STATISTICAL ANALYSIS OF AQUIFER-TEST RESULTS FOR NINE REGIONAL AQUIFERS IN LOUISIANA

By Angel Martin, Jr., and David A. Early

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CONVERSION FACTORS AND ABBREVIATIONS

For the convenience of readers who may prefer to use metric (International System) units rather than the inch-pound units used in this report, values may be converted by using the following factors:

Multiply inch-pound unit	By	To obtain metric unit
inch (in.)	25.4	millimeter (mm)
foot (ft)	0.3048	meter (m)
foot per day (ft/d)	0.3048	meter per day (m/d)
foot squared per day (ft^2/d)	0.09290	meter squared per day (m^2/d)
gallon per minute (gal/min)	0.06309	liter per second (L/s)

National Geodetic Vertical Datum of 1929 (NGVD of 1929): A geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called "Mean Sea Level."

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ABSTRACT

This report, prepared as part of the Gulf Coast Regional Aquifer-System Analysis project, presents a compilation, summarization, and statistical analysis of aquifer-test results for nine regional aquifers in Louisiana. These are from youngest to oldest: The alluvial, Pleistocene, Evangeline, Jasper, Catahoula, Cockfield, Sparta, Carrizo, and Wilcox aquifers. Approximately 1,500 aquifer tests in the U.S. Geological Survey files in Louisiana were examined and 1,001 were input to a computer file.

Analysis of the aquifer-test results and plots that describe aquifer hydraulic characteristics were made for each regional aquifer. Results indicate that, on the average, permeability (hydraulic conductivity) generally tends to decrease from the youngest aquifers to the oldest. The most permeable aquifers in Louisiana are the alluvial and Pleistocene aquifers; whereas, the least permeable are the Carrizo and Wilcox aquifers.

INTRODUCTION

Little hydraulic information for regional aquifers in Louisiana has been summarized or published. Some information limited to specific areas have been published in technical reports of the U.S. Geological Survey and cooperating State agencies.

As part of the Gulf Coast Regional Aquifer-System Analysis project (Grubb, 1984), data on the hydraulic characteristics of aquifers are needed for input to a regional ground-water flow model to be used to investigate the ground-water flow system of the Gulf Coastal Plain. Regional values of hydraulic conductivity and transmissivity for aquifers in Louisiana also will be useful to other water-resources investigators. This report presents a compilation, summarization, and statistical analysis of aquifer-test results for nine regional aquifers in Louisiana.

The nine regional aquifers in Louisiana from youngest to oldest are: The alluvial, Pleistocene, Evangeline, Jasper, Catahoula (in the Catahoula Formation), Cockfield (in the Cockfield Formation), Sparta (in the Sparta Sand), Carrizo (in the Carrizo Sand), and Wilcox (in the Wilcox Group) aquifers, all of Tertiary age and younger. A generalized description of the occurrence, geometry, and hydraulics of the aquifers is given by Grubb (1984).

SUMMARY OF DATA COLLECTION

Aquifer-test data have been gathered by the U.S. Geological Survey in Louisiana from various sources since the 1930's. Aquifer tests on file come from the following sources:

1. U.S. Geological Survey
2. Other Federal agencies
3. Private consultants
4. Well drillers
5. Industries
6. Municipalities
7. Louisiana State agencies.

These aquifer tests are tabulated in various ways with a wide range of reliability and detail. Some tests involve only a pumping well, using crude equipment and methods. Some single-well tests were not designed to measure aquifer characteristics, but to determine if a suitable quantity or quality of water could be obtained, or to test the efficiency of the well. Other tests were specifically designed to measure the hydraulic characteristics of the aquifers, and state-of-the-art equipment and methods were used. Many of these tests included a pumping well and, usually, at least one properly spaced observation well. The remaining tests in the file could be classified as intermediate between the two previously described groups.

STATISTICAL ANALYSIS OF AQUIFER-TEST RESULTS

Data Manipulation and Procedures

Approximately 1,500 aquifer tests were examined and 1,001 were coded and input to a computer file. Plate 1 shows the areal distribution of the aquifer tests in Louisiana. Many tests were not used because of insufficient data. Table 1 shows an example of a sample coding form for aquifer-test data. A brief explanation of the field headings is given below:

Fields 1-2: Column and row, respectively--Grid coordinates used to locate the aquifer tests.

Field 3: Aquifer--Refers to the regional aquifer tested. For example, number 11 refers to the alluvial aquifer.

Field 4: Parish--Parish where the pumping well is located.

Field 5: Altitude--Altitude of the land surface at the location of the pumping well (feet above NGVD of 1929).

Field 6: Number of wells--Total number of pumping and observation wells in the aquifer test.

Fields 7-10: Seven, well depth (feet below land surface); 8, screen diameter (inches); 9, depth to top of screen (feet below land surface); and 10, screen length (feet)--These refer to construction characteristics of the pumping well.

Field 11: Unit thickness--Thickness (feet) of the predominantly sand unit within the regional aquifer in which the pumping well is completed.

Table 1.--Sample coding form for aquifer-test data with example

[ft, feet; in., inches; gal/min, gallons per minute; ft^2/d, feet squared per day; gal/min/ft, gallons per minute per foot of drawdown; G, good; F, fair; P, poor]

	Column	Row	Aquifer	Parish	Altitude (ft)	Number of wells	Well depth (ft)	Screen diameter (in.)	Depth to top of screen (ft)	Screen length (ft)	Unit thickness (ft)	Sand in screened interval (percent)	Well discharge (gal/min)	Drawdown (ft)	Total time (min)	Transmissivity (ft^2/d)	Storage coefficient (dimensionless)	Specific capacity (gal/min/ft)	Rating (G,F,P)	Local well no.	Log type	Total thickness of sand (ft)	Total sand (percent)
Field	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Example	33	61	11	LAEB	45	8	193	16	103	90	90	100	1,900	24.3	2,777	22,727	0.0013	78.2	G	EB-530	EG	90	100

Field 12: Percentage of sand in screened interval--Percentage of the screened interval of the pumping well that is in sand.

Field 13: Well discharge--Stabilized pumping rate (gallons per minute).

Field 14: Drawdown--Difference (feet) between the static and final pumping water levels. This value was coded as negative for recovery water levels measured in recharge, slug, and recovery aquifer tests.

Field 15: Total time--Total time of the aquifer test in minutes.

Field 16: Transmissivity--Transmissivity (feet squared per day). Representative aquifer value calculated from the drawdown or recovery part of the aquifer test.

Field 17: Storage coefficient--Storage coefficient (dimensionless). Representative aquifer value calculated from the drawdown or recovery part of the aquifer test.

Field 18: Specific capacity--Calculated specific capacity of the pumping well (gallons per minute per foot of drawdown).

Field 19: Rating--Subjective rating of the quality of the aquifer test: G, good; F, fair; or P, poor.

Field 20: Local well number--U.S. Geological Survey local well identification number.

Field 21: Log type--Source of information available for the lithologic description: E, electric log; G, geologic log; D, driller's log; and C, caliper log.

Field 22: Total thickness of sand--Thickness of sand (feet) within the unit.

Field 23: Total percentage of sand--Percentage of sand within the unit.

Approximately 20 of the 1,001 coded tests involved aquifers under water-table conditions. All other tests involved artesian aquifers. Complete hydraulic information was not available for every coded test. For example, only 123 tests had calculated storage-coefficient values (field 17) and 598 tests had calculated transmissivity values (field 16). Although many tests had incomplete information, sufficient data were available for estimating some hydraulic characteristics of the aquifer and were, therefore, entered into the computer file. Aquifer tests involving the pumping well and at least one properly spaced observation well generally are more reliable than single-well tests for determining hydraulic characteristics of the aquifer. Table 2 shows the number of tests input to the computer file by parish and aquifer, and whether the tests involve a single well or multiple wells. Nine of the 1,001 coded aquifer tests were not in the nine regional aquifers considered in this report and, therefore, were not listed in table 2 or considered in the statistical analyses. For multiple-well tests, more than one value of transmissivity and storage coefficient were commonly calculated. The transmissivity and storage-coefficient values selected for the computer file were those that best represented the aquifer at that site. For some tests, both drawdown and recovery data were available. Usually, transmissivity and storage-coefficient values calculated from the recovery data were coded because fluctuating pumping rates sometimes distort the aquifer-test analysis during the drawdown phase. Fluctuating pumping rates are not a factor during recovery.

Table 2.--Single and multiple-well aquifer tests by parish and aquifer unit

[First number represents the number of single-well tests; second number represents the number of multiple-well tests; blank space or hyphen means no test data available]

Parish	Aquifer								
	Alluvial	Pleistocene	Evangeline	Jasper	Catahoula	Cockfield	Sparta	Carrizo	Wilcox
Acadia---------		-,4							
Allen----------		-,1	6,-						
Ascension------	-,1	1,2							
Avoyelles------	-,1		4,-						
Bienville------						1,-	-,3		3,-
Bossier--------	-,2	-,1							-,1
Caddo----------	-,4						2,-	2,-	12,-
Calcasieu------	-,-	11,4							
Caldwell-------	-,-					15,1	1,-		
Cameron--------	-,-	7,-							
Catahoula------	1,-			2,-	19,-				
Claiborne------							11,-		
Concordia------				4,-	2,-				
De Soto--------		2,-							38,1
E. Baton Rouge-	2,1	16,14	27,5	34,3	9,1				
East Carroll---	-,2					8,1			
East Feliciana-			3,2	1,1					
Evangeline-----		3,8	27,2						
Franklin-------	1,1								
Grant----------		-,2		2,-	8,-	4,-			
Iberia---------		6,-							
Iberville------	9,4	4,-							
Jackson--------						1,-	20,3		
Jefferson------		1,5							
Jefferson Davis		3,2	1,-						
Lafayette------		12,4							
La Salle-------		2,1			7,-	9,1			
Lincoln--------							30,1		
Livingston-----		4,-	4,-	7,-					
Madison--------	1,2						1,-		
Morehouse------	1,-					6,-	3,-		
Natchitoches---	2,3	1,-			3,-		4,1	1,-	8,1
Orleans--------		1,1							
Ouachita-------	1,-						12,1		
Pointe Coupee--			4,-	8,-	2,-				
Rapides--------	-,1	6,1	5,-	54,4	10,-				
Red River------	-,3	3,-							20,-
Richland-------	2,-					6,-			
Sabine---------					6,-	3,-	3,-		13,1
St. Charles----		-,1							
St. Helena-----				2,-	7,-				
St. James------	1,-								
St. John the Baptist------	1,-	3,-							
St. Landry-----		19,3	8,1						
St. Martin-----		6,-							
St. Tammany----		4,-	4,-	1,-					
Tangipahoa-----		3,-	1,-	1,-					
Union----------						1,-	22,1		
Vermilion------		4,6							
Vernon---------		3,1		5,-	4,-				
Washington-----		2,-	6,1	24,-					
Webster--------		-,2					19,1	5,-	14,2
W. Baton Rouge-	2,-		14,1	4,-					
West Carroll---		-,2				20,2			
W. Feliciana---			1,1	12,7	3,1				
Winn-----------		1,-				6,-	18,-		
Totals for single and multiple-well tests---	24,25	128,65	115,13	161,15	80,2	80,5	146,11	8,-	108,6
Total for aquifer------	49	193	128	176	82	85	157	8	114

Each aquifer test was subjectively rated "good," "fair," or "poor" (field 19, table 1). The general, criteria used to designate the rating are briefly described below:

a. Aquifer tests coded "good" included a pumping well usually 4 in. or more in diameter, penetrated most of the unit, and pumped a sufficient quantity of water to significantly stress the screened unit. Pumping rates were consistent and no appreciable boundaries were detected. Many multiple-well tests with properly spaced observation wells were rated "good." All transmissivity and storage-coefficient values calculated with data collected at each observation well were within 20 percent. These tests were run a sufficient length to establish well defined drawdown and recovery curves. Many single-well tests were also analyzed for both drawdown and recovery phases. If transmissivity values calculated from both phases were not significantly different, the tests were also rated "good."

b. Single-well tests with some partial penetration effects but with a sufficient pumping period to establish a relative equilibrium were rated "fair." Wells were usually 4 in. or more in diameter, penetrated between 25 to 75 percent of the unit, and pumped a sufficient quantity of water to significantly stress the screened unit. Usually, these tests were analyzed only for the drawdown phase. Approximately 10 percent of the multiple-well tests were rated "fair." Factors such as unsteady pumping rates, interference from other nearby pumping wells, and poorly spaced observation wells prevented these tests from being rated "good."

c. A "poor" test was usually a single-well test pumped for a short time period, usually less than 1 hour. Many of these wells were small in diameter (less than 4 in.) and had short screens relative to the unit thickness (less than 25 percent penetration) resulting in severe partial penetration problems. Many of these tests had no calculated values of transmissivity or storage coefficient. In all, 216 tests were rated "good"; 427 tests were rated "fair"; and 358 tests were rated "poor."

