Salinas Valley Groundwater Basin, 180/400 Foot Aquifer Subbasin

- Groundwater Subbasin Number: 3-4.01
- County: Monterey
- Surface Area: 84,400 acres (132 square miles)

Basin Boundaries and Hydrology

The Salinas Valley Groundwater Basin– 180/400-Foot Aquifer Subbasin includes the lower reaches and mouth of the Salinas River. The southwestern basin boundary is the contact of Quaternary Alluvium or Terrace Deposits with the granitic basement of the Sierra de Salinas. Further north along the western Salinas Valley margin the basin boundary is the contact with the Quaternary Paso Robles Formation or Aromas Red Sands of the Corral de Tierra Area Subbasin. The extreme northwest boundary of the subbasin is shared with the Salinas Valley - Seaside Area Subbasin along the seaward projection of the King City Fault. This fault may act a groundwater flow barrier between subbasins beneath a cover of Holocene sand dunes (Durbin and others 1978). The Subbasin is bounded by Monterey Bay to the northwest. The northern subbasin boundary is shared with the Pajaro Valley Groundwater Basin and coincides with the inland projection of a 400-foot deep, buried and clay-filled paleodrainage of the Salinas River. This acts as a barrier to groundwater flow between these subbasins (DWR 1969a; Durbin and others 1978). The northeastern boundary is shared throughout most of its length by the adjacent Salinas Valley – Eastside Subbasin, and to the north with a shorter length of common boundary with the Salinas Valley – Langley Area Subbasin. The northeastern subbasin boundary generally coincides with the northeastern limit of confining conditions in the 180/400-Foot Aquifer Subbasin (DWR 1946a) and with the location of State Highway 101. The southeastern boundary (near the City of Gonzales) is shared with the adjacent Salinas Valley – Lower Forebay Subbasin and is the approximate limit of confining conditions in an up-valley direction (DWR 1946a). The 180/400 Foot Aquifer Subbasin boundaries generally coincide with those of the Pressure Subarea of the Monterey County Water Resources Agency (MCWRA).

Hydrogeologic Information

The Salinas Valley is surrounded by the Gabilan Range on the east, by the Sierra de Salinas and Santa Lucia Range on the west, and is drained by the Salinas River, which empties into Monterey Bay on the north. The King City (Rinconda-Reliz) Fault generally follows the western margin of the Valley from King City in the south to Monterey Bay in the north (Durbin and others 1978). Valley-side down, normal movement along the fault allowed the deposition of an asymmetric, westward thickening alluvial wedge. The Salinas Valley has been filled with 10,000 to 15,000 feet of Tertiary and Quaternary marine and terrestrial sediments that include up to 2,000 feet of saturated alluvium (Showalter and others 1984). Above the generally non-water bearing and consolidated granitic basement, Miocene age Monterey and Pliocene age Purisima Formations are water bearing strata within the Plio-Pleistocene age Paso Robles Formation and within Pleistocene to Holocene alluvium.

Water Bearing Formations

The 180/400-Foot Aquifer Subbasin contains two main water-bearing units that are the basis for the subbasin's name – the 180-Foot Aquifer and the 400-Foot Aquifer – so named for the average depth at which they occur. A near-surface water-bearing zone also exists but it is a relatively minor source of water due to its poor quality. The 180-Foot Aquifer only occurs in this subbasin, as its confining blue clay layer (the Salinas Aquitard) thins and disappears east of the boundary with the adjacent Eastside Subbasin and south of the town of Chualar (MW 1994; LHI 1985). This Salinas Aquitard ranges in thickness from 25 feet near Salinas to more than 100 feet near Monterey Bay. The thickness of the 180-Foot Aquifer varies from 50 to 150 feet, with an average 100 feet (MW 1994; DWR 1970). This unit consists of a complex zone of interconnected sands, gravels and clay lenses (Durbin 1978). The aquifer may be in part correlative to older portions of Quaternary terrace deposits or the upper Aromas Red Sands. The 180-Foot Aquifer is separated from the 400-Foot Aquifer by a zone of discontinuous aquifers and aquitards ranging in thickness from 10 to 70 feet; the major aquitard in this sequence is also a marine blue clay.

The 400-foot aquifer has an average thickness of 200 feet and consists of sands, gravels, and clay lenses (LHI 1985). The upper portion of the aquifer may be correlative with the Aromas Red Sands and the lower portion with the upper part of the Paso Robles Formation (MW 1994).

An additional, deeper aquifer (also referred to as the 900-Foot Aquifer or the Deep Aquifer) is present in the lower Salinas Valley. A blue marine clay aquitard also separates this aquifer from the overlying 400-Foot Aquifer. This deeper aquifer consists of alternating layers of sand-gravel mixtures and clays (up to 900 feet thick), rather than a distinct aquifer and aquitard (MW 1994). The Deep Aquifer has experienced little development except near the coast where it is used to replace groundwater from the 180- and 400-Foot Aquifers rendered unusable by seawater intrusion. Water quality and yield data are scarce.

