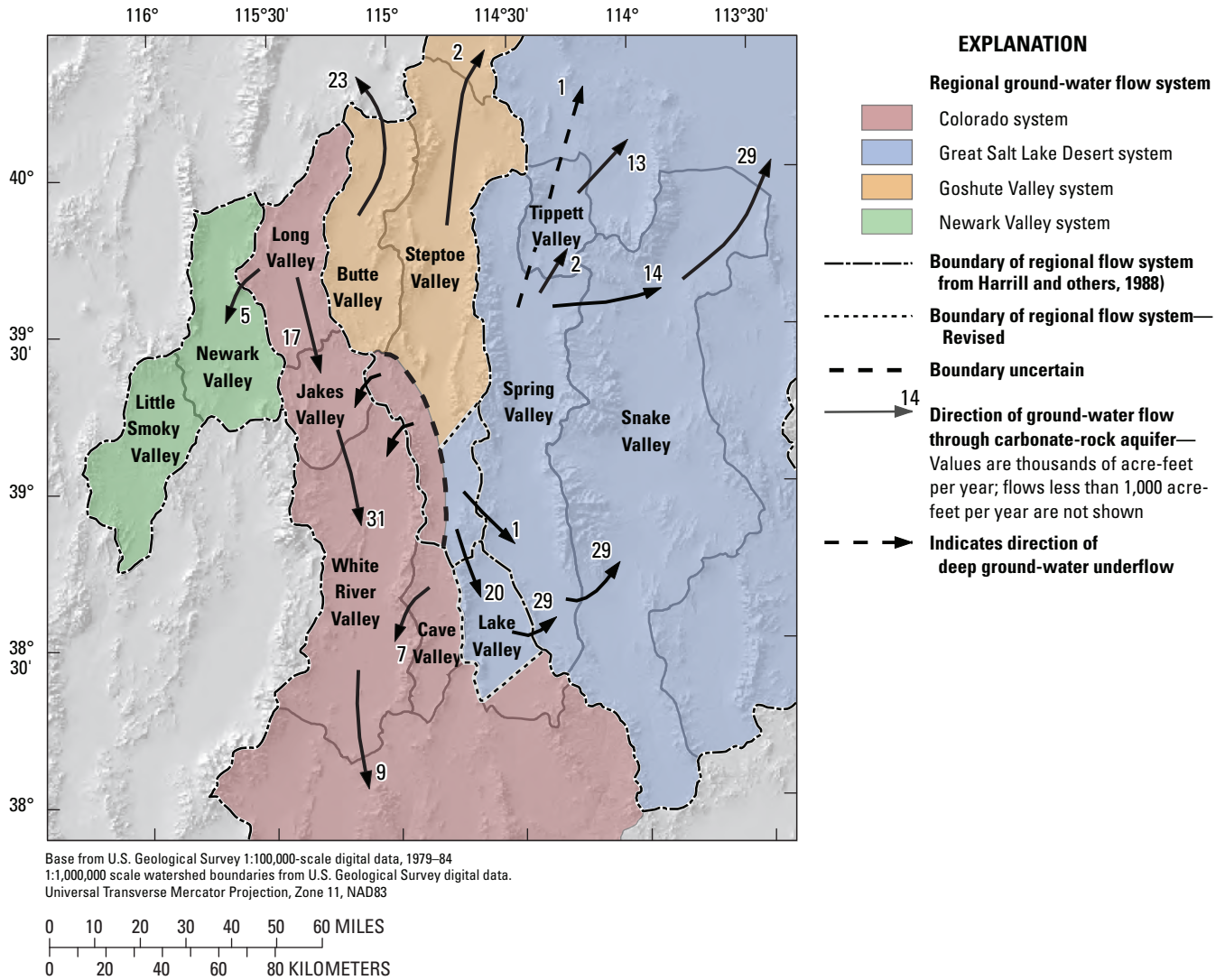

Average annual recharge minus average annual ground-water discharge, and areas of inter-basin ground-water flow.

Regional Recharge and Discharge

For the entire study area, average annual recharge equals 530,000 acre-ft, and average annual ground-water discharge equals 440,000 acre-ft under pre-development conditions. The difference between recharge and discharge indicates that about 90,000 acre-ft of ground water exits the study area annually by subsurface outflow. Most ground-water flow likely exits the study area through Snake (29,000 acre-ft/yr), Butte (23,000 acre-ft/yr), Tippett (13,000 acre-ft/yr), and White River Valleys (9,000 acre-ft/yr).

EXPLANATION

Regional ground-water flow system

Colorado system

Great Salt Lake Desert system

Goshute Valley system

Newark Valley system

—·—·—·— **Boundary of regional flow system from Harrill and others, 1988)**

·········· **Boundary of regional flow system— Revised**

— — — **Boundary uncertain**

——→ **Direction of ground-water flow through carbonate-rock aquifer—** Values are thousands of acre-feet per year; flows less than 1,000 acre-feet per year are not shown

— — → **Indicates direction of deep ground-water underflow**

Base from U.S. Geological Survey 1:100,000-scale digital data, 1979–84
1:1,000,000 scale watershed boundaries from U.S. Geological Survey digital data.
Universal Transverse Mercator Projection, Zone 11, NAD83

0 10 20 30 40 50 60 MILES
0 20 40 60 80 KILOMETERS

Regional ground-water flow through the Colorado, Great Salt Lake Desert, and other regional flow systems.