The hydraulic conductivity of each aquifer was determined by dividing the calculated transmissivity by an appropriate thickness. For most aquifer tests, the total sand thickness was used. For some single-well tests, the length of the screen was used because the tests involved low pumping rates, small well diameters, short pumping periods, and short screen lengths. Under these conditions, the calculated transmissivity value was assumed to represent only the part of the aquifer penetrated by the well screen (Meyer and others, 1975, p. 18).

Statistical Results

A description of the aquifer-test results for each aquifer is shown in table 3 and figures 1 through 9. Arithmetic means, standard deviations, and graphs showing percentile ranges of the distributions of transmissivity, hydraulic conductivity, and specific capacity were calculated for each aquifer and grouped by aquifer-test rating; a statistical analysis on storage coefficient was not done because of an insufficient number of observations.

Table 3.--Statistical analysis of aquifer-test results for nine regional aquifers in Louisiana

[ft^2/d, feet squared per day; ft/d, feet per day; gal/min/ft, gallon per minute per foot. Rating: G, good; F, fair; P, poor]

Aquifer	Rating	Number of observations	Transmissivity (ft^2/d) Mean	Transmissivity (ft^2/d) Standard deviation	Number of observations	Hydraulic conductivity (ft/d) Mean	Hydraulic conductivity (ft/d) Standard deviation	Number of observations	Specific capacity (gal/min/ft) Mean	Specific capacity (gal/min/ft) Standard deviation
Alluvial----	G	21	17,100	16,200	12	225	138	14	36	33
	F	9	23,400	26,900	7	189	106	16	33	41
	P	2	10,100	11,400	1	43	(a)	3	6	5
	GFP	32	18,400	19,300	20	203	128	33	32	36
Pleistocene-	G	34	29,200	34,100	21	112	66	19	17	19
	F	65	27,300	46,400	53	166	138	79	13	22
	P	13	20,900	35,400	11	107	101	35	8	19
	GFP	112	27,200	41,600	85	145	122	133	12	21
Evangeline--	G	23	16,000	22,400	20	112	69	23	22	32
	F	50	5,300	4,800	37	63	37	55	13	14
	P	12	6,100	8,500	8	62	48	29	4	11
	GFP	85	8,300	13,300	65	78	54	107	12	20
Jasper------	G	30	11,300	9,300	23	131	79	40	15	11
	F	45	7,300	6,900	27	115	65	68	13	16
	P	10	15,300	17,800	9	81	43	34	6	13
	GFP	85	9,600	9,800	59	116	70	142	12	14
Catahoula---	G	15	3,200	4,500	14	71	88	17	5	6
	F	24	2,400	3,300	19	51	54	42	7	10
	P	11	1,200	1,200	10	23	17	20	1	1
	GFP	50	2,400	3,400	43	51	64	79	5	8
Cockfield---	G	18	3,900	7,600	14	43	17	19	3	1
	F	33	1,900	2,100	29	37	28	39	2	2
	P	11	1,400	1,200	11	38	24	18	1	1
	GFP	62	2,400	4,400	54	39	25	76	2	2
Sparta------	G	27	3,800	3,400	23	56	32	32	4	3
	F	34	3,200	3,500	34	45	36	65	5	6
	P	20	4,100	5,500	19	53	42	47	2	2
	GFP	81	3,600	4,000	76	50	37	144	4	5
Carrizo-----	G	4	615	422	3	12	7	4	2	1
	F	1	627	(a)	1	17	(a)	1	1	(a)
	P	1	615	(a)	1	15	(a)	3	.5	.4
	GFP	6	617	327	5	14	6	8	1	1
Wilcox------	G	44	605	545	30	17	14	47	2	3
	F	31	403	363	28	14	15	38	1	1
	P	10	334	433	6	7	10	21	.7	.7
	GFP	85	499	481	64	15	14	106	1	2

[a] Standard deviation was not calculated because only one observation was available in the distribution.

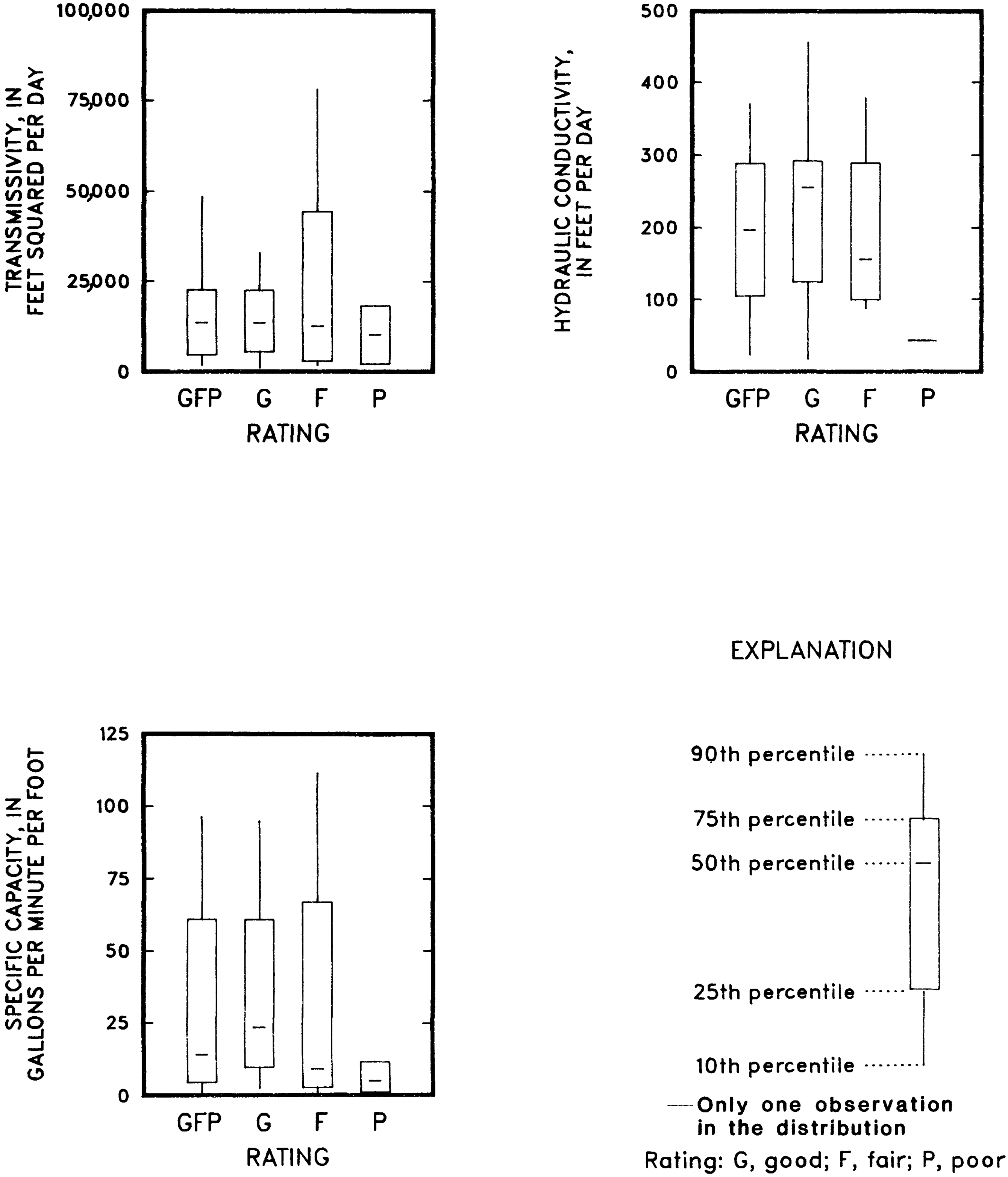

Figure 1.--Percentile ranges of the distributions of transmissivity, hydraulic conductivity, and specific capacity for the alluvial aquifer.

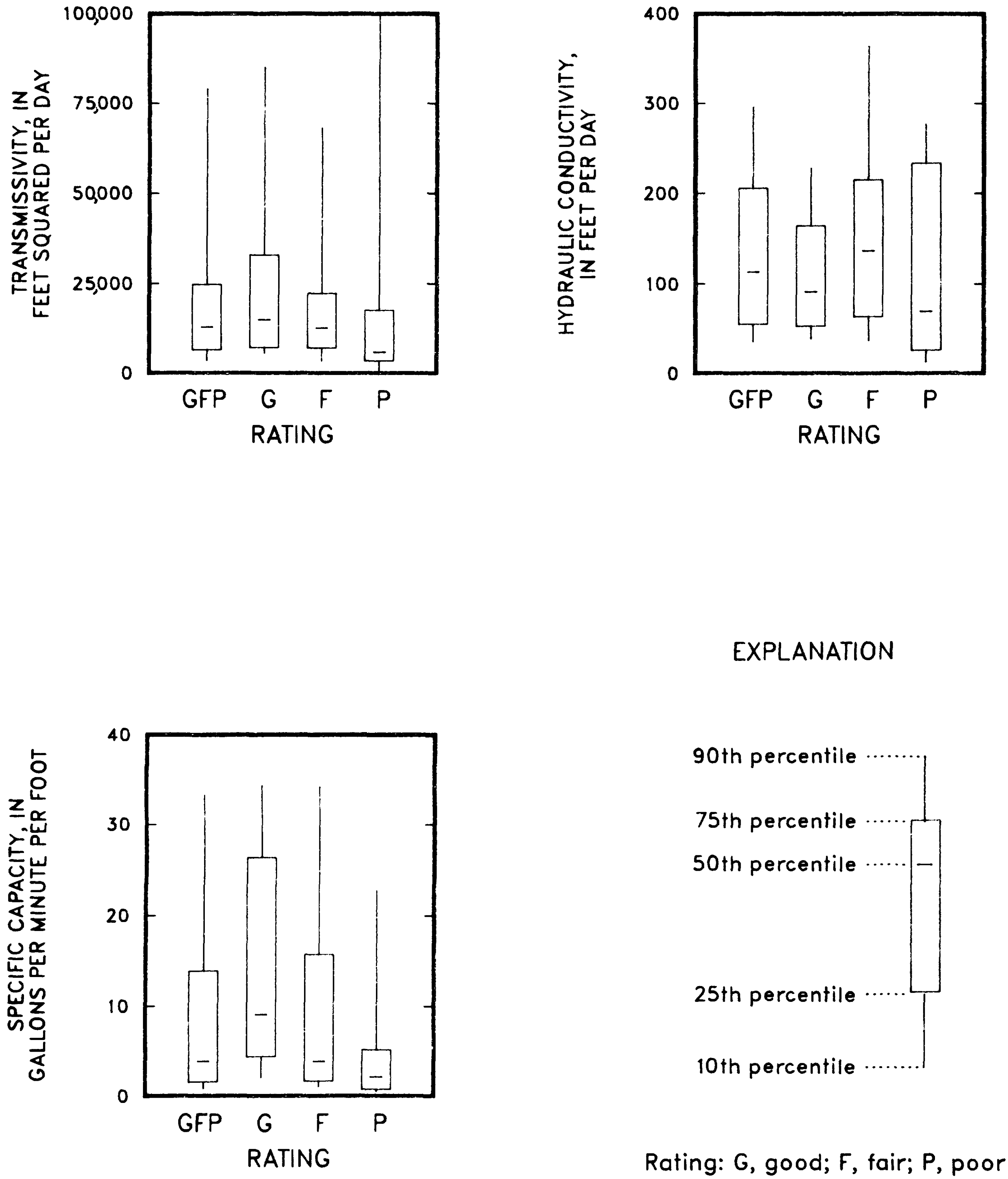

Figure 2.--Percentile ranges of the distributions of transmissivity, hydraulic conductivity, and specific capacity for the Pleistocene aquifer.

