GROUND-WATER RESOURCES OF CHESTERFIELD COUNTY, SOUTH CAROLINA

STATE OF SOUTH CAROLINA
DEPARTMENT OF NATURAL RESOURCES

LAND, WATER AND
CONSERVATION DIVISION

WATER RESOURCES
REPORT 36

2004

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by

Roy Newcome, Jr.

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STATE OF SOUTH CAROLINA
The Honorable Mark H. Sanford, Governor

South Carolina Department of Natural Resources

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ABSTRACT

Chesterfield County, in northeastern South Carolina and bordering North Carolina, has two markedly different sources of ground water. About 20 percent of the county is in the Piedmont physiographic province, where the crystalline rocks beneath a thin weathered zone contain ground water only in fractures. Wells in these rocks generally provide very low yields, often less than 5 gpm (gallons per minute); although there are exceptions—some 50-200 gpm wells have been reported.

The rest of the county lies below the Fall Line and contains sand and clay beds of the Middendorf Formation, the only formation that underlies the entire Coastal Plain of South Carolina and one of the most important sources of water supplies. The sand aquifers of the Middendorf occur to depths as great as 450 feet near the southern border of the county. Wells in these aquifers yield as much as 900 gpm, but the potential exists for yields of 2,000-3,000 gpm.

The chemical quality of water from both types of aquifer—the hard rock and the sand—is suitable for all uses. In the Piedmont, the water is more mineralized and less acidic than that in the Coastal Plain, the latter being similar to rainwater with extremely low dissolved solids and low pH. Recently, several public-supply wells in counties along and just below the Fall Line have been observed to have excessive concentrations of radium. The source and remediation are currently under investigation.

INTRODUCTION

Chesterfield County is the last remaining county, in South Carolina's Coastal Plain, that has not had a comprehensive study made of its ground-water resources. All the other counties have had an individual study or have been part of a multicounty study. There are many degrees of comprehensiveness in such studies, the most common control being the amount and range of data relating to where the water is, how much there is, and what its chemical quality is. These are the items of information needed by developers of public and industrial water supplies and by irrigators. Domestic-well drillers and users also benefit from good information on the ground water.

The main source of data for this report is the files of the South Carolina Department of Natural Resources (DNR). These files are augmented by drillers' well reports, which are required by law to be submitted to the South Carolina Department of Health and Environmental Control (DHEC). Probably the most revealing data are provided by the consulting engineers who design and direct construction of the major public-supply water wells. The most useful basic information on ground water is obtained through the use of three tools: electric logs of wells; pumping tests; and chemical analyses of water. This report uses these tools to evaluate and describe the ground-water resources of Chesterfield County.

Location and Geography

Chesterfield County occupies an area of 800 square miles in northeastern South Carolina (Fig. 1). It is bounded on the north by North Carolina, on the east by Marlboro County, on the south by Darlington County, and on the west by Lancaster and Kershaw Counties. Chesterfield County lies between latitude 34°22' and 34°49' N, longitude 79°47' and 80°34' W. Least distances from Columbia, S.C., to the southwest, and Charlotte, N.C., to the northwest, are 50 and 30 miles, respectively. Both cities have major airports. Interstate Highways 20, running west, and 95, running northeast, intersect near Florence, which is about 20 miles to the south. U.S. Highway 1 traverses the county in a southwest-northeast direction, passing through McBee, Patrick, and Cheraw.

Chesterfield County is in the Pee Dee River basin, which drains 3,500 square miles in northeastern South Carolina and double that area in North Carolina. Major streams are the Great Pee Dee River, which forms the eastern county boundary, and the Lynches River, which forms the western boundary. The Lynches drains only a narrow strip along the western edge of the county. The Great Pee Dee, with its major tributaries, Black, Cedar, and Thompson Creeks, drains the rest of the county. Lake Robinson is a 2,250-acre power-company lake on Black Creek. Half of the lake area is in Chesterfield County, the other half in Darlington County to the south.

The topography of the county is generally rolling, but there are rugged areas with many elevations greater than 500 ft (feet) above sea level. The most important feature influencing the ground-water resources is the Fall Line, where the Coastal Plain's unconsolidated sediments pinch out over the underlying bedrock of the Piedmont physiographic province. The Fall Line is depicted in Figure 1.

All or parts of 23 U. S. Geological Survey (USGS) 7.5-minute topographic quadrangles are involved in the coverage of Chesterfield County (Fig. 1). These maps reveal the range in landforms, elevation, and drainage. The lowest elevation is 70 ft above sea level and is found along the Great Pee Dee

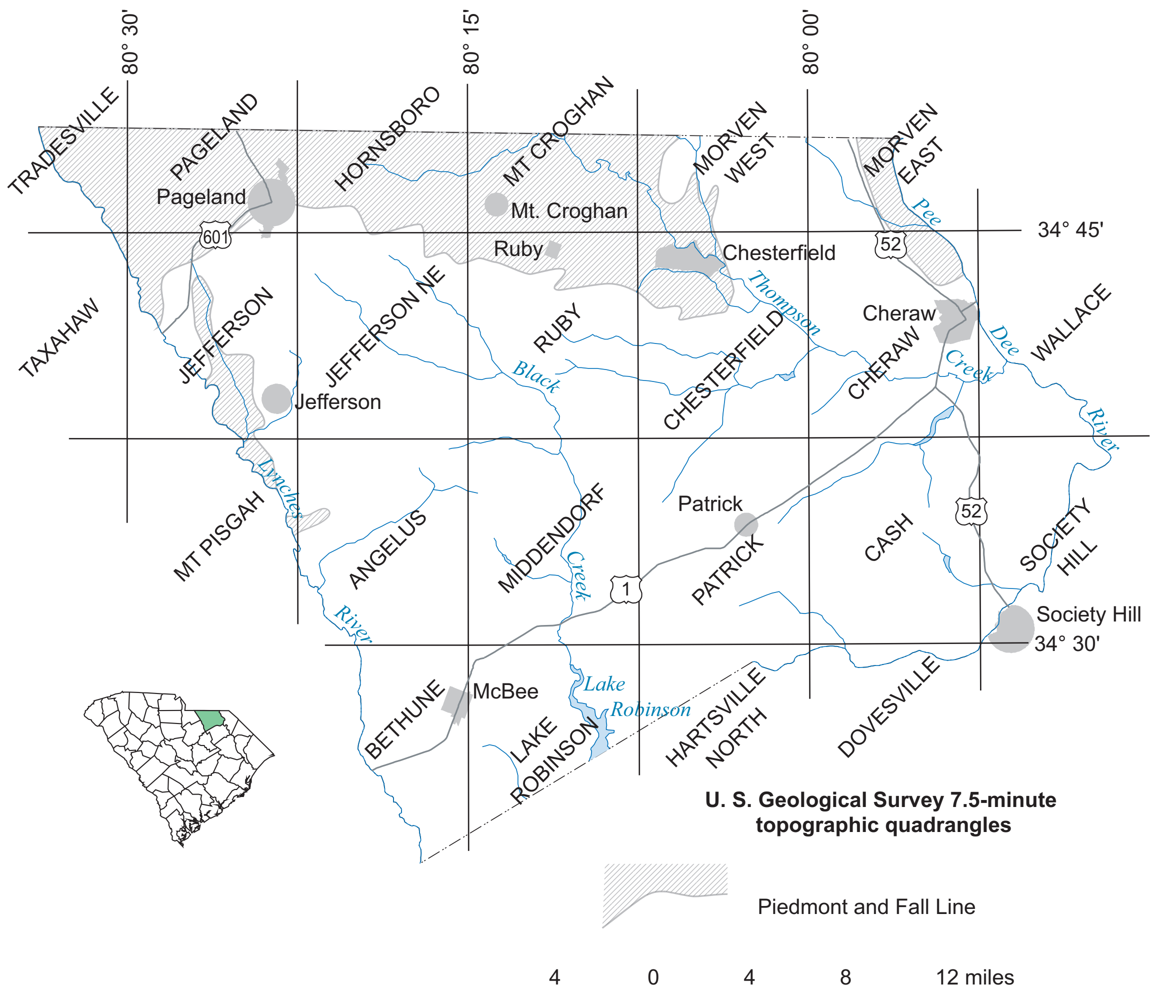


Figure 1. Location and topographic-map coverage of Chesterfield County, S.C.

