Antelope Valley Groundwater Basin

- Groundwater Basin Number: 6-44
- County: Los Angeles, Kern, San Bernardino
- Surface Area: 1,010,000 acres (1,580 square miles)

Basin Boundaries and Hydrology

Antelope Valley Groundwater Basin underlies an extensive alluvial valley in the western Mojave Desert. The elevation of the valley floor ranges from 2,300 to 3,500 feet above sea level. The basin is bounded on the northwest by the Garlock fault zone at the base of the Tehachapi Mountains and on the southwest by the San Andreas fault zone at the base of the San Gabriel Mountains. The basin is bounded on the east by ridges, buttes, and low hills that form a surface and groundwater drainage divide and on the north by Fremont Valley Groundwater Basin at a groundwater divide approximated by a southeastward-trending line from the mouth of Oak Creek through Middle Butte to exposed bedrock near Gem Hill, and by the Rand Mountains farther east.

Runoff in Big Rock and Little Rock Creeks from the San Gabriel Mountains and in Cottonwood Creek from the Tehachapi Mountains flows toward a closed basin at Rosamond Lake (Jennings and Strand 1969). Rogers Lake is a closed basin in the northern part of Antelope Valley that collects ephemeral runoff from surrounding hills (Rogers 1967). Average annual rainfall ranges from 5 to 10 inches.

Hydrogeologic Information

Water Bearing Formations

The primary water-bearing materials are Pleistocene and Holocene age unconsolidated alluvial and lacustrine deposits that consist of compact gravels, sand, silt, and clay. These deposits are coarse and rich in gravel near mountains and hills, but become finer grained and better sorted toward the central parts of the valley (Duell 1987). Coarse alluvial deposits form the two main aquifers of the basin; a lower aquifer and an upper aquifer. Most of the clays were deposited in large perennial lakes during periods of heavy precipitation. These clays are interbedded with lenses of coarser water-bearing material as thick as 20 feet; in contrast, the clay beds are as thick as 400 feet. The lake deposits form a zone of low permeability between the permeable alluvium of the upper aquifer and that of the lower aquifer, although leakage between the two aquifers may occur (Planert and Williams 1995). The upper aquifer, which is the primary source of groundwater for the valley, is generally unconfined whereas the lower aquifer is generally confined. Specific yield of these deposits ranges from 1 to 30 percent (KJC 1995), and wells typically have a moderate to high ability for water well production.

Restrictive Structures

The Antelope Valley Groundwater Basin is composed of three large sediment-filled structural basins separated by extensively faulted, elevated bedrock (Dibblee 1967; Londquist and others 1993). The rocks deposited in these basins are disrupted by strike-slip faults, normal faults, and folds, which are related to movement along the active San Andreas and Garlock fault zones. Workers at the USGS have separated the groundwater basin into subbasins using faults that have a difference in groundwater elevation across them (Bloyd 1967; Carlson and others 1998).

In addition to the Garlock and San Andreas fault zones, numerous other faults within the basin impede groundwater flow (Bloyd 1967; Durbin 1978; Carlson and others 1998). Bloyd (1967) described eight groundwater subunits in this basin bounded, in part, by faults that displace the water table. The Randsburg-Mojave, Cottonwood, Willow Springs, Rosamond, and Neenach faults displace the water table in the western part of the basin (Bloyd 1967; Dibblee 1963; 1967; Durbin 1978; Londquist and others 1993; Carlson and others 1998), as does an unnamed fault in the southwestern part of the basin (Bloyd 1967). The El Mirage, Spring, and Blake Ranch faults impede groundwater movement in the eastern part of the basin (Ikehara and Phillips 1994), and three unnamed faults displace the local water table in the southeastern part of the basin (Bloyd 1967). A ridge of bedrock buried beneath the northern part of Rogers Lake is a barrier to groundwater flow (Bloyd 1967) in the northeastern part of the basin.

Recharge

Recharge to the basin is primarily accomplished by perennial runoff from the surrounding mountains and hills. Most recharge occurs at the foot of the mountains and hills by percolation through the head of alluvial fan systems. The Big Rock and Little Rock Creeks, in the southern part of the basin, contribute about 80 percent of runoff into the basin (Durbin 1978). Other minor recharge is from return of irrigation water and septic system effluent (Duell 1987).

Groundwater Level Trends

From 1975 through 1998, groundwater level changes ranged from an increase of 84 feet to a decrease of 66 feet (Carlson and Phillips 1998). The parts of the basin with declining water levels are along the highway 14 corridor from Palmdale through Lancaster to Rosamond and surrounding Rogers Lake on Edwards Air Force Base (Carlson and Phillips 1998).

