GROUND-WATER CONDITIONS IN WESTERN HORRY COUNTY

SOUTH CAROLINA

by
A. Michel Pelletier

South Carolina Water Resources Commission
Open File Report OF-9

January 1987

CONTENTS

ILLUSTRATIONS

TABLES

GROUND-WATER CONDITIONS IN WESTERN HORRY COUNTY SOUTH CAROLINA

ABSTRACT

In western Horry County, South Carolina, four principal geologic formations provide a useful framework for describing the occurrence of ground water. These formations are, from bottom to top, the crystalline bedrock, Middendorf Formation, Black Creek Formation, and Peedee Formation combined with the shallow deposits.

The crystalline bedrock is too deep, contains water with excessive mineral content, and yields too little water to be considered a potential water supply source.

The Middendorf aquifers contain salty water beneath Conway, but the top aquifer of this formation contains fresh water just to the west of the study area at Brittons Neck, Johnsonville, and Hemingway. Wells at these locations have yielded up to 750 gpm, with specific capacities ranging from 10 to 13 gpm per foot of drawdown.

In western Horry County, all of the public supply wells and most of the domestic wells tap the aquifers of the Black Creek Formation. The water is soft, alkaline, and low in iron, but contains objectionable amounts of sodium, fluoride, and total dissolved solids. The eastern part of the formation, near Longs and Loris, contains excessive amounts of chloride in the deeper aquifers. Water levels in the Black Creek aquifers are falling at rates ranging from 1.0 to 3.2 feet per year, depending on location. Well yields have been reported to be in the 500 to 750 gpm range, but data from pumping tests indicate that the transmissivity of the aquifers increases to the west, which may make higher yields possible.

The aquifers in the Peedee and shallow deposits are discontinuous in occurrence, and exist only locally in the subsurface. The Peedee Formation can yield only limited water to wells, and it is usually considered a confining bed in this area. The shallow Tertiary deposits contain pockets of limestone or sandy shell which are locally significant water suppliers, but they often contain water with excessive hardness and iron.

In the western part of Horry County, there currently are 20 public water supply wells being operated by 6 water users. These wells have a combined rated capacity of 5,915 gpm (8.52 mgd), with a maximum design capacity of 5.68 mgd.

The prospects for developing a large-scale, ground-water-supplied, public water system in western Horry County are excellent. At least one, and possibly three, formations exist with aquifers worthy of development. These are the Black Creek Formation and, possibly, the Middendorf Formation and shallow units. It may be possible to construct as many as three wells per site, depending upon local geology, to tap each of these formations.

INTRODUCTION

In April 1986, the Horry County Council gave the Grand Strand Water and Sewer Authority the responsibility of providing water and sewer service to the areas of Horry County west of the Waccamaw River. In response to this mandate, the Authority has created a Technical Advisory Committee, consisting of their consulting engineers retained for the project, and the interested State and County agencies. This committee will help the Authority to develop a plan to provide the area with service that is both technically and environmentally sound. This report is a realistic evaluation of the ground-water resources of the new service area, and constitutes part of the contribution that the SCWRC (South Carolina Water Resources Commission) has made to this project.

HYDROGEOLOGIC FRAMEWORK

In western Horry County, SCWRC currently recognizes four principal geologic formations that provide a useful framework for describing the occurrence of ground water. These formations are, from bottom to top, the crystalline bedrock, Middendorf Formation, Black Creek Formation, and the Peedee Formation combined with the shallow deposits (Fig. 1). Each formation, or group of formations, has water-quality or water-bearing characteristics that distinguish it from the others.

Crystalline Bedrock

The crystalline bedrock is a complex of dense igneous and metamorphic rocks such as basalt, granite, schist, and gneiss. Generally, these rocks are very hard and have been fractured. The top of the bedrock complex lies at an elevation of approximately -800 ft (feet) at Green Sea and -1120 ft at Conway. Seven holes have been drilled to the bedrock, primarily to evaluate the water-supply potential of the deep sediments. Only the test well at Brittons Neck (10Q-p2) penetrated part of the bedrock complex, this to obtain lithologic data. (See note below concerning the well-numbering system.) Because of low well yields, poor water quality and excessive drilling depths, no supply wells have been developed in this unit.

Note on the well-numbering system used:

SCWRC uses a grid system, based on the latitude and longitude coordinates of wells, to assign identification numbers. For this purpose, the State has been divided into major grid blocks, each measuring 5 minutes of latitude by 5 minutes of longitude. These major blocks are identified by a number (east to west) followed by a capital letter (north to south). Each of these major grid blocks has been divided into 25 minor blocks, each being 1 minute square, which have been labeled with the lower-case letters from a to y. Within each minor block, the wells are numbered consecutively in the order they are inventoried. For example, the well with the number 10Q-p2 was the second well to be located in the minor block "p" of the major block "10Q".

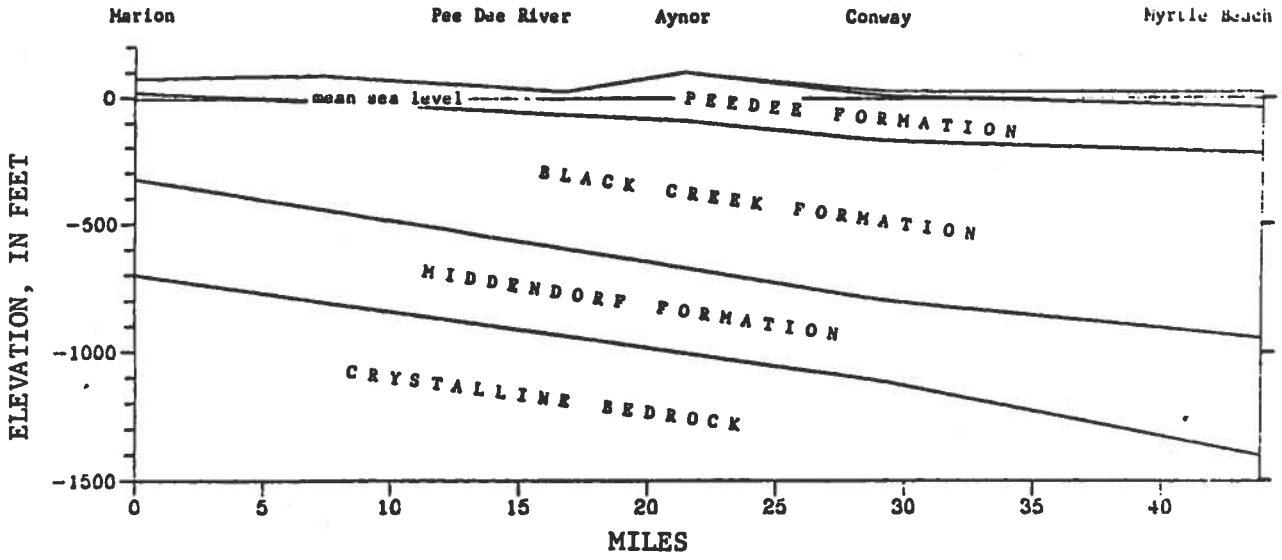

Figure 1. Geologic section from Marion to Myrtle Beach, showing the principal formations in the study area.

