GEOLOGY AND GROUND-WATER RESOURCES OF CAMDEN COUNTY, NEW JERSEY

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GLOSSARY

Aquifer. A formation, group of formations, or part of a formation that contains sufficient saturated permeable material to yield significant quantities of water to wells and springs.

Artesian aquifer. An aquifer containing water under sufficient pressure to rise above the top of the aquifer when penetrated by a well.

Coefficient of permeability (field). See hydraulic conductivity.

Coefficient of storage. See storage coefficient.

Confining bed. A body of relatively impermeable material stratigraphically adjacent to one or more aquifers. The hydraulic conductivity may range from nearly zero to some value distinctly lower than that of the aquifer.

Drawdown. The lowering of the water table or artesian water level caused by pumping.

Head, static. The height above a standard datum of the surface of a column of water (or other liquid) that can be supported by the static pressure at a given point. Head, when used alone, is understood to mean static head.

Hydraulic conductivity. A measure of the ability of material to transmit water. If the porous medium is isotropic and the fluid is homogeneous, the medium has a hydraulic conductivity of unit length per unit time if it will transmit in unit time a unit volume of water at the prevailing kinematic viscosity through a cross section of unit area, measured at right angles to the direction of flow, under a hydraulic gradient of unit change in head over unit length of flow path. The Geological Survey measures length in feet or meters and time in days. To convert from field coefficient of permeability measured in gallons per day per square foot to hydraulic conductivity measured in feet per day multiply the field coefficient by 0.134. To convert from field coefficient of permeability measured in gallons per day per square foot to hydraulic conductivity measured in meters per day multiply the field coefficient by 0.041.

Permeability. The ability of a rock or earth material to transmit water in response to head differences.

Porosity. The porosity of a rock or soil is its property of containing interstices or voids and may be expressed quantitatively as the ratio of the volume of its interstices to its total volume. It may be expressed as a decimal fraction or as a percentage.

Potentiometric surface. A surface which represents the static head in an aquifer. The potentiometric surface is defined by the levels to which water will rise in tightly cased wells. See head, static.

Recharge. The process by which water is added to an aquifer.

Runoff (average annual, in inches). The depth to which the drainage area would be covered if all the runoff for an average year were uniformly distributed on it.

Specific capacity (of a well). The rate of discharge of water from the well divided by the drawdown in the well. A properly constructed well can be used as a measure of the aquifer's transmissivity; a high specific capacity suggests a high transmissivity while a low specific capacity suggests a low transmissivity. The specific capacity of a well is a function of well construction and development, the aquifer's storage coefficient, and the portion of the aquifer in which the well is screened.

Specific yield. In general terms, the specific yield is the water yielded from a water-bearing material by gravity drainage, as occurs when the water table declines. More exactly the specific yield of a rock or soil is the ratio of 1) the volume of water which, after being saturated, the rock or soil will yield by gravity to 2) the volume of the rock or soil.

Storage coefficient. The volume of water a porous medium releases from or takes into storage per unit surface area of the aquifer per unit change in head.

In a confined water body the water derived from storage with head decline comes from expansion of the water and compression of the aquifer; similarly, water added to storage with a rise in head is accommodated partly by compression of the water and partly by expansion of the aquifer. In an unconfined water body the amount of water derived from or added to the aquifer generally is negligible compared to that involved in gravity drainage or filling of pores; hence, in an unconfined water body the storage coefficient is virtually equal to the specific yield.

Water table. That surface in an unconfined water body at which the pressure is atmospheric.

CONVERSION FACTORS

Cubic feet		
x 0.02832	=	cubic meters
x 7.48052	=	gallons
x 28.32	=	liters
Cubic feet per second		
x 0.646317	=	million gallons per day
x 448.831	=	gallons per minute
Cubic meters		
x 10^6	=	cubic centimeters
x 35.31	=	cubic feet
x 264.2	=	gallons
x 10^3	=	liters
Feet		
x 30.48	=	centimeters
x 0.3048	=	meters
Gallons		
x 3.785×10^{-3}	=	cubic meters
x 3.785	=	liters
Gallons per minute		
x 2.228×10^{-3}	=	cubic feet per second
x 0.06308	=	liters per second

CONVERSION FACTORS--Continued

Kilometer		
x 10^5	=	centimeters
x 3281	=	feet
x 10^3	=	meters
x 0.6214	=	miles
Liters		
x 0.0353	=	cubic feet
x 10^3	=	cubic meters
x 0.2642	=	gallons
Liters per second		
x 5.886×10^{-4}	=	cubic feet per second
x 4.403×10^{-3}	=	gallons per second
Meters		
x 100	=	centimeters
x 3.281	=	feet
x 39.37	=	inches
x 10^{-3}	=	kilometers
x 10^{-3}	=	millimeters
Miles (statute, U.S.)		
x 1.609×10^5	=	centimeters
x 5,280	=	feet
x 1.609	=	kilometers

Milligrams per liter		
x 1	=	parts per million
Millimeter		
x 0.1	=	centimeter
x 0.03937	=	inches
Square kilometers		
x 0.3061	=	square miles
Square meters		
x 10.76	=	square feet
x 3.861×10^{-7}	=	square miles
Square miles		
x 2.59	=	square kilometers

Relation of Units of Hydraulic Conductivity and Transmissivity

[Equivalent values shown in same horizontal lines. *indicates abandoned term]

A. Hydraulic conductivity

Hydraulic conductivity (K)		*Field coefficient of permeability (P_f)
Feet per day ($ft\ day^{-1}$)	Meters per day ($m\ day^{-1}$)	*Gallons per day per square foot *($gal\ day^{-1}\ ft^{-2}$)
One	0.305	7.48
3.28	One	24.5
.134	.041	One

B. Transmissivity (T)

Square feet per day ($ft^2\ day^{-1}$)	Square meters per day ($m^2\ day^{-1}$)	*Gallons per day per foot *($gal\ day^{-1}\ ft^{-1}$)
One	0.0929	7.48
10.76	One	80.5
.134	.0124	One

ABSTRACT

Camden County, New Jersey, is located in the Philadelphia-Camden metropolitan area. The western edge of the county is urban and industrial in character. The central part is less industrial and more suburban in character, and the eastern part is sparsely populated and predominantly agricultural, although urbanization is advancing eastward quite rapidly.

Camden County is in the Atlantic Coastal Plain physiographic province. Underlying the county are unconsolidated sediments of Quaternary, Tertiary, and Cretaceous age, consisting of mostly alternating sands, silts, and clays. The sediments dip gently to the southeast and thicken from 40 feet at the Delaware River to 2,900 feet at the Camden-Atlantic County line. Below the unconsolidated sediments is the pre-Cretaceous crystalline bedrock.

The major fresh-water aquifers in Camden County are sands and gravels of Cretaceous and Tertiary age in the Potomac Group and the Raritan and Magothy Formations; the Cohansey Sand; the Wenonah Formation-Mount Laurel Sand; and the Englishtown Formation. Minor aquifers are found in parts of the Merchantville Formation, the undifferentiated Vincentown and Manasquan Formations, and the Kirkwood Formation. Saturated sands and gravels in the surficial deposits of Quaternary age where in direct contact are commonly hydraulically connected to the underlying aquifers.

The rate of ground-water withdrawal for Camden County was 68 mgd (million gallons per day) in 1966. This was the largest average annual county pumpage in the State in 1966. Eighty-five percent (56 mgd) was pumped from the aquifer system in the Potomac Group and the Raritan and Magothy Formations.

The potentiometric surfaces of all the major artesian aquifers in Camden County declined from 1900 to 1970 as a result of pumping. The largest decline occurred in the aquifer system in the Potomac Group and the Raritan and Magothy Formations. At Haddon Heights, in the western part of the county, the potentiometric surface declined about 110 feet from 1900 to 1968. The potentiometric surface of the aquifer in the Wenonah Formation-Mount Laurel Sand declined 43 feet in about 60 years in the vicinity of Berlin Borough.

The chemical quality of ground water in Camden County

is generally satisfactory for most uses. Concentrations of iron greater than the State's potable-water standard of 0.3 milligrams per liter are found in some areas of the Potomac-Raritan-Magothy aquifer system, in scattered locations in the Wenonah Formation-Mount Laurel Sand, and in the Cohansey Sand. In general, higher values of dissolved solids, sulfate, and chloride occur in water in and near the outcrop of the Potomac-Raritan-Magothy aquifer system than downdip in the aquifer. In the southeastern part of the county chloride concentrations in excess of 250 milligrams per liter can be found in the same aquifer system. The high chloride water has remained in the aquifer system from the time of deposition or has re-entered the system from the ocean after changes in sea level since Pleistocene time.

Contamination of water in the Potomac-Raritan-Magothy aquifer system in the Philadelphia area has created a potential water-quality problem for the Camden area near the Delaware River. Contaminated ground water in Philadelphia, with high concentrations of sulfate and dissolved solids, is moving under the Delaware River toward Eagle Point in Gloucester County near the Camden County line. Decrease of pumping in Philadelphia and simultaneous increase of pumping in Camden and Gloucester Counties tends to draw ground water from Philadelphia toward New Jersey.

The greatest potential for additional ground-water development in the county is from the Cohansey Sand which is generally an unconfined aquifer. The Cohansey also has the greatest possibility of ground-water contamination because of the local effect of wastes from suburban and industrial development and the shallow depth of the Cohansey aquifer.

INTRODUCTION

PURPOSE AND SCOPE

This investigation of the ground-water resources and geology of Camden County is part of a statewide program of studies of the water resources of New Jersey. It was conducted by the U. S. Geological Survey in cooperation with the New Jersey State Department of Environmental Protection, Division of Water Resources.

Almost all public, industrial, and irrigation water supplies in Camden County are obtained from ground-water sources. The ground-water environment and its hydrologic and chemical characteristics must be understood in order to facilitate an orderly and safe development of this natural resource. The purpose of this investigation is to collect and interpret the basic hydrologic and geologic data and to appraise and report on the ground-water resources of Camden County. The objectives were to define the thickness and areal extent of the hydrologic units, evaluate the hydraulic characteristics of the aquifers, determine the effect of pumpage on the water levels of the area, define the source of recharge of the aquifers, and to evaluate the chemical quality of the ground water.

LOCATION AND EXTENT

Camden County is in the southwestern part of New Jersey (fig. 1). It is bounded by Burlington County on the northeast, Atlantic County on the southeast, Gloucester County on the southwest, and by the Delaware River on the northwest. The county is part of the Philadelphia standard metropolitan statistical area and occupies an area of 222.2 square miles. The City of Philadelphia, fourth largest city in the United States, is located across the Delaware River from Camden County.

PERSONNEL AND SUPERVISION

The investigation was made by the U. S. Geological Survey in cooperation with the State Department of Environmental Protection, Division of Water Resources. The

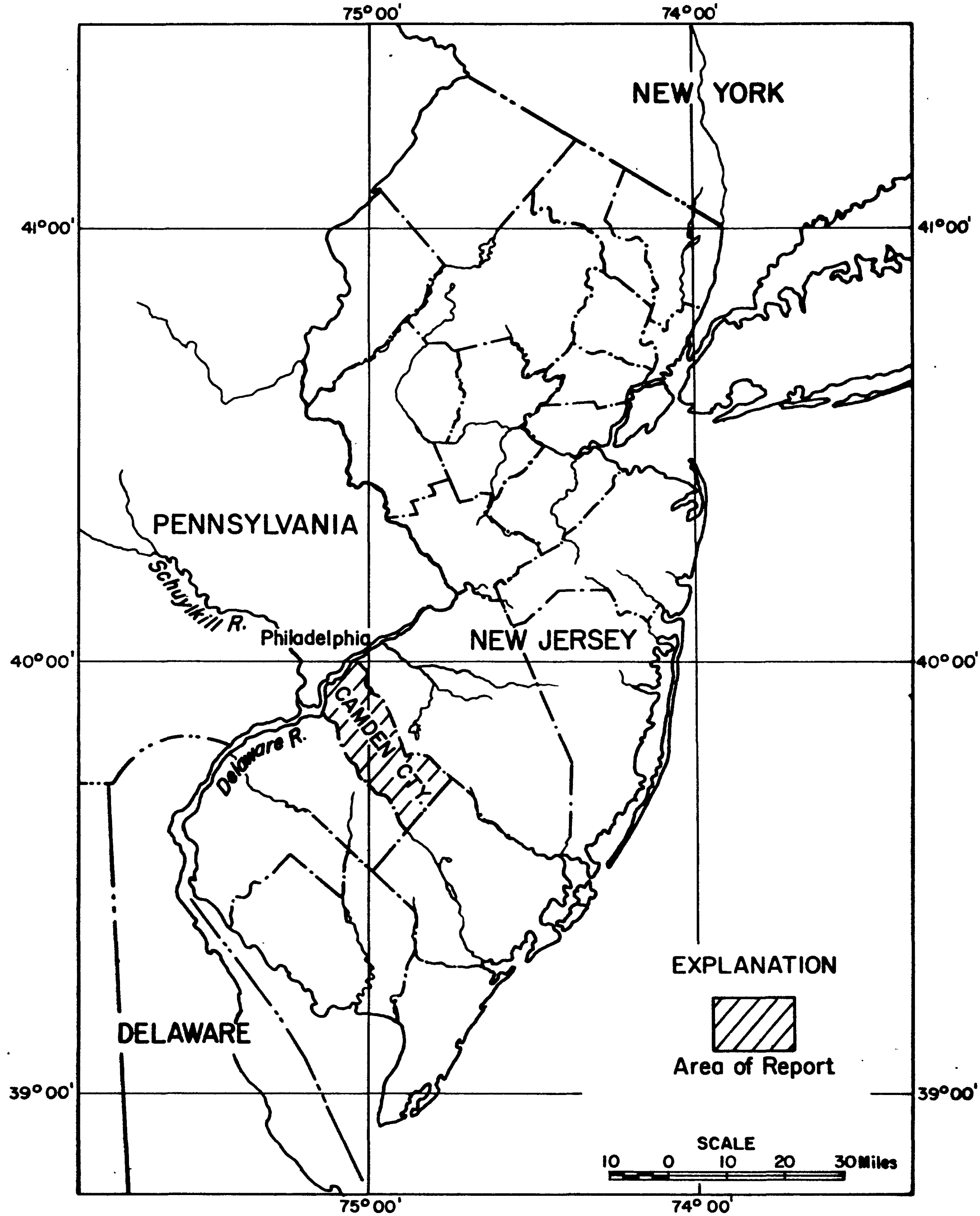


Figure 1. — Map of New Jersey showing location of Camden County.

work was performed under the general supervision of John E. McCall, District Chief, and under direct supervision of William Kam, Supervisory Hydrologist. The authors were assigned to the project in June 1969. Most of the material on the Potomac-Raritan-Magothy aquifer system in this report is from an unpublished study on the aquifer system from Trenton to Salem, New Jersey, by Gill and Farlekas. George M. Farlekas collected, compiled, and interpreted the data for the geologic units younger than the Magothy Formation up to and including the Mount Laurel Sand. Bronius Nemickas was responsible for the work on the geologic units younger than the Mount Laurel Sand. Data for wells tapping units younger than the Magothy were obtained from 1) field work in the summer and fall of 1969, 2) selected data from E. Donsky (1963), and 3) unpublished data from the Great Egg Harbor River basin compiled by P. R. Seaber in 1958. Data collection and analysis for the project was essentially completed in July 1970.

PREVIOUS INVESTIGATIONS

The geology and ground-water resources of the Camden area have been studied intermittently during the past 100 years. Almost all of the early information published in the annual reports of the State Geologist is limited to general descriptions of the water-bearing formations, with lists of wells tapping principal aquifers. Further information on the geology and hydrology of the Camden area was published by Bascom (1904) and Bascom and others (1909). The U. S. Geological Survey began ground-water investigations in New Jersey in 1923 in cooperation with the State. In 1932 a report on the ground-water supplies of the Camden area was published (Thompson, 1932). A progress report on the ground-water resources of the Lower Delaware Valley study was released in 1952 (Barksdale and Graham). The results of this tri-state study, which included Camden County, were reported later by Barksdale and others (1958). A report on the ground-water resources of the nearby Philadelphia Navy Base was prepared by Graham and Kammerer (1954). Greenman and others (1961) prepared a report on the ground-water resources of the Coastal Plain of southeastern Pennsylvania, which included the City of Philadelphia. A basic-data report on wells in Camden County was written by Donsky (1963).

Completed investigations of the geology and ground-water resources of neighboring counties include Burlington County (Rush, 1968), Gloucester County (Hardt and Hilton, 1969), and Atlantic County (Clark and others, 1968).

Iron in water of the aquifer system in the Potomac Group and Raritan and Magothy Formations has been investigated by Langmuir (1969a and 1969b). Regional geology, hydrology, and geochemistry of the aquifer system in the Potomac Group and Raritan and Magothy Formations from Salem County north to Trenton has been investigated by Gill and Farlekas (written commun., 1969).

Detailed geologic field work has been made in a number of 7-1/2 minute quadrangle areas in Burlington County (Minard, Owens, and Nichols, 1964, Owens and Minard, 1962 and 1964a), and one quadrangle in Salem County (Minard, 1965). A geologic map of part of the Coastal Plain at a scale of 1:250,000 was compiled by J. P. Owens in U. S. Geological Survey (1967).

WELL-NUMBERING AND LOCATION SYSTEM

Wells discussed in the report have been located on U. S. Geological Survey 7-1/2 minute quadrangle maps and are shown in figure 2. The municipality and the latitude and longitude in degrees, minutes, and seconds for each well were determined from the 7-1/2 minute quadrangles. Each well (table 1) has a unique number. The first six numbers and the letter N (for North) are the latitude for the well. The fifteenth number is the sequential number, usually "1". If more than one well is located at the same site, the second well will have a sequential number of 2 and the third well a sequential number of 3; with as many sequential numbers as there are wells at that latitude and longitude. The wells (table 1) are listed by municipality and numbered serially in order of decreasing latitude. Decreasing longitude is used to determine the order of the wells if two or more wells have the same latitudes.

ACKNOWLEDGMENTS

The authors gratefully acknowledge the assistance of officials and private individuals of the Camden area who furnished information on their wells and permitted access to the wells for the collection of water samples and geophysical and hydrologic data. The staff of the New Jersey Division of Water Resources was helpful in furnishing data from their files. Special thanks are extended to the many well drillers, particularly A. C. Schultes and Sons, Layne-New York Inc., and A. A. and M., for their time and assistance in furnishing well data and geophysical logs.

GEOGRAPHY

TOPOGRAPHY AND DRAINAGE

Camden County lies entirely within the Atlantic Coastal Plain physiographic province, which extends from Massachusetts to Florida. The county is characterized as a low lying, gently rolling plain that ranges in altitude from sea level to about 220 feet. The maximum altitude of about 220 feet is located in the southeastern part of Voorhees Township.

A generalized topographic map of Camden County outlining the major drainage basins is shown in figure 3. In the northeastern part of the county the major streams, the Rancocas, Pennsauken, Newton, and Big Timber Creeks and the Cooper River, flow northeast and north into the Delaware River. In the southeastern part of the county the Mullica and Great Egg Harbor Rivers flow southeast towards the Atlantic Ocean.

Topographic highs in the central part of the county form the drainage divides between the basins. Topographic lows are in the southeastern part of the county and in the northern part of the county along the Delaware River and along streams flowing into the Delaware River.

CLIMATE

The climate of Camden County is continental, generally moderate, with mild winters, warm summers, and generally evenly distributed rainfall. The prevailing direction of air movement is from west to east. During the summer months the prevailing wind direction is from the southwest.

The average annual temperature of the Philadelphia Weather Bureau station for the period 1931-60 was 53.3°F (degrees Fahrenheit). Normal daily maximum and minimum are 40.3°F and 24.3°F for January, and 85.9°F and 65.2°F for July.

Average annual precipitation at the Philadelphia Weather Bureau station for 1931-60 was 42.48 inches. Precipitation is generally distributed evenly throughout the year, with the summer precipitation characterized by localized thundershowers. The winter precipitation is usually more widespread and less intense. Precipitation data for the same

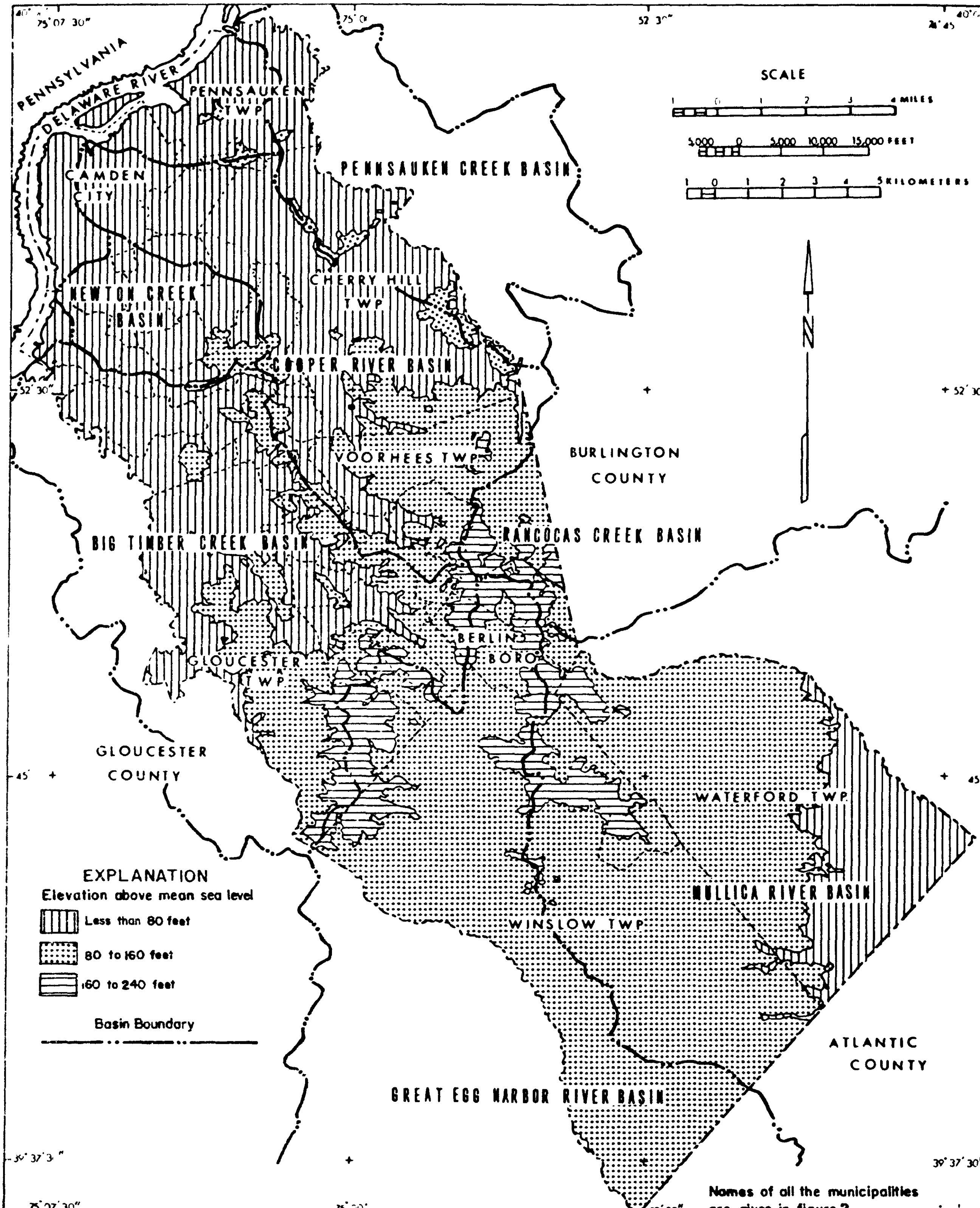


Figure 3. — Generalized topographic and drainage basin map of Camden County.

period indicate that the average of the wettest month of each year is 4.63 inches, while the average of the driest month of each year is 2.78 inches.

POPULATION AND ECONOMY

Camden County had a population of 456,291 in 1970, 392,035 in 1960, and 300,743 in 1950 (U. S. Bureau of Census). The increase from 1960 to 1970 was 16.4 percent and the increase from 1950 to 1960 was more than 30 percent. The most densely populated area is in the northern part of the county. In 1960 the municipalities north of Gloucester Township, Somerdale Borough, and Voorhees Township contained 82 percent of the total population, whereas the land area is only 31 percent. In 1970 the same municipalities contained 77 percent of the county's total population indicating a shift in population toward the southeast.

Camden County is in the Philadelphia metropolitan area and many of the county's residents work in the city or nearby counties. A large work force is employed by manufacturing companies located along the western edge of the county in the area near the Delaware River. The cities of Camden and Gloucester, as well as Pennsauken Township, have much of the manufacturing of the county, although a number of new manufacturing centers are being developed east of the New Jersey Turnpike. Three municipalities, Waterford and Winslow Townships and Chesilhurst Borough, have the largest proportion of land in the county used for agriculture. The percentage of land area used for farms in Camden County has been decreasing in recent years. The U. S. Department of Commerce, Bureau of Census reports indicate that the land area used for farms in Camden County was 8.6 percent in 1969, 10.2 percent in 1964, and 13.7 percent in 1959.

GEOLOGY

STRATIGRAPHY AND STRUCTURE

All exposed geologic units in Camden County are sedimentary and for the most part unconsolidated. They are part of the Atlantic Coastal Plain and range in age from Early Cretaceous to Quaternary. Figure 4 is a geologic map of Camden County delineating the outcrop area of the Cretaceous and Tertiary age sediments. Figures 5 and 6 show two geologic

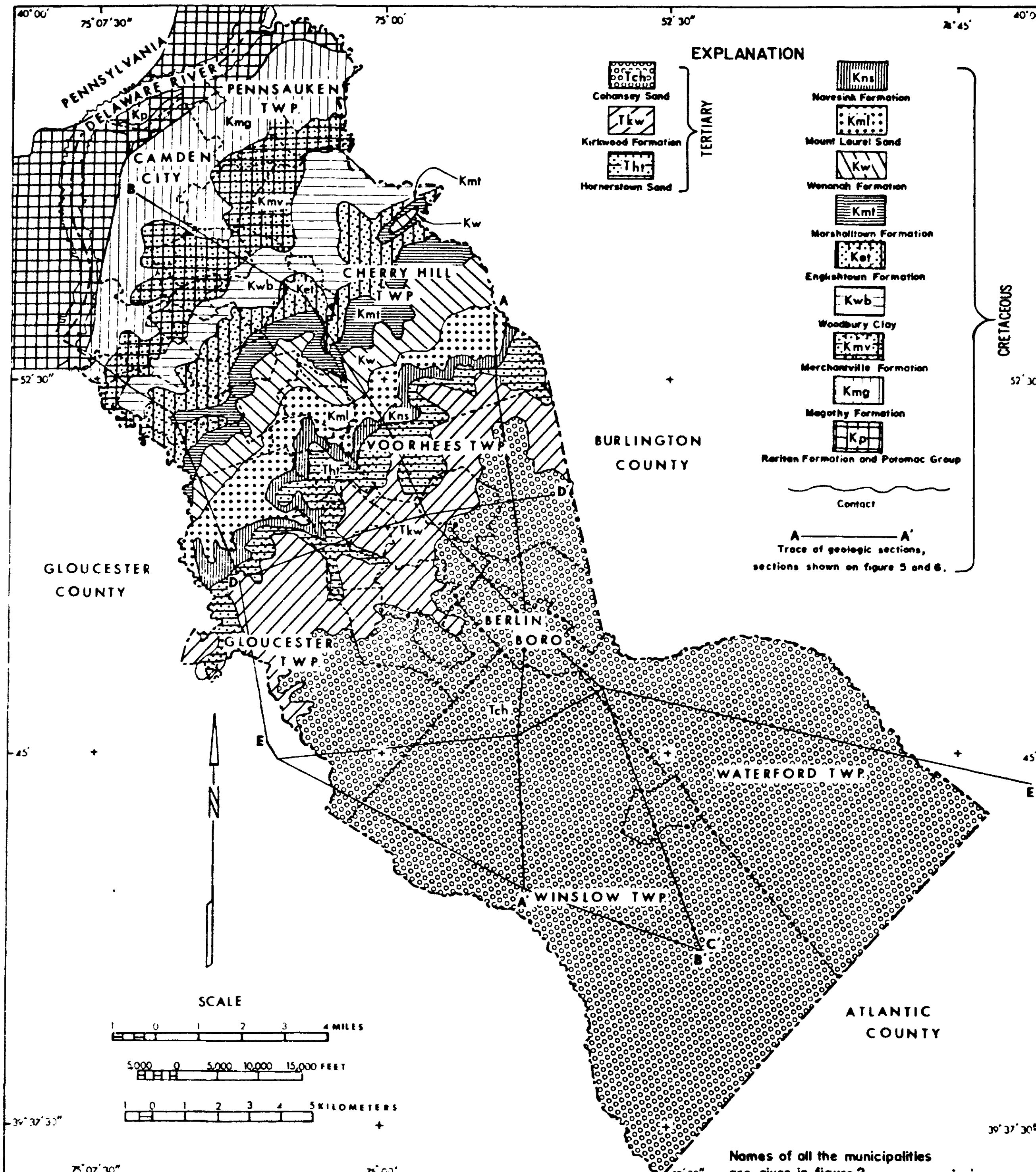


Figure 4. — Pre-Quaternary geologic map of Camden County.

sections of the Coastal Plain sediments in Camden County. The Cretaceous and Tertiary sediments dip gently to the southeast with the oldest sediments cropping out at the Delaware River. In general, the older the sediments are, the greater the dip. The Quaternary formations are essentially flat-lying beds that overlie the Cretaceous and Tertiary sediments.

Underlying the sediments of the Coastal Plain in Camden County are crystalline rocks of pre-Cretaceous age. The surface of the crystalline rocks slopes towards the southeast. The altitude of the crystalline rock surface is about 40 feet below mean sea level at the Delaware River in the vicinity of the Benjamin Franklin Bridge and about 2,800 feet below mean sea level at the Camden-Atlantic County line.

The formations present in Camden County and their water-bearing properties are described in table 2. Also given is the general lithology and range in thickness of the formations.

GEOLOGIC HISTORY

During the Precambrian a great thickness of sediments was deposited in the area. The sediments included sands, silts, clays, and carbonates. The sediments were buried by additional sediments, metamorphosed, and subsequently uplifted during Paleozoic time. Part of the sediments were reconstituted into the metamorphic rocks known as the Wissahickon Formation. In the Camden County area a period of erosion occurred in the Paleozoic Era and continued into the Mesozoic Era, extending through Triassic and Jurassic time. The next sequence of sediments found are the Cretaceous units above the metamorphic rocks. During Cretaceous time sands, clays, and silts were deposited in a deltaic complex somewhat similar to modern deltas. The streams supplying sediment to the deltaic complex flowed from the west-northwest to the east-southeast. They provided the fluvial sediments that make up the Potomac Group and the Raritan and Magothy Formations. In Late Cretaceous time marine seas inundated the area. The marine invasions were cyclic in nature rather than continuous, and periods of complete withdrawal of the sea occurred. During Late Cretaceous time deposits in the Camden area were mainly of deltaic, beach, and marine origin.

The marine environment persisted into Tertiary time, but the marine inundations were not as extensive as those in the Cretaceous. Early Tertiary deposits (Paleocene to Middle Eocene) are marine in origin; whereas, middle and late Tertiary deposits (Miocene and Pliocene) are either beach or deltaic deposits.

Sands and gravels of fluvial origin were deposited during early Pleistocene time of the Quaternary Period in extensive areas of Camden County. These deposits, known as the Bridgeton and Pennsauken Formations, may be the result of several early glacial or interglacial stages. In middle Pleistocene time sea level rose during interglacial stage. This resulted in a marine invasion of the area along the Delaware River in Camden. Clays and silts were deposited in the low-lying areas while fluvial material such as sands and gravels were deposited in the higher areas.

As the Wisconsin ice sheet advanced into the northern parts of Pennsylvania and New Jersey, sea level declined and the sea withdrew from the Camden area. Glacial meltwaters deposited sands, silts, and clays. In addition, eolian materials were deposited. Sea level rose to its present level with the withdrawal of the Wisconsin glacier. Recent measurements of sea level suggest that it is still rising.

GROUND-WATER QUALITY

Ground water contains dissolved mineral matter as the result of leaching of soluble material, primarily from the soils, sediments, or rocks through which the water moves. Thus, the natural chemical characteristics of ground water are a function of time, pressure, temperature, composition, and solubility of the minerals with which the water is in contact. Consequently, the quality of ground water may very greatly from one place to another and from one aquifer to another. Superimposed on the natural chemical characteristics of ground water is deterioration of the quality of water caused by human activities, such as the utilization of unlined industrial-retention ponds, waste-disposal wells, and improperly located or constructed sanitary landfills and septic tanks.

Pumping also can have an effect on the local quality of ground water. Changes in the potentiometric surface caused by pumping may change the direction of movement of water or greatly accelerate the movement. Thus, ground water of poor quality may move into centers of pumping. Salt water also may move from adjacent aquifers or from tidal streams into the pumped aquifer.

Water-quality standards vary widely depending on the intended use of the water. A particular industry may have requirements for water within a narrow range of a minor constituent. If the concentration is beyond this range the water may not be suitable for the particular use without treatment. The same water, however, may be acceptable for public-water supply. The Potable Water Standards of the New Jersey Department of Environmental Protection (1970) for some chemical constituents are as follows:

Chemical constituents	Maximum concentrations (mg/l)
Chloride (Cl)	250
Fluoride (F)	1.5
Hardness (as $CaCO_3$)	150
Iron (Fe)	.3
Manganese (Mn)	.05
Nitrate (NO_3-N)	30
Sodium (Na)	50
Sulfate (SO_4)	250
Dissolved solids	500

The source and significance of dissolved-mineral constituents and physical properties of ground water in Camden County are given in table 3.

Regional water-quality studies have been made for several aquifers in Camden County and vicinity. The aquifers are 1) Potomac-Raritan-Magothy aquifer system (Langmuir, 1969a and 1969b, and Gill and Farlekas, written commun., 1969); 2) the Englishtown aquifer (Seaber, 1965); and 3) the Cohansey Sand (Rhodehamel, 1966). Water-quality data for the neighboring counties are given in ground-water reports for Burlington (Rush, 1962 and 1968), Gloucester (Hardt and Hilton, 1969), and Atlantic Counties (Clark and others, 1968). The quality of water data for Camden County are given in table 4. The quality of water data for each aquifer is discussed under the appropriate sections of the individual formations.

GEOLOGIC FORMATIONS AND THEIR HYDROLOGIC CHARACTERISTICS

PRE-CRETACEOUS CRYSTALLINE ROCKS

Geology

Crystalline rocks of pre-Cretaceous age underlie the Coastal Plain sediments in Camden County. The crystalline rocks at or near the surface near Camden are part of the Wissahickon Formation. Much of the data available on the lithology and age of the rocks are from areas where the rocks are at or near the surface. Information about these rocks at depth is from drillers' logs and seismic studies.

The Wissahickon Formation is a medium to coarse-grained foliated crystalline rock that varies in composition and texture from schist to gneiss. The lithology of the formation varies greatly in both vertical and horizontal directions. The formation was probably a sedimentary series of sandstone, siltstone, and shale that have been deformed and re-crystallized by metamorphism.

The outcrop area of the Wissahickon Formation near the project area is in Pennsylvania a few miles west of the Delaware River. The formation is near the surface in the Camden City area near the Delaware River. The depth to the Wissahickon Formation at the Delaware River in the vicinity of the Benjamin Franklin Bridge is about 60 feet. The configuration of the crystalline rocks is shown in figure 7.

Hydrology

Few wells have been drilled for water supply in the crystalline rocks below the Coastal Plain of New Jersey. Two wells were drilled 600 feet into the Wissahickon Formation in Burlington County near the Delaware River. Neither well produced sufficient water to be useful to their owners. The data from these and other wells drilled into the crystalline rocks indicate that development of these rocks as a source of a large ground-water supply is unlikely.

Although the crystalline rocks do not produce a large quantity of water, they are hydrologically important. The basement rocks form a basal confining unit for the overlying unconsolidated aquifers. In addition, the configuration of the bedrock surface is hydrologically important. During Cretaceous and pre-Cretaceous time streams incised major river channels in the bedrock surface. These west to east-trending channels are filled with highly permeable Coastal Plain sediments (Gill and Farlekas, written commun., 1969).

MESOZOIC ERATHEM

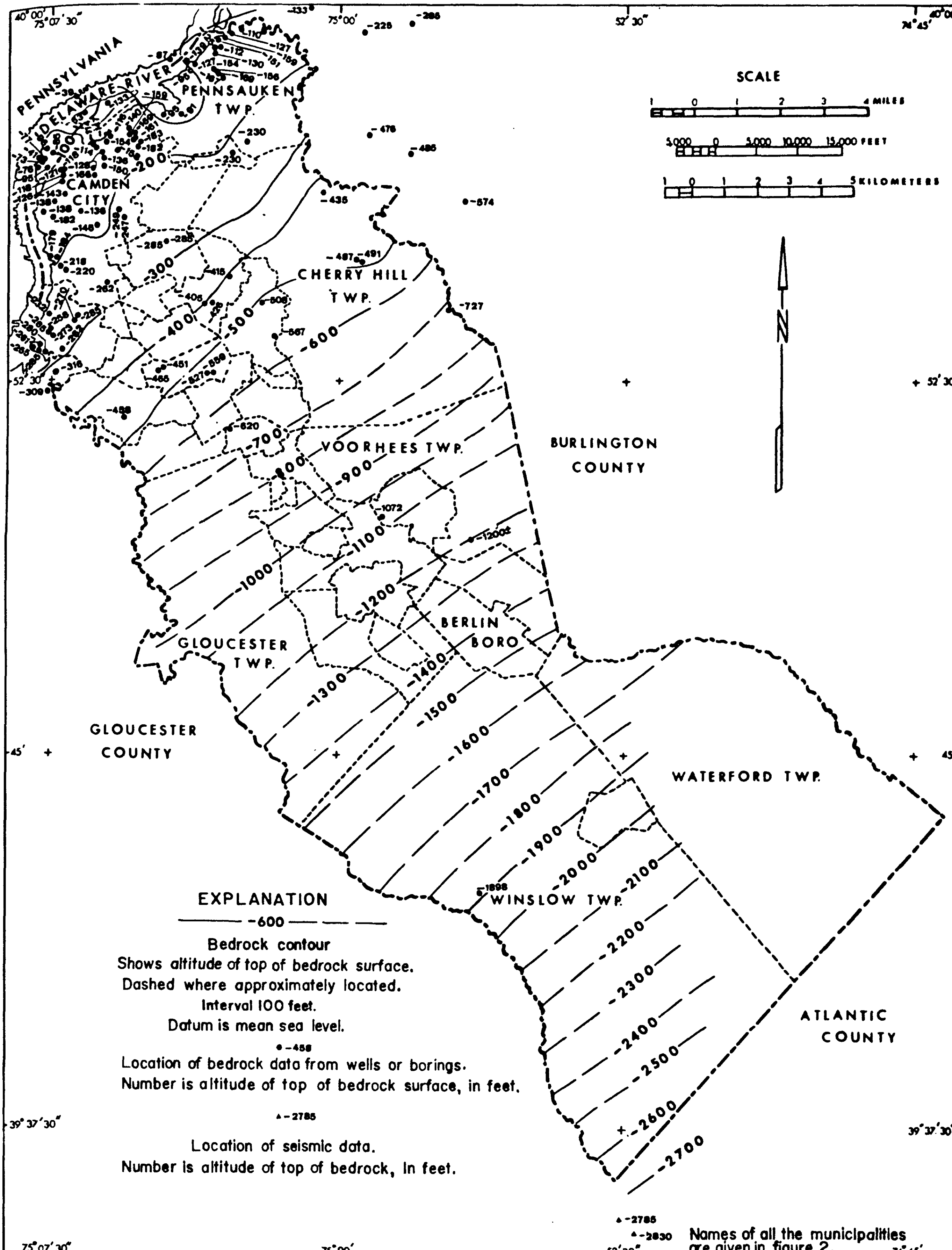


Figure 7. — Configuration of the bedrock surface beneath the Coastal Plain in Camden County.

Cretaceous System

Potomac Group and the Raritan and Magothy Formations

Regional Setting and Stratigraphic Framework

The Potomac Group and the Raritan and Magothy Formations are fluvial-marginal marine sediments of Early to Late Cretaceous age and overlie the pre-Cretaceous crystalline rocks. These sediments make up an extensive part of the Coastal Plain sediments in New Jersey and in the adjacent states. Major structures which contain the greatest thickness of sediments are the Salisbury embayment (Richards, 1945) in Delaware and the Raritan embayment in the vicinity of Raritan Bay and eastern Long Island. The area between these two embayments, which includes Camden County, contains smaller arches and troughs. The outcrop area of the Potomac Group and Raritan and Magothy Formations in Camden County (21 square miles in area) is in the northwestern part of the county near the Delaware River. The units are extensively overlain by permeable Pleistocene deposits in the outcrop area.

The Potomac Group and the Raritan and Magothy Formations form a wedge-shaped body that thickens in a downdip direction and is underlain by the crystalline basement. The configuration of the crystalline rocks is shown in figure 7. The upper limit of the wedge-shaped body is the contact between the Merchantville Formation and the top of the Magothy Formation (fig. 8). The difference between the basement and the top of the Magothy is the total thickness of Potomac Group and the Raritan and Magothy Formations (fig. 9).

In Camden County the thickness of the Potomac Group and Raritan and Magothy Formations ranges from approximately 260 feet at the Collingswood well 7 (CO 7), located near the outcrop area, to approximately 1,210 feet at the New Brooklyn Park test well (WI 27). This is shown on the thickness map in figure 9. The distance between the two wells is 13 miles.

Correlation of part of the Cretaceous stratigraphic section in northern New Jersey and Maryland as determined by Wolfe and Pakiser (1971) is given below.

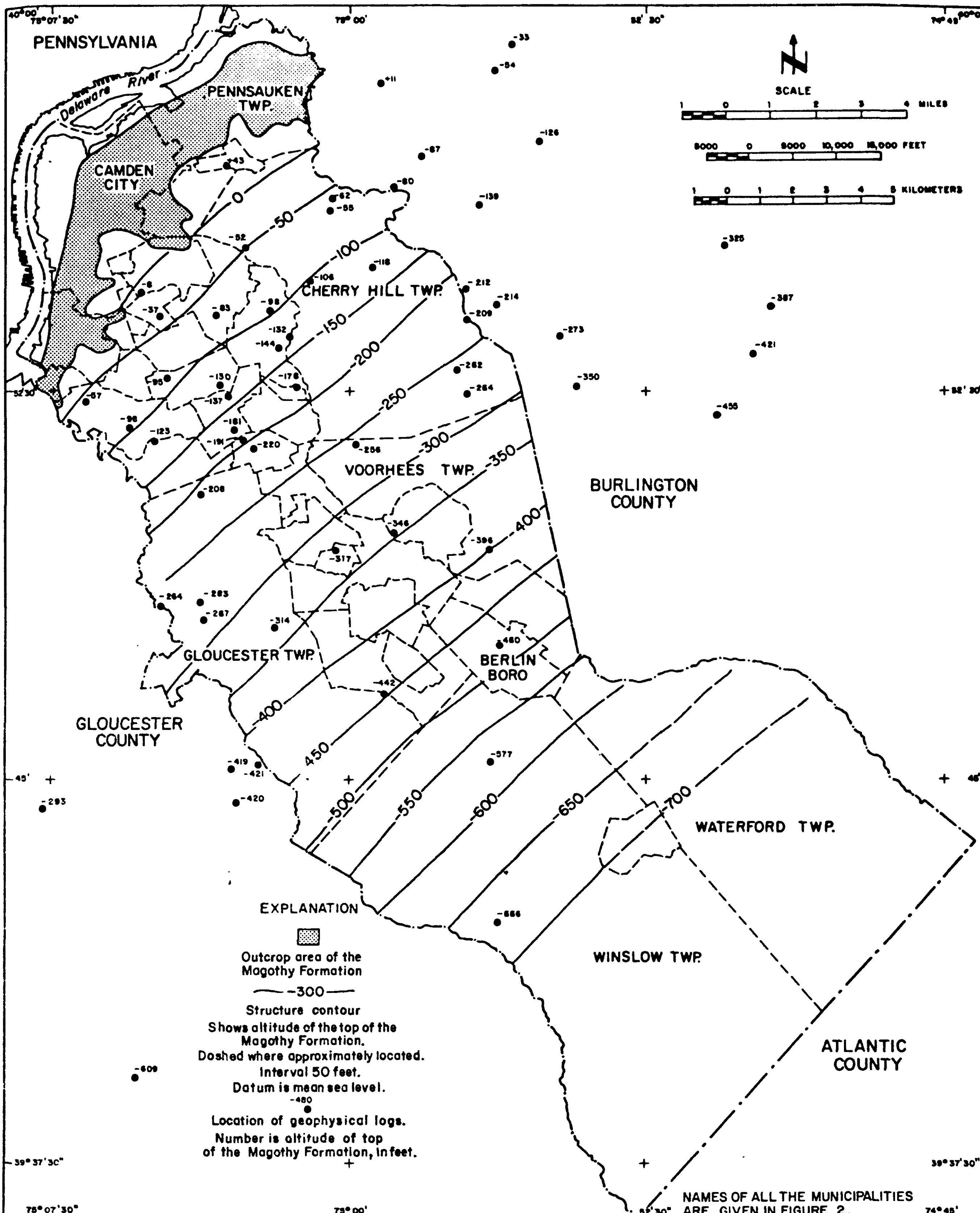


Figure 8. — Structure contour map of the top of the Magothy Formation in Camden County.

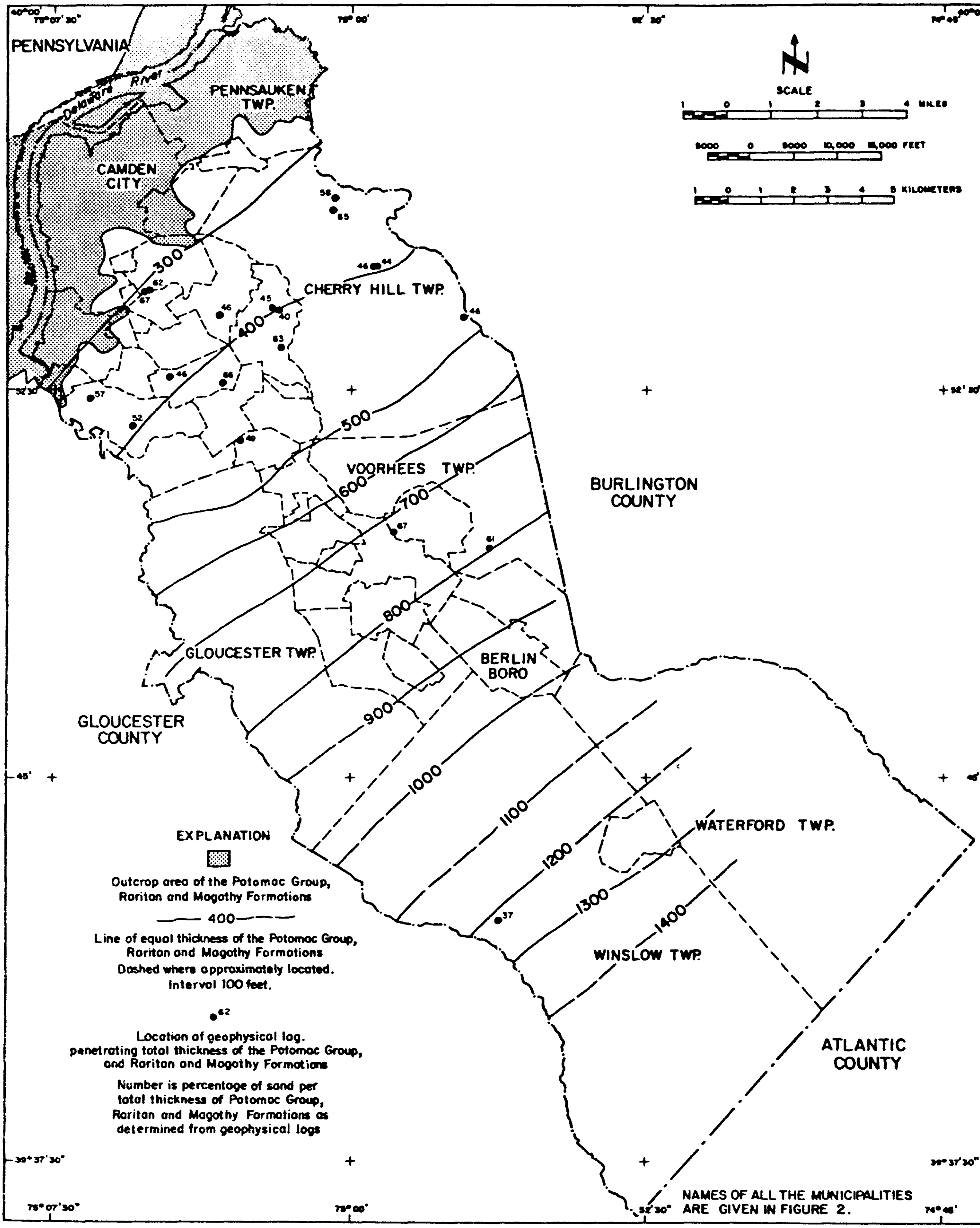
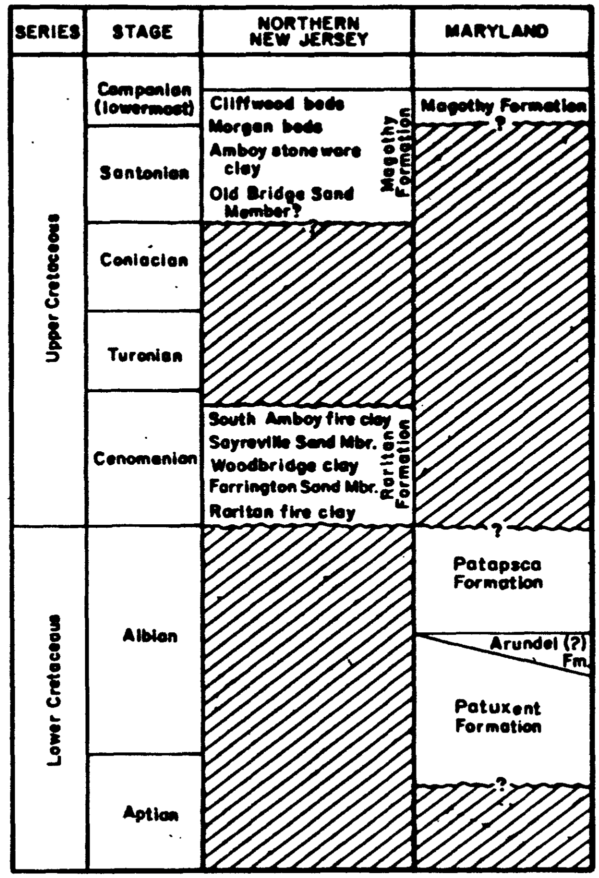


Figure 9. Thickness map of the Potomac Group and the Raritan and Magothy Formations in Camden County.



The lowermost part of the stratigraphic section, the Potomac Group, consists of the Patuxent, Arundel, and Patapsco Formations at the type locality in Maryland. Palynological studies of samples from three sites from the Camden County area by Wolfe and Pakiser (1971) and L. A. Sirkin (written commun., 1971) indicate that only the Upper Patapsco was found at two of the three sites. Berry (1911), from a study of megafossil flora, determined that the sample from a site in the outcrop near Camden is Upper Raritan. However, Wolfe and Pakiser (1971) who examined a sample from the same site indicate an uppermost Patapsco age based on palynologic data. According to Sirkin (written commun., 1971) the uppermost Patapsco can be found at Medford test well (ME 1), but not at the New Brooklyn Park test well (WI 27).

The Raritan Formation at the type locality at Raritan Bay, Middlesex County, was divided into seven units by Ries, Kümmel, and Knapp (1904) and later modified by Berry (1906). Barksdale and others (1943) assigned names to the three sand members. Recent palynological work by Wolfe and Pakiser (1971) and Doyle (1969) indicate that the upper two units, the Amboy stoneware clay and the Old Bridge Sand, are of Magothy age. Wolfe and Pakiser (1971) reassigned the Old Bridge Sand as the basal member of the Magothy Formation. However, the members of the Raritan Formation of the type area in Raritan Bay cannot be traced to the Delaware Valley as distinct lithologic units. Palynologic analysis of core samples from the New Brooklyn test well (WI 27) and the Medford test well (ME 1) indicate the Raritan Formation is present at the two sites (Sirkin, written commun., 1971).

The Magothy Formation in the Raritan Bay area has been re-examined by Owens, Minard, and Sohl (1968). Based on the then unpublished work of Wolfe and Pakiser (1971), Owens, Minard, and Sohl (1968) defined the Magothy as consisting of four units. The total thickness of the Magothy is more than 200 feet in the Raritan Bay area. Members of the Magothy Formation of the Raritan Bay area are not recognizable in the Delaware Valley. Palynological studies by Sirkin (written commun., 1971) indicate that there is about 300 feet of Magothy age sediments at New Brooklyn Park test well (WI 27) and about 100 feet at the Medford test well (ME 1).

Depositional Environment

The Potomac Group and the Raritan and Magothy Formations were deposited in a complex fluvial-deltaic environment (Owens and others, 1968). Figure 10 illustrates the idealized sand-dispersal system showing the various depositional environments for the Eocene deltas of Texas (Fisher and McGowen, 1969). The authors believed that the fluvial-deltaic sediments of the Potomac Group and the Raritan and Magothy Formations have a similar complex depositional history.

In the Camden area the sediments were deposited as part of the ancestral Schuylkill fluvial-deltaic system (Gill and Farlekas, written commun., 1969). Troughs in the bedrock surface represent erosional features that are of Late Cretaceous age or older. These troughs, filled mainly with coarse sands and gravels, have been delineated in Philadelphia by Greenman and others (1961). The sediments were deposited during Cretaceous time in the fluvial part of the system, which

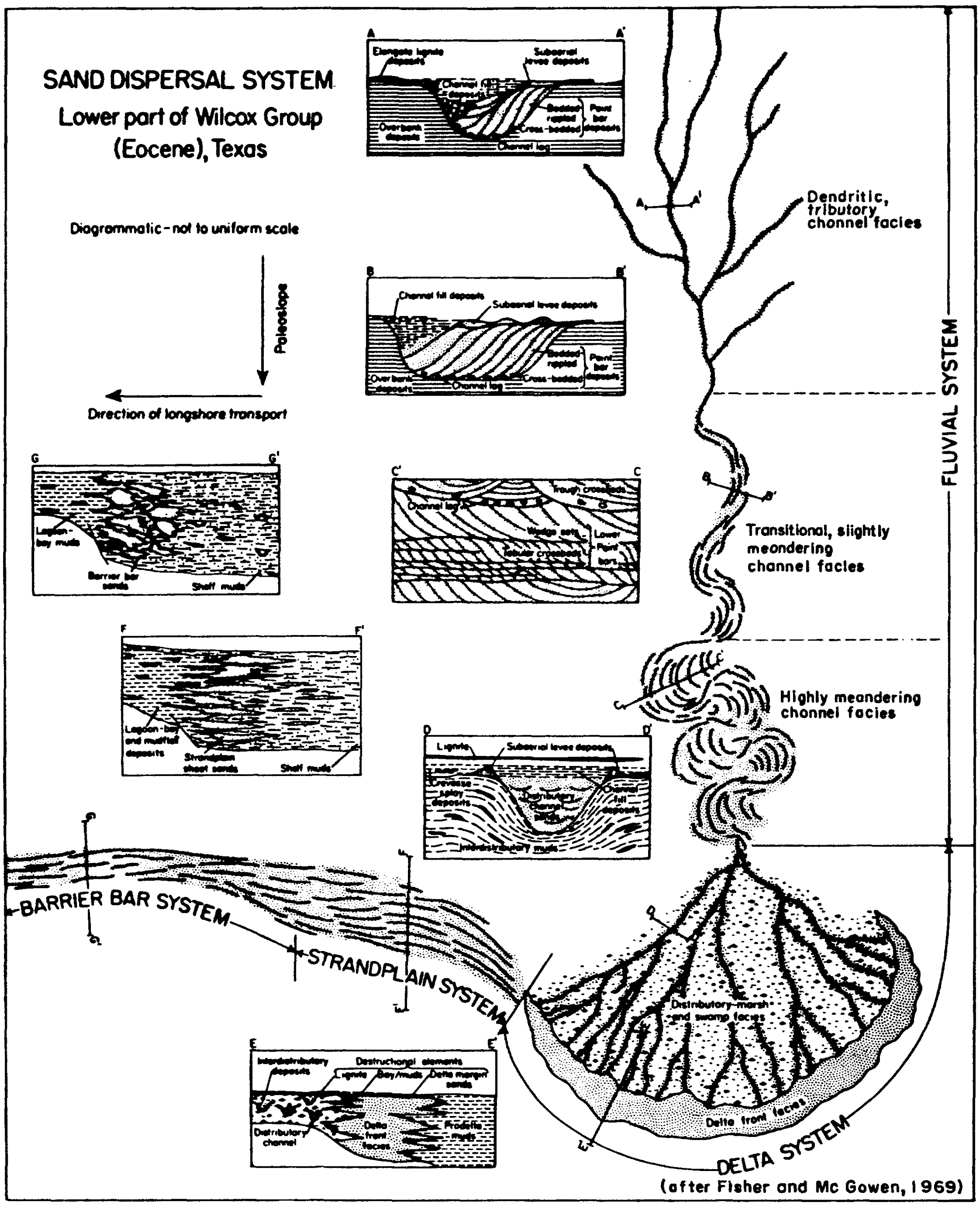


Figure 10. — Idealized sand-dispersal system in various depositional systems, Wilcox Group, Texas.

probably extended from Philadelphia to the area updip from New Brooklyn Park.

A thickness map of the Potomac Group and the Raritan and Magothy Formations is given in figure 9. Also shown is the percentage of sand as estimated from geophysical logs from wells that penetrate the section from the top of the Magothy to the crystalline rocks. The thickness lines show the thickening of the sediments downdip. The percentage of sand indicates greater values in the updip area and lower values in the downdip area. The estimated percentage of sand at the New Brooklyn Park well (WI 27) is 37. Based on the depositional concept developed by Fisher and McGowen (1969) the New Brooklyn Park well is interpreted as being in the distributary channel-marsh and swamp facies. The sediments found in the Haddonfield area are interpreted as including the transitional, slightly meandering channel facies of Fisher and McGowen (1969). The dendritic tributary channel facies is interpreted as occurring in the area from Philadelphia to the northern part of Camden County. The highly meandering channel facies probably occurs in the area downdip from Elm Tree Farms well (VO 12). Lack of data prevents the delineation of the extent of this facies downdip of the Elm Tree Farms area.

Particle-size analysis is available for samples from the New Brooklyn Park test well (WI 27) in Winslow Township (table 5). The particle-size analysis shows the predominant silt and clay values.

Hydrology

The most productive source of ground water in Camden County is the Potomac-Raritan-Magothy aquifer system. The aquifer system is made up of aquifers consisting of sand with some gravel and confining units consisting of silts and clays and is overlain in the outcrop area by highly permeable Pleistocene sand and gravel. The sands are separated into three hydrologic units, an upper, middle, and lower aquifer. The upper unit consists mainly of the sands of the Magothy Formation. The middle and lower units consist mainly of sands of the Raritan Formation and the Potomac Group. The thickness of the three hydrologic units are shown in figures 11, 12, and 13. The lower aquifer in the outcrop area is overlain by and hydraulically connected to the Pleistocene deposits and is a water-table aquifer in Philadelphia. The upper aquifer in the outcrop area is overlain by and hydraulically connected to the Pleistocene deposits in Camden County and is under water-table conditions.

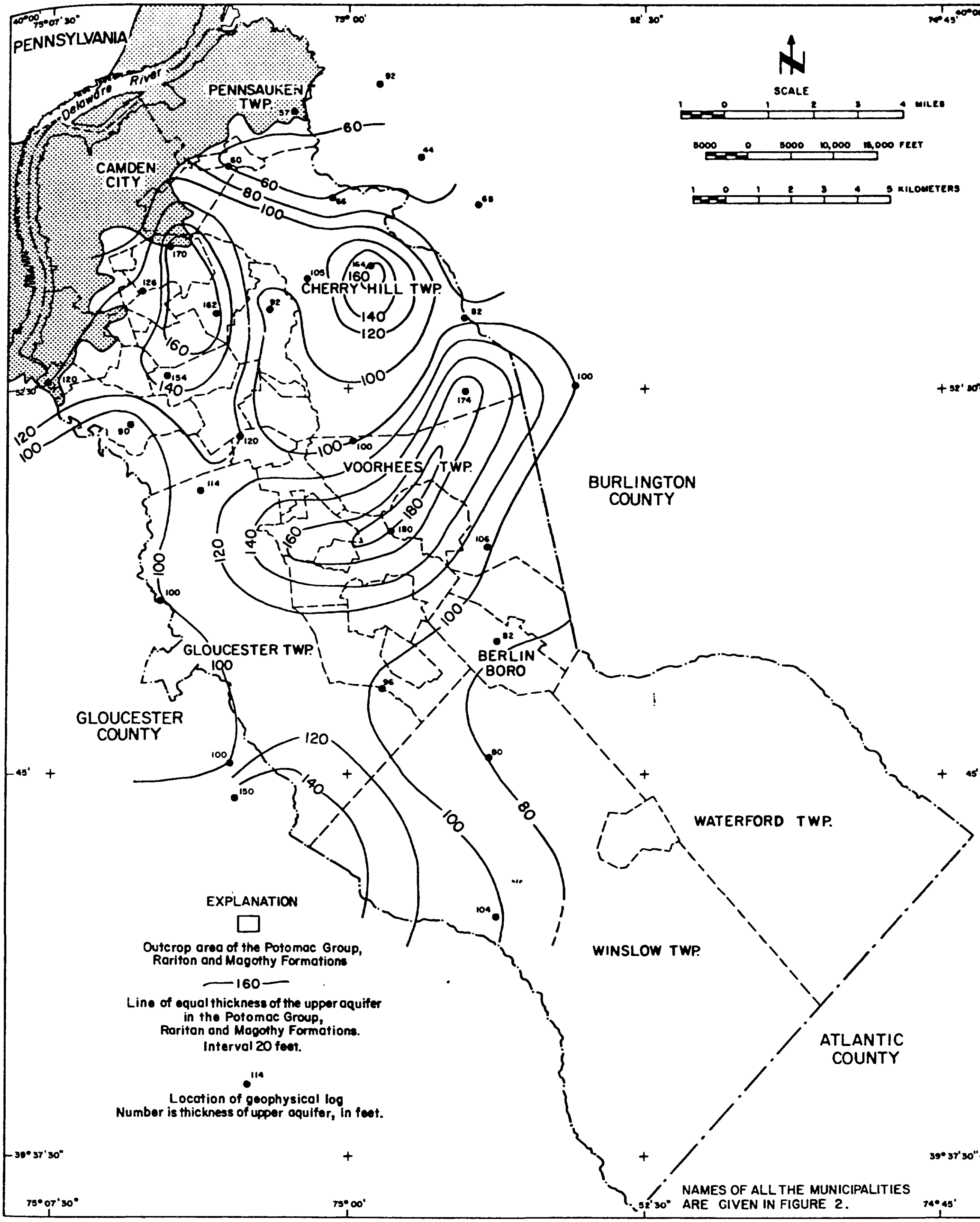


Figure 11. — Thickness map of the upper aquifer in the Potomac-Raritan-Magothy aquifer system in Camden County.