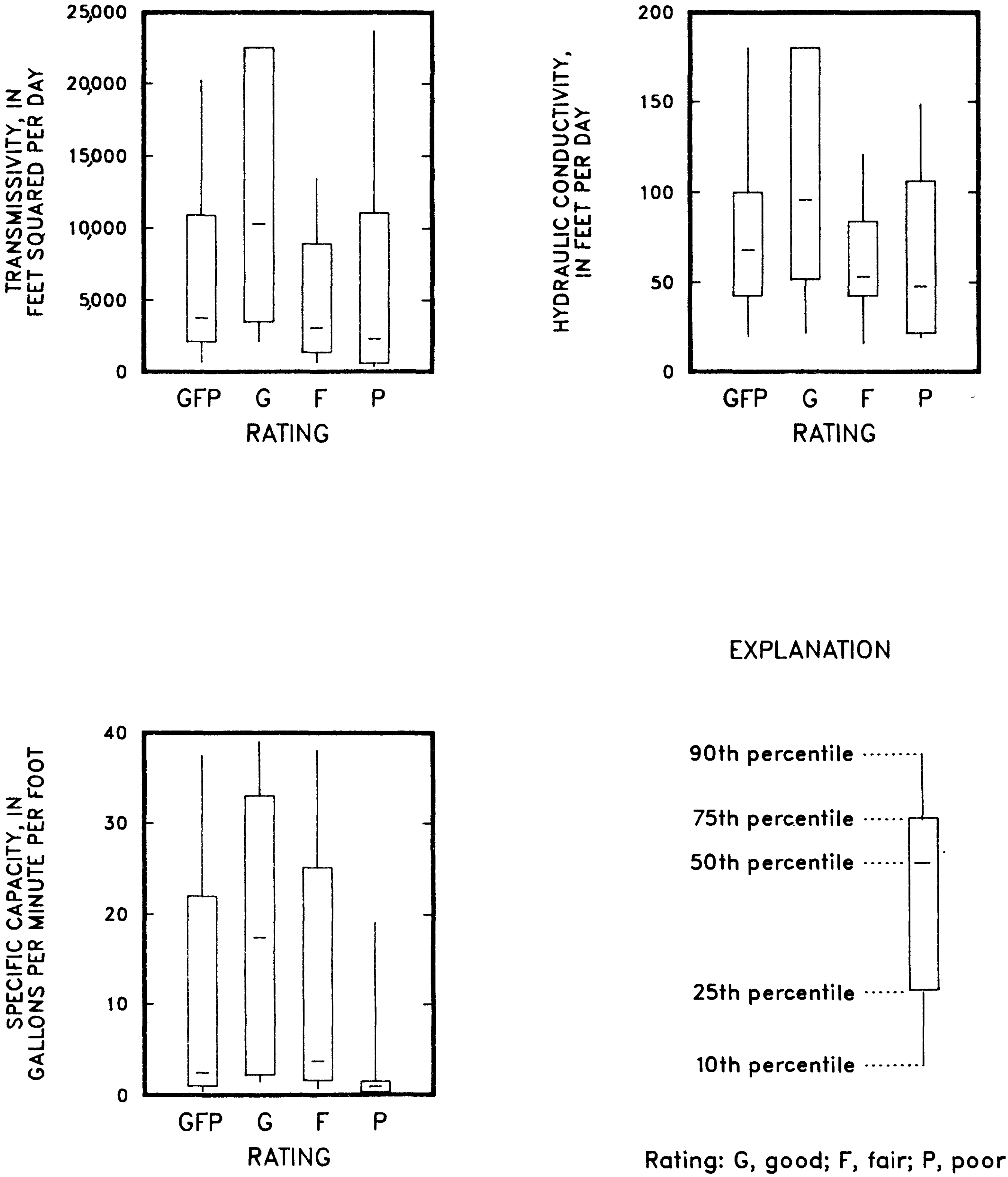

Figure 3.--Percentile ranges of the distributions of transmissivity, hydraulic conductivity, and specific capacity for the Evangeline aquifer.

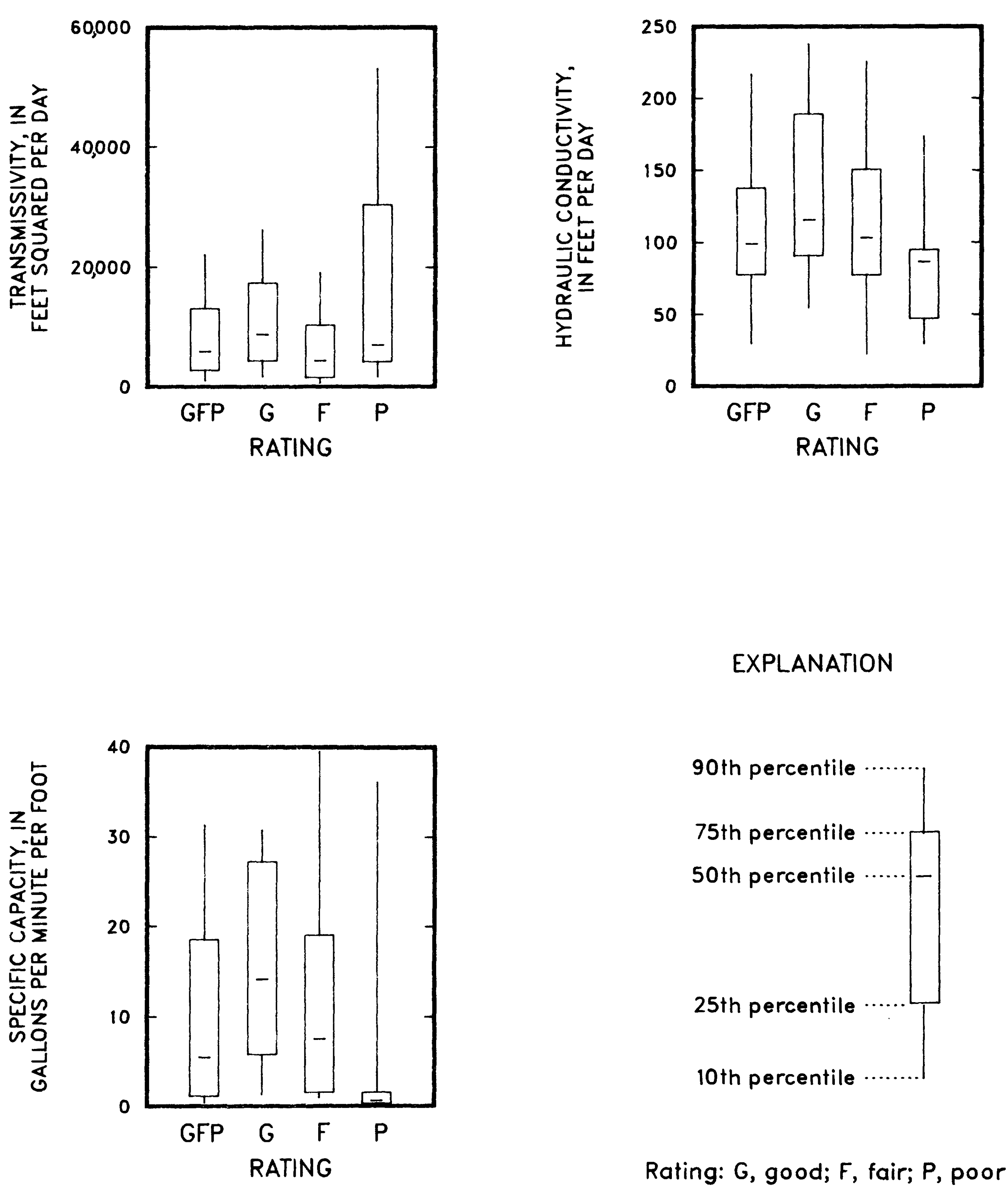

Figure 4.--Percentile ranges of the distributions of transmissivity, hydraulic conductivity, and specific capacity for the Jasper aquifer.

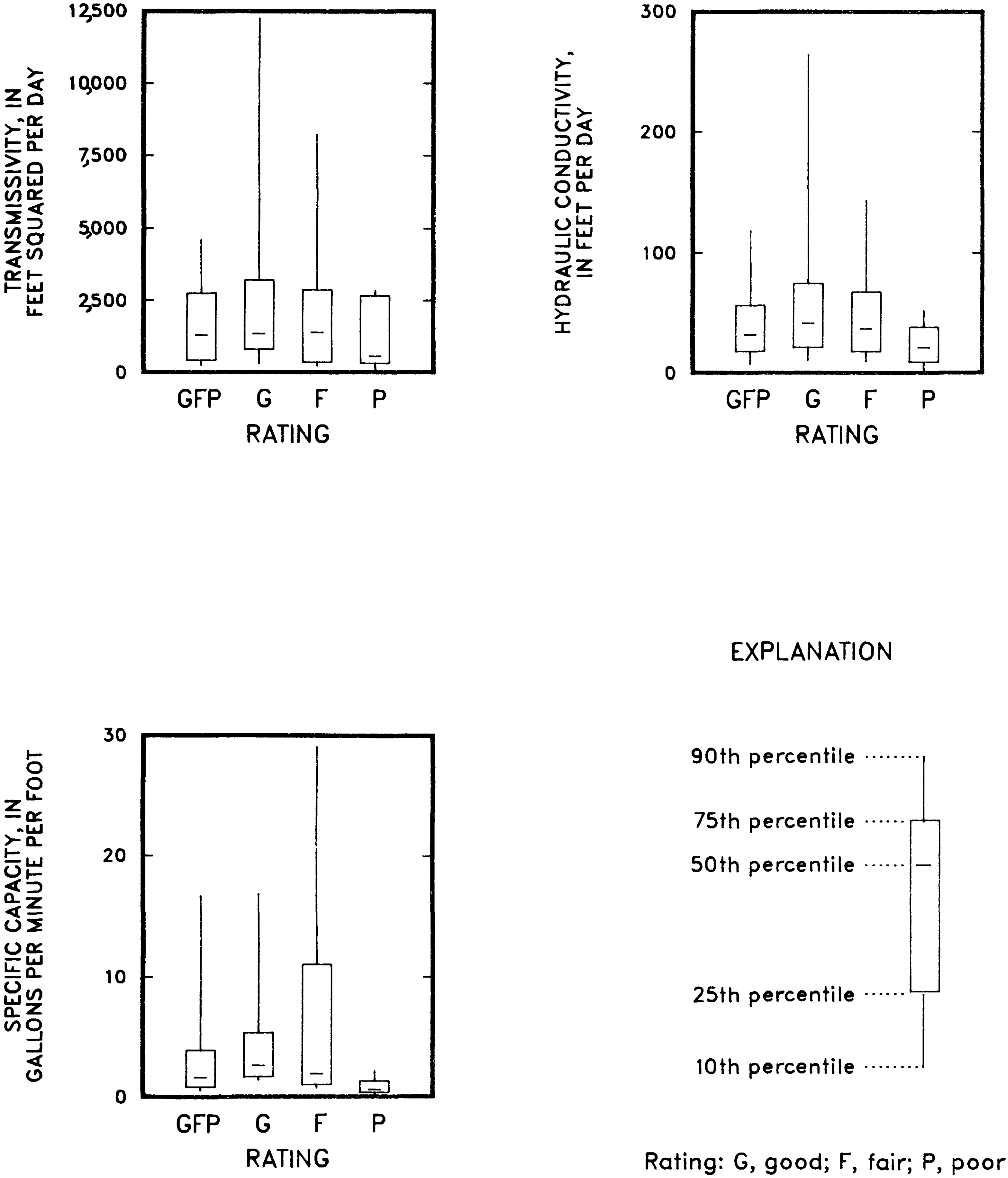

Figure 5.--Percentile ranges of the distributions of transmissivity, hydraulic conductivity, and specific capacity for the Catahoula aquifer.