Middendorf Formation

The Middendorf Formation is Late Cretaceous in age and was probably deposited in a deltaic or fluvial environment. It is composed of multicolored clay (white, red, yellow, orange, brown, and purple) and white or gray, coarse sand and gravel. The top of this formation is at approximately -600 ft near Green Sea in the north end of the study area and -800 ft at Conway in the south, with thicknesses of 200 and 320 ft, respectively. It is a major source of water supplies in many parts of the State, but it contains salty water in the coastal regions.

Water Quality

Only five Middendorf wells have been sampled for water quality in the local area. These analyses, plus analyses for two wells in Florence County and one in Williamsburg County, are shown in Table 1. The water from this formation in Florence County generally is of good to excellent quality, except for its high iron content. The 750-ft zone at Brittons Neck (10Q-p2) meets EPA (Environmental Protection Agency) standards, but with increasing depth the water becomes more mineralized. At Calabash, Georgetown, and Esterville Plantation the water from the entire thickness of the formation is highly mineralized and is not suitable for public water supplies.

Water Availability

The yields from this aquifer are not well known in western Horry County because of the lack of adequate pumping tests. In the City of Florence, in Florence County, yields of up to 2,000 gpm are reported. A well at Johnsonville (12R-b2) in Florence County, and another at Hemingway (12S-b1), in Williamsburg County, are screened in the zone analogous to the 750-ft zone in

Table 1: Selected water quality data, by formation.
(Concentrations are for dissolved constituents, expressed in milligrams per liter, except where indicated otherwise).

Well No.	Location	Sampled depth (ft)	Date sampled	Analyst	pH (units)	Alkalinity (as $CaCO_3$)	Hardness (as $CaCO_3$) Total	Hardness (as $CaCO_3$) Non-carbonate	Dissolved solids	Iron (Fe) (ug/L)	Manganese (Mn) (ug/L)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Silica (SiO_2)
	MIDDENDORF FORMATION																					
2Q-j6	Calabash, N.C.	810-820	12-06-73	USGS	9.3	420	93	0	4320	100	43	14	14	1600	40	102	514	18	2300	0.9	1.0	0.6
2Q-j2	Calabash, N.C.	1042-1052	12-06-73	USGS	8.2	549	220	0	6560	180	86	32	33	2500	33	0	669	12	3600	.9	—	4.9
10Q-p2	Brittons Neck	748-768	4-24-82	USGS	8.1	320	5.9	—	450	120	10	1.7	.4	180	2.2	0	380	13	57	2.7	< .10	—
	Do	811-831	4-19-82	USGS	7.6	680	44	—	1540	2200	89	12	3.4	580	6.1	0	819	118	359	.6	< .10	—
	Do	1010-1030	4-09-82	USGS	7.5	740	35	—	1700	5500	91	9.9	2.6	480	6.6	0	886	124	373	.6	< .10	—
	Do	1120-1140	4-01-82	USGS	8.0	360	150	—	3470	1600	400	42	12	1000	12	0	428	525	1300	6.7	< .01	—
12R-b2	Johnsonville	789-870	4-16-68	Comm.	8.5	253	7	—	360	170	0	2.8	0	—	—	—	300	10	33	1.5	—	—
12S-b1	Hemingway	826-884	10-12-70	USGS	8.8	290	6	0	401	0	—	2.4	0	151	2.7	0	350	5.2	31	2.0	.5	.8
16M-41	Florence	303-706	10-16-75	Comm.	6.4	—	20	—	—	1600	30	6.0	14	22	—	—	—	18	8.0	—	—	19
	Note: Johnsonville and Florence are in Florence County, Hemingway in Williamsburg County.									t, total												
	BLACK CREEK FORMATION																					
2Q-j5	Calabash, N.C.	338-348	5-24-73	USGS	8.2	423	56	0	1760	10	10	10	7.5	690	26	0	516	30	720	1.6	—	13
2Q-j4	Calabash, N.C.	496-506	12-06-73	USGS	8.0	546	50	0	1570	100	29	9.6	6.3	600	52	0	666	5.2	550	2.8	—	16
5S-h1	Myrtle Beach	280-750	3-08-83	SCWRC	8.2	515	13.7	—	773	21	0	3.4	1.1	308	5.6	—	620	7.0	115	4.8	—	13.7
6S-h1	Forestbrook	365-675	4-11-83	SCWRC	8.3	487	10.8	—	608	29	0	2.66	.94	345	6.9	—	580	7.5	71	4.4	—	21.4
6T-q2	Surfside Beach	419-616	4-05-83	SCWRC	8.6	485	11.2	—	519	8	0	1.9	.78	300	7.3	—	580	7.2	27	4.3	—	23.3
7Q-p1	Conway	612-728	9-13-83	SCWRC	8.3	395	9.6	—	691	29	6	2.83	.58	238	3.34	—	470	6.9	111	2.33	—	12.1
90-w1	Aynor	300-350	11-21-77	USGS	8.8	480	13	0	629	20	0	3.1	1.3	260	12	0	590	1.5	39	4.3	—	17
10Q-p1	Brittons Neck	345-355	5-02-82	USGS	8.7	240	4.3	—	313	11	1	1.4	.2	120	4.1	21.8	287	6.2	5.3	1.2	< .10	—
10Q-p2	Brittons Neck	517-537	4-30-82	USGS	8.6	400	7.8	—	496	44	2	2.3	.5	190	3.7	11.9	485	.2	36	4.7	< .10	—
9M-p1	Mullins	194-334	8-06-79	Comm.	7.3	82	14	—	148	130	20	3.16	1.53	33.6		0	100	1.2	3	.42	.05	44.8
11M-y1	Marion	190-735	3-12-84	SCWRC	7.8	118	34	—	283	109	8	10.5	1.7	66	2.84	—	140	13.9	12	.65	—	35.8
12R-g1	Johnsonville	292-386	4-12-77	USGS	9.0	220	10	0	277	30	0	2.0	1.3	95	4.9	14	240	8.1	5.3	1.7	—	26
12R-v1	Hemingway	310-495	3-26-59	USGS	9.1	170	10	—	277	70	10	2.8	.5	101	4.2	29	205	4.2	4.5	1.6	.3	24
10N-y1	Rains	230-290	3-12-84	SCWRC	8.1	438	49	—	697	0	14	12.0	3.0	207	10.6	—	365	8.8	67	1.7	—	28
	Note: Marion, Mullins and Rains are in Marion County.																					
	PEEDEE AND SHALLOW FORMATIONS																					
3R-n2	North Myrtle Beach	33-38	8-02-78	SCWRC	6.9	158	160	—	—	1150	16	59.0	2.45	26.4	1.20	—	190	11.8	30	.11	.02	—
4R-l3	Myrtle Beach	84-94	2-22-78	USGS	9.6	210	230	18	293	330	10	89	2.1	19	.9	0	260	15	32	.1	—	6.5
6Q-y1	Conway	40-45	7-26-78	SCWRC	8.0	192	176	—	-	1580	96	54.2	4.45	13.1	2.27	—	230	5.3	9.9	.13	0	18.6
	Maximum Contaminant Levels, as established by EPA				6.5-8.5**				500*	300**	50**							250**	250**	4.0*	10*	

* primary standard; ** secondary standard; Analyst: SCWRC, South Carolina Water Resources Commission; USGS, U.S. Geological Survey; Comm., Commercial Laboratory

the Brittons Neck test well (10Q-p2) and are each reported to yield 700 gpm, with specific capacities ranging from 10 to 13 gpm per foot of drawdown.