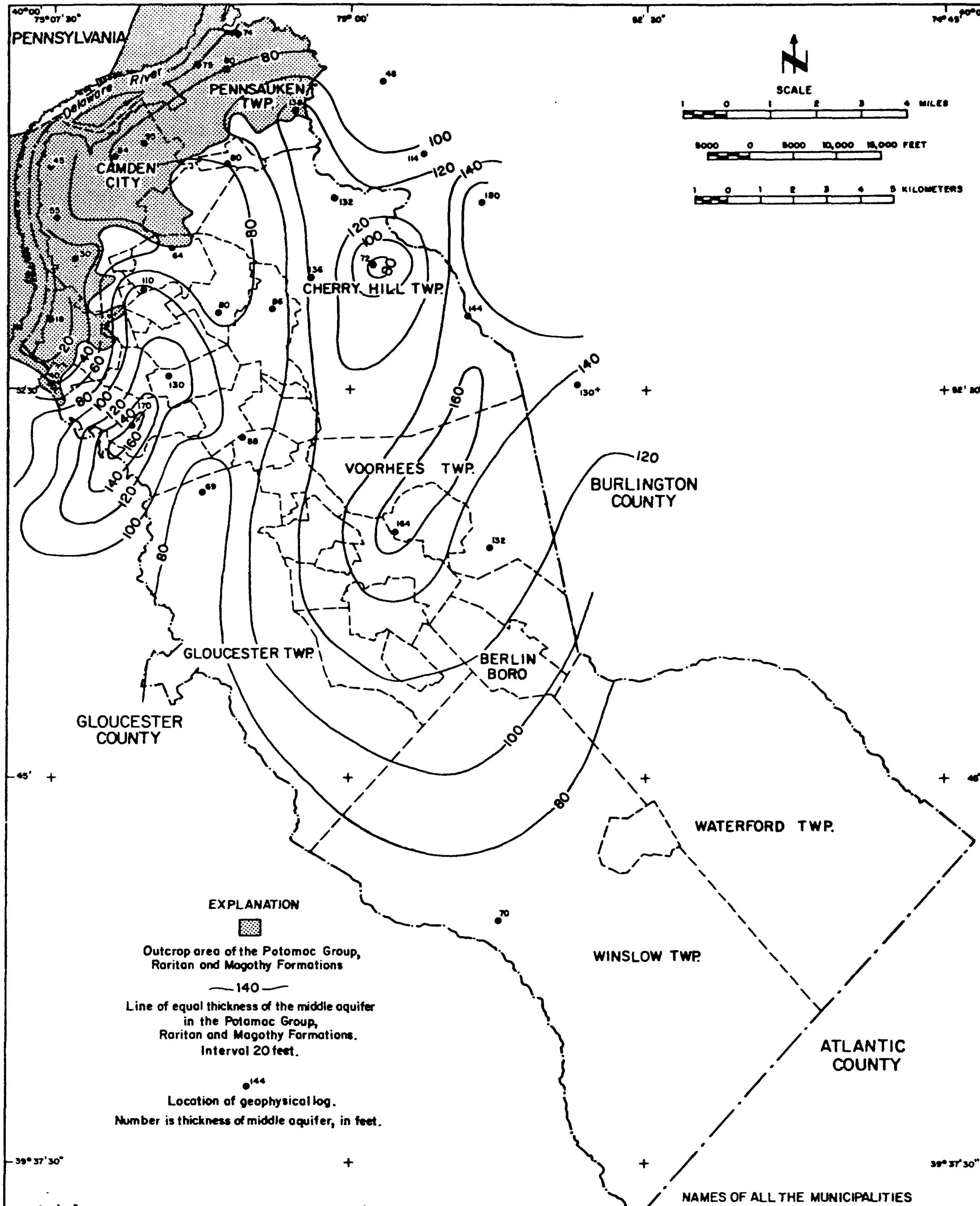


Figure 12. — Thickness map of the middle aquifer in the Potomac-Raritan-Magothy aquifer system in Camden County.

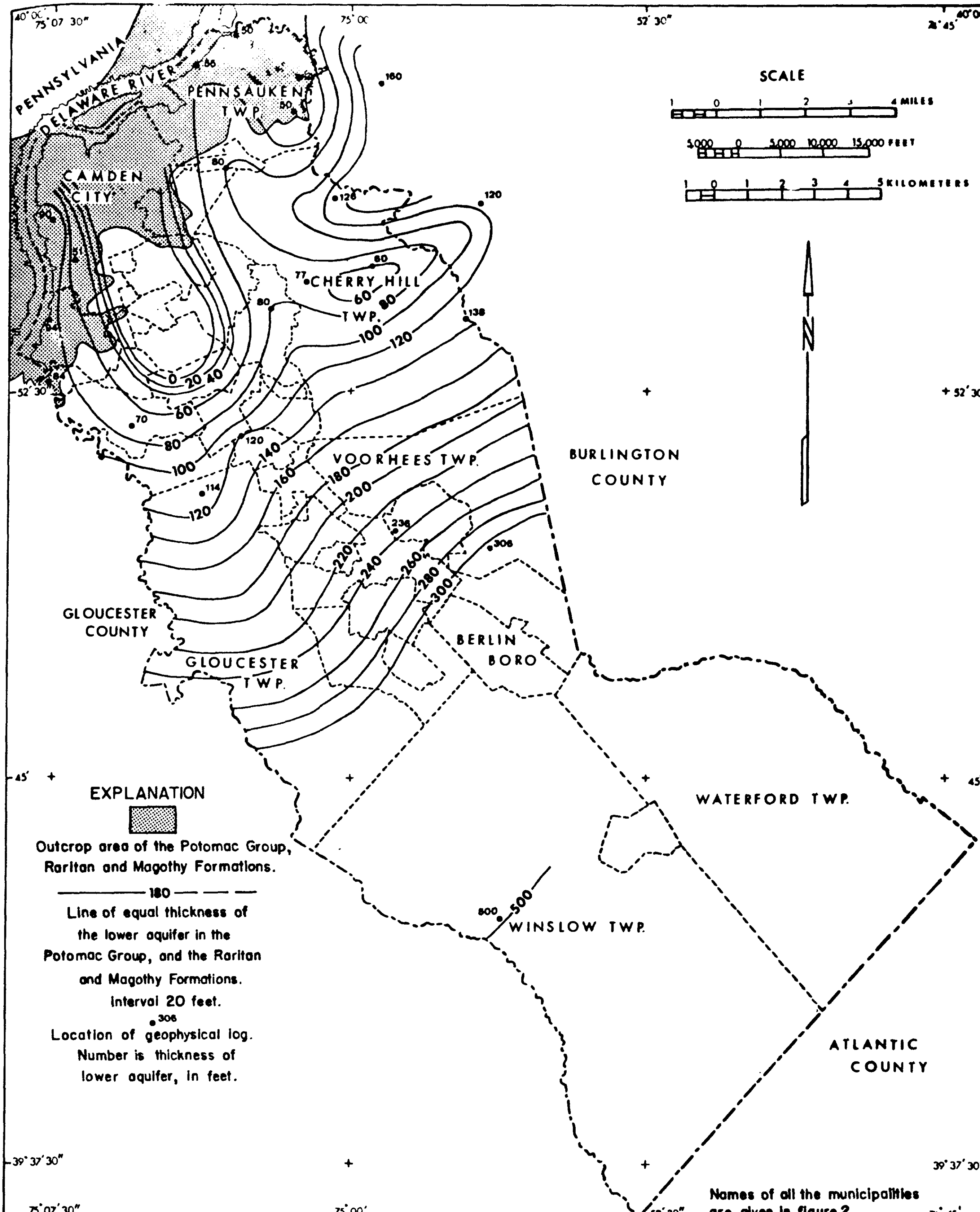


Figure 13. — Thickness map of the lower aquifer in the Potomac-Raritan-Magothy aquifer system in Camden County.

Patterns of Ground-water Movement

Pattern before development.--The natural ground-water flow regimen for the aquifer system prior to development was influenced by topography. The topographically high areas are the natural recharge zones for much of the ground-water system in the Coastal Plain. In areas of topographic highs the prepumping potentiometric surface of each aquifer was greater than that of the aquifer below. This indicates that vertical movement of ground water was downward through the semipervious confining units into the Potomac-Raritan-Magothy aquifer system. The discharge areas were the Delaware River, and to some extent, the topographic lows or stream valleys which cut across the outcrop areas.

The potentiometric map (fig. 14) represents the average natural conditions prior to 1900 for the Potomac-Raritan-Magothy aquifer system in Camden County. Most of the data for the map are from the annual reports of the State Geologist for the period 1888-1909. Water-level data for years after 1900 were used when there was reasonable certainty that the levels were indicative of natural or prepumpage conditions. In Camden County the topographically high recharge area occurs in northern Voorhees Township and southern Cherry Hill Township (fig. 14).

Pattern after development.--The first public-water supply obtained from the Potomac-Raritan-Magothy aquifer system and the hydraulically connected Pleistocene sediments in Camden County was from the Morris well field of the City of Camden in 1898. As the Camden City area's population and industry grew its need for ground water increased. Thompson (1932) describes in detail the ground-water development of the Camden area for 1898-1927. His data for Camden County were used to determine the annual pumpage from the Potomac-Raritan-Magothy aquifer system and the hydraulically connected Pleistocene sediments for 1917-27 shown in figure 15. Withdrawals by industrial wells were estimated by the present authors to be 4 mgd for 1917-27.

The early development of water in the Potomac-Raritan-Magothy aquifer system in Camden County was centered in the vicinity of Camden City, the area containing greatest concentration of population and industry. In later years suburban development had moved southeastward. During the 1950's and 1960's many new public-supply wells were drilled in

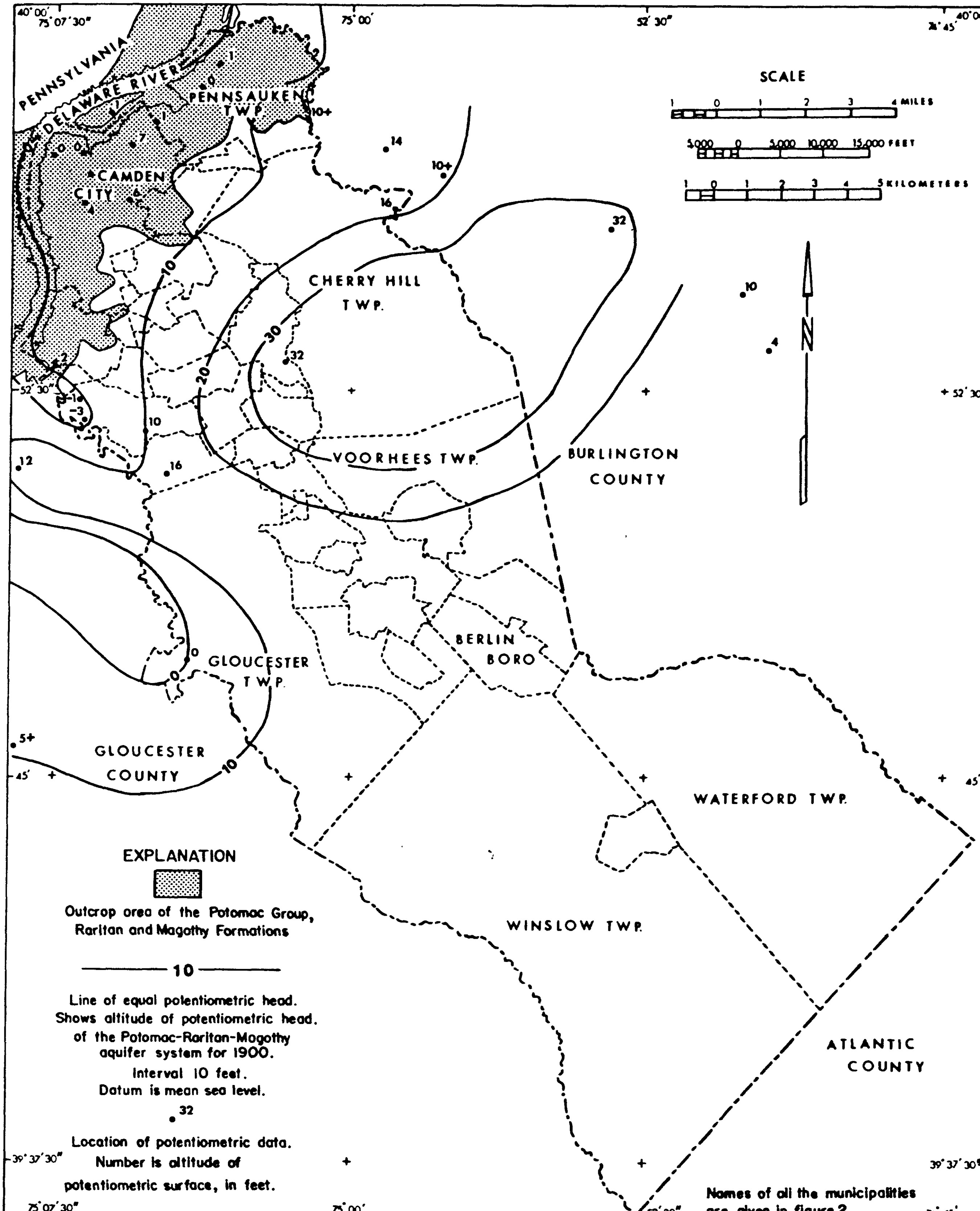


Figure 14. — Potentiometric map for the Potomac-Raritan-Magothy aquifer system in Camden County, 1900.

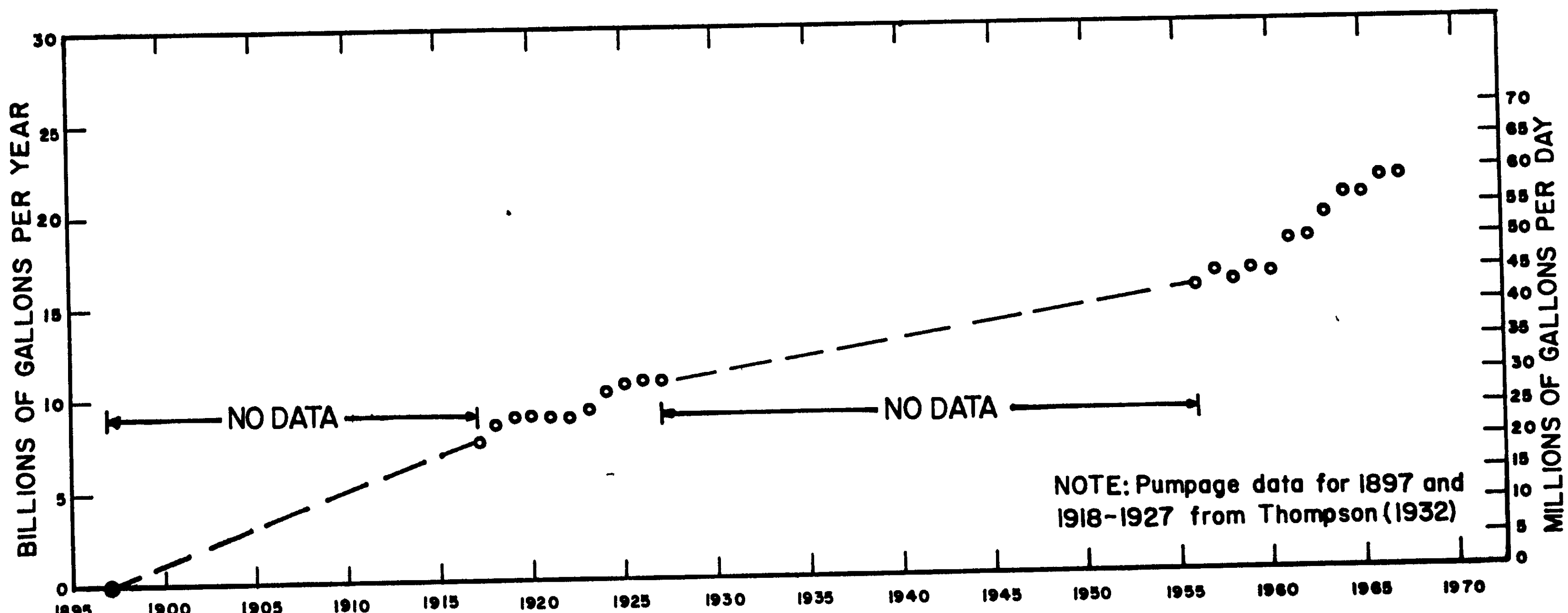


Figure 15. — Pumpage from the Potomac-Raritan-Magothy aquifer system in Camden County, 1897 - 1967.

areas where little or no water had been withdrawn from the Potomac-Raritan-Magothy aquifer system. Figure 16 shows the geographic distribution of the ground-water pumpage in 1966 for Camden County. Data used in figure 16 is tabulated in table 6. The effect of the increasing southeastward movement of demand on the aquifer system can be seen by comparing potentiometric surface maps. Figure 17 shows the 1956 potentiometric surface for the Potomac-Raritan-Magothy aquifer system. The map was developed from data from observation wells and reported data from newly drilled wells from mid-1955 to mid-1957. Figure 18 shows the potentiometric surface for 1968. This map was developed mainly from water-level measurements made over a three-day period from October 17 to October 19, 1968. A significant change in potentiometric surface occurred in the southeastern part of Camden County between 1956 and 1968. Prior to 1956 there was little ground-water diversion in the southeastern part of Camden County. New pumpage in this area after 1956, primarily from the upper and middle aquifer, is the probable cause for the change in potentiometric surface in the southeastern part of Camden County. Consequently, by 1968 a significant head difference existed between the upper and lower aquifer in southeastern Camden County and adjacent Gloucester County. The potentiometric heads for the upper and lower aquifers in the southeastern part of Camden County is shown in figure 18.

Three potentiometric decline maps were constructed from the potentiometric surface maps of the Potomac-Raritan-Magothy aquifer system. They are for 1) 1900 to 1956 (fig. 19), 2) 1956 to 1968 (fig. 20), and 3) 1900 to 1968 (fig. 21). Almost all of the decline from 1900 to 1956 occurred in the northern part of the county. The decline in the potentiometric surface during 1956 to 1968 (fig. 20) occurred throughout the county with the greatest declines in the Cherry Hill Township-Voorhees Township area and Berlin Borough area. From 1900 to 1968 the greatest potentiometric declines (more than 100 feet) occurred in the northcentral part of the county (fig. 21). Withdrawals from the Potomac-Raritan-Magothy aquifer system responsible for the decline in head are shown in figure 15. Pumpage was estimated for periods for which data were not available. Total pumpage from the Potomac-Raritan-Magothy aquifer system in Camden County from 1898 to 1968 based on figure 15 is 800 billion gallons. One-third of that pumpage was withdrawn in 13 years (1956 to 1968), which is 19 percent of the total period of pumpage.

Withdrawals in Philadelphia from the lower aquifer in the Potomac-Raritan-Magothy aquifer system has a direct effect on the potentiometric surface and ground-water flow in the Camden area. Greenman and others (1961) describe the history

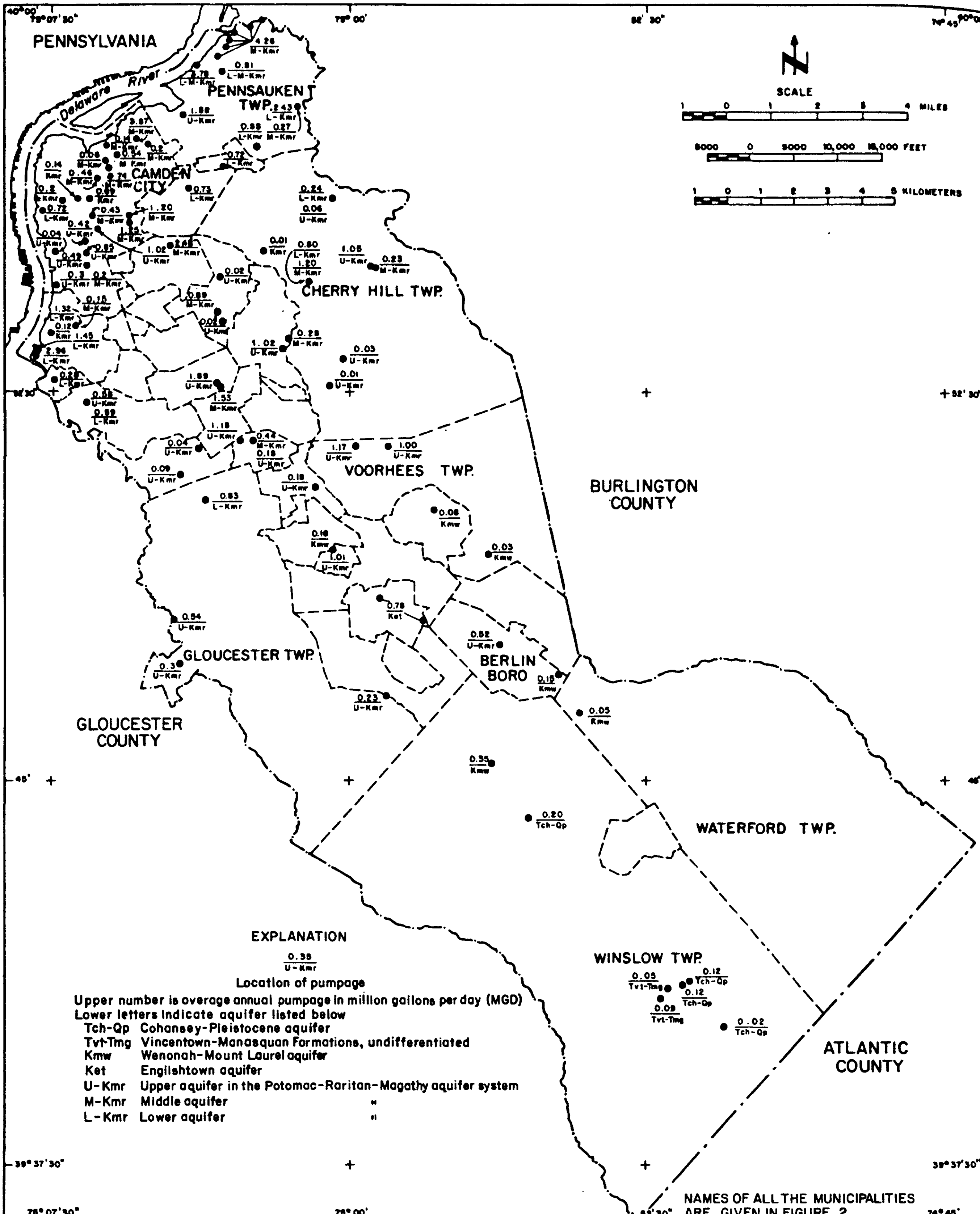


Figure 16. — Map showing the distribution of public and industrial pumpage in Camden County, 1966.

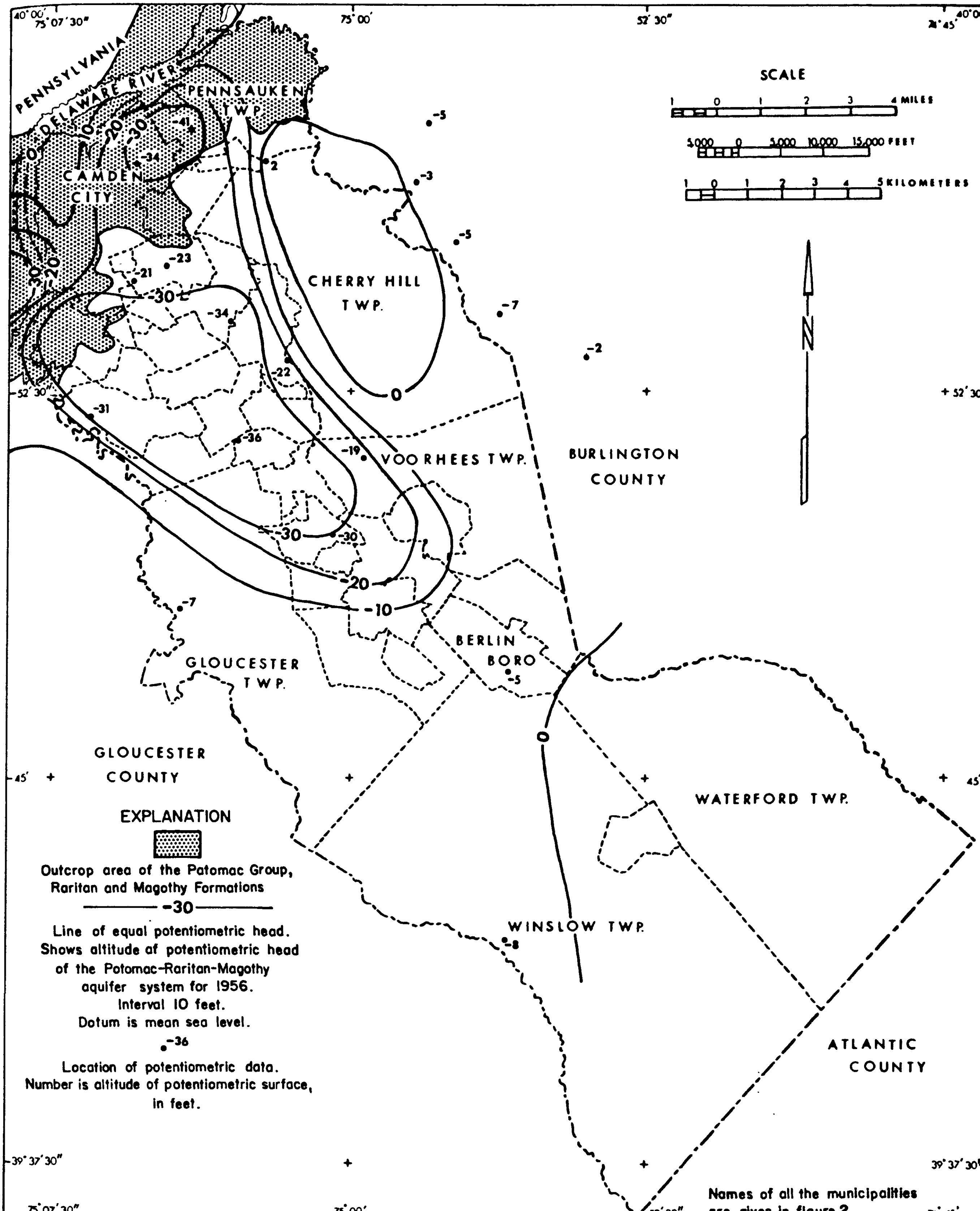


Figure 17. — Potentiometric map for the Potomac-Raritan-Magothy aquifer system in Camden County, 1956.

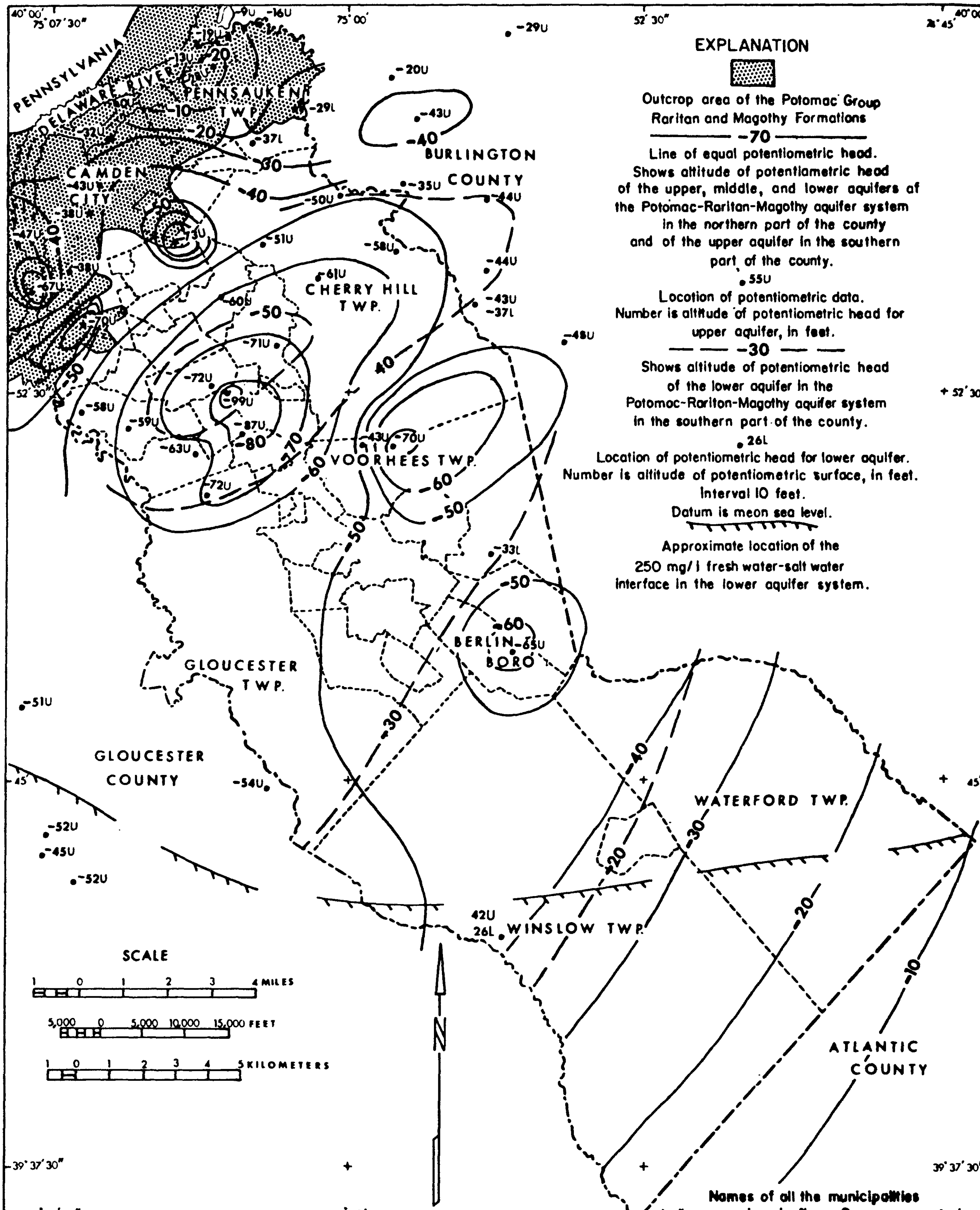


Figure 18. — Potentiometric map for the Potomac-Raritan-Magothy aquifer system in Camden County, October 17-19, 1968.

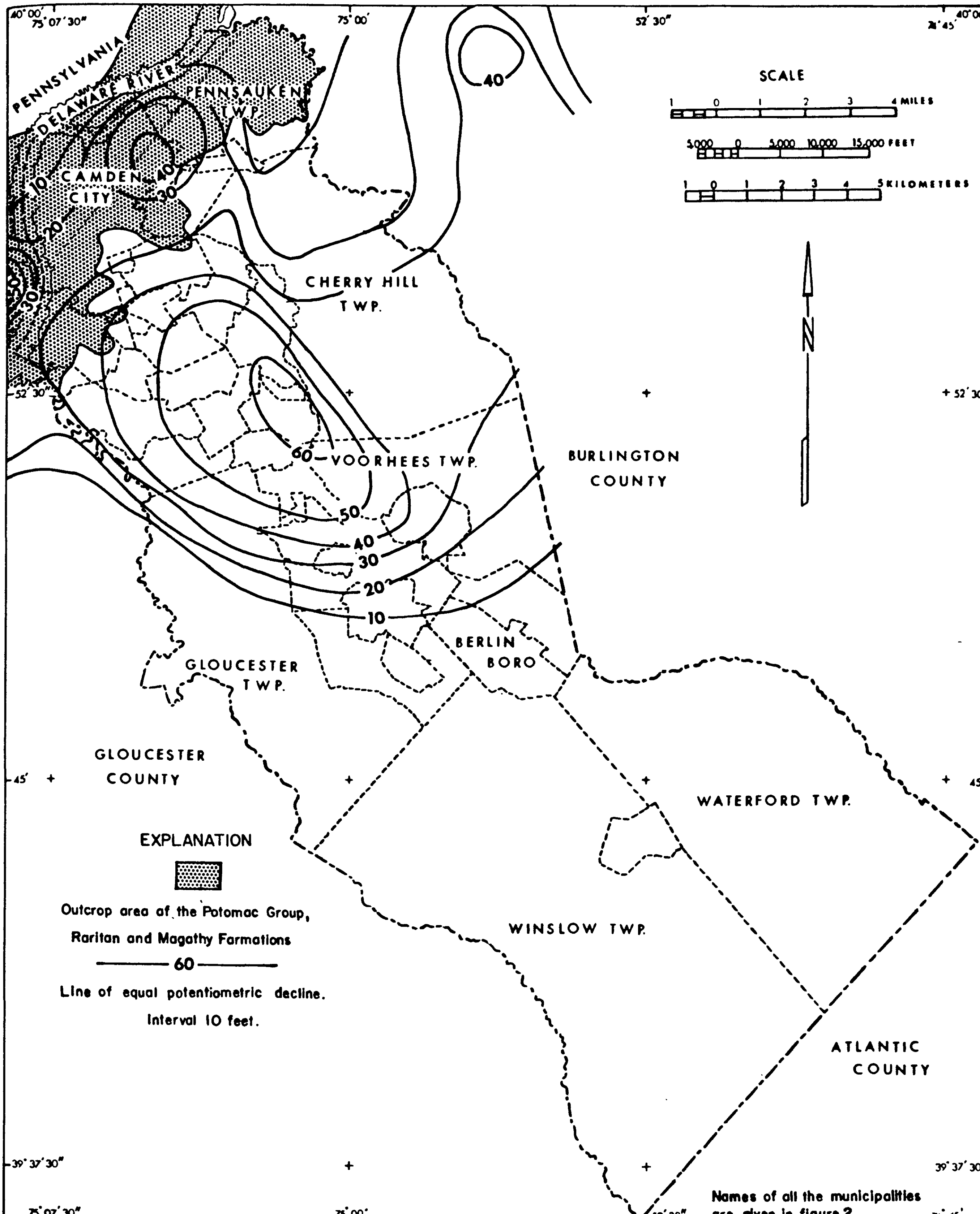


Figure 19. — Potentiometric decline map for the Potomac-Raritan-Magothy aquifer system in Camden County, 1900-56.

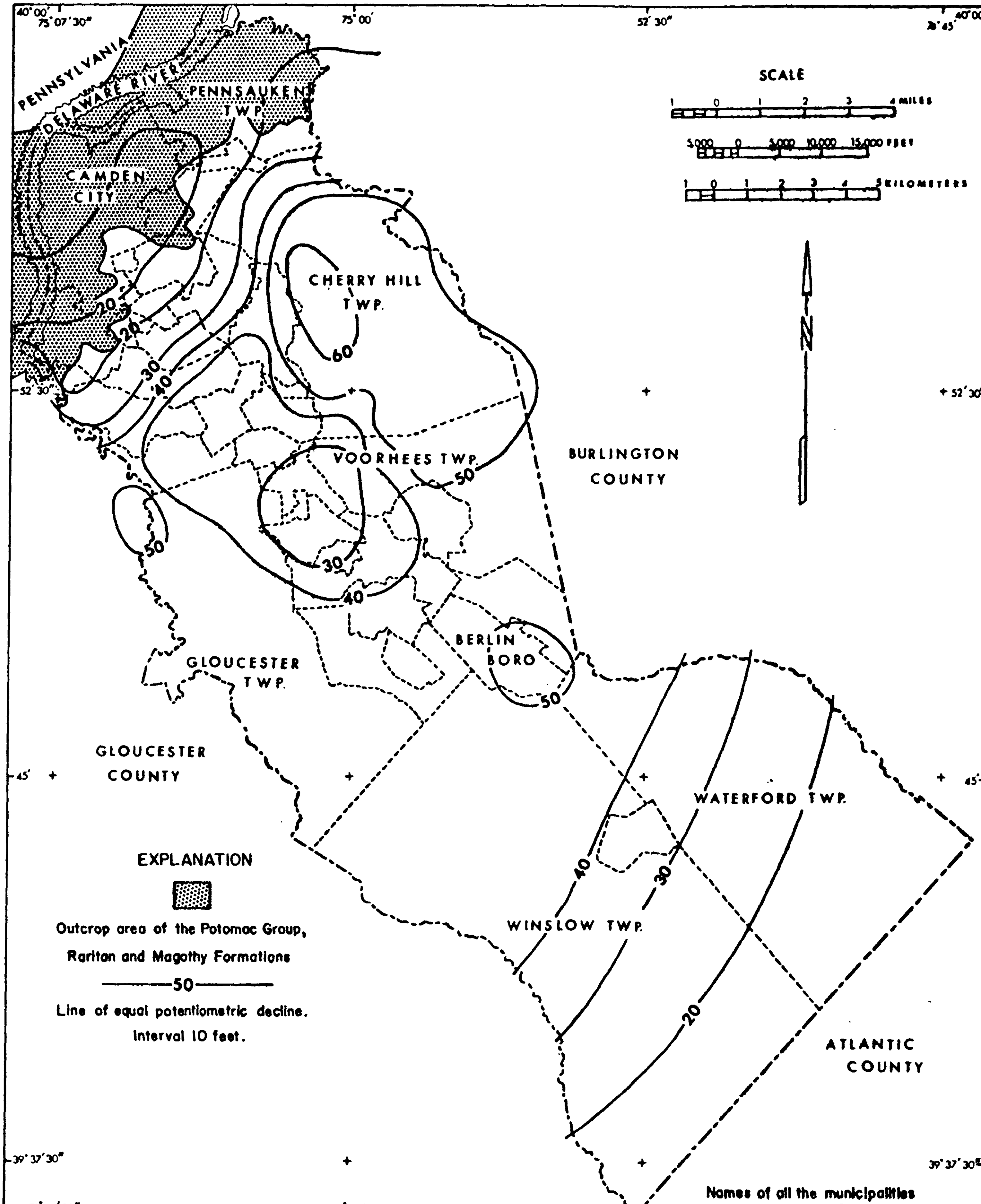


Figure 20. — Potentiometric decline map for the Potomac-Raritan-Magothy aquifer system in Camden County, 1956-68.

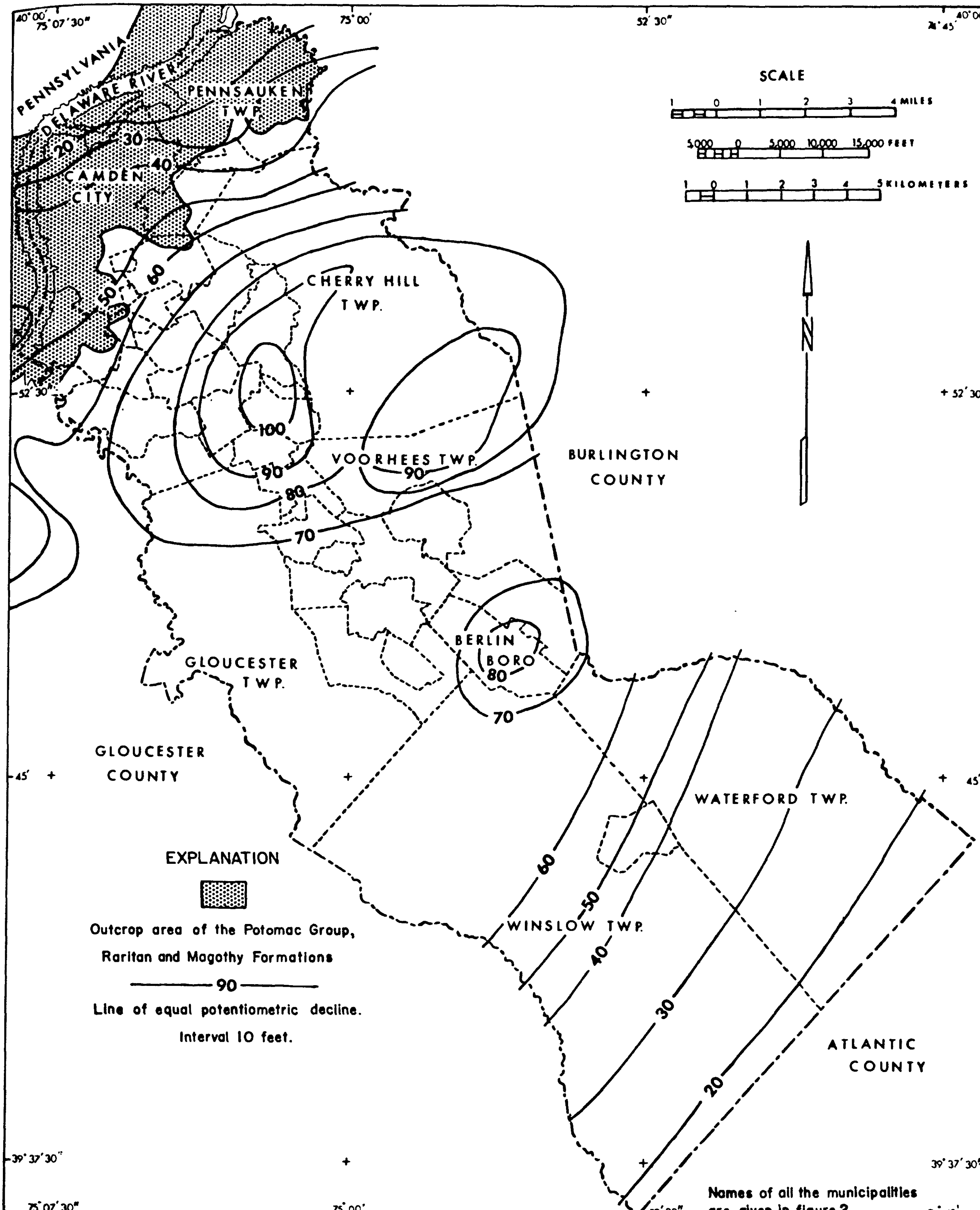


Figure 21. — Potentiometric decline map for the Potomac-Raritan-Magothy aquifer system in Camden County, 1900-68.

of development from the lower aquifer in Philadelphia and present maps of the potentiometric surface for the early 1920's, 1940, 1945, and 1954. The pumpage was approximately 5 mgd in 1920, 15 mgd in 1940, and 23 mgd in 1945. Withdrawals from the lower aquifer in Philadelphia decreased in 1946 and 1947, but again increased to 23 mgd in 1951. The rate of withdrawals declined after 1953 and pumpage in South Philadelphia in 1956 was 18 mgd. No recent complete inventory of withdrawal from the lower aquifer in Philadelphia has been made. However, spot inventories at the U. S. Navy Base and head measurements in 1968 in a few wells in Philadelphia indicate a much lower pumpage. Many wells pumped in 1956 were no longer in use in 1968.

Recharge and Movement of Ground Water

As presented in the section on patterns of ground-water movement the movement of water in the Potomac-Raritan-Magothy aquifer system prior to pumpage was influenced by recharge in topographically high areas while the discharge areas were the Delaware River, and to some extent, the topographic lows or stream valleys which cut across the outcrop areas.

Recharge and movement of water in the Potomac-Raritan-Magothy aquifer system was altered by the large amount of withdrawals, especially in the area near the Delaware River. As pumping increased the gradients were reversed in the water table and artesian aquifers near and under the Delaware River. Greenman and others (1961) suggest that induced recharge occurs from the Delaware River into the aquifers in Philadelphia. They compared the specific conductance of the water from a well located near the Delaware River and the specific conductance of the Delaware River. Fluctuations in specific conductance were similar except that there was a five-month time lag. Barksdale and others (1958) give substantial evidence to show that induced recharge from the Delaware River occurs in the heavily pumped parts of the aquifer near the river. They cite three types of evidence; aquifer test results, temperature fluctuations, and changes in chemical quality. An aquifer test at the Morro Phillips tract in Camden City near the Delaware River indicated a recharge boundary under the river and suggested that after two years of operation a well near the river would obtain 90 percent of its water from the river. Temperatures of water in a well near the river (at Beverly, Burlington County) change seasonally as does the temperature of water in the Delaware River. On the other hand the temperature of the water in a well several miles away from the river (at

Haddon Heights) remains essentially constant (Barksdale and others, 1958, p. 106-108). Changes in chemical quality of water from wells near the river were cited by Barksdale and others (1958) as evidence of induced recharge. Table 7 gives the chemical quality data of two wells, located in Pennsauken Township, used by Barksdale and others (1958, p. 121-123) and also includes more recent data. The water-quality analyses dated 1924 (table 7) were for samples collected just after completion of the wells. As pointed out by Barksdale and others (1958) the dissolved-solids content of the water from well 1 (PE 18), located near the river, more than doubled between 1924 and 1953 while the quality of water from well 4 (PE 21), located one mile from the river, remained the same. Much of the water obtained from well 1 is induced river water; whereas, well 4 receives a much greater part of its water from the aquifer and a lesser amount of water from the Delaware River. Data from samples taken after 1953 from well 1 indicate improved quality for a period of approximately 13 years. This was followed by a decline in quality as evidenced by increasing chlorides, sulfates, and specific conductance. Chlorides were 27 mg/l (milligrams per liter) in 1969, an increase from 8.0 mg/l in 1963. Changes in the quality of the river water probably caused the variation in quality of water in the wells.

Recharge of the aquifer system downdip from the outcrop area is mainly from vertical leakage through the overlying confining unit. In the area downdip of the outcrop there have been significant declines in the potentiometric surface--declines in excess of 100 feet at some locations. The difference in heads between those in the Potomac-Raritan-Magothy aquifer system and the overlying aquifers provides the driving mechanism for downward vertical leakage. The rate of vertical leakage is, with all other factors being equal, probably greater in the downdip area where large head differences occur. In the area near the outcrop the head difference is not as large, and thus the rate of vertical leakage is probably smaller. This area is also closer to the Delaware River, which is a recharge boundary. In addition to recharge of water through the confining units, significant amounts of water are released to the aquifer system from storage within the confining silts and clays in the Potomac Group and the Raritan and Magothy Formations and the overlying confining units.

An additional source of water lies outside of the political boundaries of Camden County. Water moves toward Camden from the adjacent areas outside the county line as the pumping cone of depression expands. Description of the regional pattern of ground-water flow for this aquifer system for the hydrologic unit in southern New Jersey has been studied in detail by Gill and Farlekas (written commun., 1969).

The source of water in the Potomac-Raritan-Magothy aquifer system in Camden County is therefore 1) precipitation on the outcrop area and induced recharge from streams located in the outcrop area, for example, the Delaware River, 2) recharge through the confining units, 3) water released from storage from the silts and clays of the Potomac Group and Raritan and Magothy Formations and overlying units, and 4) water from the adjacent areas as the cone of depression expands.

Aquifer Characteristics

A number of aquifer tests in the Camden County area for wells tapping the Potomac-Raritan-Magothy aquifer system have been evaluated in the past using the Theis nonequilibrium method (Ferris and others, 1962, p. 92), which assumes that the confining layers are impermeable. Results were reported in Barksdale and others (1958, p. 96-98) and Rush (1968, p. 32-33). Four of these aquifer tests have been re-evaluated (Harold Meisler, written commun., 1973) to include leaky artesian aquifer conditions proposed by Hantush (1960). Two of the four re-evaluated aquifer tests are for wells located in Camden County near the Delaware River and tap the middle aquifer of the Potomac-Raritan-Magothy aquifer system. The results of the test at the site of the Camden Water Department well 14 (CA 18) indicate that the transmissivity ranges from 2,300 to 6,700 ft^2/day (17,000-50,000 gpd/ft) with an average of 4,300 ft^2/day (32,000 gpd/ft^2). The storage coefficient ranges from 1.0×10^{-4} to 3.5×10^{-4} with an average of 1.8×10^{-4}. The re-evaluated results of the aquifer test at the Stockton pumping station (Camden Division) of the New Jersey Water Company indicate that the transmissivity ranges from 3,200 to 3,700 ft^2/day (24,000-28,000 gpd/ft) and the storage coefficient ranges from 3.3×10^{-5} to 1.5×10^{-3}.

Many large diameter high-yielding wells tap the Potomac-Raritan-Magothy aquifer system. The yields of 106 wells in Camden County (diameter 12 inches or greater) range from 455 to 1,900 gpm (gallons per minute) (table 1). The average yield for 106 wells is 1,085 gpm. The specific capacities of these wells are high, indicating a high aquifer transmissivity. The range of specific capacity of 96 wells (diameter 12 inches or greater) tapping the Potomac-Raritan-Magothy aquifer system in Camden County is 6.1 to 80 gpm/ft (gallons per minute per foot of drawdown) (table 1). The average specific capacity of these wells is 29.3

gpm/ft. Two-thirds of the specific capacities range between 15 to 35 gpm/ft. Figure 22A shows the distribution of the specific capacities of the 96 large diameter wells.

Another method for determining the hydraulic properties of aquifers is the specific capacity of a well divided by the length of well screen. The specific capacity of the well per foot of well screen may be more meaningful than specific capacity where the length of well screens differ considerably. The distribution of values of specific capacity per foot of well screen for 95 wells (diameter 12 inches or greater) tapping the Potomac-Raritan-Magothy aquifer system in Camden County is shown in figure 22B. These values range from 0.12 to 2.29 gpm per foot of screen. About 56 percent of the values range between 0.6 and 1.0 gpm per foot of screen. The average specific capacity per foot of well screen is 0.83 gpm per foot of screen. Values of specific capacity per foot of well screen for wells tapping the Potomac-Raritan-Magothy aquifer system located in the outcrop area are generally higher than those located downdip from the outcrop. The average specific capacity per foot of well screen for 60 wells located in the outcrop area is 0.95 gpm per foot of screen and the range is from 0.35 to 2.29 gpm per foot of screen. The average specific capacity per foot of well screen for 35 wells located downdip from the outcrop is 0.52 gpm per foot of screen and the range is from 0.22 to 1.7 gpm per foot of screen. The higher values for wells located in the outcrop area are attributed to better hydraulic properties of the aquifer and proximity to source of recharge, primarily from the Delaware River. This is in agreement with the evidence cited by Barksdale and others (1958) and Greenman and others (1961) indicating recharge from the Delaware River.

Quality of Water

Detailed analysis of water-quality data for the Potomac-Raritan-Magothy aquifer system has been presented in recent publications by Langmuir (1969a and 1969b) and Gill and Farlekas (written commun., 1969). Camden County was one of the counties included in these recent studies. Some of the data used in the recent studies are given in table 4.

Water from the Potomac-Raritan-Magothy aquifer system in a large part of Camden County, with the exception of iron content, meets the State's standards for potable water (New Jersey State Department of Environmental Protection, 1970) with little or no treatment and is suitable for most industrial and agricultural needs. Recent analyses of water from two wells in Camden City suggest that chromium values are equal to or above

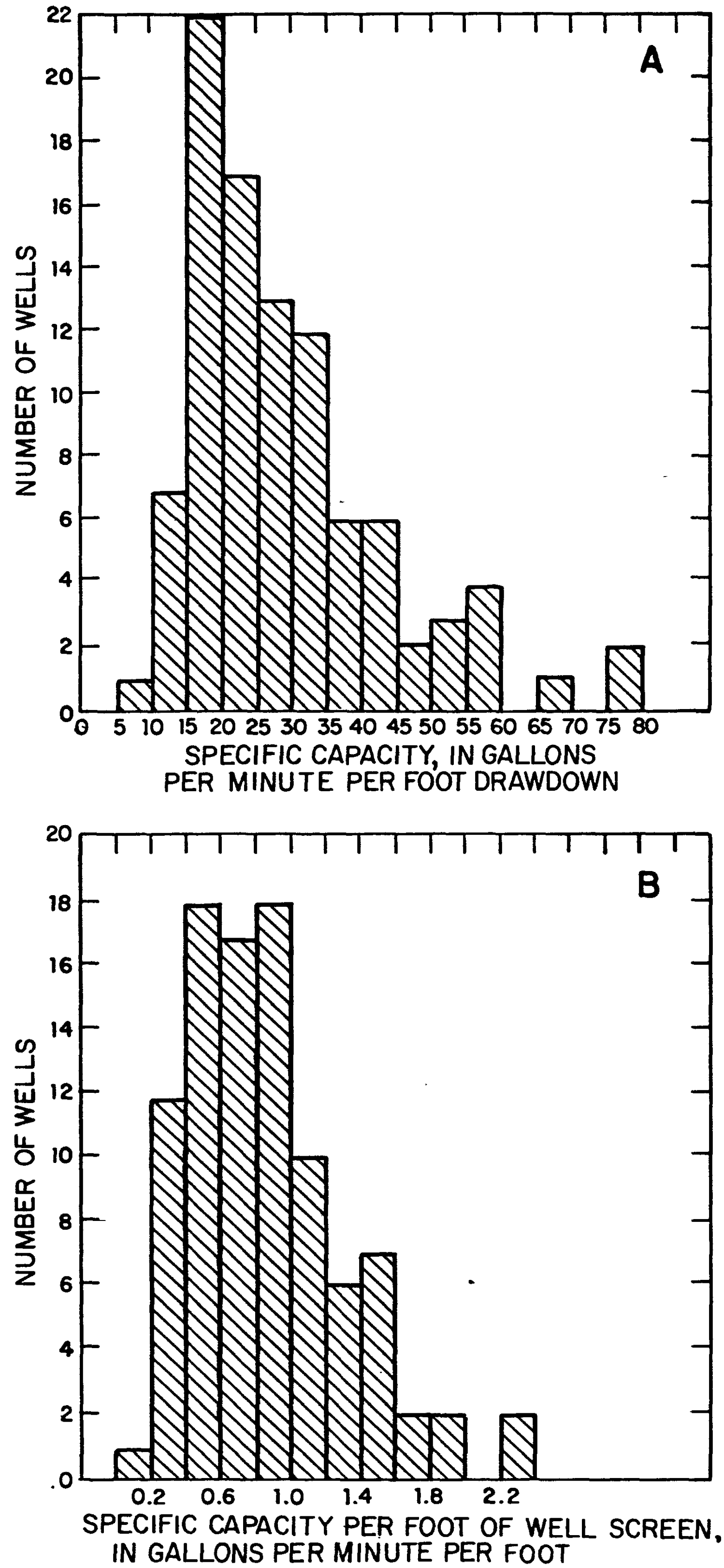


Figure 22. — Distribution of specific capacities of large diameter wells (12 inches or greater) tapping the Potomac-Raritan-Magothy aquifer system in Camden County.

the State's standards. This and additional water-quality problems are described below.

A summary of chemical analyses of water from wells tapping the Potomac-Raritan-Magothy aquifer system in Camden County is shown in table 8. This table gives maximum, average, and minimum parameters for samples from wells located in the outcrop area of the Potomac-Raritan-Magothy aquifer system and from samples from wells located downdip from the same outcrop area. Only the most recent analyses (table 4) were used to determine values shown in table 8.

The quality of water from wells located in the outcrop area of the Potomac-Raritan-Magothy aquifer system in Camden County varies from well to well. The variation is partly dependent on the depth of the well, the nature of the overlying sediments, and on the distance from the Delaware River. Chemical analyses (table 8) indicate that dissolved solids range from 39-445 mg/l; sulfates, 0.8-178 mg/l; and chlorides, 5.5-59 mg/l for samples from wells located in the outcrop area. Hardness ranges from soft to very hard (14-274 mg/l).

The quality of water of the Potomac-Raritan-Magothy aquifer system is, with the exception of iron content, within the State's standards for potable water in the area from the southeast limit of the outcrop area downdip to the vicinity of the New Brooklyn Park observation wells in Winslow Township. Water obtained from wells tapping the aquifer in the area that is overlain by the Merchantville-Woodbury confining unit, excluding the New Brooklyn Park area, is low in dissolved solids (48-150 mg/l), sulfates (2.6-34 mg/l), and chlorides (1.4-18 mg/l). Hardness ranges from soft to moderately hard (14-114 mg/l).

Samples collected in 1961 from the New Brooklyn Park well (WI 27) tapping the upper aquifer indicate chloride concentrations of approximately 4.0 mg/l; whereas, water from well (WI 28) tapping the lower aquifer in 1960 had a chloride concentration of approximately 300 mg/l (Donsky, 1963). Analyses of samples collected in 1972 for these two wells have similar values (table 4). The difference in chloride data from the New Brooklyn Park wells and other wells tapping the Potomac-Raritan-Magothy aquifer system in Ocean and Gloucester Counties (Gill and Farlekas, written commun., 1969) suggests lateral as well as vertical differences in chloride content in the aquifer system. This difference in chloride content as well as other water-quality parameters suggest that an interface exists between the salt water to the southeast and fresh water to the northwest and is represented by a broad zone of diffusion in the aquifer system. The 250 mg/l chloride line for the upper aquifer is located several miles southeastward of the 250 mg/l chloride line for the lower aquifer (fig. 19). The 250 mg/l chloride line may be considered the limit of sea-water encroachment, inasmuch as the interface of salt and fresh water probably is not far seaward from this line (Parker, 1964). The high-chloride water in the southeastern part of the Potomac-Raritan-Magothy aquifer system is probably due to brackish-marine water entering the aquifer system during deposition of the sediments or the re-entering of ocean water after changes in sea level.

Water-quality analyses for wells tapping the Potomac-Raritan-Magothy aquifer system in Camden County indicate change in quality of water in the aquifers with time. In some cases the analyses show decreases in chloride and nitrate concentrations over a period of time; whereas, in other cases analyses show increases in chloride, sulfate, and dissolved solids. A summary of chemical analyses for selected wells tapping the Potomac-Raritan-Magothy aquifer system in Camden City for 1923-70 is shown in table 9. Data used in table 9 is from Thompson (1932), Donsky (1963), and table 4.

Chlorides, as reported (Thompson, 1932) for wells at two different sites tapping the upper aquifer in Camden City, were higher than those reported for the same or comparable well samples in 1966-67. The chloride content at one of the sites (Camden City Water Department wells 3-3A) decreased from 51 mg/l in 1928 (Thompson, 1932) to 28 mg/l in 1949 (Donsky, 1963). The chloride content for the same site was 41 mg/l in 1969 (table 4). At the second site (Camden City Water Department wells 6-6N) the chloride content decreased from 72 mg/l in 1932 (Donsky, 1963) to 32 mg/l in 1969 (table 4).

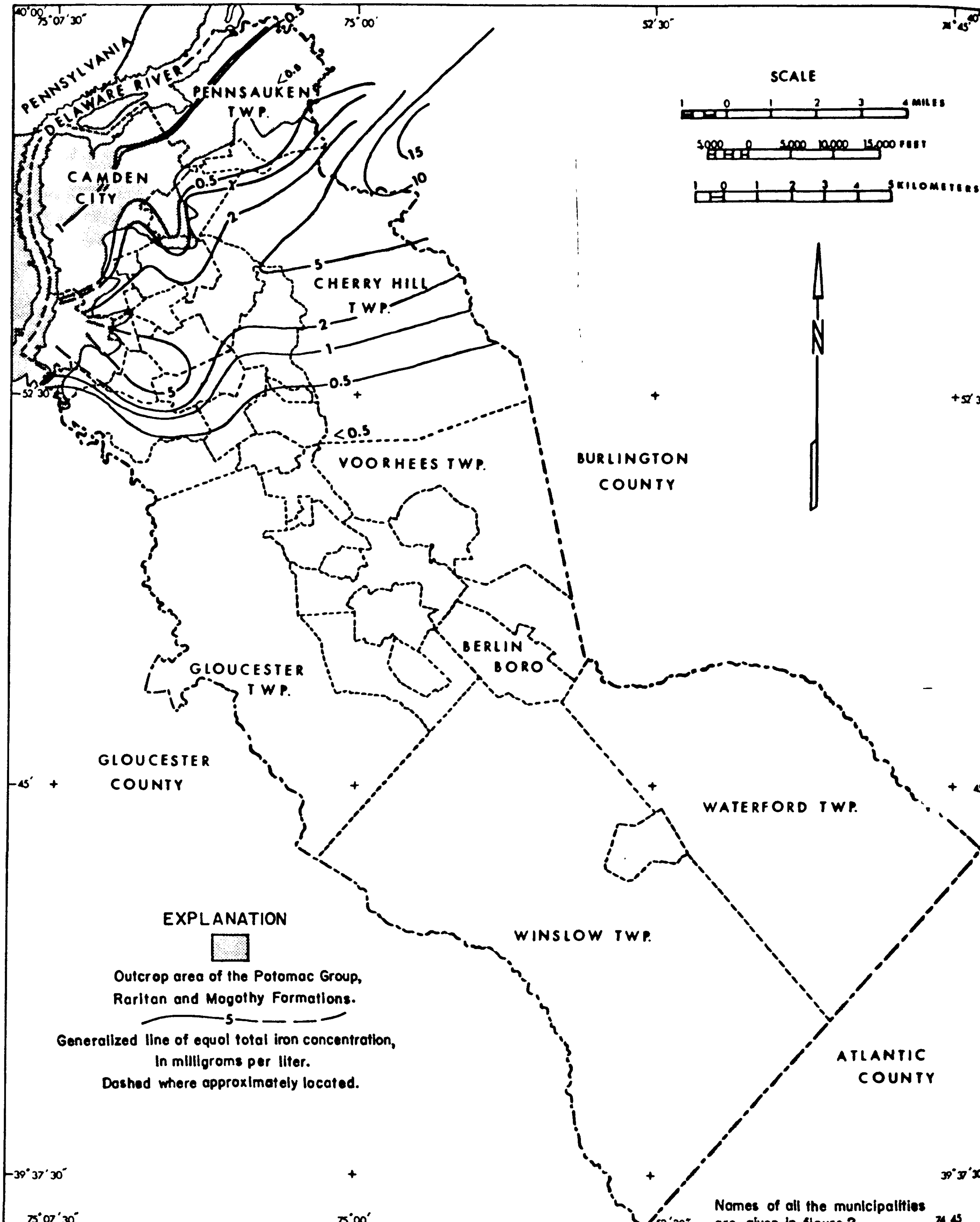
Wells tapping the middle or lower aquifer near the Delaware River generally have shown a deterioration in water quality over a period of time, as indicated by an increase in chloride and sulfate concentrations. Camden City Water Department wells at four sites (1A, 5-5N, 7, and 11) indicate a rise in chloride concentration over a period of years (table 4). There is also a corresponding rise in sulfate concentration in Camden City Water Department wells 1, 3, 4, 5, 6, and 10 (table 4). Water-quality analyses from Camden City wells 13 and 17, which tap the middle or lower aquifer, indicate that there has not been a change in quality at the two sites during the period samples. These two wells are located farther east than the other Camden City wells cited above, suggesting no change in water quality of the middle and lower aquifer in this area.

