

THICKNESS AND HYDROGEOLOGY OF AQUIFERS AND CONFINING UNITS, BELOW THE  
UPPER GLACIAL AQUIFER ON LONG ISLAND, NEW YORK

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Abstract

Three extensive unconsolidated sand and gravel aquifers on Long Island lie beneath the island's upper glacial aquifer and its southward-dipping crystalline bedrock surface. The island's aquifers have been heavily pumped, mainly for public-water supply, but most of this pumping since the 1960's has come from below the upper glacial aquifer because the upper aquifer has been increasingly contaminated by substances introduced through the land surface. In 1964, an average of 370 Mgal/d (million gallons per day) was pumped from the ground-water reservoir, 80 percent (296 Mgal/d) of which was from aquifers below the upper glacial aquifer.

The extensive Lloyd aquifer, confined between bedrock and the overlying Raritan clay, is the basal unit in Long Island's ground-water reservoir. The Lloyd underlies nearly all of the island and has a maximum thickness of about 530 feet. It is a minor aquifer; public-supply pumping from the Lloyd in 1984 averaged 18 Mgal/d.

The Moghity aquifer overlies the Raritan clay beneath most of the island and attains a maximum thickness of about 1,050 feet. The Moghity has been the principal source of public water supply since the 1960's, and public-supply pumping in 1984 averaged 278 Mgal/d.

The Jameco aquifer occurs only in buried valleys that were cut into the Moghity deposits in the extreme western part of Long Island; thus, the aquifer has good lateral and vertical hydraulic continuity with the Moghity. The Jameco attains a maximum thickness of about 200 feet. Jameco deposits have greater average hydraulic conductivity than the Moghity and are considered to form a broad, highly conductive local strainer in the upper part of the Moghity. The Jameco is a minor aquifer; in 1984, average public-supply pumping was 2 Mgal/d. In the southern part of the island, the Moghity-Jameco system is artesian, overlain by the Gardiners Clay in the western part of the island, and by the Gardiners Clay and the Monmouth greensand in the eastern two-thirds. North of the Gardiners-Monmouth line, the Moghity is "leaky" vertically because the clay beds within it are discontinuous; thus, its response to pumping stresses is similar to that of the unconfined overlying upper glacial aquifer, with which it is in hydraulic continuity to various degrees.

INTRODUCTION

Long Island's thick, extensive sand and gravel aquifer system is the major source of water supply for the island's large population. It is the sole source of supply in Nassau and Suffolk Counties and is a significant source in Queens County. Currently, most public-supply pumping is from the unconfined upper glacial aquifer, the upper glacial aquifer, which has been increasingly contaminated by substances introduced through the land surface. Because the ground-water reservoir of Long Island is of vital importance, water-supply managers and investigators must know the size, dimensions, and hydraulic characteristics of the system's components to provide for its protection and optimum use.

Purpose and Scope

This report briefly describes the hydrogeology of the seven principal aquifers and confining units below the upper glacial aquifer and depicts their extent and thickness on a series of hydrogeologic maps.

The aquifer and confining-unit thicknesses indicated on the maps are based on the authors' interpretation of hydrogeologic-unit-surface maps that are either published or are currently being prepared. (Sources of information are given in the section "Previous Investigations" and also on the maps. Thickness of a unit is defined as the normal distance between the unit's upper surface and the upper surface of the underlying unit.)

Physical Geography

Long Island lies at the extreme southeastern corner of New York State (fig. 1). The island is about 120 mi (miles) long and about 23 mi wide at its widest point and is surrounded by Long Island Sound and the Atlantic Ocean. The Counties of Kings (Brooklyn) and Queens, at the island's western end, encompass 189 mi<sup>2</sup> (square miles) and are, boroughs of New York City. Nassau and Suffolk Counties, 300 mi<sup>2</sup> and 912 mi<sup>2</sup>, respectively, form the remainder of the island.

