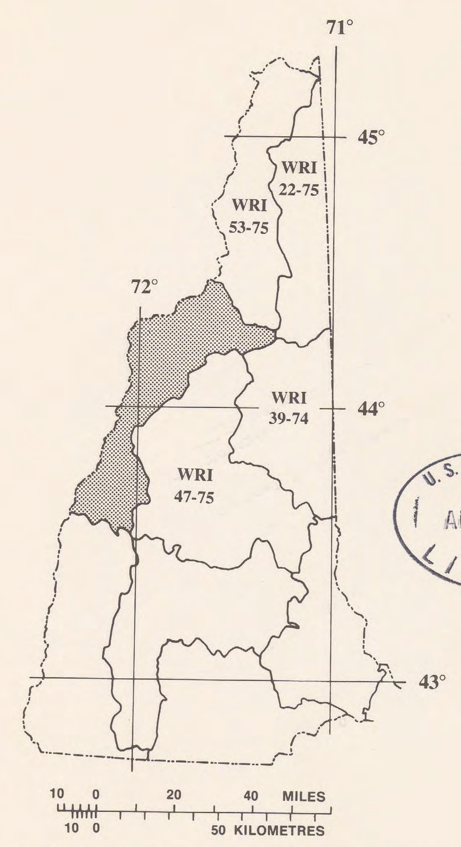


INDEX MAP SHOWING LOCATION OF STUDY AREA (SHADED) AND THE NUMBERS OF THE PREVIOUSLY PUBLISHED REPORTS IN THIS SERIES

OCCURRENCE OF GROUND WATER

This report provides a guide for ground-water exploration and for water- and land-use planning and management. Sufficient amounts of water to supply single family homes are available from the bedrock aquifer nearly everywhere in the middle Connecticut River basin. Relatively thin and narrow, unconsolidated aquifers of sand or sand and gravel commonly capable of yielding more than 200 gallons per minute (12.6 litres per second) to properly located and constructed wells are found only in major stream valleys.