River, the eastern border of the county; the highest elevation is 725 ft near the northwest corner. A broad, swampy flood plain is prominent along the Great Pee Dee River.

Approximately 20 percent of Chesterfield County is occupied by Sand Hill State Forest, Carolina Sandhills National Wildlife Refuge, and Cheraw State Park. All are in the southern half of the county. These are areas not available for crops, pastures, or industrial development.

Climate

Warm summers and mild winters, with exceptionally pleasant spring and fall seasons, characterize the climate of Chesterfield County. Daytime temperatures (°F) usually are in the 80's and 90's in the summer, 40's and 50's in the winter. Temperatures during the year average 60°; they seldom reach 100° or fall below 10°. July is the warmest month and January the coolest.

Rainfall averages 47 inches per year at Cheraw and 48 inches at Pageland over the periods of record, 70 years at Cheraw and 35 years at Pageland. July is the wettest month and November the driest. The normal growing-season length is 215 days.

Population and Economy

The 2000 U.S. Census showed 42,768 residents of the county, ranking it 25th among the State's 46 counties. The town of Chesterfield is the county seat, with 1,318 residents. Cheraw, the largest town, had 5,524 residents, and Pageland had 2,521. Five smaller communities had less than 1,000 each. They are Jefferson, McBee, Patrick, Ruby, and Mt. Croghan. About 70 percent of the population is rural.

According to the South Carolina Industrial Directory (Department of Commerce), approximately 6,300 people are employed by industries in Chesterfield County. The largest employers are Conbraco valves (1,031), A.O. Smith water heaters (740), Highland synthetics (378), DuPont protective apparel (300), and Stanley tools (300). Of the 21 industrial plants employing at least 75 people, nine are in Cheraw with 1,770 employees, seven in Pageland with 1,908, four in McBee with 1,335, and one in Chesterfield with 76. Some industries in the neighboring counties also employ substantial numbers of Chesterfield County residents.

Farming is an important part of the county's economy. Major crops are corn, soybeans, and hay. Some wheat and cotton also are grown. The McBee area is well known for its peach production, both the amount and the variety.

Water Supply

The major population centers of northern Chesterfield County obtain their water supplies from surface-water sources. Cheraw pumps 2.6 mgd (million gallons per day) from the Great Pee Dee River; Chesterfield pumps 1.1 mgd from Thompson Creek; Jefferson pumps 0.9 mgd from the Lynches River; and Pageland pumps a like amount from Lake Terry and Old Town Pond, just south of the town.

Southern Chesterfield County is served by the Alligator Rural Water Co., which has eight wells around and to the east of McBee that produce an average of 4.2 mgd, 1.6 mgd of which is sold to other water systems; by the Chesterfield County Rural Water Co., with three wells south of Cheraw; and by the Town of Patrick, with two wells near the town. Figure 2 and Table 1 locate and describe the public-supply wells. It is worth noting that the Chesterfield Rural Water Co. obtains 95 percent of its supply from the Alligator Rural Water Co.

The average daily water use in the county was about 11 million gallons in the year 2000 (Badr and others, 2004, p.18). This was distributed among public supply (5.9), industry and farm irrigation (1.5 each), domestic use (0.8), and golf-course irrigation (1.0). Only 10 of South Carolina's counties used less water than Chesterfield.

HYDROGEOLOGY

Approximately 80 percent of Chesterfield County is in the Coastal Plain, where the surface formations consist mostly of alternating beds of sand and clay. The northern and northwestern margins of the county are in the Piedmont, a crystalline-rock area. The Fall Line divides the two, and the nature of their ground-water resources is greatly different. From the Fall Line, the buried surface of the bedrock dips southeastward at about 25 ft per mile in Chesterfield County and is 1,600 ft deep on the coast at Myrtle Beach. It is even deeper (4,000 ft) at the southern tip of South Carolina. The map of Figure 3 shows the approximate position, relative to sea level, of the bedrock surface. Geologic section A-A' (Fig. 4) illustrates the increase in thickness of the Coastal Plain sediments with distance from the Fall Line.

In the crystalline bedrock, which is 500 million years old and metamorphic in type, the water available to wells occurs in fractures. The weathered portion of the rock, the upper 50 to 100 ft on the average, serves as a storage reservoir and recharge conduit for the underlying fracture zones. This weathered zone, generally clayey in composition, is called "saprolite." Once the ground water reaches the fracture zones, it is essentially unfiltered in its movement through the interconnecting network of tiny to large fissures, and it is little changed in chemical composition unless contaminated from surface sources. The water is usually confined—that is, under artesian pressure that causes it to rise in a well to some height above the zone at which it enters the well. The water level is controlled by the head imparted to it in the recharge area.

The maximum depth of freshwater occurrence in the bedrock of Chesterfield County is not known. The deepest well known to this writer is 965 ft. Generally, the occurrence of fractures declines with depth. It is possible that even the deepest fractures contain freshwater in this area.

All of the Coastal Plain sediments in Chesterfield County belong to the Middendorf Formation of Upper Cretaceous age (100 million years old). It is the only formation that occurs throughout the Coastal Plain of South Carolina; consequently,

