Geohydrology and Water Quality of Stratified-Drift Aquifers in the Upper Merrimack River Basin, South-Central New Hampshire

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CONVERSION FACTORS

Multiply	By	To obtain
cubic foot (ft^3)	0.02832	cubic meter
cubic foot per second (ft^3/s)	0.02832	cubic meter per second
cubic foot per second per square mile [$(ft^3/s)/mi^2$]	0.01093	cubic meter per second per square kilometer
foot (ft)	0.3048	meter
foot per day (ft/d)	0.3048	meter per day
foot squared per day (ft^2/d)	0.09290	meter squared per day
gallon (gal)	3.785	liter
gallon per day (gal/d)	3.7854	liter per day
gallon per minute (gal/min)	0.06309	liter per second
inch (in.)	25.4	millimeter
mile (mi)	1.609	kilometer
million gallons (Mgal)	3,785	cubic meter
million gallons per day (Mgal/d)	0.04381	cubic meter per second
million gallons per day per square mile ($(Mgal/d)/mi^2$)	1,460	cubic meter per second per square kilometer
square mile (mi^2)	2.590	square kilometer

Water temperature in degrees Celsius (°C) can be converted to degrees Farenheit (°F) by use of the following equation:

$$°F = 1.8\,(°C) + 32$$

VERTICAL DATUM

Sea level: In this report, "sea level" refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929)—a geodetic datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called Sea Level Datum of 1929.

ABBREVIATED WATER-QUALITY UNITS

In this report, the concentration of a chemical in water is expressed in milligram per liter (mg/L) or microgram per liter (µ/L). Milligram per liter is a unit expressing the concentration of chemical constituents in solution as weight (milligram) of solute per unit volume (liter) of water; 1,000 µg/L is equivalent to mg/L.

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Abstract

This report presents the results of a study by the U.S. Geological Survey, in cooperation with the New Hampshire Department of Environmental Services, Water Resources Division, to describe the geohydrology and background water quality of stratified-drift aquifers in the Upper Merrimack River Basin in south-central New Hampshire. The Upper Merrimack River Basin drains 519 square miles (mi^2) of which 87 mi^2 is underlain by stratified-drift aquifers.

Ground-water withdrawal from stratified-drift aquifers in the study area is about 1.8 million gallons per day or 39 percent of total ground-water withdrawals. In 1995, five towns withdrew the stratified-drift aquifers for municipal water supply. The water-supply potential of many stratified-drift aquifers in the study area is not fully developed.

The largest contiguous aquifer is in the central Merrimack River Valley and covers 45 mi^2. The Soucook River and Suncook River Valleys in the eastern part of the basin contain the most productive aquifers. Saturated thickness of stratified-drift aquifers is as great as 160 feet but is generally less than 80 feet. Transmissivities locally exceed 4,000 feet squared per day (ft^2/d) but are generally less than 1,000 ft^2/d. Stratified-drift aquifers identified as having a transmissivity greater than 2,000 ft^2/d are in only 4.3 mi^2 (or 0.8 percent) of the study area.

Fourteen stratified-drift aquifers, underlying the towns of Bow, Pembroke, Chichester, Loudon, Northfield, Boscawen, Franklin, Allenstown and Epsom, and the city of Concord, have the greatest potential to supply additional amounts of water. Water availability of four of these aquifers was estimated on the basis of an analytical ground-water-flow model based on the Theis confined-flow equation adjusted to account for boundary effects typically associated with unconfined stratified-drift aquifers. The maximum sustained aquifer yield during a period of no recharge was 2.8 million gallons per day from the lower Soucook River aquifer. Aquifer yields can exceed this rate during periods of recharge.

Water from six selected wells in the stratified-drift aquifers generally met the U.S. Environmental Protection Agency's primary and secondary drinking-water regulations. All wells that were sampled were in areas of no known water-quality problems. Water from five wells had elevated concentrations of manganese, and water from two wells had elevated concentrations of dissolved iron. Water from one well had a volatile organic compound (1,1,1,-trichloroethane) concentration of 1.3 micrograms per liter.

INTRODUCTION

A 1989–91 study of stratified-drift aquifers in the Upper Merrimack River Basin is one of a series of studies done by the U.S. Geological Survey (USGS), in cooperation with the New Hampshire Department of Environmental Services, Water Resources Division (NHDES-WRD), to provide geohydrologic information on the stratified-drift aquifers in New Hampshire. The reports produced from these studies include aquifer boundaries, water-table altitudes, general directions of ground-water flow, saturated thickness, and aquifer transmissivity, and ambient water quality in selected stratified-drift aquifers. This information can be used by regional and local planners in making maximum use of currently developed ground-water resources and in locating and developing new resources.

The major subbasins of the study area are the Upper Merrimack, Soucook, Suncook, and Upper Suncook River Basins (fig. 1). The population of the 15 south-central New Hampshire towns in the study area increased by 19 percent from 1980 (74,234) to 1990 (91,697) but is expected to increase at a slower rate in the future because of decreased economic growth (Thomas Duffy, New Hampshire Office of State Planning, written commun., 1992). Ground-water withdrawals from stratified drift are estimated to be 1.8 Mgal/d, or 39 percent of total ground-water withdrawals in the study area (New Hampshire Department of Environmental Services, Water Management Bureau, written commun., 1992).

Water-quality regulations established by the U.S. Environmental Protection Agency (USEPA) in 1992 include limitations on suspended sediments and bacteria, which commonly reach nuisance levels in surface water but rarely in ground water. The regulations have prompted some towns that rely primarily on surface water to consider developing their ground-water resources rather than developing costly filtration systems for use with surface-water sources. The town of Pittsfield relies entirely on surface water to meet municipal demands. The towns of Pembroke, Allenstown, Epsom, and Boscawen rely on ground-water withdrawals from stratified-drift aquifers to meet municipal needs. Water supply for the city of Concord is 75 percent surface water and 25 percent ground water.

Stratified-drift aquifers discontinuously underlie 87 mi^2 of the 519-square-mile Upper Merrimack River Basin. Fourteen of the largest and most productive stratified-drift aquifers in the study area are described in this report. Many of the aquifers may be developed to supply enough water to meet domestic, community, and municipal water needs.

Purpose and Scope

The purpose of this report is to (1) describe the geohydrologic characteristics of the stratified-drift aquifers in the Upper Merrimack River Basin, including areal extent, saturated thickness, and hydraulic characteristics of the stratified-drift aquifers; (2) provide estimates of water availability in selected aquifers on the basis of an analytical technique; and (3) describe the ambient ground-water quality in stratified-drift aquifers. The scope of this report is limited to compilations of data from significant stratified-drift aquifers that are or could potentially be major sources of ground-water supply in the study area. For the purpose of this report, significant aquifers contain coarse-grained stratified-drift deposits, cover more than 0.2 mi^2, and exceed 40 ft in saturated thickness. Analytical model results indicate that these dimensions and characteristics are necessary if the aquifer of interest is to supply an adequate water yield (greater than 0.4 Mgal/d) to municipal, industrial, or commercial users.

Description of Study Area

The Upper Merrimack River Basin in south-central New Hampshire, extends north from Bow to Gilford and east from Salisbury to Strafford (fig. 2). Population of towns in the basin in 1990 ranged from 1,061 (Salisbury) to 36,006 (Concord, the State capital) (Jane Boisvert, New Hampshire Office of State Planning, written commun., 1992). Altitude of the terrain ranges from 2,382 ft at Belknap Mountain in Gilford to 200 ft at the flood plain along the Merrimack River in Bow and Pembroke. Drainage areas of the largest subbasins, in descending order, are the Upper Merrimack, 170 mi^2; Suncook, 140 mi^2; Upper Suncook, 117 mi^2; and Soucook, 92 mi^2 (fig. 1).

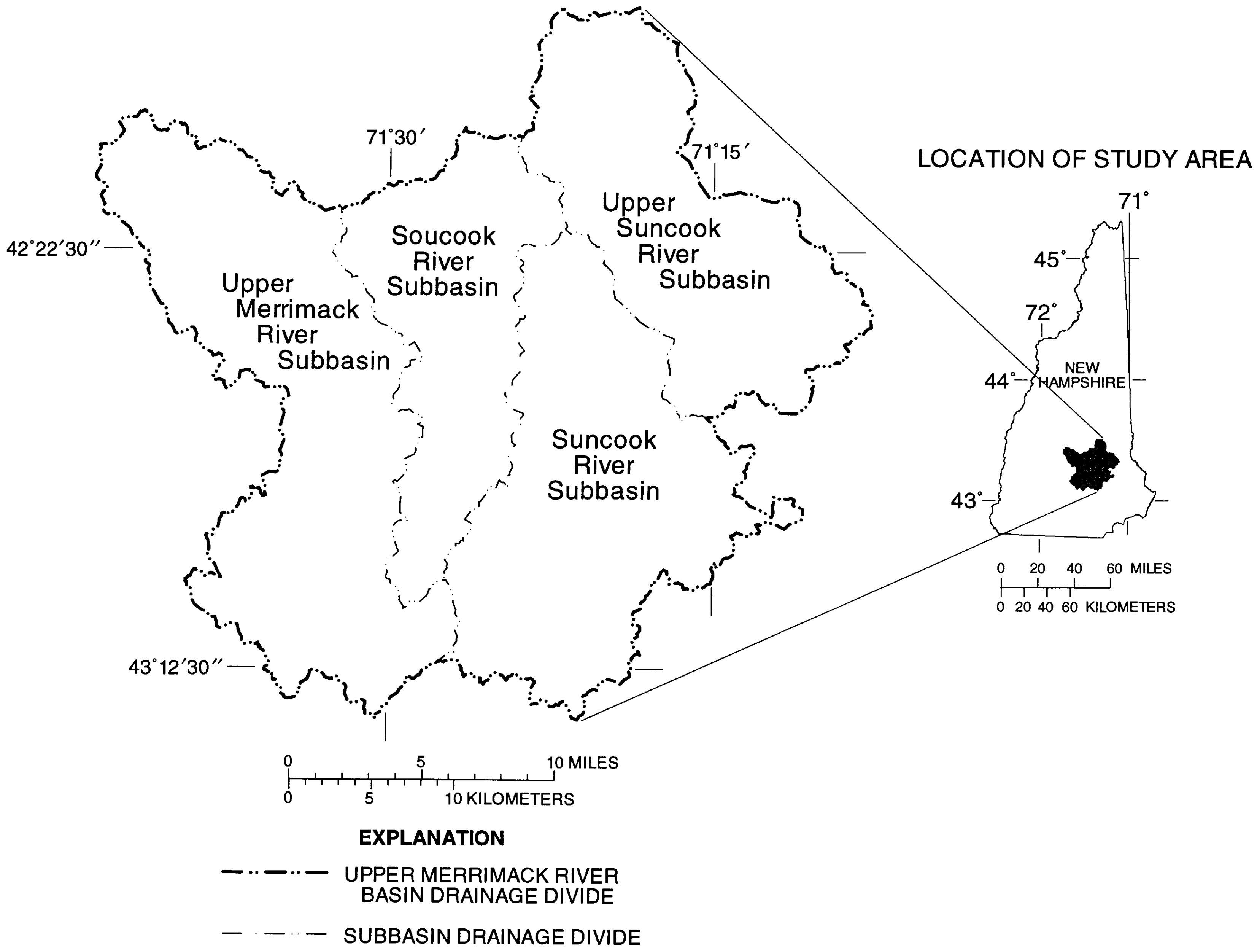


Figure 1. Location of the Upper Merrimack River Basin and major Subbasins in south-central New Hampshire.

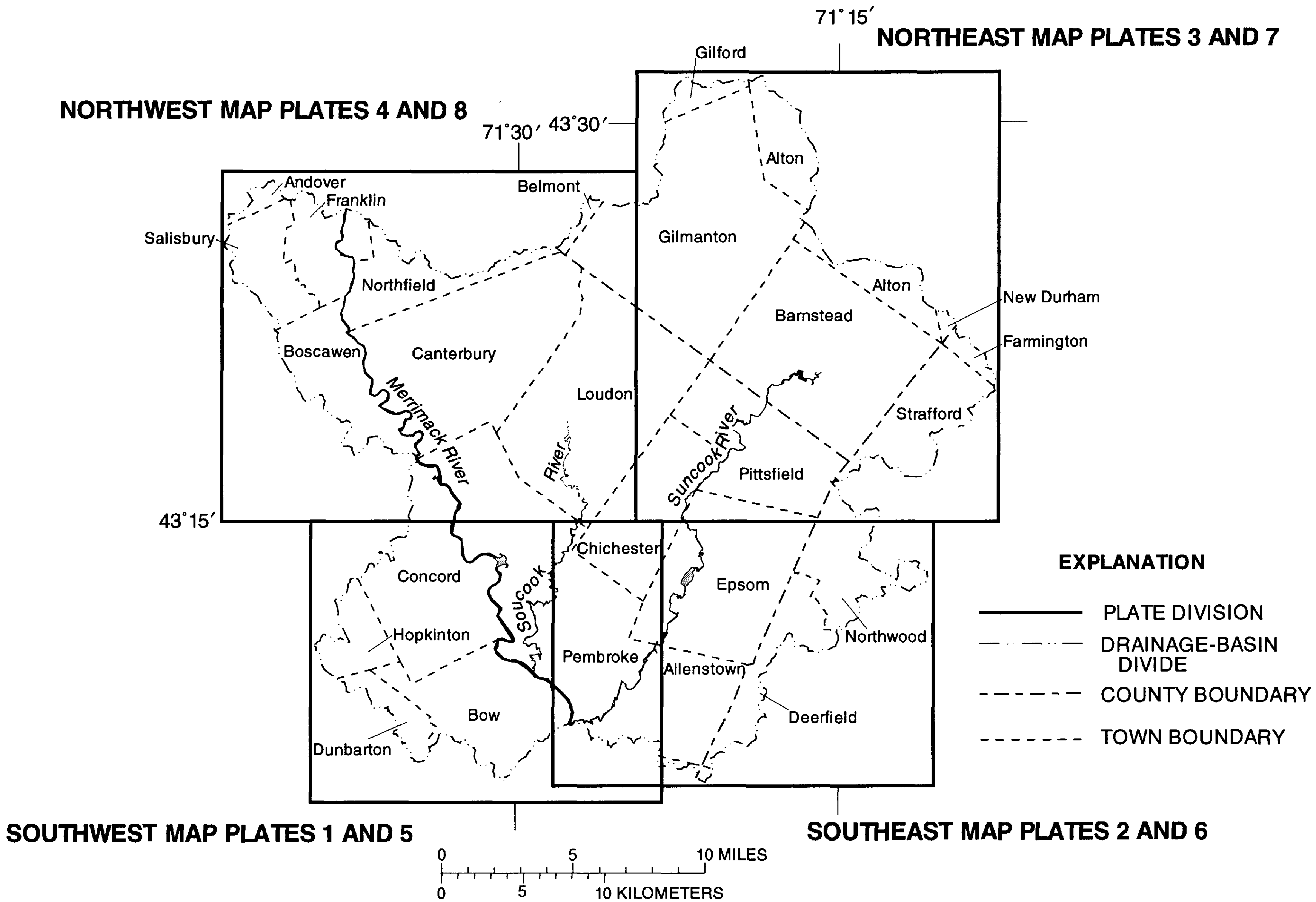


Figure 2. Southwest, southeast, northeast, and northwest map plates of the Upper Merrimack River Basin, south-central New Hampshire.

Major tributaries that partly drain coarse-grained stratified-drift deposits are the Suncook River and Soucook River (fig. 2). The 519-square-mile study area is underlain by coarse-grained stratified-drift aquifers (40 mi^2), fine-grained stratified-drift aquifers (47 mi^2), and till (432 mi^2) (fig. 3). For this report, the study area has been divided into four subareas (southwest, southeast, northwest, and northeast); two map plates (at back of report) present geohydrologic information on each subarea (fig. 2).

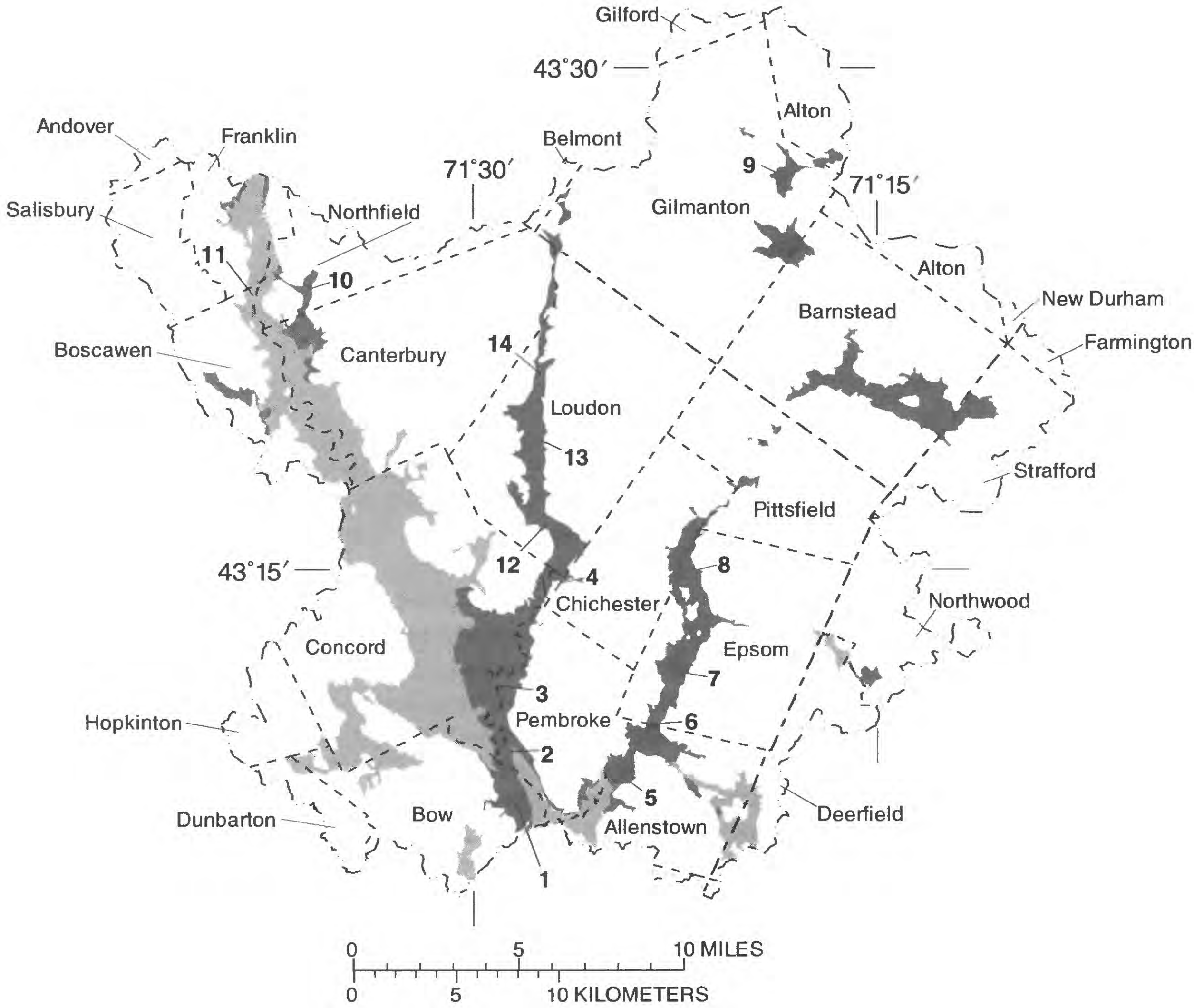
Previous Investigations

Previous maps of stratified-drift aquifers in south-central New Hampshire by the USGS include a reconnaissance map at a scale of 1:125,000 that shows the availability of ground water in the Upper Merrimack River Basin (Cotton, 1977). Surficial-geologic maps for parts of the study area are being produced at a scale of 1:24,000 as part of the Cooperative Geologic Mapping Program (COGEOMAP, now known as STATEMAP)—a cooperative program among various States and the Geologic Division of the USGS. In New Hampshire, the New Hampshire Department of Environmental Services, Office of the State Geologist, is the cooperator in this program. Two published 7.5-minute surficial-geologic quadrangle maps in the study area include Candia (Gephart, 1985) and Penacook (Pendleton, 1995a). Unpublished surficial-geologic quadrangle maps include Manchester North (Carl Koteff, U.S. Geological Survey, written commun., 1992), Concord (David Franzi, State University of New York, Plattsburgh, written commun., 1992) and Suncook (Carl Koteff, U.S. Geological Survey, written commun., 1992).

Local studies on water resources from six towns in the study area have also been done by private consultants. An assessment of water resources in the city of Concord was done by Camp Dresser and McKee, Inc. (1965). The ground-water development potential and protection in Pembroke was evaluated by Metcalf and Eddy, Inc. (1949) and Layne Well and Pump Division (1989). The D.L. Maher Company evaluated the ground-water development potential of stratified-drift aquifers in Franklin (1985) and in Boscawen (1988). Ground-water development potential and protection of stratified-drift and bedrock aquifers in Bow was evaluated by Dufresne-Henry, Inc. (1982) and by SEA, Inc. (1987).

Approach and Methods

1. Areal extent of the stratified-drift aquifers was mapped with the aid of soils maps from the U.S. Department of Agriculture, Natural Resource Conservation Service; surficial-geologic maps; and data from the STATEMAP program. Where data were unavailable, areal extent of stratified-drift aquifers was mapped by USGS personnel.
2. Published and unpublished data on ground-water levels, saturated thickness, and stratigraphy of the aquifers were obtained and compiled from the USGS, NHDES-WRD, and the New Hampshire Department of Transportation. Additional data were obtained from municipalities, local residents, well-drilling contractors, and geohydrologic consulting firms. Locations of wells, borings, and seismic lines were plotted on base maps, and pertinent well and test-hole data were added to the Ground Water Site Inventory (GWSI) data base maintained by the USGS. Each data point is cross-referenced to a site-identification number and to any other pertinent information about the site.
3. Seismic-refraction profiling, a surface-geophysical technique for subsurface exploration, was used to determine depths to the water table and bedrock surface and to estimate saturated thicknesses of aquifers (appendix C). (Locations of these profiles are shown on plates 1–4.) The methods for collecting seismic-refraction data have been outlined by Haeni (1988). Interpretation of the seismic-refraction data were based on a time-delay, ray-tracing computer program developed by Scott and others (1972). Data from nearby wells and test holes were used to verify the interpretations. Measured depths to the bedrock surface are within 10 percent of the estimates from seismic-refraction profiling.