Black Creek Formation

The Black Creek Formation overlies the Middendorf Formation and is also of Late Cretaceous age. It consists of dark-gray to light-gray fine-grained sand and clay, suggesting an estuarine or near-shore marine depositional environment. Numerous layers of hard, cemented, calcareous sandstone occur in the formation, especially in the upper half. At Green Sea this unit is 550 ft thick, between the elevations of -50 and -600 ft. At Conway it is 625 ft thick, and lies between the elevations of -175 and -800 ft.

Most large-capacity public supply wells in the study area draw their water from aquifers in the Black Creek Formation. The water is soft, has an alkaline pH, and is suitable for most uses (Table 1). The supply source for most large-capacity wells in the Black Creek Formation is a water-bearing zone called the "principal sand aquifer" (Spigner and others, 1977). This zone ranges in thickness from 60 to 100 ft, with its base generally located 180 to 220 ft beneath the top of the formation. The elevation of the base of the principal sand can be approximated by subtracting 200 ft from the values shown on Figure 2, the structure map for the top of the Black Creek Formation.

Water Use

A water use map (Fig. 3) illustrates how the pumpage from the aquifers in the Black Creek Formation was distributed across Horry and Georgetown counties in 1982. The map shows the amount of water pumped from within each 1-minute grid of latitude and longitude. Water use was concentrated in a Y-shaped area extending from Conway to Myrtle Beach and from Little River to Garden City. The balance of the water use was dispersed more or less uniformly.

Water Levels

Water levels are being measured on a regular basis in a number of wells in western Horry County. The water levels in the three wells shown in Figure 4 exhibit a steadily declining trend for the period of record. The average rates of decline at Conway and Bucksport are 2.6 and 3.2 ft per year, respectively, resulting primarily from the increasing development of the beach areas in the eastern part of Horry and Georgetown Counties. The water level at Aynor exhibits a much lower rate of decline, (1.0 to 1.8 ft per year), which is difficult to estimate from only 3 years of record.

A potentiometric (water level contour) map for September-October 1985 (Fig. 5) shows a gently sloping water surface in the western portion of Horry County, with a slope of only 2.5 ft per mile, and with water level elevations ranging from +20 ft to -20 ft.

A map of the average annual rates of decline over the period of record for all of the observation wells in Horry and Georgetown Counties (Fig. 6) shows that the contour lines on this map mimic the potentiometric contours, and that the observed rates of decline in Horry County range from almost 3 ft per year at Conway to almost 10 ft per year at Myrtle Beach.

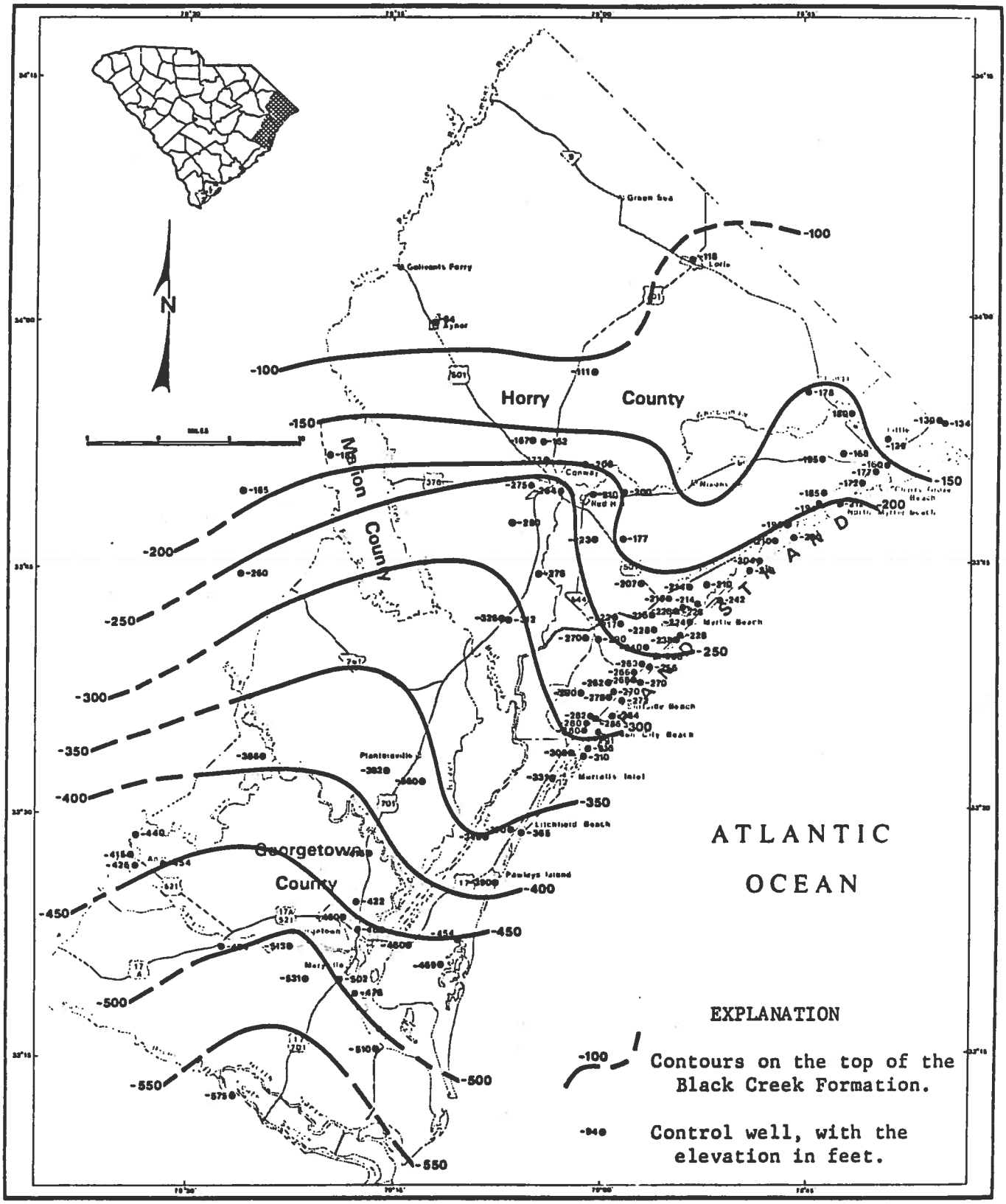

Figure 2. Structure contours on top of the Black Creek Formation.