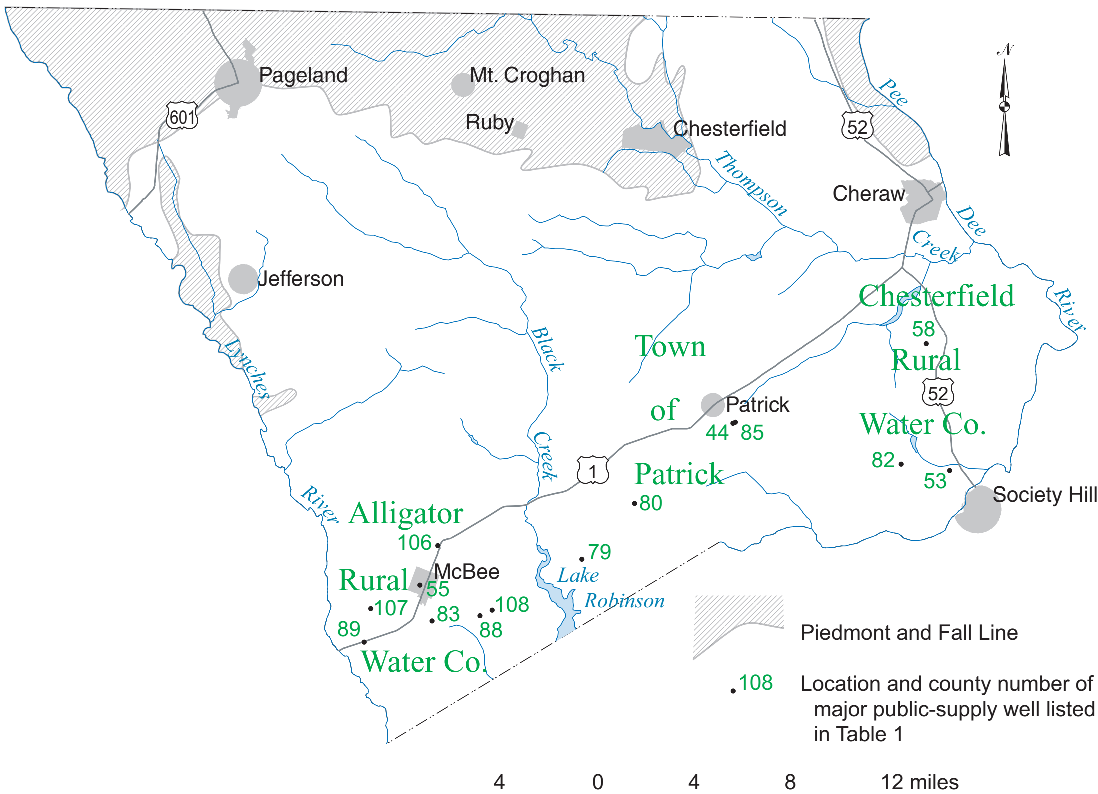


Figure 2. Locations of major public-supply wells in Chesterfield County.

Table 1. Major public-supply wells in Chesterfield County, S.C.

System	Well name	Owner no.	Depth (feet)	Yield (gpm)	Electric log	Chemical analysis	Pumping test	County number	S.C. grid number	Date drilled
Alligator Rural Water Co.	Tank site, Rd. 29	1	335	212	X	X	X	CTF-80	20I-v1	9/1991
	Rd 346	2	260	250	X	X	X	CTF-79	20J-g1	9/1991
	Rd 31	3	358	350	X	X	X	CTF-83	22J-t1	6/1995
	Sowell Road	4	333	570	X	X	X	CTF-88	21J-q1	3/2001
	Hwy 1 South	5	240	900	X	X	X	CTF-89	22J-x1	5/2001
	Hwy 145	6	303	503	X	X	X	CTF-106	21J-e2	8/2002
	Hwy 1 South (off site)	7	267	900	X	X	X	CTF-107	22J-m1	9/2002
	Hwy 131 South	8	346	603	X	X	X	CTF-108	21J-m2	1/2003
Chesterfield Rural Water Co.	Hwy. 52	2	328	60	X	X		CTF-53	17I-m1	10/1977
	Rd 494	3	155	80				CTF-58	17H-q1	11/1979
	Byrd Road	4	207	50	X	X	X	CTF-82	17I-o1	1/1996
Patrick	Off Hwy 102 South	1	130	80				CTF-44	19I-i1	4/1967
	Dirt road below well 1	2	107	76				CTF-85	19I-i2	1989

Yield is in gallons per minute (gpm). X signifies data in files. See **Well-Numbering System** under **Water Wells**.

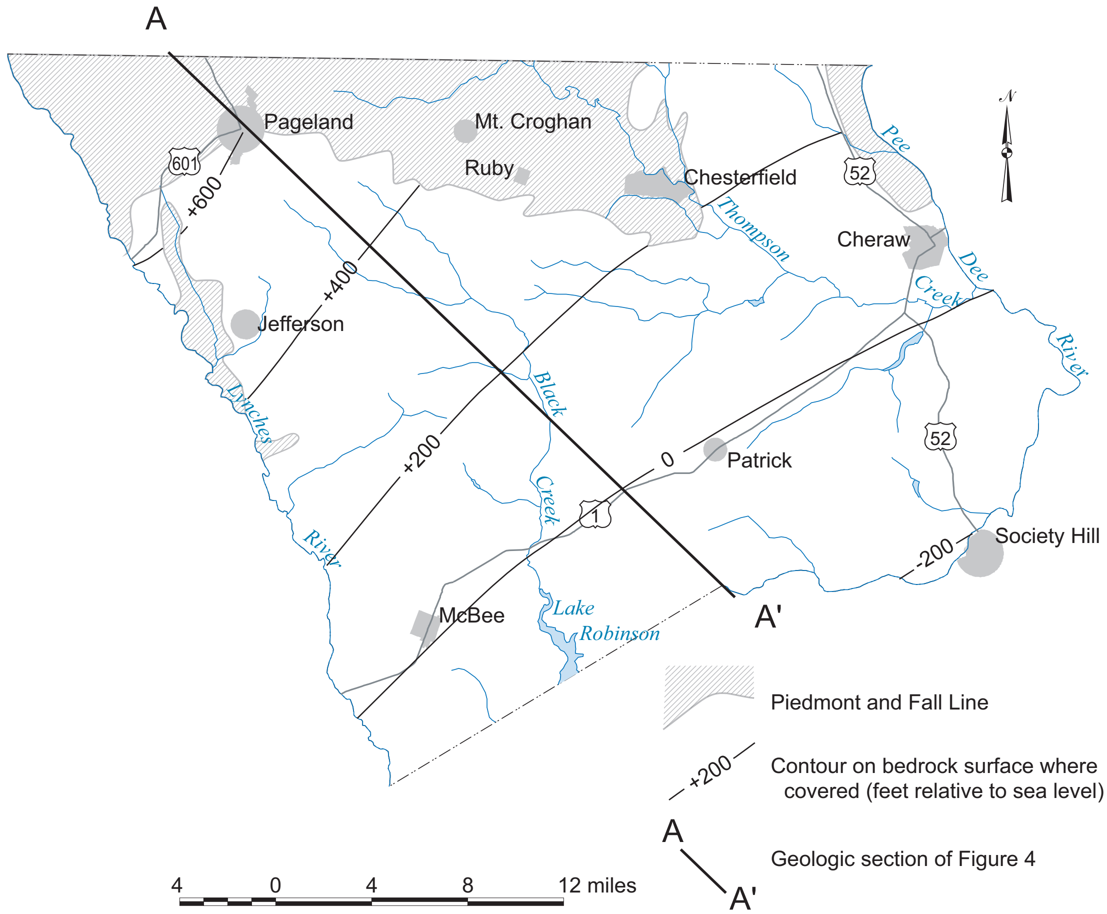


Figure 3. Estimated contours on the buried bedrock surface in Chesterfield County.

