DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

PREPARED IN COOPERATION WITH THE
COMMONWEALTH OF MASSACHUSETTS WATER RESOURCES COMMISSION
BOSTON, MASSACHUSETTS

HYDROLOGIC INVESTIGATIONS
ATLAS HA-589 (SHEET 2 OF 4)

GROUND WATER
AVAILABILITY

TRANSMISSIVITY OF STRATIFIED GLACIAL DEPOSITS OF THE COASTAL DRAINAGE BASINS. — *Continental glaciers, during the Pleistocene Epoch, scoured the bedrock surface of the study area and deposited a discontinuous mantle of till, an unconsolidated and unstratified mixture of clay, silt, sand, gravel, cobbles, and boulders. During melting of glacial ice, soil and rock fragments carried within the glacier were transported, sorted, and deposited by meltwater as stratified sand and gravel in stream channels and as silt and clay in ponds and lakes. Unconsolidated glaciofluvial deposits of sand and gravel constitute the principal aquifers in the coastal basins.*

Transmissivities shown on the map are based on analyses of lithologic logs and well specific-capacity data. Transmissivity estimates were made for more than 700 wells and borings penetrating or partly penetrating surficial deposits. Average hydraulic conductivity values were assigned (Thomas and others, 1967; J. R. Williams, written commun., 1974) to materials indicated in lithologic logs. Transmissivity values were calculated from specific-capacity data for 64 well tests using methods devised by Walton, 1962; Meyer, 1963; Narasimhan, 1967. Where possible, the calculated transmissivity values were used to refine those estimated from lithologic logs.

Transmissivity of unconsolidated deposits ranges from less than 10 ft²/d for till, silt, and clay to more than 26,000 ft²/d in thick deposits of sand and gravel. The most productive aquifers lie in the Aberjona River valley, where wells whose yields exceed 500 gal/min have been developed for municipal and heavy industrial use. Additional ground-water supplies can be developed in the valley; however, heavy ground-water pumping already reduces the flow of the Aberjona River. Use of additional ground water and its discharge outside the basin would further reduce streamflow.

Aquifers that sustain well yields of less than 200 gal/min occur in many stream valleys and swampy areas throughout the study area. These aquifers are generally less than 50 feet thick and are of small areal extent. Where such aquifers adjoin and underlie fine-grained marine or lacustrine deposits, their extent below the fine-grained deposits is not known.

Throughout the study area, water from bedrock is generally available in quantity and quality suitable for domestic supply. Bedrock is composed of a variety of igneous and metamorphic rock types. Water in bedrock occurs in secondary pore spaces, such as joints and fractures, which are commonly narrow and represent only a small percentage of total aquifer volume. Consequently, bedrock-aquifer transmissivity varies greatly with location, and overall storage capacity is generally low. Nearly all wells constructed in bedrock intercept some water-bearing fractures; however, bedrock well yields range from a fraction of a gallon per minute, in places where the fractures are small and poorly interconnected, to more than 100 gal/min, where fractures are numerous and well interconnected, as in some fault zones. The median yield of 59 bedrock wells is 10 gal/min.

MATCH LINE–SEE MAP BELOW

MATCH LINE–SEE MAP ABOVE

SCALE 1:48 000

1 ½ 0 1 2 3 MILES

1 .5 0 1 2 3 4 5 KILOMETERS

CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
DEPTH CURVES AND SOUNDINGS IN FEET—DATUM IS MEAN LOW WATER
SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER
THE MEAN RANGE OF TIDE IS APPROXIMATELY 9 FEET

EXPLANATION

TRANSMISSIVITY OF AQUIFER MATERIALS

Transmissivity is the rate at which water of prevailing kinematic viscosity is transmitted through a unit width of aquifer under a unit hydraulic gradient, expressed in cubic feet (volume), per square foot (area), per foot gradient per day or in feet squared per day (Lohman and others, 1972).

Potential well yields are based on available drawdown and estimates of transmissivity and are for properly designed and constructed individual wells at sites that have been located after exploratory drilling. Yield can be higher than estimated for wells located near surface-water sources that have good hydraulic connection with the aquifer tapped.