It can be assumed that water from wells in the Camden City area prior to 1920 probably was of slightly better quality than that reported by Thompson (1932). The change in the quality of water in the shallow and deeper aquifer between 1900 and 1967 as noted above may have been due to contamination from disposal ponds, waste-injection wells, and improperly sealed abandoned wells. The contamination may be similar to that documented by Greenman and others (1961) in adjacent areas of Philadelphia, but on a smaller scale.

Iron in the water of the Potomac-Raritan-Magothy aquifer system is the most troublesome water-quality parameter for many users. New Jersey's Potable Water Standards (1970) recommends a maximum iron concentration of less than 0.3 mg/l for potable supplies; however, most of the water analyses for the aquifer system indicate concentrations greater than 0.3 mg/l. Thus, treatment for iron removal is required for most users. The iron is present in the water as dissolved Fe^{+2} and $FeOH^{+1}$, and as suspended ferric oxyhydroxides, probably caused by the oxidation of ferrous species already in solution (Langmuir, 1969b). Langmuir (1969b) suggests that the oxyhydroxides are mixtures of goethite and amorphous materials with small amounts of hematite.

Samples from wells in the Camden County area were collected and analyzed separately for total iron and ferrous iron, with the difference assumed to be the concentration of particulate ferric hydroxide (Langmuir, 1969a, p. 19). Total iron, therefore, represents the sum of dissolved ferrous iron and colloidal ferric hydroxide. The distribution of total iron and ferrous iron concentrations in water of the Potomac-Raritan-Magothy aquifer system in the vicinity of Camden County as determined by Langmuir (1969b) is shown in figures 23 and 24. In the outcrop area dissolved ferrous or suspended ferric species are generally less than 0.5 mg/l in unpolluted waters. High concentrations in the outcrop area are interpreted by Langmuir (1969b) as the result of local ground-water contamination.

Immediately downdip of the outcrop area the ferrous and ferric iron species increase abruptly to about 7.0 mg/l. The high build-up of ferrous iron species in this area is due to the reaction with the ferrous iron minerals, such as pyrite and siderite, in the Merchantville-Woodbury confining bed. Langmuir (1969b) concluded that the parallel increase in ferric species to 6.0-11 mg/l may be caused by partial oxidation of Fe^{+2} and $FeOH^{+1}$. Total iron concentrations in the water of the Potomac-Raritan-Magothy aquifer system are highest in areas adjacent to the outcrop area. Seaber (1965) in his geochemical analysis of the Englishtown Formation also noted that the



After Longmuir 1969a.

Figure 23. — Map showing generalized total iron concentrations in water of the Potomac-Raritan-Magothy aquifer system in Camden County, 1965.

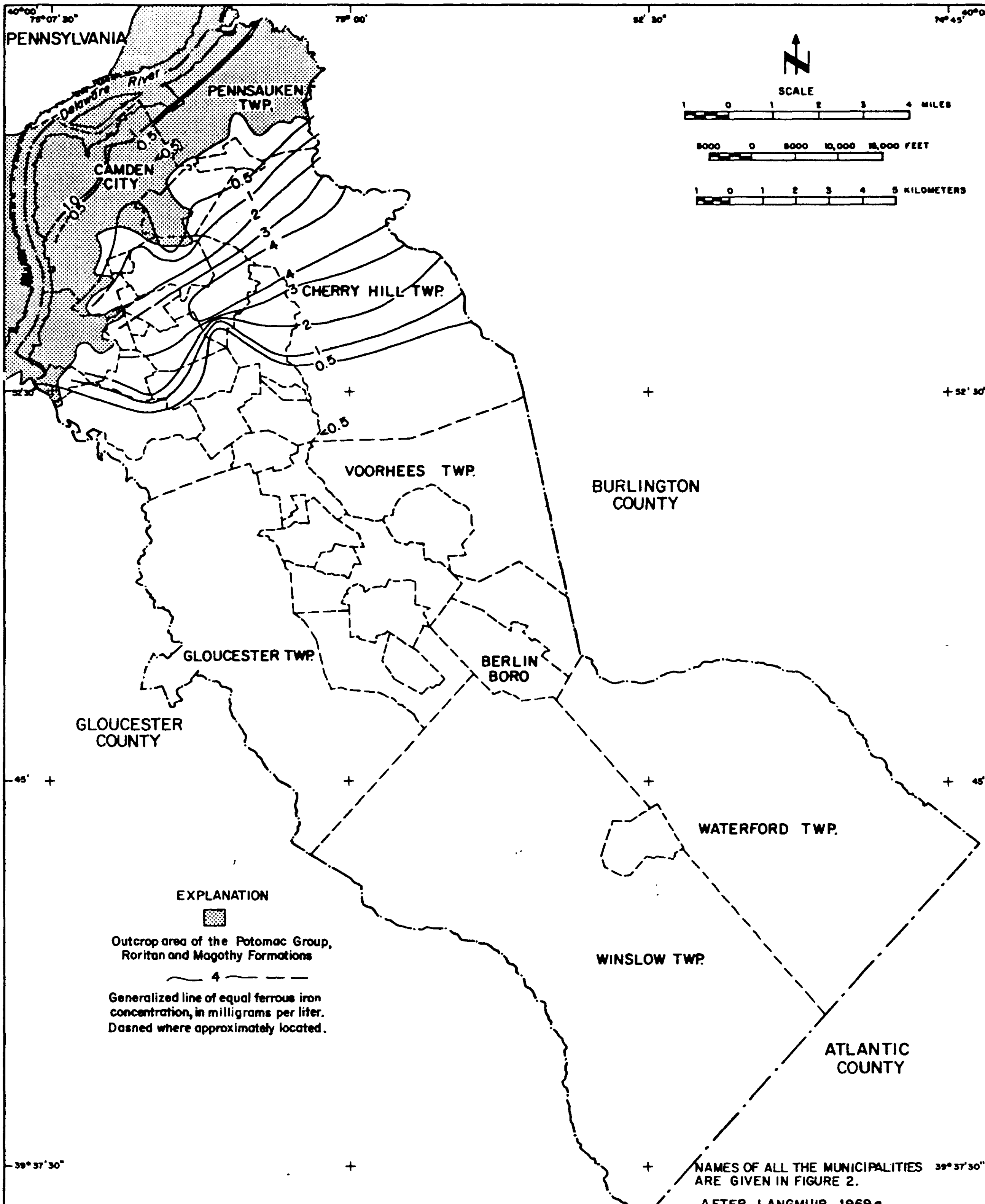


Figure 24. — Map showing generalized ferrous iron concentrations in water of the Potomac-Raritan-Magothy aquifer system in Camden County, 1965.

highest total iron concentrations occurred adjacent to the outcrop area.

Farther downdip both the dissolved ferrous and suspended ferric iron species decrease gradually to less than 0.5 mg/l. Langmuir (1969b) attributed the gradual decline in ferrous species to an increase in the stability of the suspended amorphous material due to aging, coupled with adsorption of ferrous iron by the oxyhydroxides and partial conversion of the amorphous phase to goethite. The decrease in suspended ferric species is interpreted by Langmuir as being caused by cation adsorption, aging, coagulation, and settling.

Ground-Water Contamination

Contamination of the water in the Potomac-Raritan-Magothy aquifer system is presently limited to the area at or near the outcrop. Contamination of the water-table and the artesian aquifer underlying Philadelphia has been thoroughly documented for the period prior to 1956 by Greenman and others (1961). They cite many instances of contamination, with the largest known area of contamination from industrial wastes located in the League Island Trough.

The League Island Trough is shown on the bedrock surface map of the Philadelphia area (fig. 25). The trough, filled with highly permeable sediments, has a northwest trend. A geologic section showing the distribution of the water-bearing sands and gravels from the Schuylkill River in Philadelphia through the Philadelphia Navy Base to the Texas Company's Eagle Point works near Westville, New Jersey, just south of the Camden County line, is shown in figure 26. The lower artesian aquifer (Farrington Sand of Greenman and others, 1961), consisting of sands and gravel immediately above the bedrock, has a direct hydraulic connection with the lower aquifer being tapped by the Texas Company wells in West Deptford Township, Gloucester County.

Barksdale and others (1958, p. 121) stated that, "Originally, the wells at the Navy Base yielded waters that were similar in chemical characteristics to that from the wells of The Texas Co." Greenman and others (1961, plates 21 and 22) indicate high concentrations of sulfates and dissolved solids in the water of the lower artesian aquifer in the League Island Trough in 1956. A sample from one well had more than 1,300 mg/l of sulfate. The movement of ground water with high

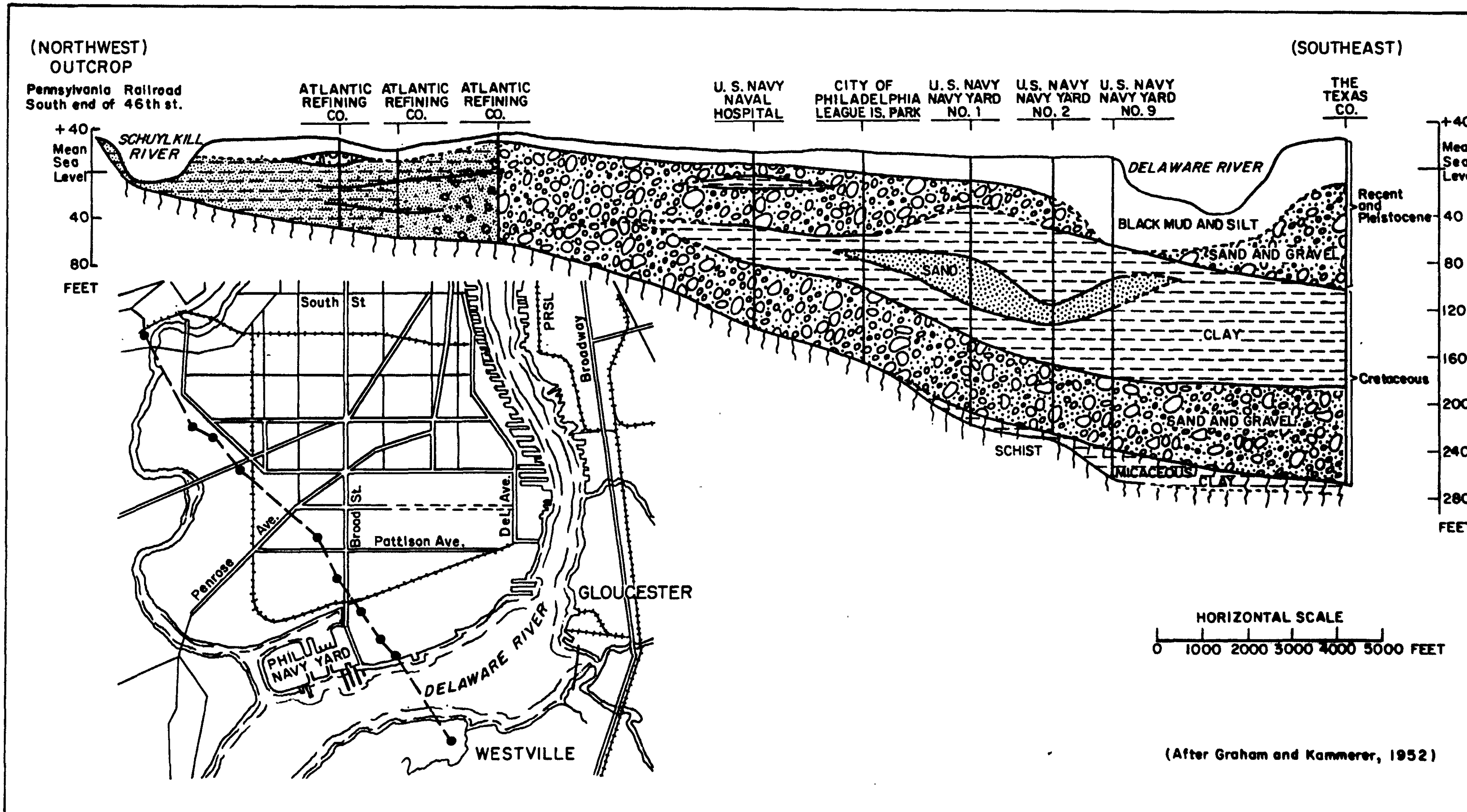


Figure 26. — Geologic cross section, Philadelphia, Pa. - Westville, N. J.

concentration of sulfates and dissolved solids was documented (Greenman and others, 1961) as moving downdip along the trough. The location of the 200 mg/l sulfate line in 1956 (Greenman and others, 1961) is shown in figure 27.

Withdrawal of water at the Philadelphia Navy Base from the lower aquifer had a regional effect on the potentiometric surface. As documented by Greenman and others (1961), heavy pumping at the Philadelphia Navy Base provided the hydraulic gradient that caused the movement of poor quality water from the head of League Island Trough downdip toward the Navy Base. Barksdale and others (1958, p. 121) stated that if pumping were greatly curtailed at the Navy Base the contaminated water would move beneath the river into New Jersey. In 1966 withdrawals at the Navy Base were substantially curtailed, while other wells in the area had been shut down. The Navy Base wells no longer act as a shield for the New Jersey wells and pumping at the Texas Company wells and other wells in New Jersey provided a new hydraulic gradient. A map of the potentiometric surface for the artesian aquifer in the Philadelphia area in October 1968 is shown on figure 28. The area with the lowest potentiometric surface is the area of the Texas Company well field. The nearest pumping to Navy Base wells is the Texas well field. Pumpage for 1968 for this well field was an average of 5.5 mgd. This was the largest total daily pumpage from the lower aquifer in the vicinity. In 1968 water samples of wells tapping the lower aquifer in Philadelphia, Camden area, and the Texas Company well field were collected and analyzed. Figure 27 shows the change in the 200 mg/l sulfate line from 1956 to 1968. The high sulfate, high dissolved-solids water will probably continue to move towards the Texas Company well field if present or increased pumpage rates are maintained.

Additional water samples were collected in 1971 from wells tapping the lower artesian aquifer for chemical (table 4) and trace-element analyses (table 10). The sulfate concentrations are shown in figure 27. Results indicate a decrease in concentrations of sulfate and dissolved solids from 1968 to 1971 in Navy Base wells 4 (PH 11) and 11 (PH 16), but an increase in Navy Base well 9 (PH 13). Navy Base wells 4 and 11 are located downdip from an area that had lower concentrations of sulfate in 1956 (Greenman and others, 1961, plate 22). If movement of ground water did occur downdip, there would be first an increase and then a decrease of sulfate content. Analyses for 1968 and 1971 indicate the decrease in sulfate concentration suggesting movement of ground water downdip. The sulfate concentration updip from Navy Base well 9 in 1956, as given in Greenman and others (1961, plate 22), indicates progressively higher sulfate concentrations.

Analysis of samples taken from Navy Base well 9 in 1967 and 1971 indicates progressively higher sulfate also suggesting movement of ground water downdip toward the Texas Oil Company well field.

The concentration of 24 trace elements in the water samples were obtained from wells tapping the lower aquifer. Results of the analysis (table 10) indicate that only iron and manganese exceed the limits suggested by the U. S. Public Health Service for drinking water. High concentrations of both these elements are not uncommon in the Potomac-Raritan-Magothy aquifer system and have been found in areas of no known contamination resulting from man's activities.

Another area of ground-water contamination, documented by Greenman and others (1961), is the artesian aquifer in the area north of the Philadelphia Navy Base, northwest of the Walt Whitman Bridge. Water from the well (PH 6) at the center of this area had a sulfate concentration of 231 mg/l in 1956 (Greenman and others, 1961, plate 22). Recent analyses of water from wells in this same area (table 4) show a lower sulfate concentration at the center of the area. Water from the same well (PH 6) at the center of the area had a sulfate concentration of 162 mg/l in July 1967 (table 4), a decrease in sulfate concentration of over 30 percent. However, sulfate and dissolved solids in water from PH 7, a well downdip from well PH 6, increased substantially. Sulfate concentration of water from well PH 7 in February 1956 was 18 mg/l (Greenman and others, 1961). In July 1967 the sulfate concentration was 22 mg/l and in May 1971, 131 mg/l (table 4), a 600 percent increase. The increase in sulfate concentration may be due to movement of water from well PH 6 toward well PH 7. Figure 28 shows the area at well PH 7 to be a center of a regional cone of depression. There is a possibility that the contaminated water in the Navy Base area may also move northward due to the much greater gradient in that direction since 1966. Continued surveillance of the quality of ground water would be a method that could be used to determine the change in quality and its possible effect on the ground-water supplies of New Jersey.

Another area of possible water-quality problems in the Potomac-Raritan-Magothy aquifer system in Camden County is located approximately one mile south of the Benjamin Franklin Bridge. Water samples from wells in Philadelphia (one mile south of the Benjamin Franklin Bridge) indicate that water in the lower aquifer contained high sulfates (as much as 284 mg/l) and dissolved solids (as much as 646 mg/l) in 1956 (Greenman and others, 1961, plates 21 and 33). Recent potentiometric measurements in the area show a gradient to the east and to the south; thus, it is possible for this poor quality water to move to New Jersey. No water samples have been collected from wells in immediately adjacent areas of Camden County. Analyses of water from wells inland show that the quality in the lower aquifer has improved since 1927 (Thompson, 1932) to 1967 (table 4).

Chromium equal to or in excess of the State's standards for potable water has been found in water from two wells in Camden City. Routine sampling of the Camden City Water Department's distribution system by the State in December 1972 showed a high chromium content in the water delivered to a residence. Analyses for chromium from samples obtained from Camden City Water Department public-supply wells in the same area indicated that well 4 (CA 42) had chromium values in excess of the State's standards. Sampling of additional wells located nearby showed even higher chromium values for the West Jersey Hospital well (CA 47). Re-sampling of water from five wells in November 1973 confirmed the high chromium values for two of the five wells. The results of the analysis are given in table 10. The chromium values are 200 μg/l (micrograms per liter) for the West Jersey Hospital well and 50 μg/l for Camden City Water Department well 4. The State's standard for potable water is 50 μg/l for hexavalent chromium. It can be assumed that most of the chromium reported in table 10 is hexavalent chromium. Both wells tap the same sand unit in the aquifer system. The well yielding water with the lower chromium values is located 600 feet east of the West Jersey Hospital well. The potentiometric head measurements made in November and December 1973 show water levels were lower east of the two wells, indicating an easterly hydraulic gradient with ground-water movement in that direction. Water-level measurements made in October 1968 indicated the same gradient direction. This would suggest the chromium content in the ground water in this sand unit would be higher in the area west of the West Jersey Hospital well.

The source of the chromium is not known. However, at least three metal plating companies are located within a radius of 1,600 feet. Analyses of waste water to sewer lines from three metal plating companies for samples collected in February and March 1973 show high chromium values in excess of 9 mg/l (written commun., New Jersey Department of Environmental Protection, 1973).

Barksdale and others (1953) and Greenman and others (1961) have shown that induced recharge from the Delaware River does occur. Deterioration of the quality of the river by man's activities may, in turn, cause water-quality problems in that part of the aquifer being recharged by the river. A "polluted" Delaware River is a possible source of water contamination in the Potomac-Raritan-Magothy aquifer system in the northeastern part of Camden County.

Salt-Water Encroachment

There are two areas of potential salt-water encroachment in the Potomac-Raritan-Magothy aquifer system in Camden County. One area is along the Delaware River and the second is near the fresh water-salt water interface in Winslow Township.

The Delaware River in the vicinity of Camden County is tidal. Normally salt water from the ocean does not reach the vicinity of Camden. In extended drought, such as that between 1961 and 1966, a decrease in fresh-water inflow to the estuary permits salt water to move farther upstream. For example, in 1965 and 1966 the salt front advanced farther upstream in the Delaware estuary than had been previously recorded. On September 1966 the 250 mg/l chloride line reached the vicinity of the Benjamin Franklin Bridge (Keighton, 1969). At the same time the chloride concentration of the Delaware River at Delaware Memorial Bridge was 4,340 mg/l. Aquifer test and water-quality data given in another section of this report have indicated hydraulic connection between the river water and nearby wells. If the river's chloride content in the Philadelphia-Camden area were to remain at relatively high levels for a long period of time, there could be movement of this water from the river into the aquifer system, especially the middle and upper aquifers.

The second area of potential salt-water encroachment in the aquifer system is in the vicinity of the salt water-fresh water interface. The interface in the aquifer system is actually a broad zone. An approximate location in Camden County based primarily on the chloride concentration of the water from the New Brooklyn Park well 1 (WI 27) is shown on figure 18. The chloride concentration of water from this well in 1960 (Donsky, 1961) was 310 mg/l. In 1967 and in 1972 the chloride concentration (table 4) was approximately the same suggesting no change in the lower aquifer for the 12-year period. The chloride concentration of a water sample from the upper aquifer (New Brooklyn Park 2, WI 28) was 4.2 mg/l in 1961 (Donsky, 1961) and 2.5 mg/l in 1972 (table 4).

The ground-water system is a dynamic one. Changes in the hydraulic gradients due to pumping may cause the movement of higher chloride water towards centers of pumpage. Withdrawals from the Potomac-Raritan-Magothy aquifer system in the central part of the county is almost all from the upper aquifer (fig. 16). In addition pumping withdrawals from the upper aquifer at Bell's Lake, Pitman, Glassboro, and Clayton in Gloucester County to the south has further enlarged the cone of depression over a sizable area (fig. 18). Increased pumping in this area of Gloucester County and additional pumping downdip of areas of existing pumping in Camden County may move water of high chloride content toward the centers of pumping. Water-level measurements made in October 1968 indicate that the potentiometric surface in the upper aquifer is lower in the area of pumping than in the downdip area (fig. 18). The direction of the hydraulic gradient is from the interface toward the center of pumping. It is, therefore, possible for the high-chloride water to migrate toward the centers of pumping.

An extensive aquifer test at Courses Landing in Salem County has shown that the most immediate danger of salt-water contamination of middle and upper aquifers is probably by vertical coning of the salt water from the lower aquifer (Gill and Farlekas, written commun., 1969). For example, heads in the upper aquifer at Courses Landing were lowered by withdrawals causing a head difference to develop between the upper and lower aquifer. This change in the hydraulic gradient caused the higher chloride water to move upward from the lower aquifer. A similar situation may exist in southeastern Camden County and adjacent Gloucester County. Head measurements made in October 1968 at the New Brooklyn Park observation wells (WI 27 and WI 28) indicate that a 16-foot head differential exists between the upper aquifer and the lower aquifer. The well tapping the upper aquifer had the lower head. The head in the upper aquifer was at an altitude of 42 feet below mean sea level. The nearest withdrawal point from the Potomac-Raritan-Magothy aquifer system is 6 miles from the New Brooklyn Park wells. In Glassboro, Gloucester County head measurements of approximately 50 feet below mean sea level were observed in October 1968 during non-pumping conditions in three wells tapping the upper aquifer. Under pumping conditions the water levels would be at least 20 feet lower near the pumping wells. The potentiometric surface for the lower aquifer is not known for the Glassboro area, but in all probability it is higher than the potentiometric surface in the upper aquifer. If the head in the lower aquifer is significantly higher than the head in the upper aquifer, the head differential would cause water to move upward into the upper aquifer. High-chloride water (chloride content greater than 250 mg/l) underlies the water in the upper aquifer in the southeastern part of Camden and adjacent Gloucester County (fig. 18). Hence, vertical coning of high-chloride water is a possibility in this area.

Merchantville Formation and Woodbury Clay

Geology

The Merchantville Formation and Woodbury Clay crop out in an irregular-shaped belt in the northwestern part of Camden County (fig. 4). Together they have an outcrop area of 18.7 square miles.

The Merchantville Formation is the oldest major marine glauconitic unit in the New Jersey Coastal Plain. The contact between the Merchantville Formation and the underlying Magothy Formation is always sharp and disconformable (Owens and Sohl, 1969). The thickness of the Merchantville Formation is consistently 50 feet in outcrop but the lithology varies along strike. The formation is essentially a dark gray to grayish-black micaceous clay to clayey silt with beds and lenses of glauconite sand, especially near the top of the formation. A sand unit which ranges from 0-30 feet thick in Camden County has been mapped from geophysical logs. The thickness is shown on figure 29. The structure contour map of the top of the sand unit is given in figure 30. Three cross sections (fig. 31) based on geophysical logs suggest that this unit is near the top of the Merchantville Formation.

The Woodbury Clay which overlies the Merchantville Formation is a grayish-black massive micaceous clayey silt. The thickness of the Woodbury in the outcrop area is reported to be 50 feet (Owens and Sohl, 1969). Calcareous fossils found at Haddonfield indicate a marine origin for the unit (Owens and Sohl, 1969). The top of the Woodbury Clay is delineated in figure 32. The thickness of the Merchantville Formation and Woodbury Clay ranges from 106 to 165 feet in Camden County and thickens downdip as shown on figure 33.

Particle-size analyses of samples of the Merchantville Formation and Woodbury Clay from the New Brooklyn Park well (WI 27) in Winslow Township are given in table 5. The analyses of the Woodbury Clay indicate a range of 70 to 98 percent clay and silt. The analyses of the Merchantville Formation indicate a range of 42 to 56 percent of clay and silt.

Hydrology

The Merchantville Formation and Woodbury Clay function

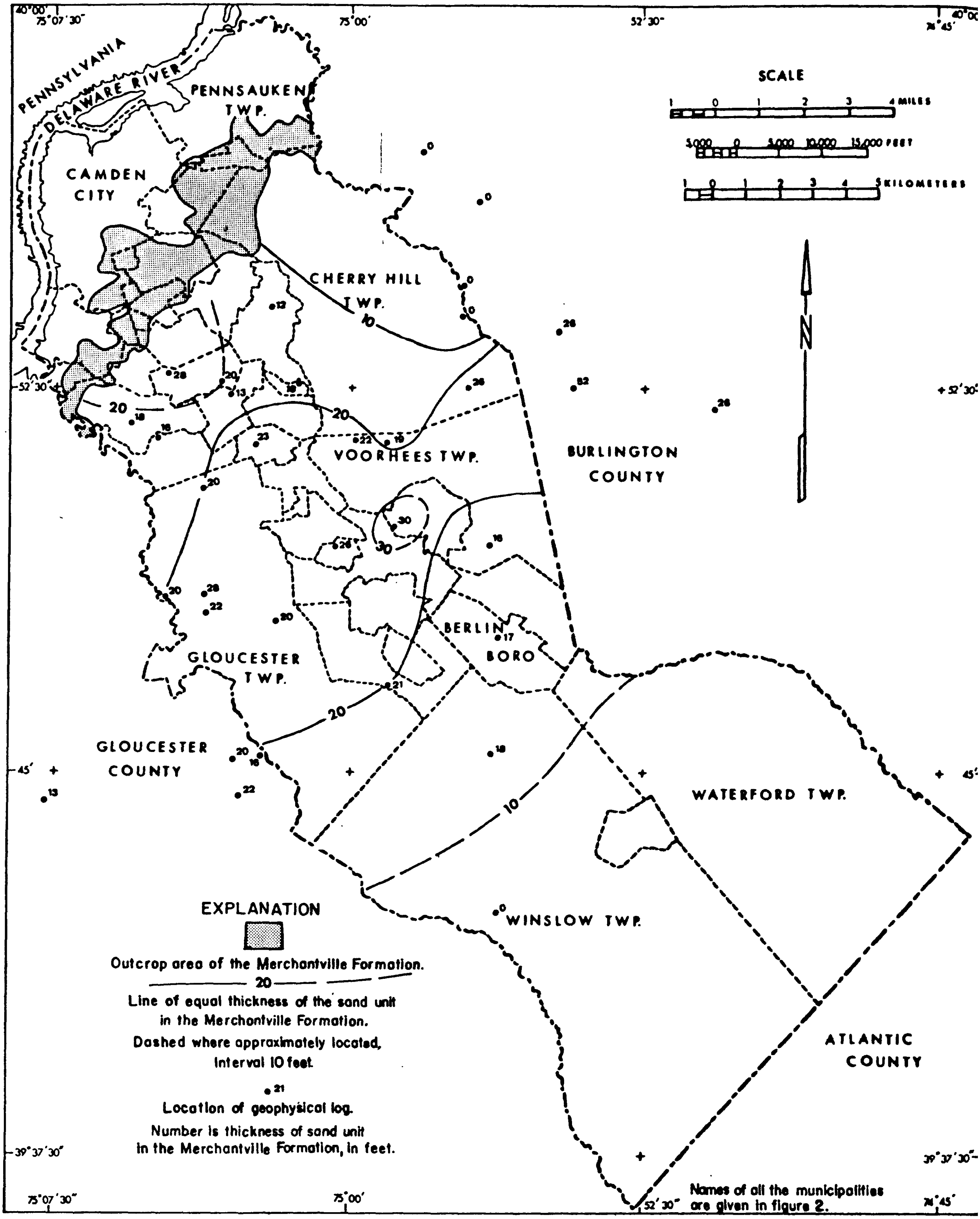


Figure 29. — Thickness map of the sand unit in the Merchantville Formation in Camden County.

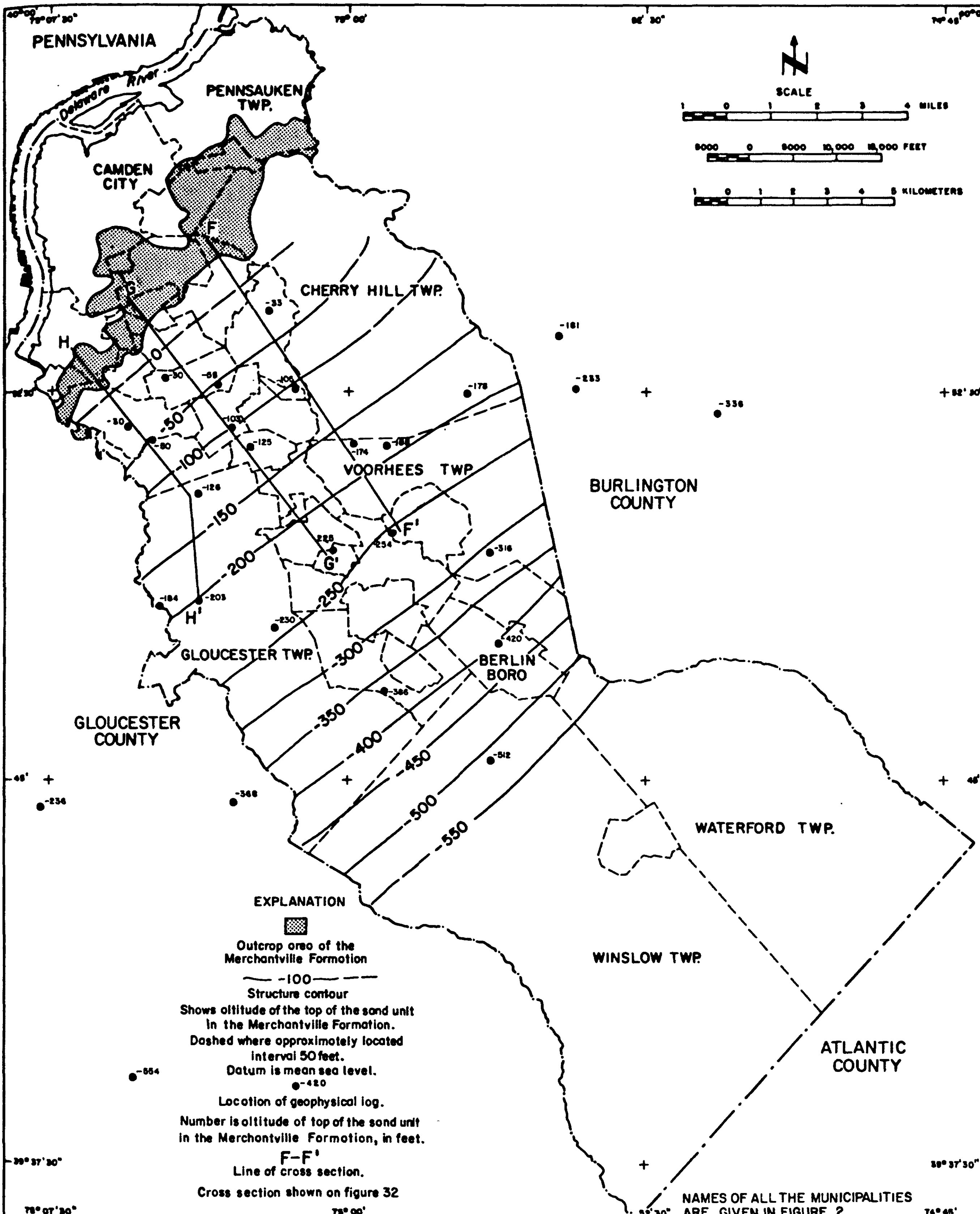


Figure 30. — Structure contour map of the top of the sand unit in the Merchantville Formation in Camden County.

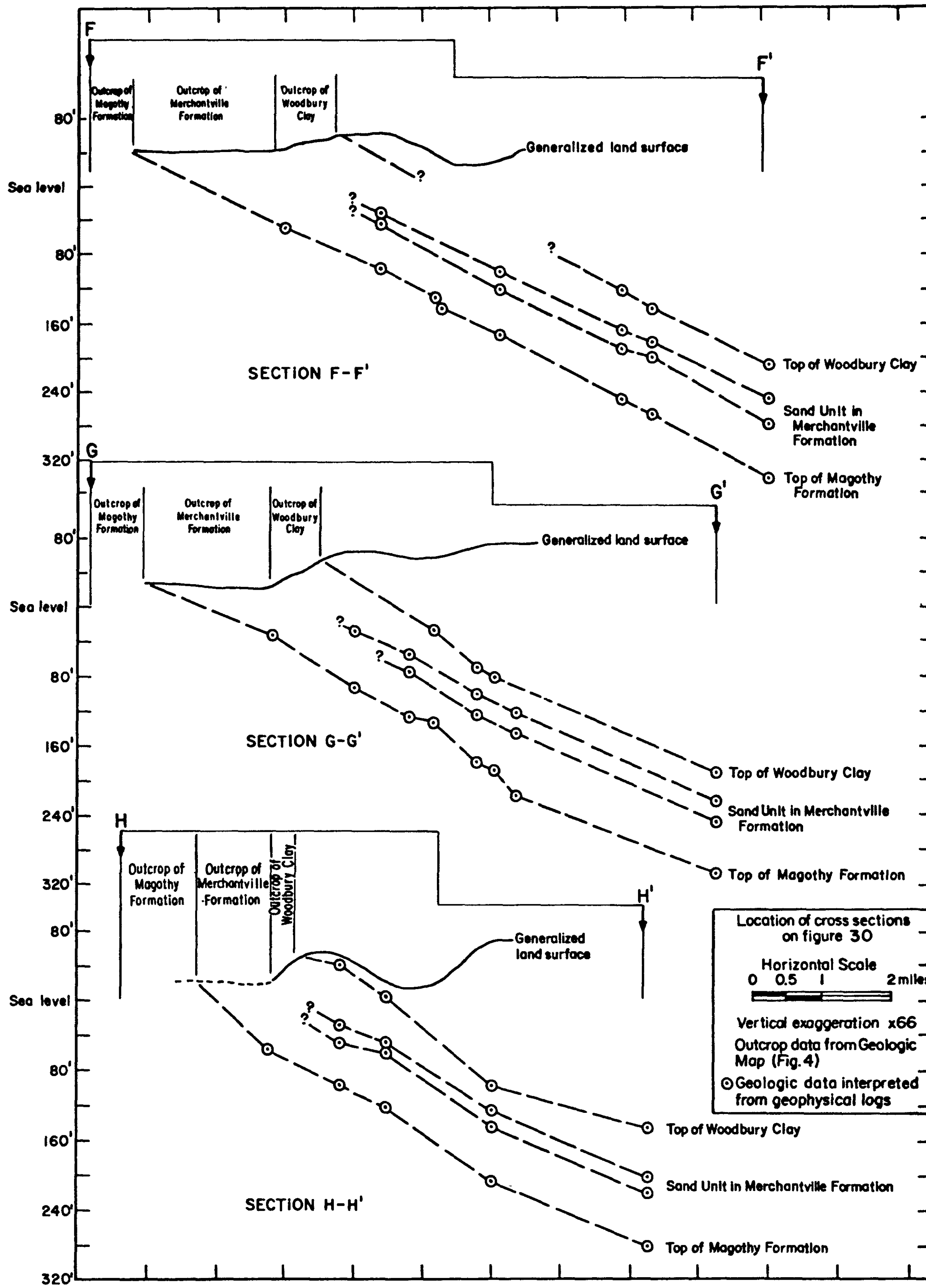


Figure 31. — Geologic sections of the Coastal Plain in the northeastern part of Camden County.

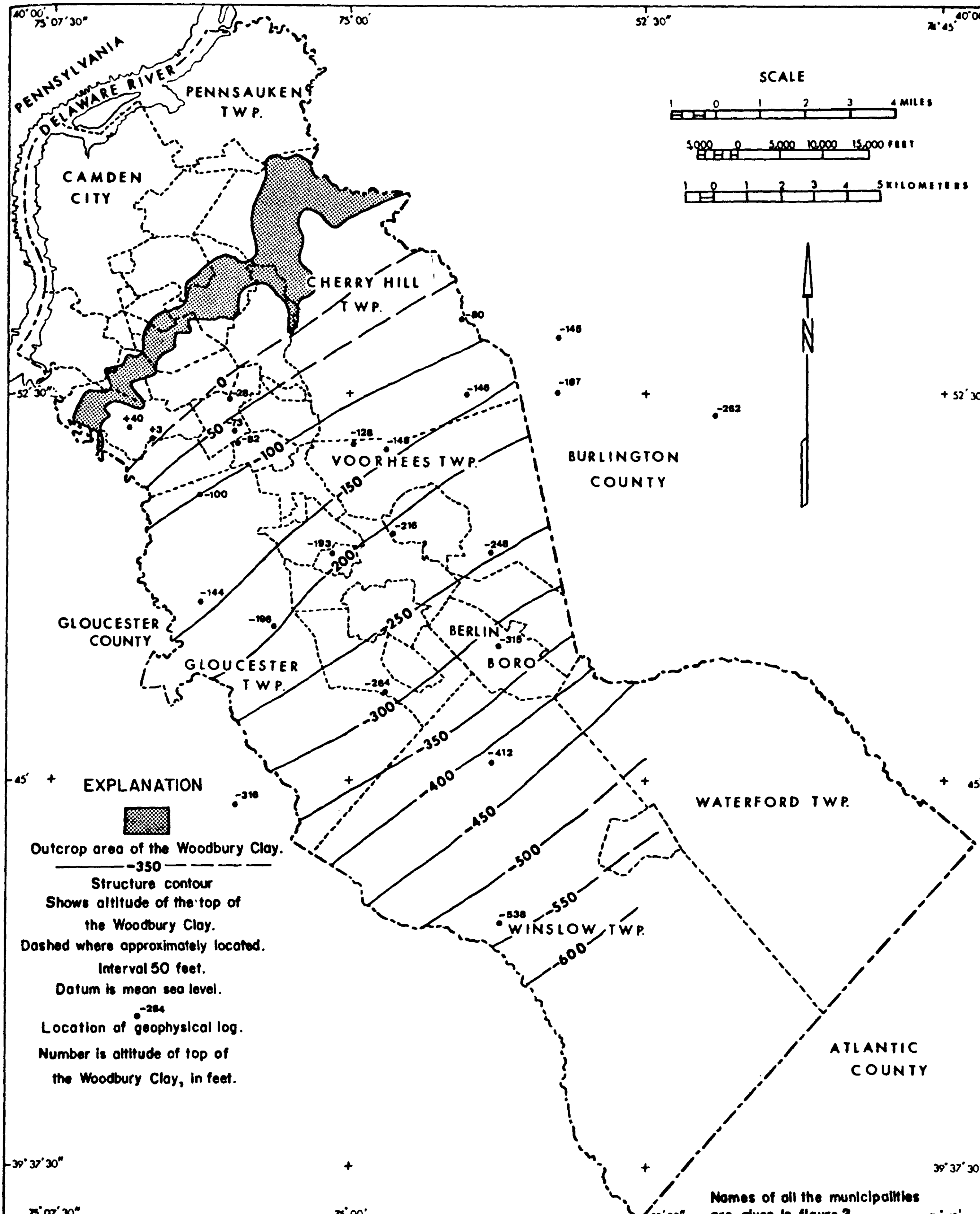


Figure 32. — Structure contour map of the top of the Woodbury Clay in Camden County.

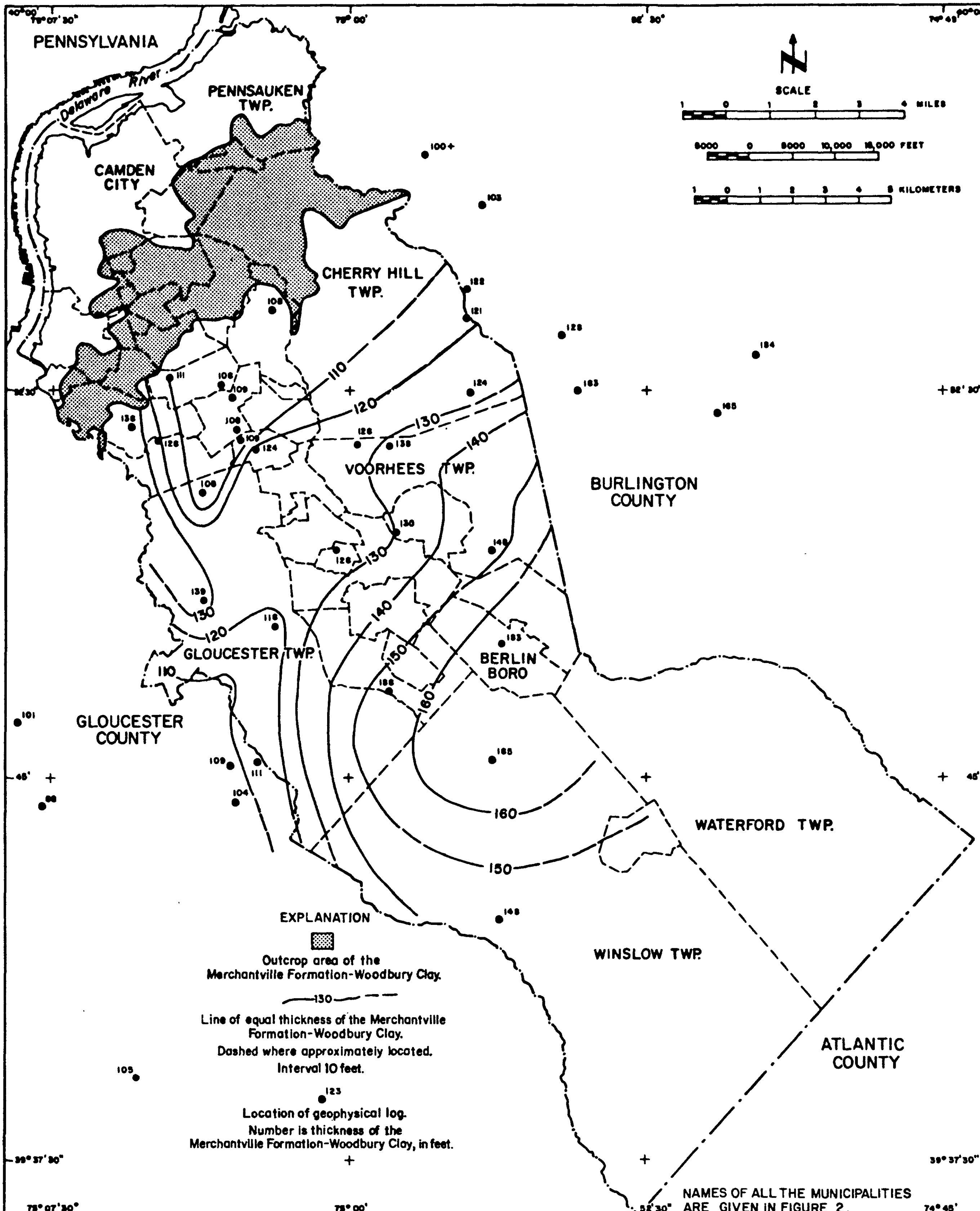


Figure 33. — Thickness map of the Merchantville Formation-Woodbury Clay in Camden County.

as semipervious confining units. However, the lensing sand unit near the top of the Merchantville Formation is tapped for domestic water supplies. Yields range from 15 to 50 gpm for the wells given in table 1. Wells that tap this sand unit are located near the outcrop area. The prepumpage potentiometric surface in this unit in Camden County was at a higher level than the prepumpage potentiometric surface of the Potomac-Raritan-Magothy aquifer system and at a lower level than the prepumpage potentiometric surface in the overlying Englishtown Formation, for the same area. Sparse water-level data from drillers' records of wells drilled in the early to mid-1950's suggest a decline in potentiometric surface from 1900 to the 1950's.

Quality of Water

Only one sample (GT 4) was obtained from a well tapping the sand unit in the Merchantville Formation. The sample (table 4) had a high pH (8.3), low chloride content (0.8 mg/l), low sulfate content (3.9 mg/l), and low dissolved solids (107 mg/l).

Englishtown Formation

Geology

The Englishtown Formation crops out in the northwestern part of the county in an area of approximately 7.7 square miles (fig. 4). It lies conformably above the Woodbury Clay. The transition from the Woodbury Clay to the Englishtown Formation is marked by a gradual increase of quartz sand and a decrease in silt and clay.

The lithology of the Englishtown Formation in New Jersey varies along strike and downdip. Several lithofacies have been recognized. In the southern part of the coastal plain the Englishtown is a massive dark-colored silty sand that resembles the non-glauconitic beds of the Merchantville Formation (Owens and Sohl, 1969). It is 40 feet thick in outcrop. Rush (1968, fig. 22) has shown that the aggregate thickness of sand in the Englishtown decreases downdip toward the south in Burlington County.

The structure contours (fig. 34) on the top of the Englishtown Formation in Camden County indicate that the

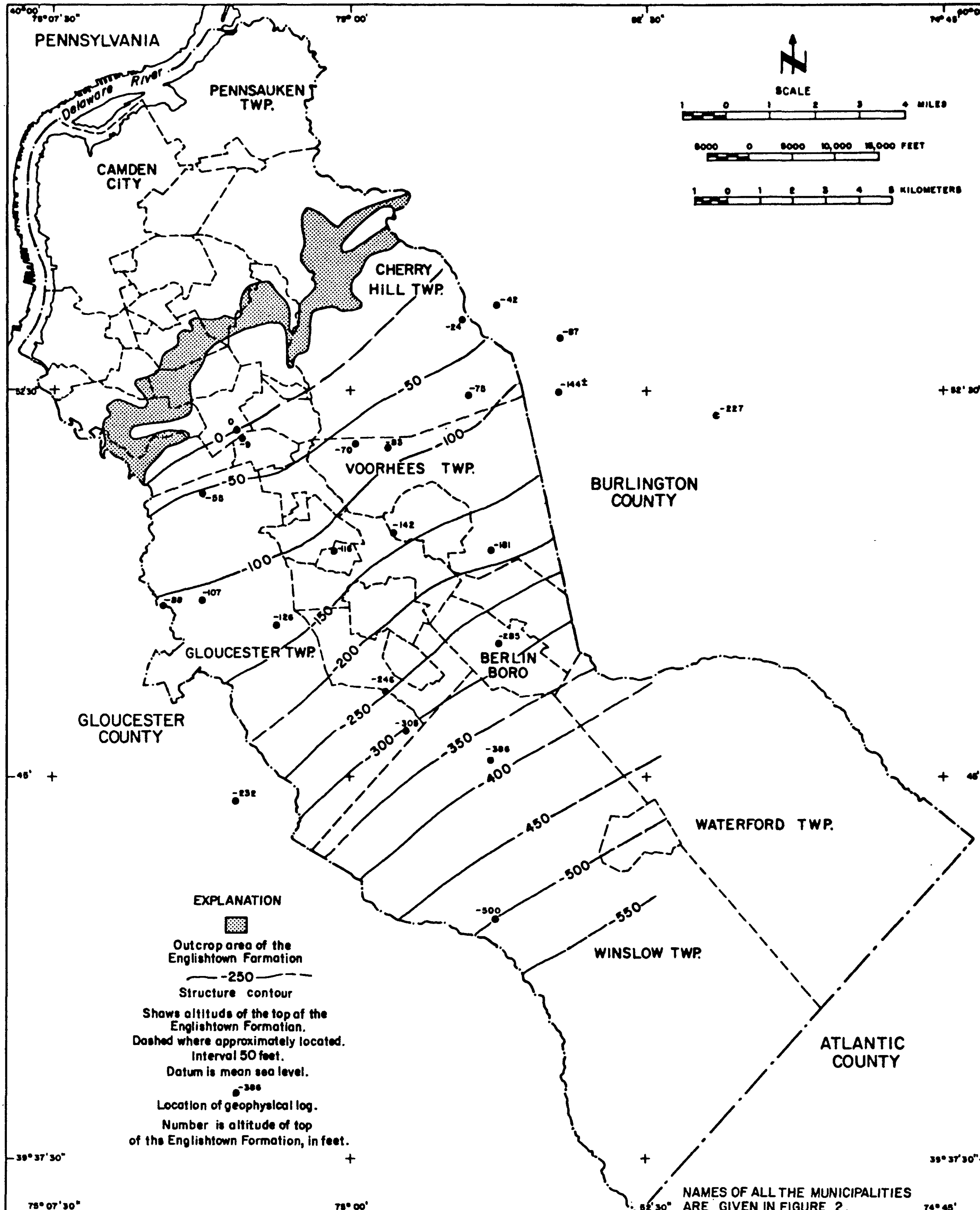


Figure 34. — Structure contour map of the top of the Englishtown Formation in Camden County.

Englishtown strikes in a northeasterly direction and has a dip of approximately 40 feet per mile toward the southeast.

Figure 35 is a lithologic map of the sand facies of the Englishtown Formation in Camden County. The aggregate thickness of the sand ranges from 5 to 30 feet with the greatest thickness of the sand in the central part of the county. The farthest downdip data available for the Englishtown in Camden County is from the New Brooklyn Park well 1 (WI 27). Particle-size analyses of samples from this test well (table 5) indicate a range of 67 to 87 percent of clay and silt.

Hydrology

Few wells tap the Englishtown Formation in Camden County (table 1). Domestic wells tapping the unit are located near the outcrop area. The only known public-supply or industrial wells tapping the formation in Camden County belong to the Clementon Water Department. All but one of their wells tap the Englishtown aquifer. The Clementon Water Department wells are located in the central part of the county, the area of greatest sand thickness. Yields of three wells in the Englishtown (Clementon Water Department wells 6, 8 and 9) are 250, 510, and 503 gpm, respectively. The specific capacities for wells 8 and 9 are 9.8 and 5.3 gpm, respectively.

Analysis of data from an aquifer test conducted in 1959 in Lakewood, Ocean County, (Seaber, 1965, p. B16) indicated a transmissivity of 1,340 ft^2/day (10,000 gpd/ft) and a coefficient of storage of 2.7×10^{-4} for the pumping phase of the test. For the recovery phase of this test the transmissivity is 2,144 ft^2/day (16,000 gpd/ft) and storage coefficient is 2.0×10^{-4}. The computed average hydraulic conductivity is about 40 ft/day (300 gpd/ft^2).

The transmissivity of the aquifer near the Clementon Water Department wells 8 and 9 was calculated using the method devised by Hurr (1966) which is based on the analysis of a single observation of drawdown at one well. This method is useful although it provides only an estimate. The computed transmissivity of the aquifer using data from the Clementon Water Department well 8 (CL 3) is 2,150 ft^2/day (16,050 gpd/ft); whereas, well 9 (CL 5) is 1,290 ft^2/day (9,630 gpd/ft). An assumed coefficient of storage of 2.7×10^{-4} was used in the calculations.

Porosity and hydraulic conductivity values obtained

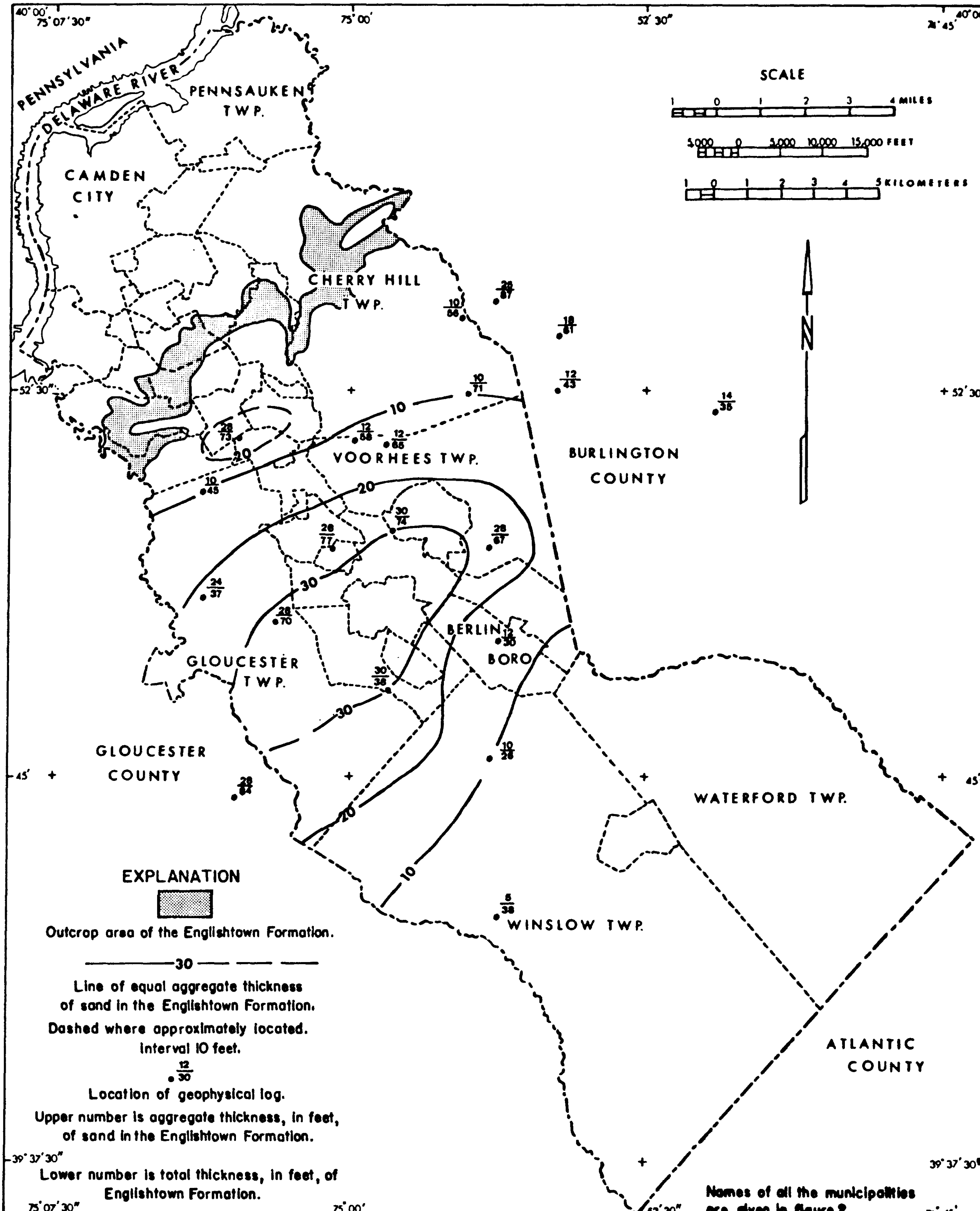


Figure 35. — Map showing aggregate thickness of the sand facies of the Englishtown Formation in Camden County.

from laboratory analyses of samples from the New Brooklyn Park well (WI 27) in Winslow Township are listed in table 5. The hydraulic conductivity values are very low indicating that the Englishtown Formation in the New Brooklyn Park area is not suitable for development as a source of water.

Seaber (1965, p. 16) indicates that the Englishtown Formation does not receive its major recharge from the outcrop area but rather from vertical leakage. The recharge is obtained from the overlying Wenonah-Mount Laurel aquifer through the Marshalltown Formation in areas of topographic highs. Figure 36 shows the potentiometric surface for the Englishtown Formation based on limited available data. The data suggest that a potentiometric high occurs in the Marlton area of Burlington County just east of Cherry Hill Township.

Pumpage from the Englishtown Formation in Camden County during 1966 amounted to 0.76 mgd. Peak use occurred in July with an average of 1.02 mgd. Additional amounts of water can be derived from the Englishtown Formation, especially in the central part of the county where the sand is thickest. However, greatly increased withdrawals from the aquifer in the county may accelerate the rate of water-level decline.

Quality of Water

Only one analysis of a well sample from the Englishtown Formation in Camden County is given in table 4. Seaber (1965, p. 6) in his study on the variations in chemical character of water from the Englishtown Formation lists additional water analyses of six wells in Camden County. The quality of the water from the Englishtown Formation in Camden County, as reported by Seaber (1965), is within the State's standards for potable water. Chloride concentration of water from the six wells ranges from 1.9-10 mg/l; sulfate from 6.9-25 mg/l; dissolved solids from 35-105 mg/l; and iron from 0.26-7.8 mg/l.

An analysis in September 1969 of a sample from the Clementon Water Department well 8 (CL 3) (table 4) is similar to a 1957 analysis of the Water Department's well 9 (CL 5). This suggests that very little change has occurred in the quality of water of the Englishtown Formation in the area.

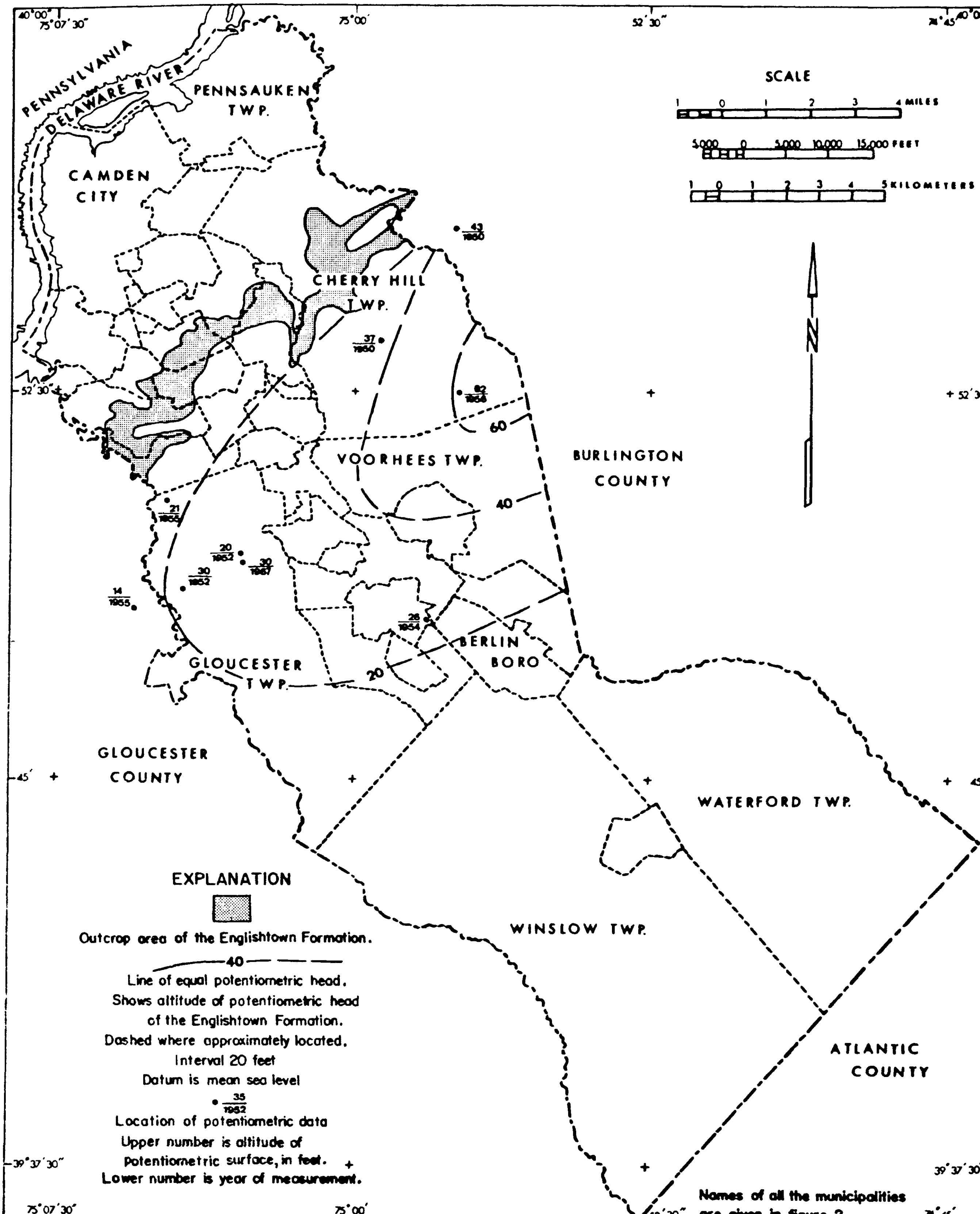


Figure 36. — Generalized potentiometric map of the Englishtown Formation in Camden County.

Marshalltown Formation

Geology

The Marshalltown Formation crops out in a northeasterly direction in northwestern Camden County in the vicinity of the New Jersey Turnpike (fig. 4) and has an outcrop area of approximately 6.3 square miles. The Marshalltown is characteristically a dark gray, micaceous, silty, glauconite sand overlying the Englishtown Formation. The abrupt change in lithology between the Marshalltown Formation and Englishtown Formation suggests a disconformable contact (Owens and Sohl, 1969). Glauconite and fossils in the Marshalltown indicate that it is of marine origin. Particle-size analysis of a sample from the New Brooklyn Park well (WI 27) in Winslow Township indicates a silty sand composition (table 5).

In the outcrop area the thickness of the Marshalltown Formation is about 20 feet. Its thickness downdip is about 20-25 feet. Hence, the altitude of the top of the Marshalltown Formation may be approximated by adding 20-25 feet to the top of the Englishtown Formation shown in figure 34.