Appendix A.   Component Estimates of Recharge, Discharge, Water Use, and Aquifer Storage.

The spreadsheet distributed as part of this report is in Microsoft® Excel 2003 format. Appendix A data are available for download at URL: http://pubs.water.usgs.gov/ofr20071156.

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Glossary

Accommodation zone: A zone of geologic structures that typically cross-cuts a region and separates two areas of different type or amount of disruption or deformation.

Alluvial: Relating to, consisting of, or formed by sediment deposited by flowing water.

Anastomosing: Pertaining to a network of branching and rejoining fault or vein surfaces or surface traces.

Anastomosis: A form of network in which streams both branch out and reconnect.

Andesite: An igneous, volcanic rock. The mineral assembly typically is dominated by plagioclase plus pyroxene and/or hornblende.

Aquifer: Rock or sediment that is saturated and can transmit sufficient water to supply wells.

Argillaceous: Pertaining to, largely composed of, or containing clay-size particles or clay minerals

Ash-flow tuff: a volcanic rock consisting of ash and other volcanic detritus deposited from an explosive volcanic eruption. It is consolidated and sometimes densely compacted and fused.

Basement: In geology, an underlying complex that behaves as a unit mass and does not deform by folding. In geophysical studies, the term can refer to consolidated, older rocks that lie beneath young basin fill.

Breccia: Clastic rock made up of angular fragments of such size that an appreciable percentage of rock volume consists of particles of granule size or larger.

Caldera: Roughly circular, steep-sided volcanic basin with diameter at least three times depth. Results from very large magnitude, explosive volcanic eruptions.

Colluvium: Rock detritus and soil accumulated at the foot of a slope.

Confining Unit: The geologic layer of low permeability that is adjacent to an aquifer and retards flow into and out of the aquifer.

Detachment: Detachment structure of strata owing to deformation, resulting in independent styles of deformation in the rocks above and below. It is associated with faulting and structural removal of rock strata.

Deuterium: An isotope of hydrogen that has one proton and one neutron in its nucleus and that has twice the mass of ordinary hydrogen.

Domain: An areal subdivision based on shared geologic traits, such as type or intensity of faulting.

en echelon: Said of geologic features that are in an overlapping or staggered arrangement, e.g., faults. Each is relatively short, but collectively they form a linear zone, in which the strike of the individual features is oblique to that of the zone as a whole.

Exotic: Applied to a boulder, block, or larger rock body unrelated to the rocks with which it is now associated, which has been moved from its place of origin by one of several processes. In plate tectonics, refers to land masses that were not originally part of the North American continent.

Facies: Assemblage of mineral, rock, or fossil features reflecting environment in which rock was formed. See sedimentary facies, metamorphic facies.

Foliation: Layering in some rocks caused by parallel alignment of minerals; textural feature of some metamorphic rocks. Produces rock cleavage.

Geosyncline: Refers to a basin in which thousands of feet of sediments have accumulated, with accompanying progressive sinking of basin floor. Common usage includes both accumulated sediments themselves and geometrical form of basin in which they are deposited.

Graben: Elongated, trench like, structural form bounded by parallel normal faults created when block that forms trench floor moves downward relative to blocks that form sides.

Great Basin: A unique internally drained physiographic feature of the western United States.

Highly attenuated domain: A region in which the stratigraphic section has been thinned as a result of tectonic processes, typically during extension, or stretching, of the earth's crust.

Hinterland: A subjective term referring to the relatively undisturbed terrain on the back of a folded mountain range.

Hydraulic head: Height above a datum plane (such as mean sea level) of the column of water that can be supported by the hydraulic pressure at a given point in a groundwater system.

Hydraulic conductivity: A coefficient of proportionality describing the rate at which water can move through a permeable medium such as an aquifer. Hydraulic conductivity is a function of both the intrinsic permeability of the porous medium and the kinematic viscosity of the water which flows through it.

Hydrogeologic unit: Any rock unit or zone which by virtue of its hydraulic properties has a distinct influence on the storage or movement of ground water.

Imbricate Structure: A tectonic structure displayed by a series of nearly parallel and overlapping minor thrust faults, high-angle reverse faults, or slides, and characterized by rock slices, sheets, plates, blocks, or wedges that are approx. equidistant and have the same displacement and that are all steeply inclined in the same direction.

Indurated: Said of a rock or soil hardened or consolidated by pressure, cementation, or heat.

Infiltration: Movement of water through the soil surface into the ground.

Karst: A type of topography that is formed on limestone and other rocks by dissolution and that is characterized by sinkholes, caves, and underground drainage.

Lacustrine: Related to lakes. For instance, lacustrine sediments refers to deposits formed beneath a lake.

Linear regression: A mathematical analysis that allows the examination of the relationship between a variable of interest and one or more explanatory variables. Of interest is the quantification of this relation into a model form to estimate or predict values for a variable based on knowledge of other variables, for which more data are available.

