

System	Series	Group	General lithology and depositional setting	Hydrogeologic element	Hydrogeologic unit	Approximate permeability (gpd/ft ²)	Relative permeability
Quaternary			Fluvial and lacustrine clastics	Ogallala aquifer	Upper aquifer	200 ^③	10 ⁸
Tertiary			Nearshore marine clastics				
Cretaceous			Fluvial deltaic and lacustrine clastics and limestones	Doctum aquifer		2-20(?) ^⑤	10 ^{6-10⁷ (?)}
Triassic							
Permian	Ochoa		Beckton gill, anhydrite, red beds, and peritidal dolomite	Evaporite aquifers	Evaporite aquifer	2 x 10 ⁻⁶ ^⑥	1
	Guadalupe	Artesia					
		Pecos River					
	Leonard	Clear Fork Wichita					
Pennsylvanian	Wolfcamp		Shelf limestone and chert	Wolfcamp carbonate aquifer	Deep-basin brine aquifer		
			Shelf platform sandstone, shale, and deltaic sandstones	Pennsylvanian carbonate aquifer			
Mississippian			Basin shale aquifer	Upper Paleozoic granite wash aquifer		2 x 10 ⁻² ^⑦	10 ⁴
					Basin shale aquifer		
Ordovician			Shelf limestone and chert	Lower Paleozoic carbonate aquifer			
	Elenburger		Shelf dolomite				
Cambrian			Shallow marine (?) sandstone	Lower Paleozoic sandstone aquifer			
Precambrian			Igneous and metamorphic	Basement aquiclude	Basement aquiclude	0	0

① Cronin and Wells (1960), Myers (1969), Cronin (1961)

② Stevens (1980, written communication)

③ Geotechnical Engineers (1978)

④ This study

Table 2

<u>Formation</u>	<u>Range (md)</u>	<u>Mean k (md)</u>	<u>Variance (md²)</u>	<u>Number of Analyses</u>
Wolfcamp	0.03 - 262.0	17.8	50.7×10^3	25
Pennsylvanian	0.04 - 694.0	87.4	1.9×10^6	25
Granite Wash	0.06 - 138.0	58.0	4×10^6	10
Mississippian and Ellenburger	0.02 - 127.0	54.9	904×10^3	11
All dst data	0.02 - 694.0	49.26	803×10^6	71

Table 3

<u>Production Zone</u>	<u>Formation</u>	<u>Perforated intervals in feet</u> <u>Depth below land surface</u>
1	Ellenburger sand	4716-4727 4732-4746
2	Upper Ellenburger	4604-4620 4632-4640
3	Mississippian L.S.	4500-4510 4520-4535
4	Pennsylvanian granite wash	4258-4270 4280-4290 4300-4312 4325-4312
5	Permian Wolfcamp Formation	3172-3189

Table 4

Formation

Permeability

Upper Ellenburger

0.1 md

Mississippian Limestone

9.0 md

Pennsylvanian granite wash

10.0 md

Table 5

<u>Oilfield Location</u>	<u>Rock age or facies</u>	<u>Range in Porosity</u>	<u>number of determinations</u>
Northern shelf of Midland Basin	Wolfcamp	16-20	3
	Pennsylvanian	5-16.5	27
Dalhart Basin	Granite Wash	13-15	3
Panhandle Oil and Gas Field	Wolfcamp	12-18.7	70
	Pennsylvanian	11.7-20	10
	Granite Wash	10-20	8
Anadarko Basin	Wolfcamp	14.3	1
	Pennsylvanian	2-21	77

Table 6

<u>County</u>	<u>Permeability md</u> ¹	<u>Porosity %</u> ²
Andrews	1-33 (4)	2-16 (8)
Cochran	1-68 (5)	8-13 (10)
Dawson	1-12 (4)	9-16 (11)
Deaf Smith*	.07-.16	
Gaines	2-811 (13)	6-15 (10)
Hockley	1-23 (5)	8-14 (11)
Lamb	1.6-2.8 (2.4)	13-15
Swisher*	.04-.1	
Yoakum	0.1-714 (3)	7-14 (10)

*results of drill-stem tests in DOE/SWEC hydrostratigraphic wells;

These results are 1/2 way ones on the back from wells in the interior of the Palo Verde Basin. Other data from Core Laboratories, Inc. 1992.

¹range of reported values and, in parentheses, geometric mean value.