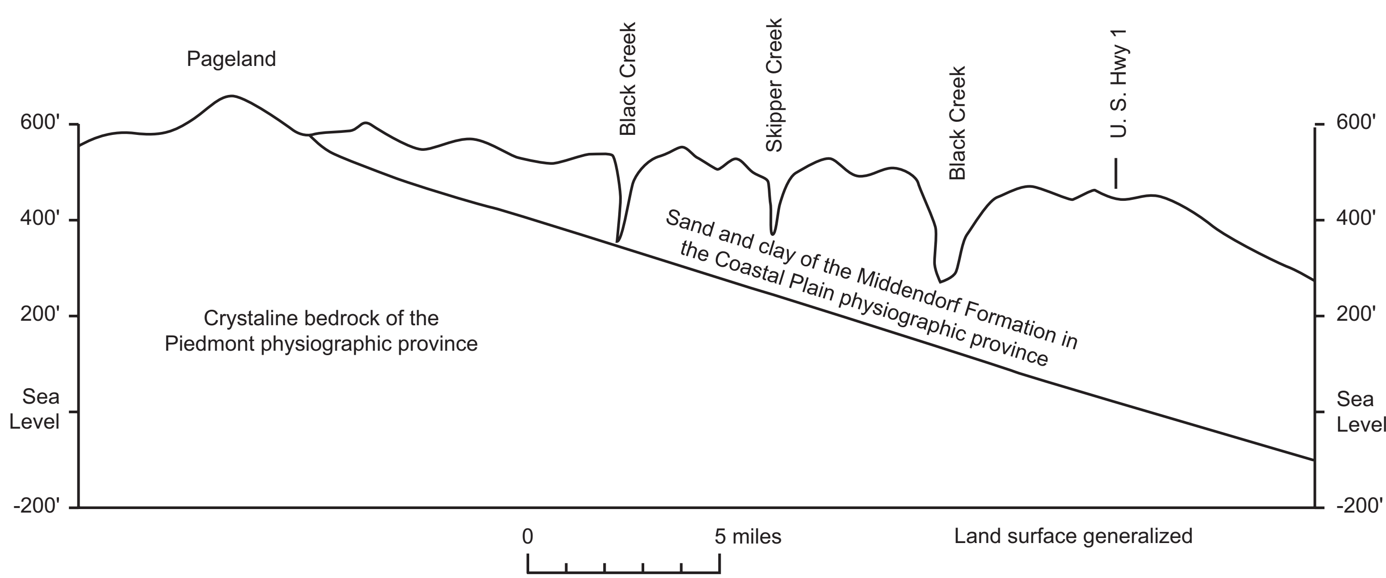


Figure 4. Geologic section along formation dip in Chesterfield County.

its aquifers are of primary importance as sources of water supply. Middendorf, a small community about 1 mile east of the U.S. Highway 1 crossing of Black Creek in the county, was the source of the formation name appended in 1904.

Sand and clay beds of greatly varying thickness and lateral extent make up the Middendorf Formation. These materials are of continental origin and were deposited in a deltaic environment by rivers carrying sediments eroded from the Appalachian highlands and Piedmont area. The geologic section of Figure 4 shows a maximum thickness of 450 ft for the Middendorf in Chesterfield County.

Aquifers in the Middendorf Formation are well-delineated by electric logs. A number of electric logs of wells in the southern part of the county provide subsurface information that is highly useful in selecting sand intervals in which to complete wells. These logs are described in Table 2 and their locations shown on Figure 5.

All water in the sand aquifers is fresh. Generally, it is under artesian conditions of occurrence, but there are some sites where a thick sand bed and deep static water level combine to produce water-table (unconfined) conditions, and the static (nonpumping) water level is below the top of the aquifer.

WATER WELLS

Well-Numbering System

Wells in DNR files have county numbers assigned sequentially as their records are obtained, as CTF-61. They also are given a number in the South Carolina well-location grid system that locates the wells to the nearest minute of latitude and longitude and assigns a sequential number within that minute. Thus, CTF-61 has the grid number 21I-p1, which would place it in the south-central part of the county, as may be seen on Figure 5.

Rock Wells

Although the bedrock exposure in Chesterfield County covers only about 20 percent of the area, much of the county's population resides in that area, largely because a large part of southern Chesterfield County is occupied by the public-owned forest, wildlife refuge, and park. In the years 2001-03, 254 water wells were installed in the bedrock aquifers (62 percent of the wells drilled in the county in that 3-year period). These wells ranged in depth from less than 100 ft to 965 ft. About two-thirds of them were less than 300 ft deep. A substantial number were drilled where Coastal Plain sediments are at the surface but hard rock is encountered at a shallow depth.

The rock wells are invariably 6 inches in diameter and usually have less than 100 ft of casing, with the rest of the well an open hole. One or more water zones produce 1 to 200 gpm (gallons per minute). The upper figure is extremely rare, but a surprising number of 50-100 gpm wells are reported. More than 80 percent of the wells yield less than 20 gpm, and more than half yield less than 10 gpm. How much a well can produce is partly controlled by the amount of available drawdown, which is the distance between the static (nonpumping) water level and the water-producing zone. Static water levels in the rock wells ranged from less than 20 to 131 ft below the land surface. Three-fourths of them were less than 40 ft.

Sand Wells

As stated earlier, the small percentage of Chesterfield County's Coastal Plain area that is available for residences, farms, and industries accounts for the relatively small number of sand wells. In 2001-03, only 154 wells (38 percent of total wells drilled) were installed in sand aquifers of the Middendorf Formation. More than three-fourths of these were less than 150 ft deep; only 10 wells were in the 300-400 ft depth range. The wells were drilled for residential supplies, irrigation, and public supplies. Wells for residences and lawn irrigation typically have 4-inch diameter casing with 20 ft of well screen in the aquifer interval. Large irrigation wells for farms and orchards and public-supply wells have 8-inch to 12-inch casing and various lengths of well screen, the latter dictated by the number and thickness of the aquifers tapped.

Most of the sand wells are installed to provide only residential or lawn-irrigation supplies and are pumped at 20 gpm or less. The large wells, for crop irrigation and public supply, produce as much as 900 gpm. See Table 1 for public-supply well yields. Among the large wells installed in the 2001-03 period, 10 produce more than 300 gpm, and 5 of these more than 500 gpm.

Water levels in the sand wells ranged from less than 30 ft below the land surface to as much as 184 ft for the wells drilled in the 2001-03 period. Whereas 77 percent of the rock wells had static water levels of less than 40 ft, only 43 percent of the sand well water levels were that shallow. The most productive sand wells are those installed in deep, thick aquifers having shallow water levels. These conditions combine, desirably, with high aquifer transmissivity to provide large available drawdown and high specific capacity. High well efficiency is also an important factor in obtaining the most water available. More on this later.

AQUIFER LOCATION

Locating water-yielding zones in the hard rock is generally a matter of drilling until the driller recognizes that he has "hit water." Most wells strike water within 400 ft, but the quantity obtainable varies widely and is unpredictable. Several rock wells in Chesterfield County are among the best seen in drilling reports, suggesting that fracture zones in the rocks there may be better developed than in most places. This is difficult to verify, however, and only pumping tests can truly evaluate the capacities of the wells.

Electric logs are not useful in locating hard-rock aquifers, and knowledge of other wells in the area seldom helps. The upshot of all this is that in the Piedmont water is "where you find it."

Table 2. Sand intervals indicated on electric logs of selected wells in and near Chesterfield, County S.C.