Listric fault: A curved downward-flattening fault, generally concave upward. Listric faults may be characterized by normal or reverse separation.

Lithosphere: Rigid outer layer of earth; includes crust and upper part of mantle.

Lysimeter: A device for measuring the infiltration of water through soils and for determining the soluble constituents removed in the drainage.

Magmatism: Of, pertaining to, or derived from magma. See also: igneous.

Metamorphic core complexes: a domelike exposure of metamorphic rocks exposed beneath a detachment fault; typically the result of large-magnitude extension, or stretching, of the earth's crust.

Metamorphosis: A process whereby rocks undergo physical or chemical changes or both to achieve equilibrium with conditions other than those under which they were originally formed. Agents of metamorphism are heat, pressure, and chemically active fluids.

Metasediment: A sediment or sedimentary rock that shows evidence of having been subjected to metamorphism.

Miogeosyncline: That part of a geosyncline in which volcanism is absent, generally located near craton.

Orogeny: Process by which mountain structures develop.

Orographic: Associated with or induced by the presence of mountains, such as orographic rainfall.

Permeability: For earth material, ability to transmit fluids.

Physiographic province: A region of which all parts are similar in geologic structure and which has consequently had a unified geomorphic history; a region whose pattern of relief features or landforms differs significantly from that of adjacent regions

Phreatophyte: A plant that obtains its water from the water table or the layer of soil just above it.

Physiography: Same as physical geography.

Playa: The lower part of an inland desert drainage basin that is periodically flooded.

Pluton: A body of igneous rock formed beneath earth surface by consolidation from magma. Sometimes extended to include bodies formed beneath surface by metasomatic replacement of older rock. A body of medium- to coarse-grained igneous rock that formed beneath the surface by crystallization of magma.

Potentiometric surface: Where based on water-level data for wells tapping the same elevation the surface is essentially a map of hydraulic head.

Quartzite: Metamorphic rock commonly formed by metamorphism of sandstone and composed of quartz.

Rhyolite: A volcanic rock rich in quartz and potassium feldspars that is the lava form of granite.

Schist: Metamorphic rock dominated by fibrous or platy minerals. Has schistose cleavage and is product of regional metamorphism.

Schistose: Said of a rock displaying schistosity.

Schistosity: The foliation in schist or other coarse-grained, crystalline rock due to the parallel, planar arrangement of mineral grains of the platy, prismatic, or ellipsoidal types, usually mica. It is considered by some to be a type of cleavage.

Silicic: In petrology, containing silica in dominant amount. Granite and rhyolite are typical silicic rocks. The synonymous terms "acid" and "acidic" are used almost as frequently as silicic.

Siliciclastic: A silica-rich sedimentary deposit.

Specific yield: The ratio of the volume of water that a given mass of saturated rock or soil will yield by gravity to the volume of that mass. This ratio is stated as a percentage.

Storage coefficient (also known as storativity): Specific storage, storativity, specific yield, and specific capacity are aquifer properties; they are measures of the ability of an aquifer to release groundwater from storage, due to a unit decline in hydraulic head. These properties are often determined in hydrogeology using an aquifer test.

Stratabound: Said of a mineral deposit confined to a single stratigraphic unit. The term can refer to a stratiform deposit, to variously oriented ore bodies contained within the unit, or to a deposit containing veinlets and alteration zones that may or may not be strictly conformable with bedding.

Stratigraphic: Pertaining to the composition, sequence, and correlation of stratified rocks

Stratigraphy: The science of rock strata. It is concerned not only with the original succession and age relations of rock strata but also with their form, distribution, lithologic composition, fossil content, geophysical and geochemical properties; indeed, with all characters and attributes of rocks as strata.

Subduction: Act of one tectonic unit's descending under another. The process of one lithospheric plate descending beneath another.

Supercontinent: A hypothetical former large continent from which other continents are held to have broken off and drifted away.

Syncline: A configuration of folded, stratified rocks in which rocks dip downward from opposite directions to come together in a trough. Reverse of anticline. A fold in which the core contains the stratigraphically younger rocks; it is generally concave upward.

Synclinorium: A compound syncline; a closely folded belt, the broad general structure of which is synclinal. Plural – synclinoria.

Thrust: An overriding movement of one crustal unit over another, such as in thrust faulting.

Transmissivity: Rate of water movement through a unit width or thickness of aquifer. T is equal of hydraulic conductivity (K) times aquifer thickness. Transmissivity is essentially a measure of the aquifer's ability to transmit water.

Transverse zone: Regional scale, east-west structural alignments that are generally perpendicular to the regional north-south alignment of mountain ranges and valleys. A zone of structures that typically cross-cuts a region and separates two areas of different type or amount of disruption or deformation.

Unconformity: Buried erosion surface separating two rock masses, older exposed to erosion for long interval of time before deposition of younger. If older rocks were deformed and not horizontal at time of subsequent deposition, surface of separation is angular unconformity. If older rocks remained essentially horizontal during erosion, surface separating them from younger rocks is called disconformity. Unconformity that develops between massive igneous or metamorphic rocks exposed to erosion and then covered by sedimentary rocks is called nonconformity.