Hydrology

The Marshalltown Formation functions as a confining layer between the Englishtown Formation and the overlying Wenonah Formation and Mount Laurel Sand. Clayey and silty beds of the lower part of the Wenonah Formation and the Marshalltown Formation form a confining layer 40 to 50 feet thick in Camden County. Vertical leakage from the Wenonah-Mount Laurel aquifer through the Marshalltown Formation recharges the Englishtown Formation. Porosity and hydraulic conductivity values from a laboratory analysis of a sample from the New Brooklyn Park well (WI 27) in Winslow Township are given in table 5. The value of hydraulic conductivity supports the contention that vertical leakage occurs through the Marshalltown Formation.

Wenonah Formation and Mount Laurel Sand

Geology

The Wenonah Formation and the Mount Laurel Sand in Camden County crops out in a northeasterly direction and has an outcrop area of about 16.6 square miles (fig. 4). The Wenonah Formation is a dark gray, poorly sorted, very micaceous, silty, fine quartz sand. Glauconite is abundant in the lower part but rapidly diminishes in the upper part (Owens and Sohl, 1969). The contact of the Wenonah Formation with the underlying Marshalltown Formation is gradational as is the contact with the overlying Mount Laurel Sand. The change from the Wenonah Formation to the Mount Laurel Sand is generally marked by an increase in average grain size, a decrease in mica, and a change in color from dark gray to lighter gray (Owens and Sohl, 1969). In general, the Mount Laurel Sand is a coarser sand unit than the Wenonah Formation and is the major component of the aquifer. The Wenonah Formation and the Mount Laurel Sand are distinct lithologic units but are hydraulically connected. Particle-size analysis of samples from the New Brooklyn Park well (WI 27) in Winslow Township are given in table 5.

The top of the Mount Laurel Sand in Camden County (fig. 37) strikes in a northeasterly direction and has a dip toward the southeast of approximately 30-35 feet per mile near the outcrop and 27 feet per mile downdip.

The combined thickness of the Wenonah Formation and Mount Laurel Sand in outcrop is about 100 feet in the Mount Holly 7-1/2 minute quadrangle, Burlington County (Minard, Owens, and Nichols, 1964). The Wenonah Formation-Mount Laurel Sand is about the same thickness in the outcrop area in Camden County. In the subsurface the Wenonah Formation and Mount Laurel Sand range in thickness from 80-90 feet near the outcrop to almost 130 feet at the New Brooklyn Park well (WI 27) in Winslow Township. The thickness map of the Wenonah Formation-Mount Laurel Sand (fig. 38) shows that the unit thickens downdip. Interpretation of geophysical logs suggest that the Wenonah Formation-Mount Laurel Sand is mainly a sand unit although the lower 20 percent of the unit consists of silt. A lithologic map of the sand facies is shown in figure 39. The greatest thickness of the sand facies is in the southcentral part of the county.

Hydrology

The Wenonah-Mount Laurel aquifer is an important water-bearing unit in Camden County. Industrial and public-supply wells are screened in this aquifer. In addition many domestic wells southeast of the outcrop area tap this unit. Almost all the wells in Camden County tapping the Wenonah-Mount Laurel aquifer are located in a northeast-trending area less than ten miles from the outcrop.

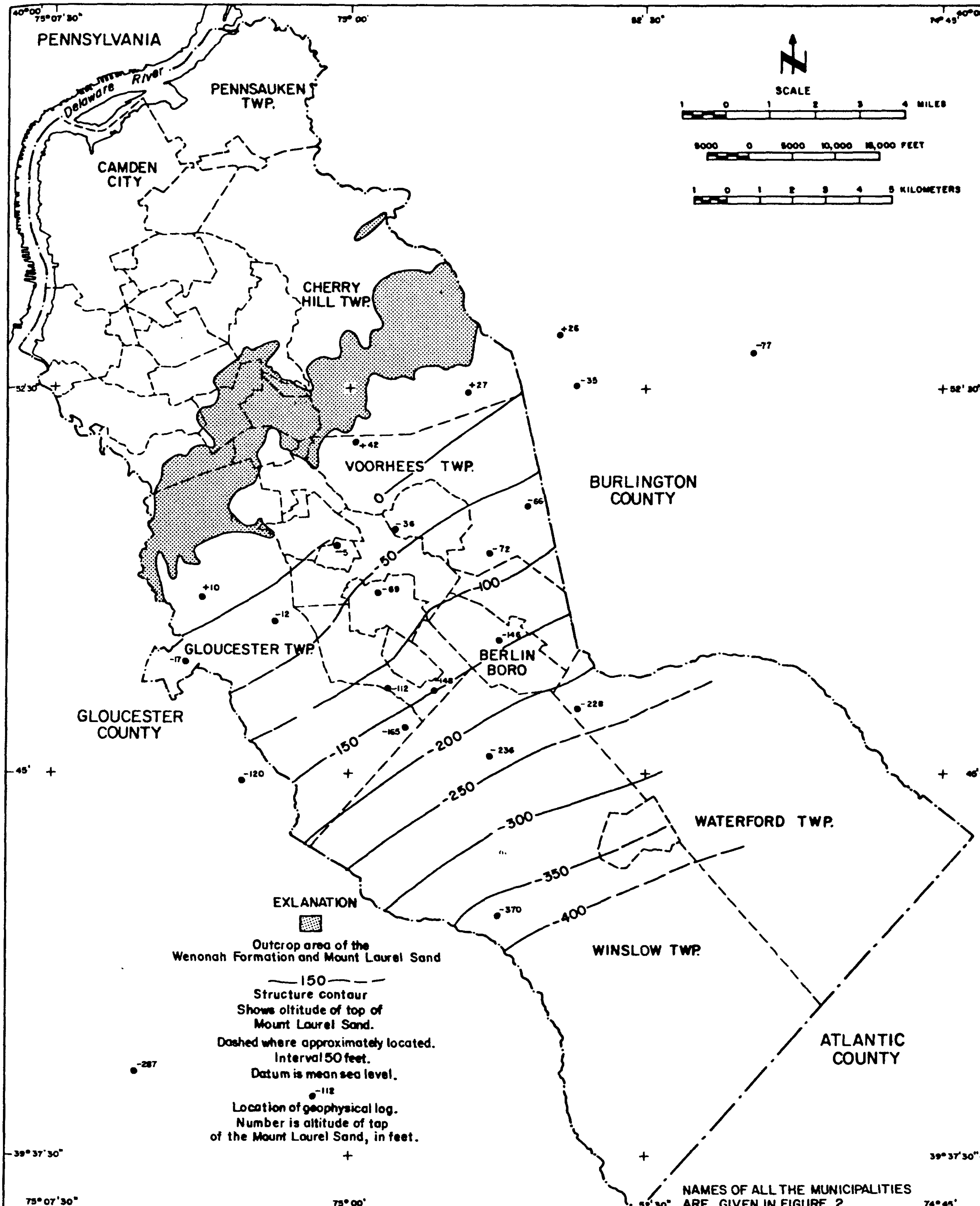


Figure 37. — Structure contour map of the top of the Mount Laurel Sand in Camden County.

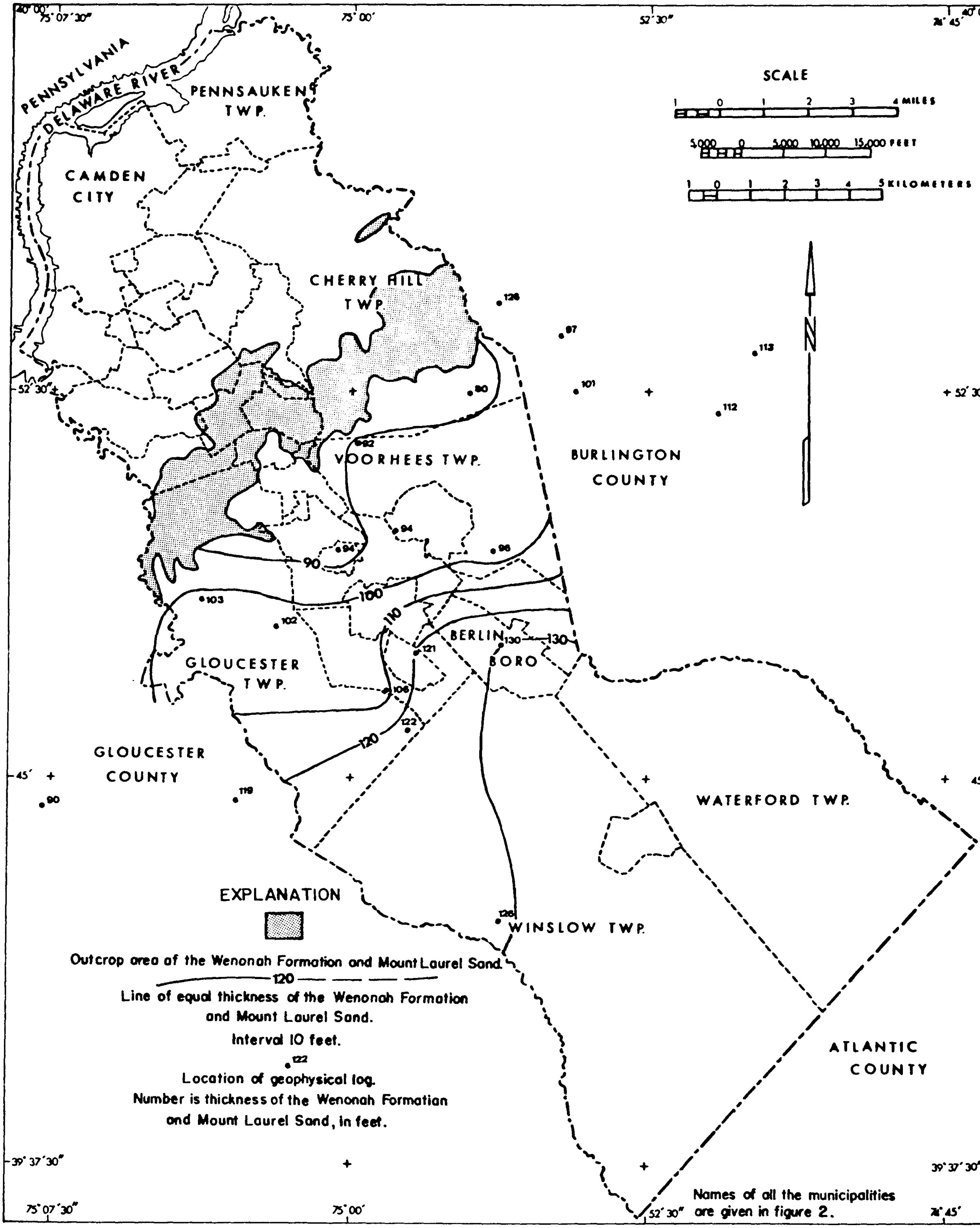


Figure 38. — Thickness map of the Wenonah Formation and Mount Laurel Sand in Camden County.

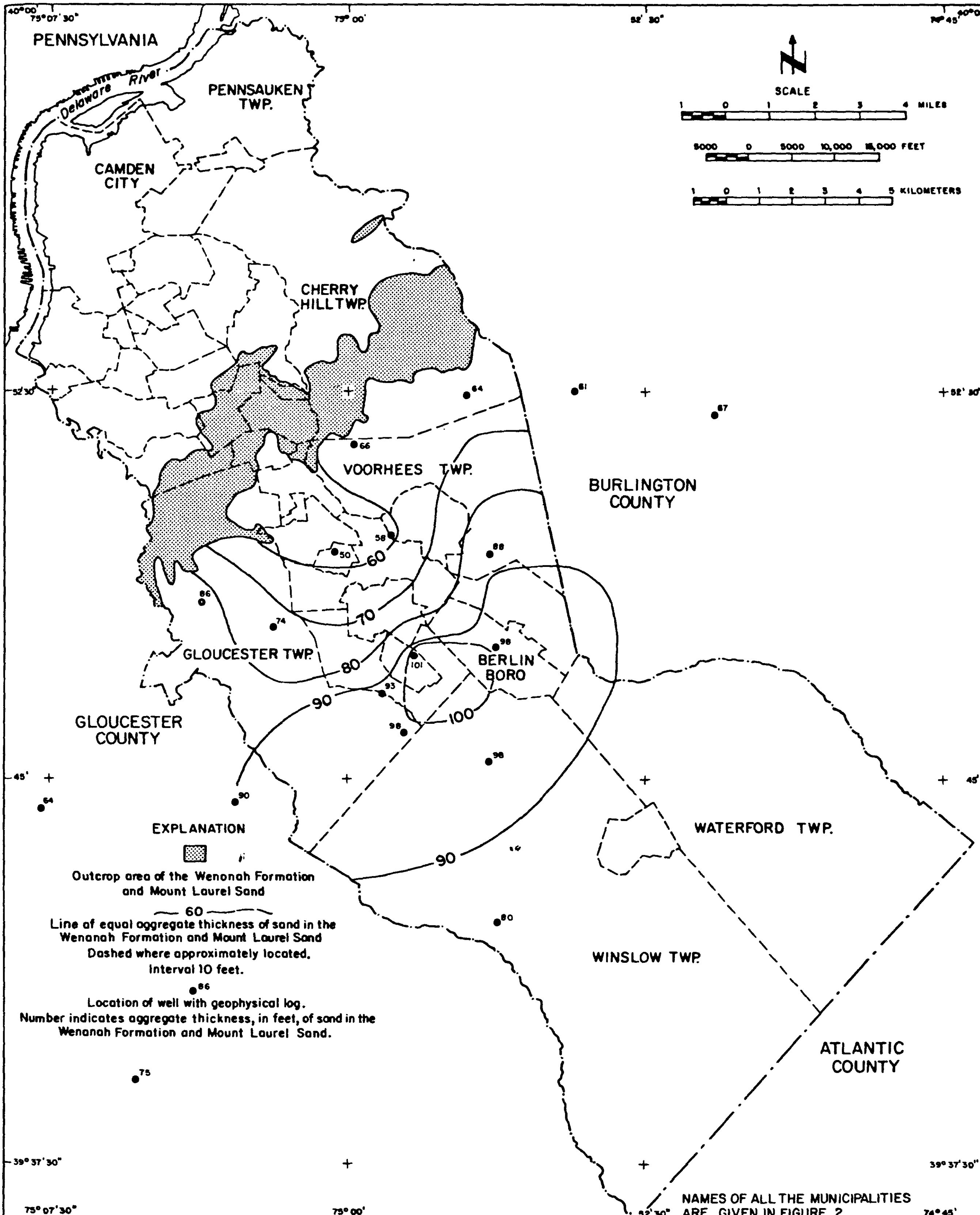


Figure 39. — Map showing aggregate thickness of the sand facies of the Wenonah Formation and Mount Laurel Sand in Camden County.

Data from three aquifer tests of the Wenonah-Mount Laurel aquifer are available. The analysis of aquifer tests conducted in 1954 at Bradley Beach in Monmouth County (Jablonski, 1968, p. 62) indicated an average transmissivity of 670 ft^2/day (5,000 gpd/ft) with a range of 360 to 1,420 ft^2/day (2,700 to 10,700 gpd/ft). The average coefficient of storage is about 1.2×10^{-4} with a range from 7.0×10^{-5} to 2.1×10^{-4}. The average hydraulic conductivity is about 17 ft/day (130 gpd/ft^2). In 1965 an aquifer test was run at Salem City, Salem County. The average transmissivity of the Wenonah-Mount Laurel aquifer was determined to be 1,200 ft^2/day (9,000 gpd/ft). The storage coefficient is 3.5×10^{-4} and the hydraulic conductivity is about 13 ft/day (100 gpd/ft^2) (Rosenau and others, 1969, p. 40). An aquifer test was run at Artificial Island in Salem County in 1968 by Dames and Moore, consulting engineers for Public Service Electric and Gas Company (Dames and Moore, 1968). The transmissivity was about 940 ft^2/day (7,000 gpd/ft), and the hydraulic conductivity was about 19 ft/day (140 gpd/ft^2).

Ten industrial and public-supply wells tapping the Wenonah-Mount Laurel aquifer in Camden County furnish sufficient specific capacity data for estimating the transmissivity by the Hurr (1966) method (table 11). Transmissivity computed for the 10 wells ranges from 430 to 1,780 ft^2/day (3,200 to 13,300 gpd/ft). The median transmissivity for the 10 wells is 780 ft^2/day (5,820 gpd/ft). The specific capacities for the 10 wells range from 1.8 to 6.4 gpm/ft. The median specific capacity for the 10 wells is 3.2 gpm/ft. A coefficient of storage of 2.4×10^{-4} was used in calculations to estimate transmissivity. Porosity and hydraulic conductivity values obtained from laboratory analyses of samples from the New Brooklyn Park well in Winslow Township are given in table 5.

A generalized potentiometric surface map of the Wenonah-Mount Laurel aquifer based on the earliest record for each well is given in figure 40. Almost all of these wells are within 10 miles of the outcrop area. The map indicates a high potentiometric surface in northeastern Voorhees Township and in southern Gloucester Township. These areas are the main recharge areas for the Wenonah-Mount Laurel aquifer in Camden County and they coincide with areas of topographic highs as shown in figure 3. Recharge is mainly from downward vertical leakage. Potentiometric highs coinciding with topographic highs have been shown to exist for the Wenonah-Mount Laurel aquifer in Burlington County (Rush, 1968, p. 49) and Gloucester County (Hardt and Hilton, 1969, p. 23).

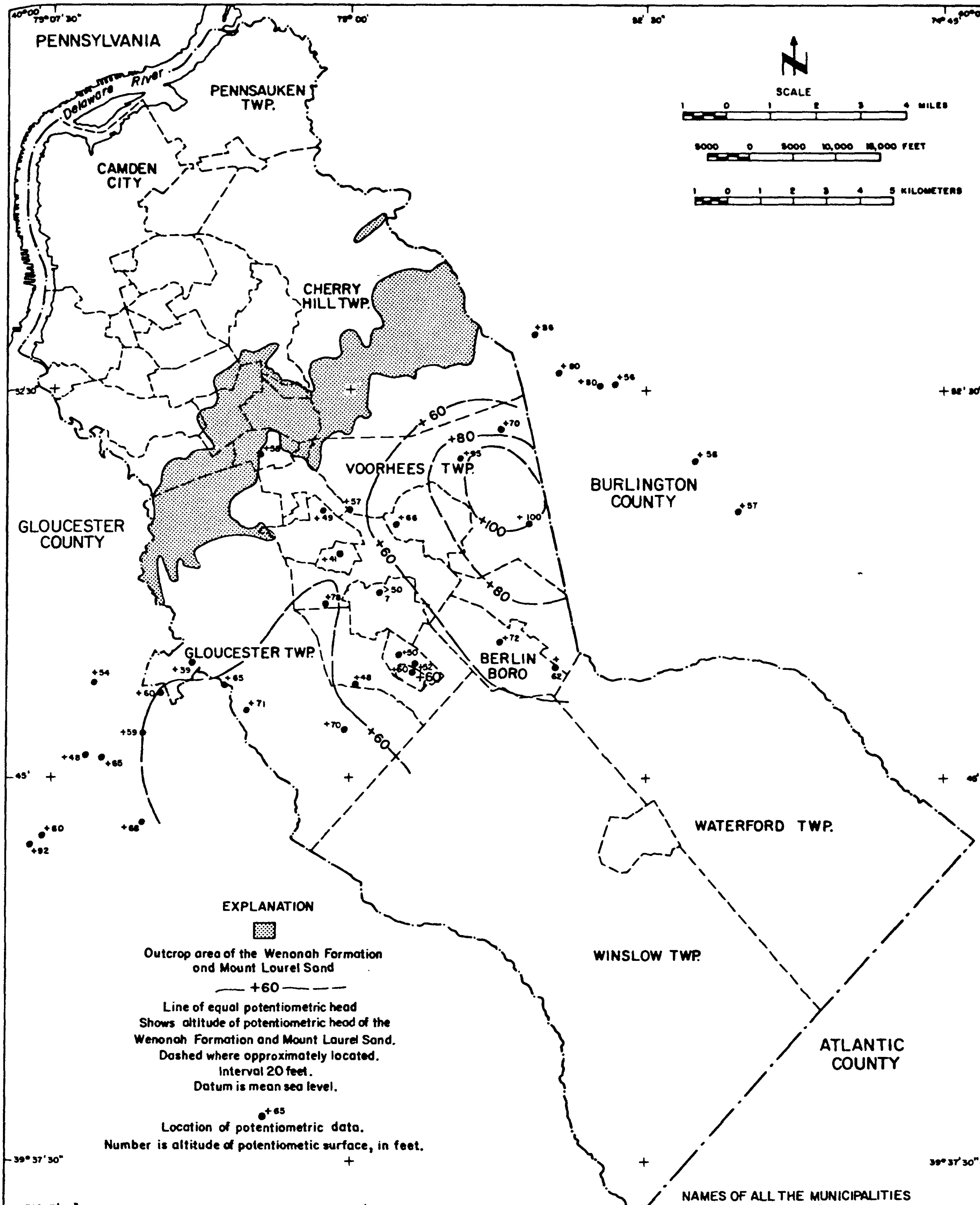


Figure 40. — Generalized potentiometric map of the Wenonah Formation and Mount Laurel Sand, based upon earliest record for each control point.

Natural discharge areas for the aquifer occur along topographic lows in the outcrop area. One of the discharge areas for the Wenonah-Mount Laurel aquifer prior to pumpage was along Cooper River in northern Somerdale Borough.

The potentiometric map of the Wenonah-Mount Laurel aquifer based on data for the period November 1968 to May 1970 is shown in figure 41. The potentiometric surface has been lowered in several areas mainly during the past 20 years. The greatest decline in head (43 feet) known in Camden County for the Wenonah-Mount Laurel aquifer is in the vicinity of Berlin Borough, an area where most of the industrial and public-supply pumpage occurs.

An observation well in the Wenonah-Mount Laurel aquifer was drilled at New Brooklyn Park (WI 29) in 1961. Head data from 1963 to 1970 are given in figure 42. From May 1962 to September 1964 the head declined about 9 feet. The decline is interpreted as being mainly due to additional pumping in the area of Berlin and northern Winslow Township including withdrawals from the Johns-Manville well (WI 3), located 3.5 miles north of the New Brooklyn Park observation well. Pumpage at Johns-Manville began in late 1963.

Quality of Water

The quality of water from the Wenonah-Mount Laurel aquifer is generally within the State's standards for potable water with the exception of high iron concentrations in local areas. A summary of chemical analyses of ground water from wells tapping the Wenonah-Mount Laurel aquifer in Camden County is shown in table 12. The water is generally low in dissolved solids (97-178 mg/l), sulfates (0-28 mg/l), and chloride (0.3-9.7 mg/l). Laboratory analyses of water samples (table 4) indicate 6 of 13 analyses have iron concentrations exceeding the State's potable-water standard of 0.3 mg/l. The range in iron concentration is 0-3.6 mg/l. There is no apparent regional distribution of the high iron concentration in the aquifer in Camden County. Hardness ranges from soft to moderately hard (17-126 mg/l).

Sulfate concentration of 28 mg/l was determined for a sample obtained in January 1970 from the New Jersey Water Company's well 4 (LS 6) at Laurel Springs. Chemical analyses (Donsky, 1963) indicate sulfate concentrations of 13 mg/l in May 1951 and 17 mg/l in August 1960 for well 8 (LS 4) which is screened at the same interval and is located near well 4. In

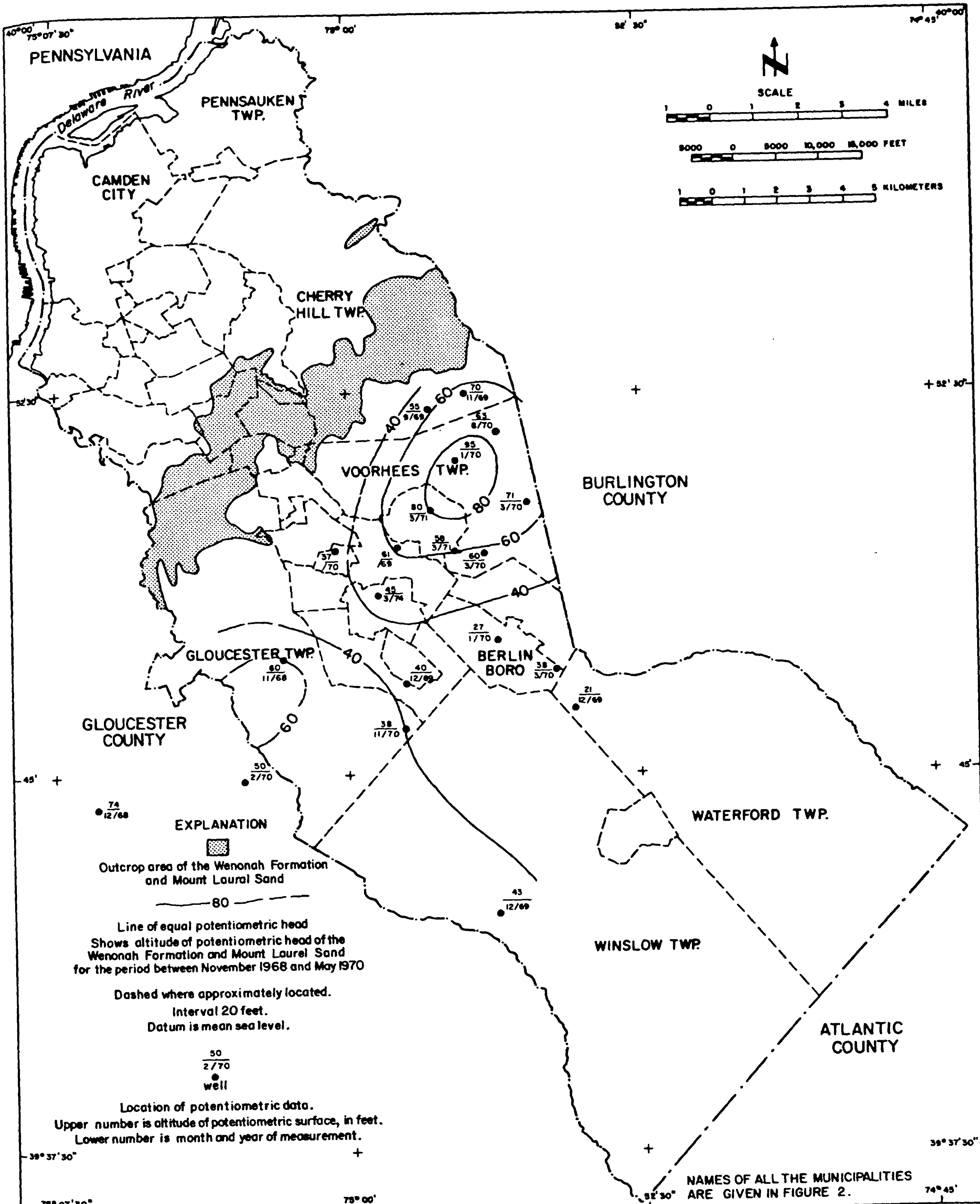


Figure 41.— Potentiometric map of the Wenonah Formation and Mount Laurel Sand, November 1968 - May 1970.

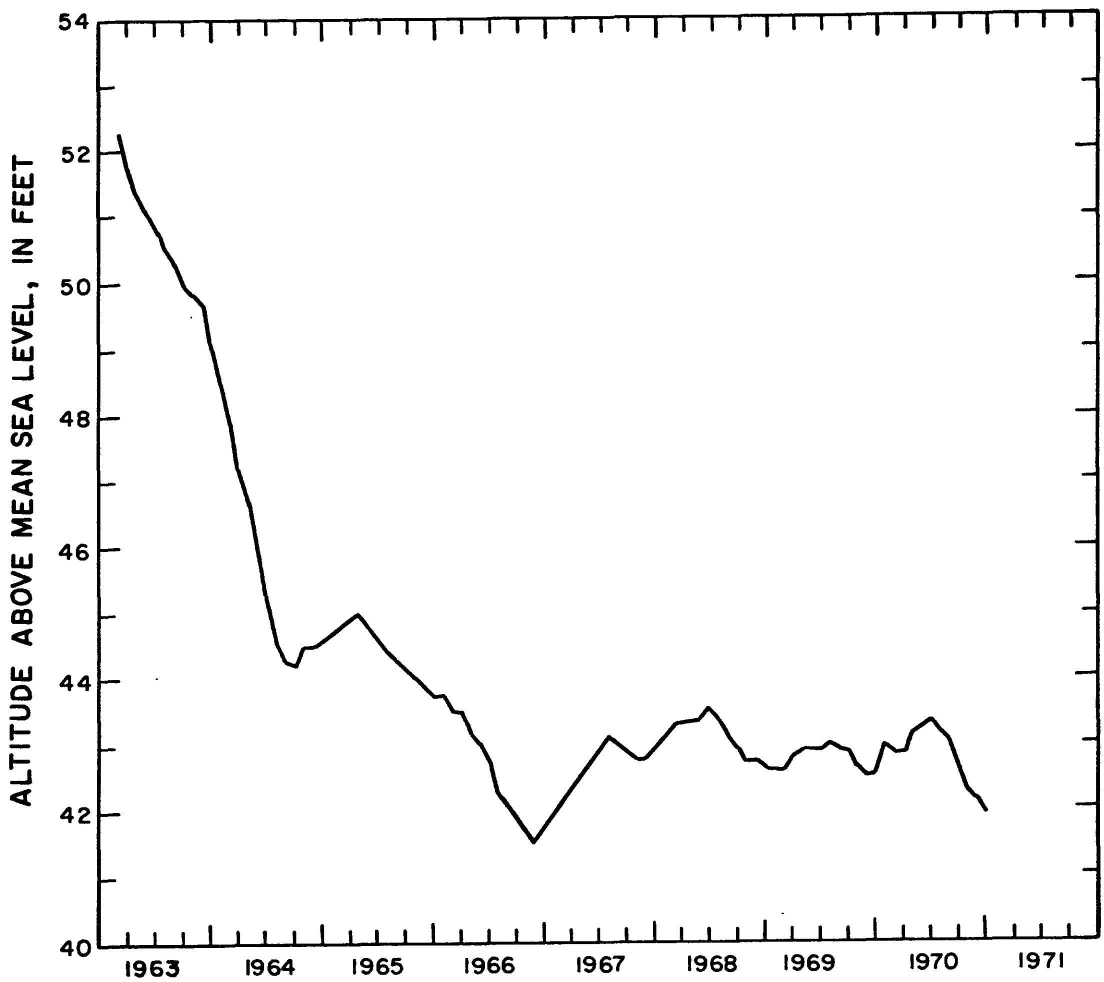


Figure 42. — Hydrograph of the lowest monthly water level in the observation well tapping the Wenonah-Mount Laurel aquifer at New Brooklyn Park, Winslow Township, January 1963 - December 1970.

addition to the increase in sulfate, there was an increase in dissolved solids. Although sulfate and dissolved solids are well within the State's Potable Water Standards, the increase may indicate a rising trend. Withdrawals from the Wenonah-Mount Laurel aquifer at Laurel Springs may have reversed the hydraulic gradient, thereby causing the water to move from the outcrop area to the well field.

A water sample obtained in February 1970 from a domestic well (GT 10) located very close to the outcrop area of the Wenonah Formation and Mount Laurel Sand had a nitrate concentration of 15 mg/l. Nitrate in the Wenonah-Mount Laurel aquifer is generally much lower (0 to 1.4 mg/l). The high nitrate suggests local ground-water contamination, possibly from fertilizers in the outcrop area or through the overlying sediments.

Navesink Formation

Geology

The Navesink Formation crops out in an irregular belt southeast of the Mount Laurel Sand in Camden County and is approximately 3.9 square miles in area (fig. 4).

The Navesink Formation in Camden County is the uppermost unit of the Cretaceous System. It is unconformably overlain by the Hornerstown Sand of Tertiary age and underlain conformably by the Mount Laurel Sand. Fossils and glauconite found in the Navesink indicate that it is of marine origin.

The Navesink Formation consists of a dark green to black glauconitic sand and clay mixed with varying amounts of quartz sand. A prominent shell zone occurs at the base of this formation and is one of the best marker horizons in Camden County. The bulk of the fossils are the thick-shelled Exogyra, Gryphaea, and Belemnites (Owens and Minard, 1960, p. 28). The formation dips about 30 feet per mile to the southeast and ranges in thickness from 15 feet in Laurel Springs Borough near the outcrop area to 34 feet in Winslow Township. Particle-size analysis of samples from the New Brooklyn Park well (WI 27) in Winslow Township are listed in table 5.

Hydrology

The Navesink Formation functions as a confining layer in Camden County. Recharge to the underlying Wenonah Formation and Mount Laurel Sand takes place as a result of vertical leakage through the Navesink Formation. Porosity and hydraulic conductivity values for samples of the formation from the New Brooklyn Park well (WI 27) in Winslow Township are listed in table 5.

In this report the Navesink Formation and the Hornerstown Sand are treated as a hydrologic unit. The total thickness of the Navesink Formation and Hornerstown Sand is shown in figure 43.

CENOZOIC ERATHEM

Tertiary System, Paleocene-Eocene Series

Hornerstown Sand

Geology

The Hornerstown Sand of Paleocene age crops out in an irregular belt southeast of the Navesink Formation (fig. 4). The outcrop area in Camden County is approximately 9.4 square miles.

The Hornerstown Sand in Camden County is the lowest unit of the Tertiary System. It unconformably overlies the Navesink Formation. Fossils and the high glauconite content of the Hornerstown Sand indicate that it is of marine origin. Dorf and Fox (1957, p. 5) suggest that the Hornerstown represents a transgressive marine phase.

The Hornerstown Sand is composed of sand and clay and contains as much as 90 percent glauconite. This mineral gives the Hornerstown Sand its dark-green color. The formation dips about 30 feet per mile to the southeast and ranges in thickness from 36 feet in Voorhees Township near the outcrop area to 18 feet in Waterford Township. Particle-size analysis of samples from the New Brooklyn Park well (WI 27) in Winslow Township are given in table 5.

Gamma-ray logs of wells in Camden County indicate that two relatively high radioactive layers occur 25 to 40 feet apart in the Navesink-Hornerstown confining layer. The layers

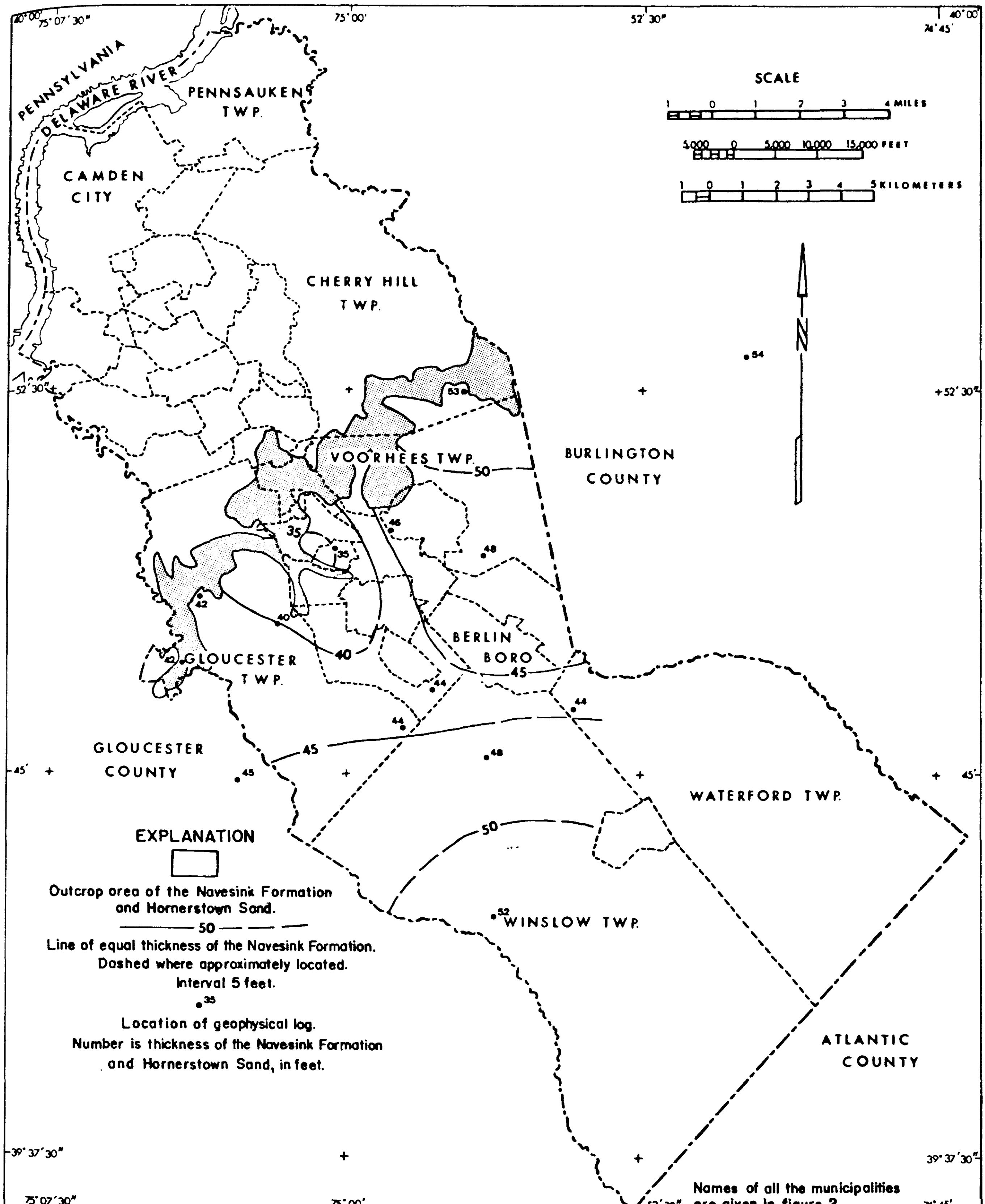


Figure 43. — Thickness map of the Navesink Formation and Hornerstown Sand in Camden County.

appear to coincide in position with high concentrations of glauconitic sand or with reported shell layers near the top of the Hornerstown Sand and the bottom of the Navesink Formation. Thus, one can establish the Tertiary-Cretaceous (Hornerstown Sand-Navesink Formation) contact zone in Camden County. These two layers were used as markers in correlating well logs shown in figure 6.

Hydrology

The Hornerstown Sand in conjunction with the underlying Navesink Formation is a leaky confining unit. Recharge to the Mount Laurel Sand takes place as a result of vertical leakage through these overlying formations. One domestic well is known to tap the Hornerstown Sand and three wells are known to tap the undifferentiated Hornerstown Sand and overlying Vincentown Formation in Camden County. Porosity and hydraulic conductivity values for samples from the New Brooklyn Park well (WI 27) in Winslow Township are given in table 5.

Vincentown and Manasquan Formations

Vincentown Formation

Geology

The Vincentown Formation of Paleocene age does not crop out in Camden County. In the subsurface the formation thickens to the southeast. The authors were unable to differentiate the Vincentown Formation from the overlying Manasquan Formation on geophysical logs. The total thickness of the Vincentown and Manasquan Formations in Camden County ranges from 0 to 210 feet (fig. 44). The Vincentown Formation is estimated to range in thickness in Camden County from 0 to 80 feet. The contact with the underlying Hornerstown Sand is unconformable.

The Vincentown Formation in Camden County consists chiefly of a light brown to light gray, very fine, calcareous, micaceous sand. The formation has two recognizable facies; (1) a quartzose sand with glauconite, and (2) a limey sandstone which contains fossil shells. Neither facies is traceable for any great distance because of the lensing nature of the limey

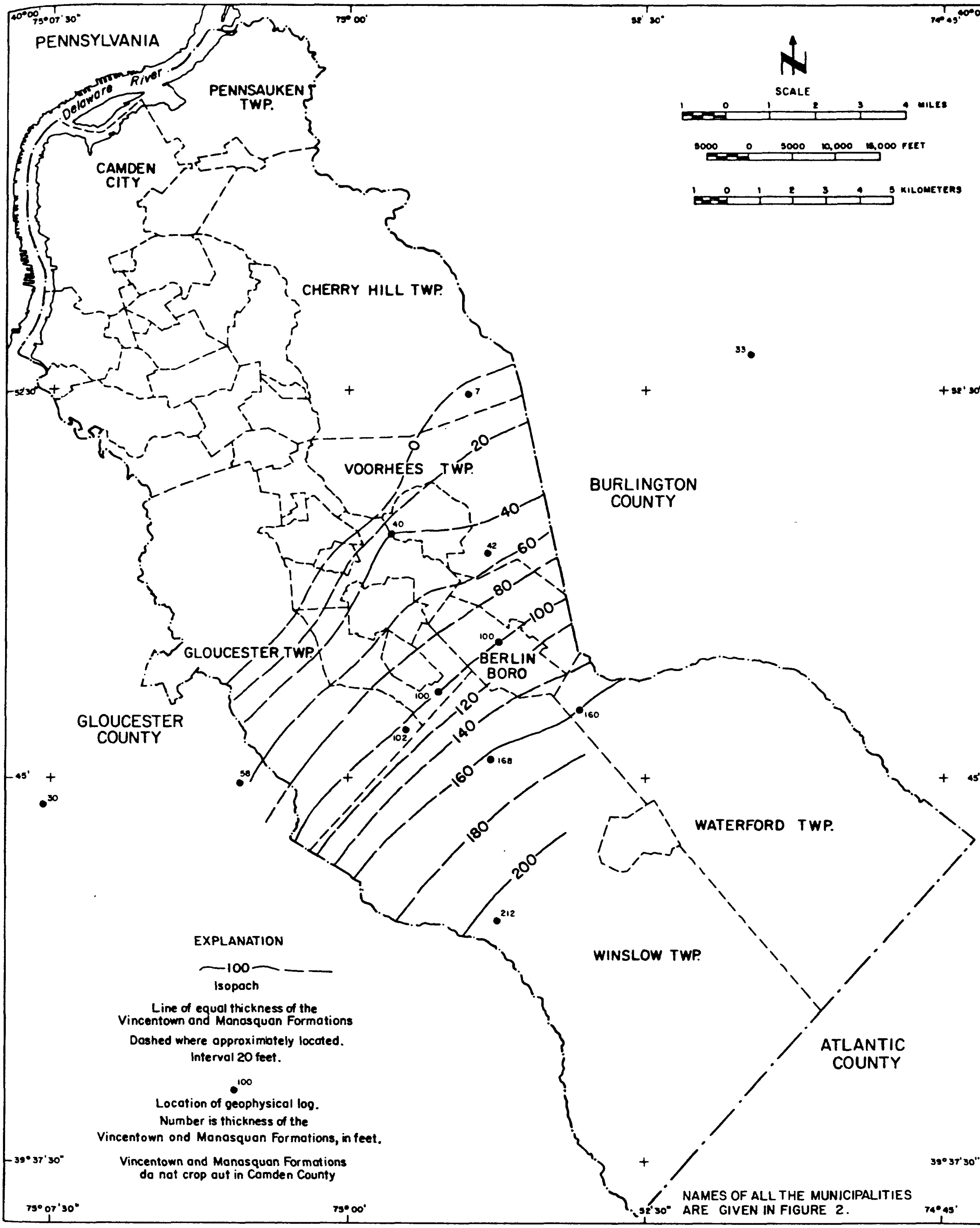


Figure 44. — Thickness map of the Vincentown and Manasquan Formations in Camden County.

sandstone. The sand fraction in the limey sandstone facies consists primarily of calcareous fragments of bryozoans, foraminifera, and corals. The clay-size fraction is primarily calcite with small amounts of montmorillonite (Owens and Minard, 1960, p. 25). The limey sandstone facies is predominant in Camden County. Particle-size analysis of samples from the New Brooklyn Park well (WI 27) in Winslow Township are given in table 5.

Manasquan Formation

Geology

The Manasquan Formation of Eocene age does not crop out in Camden County. In the subsurface the formation thickens to the southeast. The total thickness of the Manasquan and Vincentown Formations in Camden County ranges from 0 to about 210 feet (fig. 44). The Manasquan Formation is estimated to range in thickness in Camden County from 0 to about 140 feet.

The Manasquan Formation overlies the Vincentown Formation. The contact between the Manasquan Formation and the overlying Kirkwood Formation is unconformable. Fossils and glauconite found in the Manasquan Formation indicate that it is of marine origin. Dorf and Fox (1957, p. 12) considered the Manasquan Formation to represent a second transgressive phase of the lower Tertiary. Perfectly preserved specimens of Maringulina vacavillensis (Hanna) and associated small foraminifera found in the New Brooklyn Park test well (WI 27) suggest marine conditions during middle Eocene time similar to that of the present day Gulf Coast (Herrick, 1962).

The Manasquan Formation is described by Owens and Minard (1960, p. 25-26) as a clayey, quartz, glauconite sand similar to the Hornerstown Sand, except that the Manasquan has more clay and quartz sand. Samples taken from two test wells of the Manasquan Formation in Burlington County were olive gray, glauconitic, clayey sand having small amounts of mica and shell fragments. Mechanical analyses were made on six samples and a typical sample gave the following particle-size distribution: gravel, 1 percent; very coarse-grained sand, 3 percent; coarse-grained sand, 3 percent; medium-grained sand, 12 percent; fine-grained sand, 36 percent; very fine-grained sand, 20 percent; silt, 8 percent; and clay, 17 percent (Rush, 1968, p. 54). Particle-size analysis of samples from the New Brooklyn Park well (WI 27) in Winslow Township, Camden County, are given in table 5. The samples in general have more than 30 percent clay and as much as 82 percent clay.

Vincentown and Manasquan Formations Undifferentiated

Hydrology

The Vincentown and Manasquan Formations, along with the Hornerstown Sand and Navesink Formation, function as confining layers between the underlying Wenonah-Mount Laurel aquifer and overlying aquifers of the Kirkwood Formation and Cohansey Sand.

Laboratory analysis of an outcrop sample of the Vincentown Formation taken between Jacobstown and New Egypt in Burlington County indicates a hydraulic conductivity of 21 ft/day (160 gpd/ft^2). Laboratory analyses of six samples of the Manasquan Formation in Burlington County give a range for hydraulic conductivity from 0.04 to 16 ft/day (0.3 to 120 gpd/ft^2) with most hydraulic conductivity values grouped between 0.5 and 0.8 ft/day (4 and 6 gpd/ft^2) (Rush, 1968, p. 55). Hydraulic conductivity values of samples from the New Brooklyn Park well (WI 27) in Winslow Township range from 8×10^{-5} to 4×10^{-2} ft/day (0.0006 to 0.3 gpd/ft^2) (table 5).

Ancora State Hospital in Winslow Township has three wells that tap the undifferentiated Vincentown and Manasquan Formations (reported by Rush, 1968, as wells tapping the Kirkwood Formation). Wells 1 (WI 40) and 2 (WI 38) yield 185 gpm and 360 gpm, respectively. Specific capacities for wells 1 and 2 are 1.9 and 1.3 gpm/ft drawdown, respectively.

Continuous water-level data have been collected at observation well 3 (WI 37), Ancora State Hospital, since 1953. A hydrograph of monthly low water levels is shown on figure 45. A close relationship is found between monthly head fluctuations and variation in the monthly pumpage for wells 1 (WI 40) and 2 (WI 38) (fig. 45). The increased rate of head decline in 1955-56, 1958-59, and 1966-67 is the result of increased withdrawals from wells 1 and 2 as shown in figure 45.

Piney Point(?) Formation

The Piney Point(?) Formation of Eocene age does not crop out in New Jersey. The Eocene age marine sediments which are correlated with the Jackson Formation of the Gulf Coast are recognized in well logs from Delaware (Marine and Rasmussen, 1955) and southern New Jersey (Richards, 1956, p. 84). The glauconitic sands and shell beds in southern Maryland were named the Piney Point Formation (Otton, 1955, p. 85) from a well located at Piney Point, St. Mary's County, Maryland. The name was extended (Rasmussen and others, 1957, p. 61-67) to include a similar unit on the eastern shore of Maryland. The sediments penetrated by a deep well at Atlantic City, New Jersey, were tentatively assigned the name Piney Point Formation by Parker and others (1964, p. 60). The total thickness of the Piney Point Formation at Atlantic City is 290 feet (Parker and others, 1964).

Interpretation of geophysical and geologic logs suggests that the Ancora State Hospital well 3 (WI 37) may penetrate about 35 feet of sand which may be part of the Piney Point(?) Formation. This interpretation is based on stratigraphic correlation study conducted primarily in Cumberland County on the Piney Point aquifer by Nemickas and Carswell (written commun., 1974). The Piney Point aquifer in their study was extended from the Cumberland County area to the New Brooklyn Park wells. Data from the New Brooklyn Park well (WI 27) in Winslow Township in the southern part of Camden County suggests the presence of about 35 feet of sand that may be the extension of the Piney Point aquifer. In the central part of Camden County the Piney Point sand probably pinches out or is truncated by the overlying Kirkwood Formation. Figure 5 shows stratigraphic section (C-C') from Ancora State Hospital well 3 (WI 37) to the Gino's Restaurant well 1 (WA 12) showing the pinching out of the Piney Point sand. Geophysical data indicate that the Piney Point sand is present in Winslow Township in Camden County but would probably be less than 40 feet thick.

Tertiary System, Miocene Series

Kirkwood Formation

Geology

The Kirkwood Formation of Miocene age crops out in an irregular northeasterly-trending belt southeast of the outcrop area of the Hornerstown Sand (fig. 4). The outcrop area of the Kirkwood Formation in Camden County is approximately 18.9 square miles. The formation dips 15 to 25 feet per mile to the southeast and ranges in thickness from 57 feet in Voorhees Township to 96 feet in Gloucester Township. The thickness map of the Kirkwood Formation in Camden County is shown in figure 46. The Kirkwood Formation in Camden County rests

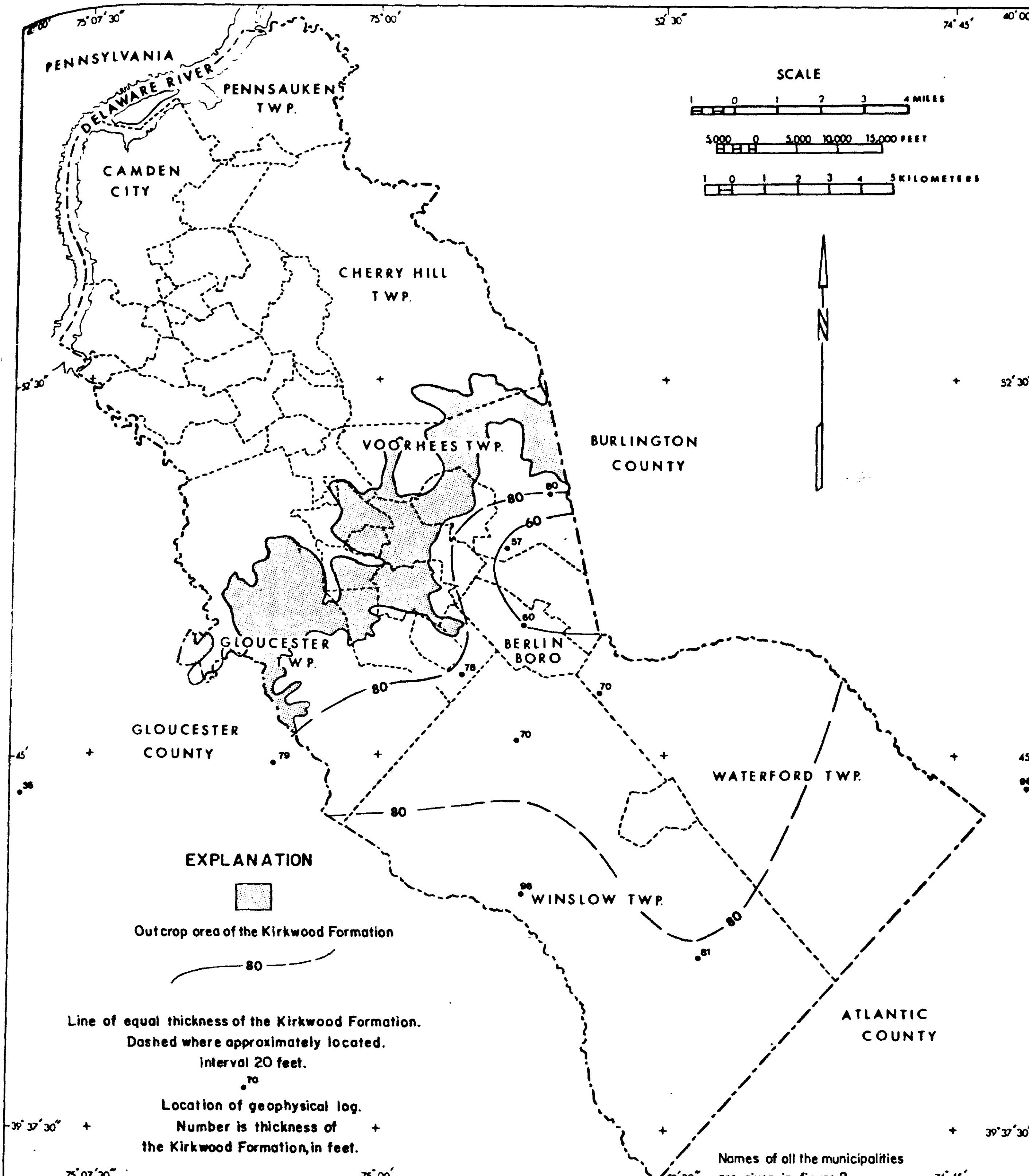


Figure 46. — Thickness map of the Kirkwood Formation in Camden County.

unconformably on the Hornerstown Sand in the outcrop area and on the Manasquan Formation in the subsurface. The structure contour maps of the base and the top of the Kirkwood Formation in Camden County (figs. 47 and 48) are based on the interpretation of geophysical and geologic logs. The Cohansey Sand unconformably overlaps the Kirkwood Formation in Camden County.

The Kirkwood Formation consists chiefly of sand, silt, and clay; dark gray where unaltered; light gray, yellowish- and grayish-orange to grayish-yellow, light red to moderate reddish-brown, and moderate to dusky yellow and yellowish-gray where weathered (Minard, 1965). The lower part of the formation is mostly thick bedded, very fine to fine-grained sand, and is typically micaceous. The basal 2 to 4 feet consists of poor to moderately sorted pebbly coarse sand with abundant glauconite. The upper part of the formation is interbedded poorly sorted silt and clay. Quartz is the dominant sand-size constituent throughout the formation; feldspar and mica (mostly muscovite) are less common (Minard, 1965). Carbonaceous matter is abundant in the basal dark-gray beds. The Kirkwood Formation unconformably overlies the Hornerstown Sand on the surface in Camden County and the Manasquan Formation in the subsurface. Particle-size analyses of samples from the New Brooklyn Park well (WI 27) in Winslow Township Atsion well 1 (SH 1) in Burlington County are listed in tables 5 and 13.

Hydrology

The Kirkwood Formation is not being utilized for water supply in Camden County. The overlying Cohansey Sand is preferred for water supply because of its shallower depth. Recharge to the Kirkwood takes place principally in upland areas by percolation into the formation from the overlying Cohansey Sand. Ground-water movement is probably toward the lowland areas where the water is discharged mostly to streams.

The Kirkwood Formation is of hydrologic importance in Camden County because its large surface area absorbs precipitation that is partly transmitted to deeper aquifers. Porosity and hydraulic conductivity values of samples from the New Brooklyn Park well (WI 27) in Winslow Township and Atsion well 1 (SH 1) in Burlington County are listed in tables 5 and 13.

The Kirkwood Formation can be developed as a source of water in the southern part of Camden County. Just southeast of

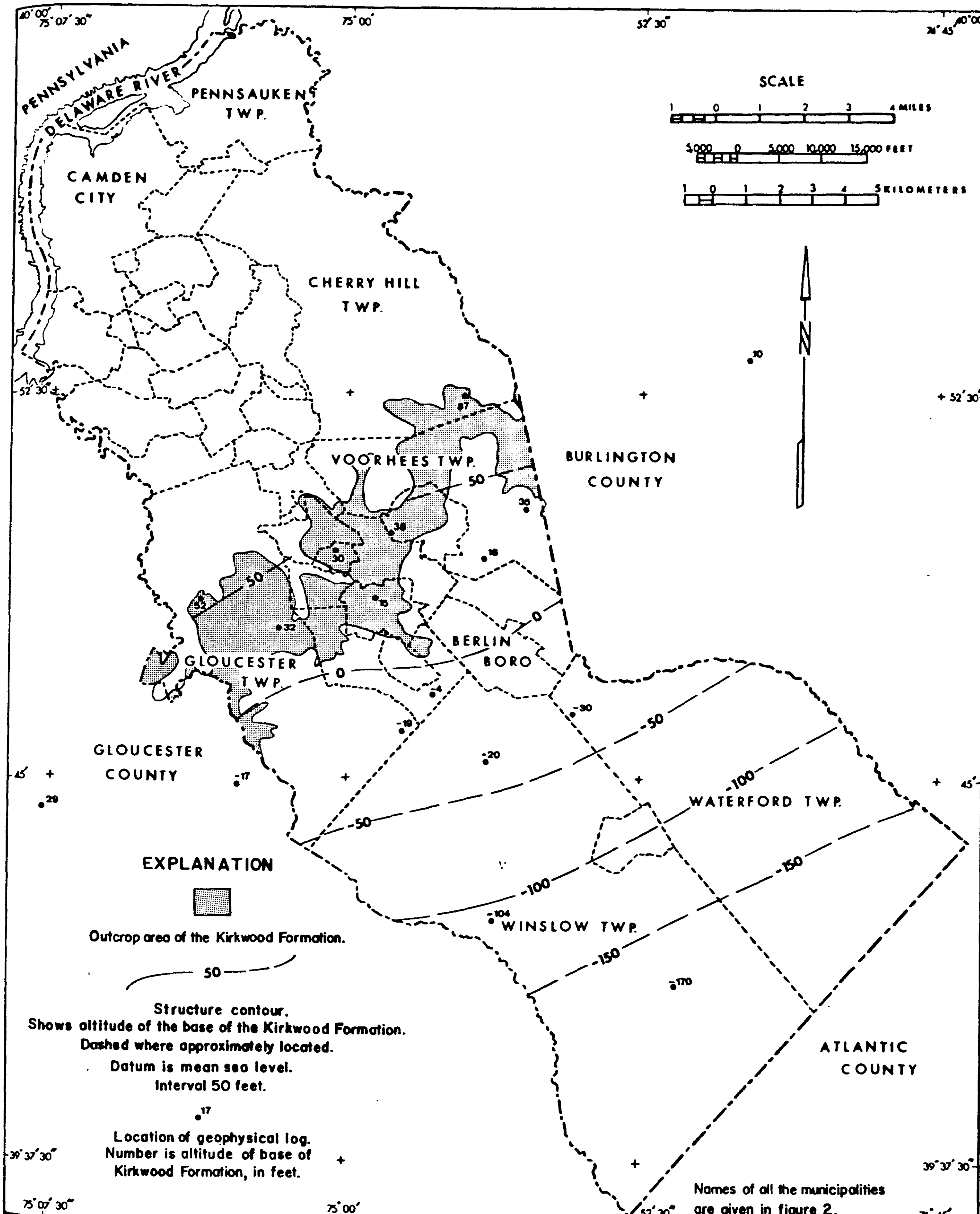


Figure 47. — Structure contour map of the base of the Kirkwood Formation in Camden County.

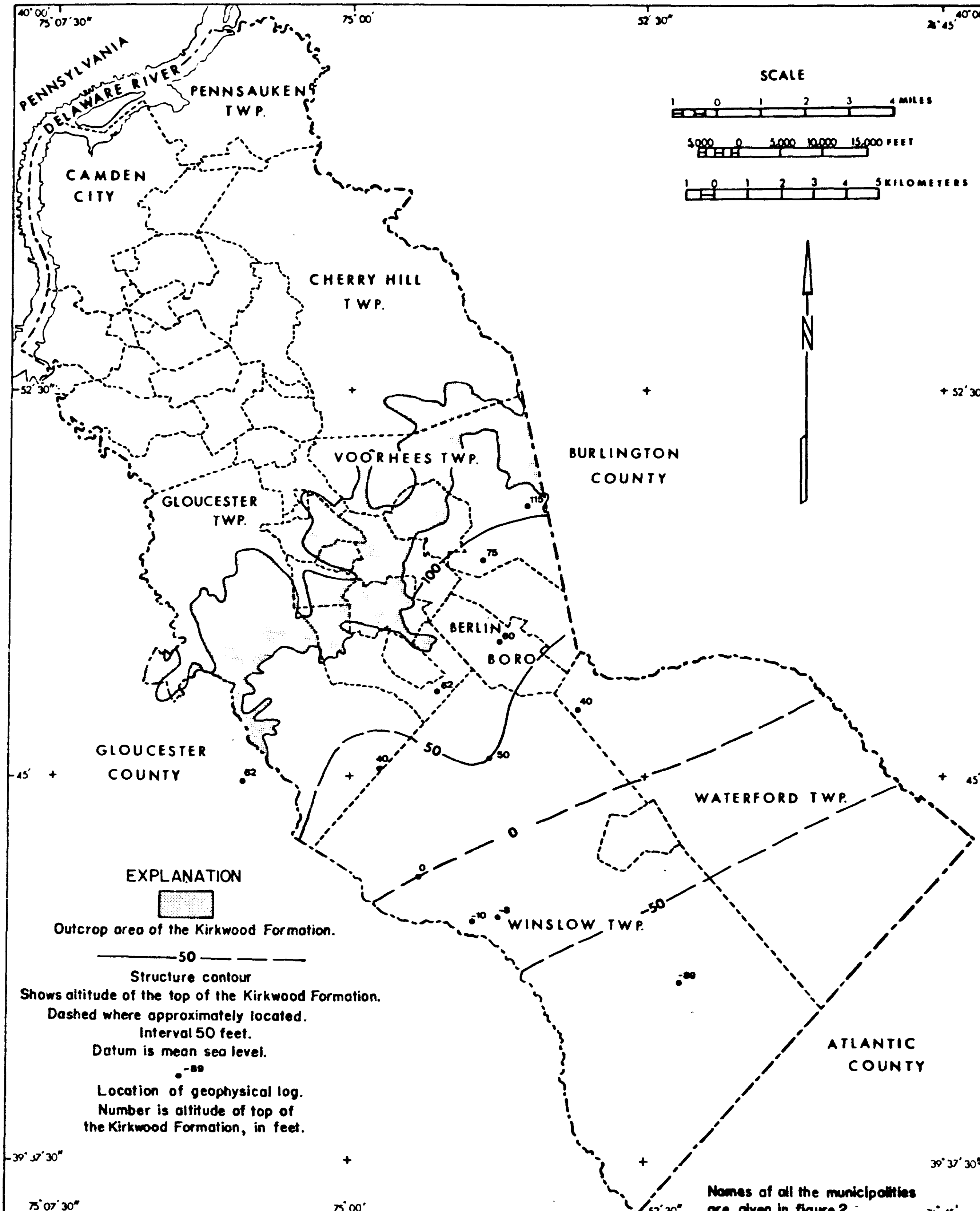


Figure 48. — Structure contour map of the top of the Kirkwood Formation in Camden County.

the Camden County line in Atlantic County yields from wells in the Kirkwood are as high as 700 gpm (Clark and others, 1968). In the outcrop area of the Kirkwood in central Camden County it has been found desirable to drill to the Wenonah Formation and Mount Laurel Sand because the Kirkwood has poor water-transmitting characteristics.