Areas of stratified glacial deposits

- Transmissivity greater than 4,000 ft²/d (potential well yield greater than 300 gal/min)
- Transmissivity 1,400 to 4,000 ft²/d (potential well yield 100 to 300 gal/min)
- Transmissivity less than 1,400 ft²/d (potential well yield less than 100 gal/min)
- Area of the Mystic River basin underlain by extensive clay deposits, which yield little or no water to wells; within this area local deposits of sand and gravel yield small amounts of water to wells and have transmissivities up to 4,000 ft²/d but generally less than 1,000 ft²/d.

Area of till and bedrock outcrops

Till is a poorly sorted glacial material, with a characteristically low transmissivity. Wells in till usually yield only a few gallons per minute but can be suitable sources of domestic supply. These wells, generally 2 to 4 feet in diameter and less than 25 feet deep, are susceptible to contamination from surface or near surface sources. Some minor stratified glacial deposits are included in this area because they have small or no saturated thickness and have potential well yields similar to till or bedrock. Distribution of surficial deposits and bedrock is modified from that shown on geologic maps referenced on this sheet and from surficial geologic map of Marblehead North quadrangle, Massachusetts (Mario Carnevale, written commun., 1974) and from surficial geologic map of Lynn quadrangle, Massachusetts (C.A. Kaye, written commun., 1974).

BEDROCK

Bedrock underlies the entire study area. Wells in bedrock yield up to 110 gal/min but generally yield less than 10 gal/min. Bedrock wells are deeper, have more available drawdown, and are generally less susceptible to contamination than wells in till.

PUMPING CENTERS IN STRATIFIED DRIFT

Number, if present, is reported pumping capacity, in million gallons per day, of selected well or well field.

- 0.55 ◎ Municipal or institutional well or well field
- 0.40 ○ Industrial well or well field

WELLS OR BORINGS USED TO DETERMINE TRANSMISSIVITY

Indicates the extent of municipal and other testing and distribution of data used to estimate transmissivity.

- 0.11 ○ Well or boring finished in unconsolidated deposits (number, if present, is reported pumping capacity, in million gallons per day, of selected wells)
- ● Well or boring finished in bedrock.
- Basin boundary
- Subbasin boundary

SELECTED REFERENCES

Number in parentheses refers to number on "Index to topographic maps and to geologic maps and reports"

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_____ 1964, Surficial geology of the Salem quadrangle, Massachusetts: U.S. Geol. Survey Geol. Quad. Map GQ-271. (7)

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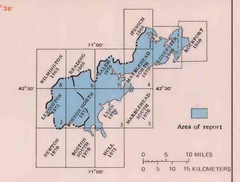
Thomas, M. P., Bednar, G. A., Thomas, C. E., Jr., and Wilson, W. E., 1967, Water resources inventory of Connecticut, part 2, Shetucket River basin: Connecticut Water Resources Bull. no. 11, 99 p.

Walton, W. C., 1962, Selected analytical methods for well and aquifer evaluation: Illinois State Water Survey Bull. 49, p. 6-8, p. 12-13.

Other sources of information: City and town reports; engineering studies for city and town Water and Public Works Departments; engineering studies for the Massachusetts Department of Public Works and the Massachusetts Water Resources Commission; records of the Metropolitan District Commission Sewer and Water Supply Division; and reports of the Metropolitan Area Planning Council.

Index to Topographic Maps and to Geologic Maps and Reports



Topographic base maps from U.S. Geological Survey 1:24,000 series are named on the index map; date is most recent topographic survey. Geologic maps and reports are indicated on the index map by numbers, which appear in parentheses in selected references on this sheet

Interior — Geological Survey, Reston, Va.— 1980—W78239

HYDROLOGY AND WATER RESOURCES OF THE COASTAL DRAINAGE BASINS OF NORTHEASTERN MASSACHUSETTS, FROM CASTLE NECK RIVER, IPSWICH, TO MYSTIC RIVER, BOSTON

By

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