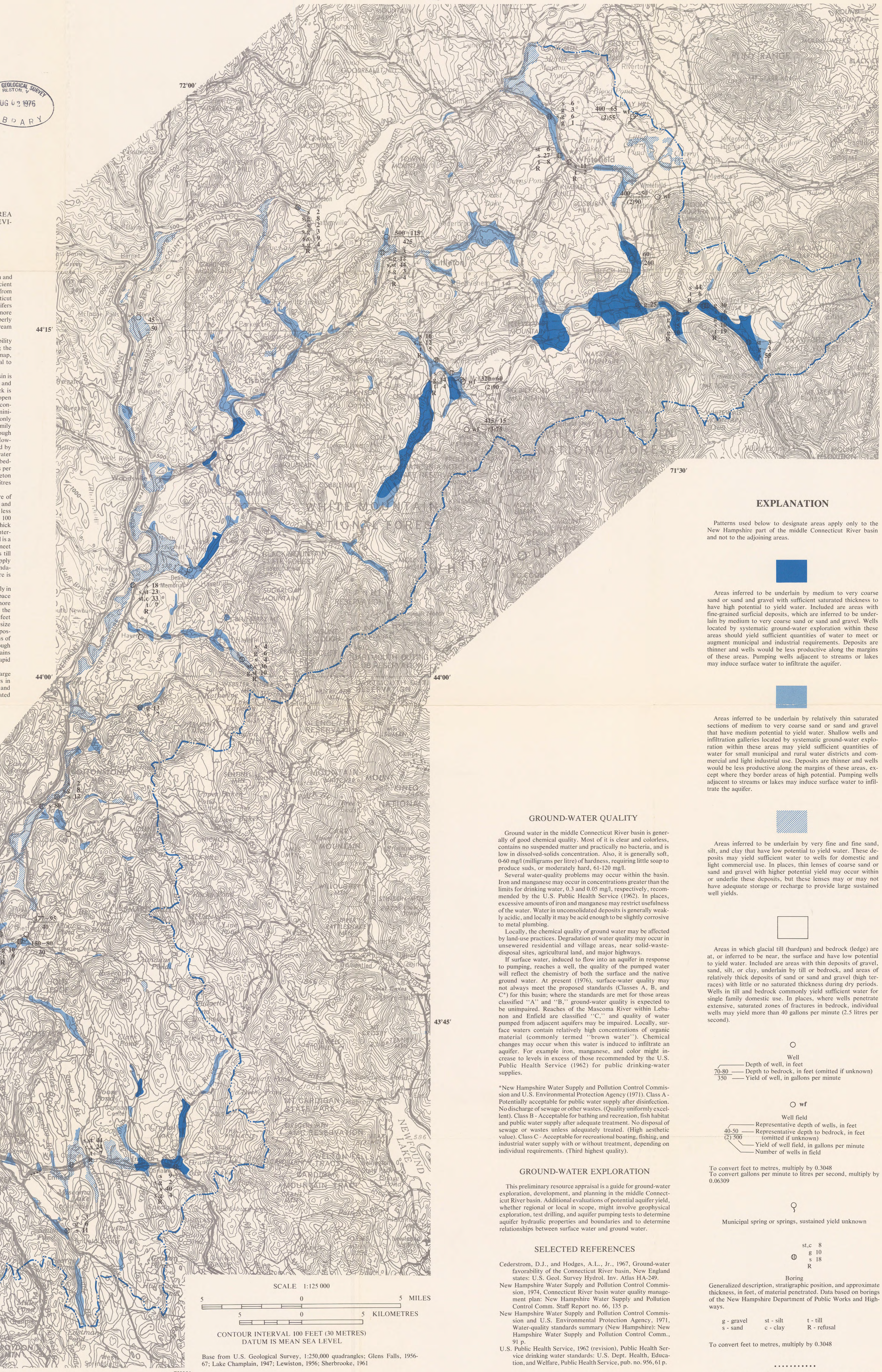
The map provides a preliminary assessment of the availability of ground water in the basin, as determined by estimating the capability of the aquifers to store and transmit water. On the map, aquifers are rated as having high, medium, or low potential to yield water.

Bedrock or ledge (crystalline rock) in most of this river basin is covered by a veneer of unconsolidated glacial deposits of till and layered (stratified) gravel, sand, silt, and clay. The bedrock is hard and compact; it contains recoverable water only in open fractures. The size, number, distribution, and degree of interconnection of fractures are highly variable, but are commonly minimal. Therefore, although wells penetrating bedrock commonly yield dependable supplies of good quality water for single family domestic needs, individual wells generally do not yield enough water to sustain supplies for municipal or industrial use. However, Whitefield and the village center of Lyme are supplied by low-yielding bedrock wells. The Franconia and Littleton water systems are partly supplied by bedrock wells. Zones where bedrock is extensively fractured may yield more than 40 gallons per minute (2.5 litres per second) to individual wells. The Littleton town well is reported to yield 425 gallons per minute (26.8 litres per second).

Glacial till, locally called hardpan, is an unsorted mixture of clay, silt, sand, gravel, and boulders. Till is widespread and overlies bedrock. The average thickness of till is probably less than 30 feet (9 metres), but in places the thickness exceeds 100 feet (30 metres). A significant amount of water is stored in thick till, but it is transmitted very slowly through the small intergranular open spaces (pores) of the deposits. Accordingly, till is a poor aquifer and normally does not yield enough water to meet municipal, industrial, or commercial needs. In some places till will yield enough water to large-diameter dug wells to supply single family domestic needs, but this yield may not be dependable during droughts, when the water table declines and there is less water in storage.

