Mad River Groundwater Basin, Mad River Lowland Subbasin

- Groundwater Basin Number: 1-8.01
- County: Humbolt
- Surface Area: 25,600 acres (40 square miles)

Basin Boundaries and Hydrology

The Mad River Lowland Subbasin is one of the principal groundwater basins in the Eureka area. The basin includes the coastal floodplain from the Freshwater Fault north to the Mad River and the elevated terrace areas to the east (Clark 1990). The basin is bounded by Arcata Bay to the south, the Mad River to the north, and mountains of the Jurassic and Cretaceous Franciscan Formation to the east. The basin also includes Blue Lake Valley to the east which is bounded by both the Franciscan Formation and outcrops of the Wildcat series sediments (Strand 1962). The Wildcat series is a group of five formations ranging in age from Miocene to Pleistocene consisting of sandstone, marine siltstone, and claystone (Evenson 1959).

Between Mad River and Arcata Bay, the coastal plain is dissected by flood-stage channels of the river that are 15- to 20-feet deep. The river discharges to the ocean approximately 5 miles north of Arcata Bay and is tidal for about 1 mile inland.

Annual precipitation in the basin ranges from 39- to 53-inches, increasing to the northeast.

Hydrogeologic Information

The Mad River Groundwater Basin in Blue Lake Valley and in the Mad River floodplain is composed of alluvium and is underlain by the Hookton Formation. Sand dunes are present along the coastline edge of the basin. The upland areas to the north and east are above the alluvium of the river floodplain and are comprised solely of the Hookton Formation. Underlying the Hookton Formation are either Tertiary Wildcat group sediments or the basement rocks of the Jurassic and Cretaceous age Franciscan Formation. The entire basin area is underlain by bedrock of the Franciscan Formation composed of consolidated shale, sandstone, conglomerate, schist, and basalt (DWR 1973).

Seawater intrusion has occurred in the shallow aquifers near the ocean and bay areas (DWR 1973); however, seawater is not present in the Hookton Formation to any appreciable extent landward of the coastline in this area. Wells located near the coastline are constructed in the Hookton Formation to avoid seawater contamination. Wells that are installed in dune sand tap freshwater overlying seawater (Fuller 1975).

Water-Bearing Formations

Water-bearing formations include Quaternary dune sand deposits, river channel deposits, floodplain deposits, and the Hookton Formation. The major aquifer in the basin is the alluvium that underlies the floodplain of the

Mad River (Fuller 1975). To a lesser extent, the Hookton Formation provides well yields sufficient for domestic use (Fuller 1975). Groundwater in the alluvium, dune sand, terrace, and river channel deposits is unconfined.

Holocene Dune Sand. Beach and dune sand deposits occur in an almost continuous strip along the coast. The dune sand is more than 100 feet thick and attains a maximum width of three-fourths of a mile along the North Spit between the entrance to Arcata Bay and the mouth of the Mad River. The dune sand is loose, subangular to subrounded, fairly well sorted, fine to coarse grained, and gray or brownish gray in color (Evenson 1959). The dune is developed as a source of water supply for shallow wells or well points that are driven into the sand far enough to penetrate the lens of freshwater overlying seawater. Recharge to the dune sand is almost wholly from local precipitation (Fuller 1975).

Holocene River Channel Deposits. River channel deposits composed of coarse gravel and small amounts of coarse sand lie along the present channels of the Mad River upstream from the floodplain (Fuller 1975). The thickness of these deposits is unknown but is estimated to be 50 feet. Little or no wells tap the river channel deposits which are saturated and presumably highly permeable (Evenson 1959).