EXPLANATION

MATERIAL TYPES

- Fine-grained stratified-drift deposits
- Coarse-grained stratified-drift deposits
- DRAINAGE-BASIN DIVIDE
- COUNTY BOUNDARY
- TOWN BOUNDARY

STRATIFIED-DRIFT AQUIFERS--Numbers identify general locations of selected aquifers

1	Bow
2	Lower Soucook River
3	Concord Plains
4	Taylor State Forest
5	Lower Suncook River
6	Bear Brook
7	Suncook River and Round Pond
8	Upper Suncook River
9	Crystal Lake
10	Sandogardy Pond
11	Boscawen
12	Soucook River and Giddis Brook
13	Loudon
14	Pearls Corner

Figure 3. Distribution of fine- and coarse-grained stratified drift and location of selected stratified-drift aquifers in the Upper Merrimack River Basin, south-central New Hampshire.

Till is not identified in the interpretations because it is generally thin and cannot be distinguished from stratified drift based on seismic-refraction methods. For this condition, the computed depth to bedrock is slightly less than the actual depth.

4. Seismic-reflection profiling, another surface-geophysical technique, was used to determine depths to bedrock and to infer the sediment type comprising the aquifers that underlie water bodies. The methods for collecting seismic-reflection data have been outlined by Haeni (1986). Seismic-reflection results differ from seismic-refraction results in that information about the texture of the subsurface sediments can sometimes be inferred from the reflection records. At some locations, the nature of the river-bottom sediments resulted in unusable records. These bottom sediments were either cobbles, compacted bottom material that reflect sound energy, thick organic-bottom sediments containing entrapped gases (such as those in shallow wetlands or areas of pooled water), or combinations of these three sediment types. These sediments scatter sound energy and prevent its penetration to deeper layers. It was possible to obtain detailed subsurface stratigraphic data in areas containing fine-grained sediments because sound penetration was excellent in these sediments. Interpreted seismic-reflection profiles completed at three locations in Bow and Boscawen are shown in figures 4-6. Locations of seismic-reflection profiles are shown on plates 1 and 4.
5. Test drilling was completed at 69 locations to collect lithologic and hydrologic data. Locations of test holes and wells are shown on plates 1–4, and data are included in appendixes A and B. Split-spoon samples of the subsurface materials were collected at 5- to 10-foot intervals. Detailed observations of the samples were made to estimate the horizontal hydraulic conductivity at those depths and to determine the stratigraphic sequence of materials making up the aquifers. Where test holes were drilled in productive aquifer materials, a 2-inch-diameter well with a polyvinyl chloride (PVC) casing and a slotted well screen was installed. Wells were initially developed by surging with compressed air to displace water and sediment from the well screen and to improve the hydraulic connection with aquifer materials. Wells were further developed with a centrifugal pump to evacuate the casing. Water levels were measured periodically in these wells, and water samples were collected from selected wells.
6. Maps showing the altitude of the water table, direction of ground-water flow, and saturated thickness were prepared from data collected based on the preceding methods.
7. Hydraulic conductivities of aquifer materials were estimated from grain-size-distribution data from 454 samples of aquifer material collected during drilling of test holes and wells in southern New Hampshire as part of this study and previous studies. Transmissivities were estimated from logs of test holes and wells by assigning horizontal hydraulic conductivities to each depth interval sampled, multiplying the hydraulic conductivities by the saturated thickness of each interval, and summing these results. Additional transmissivities were obtained from reports by geohydrologic consultants and from analysis of aquifer-test data. This information was used to prepare maps showing the transmissivity distribution of the stratified-drift aquifers (pls. 5–8).
8. Water availability of selected aquifers having the potential to supply large quantities of water were estimated by means of an analytical ground-water-flow model (Mazzaferro and others, 1979). The model incorporates image-well theory (Ferris and others, 1962) and the Theis nonequilibrium formula to solve the two-dimensional ground-water-flow equation. The model requires assumptions of homogeneous and isotropic conditions and an initially flat water table. No-flow and recharge boundaries are incorporated by use of image-well theory. In this report, the term "till or bedrock contact" is used to describe the surficial geologic contact between stratified-drift deposits and till or bedrock or till-covered bedrock. Maximum aquifer yields are constrained by availability of induced infiltration from streams and lakes, ground-water recharge, and drawdown in hypothetical pumped wells.

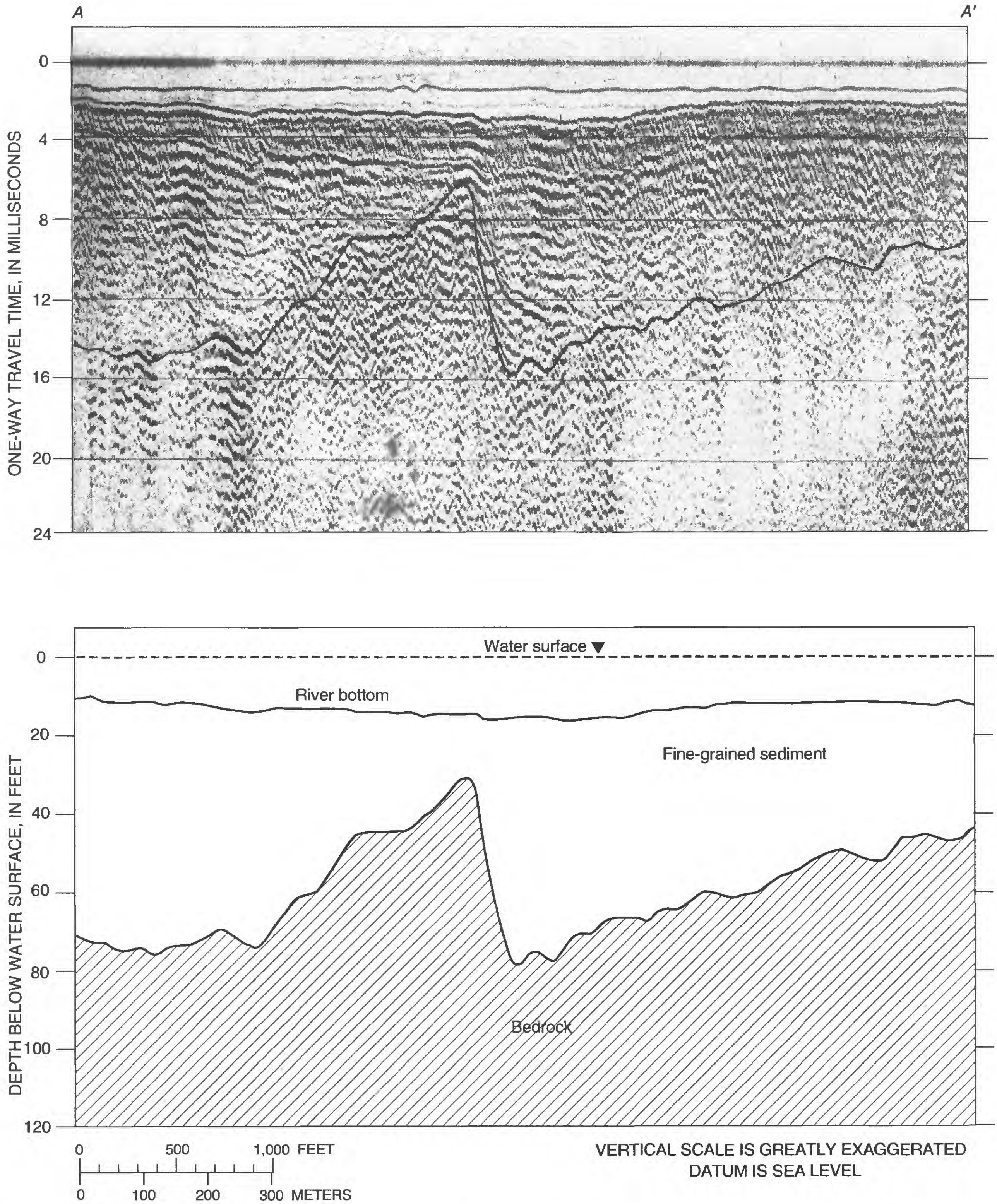
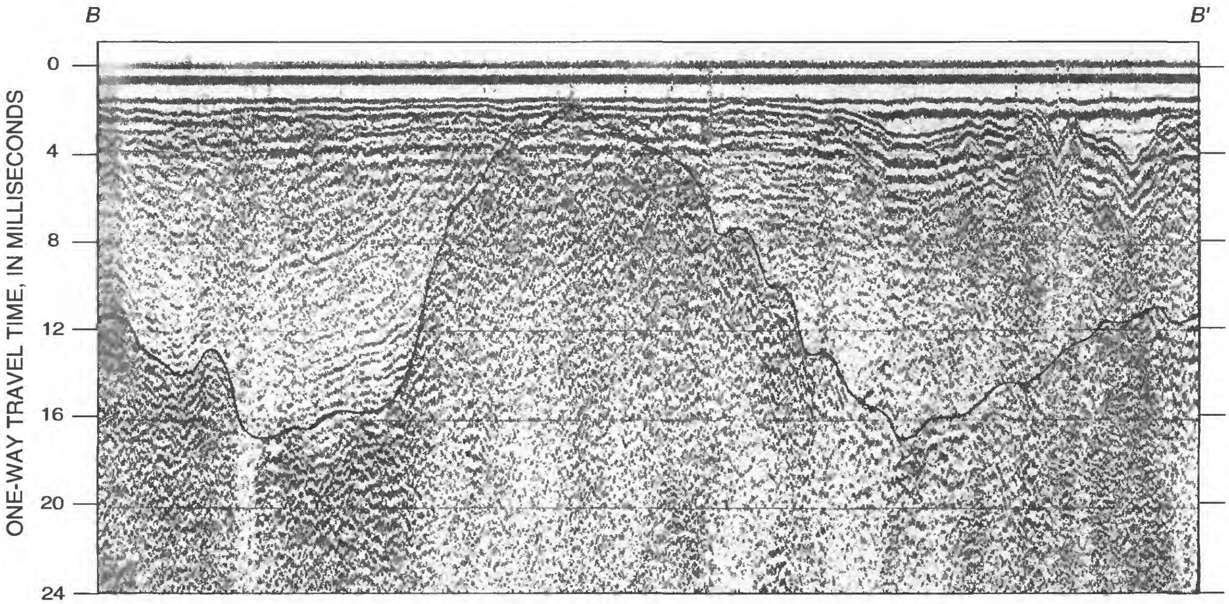


Figure 4. Geologic section *A-A′* interpreted from seismic-reflection data of the Merrimack River, Bow, New Hampshire. (Line of section is shown on plate 1.)



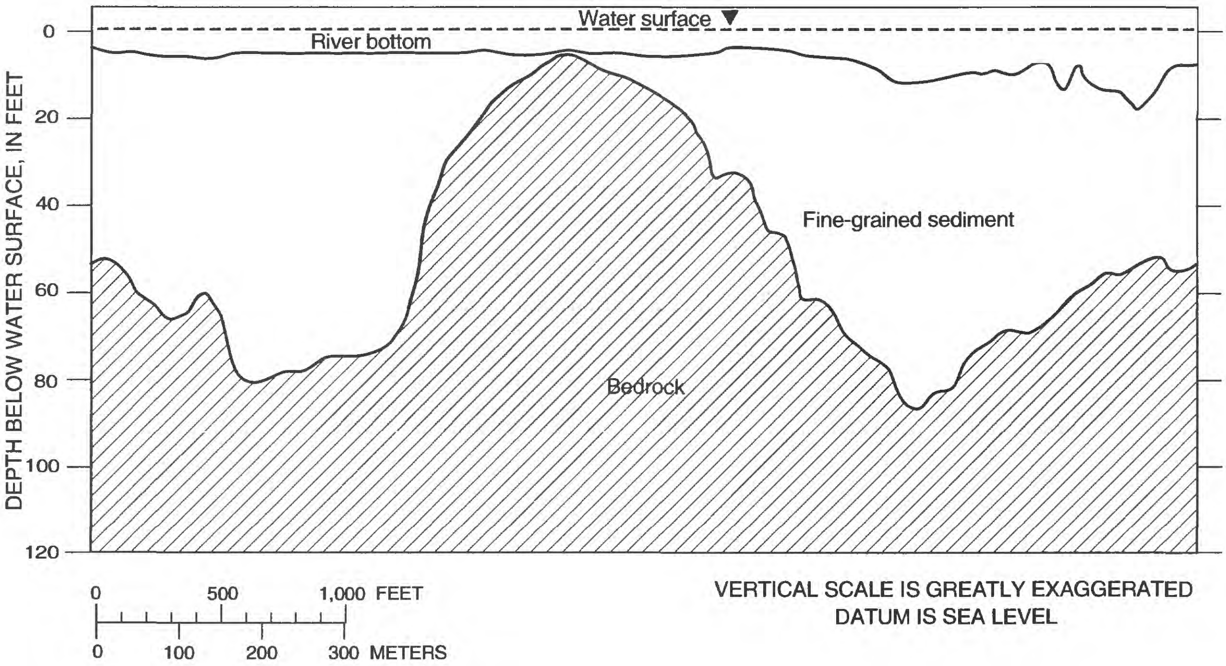


Figure 5. Geologic section *B-B′* interpreted from seismic-reflection data of the Merrimack River, Boscawen, New Hampshire. (Line of section is shown on plate 4.)

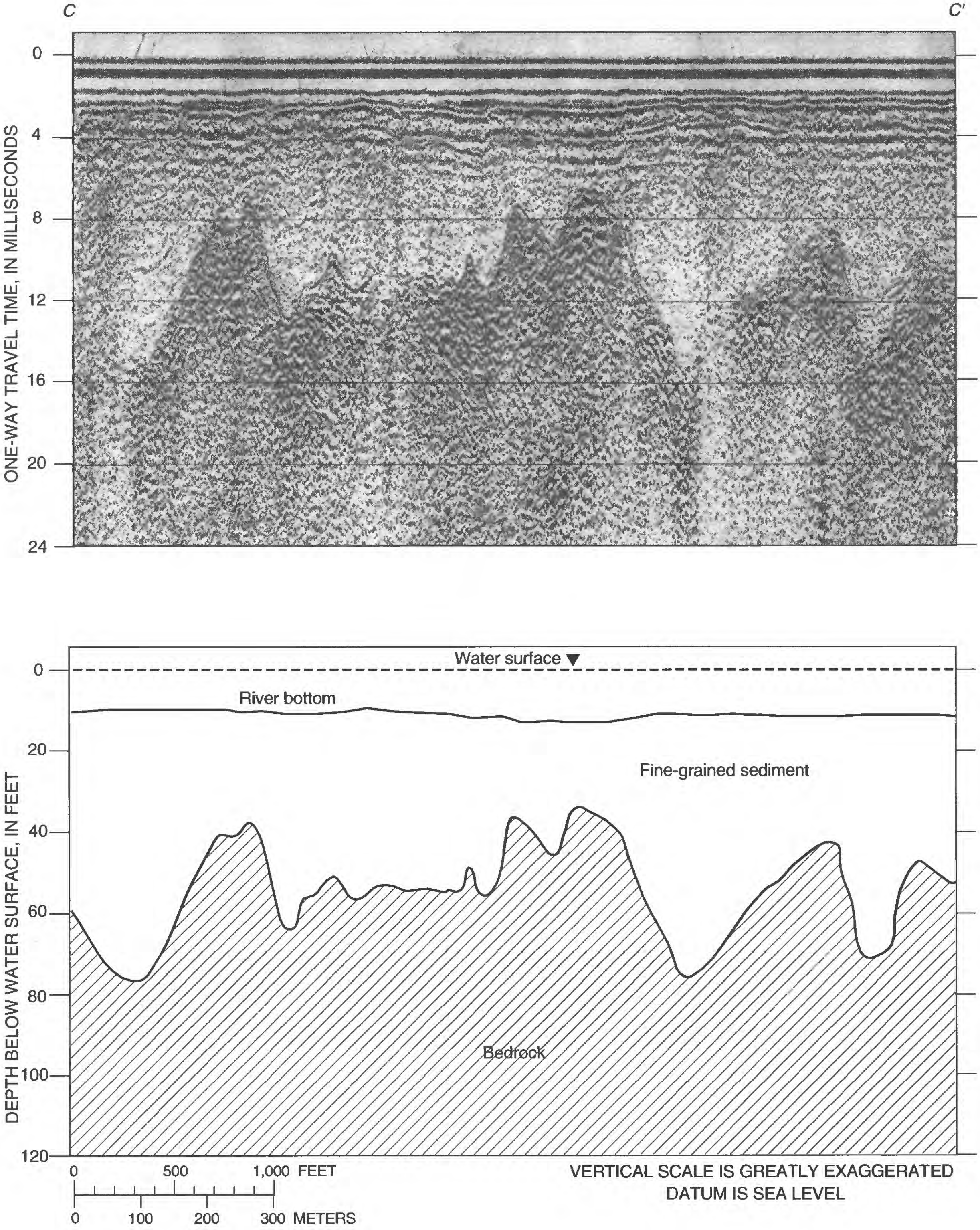


Figure 6. Geologic section *C-C′* interpreted from seismic-reflection data of the Merrimack River, Boscawen, New Hampshire. (Line of section is shown on plate 4.)

9. Streamflow was measured during low flow at 35 sites to determine the distribution of ground-water discharge and to help estimate aquifer yields. Streamflow measurements, accurate to ± 10 percent of the measured flow, were made with USGS current meters according to procedures described by Rantz and others (1982a,b). Measurements were made on September 12–13, 1989, when flow duration of the discharge of the Soucook River (at station 01089100), an unregulated river with a drainage area of 76.8 mi^2, was about 87 percent.
10. Samples of ground water from six USGS wells installed during this study were collected and analyzed. Selected physical properties of samples (specific conductance, pH, temperature) were measured in the field. Concentrations of major inorganic compounds, trace metals, inorganic constituents, and volatile organic compounds also were determined.

Numbering System for Wells and Borings

Site identifiers assigned by the USGS to wells and test borings consist of a two-character town code (table 1), a supplemental letter designation ("A" for uncased borings done for geohydrologic purposes, "B" for borings done primarily for bridge construction purposes, and "W" for all cased wells, and a sequential number within each town. For example, the first well in the city of Concord is CVW-1.

Acknowledgments

The authors thank all private citizens and town and State officials who allowed access to their property for collection of field data necessary for this investigation. Appreciation is also extended to the private consultants and well drillers who supplied reports and drilling logs and to personnel at the New Hampshire Department of Environmental Services, Water Resources Division, and the New Hampshire Department of Transportation for providing well and bridge boring data.

Table 1. Town codes used in the numbering system for wells and borings in the Upper Merrimack River Basin, south-central New Hampshire

Town	Code	Town	Code
Allenstown	AF	Franklin	FK
Barnstead	BA	Gilmanton	GL
Boscawen	BT	Loudon	LS
Bow	BU	Northfield	NR
Canterbury	CE	Northwood	NW
Chichester	CQ	Pembroke	PB
Concord	CV	Pittsfield	PH
Deerfield	DD	Salisbury	SB
Epsom	ES	Strafford	SQ

GEOHYDROLOGIC SETTING

The three types of aquifers in the study area are (1) stratified drift, which is a major source of ground water for towns and cities and is the focus of this study; (2) till, which locally can supply enough water for household needs; and (3) fractured bedrock, which is the most widely used source for household supply and in some places is a suitable source for industry.

Stratified-drift deposits constitute the most productive aquifers in the study area. Currently (1991), 83 percent of ground water withdrawn from high-capacity wells in the study area are screened in stratified drift. Ground-water withdrawal from stratified drift is about 1.8 Mgal/d, or 39 percent of total ground-water withdrawals. Towns served by these high-yielding wells include Allenstown, Boscawen, Concord, Epsom, and Pembroke (table 2). The maximum yield from 12 gravel-packed wells in these towns averages 380 gal/min and ranges from 200 to 625 gal/min. The yields of these wells (table 2) are useful approximations of the withdrawal rates from the aquifers.

Stratified Drift

Stratified drift was transported by glacial meltwater and deposited in standing water of lakes and ponds or, less commonly, stream channels. The stratified drift in the study area, as in most of the glaciated Northeastern United States, is primarily in valleys or lowlands. Stratified-drift deposits are composed of distinct layers of various grain-size distributions.

Table 2. Maximum yields for municipal water-supply wells in the Upper Merrimack River Basin, south-central New Hampshire

[Type of well: BRW, open-hole bedrock; GPW, gravel-packed well. ft, foot; gal/min, gallon per minute; No., number]

Town	Site identification No.	Local well name	Type of well	Depth of well (ft)	Maximum yield (gal/min)
Allenstown	AFW-8	Bear Brook #1	GPW	53	300
Allenstown	AFW-9	Bear Brook #2	GPW	65.5	310
Barnstead	BAW-143	Timco #1	BRW	507	100
Barnstead	BAW-144	Timco #2	BRW	360	150
Boscawen	BTW-7	Well No. 1	GPW	51	450
Boscawen	BTW-8	Well No. 2	GPW	52	450
Concord	CVW-29	Sprague Electric Corporation	BRW	332	125
Concord	PBW-51	GPW #1	GPW	37	360
Concord	PBW-52	GPW #4	GPW	40	350
Concord	PBW-50	GPW #5	GPW	39	360
Concord	PBW-49	GPW #7	GPW	48	370
Epsom	ESW-1	GPW #1	GPW	45	200
Epsom	ESW-2	GPW #2	GPW	42	250
Franklin	FKW-78	Arwood Corporation	BRW	500	150
Pembroke	PBW-32	Concord #2	GPW	85	625
Pembroke	PBW-33	Concord #3	GPW	81	535

Coarse-grained stratified drift, the focus of this study, consists of layers of sorted, mostly coarse-grained sediments (sands and gravels) deposited by glacial meltwater at the time of deglaciation. Hydrologic characteristics of these sediments that affect ground-water storage and movement are related to the glaciofluvial environment in which the sediments were deposited. For example, fast-moving meltwater streams deposit coarse-grained sediments with large pore spaces between grains. If saturated, these glaciofluvial sediments will store and transmit water readily. Fine-grained deposits, which include very fine sand, silt and clay, were deposited in lacustrine environments characterized by slow-moving and ponded meltwater; these fine-grained deposits do not transmit water as readily as coarse-grained deposits.

The deglaciation process largely determined the type of stratified-drift aquifer that formed. As the ice front systematically retreated to the north, a zone of stagnant ice remained at the margin of the ice sheet (Koteff and others, 1984). Sediment from the active ice margin and from the stagnant ice was carried away by meltwater streams confined primarily to the valley areas. The sediments were ultimately deposited either in the stagnant zone or farther away from the retreating ice. The major deposits that formed during deglaciation include ice-contact, fine-grained lake-bottom (or lacustrine), outwash, and alluvium.

Ice-contact deposits consist predominantly of sand and gravel that were laid down when the ice was still in the valley. These deposits are common in areas of shallow bedrock (such as along valley sides and near heads of outwash). Where thickly saturated and near a surface-water body, these coarse-grained deposits form significant aquifers capable of sustaining high yields to properly installed wells. The Soucook and Suncook River Valleys contain the most extensive coarse-grained deposits in the study area.

