Smith River Plain Groundwater Basin

- Groundwater Basin Number: 1-1
- County: Del Norte
- Surface Area: 40,450 acres (63 square miles)

Basin Boundaries and Hydrology

The Smith River Plain Groundwater Basin is located in Del Norte County in the extreme northwest corner of California. The plain is irregular in shape narrowing to the south against the steep scarp of the faulted mountain headland. The major structural feature in the basin is the inferred Del Norte fault which constitutes the basin boundary to the north and east (USBR 1960). The north end of the plain narrows at the mouth of the Smith River to a marine terrace less than one mile wide that continues into Oregon (DWR 1987). The basin is bounded to the north, east, and south by Mesozoic Franciscan Formation (Strand 1963).

The Smith River crosses the northern portion of the plain near the town of Smith River and is the major watercourse responsible for most of the floodplain deposits in the area. Lake Earl and Talawa are shallow brackish lakes in the west central part of the plain and form collection basins for runoff from several minor streams (Back 1957).

Annual precipitation in the basin ranges from 65- to 77-inches, increasing to the northeast.

Hydrogeologic Information

The Smith River Plain is an emerged low-relief marine terrace. The surface of the plain is comprised of sand dunes, floodplain deposits, unconsolidated river terrace deposits, and surface exposures of the marine Battery Formation. Underlying the terrace deposits are the marine Battery Formation and the St. George Formation. Beneath the St. George Formation is basement rock of the Jurassic-Cretaceous Franciscan Complex.

Water-Bearing Formations

Quaternary alluvial fan, flood-plain, terrace, and Battery Formation deposits form the primary water-bearing formations in the basin. The St. George Formation and basement rock of the Franciscan formation yield very little water to wells.

Holocene Alluvial Fan Deposits. Alluvial fan deposits form a steep, nearly continuous apron less than one mile wide along the base of the mountains. These deposits consist primarily of poorly-sorted, subrounded rocks in a silty clay matrix and are up to 50 feet thick. The occasional sand and gravel lenses represent buried stream channels. The bulk of the unit was probably derived from landslides and possibly mudflows rather than entirely from stream deposition (DWR 1987). Permeability of the fan deposits is generally low due to large amounts of interstitial clay; however, sand and gravel lenses near the western edges of the fans have a relatively high permeability. In general, yields to wells penetrating only alluvial fan deposits are relatively low but can be highly variable.

Holocene Floodplain Deposits. Floodplain deposits underlie the present floodplain of the Smith River and its tributaries. These deposits rest on either basement rock or the Battery Formation and overlie river terrace deposits along the edge of the floodplain. The overlying deposits consist of unconsolidated clay, sand, and gravel and range in thickness from about 40- to 95-feet. The deposits are commonly covered with a shallow, silty soil 2- to 3-feet in thickness. The sands and gravels are well-rounded and poorly sorted. Boulders and cobbles are common where the Smith River flows out of the mountains. As the floodplain spreads west over the plain, the alluvial deposits generally become finer (DWR 1987). The deposits contain large amounts of unconfined water and are the most productive aquifers in the Smith River Plain. Most of the irrigation wells in the area obtain water from this zone. Yields to wells range from about 200- to 800-gpm and permeabilities range from about 6,000- to 10,000-gpd per square foot (DWR 1987).

Pleistocene Terrace Deposits. The Pleistocene age terrace deposits are associated with Smith River and Rowdy Creek and serve as the major aquifer in the northern part of the basin and also provide recharge to adjacent formations. These deposits contain poorly-sorted silt, sand, and gravel and include some clay - predominantly in the upper portion. Generally, these deposits become coarser with depth and large boulders are often encountered at the base. Thickness of the deposits generally range from about 30- to 55-feet, but may exceed 75 feet in the area south of the community of Smith River (DWR 1987). These deposits are underlain by basement rocks, but locally they may rest on the Battery or St. George Formations. The river terrace deposits are moderate to highly permeable, with permeabilities ranging from 1,000- to 2,000-gpd per square foot (DWR 1987). Generally, well yields are not high due to the limited saturated thickness. Several irrigation wells in the Fort Dick and Rowdy Creek areas yield 140- to 400-gpm. Some of the smaller terraces may not have enough storage-carryover capabilities to provide adequate water supplies throughout the summer and fall months because of limited areal extents.