Holocene Alluvium. Alluvium underlies the majority of the irrigable land in the basin and is the most productive hydrogeologic unit in the area in terms of both yield to wells and total groundwater produced (DWR 1973). The alluvium typically contains many intersecting gravel channels up to 40 feet thick surrounded by finer-grained floodplain deposits. The alluvium consists of clay, sand, and gravel underlying alluvial plains of fluvial origin except near the coast where estuarine clay and silt interfinger. The maximum thickness of the alluvium may be as much as 200 feet near the mouth of the river. Most of the wells are less than 70 feet deep and do not penetrate the entire thickness of the alluvium except along the coastline where they likely tap into the Hookton Formation to avoid seawater contamination. Yields of wells constructed in alluvium range up to 1,200 gpm. Specific capacities range from 20- to 600-gpm per foot of drawdown (DWR 1973).

Pleistocene Terrace Deposits. Pleistocene terrace deposits are present along the Mad River Valley in the Blue Lake area. They occur beneath river benches and on higher slopes where they form step-like surfaces and are up to 100 feet thick. The terrace deposits consist of clay, sand, and gravel of fluvial origin and are locally an important source of groundwater (DWR 1973). They yield water to wells locally from bodies of perched groundwater and from deposits in the principal zone of saturation.

Pleistocene Hookton Formation. The Hookton Formation underlies the alluvium in the river floodplain between Aracta Bay and Mad River and is exposed in the hills to the east. The formation consists of clay, sand, and gravel. The formation is primarily fluvial in origin and ranges in thickness to 400 feet (Evenson 1959). The formation supplies unconfined groundwater to many domestic wells.

Recharge Areas

Groundwater recharge occurs from percolation from the Mad River and small tributary creeks in the foothills to the east of Arcata and deep percolation to floodplain deposits from precipitation and applied water. The Hookton Formation is likely recharged by rainfall in the upland recharge areas east of Arcata (DWR 1973). Some water also moves laterally into the alluvium from adjacent formations and some moves upward from leakage due to differences in head between the alluvium and underlying formations (Fuller 1975).

Groundwater Level Trends

Analysis incomplete.

Groundwater Storage

Groundwater Storage Capacity. Evenson (1959) estimates storage capacity in the subbasin based on the depth interval for the highest known water levels to sea level for the Arcata Plain and from the highest average water level to the maximum depth of groundwater wells for the Blue Lake Valley. The surface area was estimated to be 26,700 acres and specific yield averaged 21 percent. Based on these assumptions, storage capacity for the subbasin is estimated to be 25,000 acre-feet.

Groundwater Budget (Type B)

Estimates of groundwater extraction are based on a survey conducted by the California Department of Water Resources in 1996. The survey included land use and sources of water. Estimates of groundwater extraction for agricultural and municipal/industrial uses are 6,300 and 35 acre-feet respectively. Deep percolation from applied water is estimated to be 1,400 acre-feet.

Groundwater Quality

Characterization. Magnesium-calcium bicarbonate and calcium-magnesium bicarbonate type waters are found in the basin. Total dissolved solids (TDS) range from 55- to 280-mg/L, averaging 184 mg/L (DWR unpublished data).

Impairments. Groundwater in the basin has high iron concentrations and localized high manganese, fluoride, and phosphorus concentrations.

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	2	0
Radiological	2	0
Nitrates	2	0
Pesticides	0	0
VOCs and SVOCs	1	0
Inorganics – Secondary	2	1

[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)

The average well yield is estimated to be 72 gpm. The maximum yield is estimated to be 120 gpm. (DWR 1975)

Total depths (ft)

Domestic	Range: 10 - 303	Average: 85 (277 Well Completion Reports)
Irrigation	Range: 25 - 260	Average: 81 (31 Well Completion Reports)

Active Monitoring Data

Agency	Parameter	Number of wells /measurement frequency
DWR	Groundwater levels	4 wells semi-annually
DWR	Miscellaneous water quality	5 wells biennially
Department of Health Services and cooperators	Miscellaneous water quality	2

Basin Management

Groundwater management:	No known groundwater management plans, groundwater ordinances, or basin adjudications.
Water agencies	
Public	Fieldbrook CSD; McKinleyville CSD; Humboldt Bay MWD
Private	

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Errata

Changes made to the basin description will be noted here.