Stratified-drift deposits in the Upper Merrimack River Basin were affected by the presence of two glacial lakes—glacial Lake Merrimack and glacial Lake Hooksett. Early mapping of the surficial geology in the Lower Merrimack River Valley indicated that glacial Lake Merrimack extended from Nashua to Manchester and that glacial Lake Hooksett extended from about 3 mi south of the town of Hooksett to north of Concord (Koteff, 1970, 1976; Ayotte and Toppin, 1995, fig. 2). Both glacial lakes were controlled by a glacial-drift dam consisting of deltaic deposits. They may have coexisted, and their projected lake-level surfaces now slope 4.7–4.9 ft/mi to the south-southeast (Koteff and others, 1984).

However, more recent mapping of the surficial geology in the Penacook-Boscawen area by Pendleton (1995b) suggests that the glacial-drift dam controlling the lake levels for glacial Lake Hooksett failed or eroded away by the time the receding ice margin reached the northern end of Concord. The lake then drained to the altitude of the older glacial Lake Merrimack. Therefore, stratified-drift deposits that formed in glacial-lake waters north of Concord, such as the Penacook delta, formed in glacial Lake Merrimack (Pendleton, 1995b). The Merrimack River Valley from Bow to Franklin contains the most extensive fine-grained stratified-drift deposits in the study area (fig. 3). These deposits, formed in a glacial-lake environment, extended into numerous tributary valleys of the Merrimack River, including the lower reaches of the Suncook River, Bear Brook in Allentown, and the Turkey River in Concord.

Outwash and alluvium consist predominantly of medium to coarse sand and gravel laid down during or after deglaciation and overlying the fine-grained deposits. These deposits are commonly less than 20 ft thick and thinly saturated; therefore, outwash and alluvium are not significant aquifers in the study area.

Some of the most productive aquifers are along the shores of former glacial lakes. Along the shores, deltaic deposits are thickest and may overlie older ice-contact deposits, and recharge from stream seepage is readily available. A large delta in Concord, at Concord Heights, is one of the largest and thickest in the study area; saturated thickness is as much as 160 ft. Depositional environments ranging from high-velocity glaciofluvial to locally, low-velocity lacustrine are represented in many of the deltas and result in lenses of coarse, gravelly sands and clayey silts within deposits of well-sorted fine sands.

Till

Till is an unsorted mixture of clay, silt, sand, gravel, and rock fragments deposited directly by glacial ice. In the study area, till covers most of the bedrock surface and is overlain in the valleys by stratified drift and recent stream deposits. Thickness of till in southern New Hampshire is commonly less than 15 ft but locally can be as much as a few tens of feet (Bradley, 1964, p. 21). In south-central New Hampshire, till can be divided into an upper and a lower till (Goldthwait and others, 1951; Koteff and others, 1984). The two tills probably represent two separate major ice advances over the area (Koteff and others, 1984).

Till is generally not a major source of ground water because of its low hydraulic conductivity. Large-diameter dug wells completed in till can provide small amounts of water for household needs, but water-level fluctuations within till can be large enough to make these wells unreliable during dry seasons.

Bedrock

The Upper Merrimack River Basin is underlain by bedrock associated with the Central New Hampshire Anticlinorium (Lyons and others, 1986). This major structural belt trends generally north-northeast to south-southwest. The anticlinorium contains metamorphic rocks of Devonian and Silurian age, including gneiss, schist, and quartzite. These rocks were intruded by granite, granodiorite, syenite, and monzonite of Devonian age (Lyons and others, 1986).

The Pinnacle Fault, the single largest mapped fault in the study area, extends northeast to southwest through Pittsfield and into Suncook and trends southwest into Massachusetts. A smaller unnamed fault (locally called the Oak Hill Fault) oriented northeast to southwest, extends from Loudon center into Concord. The area from Concord to Pittsfield and north into Laconia is part of the Concord Tectonic Zone and is one of the most seismically active areas in New Hampshire (John Ebel, Weston Geophysical Laboratory, written commun., 1992).

Ground water is present in fractures in bedrock. The capacity of the bedrock to store and transmit ground water is limited by the number, size, and degree of interconnection of fractures. Wells that tap bedrock commonly yield small supplies of water that generally are adequate for individual households. In areas where the bedrock is extensively fractured, such as the brecciated zones associated with some faults, yields exceeding 50 gal/min can be obtained. Three bedrock wells drilled for industrial use—one in Barnstead, one in Concord, and one in Franklin—and one well drilled for a housing development in Boscawen have sustained yields of 100 gal/min or more (table 2). Ground-water withdrawal from bedrock aquifers is about 2.8 Mgal/d, or 61 percent of total ground-water withdrawals in the study area. Industrial and commercial withdrawals from bedrock are 0.3 Mgal/d. Domestic users withdraw 2.5 Mgal/d from bedrock aquifers.

GEOHYDROLOGY OF STRATIFIED-DRIFT AQUIFERS

The geohydrology of stratified-drift aquifers was described by identifying (1) aquifer boundaries, (2) direction of ground-water flow from recharge to discharge areas, (3) aquifer thickness and storage, (4) aquifer transmissivity, and (5) availability of ground water. Data sources included surficial geologic maps, records of wells and test borings, and seismic-refraction and seismic-reflection data. Results of the geohydrologic investigation are presented on plates 1–8 and in the following text.

Delineation of Aquifer Boundaries

The lateral boundaries of the aquifers are the contacts between stratified drift and till or bedrock valley walls. The locations of these contacts were determined by use of surficial-geologic maps, soil maps, test-boring logs, and field mapping done specifically for this study. The bottom boundary is the till and (or) bedrock surface and was determined from seismic-refraction, seismic-reflection, test borings, and domestic water-well data. The upper boundary is the water table. Water-table altitudes were determined from wells screened in stratified drift, surface-water bodies, and geophysical data.

Areal Extent and Stratigraphy of Stratified-Drift Aquifers

The areal extent of the stratified-drift aquifers is shown on plates 1–8. The approximate areal extent of coarse-grained and fine-grained deposits are shown in figure 3. Because of the regional scale of this investigation, aquifer boundaries are approximate. Coarse-grained stratified-drift aquifers may underlie fine-grained lacustrine deposits but may not have been identified because of the complexity of the stratigraphy and the lack of data. Although the lacustrine clay, silts, and very fine sands are not capable of supplying adequate amounts of water for domestic and community use, coarse-grained deposits may underlie the lacustrine deposits and may be productive aquifers.

Data for the stratigraphy of geohydrologic units were obtained from records of subsurface exploration in the study area. Additional test drilling and surface-geophysical exploration (seismic reflection) were done as part of this study to delineate texturally different geohydrologic units in the stratified drift.

Stratified drift is subdivided on plates 5–8 into four categories on the basis of grain size: (1) coarse-grained material (sand and gravel) with a median particle diameter predominantly greater than 0.0049 in., (2) coarse-grained deposits that overlie fine-grained deposits, (3) fine-grained deposits that overlie coarse-grained deposits, and (4) fine-grained deposits.

Ground-Water Site Inventory

Subsurface data from wells and test borings were inventoried, and data locations in the stratified-drift aquifers are plotted on plates 1–4. Geohydrologic data for about 2,100 sites have been added to the Ground-Water Site Inventory (GWSI) data base. Data for about 1,870 of the 2,100 sites were transferred to GWSI from the NHDES-WRD well-inventory data base. About 471 of the 2,100 sites added to the data base are in the stratified-drift aquifers. These 470 sites, used to prepare the accompanying map plates, are listed in appendix A and include an identification number for the site, latitude and longitude, depth of the well or boring, water level, and yield of the well. Stratigraphic logs of selected wells and borings in stratified drift are listed in appendix B. These data were used primarily for estimating the transmissivity of the aquifers where no aquifer-test data or grain-size data were available.

Seismic Refraction

Seismic-refraction profiles, totaling more than 8 mi, were completed at 33 locations to determine depths to the water table (pls. 1–4) and depths to the bedrock surface (pls. 5–8). A 12-channel, signal-enhancing seismograph was used to record arrival times of compressional wave energy generated by a sound source. The data were collected and interpreted according to methods described by Haeni (1988). The interpretations, made with the aid of a computer program developed by Scott and others (1972), are shown in appendix C. Estimated depths to the water table and to the bedrock surface are generally compared with control data, such as nearby well or boring logs and water-table and bedrock-outcrop observations. The accuracy of the depths to water table and bedrock are within 10 percent of the actual depth determined from test borings made along selected profiles.

Seismic Reflection

High-resolution, continuous seismic-reflection data were collected according to methods described by Haeni (1986) along the approximately 24-mile reach of the Merrimack River in the study area. These data were used to map depths to the bedrock surface and to determine stratigraphy of the geohydrologic units. During data collection, an array of receivers was towed behind a boat that traveled slowly up or down the river. Compressional waves, generated from a sound source, penetrated the river bottom and reflected back to the surface in response to the physical differences in the geologic strata. The reflected sound waves were received at the water surface and converted to an electrical signal displayed on a graphic recorder.

Results from reflection profiles along the Merrimack River in Bow and Boscawen, (pls. 1 and 4) are shown in figures 4–6. Depths to bedrock beneath water surface range from 0 to 90 ft and are highly variable even over small horizontal distances. The river valley that served as the principal drainage for the study area during deglaciation coincides with the deepest areas shown in the figures. Sediments beneath the river bottom are typically fine grained, and the reflected signal from these sediments indicates a sharp textural contrast to the reflected signal returning from the competent bedrock.

Altitude of the Water Table

The approximate altitude of the water table within stratified drift is shown on plates 1–4. These plates were prepared from (1) altitudes of streams, ponds, rivers, and lakes as shown on 1:24,000-scale USGS topographic maps; (2) all available water-level data from wells screened in the stratified drift; and (3) analysis of seismic-refraction data. Water-table altitudes were mapped only for unconfined aquifers in the stratified drift. In some areas, saturated, coarse-grained stratified drift may underlie fine-grained material and a second, deeper water table (the potentiometric surface in confined aquifers) may be present, but is not shown on the plates.

Water levels were measured seasonally at selected wells in the study area in 1989 and 1990. Water levels, in general, vary according to whether the wells are in recharge or discharge areas. Water levels in wells screened in terraces on deltas near the valley walls typically fluctuate more than those next to the rivers. Long-term hydrographs showing water levels in three representative wells (CVW-2, CVW-4 and FKW-1) in the study area are shown in figure 7. Wells CVW-4 and

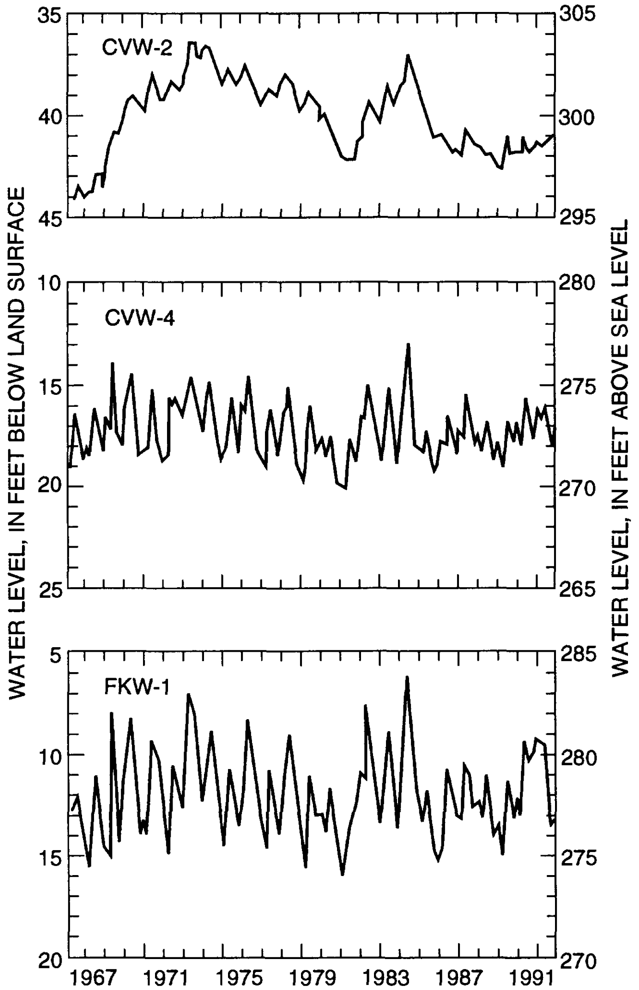


Figure 7. Water-level fluctuations in stratified drift at selected wells in south-central New Hampshire.

FKW-1 represent water-level fluctuations in fine- to medium-grained stratified-drift aquifers where the water table is less than 20 ft below land surface. The ground-water fluctuations are typical of shallow ground-water-flow circulation where the water level responds soon after rainfall. Well CVW-2 represents water-level fluctuations in fine sands and silts where the water table is more than 35 ft below land surface. Ground-water fluctuations in CVW-2 are less than those in CVW-4 and FKW-1. This attenuated fluctuation indicates that water in well CVW-2 is part of a deeper regional ground-water flow system such that the hydraulic head in the well is less sensitive to seasonal periods of recharge and discharge than are heads of wells in shallow, local flow systems. The data from these wells support the conclusion reached for other parts of New Hampshire (Cotton, 1987; Mack and Lawlor, 1992; Moore, 1990; Stekl and Flanagan, 1992; and Toppin, 1987) that natural water-level fluctuations in coarse-grained stratified drift are usually less than 5 ft but can be as much as 10 ft; therefore, a 20-foot contour interval for water-table altitudes under natural conditions would allow for 5- to 10-ft seasonal fluctuations and would be reasonable for producing a general, regional water-table map from water levels measured at different times.

Recharge, Discharge, and Direction of Ground-Water Flow

Recharge to the stratified-drift aquifers is by infiltration from precipitation that falls directly on the aquifer, surface runoff from upland hillslopes adjacent to an aquifer, and leakage from tributary streams that cross an aquifer. Leakage from streams to ground water occurs where the hydraulic head in the aquifer is less than the stream stage. Discharge from the aquifers is by ground-water flow to the rivers and ponds in the basin, by evapotranspiration in areas where ground water is near the land surface, and by ground-water withdrawals (fig. 8).

Recharge

Recharge is the process by which water is added to the zone of saturation in an aquifer. The amount of water available for development from a stratified-drift aquifer can be limited by the amount of recharge; therefore, when an aquifer yield is estimated, the amount of water that recharges the aquifer needs to be evaluated. Water pumped from aquifer storage can be replenished by natural and induced recharge, and the contributions from both sources need to be estimated. Natural sources of recharge to stratified-drift aquifers are infiltration of precipitation that falls directly on the aquifer, surface and subsurface runoff from upland hillslopes adjacent to an aquifer, leakage from streams that cross the aquifer, and flow from fractured bedrock (fig. 8). The quantity of recharge can be increased by human activities. Pumped wells near surface-water bodies can lower the water table beneath the stream or lake, inducing water to flow from the surface-water body into the aquifer. Water entering the aquifer in this manner is called induced recharge. Water-availability estimates in this report are based on regional information on ground-water discharge and streamflow.

Under steady-state conditions, the amount of water available for natural recharge from precipitation on stratified drift is roughly equivalent to the average stream runoff (Lyford and Cohen, 1988). Maps showing contours of average annual runoff for the glaciated northeast (Knox and Nordenson, 1955) were adjusted to a more recent period of precipitation (1951–90) to estimate the average annual runoff in south-central New Hampshire. From this analysis, the approximate recharge to stratified drift from precipitation is 19 in., or 0.9 (Mgal/d)/mi^2.

Lateral inflow from upland areas not drained by perennial streams recharges the stratified-drift aquifer at the till and (or) bedrock contact commonly at the base of a hillside. Recharge to stratified-drift aquifers from upland areas not drained by streams can be estimated by measuring ground-water discharge from till and (or) bedrock uplands that are drained by streams. The low flow of streams in till and bedrock terrain, specifically the 7-day, 10-year low flow ($Q_{7,10}$) can be used as a conservative estimate for the ground water draining till and bedrock uplands. The $Q_{7,10}$ is a statistically derived value; the minimum mean discharge for 7 consecutive days recurring once in 10 years. Streamflow data collected at a long-term station in the nearby Mohawk River Basin in the town of Strafford indicate the $Q_{7,10}$ from till and bedrock in this basin is 0.06 (Mgal/d)/mi^2 (Mack and Lawlor, 1992).

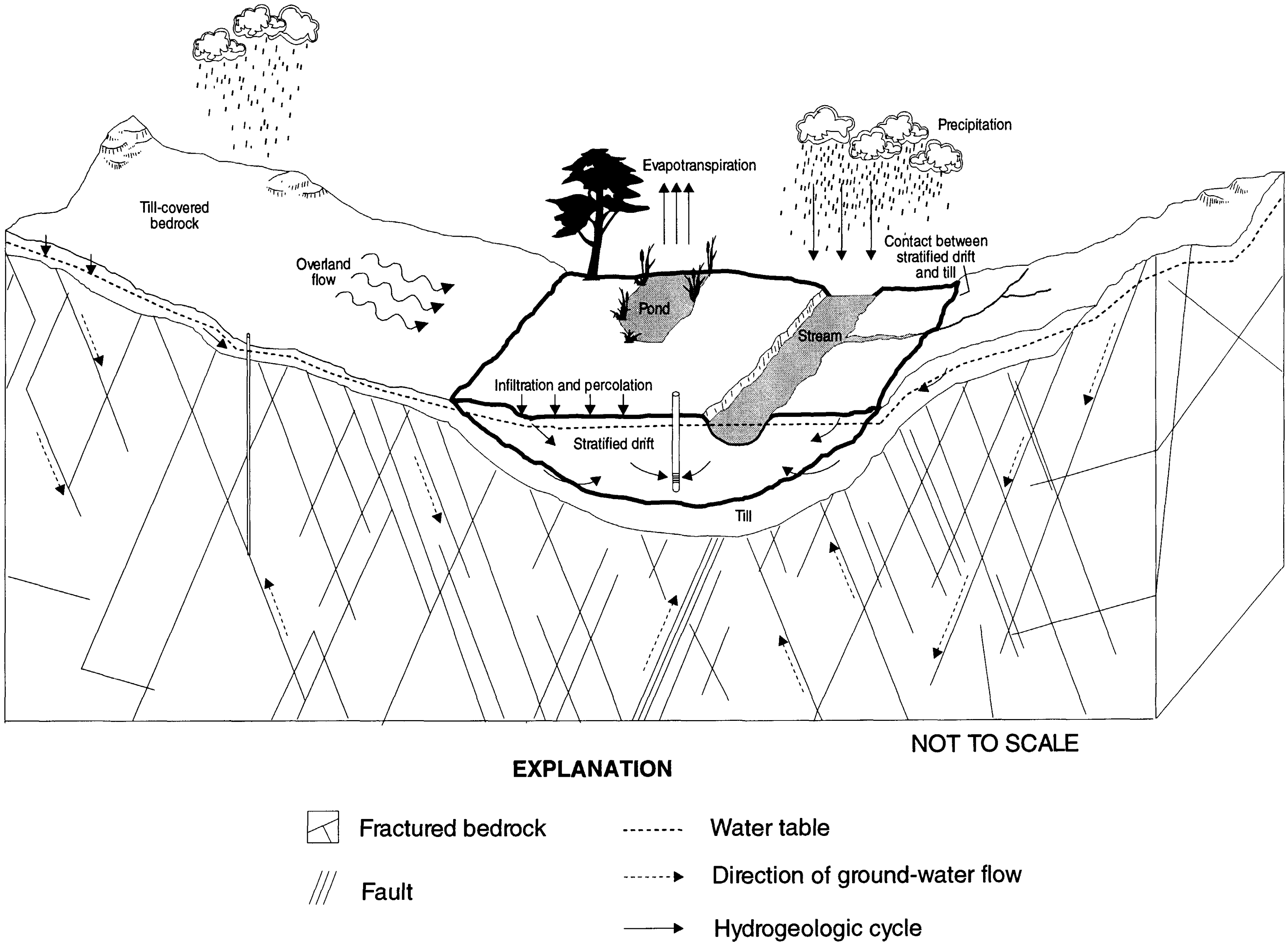


Figure 8. Idealized geohydrologic block diagram showing distribution of geologic units and ground-water flow.

This value can be used for similar till and bedrock subbasins in this study area to approximate the amount of recharge from lateral flow from adjacent upland areas by applying the rate of runoff per unit area of upland (0.06 (Mgal/d)/mi^2) to the upland areas bordering the aquifer.

Recharge from tributary seepage losses was not measured directly; however, results from several investigations indicate that rates may vary considerably depending on location within a basin and streambed characteristics (Morrissey and others, 1988). Measured tributary losses in south-central New York (Randall, 1978) were small near the margins of the main valley (average loss of 0.13 ft^3/s per 1,000 ft of channel) and increased to 1.0 ft^3/s or more per 1,000 ft of channel further downstream. Rates of seepage loss from streams can differ spatially and temporally, and upland streams can gain rather than lose water. For these reasons, determining upland recharge rates is difficult. Tributary seepage loss is common where the tributary streams flow into aquifers that have a deep water table at the stratified-drift, till, and (or) bedrock contact relative to the streambed altitude (Tepper and others, 1990).

Recharge from a surface-water body to an aquifer can be induced when sustained water withdrawal from wells that tap stratified drift lower the water table below an adjacent stream or lake. The quantity of water potentially available to an aquifer through induced recharge during dry periods is limited by streamflow and hydraulic characteristics of the stream channel. Excessive pumping near streams can result in undesirable reductions in streamflow and can perhaps dry up stream reaches during low flow.

Discharge

Natural ground-water discharge from the aquifers consists of seepage to streams and ponds and ground-water evapotranspiration. During periods of low streamflow, generally in late summer and early fall after extended periods without rainfall, streamflow consists primarily of ground-water discharge. Streamflow-gaging station 01089100, on the Soucook River in the central part of the study area (pl. 1), was used to monitor flow in the basin. On September 12, 1989, streamflow at this station was equaled or exceeded about 87 percent of the time after 6 days without precipitation, an indication that most of the water that was sustaining streams in the study area was ground-water discharge. Streamflow was measured at selected streams on September 12 and 13, 1989 (appendix D). These measurements are discussed further in the section of this report titled "Description of Selected Stratified-Drift Aquifers."

Ground-water evapotranspiration in the Northeastern United States ranges from 1 to 9 in/yr (Lyford and others, 1984) and is greatest during the growing season (April–October), when plants use large amounts of water. Large amounts of moisture are discharged to the atmosphere by evapotranspiration from wetlands and through soil where the water table is within 5 ft of the land surface. Streamflow can be reduced where such areas are extensive.

