San Joaquin Valley Groundwater Basin
Chowchilla Subbasin

- Groundwater Subbasin Number: 5-22.05
- County: Madera (and small portion of Merced)
- Surface Area: 159,000 acres (248 square miles)

Basin Boundaries and Hydrology

The San Joaquin Valley is surrounded on the west by the Coast Ranges, on the south by the San Emigdio and Tehachapi Mountains, on the east by the Sierra Nevada and on the north by the Sacramento-San Joaquin Delta and Sacramento Valley. The northern portion of the San Joaquin Valley drains toward the Delta by the San Joaquin River and its tributaries, the Fresno, Merced, Tuolumne, and Stanislaus Rivers. The southern portion of the valley is internally drained by the Kings, Kaweah, Tule, and Kern Rivers that flow into the Tulare drainage basin including the beds of the former Tulare, Buena Vista, and Kern Lakes

The Chowchilla subbasin includes lands in Madera and Merced Counties. The subbasin is bounded on the west by the San Joaquin River and the eastern boundary of the Columbia Canal Company Service Area and on the north by the southern boundary of the Merced Subbasin. The southern boundary from the west to its connection with the northern boundary runs along the southern boundary of Township 11 South, Ranges 14 East and 15 East, northerly along the eastern boundaries of sections 9, 20, 27, and 33 of Township 11S, Range 15 East, and northeasterly along the southern and eastern boundaries of Chowchilla Water District, then northeasterly following Berenda Slough and Ash Slough to the Chowchilla River.

Major rivers in the subbasin are the Fresno and Chowchilla Rivers. Average annual precipitation is estimated to be 11 inches.

Hydrogeologic Information

The San Joaquin Valley represents the southern portion of the Great Central Valley of California. The San Joaquin Valley is a structural trough up to 200 miles long and 70 miles wide. It is filled with up to 32,000 feet of marine and continental sediments deposited during periodic inundation by the Pacific Ocean and by erosion of the surrounding mountains, respectively. Continental deposits shed from the surrounding mountains form an alluvial wedge that thickens from the valley margins toward the axis of the structural trough. This depositional axis is below to slightly west of the series of rivers, lakes, sloughs, and marshes, which mark the current and historic axis of surface drainage in the San Joaquin Valley.

Water Bearing Formations

Hydrogeologic units in the Chowchilla Subbasin consist of unconsolidated deposits of Pleistocene and Holocene age. These deposits are divided into continental deposit of Tertiary and Quaternary age, and continental deposits of Quaternary age. Continental deposits of Quaternary age include older alluvium, lacustrine and marsh deposits and younger alluvium. The continental deposits of Quaternary age crop out over most of the area and yield probably more than 95 percent of the water pumped from wells. Although younger alluvium and flood-basin deposits yield small quantities of water to wells, the most important aquifer in the area is the older alluvium. It consists mostly of intercalated lenses of clay, silt, sand, and some gravel. The Corcoran Clay or E-Clay (a lacustrine and marsh deposit), which underlies most of the subbasin at depths ranging between 50 and 250 feet (DWR 1981), restricts the vertical movement of ground water and divides the water bearing deposits into confined and unconfined aquifers.

The estimated average specific yield of this subbasin is 8.6 percent (based on DWR San Joaquin District internal data and that of Davis 1959).

Restrictive Structures

Groundwater flow is generally southwestward but with groundwater mounds occurring at the subbasin center and pumping depressions in the western portion during 1999 (DWR 2000). Based on current and historical groundwater elevation maps, groundwater barriers do not appear to exist in the subbasin.

Recharge Areas

Groundwater recharge is primarily from deep percolation of applied irrigation water (DWR 1995).

Groundwater Level Trends

Changes in groundwater levels are based on annual water level measurements by DWR and cooperators. Water level changes were evaluated by quarter township and computed through a custom DWR computer program using geostatistics (kriging). On average, the subbasin water level has declined nearly 40 feet from 1970 through 2000. The period from 1970 through 1978 showed steep declines totaling about 30 feet. The nine-year period from 1978 to 1987 saw stabilization and rebound of about 25 feet, taking the water levels close to where they were in 1970. 1987 through 1996 again showed steep declines, bottoming out in 1996 at about 45 feet below 1970 levels. Water levels rose about 8 feet from 1996 to 2000. Water level declines have been more severe in the eastern portion of the subbasin from 1980 to the present, but the western basin showed the strongest declines before this time period.

