Joshua Tree Groundwater Basin

- Groundwater Basin Number: 7-62
- County: San Bernardino
- Surface Area: 33,800 acres (53.8 square miles)

Basin Boundaries and Hydrology

The Joshua Tree Basin is located in the northwestern portion of the Colorado Desert Hydrologic Study Area at an average elevation of about 2,400 feet. This basin includes the water-bearing sediments south of the Pinto Mountain fault beneath the town of Joshua Tree, eastward to immediately south of the town of Twentynine Palms, which is outside the boundaries of the basin. The northern boundary of the basin is the Pinto Mountain fault, and the southern boundary is exposed consolidated basement of the Little San Bernardino Mountains within Joshua Tree National Park. The western boundary of the basin is coincident with a basement constriction located between the towns of Yucca Valley and Joshua Tree that causes a change in the groundwater level gradient. The eastern boundary of the basin lies along a line extending from the southern tip of the Mesquite fault to a basement outcrop of the Little San Bernardino Mountains.
Precipitation at the town of Joshua Tree ranged from 2.59 inches to 9.83 inches for 1959 through 1976 and averaged 4.97 inches (Whitt and Jonker 1998).

Hydrogeologic Information

Water Bearing Formations

The productive water-bearing materials in this basin consist of unconsolidated to partly consolidated Miocene to Quaternary continental deposits (Mendez and Christensen 1997). Regionally, the continental deposits reach 10,000 feet in thickness (Moyle 1984). Interpretation of resistivity surveys suggests a maximum depth of 2,500 feet in this basin (Whitt and Jonker 1998). Whitt and Jonker (1998) estimate an average of 2,000 feet for the main portion of the basin. Wells in Joshua Tree Basin reach a maximum depth of about 785 feet without encountering bedrock (Lewis 1972). Because the Joshua Tree Basin considered in this report incorporates additional areas of shallower alluvial fill, we estimate an average thickness of 500 feet.

Groundwater in the basin is unconfined and typically occurs in interbedded gravels, conglomerates, and silts deposited in alluvial fan systems (Schaefer 1978). Other less productive deposits include active silt, clay, and sandy-clay deposits in Coyote Lake playa; and dune sands (Schaefer 1978; BEE 1994). The specific yields range from 9 to 24 percent for the productive deposits (DWR 1984) and average about 15 percent (Lewis 1972). Well production yields range from 40 to 2,200 gal/min.

Restrictive Structures

The Pinto Mountain fault is a barrier to groundwater flow, with the water table about 125 feet lower in the Copper Mountain Valley Basin to the north than in the Joshua Tree Basin to the south (Whitt and Jonker 1998; Mendez

and Christensen 1997). The basement constriction that forms the western boundary of this basin appears responsible for an eastward drop in groundwater level of about 400 feet ("Yucca barrier" of Lewis 1972; Mendez and Christensen 1997).

Groundwater Level Trends

Whitt and Jonker (1998) present data suggesting that groundwater levels have dropped by an average of 1 foot per year steadily since about 1973. The general regional groundwater flow is eastward, although local faults and basement highs modify this basic pattern. Groundwater in the Joshua Tree Basin appears to flow northward toward the Pinto Mountain fault, then eastward along the Pinto Mountain fault (DWR 1984; Mendez and Christensen 1997; Whitt and Jonker 1998). There is some indication that groundwater may discharge into the Copper Mountain Basin over or through the Pinto Mountain fault west of Copper Mountain (Whitt and Jonker 1998).

Groundwater Storage

Groundwater Storage Capacity. The storage capacity of the Joshua Tree Basin has been estimated using different approaches. Krieger and Stewart (1996) assumed a specific yield of about 15 percent, a basin area of about 6,000 acres, and a maximum thickness of about 830 feet. Krieger and Stewart's approach, indicates a total storage of about 750,000 af. Whitt and Jonker (1998) use geophysical data to delineate the basin as having an area of about 3,840 acres and a minimum average depth of about 2,000 feet. Whitt and Jonker's approach, combined with about 15 percent specific yield, results in a total storage of about 1,150,000 af. The basin, as defined in this report, extends farther to the east than is considered by Whitt and Jonker (1998) and Krieger and Stewart (1996). Some of this basin includes alluvial material that is close to outcrop of bedrock or in embayments into the consolidated bedrock and is not likely to be thick. We estimate a total storage of 2,540,000 acre-feet by using an area of about 33,800 acres, a specific yield of 15 percent, and an average thickness of basin material of 500 feet.

Groundwater in Storage. Krieger and Stewart (1996) estimate a maximum amount of 480,000 af of groundwater was in storage in 1996, using an average saturated thickness of 533 feet, leaving about 270,000 af of additional storage space available. Whitt and Jonker (1998) estimate approximately 975,000 af of groundwater in storage in 1996 using an average depth to water of 300 feet, leaving about 175,000 af of additional storage space available. An estimate of groundwater in storage of 1,010,000 acre-feet is calculated using a basin area of 33,800 acres, a specific yield of 15 percent, and using an average saturated thickness of 200 feet. This calculation indicates that about 1,530,000 af of additional storage space is available.

Groundwater Budget (Type A)

Not enough data exist to compile a detailed groundwater budget for this basin. However, the Joshua Basin Water District measures actual groundwater extraction. Krieger and Stewart (1996) report an annual average for 1985 through 1995 of 1,562 af and 1995 pumping of 1,590 af for

urban extraction. No agricultural extraction is reported (BEE 1994; Krieger and Stewart 1996; Whitt and Jonker 1998). Whitt and Jonker (1998) estimate that natural recharge averages about 975 af, or about 2.8 percent of precipitation. Subsurface inflow and outflow are unknown (BEE 1994; Whitt and Jonker 1998).

Groundwater Quality

Characterization. The groundwater in the Joshua Tree Basin is predominantly sodium bicarbonate in character (DWR 1984) or sodium-calcium bicarbonate character (Krieger and Stewart 1996). Total dissolved solids content ranged from 139 to 164 mg/L for water in production wells in 1994 (Krieger and Stewart 1996). Some wells have had total dissolved solids concentrations that exceeded 500 mg/L (BEE 1994). Electrical Conductivity ranges from 250 to 310 μmhos (Krieger and Stewart 1996). Data from 14 public supply wells shows an average TDS content of 159 mg/L and a range of 117 to 185 mg/L.

Impairments. Fluoride concentration in water from some wells has reached 9.0 mg/L, exceeding recommended maximum concentration levels of 1.4 mg/L (DWR 1984).

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	16	10
Radiological	15	2
Nitrates	16	0
Pesticides	13	0
VOCs and SVOCs	13	0
Inorganics – Secondary	16	2

[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 Characteristics

	Well yields (gal/min)	
Municipal/Irrigation	Range: – 40 – 2,200	Average (4 wells): 1,110 gal/min
	Total depths (ft)	
Domestic	Range:	Average:
Municipal/Irrigation	Range:	Average:

Active Monitoring Data

Agency	Parameter	Number of wells /measurement frequency
Joshua Basin Water District	Water Quality	4 wells/ annually (Lyons 2000)
Joshua Basin Water District/ USGS	Groundwater Levels	2 wells/ annually (Lyons 2000)
USGS	Groundwater Levels	23
USGS	Water Quality	1
Department of Health Services	Title 22	14 wells/ annually

Basin Management

Groundwater management:	Joshua Basin Water District adopted a management plan in 1996 that includes water conservation, groundwater monitoring, and conjunctive use (Krieger and Stewart 1996).
Water agencies	
Public	Joshua Basin Water District, Mojave Water Agency
Private	

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Errata

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