Topography

A narrow ridge of Pleistocene glacial terminal-moraine deposits (Harbor Hill Terminal Moraine) traverses the north-central parts of Kings and Queens Counties and bifurcates in Nassau County just east of Queens. One branch (Harbor Hill Terminal Moraine) extends across Nassau and Suffolk Counties into the island's north fork; the other branch (Ronkonkoma Terminal Moraine) traverses central Nassau County and extends into the western end of the island and into the south fork (fig. 1). The highest ridge elevations are approximately 160 ft in Kings County, 260 ft in Queens County, 370 ft in Nassau County, and 400 ft in Suffolk County. Block Island Sound and a rolling plain of low relief lie between the ridges, and a sloping outwash plain extends across the southern part of the island to the bays and the Atlantic Ocean. A string of narrow barrier beaches encloses the bays from Kings County to the south fork. The topography of Long Island is shown below (map A).

Population and Land Use

Large population increases have occurred on Long Island since World War II. The population has been trending toward stability in Queens and Nassau Counties while declining in Kings and rising sharply in Suffolk. The changes are shown below, by county.

County	Approximate population, in millions (U.S. Census)			
	1940	1950	1960	1980
Kings	2.7	2.74	2.63	2.23
Queens	1.3	1.55	1.81	1.89
Nassau	.43	.61	1.1	1.32
Suffolk	.9	.28	.67	1.28
Total	4.61	5.26	6.41	6.72

Kings and western Queens Counties are mainly urban, with light to heavy industry and commerce. Eastern Queens, Nassau, and western Suffolk Counties are mostly suburban with light industry and commerce. Eastern Suffolk County is mostly rural and suburban.

Ground Water

Water Use

Ground water is the sole source of water supply in Nassau and Suffolk Counties. Local ground water pumped by a private company in southwestern Queens County supplies about 30 percent of the County's needs; the balance is supplied by the City of New York from an upstate surface-reservoir system. All of Kings County's public-water supply has been derived from the City's sources since 1940. Before 1948, local ground water pumped by a private company supplied 10 to 15 percent of Kings' population. This pumping ceased in 1947.

In the city-supplied areas, many private wells are used for industrial and commercial cooling; nearly all users must return the pumped water to the source aquifer. Many wells in Nassau and Suffolk also are used for cooling purposes, and most of the water is returned to the source aquifer. Ground-water pumping on Long Island since the end of World War II is summarized in the following table:

County	Approximate total ground-water pumped, in million gallons per day			
	1948	1960	1970	1981
Kings	129	24	23	20
Queens	58	69	82	74
Nassau	11	11	214	211
Suffolk	53	75	155	184
Total, Long Island	235	313	474	499

1 Data source: New York State Department of Environmental Conservation, Division of Water, Water Supply Unit; Stony Brook, N.Y., written commun., December 1982.

2 Before 1948, public-supply pumping that averaged 60 Mgal/d from 1904 (Luczynski, 1952, p. 4) was halted by New York City because of water-quality deterioration from saline-water infiltration caused by pumping.

Source and Movement of Ground Water

The source of Long Island's ground water is precipitation that infiltrates the land surface and percolates to the water table and the deeper unconsolidated deposits. A major ground-water divide extends across the north-central part of the island and bifurcates into branches extending across the island's north and south forks. Ground water in the divide areas moves vertically from the water table to the base of the ground-water system; elsewhere, the ground water moves laterally northward and southward from the divide and discharges into saline ground-water bodies at the island's margins. All freshwater in the island's aquifers is derived from precipitation that reached the water table.

No part of the ground-water reservoir is completely isolated from the other parts. The movement of ground water through the system is similar to electric currents flowing through the branches of a parallel circuit in that the amount of current (water) flowing through the branches of the circuits (the hydrogeologic units) is proportional to the conductance (hydraulic conductivity) of the branches in the direction of the current (water flow). Thus, development of water supply in one area can cause stresses throughout the system. For example, pumping fresh ground water near saline ground water induces movement of saline water toward the pumping center, and pumping from an aquifer above or below an aquifer containing contaminant water induces movement of the contaminated water toward the pumping center. The pumping creates complex patterns of ground-water movement.

Long Island's aquifers contain tens of trillions of gallons of water; for example, a 1-ft-thick layer of aquifer of 1-m<sup>2</sup> area with a specific yield (percentage of water that is drainable by gravity, or pumping, from a saturated rock or soil) of 25 to 30 percent, which is typical for sand and gravel (Johnson, 1967, p. 1), contains about 55 million (million) gallons of water. Thus, knowledge of the thickness and extent of each aquifer can provide estimates of the amount of pumpable ground water in the island's aquifers. Not all water in the ground-water reservoir is necessarily available for pumping, however; outflow from the aquifers to the saline ground-water bodies of Long Island is needed to stabilize the fronts or to prevent or minimize saline-water induction by pumping.