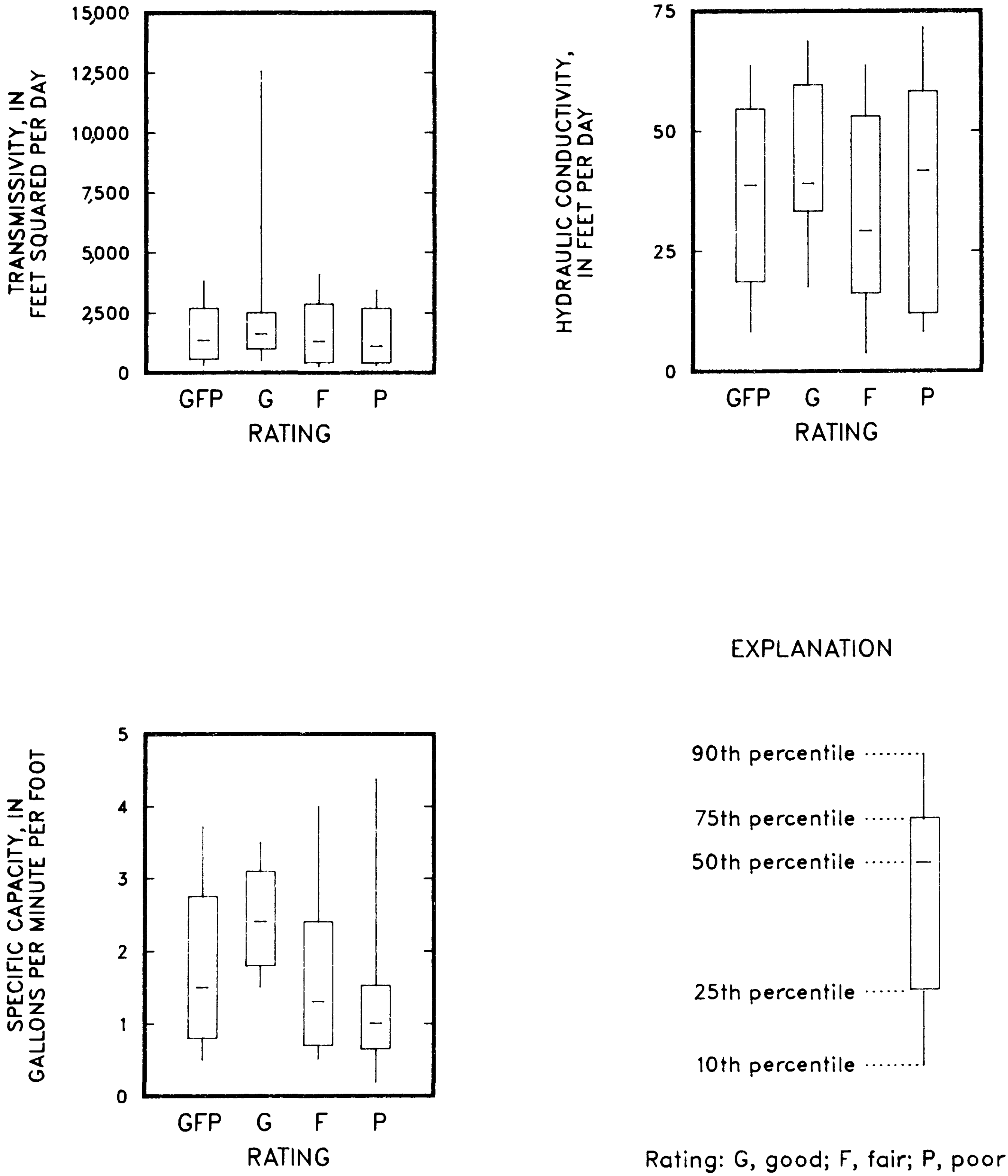

Figure 6.--Percentile ranges of the distributions of transmissivity, hydraulic conductivity, and specific capacity for the Cockfield aquifer.

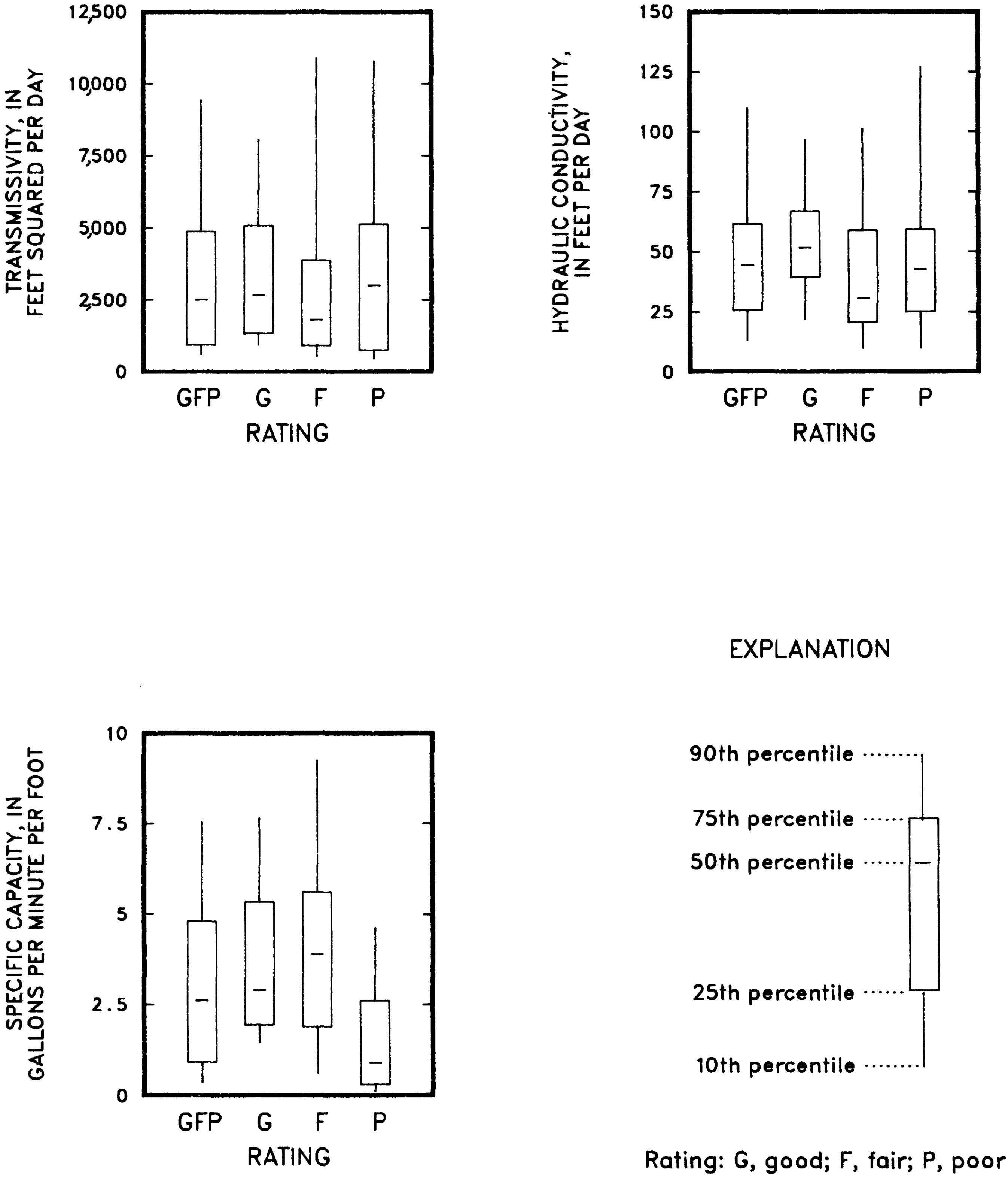

Figure 7.--Percentile ranges of the distributions of transmissivity, hydraulic conductivity, and specific capacity for the Sparta aquifer.

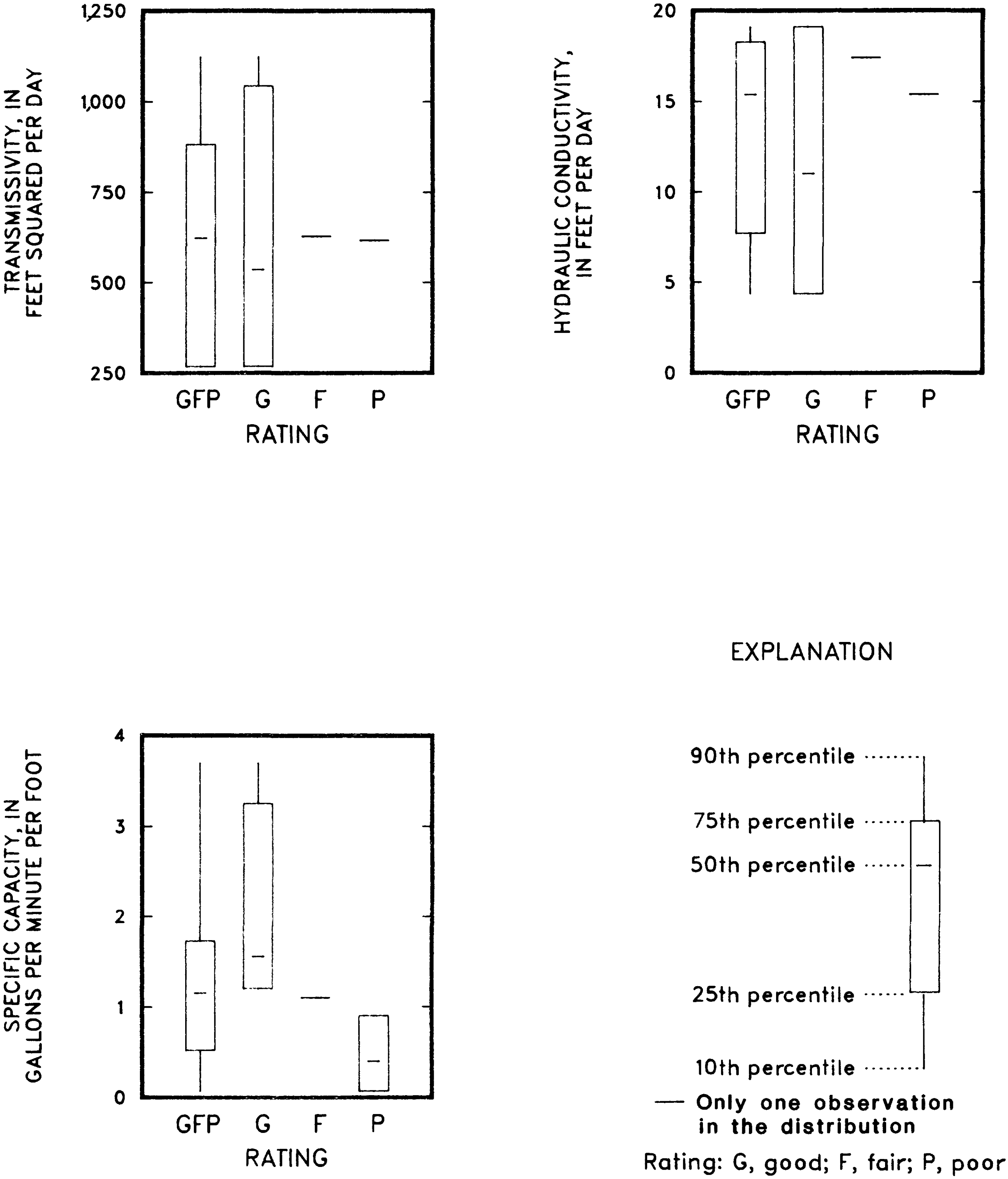

Figure 8.--Percentile ranges of the distributions of transmissivity, hydraulic conductivity, and specific capacity for the Carrizo aquifer.