Direction of Ground-Water Flow

The direction of the horizontal component of ground-water flow in the unconfined aquifers is determined from the water-table gradient. The water-table gradient is a measure of the potential energy of a column of water; water flows from regions of high potential energy to low potential energy. Flowlines are used to indicate the path followed by water moving from recharge areas at higher elevations to discharge areas at lower elevations (pls. 1–4). Flow may have a vertical as well as a horizontal component in some localities, such as along the basin-drainage divides, in and adjacent to the fine-grained lake-bottom sediments near pumped wells, and beneath ponds and streams of the basin. Water-table gradients differed throughout the study area because of topography and hydraulic conductivity of the stratified-drift deposits. Water-table gradients in fine-grained stratified drift commonly exceeded 0.05 in areas of high topographic relief. Water-table gradients in coarse-grained stratified drift in areas of low topographic relief were less than 0.001. Potentiometric surfaces within confined aquifers (coarse-grained deposits beneath fine-grained deposits) were not contoured because of insufficient data.

Aquifer Characteristics

The geohydrology of stratified-drift aquifers shown on plates 5–8 is based partly on aquifer characteristics that include saturated thickness, storage, and hydraulic conductivity. Estimates of saturated thickness and hydraulic conductivity were used to calculate transmissivity (pls. 5–8). These characteristics, along with aquifer storage, can be used to estimate water availability in an aquifer.

Saturated Thickness and Storage

Saturated thickness of an unconfined stratified-drift aquifer is the vertical distance between the water table and the bottom of the aquifer. For some stratified-drift aquifers in this study area, upper coarse-grained deposits overlie fine-grained lacustrine deposits. Saturated thicknesses shown on plates 5–8 include these fine-grained deposits. For this report, the bottom of the stratified-drift aquifer is the till or bedrock surface. Some flow is likely between stratified drift and bedrock wherever open fractures in bedrock are in contact with the stratified drift and where hydraulic head differs between these units.

The storage coefficient of an aquifer is defined as the volume of water released from or taken into storage per unit surface area of aquifer per unit change in head (Heath, 1983). A storage coefficient value of 0.2 commonly is used for specific yield for stratified-drift aquifers in New England (Moore, 1990) and for unconsolidated deposits in other areas (Freeze and Cherry, 1979). Laboratory tests on 13 unconsolidated samples from southern New Hampshire (fine-grained lacustrine sands to coarse-grained sands and gravels) indicate that specific yields range from 0.14 to 0.34 and average 0.26 (Weigle and Kranes, 1966).

The storage coefficient for confined aquifers was not determined in this study. Typical values for confined aquifers range from 0.00005 to 0.005 (Todd, 1980). This range indicates that much less water is released from storage per unit decline in head from confined aquifers than from unconfined aquifers until pumping lowers the head in confined aquifers to the point that they are no longer confined.

Maps of saturated thickness can be used with other hydrologic data to indicate areas favorable for the placement of high-yielding wells. Where all other hydrologic characteristics are equal, a thicker aquifer will yield more water than a thinner aquifer. Where saturated thickness is less than 20 ft, stratified drift usually cannot produce large water supplies, even where the deposits are coarse grained. Thinly saturated aquifers with low yield potential are found along valley margins and in upland areas where most of the section of stratified drift is dry. An example is kame-terrace deposits high on valley walls near Franklin along the Merrimack River in the northern part of the study area. The saturated thickness is less than 20 ft in areas of stratified drift where no saturated-thickness lines are shown on plates 5–8.

Saturated-thickness maps (pls. 5–8) were prepared from seismic-refraction and seismic-reflection profiles and well and test-boring data. Saturated thicknesses exceeded 120 ft in places. The values calculated for saturated thickness include the thickness of all stratified drift regardless of grain size. Layers of clay, silt, and fine sand that overlie, underlie, or are interfingered with the coarse-grained aquifer deposits are included in the thicknesses depicted on plates 5–8. This inclusion of fine material increases values of saturated thickness in areas where glacial-lake sediments are present along the Merrimack River and associated tributaries (fig. 3).

Transmissivity and Hydraulic Conductivity

Transmissivity, a measure of the ability of an aquifer to transmit water, is calculated by multiplying the horizontal hydraulic conductivity (the volume of water at the existing kinematic viscosity that moves in unit time through a unit area of aquifer under a unit hydraulic gradient) by the saturated thickness (Heath, 1983). The transmissivity distribution in an aquifer reflects the combined effects of variations in these factors. Transmissivity of an aquifer composed of well-sorted, coarse-grained material will be much higher than for an aquifer composed of fine-grained material with the same saturated thickness. For example, although saturated thicknesses of the aquifer near Horseshoe Pond in Concord and the aquifer 1.5 mi north of the New Hampshire Route 4 traffic circle in Epsom are similar, the transmissivities of the Epsom aquifer are more than four times those of the Concord aquifer because of differences in texture (grain-size distribution).

Hydraulic conductivities were estimated from stratigraphic logs of wells and test holes for sites for which reliable logs were available. These estimates are based on an empirical relation developed by Olney (1983) derived from regression analysis of hydraulic-conductivity data. The relation expresses hydraulic conductivity (K, in feet per day) as a function of effective grain size determined from grain-size analyses (D_{10}, in phi units),

$$K = 2,100\,(10)^{-0.655 D_{10}} . \qquad (1)$$

Effective size (D_{10}) is defined as the grain-size diameter at which 10 percent of the sample consists of smaller grains and 90 percent consists of larger grains. Olney (1983) developed this relation from permeameter tests of samples of stratified drift from eastern Massachusetts.

Estimates of hydraulic conductivity for the 454 samples of stratified drift collected throughout southern New Hampshire were statistically analyzed, and the results are given in table 3. The data were divided into three arbitrary categories on the basis of the inclusive graphic standard deviation, as defined by Folk (1974, p. 46). "Well sorted, medium sorted, and poorly sorted" are relative terms used here specifically in classifying glaciofluvial sands and gravels from New Hampshire. A sample of glaciofluvial sands and gravels from New Hampshire with a standard deviation less than 1.25 units is well sorted. A sample with a standard deviation of 1.25 to 1.75 phi units is medium sorted, and a sample with a standard deviation greater than 1.75 is poorly sorted. Regression analyses were done separately for each of these three categories, where median grain size was the independent variable and estimated hydraulic conductivity was the dependent variable (Moore, 1990). Hydraulic conductivities were assigned to each interval of a stratigraphic log by applying equation 1 if grain-size analyses were available, or by carefully comparing material descriptions in the logs to values in table 3 if grain-size distribution curves were unavailable. Estimates for hydraulic conductivity were made for 33 test holes by applying equation 1 and for 438 wells on the basis of lithologic descriptions and the values in table 3. Interpretation of lithologic descriptions to determine hydraulic conductivity is more subjective and less accurate than the method based on grain-size analysis; however, correlation is good between estimates derived from descriptive logs and those derived from quantitative techniques such as specific-capacity and aquifer tests (Harte and Johnson, 1995).

Table 3. Relation of mean hydraulic conductivity to median grain size and degree of sorting of stratified drift in southern New Hampshire

[Data from Ayotte and Toppin, 1995. <, actual value is less than value shown; >, actual value is greater than value shown; --, no data]

Median grain size (phi units)	Median grain description	Well sorted (standard deviation <1.25 phi)	Moderately sorted (standard deviation 1.25 phi to 1.75 phi)	Poorly sorted (standard deviation >1.75 phi)
		Mean hydraulic conductivity (K), in feet per day[1]		
-1.75	Granules	--	320	49
-1.25	Granules	--	200	35
-.75	Very coarse sand	970	120	25
-.25	Very coarse sand	470	78	18
.25	Coarse sand	220	48	13
.75	Coarse sand	110	30	9
1.25	Medium sand	51	19	7
1.75	Medium sand	25	12	5
2.25	Fine sand	12	7	3
2.75	Fine sand	6	4	2
3.25	Very fine sand	3	3	--
3.75	Very fine sand	2	2	--

[1] Hydraulic conductivity calculated based on methods described by Olney (1983).

Transmissivity of the aquifer at each well and test well was determined by multiplying the hydraulic conductivity by the saturated thickness of the corresponding interval of the stratigraphic log and summing the results. These data were used to prepare the transmissivity maps shown on plates 5–8. For example, for a lithologic description of 20 ft of "medium sorted" coarse sand overlying 30 ft of "well sorted" fine sand overlying bedrock, the hydraulic conductivities assigned would be 39 ft/d (the average of 30 and 48 ft/d) and 9 ft/d (the average of 12 and 6 ft/d). The estimate of transmissivity, based on the same description, would be (20 ft × 39 ft/d) + (30 ft × 9 ft/d) or 1,050 ft^2/d. Specific-capacity tests and (or) aquifer tests at seven wells also were used to estimate transmissivity by the methods described by Ferris and others (1962) and Theis (1963). Although specific-capacity and aquifer tests provide the most accurate estimates of transmissivity, reliable records of such tests are available for only a few municipal or test wells.

Transmissivity can differ significantly over short distances (pls. 5–8) because of the heterogeneity of the stratified-drift aquifers. Therefore, the transmissivities shown on plates 5–8 are approximate and represent bulk regional transmissivities for aquifer subareas. In addition, hydraulic conductivity has directional properties that are not accounted for by this method of assigning hydraulic conductivity from grain sizes. Bulk transmissivities for stratified-drift aquifers in the study area range from less than 1,000 ft^2/d to more than 4,000 ft^2/d. Estimated transmissivities exceed 6,000 ft^2/d at 13 well sites in the southern half of the study area.

Estimation of Water Availability for Selected Aquifers

Aquifers where conditions seem favorable for ground-water development were evaluated by use of analytical simulations of ground-water withdrawal from wells. Water-availability estimates were based on hydraulic properties of the aquifer (transmissivity and storage coefficient), characteristics of the hypothetical withdrawal wells (percentage of saturated thickness the screen intersects, the screen radius, and the pumping duration), effects of nearby withdrawal wells, and hydraulic boundaries (either impermeable or recharge). Selected aquifers were based on the following criteria:

1. Transmissivity—area-weighted average greater than 1,500 ft^2/day.
2. Saturated thickness—greater then 40 ft.
3. Aquifer sediments—grain size suitable for installation of wells.
4. Recharge—streams or lakes capable of supplying recharge by induced infiltration.

Aquifer characteristics were determined by (1) estimating an area-weighted average transmissivity from transmissivities shown on plates 5–8, (2) assuming an average specific yield (0.2) that is reasonable for unconfined sand and gravel aquifers (Mazzaferro and others, 1979), and (3) assuming an average ratio of vertical to horizontal hydraulic conductivity of 0.1. The saturated thickness of the aquifer was determined for each hypothetical well from data on plates 5–8.

Hypothetical pumped wells were simulated with a screen radius of 1 ft and a screen length equal to 30 percent of the saturated thickness; therefore, the total available drawdown at each well is assumed to be 70 percent of saturated thickness. Simulated withdrawal wells were pumped for 180 days—the time span approximately equal to the period of maximum evapotranspiration, when recharge is minimal.

Initial discharge rates were selected for each of the hypothetical wells and were adjusted until the resulting drawdown was within 1 ft of the top of the well screen after pumping for 180 days. Drawdown in the hypothetical wells was calculated by use of the Theis equation (Theis, 1938) in combination with the method of images (Ferris and others, 1962). The total drawdown at each well was equal to the drawdown produced by six possible components: (1) drawdown resulting from discharge of that well, (2) dewatering of the aquifer, (3) partial penetration of the aquifer by the well, (4) frictional well loss caused by flow into the screen, (5) pumping of nearby wells, and (6) hydraulic boundaries.

The total drawdown at each withdrawal wells is equal to drawdown produced by six possible components: (1) aquifer and well characteristics, (2) dewatering of the aquifer, (3) partial penetration of the aquifer by the pumped well, (4) well loss caused by flow into the screen, (5) nearby pumped wells, and (6) hydraulic boundaries. Hydraulic boundaries that can be simulated with the Ferris image-well theory are line-source recharge boundaries and impermeable-barrier (no flow) boundaries. Recharge boundaries represent unlimited sources of water that may be available from surface-water bodies such as streams and lakes. Because recharge boundaries function as an unlimited source of water, they limit drawdown at the pumped well (fig. 9). Impermeable-barrier boundaries can be used to represent the contact between permeable stratified-drift aquifers and the impermeable till or bedrock. Drawdown at a pumped well is amplified near a barrier boundary because flow is not simulated across this boundary (fig. 10).

The maximum discharge rate for a pumped well is simulated in the model under the criteria that drawdowns are above the well screen. Because well screens are assumed to penetrate the lower 30 percent of saturated thickness, drawdowns are limited by the criteria that aquifer dewatering at the pumped well does not exceed 70 percent of saturated thickness. If drawdowns exceed the above criteria, the discharge is adjusted, and drawdowns are recalculated until the criteria is met.

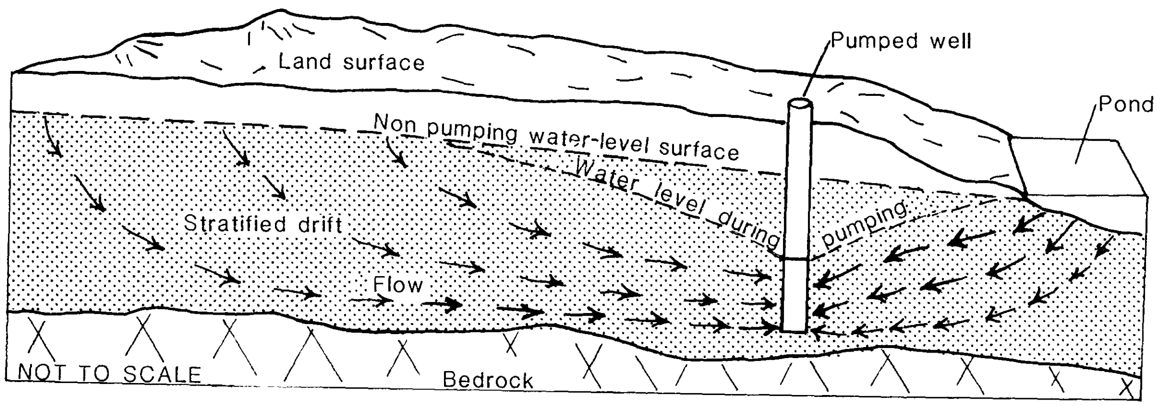


Figure 9. Ground-water flow and water-level drawdowns at a pumped well near a recharge boundary.

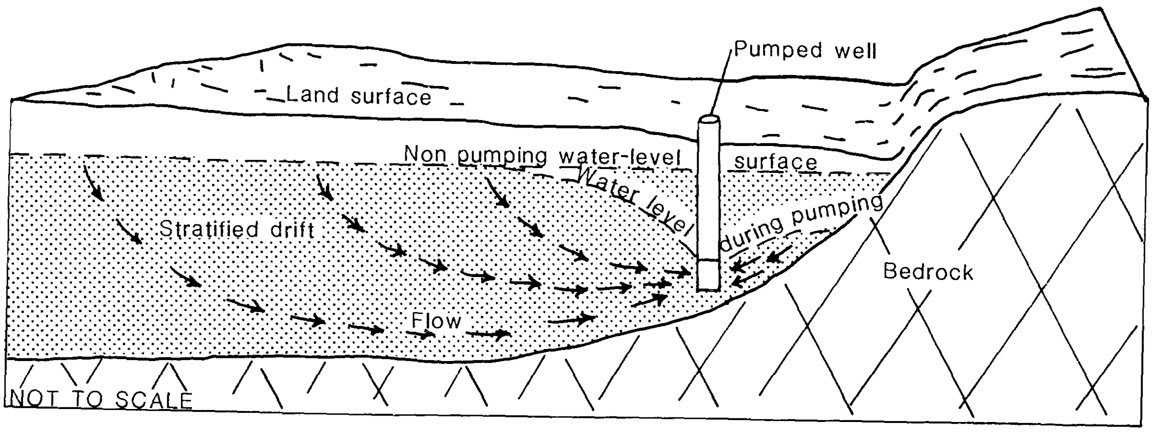


Figure 10. Ground-water flow and water-level drawdowns at a pumped well near an impermeable-barrier boundary.

For each model, hypothetical wells are distributed in the thickest, most transmissive part of the aquifer. Recharge and impermeable-barrier boundaries are idealized as vertical planes and are positioned to represent hydraulic conditions. Potential aquifer yields were estimated in two model simulations—to compare the effects of different boundary conditions and to provide a range of water-availability estimates. In the first simulation, the potential of induced infiltration from surface-water bodies is assumed to be absent. In the second simulation, the adjacent surface-water body is assumed to be a recharge boundary and to fully penetrate the aquifer. Withdrawals estimated under these two extreme conditions represents minimum and maximum long-term potential production.

Description of Selected Stratified-Drift Aquifers

Fourteen of the largest and most productive stratified-drift aquifers in the study area (fig. 3) are discussed in the following section. These aquifers, considered the most significant sources of ground-water supply in the study area, meet the following criteria: (1) they are generally composed of well-sorted sand and gravel, (2) their saturated thicknesses equal or exceed 40 ft, and (3) their areas equal or exceed 0.2 mi^2. In addition, four of the 14 aquifers were evaluated, by application of an analytical ground-water-flow model based on the Theis confined-flow equation, to determined ranges of water availability.

Bow Aquifer

The Bow aquifer, adjacent to the Merrimack River in the eastern part of Bow (fig. 3, pl. 5), is a buried valley filled with highly permeable sand, gravel, and minor silt deposited as an esker. The Bow aquifer is one of the few areas where thick coarse-grained deposits are hydraulically connected to the Merrimack River in the study area. The 3.4-square-mile aquifer trends southward from the confluence of the Soucook and Merrimack Rivers into Bow immediately north of the Public Service of New Hampshire (PSNH) powerplant. The coarse-grained deposits are bordered to the east and the west by younger, fine-grained lake-bottom deposits associated with glacial Lake Hooksett (Koteff and others, 1984). The aquifer is thickest and transmissivity is greatest within a narrow bedrock channel. The north end of the channel begins at about 0.6 mi southwest of the confluence of the Merrimack and Soucook Rivers. Results from Bow seismic line b-b' (appendix C1) indicate that thickness of saturated coarse sand and gravel exceeds 90 ft in places. Results from a 10-day aquifer test on PSNH supply well BUW-11 indicate a transmissivity of about 6,500 ft^2/d. The aquifer underlies many year-round residences and commercial and industrial businesses.

Neither a central water system nor a central sewer system has been built within the area. Each home and business maintains a private, onsite water well and a septic system. The collective effect of these land uses on ground-water quality has not been evaluated and is a central issue in determining whether this aquifer can be developed for public water supply. However, developing the aquifer for industrial water supply is probable.

The aquifer configuration and sediments along the southern part of the aquifer-Merrimack River boundary were investigated by use of seismic reflection. One seismic-reflection profile (fig. 4 and pl. 1) shows an irregular bedrock surface for a south-to-north traverse across the outlet of the Suncook River. The outlet is part of a delta consisting of well-sorted sand and minor gravel interfingered with fine sand and silt of glacial-lake origin. During deglaciation, meltwater streams flowed in the Suncook River Valley and carried sediments from the glacier and uplands into glacial Lake Hooksett. These stratified sediments differ from the stratified drift in the bedrock channel to the north. They tend to be better sorted and finer in texture (fine to medium sand and minor gravel) than the coarser ice-contact deposits in the narrow channel north of the PSNH powerplant. The seismic-reflection profile indicates that bedrock depths range from 30 to 80 ft below the river surface at the outlet. Fine-grained stratified-drift deposits predominate, as shown by the laminar bedded and layered appearance of the sediments above the bedrock surface.

The quantity of ground water potentially available from the most transmissive part of the Bow aquifer along the main stem of the Merrimack River was evaluated on the basis of an analytical model (fig. 11).

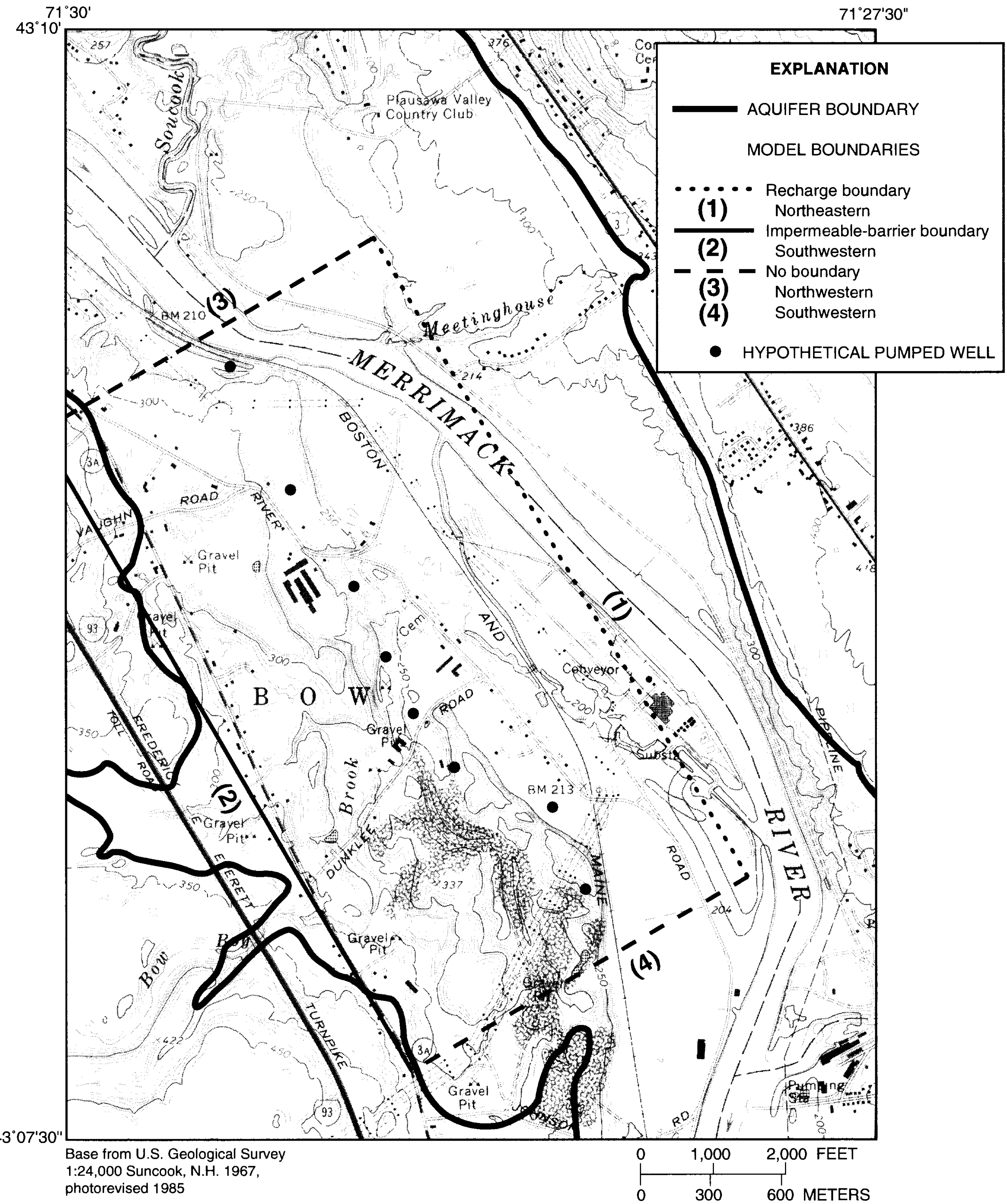


Figure 11. Locations of analytical model boundaries and hypothetical wells for water-availability estimates of the Bow aquifer, south-central New Hampshire.