Previous Investigations

Many published reports describe geologic and hydrogeologic features of Long Island. Those that are most pertinent to the material presented here, in chronological order, are those of Van Dine and others (1909); Suter and others (1949); Swarczewski (1963); Lukka (1964); Pluhowski and Kantorowicz (1964); Jensen and Soren (1968); Soren (1971a, 1971b, and 1978); Soren and Soren (1974); Kilburn (1979); Buxton and others (1981); Nemickas and Kozalika (1982); and Dorstik and Wilde-Katz (1983). The hydrogeologic-unit-surface maps presented here were compiled mostly from data in these earlier reports.

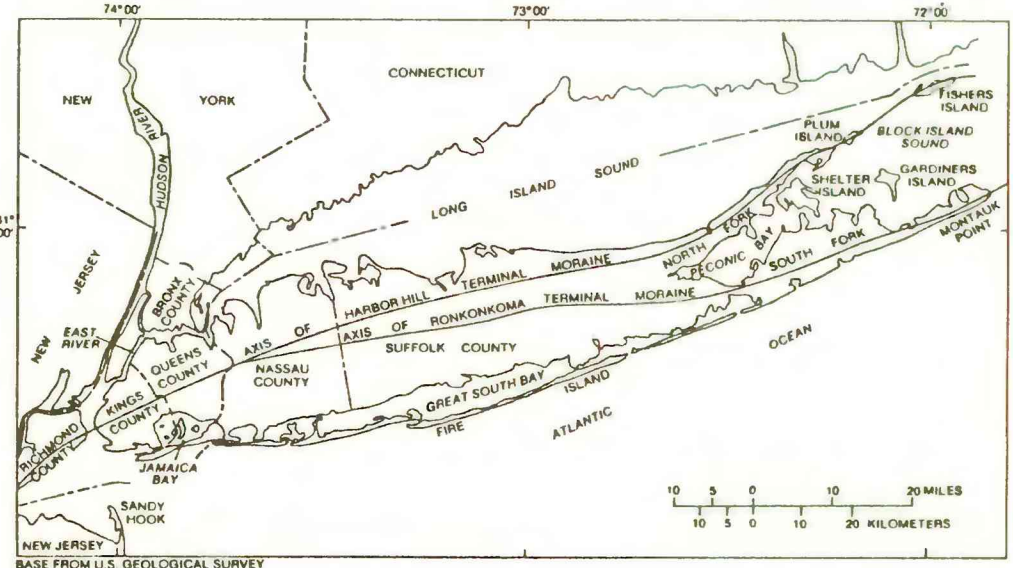


Figure 1.--Location and major geographic and physiographic features of Long Island, N.Y.

HYDROGEOLOGY

Long Island is underlain by a mass of unconsolidated deposits consisting of clay, silt, sand, gravel, and boulders of Late Cretaceous and Quaternary age. The deposits thicken southward and rest on a peninsular surface developed on complexly folded and faulted crystalline bedrock, mainly gneiss and schist, of Precambrian, Cambrian, and Ordovician age. The bedrock surface slopes south-southeast from about 80 ft/d (feet per mile) in Kings County to about 40 ft/d in Suffolk County. General sections showing the geology of Long Island are given in figures 2 and 3. The hydrogeologic-unit-surface maps presented here were compiled mostly from data in these earlier reports.

Bedrock

The bedrock surface forms the base of the ground-water reservoir of Long Island. Small bedrock outcrops occur near the East River in Queens County (Soren, 1971a, p. 7), and the unit reaches a depth of about 2,500 ft below land surface at Fire Island along the south shore, about 15 mi east of the Nassau-Suffolk boundary (Jensen and Soren, 1974, sheet 1).

The bedrock has very low hydraulic conductivity and generally yields no more than several gallons (gallons per minute) of water per acre. Several wells tap bedrock in the extreme northwestern part of Queens County; elsewhere on Long Island, water-yielding sand and gravel deposits are present at shallower depths. The bedrock-surface configuration is shown on sheet 2, map B.