²range of reported values and, in parentheses, arithmetic mean value. ✓

Table 7

<u>Production Zone</u>	<u>Br/Cl x 10⁻⁴</u>	<u>Cl</u> <u>(mg/l)</u>	<u>δ¹⁸O</u> <u>(‰)</u>	<u>δ²H</u> <u>(‰)</u>
Wolfcamp	38.2	86,000	+0.6,+0.7	-18.0,-19.3
Granite Wash	33.8	136,000	-0.4	-13.5
Mississippian Carbonates	12.8	132,000		
Top Ellenberger	36.8	133,000	-1.3	-16.2
Ellenberger	33.8	139,000	-0.2	-16.9

Table 8

Location No.	Sample No.	Date Collected	Sample Type	Temp.	pH	Na	K	Ca	Mg	HCO ₃	SO ₄	Cl	NO ₃	F	Br	B	SiO ₂	U ₃ O ₈	Br/Cl x10 ⁻⁴	δ ¹⁸ O	δ ² H
80E003	80-1027	4-01-80	Estelline Springs, Spring	11.8	8.00	23166.0	57.2	1835.0	341.0	123.6	4805.0	32225.0	0.5	0.8	6.3	2.6	6.8	3.4	2.0	-5.4	-28
80J004	80-1026	4-01-80	Jonah Creek, Bubbling Spring	21.3	7.60	28445.0	55.0	1889.0	401.0	112.6	5260.0	39457.0	0.5	0.9	10.0	3.8	11.5	0.3	2.5	-5.8	-26
80W5005	80-1029	4-02-80	Spring next to North Wichita River	18.2	7.40	9790.0	30.5	1165.0	238.0	138.3	3434.0	14210.0	0.1	0.7	4.0	3.4	12.6	3.8	2.8	-5.2	-30
80W5006	80-1032	4-02-80	Spring near Salt Creek, trib. to North Wichita	20.0	7.5	10744.0	30.4	1202.0	223.0	135.0	3853.0	16520.0	0.3	0.7	4.9	4.3	11.9	2.8	2.8	-6.2	-29
80P007	80-1031	4-03-80		19.3	7.28	11713.0	26.0	1336.0	204.0	130.7	347.0	18593.0	0.1	2.5	4.11	1.9	14.1	3.2	2.3	-6.2	-33
80I009	80-1030	4-03-80		17.0	7.63	8247.0	21.2	1266.0	179.0	143.1	3149.0	12090.0	0.1	6.5	2.8	1.6	12.2	3.4	2.3	-6.0	-31
80Q012	80-1447	5-06-80	Quitauque city well, north well	18.5	7.42	235.0	2.0	98.1	58.2	357.3	325.0	211.0	54.0	2.1	1.1	0.49	32.0	39.0	5.2	-6.5	-24
	80-2248	9-14-80	Quitauque city well	19.0	7.32	238.1	2.35	106.4	60.8	356.0	344.0	226.0	54.3	2.9	1.6	0.43	30.5	24.0	70.0	-6.4	-32
80Q013	80-1448	9-14-80	Quitauque domestic well	19.7	7.41	82.5	6.9	48.5	35.8	393.3	30.0	50.5	4.4	3.1	0.2	0.14	43.0	10.9	3.9	-6.8	-34
80T014	80-1449	9-14-80	Turkey city well, north well	20.0	7.25	72.7	3.7	136.0	53.6	240.0	191.0	182.0	94.0	0.3	0.5	0.05	28.0	2.0	2.7	-5.9	-27
	80-2247	9-13-80	Turkey city well	10.5	7.32	78.1	4.2	136.7	54.8	234.0	185.0	180.0	84.3	0.5	1.0	—	29.5	2.0	55.0	-6.0	-33
80F015	80-1450	5-07-80	Flomot city well	19.7	7.50	143.0	3.75	90.0	40.0	250.3	210.0	137.0	98.0	2.0	0.9	0.16	39.0	8.3	66.0	-6.1	-34
	80-2252	9-16-80	Flomot city well	20.0	7.48	133.8	3.9	88.1	39.4	249.0	195.0	148.0	73.2	2.1	0.9	0.26	38.2	10.0	61.0		
80LR016	80-1451	9-16-80	Well, Little Red River, TDWR 12-25-801	18.5	7.41	1450.0	9.3	705.0	350.0	178.2	2058.0	2194.0	17.0	0.1	1.0	1.52	14.0	46.3	4.5	-6.3	-29
80LR017	80-1452	9-16-80	Seep, Little Red River	31.0	7.89	35406.0	139.0	1502.0	615.0	93.0	6600.0	56880.0	6.1	0.2	10.3	4.0	8.0	27.8	1.0	-6.2	-31
80LR018	80-1453	9-16-80	Well, Little Red River	18.7	7.34	17.2	3.8	603.0	146.0	216.0	1932.0	8.0	3.0	0.3	0.1	0.96	26.0	22.4	125.0	-5.4	-26