Groundwater Storage

Estimations of the total storage capacity of the subbasin and the amount of water in storage as of 1995 were calculated using an estimated specific yield of 8.6 percent and water levels collected by DWR and cooperators. According to these calculations, the total storage capacity of this subbasin is estimated to be 8,000,000 af to a depth of 300 feet and 13,900,000 af to the base of fresh groundwater. These same calculations give an estimate of 5,500,000 af of groundwater to a depth of 300 feet stored in this subbasin as of 1995 (DWR 1995). According to published literature, the amount of stored groundwater in this subbasin as of 1961 is 15,000,000 af to a depth of $\leq$ 1000 feet (Williamson 1989).

Groundwater Budget (Type B)

Although a detailed budget was not available for this subbasin, an estimate of groundwater demand was calculated based on the 1990 normalized year and data on land and water use. A subsequent analysis was done by a DWR water budget spreadsheet to estimate overall applied water demands, agricultural groundwater pumpage, urban pumping demand and other extraction data.

Natural recharge of the subbasin is estimated to be 87,000 af. Artificial recharge and subsurface inflow are not determined. There is approximately 179,000 af of applied water recharge. Annual urban and agricultural extractions are 6,000 af and 249,000 af, respectively. There are no other extractions, and subsurface outflow has not been determined.

Groundwater Quality

Characterization. The water in this subbasin is of a calcium-sodium bicarbonate type in the eastern part of the subbasin. This turns into calcium bicarbonate, sodium-calcium bicarbonate, and sodium chloride water types towards the western part of the subbasin (Mitten 1970). TDS values range from 120 to 6,400 mg/L, with a typical range of 200 to 500 mg/L. The Department of Health Services, which monitors Title 22 water quality standards, reports TDS values in eight wells ranging from 120 to 390 mg/L, with an average value of 228 mg/L. EC values range from 150 to 3,380 µmhos/cm, with an average value of 508 µmhos/cm.

Impairments. There are local areas of high nitrate, hardness, iron, and chloride in the subbasin.

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	12	0
Radiological	10	0
Nitrates	10	0
Pesticides	12	0
VOCs and SVOCs	12	0
Inorganics – Secondary	12	0

[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: 50-4,750	Average: 750-2,000
	Total depths (ft)	
Domestic		
Municipal/Irrigation	Range: 100 – 800	

Active Monitoring Data

Agency	Parameter	Number of wells /measurement frequency
DWR (including Cooperators)	Groundwater levels	203 Semi-annually
DWR (including Cooperators)	Mineral, nutrient, & minor element.	
Department of Health Services (including Cooperators)	Title 22 water quality	28 Varies

Basin Management

Groundwater management:	None
Water agencies	
Public	Chowchilla WD; Clayton WD; El Nido ID; New Stone W.D.; Sierra WD (inactive)
Private	California Water Service Co.
Water Projects:	CVP Madera Canal

References Cited

California Department of Water Resources (DWR), San Joaquin District. Unpublished Land and Water Use Data.

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________. 1981. *Depth to Top of Corcoran Clay.* 1:253,440 scale map.

________. 1995. Internal computer spreadsheet for 1990 normal computation of net water demand used in preparation of DWR Bulletin 160-93.

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Davis, GH, Green, JH, Olmstead, SH, and Brown, DW. 1959. *Ground Water Conditions and Storage Capacity in the San Joaquin Valley, California*. US Geological Survey Water Supply Paper No. 1469. 287p.

Mitten, HT, LeBlanc, RA, and Bertoldi, GL. 1970. *Geology, Hydrology, and Quality of Water in the Madera Area, San Joaquin Valley, California*. USGS Open-File Report.

Williamson, Alex K, Prudic, David E, and Swain, Lindsay A. 1989. *Groundwater flow in the Central Valley, California.* US Geological Survey Professional Paper 1401-D. 127 p.

Additional References

California Department of Water Resources (DWR). 1994. Bulletin 160-93. *California Water Plan Update, Vol. 1*

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Errata

Changes made to the basin description will be noted here.