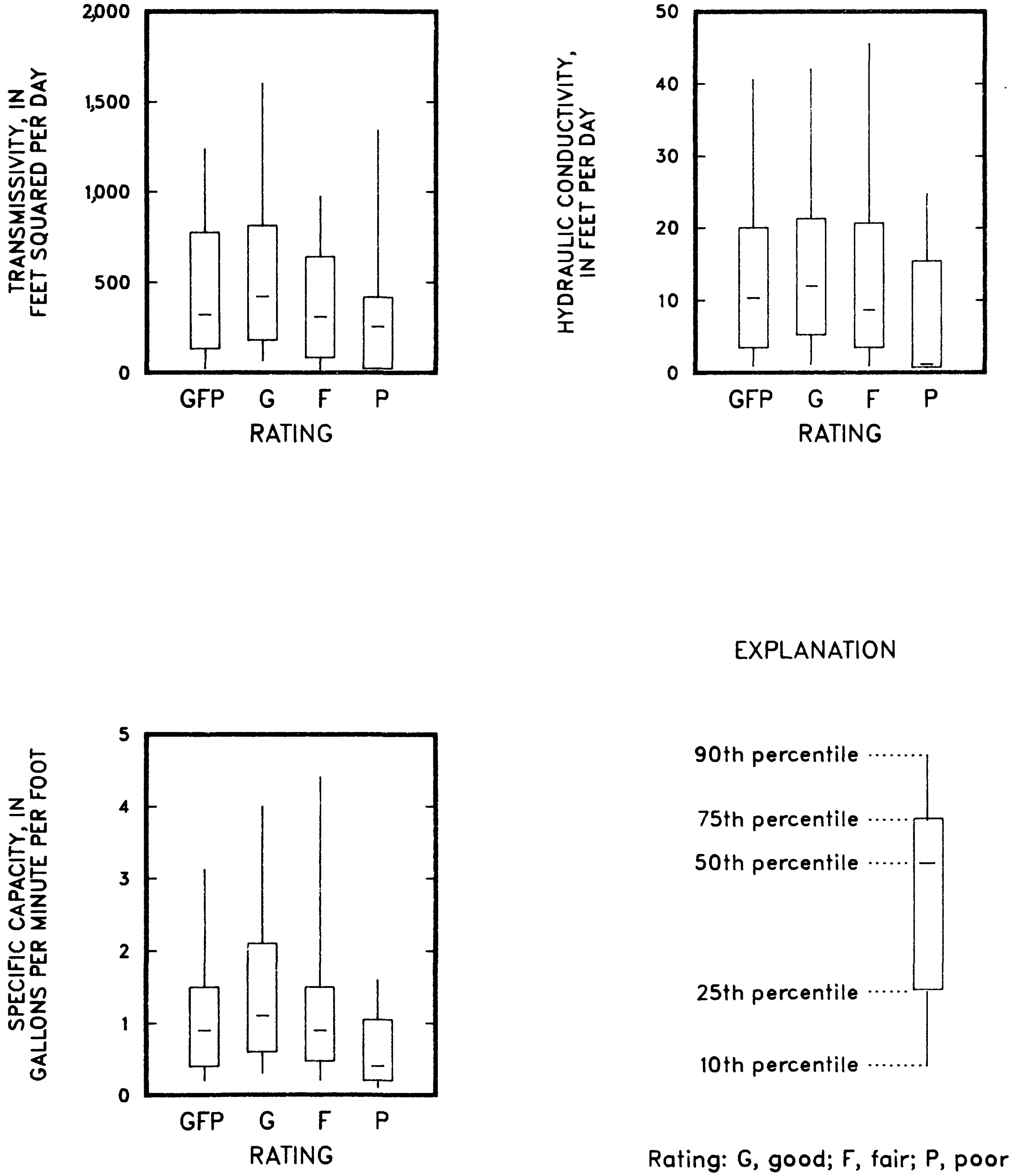

Figure 9.--Percentile ranges of the distributions of transmissivity, hydraulic conductivity, and specific capacity for the Wilcox aquifer.

Results from data rated "good" are considered to be the most reliable. Test data rated "fair" and "poor" are considered less reliable but still useful for estimating generalized hydraulic characteristics of the aquifers. The tests rated "fair" and "poor" also were considered because these may have been the only tests available over large areas.

Results of the analyses shown in table 3 indicate that, on the average, permeability (hydraulic conductivity) generally decreases from the youngest aquifers to the oldest. The most permeable aquifers in Louisiana are the alluvial and Pleistocene aquifers; whereas, the least permeable are the Carrizo and Wilcox aquifers. The graphs showing percentile ranges (figs. 1-9) indicate the large skewness of many of the distributions.

The calculations of standard deviation and graphs showing percentile ranges indicate a large dispersion of the aquifer-test results for all nine regional aquifers. The dispersion in the hydraulic conductivity can probably be attributed to the heterogeneity of the materials that compose the regional aquifers. The dispersion in transmissivity is a result of variations in hydraulic conductivity and aquifer thickness. The dispersion in specific capacity is believed to be caused primarily by variations in transmissivity and well efficiency.

Plots showing the relation between transmissivity (T) and specific capacity (SC) for each of the nine regional aquifers in Louisiana are shown in figures 10 through 18. The figures show the scatter plot of points designated from tests rated "good," "fair," or "poor" and the least-squares regression best-fit line which was constrained to pass through the origin defining transmissivity to be zero when specific capacity is given to be zero. The extreme points in each plot were eliminated if determined to be outliers using Chauvenet's criterion (Neville and Kennedy, 1964). Regressions were calculated for each regional aquifer after the most extreme outlier was eliminated. These regressions were compared to previous regressions to determine whether the elimination of the outlier produced significantly different regression results. This process was repeated until all extreme points were tested. The number of observations, regression equation, corresponding correlation coefficient, and standard error of estimate, for each aquifer are listed below with transmissivity and specific capacity in units of feet squared per day and gallons per minute per foot of drawdown, respectively:

Aquifer	Number of observations	Regression equation	Correlation coefficient	Standard error of estimate
Alluvial------	21	T = 666 X SC	0.88	14,320
Pleistocene---	59	T = 641 X SC	.89	10,580
Evangeline----	64	T = 496 X SC	.87	4,715
Jasper--------	56	T = 685 X SC	.88	6,040
Catahoula-----	45	T = 503 X SC	.85	1,865
Cockfield-----	54	T = 767 X SC	.86	940
Sparta--------	67	T = 476 X SC	.76	2,920
Carrizo-------	6	T = 337 X SC	.93	270
Wilcox--------	105	T = 344 X SC	.89	305

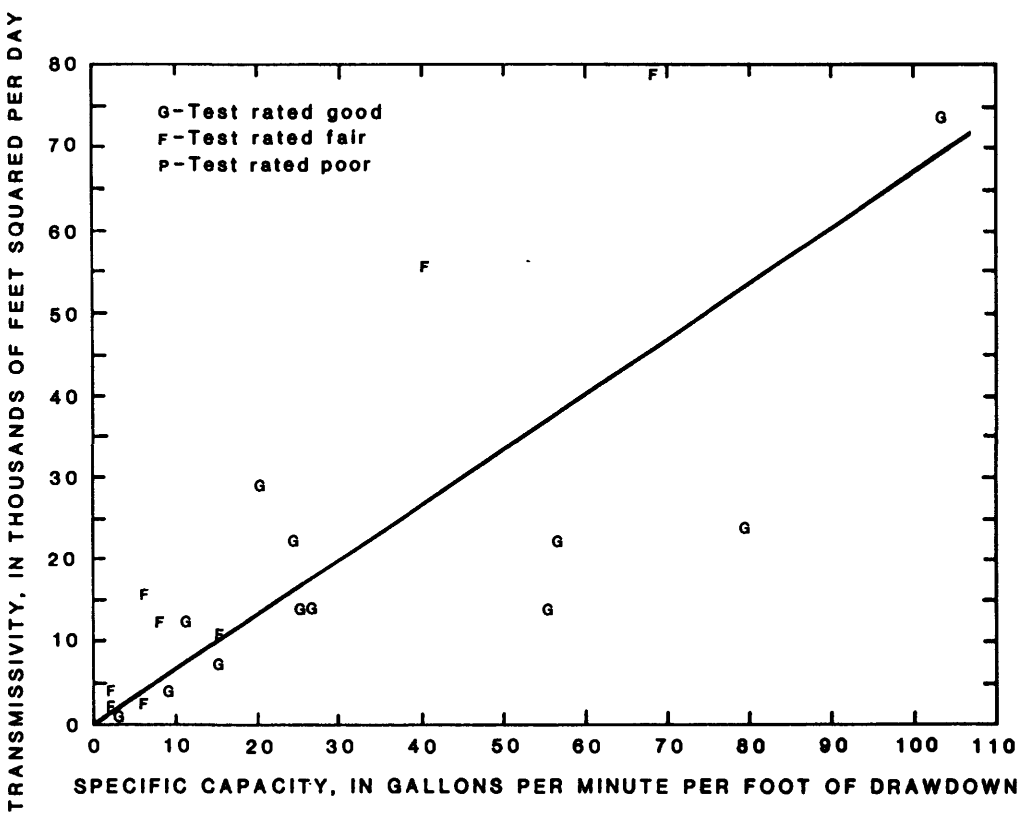

Figure 10.--Relation of transmissivity to specific capacity for the alluvial aquifer.