Stratified deposits of gravel, sand, silt, and clay occur chiefly in the valley bottoms. These materials have abundant pore space between grains to store water; pore space may amount to more than 30 percent of the total volume of the deposit. In places the water-saturated thickness of these deposits is more than 80 feet (24 metres). The average grain size and the average pore size between grains varies greatly, and thus the ability of these deposits to transmit water varies greatly. The pores between grains of clay, silt, and fine sand are so small that the water flows through them very slowly. The relatively large pore spaces between grains of medium to very coarse sand and gravel allow relatively rapid transmission of water.

Because sand and gravel can both store and transmit large quantities of water, they form the most productive aquifers in New Hampshire. For this reason, ground-water exploration and development has been most successful in thick, water-saturated sand and gravel deposits.



SCALE 1:125 000

5 0 5 MILES

5 0 5 KILOMETRES

CONTOUR INTERVAL 100 FEET (30 METRES)
DATUM IS MEAN SEA LEVEL

Base from U.S. Geological Survey, 1:250,000 quadrangles; Glens Falls, 1956-67; Lake Champlain, 1947; Lewiston, 1956; Sherbrooke, 1961

GROUND-WATER QUALITY

Ground water in the middle Connecticut River basin is generally of good chemical quality. Most of it is clear and colorless, contains no suspended matter and practically no bacteria, and is low in dissolved-solids concentration. Also, it is generally soft, 0-60 mg/l (milligrams per litre) of hardness, requiring little soap to produce suds, or moderately hard, 61-120 mg/l.

Several water-quality problems may occur within the basin. Iron and manganese may occur in concentrations greater than the limits for drinking water, 0.3 and 0.05 mg/l, respectively, recommended by the U.S. Public Health Service (1962). In places, excessive amounts of iron and manganese may restrict usefulness of the water. Water in unconsolidated deposits is generally weakly acidic, and locally it may be acid enough to be slightly corrosive to metal plumbing.

Locally, the chemical quality of ground water may be affected by land-use practices. Degradation of water quality may occur in unsewered residential and village areas, near solid-waste-disposal sites, agricultural land, and major highways.

If surface water, induced to flow into an aquifer in response to pumping, reaches a well, the quality of the pumped water will reflect the chemistry of both the surface and the native ground water. At present (1976), surface-water quality may not always meet the proposed standards (Classes A, B, and C*) for this basin; where the standards are met for those areas classified "A" and "B," ground-water quality is expected to be unimpaired. Reaches of the Mascoma River within Lebanon and Enfield are classified "C," and quality of water pumped from adjacent aquifers may be impaired. Locally, surface waters contain relatively high concentrations of organic material (commonly termed "brown water"). Chemical changes may occur when this water is induced to infiltrate an aquifer. For example iron, manganese, and color might increase to levels in excess of those recommended by the U.S. Public Health Service (1962) for public drinking-water supplies.

*New Hampshire Water Supply and Pollution Control Commission and U.S. Environmental Protection Agency (1971). Class A - Potentially acceptable for public water supply after disinfection. No discharge of sewage or other wastes. (Quality uniformly excellent). Class B - Acceptable for bathing and recreation, fish habitat and public water supply after adequate treatment. No disposal of sewage or wastes unless adequately treated. (High aesthetic value). Class C - Acceptable for recreational boating, fishing, and industrial water supply with or without treatment, depending on individual requirements. (Third highest quality).

GROUND-WATER EXPLORATION

This preliminary resource appraisal is a guide for ground-water exploration, development, and planning in the middle Connecticut River basin. Additional evaluations of potential aquifer yield, whether regional or local in scope, might involve geophysical exploration, test drilling, and aquifer pumping tests to determine aquifer hydraulic properties and boundaries and to determine relationships between surface water and ground water.

SELECTED REFERENCES

Cederstrom, D.J., and Hodges, A.L., Jr., 1967, Ground-water favorability of the Connecticut River basin, New England states: U.S. Geol. Survey Hydrol. Inv. Atlas HA-249.