County well number	CTF-19	CTF-55	CTF-61	CTF-62	CTF-79	CTF-80	CTF-81	CTF-82	CTF-83	CTF-84	CTF-88
S.C. grid number	18H-m2	22J-j1	21I-p1	18G-u1	20J-g1	20I-v1	17H-f1	17I-o1	22J-t1	18I-e1	21J-q1
Elevation, in feet MSL	200	465	485	185	360	440	190	205	420	245	395
Sand intervals, in feet below land surface TD, total depth of log; BR, depth to bedrock	10-18 43-87 95-123 TD 147	35-60 63-72 78-86 89-158 198-240 248-254 263-330 334-343 TD 347	Driller's log shows mostly sand above 200 ft 215-322 TD 328	12-68 80-94 128-140 TD 140 BR 127	64-120 152-186 220-259 325-333 TD 358	5-16 42-70 132-200 223-232 272-292 304-365 TD 365	40-100 105-115 163-190 200-212 215-218 TD 245 BR 220	50-68 72-98 145-158 194-202 TD 308	0-24 35-108 245-312 322-347 TD 395	20-90 115-170 TD 336 BR 288	20-85 115-184 225-300 314-370 395-412 TD 424 BR 425

CTF-89	CTF-90	CTF-106	CTF-107	CTF-108	DAR-103	DAR-228	KER-66	MLB-136	MLB-191
22J-x1	21I-y3	21J-e2	21J-m1	21J-m2	20J-u1	17J-m1	22K-e2	17G-j4	15H-x1
280	510	480	360	430	418	172	222	152	140
20-38 50-70 83-110 115-184 190-210 215-240 TD 253	Casing to 93 ft 93-170 180-235 255-340 TD 344	?-130 230-313 TD 313	80-90 100-130 145-210 218-234 240-273 TD 275	210-255 263-307 TD 307	100-160 170-180 190-304 352-392 418-438 462-488 505-548 TD 565	40-78 86-106 114-129 152-192 200-226 255-270 300-328 TD 332	16-182 TD 177 BR 182	10-18 61-66 80-85 134-141 172-181 189-200 TD 205	62-84 93-120 125-132 180-210 TD 360

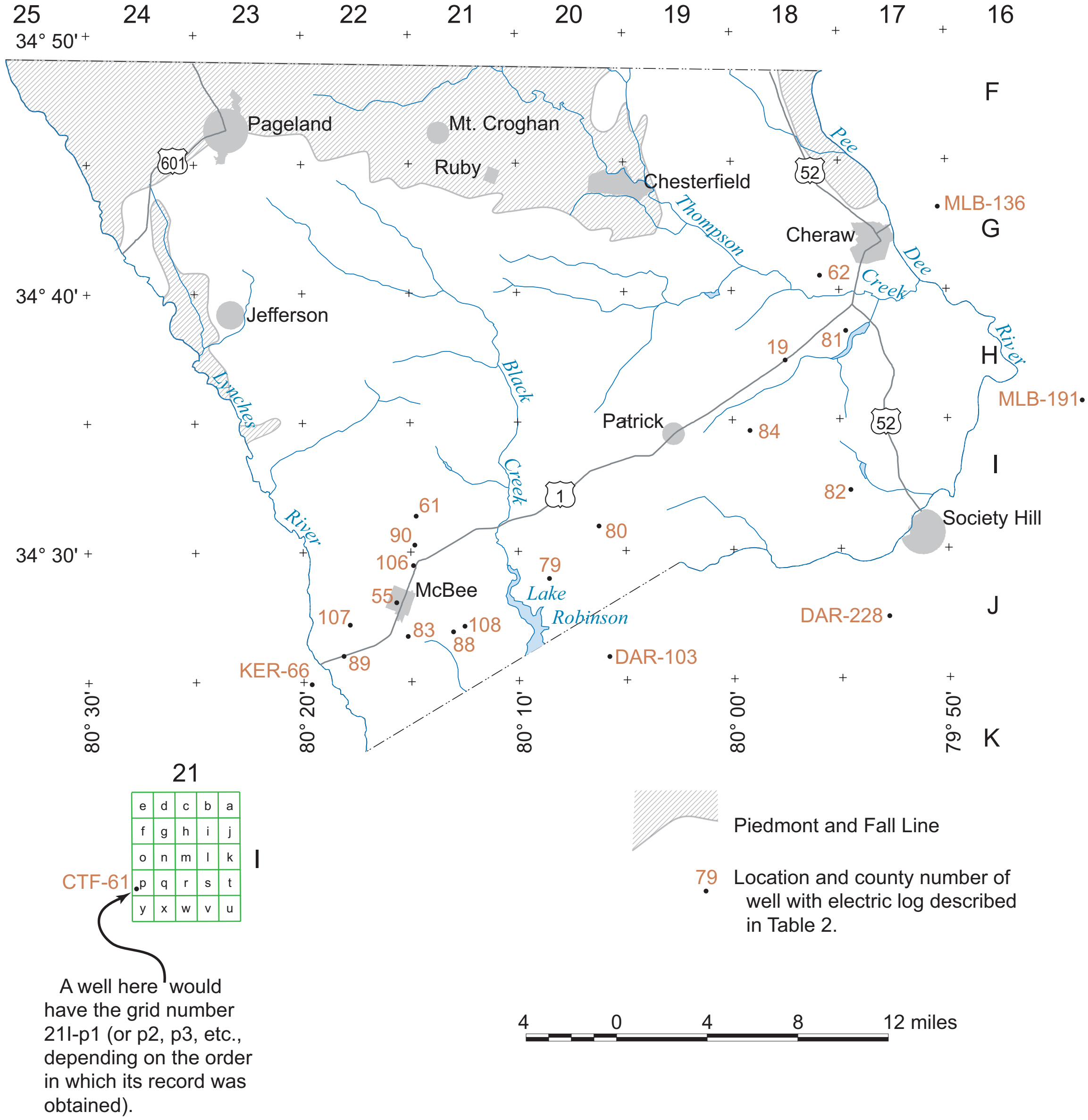


Figure 5. Locations of electric logs in Chesterfield County.

The story is different in the unconsolidated formations overlying the bedrock. There are no "dry holes," and one can nearly always be assured of an adequate supply of good water. As stated earlier, the best combination of properties to assure a large water supply is a deep, thick sand bed with a shallow water level.

The electric log is of great help in locating sand aquifers. The log of a previously drilled well provides the best means for predicting the depth, thickness, and something of the water quality of aquifers in the area. A good scattering of electric logs is most useful in mapping the ground-water resources of sizable areas. It would be a great help in evaluating the ground-water resources of Chesterfield County to have some electric logs representing the large public areas of the central part of the county.

AQUIFER AND WELL TESTING

Pumping tests show that the sand aquifers in southern Chesterfield County have good hydraulic conductivity (permeability). This would be expected in deposits not far below the Fall Line, as we have here. As streams carried sediments out of the highlands, they dropped their coarsest (and heaviest) materials first at any decrease in gradient. Thus, the hydraulic conductivity lessens with distance seaward from the Fall Line.

Transmissivity, which is hydraulic conductivity multiplied by aquifer thickness, and expressed in gallons per day per foot of aquifer width (gpd/ft), is the aquifer property that determines how much water is potentially available from wells. Well properties such as diameter, screened interval, screen-opening size, available drawdown, specific capacity, and well efficiency influence the productivity of a well. These factors all have important roles in well performance, especially of large wells for public water supply, crop irrigation, and industrial use. The well properties named above are briefly discussed below.

Well diameter:—A well must be of sufficient diameter to accommodate the pump chosen to deliver the designed flow. The smaller the well diameter, the more head (pressure) is lost in moving water up the well to constantly replace that which is being pumped out.

Screened interval:—When only part of an aquifer's thickness is screened in a well, the situation is referred to as "partial penetration." Partial-penetration effects can severely reduce a well's potential yield. For example, if only the lower (or upper) part of a thick aquifer is screened, only a fraction of the total water available will be obtained. Setting two or more screens at separated intervals in an aquifer may, however, allow the well to produce most of the flow available to it. Judiciously screening 75 percent of an aquifer may produce 90 percent of the water that could be obtained by total screening—and save some construction costs.