Vug: Small unfilled cavity in rock, usually lined with crystalline layer of different composition from surrounding rock.

Water table: Surface of contact between the zone of saturation and the zone of aeration; that surface of a body of unconfined groundwater at which the pressure is equal to that of the atmosphere. Zeolite: A generic term for class of hydrated silicate minerals of aluminum and either sodium or calcium or both.

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Appendix A. Component estimates of recharge, discharge, water use, and aquifer storage.

[ET-unit acreage, in acres]

Hydrographic area	Hydrographic area subbasin	Marshland	Meadowland	Grassland	Dense desert shrubland	Moderately dense desert shrubland	Sparse desert shrubland	Moist bare soil	Open water	Dry playa
Butte Valley	1	64	478	615	5,827	50,897	7,891	0	4	0
Butte Valley	2	0	0	0	79	3,244	371	0	0	0
Cave Valley	1	81	503	280	842	354	6	0	0	0
Cave Valley	2	0	0	2	534	7,005	3,546	0	0	194
Jakes Valley	--	25	91	146	540	203	6	0	26	0
Lake Valley	1	630	1,143	822	4,077	32,384	16,296	0	26	94
Lake Valley	2	0	0	0	0	0	0	0	0	0
Little Smoky Valley	--	62	355	379	1,191	1,678	2,108	0	5	5
Little Smoky Valley	--	0	0	0	0	0	0	0	0	0
Long Valley	1	2	3	4	1,219	12,155	4,901	0	1	1	0
Newark Valley	1	996	2,247	1,397	6,228	11,110	2,556	1	1	1,111
Newark Valley	2	192	639	661	3,620	14,284	6,035	0	1	10,625
Newark Valley	3	0	1	0	172	7,526	2,830	0	0	24
Snake Valley	1	334	693	347	2,527	6,854	17,772	0	0	56,499
Snake Valley	2	541	1,746	1,463	7,988	34,568	66,023	578	115	5,553
Snake Valley	3	432	1,696	799	3,638	26,758	46,090	0	100	1,081
Snake Valley	4	535	1,816	834	7,368	17,297	3,254	0	212	0
Snake Valley	5	0	0	0	0	0	0	0	0	0
Spring Valley	1	119	303	154	747	377	61	0	0	0
Spring Valley	2	1,259	3,223	2,386	13,055	43,870	23,563	2,810	6	15,509
Spring Valley	3	699	1,639	1,007	9,301	39,639	12,083	9	0	520
Spring Valley	4	0	0	0	0	0	0	0	0	0
Steptoe Valley	1	790	2,251	2,442	16,691	69,506	26,861	237	5	2,464
Steptoe Valley	2	2,993	5,171	3,813	13,197	15,992	3,158	21	147	0
Steptoe Valley	3	152	498	254	1,427	985	76	0	287	0
Tippett Valley	--	0	21	51	1,013	4,569	1,623	0	0	497
White River Valley	1	142	340	188	737	748	134	0	0	0
White River Valley	2	48	293	253	2,419	15,552	9,881	0	0	19
White River Valley	3	104	1,114	1,083	4,733	4,953	541	0	0	9
White River Valley	4	2,877	2,182	2,413	16,450	68,298	34,353	14	685	941
Total		13,077	28,446	21,793	125,620	490,806	292,019	3,670	1,615	95,145

Irrigated cropland	Subbasin total	Hydrographic area total
202	65,978	69,672
0	3,694	
0	2,066	13,347
0	11,281	
187	1,224	1,224
0	55,472	55,472
0	0	
216	5,994	5,994
0	0	
0	18,284	18,284
208	25,855	72,750
285	36,342	
0	10,553	
1,785	86,811	325,443
1,138	119,713	
5,136	85,730	
1,873	33,189	
0	0	
0	1,761	177,698
2,867	108,548	
2,492	67,389	
0	0	
2,766	124,013	174,538
2,354	46,846	
0	3,679	
0	7,774	7,774
841	3,130	178,095
490	28,955	
4,965	17,502	
295	128,508	
28,100	**1,100,291**	

Appendix A. Component estimates of recharge, discharge, water use, and aquifer storage--Continued.

[Annual precipitation rate on potential discharge areas, in feet]

Hydrographic area	Hydrographic area subbasin	Marshland	Meadowland	Grassland	Dense desert shrubland	Moderately dense desert shrubland	Sparse desert shrubland	Moist bare soil	Open water	Dry playa
Butte Valley	1	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Butte Valley	2	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Cave Valley	1	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11
Cave Valley	2	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08
Jakes Valley	--	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Lake Valley	1	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Lake Valley	2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Little Smoky Valley	--	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52
Little Smoky Valley	--	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Long Valley	1	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Newark Valley	1	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Newark Valley	2	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Newark Valley	3	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78
Snake Valley	1	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55
Snake Valley	2	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55
Snake Valley	3	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56
Snake Valley	4	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68
Snake Valley	5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Spring Valley	1	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
Spring Valley	2	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69
Spring Valley	3	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79
Spring Valley	4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Steptoe Valley	1	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67
Steptoe Valley	2	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77
Steptoe Valley	3	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Tippett Valley	--	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
White River Valley	1	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
White River Valley	2	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
White River Valley	3	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
White River Valley	4	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77

Irrigated cropland
0.95
0.85
1.11
1.08
0.96
0.99
N/A
N/A
0.52
N/A
0.94
0.91
0.86
0.78
0.55
0.55
0.56
0.68
N/A
0.81
0.69
0.79
N/A
0.67
0.77
0.94
0.80
0.94
0.75
0.86
0.77

Precipitation_rate

Appendix A. Component estimates of recharge, discharge, water use, and aquifer storage--Continued.