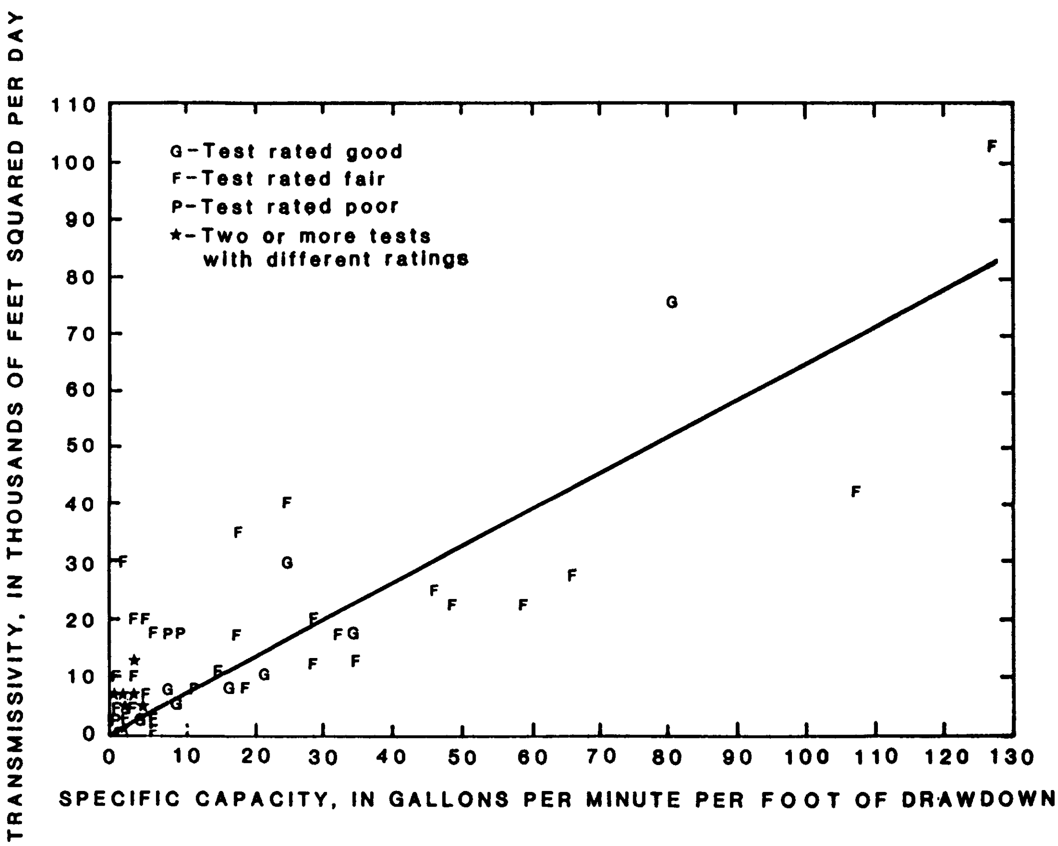

Figure 11.--Relation of transmissivity to specific capacity for the Pleistocene aquifer.

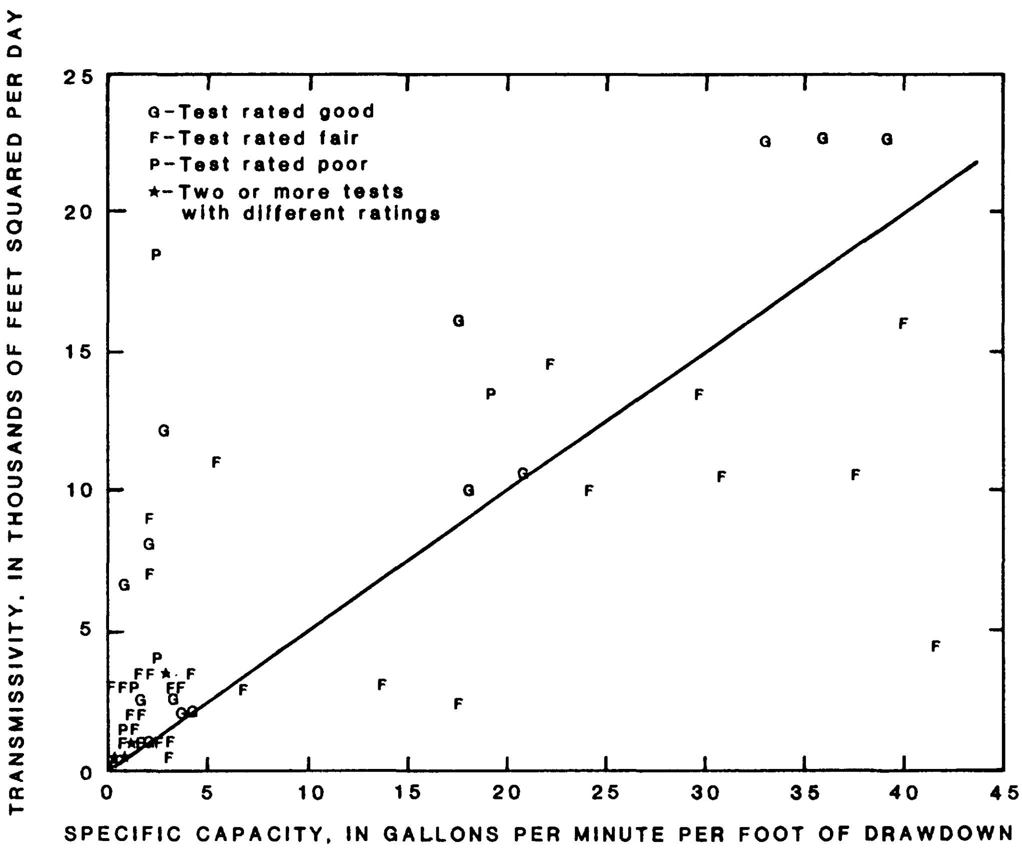

Figure 12.--Relation of transmissivity to specific capacity for the Evangeline aquifer.

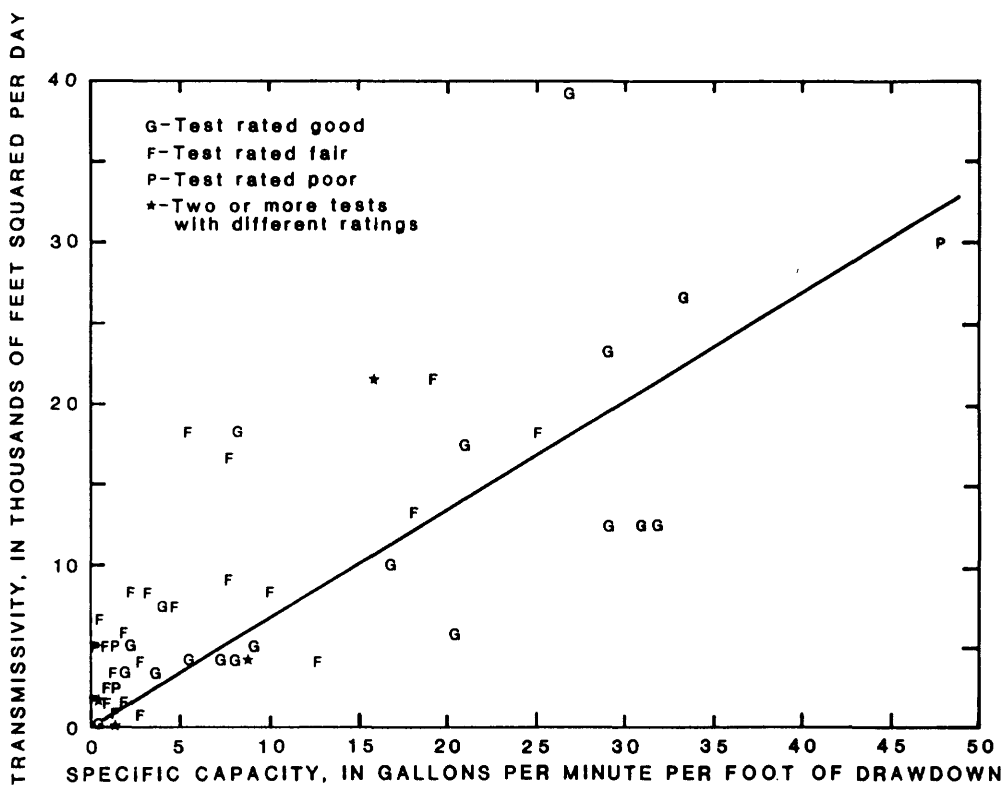

Figure 13.--Relation of transmissivity to specific capacity for the Jasper aquifer.

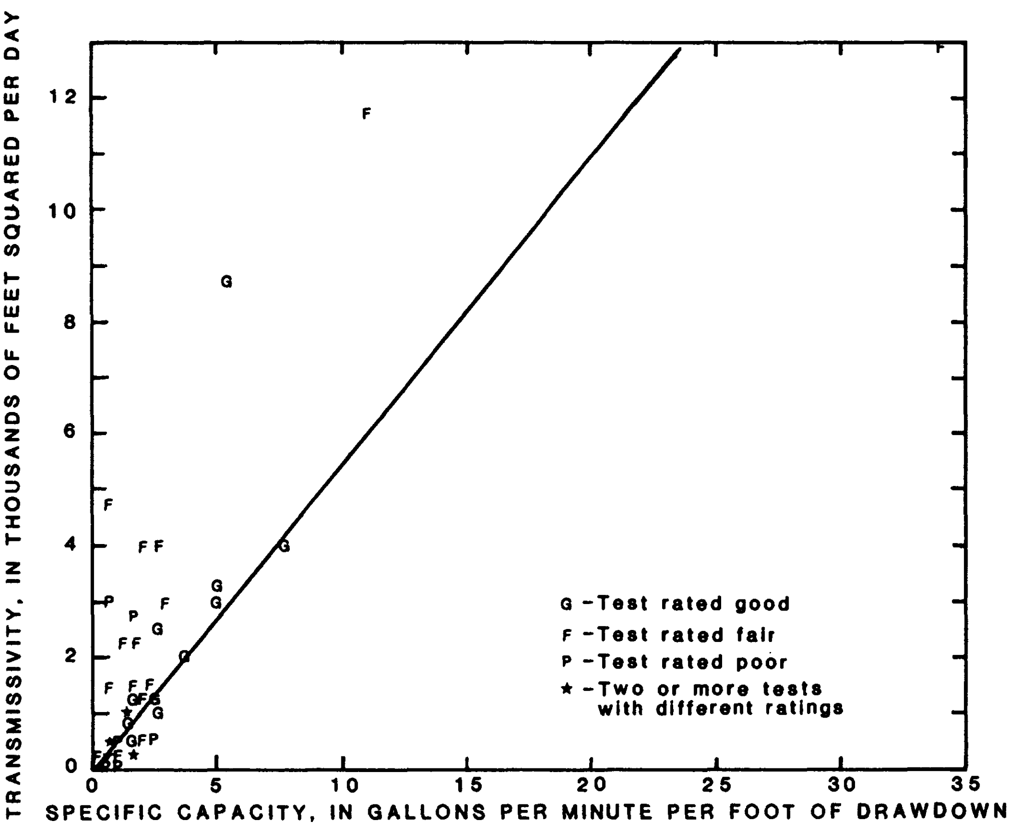

Figure 14.--Relation of transmissivity to specific capacity for the Catahoula aquifer.

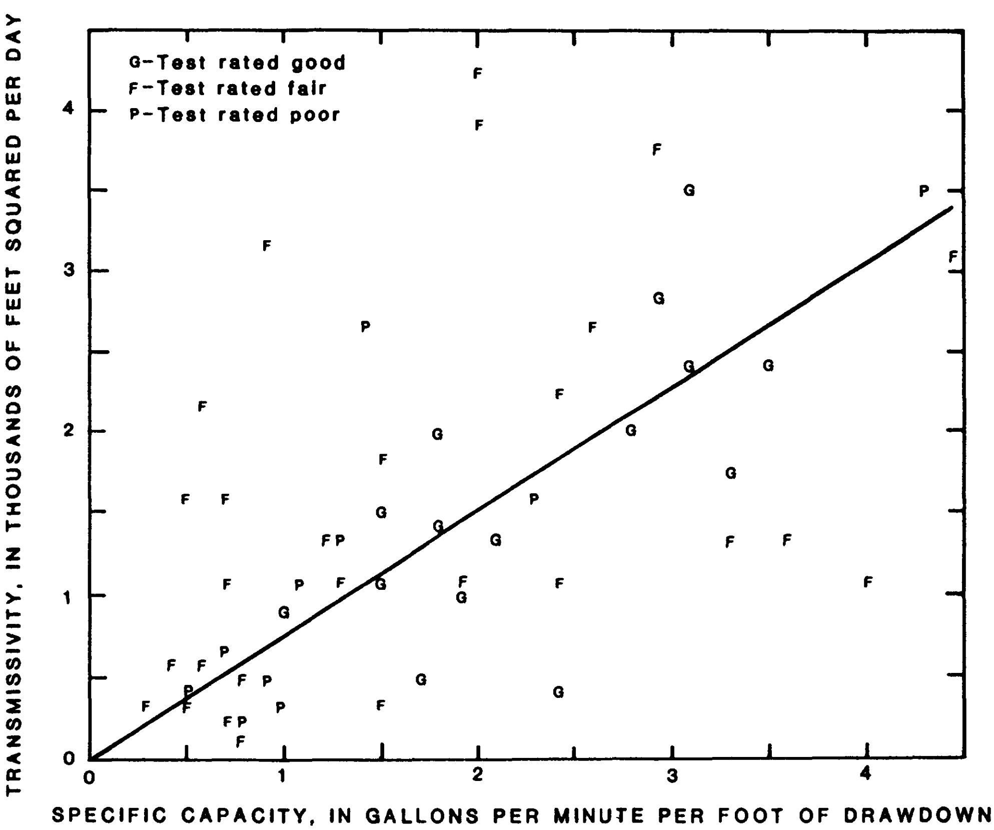

Figure 15.--Relation of transmissivity to specific capacity for the Cockfield aquifer.

