Butte Valley Groundwater Basin

- Groundwater Basin Number: 1-3
- County: Siskiyou
- Surface Area: 79,700 acres (125 square miles)

Basin Boundaries and Hydrology

Butte Valley Groundwater Basin is a complexly downfaulted basin located near the west edge of the Modoc Plateau, just south of the Oregon border. It is bounded on the east by a prominent northwestward trending fault block (the Mahogany Mountain ridge) that separates Butte Valley from the Lower Klamath Lake marshland to the east. The basin is bounded on the southeast by Sheep Mountain and Red Rock Valley, and on the north, south and west by the Cascade Mountains (Wood 1960). Annual precipitation ranges from 13- to 21-inches, increasing to the north.

Hydrogeologic Information

Water-Bearing Formations

The principal aquifer systems in the basin are Pleistocene to Holocene age alluvial fan, lake deposits, pyroclastic rocks, and Butte Valley Basalt, and Pliocene to Pleistocene volcanic rocks of the "High Cascades". The following descriptions are from Wood (1960) unless otherwise noted.

Pleistocene to Holocene Alluvial Fan Deposits. Isolated remnants of alluvial fan deposits are located on the west side of Butte Valley. These deposits are composed of poorly-sorted volcanic rock debris, cobbles, gravel, sand and clay from the Cascade Range. The deposits are coarse near the mountain fronts and grade into fine materials in the lower part of the fans. The fans interfinger with lake deposits at depth. The deposits have low permeability except where well-sorted gravel lenses are encountered and generally yield small quantities of water to wells. Thickness of the deposits range up to 350 feet.

Pleistocene to Holocene Lake Deposits. The Lake deposits consist of sand, silt, clay, ash, lenses of diatomaceous clay, and local stringers of gravelly sand. These deposits generally thicken to the west and unconformably overlie the older volcanic rocks of the High Cascades. In the central part of the valley a calcium carbonate cemented clay hardpan soil is usually present within several feet of the surface. In the remainder of the valley, soils are less restrictive.

The lake deposits vary widely in their ability to transmit water. The portion of the basin west of Highway 97 usually has fine grained silts and clays of very low permeability that commonly serve as confining layers. Coarser layers in the western and northwestern part of the basin generally yield sufficient water for stock wells.

Along the east side of the basin east of Highway 97 the deposits are loose, fine to medium grained bedded sands interbedded with clay. Near the eastern valley border, the deposits contain a larger percentage of sand where yields up to 2,500 gpm have been documented. In the eastern half of the basin specific capacities range from 9- to 62-gpm per foot of drawdown. In the southern part of the basin these deposits are interfingered with the Butte Valley Basalt which provides recharge in the subsurface. Individual well yields exceeding 4,100 gpm have been recorded.

Locally, and along the eastside basin margin in particular, sandy lake deposits may be interfingered with even more highly permeable deposits of beach sand and talus debris.

Thickness of the deposit in the basin is variable and can ranges from 350 to 950 feet. Generally, lakebed deposits increase in thickness to the west.

Late Pleistocene or Holocene Butte Valley Basalt. The Butte Valley basalt is a highly permeable uniform sheet of vesicular basalt that overlies and interfingers with lakebed deposits. The basalt ranges in thickness to 80 feet, averaging approximately 40 feet. The subsurface extent is estimated to be 27 square miles. The fractured basalt is commonly rough, broken, cavernous and scoriaceous at contacts between relatively thin flow units. The basalt is predominantly located in the southern and southeastern region of the valley at depths of less than 150 feet. The rough broken surface exposures provide areas of recharge.

This deposit yields large quantities of water to wells, primarily in the Macdoel-Mount Hebron area. Specific capacities of 100 gpm per foot of drawdown are common and values up to 1,100 gpm per foot of drawdown have been documented. A temporary annual overdraft occurs during the latter part of the irrigation season evidenced by well interference from over-utilization (USBR 1980). In 1980 it was generally acknowledged that this aquifer was developed to its maximum productivity.

Holocene and Pleistocene Pyroclastic Rocks. Pyroclastic rocks are typically well consolidated, massive to thin-bedded lapilli tuffs and cindery tuff breccias that are generally cross-bedded and include abundant fragments of basalt and scoria. The deposits underlie a region located east and southeast of Macdoel ranging up to 400 feet in thickness. These deposits rest upon lake deposits and are partially overlapped by Butte Valley basalt. These rocks have largely been developed for stock wells.