The analytical model covers 2.0 mi^2. Two simulations were done to evaluate effects of boundary changes on water availability.

The model is oriented with the predominant valley trend. A recharge boundary corresponds to the Merrimack River along the northeast side of the model (fig. 11). The till-bedrock contact forms an impermeable-barrier boundary along the southwest side (fig. 11). The northwest and southeast sides represent continuations of the aquifer and were simulated as open or infinite (fig. 11). Where no boundaries are used, drawdowns were assumed to persist indefinitely in that direction until equilibrium was reached without interference from hydraulic boundaries (Harte and Johnson, 1995).

For the most conservative water-availability estimate, the northeast side, as well as the southwestern side, were simulated as impermeable-barrier boundaries. This means that any possible recharge potential from the Merrimack River was not simulated. When an impermeable-barrier boundary is simulated, no recharge is available; therefore, drawdowns are greater than if the boundary was simulated as recharge or open.

In the second model simulation, the water-availability estimate was optimized by simulating the northeast side as a recharge boundary. This allowed induced infiltration from the Merrimack River to increase aquifer yield. The northwest and southeast sides remained open.

Eight hypothetical pumped wells were simulated at a spacing of about 1,000 to 2,000 ft. The hypothetical wells were aligned in the same orientation as that of the model and the axis of the buried valley. Each hypothetical well was assigned a saturated thickness estimated from plate 7 or from a well log near the hypothetical-well position in the model area.

A transmissivity of 2,400 ft^2/d, which is the area-weighted transmissivity of the model area, was assigned to the aquifer at the location of the eight hypothetical wells. Calculation of this area-weighted average was based on ranges of transmissivity from plate 5 and percentages of the model area to which those ranges apply (Flanagan, 1996).

Water availability simulated in the analytical model ranged from 1.6 to 1.9 Mgal/d. A yield of 1.9 Mgal/d is probable if gravel-packed production wells are installed in the coarse esker deposits of the Bow aquifer and sited within a few hundred feet of the Merrimack River to induce recharge from the river. Streamflow of the Merrimack River is measured downstream of the study area by the USGS at Goffs Falls, in Manchester, New Hampshire (station 01092000; Toppin and others, 1992). The 7-day, 10-year estimate of low streamflow ($Q_{7,10}$) can be used as a measure of the amount of induced recharge available during dry periods. For the period 1938-92, the ($Q_{7,10}$) was 7 Mgal/d or 650 ft^3/s (Kenneth W. Toppin, U.S. Geological Survey, written commun., 1995). Therefore, 1.9 Mgal/d, the maximum yield simulated in the model, probably could be withdrawn from the Bow aquifer without affecting the river, although it is uncertain how much of this amount could be captured by way of induced infiltration.

Lower Soucook River Aquifer

The lower Soucook River aquifer is at the south end of a long, continuous, valley-fill deposit of sand and gravel that extends from Gilmanton to Concord along the mainstem of the Soucook River (fig. 3, pls. 5 and 8). The saturated thickness of this 2.4-square-mile aquifer exceeds 100 ft in the deeper sections near the Concord-Pembroke town line (fig. 12). Seismic-refraction data (Pembroke line b-b', appendix C11) indicate that part of the aquifer fills a bedrock channel scoured by glacial ice about 500 ft east of the current (1995) course of the Soucook River. Saturated thickness in the channel ranges from 25 to 130 ft. The aquifer thins to the east towards New Hampshire Route 106. Data from USGS test well PBW-34 and boring PBA-2 indicate that saturated thickness of the highly permeable coarse sand and gravel deposits exceed 65 ft and overlie about 20 to 30 ft of fine sand and silt. The aquifer is drained by the Soucook River; streamflow was 16.8 ft^3/s (10.9 Mgal/d) on September 12, 1989, at site 17 (appendix D, pl. 1). Streamflow was measured at site 17 during the pumping of two gravel-packed municipal wells (PBW-32, 33), which are owned by the town of Pembroke. These two wells are within 100 ft of the river and less than 1 mi north of site 17. The combined maximum yield for the two wells is 1.6 Mgal/d (Maurice Lavoie, Town of Pembroke, oral commun., 1992). Despite withdrawal from the Pembroke well field, the Soucook River maintained a

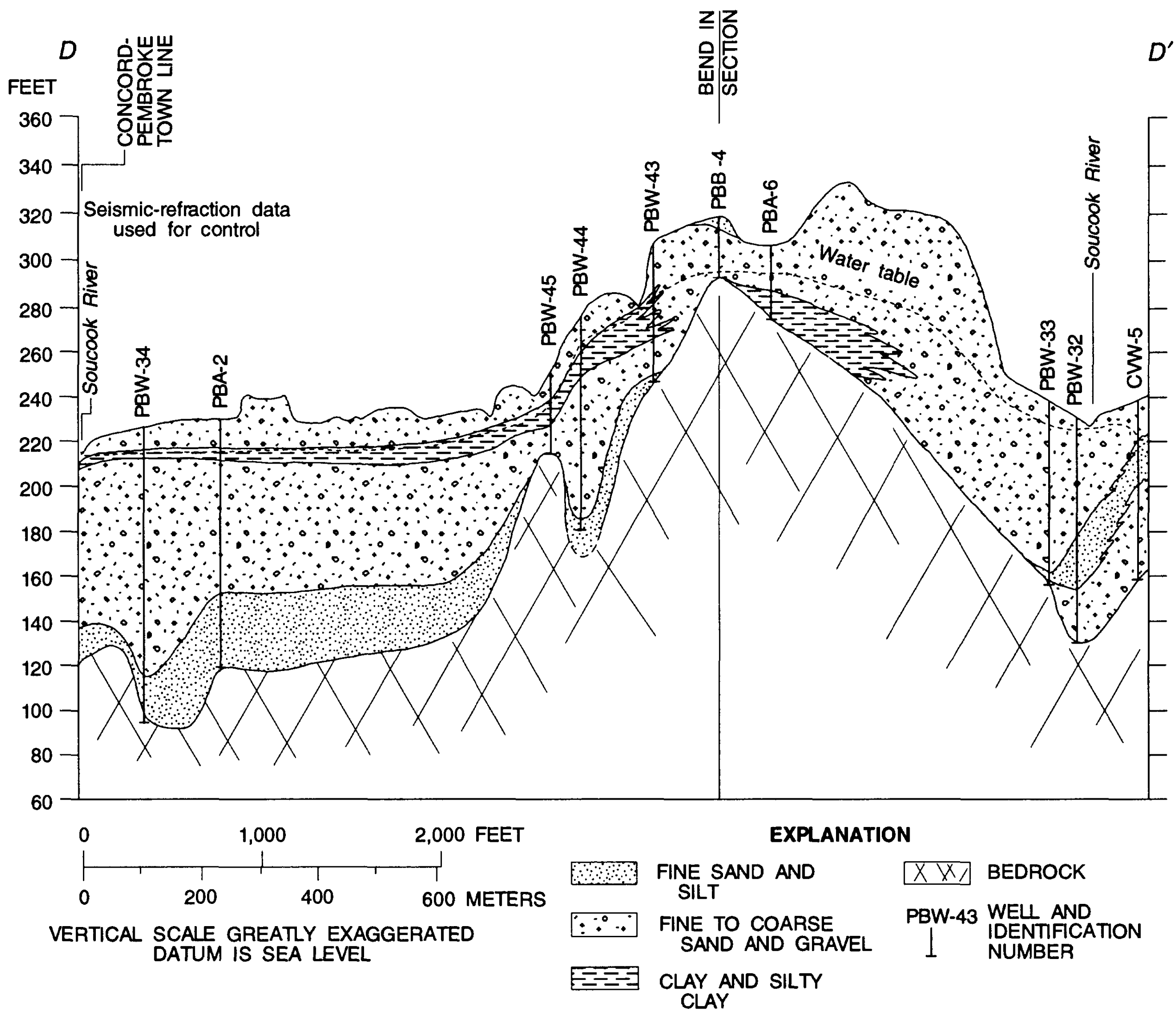


Figure 12. Geohydrologic section *D-D′* showing a bedrock channel in the lower Soucook River aquifer, south-central New Hampshire. (Line of section shown on plate 1.)

discharge of 0.12 (Mgal/d)/mi^2, which is equivalent to base flow per unit square mile measured upstream at sites 14 and 16 and downstream at site 18 (appendix D).Given that the streamflow is generally unaffected by current levels of withdrawal, additional water is probably available from this aquifer for future ground-water development.

A 0.4-square-mile area of the lower Soucook River aquifer, near the junction of New Hampshire Route 106 and Route 3 in Pembroke, was simulated to determine ranges of water availability (fig. 13). The model is oriented with the predominant valley trend. A recharge boundary corresponds to the Soucook River along the northwest side of the model area (fig. 13). Northeast, southeast, and southwest boundaries correspond to continuations of the stratified-drift aquifer and were simulated as open or infinite boundaries (fig. 13).

In one model simulation, the northwest side of the model area was treated as an impermeable-barrier boundary, which meant that any possible recharge potential from the Soucook River was not simulated.

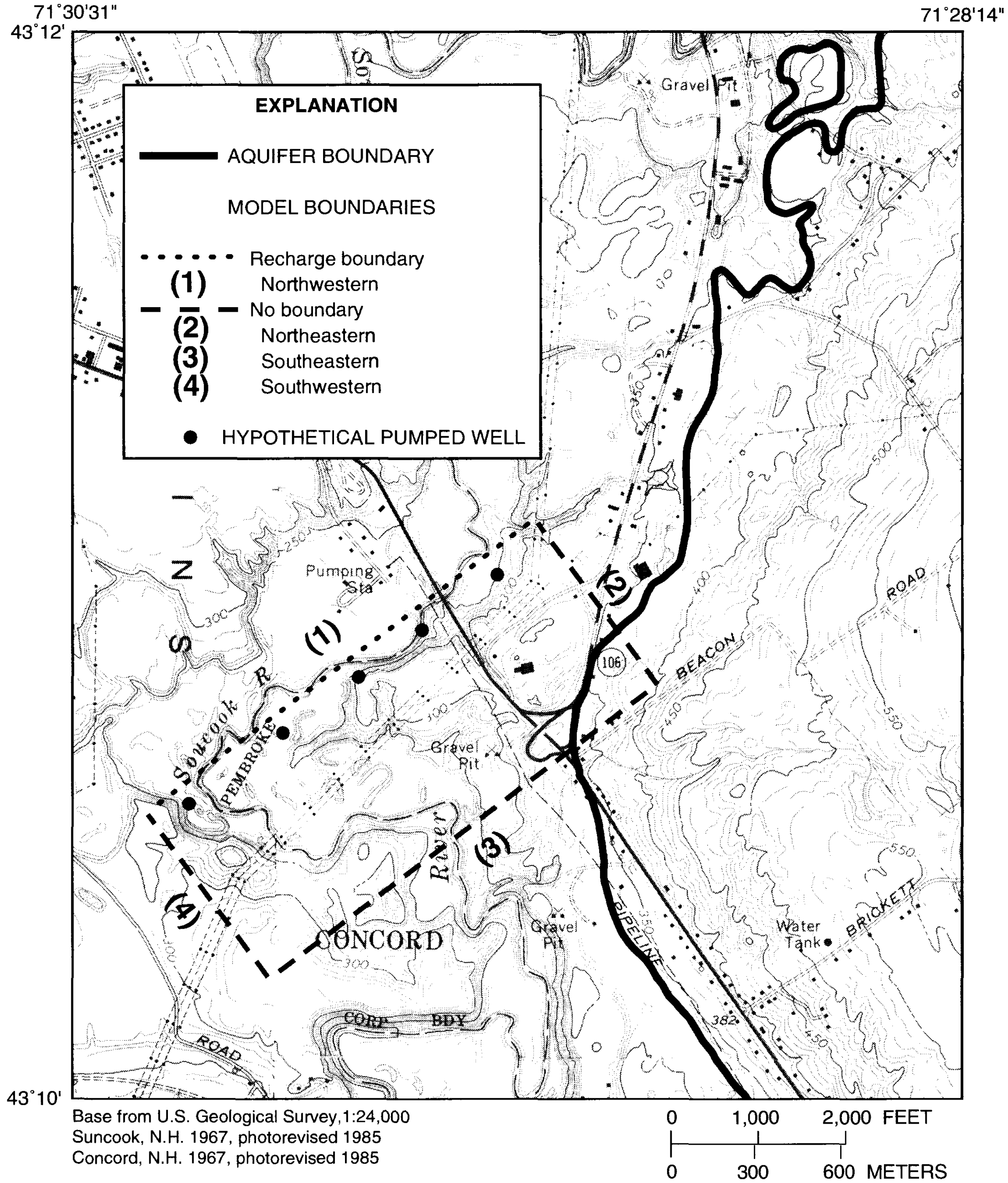


Figure 13. Locations of analytical model boundaries and hypothetical wells for water-availability estimates of the lower Soucook River aquifer, south-central New Hampshire.

The northeast, southeast, and southwest sides were open. The most conservative water-availability estimate was simulated in this model.

In the second model simulation, the water-availability estimate was optimized by simulating the northwest side as a recharge boundary. This allowed induced infiltration from the Soucook River to increase aquifer yield. The northeast, southeast, and southwest sides remained open.

Six hypothetical wells were simulated in the most transmissive parts of the aquifer at a spacing of 1,000 ft (fig. 13). Each hypothetical well was assigned a saturated thickness from plates 5 or 8 or from a well log near the well position in the model area. For example, one of the hypothetical wells was placed in the same location as Pembroke municipal wells PBW-32 and 33 and was assigned the same saturated thickness as found near these wells. The six hypothetical wells were assigned the area-weighted average transmissivity of the model area, which was calculated at 3,300 ft^2/d.

Water availability simulated in the analytical model ranged from 1.5 to 2.8 Mgal/d. Currently (1995), Pembroke municipal wells PBW-32 and PBW-33 withdraw a maximum of 1.6 Mgal/d from the aquifer. Therefore, as much as 1.2 Mgal/d may be available for additional development, depending on the amount of recharge that can be induced from the Soucook River.

Lower Suncook River Aquifer

The lower Suncook River aquifer in east Pembroke (fig. 3, pl. 6) contains coarse-grained deltaic deposits overlying fine-grained lake-bottom deposits. The delta formed as glacial meltwater deposited sediments into the basin of glacial Lake Hooksett, now occupied by the Suncook River, south of Bear Brook State Park. Average saturated thickness and transmissivity of the 0.9-square-mile aquifer are 33 ft and 1,900 ft^2/d. The thickest, most transmissive deposits are in the flood plain immediately west of the Suncook River. Transmissivity is much less, however, in areas where clay and silty clay (as much as 36 ft in thickness) interfinger with or underlie coarse-grained sand and gravel deposits (fig. 14). East of the Suncook River, near New Hampshire Route 28, the aquifer consists predominantly of coarse sand and gravel deposits and saturated thickness is less than 20 ft. Four test wells (PBW-41 and PBW-42, AFW 22 and AFW-23; appendix A) were drilled as part of a ground-water exploration program for Pembroke and were screened in the confined part of the aquifer beneath the glacial-lake silt and clay deposits (fig. 14).

Concord Plains Aquifer

The Concord Plains aquifer in Concord is at the confluence of Frenchs Brook and the Soucook River and east of the junction of New Hampshire Route 106 and Pembroke Road (fig. 3, pl. 5). The 1.9-square-mile aquifer is most transmissive at the outlet of Frenchs Brook where transmissivity exceeds 4,000 ft^2/d (pl. 5). The aquifer is part of a deposit consisting of coarse sand and gravel that filled the Soucook River Valley and terminates in a large delta in the Concord Heights area. The delta forms the western edge of the aquifer and is the most prominent stratified-drift landform in Concord. The delta is one of a series in the Merrimack River Valley that progrades and overlies fine-grained lake-bottom deposits that formed in glacial Lake Hooksett (fig. 15). Although saturated thickness exceeds 70 ft in the deltaic deposits, transmissivity generally is lower than in deposits mapped to the east in the Soucook River. Four municipal wells (PBW49–52; appendix A) used by the city of Concord are in the aquifer on the Pembroke (east) side of the Soucook River and yield 1.0 Mgal/d (John Forrestall, City of Concord, oral commun., 1991). The municipal wells are in the most transmissive section of the aquifer in an area drained by the Soucook River and Frenchs Brook.

Taylor State Forest Aquifer

The Taylor State Forest aquifer in east Concord (fig. 3, pl. 5) is in a narrow valley of the Soucook River and is bounded by steeply rising bedrock covered with till to the east and west. The aquifer is part of a long, continuous stratified-drift deposit centered in the Soucook River Valley. Average saturated thickness of the aquifer is about 35 ft; maximum saturated thickness (51 ft) is in the center of the valley at the Soucook River channel. The area of maximum transmissivity (4,000–5,000 ft^2/d) is just south of U.S. Route 393 in an area of numerous eskers and collapsed outwash consisting of coarse-grained sand and gravel. Based on low streamflow measurements of the Soucook River in September 1989 (site 14, appendix D), ground-water discharge was about 13.2 ft^3/s (8.5 Mgal/d).

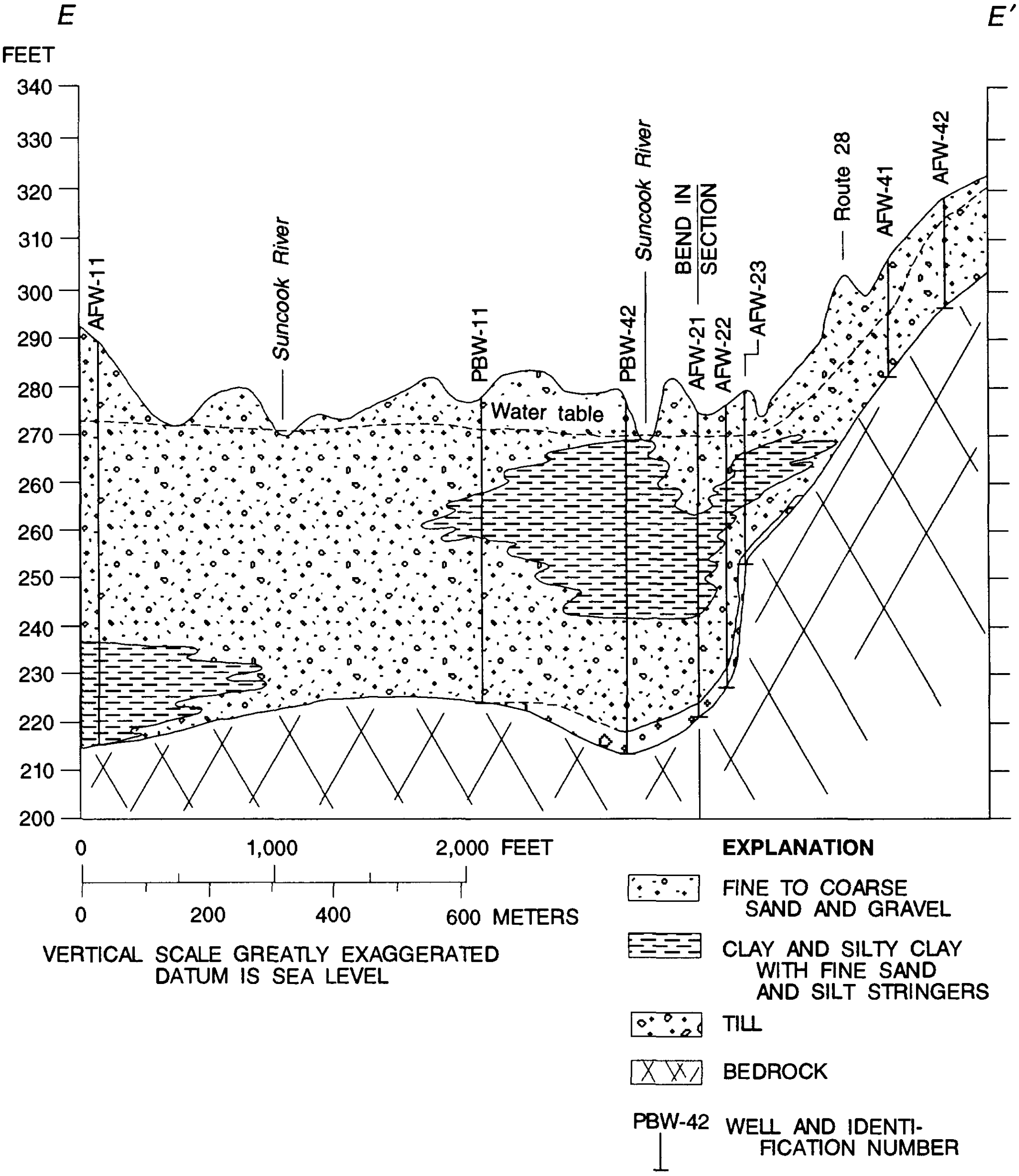


Figure 14. Geohydrologic section *E-E'* of the lower Suncook River aquifer in Pembroke and Allenstown, south-central New Hampshire. (Line of section shown on plate 2.)

Bear Brook Aquifer

The Bear Brook aquifer, at the confluence of Bear Brook and the Suncook River, originates in Epsom in a narrow valley that widens to the south in Allenstown. The 1.7-square-mile aquifer extends eastward from the Suncook River into a low, broad basin drained by Bear Brook (fig. 3, pl. 6).