Location No.	Sample No.	Date Collected	Sample Type	Temp.	pH	Na	K	Ca	Mg	HCO ₃	SO ₄	Cl	NO ₃	F	Br	B	SiO ₂	U ₃ O ₈	Br/Cl x10 ⁻⁴	δ ¹⁸ O	δ ² H
80E019	80-1454	9-16-80	Estelline Springs	22.5	8.17	22662.0	55.8	1816.0	340.0	110.0	5556.0	31480.0	1.1	0.6	7.8	2.2	5.0	4.5	2.5	-4.7	-26
80M020	80-1456	5-08-80	Matador city well, Graham well #3	19.8	7.41	55.3	8.55	42.1	35.9	357.5	42.8	25.6	4.0	2.4	0.1	0.17	53.0	8.9	3.8	-6.0	-28
80P028	80-2242	9-10-80	Paducah city well	20.5	7.23	68.5	2.8	131.8	25.0	253.0	285.0	23.0	33.5	0.8	0.4	0.30	24.2	6.0	173.0	-5.9	-30
80D029	80-2243	9-11-80	Dickens city well, Dickenson County	19.2	7.28	122.4	2.6	103.4	25.6	398.0	136.0	130.0	13.7	1.5	0.5	0.47	26.5	17.0	38.0	-3.1	-9
80RS030	80-2244	9-11-80	Roaring Springs city well	20.5	7.62	98.7	7.75	50.8	23.8	331.0	53.7	60.0	0.5	2.0	0.3	—	22.2	14.0	50.0	-6.0	-25
80N035	80-2249	9-12-80	Northfield domestic well, TDWR 12-44-401	20.5	7.30	31.0	2.6	624.1	123.1	79.2	1786.0	137.0	8.3	0.6	0.5	0.20	21.0	2.0	30.0	-6.2	-30
80B039	80-2253	9-17-80	Brice irrigation well, TDWR 12-13-501	19.0	7.32	402.3	4.7	517.2	202.6	190.0	1989.0	634.0	24.5	0.6	1.3	0.21	40.2	7.0	21.0	-6.8	-26
81MP040	81-230	3-25-81	Middle Pease River Corps of Engineers well 81-173	18.0	7.48	10500.0	26.5	1290.0	255.3	165.0	3650.0	16000.0	—	0.5	6.5	2.5	11.5	3.0	4.1		
81MP041	81-231	3-26-81	Middle Pease River Corps of Engineers well 74-86	19.8	7.62	10600.0	23.0	1300.0	255.5	135.0	3700.0	15950.0	—	0.5	7.0	2.8	11.0	3.0	4.4		
81MP042	81-232	3-06-81	Middle Pease River Corps of Engineers well 29-34	19.0	7.30	10400.0	20.7	1260.0	244.3	121.0	3790.0	15950.0	—	0.5	6.5	2.0	10.5	4.0	4.1		
81MP043	81-233	3-16-81	Middle Pease River Corps of Engineers well 71-83	19.0	7.20	8450.0	12.8	1190.0	200.0	125.0	3600.0	13100.0	—	0.5	7.0	2.0	11.0	2.0	5.4		
81MP044	81-234	3-17-81	Middle Pease River Corps of Engineers well 73-103	19.0	7.40	9880.0	20.5	1260.0	240.0	152.0	3475.0	15100.0	—	0.5	7.0	2.5	13.0	3.0	4.6		
81MP045	81-235	3-19-81	Middle Pease River Corps of Engineers well 103-151	19.0	7.48	10400.0	20.6	1290.0	249.0	127.0	4040.0	16000.0	—	0.5	7.0	2.7	11.5	3.0	4.4		