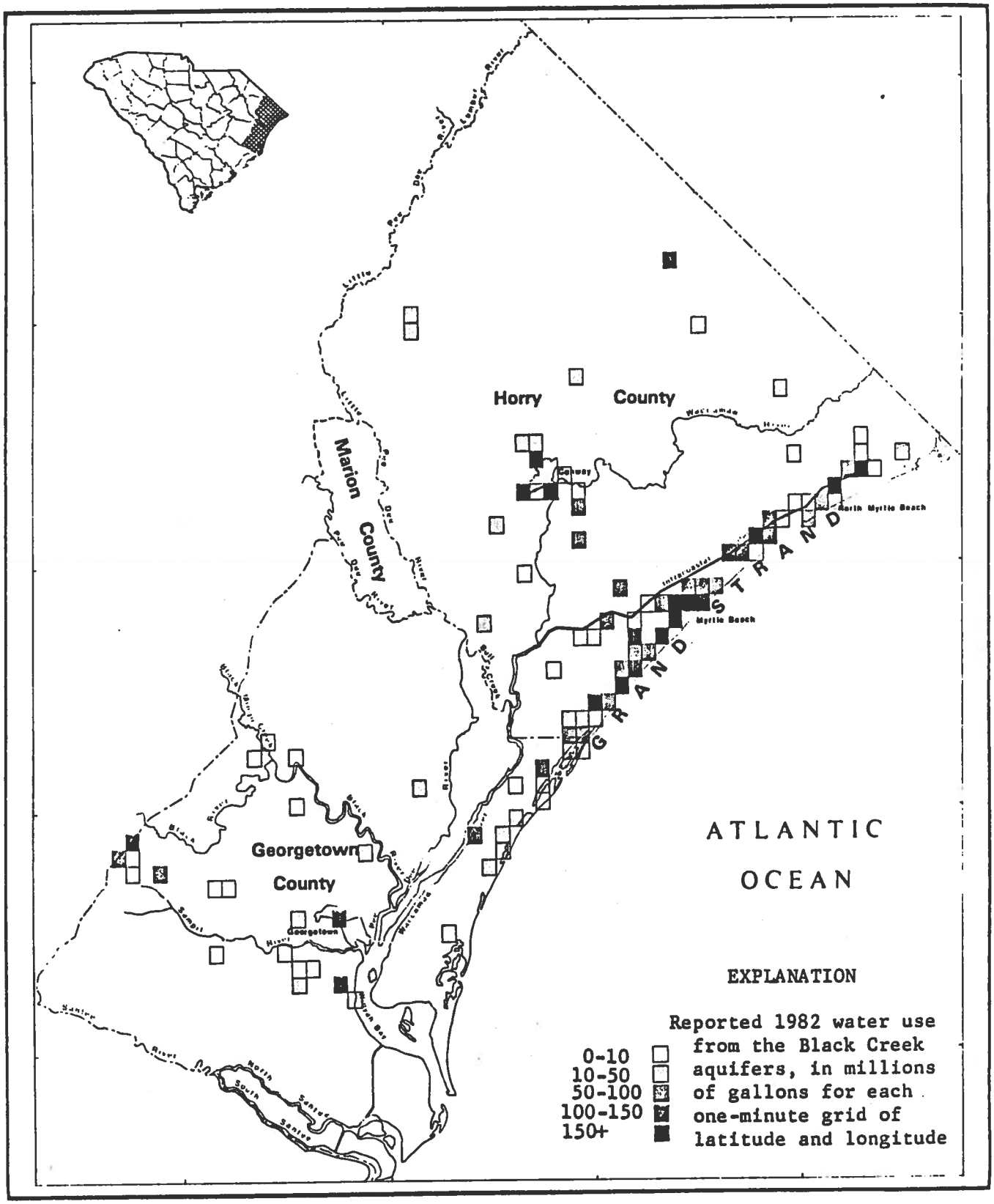

Figure 3. Areal distribution and intensity of reported water use from aquifers in the the Black Creek Formation during 1982.

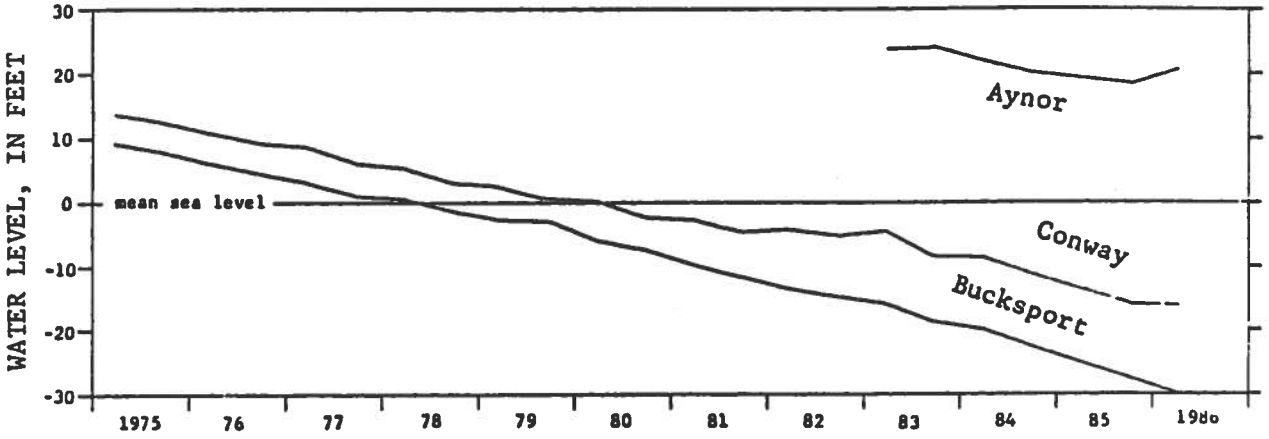

Figure 4. Water level trends for Black Creek wells in Aynor, Conway, and Bucksport.

Water Quality

The Black Creek aquifers provide water of a sodium bicarbonate type, those constituents being the two predominant ions in solution. The water is soft, low in iron, and alkaline. There are several objectionable water quality characteristics, however, that will be important in future decisions. These characteristics are the elevated chloride, fluoride, sodium, and total dissolved solids content of the water. Another problem, although a localized one, is turbidity (cloudy water), which has been reported in scattered wells across the Coastal Plain of the State.

EPA is currently proposing changes in and additions to the existing standards for drinking water. These new standards are expected to restrict the sodium and dissolved solids content of the water, which will present new challenges to the continued use of ground water from the Black Creek aquifers.

Chloride.--Some parts of the Black Creek Formation contain chloride levels in excess of the recommended limit of 250 mg/L (milligrams per liter). The major problem occurs in a triangular area from Loris to North Myrtle Beach to the North Carolina line. In this area, excessive chloride levels occur in all, or most, of the deeper Black Creek aquifers. The probable source of this chloride is the original seawater in which the Black Creek sediments were deposited. The saltwater has not been flushed out of these sediments because the Cape Fear Arch has deflected the fresher ground-water flow around them (Zack, 1977).

Another chloride problem may occur in the future, owing to the potential for saltwater intrusion or encroachment. To date, no such movement of saltwater has been detected, but it is probably occurring in the portion of the aquifer beneath the Atlantic Ocean, and it may be occurring at a very slow rate beneath North Myrtle Beach, as well. It is this salty water under the area of North Myrtle Beach that poses the most immediate saltwater intrusion threat to the wells in the western portion of Horry County. If groundwater development creates a large cone of depression in the western Horry area, it could influence this resident salty water to migrate in a westward direction.