[Annual recharge, in acre-feet]

Hydrographic-area	Hydrographic-area subbasin	Potential in-place	Potential runoff	Computed runoff	Sub-basin total	Hydrographic area total
Butte Valley	1	29,034	8,900	1,335	30,369	35,345
Butte Valley	2	4,383	3,949	592	4,975	
Cave Valley	1	5,297	3,542	531	5,828	10,859
Cave Valley	2	4,700	2,204	331	5,030	
Jakes Valley	--	14,844	5,568	835	15,680	15,680
Lake Valley	1	8,149	8,072	1,211	9,359	13,092
Lake Valley	2	2,113	10,802	1,620	3,733	
Little Smoky Valley	--	4,042	1,259	189	4,231	4,459
Little Smoky Valley	--	196	214	32	229	
Long Valley	1	23,511	7,689	1,153	24,665	24,665
Newark Valley	1	7,415	2,080	312	7,727	21,179
Newark Valley	2	4,152	6,596	989	5,141	
Newark Valley	3	7,915	2,642	396	8,311	
Snake Valley	1	1,207	13,460	2,019	3,226	111,337
Snake Valley	2	34,194	27,116	4,067	38,261	
Snake Valley	3	22,806	35,339	5,301	28,107	
Snake Valley	4	31,617	7,238	1,086	32,703	
Snake Valley	5	4,287	31,688	4,753	9,040	
Spring Valley	1	12,355	6,451	968	13,323	93,128
Spring Valley	2	45,808	59,584	8,938	54,745	
Spring Valley	3	17,687	18,708	2,806	20,493	
Spring Valley	4	3,646	6,139	921	4,567	
Steptoe Valley	1	59,292	29,457	4,419	63,710	154,068
Steptoe Valley	2	58,635	31,292	4,694	63,329	
Steptoe Valley	3	25,705	8,826	1,324	27,029	
Tippett Valley	--	11,490	5,781	867	12,357	12,357
White River Valley	1	6,659	10,241	1,536	8,196	35,243
White River Valley	2	3,245	786	118	3,363	
White River Valley	3	16,275	3,465	520	16,795	
White River Valley	4	6,631	1,719	258	6,889	
Total		477,290	360,807			531,411

Appendix A. Component estimates of recharge, discharge, water use, and aquifer storage--Continued.

[Annual evapotranspiration rate, in feet]

Hydrographic area	Hydrographic area subbasin	Marshland	Meadowland	Grassland	Moderately Dense desert shrubland	Moderately dense desert shrubland	Sparse desert shrubland	Moist bare soil	Open water	Dry playa
Butte Valley	1	4.11	2.56	2.06	1.21	1.10	0.98	2.00	5.10	0.75
Butte Valley	2	4.10	2.75	2.15	1.11	1.00	0.98	2.00	5.10	0.75
Cave Valley	1	4.11	2.53	2.15	1.37	1.30	0.98	2.00	5.10	0.75
Cave Valley	2	4.10	2.75	1.97	1.11	1.00	0.98	2.00	5.10	0.75
Jakes Valley	--	4.06	2.41	2.06	1.37	1.30	0.98	2.00	5.10	0.75
Lake Valley	1	4.11	2.59	2.15	1.21	1.00	0.98	2.00	5.10	1.00
Lake Valley	2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Little Smoky Valley	--	4.02	2.47	2.06	1.37	1.00	0.74	2.00	5.10	0.75
Little Smoky Valley	--	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Long Valley	1	4.01	2.47	1.97	1.11	1.00	0.98	2.00	5.10	0.75
Newark Valley	1	4.08	2.62	2.15	1.27	1.20	0.86	2.00	5.10	1.00
Newark Valley	2	4.10	2.35	2.15	1.11	1.00	0.98	2.00	5.10	1.00
Newark Valley	3	4.06	2.41	2.15	1.37	1.30	0.74	2.00	5.10	1.00
Snake Valley	1	4.07	2.56	2.15	1.27	1.00	0.74	2.00	5.10	0.63
Snake Valley	2	4.10	2.26	2.15	1.21	1.10	0.86	2.00	5.10	0.63
Snake Valley	3	4.13	2.59	2.15	1.27	1.00	0.86	2.00	5.10	0.63
Snake Valley	4	4.12	2.71	2.15	1.21	1.10	0.98	2.00	5.10	0.63
Snake Valley	5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Spring Valley	1	4.12	2.76	2.15	1.32	1.20	0.98	2.00	5.10	0.81
Spring Valley	2	4.11	2.62	2.15	1.27	1.00	0.86	2.00	5.10	0.81
Spring Valley	3	4.11	2.71	2.15	1.21	1.10	0.98	2.00	5.10	0.81
Spring Valley	4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Steptoe Valley	1	4.11	2.53	2.06	1.21	1.10	0.86	2.00	5.10	0.81
Steptoe Valley	2	4.05	2.59	2.15	1.32	1.20	0.86	2.00	5.10	0.81
Steptoe Valley	3	4.03	2.65	2.24	1.27	1.20	0.98	2.00	5.10	0.81
Tippett Valley	--	4.10	2.35	2.06	1.21	1.00	0.98	2.00	5.10	0.81
White River Valley	1	4.12	2.62	2.15	1.32	1.20	0.98	2.00	5.10	0.88
White River Valley	2	4.12	2.62	2.15	1.21	1.00	0.98	2.00	5.10	0.88
White River Valley	3	4.03	2.50	2.06	1.21	1.10	0.98	2.00	5.10	0.88
White River Valley	4	4.03	2.50	2.06	1.21	1.10	0.98	2.00	5.10	0.88