Quality of Water

One chemical analysis of water is available from the Kirkwood Formation in Camden County. The analysis, from the New Brooklyn Park well 4 (WI 30), indicates an iron concentration of 6.0 mg/l and dissolved solids of 136 mg/l. In adjacent Burlington County, analyses from eight wells indicate generally good chemical quality; however, some analyses showed high iron concentrations, ranging from 0.02 to 2.9 mg/l. The water is generally very soft (2 to 94 mg/l) and the dissolved solids are low, ranging from 13 to 125 mg/l.

In Atlantic County (Clark and others, 1968) analyses of water samples from seven wells located 1 to 8 miles from the Camden County line indicate some objectionable chemical characteristics. Iron concentrations range from 0.13 to 4.6 mg/l. Six of the seven samples are above the limit set in the State's Potable Water Standards. Dissolved solids range from 51 to 98 mg/l. Hardness of the seven samples ranges from 9 to 28 mg/l and pH from 5.0 to 7.4.

Tertiary System, Miocene(?) and Pliocene(?) Series

Cohansey Sand and Younger Sediments

Geology

The Cohansey Sand was named and defined by Ries, Kümmel, and Knapp (1904, p. 139). It crops out in all of the southeastern half of Camden County (fig. 4). The outcrop area in Camden County is approximately 124 square miles or about 55 percent of the total county area. The Cohansey Sand rests unconformably on the Kirkwood Formation and is unconformably overlain by the Bridgeton Formation of Pleistocene age.

The structure contour map of the top of the Kirkwood Formation in Camden County, shown in figure 48, also delineates the base of the Cohansey Sand. The Cohansey Sand strikes in a northeasterly direction and dips from 10 to 20 feet per mile to the southeast. The steeper dips, in general, are encountered to the southeast. The estimated thickness of the Cohansey Sand ranges from 0 to 140 feet. The saturated thickness of the Cohansey Sand and the overlying younger sediments ranges from 0 to 190 feet as shown on figure 49 which is based on interpretation of geophysical and geologic logs and water-level measurements (1951 to 1969).

The Cohansey Sand in Camden County consists chiefly of yellowish-orange, fine- to coarse-grained quartzose sand and fine gravel. The sand also contains lenses of silt and clay which are as much as 30 feet thick. The average grain size of the materials decreases southeastward; beds of silt and clay become thicker, more numerous, and more extensive to the southeast. Mechanical analysis of samples from the New Brooklyn Park well (WI 27) in Winslow Township, Camden County, and Atsion well (SH 1) in Burlington County are given in tables 5 and 13.

The Cohansey Sand was derived in part from older sedimentary rocks and from deeply weathered crystalline rocks of the New Jersey Highlands. Sedimentary rocks of Paleozoic age, as indicated by fossiliferous chert pebbles, were incorporated into the Cohansey Sand. The almost complete absence of glauconite in the Cohansey Sand indicates that the older marine Coastal Plain sediments (pre-Kirkwood) were not a major contributing source of sediments. These older glauconitic sediments were either covered by the Kirkwood Formation or the sediments were being transported by longshore currents from the north. The clearness and angularity of most of the quartz grains and the absence of amphiboles, pyroxene, and feldspars indicate a deeply weathered crystalline source. The absence of fossils and the lack of glauconite in the Cohansey Sand indicate a non-marine environment. "Cross-bedding, local cut and fill structures, and heterogenity of grain size suggest an active stream environment on an extensive alluvial plain in the inland deposits" (Markewicz, 1969, p. 368-369). Its coarse texture, poor sorting, and cross-bedding fit this interpretation. However, Owens and Minard (1960, p. 27) discount this hypothesis on the grounds that the formation is too widespread. They favor a hypothesis of beach deposition. Rhodehamel (oral communication, 1970) interprets the Cohansey Sand as a deltaic deposit.

Hydrology

The Cohansey Sand is one of the important aquifers in

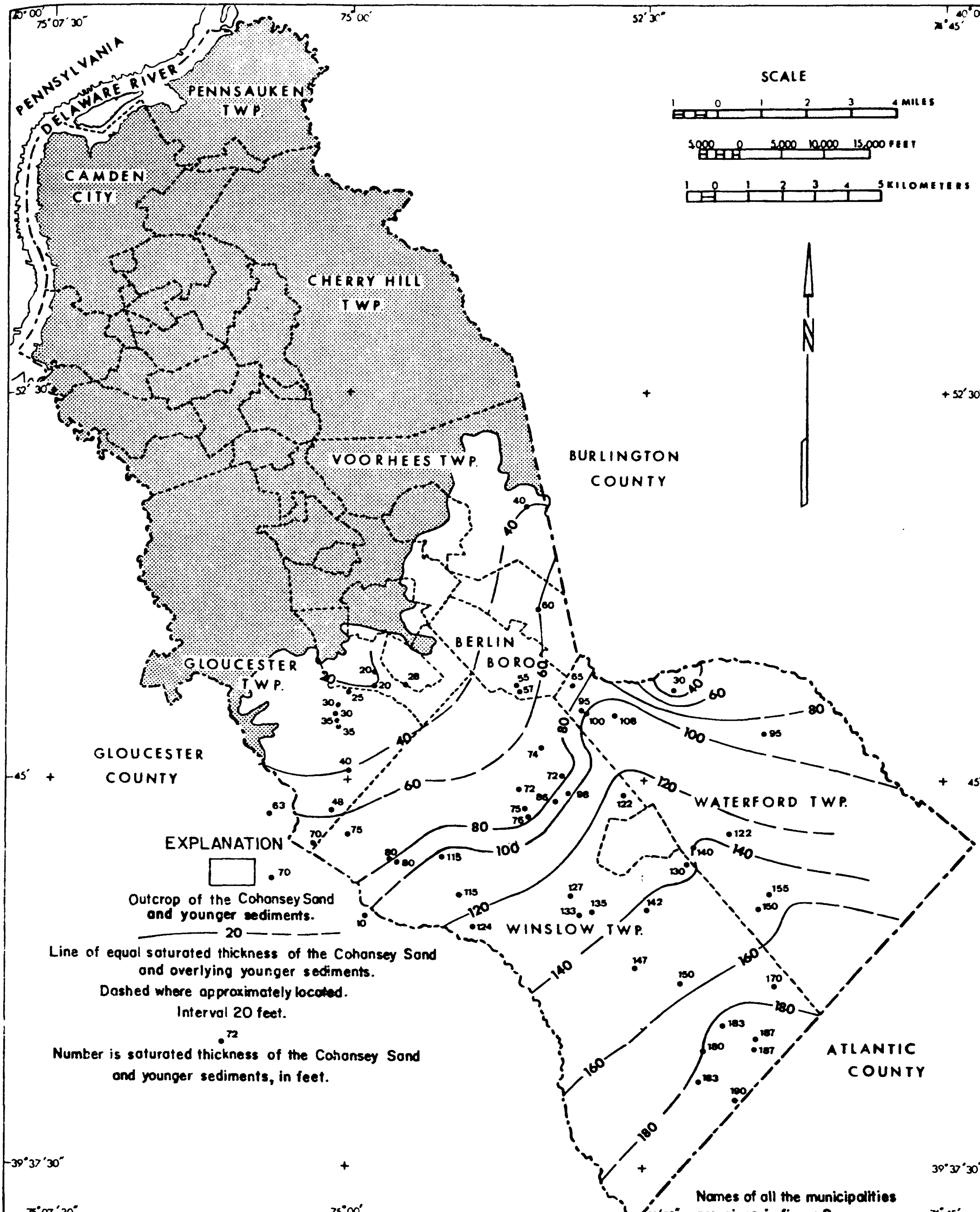


Figure 49. — Saturated thickness of the Cohansey Sand and overlying younger sediments in Camden County.

Camden County. The Cohansey Sand and the overlying younger material consist of as much as 190 feet of saturated sediments of high porosity and permeability. It is virtually untapped by wells and has an excellent potential for water development in the southeastern part of the county. The Cohansey Sand in many areas is hydraulically connected with the underlying Kirkwood Formation. There are no extensive confining beds overlying it, but clay lenses commonly cause local perched water-table conditions. However, most of the formation in Camden County is under water-table conditions.

Water enters the aquifer directly from precipitation and moves toward low-level areas where it is ultimately discharged into streams. The generalized water-table map of the Cohansey Sand and overlying sediments (fig. 50) is a subdued replica of the topography (fig. 3).

In Camden County the Cohansey Sand is tapped mostly by domestic and irrigation wells. Relatively few industrial and public-supply wells draw water from the Cohansey Sand as yet because of the rural nature of the area. Berlin Water Department well 5 (BB 4) yields 365 gpm. The other large diameter wells that draw water from the Cohansey Sand are located in Winslow Township. Water-yield data are given below.

Map Number	Owner	Well Number	Yield (gpm)	Specific Capacity (gpm/ft of drawdown)
WI 36	Ancora State Hospital	4	708	9.1
WI 35	Do.	5	502	8.4
WI 12	Certain-teed Saint Gobin	1	524	12.1
WI 11	Do.	2	510	19.6
WI 42	M. and R. Refractory Metals	-	377	10
WI 19	Winslow Water Company	Prod. 1	1,000	35
WI 14	Do.	Prod. 2	1,000	25.6

Aquifer tests on wells in the Cohansey have been conducted in Camden, Atlantic, Cape May, and Cumberland Counties. In these tests the aquifer was not completely penetrated and was partially confined beneath clay layers. The storage coefficient ranged from 2.7×10^{-3} to 4×10^{-5}. Computed transmissivity, which did not represent the total thickness of the Cohansey Sand, ranged from 2,410 to 20,100 ft^2/day (18,000 to 150,000 gpd/ft). Computed hydraulic

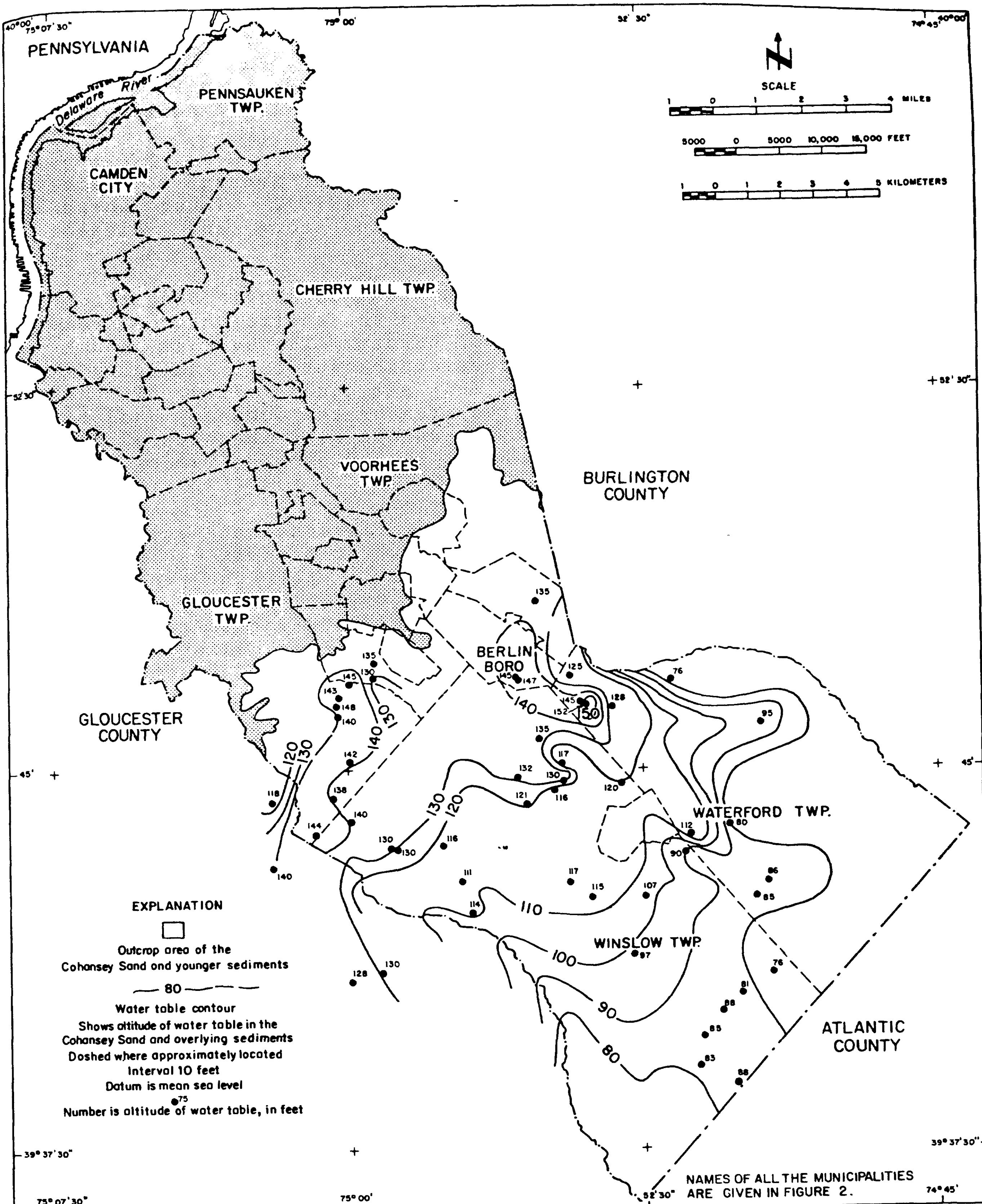


Figure 50. — Generalized water-table surface of the Cohansey Sand and overlying younger sediments in Camden County.

conductivities range from 64 to 442 ft/day (480 to 3,300 gpd/ft^2), but typically range from 100 to 134 ft/day (750 to 1,000 gpd/ft^2) (Rhodehamel, 1972). Porosity and hydraulic conductivity values of samples from the New Brooklyn Park well (WI 27) and of samples from Atsion well (SH 1) in Burlington County are given in tables 5 and 13.

The Cohansey Sand has an estimated average specific yield of about 21 percent (Rhodehamel, 1970). Thus, where sufficiently thick, the Cohansey Sand can store and release substantial quantities of water.

Rhodehamel (1970) evaluated the hydrologic budget for the Pine Barrens region which includes the entire outcrop area of the Cohansey Sand in Camden County. The average annual stream runoff, measured as inches depth over the Pine Barrens region, was 22.5 inches (1.07 mgd per square mile). If the same value is used for the outcrop area of the Cohansey Sand in Camden County, the 22.5 inches of runoff over the area of 124 square miles is equivalent to about 130 mgd average runoff from the Cohansey Sand in Camden County.

The Cohansey Sand is capable of extensive development as a source of water in Camden County. At present the amount of water withdrawn is small compared to the quantity potentially available. Locally, there may be more than one water-bearing zone present; however, the formation is generally regarded as a hydrologic unit. Large diameter wells (12 or more inches in diameter) can continuously yield 500 to 1,000 gpm of water. A well pumping at a rate of about 700 gpm will produce 1 mgd--enough water for many moderate-sized industries (Rhodehamel, 1966). Development of the water resources could be achieved by a number of ways. One way mentioned by Rhodehamel (1970) is to locate high-yielding wells adjacent to the downstream reaches of major streams thus inducing recharge. Additional wells could be located farther from the stream for use during prolonged low-flow periods.

Reported industrial and institutional withdrawals from the Cohansey Sand in Camden County for 1966 amounted to 0.45 mgd. No public-supply pumpage was reported from the Cohansey Sand in 1966. Annual average use of water for irrigation in Camden County was estimated to be 10 mgd shown below (Asghar Hasan, 1970, New Jersey Division of Water Resources, written commun.).

IRRIGATIONAL DEMAND FOR THE GROWING SEASON
(JUNE-AUG.) FOR CAMDEN COUNTY
(Based on 1966 Controlling Year)
(Hasan, 1970, written communication)

FARMS				GOLF COURSES AND RECREATIONAL, ETC.				TOTAL			
Irrigated (acres)	Rate of Delivery (in/wk)	Water Delivered (mg)	Seasonal Average (mgd)	Irrigated (acres)	Rate of Delivery (in/wk)	Water Delivered (mg)	Seasonal Average (mgd)	Irrigated (acres)	Water Delivered (mg)	Seasonal Average (mgd)	Annual Average (mgd)
5,000	1.3	2,294	25	3,048	1.37	1,475	16	8,048	3,769	41	10

Quality of Water

Chemical analyses of eight samples from wells in the Cohansey Sand and Pleistocene sediments are listed in table 4; the well locations are shown in figure 2. The summary of the analyses (table 14) indicate that water in the Cohansey Sand in Camden County has some objectionable chemical and physical characteristics, such as low pH, high iron concentration, and undesirable color; but, in general, it is suitable for man's use after treatment. The water in the Cohansey is low in dissolved-solids content, ranging from 13 to 125 mg/l in Camden County. Hardness of the water is generally less than 25 mg/l. The pH ranges from 5.3 to 8.4. In areas of low pH the water is corrosive and readily dissolves iron from the minerals in the soil and underlying sediments. Concentrations of iron range from less than 0.1 mg/l to 3.8 mg/l.

Quaternary System, Pleistocene Series

The Pleistocene Series consists of the Bridgeton, Pensauken, and Cape May Formations. These formations have similar geohydrologic characteristics and cap the older sediments in Camden County. They are normally thin, usually less than 40 feet thick.

The mode of deposition of the Pleistocene formations differs markedly from most of the older Coastal Plain formations. Most of the evidence suggests that the Pleistocene sediments are primarily stream deposits (Owens and Minard, 1960, p. 28). Where these formations overlie aquifers the recharge they receive from precipitation is transmitted downward to the underlying aquifers.

Bridgeton Formation

The Bridgeton Formation occurs as isolated patches on topographic highs. It unconformably overlies the Cohansey Sand and the Kirkwood Formation and is connected hydraulically with them. The thickness of the formation ranges from a few feet to about 30 feet in Camden County.

The Bridgeton Formation consists of fine to very coarse quartzose sand and gravel. Mechanical analysis of a sample collected 2 miles northeast of Mullica Hill in Gloucester County contains more than 95 percent medium- to very coarse-grained sand. The sand is white to brown in color and usually is fairly well sorted and subangular (Hart and Hilton, 1969, p. 30-31).

Pensauken Formation

The Pensauken Formation crops out in isolated and irregular patches in the northcentral part of Camden County and near the Delaware River. The geohydrologic characteristics of the Pensauken Formation are similar to those of the Bridgeton Formation. The Pensauken Formation ranges in thickness from a few feet to 30 feet in Camden County.

The formation consists of medium- to coarse-grained quartzose sand, gravel, and clay. The sand is generally poorly sorted, subangular, and with color ranging from yellow to brown. Because the lithologies of the Pensauken Formation and the older Bridgeton Formation are similar it is difficult to differentiate the two formations.

Cape May Formation

The Cape May Formation occurs adjacent to the Delaware River and tributary streams. The outcrop area is fairly flat and precipitation infiltrates easily through the formation into the underlying Raritan and Magothy Formations. The Cape May Formation ranges in thickness from a few feet to 40 feet in Camden County. The hydrology of the Cape May Formation is discussed with the Potomac-Raritan-Magothy aquifer system, because where both are present they are hydraulically connected.

The Cape May Formation consists of medium- to coarse-grained quartzose sand, gravel, and clay. The sand and gravel is usually yellow to brown to gray in color. The clays are yellow, brown, gray, and black. The Cape May is commonly poorly sorted, and the sand grains are subangular. In some areas it is difficult to distinguish the Cape May Formation from the Pensauken Formation because of similar lithologies.

Quaternary System, Holocene Series

Eolian Deposits

Windblown deposits occur locally and are generally thin in Camden County. They are light gray, well sorted quartz sands that have been rounded by wind action. Due to the high permeability of the eolian deposits water percolates through the sands into the underlying aquifers.

Alluvium

The alluvium is a mixture of clay, silt, organic material, sand, and gravel deposited in tidal flats and low-gradient stream channels. Most of the alluvial material consists of fine silt and clay of relatively low permeability. The alluvial deposits retard brackish water from the Delaware River from entering the water-bearing sands of the Potomac-Raritan-Magothy aquifer system where the water levels in this aquifer are below the river level.

SUMMARY AND CONCLUSIONS

Nearly all of the water supplies of Camden County are derived from ground-water sources. The average annual ground-water use of approximately 68 mgd in Camden County during 1966 was the largest county use in the State.

The major fresh-water aquifers are in the unconsolidated sediments of Cretaceous and Tertiary age. The largest producer is the Potomac-Raritan-Magothy aquifer system. In 1966 almost 56 mgd was withdrawn from this aquifer system which was approximately 85 percent of the total pumpage in the county. Other aquifers yielding large amounts of water were the aquifers in the Cohansey Sand, the Wenonah Formation and Mount Laurel Sand, and the Englishtown Formation. The Cohansey Sand is the only water-table aquifer producing significant amounts of water.

The artesian aquifers have had declines in the potentiometric surface due to pumping. The largest decline occurred in the Potomac-Raritan-Magothy aquifer system. The head decline at Haddon Heights from 1900 to 1968 has been over 110 feet. The decline in the potentiometric surface in the aquifer in the Wenonah Formation and Mount Laurel Sand has been about 43 feet at Berlin.

The quality of ground water is generally good; however, there are some exceptions. High iron concentrations (in excess of 0.3 mg/l) are found in some areas of the Potomac-Raritan-Magothy aquifer system, at scattered locations in the Wenonah Formation and Mount Laurel Sand aquifer, and in the Cohansey Sand. In the southeastern part of the county a fresh water-salt water interface exists in the Potomac-Raritan-Magothy aquifer system. Overdevelopment in this area may cause the water to move updip or move upward by vertical coning. There also exists a potential salt-water encroachment of the Potomac-Raritan-Magothy aquifer system in the vicinity of the Delaware River. Previous investigations have shown a hydraulic connection of the upper sands and gravels with the Delaware River. If the Delaware River in the vicinity of Camden sustains high chloride levels for an extended period of time, heavy withdrawals from along the river may induce the high-chloride water into the aquifer system.

Contamination of ground water in Philadelphia has created a potential water-quality problem for the Camden area near the Delaware River. High concentrations of sulfate (in excess of 250 mg/l) and dissolved solids (in excess of 500 mg/l) in water in the Potomac-Raritan-Magothy aquifer system underlying Philadelphia are moving under the Delaware River toward the Texas Company's Eagle Point Plant in Gloucester County near the Camden County line.

Camden County has an abundant supply of ground water. The Potomac-Raritan-Magothy aquifer system will probably remain the largest source for many years. The Cohansey Sand is capable of extensive development in Camden County. Additional supplies of water can be obtained from the aquifers in the Wenonah Formation-Mount Laurel Sand and the Englishtown Formation in parts of Camden County. The Kirkwood Formation, presently untapped in Camden County, can yield an additional supply of water under artesian conditions mainly in the area near the Atlantic County line.

SELECTED REFERENCES

Allen, J. R. L., 1965, Late Quaternary Niger delta and adjacent areas--sedimentary environments and lithofacies: Am. Assoc. Petroleum Geologists Bull., v. 49, p. 547-600.

Anderson, H. R., and Appel, C. A., 1969, Geology and ground-water resources of Ocean County, New Jersey: New Jersey Dept. Conserv. and Econ. Devel., Div. Water Policy and Supply, Spec. Rept. 29, 93 p.

Barksdale, H. C., 1952, Ground water in the New Jersey Pine Barrens area, in The Pine Barrens of New Jersey, a symposium: Bartonia, no. 26, p. 36-38.

Barksdale, H. C., and Graham, J. B., 1952, Progress of the investigation of the ground-water resources of the Lower Delaware River valley: U. S. Geol. Survey open-file report.

Barksdale, H. C., Greenman, D. W., Lang, S. M., Hilton, G. S., and Outlaw, D. E., 1958, Ground-water resources in the tri-state region adjacent to the lower Delaware River: New Jersey Dept. Conserv. and Econ. Devel., Div. Water Policy and Supply, Spec. Rept. 13, 190 p.

Barksdale, H. C., Johnson, M. E., Baker, R. C., Schaefer, E. J., and DeBuchananne, G. D., 1943, The ground-water supplies of Middlesex County, New Jersey: New Jersey Water Policy Comm. Spec. Rept. 8, 160 p.

Barksdale, H. C., and Jones, P. H., 1953, Availability of ground water in Lower Delaware basin: Pennsylvania Dept. Internal Affairs Bull., v. 21, no. 2, p. 3-10, 26.

Barksdale, H. C., and Lang, S. M., 1955, Ground water in the Delaware River valley: Am. Soc. Civil Eng. Proc., v. 81, Separate No. 593.

Bascom, Florence, 1904, Water resources of the Philadelphia district: U. S. Geol. Survey Water-Supply Paper 106, 75 p.

Bascom, Florence, Clark, W. D., Darton, N. H., Kümmel, H. B., Salisbury, R. D., Miller, B. L., and Knapp, G. N., 1909, Description of the Philadelphia district [Pennsylvania-New Jersey-Delaware]: U. S. Geol. Survey Geol. Atlas, Folio 162, 24 p.

Berry, E. W., 1906, The Flora of the Cliffwood clays: New Jersey Geol. Survey Ann. Rept. 1905, p. 135-172.

__________ 1911, The Flora of the Raritan Formation: New Jersey Geol. Survey Bull. 3, 233 p.

Brenner, G. J., 1963, The spores and pollen of the Potomac Group: Maryland Dept. Geology, Mines and Water Resources Bull. 27, 215 p.

Clark, G. A., Meisler, Harold, Rhodehamel, E. C., and Gill, H. E., 1968, Summary of ground-water resources of Atlantic County, New Jersey with special reference to public water supplies: New Jersey Dept. Conserv. and Econ. Devel., Div. Water Policy and Supply, Water Resources Circ. 18, 53 p.

Dames and Moore, 1968, Report ground water supply proposed nuclear generating station near Salem, New Jersey: Public Service Electric and Gas Company, 18 p.

Davis, G. H., Small, J. B., and Counts, H. B., 1963, Land subsidence related to decline of artesian pressure in Ocala Limestone at Savannah, Georgia, in Trask, P. D. and Kiersch, G. A., eds., Engineering geology case histories, no. 4: Geol. Soc. America, 57 p.

Donsky, Ellis, 1963, Records of wells and ground-water quality in Camden County, New Jersey: New Jersey Dept. Conserv. and Econ. Devel., Div. Water Policy and Supply, Water Resources Circ. 10, 70 p.

Dorf, Erling, and Fox, S. K., 1957, Cretaceous and Cenozoic of the New Jersey Coastal Plain, in Dorf, Erling, ed., Guidebook for field trips, Atlantic City meetings: Geol. Soc. America, 1957, p. 3-27.

Doyle, J. A., 1969, Cretaceous angiosperm pollen of the Atlantic Coastal Plain and its evolutionary significance: Jour. Arnold Arboretun 50 (1), 35 p.

Ferris, J. B., Knowles, D. B., Brown, R. H., and Stallman, R. W., 1962, Theory of aquifer tests: U. S. Geol. Survey Water-Supply Paper 1536-E, 174 p.

Fisher, W. L., and McGowen, J. H., 1969, Depositional systems in Wilcox Group (Eocene) of Texas and their relation to occurrence of oil and gas: Am. Assoc. Petroleum Geologists Bull., v. 53, p. 30-54.

Gallaher, J. E., and Price, W. E., Jr., 1966, Hydrology of the Alluvial Deposits in the Ohio River Valley in Kentucky: U. S. Geol. Survey Water-Supply Paper 1818, 80 p.

Gill, H. E., Seaber, P. R., Vecchioli, John, and Anderson, H. R., 1963, Evaluation of geologic and hydrologic data from the test-drilling program at Island Beach State Park, New Jersey: New Jersey Dept. Conserv. and Econ. Devel., Div. Water Policy and Supply, Water Resources Circ. 12, 25 p.

Graham, J. B., and Kammerer, J. C., 1954, Ground-water resources of the U. S. Naval Base, Philadelphia, Pa.: U. S. Geol. Survey open-file report, 137 p.

Greenman, D. W., Rima, D. R., Lockwood, W. N., and Meisler, Harold, 1961, Ground-water resources of the Coastal Plain area of southeastern Pennsylvania: Pennsylvania Geol. Survey Bull., 4th ser., W 13, 375 p.

Hantush, M. S., 1960, Modification of the theory of leaky aquifers: Jour. Geophys. Research, v. 65, no. 11, p. 3713-3725.

Hardt, W. F., 1963, Public water supplies in Gloucester County, New Jersey: New Jersey Dept. Conserv. and Econ. Devel., Div. Water Policy and Supply, Water Resources Circ. 9, 55 p.

Hardt, W. F., and Hilton, G. S., 1969, Water resources and geology of Gloucester County, New Jersey: New Jersey Dept. Conserv. and Econ. Devel., Div. Water Policy and Supply, Spec. Rept. 30, 130 p.

Hely, A. G., Nordenson, T. J., and others, 1961, Precipitation, water loss, and runoff in the Delaware River basin and New Jersey: U. S. Geol. Survey Hydrol. Inv. Atlas HA-11, 11 p.

Hem, J. D., 1970, Study and interpretation of the chemical characteristics of natural waters [2d ed.]: U. S. Geol. Survey Water-Supply Paper 1473, 363 p.

Herrick, S. M., 1962, Marginal sea of middle Eocene age in New Jersey, in Short papers in geology, hydrology, and topography: U. S. Geol. Survey Prof. Paper 450-B, p. B56-B58.

Hurr, R. T., 1966, A new approach for estimating transmissibility from specific capacity: Water Resources Research, v. 2, no. 4, p. 657-664.

Jablonski, L. A., 1968, Ground-water resources of Monmouth County, New Jersey: New Jersey Dept. Conserv. and Econ. Devel., Div. Water Policy and Supply, Spec. Rept. 23, 117 p.

Keighton, W. B., 1969, Water quality in the Delaware Estuary for two years of drought: 1965 and 1966 from Trenton, New Jersey to Reedy Island, Delaware: U. S. Geol. Survey Hydrol. Inv. Atlas HA-335.

Lang, S. M., 1961, Natural movement of ground water at a site on the Mullica River in Wharton Tract, southern New Jersey, in Short papers in the geologic and hydrologic sciences: U. S. Geol. Survey Prof. Paper 424-D, p. D52-D54.

Lang, S. M., and Rhodehamel, E. C., 1962, Movement of ground water beneath the bed of the Mullica River in the Wharton Tract, southern New Jersey, in Short papers in geology, hydrology, and topography: U. S. Geol. Survey Prof. Paper 450-B, p. B90-B92.

Langmuir, Donald, 1969a, Iron in ground waters of the Magothy and Raritan Formations in Camden and Burlington counties, New Jersey: New Jersey Dept. Conserv. and Econ. Devel., Div. Water Policy and Supply, Water Resources Circ. 19, 49 p.

__________ 1969b, Geochemistry of iron in a coastal-plain ground water of the Camden, New Jersey, area: U. S. Geol. Survey Prof. Paper 650-C, p. C224-235.

Lohman, S. W., and others, 1972, Definitions of selected ground-water terms--revisions and conceptual refinements: U. S. Geol. Survey Water Supply Paper 1988, 21 p.

Marine, I. W., and Rasmussen, W. C., 1955, Preliminary report on the geology and ground-water resources of Delaware: Delaware Geol. Survey Bull. 4, 335 p.

Markewicz, J. F., 1969, Ilmenite deposits of the New Jersey

Coastal Plain, in Subitzky, Seymour, ed., Geology of selected areas in New Jersey and eastern Pennsylvania: New Jersey, Rutgers Univ. Press, p. 363-382.

Minard, J. P., 1964, Geology of the Roosevelt quadrangle, New Jersey: U. S. Geol. Survey Geol. Quad. Map GQ-340.

__________ 1965, Geologic map of the Woodstown quadrangle Gloucester and Salem counties, New Jersey: U. S. Geol. Survey Geol. Quad. Map GQ-404.

Minard, J. P., and Owens, J. P., 1960 Differential subsidence of the southern part of the New Jersey coastal plain since early Late Cretaceous time: U. S. Geol. Survey Prof. Paper 400-B, art. 82, p. B184-B186.

Minard, J. P., and Owens, J. P., 1962, Pre-Quaternary geology of the New Egypt quadrangle, New Jersey: U. S. Geol. Survey Geol. Quad. Map GQ-161.

Minard, J. P., Owens, J. P., and Nichols, T. C., 1964, Pre-Quaternary geology of the Mount Holly quadrangle, New Jersey: U. S. Geol. Survey Geol. Quad. Map GQ-272.

Minard, J. P., Owens, J. P., and Todd, Ruth, 1961, Redefinition of the Mount Laurel Sand (Upper Cretaceous) in New Jersey: U. S. Geol. Survey Prof. Paper 424-C, p. C64-C67.

New Jersey State Department of Environmental Protection, 1970, Potable water standards: New Jersey Dept. Environ. Prot., 6 p.

Ogorsky, H. O., and Mockus, Victor, 1964, Hydrology of agricultural lands, in Ven Te Chow, ed., Handbook of applied hydrology, 1964: New York, McGraw-Hill Book Co., p. 21-1 - 21-95.

Otton, E. G., 1955, Ground-water resources of the southern Maryland Coastal Plain: Maryland Dept. Geology, Mines and Water Resources Bull. 15, 347 p.

Owens, J. P., and Minard, J. P., 1960, The geology of the northcentral part of the New Jersey Coastal Plain: Johns Hopkins Univ. Studies in Geology no. 18, 31 p.

__________ 1962, Pre-Quaternary geology of the Columbus quadrangle, New Jersey: U. S. Geol. Survey Geol. Quad. Map GQ-160.

__________ 1964a, Pre-Quaternary geology of the Pemberton quadrangle, New Jersey: U. S. Geol. Survey Geol. Quad. Map GQ-262.

Owens, J. P., and Minard, J. P., 1964b, Pre-Quaternary geology of the Trenton East quadrangle, New Jersey-Pennsylvania: U. S. Geol. Survey Geol. Quad. Map GQ-341.

__________ 1964c, Pre-Quaternary geology of the Bristol quadrangle, New Jersey-Pennsylvania: U. S. Geol. Survey Geol. Quad. Map GQ-342.

__________ 1966, Pre-Quaternary geology of the Allentown quadrangle, New Jersey: U. S. Geol. Survey Geol. Quad. Map GQ-566.

Owens, J. P., Minard, J. P., and Sohl, N. F., 1968, Cretaceous deltas in the northern New Jersey Coastal Plain, in Finks, R. L., ed., Guidebook to field excursions at the 40th Annual Meeting of the New York State Geological Association: New York, Queens College of the City Univ., p. 33-48.

Owens, J. P., and Sohl, N. F., 1969, Shelf and deltaic paleoenvironments in the Cretaceous-Tertiary Formations of the New Jersey Coastal Plain, in Subitzky, Seymour, ed., Geology of the selected areas in New Jersey and eastern Pennsylvania and guidebook of excursions: Geol. Soc. America and Associated Societies, Nov. 1969, Ann. Mtg., Atlantic City, N. J., New Brunswick, N. J., Rutgers Univ. Press, p. 235-278.

Parker, G. G., Hely, A. G., Keighton, W. B., and Olmsted, F. H., 1964, Water resources of the Delaware River basin: U. S. Geol. Survey Prof. Paper 381, 200 p.

Powell, S. T., Leggette, R. M., and Brashears, M. L., Jr., 1954, Report on the effect of ship channel enlargement, above Philadelphia: Prepared for the Committee for Study of the Delaware River, 37 p.

Rainwater, F. H., and Thatcher, L. L., 1960, Methods for collection and analysis of water samples: U. S. Geol. Survey Water-Supply Paper 1454, 301 p.

Rasmussen, W. C., Slaughter, J. H., Hulme, A. E., and Murphy, J. J., 1947, The water resources of Carolina, Dorchester, and Talbot counties: Maryland Dept. Geology, Mines and Water Resources Bull. 18, 371 p.

Renfro, G. M., 1959, U. S. Conservation Service, Spartanburg, South Carolina, unpublished material, in Ven Te Chow, ed., Handbook of applied hydrology, 1964: New York, McGraw-Hill Book Co., chap. 21, p. 83.

Rhodehamel, E. C., 1966, A hydrologic analysis of the New Jersey Pine Barrens region: U. S. Geol. Survey open-file report, 76 p. [1968].

__________ 1970, A hydrologic analysis of the New Jersey Pine Barrens region: New Jersey Dept. Environ. Prot., Div. Water Policy and Supply, Water Resources Circ. 22, 35 p.

__________ 1972, Geology and water resources of the Wharton Tract and the Mullica River basin in southern New Jersey: U. S. Geol. Survey open-file report.

Richards, H. G., 1945, Subsurface stratigraphy of Atlantic Coastal Plain between New Jersey and Georgia: Am. Assoc. Petroleum Geologists Bull., v. 29, no. 7, p. 885-955.

__________ 1948, Studies on the subsurface geology and paleontology of the Atlantic Coastal Plain: Philadelphia Acad. Nat. Sci. Proc., v. C, p. 39-76.

__________ 1956, Geology of the Delaware Valley: Mineralog. Soc. Pennsylvania, Philadelphia, Pa., 106 p.

Richards, H. G., Olmsted, F. H., and Ruhle, J. L., 1962, Generalized structure contour maps of the New Jersey Coastal Plain: New Jersey Geol. Rept., ser. 4, 38 p.

Ries, Heinrich, Kümmel, H. B., and Knapp, G. N., 1904, The clays and clay industry of New Jersey, in Final report of the State Geologist: New Jersey Geol. Survey Final Rept. 6, pt. 2, p. 117-208.

Rorebaugh, M. I., 1948, Ground-water resources in the northeastern part of the Louisville area, Kentucky: U. S. Geol. Survey Water-Supply Paper 1360-B.

Rosenau, J. C., Lang, S. M., Hilton, G. S., and Rooney, J. G., 1969, Geology and ground-water resources of Salem County, New Jersey: New Jersey Dept. Conserv. and Econ. Devel., Div. Water Policy and Supply, Spec. Rept. 33, 142 p.

Rush, F. E., 1962, Records of wells and ground-water quality in Burlington County, New Jersey--A preliminary report: New Jersey Dept. Conserv. and Econ. Devel., Div. Water Policy and Supply, Water Resources Circ. 7, 104 p.

__________ 1968, Geology and ground-water resources of Burlington County, New Jersey: New Jersey Dept. Conserv. and Econ. Devel., Div. Water Policy and Supply, Spec. Rept. 26, 65 p.

Seaber, P. R., 1963, Chloride concentrations of water from wells in the Atlantic Coastal Plain of New Jersey, 1923-61: New Jersey Dept. Conserv. and Econ. Devel., Div. Water Policy and Supply, Spec. Rept. 22, 250 p.

__________ 1965, Variations in chemical character of water in the Englishtown Formation, New Jersey: U. S. Geol. Survey Prof. Paper 498-B, 35 p.

Spangler, W. B., and Peterson, J. J., 1950, Subsurface geology of the Atlantic Coastal Plain in New Jersey, Delaware, Maryland, and Virginia: Am. Assoc. Petroleum Geologist, v. 31, no. 1, p. 1-99.

Thompson, D. G., 1932, Ground-water supplies of the Camden area, New Jersey: New Jersey Dept. Conserv. and Econ. Devel., Div. Water Policy and Supply Bull. 39, 80 p.

U. S. Geological Survey, 1967, Engineering geology of the Northeast Corridor, Washington, D. C., to Boston, Mass. Coastal Plain and surficial geology: U. S. Geol. Survey Misc. Geol. Inv. Map I-514-B.

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

Weller, Stuart, 1907, Cretaceous paleontology of New Jersey: Geol. Survey of New Jersey, Paleontology Ser. 4, v. 7, 1106 p.

Wentworth, C. K., 1922, A scale of grade and class terms for clastic sediments: Jour. Geology, v. 30, p. 377-392.

Wolfe, J. A. and Pakiser, H. M., 1971, Stratigraphic interpretations of some cretaceous microfossil floras of the Middle Atlantic States: U. S. Geol. Survey Prof. Paper 750-B, p. B35-B47.

TABLES

Table 1.--Records of selected wells in Camden County and vicinity

MAP NUMBER	MUNICIPALITY	LAT-LONG	OWNER	LOCAL WELL NUMBER	DATE DRILLED (YEAR)	ALTI-TUDE OF LSD (FT)	CASING DEPTH (FT)	WELL DEPTH (FT)
			ATLANTIC COUNTY					
HA-1	HAMMONTON TOWN	393653N0744933.1	ATLANTIC C EXPR	HAMMONTON 1	1964	77	220	230
			BURLINGTON COUNTY					
EV-1	EVESHAM TWP	395430N0745706.1	EVESHAM M U A	EMUA 3	1967	60	288	334
EV-2	EVESHAM TWP	395412N0745618.1	BYRON T ROBERTS	ROBERTS 2	1957	93	322	375
EV-3	EVESHAM TWP	395344N0745503.1	EVESHAM M U A	EMUA 2	1963	115	405	435
EV-4	EVESHAM TWP	395336N0745440.1	EVESHAM M U A	EMUA 1	1956	89	369	389
EV-5	EVESHAM TWP	395314N0745502.1	EVESHAM TWP W D	ETWD 1	1897	115	--	212
EV-6	EVESHAM TWP	395233N0745418.1	EVESHAM M U A	TEST WELL 11	1969	110	689	699
EV-7	EVESHAM TWP	395233N0745418.2	EVESHAM M U A	EMUA 4	1970	110	464	500
EV-8	EVESHAM TWP	395218N0745344.1	US ARMY	CONTROL AREA	1954	84	138	158
MS-1	MAPLE SHADE TWP	395728N0745917.1	MAPLE SHADE W D	MSWD 4	1955	10	211	272
MS-2	MAPLE SHADE TWP	395725N0745914.1	MAPLE SHADE W D	MSWD 5	1961	20	410	494
MS-3	MAPLE SHADE TWP	395628N0745834.1	MAPLE SHADE W D	MSWD 1	--	35	413	493
MS-4	MAPLE SHADE TWP	395628N0745834.2	MAPLE SHADE W D	MSWD 6	1965	40	173	208
MS-5	MAPLE SHADE TWP	395628N0745834.3	MAPLE SHADE W D	MSWD 7	1968	29	140	195
ML-1	MEDFORD LAKES BOR	395120N0744851.1	LINGO	--	1968	75	--	260
ML-2	MEDFORD LAKES BOR	395105N0744826.1	L G CAMPANELLI	--	1968	100	--	310
ML-3	MEDFORD LAKES BOR	395100N0744823.1	THOMAS DICKINSN	1	1969	120	--	320
ME-1	MEDFORD TWP	395525N0745026.1	US GEOL SURVEY	MEDFORD 4	1967	72	1125	1145
ME-2	MEDFORD TWP	395525N0745025.1	US GEOL SURVEY	MEDFORD 5	1967	70	740	750
ME-3	MEDFORD TWP	395524N0745025.1	US GEOL SURVEY	MEDFORD 1	1963	70	400	410
ME-4	MEDFORD TWP	395413N0744922.1	MEDFORD W C	MWC 3	1957	48	506	536
ME-5	MEDFORD TWP	395316N0744946.1	MEDFORD W C	MWC 2	1968	45	506	536
ME-6	MEDFORD TWP	395250N0745100.1	PASSAMONTI	1	1968	50	--	130
ME-7	MEDFORD TWP	395209N0745043.1	LAKES WATER CO	LWC 3	1968	55	523	544
ME-8	MEDFORD TWP	395155N0744629.1	MEDFORD LAUND	LAUNDROMAT 1	1967	50	193	209
ME-9	MEDFORD TWP	395146N0745102.1	LAKES W C	2	1950	52	180	200
ME-10	MEDFORD TWP	395112N0745123.1	TAUNTON LAKE WC	1	1950	57	230	252
ME-11	MEDFORD TWP	395106N0745108.1	ROBERT DICKSON	--	1951	66	222	242
ME-12	MEDFORD TWP	395026N0744758.1	GEORGE AARON	--	1952	116	320	340
ME-13	MEDFORD TWP	395018N0745051.1	W G FREEMAN	--	1955	65	260	275
MO-1	MOORESTOWN TWP	395915N0745554.1	MOORESTOWN T WD	TEST HOLE 1-66	1966	88	320	340
MO-2	MOORESTOWN TWP	395838N0745905.1	CAMPBELL SOUP	CAMPBELL 1	1958	40	242	268
MO-3	MOORESTOWN TWP	395828N0745914.1	MOORESTOWN T WD	TEST HOLE 1-68	1968	35	315	375
MO-4	MOORESTOWN TWP	395751N0745832.1	LAYNE NY CO	LAYNE 1	1960	70	--	288
MO-5	MOORESTOWN TWP	395702N0745607.1	MOORESTOWN T WD	MTWD 5	1963	35	248	288
MO-6	MOORESTOWN TWP	395702N0745607.2	MOORESTOWN T WD	MTWD 6	1963	47	248	288
MT-1	MOUNT LAUREL TWP	395607N0745643.1	MT LAUREL W CO	MLWC 1	1961	20	558	589
MT-2	MOUNT LAUREL TWP	395555N0745152.1	EVA DIAMOND	--	1951	73	190	202
MT-3	MOUNT LAUREL TWP	395546N0745723.1	RALPH VASTURO	--	1950	68	100	119
MT-4	MOUNT LAUREL TWP	395552N0745703.1	NJ TRNPKE AUTH	INTERCHANGE 4	1961	35	137	147
SH-1	SHAMONG TWP	394422N0744309.1	US GEOL SURVEY	ATSION 1	1963	46	240	260
SH-2	SHAMONG TWP	394422N0744309.2	US GEOL SURVEY	ATSION 2	1963	49	63	65
SH-3	SHAMONG TWP	394422N0744309.3	US GEOL SURVEY	ATSION 3	1963	47	14	17
			CAMDEN COUNTY					
AU-1	AUDUBON BORO	395327N0750524.1	PUBLIC SERV E-G	PSEGC 1	1953	25	120	130
AU-2	AUDUBON BORO	395326N0750358.1	D CORVELLI	--	1949	65	183	191
BA-1	BARRINGTON BORO	395224N0750303.1	NJ WATER CO	TEST WELL T 1	1968	70	482	492
BA-2	BARRINGTON BORO	395224N0750303.2	NJ WATER CO	TEST WELL T 2	1968	70	350	360
BA-3	BARRINGTON BORO	395146N0750254.1	OWENS CORNING	CORNING 1	1956	60	285	318
BL-1	BELLMAWR BORO	395222N0750632.1	BELLMAWR B W D	BBWD 1	1942	31	111	160
BL-2	BELLMAWR BORO	395221N0750633.1	BELLMAWR B W D	BBWD 3	1956	31	331	356
BL-3	BELLMAWR BORO	395219N0750641.1	BELLMAWR B W D	BBWD 2	1942	31	111	159
BL-4	BELLMAWR BORO	395151N0750533.1	BELLMAWR B W D	BBWD 4	1965	82	380	557
BB-1	BERLIN BORO	394738N0745614.1	BERLIN WATER D	BWD 9	1955	150	650	713
BB-2	BERLIN BORO	394738N0745614.2	BERLIN WATER D	BWD 10	1967	145	645	713
BB-3	BERLIN BORO	394738N0745614.3	BERLIN WATER D	BWD 1	1923	145	299	339
BB-4	BERLIN BORO	394738N0745614.4	BERLIN WATER D	BWD 5	1950	150	67	82
BB-5	BERLIN BORO	394738N0745614.5	BERLIN WATER D	BWD 8	1952	150	310	360
BB-6	BERLIN BORO	394705N0745444.1	OWENS CORNING	1	1951	160	410	440
BB-7	BERLIN BORO	394653N0745543.1	D CHILLENNI	--	1951	160	68	78
BB-8	BERLIN BORO	394644N0745539.1	GREGORY PORRAL	--	1954	155	40	60
BT-1	BERLIN TWP	394818N0745512.1	ARTHUR TILLER	--	1952	175	34	40
BR-1	BROOKLAWN BORO	395244N0750727.1	BROOKLAWN B W D	BBWD 2	1956	13	133	167
BR-2	BROOKLAWN BORO	395244N0750727.2	BROOKLAWN B W D	BBWD 3	1961	13	307	328
BR-3	BROOKLAWN BORO	395243N0750724.1	BROOKLAWN B W D	BBWD NEW WELL	1967	13	288	321
BR-4	BROOKLAWN BORO	395242N0750725.1	BROOKLAWN B W D	LEGION	1942	13	120	161
CA-1	CAMDEN CITY	395732N0750532.1	NJ WATER CO	CAMDEN DIV 27	1924	10	102	135
CA-2	CAMDEN CITY	395728N0750520.1	NJ WATER CO	CAMDEN DIV 48	1954	10	122	164
CA-3	CAMDEN CITY	395726N0750518.1	NJ WATER CO	CAMDEN DIV 50	1958	10	139	170
CA-4	CAMDEN CITY	395725N0750521.1	NJ WATER CO	CAMDEN DIV 49	1955	9	137	169
CA-5	CAMDEN CITY	395722N0750523.1	NJ WATER CO	CAMDEN DIV 46	1950	9	148	178
CA-6	CAMDEN CITY	395722N0750514.1	NJ WATER CO	CAMDEN DIV 10	1932	11	--	150
CA-7	CAMDEN CITY	395720N0750513.1	NJ WATER CO	CAMDEN DIV 51	1965	10	140	192
CA-8	CAMDEN CITY	395719N0750517.1	NJ WATER CO	CAMDEN DIV 45	1950	10	142	173
CA-9	CAMDEN CITY	395718N0750513.1	NJ WATER CO	CAMDEN DIV 47	1953	20	159	174
CA-10	CAMDEN CITY	395718N0750507.1	H KOHNSTAMM CO	6	1967	30	163	183
CA-11	CAMDEN CITY	395716N0750608.1	CAMDEN CITY W D	CITY 15	1954	8	116	136
CA-12	CAMDEN CITY	395716N0750507.1	H KOHNSTAMM CO	3	1954	30	116	136
CA-13	CAMDEN CITY	395716N0750507.2	H KOHNSTAMM CO	4	1959	30	133	158
CA-14	CAMDEN CITY	395716N0750507.3	H KOHNSTAMM CO	5	1960	30	112	138
CA-15	CAMDEN CITY	395715N0750519.1	NJ WATER CO	CAMDEN DIV 52	1965	18	--	200
CA-16	CAMDEN CITY	395715N0750517.1	NJ WATER CO	CAMDEN DIV 44	1950	20	147	198
CA-17	CAMDEN CITY	395711N0750534.1	NJ WATER CO	36 OBS 27TH ST	1932	50	185	202
CA-18	CAMDEN CITY	395707N0750615.1	CAMDEN CITY W D	CITY 14	1953	8	105	145

Table 1.--Records of selected wells in Camden County and vicinity--Continued

Map number	Length of well open to aquifer (feet)	Depth to consolidated rock (ft)	Casing diameter (in)	Water level (ft)	Date water level measured	Yield (gpm)	Draw down (ft)	Specific capacity	Pumping period (hours)	Use of water	Major aquifer
					ATLANTIC COUNTY						
HA-1	10	--	6	9	5-64	61	72	0.8	12	H	TM KW
					BURLINGTON COUNTY						
EV-1	46	--	10	104	6-67	608	64	9.5	6	P	KJ MR
EV-2	53	--	8	100	11-57	750	80	9.4	--	I	KJ MR
EV-3	30	--	10	135	10-63	800	85	9.4	8	P	K3 MR
EV-4	20	--	8	91	6-56	517	168	3.1	--	P	K3 MR
EV-5	--	--	6	42	--	100	--	--	--	P	KJ ET
EV-6	10	--	6	159	12-69	109	12	9.1	--	U	KJ MR
EV-7	36	--	12	172	5-70	1012	41	24.7	8	P	KJ MR
EV-8	20	--	8	41	6-54	200	43	4.7	--	--	K3 MW
MS-1	61	--	12	19	12-55	1020	42	24.3	48	P	KJ MR
MS-2	55	494	8	45	9-61	1001	64	15.6	8	P	K3 MR
MS-3	60	--	--	53	--	131	--	--	--	P	K3 MR
MS-4	25	--	12	57	12-65	1034	69	15.0	8	P	KJ MR
MS-5	55	--	8	60	7-68	600	60	10.0	8	P	KJ MR
ML-1	--	--	4	45	8-68	70	--	--	1	H	KJ MW
ML-2	--	--	4	75	10-68	100	--	--	1	H	KJ MW
ML-3	--	--	4	70	7-69	100	--	--	1	H	KJ MW
ME-1	--	--	6	95	1-68	--	--	--	--	U	KJ MR
ME-2	10	--	5	92	1-68	--	--	--	--	U	K3 MR
ME-3	10	--	6	86	10-63	--	--	--	--	U	K3 MR
ME-4	30	--	8	48	--	517	86	6.0	--	P	K3 MR
ME-5	30	--	8	84	10-68	524	35	15.0	8	P	KJ MR
ME-6	--	--	4	10	10-68	100	--	--	1	H	K3 MW
ME-7	21	--	8	93	10-68	307	78	3.9	8	P	KJ MR
ME-8	16	--	4	--	--	--	--	--	--	H	KJ MW
ME-9	20	--	6	20	1-50	100	--	--	6	P	KJ MW
ME-10	--	--	6	25	11-50	300	--	--	--	P	K3 MW
ME-11	20	--	4	20	1-51	100	--	--	--	H	K3 MW
ME-12	20	--	4	50	5-52	50	--	--	--	H	KJ MW
ME-13	15	--	4	20	1-55	40	--	--	--	H	KJ MW
MO-1	20	--	8	90	11-66	530	--	--	--	U	KJ MR
MO-2	21	--	10	41	10-58	560	54	10.4	8	A	KJ MR
MO-3	40	--	8	50	3-68	350	--	--	--	U	K3 MR
MO-4	--	--	--	--	--	--	--	--	--	N	K3 MR
MO-5	40	--	12	67	11-63	805	36	22.4	8	P	KJ MR
MO-6	40	--	12	55	10-63	1000	55	16.2	8	P	K3 MR
MT-1	31	594	8	36	8-61	548	78	7.0	8	P	KJ MR
MT-2	10	--	4	48	9-51	10	6	1.7	--	H	KJ ET
MT-3	19	--	5	25	--	10	--	--	--	H	KJ ET
MT-4	10	--	6	39	6-61	25	40	0.6	16	H	KJ MR
SH-1	20	--	6	+6	9-63	--	--	--	--	U	TE MA
SH-2	5	--	1	6	10-63	--	--	--	--	U	AA CP
SH-3	3	--	1	7	12-63	--	--	--	--	U	AA CP
					CAMDEN COUNTY						
AU-1	10	--	4	40	1-53	50	--	--	6	N	KJ MR
AU-2	4	--	4	62	9-49	30	18	1.7	--	H	KJ MR
BA-1	10	510	6	111	3-68	130	21	6.2	24	U	KJ MR
BA-2	10	510	4	116	3-68	40	6	6.7	60	U	K3 MR
BA-3	30	--	12	96	2-56	1045	43	24.3	8	N	K3 MR
BL-1	49	--	12	42	7-42	1000	18	55.6	36	P	K3 MR
BL-2	25	--	8	62	8-56	1001	71	14.1	8	P	KJ MR
BL-3	48	--	12	45	10-42	500	12	41.7	24	P	K3 MR
BL-4	59	570	12	127	8-66	1016	25	40.6	24	P	K3 MR
BB-1	63	--	8	155	7-55	1000	99	10.1	8	P	K3 MR
BB-2	42	--	8	--	--	1012	69	14.7	8	P	KJ MR
BB-3	40	--	6	73	12-23	155	--	--	--	P	KJ MW
BB-4	15	--	8	--	--	365	--	--	--	P	AA CP
BB-5	50	--	8	98	6-52	450	138	3.3	8	P	KJ MW
BB-6	30	--	6	98	6-51	115	63	1.8	8	N	K3 MW
BB-7	10	--	3	15	10-51	30	1	30.0	3	H	AA CP
BB-8	20	--	4	8	3-54	50	--	--	5	N	AA CP
BT-1	6	--	4	21	9-52	--	--	--	--	H	AA CP
BR-1	34	--	10	16	2-60	455	18	25.3	--	P	KJ MR
BR-2	21	328	5	11	6-61	500	33	15.2	--	P	K3 MR
BR-3	33	--	10	70	--	--	--	--	--	P	K3 MR
BR-4	25	--	12	22	8-42	455	18	25.3	8	P	KJ MR
CA-1	33	--	18	21	5-24	1050	22	47.7	--	P	K3 MR
CA-2	32	164	12	45	9-54	1412	54	26.1	2	--	KJ MR
CA-3	31	--	12	44	5-56	1000	52	19.2	8	P	K3 MR
CA-4	32	169	12	44	5-55	--	--	--	--	P	K3 MR
CA-5	30	--	12	35	11-50	1400	55	25.5	8	P	K3 MR
CA-6	--	--	8	10	3-33	--	--	--	--	U	KJ MR
CA-7	51	193	16	56	1-65	1471	74	19.9	5	P	K3 MR
CA-8	31	--	12	35	8-50	700	65	10.8	--	P	K3 MR
CA-9	25	--	12	38	9-53	1012	45	22.5	4	P	KJ MR
CA-10	20	--	8	40	2-67	200	--	--	48	N	KJ MR
CA-11	20	148	18	37	3-54	1000	70	14.3	8	P	K3 MR
CA-12	20	--	6	50	12-54	150	--	--	6	N	K3 MR
CA-13	25	--	6	40	3-59	250	20	12.5	6	N	K3 MR
CA-14	26	--	6	40	4-60	200	20	10.0	4	N	K3 MR
CA-15	--	200	16	60	7-65	1404	--	--	5	P	K3 MR
CA-16	51	--	12	61	5-50	1400	26	53.8	3	P	K3 MR
CA-17	10	--	6	57	6-32	--	--	--	--	U	K3 MR
CA-18	40	164	18	35	2-53	1000	52	19.2	8	P	K3 MR