New Hampshire Water Supply and Pollution Control Commission, 1974, Connecticut River basin water quality management plan: New Hampshire Water Supply and Pollution Control Comm. Staff Report no. 66, 135 p.

New Hampshire Water Supply and Pollution Control Commission and U.S. Environmental Protection Agency, 1971, Water-quality standards summary (New Hampshire): New Hampshire Water Supply and Pollution Control Comm., 91 p.

U.S. Public Health Service, 1962 (revision), Public Health Service drinking water standards: U.S. Dept. Health, Education, and Welfare, Public Health Service, pub. no. 956, 61 p.

EXPLANATION

Patterns used below to designate areas apply only to the New Hampshire part of the middle Connecticut River basin and not to the adjoining areas.

Areas inferred to be underlain by medium to very coarse sand or sand and gravel with sufficient saturated thickness to have high potential to yield water. Included are areas with fine-grained surficial deposits, which are inferred to be underlain by medium to very coarse sand or sand and gravel. Wells located by systematic ground-water exploration within these areas should yield sufficient quantities of water to meet or augment municipal and industrial requirements. Deposits are thinner and wells would be less productive along the margins of these areas. Pumping wells adjacent to streams or lakes may induce surface water to infiltrate the aquifer.

Areas inferred to be underlain by relatively thin saturated sections of medium to very coarse sand or sand and gravel that have medium potential to yield water. Shallow wells and infiltration galleries located by systematic ground-water exploration within these areas may yield sufficient quantities of water for small municipal and rural water districts and commercial and light industrial use. Deposits are thinner and wells would be less productive along the margins of these areas, except where they border areas of high potential. Pumping wells adjacent to streams or lakes may induce surface water to infiltrate the aquifer.

Areas inferred to be underlain by very fine and fine sand, silt, and clay that have low potential to yield water. These deposits may yield sufficient water to wells for domestic and light commercial use. In places, thin lenses of coarse sand or sand and gravel with higher potential yield may occur within or underlie these deposits, but these lenses may or may not have adequate storage or recharge to provide large sustained well yields.

Areas in which glacial till (hardpan) and bedrock (ledge) are at, or inferred to be near, the surface and have low potential to yield water. Included are areas with thin deposits of gravel, sand, silt, or clay, underlain by till or bedrock, and areas of relatively thick deposits of sand or sand and gravel (high terraces) with little or no saturated thickness during dry periods. Wells in till and bedrock commonly yield sufficient water for single family domestic use. In places, where wells penetrate extensive, saturated zones of fractures in bedrock, individual wells may yield more than 40 gallons per minute (2.5 litres per second).

Well

70-80 / 350
- Depth of well, in feet
- Depth to bedrock, in feet (omitted if unknown)
- Yield of well, in gallons per minute

wf

Well field

40-50 / (2) 500
- Representative depth of wells, in feet
- Representative depth to bedrock, in feet (omitted if unknown)
- Yield of well field, in gallons per minute
- Number of wells in field

To convert feet to metres, multiply by 0.3048
To convert gallons per minute to litres per second, multiply by 0.06309

Municipal spring or springs, sustained yield unknown

st,c 8
g 10
s 18
R

Boring

Generalized description, stratigraphic position, and approximate thickness, in feet, of material penetrated. Data based on borings of the New Hampshire Department of Public Works and Highways.

g - gravel	st - silt	t - till
s - sand	c - clay	R - refusal

To convert feet to metres, multiply by 0.3048

Reaches of Mascoma River designated by New Hampshire Water Supply and Pollution Control Commission to meet water-quality standards of Class C. All other surface water in the basin designated to meet standards of Classes A or B.

Basin boundary

AVAILABILITY OF GROUND WATER IN THE MIDDLE CONNECTICUT RIVER BASIN, WEST-CENTRAL NEW HAMPSHIRE

By
John E. Cotton

1976

OPEN-FILE REPORT
CONCORD, NEW HAMPSHIRE