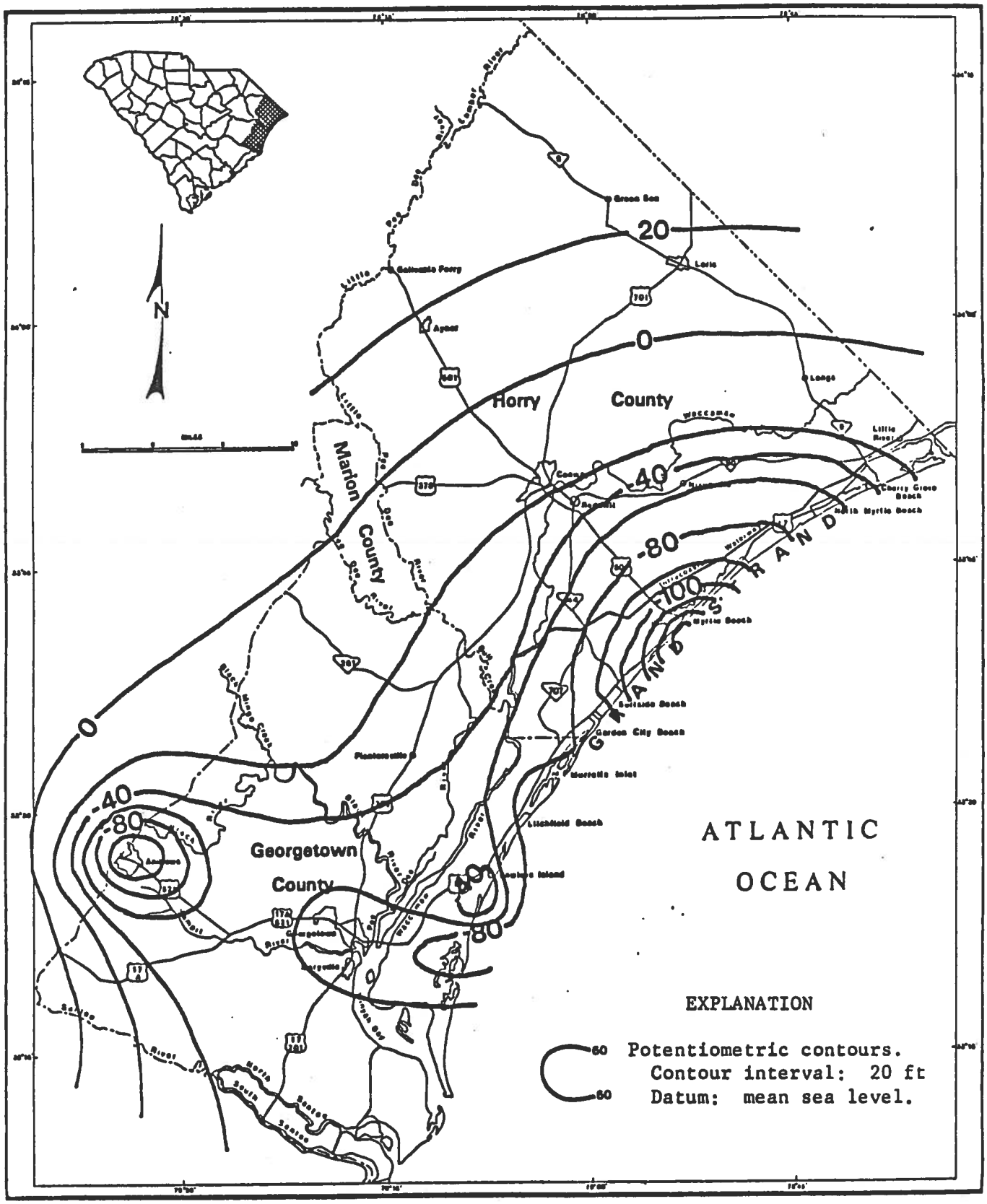

Figure 5. Potentiometric contours for the Black Creek Formation, September-October 1985.

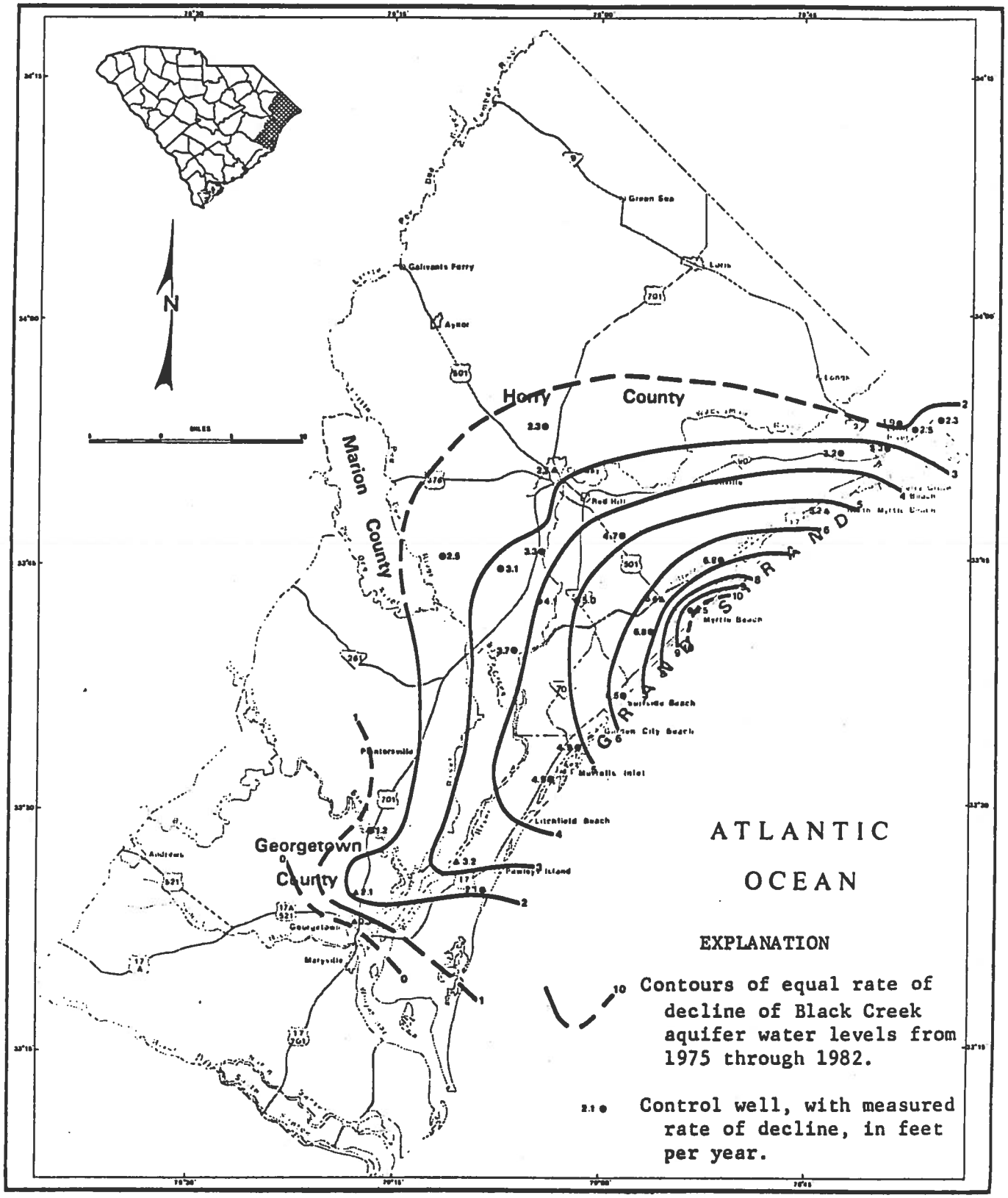

Figure 6. Contours showing rates of decline, in feet per year, of water levels in the Black Creek Formation, 1975-1982.