Table 1.--Records of selected wells in Camden County and vicinity--Continued

MAP NUMBER	MUNICIPALITY	LAT-LONG	OWNER	LOCAL WELL NUMBER	DATE DRILLED (YEAR)	ALTI-TUDE OF LSD (FT)	CASING DEPTH (FT)	WELL DEPTH (FT)
				CAMDEN COUNTY				
CA-19	CAMDEN CITY	395706N0750553.1	CAMDEN CITY W D	CITY 16	1954	23	149	179
CA-20	CAMDEN CITY	395659N0750610.1	CAMDEN CITY W D	CITY 9	1957	9	116	146
CA-21	CAMDEN CITY	395659N0750610.2	CAMDEN CITY W D	TEST WELL 1950	1950	5	129	150
CA-22	CAMDEN CITY	395659N0750610.3	CAMDEN CITY W D	CITY 9-1924	1924	9	106	146
CA-23	CAMDEN CITY	395652N0750607.1	CAMDEN CITY W D	CITY 10	1935	10	126	158
CA-24	CAMDEN CITY	395649N0750743.1	ESTERBROOK PEN	ESTERBROOK OBS	--	8	--	300
CA-25	CAMDEN CITY	395640N0750622.1	CAMDEN CITY W D	CITY 1-1940	1940	5	135	168
CA-26	CAMDEN CITY	395638N0750622.1	CAMDEN CITY W D	CITY 1A	1953	10	135	170
CA-27	CAMDEN CITY	395638N0750622.2	CAMDEN CITY W D	CITY 1-1922	1922	5	146	174
CA-28	CAMDEN CITY	395617N0750710.1	CAMDEN CITY W D	CITY 12	1945	23	136	166
CA-29	CAMDEN CITY	395615N0750633.1	CAMDEN CITY W D	CITY 5N	1963	22	134	169
CA-30	CAMDEN CITY	395614N0750633.2	CAMDEN CITY W D	CITY 5-1937	1937	22	142	172
CA-31	CAMDEN CITY	395614N0750633.1	CAMDEN CITY W D	CITY 5-1928	1928	22	152	171
CA-32	CAMDEN CITY	395604N0750735.1	PUBLIC SERV E G	6 REPLACEMENT	1954	5	118	145
CA-33	CAMDEN CITY	395603N0750736.1	PUBLIC SERV E-G	PSEGC 8	1955	4	119	145
CA-34	CAMDEN CITY	395602N0750744.1	PUBLIC SERV E-G	PSEGC 7	1947	4	116	145
CA-35	CAMDEN CITY	395557N0750629.1	CAMDEN CITY W D	CITY 3A	1953	15	91	115
CA-36	CAMDEN CITY	395557N0750629.2	CAMDEN CITY W D	CITY 3-1934	1934	15	91	113
CA-37	CAMDEN CITY	395557N0750629.3	CAMDEN CITY W D	CITY 3-1922	1922	15	85	110
CA-38	CAMDEN CITY	395552N0750535.1	CAMDEN CITY W D	CITY 13	1953	30	185	225
CA-39	CAMDEN CITY	395551N0750725.1	PUBLIC SERV E-G	PSEGC 14	1950	5	120	146
CA-40	CAMDEN CITY	395550N0750729.1	CAMDEN CITY W D	CITY 2B	1953	8	111	136
CA-41	CAMDEN CITY	395546N0750533.1	CAMDEN CITY W D	CITY 17	1954	34	230	265
CA-42	CAMDEN CITY	395541N0750622.1	CAMDEN CITY W D	CITY 4	1950	41	131	156
CA-43	CAMDEN CITY	395541N0750622.2	CAMDEN CITY W D	CITY 4-1935	1935	40	121	156
CA-44	CAMDEN CITY	395541N0750622.3	CAMDEN CITY W D	CITY 4-1922	1922	40	--	--
CA-45	CAMDEN CITY	395540N0750742.1	CAMDEN CITY W D	CITY 8	1928	6	150	175
CA-46	CAMDEN CITY	395540N0750742.2	CAMDEN CITY W D	CITY 8A	1953	6	89	124
CA-47	CAMDEN CITY	395539N0750630.1	W JERSEY HOSP	W JERSEY HOSP1	1958	30	119	140
CA-48	CAMDEN CITY	395539N0750541.1	OLOL HOSPITAL	STAND BY WELL	1963	30	241	258
CA-49	CAMDEN CITY	395534N0750724.1	GALLAGHERS WHSE	EVRSN LVRNG 1	1929	10	--	170
CA-50	CAMDEN CITY	395532N0750720.1	GALLAGHERS WHSE	EVRSN LVRNG 2	1933	10	145	171
CA-51	CAMDEN CITY	395530N0750719.1	GALLAGHERS WHSE	EVRSN LVRNG 5	1929	10	--	203
CA-52	CAMDEN CITY	395528N0750538.1	A N STOLLWRECK	2	1950	28	111	131
CA-53	CAMDEN CITY	395527N0750646.1	CAMDEN CITY W D	CITY 6N	1948	14	111	136
CA-54	CAMDEN CITY	395527N0750646.2	CAMDEN CITY W D	CITY 6-1928	1928	14	111	135
CA-55	CAMDEN CITY	395523N0750729.1	CAMDEN CITY	SEWAGE PLANT 1	1954	9	163	193
CA-56	CAMDEN CITY	395512N0750640.1	CAMDEN CITY W D	CITY 11	1942	13	124	154
CA-57	CAMDEN CITY	395502N0750655.1	CAMDEN BREWERY	--	--	18	160	180
CA-58	CAMDEN CITY	395457N0750641.1	CAMDEN CITY W D	CITY 7	1945	21	126	160
CA-59	CAMDEN CITY	395457N0750641.2	CAMDEN CITY W D	CITY 7-1928	1928	21	126	164
CA-60	CAMDEN CITY	395457N0750640.1	CAMDEN CITY W D	CITY 7N	1966	21	123	163
CA-61	CAMDEN CITY	395455N0750716.1	SO JRSY PORT CM	NY SHIP 7	1942	12	187	229
CA-62	CAMDEN CITY	395449N0750716.1	SO JRSY PORT CM	NY SHIP 6	1941	12	119	225
CA-63	CAMDEN CITY	395447N0750711.1	SO JRSY PORT CM	NY SHIP 5A	1940	12	87	104
CA-64	CAMDEN CITY	395435N0750720.1	SO JRSY PORT CM	NY SHIP PW 1	1956	12	50	124
CA-65	CAMDEN CITY	395427N0750606.1	CAMDEN CITY W D	WATER WORKS T1	1942	15	247	300
CH-1	CHERRY HILL TWP	395621N0745840.1	ANTHONY MALADRA	--	1955	60	--	115
CH-2	CHERRY HILL TWP	395616N0750027.1	NJ WATER CO	COLUMBIA 22	1960	39	371	453
CH-3	CHERRY HILL TWP	395615N0750027.1	NJ WATER CO	COLUMBIA 24	1961	34	153	167
CH-4	CHERRY HILL TWP	395613N0750052.1	JERRY SCHAEFER	1	1965	45	100	105
CH-5	CHERRY HILL TWP	395612N0750142.1	RADIO CORP AMER	RCA 1	1955	128	220	--
CH-6	CHERRY HILL TWP	395606N0750148.1	GS RACING ASSCT	CHRY HLL INN 1	1954	80	--	179
CH-7	CHERRY HILL TWP	395606N0750148.2	GS RACING ASSCT	CHRY HLL INN 2	1967	60	148	172
CH-8	CHERRY HILL TWP	395603N0750031.1	NJ WATER CO	COLUMBIA 31	1967	45	376	427
CH-9	CHERRY HILL TWP	395556N0745924.1	M HOLZER	--	1953	75	178	183
CH-10	CHERRY HILL TWP	395530N0750301.1	E H ELLIS SON	1	1949	23	158	168
CH-11	CHERRY HILL TWP	395514N0750213.1	GARDEN STATE PK	RACE TRACK	--	25	128	158
CH-12	CHERRY HILL TWP	395511N0750202.1	WIDELL AND SONS	--	1953	27	125	135
CH-13	CHERRY HILL TWP	395502N0750221.1	N J NATIONAL GD	1	1956	10	97	111
CH-14	CHERRY HILL TWP	395455N0745929.1	NJ WATER CO	KINGSTON 25	1961	44	309	367
CH-15	CHERRY HILL TWP	395455N0745929.2	NJ WATER CO	KINGSTON 28	1964	44	175	207
CH-16	CHERRY HILL TWP	395455N0745924.1	NJ WATER CO	KINGSTON 27	1963	40	365	417
CH-17	CHERRY HILL TWP	395452N0750035.1	W J OSTERTAG	1	1953	55	87	115
CH-18	CHERRY HILL TWP	395442N0750103.1	NJ WATER CO	ELLISBURG 13	1960	39	491	527
CH-19	CHERRY HILL TWP	395441N0750104.1	NJ WATER CO	ELLISBURG 16	1957	39	187	220
CH-20	CHERRY HILL TWP	395438N0750107.1	NJ WATER CO	ELLISBURG 23	1960	32	318	375
CH-21	CHERRY HILL TWP	395422N0745641.1	DEER PARK FIRE	CO 1	1954	70	252	258
CH-22	CHERRY HILL TWP	395419N0745721.1	FRANK POWERS	--	1949	72	310	320
CH-23	CHERRY HILL TWP	395409N0750048.1	P A VATTER	--	1953	64	224	234
CH-24	CHERRY HILL TWP	395409N0745957.1	ROBERT COLEMAN	--	195_	17	98	108
CH-25	CHERRY HILL TWP	395406N0745841.1	ARNOLD PALMER	DRIVING RANGE	1964	60	275	285
CH-26	CHERRY HILL TWP	395356N0745708.1	NJ WATER CO	OLD ORCHARD A	1967	71	743	748
CH-27	CHERRY HILL TWP	395356N0745708.2	NJ WATER CO	OLD ORCHARD B	1967	71	328	342
CH-28	CHERRY HILL TWP	395356N0745708.3	NJ WATER CO	OLD ORCHARD C	1967	71	487	500
CH-29	CHERRY HILL TWP	395356N0745708.4	NJ WATER CO	OLD ORCHARD 36	1968	8	299	349
CH-30	CHERRY HILL TWP	395356N0745708.5	NJ WATER CO	OLD ORCHARD 37	1968	6	454	488
CH-31	CHERRY HILL TWP	395356N0745708.6	NJ WATER CO	OLD ORCHARD 38	1968	72	443	493
CH-32	CHERRY HILL TWP	395331N0745920.1	A R ROSS	1	1950	100	125	135
CH-33	CHERRY HILL TWP	395321N0745617.1	EUGENE MILLER	1	1954	92	360	370

MAP NUMBER	LENGTH OF WELL OPEN TO AQUIFER (FEET)	DEPTH TO CONSOLI-DATED ROCK (FT)	CASING DIAM-ETER (IN)	WATER LEVEL (FT)	DATE WATER LEVEL MEASURED	YIELD (GPM)	DRAW DOWN (FT)	SPECIFIC CAPACITY	PUMPING PERIOD (HOURS)	USE OF WATER	MAJOR AQUIFER
CAMDEN COUNTY											
CA-19	30	--	18	50	12-54	1130	53	21.3	8	P	K3 MR
CA-20	30	146	18	48	11-57	1020	53	19.2	--	P	K3 MR
CA-21	21	166	6	23	7-50	300	57	5.3	--	U	K3 MR
CA-22	40	146	26	15	3-24	1420	72	19.7	--	P	K3 MR
CA-23	30	158	18	57	11-57	1020	32	31.9	--	P	K3 MR
CA-24	--	--	6	--	--	--	--	--	--	U	WG
CA-25	32	--	18	--	--	--	--	--	--	P	K3 MR
CA-26	35	--	18	42	12-53	1000	54	18.5	8	P	K3 MR
CA-27	39	--	26	12	10-22	1050	67	15.7	--	P	K3 MR
CA-28	30	--	16	32	-45	857	74	11.6	--	P	K3 MR
CA-29	35	--	18	58	10-63	1000	32	31.2	--	P	K3 MR
CA-30	30	--	18	--	--	--	--	--	--	P	K3 MR
CA-31	19	--	26	31	5-28	1100	37	29.7	--	P	K3 MR
CA-32	32	--	8	35	12-54	350	25	14.0	24	N	K3 MR
CA-33	26	--	--	--	--	--	--	--	--	N	K3 MR
CA-34	29	--	--	--	--	--	--	--	--	N	K3 MR
CA-35	25	--	18	37	12-55	1000	46	21.7	8	P	K3 MR
CA-36	22	--	18	--	--	--	--	--	--	P	K3 MR
CA-37	24	--	26	15	8-22	1160	55	21.1	--	P	K3 MR
CA-38	40	--	18	46	6-53	1000	24	41.7	--	P	K3 MR
CA-39	26	--	10	31	5-50	506	34	14.9	12	N	K3 MR
CA-40	25	190	18	41	12-54	1000	46	21.7	8	P	K3 MR
CA-41	35	--	18	64	7-58	1250	32	39.1	8	P	K3 MR
CA-42	25	--	18	77	11-57	1000	27	37.0	--	P	K3 MR
CA-43	35	--	18	56	8-35	1200	34	35.3	--	P	K3 MR
CA-44	--	--	--	--	--	--	--	--	--	P	K3 MR
CA-45	25	--	18	21	9-28	1085	52	20.9	--	P	K3 MR
CA-46	35	--	18	12	7-53	1000	30	33.3	8	P	K3 MR
CA-47	21	--	8	52	12-58	205	58	3.5	8	T	K3 MR
CA-48	21	--	8	68	9-63	275	11	25.0	4	T	K3 MR
CA-49	--	--	4	--	--	150	--	--	--	N	K3 MR
CA-50	26	--	8	--	--	300	--	--	--	N	K3 MR
CA-51	--	--	12	--	--	--	--	--	--	N	K3 MR
CA-52	20	--	8	52	2-50	210	8	26.2	3	N	K3 MR
CA-53	25	--	18	39	2-48	1012	31	32.6	8	P	K3 MR
CA-54	25	--	26	18	9-28	1180	47	25.1	--	P	K3 MR
CA-55	--	201	10	36	1-54	907	--	--	--	U	K3 MR
CA-56	30	--	16	32	9-42	1005	30	33.5	8	P	K3 MR
CA-57	20	--	--	--	--	--	--	--	--	N	K3 MR
CA-58	40	--	18	49	7-45	775	47	16.5	--	P	K3 MR
CA-59	38	--	26	29	9-28	1000	38	26.3	--	P	K3 MR
CA-60	40	--	18	60	6-66	1023	21	48.7	8	P	K3 MR
CA-61	42	--	12	35	5-43	1005	57	17.6	--	U	K3 MR
CA-62	26	--	10	28	3-41	830	81	10.2	--	N	K3 MR
CA-63	17	--	8	28	4-41	533	37	14.4	--	U	K3 MR
CA-64	62	--	16	17	1-56	--	56	--	40	N	K3 MR
CA-65	--	--	6	27	5-42	--	--	--	--	U	K3 MR
CH-1	--	--	--	55	1-55	15	--	--	2	H	K3 MV
CH-2	82	--	12	57	3-60	1067	49	21.8	8	P	K3 MR
CH-3	14	--	12	26	--	1051	44	23.9	8	P	K3 MR
CH-4	5	--	4	50	1-65	20	10	2.0	5	H	K3 MR
CH-5	--	--	6	48	--	50	--	--	4	N	K3 MR
CH-6	25	--	8	92	9-54	400	43	9.3	10	U	K3 MR
CH-7	24	--	12	--	--	--	--	--	--	I	K3 MR
CH-8	47	--	12	85	1-67	1030	57	18.1	24	--	K3 MR
CH-9	5	--	4	45	3-53	15	10	1.5	2	H	K3 MR
CH-10	10	--	5	25	4-49	15	20	0.7	4	N	K3 MR
CH-11	30	--	--	--	--	--	--	--	--	I	K3 MR
CH-12	10	--	6	25	3-53	60	--	--	6	H	K3 MR
CH-13	5	--	6	36	5-56	150	14	10.7	8	T	K3 MR
CH-14	58	528	12	69	9-61	1000	--	--	8	P	K3 MR
CH-15	26	--	12	82	10-64	857	70	12.2	8	P	K3 MR
CH-16	52	531	12	73	12-63	812	70	11.6	8	P	K3 MR
CH-17	--	--	8	74	10-53	25	--	--	2	H	K3 MV
CH-18	36	--	10	54	4-53	1200	50	24.0	8	P	K3 MR
CH-19	33	--	12	59	11-57	1000	62	16.1	5	P	K3 MR
CH-20	57	--	12	62	5-60	1001	34	29.4	8	P	K3 MR
CH-21	6	--	4	85	11-54	20	15	1.3	2	H	K3 MR
CH-22	10	--	5	80	12-49	100	20	5.0	4	H	K3 MR
CH-23	10	--	3	80	2-53	40	--	--	4	H	K3 MR
CH-24	10	--	4	43	5-53	40	17	2.4	--	H	K3 MV
CH-25	10	--	4	90	5-64	50	10	5.0	--	I	K3 MR
CH-26	5	807	2	107	3-67	--	--	--	--	U	K3 MR
CH-27	5	--	3	110	3-67	--	--	--	--	U	K3 MR
CH-28	5	--	3	109	--	--	--	--	--	U	K3 MR
CH-29	50	--	12	123	4-68	703	116	6.1	24	P	K3 MR
CH-30	34	--	12	109	4-68	1209	47	25.7	24	P	K3 MR
CH-31	50	--	12	113	5-68	1455	49	29.7	24	P	K3 MR
CH-32	--	--	6	63	9-50	250	--	--	--	H	K3 ET
CH-33	10	--	6	92	7-54	200	18	11.1	6	H	K3 MR

MAP NUMBER	MUNICIPALITY	LAT-LONG	OWNER	LOCAL WELL NUMBER	DATE DRILLED (YEAR)	ALTITUDE OF LSD (FT)	CASING DEPTH (FT)	WELL DEPTH (FT)
			CAMDEN COUNTY					
CH-34	CHERRY HILL TWP	395308N0750015.1	NJ TURNPIKE AU	SERVICE 3S-2	1951	65	231	261
CH-35	CHERRY HILL TWP	395259N0745720.1	IMMAC CONCEPTN	NOVITIATE 2	1952	65	329	339
CH-36	CHERRY HILL TWP	395254N0745822.1	F MYERS	1	1967	60	321	331
CH-37	CHERRY HILL TWP	395238N0750030.1	HUSSMAN REFRIDG	HUSSMAN	1957	67	276	306
CH-38	CHERRY HILL TWP	395229N0745722.1	HAROLD SNYDER	1	1956	127	210	215
CH-39	CHERRY HILL TWP	395229N0745712.1	NJ WATER CO	HUTTON HILL 1	1965	156	552	562
CH-40	CHERRY HILL TWP	395229N0745712.2	NJ WATER CO	HUTTON HILL 2	1965	156	137	147
CH-41	CHERRY HILL TWP	395212N0745757.1	DR E BROWN	--	1969	100	105	115
CH-42	CHERRY HILL TWP	395150N0745916.1	WOODCREST CT CL	CLUB 1	1949	92	400	420
CH-43	CHERRY HILL TWP	395150N0745913.1	WOODCREST CT CL	CLUB 2	1955	100	354	385
CL-1	CLEMENTON BORO	394832N0745915.1	CLEMENTON W D	CWD 6	1924	59	--	240
CL-2	CLEMENTON BORO	394832N0745915.2	CLEMENTON W D	CWD 7	1943	59	543	633
CL-3	CLEMENTON BORO	394832N0745915.3	CLEMENTON W D	CWD 8	1950	60	251	276
CL-4	CLEMENTON BORO	394832N0745915.4	CLEMENTON W D	ABANDON WELL	--	55	126	168
CL-5	CLEMENTON BORO	394807N0745806.1	CLEMENTON W D	CWD 9	1954	150	367	457
CO-1	COLLINGSWOOD BORO	395526N0750424.1	COLLINGSWOOD WD	CWD 5	1956	20	248	278
CO-2	COLLINGSWOOD BORO	395522N0750432.1	COLLINGSWOOD WD	CWD 3	1960	10	257	287
CO-3	COLLINGSWOOD BORO	395521N0750435.1	COLLINGSWOOD WD	CWD 4	1942	9	275	304
CO-4	COLLINGSWOOD BORO	395519N0750432.1	COLLINGSWOOD WD	CWD 2R	1960	12	248	278
CO-5	COLLINGSWOOD BORO	395515N0750436.1	COLLINGSWOOD WD	CWD 1R	1950	16	266	306
CO-6	COLLINGSWOOD BORO	395506N0750507.1	FRIENDSHIP DAIR	DAIRY 1	1955	21	143	164
CO-7	COLLINGSWOOD BORO	395426N0750514.1	COLLINGSWOOD WD	CWD 7	1965	10	224	313
CO-8	COLLINGSWOOD BORO	395426N0750514.2	COLLINGSWOOD WD	CWD 6	1965	10	218	312
GI-1	GIBBSBORO BORO	395015N0745752.1	LUCAS PAINT CO	MAIN	--	93	--	165
GI-2	GIBBSBORO BORO	395015N0745752.2	LUCAS PAINT CO	STEAM PUMP	--	93	--	160
GI-3	GIBBSBORO BORO	394955N0745852.1	KARL W FUCHS	1	1951	70	108	108
GI-4	GIBBSBORO BORO	394946N0745855.1	NJ WATER CO	GIBBSBORO OB 1	1969	70	1081	1091
GI-5	GIBBSBORO BORO	394946N0745855.2	NJ WATER CO	GIBBSBORO OB 2	1969	70	940	950
GI-6	GIBBSBORO BORO	394946N0745855.3	NJ WATER CO	GIBBSBORO OB 3	1969	70	670	680
GI-7	GIBBSBORO BORO	394944N0745717.1	JAMES E HALE	--	1952	135	138	150
GI-8	GIBBSBORO BORO	394927N0745715.1	US AIR FORCE	RADAR 1	1959	191	260	290
GI-9	GIBBSBORO BORO	394923N0745714.1	US AIR FORCE	RADAR 2	1960	193	280	310
GC-1	GLOUCESTER CITY	395359N0750654.1	GLOUCESTER C WD	GCWD 41	1965	10	226	266
GC-2	GLOUCESTER CITY	395355N0750738.1	US GEOL SURVEY	COAST GUARD 1	1966	10	162	170
GC-3	GLOUCESTER CITY	395349N0750651.1	GLOUCESTER C WD	GCWD 40	1961	10	221	262
GC-4	GLOUCESTER CITY	395348N0750654.1	GLOUCESTER C WD	GCWD 37	1947	5	84	125
GC-5	GLOUCESTER CITY	395348N0750654.2	GLOUCESTER C WD	GCWD 30	1936	13	152	175
GC-6	GLOUCESTER CITY	395348N0750654.3	GLOUCESTER C WD	GCWD 34	1942	10	--	175
GC-7	GLOUCESTER CITY	395348N0750654.4	GLOUCESTER C WD	GCWD 35	1944	5	88	122
GC-8	GLOUCESTER CITY	395348N0750654.5	GLOUCESTER C WD	GCWD 36	1946	5	85	126
GC-9	GLOUCESTER CITY	395347N0750652.1	GLOUCESTER C WD	GCWD 33	1938	14	220	240
GC-10	GLOUCESTER CITY	395347N0750651.1	GLOUCESTER C WD	GCWD 38	1949	10	279	300
GC-11	GLOUCESTER CITY	395346N0750651.1	GLOUCESTER C WD	GCWD 32	1938	11	--	175
GC-12	GLOUCESTER CITY	395345N0750653.1	GLOUCESTER C WD	GCWD 2	1929	11	140	171
GC-13	GLOUCESTER CITY	395343N0750652.1	GLOUCESTER C WD	GCWD 42	1968	15	--	306
GC-14	GLOUCESTER CITY	395332N0750734.1	HINDE AND DAUCH	JERSEY AVE 1	1945	9	241	261
GC-15	GLOUCESTER CITY	395329N0750732.1	HINDE AND DAUCH	2	1945	9	241	261
GC-16	GLOUCESTER CITY	395324N0750736.1	HINDE AND DAUCH	3	1945	7	240	260
GC-17	GLOUCESTER CITY	395322N0750757.1	HARSHAW CHEM CO	HARSHAW 4	1953	5	235	260
GC-18	GLOUCESTER CITY	395322N0750751.1	HARSHAW CHEM CO	HARSHAW 2	1951	6	221	251
GC-19	GLOUCESTER CITY	395321N0750747.1	HARSHAW CHEM CO	HARSHAW 3	1952	8	245	265
GC-20	GLOUCESTER CITY	395318N0750755.1	HARSHAW CHEM CO	HARSHAW 1	1948	5	246	266
GC-21	GLOUCESTER CITY	395315N0750617.1	H W WILSON JR	1	1954	25	102	112
GC-22	GLOUCESTER CITY	395314N0750749.1	NJ ZINC CO	1-DEEP	1945	5	230	250
GC-23	GLOUCESTER CITY	395313N0750804.1	NJ ZINC CO	3-DEEP	1958	5	223	255
GC-24	GLOUCESTER CITY	395308N0750757.1	NJ ZINC CO	2-DEEP	1954	5	245	275
GC-25	GLOUCESTER CITY	395308N0750749.1	NJ ZINC CO	5-DEEP	--	5	--	175
GC-26	GLOUCESTER CITY	395308N0750744.1	NJ ZINC CO	4-DEEP	--	5	249	279
GC-27	GLOUCESTER CITY	395252N0750623.1	GLOUCESTER C WD	GCWD 39	1958	24	161	185
GT-1	GLOUCESTER TWP	395030N0750347.1	NJ WATER CO	OTTERBROOK 29	1965	58	612	712
GT-2	GLOUCESTER TWP	395030N0750347.2	NJ WATER CO	OTTERBROOK 39	1968	60	269	349
GT-3	GLOUCESTER TWP	395028N0750344.1	NJ WATER CO	OTTERBROOK 34	1967	60	288	377
GT-4	GLOUCESTER TWP	395026N0750502.1	EDWARD MARSH	--	1952	15	--	150
GT-5	GLOUCESTER TWP	395025N0750443.1	HOWARD BROWN	--	1955	44	65	75
GT-6	GLOUCESTER TWP	395017N0750459.1	W L DOUGHERTY	--	1949	31	132	142
GT-7	GLOUCESTER TWP	395007N0750425.1	J STEZZI	--	1955	30	274	287
GT-8	GLOUCESTER TWP	394932N0750301.1	JOHN WARGO	--	1949	71	359	377
GT-9	GLOUCESTER TWP	394914N0750244.1	JOHN BISHOP	1	1967	70	160	170
GT-10	GLOUCESTER TWP	394855N0750442.1	THEISS	1	1968	65	56	71
GT-11	GLOUCESTER TWP	394841N0750354.1	EILLEN GESSWIN	--	1952	70	170	180
GT-12	GLOUCESTER TWP	394840N0750314.1	ROBERT MANNING	--	1953	104	121	131
GT-13	GLOUCESTER TWP	394839N0750410.1	MARY BENNIE	1	1950	72	166	176
GT-14	GLOUCESTER TWP	394836N0750150.1	WARNER LOMBARDI	--	1955	81	275	290
GT-15	GLOUCESTER TWP	394833N0750355.1	ARTHUR JONES	--	--	70	179	185
GT-16	GLOUCESTER TWP	394830N0750428.1	WM D CATHCART	1	1967	68	175	185
GT-17	GLOUCESTER TWP	394829N0750347.1	SUN TEMP INDUST	--	1966	80	--	388
GT-18	GLOUCESTER TWP	394820N0750445.1	GLOUC M U AUTH	TREAT PLANT	1971	20	--	358
GT-19	GLOUCESTER TWP	394815N0750356.1	AMANDUS CARLSON	--	1953	25	188	198
GT-20	GLOUCESTER TWP	394806N0750426.1	GAR ST WC-BLKWD	BLACKWOD DIV 1	1948	20	335	386
GT-21	GLOUCESTER TWP	394806N0750426.2	GAR ST WC-BLKWD	BLACKWOD DIV 5	1930	60	49	79

Table 1.--Records of selected wells in Camden County and vicinity--Continued

MAP NUMBER	LENGTH OF WELL OPEN TO AQUIFER (FEET)	DEPTH TO CONSOLI-DATED ROCK (FT)	CASING DIAM-ETER (IN)	WATER LEVEL (FT)	DATE WATER LEVEL MEASURED	YIELD (GPM)	DRAW DOWN (FT)	SPECIFIC CAPACITY	PUMPING PERIOD (HOURS)	USE OF WATER	MAJOR AQUIFER
					CAMDEN COUNTY						
CH-34	30	--	8	81	8-51	13	24	0.5	48	H	K3 MR
CH-35	10	--	6	41	-52	--	--	--	--	H	K3 MR
CH-36	10	--	4	--	9-67	100	--	--	--	H	K3 MR
CH-37	30	--	8	87	7-59	317	19	16.7	4	N	K3 MR
CH-38	5	--	4	65	2-56	100	--	--	5	H	K3 ET
CH-39	10	--	6	200	10-65	--	--	--	--	U	K3 MR
CH-40	10	--	6	88	10-65	--	--	--	--	U	K3 MW
CH-41	10	--	4	45	9-69	30	10	3.0	1	H	K3 MW
CH-42	20	--	6	100	5-49	150	9	16.7	5	H	K3 MR
CH-43	31	--	10	90	7-55	300	15	20.0	8	H	K3 MR
CL-1	--	--	8	--	--	250	--	--	--	P	K3 ET
CL-2	90	--	6	53	4-50	500	135	3.7	--	P	K3 MR
CL-3	25	--	10	48	7-50	510	--	--	15	P	K3 ET
CL-4	42	--	8	10	3-70	--	--	--	--	U	K3 MW
CL-5	46	--	8	124	7-54	503	96	5.2	4	P	K3 ET
CO-1	30	--	12	43	2-56	1000	71	14.1	8	P	K3 MR
CO-2	30	--	12	57	-53	1000	63	15.9	8	P	K3 MR
CO-3	30	--	10	32	7-42	760	37	20.5	8	P	K3 MR
CO-4	30	300	12	57	6-60	1000	51	19.6	8	P	K3 MR
CO-5	40	--	12	54	10-49	1023	44	23.2	8	P	K3 MR
CO-6	21	--	6	41	1-55	100	38	2.6	68	N	K3 MR
CO-7	89	--	12	49	3-65	1034	18	57.4	8	P	K3 MR
CO-8	53	--	12	46	5-65	1034	13	79.5	8	P	K3 MR
GI-1	--	--	4	--	--	150	--	--	--	N	K3 MW
GI-2	--	--	--	--	--	--	--	--	--	I	K3 MW
GI-3	--	--	3	4	7-51	50	--	--	6	H	K3 MW
GI-4	10	1142	3	115	3-69	43	30	1.4	2	U	K3 MR
GI-5	10	1142	3	125	1-69	--	--	--	--	U	K3 MR
GI-6	10	1142	3	119	2-69	35	9	3.9	--	U	K3 MR
GI-7	--	--	4	42	11-52	60	--	--	--	H	TL --
GI-8	--	--	8	118	4-59	55	--	--	--	H	K3 MW
GI-9	--	--	8	130	8-60	102	--	--	24	N	K3 MW
GC-1	40	--	12	58	10-65	1034	42	24.6	8	P	K3 MR
GC-2	8	252	6	--	--	--	--	--	--	U	K3 MR
GC-3	40	--	12	58	6-61	1000	41	24.4	4	P	K3 MR
GC-4	41	--	6	--	8-61	70	--	--	--	U	K3 MR
GC-5	23	--	8	--	--	--	--	--	--	U	K3 MR
GC-6	--	--	8	--	--	--	--	--	--	U	K3 MR
GC-7	22	--	10	17	6-44	600	28	21.4	2	U	K3 MR
GC-8	24	--	8	29	1-46	400	13	30.8	2	U	K3 MR
GC-9	20	--	12	21	3-38	875	52	16.8	--	U	K3 MR
GC-10	21	--	8	36	--	300	--	--	24	U	K3 MR
GC-11	--	--	8	--	--	--	--	--	--	U	K3 MR
GC-12	30	--	8	33	4-53	200	32	6.2	--	U	K3 MR
GC-13	--	--	10	--	--	--	--	--	--	P	K3 MR
GC-14	20	--	10	--	--	--	--	--	--	N	K3 MR
GC-15	20	--	10	--	--	--	--	--	--	N	K3 MR
GC-16	20	--	10	--	--	--	--	--	--	N	K3 MR
GC-17	25	--	10	55	3-53	566	22	25.7	--	N	K3 MR
GC-18	30	--	10	77	3-51	578	24	24.1	8	N	K3 MR
GC-19	20	--	10	57	9-52	530	26	20.4	8	U	K3 MR
GC-20	20	--	10	38	9-48	560	45	12.4	8	N	K3 MR
GC-21	10	--	3	33	4-53	25	--	--	8	H	K3 MR
GC-22	20	--	--	34	-45	600	25	24.0	--	N	K3 MR
GC-23	30	260	10	64	12-57	600	24	25.0	8	N	K3 MR
GC-24	30	--	10	49	7-54	600	29	20.7	8	N	K3 MR
GC-25	--	--	--	--	--	--	--	--	--	N	K3 MR
GC-26	30	285	10	57	--	600	35	17.1	8	N	K3 MR
GC-27	24	--	10	49	3-60	500	46	10.9	48	U	K3 MR
GT-1	89	--	10	111	1-65	1010	32	31.6	5	P	K3 MR
GT-2	80	--	12	112	4-68	1529	54	28.3	24	P	K3 MR
GT-3	82	--	12	108	1-67	1000	35	28.6	8	P	K3 MR
GT-4	--	--	4	5	10-52	25	--	--	--	H	K3 MV
GT-5	6	--	4	12	1-55	60	4	15.0	--	H	K3 ET
GT-6	10	--	3	20	4-49	25	10	2.5	4	H	K3 MR
GT-7	10	--	3	47	1-55	20	7	2.9	8	H	K3 MR
GT-8	18	--	4	86	6-49	250	6	41.7	12	H	K3 MR
GT-9	10	--	4	40	10-67	50	10	5.0	1	H	K3 ET
GT-10	10	--	4	35	12-68	8	20	0.4	1	H	K3 MW
GT-11	10	--	3	40	1-52	20	--	--	2	H	K3 ET
GT-12	10	--	3	90	6-53	40	--	--	4	H	K3 MR
GT-13	10	--	4	45	3-50	--	--	--	2	H	K3 ET
GT-14	--	--	4	71	8-55	25	--	--	12	H	K3 MR
GT-15	6	--	4	--	--	--	10	--	4	H	K3 ET
GT-16	--	--	4	--	--	50	--	--	--	H	K3 ET
GT-17	--	--	6	123	9-66	--	--	--	--	N	K3 MR
GT-18	--	--	--	--	--	--	--	--	--	--	--
GT-19	10	--	3	43	2-53	--	--	--	--	H	K3 ET
GT-20	38	--	8	24	8-48	600	40	15.0	8	P	K3 MR
GT-21	30	--	6	4	1-30	100	--	--	10	P	K3 MW

MAP NUMBER	MUNICIPALITY	LAT-LONG	OWNER	LOCAL WELL NUMBER	DATE DRILLED (YEAR)	ALTITUDE OF LSD (FT)	CASING DEPTH (FT)	WELL DEPTH (FT)
			CAMDEN COUNTY					
GT-22	GLOUCESTER TWP	394759N0750158.1	GARDEN STATE WC	TEST 1	1970	78	458	468
GT-23	GLOUCESTER TWP	394754N0750343.1	GAR ST WC-BLKWD	BLACKWOD DIV 3	1956	81	426	447
GT-24	GLOUCESTER TWP	394739N0750227.1	GLOU TWP BD ED	LEWIS SCHOOL	1964	117	455	475
GT-25	GLOUCESTER TWP	394719N0750146.1	ROBERT BENNETT	MONARCH BOILER	1968	110	--	200
GT-26	GLOUCESTER TWP	394718N0750341.1	GARDEN STATE WC	PEOPLES 1	1953	65	419	449
GT-27	GLOUCESTER TWP	394716N0750420.1	CAMDEN COUNTY	LAKELAND 1	--	55	--	420
GT-28	GLOUCESTER TWP	394714N0750410.1	CAMDEN COUNTY	LAKELAND 3	--	25	--	93
GT-29	GLOUCESTER TWP	394712N0750413.1	CAMDEN COUNTY	LAKELAND 2	--	25	--	386
GT-30	GLOUCESTER TWP	394712N0750220.1	SOCIETY DIVINE	SAVIOR	1951	107	492	512
GT-31	GLOUCESTER TWP	394711N0750418.1	CAMDEN COUNTY	LAKELAND FOUNT	--	25	--	--
GT-32	GLOUCESTER TWP	394702N0750321.1	MYRA LORING	--	1957	73	109	130
GT-33	GLOUCESTER TWP	394658N0750305.1	P HENDRICKS	--	1956	81	100	135
GT-34	GLOUCESTER TWP	394641N0745959.1	P BARATTA	--	1951	180	56	66
GT-35	GLOUCESTER TWP	394626N0750015.1	A MINARDI	1	1954	175	52	62
GT-36	GLOUCESTER TWP	394620N0750032.1	ROBERT BENNETT	HOME WELL	--	172	--	72
GT-37	GLOUCESTER TWP	394618N0750235.1	H A SANDBERG	--	1952	130	218	250
GT-38	GLOUCESTER TWP	394617N0750237.1	J BECICA	--	1949	111	200	220
GT-39	GLOUCESTER TWP	394614N0750017.1	POWELL	--	1951	178	49	54
GT-40	GLOUCESTER TWP	394607N0750031.1	GLOUCESTER TWP	BD OF EDUCATN	1960	178	293	315
GT-41	GLOUCESTER TWP	394606N0750016.1	F MORRISEY	--	1955	178	55	65
GT-42	GLOUCESTER TWP	394605N0750016.1	HOWARD MORRISEY	--	1956	178	55	60
GT-43	GLOUCESTER TWP	394558N0750210.1	E G HOTHO	--	1955	98	122	135
GT-44	GLOUCESTER TWP	394556N0745835.1	CAMDEN CO BD ED	VOC&TECH H S 1	1967	145	322	401
GT-45	GLOUCESTER TWP	394512N0750145.1	WALTER JOHNSON	--	1954	110	220	240
GT-46	GLOUCESTER TWP	394509N0745958.1	US ARMY	--	1954	173	82	102
GT-47	GLOUCESTER TWP	394430N0745958.1	US ARMY	--	1954	170	62	82
GT-48	GLOUCESTER TWP	394421N0750025.1	JOSEPH A MELZI	--	1952	162	58	64
GT-49	GLOUCESTER TWP	394343N0750049.1	B W BAUER	--	1951	164	40	45
HA-1	HADDON TWP	395444N0750316.1	MILGRAM THEATER	WESTMONT	--	50	135	150
HA-2	HADDON TWP	395436N0750252.1	MORGAN BROTHERS	REPLACEMENT	1967	50	431	451
HA-3	HADDON TWP	395416N0750336.1	HADDON TWP BD E	HADDON TWP HS1	1966	10	141	165
HA-4	HADDON TWP	395412N0750338.1	HADDON TWP W D	HTWD 4	1965	82	417	448
HA-5	HADDON TWP	395406N0750317.1	HADDON TWP W D	HTWD 1	1952	56	436	468
HA-6	HADDON TWP	395406N0750317.2	HADDON TWP W D	HTWD 1-R	1968	56	--	480
HA-7	HADDON TWP	395403N0750322.1	HADDON TWP W D	HTWD 2	1952	50	439	470
HA-8	HADDON TWP	395359N0750322.1	HADDON TWP W D	HTWD 3	1956	61	432	469
HA-9	HADDON TWP	395351N0750313.1	GREEN VALLEY FM	FARM 2	1965	77	194	215
HF-1	HADDONFIELD BORO	395404N0750202.1	HADDONFIELD W D	TEST WELL 1965	1965	45	490	510
HF-2	HADDONFIELD BORO	395404N0750202.2	HADDONFIELD W D	LAKE ST WELL	1967	50	307	372
HF-3	HADDONFIELD BORO	395333N0750132.1	HADDONFIELD W D	RULON	1956	20	523	572
HF-4	HADDONFIELD BORO	395324N0750138.1	HADDONFIELD W D	CREEK 3	1938	18	211	245
HF-5	HADDONFIELD BORO	395322N0750154.1	HADDONFIELD W D	LAYNE 2	1956	30	206	246
HF-6	HADDONFIELD BORO	395322N0750147.1	HADDONFIELD W D	HWD 2	1956	38	152	192
HF-7	HADDONFIELD BORO	395317N0750141.1	HADDONFIELD W D	HWD 4	1943	18	186	240
HH-1	HADDON HGTS BORO	395248N0750433.1	NJ WATER CO	EGGBERT 18	1958	22	144	191
HH-2	HADDON HGTS BORO	395248N0750433.2	NJ WATER CO	EGGBERT 6	1926	23	154	202
HH-3	HADDON HGTS BORO	395247N0750432.1	NJ WATER CO	EGGBERT 35	1967	22	425	484
HH-4	HADDON HGTS BORO	395246N0750433.1	NJ WATER CO	EGBERT	1962	24	445	455
HH-5	HADDON HGTS BORO	395242N0750320.1	NJ WATER CO	HADDON 11	1945	84	212	272
HH-6	HADDON HGTS BORO	395240N0750324.1	NJ WATER CO	HADDON 14	1954	76	506	598
HH-7	HADDON HGTS BORO	395240N0750318.1	NJ WATER CO	HADDON 12	1947	66	227	267
HH-8	HADDON HGTS BORO	395238N0750317.1	NJ WATER CO	HADDON 30	1965	65	224	279
HH-9	HADDON HGTS BORO	395238N0750316.1	NJ WATER CO	HADDON 15	1956	65	452	631
HH-10	HADDON HGTS BORO	395231N0750314.1	NJ WATER CO	HADDON 20	1958	60	241	275
LS-1	LAUREL SPRGS BORO	394928N0750027.1	NJ WATER CO	LAUREL 15	1964	75	395	473
LS-2	LAUREL SPRGS BORO	394928N0750024.1	NJ WATER CO	LAUREL 13	1954	77	395	456
LS-3	LAUREL SPRGS BORO	394928N0750023.1	NJ WATER CO	LAUREL 6	1918	77	--	120
LS-4	LAUREL SPRGS BORO	394928N0750021.1	NJ WATER CO	LAUREL 8	1920	77	105	125
LS-5	LAUREL SPRGS BORO	394928N0750021.2	NJ WATER CO	LAUREL 10	1923	77	99	126
LS-6	LAUREL SPRGS BORO	394927N0750025.1	NJ WATER CO	LAUREL 4	1918	77	--	128
LS-7	LAUREL SPRGS BORO	394927N0750024.1	NJ WATER CO	LAUREL 1	1918	77	100	120
LI-1	LINDENWOLD BORO	394932N0745854.1	MUN UTIL AUTH	SEWAGE PLANT 1	1964	78	141	152
LI-2	LINDENWOLD BORO	394929N0745208.1	J A PIPPET	--	1954	93	92	100
LI-3	LINDENWOLD BORO	394805N0745732.1	LINDENWOLD ANM	ANIMAL SHELT 1	1967	160	--	285
MA-1	MAGNOLIA BORO	395135N0750246.1	OWENS CORNING	CORNING 2	1956	67	290	320
MA-2	MAGNOLIA BORO	395134N0750251.1	OWENS CORNING	TEST 2	1964	65	565	680
MA-3	MAGNOLIA BORO	395134N0750230.1	NJ WATER CO	MAGNOLIA 33	1967	60	271	348
MA-4	MAGNOLIA BORO	395134N0750229.1	NJ WATER CO	MAGNOLIA 16	1964	70	428	510
ME-1	MRCHNTVILLE BORO	395652N0750307.1	MERCH-PENNS W C	WOODBINE 1	1963	90	245	285
OA-1	OAKLYN BORO	395358N0750447.1	NJ WATER CO	OAKLYN TEST	1961	33	104	113
PE-1	PENNSAUKEN TWP	395943N0750212.1	CAMDEN CITY W D	MORRIS 1	--	9	77	107
PE-2	PENNSAUKEN TWP	395940N0750230.1	CAMDEN CITY W D	MORRIS 5NA	1960	5	79	114
PE-3	PENNSAUKEN TWP	395939N0750229.1	CAMDEN CITY W D	MORRIS 5	1932	5	80	115
PE-4	PENNSAUKEN TWP	395934N0750229.1	CAMDEN CITY W D	MORRIS 3A	1953	17	73	107
PE-5	PENNSAUKEN TWP	395929N0750253.1	CAMDEN CITY W D	MORRIS 4A	1960	8	95	134
PE-6	PENNSAUKEN TWP	395929N0750253.2	CAMDEN CITY W D	MORRIS 4	--	8	95	130
PE-7	PENNSAUKEN TWP	395925N0750230.1	KINGSTON TRAP	TRAP RK IND 2	1966	35	115	123
PE-8	PENNSAUKEN TWP	395923N0750300.1	CAMDEN CITY W D	MORRIS 10	1960	16	75	115
PE-9	PENNSAUKEN TWP	395916N0750303.1	CAMDEN CITY W D	MORRIS 7	1932	10	85	120
PE-10	PENNSAUKEN TWP	395910N0750307.1	CAMDEN CITY W D	MORRIS 8	--	10	89	124

MAP NUMBER	LENGTH OF WELL OPEN TO AQUIFER (FEET)	DEPTH TO CONSOLIDATED ROCK (FT)	CASING DIAMETER (IN)	WATER LEVEL (FT)	DATE WATER LEVEL MEASURED	YIELD (GPM)	DRAW DOWN (FT)	SPECIFIC CAPACITY	PUMPING PERIOD (HOURS)	USE OF WATER	MAJOR AQUIFER
					CAMDEN COUNTY						
GT-22	10	--	6	125	11-70	75	33	2.3	5	U	K3 MR
GT-23	21	--	12	88	7-56	708	43	16.5	8	P	K3 MR
GT-24	20	--	6	129	8-64	220	56	3.9	8	T	K3 MR
GT-25	--	--	4	50	11-68	100	--	--	1	N	K3 MW
GT-26	30	--	6	70	--	--	--	--	--	P	K3 MR
GT-27	--	--	--	--	--	--	--	--	--	T	K3 MR
GT-28	--	--	--	F	8-70	--	--	--	--	T	K3 MW
GT-29	--	--	--	--	--	--	--	--	--	T	K3 MR
GT-30	20	--	10	103	9-51	510	100	5.1	72	H	K3 MR
GT-31	--	--	--	+34	8-70	--	--	--	--	T	K3 MW
GT-32	21	--	3	25	11-57	100	--	--	3	H	K3 MW
GT-33	--	--	4	6	10-56	150	--	--	4	H	K3 NA
GT-34	10	--	3	35	10-51	25	5	5.0	--	H	AA CP
GT-35	10	--	3	32	7-54	8	3	2.7	6	H	AA CP
GT-36	--	--	--	--	--	--	--	--	--	--	AA CP
GT-37	32	--	4	48	6-52	170	--	--	--	H	K3 MW
GT-38	20	--	4	40	11-49	50	--	--	2	H	K3 MW
GT-39	5	--	3	30	11-51	5	6	0.8	--	H	AA CP
GT-40	--	--	6	125	4-60	80	--	--	8	H	K3 MW
GT-41	10	--	4	40	9-55	30	5	6.0	3	H	AA CP
GT-42	5	--	4	38	10-56	25	4	6.2	2	H	AA CP
GT-43	13	--	4	159	1-55	100	--	--	5	H	TL VH
GT-44	79	--	8	113	9-67	320	123	2.6	8	P	K3 MW
GT-45	20	--	4	40	11-54	80	15	5.3	5	H	TL HT
GT-46	20	--	8	36	6-54	240	48	5.0	24	P	AA CP
GT-47	20	--	8	30	6-54	240	40	6.0	24	P	AA CP
GT-48	6	--	4	24	9-52	25	--	--	5	H	AA CP
GT-49	5	--	3	20	10-51	5	5	1.0	--	H	AA CP
HA-1	15	--	8	--	--	150	--	--	--	--	K3 MR
HA-2	--	465	10	104	--	302	--	--	8	N	K3 MR
HA-3	20	--	6	60	11-66	200	23	8.7	--	I	K3 MR
HA-4	27	455	12	100	8-65	726	42	17.3	8	P	K3 MR
HA-5	32	475	10	80	2-52	800	40	20.0	8	P	K3 MR
HA-6	--	--	12	125	11-66	870	--	--	8	P	K3 MR
HA-7	31	--	10	74	4-52	1000	41	24.4	8	P	K3 MR
HA-8	37	--	10	95	6-56	800	35	22.9	--	P	K3 MR
HA-9	21	--	6	121	1-65	151	12	12.6	6	I	K3 MR
HF-1	20	553	6	90	1-65	350	35	10.0	8	U	K3 MR
HF-2	50	--	12	107	6-67	1030	48	21.5	8	P	K3 MR
HF-3	49	--	12	42	6-56	1100	38	28.9	48	P	K3 MR
HF-4	33	--	8	56	7-59	450	54	8.3	--	--	K3 MR
HF-5	40	--	12	105	5-56	1001	46	21.8	8	P	K3 MR
HF-6	40	--	8	55	7-59	600	31	19.4	--	P	K3 MR
HF-7	54	--	6	56	3-56	600	26	23.1	8	P	K3 MR
HH-1	47	--	12	69	7-58	708	45	15.7	8	P	K3 MR
HH-2	48	--	8	23	-26	535	25	21.4	3	P	K3 MR
HH-3	44	477	12	83	3-67	850	60	14.2	8	P	K3 MR
HH-4	10	479	6	61	1-62	30	30	1.0	8	U	K3 MR
HH-5	60	--	12	123	--	450	--	--	--	P	K3 MR
HH-6	53	603	8	101	8-54	1018	88	11.6	6	P	K3 MR
HH-7	40	--	10	93	--	--	--	--	--	P	K3 MR
HH-8	51	--	--	129	3-65	811	38	21.3	--	P	K3 MR
HH-9	74	--	8	72	2-56	1100	35	31.4	6	P	K3 MR
HH-10	21	--	12	36	8-58	950	52	18.3	8	P	K3 MR
LS-1	64	--	8	130	--	650	98	6.6	24	P	K3 MR
LS-2	61	--	8	84	6-54	759	80	9.5	--	P	K3 MR
LS-3	--	--	8	--	--	--	--	--	--	U	K3 MW
LS-4	20	--	8	44	9-52	175	--	--	--	P	K3 MW
LS-5	--	--	8	--	--	200	--	--	--	P	K3 MW
LS-6	--	--	8	--	--	330	--	--	--	P	K3 MW
LS-7	--	--	8	--	--	300	--	--	--	P	K3 MW
LI-1	11	--	6	16	11-64	60	--	--	--	--	K3 MW
LI-2	--	--	3	18	7-54	14	--	--	7	H	TL VH
LI-3	--	--	4	--	--	--	--	--	--	H	K3 MW
MA-1	30	--	12	96	3-56	1000	41	24.4	8	N	K3 MR
MA-2	60	--	6	128	6-64	668	48	13.9	22	N	K3 MR
MA-3	77	--	12	141	3-67	1090	46	23.7	24	P	K3 MR
MA-4	--	--	--	--	--	--	--	--	--	P	K3 MR
ME-1	--	--	12	85	9-63	1040	--	--	--	P	K3 MR
OA-1	8	--	6	56	10-61	50	16	3.1	16	U	K3 MR
PE-1	30	--	18	--	--	1180	--	--	--	P	K3 MR
PE-2	35	--	18	12	11-60	1450	46	31.5	--	P	K3 MR
PE-3	35	--	26	15	8-32	1630	37	44.1	8	P	K3 MR
PE-4	30	136	30	12	7-53	1000	34	29.4	8	P	K3 MR
PE-5	35	--	18	13	10-60	1585	28	56.6	8	P	K3 MR
PE-6	35	--	26	--	--	--	--	--	--	P	K3 MR
PE-7	8	--	8	26	8-66	200	34	5.9	2	N	K3 MR
PE-8	40	--	18	11	11-61	1450	35	41.4	8	P	K3 MR
PE-9	35	--	26	13	--	1680	32	52.5	8	P	K3 MR
PE-10	35	--	26	--	--	1412	--	--	--	P	K3 MR

Table 1.--Records of selected wells in Camden County and vicinity--Continued

MAP NUMBER	MUNICIPALITY	LAT-LONG	OWNER	LOCAL WELL NUMBER	DATE DRILLED (YEAR)	ALTI-TUDE- OF LSD (FT)	CASING DEPTH (FT)	WELL DEPTH (FT)
			CAMDEN COUNTY					
PE-11	PENNSAUKEN TWP	395906N0750313.1	CAMDEN CITY W D	MORRIS 9	1932	10	118	143
PE-12	PENNSAUKEN TWP	395902N0750318.1	CAMDEN CITY W D	MORRIS 6	1932	8	98	133
PE-13	PENNSAUKEN TWP	395902N0750153.1	MERCH-PENNS W C	NATIONAL HWY 1	1967	40	195	231
PE-14	PENNSAUKEN TWP	395853N0750348.1	CAMDEN CITY W D	DELAIR 3	1930	8	86	126
PE-15	PENNSAUKEN TWP	395851N0750355.1	CAMDEN CITY W D	DELAIR 2	1930	10	111	141
PE-16	PENNSAUKEN TWP	395848N0750347.1	CAMDEN CITY W D	DELAIR 1	1960	10	103	138
PE-17	PENNSAUKEN TWP	395845N0750317.1	CAMDEN CITY W D	PUCHACK 3	1924	10	127	175
PE-18	PENNSAUKEN TWP	395845N0750312.1	CAMDEN CITY W D	PUCHACK 1	1924	10	108	140
PE-19	PENNSAUKEN TWP	395844N0750352.1	PENNSYLVANIA RR	PRR TEST 1	1951	30	102	122
PE-20	PENNSAUKEN TWP	395842N0750312.1	CAMDEN CITY W D	PUCHACK 2	1924	14	126	169
PE-21	PENNSAUKEN TWP	395839N0750306.1	CAMDEN CITY W D	PUCHACK 4	1924	10	136	184
PE-22	PENNSAUKEN TWP	395837N0750151.1	CHRISTIAN BR SH	1	1950	73	125	136
PE-23	PENNSAUKEN TWP	395835N0750308.1	CAMDEN CITY W D	PUCHACK 5	1924	19	136	186
PE-24	PENNSAUKEN TWP	395827N0750246.1	H W LAYER	--	1951	40	127	137
PE-25	PENNSAUKEN TWP	395815N0750359.1	PARAGON OIL CO	1	1961	25	51	61
PE-26	PENNSAUKEN TWP	395811N0750549.1	CITIES SERVICE	PETTY IS OBS	--	11	--	143
PE-27	PENNSAUKEN TWP	395802N0750118.1	MERCH-PENNS W C	PARK AVE 2	1943	12	232	257
PE-28	PENNSAUKEN TWP	395802N0750117.1	MERCH PENNS W C	PARK AVE 1	1947	19	240	270
PE-29	PENNSAUKEN TWP	395801N0750119.1	MERCH PENNS W C	PARK AVE 3	1958	19	240	275
PE-30	PENNSAUKEN TWP	395800N0750125.1	MERCH PENNS W C	PARK AVE 4	1933	20	146	181
PE-31	PENNSAUKEN TWP	395800N0750115.1	MERCH-PENNS W C	PARK AVE REP 6	1940	15	212	260
PE-32	PENNSAUKEN TWP	395758N0750120.1	MERCH-PENNS W C	PARK AVE 5	1948	20	248	288
PE-33	PENNSAUKEN TWP	395757N0750640.1	U S GEOL SURVEY	PETTY I WEST 1	1966	5	77	84
PE-34	PENNSAUKEN TWP	395752N0750411.1	MERCH-PENNS W C	DELA GARDEN 1	1945	50	97	123
PE-35	PENNSAUKEN TWP	395752N0750411.2	MERCH-PENNS W C	DELA GARDEN 2	1955	39	115	145
PE-36	PENNSAUKEN TWP	395752N0750411.3	MERCH-PENNS W C	DELA GARDEN 1A	1968	50	109	139
PE-37	PENNSAUKEN TWP	395737N0750626.1	U S GEOL SURVEY	PETTY ISLAND 2	1966	5	--	129
PE-38	PENNSAUKEN TWP	395737N0750626.2	U S GEOL SURVEY	PETTY I EAST 3	1966	5	44	55
PE-39	PENNSAUKEN TWP	395720N0750225.1	MERCH-PENNS W C	MARION 1	1957	61	243	278
PE-40	PENNSAUKEN TWP	395713N0750405.1	MERCH-PENNS W C	AMDN HGTS 2	1923	69	157	176
PE-41	PENNSAUKEN TWP	395711N0750220.1	MERCH-PENNS W C	MARION 2	1963	60	223	258
PE-42	PENNSAUKEN TWP	395628N0750406.1	MERCH PENNS W C	FROSTHOFFER T2	1963	25	204	224
PE-43	PENNSAUKEN TWP	395628N0750406.2	MERCH-PENNS W C	BROWNING 2A	1965	30	110	140
PE-44	PENNSAUKEN TWP	395627N0750404.1	MERCH-PENNS W C	BROWNING 1	1960	25	107	137
PE-45	PENNSAUKEN TWP	395627N0750404.2	MERCH PENNS W C	FROSTHOFFER T1	1963	25	118	138
PH-1	PINE HILL BORO	394707N0745921.1	HARRY WEBER	--	1955	165	56	60
PH-2	PINE HILL BORO	394650N0745922.1	J MC GILLEN	--	1954	160	40	50
PH-3	PINE HILL BORO	394649N0745833.1	PINE HILL M U A	PHMUA 2	1957	160	296	355
PH-4	PINE HILL BORO	394649N0745833.2	PINE HILL M U A	PHMUA 3	1960	160	31	86
PH-5	PINE HILL BORO	394642N0745953.1	LEROY KINGETT	--	1949	180	337	347
PH-6	PINE HILL BORO	394641N0745909.1	PINE HILL M U A	PHMUA 1	1962	150	600	687
PH-7	PINE HILL BORO	394639N0745750.1	OVERBROOK REG H	--	1971	160	310	330
PV-1	PINE VALLEY BORO	394728N0745837.1	JOHN GALBRAITH	--	1952	170	300	355
PV-2	PINE VALLEY BORO	394722N0745810.1	PINE VALLEY G C	GOLF CLUB	1955	85	--	267
PV-3	PINE VALLEY BORO	394712N0745841.1	J R FERGUSON	--	1950	172	330	360
PV-4	PINE VALLEY BORO	394702N0745824.1	PINE VALLEY G C	GOLF CLUB 1-49	1949	170	310	370
RU-1	RUNNEMEDE BORO	395134N0750454.1	TRAP ROCK CO	2	1963	40	196	222
RU-2	RUNNEMEDE BORO	395133N0750455.1	TRAP ROCK IND	3	1968	40	195	215
RU-3	RUNNEMEDE BORO	395128N0750350.1	EASTERN RECORD	EASTERN 1	1963	40	250	260
RU-4	RUNNEMEDE BORO	395115N0750325.1	RED COACH INC	HIRST	1964	79	302	312
RU-5	RUNNEMEDE BORO	395056N0750417.1	NJ WATER CO	RUNNEMEDE 19	1958	67	301	338
RU-6	RUNNEMEDE BORO	395055N0750418.1	NJ WATER CO	RUNNEMEDE 7	1926	67	265	318
SO-1	SOMERDALE BORO	395041N0750053.1	NJ WATER CO	SOMERDALE 14	1956	105	389	441
TA-1	TAVISTOCK BORO	395237N0750122.1	TAVISTOCK CLUB	COUNTRY CLUB 1	1968	30	217	246
VO-1	VOORHEES TWP	395148N0745615.1	THOMAS DECAU	1	1957	115	127	147
VO-2	VOORHEES TWP	395129N0745906.1	NJ WATER CO	VOORHEES 21	1959	129	422	482
VO-3	VOORHEES TWP	395128N0745954.1	NJ WATER CO	ASHLAND TER 32	1966	70	--	459
VO-4	VOORHEES TWP	395128N0745954.2	NJ WATER CO	ASHLAND TER 9	1926	74	355	407
VO-5	VOORHEES TWP	395128N0745954.3	NJ WATER CO	ASHLAND TER 9R	1966	74	364	437
VO-6	VOORHEES TWP	395124N0745952.1	NJ WATER CO	ASHLAND 17	1958	100	379	421
VO-7	VOORHEES TWP	395109N0745715.1	RADIO CORP AMER	RCA	1955	175	220	234
VO-8	VOORHEES TWP	395107N0745854.1	R H DOBBS	--	1949	121	140	161
VO-9	VOORHEES TWP	395044N0745749.1	HAINES BLOCK CO	--	1955	118	--	160
VO-10	VOORHEES TWP	395015N0745528.1	CAMDEN LIME CO	3	--	155	--	265
VO-11	VOORHEES TWP	394954N0745530.1	CAMDEN LIME CO	1	1955	175	260	280
VO-12	VOORHEES TWP	394922N0745633.1	NJ WATER CO	ELM TREE 2	1963	148	1217	1227
VO-13	VOORHEES TWP	394922N0745633.2	NJ WATER CO	ELM TREE 3	1963	147	706	717
VO-14	VOORHEES TWP	394922N0745633.3	NJ WATER CO	ELM TREE 26	1960	150	237	275
WA-1	WATERFORD TWP	394651N0745421.1	ATCO DRIVE-IN	--	1955	170	65	76
WA-2	WATERFORD TWP	394645N0745146.1	CENTRAL SUPPLY	--	1955	121	78	83
WA-3	WATERFORD TWP	394620N0745403.1	GREEN ACRES MTL	MOTEL 1	1968	165	71	81
WA-4	WATERFORD TWP	394618N0745413.1	IVYSTONE W W	WATER WKS 2-62	1962	159	420	460
WA-5	WATERFORD TWP	394618N0745413.2	IVYSTONE W W	WATER WKS 3-65	1965	159	420	460
WA-6	WATERFORD TWP	394615N0745358.1	WILLIAM JULANO	--	1955	170	79	83
WA-7	WATERFORD TWP	394614N0745316.1	H W GSELL	--	1947	159	93	103
WA-8	WATERFORD TWP	394613N0745353.1	AL GIORDANO	1	1965	170	98	113
WA-9	WATERFORD TWP	394552N0744930.1	JOSEPH LANNI	--	1951	101	65	75
WA-10	WATERFORD TWP	394357N0745022.1	ALBERT PAGIA	--	1952	102	72	82
WA-11	WATERFORD TWP	394341N0745117.1	BRIDGE VIEW FAR	1	1966	120	110	130
WA-12	WATERFORD TWP	394243N0744932.1	EUGENE BRITTIN	--	1955	88	100	105

Table 1.--Records of selected wells in Camden County and vicinity--Continued

MAP NUMBER	LENGTH OF WELL OPEN TO AQUIFER (FEET)	DEPTH TO CONSOLIDATED ROCK (FT)	CASING DIAMETER (IN)	WATER LEVEL (FT)	DATE WATER LEVEL MEASURED	YIELD (GPM)	DRAW DOWN (FT)	SPECIFIC CAPACITY	PUMPING PERIOD (HOURS)	USE OF WATER	MAJOR AQUIFER
					CAMDEN COUNTY						
PE-11	35	--	26	12	7-32	1900	28	67.9	8	P	K3 MR
PE-12	35	--	26	14	7-32	1700	46	37.0	8	P	K3 MR
PE-13	25	--	12	80	7-67	1000	29	34.5	8	P	K3 MR
PE-14	30	135	26	11	11-30	1850	49	37.8	8	P	K3 MR
PE-15	30	--	26	13	10-30	1330	75	17.7	8	P	K3 MR
PE-16	35	--	18	20	10-30	1680	21	80.0	--	P	K3 MR
PE-17	48	--	26	14	5-24	1175	67	17.5	--	P	K3 MR
PE-18	32	--	26	20	10-24	1400	48	29.2	--	P	K3 MR
PE-19	20	--	3	58	12-51	--	--	--	--	N	K3 MR
PE-20	43	174	26	20	4-24	1440	49	29.4	6	P	K3 MR
PE-21	48	--	26	18	5-24	1680	40	42.0	--	P	K3 MR
PE-22	11	--	6	--	11-50	75	--	--	--	H	K3 MR
PE-23	--	--	26	38	8-24	1000	--	--	--	P	K3 MR
PE-24	10	--	4	95	4-51	25	--	--	2	H	K3 MR
PE-25	10	--	6	14	3-61	100	5	20.0	6	N	K3 MR
PE-26	--	--	8	6	12-50	--	--	--	--	U	K3 MR
PE-27	25	--	12	17	10-43	1000	27	37.0	8	P	K3 MR
PE-28	30	--	12	15	11-47	1005	23	43.7	8	P	K3 MR
PE-29	35	--	12	39	8-58	1034	37	27.9	8	P	K3 MR
PE-30	35	--	10	34	7-33	600	36	16.7	12	P	K3 MR
PE-31	50	--	12	6	1-40	720	20	36.0	24	P	K3 MR
PE-32	40	--	12	22	4-48	1005	53	19.0	8	P	K3 MR
PE-33	--	71	10	--	--	--	--	--	--	U	K3 MR
PE-34	26	--	18	64	4-55	900	8	112.5	--	P	K3 MR
PE-35	30	--	12	50	7-55	728	23	31.7	8	P	K3 MR
PE-36	30	--	12	53	4-68	882	15	58.8	8	P	K3 MR
PE-37	--	116	10	--	--	--	--	--	--	U	K3 MR
PE-38	9	--	--	--	--	--	--	--	--	U	K3 MR
PE-39	35	--	12	59	7-57	1020	39	26.2	8	P	K3 MR
PE-40	20	--	10	67	--	130	--	--	--	U	K3 MR
PE-41	35	--	12	90	10-62	1000	43	23.3	8	P	K3 MR
PE-42	20	--	6	48	-63	250	16	15.6	--	U	K3 MR
PE-43	30	--	12	43	5-65	900	25	36.0	8	P	K3 MR
PE-44	30	--	12	47	12-59	875	26	33.7	8	P	K3 MR
PE-45	20	--	6	40	9-63	400	23	17.4	8	U	K3 MR
PH-1	10	--	3	30	9-55	25	10	2.5	3	H	AA CP
PH-2	10	--	4	30	8-54	15	5	3.0	4	H	AA CP
PH-3	36	--	4	120	8-57	197	61	3.2	4	P	K3 MW
PH-4	55	--	8	22	3-60	100	58	1.7	10	P	AA CP
PH-5	10	--	4	132	11-49	40	18	2.2	8	H	K3 MW
PH-6	61	--	8	180	10-62	759	35	21.7	8	P	K3 MR
PH-7	20	--	--	126	5-71	--	--	--	--	T	K3 MW
PV-1	55	--	6	124	2-52	100	--	--	10	H	K3 MW
PV-2	--	--	10	40	10-55	200	--	--	8	P	K3 MW
PV-3	--	--	6	120	8-50	50	--	--	8	H	K3 MW
PV-4	60	--	8	110	9-49	125	20	6.2	8	H	K3 MW
RU-1	26	--	8	62	8-63	250	18	13.9	2	N	K3 MR
RU-2	10	--	4	80	12-68	100	20	5.0	1	H	K3 MR
PU-3	10	--	6	90	8-63	150	9	16.7	--	I	K3 MR
RU-4	10	--	3	120	3-64	70	5	14.0	--	H	K3 MR
RU-5	42	--	12	98	4-58	1900	61	31.1	8	P	K3 MR
RU-6	53	--	6	90	9-26	527	25	21.1	--	P	K3 MR
SO-1	52	--	10	115	5-56	709	76	9.3	8	P	K3 MR
TA-1	23	--	8	101	7-68	285	25	11.4	4	I	K3 MR
VO-1	20	--	8	45	9-57	300	45	6.7	6	I	K3 MW
VO-2	60	--	12	161	6-59	1012	30	33.7	8	P	K3 MR
VO-3	--	--	12	--	--	--	--	--	--	P	K3 MR
VO-4	50	--	12	94	--	1000	57	17.5	--	P	K3 MR
VO-5	40	--	8	136	6-66	709	22	32.2	8	P	K3 MR
VO-6	42	--	12	93	12-57	1016	38	26.7	8	P	K3 MR
VO-7	14	--	6	80	4-55	50	--	--	4	H	K3 MW
VO-8	21	--	6	38	12-49	100	--	--	10	H	K3 MW
VO-9	--	--	4	11	2-55	50	--	--	--	N	K3 MW
VO-10	--	--	4	81	3-70	--	--	--	--	U	K3 MW
VO-11	20	--	4	50	11-55	50	10	5.0	4	N	K3 MW
VO-12	10	1259	6	183	2-63	10	258	0.0	--	U	K3 MR
VO-13	11	--	6	190	2-63	15	--	--	--	U	K3 MR
VO-14	42	--	8	81	6-60	--	--	--	--	P	K3 MW
WA-1	11	--	6	45	6-55	60	8	7.5	5	N	AA CP
WA-2	5	--	4	45	3-55	45	5	9.0	1	H	AA CP
WA-3	10	--	4	20	10-68	70	10	7.0	1	H	AA CP
WA-4	40	--	10	135	5-62	535	155	3.5	48	P	K3 MW
WA-5	40	--	6	140	2-65	500	108	4.6	8	P	K3 MW
WA-6	5	--	4	18	5-55	30	7	4.3	4	H	AA CP
WA-7	10	--	--	31	12-47	8	--	--	--	H	AA CP
WA-8	--	--	4	--	--	--	--	--	--	I	AA CP
WA-9	10	--	6	6	8-51	50	--	--	6	H	AA CP
WA-10	10	--	3	22	11-52	40	6	6.7	4	H	AA CP
WA-11	20	--	4	8	4-66	60	1	60.0	2	I	AA CP
WA-12	5	--	6	42	8-55	50	12	4.2	6	H	AA CP