Screen-opening size:—This is based on grain size of the aquifer. Commonly, the screen is selected to pass 60 percent of the aquifer material. This permits the well-development process to create a zone of increased permeability in the vicinity of the well that enhances the smooth (laminar) flow of water through the screen, thus decreasing the likelihood of the well pumping sand and requiring less head loss in moving water through the screen.

Available drawdown:—The distance between a well's static (nonpumping) water level and the top of the well screen (or top of the aquifer if so chosen). It is highly desirable to avoid setting the pump below the top of the screen or, in some situations, below the top of the aquifer. This is because pumping from the screen is likely to create turbulent flow through the screen and enhance sand movement into the well. At the same time, if the pumping level is lowered sufficiently to allow aeration of the screen, the proliferation of iron-reducing bacteria is enhanced, a common cause of "red water." Encrustation of the screen from chemical precipitation also can occur.

Specific capacity:—This is truly a critical item. It is the number of gallons per minute produced per foot of water-level drawdown during pumping. It is normally calculated or extrapolated for a 1-day period and is the number that most closely relates aquifer and well. For the confined (artesian) aquifers of the Coastal Plain, the rule-of-thumb relationship is "specific capacity should be $1/2{,}000^{th}$ of the transmissivity."

Well efficiency:—The measured specific capacity divided by the ideal specific capacity (as just described). If, as often occurs, a hydrologic boundary is encountered in the course of pumping, it must be taken into account when calculating the well efficiency. (See Newcome, 1997.)

POTENTIAL WELL YIELDS AND PUMPING EFFECTS

Several pumping tests in southern Chesterfield County show that the aquifers in this updip area of the Middendorf Formation are capable of supporting moderate to large well yields (Table 3 and Figure 6). The last column in Table 3, potential yield, was calculated by multiplying the specific capacity by the available drawdown. This is for the wells as they are constructed, with no account taken of well efficiency. If all wells were fully efficient, the potential yields of some of them would be considerably greater. Well yields of 2,000-3,000 gpm in places would be possible for these aquifers. Development of such wells would have to follow subsurface examination of the sites, using electric logging and aquifer sampling as key tools of exploration.

When we talk about large well yields, we have to consider the effects of that pumping on the ground-water resources. The immediate effect is to lower ground-water levels in the vicinity. The graphs of Figure 7 will give the reader an idea of the drawdown that could be expected with various

Table 3. Results of pumping tests in Chesterfield County, S.C. (Modified from Newcome, 2000)

County well number	S.C. grid number	Location	Electric log available	Depth (ft)	Aquifer thickness (ft)	Date of test	Duration of test (hours) drawdown /recovery	Static water level (ft)	Discharge (gpm)	Transmissivity (gpd/ft)	Specific capacity (gpm/ft)	Available drawdown (ft)	Potential yield (gpm)
CTF-49	19I-w1	Patrick, 5 mi S		240	31	3/14/1969	24/	85	60	17,000	4.2	143	600
CTF-62	18G-u1	Cheraw, 3 mi SW	X	135	28	8/9/1977	24/5	52	105	5,300	5.3	28	150
CTF-79	20J-g1	McBee, 6 1/2 mi E	X	260	85	10/1/1991	24/	111	250	47,000	6.2	64	400
CTF-80	20I-v1	Patrick, 5 mi SW	X	335	115	9/23/1991	24/	116	250	66,000	8.5	58	500
CTF-82	17I-o1	Patrick, 8 mi ESE	X	207	35	1/30/1996	24/1	55	50	2,600	.8	61	50
CTF-83	22J-t1	McBee, 1 1/2 mi S	X	358	125	6/9/1995	24/12	135	400	81,000	6.1	76	465
CTF-84	18I-e1	Patrick, 4 mi E	X	215	75	8/27/1996	20/4	67	30	1,500	.6	63	40
CTF-88	21J-q1	McBee, 3 mi SE	X	333	130	5/2/2001	24/1	110	600	49,000	17	55	935
CTF-89	22J-x1	McBee, 3 mi SW	X	240	110	7/16/2001	24/	33	913	40,000	17	87	1,480
CTF-106	21J-e2	McBee, 1 3/4 mi NE	X	303	80	8/6/2002	24/2.2	172	503	15,000	4.7	88	415
CTF-107	22J-m1	McBee, 2 1/2 mi SW	X	267	130	9/11/2002	24/2.5	53	900	48,000	25	67	1,675
CTF-108	21J-m2	McBee, 3 mi ESE	X	346	105	1/6/2003	24/2.2	152	603	32,000	19	68	1,300