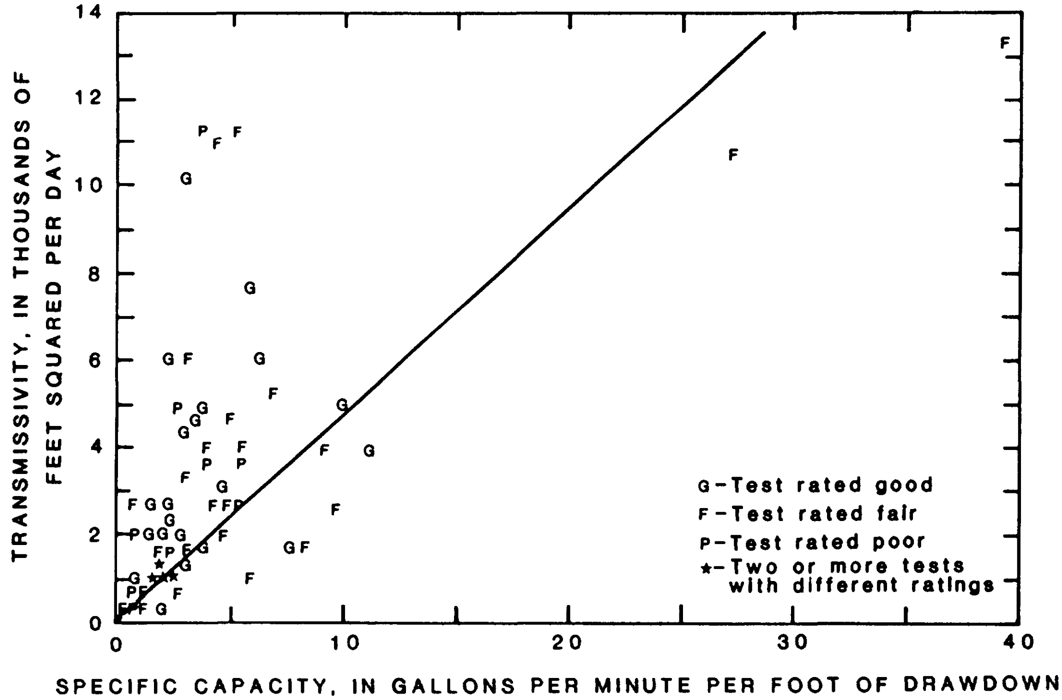

Figure 16.--Relation of transmissivity to specific capacity for the Sparta aquifer.

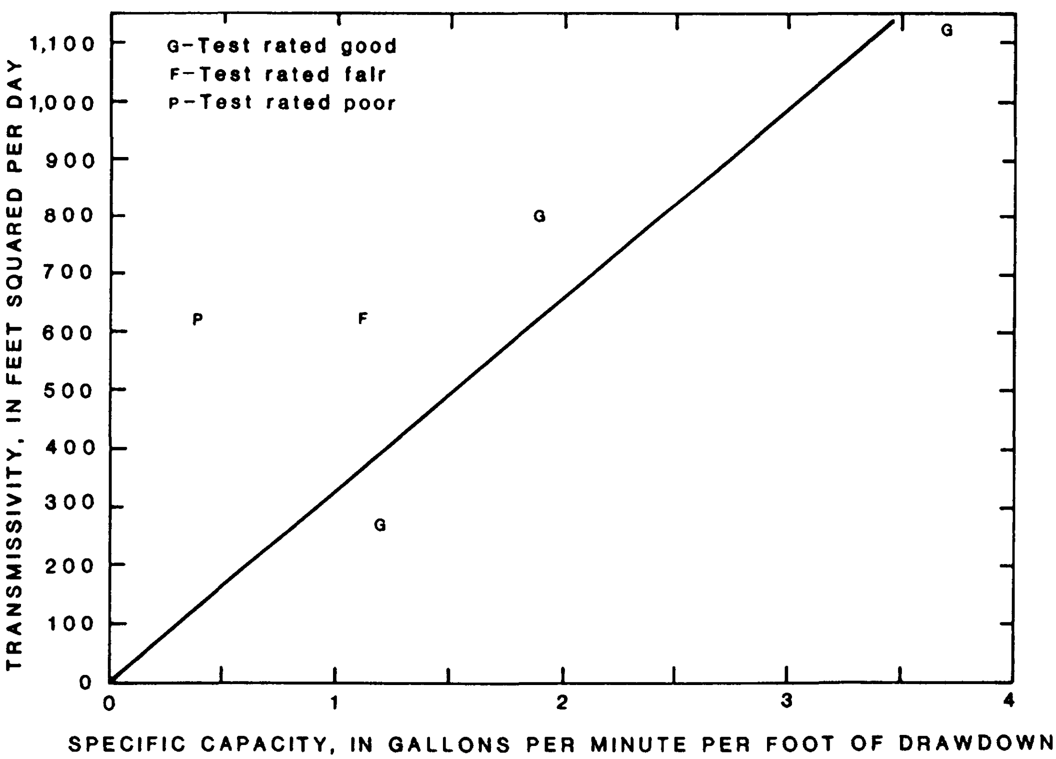

Figure 17.--Relation of transmissivity to specific capacity for the Carrizo aquifer.

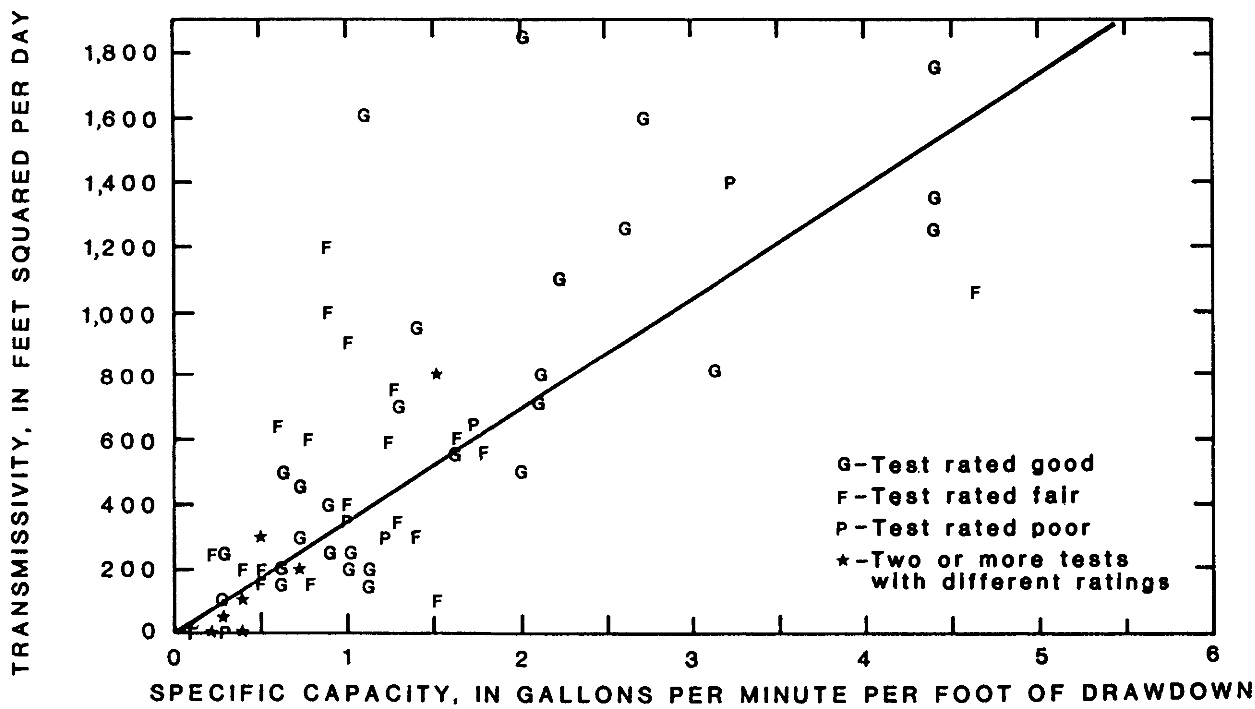

Figure 18.--Relation of transmissivity to specific capacity for the Wilcox aquifer.

A least-squares regression of log of transmissivity as a function of log of specific capacity were done for each of the nine regional aquifers. This log-log transform did not produce significantly different regression results.

To test whether transmissivity and specific capacity were dependent and correlative, correlation coefficients for each regression were tested by using tabulated values of correlation coefficient, which can be expected at a given level of significance from observations drawn by chance where there is no correlation (Duncan, 1974). If the absolute value of the calculated correlation coefficient exceeds the tabulated value, a correlation exists. The level of significance represents the probability of having drawn a wrong conclusion, that is, assuming a non-zero correlation exists given the true correlation is zero.

The calculated correlation coefficients exceeded their corresponding tabulated values (Neville and Kennedy, 1964, table A-11) at the 0.01 probability level of significance for all aquifers except the Carrizo, whose calculated correlation coefficient exceeded its corresponding tabulated value at the 0.05 probability level of significance. This indicates that there is correlation between transmissivity and specific capacity with less than a 5-percent chance of being wrong for the Carrizo aquifer and less than a 1-percent chance for all other aquifers. These levels of significance depend on the assumption of bivariate (transmissivity and specific capacity) normality. The standard error of estimate is an estimate of the variation of the observed values of transmissivity about the average values of transmissivity as given by the least squares regression line for a given specific capacity. The high standard error of estimate for some of the regressions indicates the large dispersion of the data about the regression line. The dispersions can be primarily attributed to variations in hydraulic conductivity, aquifer thickness, and well efficiency.

Theis (1963) and Brown (1963) derived equations, for water-table and artesian aquifers, respectively, relating transmissivity to specific capacity, storage coefficient, and length of the aquifer test. From their discussions, the multiplication factor for the specific capacity can range plus or minus 30 percent. For small-diameter, poorly-developed wells, the multiplication factor can be as much as 30 percent greater than the calculated value; whereas, for large-diameter, well-developed wells, the factor can be as much as 30 percent less than the calculated value.

The number of estimates for transmissivity for input to the regional ground-water flow model is greatly expanded by using the above equations and specific capacities. These equations should be used in the context of estimating generalized, average values of transmissivity where only values of specific capacity are available.