MAP NUMBER	MUNICIPALITY	LAT-LONG	OWNER	LOCAL WELL NUMBER	DATE DRILLED (YEAR)	ALTI-TUDE-OF LSD (FT)	CASING DEPTH (FT)	WELL DEPTH (FT)
			CAMDEN COUNTY					
WA-13	WATERFORD TWP	394243N0744918.1	E A CAPOFERRI	1	1966	92	10	130
WA-14	WATERFORD TWP	394229N0744941.1	E A CAPOFERRI	2	1966	89	30	129
WI-1	WINSLOW TWP	394623N0745544.1	HERBERT WILSON	1	1966	163	53	58
WI-2	WINSLOW TWP	394538N0745506.1	ROY W KRESGE	--	1956	160	61	67
WI-3	WINSLOW TWP	394522N0745625.1	JOHNS-MANVILLE	1	1963	160	410	450
WI-4	WINSLOW TWP	394522N0745625.2	JOHNS-MANVILLE	2	1963	160	410	450
WI-5	WINSLOW TWP	394522N0745625.3	JOHNS-MANVILLE	TEST HOLE 1	1963	160	--	890
WI-6	WINSLOW TWP	394507N0745438.1	PETER SEN	--	1952	143	90	97
WI-7	WINSLOW TWP	394449N0745540.1	FORMEGLI CORP	--	1957	150	86	106
WI-8	WINSLOW TWP	394443N0745434.1	CAMDEN CO R H S	REGIONAL H S 1	1957	175	102	110
WI-9	WINSLOW TWP	394443N0745304.1	DOMENIC CASARIO	--	1951	150	53	60
WI-10	WINSLOW TWP	394433N0745445.1	AMERICAN TELEPH	TELEGRAPH 1	1966	172	120	130
WI-11	WINSLOW TWP	394423N0745540.1	CERTAIN TEED ST	2	1969	160	113	138
WI-12	WINSLOW TWP	394417N0745538.1	CERTAIN TEED ST	1	1965	160	113	138
WI-13	WINSLOW TWP	394400N0745959.1	N TOMASELLA	1	1964	165	82	101
WI-14	WINSLOW TWP	394332N0745740.1	WINSLOW W C	PROD 2	1971	120	64	90
WI-15	WINSLOW TWP	394326N0745856.1	JOSEPH VOLPA	--	--	159	112	127
WI-16	WINSLOW TWP	394326N0745849.1	J LA GRATTO	--	1951	160	68	75
WI-17	WINSLOW TWP	394322N0745125.1	JAMES SARAPPA	--	1955	125	113	133
WI-18	WINSLOW TWP	394302N0745817.1	WINSLOW W C	TEST 5	1970	145	--	167
WI-19	WINSLOW TWP	394248N0745710.1	WINSLOW W C	PROD 1	1971	115	72	103
WI-20	WINSLOW TWP	394248N0745423.1	NICK ETTORE	--	1952	135	84	90
WI-21	WINSLOW TWP	394246N0745708.1	WINSLOW W C	OBS 1	1970	115	25	30
WI-22	WINSLOW TWP	394246N0745708.2	WINSLOW W C	OBS 2	1970	115	77	103
WI-23	WINSLOW TWP	394244N0745707.1	WINSLOW W C	OBS 3	1970	115	77	103
WI-24	WINSLOW TWP	394230N0745229.1	WINSLOW BD ED	1	1968	120	118	139
WI-25	WINSLOW TWP	394228N0745341.1	HOWARD BUSER	--	1955	130	87	94
WI-26	WINSLOW TWP	394221N0745412.1	A K BROWN JR	1	1967	140	40	100
WI-27	WINSLOW TWP	394215N0745617.1	US GEOL SURVEY	NEW BROOKLYN 1	1960	112	1485	1495
WI-28	WINSLOW TWP	394215N0745617.2	US GEOL SURVEY	NEW BROOKLYN 2	1961	112	829	839
WI-29	WINSLOW TWP	394215N0745617.3	US GEOL SURVEY	NEW BROOKLYN 3	1961	111	520	530
WI-30	WINSLOW TWP	394215N0745617.4	US GEOL SURVEY	NEW BROOKLYN 4	1961	112	200	210
WI-31	WINSLOW TWP	394210N0745654.1	WINSLOW W C	TEST 1	1970	115	94	114
WI-32	WINSLOW TWP	394139N0745424.1	RUDOLPH KRUGER	--	1953	134	49	55
WI-33	WINSLOW TWP	394129N0745055.1	ANCORA FARM	POOR FARM	1942	105	--	325
WI-34	WINSLOW TWP	394121N0745247.1	WINSLOW BD ED	--	1952	130	64	70
WI-35	WINSLOW TWP	394107N0745123.1	ANCORA STA HOSP	5	1953	105	117	138
WI-36	WINSLOW TWP	394105N0745134.1	ANCORA STA HOSP	4	1953	108	141	167
WI-37	WINSLOW TWP	394104N0745134.1	ANCORA STA HOSP	ASH 3	1952	109	326	356
WI-38	WINSLOW TWP	394100N0745157.1	ANCORA STA HOSP	2	1952	114	306	331
WI-39	WINSLOW TWP	394100N0744912.1	CARMEN GRASSE	--	1954	91	65	71
WI-40	WINSLOW TWP	394046N0745208.1	ANCORA STA HOSP	1	1952	135	344	372
WI-41	WINSLOW TWP	394038N0744958.1	WINSLOW BD ED	--	1951	93	144	151
WI-42	WINSLOW TWP	394015N0745030.1	M&R REFRACTORY	1	1965	110	70	104
WI-43	WINSLOW TWP	393957N0744940.1	JOSEPH DEMEGLIO	1	1966	105	20	200
WI-44	WINSLOW TWP	393946N0745102.1	SJ TRANSIT MIX	1	1965	100	33	53
WI-45	WINSLOW TWP	393946N0744940.1	JOSEPH PAGANO	1	1966	100	40	180
WI-46	WINSLOW TWP	393945N0745102.1	LORENZO ROMANO	--	1953	95	97	103
WI-47	WINSLOW TWP	393909N0745104.1	THOMAS FEBO	1	1969	98	57	67
WI-48	WINSLOW TWP	393845N0745009.1	A SCARDO JR	1	1968	102	122	122
			GLOUCESTER COUNTY					
CL-1	CLAYTON BORO	393912N0750522.1	CLAYTON W D	CWD 3	1956	133	746	800
DE-1	DEPTFORD TWP	395003N0750722.1	WALTER POTTS	--	1949	60	120	130
DE-2	DEPTFORD TWP	394950N0750626.1	LEROY LLOYD	--	1952	55	47	55
DE-3	DEPTFORD TWP	394947N0750731.1	WM PINTOZZI	--	1968	45	110	120
DE-4	DEPTFORD TWP	394827N0750758.1	MARION THOMPSON	--	1953	102	83	107
DE-5	DEPTFORD TWP	394821N0750530.1	ROBERT A GREER	--	1955	44	120	132
DE-6	DEPTFORD TWP	394816N0750730.1	NEW SHARON F C	--	1953	82	30	35
DE-7	DEPTFORD TWP	394805N0750913.1	DEPTFORD T M A	DTMA 2	1958	40	255	281
DE-8	DEPTFORD TWP	394628N0750813.2	WOODBURY W D	SEWELL 1A	1967	20	263	311
GL-1	GLASSBORO BORO	394142N0750608.1	E FOULKES	1	1966	138	306	311
MA-1	MANTUA TWP	394712N0751008.1	MANTUA WATER CO	MWC 2	1954	65	295	317
MA-2	MANTUA TWP	394636N0751115.1	EDENWOOD W C	EWC 1	1957	88	315	337
MA-3	MANTUA TWP	394629N0750859.1	SEWELL W C	SWC 2	1965	60	336	368
MA-4	MANTUA TWP	394617N0750833.1	PRICKETTS NURS	NURSERY 1	1969	80	377	397
MA-5	MANTUA TWP	394430N0750911.1	PITMAN CNTY CLB	COUNTRY CLUB 1	1967	85	378	408
MO-1	MONROE TWP	394059N0745913.1	THOMAS BRYNELL	--	1968	140	75	85
MO-2	MONROE TWP	394050N0745958.1	VIOLET PACKING	2	1967	155	115	150
NP-1	NATIONAL PK BORO	395156N0751053.1	NATIONAL PK W D	NPWD 2	1956	30	241	282
PI-1	PITMAN BORO	394427N0750743.1	PITMAN W D	PWD P3	1960	99	447	487
WA-1	WASHINGTON TWP	394649N0750624.1	RUSSEL GRASMICK	--	1954	100	106	125
WA-2	WASHINGTON TWP	394649N0750624.2	RUSSEL GRASMICK	1	1968	105	--	124
WA-3	WASHINGTON TWP	394641N0750449.1	WILLIAM MICHAEL	--	1952	80	122	140
WA-4	WASHINGTON TWP	394623N0750328.1	RUTH SAGERS	--	1953	89	75	105
WA-5	WASHINGTON TWP	394610N0750303.1	PRIMROSE MOTEL	--	1955	83	164	190
WA-6	WASHINGTON TWP	394533N0750323.1	WASHINGTON TMUA	WTMUA 2	1965	90	543	577
WA-7	WASHINGTON TWP	394531N0750653.1	R KRAEMER	1	1968	60	72	104
WA-8	WASHINGTON TWP	394525N0750640.1	C BRETT	--	1960	70	--	90
WA-9	WASHINGTON TWP	394522N0750617.1	CARLTON GANT	--	1953	81	107	125
WA-10	WASHINGTON TWP	394520N0750218.1	WASHINGTON TMUA	WTMUA 1	1959	100	581	612
WA-11	WASHINGTON TWP	394517N0750300.2	BELLS LAKE W C	2	1968	130	547	620

Table 1.--Records of selected wells in Camden County and vicinity--Continued

MAP NUMBER	LENGTH OF WELL OPEN TO AQUIFER (FEET)	DEPTH TO CONSOLI-DATED ROCK (FT)	CASING DIAM-ETER (IN)	WATER LEVEL (FT)	DATE WATER LEVEL MEASURED	YIELD (GPM)	DRAW DOWN (FT)	SPECIFIC CAPACITY	PUMPING PERIOD (HOURS)	USE OF WATER	MAJOR AQUIFER
					CAMDEN COUNTY						
WA-13	120	--	6	6	4-66	60	1	60.0	3	I	AA CP
WA-14	99	--	6	4	4-66	60	1	60.0	2	I	AA CP
WI-1	5	--	3	--	--	--	--	--	--	H	AA CP
WI-2	6	--	3	25	1-56	7	10	0.7	C	H	AA CP
WI-3	40	--	10	126	10-63	300	124	2.4	24	N	K3 MW
WI-4	40	--	8	126	8-63	200	98	2.0	48	N	K3 MW
WI-5	--	--	--	--	--	--	--	--	--	U	--
WI-6	7	--	3	26	2-52	15	2	7.5	5	H	AA CP
WI-7	20	--	6	18	2-57	100	--	--	4	N	AA CP
WI-8	8	--	6	48	9-57	240	12	20.0	8	T	AA CP
WI-9	7	--	3	30	8-51	10	--	--	5	H	AA CP
WI-10	--	--	6	59	1-66	150	--	--	4	C	AA CP
WI-11	--	--	--	35	7-69	510	--	--	--	N	AA CP
WI-12	--	--	8	39	7-65	524	--	--	--	N	AA CP
WI-13	21	--	12	32	1-64	596	42	14.2	8	I	AA CP
WI-14	26	--	24	4	1-71	1000	39	25.6	48	P	AA CP
WI-15	15	--	8	29	--	--	--	--	--	I	AA CP
WI-16	7	--	3	30	8-51	10	--	--	8	H	AA CP
WI-17	20	--	4	35	4-55	50	--	--	4	H	AA CP
WI-18	--	--	--	--	--	--	--	--	--	U	--
WI-19	31	--	24	5	12-70	1000	28	35.7	48	P	AA CP
WI-20	6	--	2	18	2-52	20	10	2.0	2	H	AA CP
WI-21	5	--	2	3	12-70	--	--	--	--	U	AA CP
WI-22	26	--	2	3	12-70	--	--	--	--	U	AA CP
WI-23	26	--	2	3	12-70	--	--	--	--	U	AA CP
WI-24	20	--	8	14	5-68	225	9	25.0	8	H	AA CP
WI-25	7	--	3	15	2-55	50	1	50.0	4	H	AA CP
WI-26	60	--	6	27	4-67	300	53	5.7	2	I	AA CP
WI-27	10	2010	4	120	8-60	30	4	7.5	8	U	K3 MR
WI-28	10	--	6	131	4-61	14	6	2.3	58	U	K3 MR
WI-29	10	--	5	56	5-61	6	49	0.1	8	U	K3 MW
WI-30	10	--	5	4	4-61	3	--	--	57	U	TH KW
WI-31	20	--	6	1	12-70	--	--	--	--	U	AA CP
WI-32	6	--	3	--	--	--	--	--	--	H	AA CP
WI-33	--	--	--	--	--	--	--	--	--	T	TS MV
WI-34	10	--	3	33	7-52	7	2	3.5	--	H	AA CP
WI-35	21	--	8	16	10-54	502	60	8.4	5	T	AA CP
WI-36	26	--	8	22	7-53	708	78	9.1	8	T	AA CP
WI-37	30	--	8	41	1-63	--	--	--	--	T	TS MV
WI-38	25	--	8	46	9-52	360	206	1.7	24	T	TS MV
WI-39	6	--	3	15	2-54	6	6	1.0	1	H	AA CP
WI-40	28	--	8	72	10-54	185	98	1.9	4	T	TS MV
WI-41	7	--	3	12	6-51	30	--	--	--	P	AA CP
WI-42	34	--	8	22	11-65	377	38	9.9	1	N	AA CP
WI-43	180	--	6	18	5-66	60	1	60.0	3	I	AA CP
WI-44	20	--	4	16	9-65	72	21	3.4	5	N	AA CP
WI-45	140	--	6	13	5-66	60	1	60.0	3	I	AA CP
WI-46	6	--	4	10	9-53	30	12	2.5	1	H	AA CP
WI-47	10	--	3	15	11-69	40	10	4.0	1	H	AA CP
WI-48	92	--	6	12	5-68	75	2	37.5	1	I	AA CP
					GLOUCESTER COUNTY						
CL-1	30	--	8	151	11-56	708	90	7.9	8	P	K3 MR
DE-1	20	--	4	50	4-49	50	10	5.0	4	H	K3 MV
DE-2	10	--	3	4	10-52	25	--	--	6	H	K3 MW
DE-3	10	--	4	80	8-68	20	20	1.0	1	H	K3 MW
DE-4	24	--	4	23	4-53	25	--	--	8	H	K3 MW
DE-5	12	--	4	30	10-55	30	10	3.0	4	H	K3 ET
DE-6	5	--	4	10	12-53	25	--	--	2	H	K3 MW
DE-7	26	--	12	70	1-58	1018	59	17.3	8	P	K3 MR
DE-8	42	--	12	60	11-67	1150	25	46.0	8	P	K3 MR
GL-1	5	--	4	80	5-66	5	5	1.0	--	U	K3 MW
MA-1	21	700	8	90	12-53	287	40	7.2	4	P	K3 MR
MA-2	22	--	12	93	2-57	533	13	41.0	8	P	K3 MR
MA-3	32	--	10	102	4-65	525	13	40.4	4	P	K3 MR
MA-4	20	--	6	120	3-69	150	12	12.5	2	H	K3 MR
MA-5	30	--	10	122	3-67	411	34	12.1	8	I	K3 MR
MO-1	10	--	4	10	4-68	60	5	12.0	1	H	AA CP
MO-2	35	--	8	27	11-69	300	20	15.0	3	N	AA CP
NP-1	41	288	8	52	4-56	636	31	20.5	8	P	K3 MR
PI-1	40	--	10	122	12-60	1000	27	37.0	8	P	K3 MR
WA-1	19	--	4	44	2-54	90	--	--	--	H	K3 MW
WA-2	--	--	--	--	--	--	--	--	--	H	K3 MW
WA-3	18	--	4	20	5-52	100	--	--	8	H	K3 MW
WA-4	30	--	3	23	9-53	50	--	--	2	H	TL --
WA-5	20	--	4	30	7-55	150	--	--	3	H	K3 MW
WA-6	30	--	8	119	7-65	503	33	15.2	8	P	K3 MR
WA-7	32	--	4	7	2-68	50	10	5.0	1	H	K3 MW
WA-8	--	--	3	--	--	--	--	--	--	H	TF CS
WA-9	18	--	4	16	5-53	90	--	--	4	H	K3 MW
WA-10	31	--	8	131	9-59	626	28	22.4	8	P	K3 MR
WA-11	50	--	8	174	3-68	735	33	22.3	8	P	K3 MR

Table 1.--Records of selected wells in Camden County and vicinity--Continued

MAP NUMBER	MUNICIPALITY	LAT-LONG	OWNER	LOCAL WELL NUMBER	DATE DRILLED (YEAR)	ALTI-TUDE OF LSD (FT)	CASING DEPTH (FT)	WELL DEPTH (FT)
				GLOUCESTER COUNTY				
WA-12	WASHINGTON TWP	394452N0750243.1	GINO'S REST	1	1970	150	278	310
WA-13	WASHINGTON TWP	394442N0750504.1	WALTER F EMOND	1	1968	150	220	244
WA-14	WASHINGTON TWP	394433N0750250.1	FRIES MILLS W C	FMWC 1	1964	152	584	652
WA-15	WASHINGTON TWP	394423N0750157.1	C W GREENE	--	1954	150	57	67
WA-16	WASHINGTON TWP	394420N0750630.1	HARRY J DE SOI	1	1968	90	141	165
WA-17	WASHINGTON TWP	394309N0750155.1	JOSEPH BRYAN	--	1954	155	42	47
WE-1	WENONAH BORO	394751N0750912.1	WENONAH WATER D	WWD 2	1951	30	270	310
WE-2	WENONAH BORO	394743N0750902.1	WENONAH WATER D	WWD 1	1944	80	280	320
WD-1	WEST DEPTFORD TWP	395236N0750821.1	TEXAS OIL CO	EAGLE PT OBS 4	1948	10	214	224
WD-2	WEST DEPTFORD TWP	395232N0750942.1	TEXAS OIL CO	EAGLE PT OBS 3	1948	21	255	276
WD-3	WEST DEPTFORD TWP	395222N0750918.1	TEXAS OIL CO	EAGLE POINT 3	1947	20	258	288
WD-4	WEST DEPTFORD TWP	395221N0750856.1	TEXAS OIL CO	EAGLE POINT 5	1948	10	237	277
WD-5	WEST DEPTFORD TWP	395216N0750915.1	TEXAS OIL CO	EAGLE POINT 1	1947	32	248	288
WD-6	WEST DEPTFORD TWP	395213N0750936.1	TEXAS OIL CO	EAGLE POINT 4	1948	14	259	289
WD-7	WEST DEPTFORD TWP	395207N0750930.1	TEXAS OIL CO	EAGLE POINT 2	1948	17	263	289
WD-8	WEST DEPTFORD TWP	395159N0750907.1	TEXAS OIL CO	EAGLE PT OBS 1	1948	32	288	298
WD-9	WEST DEPTFORD TWP	395158N0750950.1	TEXAS OIL CO	EAGLE PT OBS 2	1948	10	285	295
WD-10	WEST DEPTFORD TWP	395153N0750946.1	TEXAS OIL CO	EAGLE POINT 6	1949	15	279	318
WD-11	WEST DEPTFORD TWP	394919N0751256.2	SHELL CHEM CO	SHELL 3	1962	30	358	384
WD-12	WEST DEPTFORD TWP	394917N0751307.1	SHELL CHEM CO	SHELL 1	1962	12	328	360
WS-1	WESTVILLE BORO	395221N0750737.1	WESTVILLE W D	WWD 4	1957	16	286	313
WS-2	WESTVILLE BORO	395221N0750737.2	WESTVILLE W D	WWD 3	1945	16	115	140
WB-1	WOODBURY CITY	394950N0750909.1	WOODBURY W D	RAILROAD 5	1960	35	405	457
				PHILADELPHIA COUNTY				
PH-1	PHILADELPHIA CITY	395538N0750843.1	CROWN PAPER BRD	1	1925	13	--	108
PH-2	PHILADELPHIA CITY	395536N0750905.1	S P DRESS BEEF	S PHILA BEEF 4	--	15	--	60
PH-3	PHILADELPHIA CITY	395534N0751106.1	GILBERT ADDED	PRES THEATER	1936	30	65	86
PH-4	PHILADELPHIA CITY	395524N0750822.1	CONTINENTL DIST	CONT DIST R-7	1948	10	118	128
PH-5	PHILADELPHIA CITY	395511N0750833.1	WILSON-MARTIN	WILSON 1	1953	13	150	175
PH-6	PHILADELPHIA CITY	395448N0750856.1	TWIN PACKING CO	1	--	10	140	180
PH-7	PHILADELPHIA CITY	395428N0750804.1	PUBLICKER IND	P INDUSTRIES17	1937	8	159	189
PH-8	PHILADELPHIA CITY	395412N0751211.1	GULF OIL CORP	WEST WELL	1946	17	72	182
PH-9	PHILADELPHIA CITY	395342N0751021.1	U S NAVAL BASE	OBS WELL PH-12	1944	10	94	104
PH-10	PHILADELPHIA CITY	395329N0751012.1	U S NAVAL BASE	2	1940	10	207	232
PH-11	PHILADELPHIA CITY	395328N0751034.1	U S NAVAL BASE	4	1941	11	237	267
PH-12	PHILADELPHIA CITY	395328N0751028.1	U S NAVAL BASE	3	1941	12	238	268
PH-13	PHILADELPHIA CITY	395318N0750938.1	U S NAVAL BASE	9	1943	12	189	228
PH-14	PHILADELPHIA CITY	395316N0751049.1	U S NAVAL BASE	OBS WELL PH-20	1946	13	238	243
PH-15	PHILADELPHIA CITY	395316N0751031.1	U S NAVAL BASE	8	1944	12	200	230
PH-16	PHILADELPHIA CITY	395315N0751007.1	U S NAVAL BASE	11	1952	11	214	245

EXPLANATION

1. AQUIFER
   - WG WISSAHICKON FORMATION
   - K3RA RARITAN FORMATION
   - K3MR MAGOTHY-RARITAN FORMATIONS
   - K3MV MERCHANTVILLE FORMATION
   - K3ET ENGLISHTOWN FORMATION
   - K3MW MOUNT LAUREL SAND-WENONAH FORMATION
   - K3NA NAVESINK FORMATION
   - TLHT HORNERSTOWN SAND
   - TLVH VINCENTOWN FORMATION-HORNERSTOWN SAND
   - TSMV MANASQUAN-VINCENTOWN FORMATION
   - TEMA MANASQUAN FORMATION
   - TMKW KIRKWOOD FORMATION
   - TFCS COHANSEY SAND
   - AACP PLEISTOCENE-COHANSEY SAND
   - TL TERTIARY-PALEOCENE
   - QGCM CAPE MAY FORMATION

2. WATER LEVEL BELOW LAND SURFACE
   - F FLOWS

3. WATER USE
   - A AIR CONDITION
   - C COMMERCIAL
   - H DOMESTIC
   - I IRRIGATION
   - N INDUSTRIAL
   - P PUBLIC SUPPLY
   - T INSTITUTIONAL
   - U UNUSED
   - Z OTHER

Table 1.--Records of selected wells in Camden County and vicinity--Continued

MAP NUMBER	LENGTH OF WELL OPEN TO AQUIFER (FEET)	DEPTH TO CONSOLI-DATED ROCK (FT)	CASING DIAM-ETER (IN)	WATER LEVEL (FT)	DATE WATER LEVEL MEASURED	YIELD (GPM)	DRAW DOWN (FT)	SPECIFIC CAPACITY	PUMPING PERIOD (HOURS)	USE OF WATER	MAJOR AQUIFER
					GLOUCESTER COUNTY						
WA-12	32	--	6	100	2-70	--	--	--	--	C	K3 MW
WA-13	24	--	4	74	2-68	60	15	4.0	1	H	K3 MW
WA-14	68	--	8	188	9-64	858	50	17.2	--	P	K3 MR
WA-15	10	--	4	32	10-54	15	6	2.5	--	H	AA CP
WA-16	24	--	4	16	12-68	60	12	5.0	2	H	K3 MW
WA-17	5	--	3	15	5-54	9	7	1.3	4	H	AA CP
WE-1	46	--	12	67	2-51	1200	40	30.0	8	P	K3 MR
WE-2	40	700	12	90	5-44	500	30	16.7	24	P	K3 MR
WD-1	10	--	3	31	7-48	--	--	--	--	U	K3 MR
WD-2	20	298	6	42	11-52	--	--	--	--	U	K3 MR
WD-3	30	288	12	39	12-47	1012	43	23.5	24	N	K3 MR
WD-4	40	287	12	46	10-48	1029	44	23.4	8	N	K3 MR
WD-5	40	--	12	39	11-47	1110	34	32.6	8	N	K3 MR
WD-6	31	--	16	38	3-48	1100	52	21.2	90	N	K3 MR
WD-7	31	--	16	38	1-48	1100	59	18.6	24	N	K3 MR
WD-8	10	--	4	--	10-47	--	--	--	--	U	K3 MR
WD-9	10	--	3	18	7-48	250	--	--	--	U	K3 MR
WD-10	39	--	16	35	1-49	1200	76	15.8	48	N	K3 MR
WD-11	25	--	12	35	12-61	1000	105	9.5	8	N	K3 MR
WD-12	30	--	12	30	10-61	1000	36	27.8	8	N	K3 MR
WS-1	27	325	10	51	--	1205	95	12.7	8	P	K3 MR
WS-2	28	--	10	24	6-45	500	28	17.9	2	P	K3 MR
WB-1	52	--	12	62	4-60	1016	24	42.3	10	P	K3 MR
					PHILADELPHIA COUNTY						
PH-1	--	--	8	18	--	100	--	--	--	N	K3 MR
PH-2	--	--	--	--	--	--	--	--	--	Z	K3 MR
PH-3	21	--	8	39	6-36	90	30	3.0	--	A	QG CM
PH-4	17	--	10	41	10-48	--	--	--	--	N	K3 RA
PH-5	25	--	10	--	--	250	--	--	--	Z	K3 MR
PH-6	15	172	--	72	12-43	726	--	--	--	N	K3 RA
PH-7	30	--	18	48	--	1030	--	--	--	I	K3 RA
PH-8	10	--	6	14	3-46	420	--	--	--	N	K3 RA
PH-9	10	--	8	27	11-44	--	--	--	--	U	K3 MR
PH-10	35	--	12	18	7-40	730	75	9.7	--	N	K3 RA
PH-11	30	--	12	25	--	800	--	--	--	N	K3 RA
PH-12	--	--	12	30	--	860	--	--	--	N	K3 RA
PH-13	--	--	12	32	--	710	--	--	--	N	K3 RA
PH-14	5	--	8	23	5-46	--	--	--	--	U	K3 MR
PH-15	30	--	8	51	12-44	740	--	--	--	N	K3 RA
PH-16	31	--	12	47	--	640	--	--	--	N	K3 RA

 (Page 124 follows)

Table 3.--Source and significance of dissolved mineral constituents and physical properties of ground water in Camden County

(Gallaher and Price, 1966)

[Mg/l, milligrams per liter]

Constituent or physical property	Source or cause	Significance
Silica (SiO_2)	Dissolved from almost all rocks and soils, usually in small amounts from 1-30 mg/l. High concentrations--as much as 100 mg/l--generally occur in highly alkaline waters.	Forms hard scale in pipes and boilers. Carried over in steam of high-pressure boilers to form deposits on blades of steam turbines. Inhibits deterioration of zeolite-type water softeners.
Iron (Fe)	Dissolved from almost all rocks and soils. May also be derived from iron pipes, pumps, and other equipment. More than 1 or 2 mg/l of soluble iron in surface water usually indicates acid wastes from mine drainage or other sources.	On exposure to air, iron in ground water oxidizes to reddish-brown sediment. Content of more than about 0.3 mg/l stains laundry and utensils reddish brown. Objectionable for food processing, beverages, dyeing, bleaching, ice manufacture, brewing, and other processes. The U. S. Public Health Service (1962) recommends, in its water-quality standards, that iron and manganese together should not exceed 0.3 mg/l; larger quantities cause unpleasant taste and favor growth of iron bacteria.
Manganese (Mn)	Dissolved from some rocks and soils. Not as common as iron. Large quantities often associated with high iron content and with acid waters.	Same objectionable features as iron. Causes dark-brown or black stain. Federal standards recommend that iron and manganese together should not exceed 0.3 mg/l.
Calcium (Ca) and magnesium (Mg)	Dissolved from almost all soils and rocks, especially limestone, dolomite, and gypsum. Calcium and magnesium are found in large quantities in some brines. Large quantities of magnesium are present in sea water.	Cause most of the hardness and scale-forming properties of water; soap consuming (see hardness). Water with low calcium and magnesium contents desired for electroplating, tanning, dyeing, and textile manufacturing.
Sodium (Na) and potassium (K)	Dissolved from almost all rocks and soils. Found also in ancient brines, sea water, some industrial brines, and sewage.	Large amounts, in combination with chloride, give a salty taste. Moderate quantities have little effect on the usefulness of water for most purposes. Sodium salts may cause foaming in steam boilers, and a high sodium ratio may limit the use of water for irrigation.
Bicarbonate (HCO_3) and carbonate (CO_3)	Action of carbon dioxide in water on carbonate rocks such as limestone and dolomite.	Bicarbonate and carbonate produce alkalinity. Bicarbonates of calcium and magnesium decompose in steam boilers and hot-water facilities to form scale and release corrosive carbon dioxide gas. In combination with calcium and magnesium cause carbonate hardness.
Sulfate (SO_4)	Dissolved from rocks and soils containing gypsum, iron sulfides, and other sulfur compounds. Usually present in mine waters and in some industrial wastes.	Sulfate in water containing calcium forms hard scale in steam boilers. In large amounts, sulfate in combination with other ions gives bitter taste to water. Some calcium sulfate is considered beneficial in the brewing process. Federal standards recommend that the sulfate content should not exceed 250 mg/l.
Chloride (Cl)	Dissolved from rocks and soils. Present in sewage. Found in large amounts in ancient brines, sea water, and industrial brines.	In large amounts in combination with sodium gives salty taste to drinking water. In large quantities increases the corrosiveness of water. Federal standards recommend that chloride content should not exceed 250 mg/l.

Table 3.--Source and significance of dissolved mineral constituents and physical properties of ground water in Camden County--Continued

(Gallaher and Price, 1966)

[Mg/l, milligrams per liter]

Constituent or physical property	Source or cause	Significance
Fluoride (F)	Dissolved in small to minute quantities from most rocks and soils.	Fluoride in drinking water reduces the incidence of tooth decay when the water is consumed during the period of calcification. However, it may cause mottling of the teeth depending on the concentration of fluoride, age of the child, amount of drinking water consumed, and susceptibility of the individual.
Nitrate (NO_3)	Decaying organic matter, sewage, and soil nitrates.	Concentrations much greater than the local average may suggest pollution. There is evidence that more than about 45 mg/l of nitrate may cause a type of methemoglobinemia in infants, sometimes fatal. Nitrate has shown to be helpful in reducing intercrystalline cracking of boiler steel. It encourages growth of algae and other organisms which produce undesirable tastes and odors.
Dissolved solids	Chiefly mineral constituents dissolved from rocks and soils. Includes any organic matter and some water of crystallization.	Federal standards recommend that dissolved solids should not exceed 500 mg/l. Water becomes unsuitable for many purposes when it contains more than 1,000 mg/l of dissolved solids.
Hardness as $CaCO_3$	Nearly all of the hardness in most waters is due to calcium and magnesium. All metallic cations other than the alkali metals also cause hardness.	Consumes soap before a lather will form. Deposits soap curd on bathtubs. Hard water forms scale in boilers, water heaters, and pipes. Hardness equivalent to the bicarbonate and carbonate is called carbonate hardness. Any hardness in excess of this is called noncarbonate hardness. Waters of hardness up to 60 mg/l are considered soft; 61-120 mg/l, moderately hard; 121-200 mg/l, hard; more than 200 mg/l, very hard.
Specific conductance (micromhos at 25°C)	Mineral content of the water.	Specific conductance is a measure of the capacity of water to conduct an electric current; varies with concentration and degree of ionization of the constituents. Varies with temperature, reported at 25°C.
Hydrogen-ion concentration (pH)	Acids, acid-generating salts, and free carbon dioxide lower the pH. Carbonates, bicarbonates, hydroxides, silicates, and borates raise the pH.	pH of 7.0 indicates neutrality of a solution. Values higher than 7.0 denote increasing alkalinity; values lower than 7.0 indicate increasing acidity. The pH is a measure of hydrogen-ion activity. The corrosive properties of water generally increase with decreasing pH; however, excessively alkaline water may also attack metals.
Temperature		Affects the usefulness of water for many purposes. For most uses, a water of uniformly low temperature is desired. Shallow wells show some seasonal fluctuations in water temperature. Ground water from moderate depths usually is nearly constant in temperature, which is near the mean annual air temperature of the area. In very deep wells the water temperature generally increases on the average about 1°C with each 100-ft increment of depth. Seasonal fluctuations in temperatures of surface water are comparatively large--depending on the depth of water--but do not reach the extremes of air temperature.

Table 4.--Chemical analysis of water samples from wells tapping the various aquifers of the Camden County area

MAP NUMBER	WELL OWNER	LOCAL NUMBER	MAJOR AQUIFER	DATE OF SAMPLE	SILICA (SIO2) (MG/L)	TOTAL IRON (FE) (UG/L)	TOTAL MAN-GANESE (MN) (UG/L)	CAL-CIUM (CA) (MG/L)	MAG-NE-SIUM (MG) (MG/L)	SODIUM (NA) (MG/L)	PO-TAS-SIUM (K) (MG/L)
HA-1	ATLANTIC C EXPR	HAMMONTON 1	TMKW	11-06-69	--	--	--	--	--	--	--
EV-3	EVESHAM M U A	EMUA 2	K3MR	08-11-66	8.0	350	0	31	7.6	3.5	7.0
EV-4	EVESHAM M U A	EMUA 1	K3MR	08-11-66	8.7	390	0	31	7.7	2.5	8.8
MS-1	MAPLE SHADE W D	MSWD 4	K3MR	08-10-66	10	3100	0	14	3.8	1.8	2.1
MS-2	MAPLE SHADE W D	MSWD 5	K3MR	08-10-66	13	3200	0	17	4.9	3.0	4.7
ME-4	MEDFORD W C	MWC 3	K3MR	08-12-66	9.1	460	0	24	5.6	9.0	8.2
MO-2	CAMPBELL SOUP	CAMPBELL 1	K3MR	08-16-66	10	210	80	3.5	1.6	4.6	1.8
MO-4	LAYNE NY CO	LAYNE 1	K3MR	08-11-66	13	1900	0	8.1	3.3	1.8	2.1
MO-6	MOORESTOWN T WD	MTWD 6	K3MR	08-10-66	10	3000	0	16	3.8	3.0	4.0
MT-1	MT LAUREL W CO	MLWC 1	K3MR	08-11-66	9.8	3000	0	17	3.0	6.2	5.5
BL-1	BELLMAWR B W D	BBWD 1	K3MR	08-19-66	9.1	670	0	21	6.0	7.6	4.8
BL-2	BELLMAWR B W D	BBWD 3	K3MR	08-19-66	8.7	480	0	13	3.0	19	6.8
BL-4	BELLMAWR B W D	BBWD 4	K3MR	08-17-67	8.4	380	50	15	3.3	16	6.7
BB-1	BERLIN WATER D	BWD 9	K3MR	08-23-66	9.1	180	0	15	5.6	18	8.8
BB-2	BERLIN WATER D	BWD 10	K3MR	01-13-70	--	--	--	--	--	--	--
BB-6	OWENS CORNING	1	K3MW	01-16-70	9.8	50	0	23	6.0	3.8	7.7
BR-1	BROOKLAWN B W D	BBWD 2	K3MR	08-19-66	12	3500	60	39	8.8	13	8.8
BR-2	BROOKLAWN B W D	BBWD 3	K3MR	08-19-66	9.3	540	50	16	3.8	18	7.0
CA-4	NJ WATER CO	CAMDEN DIV 49	K3MR	08-31-66	4.5	15000	3600	22	12	12	3.1
CA-7	NJ WATER CO	CAMDEN DIV 51	K3MR	08-31-66	8.4	120	50	30	.6	51	2.1
CA-20	CAMDEN CITY W D	CITY 9	K3MR	08-24-66	6.4	6700	6200	38	14	23	3.6
CA-20	CAMDEN CITY W D	CITY 9	K3MR	12-07-65	--	--	--	--	--	--	--
CA-20	CAMDEN CITY W D	CITY 9	K3MR	11-17-65	--	--	--	--	--	--	--
CA-20	CAMDEN CITY W D	CITY 9	K3MR	08-13-63	--	--	--	--	--	--	--
CA-20	CAMDEN CITY W D	CITY 9	K3MR	04-12-63	--	--	--	--	--	--	--
CA-20	CAMDEN CITY W D	CITY 9	K3MR	10-02-62	--	--	--	--	--	--	--
CA-20	CAMDEN CITY W D	CITY 9	K3MR	04-24-62	--	--	--	--	--	--	--
CA-20	CAMDEN CITY W D	CITY 9	K3MR	08-31-61	--	--	--	--	--	--	--
CA-23	CAMDEN CITY W D	CITY 10	K3MR	03-10-69	--	--	--	--	--	--	--
CA-23	CAMDEN CITY W D	CITY 10	K3MR	02-12-69	--	--	--	--	--	--	--
CA-23	CAMDEN CITY W D	CITY 10	K3MR	12-07-65	--	--	--	--	--	--	--
CA-23	CAMDEN CITY W D	CITY 10	K3MR	11-17-65	--	--	--	--	--	--	--
CA-23	CAMDEN CITY W D	CITY 10	K3MR	04-16-64	10	480	4400	26	12	29	3.2
CA-26	CAMDEN CITY W D	CITY 1A	K3MR	03-10-69	--	--	--	--	--	--	--
CA-26	CAMDEN CITY W D	CITY 1A	K3MR	03-10-69	--	--	--	--	--	--	--
CA-26	CAMDEN CITY W D	CITY 1A	K3MR	12-08-65	--	--	--	--	--	--	--
CA-26	CAMDEN CITY W D	CITY 1A	K3MR	11-17-65	--	--	--	--	--	--	--
CA-26	CAMDEN CITY W D	CITY 1A	K3MR	08-24-66	13	4800	2600	28	10	42	4.5
CA-26	CAMDEN CITY W D	CITY 1A	K3MR	12-08-65	--	--	--	--	--	--	--
CA-26	CAMDEN CITY W D	CITY 1A	K3MR	11-17-65	--	--	--	--	--	--	--
CA-29	CAMDEN CITY W D	CITY 5N	K3MR	10-08-69	--	--	--	--	--	--	--
CA-29	CAMDEN CITY W D	CITY 5N	K3MR	03-10-69	--	--	--	--	--	--	--
CA-29	CAMDEN CITY W D	CITY 5N	K3MR	02-12-69	--	--	--	--	--	--	--
CA-29	CAMDEN CITY W D	CITY 5N	K3MR	08-24-66	12	360	260	24	10	34	4.7
CA-29	CAMDEN CITY W D	CITY 5N	K3MR	11-17-65	--	--	--	--	--	--	--
CA-29	CAMDEN CITY W D	CITY 5N	K3MR	05-01-64	--	--	--	--	--	--	--
CA-35	CAMDEN CITY W D	CITY 3A	K3MR	03-11-69	--	--	--	--	--	--	--
CA-35	CAMDEN CITY W D	CITY 3A	K3MR	12-08-65	--	--	--	--	--	--	--
CA-35	CAMDEN CITY W D	CITY 3A	K3MR	11-29-65	--	--	--	--	--	--	--
CA-35	CAMDEN CITY W D	CITY 3A	K3MR	11-19-65	--	--	--	--	--	--	--
CA-35	CAMDEN CITY W D	CITY 3A	K3MR	11-17-65	--	--	--	--	--	--	--
CA-38	CAMDEN CITY W D	CITY 13	K3MR	03-11-69	--	--	--	--	--	--	--
CA-38	CAMDEN CITY W D	CITY 13	K3MR	08-24-66	14	930	120	12	4.4	11	3.3
CA-38	CAMDEN CITY W D	CITY 13	K3MR	12-09-65	--	--	--	--	--	--	--
CA-38	CAMDEN CITY W D	CITY 13	K3MR	11-17-65	--	--	--	--	--	--	--
CA-38	CAMDEN CITY W D	CITY 13	K3MR	08-13-63	14	1500	140	11	3.4	5.9	2.4
CA-38	CAMDEN CITY W D	CITY 13	K3MR	04-12-63	15	2100	80	9.6	3.4	6.9	2.2
CA-41	CAMDEN CITY W D	CITY 17	K3MR	12-22-70	11	1300	100	16	4.8	8.4	4.1
CA-41	CAMDEN CITY W D	CITY 17	K3MR	02-12-69	--	--	--	--	--	--	--
CA-41	CAMDEN CITY W D	CITY 17	K3MR	08-24-66	10	1600	80	16	5.2	6.3	4.0
CA-41	CAMDEN CITY W D	CITY 17	K3MR	11-18-65	--	--	--	--	--	--	--
CA-41	CAMDEN CITY W D	CITY 17	K3MR	11-17-65	--	--	--	--	--	--	--
CA-41	CAMDEN CITY W D	CITY 17	K3MR	04-16-64	--	1300	120	--	--	--	--
CA-41	CAMDEN CITY W D	CITY 17	K3MR	08-13-63	11	20	150	17	5.1	5.6	3.2
CA-41	CAMDEN CITY W D	CITY 17	K3MR	04-12-63	12	1400	50	16	5.1	6.0	3.2
CA-41	CAMDEN CITY W D	CITY 17	K3MR	10-02-62	11	1200	110	16	5.1	5.5	3.6
CA-41	CAMDEN CITY W D	CITY 17	K3MR	04-24-62	--	--	--	--	--	--	--
CA-41	CAMDEN CITY W D	CITY 17	K3MR	08-31-61	--	--	--	--	--	--	--
CA-42	CAMDEN CITY W D	CITY 4	K3MR	10-08-69	--	--	--	--	--	--	--
CA-42	CAMDEN CITY W D	CITY 4	K3MR	03-11-69	--	--	--	--	--	--	--
CA-42	CAMDEN CITY W D	CITY 4	K3MR	08-24-66	7.6	290	100	32	23	25	11
CA-42	CAMDEN CITY W D	CITY 4	K3MR	12-07-65	--	--	--	--	--	--	--
CA-42	CAMDEN CITY W D	CITY 4	K3MR	11-17-65	--	--	--	--	--	--	--
CA-53	CAMDEN CITY W D	CITY 6N	K3MR	03-11-69	--	--	--	--	--	--	--
CA-53	CAMDEN CITY W D	CITY 6N	K3MR	08-24-66	4.0	140	1000	52	35	29	14
CA-53	CAMDEN CITY W D	CITY 6N	K3MR	04-16-64	--	--	--	--	--	--	--
CA-53	CAMDEN CITY W D	CITY 6N	K3MR	08-13-63	--	--	--	--	--	--	--
CA-53	CAMDEN CITY W D	CITY 6N	K3MR	10-02-62	--	--	--	--	--	--	--
CA-56	CAMDEN CITY W D	CITY 11	K3MR	03-11-69	--	--	--	--	--	--	--
CA-56	CAMDEN CITY W D	CITY 11	K3MR	12-09-65	--	--	--	--	--	--	--

Table 4.--Chemical analysis of water samples from wells tapping the various aquifers of the Camden County area--Continued

MAP NUMBER	BICAR-BONATE (HCO3) (MG/L)	CAR-BONATE (CO3) (MG/L)	SULFATE (SO4) (MG/L)	CHLO-RIDE (CL) (MG/L)	FLUO-RIDE (F) (MG/L)	NITRATE (NO3) (MG/L)	DISS-OLVED SOLIDS (RESI-DUE AT 180 C)	HARD-NESS (CA,MG) (MG/L)	NON-CAR-BONATE HARD-NESS (MG/L)	SPECI-FIC COND-UCTANCE (MICRO-MHOS)	PH	COLOR	TEMP-ERATURE (DEG C)
HA-1	--	--	--	4.5	--	--	--	--	--	60	--	--	--
EV-3	112	0	36	.6	.1	.8	153	109	17	255	7.7	3	--
EV-4	103	0	35	1.2	.0	1.2	148	109	25	252	7.1	2	--
MS-1	43	0	15	3.5	.0	.3	78	51	16	115	6.1	3	--
MS-2	64	0	14	5.0	.1	.1	91	63	10	146	6.4	2	--
ME-4	106	0	19	8.6	.0	.2	125	83	0	205	7.9	5	--
MO-2	4	0	3.8	5.8	.0	16	59	15	12	69	5.4	2	16.5
MO-4	34	0	9.4	3.0	.0	.2	59	34	6	86	6.1	3	--
MO-6	46	0	27	2.2	.0	.2	89	56	18	139	6.2	2	--
MT-1	57	0	23	3.4	.0	.3	97	55	9	155	6.6	3	--
BL-1	89	0	25	1.6	.2	.7	133	77	4	200	7.4	2	13.5
BL-2	85	0	16	7.4	.2	.6	110	45	0	188	7.6	10	16.5
BL-4	83	0	19	6.0	.4	.1	124	51	0	188	7.3	2	15.5
BB-1	108	0	19	1.6	.2	.0	132	61	0	212	7.9	3	19.5
BB-2	--	--	--	4.5	--	--	--	--	--	223	--	--	17.8
BB-6	104	0	8.4	2.0	.4	.2	118	82	0	192	8.1	3	15.0
BR-1	150	0	36	16	.2	.2	214	134	11	350	7.2	5	14.5
BR-2	90	0	23	6.4	.2	.2	128	56	0	209	7.1	5	14.0
CA-4	148	0	.8	17	1.0	.2	152	105	0	286	6.9	3	13.5
CA-7	136	0	46	23	.2	8.7	244	78	0	393	6.9	0	14.5
CA-20	140	0	21	54	.5	1.7	256	153	38	433	6.7	5	16.5
CA-20	--	--	--	56	--	--	--	--	--	--	--	--	--
CA-20	--	--	--	46	--	--	--	--	--	--	--	--	--
CA-20	--	--	--	44	--	--	--	--	--	594	--	--	14.5
CA-20	--	--	--	46	--	--	--	--	--	621	--	--	13.5
CA-20	--	--	--	42	--	--	--	--	--	580	--	--	14.5
CA-20	--	--	--	44	--	--	--	--	--	504	--	--	--
CA-20	--	--	--	38	--	--	--	--	--	519	--	--	14.5
CA-23	--	--	--	54	--	--	--	--	--	503	--	--	--
CA-23	--	--	--	55	--	--	--	--	--	491	--	--	14.0
CA-23	--	--	--	64	--	--	--	--	--	--	--	--	--
CA-23	--	--	--	20	--	--	--	--	--	--	--	--	--
CA-23	50	0	69	47	.1	6.1	236	115	74	396	6.1	2	14.0
CA-26	--	--	--	61	--	--	--	--	--	477	--	--	--
CA-26	--	--	--	61	--	--	--	--	--	477	--	--	--
CA-26	--	--	--	78	--	--	--	--	--	--	--	--	--
CA-26	--	--	--	80	--	--	--	--	--	--	--	--	--
CA-26	61	0	81	59	.1	.2	286	111	61	474	6.4	2	14.5
CA-26	--	--	--	78	--	--	--	--	--	--	--	--	--
CA-26	--	--	--	80	--	--	--	--	--	--	--	--	--
CA-29	--	--	--	46	--	--	--	--	--	428	6.0	--	15.5
CA-29	--	--	--	40	--	--	--	--	--	435	--	--	--
CA-29	--	--	--	41	--	--	--	--	--	441	--	--	16.0
CA-29	57	0	82	36	.0	7.6	247	101	55	398	6.3	2	15.0
CA-29	--	--	--	41	--	--	--	--	--	--	--	--	--
CA-29	--	--	--	28	--	--	--	--	--	293	--	--	15.0
CA-35	--	--	--	41	--	--	--	--	--	577	--	--	--
CA-35	--	--	--	50	--	--	--	--	--	--	--	--	--
CA-35	--	--	--	50	--	--	--	--	--	--	--	--	--
CA-35	--	--	--	36	--	--	--	--	--	--	--	--	--
CA-35	--	--	--	48	--	--	--	--	--	--	--	--	--
CA-38	--	--	--	25	--	--	--	--	--	237	--	--	--
CA-38	32	0	24	16	.0	5.3	111	48	22	162	6.2	5	13.5
CA-38	--	--	--	17	--	--	--	--	--	--	--	--	--
CA-38	--	--	--	16	--	--	--	--	--	--	--	--	--
CA-38	28	0	16	10	.2	4.5	96	42	19	130	6.3	4	14.0
CA-38	27	0	16	9.5	.0	4.6	77	38	16	138	6.2	2	13.5
CA-41	42	0	32	11	.0	1.9	109	60	25	181	7.2	1	13.5
CA-41	--	--	--	10	--	--	--	--	--	186	--	--	14.0
CA-41	45	0	31	9.1	.0	.9	111	62	25	170	6.3	3	13.5
CA-41	--	--	--	11	--	--	--	--	--	--	--	--	--
CA-41	--	--	--	16	--	--	--	--	--	--	--	--	--
CA-41	47	0	29	8.2	.0	.1	104	61	23	170	6.2	--	14.0
CA-41	49	0	30	8.4	.3	.8	109	64	24	174	6.3	4	14.0
CA-41	45	0	29	7.0	.0	.9	101	61	24	185	6.2	2	13.5
CA-41	47	0	28	8.0	.0	.1	112	61	23	173	6.3	5	14.0
CA-41	--	--	--	8.4	--	--	--	--	--	167	--	--	--
CA-41	--	--	--	8.8	--	--	--	--	--	170	--	--	14.0
CA-42	--	--	--	48	--	--	--	--	--	538	6.1	--	15.1
CA-42	--	--	--	37	--	--	--	--	--	530	--	--	--
CA-42	102	0	101	28	.1	16	308	175	91	493	6.6	3	14.5
CA-42	--	--	--	35	--	--	--	--	--	--	--	--	--
CA-42	--	--	--	32	--	--	--	--	--	--	--	--	--
CA-53	--	--	--	32	--	--	--	--	--	699	--	--	--
CA-53	160	0	178	29	.0	5.5	445	274	143	702	6.4	5	14.5
CA-53	--	--	--	30	--	--	--	--	--	778	--	--	15.0
CA-53	--	--	--	30	--	--	--	--	--	765	--	--	15.0
CA-53	--	--	--	31	--	--	--	--	--	805	--	--	15.5
CA-56	--	--	--	40	--	--	--	--	--	391	--	--	--
CA-56	--	--	--	80	--	--	--	--	--	--	--	--	--

Table 4.--Chemical analysis of water samples from wells tapping the various aquifers of the Camden County area--Continued

MAP NUMBER	WELL OWNER	LOCAL NUMBER	MAJOR AQUIFER	DATE OF SAMPLE	SILICA (SIO2) (MG/L)	TOTAL IRON (FE) (UG/L)	TOTAL MANGANESE (MN) (UG/L)	CALCIUM (CA) (MG/L)	MAGNESIUM (MG) (MG/L)	SODIUM (NA) (MG/L)	POTASSIUM (K) (MG/L)
CA-56	CAMDEN CITY W D	CITY 11	K3MR	11-18-65	--	--	--	--	--	--	--
CA-58	CAMDEN CITY W D	CITY 7	K3MR	11-18-65	--	--	--	--	--	--	--
CA-60	CAMDEN CITY W D	CITY 7N	K3MR	03-11-69	--	--	--	--	--	--	--
CA-60	CAMDEN CITY W D	CITY 7N	K3MR	02-12-69	--	--	--	--	--	--	--
CA-61	SO JRSY PORT CM	NY SHIP 7	K3MR	07-14-71	5.9	3900	330	20	4.5	17	4.1
CH-5	RADIO CORP AMER	RCA 1	K3MR	08-18-67	12	3800	50	33	7.5	2.5	5.0
CH-14	NJ WATER CO	KINGSTON 25	K3MR	08-17-66	8.0	2900	90	27	6.0	3.1	7.2
CH-19	NJ WATER CO	ELLISBURG 16	K3MR	08-23-66	9.1	3600	100	24	5.4	10	6.2
CH-20	NJ WATER CO	ELLISBURG 23	K3MR	08-17-66	7.8	3700	0	27	5.4	1.7	4.2
CH-37	HUSSMAN REFRIDG	HUSSMAN	K3MR	08-24-66	8.4	310	40	27	6.4	5.8	8.6
CL-3	CLEMENTON W D	CWD 8	K3ET	09-11-69	12	350	0	25	3.0	1.8	3.8
CO-2	COLLINGSWOOD WD	CWD 3	K3MR	08-23-66	11	810	0	18	6.0	2.8	4.0
CO-7	COLLINGSWOOD WD	CWD 7	K3MR	08-23-66	9.1	3000	0	23	4.8	6.0	7.2
GI-3	KARL W FUCHS	1	K3MW	01-15-70	--	--	--	--	--	--	--
GI-8	US AIR FORCE	RADAR 1	K3MW	01-04-71	10	1100	20	25	2.5	2.7	4.0
GI-8	US AIR FORCE	RADAR 1	K3MW	12-04-67	10	800	10	24	2.5	2.8	4.0
GI-9	US AIR FORCE	RADAR 2	K3MW	01-04-71	10	130	10	25	2.5	2.7	4.2
GI-9	US AIR FORCE	RADAR 2	K3MW	12-04-67	9.8	560	20	24	1.8	2.0	3.7
GC-3	GLOUCESTER C WD	GCWD 40	K3MR	08-31-66	12	2800	50	22	5.2	12	7.8
GC-4	GLOUCESTER C WD	GCWD 37	K3MR	08-31-66	11	7800	180	18	12	20	6.6
GC-10	GLOUCESTER C WD	GCWD 38	K3MR	08-31-66	14	3900	70	28	6.6	14	8.8
GC-14	HINDE AND DAUCH	JERSEY AVE 1	K3MR	08-31-66	15	3600	90	22	5.2	15	7.4
GC-17	HARSHAW CHEM CO	HARSHAW 4	K3MR	12-12-68	--	--	--	--	--	--	--
GC-23	NJ ZINC CO	3-DEEP	K3MR	05-14-71	10	3100	130	46	10	30	12
GC-23	NJ ZINC CO	3-DEEP	K3MR	12-12-68	--	--	--	--	--	--	--
GC-24	NJ ZINC CO	2-DEEP	K3MR	12-12-68	--	--	--	--	--	--	--
GC-26	NJ ZINC CO	4-DEEP	K3MR	12-12-68	--	--	--	--	--	--	--
GT-4	EDWARD MARSH	--	K3MV	11-06-69	11	120	20	26	3.5	3.4	5.1
GT-9	JOHN BISHOP	1	K3ET	01-28-70	--	--	--	--	--	--	--
GT-10	THEISS	1	K3MW	02-16-70	16	20	100	2.0	2.8	3.4	2.6
GT-20	GAR ST WC-BLKWD	BLACKWOD DIV 1	K3MR	08-25-66	9.1	140	30	12	3.2	24	6.8
GT-25	ROBERT BENNETT	MONARCH BOILER	K3MW	02-16-70	9.0	70	10	22	1.5	1.3	2.0
GT-29	CAMDEN COUNTY	LAKELAND 2	K3MR	11-07-69	--	--	--	--	--	--	--
GT-32	MYRA LORING	--	K3MW	11-06-69	--	--	--	--	--	--	--
GT-36	ROBERT BENNETT	HOME WELL	AACP	02-16-70	4.4	1100	20	12	2.8	7.8	6.4
GT-38	J BECICA	--	K3MW	11-06-69	--	--	--	--	--	--	--
GT-44	CAMDEN CO BD ED	VOC&TECH H S 1	K3MW	01-15-70	8.3	20	20	23	7.0	8.4	8.4
HA-5	HADDON TWP W D	HTWD 1	K3MR	08-23-66	9.1	210	100	22	5.0	7.2	7.4
HA-7	HADDON TWP W D	HTWD 2	K3MR	08-23-66	9.5	4200	60	22	5.4	7.1	7.8
HF-3	HADDONFIELD W D	RULON	K3MR	08-22-66	9.1	1300	50	20	4.8	8.8	8.4
HF-5	HADDONFIELD W D	LAYNE 2	K3MR	08-22-66	8.4	1400	60	26	5.8	4.6	7.8
HH-1	NJ WATER CO	EGGBERT 18	K3MR	08-21-67	7.6	970	0	17	3.8	11	8.3
HH-8	NJ WATER CO	HADDON 30	K3MR	08-17-66	9.1	680	40	26	5.6	6.0	8.2
HH-9	NJ WATER CO	HADDON 15	K3MR	08-17-66	8.9	730	40	18	3.8	11	6.8
LS-6	NJ WATER CO	LAUREL 4	K3MW	01-22-70	15	2000	30	46	2.6	2.0	2.2
LI-1	MUN UTIL AUTH	SEWAGE PLANT 1	K3MW	11-06-69	12	2000	40	27	1.0	1.6	2.7
ME-1	MERCH-PENNS W C	WOODBINE 1	K3MR	08-19-66	11	80	20	6.5	3.2	12	2.1
PE-1	CAMDEN CITY W D	MORRIS 1	K3MR	08-30-66	4.9	5300	3600	21	11	18	2.4
PE-4	CAMDEN CITY W D	MORRIS 3A	K3MR	08-30-66	4.4	6800	8300	34	22	24	2.2
PE-4	CAMDEN CITY W D	MORRIS 3A	K3MR	08-13-63	--	--	--	--	--	--	--
PE-4	CAMDEN CITY W D	MORRIS 3A	K3MR	08-31-61	--	--	--	--	--	--	--
PE-10	CAMDEN CITY W D	MORRIS 8	K3MR	08-30-66	5.5	6800	2800	16	7.0	10	1.4
PE-14	CAMDEN CITY W D	DELAIR 3	K3MR	08-30-66	6.5	100	1100	17	11	17	4.0
PE-15	CAMDEN CITY W D	DELAIR 2	K3MR	08-30-66	6.7	9100	2400	12	4.6	20	2.4
PE-18	CAMDEN CITY W D	PUCHACK I	K3MR	06-11-69	4.1	20	1900	16	6.9	18	2.2
PE-18	CAMDEN CITY W D	PUCHACK 1	K3MR	08-30-66	3.8	0	1300	16	10	12	2.0
PE-21	CAMDEN CITY W D	PUCHACK 4	K3MR	06-11-69	7.7	120	50	5.3	2.3	4.0	.2
PE-21	CAMDEN CITY W D	PUCHACK 4	K3MR	08-30-66	8.4	0	0	6.5	3.0	3.2	1.4
PE-23	CAMDEN CITY W D	PUCHACK 5	K3MR	06-11-69	7.4	50	100	9.2	4.7	9.0	2.3
PE-27	MERCH-PENNS W C	PARK AVE 2	K3MR	09-20-66	13	600	80	4.2	1.4	7.0	.6
PE-34	MERCH-PENNS W C	DELA GARDEN 1	K3MR	08-31-66	5.5	160	100	12	5.2	11	2.8
PE-39	MERCH-PENNS W C	MARION 1	K3MR	08-31-66	12	160	100	5.0	2.2	5.1	2.0
PE-41	MERCH-PENNS W C	MARION 2	K3MR	08-19-66	13	160	30	3.5	1.4	3.5	1.6
PE-43	MERCH-PENNS W C	BROWNING 2A	K3MR	08-19-66	15	1600	70	3.0	1.4	4.5	1.1
PE-44	MERCH-PENNS W C	BROWNING 1	K3MR	08-19-66	12	2000	60	3.0	1.4	4.5	1.1
PH-6	PINE HILL M U A	PHMUA 1	K3MR	08-17-67	8.7	30	0	12	4.5	22	9.6
PV-4	PINE VALLEY G C	GOLF CLUB 1-49	K3MW	08-16-67	11	340	50	25	4.3	2.5	4.9
RU-5	NJ WATER CO	RUNNEMEDE 19	K3MR	09-21-66	8.7	280	0	16	3.4	12	7.2
SO-1	NJ WATER CO	SOMERDALE 14	K3MR	08-17-66	9.1	990	30	18	4.5	11	7.6
VO-6	NJ WATER CO	ASHLAND 17	K3MR	08-17-66	9.5	290	50	22	6.2	7.2	9.0
VO-7	RADIO CORP AMER	RCA	K3MW	01-15-70	--	--	--	--	--	--	--
VO-11	CAMDEN LIME CO	1	K3MW	01-15-70	12	130	10	26	2.5	2.0	2.6
VO-14	NJ WATER CO	ELM TREE 26	K3MW	03-16-70	10	40	10	22	1.8	2.0	3.2
WA-4	IVYSTONE W W	WATER WKS 2-62	K3MW	04-25-69	10	1500	20	22	6.3	7.0	9.2
WA-5	IVYSTONE W W	WATER WKS 3-65	K3MW	12-16-69	--	--	--	--	--	--	--
WA-8	AL GIORDANO	1	AACP	03-11-70	5.5	3800	30	1.4	1.8	4.5	1.2
WI-3	JOHNS-MANVILLE	1	K3MW	01-22-70	9.3	3600	60	16	4.0	7.8	5.2
WI-8	CAMDEN CO R H S	REGIONAL H S 1	AACP	02-16-70	5.2	0	10	22	1.6	3.0	2.6
WI-10	AMERICAN TELEPH	TELEGRAPH 1	AACP	11-06-69	--	--	--	--	--	--	--
WI-12	CERTAIN TEED ST	1	AACP	11-06-69	5.7	100	10	.3	.4	1.4	.6