Unconsolidated Deposits

Unconsolidated deposits of Upper Cretaceous and Quaternary age extend from bedrock to land surface. The uppermost of these units are upper Pleistocene (Mississippi-stage) deposits of glacial drift, which constitute the upper glacial aquifer of Long Island. The upper glacial aquifer is not discussed herein because its use for water supply is decreasing as a result of contamination from surface sources since the 1960's in western Long Island, and since the 1970's in the eastern part. Consequently, the deeper aquifers are being used increasingly for public-water supply.

The unconsolidated formations and hydrogeologic units that are discussed here are, from oldest (deepest) to youngest, the Raritan Formation, Matamoras Group and Monmouth Formation, undifferentiated and Monmouth Group, undifferentiated, all of Late Cretaceous age; the Jameco Gravel, of Pleistocene (Mississippi?) age; and the Gardiners Clay, of Pleistocene Sangamon age (fig. 2). These formations contain the following hydrogeologic units (aquifers and confining units):

- (1) The Raritan Formation consists of the Lloyd Sand Member (Lloyd aquifer), a minor but significant aquifer overlain by a clay member confining unit known as the Raritan clay.
- (2) The Matamoras-Monmouth deposits form the Moghity aquifer, which since the 1960's has become the major source of ground water for public supply on Long Island.
- (3) The Monmouth Group comprises the Monmouth greensand, a confining unit.
- (4) The Jameco Gravel forms the Jameco aquifer, a minor water-bearing unit in Kings and Queens Counties.
- (5) The Gardiners Clay (the hydrogeologic unit has the same name), is a confining unit.

The relative thickness and position of these units are shown in figure 2.

THICKNESS, EXTENT, AND CHARACTERISTICS OF HYDROGEOLOGIC UNITS

Lloyd Aquifer

The Lloyd aquifer ranges in thickness from a knife edge in the western and northern parts of Long Island to about 150 ft in the eastern part of Suffolk County, near the Nassau-Suffolk boundary. Map C (sheet 2) shows the thickness and extent of the Lloyd. The aquifer was eroded to a knife edge from northwestern Queens County eastward along the north shore of Long Island. The thickness of unsorted Lloyd deposits near Long Island's north shore is about 200 ft. The present limit of Lloyd deposition on Long Island is in western Queens and Kings Counties, where the Lloyd deposits pinch out. The greatest thickness of the Lloyd is probably south of Long Island, but offshore drilling or geophysical methods would be needed for measurement.

The Lloyd aquifer is a well-confined (artesian) unit between the bedrock and Raritan clay (fig. 2). The aquifer material consists of beds and lenses of clay, silt, sand, and gravel.

The average horizontal hydraulic conductivity of the Lloyd aquifer has been estimated to range from 40 ft/d (feet per day) (Frank and Cohen, 1972, p. 271) to between 53 and 67 ft/d (Soren, 1971a, p. A11). High-capacity wells that tap the Lloyd have produced as much as 1,600 gal/min; however, most of the wells are pumped less than 1,000 gal/min (Soren, 1971a, p. A11). Specific capacity of wells screened in the Lloyd—that is, discharge in gal/min per foot of drawdown in the well—is reported to range from about 4 to 40 (gal/min)/ft (Soren, 1971a, p. A11).

Because the Lloyd is highly confined, pumping causes large cones of depression in the aquifer's potentiometric surface, and heavy pumping from the Lloyd is conducive to rapid landward infiltration of saline ground water that surrounds Long Island. This susceptibility to saline ground-water infiltration and the generally great depth to the Lloyd prevent the aquifer from being more than a relatively minor source of public supply. In 1984, an average of only 18 Mgal/d was pumped for public supply—13 Mgal/d in Nassau County and 5 Mgal/d in Queens County pumping in Suffolk County was insignificant (Paul George, New York State Department of Environmental Conservation, Stony Brook, N.Y., oral commun., August 12, 1985). Most of the public-supply pumping from the Lloyd is in the barrier-beach communities of southwestern Nassau County, where the Lloyd is the only significant source of freshwater supply.

Raritan Clay Confining Unit

The Raritan clay is the upper confining unit for the Lloyd aquifer and underlies the Moghity aquifer (fig. 2). The clay overlaps the Lloyd in western Long Island, where it was deposited beyond the Lloyd terminus; whether overlap occurred north of Long Island is not known.