Because of the confined nature of the aquifers in the subbasin, an estimate of specific yield is not quite applicable. However, Yates (1988) estimated a storage coefficient of 0.018 in the northern Subbasin and 0.015 in the southern subbasin. A value of 0.075 was estimated for the central subbasin area. MW (1994) estimated specific yields for the three main aquifers in the Salinas Valley for their Integrated Ground and Surface Water Model (IGSM). The estimated values for the 180-Foot, 400-Foot, and Deep Aquifers were 8-16 percent, 6 percent, and 6 percent, respectively.

Heavy pumping of the 180- and 400-Foot Aquifers has caused significant seawater intrusion into both these aquifers, which was first documented in 1930s (DWR 1946a). Groundwater flow in the northernmost subbasin has been directed from Monterey Bay inland since at least this time. By 1995, seawater had intruded over five miles inland through the 180-Foot Aquifer, including the area beneath the towns of Castroville and Marina. Seawater has also intruded over two miles into the 400-Foot Aquifer by 1995.

Along with water quality issues associated with seawater intrusion, long-term agricultural production in the Salinas Valley has contributed to an extensive non-point source nitrate problem. Nitrate concentrations in many wells in the Valley exceed drinking water standards (DWR 1970; MCWRA 1997), including areas of the subbasin between Marina and Salinas, and to the northwest of Gonzales.

Recharge Areas

Due to the impermeable nature of the clay aquitard above the 180-Foot Aquifer, subbasin recharge (including that from precipitation, agricultural return flows, or river flow) is nil. Instead, recharge is from underflow originating in upper valley areas such as the Arroyo Seco Cone and Salinas River bed or the adjacent Eastside Subbasin, and more recently, from seawater intrusion. Historically, groundwater flowed from subbasins to the south and east through the subbasin and seaward to discharge zones in the walls of the submarine canyon in Monterey Bay (Durbin and others 1978; Greene 1970). With increased pumping in the adjacent Eastside Subbasin since the 1970s, groundwater flow is dominantly northeastward in the central and southern subbasin.

Groundwater Level Trends

Between 1964 and 1974, the amount of groundwater in storage has increased by 38,100 af. This increase continued from 1974 to 1984 with a rise of 8,200 af. This trend reversed itself between 1984 and 1994, when there was a decrease of 62,600 af in the amount of groundwater stored (MW 1998).

Groundwater Storage

Calculations done by DWR (2000) estimate the total storage capacity of this subbasin to be 7,240,000 af. As of 1998, there was 6,860,000 af of groundwater in storage (MW 1998).

Groundwater Budget (Type A)

A detailed groundwater budget for this subbasin was calculated for 1994 (MW 1998). Natural recharge into the aquifer was estimated to be 117,000 af. There is no artificial recharge. Applied water recharge is approximately 11,000 af, but because this recharge is caused by seawater intrusion, it is not included in the total basin inflow estimate. Subsurface inflow is estimated to be 21,000 af. Annual urban and agricultural extractions total approximately 130,000 af. There are no other extractions. Subsurface outflow is approximately 8,000 af.

Groundwater Quality

Characterization. The 180-Foot Aquifer is characterized by calcium sulfate to calcium sodium bicarbonate sulfate groundwaters (JSA 1990). Where this aquifer is intruded by seawater, the water is typically characterized by sodium chloride to calcium chloride. TDS values range from 223 to 1,013 mg/L, with an average value of 478 mg/L (based on 187 analyses; DHS 2000). TDS values from 30 public supply wells were reported as ranging from 233 to 996 mg/L, with an average value of 556 mg/L. EC values for this subbasin range from 320 to 1,526 µmhos/cm, with an average value of 741 µmhos/cm.

Impairments. Of 194 wells sampled during 1995 for nitrate in both the 180-Foot and 400-Foot Aquifers, 21 exceeded the drinking water standard. The average nitrate values for these aquifers were 35 and 9 mg/L, respectively (MCWRA 1997). Approximately 20,000 acres of the 180-Foot Aquifer and 10,000 acres of the 400-Foot Aquifer had been intruded by seawater (defined by chloride levels above 500 mg/L) by 1995 (MCWRA 1997).

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	33	0
Radiological	36	3
Nitrates	33	2
Pesticides	41	0
VOCs and SOCs	41	4
Inorganics – Secondary	33	7

[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		
	Total depths (ft)	
Domestic		
Municipal/Irrigation	Range: 150 - 886	Average: 464 (74 Well Completion Reports)

Active Monitoring Data

Agency	Parameter	Number of wells /measurement frequency
MCWRA	Groundwater levels	166 Varies (Geomatrix 2001)
MCWRA	Mineral, nutrient, & minor element.	218 Annually (Geomatrix 2001)
Department of Health Services (incl. Cooperators)	Title 22 water quality	82 Varies

Basin Management

Groundwater management:	MCWRA requires annual extraction reports form all agricultural and municipal well operators; and has researched, developed and/or constructed projects to reduce seawater intrusion, manage nitrate contamination in the ground water, provide adequate water supplies to meet current and future needs, and to hydrologically balance the ground water basin in the Salinas Valley.
Water agencies	
Public	Monterey County Water Resources Agency; Castroville CWD; City of Gonzales
Private	California Water Service Co. (CWS)–Salinas; CWS – Oak Hills

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Errata

Changes made to the basin description will be noted here.