Table 4.--Chemical analysis of water samples from wells tapping the various aquifers of the Camden County area--Continued

MAP NUMBER	BICARBONATE (HCO3) (MG/L)	CARBONATE (CO3) (MG/L)	SULFATE (SO4) (MG/L)	CHLORIDE (CL) (MG/L)	FLUORIDE (F) (MG/L)	NITRATE (NO3) (MG/L)	DISSOLVED SOLIDS (RESIDUE AT 180 C)	HARDNESS (CA,MG) (MG/L)	NONCARBONATE HARDNESS (MG/L)	SPECIFIC CONDUCTANCE (MICROMHOS)	PH	COLOR	TEMPERATURE (DEG C)
CA-56	--	--	--	82	--	--	--	--	--	--	--	--	--
CA-58	--	--	--	27	--	--	--	--	--	--	--	--	--
CA-60	--	--	--	30	--	--	--	--	--	227	--	--	--
CA-60	--	--	--	30	--	--	--	--	--	236	--	--	15.0
CA-61	48	0	23	23	.0	1.1	135	69	29	226	7.5	1	14.9
CH-5	134	0	11	3.0	.0	.1	150	114	4	232	7.1	2	15.0
CH-14	92	0	33	1.8	.0	.2	132	92	17	212	6.0	10	14.5
CH-19	94	0	34	2.0	.1	.0	148	82	5	221	7.2	3	14.5
CH-20	78	0	35	2.1	.0	.3	121	90	26	198	7.1	3	14.5
CH-37	104	0	29	1.4	.2	1.1	141	94	9	226	7.6	3	17.0
CL-3	86	0	8.4	2.0	.2	.0	105	75	5	167	8.0	3	17.0
CO-2	64	0	23	4.2	.1	.2	105	70	17	163	6.7	3	13.5
CO-7	82	0	28	2.8	.1	.3	118	77	10	201	6.7	2	14.5
GI-3	--	--	--	6.2	--	--	--	--	--	185	--	--	11.0
GI-8	77	0	11	7.6	.4	.2	98	73	10	171	7.9	0	--
GI-8	72	0	11	5.9	.2	.5	104	71	12	160	7.2	2	14.0
GI-9	79	0	12	8.0	.3	.1	100	73	8	174	7.5	5	--
GI-9	72	0	12	2.6	.2	.4	92	68	9	148	7.0	2	19.0
GC-3	80	0	33	11	.0	.0	142	77	11	235	6.8	3	13.5
GC-4	12	0	105	23	.0	.8	203	95	85	331	5.7	5	15.0
GC-10	78	0	51	18	.0	.2	185	97	33	293	6.8	5	14.5
GC-14	67	0	38	21	.0	.2	160	77	22	253	6.3	5	14.0
GC-17	--	--	11	--	--	--	--	--	--	693	--	--	14.0
GC-23	241	--	9.8	20	.3	4.5	248	156	0	439	7.3	1	14.4
GC-23	--	--	6.3	--	--	--	--	--	--	393	--	--	13.0
GC-24	--	--	26	--	--	--	--	--	--	303	--	--	13.0
GC-26	--	--	55	--	--	--	--	--	--	434	--	--	14.0
GT-4	106	0	3.9	.8	.6	.0	107	80	0	181	8.3	1	--
GT-9	--	--	--	4.2	--	--	--	--	--	147	--	--	12.0
GT-10	15	0	.1	1.1	.1	15	97	17	4	116	6.7	3	14.0
GT-20	107	0	15	3.1	.0	.0	124	43	0	201	8.0	3	15.5
GT-25	66	0	10	.3	.4	.4	100	61	7	143	8.1	3	--
GT-29	--	--	--	3.8	--	--	--	--	--	213	--	--	--
GT-32	--	--	--	5.0	--	--	--	--	--	180	--	--	--
GT-36	3	0	.5	11	.1	57	120	42	39	137	5.6	3	12.0
GT-38	--	--	--	2.8	--	--	--	--	--	202	--	--	--
GT-44	127	0	9.8	1.0	.4	.1	137	87	0	228	8.3	3	10.0
HA-5	86	0	29	3.8	.0	.0	125	76	5	200	7.3	5	--
HA-7	88	0	28	3.8	.0	.0	129	77	5	205	6.9	2	14.5
HF-3	91	0	21	4.0	.1	.0	120	70	0	197	7.5	5	16.0
HF-5	97	0	30	1.7	.0	.0	137	89	10	218	7.2	8	14.5
HH-1	83	0	20	4.0	.2	.2	120	58	1	182	7.4	1	--
HH-8	98	0	27	2.0	.1	.7	133	88	8	221	7.5	3	13.5
HH-9	86	0	19	4.4	.2	.2	108	61	0	184	7.1	10	15.5
LS-6	100	0	28	9.7	.2	.3	178	126	44	266	8.3	3	12.0
LI-1	82	0	8.7	2.3	.4	.0	98	--	5	155	8.1	0	17.0
ME-1	11	0	7.8	18	.0	22	86	29	20	126	5.9	15	12.5
PE-1	75	0	47	22	.2	.2	170	98	36	300	6.9	2	14.5
PE-4	179	0	36	38	.1	.5	263	176	29	484	6.6	3	13.5
PE-4	--	--	--	20	--	--	--	--	--	353	--	--	12.5
PE-4	--	--	--	8.4	--	--	--	--	--	141	--	--	13.5
PE-10	41	0	31	19	.2	1.8	110	69	36	211	6.3	3	12.5
PE-14	59	0	40	26	.1	8.8	172	88	39	279	6.4	3	14.0
PE-15	46	0	36	22	.0	.0	130	49	12	228	6.5	5	15.0
PE-18	45	0	36	27	.2	5.6	137	69	32	245	7.6	1	17.0
PE-18	53	0	35	23	.2	.5	137	81	38	235	6.5	4	--
PE-21	4	0	13	6.8	.1	9.6	60	23	19	86	6.6	1	13.0
PE-21	4	0	15	7.6	.0	11	63	29	25	95	5.4	2	12.0
PE-23	11	0	31	14	.2	8.0	90	43	34	153	7.1	1	13.0
PE-27	12	0	6.6	5.5	.0	7.2	67	17	7	66	6.0	8	--
PE-34	43	0	20	15	.1	.6	96	52	17	163	6.1	3	13.5
PE-39	5	0	7.4	10	.1	10	62	22	18	81	5.5	0	12.0
PE-41	9	0	2.6	6.4	.0	6.5	48	14	7	53	5.9	5	13.5
PE-43	9	0	.6	11	.0	2.8	48	14	4	55	7.1	15	13.5
PE-44	13	0	4.0	7.0	.0	.7	39	14	3	48	6.1	10	13.5
PH-6	108	0	19	1.7	.4	.0	137	49	0	210	7.4	1	19.0
PV-4	96	0	11	1.0	.2	.1	117	80	2	172	7.7	4	14.5
RU-5	84	0	17	2.2	.2	.6	116	54	0	171	7.4	5	--
SO-1	84	0	23	4.4	.2	.2	110	64	0	185	7.5	15	15.0
VO-6	102	0	24	1.6	.0	.0	130	81	0	211	7.6	2	14.5
VO-7	--	--	--	4.0	--	--	--	--	--	154	--	--	12.0
VO-11	87	0	4.8	3.0	.3	.2	113	75	4	161	8.0	3	13.0
VO-14	76	0	.0	2.6	.5	.8	98	63	0	155	8.1	3	14.0
WA-4	114	1	14	2.1	.3	.6	118	81	0	206	8.4	2	16.0
WA-5	--	--	--	2.8	--	--	--	--	--	156	--	--	14.0
WA-8	2	0	.4	10	.1	15	53	11	10	69	5.3	3	12.2
WI-3	125	0	7.3	1.0	.4	1.4	134	57	0	227	8.3	3	14.0
WI-8	4	0	9.8	4.0	.1	16	50	12	9	61	6.0	3	12.0
WI-10	--	--	--	2.2	--	--	--	--	--	17	--	--	--
WI-12	4	--	.0	2.2	.0	1.0	13	2	0	24	6.6	0	14.0

Table 4.--Chemical analysis of water samples from wells tapping the various aquifers of the Camden County area--Continued

MAP NUMBER	WELL OWNER	LOCAL NUMBER	MAJOR AQUIFER	DATE OF SAMPLE	SILICA (SIO2) (MG/L)	TOTAL IRON (FE) (UG/L)	TOTAL MAN-GANESE (MN) (UG/L)	CAL-CIUM (CA) (MG/L)	MAG-NE-SIUM (MG) (MG/L)	SODIUM (NA) (MG/L)	PO-TAS-SIUM (K) (MG/L)
WI-27	US GEOL SURVEY	NEW BROOKLYN 1	K3MR	04-27-72	12	680	20	10	2.4	240	5.8
WI-27	US GEOL SURVEY	NEW BROOKLYN 1	K3MR	04-06-67	--	1600	110	11	2.4	229	5.0
WI-28	US GEOL SURVEY	NEW BROOKLYN 2	K3MR	04-26-72	14	--	0	3.6	.4	97	9.9
WI-30	US GEOL SURVEY	NEW BROOKLYN 4	TMKW	02-07-64	15	6000	520	8.8	1.2	13	2.0
WI-38	ANCORA STA HOSP	2	TSMV	04-25-69	9.6	30	10	9.2	2.6	44	7.3
WI-42	M&R REFRACTORY	1	AACP	11-05-69	4.6	100	10	.2	.4	2.0	.5
CL-1	CLAYTON W D	CWD 3	K3MR	07-13-67	9.8	950	150	2.4	1.2	222	7.2
DE-7	DEPTFORD T M A	OTMA 2	K3MR	08-17-67	7.6	80	0	8.7	2.2	57	6.3
GL-1	E FOULKES	1	K3MW	01-23-70	--	--	--	--	--	--	--
MA-1	MANTUA WATER CO	MWC 2	K3MR	07-17-67	9.8	90	100	8.5	2.2	82	5.5
MA-2	EDENWOOD W C	EWC 1	K3MR	08-15-67	8.0	120	100	7.0	2.0	92	6.7
MA-3	SEWELL W C	SWC 2	K3MR	07-17-67	9.5	270	190	6.0	1.8	80	5.8
MO-2	VIOLET PACKING	2	AACP	11-06-69	--	--	--	--	--	--	--
NP-1	NATIONAL PK W O	NPWD 2	K3MR	05-18-71	10	780	30	8.5	2.3	53	4.5
NP-1	NATIONAL PK W D	NPWD 2	K3MR	07-13-67	11	90	50	6.5	1.5	60	3.2
NP-1	NATIONAL PK W O	NPWD 2	K3MR	08-29-66	9.8	530	20	6.5	2.2	57	3.8
WA-5	PRIMROSE MOTEL	--	K3MW	01-22-70	--	--	--	--	--	--	--
WA-6	WASHINGTON TMUA	WTMUA 2	K3MR	08-17-67	8.0	70	50	5.0	1.9	46	6.4
WA-7	R KRAEMER	1	K3MW	01-20-70	--	--	--	--	--	--	--
WA-8	C BRETT	--	TFCS	10-20-68	20	590	30	36	.9	2.5	1.7
WA-10	WASHINGTON TMUA	WTMUA 1	K3MR	08-17-67	9.8	130	0	5.2	2.0	48	6.8
WA-12	GINO'S REST	1	K3MW	02-25-70	8.6	50	20	20	7.0	6.2	6.8
WA-13	WALTER F EMOND	1	K3MW	01-23-70	--	--	--	--	--	--	--
WA-14	FRIES MILLS W C	FMWC 1	K3MR	08-15-67	8.7	90	50	3.5	1.5	65	5.9
WA-16	HARRY J DE SOI	1	K3MW	01-20-70	--	--	--	--	--	--	--
WE-1	WENONAH WATER D	WWD 2	K3MR	07-17-67	9.5	170	0	7.5	2.1	58	5.8
WE-2	WENONAH WATER D	WWD 1	K3MR	07-17-67	9.6	290	150	7.3	2.0	60	5.8
WD-2	TEXAS OIL CO	EAGLE PT OBS 3	K3MR	05-18-71	11	2600	90	26	5.9	34	8.4
WD-5	TEXAS OIL CO	EAGLE POINT 1	K3MR	08-25-66	10	1400	50	16	4.0	33	6.4
WD-6	TEXAS OIL CO	EAGLE POINT 4	K3MR	05-18-71	12	1200	40	11	2.9	44	5.2
WD-6	TEXAS OIL CO	EAGLE POINT 4	K3MR	12-19-68	--	--	--	--	--	--	--
WO-6	TEXAS OIL CO	EAGLE POINT 4	K3MR	08-25-66	11	660	0	7.5	3.0	36	3.9
WD-7	TEXAS OIL CO	EAGLE POINT 2	K3MR	08-25-66	11	820	0	11	5.0	32	5.5
WD-10	TEXAS OIL CO	EAGLE POINT 6	K3MR	12-22-70	13	2200	60	15	3.0	30	5.1
WD-11	SHELL CHEM CO	SHELL 1	K3MR	08-15-67	8.0	460	100	8.0	1.9	165	4.9
WD-12	SHELL CHEM CO	SHELL 3	K3MR	08-15-67	9.3	670	110	7.5	1.5	144	4.3
WS-1	WESTVILLE W D	WWD 4	K3MR	05-20-71	8.9	450	30	13	2.9	23	6.6
WS-1	WESTVILLE W D	WWD 4	K3MR	07-13-67	9.1	--	--	12	2.3	25	5.2
W8-1	WOODBURY W D	RAILROAD 5	K3MR	07-12-67	9.5	110	280	3.9	1.4	71	4.0
PH-1	CROWN PAPER BRD	1	K3MR	07-31-67	12	80	3400	30	15	30	7.8
PH-2	S P DRESS BEEF	S PHILA BEEF 4	K3MR	12-13-68	--	--	--	--	--	--	--
PH-3	GILBERT ADDEO	PRES THEATER	QGCM	06-08-71	24	24500	630	60	78	38	7.6
PH-4	CONTINENTL DIST	CONT DIST R-7	K3RA	07-31-67	15	18000	1100	14	6.8	25	3.4
PH-5	WILSON-MARTIN	WILSON 1	K3MR	12-19-68	--	--	--	--	--	--	--
PH-6	TWIN PACKING CO	1	K3RA	07-30-67	14	40	420	74	67	62	10
PH-7	PUBLICKER IND	P INDUSTRIES17	K3RA	05-28-71	9.9	64000	1310	60	26	50	7.8
PH-7	PUBLICKER IND	P INDUSTRIES17	K3RA	07-31-67	9.5	3700	40	22	5.5	14	8.6
PH-8	GULF OIL CORP	WEST WELL	K3RA	05-13-71	23	1530	100	40	26	29	3.8
PH-8	GULF OIL CORP	WEST WELL	K3RA	07-31-67	23	33000	2500	52	36	26	4.9
PH-10	U S NAVAL BASE	2	K3RA	12-08-71	9.6	56000	2900	55	26	39	12
PH-11	U S NAVAL BASE	4	K3RA	05-17-71	13	36000	300	45	24	22	4.4
PH-11	U S NAVAL BASE	4	K3RA	08-04-67	14	10000	320	42	26	26	4.2
PH-12	U S NAVAL BASE	3	K3RA	08-04-67	14	4700	200	30	16	30	3.6
PH-13	U S NAVAL BASE	9	K3RA	12-08-71	11	24000	210	100	38	65	.7
PH-13	U S NAVAL BASE	9	K3RA	08-04-67	13	17000	200	84	33	70	12
PH-15	U S NAVAL BASE	8	K3RA	08-04-67	8.9	46000	430	44	26	25	8.0
PH-16	U S NAVAL BASE	11	K3RA	06-02-71	10	6300	3200	70	28	40	8.1
PH-16	U S NAVAL BASE	11	K3RA	08-04-67	13	8700	100	88	44	59	10

EXPLANATION

AQUIFER

K3RA RARITAN FORMATION
K3MR MAGOTHY-RARITAN FORMATIONS
K3MV MERCHANTVILLE FORMATION
K3ET ENGLISHTOWN FORMATION
K3MW MOUNT LAUREL SAND-WENONAH FORMATION
TSMV MANASQUAN-VINCENTOWN FORMATION
TMKW KIRKWOOD FORMATION
TFCS COHANSEY SAND
AACP PLEISTOCENE-COHANSEY SAND
QGCM CAPE MAY FORMATION

Table 4.--Chemical analysis of water samples from wells tapping the various aquifers of the Camden County area--Continued

MAP NUMBER	BICARBONATE (HCO3) (MG/L)	CARBONATE (CO3) (MG/L)	SULFATE (SO4) (MG/L)	CHLORIDE (CL) (MG/L)	FLUORIDE (F) (MG/L)	NITRATE (NO3) (MG/L)	DISSOLVED SOLIDS (RESIDUE AT 180 C)	HARDNESS (CA,MG) (MG/L)	NONCARBONATE HARDNESS (MG/L)	SPECIFIC CONDUCTANCE (MICROMHOS)	PH	COLOR	TEMPERATURE (DEG C)
WI-27	162	0	5.3	283	1.9	.9	663	35	0	1110	7.6	10	22.0
WI-27	168	0	6.9	298	1.6	.3	670	38	0	1220	8.1	7	24.0
WI-28	172	54	4.7	2.5	.5	.4	297	11	0	453	9.4	40	18.5
WI-30	3	0	56	2.6	.3	.2	136	27	25	167	5.1	3	12.0
WI-38	151	3	12	2.0	.6	.4	165	34	0	256	8.6	4	13.0
WI-42	4	0	.1	5.0	.1	.9	19	2	0	21	6.4	3	14.0
CL-1	369	4	.6	129	1.6	.2	568	11	0	961	8.5	5	20.5
DE-7	162	0	7.8	9.2	1.0	.4	173	31	0	285	7.7	1	16.5
GL-1	--	--	--	3.8	--	--	--	--	--	196	--	--	11.0
MA-1	189	6	6.1	26	2.0	.8	241	30	0	391	8.5	3	14.5
MA-2	227	0	5.5	30	1.6	.1	276	26	0	438	7.9	4	15.0
MA-3	204	5	5.1	20	1.6	1.2	231	23	0	378	8.5	4	13.5
MO-2	--	--	--	9.0	--	--	--	--	--	51	--	--	--
NP-1	120	0	8.8	30	.8	.0	178	31	0	316	6.5	5	13.4
NP-1	120	0	8.4	34	.8	.2	187	22	0	312	8.0	4	13.5
NP-1	120	0	8.8	37	1.0	.0	191	25	0	318	7.8	3	13.5
WA-5	--	--	--	3.5	--	--	--	--	--	183	--	--	13.0
WA-6	134	0	13	2.0	.6	.1	159	21	0	233	7.7	5	18.5
WA-7	--	--	--	4.0	--	--	--	--	--	160	--	--	11.0
WA-8	95	1	19	4.7	.2	.4	125	94	14	212	8.4	1	--
WA-10	140	0	15	2.3	.0	.2	136	21	0	237	7.8	1	17.0
WA-12	110	0	6.9	1.5	.4	.2	122	79	0	211	8.0	3	15.0
WA-13	--	--	--	3.5	--	--	--	--	--	176	--	--	11.0
WA-14	174	0	7.6	2.0	.6	.2	186	15	0	278	7.9	2	18.5
WA-16	--	--	--	6.0	--	--	--	--	--	208	--	--	12.0
WE-1	171	0	6.9	12	1.6	.3	190	27	0	307	8.2	3	11.0
WE-2	173	0	6.9	12	1.6	.0	205	26	0	308	8.2	3	13.5
WD-2	164	0	5.4	20	.3	.7	189	90	0	337	7.1	0	14.5
WD-5	145	0	7.8	13	.0	.0	164	57	0	274	7.3	3	13.5
WD-6	117	0	10	23	.4	.9	164	40	0	289	7.1	11	14.2
WD-6	--	--	15	--	--	--	--	--	--	265	--	--	13.0
WD-6	85	0	14	25	.4	.6	143	31	0	236	7.5	5	13.5
WD-7	80	0	27	23	.3	.8	158	48	0	254	7.2	13	13.5
WD-10	33	0	65	24	.2	.3	169	50	23	275	6.9	1	13.8
WD-11	180	0	9.2	165	1.2	.1	464	28	0	806	7.7	3	14.5
WD-12	165	0	10	138	2.4	.3	425	25	0	708	7.8	5	14.5
WS-1	92	0	15	7.6	.5	--	119	45	0	202	7.4	1	14.2
WS-1	90	0	15	7.5	.4	.4	121	40	0	191	8.0	3	14.5
W8-1	122	0	7.9	48	.9	.1	213	16	0	354	7.8	3	14.5
PH-1	158	0	28	46	.5	.4	272	137	7	451	8.1	2	14.5
PH-2	--	--	139	--	--	--	--	--	--	815	--	--	16.0
PH-3	259	0	276	57	.3	1.2	708	471	259	970	7.4	5	15.6
PH-4	25	0	31	42	.3	19	204	63	43	298	6.1	2	11.0
PH-5	--	--	95	--	--	--	--	--	--	770	--	--	16.0
PH-6	400	0	162	68	.0	10	665	460	132	1050	7.4	2	15.5
PH-7	158	0	131	66	.4	.0	479	257	127	802	6.4	1	14.8
PH-7	94	0	22	14	.2	.8	147	78	0	235	6.9	2	14.5
PH-8	193	0	57	51	.2	.0	337	210	52	563	6.2	1	15.9
PH-8	316	0	38	32	.0	.1	372	278	19	629	6.9	5	13.5
PH-10	258	0	95	41	.8	1.9	402	244	33	696	6.7	1	16.3
PH-11	186	0	82	21	.4	.2	325	211	59	524	6.4	1	15.1
PH-11	173	0	96	20	.2	.2	335	212	70	508	6.6	2	--
PH-12	152	0	48	27	.2	.2	248	141	17	415	6.6	2	--
PH-13	221	0	281	82	.2	.1	709	406	225	1030	6.2	1	14.2
PH-13	152	0	247	102	.0	.2	700	345	221	992	6.6	2	--
PH-15	279	0	22	24	.6	.2	295	217	0	546	6.7	5	--
PH-16	289	0	107	38	.4	.4	414	290	53	727	6.5	2	14.9
PH-16	238	0	250	58	.0	.2	691	401	206	966	6.6	2	--

Table 5.--Laboratory determinations of particle size, porosity, and hydraulic conductivity of core samples from New Brooklyn Park test wells in Winslow Township, Camden County

Formation	Sample depth below land surface (feet)	Particle-size diameter, in millimeters												Porosity (percent)	Hydraulic Conductivity (ft^2/day)	Coefficient of Permeability (gpd/ft^2)
		Clay sizes, in percent (.004 mm)	Silt sizes, in percent (.004-.0625 mm)	Sand sizes, in percent					Gravel sizes, in percent							
				V. fine (.0625-.125 mm)	Fine (.125-.25 mm)	Medium (.25-.5 mm)	Coarse (.5-1 mm)	V. coarse (1-2 mm)	V. fine (2-4 mm)	Fine (4-8 mm)	Medium (8-16 mm)	Coarse (16-32 mm)	V. coarse (32-64 mm)			
Cohansey Sand and younger	10-12	4.8		5.9	27.1	41.8	17.5	2.4	.5	--	--	--	--	36.2	27	200
Do.	20-22	7.7	12.1	3.0	18.6	39.4	13.4	4.8	.8	.2	--	--	--	31.1	1.1	8.0
Do.	30.5-32.5	36.9	20	2.3	15.8	17.1	3.1	1.5	1.5	1.8	--	--	--	50.9	.04	.3
Do.	51-53	8.0	3.1	1.1	5.2	11.6	28.1	22.2	14.2	5.9	.6	--	--	31.2	.94	7.0
Do.	110-112	4.3	5.1	5.9	15.3	16.3	14.2	9.8	7.6	6.8	8.4	6.3	--	27.4	.94	7.0
Kirkwood Formation	120-122	9.9	6.0	32.3	16	2.4	7.8	5.9	3.0	2.3	8.7	5.7	--	42.6	2.3	17
Do.	130-132	10.7	14	47.6	17.7	.6	.4	.5	.6	2.0	5.9	--	--	46.2	1.6	12
Do.	140-142	7.5	22.8	32.6	7.6	.6	.7	.7	.7	3.0	17.5	6.3	--	42.6	.54	4.0
Do.	150-152	23.7	31.9	9.6	33	1.8	--	--	--	--	--	--	--	41.1	.007	.05
Do.	162-164	26	34.6	9.4	15.8	14.2	--	--	--	--	--	--	--	40.7	.0001	.001
Do.	174-176	25.2	67.6	5.0	1.8	.4	--	--	--	--	--	--	--	46.5	.003	.02
Do.	186-188	6.7	24.1	66	2.4	.8	--	--	--	--	--	--	--	53	2.28	17
Do.	198-200	7.7	54.1	37	1.0	.2	--	--	--	--	--	--	--	50.7	1.1	8.0
Do.	210-212	8.0	35.6	54	1.0	.8	.6	--	--	--	--	--	--	54.5	1.7	13
Manasquan and Vincentown Formations undifferentiated	220-222	25.9	19.9	7.8	19.8	23.4	3.0	.2	--	--	--	--	--	45.1	.01	.1
Do.	230-232	30.8	18.8	13.9	19.2	15.6	1.6	.0	.1	--	--	--	--	43.8	.003	.02
Do.	240-242	31.4	18.6	20.6	20	8.6	.6	.2	--	--	--	--	--	44	.001	.01
Do.	250-252	25.8	20	45.2	7.4	1.2	.2	.2	--	--	--	--	--	42.8	.003	.02
Do.	260-262	42.1	37.1	18.8	1.6	.4	--	--	--	--	--	--	--	41.2	.0001	.001
Do.	270-272	43.4	46	7.4	2.6	.6	--	--	--	--	--	--	--	40	.0003	.002
Do.	280-282	34.1	29.5	23.4	7.8	5.2	--	--	--	--	--	--	--	56.9	.004	.03
Do.	290-292	39.8	41	16.4	1.8	1.0	--	--	--	--	--	--	--	41.6	.0003	.002
Do.	300-302	33.6	23.2	7.6	13.8	19.8	1.6	.4	--	--	--	--	--	41.1	.007	.05
Do.	310-312	35.7	31.9	22.8	6.2	2.8	.6	--	--	--	--	--	--	47.8	.001	.01
Do.	320-322	43	29.2	10.2	8.5	6.4	2.0	.2	.4	.1	--	--	--	58.7	.003	.02
Do.	330-332	49	29.2	20.8	.8	.2	--	--	--	--	--	--	--	35.2	.009	.07
Do.	340-342	65	24.8	9.0	1.0	.2	--	--	--	--	--	--	--	53.2	.0001	.001
Do.	350-352	81.7	12.7	.8	2.2	2.6	--	--	--	--	--	--	--	34.1	.0003	.002
Do.	360-362	72.6	26.8	.4	.0	.2	--	--	--	--	--	--	--	31.1	.00008	.0006
Do.	370-372	76.1	23.5	.2	.2	--	--	--	--	--	--	--	--	44.7	.0003	.002

Table 5.--Laboratory determinations of particle size, porosity, and hydraulic conductivity of core samples from New Brooklyn Park test wells in Winslow Township, Camden County--Continued

Formation	Sample depth below land surface (feet)	Particle-size diameter, in millimeters: Clay sizes, in percent (.004 mm)	Silt sizes, in percent (.004-.0625 mm)	Sand sizes, in percent: V. fine (.0625-.125 mm)	Fine (.125-.25 mm)	Medium (.25-.5 mm)	Coarse (.5-1 mm)	V. coarse (1-2 mm)	Gravel sizes, in percent: V. fine (2-4 mm)	Fine (4-8 mm)	Medium (8-16 mm)	Coarse (16-32 mm)	V. coarse (32-64 mm)	Porosity (percent)	Hydraulic Conductivity (ft^2/day)	Coefficient of Permeability (gpd/ft^2)
Manasquan and Vincentown Formations undifferentiated--Cont.	380-382	76	23.4	.4	.2	--	--	--	--	--	--	--	--	37.9	.0005	.004
Do.	390-392	82	17.4	.2	.2	.2	--	--	--	--	--	--	--	39	.0003	.002
Do.	400-402	78.9	20.3	.6	.2	--	--	--	--	--	--	--	--	38.1	.0003	.002
Do.	408-410	26.8	25.6	46	1.4	.2	--	--	--	--	--	--	--	34.9	.04	.3
Do.	420-422	29.2	23.4	22.6	7.0	13.4	4.4	--	--	--	--	--	--	33.9	.0003	.002
Hornerstown Sand	430-432	13.4	10.2	6.8	17.2	30.4	21.4	.6	--	--	--	--	--	43.3	.04	.3
Do.	440-442	13.4	6.4	4.6	22.8	43.4	9.2	.2	--	--	--	--	--	45.7	.67	5.0
Do.	450-452	23.5	16.5	3.4	16	38.8	1.8	--	--	--	--	--	--	38.7	.008	.06
Navesink Formation	460-462	27	15.5	3.6	12.5	33	7.5	.2	.4	.3	--	--	--	34.2	.0005	.004
Do.	470-472	26.1	15.7	3.5	12.9	31.1	7.9	1.8	.5	.5	--	--	--	45.2	.13	1.0
Do.	480-482	19.3	14.8	4.0	13.3	36.7	9.4	2.2	.1	.2	--	--	--	41.8	.13	1.0
Mount Laurel Sand and Wenonah Formation undifferentiated	490-492	22.4	11.6	2.2	10	40.7	10.2	2.8	.1	--	--	--	--	35.1	.01	.08
Do.	500-502	22.4	9.7	2.0	10.4	47.1	7.6	.6	.1	.1	--	--	--	44	.12	.9
Do.	509-511	15.7	9.2	3.0	10.9	50.4	9.0	1.4	.2	.2	--	--	--	43.8	.67	5.0
Do.	520-522	12.9	9.4	2.9	13.4	50.4	6.5	.6	.3	2.1	1.5	--	--	43.4	1.2	9.0
Do.	530-532	14	10.7	3.1	10.9	41.3	5.2	.5	.8	7.2	6.3	--	--	42.1	.40	3.0
Do.	540-542	15.3	6.3	3.9	22.1	43.1	6.3	1.0	.9	1.1	--	--	--	42.3	.40	3.0
Do.	550-552	16.9	6.3	3.5	39.9	29.2	1.6	.2	.6	1.4	.4	--	--	47.4	1.07	8.0
Do.	560-562	19.8	7.3	5.0	49.1	18	.4	.2	.0	.2	--	--	--	47.6	.40	3.0
Do.	570-572	19.6	9.8	6.4	51.1	12.6	.2	.2	.1	--	--	--	--	52.4	.67	5.0
Do.	580-582	24.1	16.3	11.8	39.2	6.9	.4	.2	.5	.6	--	--	--	35.6	.001	.01
Do.	590-592	24.2	22.2	27.4	13.5	1.1	.4	.5	1.0	4.2	5.5	--	--	52.5	.07	.5
Do.	600-602	28.2	29	20.3	13.7	7.8	.4	.2	.2	.2	--	--	--	52.3	.04	.3
Marshalltown Formation	610-612	17.1	40.5	38.8	3.0	.2	.0	.0	.4	--	--	--	--	55.5	.13	1.0
Englishtown Formation	620-622	21.2	46.2	14.6	1.6	.6	.6	.3	.5	.2	1.7	12.5	--	55	.04	.3
Do.	630-632	21.3	57.7	18.6	1.6	.6	.2	--	--	--	--	--	--	45.6	.013	.1
Do.	640-642	35.3	51.9	11.2	1.2	.4	--	--	--	--	--	--	--	35.7	.00007	.0005
Woodbury Clay	650-652	42.2	42.8	6.2	5.0	3.0	.6	.2	--	--	--	--	--	32	.0001	.001
Do.	660-662	18.4	51.2	14.7	3.3	.5	.2	.2	.4	1.3	2.8	7.0	--	40.1	.001	.01
Do.	670-672	29.4	49.8	14.1	4.6	1.0	.6	.2	.2	.1	--	--	--	59	.05	.4

Table 5.--Laboratory determinations of particle size, porosity, and hydraulic conductivity of core samples from New Brooklyn Park test wells in Winslow Township, Camden County--Continued

Formation	Sample depth below land surface (feet)	Particle-size diameter, in millimeters												Porosity (percent)	Hydraulic Conductivity (ft^2/day)	Coefficient of Permeability (gpd/ft^2)
		Clay sizes, in percent (.004 mm)	Silt sizes, in percent (.004-.0625 mm)	Sand sizes, in percent					Gravel sizes, in percent							
				V. fine (.0625-.125 mm)	Fine (.125-.25 mm)	Medium (.25-.5 mm)	Coarse (.5-1 mm)	V. coarse (1-2 mm)	V. fine (2-4 mm)	Fine (4-8 mm)	Medium (8-16 mm)	Coarse (16-32 mm)	V. coarse (32-64 mm)			
Woodbury Clay	680-682	44.8	51.2	3.4	.2	.2	.2	--	--	--	--	--	--	33.2	.0005	.004
Do.	690-692	43.2	47.7	2.5	1.6	.9	.2	.2	.3	1.6	1.8	--	--	53.6	.03	.2
Do.	700-702	55.9	41.1	1.6	.6	.8	--	--	--	--	--	--	--	58.5	.004	.03
Do.	710-712	54.2	41.3	1.4	.8	.6	.4	.2	.1	1.0	--	--	--	58	.003	.02
Do.	720-722	47.7	46.3	4.8	.6	.6	--	--	--	--	--	--	--	58.1	.004	.03
Do.	730-732	53.6	44.4	1.2	.6	.2	--	--	--	--	--	--	--	36.7	.0003	.002
Do.	740-742	61.4	37	.8	.4	.2	.2	--	--	--	--	--	--	57.9	.001	.01
Merchantville Formation	750-752	28.8	23.5	3.8	20.8	22	.6	.4	.1	--	--	--	--	32.5	.0003	.002
Do.	760-762	21.4	16.6	7.6	32	22	.4	--	--	--	--	--	--	33.6	.0004	.003
Do.	770-772	20.5	21.6	11.6	26.3	19.2	.6	.0	.1	.1	--	--	--	33.6	.0001	.0009
Do.	790-792	25	31.4	15.4	16.2	9.2	2.2	.6	--	--	--	--	--	37.1	.0001	.001
Magothy Formation	820-822	13.1	13.2	6.1	13.4	9.6	6.7	12.9	17.5	7.5	--	--	--	30.5	.008	.06
Do.	1035-1038	35.6	35	7.6	1.1	1.2	1.7	1.3	4.6	5.5	6.4	--	--	--	99	740
Do.	1056-1058	30	60	9.4	.2	.4	--	--	--	--	--	--	--	--	.01	.1
Raritan Formation	1148-1149	35.2	42.8	6.4	4.6	9.8	1.2	--	--	--	--	--	--	--	--	--
Do.	1153-1155	40	37.2	8.2	7.4	7.0	.2	--	--	--	--	--	--	--	--	--
Do.	1237-1239	33	34.9	9.5	8.3	7.7	3.1	3.5	.9	1.4	1.2	--	--	--	--	--
Do.	1283-1285	24.4	31.5	28.4	14.2	1.2	.2	.0	.1	--	--	--	--	--	.007	.05
Do.	1394-1395	49.8	31.8	3.6	3.8	8.6	2.4	--	--	--	--	--	--	--	--	--
Do.	1516-1518	17.5	32.5	10	9.5	11.2	11.8	6.1	1.1	--	.8	--	--	--	--	--
Do.	1729-1730	32.8	35.8	13.6	7.0	9.0	1.8	--	--	--	--	--	--	--	.001	.01

Table 6.--Pumpage for selected wells in Camden County for 1966

Municipality	Pumpage by aquifer, in million gallons per day								Pumpage by use, in million gallons per day			
	Potomac-Raritan-Magothy aquifer system				Englishtown Formation	Wenonah Formation-Mount Laurel Sand	Vincentown and Manasquan Formations, undifferentiated	Cohansey Sand	Public supply	Industrial	Miscellaneous	Total pumpage (mgd)
	Lower aquifer	Middle aquifer	Upper aquifer	Total								
Bellmawr Boro	.59	--	.58	1.17	--	--	--	--	1.17	--	--	1.17
Berlin Boro	--	--	.52	.52	--	.15	--	--	.52	.15	--	.67
Brooklawn Boro	.28	--	--	.28	--	--	--	--	.28	--	--	.28
Camden City	2.92	8.89	1.81	13.76*	--	--	--	--	11.94	1.82	--	13.76
Clementon Boro	--	--	--	--	.76	--	--	--	.76	--	--	.76
Collingswood Boro	--	2.48	--	2.48	--	--	--	--	2.48	--	--	2.48
Cherry Hill Twp.	1.04	1.44	1.15	3.63	--	--	--	--	3.58	.01	.04	3.63
Gibbsboro Boro	--	--	--	--	--	.08	--	--	--	--	.08	.08
Gloucester City	5.73	.15	--	6.00*	--	--	--	--	1.32	4.68	--	6.00
Gloucester Twp.	.83	--	.84	1.67	--	--	--	--	1.37	--	.30	1.67
Haddon Twp.	--	.89	.04	.93	--	--	--	--	.89	.02	.02	.93
Haddonfield Boro	--	.26	1.02	1.28	--	--	--	--	1.28	--	--	1.28
Haddon Heights Boro	--	1.53	1.89	3.42	--	--	--	--	3.42	--	--	3.42
Laurel Springs Boro	--	--	1.01	1.01	--	.18	--	--	1.19	--	--	1.19
Magnolia Boro	--	.44	1.36	1.80	--	--	--	--	.62	1.18	--	1.80
Merchantville Boro	.72	--	--	.72	--	--	--	--	.72	--	--	.72
Pennsauken Twp.	12.96		1.58	14.54	--	--	--	--	14.54	--	--	14.54
Pine Hill Boro	--	--	.23	.23	--	--	--	--	.23	--	--	.23
Runnemede Boro	--	--	.13	.13	--	--	--	--	.09	.04	--	.13
Somerdale Boro	--	--	.18	.18	--	--	--	--	.18	--	--	.18
Voorhees Twp.	--	--	2.17	2.17	--	.03	--	--	2.20	--	--	2.20
Waterford Twp.	--	--	--	--	--	.05	--	--	.05	--	--	.05
Winslow Twp.	--	--	--	--	--	.35	.14	.46	--	.55	.40	.95
Total	41.15		14.51	55.92*	.76	.84	.14	.46	48.83	8.45	.84	58.12

*Includes additional pumpage from Potomac-Raritan-Magothy aquifer system, individual aquifer not known.

Note - Pumpage is from 1) data reported to the State by public-supply purveyors and industrial users and 2) from water use inventory of non-reporting users which may have omissions.

Does not include all irrigation pumpage, most of which is from the Cohansey Sand. Estimated water use for irrigation from the Cohansey Sand is about 10 mgd.

Table 7.--Analyses of water from wells 1 and 4 at the Puchack Run station of the Camden Water Department, 1924-69

(Milligrams per liter except pH and specific conductance)

Analyzed by the U. S. Geological Survey

Date Collected	Silica (SiO_2)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Hardness as $CaCO_3$	pH	Dissolved Solids (residue at 180°C)	Specific Conductance (micromhos at 25°C)
WELL 1 (PE 18)																
03/27/24	6.5	.03	--	5.1	1.4	5.3		3.7	1.6	3.0	--	26	16	--	56	--
12/08/26	--	.01	--	--	--	--	--	2.0	3.0	11	--	17	25	--	--	--
11/21/32	7.3	.66	0	6.4	3.0	6.8	1.6	6.0	10	12	--	16	28	--	71	--
11/21/33	7.6	.09	--	6.8	3.7	9.2	1.9	7.0	13	15	--	17	32	--	83	--
02/06/34	6.7	.19	.24	7.0	3.6	8.8	1.8	6.0	13	14	--	15	32	--	73	--
11/07/49	5.6	.17	.01	12	7.2	11	2.6	13	51	10	.1	6.9	60	5.4	116	199
07/03/53	4.0	.0	.14	14	7.8	10	3.0	39	40	10	.0	7.5	67	6.5	128	198
08/07/57	5.4	.11	.12	17	8.9	9.9	3.0	66	29	11	.1	5.7	79	7.9	123	212
09/07/61	5.0	.0	.48	19	8.8	10	2.5	70	27	12	.1	5.8	84	6.8	125	224
07/24/62	--	--	--	--	--	--	--	--	--	12.	--	--	--	--	--	192
10/02/62	--	--	--	--	--	--	--	--	--	9.2	--	--	--	--	--	181
04/12/63	3.9	.88	.32	13	6.1	9.4	1.5	54	18	8.0	0	4.3	58	6.1	91	185
08/14/63	4.3	.0	.32	12	6.3	8.6	1.7	65	16	8.9	.1	.8	56	6.5	91	171
05/08/64	4.1	.18	.64	14	7.3	8.7	2.0	49	26	9.8	.2	5.0	102	6.4	102	188
07/09/65	--	--	--	--	--	--	--	--	24	12	--	5.1	--	--	--	198
07/30/66	3.8	.0	1.3	16	10	12	2.0	53	35	23	.2	.5	81	6.5	129	235
06/11/69	4.1	.02	1.9	16	6.9	18	2.2	45	36	27	.2	5.6	69	7.6	138	245
WELL 4 (PE 21)																
05/10/24	7.0	.03	--	3.3	1.0	3.0		3.7	1.1	2.5	--	16	12	--	47	--
12/08/26	--	.01	--	--	--	--	--	5.0	1.0	1.0	--	7	14	--	--	--
11/21/32	7.0	.48	.3	6.2	2.8	4.1	1.2	15	7.1	7.0	--	13	27	--	57	--
11/12/33	8.4	.08	--	5.0	2.0	3.6	1.0	12	1.7	5.0	--	12	21	--	44	--
02/06/34	7.2	.49	.24	6.6	3.3	7.5	1.4	8.0	9.2	11	--	14	30	--	66	--
11/12/35	--	.23	.12	--	--	--	--	13	--	6.2	--	10	--	--	--	--
11/07/49	8.7	.07	.01	4.0	1.9	3.9	1.2	4.0	4.9	6.1	.0	13	18	5.3	49	69.8
07/03/53	7.9	.0	.41	5.2	1.8	3.5	2.1	4.0	10	7.2	.0	12	20	5.8	62	79.7
08/07/57	10	.07	.03	5.5	2.2	4.4	1.8	3.0	10	7.0	.1	14	23	6.3	56	85
08/14/63	8.8	.0	.02	6.4	2.2	4.3	1.2	4.0	13	7.3	.0	12	25	5.2	57	95
05/08/64	13	.19	.02	7.6	3.4	5.0	.6	5.0	16.	8.2	.1	14	33	5.4	70	111
08/30/66	8.4	.0	.0	6.5	3.0	3.2	1.4	4.0	15	7.6	0	11	29	5.4	58	95
06/11/69	7.7	.12	.05	5.3	2.3	4.0	.2	4.0	13	6.8	.1	9.6	23	6.6	51	86

Table 8.--Summary of chemical analyses of water from the Potomac-Raritan-Magothy aquifer system in Camden County

(Milligrams per liter except pH and specific conductance)

	Wells located in outcrop of Potomac-Raritan-Magothy aquifer system			Wells located downdip of outcrop of Potomac-Raritan-Magothy aquifer system*		
	Maximum	Average	Minimum	Maximum	Average	Minimum
Iron (Fe)	15	2.9	.0	4.2	1.3	.03
Calcium (Ca)	52	20	3.0	33	19	3.5
Magnesium (Mg)	35	8.5	.6	6.4	4.8	1.4
Sodium (Na)	51	17	3.2	22	8.8	1.7
Potassium (K)	14	4.1	.2	9.6	6.5	1.6
Bicarbonate (HCO_3)	179	66	4.0	134	82	5.0
Sulfate (SO_4)	178	42	.8	34	9.8	2.6
Chloride (Cl)	59	22	5.5	18	4.1	1.4
Fluoride (F)	1.0	.1	.0	.4	.1	.0
Nitrate (NO_3)	16	3.6	.0	22	1.8	.0
Dissolved solids (residue on evaporation at 180°C)	445	166	39	148	118	48
Hardness, as $CaCO_3$:						
Calcium, magnesium	274	85	14	114	66	14
Noncarbonate	143	32	0	26	7.0	.0
Specific conductance (micromhos at 25°C)	702	273	48	232	187	53
pH	7.6	--	5.4	7.9	--	5.5

*Does not include New Brooklyn Park Well No. 1 (WI 27)

Table 9.--Chemical analyses of water samples from selected wells tapping the Potomac-Raritan-Magothy aquifer system in Camden City

Map number	Well owner	Local number	Source of data	Date of sample	Chloride (Cl) (mg/l)	Sulfate (SO_4) (mg/l)	Nitrate (NO_3) (mg/l)	Dissolved solids (residue at 180°C)
CA 27	Camden City W. D.	1-1922	A	05-08-23	4.0	--	--	--
CA 27	Do.	1-1922	A	12-08-26	10	20	3.0	--
CA 27	Do.	1-1922	B	11-21-32	12	10	13	84
CA 25	Do.	1-1940	B	11-28-49	37	1.0	--	181
CA 26	Do.	1A	B	04-30-56	47	--	.3	--
CA 26	Do.	1A	B	06-03-58	25	59	2.4	--
CA 26	Do.	1A	Table 4	11-16-65	30	--	--	--
CA 26	Do.	1A	Table 4	12-08-65	78	--	--	--
CA 26	Do.	1A	Table 4	08-24-66	59	81	.2	286
CA 26	Do.	1A	Table 4	03-10-69	61	--	--	--
CA 37	Do.	3-1922	A	12-08-26	51	80	35	--
CA 37	Do.	3-1922	B	11-21-32	46	85	45	--
CA 36	Do.	3-1934	B	11-28-49	28	101	28	273
CA 35	Do.	3A	Table 4	11-17-65	48	--	--	--
CA 35	Do.	3A	Table 4	12-08-65	50	--	--	--
CA 35	Do.	3A	Table 4	03-11-69	41	--	--	--
CA 44	Do.	4-1922	A	05-09-23	23	--	--	--
CA 44	Do.	4-1922	A	12-08-26	25	28	28	--
CA 44	Do.	4-1922	B	11-21-32	37	36	29	--
CA 43	Do.	4-1935	B	02-16-51	14	48	11	132
CA 42	Do.	4	B	11-17-65	32	--	--	--
CA 42	Do.	4	Table 4	08-24-66	28	101	16	308
CA 42	Do.	4	Table 4	12-07-65	35	--	--	--
CA 42	Do.	4	Table 4	03-11-69	37	--	--	--
CA 42	Do.	4	Table 4	10-08-69	48	--	--	538
CA 30	Do.	5-1937	B	11-07-49	5.8	27	1.8	80
CA 30	Do.	5-1937	B	08-07-57	7.2	32	2.0	85
CA 29	Do.	5N	Table 4	05-01-64	28	--	--	--
CA 29	Do.	5N	Table 4	11-17-65	41	--	--	--
CA 29	Do.	5N	Table 4	08-24-66	36	82	7.6	247
CA 29	Do.	5N	Table 4	03-10-69	40	--	--	--
CA 29	Do.	5N	Table 4	10-08-69	46	--	--	--

Table 9.--Chemical analyses of water samples from selected wells tapping the Potomac-Raritan-Magothy aquifer system in Camden City--Continued

Map number	Well owner	Local number	Source of data	Date of sample	Chloride (Cl) (mg/l)	Sulfate (SO_4) (mg/l)	Nitrate (NO_3) (mg/l)	Dissolved solids (residue at 180°C)
CA 54	Camden City W. D.	6-1928	B	11-21-32	72	60	46	--
CA 53	Do.	6N	B	11-28-49	48	137	52	460
CA 53	Do.	6N	B	08-31-61	32	227	10	490
CA 53	Do.	6N	Table 4	10-02-62	31	222	2.2	489
CA 53	Do.	6N	Table 4	08-13-63	30	212	5.8	507
CA 53	Do.	6N	Table 4	04-16-64	30	222	6.8	493
CA 53	Do.	6N	Table 4	08-24-66	29	178	5.5	445
CA 53	Do.	6N	Table 4	03-11-69	32	--	--	--
CA 59	Do.	7-1928	B	11-21-32	13	34	16	102
CA 58	Do.	7	B	12-22-49	11	38	5.2	90
CA 58	Do.	7	B	02-16-51	13	41	4.0	103
CA 58	Do.	7	Table 4	11-18-65	27	--	--	--
CA 60	Do.	7N	Table 4	02-12-69	30	--	--	--
CA 22	Do.	9-1924	B	11-12-35	44	--	49	--
CA 22	Do.	9-1924	B	11-11-49	12	47	3.8	169
CA 22	Do.	9-1924	B	10-14-52	13	60	12	144
CA 22	Do.	9-1924	B	07-03-53	14	68	14	240
CA 20	Do.	9	B	08-31-61	38	46	25	228
CA 20	Do.	9	B	04-24-62	44	48	26	297
CA 20	Do.	9	Table 4	04-12-63	46	59	37	209
CA 20	Do.	9	Table 4	08-13-63	44	44	4.1	213
CA 20	Do.	9	Table 4	11-17-65	46	--	--	--
CA 20	Do.	9	Table 4	12-07-65	56	--	--	--
CA 20	Do.	9	Table 4	08-24-66	54	21	1.7	256
CA 23	Do.	10	B	11-12-35	12	--	--	--
CA 23	Do.	10	B	11-28-49	17	38	16	175
CA 23	Do.	10	B	02-16-51	22	38	11	187
CA 23	Do.	10	B	07-03-53	34	49	16	206
CA 23	Do.	10	B	04-30-56	40	--	2.4	--
CA 23	Do.	10	Table 4	04-16-64	47	69	6.1	236
CA 23	Do.	10	Table 4	11-17-65	20	--	--	--

Table 9.--Chemical analyses of water samples from selected wells tapping the Potomac-Raritan-Magothy aquifer system in Camden City--Continued

Map number	Well owner	Local number	Source of data	Date of sample	Chloride (Cl) (mg/l)	Sulfate (SO_4) (mg/l)	Nitrate (NO_3) (mg/l)	Dissolved solids (residue at 180°C)
CA 23	Camden City W. D.	10	Table 4	12-07-65	64	--	--	--
CA 23	Do.	10	Table 4	02-12-69	55	--	--	--
CA 23	Do.	10	Table 4	03-10-69	54	--	--	--
CA 56	Do.	11	B	11-28-49	18	60	17	154
CA 56	Do.	11	B	02-15-51	24	70	5.0	196
CA 56	Do.	11	Table 4	11-18-65	82	--	--	--
CA 56	Do.	11	Table 4	12-09-65	80	--	--	--
CA 56	Do.	11	Table 4	03-11-69	40	--	--	--
CA 38	Do.	13	B	11-16-53	10	--	.2	70
CA 38	Do.	13	B	08-03-60	8.2	14	3.2	69
CA 38	Do.	13	B	08-31-61	10	14	4.0	80
CA 38	Do.	13	B	04-24-62	9.0	15	4.2	76
CA 38	Do.	13	Table 4	04-12-63	9.5	16	4.6	77
CA 38	Do.	13	Table 4	08-13-63	10	16	4.5	96
CA 38	Do.	13	Table 4	11-17-65	16	--	--	--
CA 38	Do.	13	Table 4	12-09-65	17	--	--	--
CA 38	Do.	13	Table 4	08-24-66	16	24	5.3	111
CA 38	Do.	13	Table 4	03-11-69	25	--	--	--
CA 41	Do.	17	B	10-06-54	7.0	--	.1	147
CA 41	Do.	17	B	08-03-60	8.2	34	.2	122
CA 41	Do.	17	B	08-31-61	8.8	31	.2	105
CA 41	Do.	17	B	04-24-62	7.8	28	.4	103
CA 41	Do.	17	Table 4	10-02-62	8.0	28	.1	112
CA 41	Do.	17	Table 4	04-12-63	7.0	29	.9	101
CA 41	Do.	17	Table 4	08-13-63	8.4	30	.8	109
CA 41	Do.	17	Table 4	04-16-64	8.2	29	.1	104
CA 41	Do.	17	Table 4	11-17-65	16	--	--	--
CA 41	Do.	17	Table 4	08-24-66	9.1	31	.9	111
CA 41	Do.	17	Table 4	02-12-69	10	--	--	--
CA 41	Do.	17	Table 4	12-22-70	11	32	1.9	109

A - Thompson, 1932
B - Donsky, 1961

(page 143 follows)

Table 11.--Specific capacity and estimated transmissivity for selected industrial and large capacity wells tapping the Wenonah-Mount Laurel aquifer in Camden County

Map number	Municipality	Well owner and number	Specific capacity (gpm per ft drawdown)	Estimated transmissivity (ft^2/day)	Estimated coefficien of transmissibility (gpd/ft)
BB 5	Berlin Boro	Berlin Boro W. D. 8	3.3	760	5,700
BB 6	Berlin Boro	Owens Corning 1	1.8	430	3,200
GI 9	Gibbsboro Boro	U.S. Air Force Radar 2	6.4	1,780	13,300
GT 44	Gloucester Twp.	Camden Co. Bd. Ed. Voc. & Tech. H.S. 1	2.6	610	4,500
PV 4	Pine Valley Boro	Pine Valley Golf Club 1-49	6.2	1,530	11,400
PH 3	Pine Hill Boro	Pine Hill MUA 2	3.2	790	5,900
WA 4	Waterford Twp.	Ivystone Water Works 2-62	3.5	900	6,700
WA 5	Waterford Twp.	Ivystone Water Works 3-65	4.6	1,200	8,700
WI 3	Winslow Twp.	Johns Mansville 1	2.4	600	4,400
WI 4	Winslow Twp.	Johns Mansville 2	2.0	530	4,000

Table 12.--Summary of chemical analyses of water from the Wenonah-Mount Laurel aquifer in Camden County

(Milligrams per liter except pH and specific conductance)

	Maximum	Average	Minimum
Iron (Fe)	3.6	.8	.0
Calcium (Ca)	46	23	2.0
Magnesium (Mg)	7.0	3.6	1.0
Sodium (Na)	8.4	3.4	1.3
Potassium (K)	9.2	4.4	2.0
Bicarbonate (HCO_3)	127	89	15
Sulfate (SO_4)	28	9.5	.0
Chloride (Cl)	9.7	3.4	.3
Fluoride (F)	.5	.3	.1
Nitrate (NO_3)	15	1.4	.0
Dissolved solids (residue on evaporation at 180°C)	178	116	97
Hardness, as $CaCO_3$:			
Calcium, magnesium	126	73	17
Noncarbonate	44	6.0	.0
Specific conductance (micromhos at 25°C)	266	181	116
pH	8.4	--	7.5

Table 13.--Laboratory determinations of particle size and hydraulic conductivity of core samples from Atsion well 1 in Shamong Township, Burlington County

Formation	Sample depth below land surface (feet)	Particle-size diameter, in millimeters												Hydraulic Conductivity (ft²/day)	Coefficient of Permeability (gpd/ft²)
		Clay sizes, in percent (.004 mm)	Silt sizes, in percent (.004-.0625 mm)	Sand sizes, in percent					Gravel sizes, in percent						
				V. fine (.0625-.125 mm)	Fine (.125-.25 mm)	Medium (.25-.5 mm)	Coarse (.5-1 mm)	V. coarse (1-2 mm)	V. fine (2-4 mm)	Fine (4-8 mm)	Medium (8-16 mm)	Coarse (16-32 mm)	V. coarse (32-64 mm)		
Cohansey Sand and younger	0-5	6.5	5.6	15.1	28.1	22.1	14.9	4.0	.8	2.8	.1	--	--	--	--
Do.	5-10	6.2		2.5	8.2	25.6	44.8	12.1	.6	--	--	--	--	--	--
Do.	10-15	.7		.3	1.5	6.8	28.8	30	13.2	2.1	3.2	13.4	--	--	--
Do.	20-22	32.9	23.5	2.7	2.8	3.2	7.3	10.6	14.2	1.5	1.3	--	--	--	--
Do.	22-25	5.4	7.6	16.6	51.4	13.6	4.8	.6	--	--	--	--	--	1.6	12
Do.	30-35	10.8		15.9	39.5	18.1	6.9	4.8	3.2	.8	--	--	--	--	--
Do.	35-40	4.9		4.5	16.3	29.9	25.9	16	2.5	--	--	--	--	--	--
Do.	40-45	34.8	27.8	6.6	14.4	15.6	.8	--	--	--	--	--	--	.01	.1
Do.	58-60	5.9		2.1	8.3	36	24.6	9.7	7.5	5.4	.5	--	--	--	--
Do.	65-70	3.0		4.2	19.5	48.7	21.5	2.6	.5	--	--	--	--	--	--
Do.	75-80	17.7		2.2	7.3	31.4	30.2	10.5	.7	--	--	--	--	--	--
Do.	85-90	6.2		5.5	15.8	32.6	33.4	6.0	.5	--	--	--	--	--	--
Do.	95-100	5.0		3.8	10.9	29.4	30.2	16.2	4.2	.3	--	--	--	--	--
Do.	110-112	7.5		2.9	26.5	39.2	16.7	5.3	1.7	.2	--	--	--	--	--
Do.	115-120	5.1		2.7	21.6	41.8	22.2	4.7	1.9	--	--	--	--	--	--
Do.	125-130	5.0	7.3	15.1	38.8	20.2	7.3	5.4	.9	--	--	--	--	--	--
Kirkwood Formation	137-139	5.7	8.0	18	38.7	21.5	5.5	1.8	.7	.1	--	--	--	1.6	12
Do.	145-150	9.9	17.9	32.2	27.8	3.5	2.4	4.1	1.9	.3	--	--	--	--	--
Do.	155-160	12	47.2	21.2	12.8	6.8	--	--	--	--	--	--	--	--	--
Do.	165-170	23.6	67.9	5.7	1.2	.4	.2	.0	.1	.9	--	--	--	.03	.2
Do.	175-177	22.4	63.4	9.6	3.8	.8	--	--	--	--	--	--	--	--	--
Do.	184-185	18.2	17.8	55.5	6.9	.2	.4	.0	.2	.4	.4	--	--	--	--
Do.	185-190	9.4	69.4	18.4	2.4	.4	--	--	--	--	--	--	--	--	--
Do.	202-203	10.5		34.8	3.5	5.8	13.8	10.8	13.6	5.4	1.8	--	--	--	--
Do.	203-205	8.5	29.3	57.8	3.4	.6	.2	.2	--	--	--	--	--	.54	4.0
Do.	205-210	10.3	32.3	52.8	4.4	.2	--	--	--	--	--	--	--	--	--
Do.	215-220	12.4	31.2	52.2	2.8	.6	.4	.4	--	--	--	--	--	--	--
Do.	225-230	13.2	29.8	21.6	16.6	12.8	5.8	.2	--	--	--	--	--	--	--
Eocene undifferentiated	235-237	28.5	17.3	5.2	29.6	18.4	1.0	--	--	--	--	--	--	.03	.2
Do.	237-240	14	17.4	14.5	24.9	23.7	3.7	.4	1.4	--	--	--	--	--	--
Do.	245-250	16.6	16.8	8.0	25.4	27.4	5.4	.4	--	--	--	--	--	--	--
Do.	260-262	14	18	5.4	45.4	16.4	.8	--	--	--	--	--	--	.11	.8

Table 14.--Summary of chemical analyses of water from the Cohansey Sand and Pleistocene sediments in Camden County

(Milligrams per liter except pH and specific conductance)

	Maximum	Average	Minimum
Iron (Fe)	3.8	.9	.0
Calcium (Ca)	36	12	.2
Magnesium (Mg)	2.8	1.3	.4
Sodium (Na)	7.8	3.8	1.4
Potassium (K)	6.4	2.3	.5
Bicarbonate (HCO_3)	95	19	2.0
Sulfate (SO_4)	19	5.0	.0
Chloride (Cl)	9.0	6.0	2.2
Fluoride (F)	.2	.1	.0
Nitrate (NO_3)	57	15	.4
Dissolved solids (residue on evaporation at 180°C)	125	63	13
Hardness, as $CaCO_3$:			
Calcium, magnesium	94	27	42
Noncarbonate	39	12	.0
Specific conductance (micromhos at 25°C)	212	64	17
pH	8.4	--	5.3