Plots of hydraulic conductivity as a function of total thickness of sand were made for each regional aquifer. Correlation coefficients calculated in each regression were tested, in the same manner as previously described. Hydraulic conductivity and total thickness of sand significantly correlated (significance level of 0.05) only in the regressions for the alluvial and Evangeline aquifers. For all other aquifers, no significant correlation between hydraulic conductivity and total thickness of sand were found. Figures 19 and 20 show the scatter plot of points and the least-squares regression line of hydraulic conductivity (K, in feet per day) as a function of total thickness of sand (s, in feet) for the alluvial and Evangeline aquifers, respectively. The number of observations, regression equation, corresponding correlation coefficient, and standard error of estimate are listed below:

Aquifer	Number of observations	Regression equation	Correlation coefficient	Standard error of estimate
Alluvial------	19	K = (1.29) X s + 104	0.59	106
Evangeline----	56	K = (.53) X s + 27	.58	46

Both of these correlations are low positive, meaning that for increasing total thickness of sand, the hydraulic conductivity increases. A possible explanation for this relation is that the thicker sands represent channel deposits where stream velocities were highest during periods of deposition, resulting in coarser, better sorted, and cleaner sands with higher hydraulic conductivities (Payne, 1968 and 1970).

Further statistical analysis is needed to determine if hydraulic conductivity and total sand thickness can be related for the other aquifers using multiple linear regression or nonlinear relations.

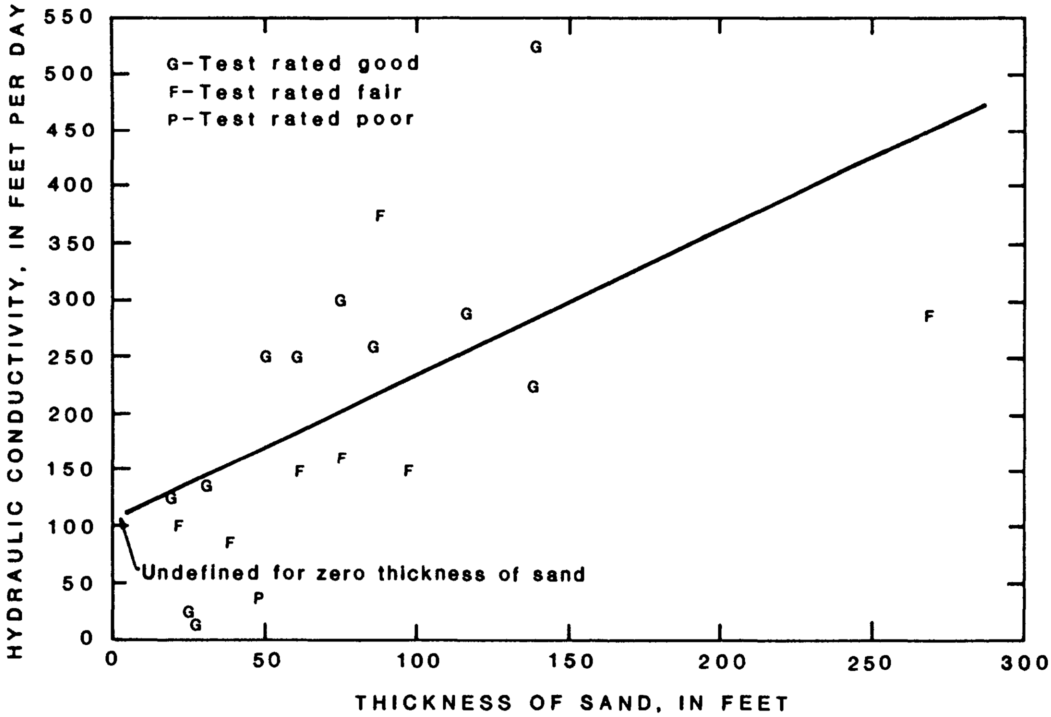

Figure 19.--Relation of hydraulic conductivity to total thickness of sand for the alluvial aquifer.

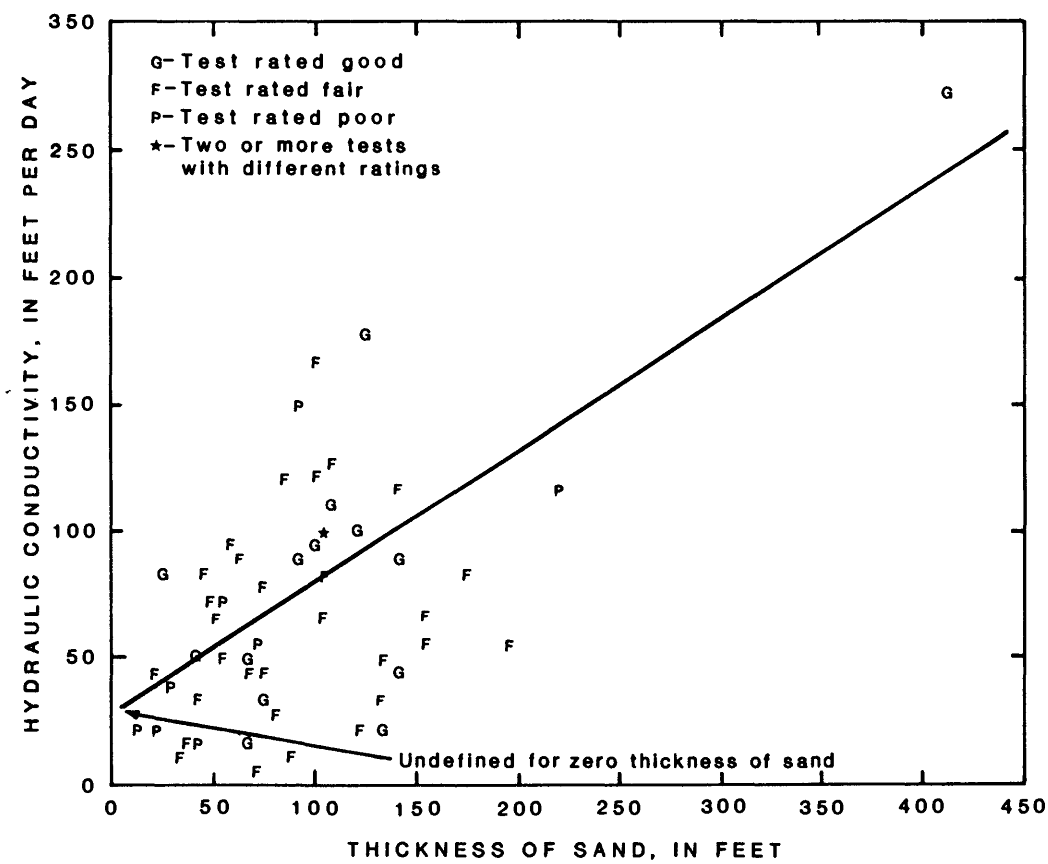

Figure 20.--Relation of hydraulic conductivity to total thickness of sand for the Evangeline aquifer.

SUMMARY

Approximately 1,500 aquifer tests from U.S. Geological Survey files in Louisiana were examined, and data from 1,001 tests were entered into a computer file. A statistical analysis of hydraulic characteristics for nine regional aquifers (from youngest to oldest: alluvial, Pleistocene, Evangeline, Jasper, Catahoula, Cockfield, Sparta, Carrizo, and Wilcox) was compiled along with plots and regression equations that describe the relation between transmissivity and specific capacity and between hydraulic conductivity and total thickness of sand. The analysis showed that, in general, permeability (hydraulic conductivity) decreases from the youngest aquifers to the oldest. The most permeable aquifers in Louisiana are the alluvial and Pleistocene aquifers; whereas, the least permeable are the Carrizo and Wilcox aquifers. Calculated standard deviations indicate a large dispersion of the results. Transmissivity and specific capacity were dependent and correlative for all nine aquifers; whereas, hydraulic conductivity and total sand thickness could be statistically correlated for only the alluvial and Evangeline aquifers.

This report gives general hydraulic characteristics of the nine regional aquifers in Louisiana. Care should be taken in applying the results in a specific, localized context.

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DEPARTMENT OF THE INTERIOR
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WATER-RESOURCES INVESTIGATIONS
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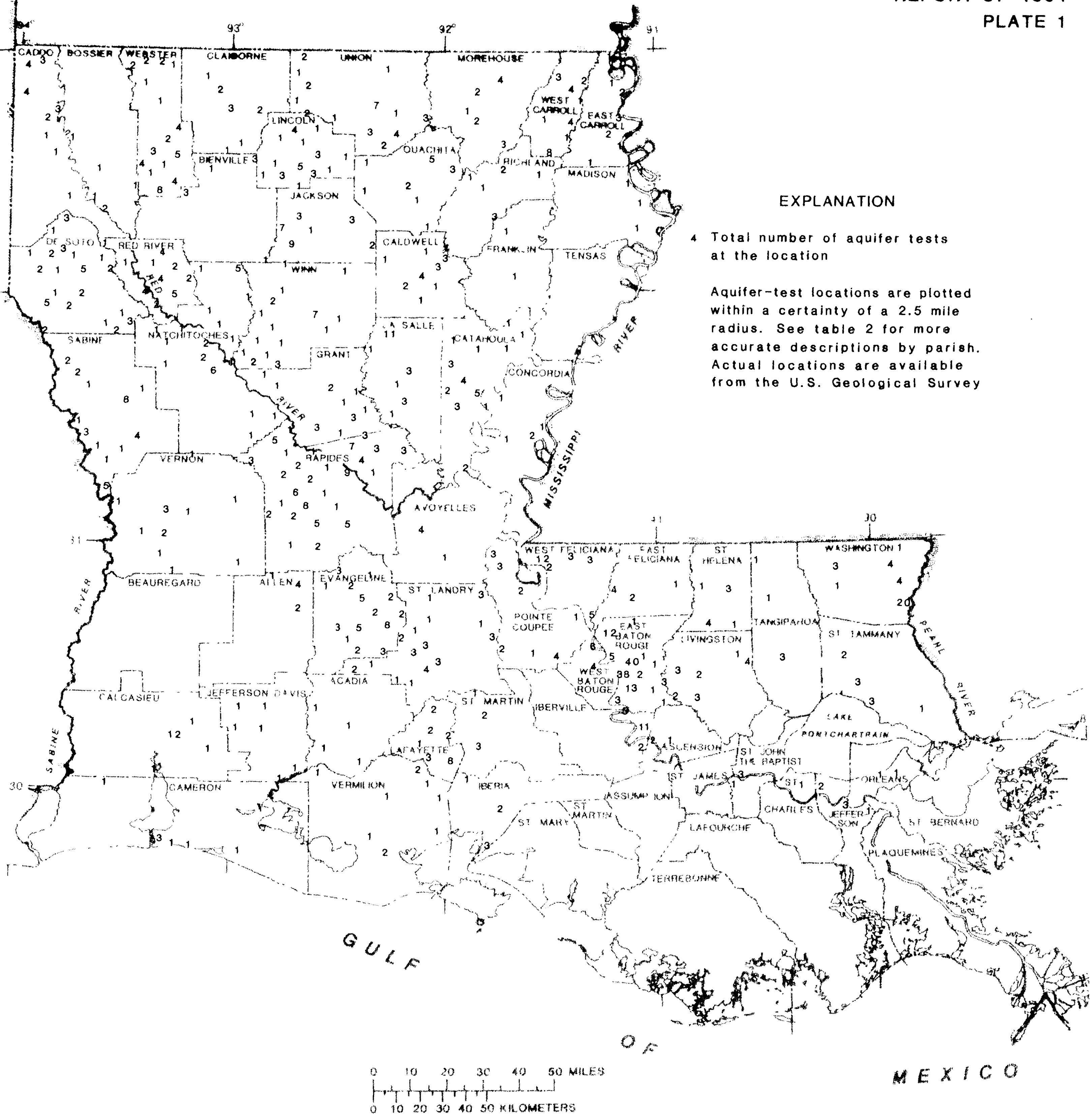
PLATE 1



AREAL DISTRIBUTION OF CODED AQUIFER TESTS, LOUISIANA