Fluoride.--For the purpose of preventing dental fluorosis (tooth mottling) EPA has established a limit of 4.0 mg/L for the fluoride concentration in public water supplies in this area. The water from nearly every Black Creek well in the area has a fluoride level between 2.0 and 5.0 mg/L, with one sample from a well at the Myrtle Beach Air Force Base (6T-b2) having been measured as high as 7.0 mg/L from a single zone. The wells in the communities just west of Horry County have levels of less than 2.0, and the wells at the Town of Aynor report a level of 4.7 mg/L (Table 1). The source of this fluoride, according to Zack (1980), appears to be the fluorapatite in fossilized shark teeth, known to be abundant in the Black Creek Formation. Through a series of chemical exchanges, the fluorapatite in the teeth becomes hydroxylapatite while releasing fluoride ions to the water.

Sodium.--At present, there is no EPA limit for sodium. However, for heart patients and those who have high blood pressure and kidney disease, there is concern about the sodium content of the water. The American Heart Association has recommended to EPA that a limit of 20 mg/L be adopted as a national standard, in order to protect the heart and kidney patients on low-sodium diets (Calabrese and others, 1980). Sodium levels in local ground-water systems, however, have been measured at approximately 700 mg/L near the North Carolina line, diminishing to 250-300 mg/L at the Horry-Georgetown County line and to 200-250 mg/L at the western boundary of Horry County. For people on a sodium-restricted diet, these levels necessitate the use of bottled water or the purchase of an in-home distillation or reverse osmosis unit.

Dissolved Solids.--The EPA list of secondary water quality standards indicates a limit of 500 mg/L for total dissolved solids. The drinking water obtained from the Black Creek aquifers along the coast near the North Carolina line contains more than 1,600 mg/L of dissolved solids. The content decreases to approximately 500 mg/L at the Horry-Georgetown line and to 600 mg/L in the wells at Aynor. This is mainly an aesthetic standard, having limited health-related implications, but water having high solids often has a cloudy appearance and leaves spots on dishes, glassware, sinks, countertops, and cars when they are washed and allowed to air dry.

Turbidity.--Several Black Creek wells have initially produced water with excessive turbidity caused by a form of calcium carbonate (aragonite) in suspension. The problem has been found throughout the South Carolina Coastal Plain, though it follows no obvious pattern. For example, in Myrtle Beach, a cloudy-water well (5S-i8) was drilled only 50 ft from an existing clear-water well (5S-i3). In all cases the cloudiness has been found to dissipate with time and pumping. Several wells have been successfully treated by installing a timer that automatically cycles the pump to waste for short periods.

The facts that the problem follows no apparent geographic pattern, that the cloudiness eventually clears up, and that the water in the Black Creek aquifers contains little calcium (Table 1), suggest that the problem may be caused by an agent introduced during the drilling or construction stages of the well. More study is needed to document the occurrence and causes of this phenomenon, so that it may be avoided in the future.

Water Availability

The Black Creek Formation contains the most productive and areally extensive aquifers in Horry and Georgetown Counties. It produces large volumes of potable water at reasonable cost. Well yields are as high as 1,000 gpm just south of Myrtle Beach, but they more commonly fall into the 300- to 700-gpm range across most of Horry County.

The transmissivity values of the Black Creek aquifers, calculated from 70 pumping tests, are represented in Figure 7. The results have been segregated into five geographical areas for the purpose of comparison. The diagram indicates that the aquifers are generally more transmissive in the northern and western (inland) portions of the two counties. Expected yields from properly constructed wells in the western portion of the county may be in the range of 500 to 700 gpm, and perhaps higher.

The theoretical yield shown at the bottom of figure 17 was calculated for a 75-percent efficient, 12-inch well having 100 ft of drawdown after 24 hours of pumping from an aquifer having the indicated transmissivity. The calculations used the Theis equations (Theis, 1935) for drawdown and yield.

Peedee and Shallow Formations

The Peedee Formation is the uppermost Cretaceous formation in the State. It was deposited in an open-shelf environment, and it is composed of thin, alternating beds of fine sand and clay with some beds of loose shell and coarse sand. The aquifers in this formation are not utilized for large municipal wells, owing to poor water quality and limited well yields, as contrasted with aquifers in the Black Creek Formation. This formation is only 150 ft thick at Green Sea, extending from land surface (+100 ft) to -50 ft and is 200 ft thick at Conway, between land surface (+25 ft) and -175 ft.

The shallow deposits consist of undifferentiated near-surface clay, sand, gravel, limestone, and shell of Tertiary and Quaternary age. These deposits exist as discontinuous islands or pockets in the subsurface of western Horry County, and as a band along the Little Pee Dee River flood plain. Some of the sand and shell beds have been mined for roadbed and fill material.

Water Availability

The Peedee and shallow aquifers are important sources of water for the region. Wells completed in them probably number in the thousands. These wells usually are less than 200 ft deep and produce 60-100 gpm where maximum yields are sought. Some wells have produced as much as 600 gpm in North Myrtle Beach. There is considerable variability in the lithologic composition of these aquifers, and detailed investigations will be necessary to identify areas of highest transmissivity, where consistently high well yields could be obtained. Along the Little Pee Dee River, there may be sites suitable for shallow infiltration wells. These wells would withdraw water from the flood-plain deposits (generally sand and gravel), which are recharged by the river when ground-water levels are lowered sufficiently. The pumped water would be sodium and fluoride free and would be naturally filtered by the riverbed materials. Some infiltration wells at other locations in the State

