

ESTIMATED GROUND-WATER PUMPAGE IN THE WILLCOX AREA

[Numbers rounded to nearest thousand acre-feet]

Year	Pumpage, in thousands of acre-feet	Year	Pumpage, in thousands of acre-feet
1915	2	1947	20
1916	2	1948	23
1917	1	1949	28
1918	(1)	1950	35
1919	(1)	1951	38
1920	(1)	1952	39
1921	(1)	1953	94
1922	(1)	1954	105
1923	(1)	1955	110
1924	(1)	1956	120
1925	(1)	1957	135
1926	1	1958	155
1927	1	1959	183
1928	2	1960	195
1929	2	1961	184
1930	1	1962	180
1931	1	1963	180
1932	1	1964	220
1933	1	1965	250
1934	1	1966	240
1935	1	1967	300
1936	1	1968	290
1937	1	1969	291
1938	2	1970	289
1939	2	1971	309
1940	2	1972	292
1941	5	1973	305
1942	5	1974	339
1943	5	1975	293
1944	5		
1945	9		
1946	15	TOTAL	5,311

(1) Pumpage was 500 acre-feet or less.

The Willcox area includes about 1,500 mi² in the northern part of Sulphur Springs Valley in southeastern Arizona. The area is a closed basin that is topographically and hydrologically separate from the southern part of the valley. Streams flow only in response to precipitation and drain toward the Willcox Playa in the south-central part of the area. The valley floor, which occupies about 950 mi², is underlain by unconsolidated to moderately consolidated sedimentary deposits composed mainly of gravel, sand, silt, and clay. The surrounding mountains are made up of igneous, metamorphic, and sedimentary rocks.

The sedimentary deposits that underlie the valley floor are the main source of the ground water. The sedimentary deposits consist of two units—stream deposits and lake-bed deposits (Brown and Schumann, 1969, p. 13). The stream deposits consist of lenticular beds of gravel, sand, silt, and clay and mixtures of these materials. The stream deposits are the most productive water-bearing unit in the area, and well yields range from a few tens of gallons per minute from domestic and livestock wells to more than 2,000 gal/min from irrigation wells. The lake-bed deposits consist mainly of clay. The lake-bed deposits crop out in the Willcox Playa, and are interbedded with the stream deposits at depths of 200 to 300 ft in other parts of the area. Near the playa, the fine-grained lake-bed deposits act as a confining layer to the water in the underlying stream deposits and cause local artesian conditions. The coarse-grained stream deposits may contain perched ground water where underlain by the lake-bed deposits. The igneous, metamorphic, and sedimentary rocks that form the surrounding mountains generally do not yield more than a few gallons per minute of water to springs and domestic and livestock wells. The water-bearing characteristics of the rocks are dependent on the amount of fractures.

The direction of ground-water movement in the sedimentary deposits has been altered significantly by the large-scale withdrawal of ground water. Prior to extensive withdrawal, the general direction of ground-water movement was from the perimeter of Sulphur Springs Valley toward the Willcox Playa. The water-level contours shown on sheet 3 indicate that the general direction of movement in 1975 was toward the several pumping centers in the main agricultural areas along the valley floor.

The main use of ground water in the Willcox area is for irrigation. For 1954-75, the estimated ground-water pumpage exceeded 400,000 acre-ft per year, and for 1967-75, the ground-water pumpage averaged about 300,000 acre-ft per year. The ground-water withdrawals have resulted in general water-level declines in most of the developed part of the area; however, a few anomalous rises in water level occurred for 1963-75. For 1954-75, water levels declined more than 200 ft in 9 of the 36 wells in which water levels are measured periodically; small rises of less than 8 ft were measured in 6 of the wells.

The hydrologic data on which these maps are based are available, for the most part, in computer-printout form for consultation at the Arizona Water Commission, 222 North Central Avenue, Suite 800, Phoenix, and at U.S. Geological Survey offices in: Federal Building, 301 West Congress Street, Tucson, and Valley Center, Suite 1880, Phoenix. Material from which copies can be made at private expense is available at the Tucson and Phoenix offices of the U.S. Geological Survey.

SELECTED REFERENCES

Arizona Crop and Livestock Reporting Service, 1974, Cropland atlas of Arizona: Phoenix, Arizona Crop and Livestock Reporting Service duplicated report, 68 p.

Brown, S. G., and Schumann, H. H., 1969, Geology and water utilization in the Willcox basin, Graham and Cochise Counties, Arizona: U.S. Geol. Survey Water-Supply Paper 1859-F, 32 p.

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Kister, L. R., Brown, S. G., Schumann, H. H., and Johnson, P. W., 1966, Maps showing fluoride content and salinity of ground water in the Willcox basin, Graham and Cochise Counties, Arizona: U.S. Geol. Survey Hydrol. Inv. Atlas HA-214, 2 sheets.

National Academy of Sciences and National Academy of Engineering, 1973 [1974], Water quality criteria, 1972: U.S. Environmental Protection Agency Report, EPA-R3-73-033, 594 p.

U.S. Environmental Protection Agency, 1977, Quality criteria for water: U.S. Environmental Protection Agency Publication, 256 p.

U.S. Public Health Service, 1962, Drinking water standards, 1962: U.S. Public Health Service Pub. 956, 61 p.

