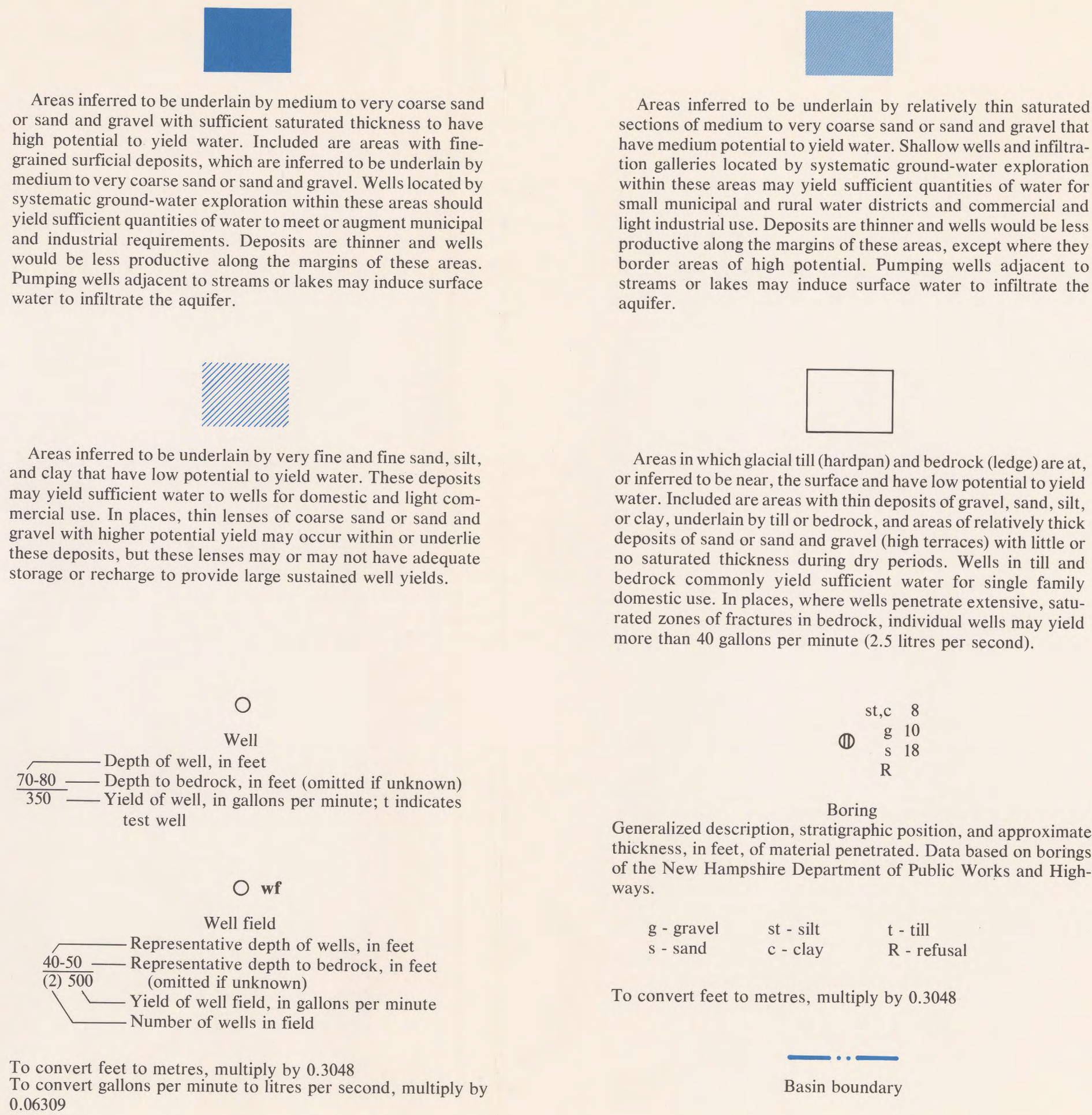


EXPLANATION

Patterns used below to designate areas apply only to the middle Merrimack River basin and not to the adjoining areas.



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 Merrimack 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, Warner is partly supplied by a bedrock well. Zones where bedrock is extensively fractured may yield more than 40 gallons per minute (2.5 litres per second) to individual wells. The Warner town well is reported to yield 50 gallons per minute (3.1 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 inter-granular 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 100 feet (30 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.

GROUND-WATER QUALITY

Ground water in the middle Merrimack 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, 0.40 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 the usefulness of the water. Fluoride concentrations greater than 1.5 mg/l, the upper limit recommended by the U.S. Public Health Service (1962), for areas where the annual average of maximum daily air temperature is within the range of 53.8° to 58.3°F (12.1° to 14.6°C), may be common in water from bedrock wells. 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 and B*) for this basin; where the standards are met, ground-water quality is expected to be unimpaired. 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). New Hampshire Water Supply and Pollution Control Commission (1972). 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).

GROUND-WATER EXPLORATION

This preliminary resource appraisal is a guide for ground-water exploration, development, and planning in the middle Merrimack 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

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AVAILABILITY OF GROUND WATER IN THE MIDDLE MERRIMACK RIVER BASIN, CENTRAL AND SOUTHERN NEW HAMPSHIRE

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