Thickness of the Raritan clay ranges from a knife edge where the unit terminates in western and northern Long Island, to about 300 ft near the western end of the Fire Island. Thickness of the Raritan clay near the island's western and northern shores ranges from 100 to 150 ft. Offshore the thickness of the Raritan clay south of Long Island is not known. The Raritan clay overlies the underlying Lloyd aquifer at the western end of Long Island and appears to extend into the southern part of Staten Island (Richmond County) west of Kings County (fig. 1). Map D (sheet 2) shows the thickness and extent of the Raritan clay on Long Island.

Hydraulic conductivity of the Raritan clay is very low—about 0.001 ft/d vertically (Frank and Cohen, 1972, p. 27). This low conductivity greatly limits downward movement of water into the Lloyd aquifer and leads to large cones of depression in the potentiometric surface of the Lloyd when the aquifer is pumped. An example of such a large cone of depression in the Lloyd resulting from relatively heavy pumping in Queens County (about 4.5 Mgal/d) is shown by Soren (1971a, pl. 2).

Moghity Aquifer

The Moghity aquifer is the thickest hydrogeologic unit on Long Island and currently (1984) is most widely used for public-water supply. Its thickness varies greatly throughout Long Island because it was extensively eroded between Upper Cretaceous and Pleistocene time. The Moghity thickens from a knife edge at its limits in western and northern Long Island, beyond which the unit was completely eroded, to about 1,050 ft in Suffolk County on the Fire Island barrier bay, about 30 mi east of the Nassau County border. Map E (sheet 3) shows the extent and thickness of the Moghity aquifer on Long Island.

Buried channels cut into the Moghity at many places on the island; two extend north-south across the entire island. One in Queens County was probably cut by an ancestral Hudson River (Soren, 1978, p. 12); the other, which extends from the eastern end of the north fork southward across the south fork, was probably cut by the ancestral Connecticut River (Soren, 1983, p. 203). Both valleys were cut before the Wisconsin glaciation.

Two other significant channels are known in Suffolk County—the Huntington buried valley (Lubbe, 1964, p. 23), 5 mi east of the Nassau County border, cuts northward toward Long Island Sound (pl. E, sheet 3); the other valley, the Ronkonkoma basin (Soren, 1971b, p. 11), cuts northward

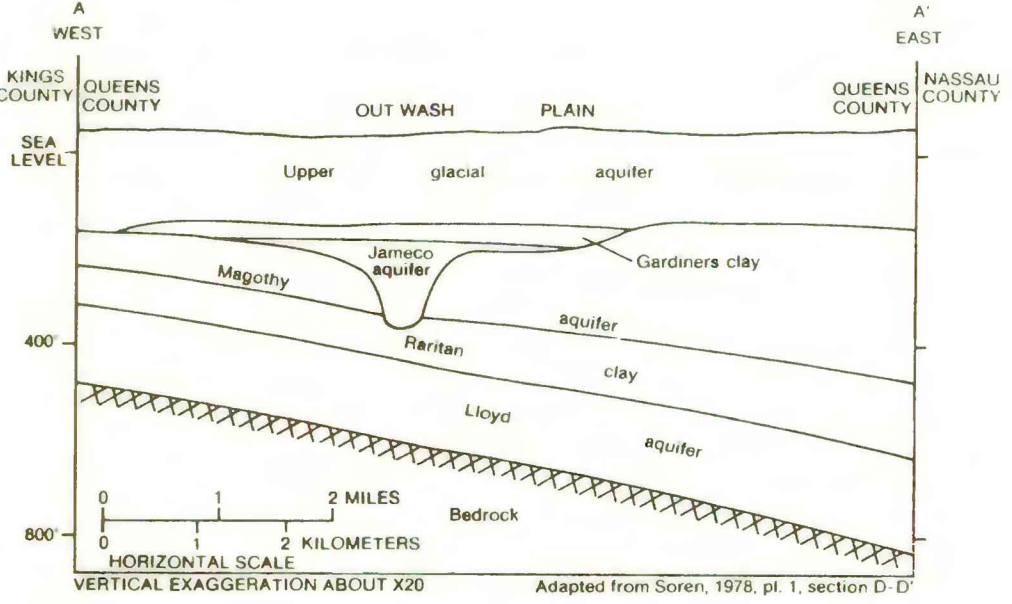


Figure 2A.--Hydrologic section A-A' in Queens County, Long Island. (Location shown on map below.)