The stratified sediments consist predominantly of fine sand, silt, and clay lake-bottom deposits. Maximum saturated thickness (81 ft) and transmissivity (9,300 ft^2/d) are within a bedrock channel that extends under the present course of the Suncook River. Seismic line Allenstown a-a' (appendix C1) indicates that saturated thickness is 65 ft at the Suncook River and

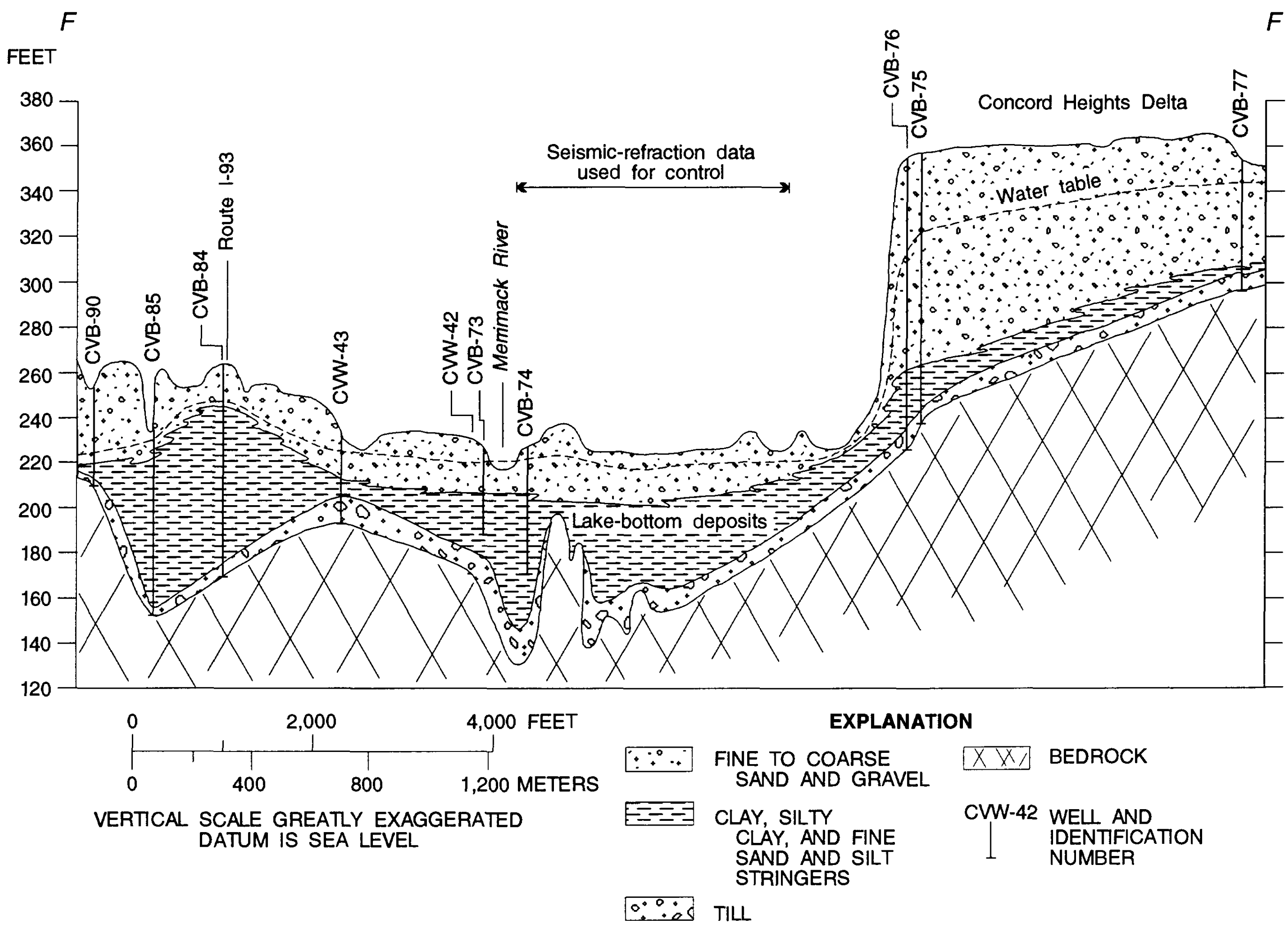


Figure 15. Geohydrologic section *F-F′* showing Concord Heights delta and lake-bottom deposits that formed in Glacial Lake Hooksett, south-central New Hampshire. (Line of section is shown on plate 1.)

decreases to a minimum of 19 ft east of the river. The sediments in the bedrock channel consist predominantly of permeable coarse-grained sand and gravel deposits. Two municipal wells owned by the town of Pembroke (AFW-8 and AFW-9) are in the most transmissive part of the aquifer and yield a maximum 0.9 Mgal/d (pl. 2).

Suncook River and Round Pond Aquifer

The Suncook River and Round Pond aquifer in Epsom (fig. 3, pl. 6) is bounded to the north and south by relatively impermeable very fine sand, silt and clay lake-bottom deposits. The total aquifer area that receives direct recharge from precipitation is about at 1.5 mi^2. A deep bedrock channel extends south from Bear Island and contains as much as 65 ft of saturated medium to coarse-grained sand and gravel deposits overlying thick, fine-grained sand and silt deposits. The saturated thickness in the bedrock channel is greater than 120 ft in places. Deposits outside the channel typically are fine grained. The channel trends northeast to southwest, beginning just east of the southern tip of Bear Island and extending 1.3 mi to the southwest. One gravel-packed municipal well (ESW-2) 200 ft north of Round Pond yields a maximum 0.35 Mgal/d for the town of Epsom (pl. 2, appendix A).

Upper Suncook River Aquifer

The upper Suncook River aquifer, largely in the northwestern part of the town of Epsom and partly in the town of Chichester (fig. 3, pls. 6 and 7), is composed of a heterogeneous mix of coarse sand and gravel deposits interfingered with and underlain by fine-grained lake-bottom deposits. Numerous discontinuous beds of clay and silt are present throughout the 1.1-square-mile aquifer. Several oxbows in the Suncook River flood plain are remnants of the postglacial meanderings of the Suncook River. The streambanks expose a highly varied stratigraphy of recent alluvium, lake-bottom clay, and stratified-drift deposits. Test drilling in the aquifer area by the USGS indicates that aquifer sediments are similar in composition. USGS observation well ESW-7 penetrated alternating layers of coarse-grained and fine-grained stratified-drift deposits (appendix B). The saturated thickness is about 40 ft throughout much of the aquifer and about 60 ft in the center. Estimates of transmissivity exceed 2,000 ft^2/d in the deep central zone.

A 0.3-square-mile area of the upper Suncook River aquifer was simulated to determine ranges of water availability (fig. 16). A recharge boundary corresponds to the Soucook River along the southwest side of the model area (fig. 16). The northeast and southeast sides are defined by a till-bedrock contact and thinly saturated coarse-grained stratified drift and were simulated as impermeable-barrier boundaries (fig. 16). The northwest side corresponds to continuation of the stratified-drift aquifer and was simulated as an open boundary (fig. 16).

In one model simulation, the southwest side of the model area was treated as an impermeable-barrier boundary to provide the most conservative water-availability estimate. In the second model simulation, the water-availability estimate was optimized by treating the southwest side as a recharge boundary, which allowed induced infiltration from the Soucook River to increase aquifer yield (fig. 16). Five hypothetical wells were simulated in the most transmissive parts of the aquifer at a spacing of about 1,000 ft apart (fig. 16). An area-weighted average transmissivity of 2,300 ft^2/d was assigned at the locations of the hypothetical wells.

Water availability simulated in the analytical model ranged from 0.7 to 1.0 Mgal/d. Analysis of water availability indicates that 1.0 Mgal is potentially available, depending upon annual and seasonal variations in ground-water recharge and storage.

Crystal Lake Aquifer

The Crystal Lake aquifer in Gilmanton is a large head of outwash covering an area of 0.7 mi^2 (fig. 3, pl. 7). The saturated thickness exceeds 100 ft in the center of the aquifer. Results of test drilling indicate as much as 30 ft of coarse-grained orange-brown, iron-stained sand and gravel overlie as much as 70 ft of gray-brown fine-grained lake-bottom deposits. Average transmissivity for this aquifer is 3,500 ft^2/d. The Suncook River and Crystal Lake are in hydraulic connection with the aquifer. These surface-water bodies could provide induced infiltration to future development of the aquifer.

Sondogardy Pond Aquifer

The Sondogardy Pond aquifer (fig. 3, pl. 8) is a narrow valley-fill deposit that covers 0.3 mi^2 and originates from a head of outwash at Sondogardy Pond in Northfield and grades southward into a delta that slopes to the Merrimack River Valley in Canterbury. The aquifer is composed of sand and gravel deposited by melting ice that was temporarily held at the site of present-day Sondogardy Pond. Deposits tend to be coarse grained near the head of outwash and more fine grained and well sorted to the south, toward the delta. Saturated thickness in this aquifer averages 40 ft, and transmissivity of the coarse-grained deposits average about 2,000 ft^2/d (pl. 8). The thickest and most transmissive aquifer section is about half a mile south of the Northfield-Canterbury town line, near Intervale Road. Lithologic data from USGS well CEW-1 and seismic line Canterbury b-b' (appendix C2; pl. 4) indicate a maximum saturated thickness of 80 ft and a maximum transmissivity of 5,000 ft^2/d.

Boscawen Aquifer

The Boscawen aquifer is adjacent to the Merrimack River near the Boscawen–Franklin town line and New Hampshire Route 3. The aquifer consists of coarse-grained ice-contact esker deposits confined beneath and surrounded by silt and fine-sand lacustrine deposits. The aquifer covers only about 0.1 mi^2 but is hydraulically connected to the Merrimack River.

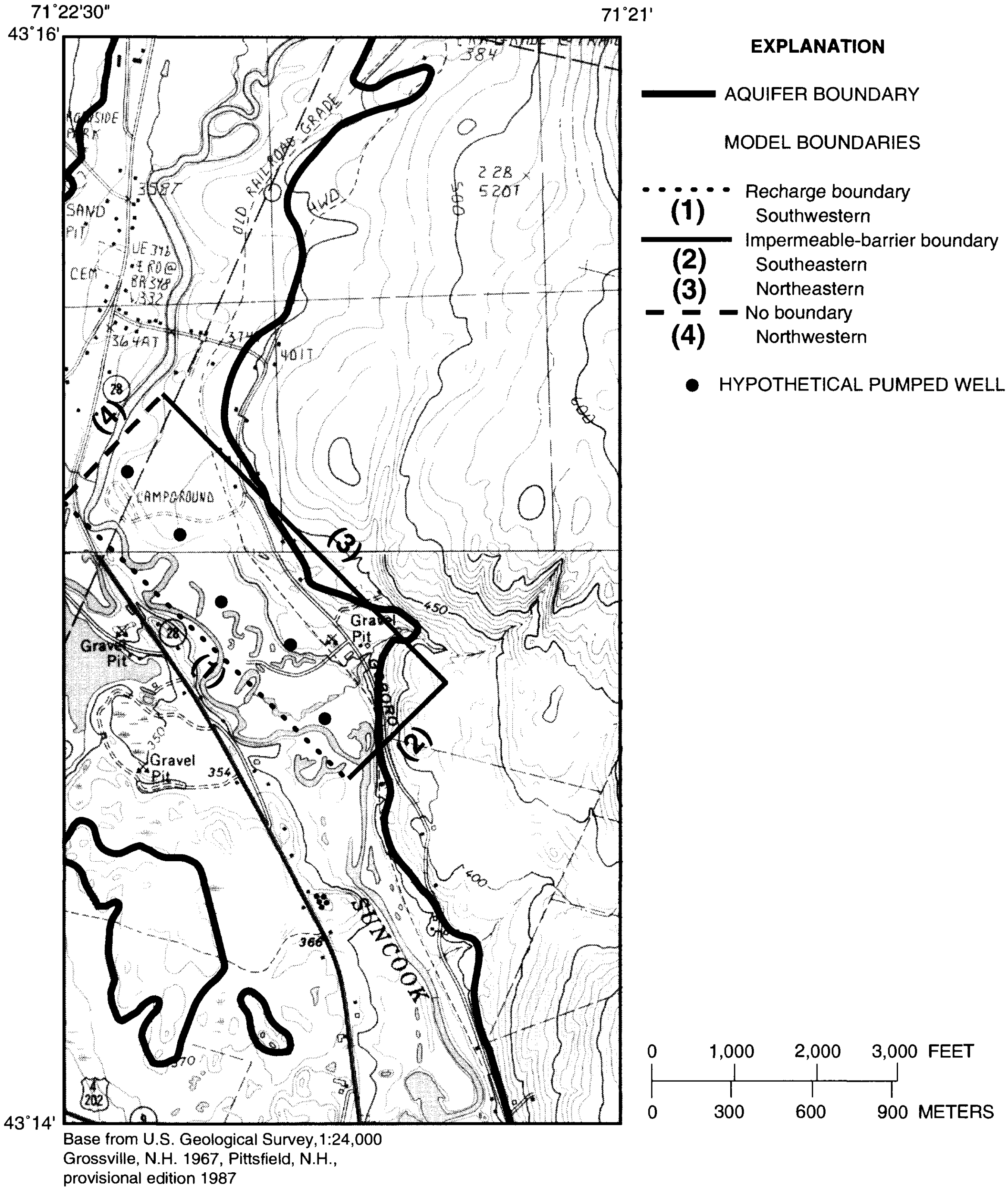


Figure 16. Locations of analytical model boundaries and hypothetical wells for water-availability estimates of the upper Suncook River aquifer, south-central New Hampshire.

Test drilling in the aquifer area indicates that saturated thickness of the coarse-grained esker deposits averages 30 ft. Transmissivity calculated from aquifer-test data for municipal well BTW-7 ranges from 5,000 to 9,500 ft^2/d, and the hydraulic conductivity averages 200 ft/d (D.L. Maher Co., written commun., 1995). The aquifer is currently (1996) used by the Boscawen–Penacook Water Precinct for municipal water supply. Boscawen municipal wells BTW-7 and BTW-8 each yield 450 gal/min (D.L. Maher Co., written commun., 1995).

Soucook River and Giddis Brook Aquifer

The Soucook River and Giddis Brook aquifer is in the southern part of Loudon and is part of a continuous stratified-drift deposit that originates at Rocky Pond in Gilmanton (fig. 3, pl. 8). Saturated thickness in this aquifer is highly variable, ranging from near zero where bedrock crops out in the Soucook River to a maximum of about 74 ft at seismic line Loudon a-a' (appendix C6, pl. 4) 1,500 ft to the north. The lithologic log for USGS well LSW-9 indicates 56 ft of saturated coarse sand and gravel overlying 15 ft of fine sand over till. Maximum transmissivity of this aquifer section is about 5,000 ft^2/d. Low streamflow measurements made on the Soucook River at sites 9 and 13 (appendix D) on September 12, 1989, indicate an approximate increase in streamflow of 1.5 ft^3/s (1.0 Mgal/d) along a 1.9-mile reach of the river. These flow measurements can be used to estimate water availability of the aquifer.

Loudon Aquifer

The Loudon aquifer north of Loudon town center underlies an area of about 1.3 mi^2 (fig. 3; pl. 8). Eskers composed of coarse-grained sand and gravel are subparallel to the Soucook River and comprise the most permeable aquifer material. Saturated thickness in this aquifer exceeds 60 ft in places and averages 40 ft (pl. 8). The deepest sections of a bedrock channel generally coincide with the course of the present-day Soucook River. Transmissivity of the coarse-grained sediments is greater than 4,500 ft^2/d in a small section of the southern part of the aquifer, and averages about 2,500 ft^2/d.

A 0.8-square-mile area of the Loudon aquifer was simulated to determine ranges of water availability (fig. 17). A recharge boundary corresponds to the Soucook River along the eastern side of the model area. The western side is defined by a till-bedrock contact and thinly saturated stratified drift and was simulated as in impermeable-barrier boundary (fig. 17). The north and south sides correspond to continuations of the stratified-drift aquifer and were simulated as open boundaries (fig. 17).

In one model simulation, the eastern side of the model area was treated as a impermeable-barrier boundary to provide the most conservative water-availability estimate. In the second model simulation, the water-availability estimate was optimized by treating the east side as a recharge boundary, which allowed induced infiltration from the Soucook River to increase aquifer yield (fig. 17). Eight hypothetical wells were simulated in the deepest part of the aquifer that underlies the river at a spacing of about 1,000 ft (fig. 17). An area-weighted average transmissivity of 1,600 ft^2/d was assigned at the locations of the hypothetical wells. Water availability simulated in the analytical model ranges from 0.9 to 1.0 Mgal/d. Analyses of aquifer yield indicate that the primary limitation on water availability is the amount of induced infiltration from the Soucook River and available drawdown in the aquifer.

Pearls Corner Aquifer

The Pearls Corner aquifer (0.9 mi^2) occupies a narrow valley south of the headwaters of the Soucook River in the northwestern part of Loudon (fig. 3; pl. 8). The most permeable sections consists of numerous kame and esker deposits composed of coarse sand and gravel. The saturated thickness of these ice-contact deposits thins to 20 ft or less about 1.5 mi north of Pearl's Corner along New Hampshire Route 106. Transmissivity and ground-water-development potential is greatest in two areas: (1) the confluence of the Soucook River and Gues Meadow Brook, where saturated thickness of fine to medium sand and gravel exceeds 50 ft in places (seismic line Loudon j-j', appendix C9; pl. 4) and transmissivity is about 3,000 ft^2/d and (2) 0.75 mi south of Pearls Corner and 1.5 mi northwest of Clough Hill, where the saturated thickness of the aquifer exceeds 80 ft (seismic line Loudon i-i', appendix C9; pl. 4) and transmissivity is about 4,000 ft^2/d.

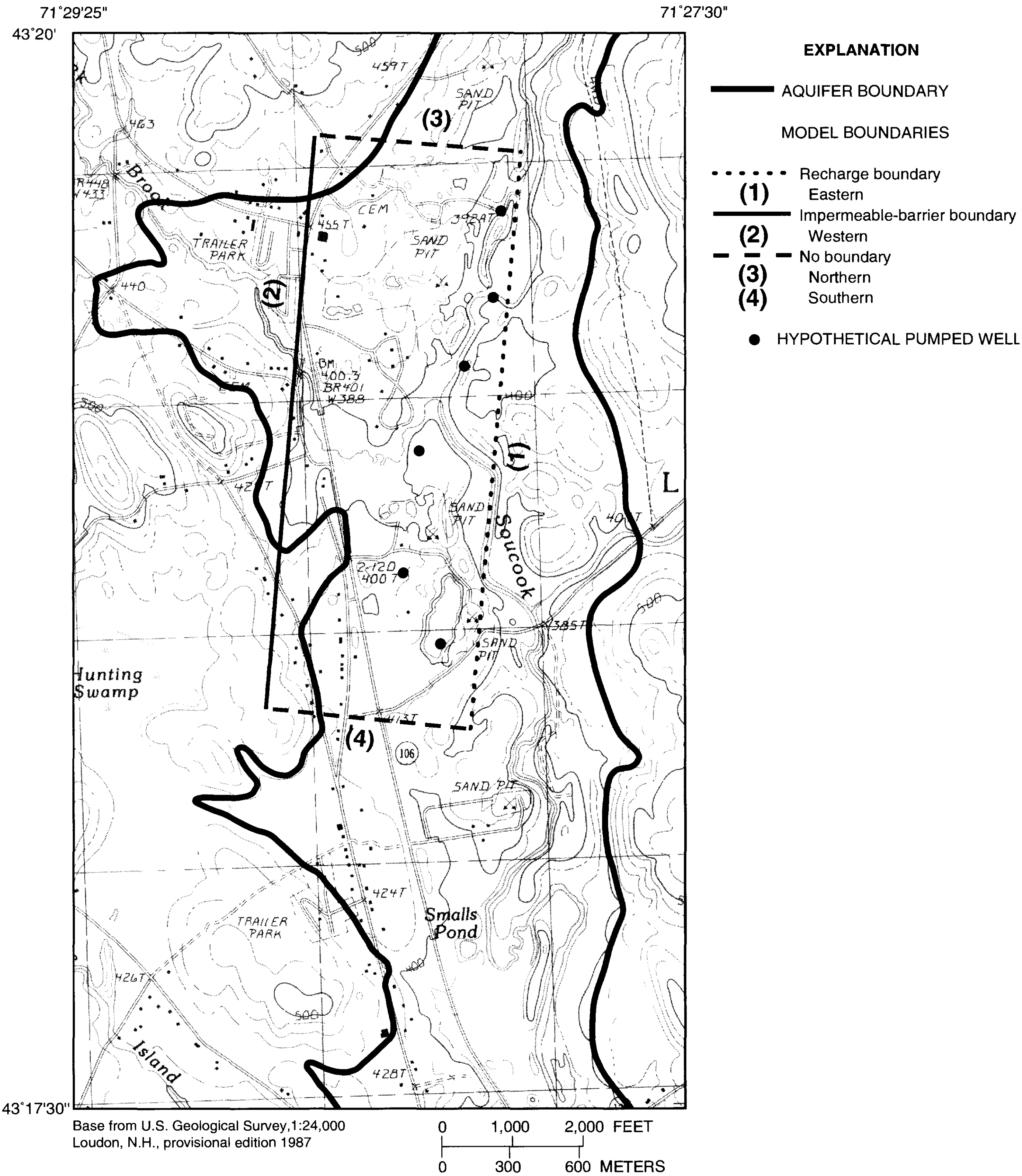


Figure 17. Locations of analytical model boundaries and hypothetical wells for the water-availability estimates of the Loudon aquifer, south-central New Hampshire.

GROUND-WATER QUALITY

Ground-water samples collected during August 1990 from six USGS observation wells screened in stratified drift were analyzed for inorganic and organic constituents (pls. 1–4). Samples were collected at wells where the water quality is most likely to reflect ambient conditions; areas of known ground water contamination were avoided.

All water samples were analyzed by the USGS National Water Quality Laboratory (NWQL) in Arvada, Colo. Samples were collected and analyzed according to procedures described by Fishman and Friedman (1989). All the sampled wells were developed either with compressed air or with a centrifugal pump to remove water introduced during drilling, to flush out foreign material and sediment, and to improve the hydraulic connection with the aquifer. Samples were collected for water-quality analysis no less than 1 month after well development. Wells were pumped until at least three times the volume of water in the well had been evacuated and until the temperature, specific conductance, and dissolved oxygen concentration had stabilized. These procedures ensured that samples were derived from the aquifer and not from the stagnant water in the well casing.

Results of the chemical analyses are summarized, along with the U.S. Environmental Protection Agency (1992) primary and secondary drinking-water regulations and the New Hampshire Department of Environmental Services, Water Supply Engineering Bureau (1990) drinking-water regulations, in table 4. Water from the six wells is generally suitable for drinking and other domestic uses except as follows:

1. Manganese concentrations in water from five wells exceeded the USEPA Secondary Maximum Contaminant Level[1] (SMCL) of 50 µg/L.
2. Iron concentrations in water from two wells exceeded the USEPA SMCL of 300 µg/L.
3. The sodium concentrations in water from one well exceeded the USEPA health advisory level of 20 mg/L.

Individual constituents and properties are discussed in the following paragraphs.