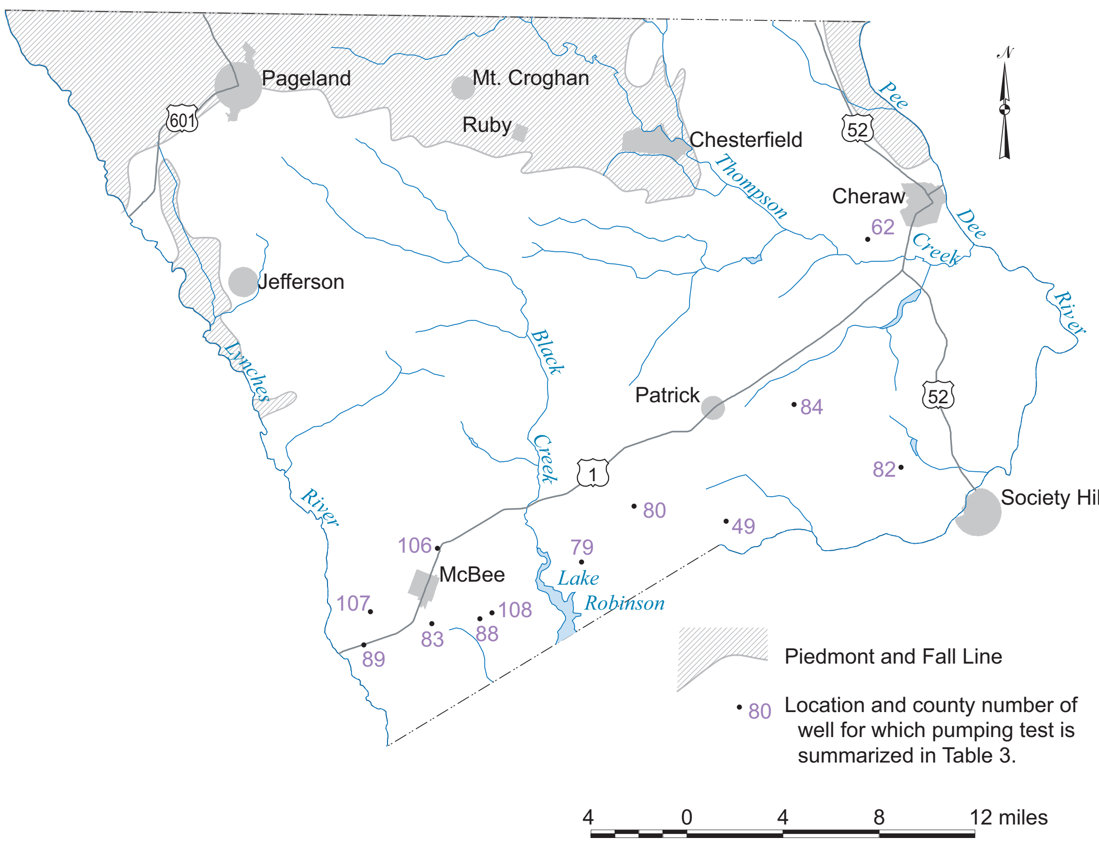
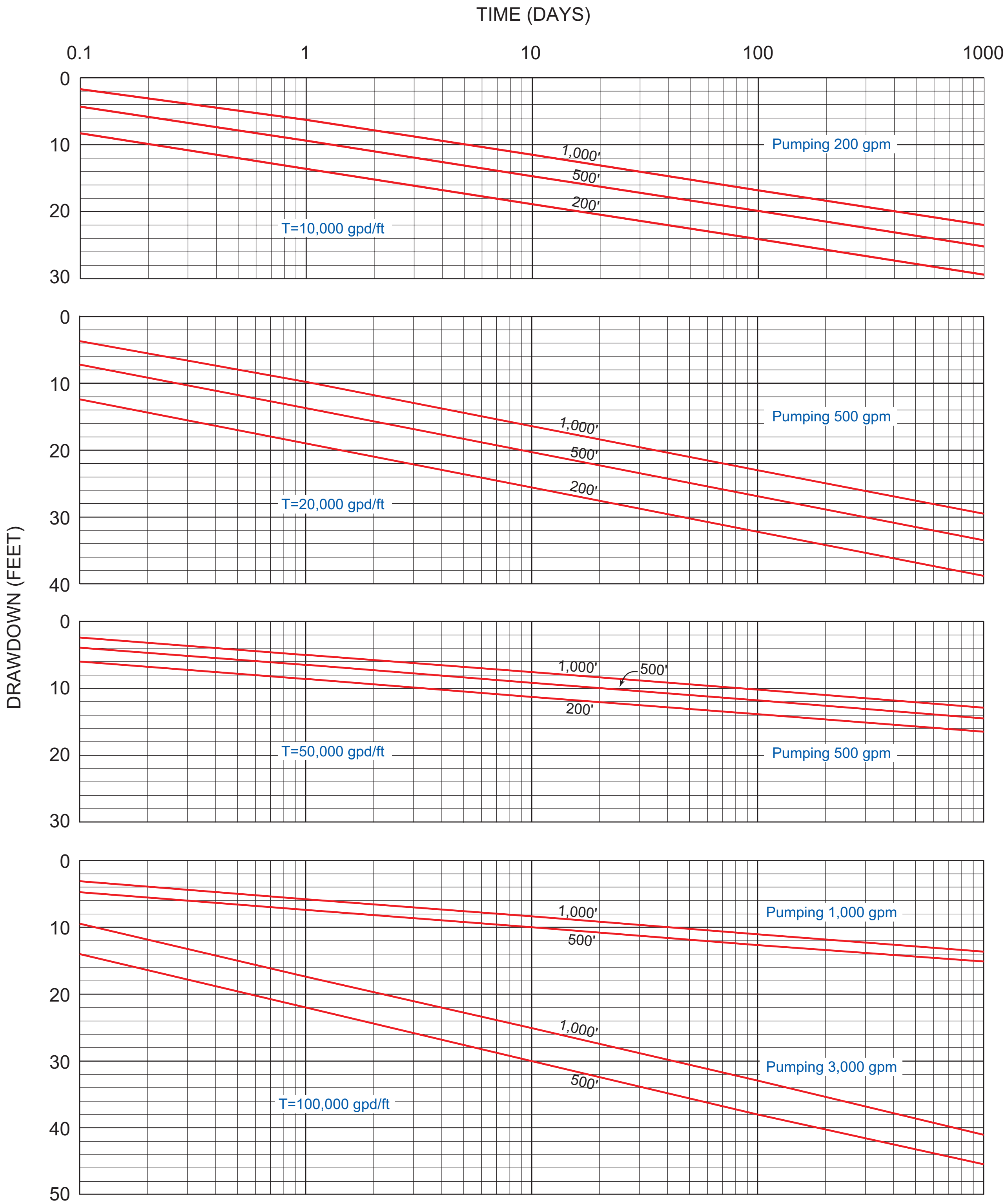


Figure 6. Locations of pumping tests in Chesterfield County.



ASSUMED CONDITIONS

Pumping rate and transmissivity as indicated. Storage coefficient: 0.0002 (artesian)

For other pumping rates, the drawdown will vary in direct proportion.

For example, doubling the pumping rate will double the drawdown at a given distance and time.

Figure 7. Predicted pumping effects at various times and distances for the Middendorf Formation in Chesterfield County.

combinations of transmissivity, pumping rate, time, and distance. Use of these graphs should guide the spacing of wells.

WATER QUALITY

The two aquifer types in Chesterfield County, fractured crystalline rock and unconsolidated sand, yield different types of water. That from wells in the rock, while not highly mineralized, usually is much more so than water from the sand wells. It is also less acidic and is generally harder. Examples of the water are illustrated by chemical analyses in Table 4; the locations of the wells tested are shown on Figure 8.

Water from wells in the sand aquifers is, except in unusual cases, extremely low in mineralization and very soft. It is acidic and often could be confused with rainwater in an analysis. It follows, then, that this water is eminently suitable for irrigation use. Considering this quality and the large yields available from wells, the water is a very valuable natural resource for Chesterfield County to possess.

A cautionary note—radionuclides (radium 226 and 228) in concentrations exceeding maximum contaminant levels, as defined by the U. S. Environmental Protection Agency, have been observed in some public-supply wells in the counties along and just below the Fall Line in South Carolina. This includes Chesterfield County.

SUMMARY

Chesterfield County has two types of aquifers available for water supplies. In and near the Piedmont, wells obtain water from fractures in the hard crystalline bedrock. The water generally has low mineralization, is soft to moderately hard, and is near neutral in acidity. Wells usually are of low yield, but 50-200 gpm have been reported.

The Coastal Plain, which includes 80 percent of the county, has many sand aquifers available for public supplies, industry, and irrigation. These aquifers are irregular in thickness and areal extent but are part of the massive aquifer system that underlies the entire Coastal Plain of South Carolina. In Chesterfield County the system is 450 ft thick in places. The water in these aquifers is usually similar to rainwater, being almost devoid of mineralization and hardness and often quite acidic. Wells yield as much as 900 gpm, but 2,000-3,000 gpm are potentially available from efficient wells equipped to take advantage of the available drawdown.

