2004 - Salinas Valley Groundwater Basin, Forebay Aquifer Subbasin, California Groundwater Bulletin 118 - Update

Salinas Valley Groundwater Basin, Forebay Aquifer Subbasin

- Groundwater Basin Number: 3-4.04
- County: Monterey
- Surface Area: 94,000 acres (147 square miles)

Basin Boundaries and Hydrology

The Salinas Valley Groundwater Basin – Forebay Aquifer Subbasin occupies the central portion of the Salinas Valley and extends from the town of Gonzales in the north to approximately three miles south of Greenfield.

The subbasin is bounded to the west by the contact of Quaternary terrace deposits of the subbasin with Mesozoic metamorphic rocks (Sur Series) or middle Miocene marine sedimentary rocks (Monterey Shale) of the Sierra de Salinas. To the east, the boundary is the contact of Quaternary terrace deposits or alluvium with granitic rocks of the Gabilan Range. The northern subbasin boundary is shared with the Salinas Valley –180/400-Foot Aquifer and –Eastside Aquifer and represents the southern limit of confining conditions in the 180/400-Foot Aquifer Subbasin. The southern boundary is shared with the Salinas Valley – Upper Valley Aquifer Subbasin and generally represents the southern limit of confining conditions above the 400-Foot Aquifer (MW 1994). This boundary also represents a constriction of the Valley floor caused by encroachment from the west by the composite alluvial fan of Arroyo Seco and Monroe Creek.

Intermittent streams such as Stonewall and Chalone Creeks drain the western slopes of the Gabilan Range and flow westward across the subbasin toward the Salinas River. The major tributary drainage to the Salinas River in the Salinas Valley is Arroyo Seco, which drains a large portion of the Sierra de Salinas west of Greenfield. The Subbasin boundaries are generally correlative with those of the Forebay Subarea of the Monterey County Water Resources Agency (MCWRA). Average annual precipitation is approximately 11 inches at the Valley floor to 17 inches at the western margin of the subbasin.

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 (Durbin 1978) generally follows the western margin of the Valley from King City in the south to Monterey Bay in the north. 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 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. Along the southern margins of the Forebay Aquifer Subbasin, the Pancho Rico

Formation is the equivalent of the Purisima Formation. The depth to the base of fresh water in the subbasin ranges from about 200 feet at the eastern Valley margin to 2,200 feet at the western margin (Durbin 1978) with a sharp rise from about 2,000 to 1,000 feet at the southern Subbasin margin.

Water Bearing Formations

The primary water-bearing units of this subbasin are the same units that produce water in the adjacent 180/400-Foot Aquifer Subbasin – namely, the 180-Foot Aquifer and the 400-Foot Aquifer. However, the near-surface confining unit (Salinas Aquitard) of the 180/400-Foot Aquifer Subbasin does not extend into the Forebay or other subbasins. Groundwater in the Forebay Aquifer Subbasin is unconfined and occurs in lenses of sand and gravel that are interbedded with massive units of finer grained material (Durbin 1970).

The thickness of the 180-foot aquifer varies from 50 to 150 feet in the Salinas Valley, with an average 100 feet (MW 1994; DWR 1970). The 180-Foot Aquifer may be in part correlative to older portions of Quaternary terrace deposits or the upper Aromas Red Sands. More recent studies suggest the 400-Foot Aquifer exist not only in the 180/400-Foot Aquifer Subbasin, but also in lower Forebay Aquifer Subbasin (MW 1994). 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 this aquifer may be correlative with the Aromas Red Sands and the lower portion with the upper part of the Paso Robles Formation (MW 1994). The 180-Foot Aquifer is separated from the 400-Foot Aquifer by a zone of discontinuous sands and blue clays called the 180/400-foot Aquiclude (MW 1998) which ranges in thickness from 10 to 70 feet.

Recent reports apply the titles "shallow zone" and "deep zone" to the 180-Foot Aquifer and the 400-Foot Aquifer, respectively, in the Forebay Subbasin (MW 1998).

An additional deeper aquifer (also referred to as the 900-Foot Aquifer or the Deep Aquifer) is present in the lower and central Salinas Valley, including beneath the Forebay Aquifer Subbasin. 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. Well yield and water quality data for this aquifer are scarce but available data suggests a high sodium content limits the water's agricultural use.