Pliocene to Pleistocene High Cascades Volcanics. The High Cascade Volcanics include successive sheets of basalt, basaltic andesite, discontinuous layers of massive basaltic tuff and tuff breccia, and some isolated lapilli tuff and cinder-cone deposits. These rocks form the boundaries on the western, northern, and eastern extents of the basin and underlie the lake bed deposits. The rocks are highly fractured, very permeable and are a major element of the groundwater storage reservoir and recharge mechanism for the basin. The individual flow units range in thickness from 10- to 50-feet and intermittently up to 100 feet. Wells are routinely developed in these volcanic rocks within and beyond the margin of the basin and often produce over 3,000 gpm. Individual well yields are quite variable however, depending on the flow thickness and number of flow contacts intercepted, as well as vertical fracturing. Groundwater is usually confined in these rocks within the valley and along the valley margin by lake deposits. Tuffaceous deposits are essentially non-water-bearing except for fracture zones and intercalated basaltic flows. These volcanic rocks are extremely valuable as an intake media for groundwater recharge due to their large areal extent beyond the basin margin.

Recharge Areas

Natural recharge in this closed basin is primarily from the infiltration of precipitation, underflow from the adjacent volcanic rocks (on the north, west and south margins) and streamflow losses. In the southern part of the valley, seepage losses from unlined canals along the western fringe and deep percolation from irrigation also contribute to recharge.

Groundwater Level Trends

Analysis Incomplete.

Groundwater Storage

Groundwater Storage Capacity. The basin boundary has been delineated by the contact of the alluvial fill with the surrounding hard rock. Although some wells produce water from the alluvium, many wells also produce water from underlying volcanic rock. All units in the valley are hydrologically interconnected. The volcanic units provide storage and recharge to the basin and also serve as recharge and storage to areas outside of the basin. Due to the complexity of the region with respect to the extensive network of volcanic recharge/storage areas, the amount of groundwater in storage has not been estimated.

Groundwater Budget (Type B)

Estimates of groundwater extraction are based on a survey conducted by the California Department of Water Resources in 1991. The survey included land use and sources of water. Estimates of groundwater extraction for agricultural, municipal/industrial; and environmental wetland uses are 47,000, 320 and 4,500 acre-feet respectively. Deep percolation of applied water is estimated to be 9,900 acre-feet.

Groundwater Quality

Characterization. The chemical quality of most of the groundwater in the basin is satisfactory for most uses and is of a mixed-cation to magnesium-bicarbonate character. The dissolved-solids content is commonly less than 360 mg/l. However, several wells have had total dissolved solids concentrations in excess of 1,100 mg/L (with one isolated, atypical sample from a 107 foot well developed in lake sediments reported at 1,890 mg/L). These wells are probably degraded by evaporites from localized playa deposits. Waters from wells located in volcanic rocks adjacent to, or interfingered with the lake deposits, or from deep wells developed beneath the confining lake deposits typically contain a low to moderate dissolved-solids content. Shallow wells developed with hydraulic continuity to Meiss Lake, where salts from natural inflow and irrigation-return flows are concentrated by evaporation, could be degraded with high percentages of sodium and dissolved-solids concentrations. Several deeper wells near Dorris that were developed near a fault in the older volcanic rocks of the

High Cascades have had hydrogen sulphide odors and detectable concentrations in excess of 2 mg/L. Some shallow wells in the Dorris area have been moderately degraded by surface sources of arsenic (DWR 1968).

Impairments. Locally high arsenic, iron, manganese, boron, total dissolved solids, sodium, calcium, ASAR, ammonia, hydrogen sulphide, phosphorus, and electrical conductivity 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	2	0
Nitrates	1	0
Pesticides	0	0
VOCs and SVOCs	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)	
Irrigation	Range: 200 – 5000	Average: 2358 (20 Well Completion Reports)
	Total depths (ft)	
Domestic	Range: 32 - 1031	Average: 185 (152 Well Completion Reports)
Irrigation	Range: 29 - 1506	Average: 343 (149 Well Completion Reports)

Active Monitoring Data

Agency	Parameter	Number of wells /measurement frequency
DWR	Groundwater levels	28 wells semi-annually
DWR	Miscellaneous Water Quality	13 wells biennial
Department of Health Services and cooperators	Miscellaneous Water Quality	8

Basin Management

Groundwater management:	Siskiyou County adopted a groundwater management ordinance in 1998.
Water agencies	
Public	Butte Valley ID
Private	

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Errata

Changes made to the basin description will be noted here.