The pH of water is a measure of the hydrogen ion concentration in the water. On the pH scale, 7 is neutral, less than 7 is acidic, and greater than 7 is alkaline. The pH of most ground water in the United States ranges from 6.0 to 8.5 (Hem, 1985). The field-measured pH of the six water samples ranged from 5.4 to 6.2; the median was 6.1. The least acidic ground-water sample (pH 6.2) was from well PBW-34 in the town of Pembroke, and the most acidic sample (pH 5.4) was from well GLW-2 in the town of Gilmanton. At a pH less than 6.5, some metals in metallic piping can dissolve, and a metallic taste can be imparted to the water (U.S. Environmental Protection Agency, 1989).

The alkalinity of a solution is defined as the capacity for solutes in water to react with and neutralize acid (Hem, 1985). It is commonly known as an indicator of buffering capacity—the capacity of water to resist changes in pH upon addition of an acid. The buffering capacity of water from stratified-drift aquifers in New Hampshire is generally low. Alkalinity of six water samples ranged from 3 mg/L (as $CaCO_3$) at well GLW-2 to 25 mg/L (as $CaCO_3$) at wells ESW-12 and PBW-34; the median was 11 mg/L. The low alkalinity of the ground water in these samples indicates little buffering capacity or ability to resist acidification.

Specific conductance, a measure of the ability of water to conduct electrical current at 25°C, is an indication of the concentration of ions in solution or of dissolved solids. High specific conductance indicates that the concentration of one or more ions in solution is high. Specific conductance of six water samples ranged from 45 µS/cm at well GLW-2 to 176 µS/cm at well ESW-5; the median was 74 µS/cm. The median for all samples (74 µS/cm) was less than the statewide median (132 µS/cm) for public supply wells completed in stratified-drift aquifers (Morrissey and Regan, 1987).

Sodium and chloride can be introduced into ground water from natural sources and human activity. The principal source of natural chloride is atmospheric precipitation and dry fallout, which contribute about 0.5 mg/L to the land surface of New Hampshire (Hall, 1975). The principal human activity contributing sodium and chloride to ground water is road deicing.

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[1]SMCL, secondary maximum contaminant level: Nonenforceable regulation that affects the aesthetic quality of drinking water. At high concentrations or values, health implications as well as aesthetic degradation may exist. These are intended as guidelines for the States.

Table 4. Chemical analyses of ground-water samples from selected wells in south-central New Hampshire

[ft, foot; µS/cm, microsiemen per centimeter at 25 degrees Celsius; °C, degree Celsius; mg/L, milligram per liter; µg/L, microgram per liter; <, less than; --, no data]

Local well No.	Date of sampling	Water level, in depth below land surface (ft)	Depth of well (ft)	Depth to top of sample interval (ft)	Specific conductance, field (µS/cm)	pH, field	Temperature, water (°C)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Sodium, dissolved (mg/L)	Potassium, dissolved (mg/L)	Alkalinity, field (mg/L as $CaCO_3$)
CEW-1	8-22-90	18.71	60	57.5	54	6.1	12.0	12	3.4	0.89	2.2	0.7	10
ESW-5	8-21-90	10.68	30.2	27.7	176	5.6	12.0	18	5.2	1.2	23	3.9	11
ESW-12	8-21-90	16.11	50	47.5	135	6.1	12.0	26	7.1	2.1	9.4	1.3	25
GLW-2	8-21-90	4.0	22.7	20.2	45	5.4	11.0	11	3.6	.41	1.7	.8	3
LSW-13	8-22-90	5.84	49	46.5	69	6.1	9.5	20	5.2	1.6	2.6	1.0	10
PBW-34	8-22-90	10.62	33.1	30.6	74	6.2	11.5	50	4.3	1.1	2.8	<.1	25
SMCL[1]	--	--	--	--	--	--	--	--	--	--	--	--	--
MCL[2]	--	--	--	--	--	--	--	--	--	--	--	--	--

Local well No.	Sulfate, dissolved (mg/L)	Chloride, dissolved (mg/L)	Fluoride, dissolved (mg/L)	Silica, dissolved (mg/L)	Solids, residue at 180°C, dissolved (mg/L)	Nitrogen, nitrite, dissolved (mg/L as N)	Nitrogen, nitrite plus nitrate, dissolved (mg /L as N)	Nitrogen, ammonium, dissolved (mg/L as N)	Nitrogen, ammonia plus organic, dissolved (mg/L as N)	Phosphorus, dissolved (µg/L)	Aluminum, dissolved (µg /L)	Arsenic, dissolved (µg/L)	Barium dissolved (µg/L)	Beryllium, dissolved (µg/L)
CEW-1	6.5	2.7	<0.1	14	33	<0.01	<0.10	0.04	<0.2	<0.01	<10	3	<2	<0.5
ESW-5	9.6	30	<.1	12	100	<.01	1.0	.03	.4	<.01	20	<1	9	<.5
ESW-12	2.1	21	<.1	11	73	<.01	.2	.06	.3	<.01	20	<1	4	<.5
GLW-2	7.0	2	<.1	5.9	33	<.01	.3	.02	<.2	<.01	40	<1	20	.6
LSW-13	13	4.8	<.1	11	36	<.01	.1	.03	.2	.03	<10	2	9	<.5
PBW-34	1.0	5.8	<.1	13	50	<.01	<.10	.3	.4	<.01	20	<1	3	<.5
SMCL[1]	[3]250	[3]250	[3]2.0	--	--	--	--	--	--	--	50	--	--	--
MCL[2]	--	--	4.0	--	--	1	10	10	--	--	--	50	2,000	4

Table 4. Chemical analyses of ground-water samples from selected wells in south-central New Hampshire—*Continued*

Local well No.	Cadmium, dissoved (µg/L)	Cobalt, dissolved (µg/L)	Copper, dissolved (µg/L)	Iron, total recoverable (µg/L)	Iron, dissolved (µg/L)	Lead, dissolved (µg/L)	Lithium, dissolved (µg/L)	Manganese, dissolved (µg/L)	Molybdenum, dissolved (µg/L)	Nickel, dissolved (µg/L)	Strontium, dissolved (µg/L)	Vanadium, dissolved (µg/L)	Zinc, dissolved (µg/L)	Carbon, organic, dissolved (mg/L as C)	Dichlorobromomethane, total (µg/L)
CEW-1	<1	<3	<10	890	560	<10	<4	260	<10	2	19	<6	64	2	<0.20
ESW-5	<1	<3	<10	2,400	35	<10	<4	110	<10	1	140	<6	41	.5	<.20
ESW-12	2	7	<10	16,000	250	<10	<4	3,500	<10	3	60	<6	260	.8	<.20
GLW-2	2	4	<10	16,000	180	<10	<4	48	<10	5	35	<6	300	.4	--
LSW-13	<1	4	<10	23,000	160	<10	<4	67	<10	5	46	<6	48	.5	<.20
PBW-34	1	<3	<10	17,000	6,600	<10	<4	150	<10	4	35	<6	23	1.7	<.20
SMCL[1]	--	--	[3]1,300	--	300	0	--	50	--	--	--	--	--	--	--
MCL[2]	5	--	--	--	--	50	--	--	--	100	--	--	5,000	--	--

Local well No.	Carbon tetrachloride, total (µg/L)	1, 2-Dichloroethane, total (µg/L)	Bromoform, total (µg/L)	Chloro-dibromomethane, total (µg/L)	Chloroform, total (µg/L)	Toluene, total (µg/L)	Benzene, total (µg/L)	Chlorobenzene, total (µg/L)	Chloroethane, total (µg/L)	Ethylbenzene, total (µg/L)	Methylene chloride, total (µg/L)	Tetrachloroethylene, total (µg/L)	1,1-Dichloroethane, total (µg/L)	1,1-Dichloroethylene, total (µg/L)
CEW-1	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
ESW-5	<.20	<.20	<.20	<.20	<.20	<.20	<.20	<.20	<.20	<.20	<.20	<.20	<.20	<.20
ESW-12	<.20	<.20	<.20	<.20	<.20	<.20	<.20	<.20	<.20	<.20	<.20	<.20	<.20	<.20
GLW-2	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LSW-13	<.20	<.20	<.20	<.20	<.20	<.20	<.20	<.20	<.20	<.20	<.20	<.20	<.20	<.20
PBW-34	<.20	<.20	<.20	<.20	<.20	<.20	<.20	<.20	<.20	<.20	<.20	<.20	<.20	<.20
SMCL	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MCL[2]	--	--	--	--	--	1,000	--	--	--	--	--	--	--	--

Table 4. Chemical analyses of ground-water samples from selected wells in south-central New Hampshire—*Continued*

Local well No.	1,1,1,-Tri-chloro-ethane, total (µg/L)	1,1,2-Tri-chloro-ethane, total (µg/L)	1,1,2,2 Tetra-chloro-ethane, total (µg/L)	1,2-Di-chloro-benzene, total (µg/L)	1,2-Di-chloro-propane, total (µg/L)	1,3-Di-chloro-propene, total (µg/L)	1,3-Di-chloro-benzene, total (µg/L)	1,4-Di-chloro-benzene, total (µg/L)	2-Chloro-ethylvinyl-ether, total (µg/L)	Bromo-methane, total (µg/L)	Trans-1,2-Di-chloro-ethyene, total (µg/L)	1,1-Di-chloro-ethylene, total (µg/L)	Chloro-methane, total (µg/L)	Vinyl chlo-ride, total (µg/L)	Tri-chloro-ethylene, total (µg/L)
CEW-1	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
ESW-5	< .20	< .20	< .20	< .20	< .20	< .20	< .20	< .20	< .20	< .20	< .20	< .20	< .20	< .20	< .20
ESW-12	< .20	< .20	< .20	< .20	< .20	< .20	< .20	< .20	< .20	< .20	< .20	< .20	< .20	< .20	< .20
GLW-2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LSW-13	< .20	< .20	< .20	< .20	< .20	< .20	< .20	< .20	< .20	< .20	< .20	< .20	< .20	< .20	< .20
PBW-34	1.3	< .20	< .20	< .20	< .20	< .20	< .20	< .20	< .20	< .20	< .20	< .20	< .20	< .20	< .20
SMCL	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MCL[2]	200	5	--	--	--	--	--	--	--	--	100	7	--	2	5

[1] SMCL—Secondary Maximum Contaminant Level: contaminants that affect the aesthetic quality of drinking water. At high concentrations or values, health implications as well as aesthetic degradation may exist. SMCL's are not Federally enforceable but are intended as guidelines for the States (U.S. Environmental Protection Agency, 1992).

[2] MCL—Maximum Contaminant Level: Enforceable, health-based regulation that is to be set as close as is feasible to the level at which no known or anticipated adverse effects on the health of a person occur. The definition of feasible means the use of the best technology, treatment techniques, and other means that the Administrator of the U.S. Environmental Protection Agency finds, after examination for efficacy under field conditions and not solely under laboratory conditions, are generally available (taking cost into consideration) (U.S. Environmental Protection Agency, 1992).

[3] Secondary level set by the New Hampshire Department of Environmental Services, Water Supply Bureau (New Hampshire Department of Environmental Services, Water Supply Bureau, written commun., 1987).

The highest concentration of sodium (23 mg/L) and chloride (30 mg/L) was from water in Epsom well ESW-5. The sodium concentration in water from well ESW-5 slightly exceeds the Health Advisory Level for sodium (20 mg/L) established by the USEPA (1985) as a recommended limit for people with heart disease, hypertension, or kidney problems. The chloride concentration in water from well ESW-5 (30 mg/L) is much lower than the USEPA (1992) SMCL for chloride (250 mg/L) established as a taste threshold.

Nitrogen is present in water as the anions nitrite (NO_2^-) or nitrate (NO_3^-), as the cation ammonium (NH_4^+), and in an intermediate oxidation state as a part of organic solutes (Hem, 1985, p. 124). Excess nitrate in ground water can result from fertilizer applications, leachate from sewage systems, or agricultural wastes. Excessive concentrations of nitrate in drinking water (greater than 10 mg/L as nitrogen or greater than 44 mg/L as nitrate) may cause methemoglobinemia in small children (Hem, 1985, p. 125). Concentrations of dissolved nitrite plus nitrate (as N) in six samples ranged from less than 0.1 to 1.0 mg/L.

Sulfate (SO_4^{-2}) is one of the major anions in natural water. Oxidation of sulfide ores, gypsum, and anhydrite and atmospheric deposition are sources of sulfate. Sulfate is reduced to hydrogen sulfide gas (H_2S) under anaerobic conditions, and its odor can be detected at a concentration of only a few tenths of a milligram per liter. H_2S could be present in stratified-drift aquifers that are near, under, or overlain by peat bogs or swamps. The sulfate concentration of six water samples ranged from 1.0 to 13.0 mg/L; the median was 6.5 mg/L. The SMCL for sulfate (SO_4^{-2}) in drinking water is 250 mg/L (U.S. Environmental Protection Agency, 1992).

Manganese and iron are common elements in minerals in stratified-drift deposits in the study area. Elevated concentration of manganese, sometimes associated with elevated concentration of iron, was the most common water-quality problem found during this investigation. Manganese, an abundant metallic element, is an undesirable impurity in water because of its tendency to deposit black oxide stains (Hem, 1985, p. 85). Water from five wells had manganese concentrations that exceeded the SMCL of 50 μg/L (U.S. Environmental Protection Agency, 1992): 3,500 μg/L at ESW-12, 260 μg/L at CEW-1, 150 μg/L at PBW-34, 110 μg/L at ESW-5, 67 μg /L at LSW-13. Iron, if present at concentrations exceeding 300 μg/L in residential water supplies, forms red oxyhydroxide precipitates that can stain clothes and plumbing fixtures. Concentrations of iron in water from two of the sampled wells, 6,600 μg/L at well PBW-34 and 560 μg/L at well CEW-1, exceeded the SMCL of 300 μg/L (U.S. Environmental Protection Agency, 1992).

Concentration of aluminum, the third most abundant element in the Earth's crust, rarely exceeds a few hundredths or a few tenths of a milligram per liter of water (Hem, 1985, p. 73). Exceptions can be found in highly acidic waters where the aluminum cation (Al^{+3}) can be dissolved. Water from well GLW-2 had the highest concentration of aluminum (40 μg/L) and the lowest pH (5.4).

Arsenic in ground water can originate from geologic sources or human activity. Geologic sources of arsenic include dissolution of minerals such as arsenopyrite. An example of a source relating to human activity is application of pesticides that contain arsenic, which can enter ground water through waste disposal or agricultural drainage (Hem, 1985). Although arsenic is found in water from fractured bedrock in many parts of New Hampshire, it was not found in elevated concentrations in the water from selected stratified-drift aquifers in this study. Arsenic concentrations did not exceed the maximum contaminant level (MCL)[2] of 50 μg/L (U.S. Environmental Protection Agency, 1992) in any well sample. Water samples collected from the six USGS wells in the study area and analyzed for dissolved barium, beryllium, boron, cadmium, cobalt, copper, fluoride, lead, lithium, molybdenum, nickel, and vanadium had concentrations that ranged from less than detection level to 20 μg/L. Samples with concentrations of trace elements consistently above detection level, but less than 1.0 mg/L, were strontium (19–140 μg/L) and zinc (23–300 μg/L). Strontium is a fairly common element, replacing calcium or

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[2]MCL, maximum contaminant level: Enforceable, health-based regulation that is to be set as close to the level at which no known or anticipated adverse effects on the health of a person occur as is feasible. The definition of feasible means the use of the best technology, treatment techniques, and other means that the Administrator of the U.S. Environmental Protection Agency finds, after examination for efficacy under field conditions and not solely under laboratory conditions, are generally available (taking cost into consideration).

potassium in igneous-rock minerals in minor amounts, especially in granite rocks (Hem, 1985). The source of the zinc in the six water samples is unknown.

Volatile organic compounds (VOC's), composed primarily of solvents from industrial wastes, are some of the major ground-water contaminants in New Hampshire (Morrissey and Regan, 1987). Water samples from five wells were analyzed for 31 VOC's at a detection level of 0.2 µg/L. Four of the five water samples had no detectable levels of VOC's. Water from well PBW-34 had a 1,1,1-trichloroethane concentration of 1.3 µg/L, which is less than the MCL of 200 µg/L (U.S. Environmental Protection Agency, 1992).

SUMMARY AND CONCLUSIONS

The Upper Merrimack River Basin in south-central New Hampshire encompasses 519 mi^2, of which 16.8 percent (87 mi^2) is underlain by stratified-drift deposits. About 83 percent of the water pumped from high-capacity wells is derived from wells screened in coarse-grained stratified drift. A 19-percent increase in population from 1980 to 1990 increased the demand on the water resources of this area. Currently (1993), ground-water withdrawals from stratified drift for public supply in the basin do not exceed 2.6 Mgal/d. The city of Concord and the towns of Pembroke and Epsom are the primary users of this ground water. Many of the shallow stratified-drift aquifers underlying the study area could be potential sources of future domestic and municipal water supplies.

The sediments composing the stratified-drift aquifers were deposited primarily in two glacial lakes (Lake Hooksett and Lake Merrimack) that covered the present day Merrimack River Valley north of Bow. The Merrimack River Valley, including the lower reaches of the Suncook River, contains predominantly fine-grained stratified-drift deposits of low permeability. Some ice-contact deposits of high permeability are interbedded with the fine deposits and extend to the Merrimack River, such as in Bow, Franklin, and Boscawen. The Soucook and upper Suncook River Valleys contain predominantly coarse-grained stratified-drift deposits of high permeability. The most productive aquifers are ice-contact (eskers and kames) and proglacial outwash deposits. In many places, the outwash deposits are deltaic and contain or are underlain by discontinuous, fine-grained lake-bottom deposits.

Saturated thickness of stratified drift exceeds 120 ft in 11 areas but is generally less than 80 ft. Maximum saturated thickness is approximately 160 ft in a narrow, deeply eroded bedrock channel next to the Merrimack River in Franklin. Transmissivity exceeds 4,000 ft^2/d in 8 aquifers but is more commonly less than 1,000 ft^2/d. The maximum transmissivity of approximately 10,600 ft^2/d is in Pembroke along the Soucook River.

Aquifers that are the most transmissive and greatest source for current or potential ground-water supply include the Bow aquifer, lower Soucook River aquifer, Concord Plains aquifer, Taylor State Forest aquifer, lower Suncook River aquifer, Bear Brook aquifer, Suncook River and Round Pond aquifer, upper Suncook River aquifer, Crystal Lake aquifer, Sondogardy Pond aquifer, Boscawen aquifer, Soucook River and Giddis Brook aquifer, Loudon aquifer, and the Pearls Corner aquifer. Water availability was estimated for four of these aquifers by means of an analytical ground-water-flow model based on the Theis flow equation adjusted to account for boundary effects typically associated with stratified-drift aquifers. The maximum sustained water-availability estimate during a period of no recharge was 2.8 Mgal/d for the lower Soucook River aquifer. Availability of water can exceed this rate during periods of recharge.

Quality of water from six wells screened in stratified-drift aquifers is suitable for drinking and other domestic uses. Water samples from five wells had concentrations of manganese that exceeded the SMCL of 50 µg/L. Water from two wells (CEW-1 and PBW-34) had concentrations of iron that exceeded the SMCL of 300 µg/L. Ground water that contained elevated concentrations of iron an manganese would probably require treatment before use as a source of drinking water. Five water samples were analyzed for 31 volatile organic compounds. One volatile organic compound (1,1,1,-trichloroethane) was detected in Pembroke well PBW-34 at a trace concentration of 1.3 µg/L. Contamination of water from well PBW-34 is unlikely, however, because only one volatile organic compound was detected. If ground water is contaminated, a number of constituents will commonly be detected in an analysis.

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GLOSSARY

Aquifer: A geologic formation, group of formations, or part of a formation that contains sufficient saturated permeable materials to yield significant quantities of water to wells and springs. Where water only partly fills an aquifer, the upper surface of the saturated zone is free to rise and decline.

Aquifer boundary: A geologic or hydrologic feature that limits the extent of an aquifer.

Bedrock: Solid rock, colloquially called "ledge," that forms the earth's crust. It may be exposed at the surface but more commonly is buried beneath a few inches to more than 100 ft of unconsolidated deposits.

Confined aquifer: An aquifer saturated with water and bounded above and below by material having a distinctly lower hydraulic conductivity than that of the aquifer.

Contact: A plane or irregular surface between two different types or ages of rocks or unconsolidated sediments.

Cubic feet per second (ft^3/s): A unit expressing rate of discharge. One cubic foot per second is equal to the discharge of a stream 1 foot wide and 1 foot deep flowing at an average velocity of 1 foot per second.

Cubic feet per second per square mile [$(ft^3/s)/mi^2$]: A unit expressing average number of cubic feet of water flowing per second from each square mile of area drained.

Darcy's Law: An equation relating the factors controlling ground-water flow. Darcy's law is $Q = KA\ (dh/dl)$, where Q is the quantity of water per unit of time; K is the hydraulic conductivity and depends on size and arrangement of the water-transmitting openings (pores and fractures) and on the dynamic characteristics of the fluid (water) such as kinematic viscosity, density, and the strength of the gravitational field; A is the cross-sectional area, at a right angle to the flow direction, through which the water flows; and dh/dl is the hydraulic gradient.

Deposit: Earth material that has accumulated by some natural process.

Dissolved solids: The residue from a clear sample of water after evaporation and drying for 1 hour at 180 degrees Celsius; consists primarily of dissolved mineral constituents, but may also contain organic matter and water of crystallization.

Drainage area: The area or tract of land that gathers water and contributes it ultimately to some point on a stream channel, lake, reservoir, or other water body.

Drawdown: The lowering of the water table or potentiometric surface caused by the withdrawal of water from an aquifer by pumping; equal to the difference between the static water level and the pumping water level.

Effective grain size: The grain size at which 10 percent of the sample consists of smaller grains and 90 percent consists of larger grains.

Esker: A long ridge of sand and gravel that was deposited by water flowing in tunnels within or beneath glacial ice.

Flow duration, of a stream: The percentage of time during which specified daily discharges are equaled or exceeded within a given time period.

Fluvial: Pertaining to the flow of liquid water in the natural environment.

Fracture: A break, crack, or opening in bedrock along which water may move.

Glacial lake: A lake that derives much or all of its water from the melting of glaciers. In this study area, it refers to areas where such lake water was dammed by local topographic or geomorphic features.

Glaciofluvial: Pertaining to the flow of meltwater streams from glacial ice and to the landforms produced by such streams, including kames, kame terraces, and outwash.

Glaciolacustrine: Pertaining to deposits in glacial lakes; especially deposits such as deltas and varved sediments, composed of material brought by meltwater streams flowing into lakes bordering the glacier.

Gneiss: A coarse-grained metamorphic rock with alternating bands of granular and micaceous minerals.

Granite: A coarse-grained, light colored, igneous rock.

Gravel: Unconsolidated rock debris composed principally of particles larger than 2 millimeter in diameter.