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. An average weighted specific yield of 12.1 percent was derived by the DWR (1955) for three depth zones in the Subbasin within the interval 20 to 200 feet below grade. Yates (1988) estimated a storage coefficient of 0.180 for the Arroyo Seco Cone and 0.306 for the northern Subbasin.

Groundwater quality issues primarily stem from long-term agricultural production in the Salinas Valley that has contributed to an extensive non-point source nitrate problem. Nitrate concentrations in many wells in the Valley exceed drinking water standards (DWR 1970), including in wells throughout the Forebay Aquifer Subbasin (MCWRA 1997).

Recharge Areas

Subbasin recharge is primarily from percolation in stream channel deposits in the Arroyo Seco and Salinas River drainages (DWR 1946a). About half again as much recharge results from applied irrigation water (MW 1998). Recharge from direct precipitation is minor and probably occurs only in wet years. Subsurface flow from the Upper Valley Subbasin and subsurface flow from the east and west subbasin boundaries account for the remainder of recharge.

Groundwater flow is generally in a down-valley direction. Recharge from McCoy Creek east of Gonzales appeared to create a slight groundwater mound at the northeast corner of the subbasin during Fall 1995 (MCWRA 1997).

Groundwater Level Trends

From 1964 to 1974, the amount of groundwater in storage increased 23,300 af. This increasing trend continued through 1974 to 1984, with an increase of 60,100 af. Between 1984 and 1994, the amount of groundwater in storage declined 99,700 af (MW 1998).

Groundwater Storage

Calculations made by DWR (2000) for this report indicate that the total storage capacity of the subbasin is approximately 5,720,000 af. As of 1994, there was an estimate of 4,530,000 af of stored groundwater in the subbasin (MW 1998).

Groundwater Budget (Type A)

A detailed budget was available for 1994 (MW 1998). Natural recharge is estimated to be 154,000 af. Applied water recharge is included in this figure. Subsurface inflow is approximately 31,000 af. Annual urban and agricultural extractions total approximately 160,000 af. Subsurface outflow is estimated to be 20,000 af.

Groundwater Quality

Characterization. The eastern subbasin contains a lower quality sodium sulfate water. The western subbasin contains good quality calcium bicarbonate waters that are generally derived from recharge along the Arroyo Seco and Salinas Rivers (JSA 1990). TDS levels range from 300 to 1,100 mg/L, with an average value of 624 mg/L (based on 68 analyses; DHS 2000). The Department of Health Services, which monitors Title 22 water quality standards, reports TDS values in the Upper Forebay area (formerly basin number 3-4.04) ranging from 380 to 600 mg/L, with an average value of 490 mg/L (based on analyses of 2 public supply wells). The DHS also reports TDS values for the Lower Forebay Aquifer (formerly basin number 3-4.03) ranging from 410 to 1,100 mg/L, with an average value of 654 mg/L (based on analyses of 13 public supply wells). EC values range from 721 to 3110 µmhos/cm, with an average value of 1,590 µmhos/cm (based on 7 wells; DWR 1969b). DHS (2000) reports EC values in the subbasin ranging from 389 to 1,600 µmhos/cm, with an average value of 936 µmhos/cm (based on 73 analyses).

Impairments. Of 81 wells sampled by the MCWRA in 1995, 30 exceeded the drinking water standard for nitrate (45 mg/L). The average concentration was 45 mg/L (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	15	2
Radiological	17	0
Nitrates	14	3
Pesticides	14	0
VOCs and SOCs	15	0
Inorganics – Secondary	15	6

[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: 120 - 807	Average: 349 (30 Well Completion Reports)

Active Monitoring Data

Agency	Parameter	Number of wells /measurement frequency
MCWRA	Groundwater Levels	89 Varies (Geomatrix 2001)
MCWRA	Groundwater Quality	91 Annually (Geomatrix 2001)
Department of Health Services (incl. Cooperators)	Title 22 water quality	35 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 groundwater, provide adequate water supplies to meet current and future needs, and to hydrologically balance the groundwater basin in the Salinas Valley.
Water agencies	
Public	Monterey County Water Resources Agency; City of Soledad; City of Greenfield; State Correctional Facility at Soledad
Private	Over 15 private small water systems

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Errata

Changes made to the basin description will be noted here.