to the Sound from the Ronkonkoma area, about 15 mi east of the Nassau boundary. The Huntington and Ronkonkoma valleys probably extended completely across Long Island before the Wisconsin glaciation. The configuration of the Moghity surface southeast of the valleys as shown by Jensen and Soren (1974, sheet 1) indicates that complete island transverse probably occurred; glacial scouring probably further deepened the northern parts of the valleys, leaving southeast- and northwest-trending valleys separated by a divide. Smaller northeast-trending valleys made by post-Cretaceous and post-Wisconsinan subsequent streams are evident from notches in the Cretaceous and bedrock surfaces (Jensen and Soren, 1974, sheet 1) along much of Long Island's north-shore area.

The Moghity aquifer consists of beds and lenses of clay, silt, sand, and gravel; the coarsest sand and gravel generally are in the basal 50 to 100 ft of the unit. Horizontal hydraulic conductivity of the Moghity has been estimated to average from 50 ft/d (Frank and Cohen, 1972, p. 271) to 67 ft/d (Soren, 1971a, p. A10) but varies locally according to the composition of the deposits. High-capacity wells tapping the Moghity aquifer have yielded as much as 1,600 gal/min, and most of the wells are pumped less than 1,000 gal/min. Specific capacities of wells in the Moghity aquifer have been reported to range from 15 to 40 (gal/min)/ft in Queens County (Soren, 1971a, p. A10) and from 14 to 86 (gal/min)/ft in Suffolk County (Cohen, in Soren, 1971b, p. 35).

Discontinuous beds and lenses of clay and clayey and silty sand within the Moghity aquifer provide local confining effects between the Moghity and the overlying upper glacial aquifer where the Monmouth greensand, Gardiners Clay, or beds are absent. Interbedded clay and clayey and silty beds and lenses in the aquifer create local confinement. Generally, the Moghity is a leaky artesian unit whose response to pumping stresses is similar to that of the unconfined upper glacial aquifer (Soren, 1971a, p. 12a-0). However, the two formations are in good hydraulic connection, upper Pleistocene deposits function as part of the upper glacial aquifer. The Moghity aquifer is highly confined only in the southern part of Long Island, where the Monmouth and Gardiners Clays are present.

In 1984, pumping for public supply from the Moghity aquifer on Long Island averaged 278 Mgal/d (Paul George, New York State Department of Environmental Conservation, Stony Brook, N.Y., oral commun., August 12, 1985). Of this pumping, 58 percent (162 Mgal/d) was in Nassau County, 30 percent (84 Mgal/d) was in Suffolk, and 12 percent (32 Mgal/d) was in Queens.

Monmouth Greensand Confining Unit

The Monmouth greensand, in the extreme southern part of Long Island, thickens seaward from a knife edge to about 150 ft. Its maximum thickness is about 150 ft. The unit is a leaky artesian unit whose response to pumping stresses is similar to that of the unconfined upper glacial aquifer (Soren, 1971a, p. 12a-0). However, the two formations are in good hydraulic connection, upper Pleistocene deposits function as part of the upper glacial aquifer. The Moghity aquifer is highly confined only in the southern part of Long Island, where the Monmouth and Gardiners Clays are present.

The Monmouth greensand is a clayey unit that confines water in the underlying Moghity aquifer mainly along Suffolk County's Fire Island barrier bay (fig. 1). The vertical hydraulic conductivity of the unit has not been determined or estimated; however, clayey nature probably indicates that hydraulic conductivity is low, similar to that of the Raritan clay.

Jameco Aquifer

The Jameco aquifer occurs mainly in Kings and Queens Counties and is reported also in a small part of southeastern Nassau County. The Jameco deposits are described as having been laid down in a probable ancestral Hudson River system channel (Soren, 1978, p. 12). The unit is a gravelly sand and is hydraulically part of the Moghity aquifer, with which it is in lateral and vertical contact. The Jameco is accordingly considered to be a wide, local zone of increased hydraulic conductivity in the Moghity.

The thickness of the Jameco deposits ranges from a knife edge to about 200 ft; the deposits are in the Hudson River(?) buried channel through central Queens. Jameco deposits are missing from northern Kings and Queens, where they were eroded by the Wisconsin glaciation. Map G (sheet 3) shows the thickness and extent of the Jameco aquifer.