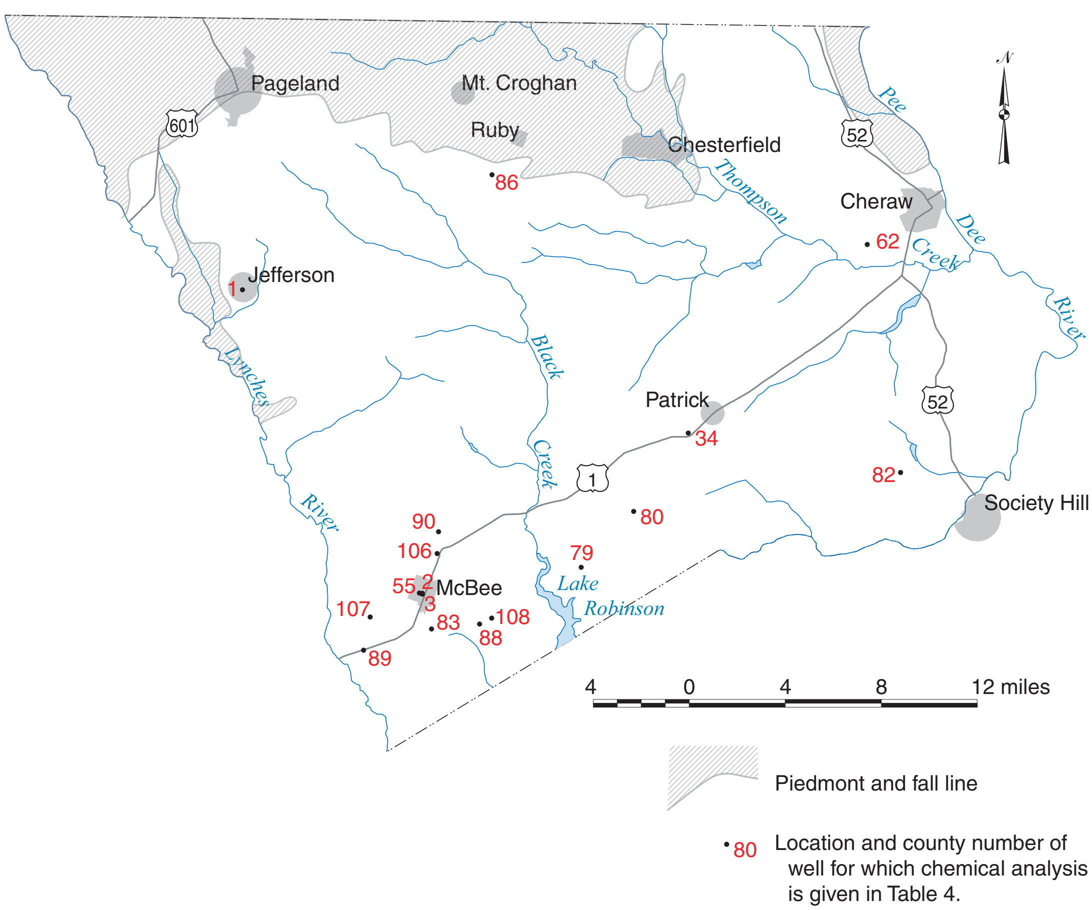


Figure 8. Locations of chemical analyses of Chesterfield County wells.

Table 4. Chemical analyses of water from wells in Chesterfield County, S.C. (constituents and properties in milligrams per liter, except pH)

County well no.	S.C. grid no.	Location	Date	Depth (ft)	Silica	Iron	Calcium	Magnesium	Sodium	Potassium	Bicarbonate	Sulfate	Chloride	Fluoride	Nitrate	Dissolved solids	Hardness	pH	Analyst*
								Rock Wells											
CTF-1	23H-d1	Jefferson	1/1955	205	24	0.00	11	4.60	4.6	0.5	54	5	8.2	0.2	1.5	87	46	6.9	USGS
CTF-86	21G-h1	Ruby, 2mi SW	9/1997	500		.08	10		7.7		56	5.4	.9	<.2	<.05	70	25	7.2	COM
CTF-141	23F-v1	Pageland, 2 mi ESE	5/1991	145		<.01	3.1	0.50	5.4								10		DHEC
CTF-144	23F-g1	Pageland, 3 mi NNW	5/1991	245		.23	4.8	4.20	9.1		7						29		DHEC
CTF-161	23H-c1	Pageland, 1 mi NNE	12/1986	425		<.05	.9	0.90			38		4.0	<.1	0.99	16	6	5.8	DHEC
CTF-162	23H-c2	Pageland, 1 mi NNE	12/1986	305		.12	3.4	2.00					2.0	.1	.1	62	17	6.8	DHEC
CTF-164	21G-c2	Ruby, 1 1/2 mi SW	5/2000	305		<.02	.8	1.70	5.1						<.02		9		DHEC
CTF-165	23F-f1	Pageland, 2 1/2 mi NNW	5/1991	245		2.1	10	7.70	9.7								57		DHEC
								Sand Wells											
CTF-2	22J-j3	McBee	12/1954	188	6.4	0.05	1.2	0.1	1.8	0.2	0.6	0.1	3.8	0.1	2.1	16	4	4.7	USGS
CTF-3	22J-j4	McBee	3/1946	190		.05					4	1	12	.1	5.8		12		USGS
CTF-34	19I-g1	Patrick, 1 mi SW	5/1955	100	11	.25	.6	.2	2.2	1.4	2	4.6	2.5	.0	.3	24	2	5.0	USGS
CTF-45	19I-d1	Patrick	8/1987	105		.05	13	.2	.5				2.0	.1	.1		33	7.2	DHEC
CTF-55	22J-j1	McBee	2/1973	330		.15	4.4	1.8			13	6.2	7			22	18	5.8	COM
CTF-58	17H-q1	Cheraw, 6 mi S	8/1987	155		.05	.3	.2	.6				1.5	.1	.41		2	5.2	DHEC
CTF-63	18G-u2	Cheraw, 2 mi SW	9/1977	147	14	.25	1.0	.2	(10)		10	8.0	.0	.2	2.6	44	10	6.0	COM
CTF-79	20J-g1	McBee, 7 mi E	1/1991	260		<.05	.2	.1	2	.1	<20	<5	<5	<.1	<.1	10	1	6.9	COM
CTF-80	20I-v1	Patrick, 5 mi SW	9/1991	335		<.05	.3	.1	.7	.1	<20	<5	<5	<.1	<.1	4	1	5.9	COM
CTF-82	17I-o1	Society Hill, 4 mi WNW	2/1996	207		.20	.6	.2	1.6	2.3	2.1	6.0	0	0	.3	12	2	5.4	COM
CTF-83	22J-t1	McBee, 1 1/2 mi SSW	6/1995	360		<.1	<1	.3	1.8	<2	1.6	1.5			<5	<10	2	5.7	COM
CTF-84	18I-e1	Patrick, 4 mi E	8/1996	215		<.05			1.6		3.9	<1.0	1.6	<.2	<.5	3	2	5.5	COM
CTF-88	21J-q1	McBee 2 1/2 mi SE	5/2001	333		.03	.53	.3	1.8		1±	<5	<5	<.1	.86	10	2	4.8	COM
CTF-89	22J-x1	McBee, 3 mi SW	8/2001	240		<.03	.45	.2	1.6		1±	<5	<5	<.1	.60	<10	2	4.2	COM
CTF-106	21J-e2	McBee, 2 mi NNE	8/2002	303		<.05	.42	.1	1.8		2.0	6	<5	<.2	.41	15	2	6.0	COM
CTF-107	22J-m1	McBee, 2 1/2 mi SW	9/2002	267			.51	.3	2.7		3.0		5		1.0	11	2	6.6	COM
CTF-108	21J-m2	McBee, 3 mi ESE	1/2003	346		.30	1.2	.6	1.5		20	10	<5	<.1	1.7	15	5	5.2	COM
CTF-163	22I-u1	McBee, 2 3/4 mi N	9/1993	235		<.1	1.0	0.3	2.8		<1	<1	2.6	<.2	1.8	24	4		COM
CTF-169	18I-j1	Patrick, 7 mi E	9/1995	142		0.2	.16	.1	6.0		<1	<1	8.6	<.1	.02		<1		DHEC

*Analysts are COM, commercial; DHEC, Department of Health and Environmental Control; USGS, U.S. Geological Survey.

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