Irrigated cropland
1.40
1.40
1.40
1.40
1.40
1.40
N/A
1.40
N/A
1.40
1.40
1.40
1.40
1.40
N/A
1.40
1.40
1.40
1.40
1.40
1.40
N/A
1.40
1.40
1.40
1.40
1.40
N/A
1.40
1.40
1.40
1.40
1.40
1.40
1.40
1.40

Appendix A. Component estimates of recharge, discharge, water use, and aquifer storage--Continued.

[Annual discharge rate, in feet]

Discharge_rate

Hydrographic area	Hydrographic area subbasin	Marshland	Meadowland	Grassland	Dense desert shrubland	Moderately dense desert shrubland	Sparse desert shrubland	Moist bare soil	Open water	Dry playa
Butte Valley	1	3.16	1.61	1.11	0.27	0.15	0.03	1.05	4.15	0.00
Butte Valley	2	3.25	1.90	1.30	0.26	0.13	0.13	1.15	4.25	0.00
Cave Valley	1	3.00	1.42	1.04	0.19	0.00	0.00	0.89	3.99	0.00
Cave Valley	2	3.02	1.67	0.89	0.03	0.00	0.00	0.92	4.02	0.00
Jakes Valley	--	3.11	1.45	1.10	0.42	0.34	0.02	1.04	4.14	0.00
Lake Valley	1	3.12	1.60	1.16	0.22	0.01	0.00	1.01	4.11	0.01
Lake Valley	1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Lake Valley	2	3.50	1.95	1.54	0.85	0.48	0.22	1.48	4.58	0.23
Little Smoky Valley	--	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Long Valley	1	3.07	1.53	1.03	0.17	0.06	0.04	1.06	4.16	0.00
Newark Valley	1	3.17	1.70	1.24	0.36	0.29	0.00	1.09	4.19	0.09
Newark Valley	2	3.24	1.49	1.29	0.25	0.14	0.12	1.14	4.24	0.14
Newark Valley	3	3.28	1.63	1.37	0.59	0.52	0.00	1.22	4.32	0.22
Snake Valley	1	3.52	2.01	1.60	0.72	0.45	0.19	1.45	4.55	0.08
Snake Valley	2	3.55	1.71	1.60	0.66	0.55	0.31	1.45	4.55	0.08
Snake Valley	3	3.56	2.02	1.59	0.70	0.44	0.30	1.44	4.54	0.06
Snake Valley	4	3.43	2.02	1.47	0.53	0.42	0.30	1.32	4.42	0.00
Snake Valley	5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Spring Valley	1	3.31	1.96	1.34	0.51	0.39	0.17	1.19	4.29	0.00
Spring Valley	2	3.43	1.93	1.46	0.58	0.31	0.17	1.31	4.41	0.12
Spring Valley	3	3.32	1.92	1.36	0.42	0.31	0.19	1.21	4.31	0.02
Spring Valley	4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Steptoe Valley	1	3.44	1.86	1.39	0.54	0.43	0.19	1.33	4.43	0.14
Steptoe Valley	2	3.28	1.82	1.38	0.55	0.43	0.09	1.23	4.33	0.04
Steptoe Valley	3	3.09	1.71	1.30	0.33	0.26	0.04	1.06	4.16	0.00
Tippett Valley	--	3.30	1.55	1.26	0.42	0.20	0.18	1.20	4.30	0.01
White River Valley	1	3.17	1.68	1.21	0.38	0.26	0.04	1.06	4.16	0.00
White River Valley	2	3.37	1.87	1.40	0.46	0.25	0.23	1.25	4.35	0.13
White River Valley	3	3.18	1.64	1.20	0.36	0.24	0.12	1.14	4.24	0.02
White River Valley	4	3.26	1.73	1.29	0.44	0.33	0.21	1.23	4.33	0.11

Irrigated cropland
0.45
0.55
0.29
0.32
0.44
0.41
N/A
0.54
0.88
N/A
0.46
0.49
0.54
0.62
0.85
0.85
0.84
0.72
N/A
0.59
0.71
0.61
N/A
0.73
0.46
0.60
0.46
0.65
0.54
0.63

Appendix A. Component estimates of recharge, discharge, water use, and aquifer storage--Continued.