The Jameco aquifer in Kings and Queens has a high horizontal hydraulic conductivity, estimated to be as much as 267 ft/d (Soren, 1971a, p. A9). High-capacity wells screened in the Jameco have yielded as much as 1,600 gal/min, and wells in the Jameco aquifer have yielded the highest known specific capacities on Long Island—as much as 180 (gal/min)/ft.

The Jameco aquifer is confined by the overlying Gardiners Clay but is in good lateral and vertical hydraulic contact with sandy beds of the Moghity aquifer; it is therefore considered to be a wide, local strainer of increased hydraulic conductivity in the upper part of the Moghity.

The Jameco aquifer is used very little for public supply. In 1984, an average of 2 Mgal/d was pumped for public supply in Queens County (Paul George, New York State Department of Environmental Conservation, Stony Brook, N.Y., oral commun., August 12, 1985). The unit's proximity to saline ground water and its high hydraulic conductivity could facilitate rapid landward movement of saline ground water in response to heavy pumping.

Gardiners Clay Confining Unit

The Gardiners Clay extends beneath most of Kings County, the southern half of Queens County, and eastward along the south-shore areas of Long Island to the middle of the south fork. Gardiners deposits range in thickness from a knife edge to about 100 ft. The thickest part is in south-central Queens east of Queens it thins to a maximum of about 50 ft. Map G (sheet 3) shows the thickness and extent of the Gardiners Clay.

The Gardiners Clay confines water in the Jameco and Moghity aquifers in western Long Island and, together with the Monmouth greensand, tends to confine water in the Moghity aquifer from the south-shore and barrier-bay areas of Nassau and Suffolk Counties eastward. The confining effect of the Gardiners probably diminishes eastward because the unit becomes increasingly sandy (Perlmutter and Todd, 1965, pl. 8, section C-C').

Clay beds in the Gardiners are less hard and denser than those in the Monmouth greensand and Raritan clay. Where the Gardiners is mostly clayey, its vertical hydraulic conductivity is probably about 0.01 ft/d (Frank and Cohen, 1972, p. 271); as the deposits become sandier eastward, its vertical hydraulic conductivity approaches that of the sand and gravel deposits in the

overlying upper glacial aquifer—estimated to be 27 ft/d by Frank and Cohen (1972, p. 271) and 10 ft/d by Soren (1984, p. 26). Consequently, confining effects above the Moghity aquifer in the eastern two-thirds of southern Long Island are caused more by the Monmouth greensand than by the Gardiners Clay.

SUMMARY AND CONCLUSIONS

Information on the hydrogeologic system of Long Island is necessary to optimize development of the system and minimize harmful effects on the water supply. Maps showing the thickness and extent of aquifers and confining units below the upper glacial (surficial) aquifer and descriptions of the deposits' hydrogeologic characteristics provide information needed by water-supply managers and planners to predict and analyze effects of water development on the hydrologic system.

The Moghity aquifer is the thickest of the water-bearing units below the upper glacial aquifer, and it underlies nearly all of Long Island. The Moghity is thickest in the southern half of the island and attains its greatest known thickness, about 1,050 ft, near the western end of Fire Island. Most of the public-supply pumping on Long Island since the 1960's has been from the Moghity. The aquifer is confined between the Raritan clay and the Monmouth greensand in the southern part of the island and elsewhere it is part of a leaky artesian system, and its response to pumping stresses is similar to that of an unconfined aquifer.

The thickness of the Lloyd aquifer increases southeastward to about 550 ft near the western end of Fire Island. Most of the public-supply pumping from the Lloyd has been in the barrier-beach areas of southeastern Nassau County, where it is the only significant source of freshwater supply. The Lloyd is a well-confined artesian system between the bedrock and Raritan clay; consequently, heavy pumping results in a large cone of depression that is conducive to saline-water induction.

The Jameco aquifer occurs in Kings and Queens Counties, where it is little used for water supply. The aquifer is thickest (about 200 ft) in central and southern Queens County. The Jameco is currently the least-used aquifer on Long Island. It was deposited in a valley cut into the Moghity and Matamoras deposits and is mostly overlain by the Gardiners Clay; therefore, it is hydraulically part of the Moghity aquifer, with which it is in lateral and vertical contact. The Jameco is accordingly considered to be a wide, local zone of increased hydraulic conductivity in the Moghity.

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A. Topography