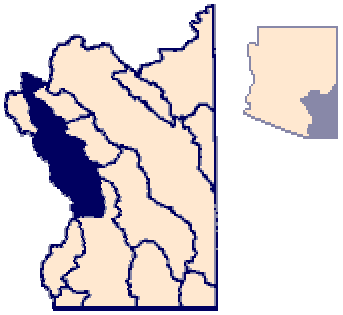
LOWER SAN PEDRO BASIN



The Lower San Pedro basin is in southeastern Arizona and contains approximately 1,600 square miles (Figure 17). The basin lies entirely within the Basin and Range physiographic province and consists of the northwest-trending San Pedro River Valley and the surrounding mountains. Elevations along the valley floor range from 3,400 feet above mean sea level at the basin's southern end to 1,920 feet above mean sea level at its northern end near Winkelman, Arizona. The mountains bordering the basin range from 6,000 feet to over 8,000 feet in elevation. The basin is bounded on the north and east by the Galiuro and Dripping Springs Mountains, and on the west by the Rincon, Santa Catalina, Black, and Tortilla Mountains.

The San Pedro River is the major surface drainage in the basin. It enters the U.S. near Palominas, Arizona, and flows northwest for about 140 miles before emptying into the Gila River near Winkelman, Arizona (Brown and Aldridge, 1973). The Lower San Pedro basin contains the last 65 miles of the river, from an area called "the Narrows", (about 12 miles north of Pomerene, Arizona) downstream to its confluence with the Gila River near Winkelman. The San Pedro River's main tributary within this reach is Aravaipa Creek.

The Gila River enters the northern end of the basin a few miles east of Winkelman, then flows north and west for approximately 15 miles before exiting the basin near Kelvin, Arizona. The very northern section of the basin contains the Muddy Creek Drainage, which flows from the Dripping Springs Mountains south to the Gila River.

In the Lower San Pedro basin two major water-bearing units have been identified based on their ability to transmit and supply groundwater: the streambed alluvium that forms the San Pedro River's channel and floodplain, and the alluvial basin-fill sediments that fill the valley. The streambed alluvium is more permeable than the basin-fill, but the alluvium's limited areal extent only makes it an important local aquifer in the central valley along the San Pedro River floodplain. The alluvial basin-fill sediments are composed of a younger basin-fill, older basin-fill, and basal conglomerate, and form the basin's principal aquifer because of its high permeability and large volume. Consolidated bedrock found in the surrounding mountains only yields small amounts of water from localized aquifers.

The streambed alluvium that occupies the San Pedro River's stream channel and floodplain is very permeable and well yields range from 250 to 2,700 gallons per minute (Roeske and Werrell, 1973). Groundwater in the alluvium is unconfined, and water levels are usually less than 60 feet below land surface (Jones, 1980). The streambed alluvium is recharged primarily by surface water flows in the San Pedro River. As a result, water levels in the alluvium fluctuate seasonally in response to surface water flows in the riverbed: rising slightly in the spring and early summer and declining in the fall and winter (Page, 1963).

The hydrologic characteristics of the regional aquifer vary widely due to the amount of compaction and the presence of fine-grained layers in the basin-fill. The younger and older basin-fill units generally are fair-to-good aquifers and provide the bulk of water pumped from the regional aquifer. Well yields of 70 to 1,900 gallons per minute have been reported from the basin-fill aquifer (Roeske and Werrell, 1973). The basal conglomerate unit generally is tightly cemented, but where weakly cemented or fractured by faults, well yields of several hundred gallons per minute have been reported (Roeske and Werrell, 1973).

Groundwater in the basin-fill is found in both unconfined (water table) and confined (artesian) conditions. Depth to water in unconfined areas of the basin-fill in 1978 was 50 to 253 feet below land surface (Jones, 1980). Water levels are generally stable in the basin except in the area around San Manuel and Mammoth where large groundwater pumpage rates are causing water-level declines (Arizona Department of Water Resources, 1990). Confined (artesian) conditions are located from about 5 miles north to 10 miles south of Mammoth, Arizona. Deep wells located in or near the river's floodplain encounter fine-grained layers that restrict vertical groundwater movement creating confined (artesian)

conditions (Heindl, 1952). Most wells drilled deeper than 500 feet encounter confined (artesian) conditions, and the main confined (artesian) aquifers are sand and gravel layers that are 600 to 800 feet and 1,200 to 1,300 feet deep (Page, 1963). Discharge from these artesian wells ranges from barely flowing to 350 gallons per minute (Page, 1963).