[Annual evapotranspiration, in acre-feet]

Hydrographic-Area	Hydrographic-Area Subbasin	Marshland	Meadowland	Grassland	Moderately			Moist Bare Soil	Open Water	Dry Playa
					Dense Desert Shrubland	Dense Desert Shrubland	Moderately Dense Desert Shrubland	Sparse Desert Shrubland		
Butte Valley	1	265	1,221	1,265	7,070	55,987	7,734	0	19	0
Butte Valley	2	0	0	0	87	3,244	363	0	0	0
Cave Valley	1	332	1,271	603	1,156	7,005	3,475	0	0	0
Cave Valley	2	0	0	5	591	460	6	0	0	146
Jakes Valley	--	101	220	301	741	263	6	0	135	0
Lake Valley	1	2,588	2,956	1,766	4,947	32,384	15,970	0	132	94
Lake Valley	2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Little Smoky Valley	--	251	875	780	1,635	1,678	1,560	0	0	3
Little Smoky Valley	--	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Long Valley	1	9	7	8	1,349	12,155	4,803	0	0	0
Newark Valley	1	4,065	5,879	3,003	7,889	13,333	2,198	2	5	1,111
Newark Valley	2	786	1,500	1,422	4,006	14,284	5,915	1,155	510	10,625
Newark Valley	3	0	2	0	236	9,784	2,094	0	0	24
Snake Valley	1	1,358	1,772	746	3,200	6,854	13,151	0	0	35,312
Snake Valley	2	2,220	3,945	3,145	9,692	38,024	56,780	0	586	3,470
Snake Valley	3	1,780	4,386	1,718	4,608	26,758	39,638	0	5	676
Snake Valley	4	2,203	4,912	1,793	8,940	19,027	3,188	0	1,083	0
Snake Valley	5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Spring Valley	1	488	838	331	986	453	60	0	0	0
Spring Valley	2	5,179	8,432	5,131	16,537	43,870	20,264	5,620	31	12,601
Spring Valley	3	2,871	4,433	2,164	11,285	43,602	11,842	19	0	422
Spring Valley	4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Steptoe Valley	1	3,248	5,688	5,026	20,251	76,456	23,101	474	28	2,002
Steptoe Valley	2	12,128	13,375	8,199	17,421	19,191	2,716	41	752	0
Steptoe Valley	3	614	1,318	568	1,808	1,182	75	0	1,462	0
Tippett Valley	--	0	49	105	1,230	4,569	1,591	0	0	404
White River Valley	1	586	889	404	973	898	132	0	0	0
White River Valley	2	199	765	544	2,935	15,552	9,683	0	0	17
White River Valley	3	421	2,783	2,229	5,743	5,448	530	0	0	8
White River Valley	4	11,599	5,449	4,966	19,960	75,128	33,666	28	3,493	824
Total		53,291	72,965	46,222	155,276	527,589	260,541	7,339	8,241	67,739

Irrigated Cropland	Sub-basin total	Hydrographic Area Total
283	73,844	77,538
0	3,694	
0	3,828	15,050
0	11,222	
262	2,029	2,029
0	60,837	60,837
N/A	0	
303	7,085	7,085
N/A	0	
0	18,331	18,331
292	37,777	88,859
399	38,942	
0	12,140	
2,499	64,892	316,535
1,593	120,610	
7,190	87,264	
2,623	43,769	
N/A	0	
0	3,156	204,962
4,014	121,679	
3,489	80,127	
N/A	0	
3,872	140,146	224,292
3,296	77,119	
0	7,027	
1,177	7,948	7,948
0	5,059	215,079
686	30,381	
6,951	24,113	
413	155,526	
39,342		**1,238,545**

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Appendix A. Component estimates of recharge, discharge, water use, and aquifer storage--Continued.

[Annual discharge, in acre-feet]

