Madeline Plains Groundwater Basin

- Groundwater Basin Number: 6-2
- County: Lassen
- Surface Area: 156,150 acres (244 square miles)

Basin Boundaries and Hydrology

Madeline Plains Groundwater Basin is a closed basin bounded by mountainous terrain consisting predominantly of Plio-Pleistocene basalt. The mountains are dominated by the old volcanic cones of Observation Peak, McDonald Peak, and Heavey Mountain. The basin includes the subbasins of Madeline and Ravendale. The Ravendale and Madeline subbasin boundary is near Termo. Annual precipitation ranges from 11 to 17 inches.

Hydrogeologic Information

Water-Bearing Formations

The principal water-bearing units in the basin are Holocene sedimentary deposits, Pleistocene lake and near-shore deposits, and Plio-Pleistocene and Pleistocene basalt flows. The following summary of the formations is from DWR (1963).\

Holocene Sedimentary Deposits. The Holocene sedimentary deposits consist of intermediate alluvium and alluvial fans located at the margins of the valley floor. The alluvium consists of unconsolidated silt, clay, sand, and gravel. The alluvial fan deposits consist of unconsolidated, poorly sorted silt, sand, and gravel, with some clay. The deposits are moderately permeable, have limited areal extents, and yield moderate quantities of groundwater to shallow wells. Thickness of the deposits ranges to 100 feet.

Pleistocene Near-shore Deposits. These deposits are slightly consolidated beach deposits of sand and gravel with minor amounts of silt and clay found along the margins of the Madeline Plains. Thickness of the deposits ranges to 75 feet. These are moderately permeable and yield moderate supplies of water to shallow wells. The deposits serve primarily as recharge areas.

Pleistocene Lake Deposits. The Pleistocene lake deposits consist of slightly to moderately consolidated clay, silt, and fine sand with interbedded lava flows. Thickness of the deposits range to 1000 feet. These are in the central portions of Madeline Plains. Yields may be sufficient for domestic and stock uses with greater yields occurring from areas where the deposits intercept buried lava flows.

Plio-Pleistocene and Pleistocene Basalt. The basalt units consist of gray-black jointed, fractured, vesicular basalt. The basalt makes up approximately 80 percent of the land surface surrounding Madeline Plains. The unit is highly permeable where it is fractured or jointed. Buried flows provide large amounts of groundwater to wells and also serve as recharge to the basin. The basalt interbeds range in thickness to 50 feet. Well yields are generally less than 500 gpm. Some wells reportedly yield between 1,000 and 3,800 gpm.

Restrictive Structures

A group of northwest-southeast trending faults occur in the northwest part of the basin. Movement along several of these faults has uplifted the ridge that separates Dry Valley from Madeline Plains. The ridge may partially restrict groundwater movement between the two regions.

Recharge Areas

The recharge areas for the basin consist of the Plio-Pleistocene basalts exposed in the uplands surrounding the basin.

Groundwater Level Trends

Groundwater levels in the basin declined 3 to 8 feet during the period of the early 1990s and have mostly recovered through 1999.

Groundwater Storage

Groundwater Storage Capacity. The groundwater storage capacity to a depth of 400 feet is estimated to be 2 million acre-feet (DWR 1963). This estimate includes the Grasshopper Basin to the west. DWR (1963) notes that the quantity of usable water is unknown.

Groundwater Budget (Type B)

Estimates of groundwater extraction are based on a survey conducted by the California Department of Water Resources during 1997. The survey included land use and sources of water. Estimates of groundwater extraction for agricultural and municipal/industrial uses are 22,000, and 21 acre-feet, respectively. Deep percolation from applied water is estimated to be 3,700 acre-feet.

Groundwater Quality

Characterization. The water type in the basin is bicarbonate with mixed cationic character. The concentration of total dissolved solids ranges from 81 to 1790 mg/L, averaging 402 mg/L (DWR unpublished data).

Impairments. Areas of the basin have high conductivity and salinity concentrations. There are locally high total dissolved solids, hardness, nitrates, iron, boron, calcium, magnesium, sodium, ASAR, sulfate, and chloride that occur in the basin.

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	1	0
Radiological	0	0
Nitrates	1	0
Pesticides	0	0
VOCs and VSOCs	0	0
Inorganics – Secondary	1	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 Production Characteristics

Well yields (gal/min)

Well yields are generally less than 500 gpm. Some wells reportedly yield between 1,000 and 3,800 gpm (DWR 1963)

Total depths (ft)

Domestic	Range: 35 – 700	Average: 159 (96 Well Completion Reports)
Irrigation	Range: 65 – 1,506	Average: 485 (37 Well Completion Reports)

Active Monitoring Data

Agency	Parameter	Number of wells /measurement frequency
DWR	Groundwater levels	2 wells/semi-annually
DWR	Miscellaneous water quality	6 wells

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Errata

Changes made to the basin description will be noted here.