U.S. Salinity Laboratory Staff, 1954, Diagnosis and improvement of saline and alkali soils: U.S. Dept. of Agriculture Handb. 60, 160 p.

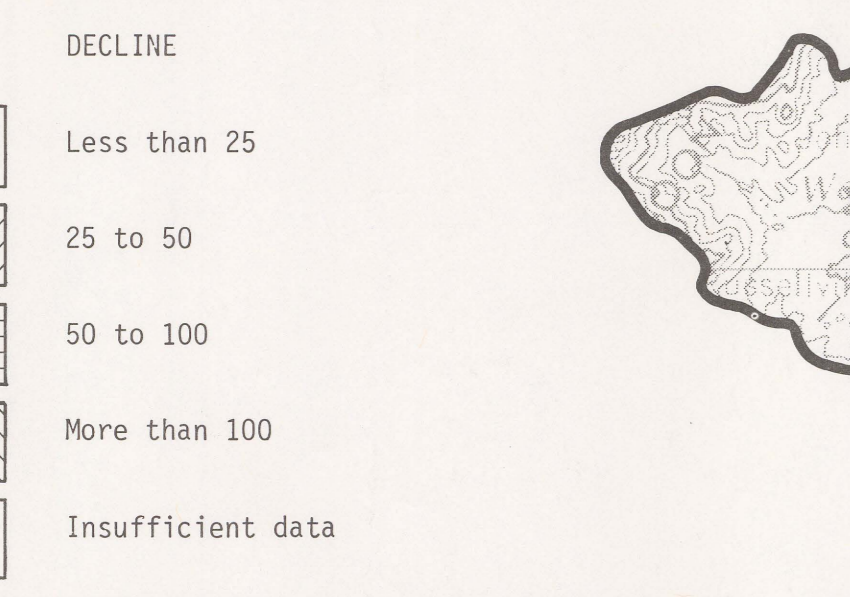
CONVERSION FACTORS

For use of those readers who may prefer to use metric units rather than U.S. customary units, the conversion factors for the terms used in this report are listed below:

Multiply U.S. customary unit	By	To obtain metric unit
foot (ft)	0.3048	meter (m)
square mile (mi ²)	2.590	square kilometer (km ²)
acre-foot (acre-ft)	.001233	cubic hectometer (hm ³)
gallon per minute (gal/min)	.06309	liter per second (L/s)

EXPLANATION

CHANGE IN WATER LEVEL, IN FEET, 1963-75—In some parts of the area the water-level changes were estimated on the basis of the trend in water levels since about 1957

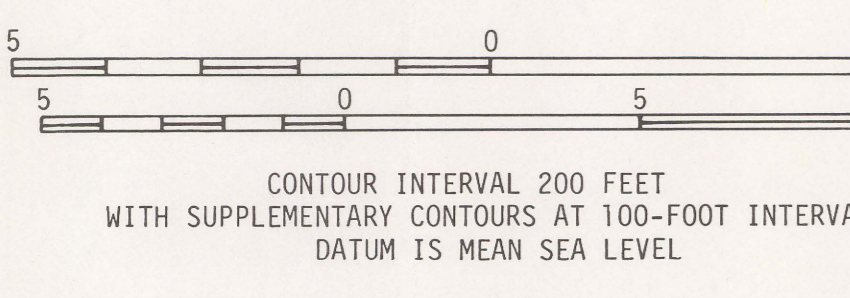


WELL IN WHICH DEPTH TO WATER WAS MEASURED IN 1963 AND 1975—Number, -18, is the difference, in feet, between the 1963 and 1975 measurements

IRRIGATED AREA AS OF 1972-73—Based on data from the Arizona Crop and Livestock Reporting Service (1974); not field checked. Land under cultivation or that prepared for cultivation was considered irrigated

APPROXIMATE BOUNDARY OF THE MAIN WATER-BEARING UNIT—The main water-bearing unit consists principally of sedimentary deposits of gravel, sand, silt, and clay. The igneous, metamorphic, and sedimentary rocks, which make up the surrounding mountains, generally yield a few gallons per minute of water where fractured. Quoted where uncertain

ARBITRARY BOUNDARY OF GROUND-WATER AREA

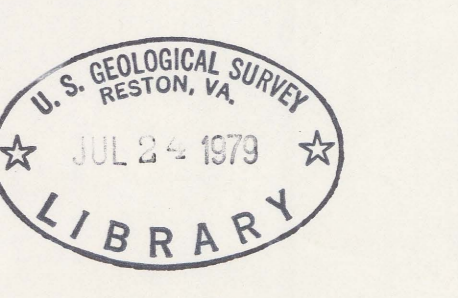


BASE FROM U.S. GEOLOGICAL SURVEY
TUCSON 1:250,000, 1956,
NOGALES 1:250,000, 1956,
SILVER CITY 1:250,000, 1954,
AND DOUGLAS 1:250,000, 1959

CHANGE IN WATER LEVEL, 1963-75, IRRIGATED AREA, AND HYDROGRAPHS OF THE WATER LEVEL IN SELECTED WELLS

MAPS SHOWING GROUND-WATER CONDITIONS IN THE WILLCOX AREA, COCHISE AND GRAHAM COUNTIES, ARIZONA—1975

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