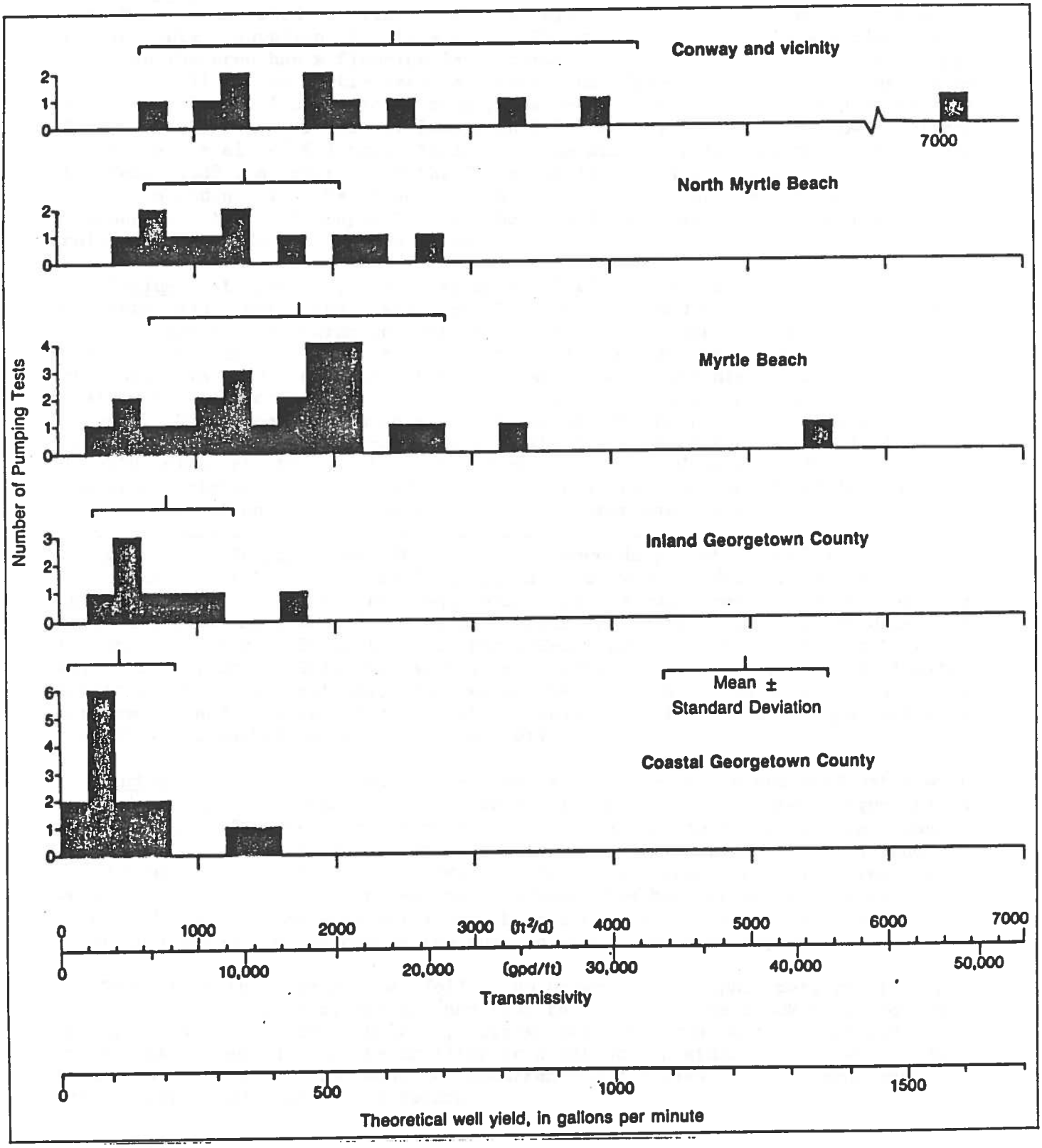

Figure 7: Range and variation in transmissivity, as indicated by pumping tests in the Waccamaw Capacity Use Area.

have experienced problems with high iron concentrations. If this occurred, an additional treatment step prior to distribution would be required.

Water-level data indicate that the Peedee and shallower formations contain two aquifer systems that are not necessarily divided at the formational boundaries. The shallower of the two systems occurs under water-table, and locally artesian, conditions. It comprises all of the Tertiary and younger deposits and may locally include the upper part of the Peedee Formation. The water levels tend to reflect the topography and drainage patterns, except where artesian conditions occur. The deeper of the two aquifer systems lies just above the Peedee-Black Creek contact. The water occurs under artesian conditions and the water levels appear to be dropping, but at slower rates than in the Black Creek aquifers. This may indicate that this lower unit is actually a part of a larger aquifer system that includes the Black Creek Formation. Further study is needed to define these aquifers and to perhaps redefine the aquifer and formation boundaries.

Streamflow data for the area indicate that the average volume of water being added to the streams during rainfree periods ranges from near zero to 1.6 cubic feet per second per square mile, or 0 to 1.0 mgd/mi^2 (million gallons per day per square mile). This range brackets the USGS estimate of 0.6 mgd/mi^2, which was based on rainfall and evaporation data (W. Lichtler, USGS, oral comm.). This water is derived principally from ground-water storage in the shallow water-table aquifer, which is recharged by local rainfall. Practically speaking, only a fraction of this volume in storage would be available to wells. The recoverable percentage would depend on the thickness and permeability of the aquifer, spacing of wells, available drawdown, and threat of saltwater intrusion. If 25 percent of the total recharge volume is used to estimate the amount available to wells, then the area bounded by the North Carolina line, the Little Pee Dee River, and the Waccamaw River (800 mi^2) theoretically could yield 120 mgd on a continuing basis (0.6 mgd/mi^2 x 0.25 x 800 mi^2). This is a sufficient volume to have supplied all of the ground water users in Horry and Georgetown Counties four times over in 1982.

Water Quality

The water quality in these formations is highly variable, ranging from very poor to excellent (Table 1). Local problems have been experienced with elevated levels of iron, hardness, hydrogen sulfide, and color. Otherwise, the water is low in sodium, fluoride, and dissolved solids. Problems with chloride levels have been found to exist along the coastal margin of the area in the shallower deposits. Many of these water quality problems are localized, with no apparent pattern to their occurrence. More study would be required to define and map the various water quality zones and to target areas of better quality for possible public supply wells.

EXISTING INFRASTRUCTURE

In the western part of Horry County, there currently are 20 Class A water supply wells being operated by 6 water users (Table 2 and Fig. 8). These wells have a combined rated capacity of 5,915 gpm (8.52 mgd), or a maximum design capacity of 5.68 mgd under current DHEC regulations.

The wells are generally 8 to 10 inches in diameter and range in depth from 100 to 800 ft. A single well (50-g4) is completed in the aquifers of the shallow deposits, with the remainder completed in the Black Creek aquifers. A test hole for a well at Conway (7Q-p1) penetrated the entire thickness of sedimentary formations and went into the crystalline bedrock, but the water below 850 ft was of unacceptable quality for a public water supply. The Town of Aynor drilled a test hole to 720 ft in 1975 (90-w1) but stopped approximately 50 ft short of the top of the Middendorf Formation. The well was completed at 359 ft in the principal sand aquifer of the Black Creek Formation.

SUMMARY AND CONCLUSIONS

In western Horry County, the prospects for developing a large-scale, ground-water-supplied public water system are excellent. At least one, and possibly three, formations exist with aquifers worthy of development. These are the Black Creek Formation and, possibly, the Middendorf Formation and shallow units. It may be possible to construct as many as three wells per site, depending upon local geology, to tap each of these formations.

With increasing distance inland, the aquifers in the Black Creek Formation become more transmissive and contain water of better quality. Yields of properly constructed wells can be expected to range from 500 to 700 gpm, and possibly higher. The Myrtle Beach cone of water-level depression caused by pumping is distant enough to have only limited impact.

The towns of Johnsonville and Hemingway currently withdraw water from Middendorf wells, and a test well at Brittons Neck found freshwater in the top sand of this formation at a depth of 750 ft. The wells at Hemingway and Johnsonville are reported to yield 700 to 750 gpm with specific capacities between 10 and 13 gpm per foot of drawdown.

The shallow flood-plain deposits along the Little Pee Dee River may contain sufficient sand and gravel deposits to make shallow infiltration wells feasible. These deposits may receive recharge directly from the river and would be unaffected by pumping from the deeper aquifers. Each infiltration-well site may be suitable for a 300-to 500-ft Black Creek well and a 600- to 800-ft Middendorf well. This triple siting would allow treatment and on-site mixing prior to transmission of the water, to produce net low sodium, fluoride, and iron concentrations.