Hydrographic area	Hydrographic area subbasin	Marshland	Meadowland	Grassland	Dense desert shrubland	Moderately dense desert shrubland	Sparse desert shrubland	Moist bare soil	Open water	Dry playa	Irrigated cropland	Subbasin total	Hydrographic area total
Butte Valley	1	204	769	683	1,548	7,753	255	0	16	0	91	11,319	11,876
Butte Valley	2	0	0	0	20	489	48	0	0	0	0	557	
Cave Valley	1	242	712	292	221	67	0	0	0	0	0	1,534	1,550
Cave Valley	2	0	0	2	14	0	0	0	0	0	0	16	
Jakes Valley	--	77	132	161	225	70	0	0	110	0	83	858	858
Lake Valley	1	1,964	1,826	954	916	367	0	0	106	1	0	6,134	6,134
Lake Valley	2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	
Little Smoky Valley	--	218	690	582	1,013	802	459	0	0	1	190	3,955	3,955
Little Smoky Valley	--	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	
Long Valley	1	7	4	4	209	789	220	0	0	0	0	1,233	1,233
Newark Valley	1	3,157	3,831	1,730	2,213	3,208	0	1	4	99	102	14,345	26,058
Newark Valley	2	621	951	854	894	2,004	726	0	4	1,491	154	7,699	
Newark Valley	3	0	1	0	102	3,906	0	0	0	5	0	4,014	
Snake Valley	1	1,176	1,392	556	1,817	3,101	3,421	0	0	4,377	1,522	17,362	132,285
Snake Valley	2	1,923	2,986	2,341	5,303	19,031	20,504	838	523	420	968	54,837	
Snake Valley	3	1,537	3,432	1,268	2,562	11,706	13,711	0	453	68	4,301	39,038	
Snake Valley	4	1,836	3,669	1,222	3,896	7,187	961	0	937	0	1,340	21,048	
Snake Valley	5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	
Spring Valley	1	392	593	207	383	148	10	0	0	0	0	1,733	75,615
Spring Valley	2	4,313	6,215	3,489	7,554	13,685	4,052	3,686	27	1,930	2,041	46,992	
Spring Valley	3	2,319	3,139	1,369	3,937	12,287	2,296	11	0	12	1,520	26,890	
Spring Valley	4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	
Steptoe Valley	1	2,718	4,178	3,388	9,053	29,824	5,079	315	24	349	2,017	56,945	101,497
Steptoe Valley	2	9,819	9,386	5,258	7,241	6,855	280	25	638	0	1,480	40,982	
Steptoe Valley	3	471	850	330	467	256	3	0	1,193	0	0	3,570	
Tippett Valley	--	0	32	64	421	923	295	0	0	7	0	1,742	1,742
White River Valley	1	452	569	227	280	194	5	0	0	0	386	2,113	76,701
White River Valley	2	163	546	355	1,122	3,894	2,277	0	0	2	319	8,678	
White River Valley	3	331	1,829	1,301	1,690	1,207	67	0	0	0	2,699	9,124	
White River Valley	4	9,386	3,773	3,112	7,320	22,651	7,271	18	0	100	186	56,786	
Total		43,328	51,505	29,749	60,421	152,404	61,940	4,894	7,002	8,862	19,399	439,504	

Appendix A. Component estimates of recharge, discharge, water use, and aquifer storage--Continued.

[Water use data table]

Hydrographic area	Irrigated acreage (acres)	Irrigation consumptive use (acre-feet)	Average application rate (acre-feet/acre)	Average irrigation (acre-feet)	Stock (acre-feet)	Mining (acre-feet)	Public supply (acre-feet)	Domestic (acre-feet)
Butte Valley	193	537	3.4	656	10	0	0	10
Cave Valley	0	0	N/A	0	3	0	0	10
Jakes Valley	178	504	3.5	630	10	0	0	10
Lake Valley	4,360	13,347	3.0	13,161	75	0	0	10
Little Smoky Valley	1,207	3,712	3.8	4,586	7	0	0	10
Long Valley	0	0	N/A	0	20	339	0	10
Newark Valley	2,078	6,234	3.4	7,085	25	0	65	16
Snake Valley	9,200	27,554	3.7	33,692	99	0	542	216
Spring Valley	4,888	13,728	3.5	17,513	44	0	2	26
Steptoe Valley	3,742	10,420	3.4	12,859	84	6,098	5,423	855
Tippett Valley	0	0	N/A	0	6	0	0	10
White River Valley	6,078	18,031	3.6	21,839	105	0	88	133
Total	**31,923**	**94,067**		**112,021**	**488**	**6,437**	**6,120**	**1,317**

Total (acre-feet)
676
13
650
13,246
4,603
369
7,190
34,549
17,585
25,319
16
22,166
126,382

Appendix A. Component estimates of recharge, discharge, water use, and aquifer storage--Continued.

[Ground-water storage data table]

Hydrographic area	Playa acreage (acres)	Saturated basin-fill acreage (acres)	Drainable basin-fill acreage (acres)	Unconfined storage\1 (acre-feet)	Confined storage\2 (acre-ft)	Total storage (acre-feet)
Butte Valley	47,753	191,816	144,062	2,160,937	1,918	2,162,855
Cave Valley	20,448	74,132	53,684	805,255	741	805,996
Jakes Valley	0	64,865	64,865	972,977	649	973,626
Lake Valley	53,189	139,306	86,116	1,291,743	1,393	1,293,136
Little Smoky Valley	1,668	125,406	123,738	1,856,070	1,254	1,857,324
Long Valley	38,240	115,831	77,591	1,163,866	1,158	1,165,025
Newark Valley	25,637	178,225	152,588	2,288,814	1,782	2,290,596
Snake Valley	256,372	852,699	596,327	8,944,906	8,527	8,953,433
Spring Valley	115,028	367,569	252,542	3,788,125	3,676	3,791,801
Steptoe Valley	39,660	435,523	395,863	5,937,942	4,355	5,942,298
Tippett Valley	18,965	73,452	54,487	817,301	735	818,036
White River Valley	0	374,921	374,921	5,623,810	3,749	5,627,559
Total	**616,960**	**2,993,743**		**35,651,747**	**29,937**	**35,681,684**

1/ Unconfined storage computed as product of the drainable basin-fill acreage, a specific yield of 0.15, and a regionalized water-level decline of 100 feet.

2/ Confined storage computed as product of basin-fill acreage, a storage coefficient of 0.0001, and a regionalized hydraulic-head decline of 100 feet.