The consolidated bedrock of the mountains surrounding the basin only yield water where sufficiently faulted and fractured. The small, localized aquifers created by these fault zones only provide enough water for stock and low use domestic wells. Springs in the bedrock tend to be small and have measured discharges of 0.06 to 112 gallons per minute (Jones, 1980). The largest spring in the basin, Leroy Spring, is located about 6 miles upstream from Winkelman in the San Pedro River channel. The spring has an average flow of 1,032 gallons per minute (Roeske and Werrell, 1973).

Groundwater movement in the basin is from the higher elevations in the mountains towards the valley and then northwest along the riverbed. Groundwater moves readily between the younger and older basin-fill units, and between the streambed alluvium and the basin-fill units. Page (1963) concluded that water from the confined (artesian) aquifer, in the area near Mammoth, may leak upwards into the water-table aquifer. The total amount of groundwater in storage in the Lower San Pedro basin is estimated to be 25.6 million acre-feet (Arizona Department of Water Resources, 1990).

Recharge enters the aquifers by mountain-front recharge and by streambed infiltration. A smaller amount enters the basin as groundwater underflow from Aravaipa Canyon basin and from the Upper San Pedro basin. Mountain-front recharge consists of surface runoff that flows off the bedrock in the mountains and infiltrates into the permeable basin-fill sediments on the alluvial fans surrounding the mountains and eventually reaches the water table. Streambed infiltration occurs when surface water flows in the San Pedro River and its tributaries infiltrates through the coarse riverbed sands down into the water table.

Mountain-front recharge is the main source of recharge for the regional basin-fill aquifer, and streambed infiltration is the main source of recharge for the streambed alluvium in the San Pedro River. Recharge also enters the regional aquifer as infiltration from the streambed alluvium. Direct infiltration of precipitation falling on the valley floor is considered negligible due to high evaporation rates and low rainfall totals (Freethey, 1982). Groundwater recharge from streambed infiltration and mountain-front recharge is estimated to total 24,000 acre-feet per year. Underflow into the basin is estimated to be 120 acre-feet per year from the Upper San Pedro basin and 800 acre-feet per year from Aravaipa Canyon basin (Arizona Department of Water Resources, 1990). Total groundwater recharge into the basin is estimated to be nearly 25,000 acre-feet per year (Arizona Department of Water Resources, 1990).

Groundwater is discharged from the basin by pumpage from wells, evapotranspiration from phreatophytes and crops, evaporation from open water in the riverbed, and by discharge from springs and seeps. Pumpage is the largest source of discharge and in 1988-1989 was estimated to total 35,750 acre-feet (Arizona Department of Water Resources, 1990). Estimated groundwater pumpage in the Lower San Pedro basin for 1988-1989 is shown in Table 25.

TABLE 25
PUMPAGE OF GROUNDWATER IN THE LOWER SAN PEDRO BASIN FOR WATER YEAR 1988-1989

Water Use	Pumpage (ac-ft/yr)
Mining/Industrial	21,220
Irrigation	13,250
Public Supply/Domestic	1,280
Total	35,750

Source: Arizona Department of Water Resources, 1990.

The Magma Copper Company near San Manuel and the American Smelting and Refining Company (ASARCO) near Winkelman are the two largest mines and are the major water users in the basin. Most mining, industrial, and domestic/public supply wells are located in the regional basin-fill aquifer. In 1990, approximately 6,500 acres of land were irrigated in the Lower San Pedro basin (Arizona Department of Water Resources, 1990). Most irrigation wells are located in the streambed alluvium.

The quality of groundwater in the Lower San Pedro basin generally is suitable for most uses. The total dissolved solids concentrations of samples collected in 1978 to 1980 ranged from 207 to 1,500 milligrams per liter (Jones, 1980). The recommended secondary maximum contaminant levels for total dissolved solids in drinking water is 500 milligrams per liter.

Fluoride concentrations for the samples collected in 1978 through 1980 (Jones, 1980) ranged from 0.3 to 6.1 milligrams per liter (mg/l). Fluoride concentrations were highest in wells completed in the streambed alluvium along the San Pedro River. The floodplain area from Winkelman upstream to the San Manuel area had the highest fluoride values. The maximum contaminant level for fluoride in drinking water has been set by the Arizona Department of Environmental Quality at 4.0 mg/l.