Location No.	Sample No.	Date Collected	Sample Type	Temp.	pH	Na	K	Ca	Mg	HCO ₃	SO ₄	Cl	NO ₃	F	Br	B	SiO ₂	U ₃ O ₈	Br/Cl x10 ⁻⁴	δ ¹⁸ O	δ ² H
81JC051	81-489	4-30-81	Jonah Creek Corps of Engineers well 35-88	21.0	4.50	24040.0	48.0	1670.0	345.0	1.0	4725.0	37150.0	0.2	1.0	4.5	—	11.0	1.5	1.2		
81JC052	81-490	5-06-81	Jonah Creek Corps of Engineers well 48-50	21.0	8.40	12740.0	36.4	1380.0	290.0	175.0	4050.0	19450.0	0.4	1.0	7.5	—	17.0	4.5	3.8		
81JC053	81-491	4-27-81	Jonah Creek Corps of Engineers well 32-50	21.0	8.00	24090.0	47.2	1580.0	340.0	113.0	4830.0	36550.0	0.5	1.0	10.0	—	11.0	1.0	2.7		
81JC054	81-492	5-16-81	Jonah Creek Corps of Engineers well 127-132	20.0	8.10	23890.0	46.2	1650.0	360.0	114.0	4810.0	37400.0	0.3	1.0	13.0	—	9.8	1.5	3.5		
81JC055	81-493	5-11-81	Jonah Creek Corps of Engineers well 73-104	21.0	7.70	24950.0	60.8	1780.0	415.0	53.0	4950.0	37400.0	0.2	0.8	10.5	—	4.7	—	2.9		
81JC056	81-494	5-17-81	Jonah Creek Corps of Engineers well	21.0	7.08	22170.0	48.2	1630.0	360.0	127.0	4760.0	34000.0	0.6	1.0	10.0	—	12.1	1.5	2.9		
81JC057	81-769	6-20-81		20.0	6.75	79600.0	227.0	2230.0	770.0	56.0	3100.0	125400.0	—	0.4	65.0	—	4.4	—			
81JC058	81-770	6-22-81		20.0	6.92	64200.0	170.0	2060.0	595.0	101.0	3000.0	99800.0	3.2	0.5	48.0	—	6.5	—			
81JC060	81-766	6-19-81		20.0	7.30	112000.0	220.0	1950.0	750.0	71.6	2670.0	175100.0	—	0.3	70.0	—	3.2	—	4.0		
81JC061	81-767	6-18-81		20.0	7.30	101200.0	235.0	2100.0	780.0	75.8	2920.0	158700.0	—	0.4	70.0	—	3.9	—	4.4		
81JC062	81-768	6-20-81		20.0	7.50	73300.0	227.0	2250.0	770.0	79.3	3000.0	116000.0	6.3	0.4	65.0	—	5.3	—	5.6		

Table 9

Sample No.	Ca	Na	Mg	Initial Conditions			pH	SI	Calcite Equilibrium		
				HCO ₃	Cl	SO ₄			pH	P _{CO2} (atm.)	Slope
Hartley	1100	60310	1069	302	88154	13090	6.8	0.20	6.59	0.09	0.96
Pott. #1	3660	40900	1350	278	71600	2350	7.9	1.56	6.19	0.15	0.91
Pott. #2	7960	56200	1540	173	104000	1600	6.8	0.64	6.15	0.10	0.98
Pott. #3	6578	47193	841	106	85566	1735	8.0	1.69	6.40	0.03	0.71
Hall #1	32340	58579	2245	56	153982	517	6.24	-0.09	6.30	0.15	0.96
Floyd #1	6234	84667	1782	132	146281	1035	6.32	0.06	6.26	0.07	0.95
Floyd #2	5560	34600	1848	581	65600	3640	6.7	0.96	5.80	0.62	0.99
Motley #1	4927	33177	1933	99	63800	2350	6.7	0.07	-6.63	0.15	0.98
Motley #3	3920	46112	1972	296	71050	1450	7.5	1.21	6.20	0.15	0.96
Lamb	15120	46607	3072	195	106500	1700	6.4	0.42	6.00	0.09	0.99
Hock #1	3823	83135	884	333	137190	588	6.9	0.96	5.80	0.56	0.95
Hock #2	4687	18907	2534	652	42777	2252	6.4	0.63	5.80	0.43	0.99
Hock #3	1840	16347	488	927	27300	3400	7.2	1.50	5.70	1.28	0.97
Hock #4	3286	29581	648	801	51304	2120	6.6	1.02	-5.70	0.91	0.98
Crosby #1	6880	30143	2246	139	62891	2913	-8.6	1.76	6.35	0.04	0.79
Crosby #2	8164	80271	992	187	140729	365	7.31	1.23	6.00	0.15	0.94