Pleistocene Battery Formation. The Pleistocene Battery Formation is a thin, flat-lying, marine terrace deposit that unconformably overlies the basement rocks of the Franciscan complex or the Pliocene St. George Formation. It consists of alternating sand and clay beds with interbedded continental deposits of stream gravel and sand. Well logs and seismic data indicate that it is 30- to 70-feet thick. It underlies most of the plain south and east of Lake Earl and forms the narrow marine terrace north of the mouth of Smith River. The Battery Formation is the principal aquifer in the southern two-thirds of the plain. The producing zones consist of lenticular beds of fine to medium grained, well sorted sand. Depth to this aquifer ranges from 5- to 30-feet and averages about 20 feet. Groundwater in this aquifer is either perched or unconfined. Permeability ranges from 150- to 900-gpd per square foot and is commonly about 350- to 450-gpd per square foot (Back 1957). The formation is moderately permeable, but has limited saturated thickness. Well yields are large enough for domestic and limited irrigation uses.

Tertiary Pliocene St. George Formation. The Pliocene St. George Formation consists of massive, poorly indurated siltstone and shale that contain irregular and sporadic lenses of sand and pebbles. The formation thickness is estimated at about 400 feet (Back 1957). The permeability of the St. George Formation is very low but contains two prominent joint sets that yield limited water to some wells.

Restrictive Structures

Sand dunes within the basin form a narrow strip about one mile wide from west of Crescent City to the mouth of Smith River. These dunes form elongated ridges as much as 60 feet high and form a barrier to surface runoff from the central part of the plain resulting in the formation of lake Earl and Lake Talawa (DWR 1987).

Recharge Areas

Recharge is accomplished by direct infiltration of precipitation, subsurface inflow from surface water/precipitation infiltration of alluvial fans or dune areas, and infiltration of runoff in the lower reaches of the Smith River and other permeable stream channels (Back 1957).

Groundwater Level Trends

Review of hydrographs for long-term comparison of spring-spring groundwater levels indicates a slight decline associated with the 1976-77 and 1987-94 droughts, followed by a recovery to pre-drought conditions of the early 1970's and 1980's. Generally, groundwater level data show a seasonal fluctuation of approximate 5- to 15-feet for normal and dry years. Overall, there does not appear to be any increasing or decreasing trends in groundwater levels.

Groundwater Storage

Groundwater Storage Capacity. Storage capacity in the basin is estimated to be 99,350 acre-feet based a surface area of 31,070 acres, a depth interval of 10- to 35-feet below ground surface, and an average specific yield of 12.8 percent (Back 1957).

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 landuse and sources of water. Estimates of groundwater extraction for agricultural and municipal/industrial uses are 12,000 and 990 acre-feet respectively. Deep percolation from applied water is estimated to be 3,100 acre-feet.

Groundwater Quality

Characterization. Groundwater in the basin consists of magnesium bicarbonate and magnesium-sodium bicarbonate type waters. Increasing proportions of sodium and chloride are found in waters from the southern half of the basin (Back 1957). Total dissolved solids (TDS) range from 50- to 500-mg/L, averaging 100 mg/L (DWR unpublished data).

Impairments. High levels of iron are found in some areas. Locally high chloride, calcium, and TDS are also found.

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	23	1
Radiological	12	0
Nitrates	26	0
Pesticides	8	0
VOCs and SVOCs	15	1
Inorganics – Secondary	23	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 Production characteristics

	Well yields (gal/min)	
Municipal/Irrigation	Average well yield is estimated to be 50	Maximum well yield is estimated to be 500. (DWR 1975)
	Total depths (ft)	
Domestic	Range: 15 - 400	Average: 44 (1,017 Well Completion Reports)
Municipal/Irrigation	Range: 16 - 110	Average: 39 (19 Well Completion Reports)

Active Monitoring Data

Agency	Parameter	Number of wells /measurement frequency
DWR	Groundwater levels	7 wells semi-annually
DWR	Miscellaneous water quality	10 wells biennial
Department of Health Services and cooperators	Miscellaneous water quality	33

Basin Management

Groundwater management:	No known groundwater management plans, groundwater ordinances, or basin adjudications.
Water agencies	
Public	Smith River CSD, Church Tree CSD., Bertsch-Oceanview CSD, Klamath CSD, Roosevelt Water System
Private	Crescent City WC

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Errata

Changes made to the basin description will be noted here.