Historically, groundwater in the basin flowed north from the San Gabriel Mountains and south and east from the Tehachapi Mountains toward Rosamond Lake, Rogers Lake, and Buckhorn Lake. These dry lakes are places where groundwater can discharge by evaporation. Because of recent groundwater pumping, groundwater levels and flow have been altered in urban areas such as Lancaster and Edwards Air Force Base. Groundwater pumping has caused subsidence of the ground surface as well as earth fissures to appear in Lancaster and on Edwards Air Force Base. By 1992, 292 square miles of Antelope Valley had subsided more than one foot. This subsidence has permanently reduced aquifer-system storage by about 50,000 acre-feet (Sneed and Galloway 2000; Ikehara and Phillips 1994).

Groundwater Storage

Groundwater Storage Capacity. The total storage capacity has been reported at 68,000,000 af (Planert and Williams 1995) and 70,000,000 af (DWR 1975). For the part of the basin between 20 and 220 feet in depth, the storage capacity has been reported to be 5,400,000 af (Bader 1969).

Groundwater Budget (Type A)

Though a current groundwater budget for the Antelope Valley Groundwater Basin is not available, Durbin (1978) produced a mathematical model for this basin. In addition, Planert and Williams (1995) report 25,803 af of urban extraction and 1,006 af of agricultural extraction for 1992. Fuller (2000) reports an average natural recharge of about 48,000 af, and KJC (1995) reports a range in annual natural recharge of 31,200 to 59,100 af/year.

Groundwater Quality

Characterization. Groundwater is typically calcium bicarbonate in character near the surrounding mountains and is sodium bicarbonate or sodium sulfate character in the central part of the basin (Duell 1987). In the eastern part of the basin, the upper aquifer has sodium-calcium bicarbonate type water and the lower aquifer has sodium bicarbonate type water (Bader 1969). TDS content in the basin averages 300 mg/L and ranges from 200 to 800 mg/L (KJC 1995). Data from 213 public supply wells show an average TDS content of 374 mg/L and ranges from 123 to 1,970 mg/L.

Impairments. High levels of boron and nitrates have been observed (JKC 1995).

Water Quality in Public Supply Wells

Constituent Group[1]	Number of wells sampled[2]	Number of wells with a concentration above an MCL[3]
Inorganics – Primary	214	25
Radiological	183	6
Nitrates	243	8
Pesticides	207	2
VOCs and SVOCs	207	4
Inorganics – Secondary	214	39

[1] A description of each member in the constituent groups and a generalized discussion of the relevance of these groups are included in *California's Groundwater – Bulletin 118* by DWR (2003).
[2] Represents distinct number of wells sampled as required under DHS Title 22 program from 1994 through 2000.
[3] Each well reported with a concentration above an MCL was confirmed with a second detection above an MCL. This information is intended as an indicator of the types of activities that cause contamination in a given basin. It represents the water quality at the sample location. It does not indicate the water quality delivered to the consumer. More detailed drinking water quality information can be obtained from the local water purveyor and its annual Consumer Confidence Report.

Well Production Characteristics

	Well yields (gal/min)	
Municipal/Irrigation	Range to 7,500 gal/min	Average: 286 gal/min
	Total depths (ft)	
Domestic		
Municipal/Irrigation		

Active Monitoring Data

Agency	Parameter	Number of wells /measurement frequency
USGS	Groundwater levels	262
USGS	Miscellaneous water quality	10
Department of Health Services and cooperators	Title 22 water quality	248

Basin Management

Groundwater management:	The Antelope Valley Water Group is an ad hoc coalition that plays a large role in groundwater management for this basin. They are developing an AB3030 plan for this basin.
Water agencies	
Public	Boron Community Services District, Desert Lake Community Service District, Los Angeles County Water Works, Littlerock Creek Irrigation District, Mojave Public Utility District, North Edwards Water District, Palmdale Water District, Quartz Hill Water District, Rosamond Community Service District, San Bernardino CountyService Area No. 70L
Private	Antelope Valley Water Company, Edgemont Acres Mutual Water Company, Evergreen Mutual Water Company, Land Project Mutual Water Company, Landale Mutual Water Company, Oak Springs Valley Water Company, Sunnyside Farms Mutual Water Company, White Fence Farms Mutual Water Company

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Errata

Substantive changes made to the basin description will be noted here.