The shallow formations in other parts of Horry County are composed of a sandy, shelly limestone locally called coquina. These coquina deposits may be capable of yielding significant volumes of water to properly constructed wells, provided the wells are managed to limit local interference problems, and to limit the potential for subsidence and sinkhole collapses within their areas of pumping influence.

Table 2. Selected data from the Class A wells north and west of the Waccamaw River in Horry County

Well No.	Owner	Diameter (inches)	Depth (feet)	Pump rate (gpm)	Completion date
4P-u1	Grand Strand W&S	10	374	250	1979
4Q-a1	Do	8	350	150	1986
5O-g1	Town of Loris	-	438	Stby	1961
5O-g2	Do	-	520	Stby	1935
5O-g3	Do	-	425	Stby	1950
5O-g4	Do	-	102	Stby	1962
5O-g5	Do	10	325	380	1973
5O-h1	Do	10	327	400	1983
7P-t1	United Merchants	6	400	575	1973
7Q-o1	City of Conway	10	800	550	1978
7Q-p1	Do	8	737	520	1973
7Q-q1	Do	8	715	500	1958
7Q-v1	Do	10	789	500	1978
7R-c1	Do	8	715	320	1952
7R-e1	Do	8	780	500	1965
7S-e1	Bucksport Water	8	520	250	1975
8R-l1	Do	8	605	250	1981
8S-r4	Do	8	618	250	1981
9O-w1	Town of Aynor	8	359	320	1975
9P-c2	Do	14	355	200	1959

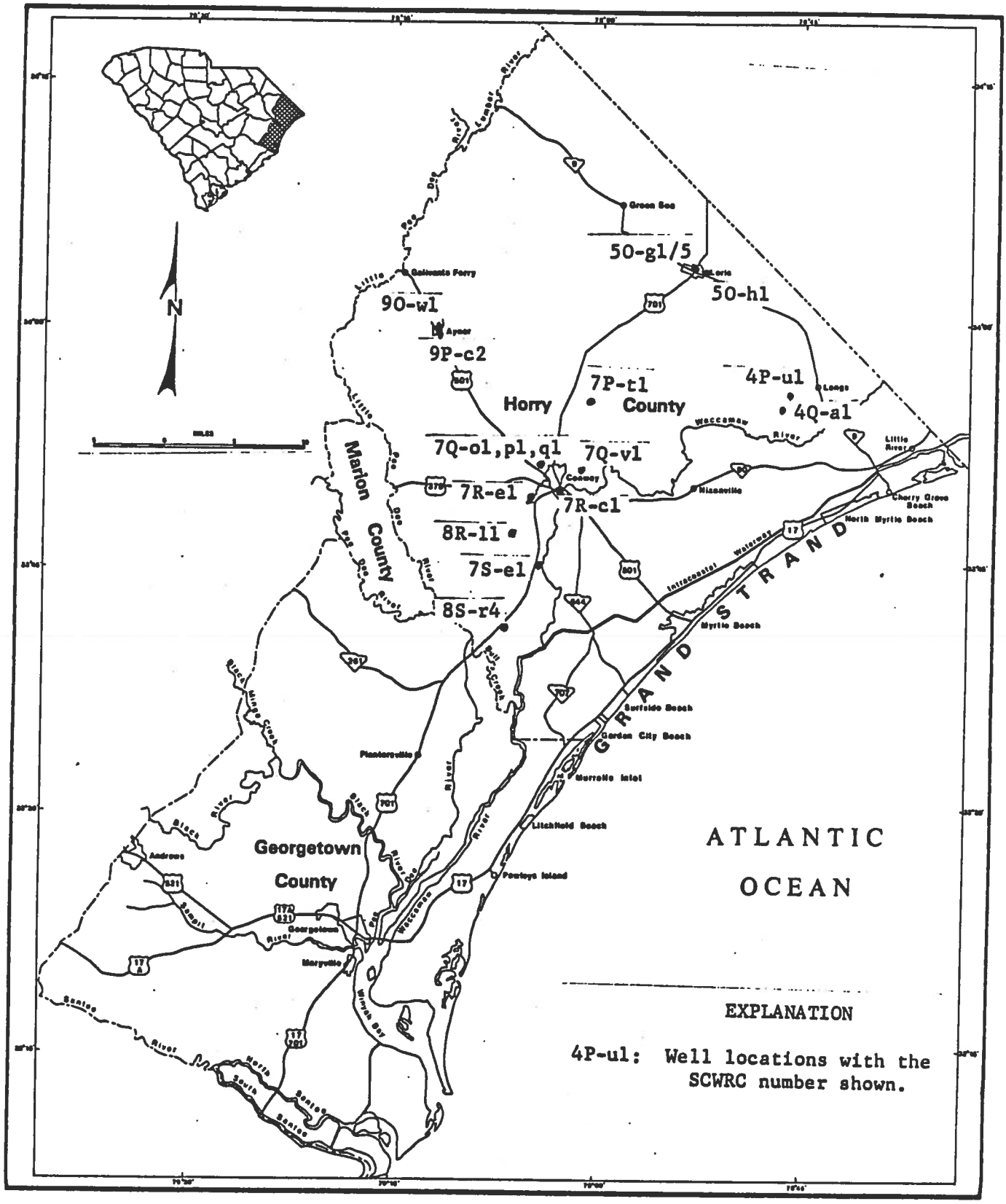

Figure 8: Location of existing Class A wells north and west of the Waccamaw River in Horry County.

Selected Reference

Calabrese, E.J., Tuthill, R.W., Klar, J.M., and Sieger, T.L., 1980, Elevated levels of sodium in community drinking water: Journal of the American Water Works Assoc., November 1980, p. 645-649.

Cooke, C.W., 1936, Geology of the Coastal Plain of South Carolina: U.S. Geological Survey Bulletin 867, 196 p.

Pelletier, A.M., 1985, Ground-water conditions and water-supply alternatives in the Waccamaw Capacity Use Area South Carolina: S.C. Water Resources Commission Report No. 144, 32 p.

South Carolina Water Resources Commission, 1983, South Carolina state water assessment: S.C. Water Resources Commission Report No. 140, September 1983, 367 p.

Spigner, B.C., Stevens, Kenneth, and Moser, W.C., 1977, Report on the ground-water resources of Horry and Georgetown Counties, South Carolina: S.C. Water Resources Commission No. 129, 52 p.

Swift, D.J.P., and Heron, S.D., Jr., 1969, Stratigraphy of the Carolina Cretaceous: Southeastern Geology, vol. 10, No. 4, pp. 201-245.

Theis, C.V., 1935, The relation between the lowering of the piezometric surface and the rate and duration of discharge of a well using ground-water storage: Am. Geophs. Union Trans., 16th Ann. Mtg., part 2, pp. 519-524.

U.S. Environmental Protection Agency, 1975, National interim primary drinking water regulations: Federal Register, December 24, 1975, vol. 40, No. 248, pp. 59566-59588.

Zack, Allen, 1977, The occurrence, availability, and chemical quality of ground water, Grand Strand and surrounding parts of Horry and Georgetown Counties, South Carolina: S.C. Water Resources Commission Report No. 8, 100 p.

_____ 1980, Geochemistry of fluoride in the Black Creek aquifer system of Horry and Georgetown Counties, South Carolina - and its physiological implications: U.S. Geological Survey Water Supply Paper 2067, 40 p.