Ground water: Water beneath the water table in soils or geologic formations that are fully saturated.

Ground-water discharge: The discharge of water from the saturated zone by (1) natural processes such as ground-water seepage into stream channels and ground-water evapotranspiration and (2) discharge through wells and other manmade structures.

Ground-water divide: A hypothetical line on a water table on each side of which the water table slopes downward in a direction away from the line. In the vertical dimension, a plane across which no ground water flows.

Ground-water recharge: Water that is added to the saturated zone of an aquifer.

Ground-Water Site Inventory (GWSI): A computerized file maintained by the U.S. Geological Survey that contains information about wells and springs collected throughout the United States.

Head of outwash: The upper part or end of a slope or valley where a poorly stratified, compact mass of boulders mixed with sand and clay form a ridge at the glacial ice margin.

Head, static: The height of the surface of a water column above a standard datum that can be supported by the static pressure of a given point.

Hydraulic conductivity (*K*): A measure of the ability of a porous medium to transmit a fluid; can be expressed in unit length per unit time. A material has a hydraulic conductivity of 1 foot per day if it will transmit in 1 day, 1 cubic foot of water at the prevailing kinematic viscosity through a 1-square-foot cross section of aquifer, measured at right angles to the direction of flow, under a hydraulic gradient, of 1-foot change in head over 1-foot length of flow path.

Hydraulic gradient: The change in static head per unit of distance in a given direction. If not specified, the direction is generally understood to be that of the maximum rate of decrease in head.

Hydrograph: A graph showing stage (height), flow velocity, or other property of water with respect to time.

Ice-contact deposit: Stratified drift deposited in contact with melting glacial ice. Landforms include eskers, kames, kame terraces, and grounding-line deltas.

Igneous: Descriptive term for rocks or minerals solidified from molten or partially molten material; that is, from a magma, such as basalt or granite.

Induced infiltration: The process by which water infiltrates an aquifer from an adjacent surface-water body in response to pumping.

Kame: A low mound, knob, hummock or short irregular ridge composed of stratified sand and gravel deposited by glacial meltwater; the precise mode of formation is uncertain.

Kame terrace: A terrace-like ridge consisting of stratified sand and gravel formed as a glaciofluvial deposit between a melting glacier or stagnant ice lobe and a higher valley wall, and left standing after the disappearance of the ice.

Lacustrine: Pertaining to lake environments. In this study, "lacustrine" refers to areas associated with glacial-lake environments.

Lake-bottom deposit: Stratified drift deposited in a standing body of water, usually in glacial-lake environments. Composition of deposits are almost exclusively very fine sand to clay.

Median: The middle value of a set of measurements that are ordered from lowest to highest; 50 percent of the measurements are lower than the median and 50 percent are higher.

Metamorphic: Descriptive term for rocks such as gneiss and schist that have formed, in the solid state, from other rocks.

Micrograms per liter (μg/L): A unit expressing the concentration of chemical constituents in solution as the mass (micrograms) of a constituent per unit volume (liter) of water. One thousand micrograms per liter is equivalent to one milligram per liter.

Milligrams per liter (mg/L): A unit for expressing the concentration of chemical constituents in solution as the mass (milligram) of a constituent per unit volume (liter) of water.

Outwash: Stratified deposits chiefly of sand and gravel removed or "washed out" from a glacier by meltwater dlstreams and deposited beyond the margin of a glacier. Usually found in flat or gently sloping outwash plains.

Outwash deltas: Deltas formed beyond the margin of the glacier where glacial meltwater entered a water body.

pH: The negative logarithm of the hydrogen ion concentration. A pH of 7.0 indicates neutrality; values below 7.0 denote acidity, those above 7.0 denote alkalinity.

Phi grade scale: A logarithmic transformation of the Wentworth grade scale based on the negative logarithm to the base 2 of the particle diameter, in millimeters.

Porosity: The property of a rock or unconsolidated deposit that is a measure of the size and number of internal voids or open spaces; it may be expressed quantitatively as the ratio of the volume of its open spaces to its total volume.

Precipitation: The discharge of water from the atmosphere, either in a liquid or solid state.

Quartzite: A metamorphic rock consisting mainly of quartz and formed by recrystallization of quartz.

Runoff: That part of the precipitation that appears in streams. It is the same as streamflow unaffected by artificial diversions, storage, or other human activities in or on the stream channels.

Saturated thickness (of stratified drift): Thickness of stratified drift extending down from the water table to the till or the bedrock surface.

Saturated zone: The subsurface zone in which all open (interconnected) spaces are filled with water. Water below the water table, the upper limit of the saturated zone, is under pressure greater than atmospheric.

Schist: A metamorphic rock with subparallel orientation of the visible micaceous minerals, which dominate its composition.

Sediment: Fragmental material that originates from weathering of rocks. It can be transported by, suspended in, or deposited by, water.

Slate: A compact, fine-grained metamorphic rock which is platy and formed from shale.

Specific capacity, of a well: The rate of discharge of water divided by the corresponding drawdown of the water level in the well. Stated in this report in gallons per minute per foot [(gal/min)/ft].

Specific yield: The ratio of the volume of water that a rock or soil will yield, by gravity drainage, after being saturated to the total volume of the rock or soil.

Standard deviation: A measure of the amount of variability within a sample; it is the square root of the average of the squares of the deviations about the arithmetic mean of a set of data.

Storage coefficient: The volume of water an aquifer releases from or takes into storage per unit surface area of the aquifer per unit change in head. In an unconfined aquifer, the storage coefficient is virtually equal to the specific yield.

Stratified drift: Sorted and layered unconsolidated material deposited in meltwater streams flowing from glaciers or settled from suspension in ponded-water bodies fed by meltwater streams.

Surficial geology: The study of or distribution of unconsolidated deposits at or near the land surface.

Till: A predominantly nonsorted, nonstratified sediment deposited directly by a glacier and composed of boulders, gravel, sand, silt and clay mixed in various proportions.

Transmissivity: The rate at which water is transmitted through a unit width of aquifer under a unit hydraulic gradient. Equal to the average hydraulic conductivity times the saturated thickness.

Unconfined aquifer (water-table aquifer): An aquifer in which the water is unconfined in that the water table or upper surface of the saturated zone is at atmospheric pressure and is free to rise and fall.

Unsaturated zone: The zone between the water table and the land surface in which the open spaces are not completely filled with water.

Valley-fill aquifer: Unconsolidated sediment, typically stratified drift, that fills or partly fills a valley.

Water availability: An amount of water potentially available for water supply; in this study, the term refers to water wells.

Water table: The upper surface of the saturated zone. Water at the water table is at atmospheric pressure.

APPENDIX A

Appendix A. Description of selected wells, auger holes, and borings in south-central New Hampshire

Local well number: First two characters are U.S. Geological Survey town codes. The third character indicates—**A**, borings done for hydrologic purposes; **B**, boring done primarily for construction type of structure; **W**, well.

Latitude, longitude: Accurate within 5 seconds. Expressed in the form of degree, minute, and second (° ′ ″).

Owner or user: Owner of the property or user/agency responsible for drilling:
Bros, Brothers; **CL**, club; **Cnty**, country; **CO**, company; **Dept.**; department; **Dist.**, District; **INC**, Incorporated; **LK Vil WTR Dist**, Lake Village Water District; **MTN. REHAB. CE.**, Mountain Rehabilitation Center; **NE**, New England; **NH Dept. Env. Serv.**, New Hampshire Department of Environmental Services; **NHDOT**, New Hampshire Department of Transportation; **NH PUB WKS HWY**, New Hampshire Public Works Highway; **Scho**, school; **USCOE**, U.S. Army Corps of Engineers; **USGS**, U. S. Geological Survey.

Depth of hole: Depth hole was drilled, in feet below land-surface datum.

Depth of casing: Depth to the bottom of well casing, in feet below land-surface datum.

Depth of well: Depth, in feet below land-surface datum, to the bottom of the screen or open section in which water enters the well.

Diameter of well: Nominal inside diameters of the well casings, in inches.

Depth to refusal: Depth to refusal, in feet below land-surface datum.

Type of site: **BrW**, bedrock well; **TH**, test hole.
Wells or borings in surficial deposits—**BB**, bridge boring; **Dug**, dug well; **GPW**, gravel-packed well; **Gvl,** drilled in gravel; **Obs**, observation well; **Wsh**, drive and wash well.

Water level: In feet below land-surface datum; negative sign indicates water level above land surface datum; mm-dd-yy, month-day-year.

Primary use of water: **C**, commercial; **H**, domestic; **I**, irrigation; **N**, industrial; **P**, public supply; **S**, stock; **U**, unused.

Maximum well yield: Discharge, in gallons per minute.

Assignor of other identifier: **Bay St Tst Brng**, Bay State Test Boring, Inc.; **Con-Tec,** Con-Tec, Inc; **Heynen Eng.**, Heynen Engineers, Inc.; **Layne NE**, Layne New England, **Miller Eng.**, Miller Engineering and Testing, Inc.; **NHWRD**, New Hampshire Water Resources Division, Well Water Board; **NHDOT**, New Hampshire Department of Transportation; **Prtr & Dsmnd**, Porter & Desmond, Inc.; **Soils Eng.**, Soils Engineering Company.

Depth to bedrock: Depth to bedrock in feet below land-surface datum.

Appendix A. Description of selected wells, auger holes, and borings in south-central New Hampshire

[No., number; --, no data available; ft, foot; in., inch]

Local well No.	Latitude (° ′ ″)	Longitude (° ′ ″)	Owner or user	Year completed	Elevation above sea level (ft)	Depth of hole (ft)	Bottom of casing (ft)	Depth of well (ft)	Diameter of well (in.)	Depth to refusal (ft)
				BELKNAP COUNTY						
				Barnstead						
BAA 1	432058	0711556	Hayes, Arnold	1989	542	10	--	--	--	--
BAA 2	432023	0711548	--	1989	510	16	--	--	--	16
BAA 3	431905	0711224	NHDOT	1989	605	32	--	--	--	--
BAA 4	431902	0711208	NHDOT	1989	602	54	--	--	--	--
BAA 5	432345	0711751	Camp Fatima	1989	561	49	--	--	--	--
BAW 1	432018	0711540	Town of Barnstead	1989	505	30	17.5	20	2	
BAW 2	431945	0711502	Teide, Ernie	1989	524	41	30.4	32.4	2	--
BAW 3	431944	0711411	Riel, Peter	1989	520	46	30.5	32.5	2	--
BAW 4	431935	0711349	Tasker, Roscoe	1989	518	40	30.3	32.3	2	--
BAW 9	432008	0711608	Timco, Inc.	1990	510	48	37.5	40	2	--
BAW 10	431916	0711259	Dupee, Francesca	1990	530	25	23	25	2	--
BAW 11	432006	0711539	Duhaime	1984	500	--	--	10	--	--
BAW 23	431952	0711810	Knirsch	1985	520	--	--	365	6	--
BAW 27	432007	0711511	Jenks, D.	1985	560	--	39	200	--	--
BAW 34	431917	0711241	Goulet, S.	1986	540	--	94	202	--	--
BAW 38	432025	0711719	Osborne	1986	560	--	--	163	6	--
BAW 43	432127	0711545	Bartlett, J.	1986	550	--	117	142	--	--
BAW 60	432009	0711710	Richardson	1987	500	--	--	401	6	--
BAW 80	431952	0711546	McGranagha	1987	525	--	--	205	6	--
BAW 81	432000	0711533	Knolton	1987	520	--	--	325	6	--
BAW 82	431955	0711547	Knolton	1987	525	--	--	245	6	--
BAW 90	432037	0711608	Stockman, L.	1987	530	--	79	185	--	--
BAW 93	432024	0711727	Laventure	1988	550	--	--	304	6	--
BAW 104	432003	0711326	Dion, N.	1988	570	--	2	11	--	--
BAW 109	432025	0711258	Rosewater, M.	1988	640	--	39	485	--	--
BAW 110	432017	0711312	Piercey, W.	1988	570	--	--	16	--	--
BAW 115	432026	0711539	Graves, W. & R.	1989	515	--	65	142	--	--
BAW 117	431912	0711224	DeHart, D.	1989	565	--	49	280	--	--
BAW 125	432348	0711703	Haley, J.	1989	580	--	41	265	--	--
BAW 142	432412	0711744	Purdy, C.	1986	560	--	145	210	--	--
BAW 151	432015	0711605	Timco, Inc.	1982	510	507	48	507	8	--
BAW 152	432015	0711605	Timco, Inc.	1985	510	360	48	360	8	--
				Gilmanton						
GLA 1	432401	0711800	Camp Fatima	1989	562	109	--	--	--	--
GLW 1	432552	0711819	Town of Gilmanton	1989	730	100	29.8	31.8	2	--
GLW 2	432606	0711830	Town of Gilmanton	1989	731	39	17.5	20	2	--
GLW 3	432421	0711811	Town of Gilmanton	1990	580	36	--	28	--	36
GLW 4	432404	0711828	Town of Gilmanton	1990	560	53	--	48	--	53
GLW 29	432657	0711831	Boley G.	1986	660	--	86	195	--	--
GLW 51	432433	0711808	Sweeney A.	1987	580	--	--	58	165	--
GLW 52	432621	0711825	Widger C.	1986	640	--	--	120	419	--
GLW 67	432541	0711821	Sawyer K.	1987	660	--	--	57	120	--
GLW 82	432426	0711759	Bernham A.	1987	560	--	--	80	281	--

Local well No.	Type of site	Water level: Depth (ft)	Water level: Date (mm-dd-yy)	Use	Maximum well yield (gallons per minute)	Other identifier	Assignor of other identifier	Depth to bedrock (ft)
BELKNAP COUNTY								
Barnstead								
BAA 1	TH	--	--	U	--	--	--	10
BAA 2	TH	--	--	U	--	--	--	--
BAA 3	TH	--	--	U	--	--	--	32
BAA 4	TH	--	--	U	--	--	--	54
BAA 5	TH	--	--	U	--	--	--	--
BAW 1	Obs	79	8-24-89	U	--	--	--	30
BAW 2	Obs	9.77	8-24-89	U	--	--	--	41
BAW 3	Obs	18.8	12-26-89	U	--	--	--	46
BAW 4	Obs	19.4	1-02-90	U	--	--	--	40
BAW 9	Obs	7	6-29-90	U	--	--	--	48
BAW 10	Obs	6	10-12-90	U	--	--	--	25
BAW 11	Dug	7	6-29-90	U	30	014.0003	NHWRD	--
BAW 23	BrW	--	--	H	6	014.0018	NHWRD	58
BAW 27	BrW	--	--	H	20	014.0022	NHWRD	15
BAW 34	BrW	--	--	H	75	014.0031	NHWRD	70
BAW 38	BrW	--	--	H	30	014.0035	NHWRD	--
BAW 43	BrW	--	--	H	20	014.0040	NHWRD	108
BAW 60	BrW	--	--	H	5.5	014.0057	NHWRD	20
BAW 80	BrW	--	--	H	100	014.0080	NHWRD	60
BAW 81	BrW	--	--	H	2	014.0081	NHWRD	50
BAW 82	BrW	17	8-25-87	H	10	014.0082	NHWRD	56
BAW 90	BrW	10	8-11-87	C	40	014.0092	NHWRD	65
BAW 93	BrW	8	3-16-88	H	1.5	014.0095	NHWRD	30
BAW 104	Dug	5	9-22-88	H	300	014.0107	NHWRD	11
BAW 109	BrW	--	--	H	15	014.0113	NHWRD	16
BAW 110	Dug	12	11-10-88	H	--	014.0114	NHWRD	--
BAW 115	BrW	--	--	H	9	014.0119	NHWRD	51
BAW 117	BrW	--	--	H	5	014.0121	NHWRD	34
BAW 125	BrW	15	7-16-89	H	7	014.0130	NHWRD	18
BAW 142	BrW	--	--	H	25	014.0149	NHWRD	130
BAW 151	BrW	--	--	H	87	--	--	--
BAW 152	BrW	--	--	H	150	--	--	--
Gilmanton								
GLA 1	TH	--	--	U	--	--	--	109
GLW 1	Obs	6.77	8-23-89	U	--	--	--	100
GLW 2	Obs	4	7-27-89	U	--	--	--	--
GLW 3	Obs	5	6-21-90	U	--	--	--	--
GLW 4	Obs	7	6-21-90	U	--	--	--	--
GLW 29	BrW	15	1-24-86	H	7.50	091.0032	NHWRD	80
GLW 51	BrW	8	3-05-87	H	7	091.0062	NHWRD	50
GLW 52	BrW	--	--	H	2.50	091.0063	NHWRD	100
GLW 67	BrW	1.5	7-10-87	H	5	091.0083	NHWRD	50
GLW 82	BrW	--	--	H	100	091.0101	NHWRD	55

Appendix A. Description of selected wells, auger holes, and borings in south-central New Hampshire—*Continued*

Local well No.	Latitude (° ′ ″)	Longitude (° ′ ″)	Owner or user	Year completed	Elevation above sea level (ft)	Depth of hole (ft)	Bottom of casing (ft)	Depth of well (ft)	Diameter of well (in.)	Depth to refusal (ft)
			BELKNAP COUNTY—*Continued*							
			Gilmanton—*Continued*							
GLW 83	432632	0711807	Crystal Spring	1986	640	--	--	572	--	--
GLW 93	432416	0712709	Hamilton	1987	540	--	--	500	--	--
GLW 100	432435	0711913	Gavill R.	1987	580	--	54	250	--	--
GLW 148	432551	0711803	Fountain J.	1988	630	--	11	12	--	--
GLW 156	432422	0711849	Buontempo R.	1988	580	--	99	302	--	--
GLW 181	432419	0711844	Anastasy K.	1989	580	--	99	322	--	--
GLW 182	432615	0711836	Stone	1989	640	--	--	250	6	--
GLW 191	432430	0712709	Town of Gilmanton	1989	560	--	--	225	--	--
GLW 199	432414	0711842	Anastasy K.	1989	570	--	110	522	--	--
GLW 202	432612	0711836	Peterson	1990	640	--	171	475	--	--
GLW 206	432413	0711823	Dube J.	1990	--	--	67	101	--	--
			MERRIMACK COUNTY							
			Allenstown							
AFA 3	430734	0712739	Town of Pembroke	1971	210	20	--	--	--	20
AFA 4	430800	0712527	Town of Pembroke	1964	332	45	--	45	--	45
AFA 5	430752	0712546	Town of Pembroke	1949	310	100	--	--	--	--
AFA 6	430804	0712603	Town of Pembroke	1964	280	91	--	--	--	91
AFA 7	430832	0712536	Town of Pembroke	1973	284	86.8	--	--	--	86.8
AFA 8	430851	0712507	Town of Pembroke	1973	292	6	--	--	--	67
AFA 9	430826	0712531	Town of Pembroke	1973	285	107	--	--	--	107
AFA 11	430937	0712242	Bear Brook State Park	1990	340	63	--	--	--	63
AFA 12	430824	0712107	Bear Brook State Park	1990	425	61	--	--	--	61
AFW 8	430951	0712407	Town of Pembroke	1971	310	56	--	56	--	--
AFW 9	430958	0712405	Town of Pembroke	1979	310	67.5	--	67.5	--	--
AFW 10	430816	0712520	Town of Pembroke	1964	300	78	--	75	--	78
AFW 11	430903	0712523	Town of Pembroke	1949	300	84	--	--	8	--
AFW 12	431013	0712348	N.H. Bear Brook State Park	1989	310	86.5	59.1	61.1	2	86.5
AFW 13	431010	0712346	N.H. Bear Brook State Park	1989	320	82.5	50	52	2	82.5
AFW 19	430814	0712457	Town of Pembroke	1964	300	49	--	36	--	49
AFW 20	430847	0712505	Town of Pembroke	1973	298	57	--	38	--	57
AFW 21	430901	0712441	Town of Pembroke	1973	285	63	43	53	2.5	63
AFW 22	430900	0712438	Town of Pembroke	1973	288	57	--	55	--	57
AFW 23	430858	0712441	Town of Pembroke	1973	290	63	--	34	--	36
AFW 24	430946	0712403	Town of Pembroke	1971	312	44	39	44	2.5	44
AFW 25	430944	0712406	Town of Pembroke	1971	330	45	40	45	2.5	45
AFW 27	430822	0712541	Balkin	1984	280	--	29	32	6	--
AFW 30	430918	0712419	Peck, R.	1985	330	--	116	363	--	--
AFW 31	430855	0712433	N.H. Highway Patrol	1985	320	--	79	500	--	--
AFW 34	430821	0712531	Wheeler	1986	290	--	104	112	6	--
AFW 41	430851	0712436	Fowler, G.	1986	317	--	39	125	--	--
AFW 42	430848	0712439	Berube, D.	1986	330	--	29	125	--	--
AFW 43	430841	0712518	Chaloux, L.	1986	310	--	133	135	--	--

Local well No.	Type of site	Water level: Depth (ft)	Water level: Date (mm-dd-yy)	Use	Maximum well yield (gallons per minute)	Other identifier	Assignor of other identifier	Depth to bedrock (ft)
BELKNAP COUNTY—*Continued*								
Gilmanton—*Continued*								
GLW 83	BrW	--	--	H	12	091.0102	NHWRD	62
GLW 93	BrW	--	--	H	2	091.0112	NHWRD	40
GLW 100	BrW	--	--	H	4	091.0119	NHWRD	30
GLW 148	Dug	9	10-15-88	H	--	091.0173	NHWRD	3
GLW 156	BrW	--	--	H	10	091.0182	NHWRD	88
GLW 181	BrW	--	--	H	5	091.0212	NHWRD	88
GLW 182	BrW	--	--	H	0	091.0213	NHWRD	102
GLW 191	BrW	25	8-04-89	H	12	091.0223	NHWRD	4
GLW 199	BrW	--	--	H	4	091.0231	NHWRD	90
GLW 202	BrW	20	2-09-90	H	2	091.0234	NHWRD	158
GLW 206	BrW	15	5-19-90	H	10	091.0239	NHWRD	58
MERRIMACK COUNTY								
Allenstown								
AFA 3	TH	--	--	U	--	3-71/Ferry St	R.E. Chapman	--
AFA 4	TH	20	10-20-64	U	--	2-64	R.E. Chapman	--
AFA 5	TH	--	--	U	--	Site No. 5	Layne NE	100
AFA 6	TH	18.2	10-21-64	U	--	3-64	R.E. Chapman	--
AFA 7	TH	--	--	U	--	6-73	R.E. Chapman	--
AFA 8	TH	13.1	8-17-73	U	--	3-73	R.E. Chapman	--
AFA 9	TH	--	--	U	--	5-73	R.E. Chapman	--
AFA 11	TH	10	6-20-90	U	--	--	--	--
AFA 12	TH	--	6-20-90	U	--	--	--	--
AFW 8	--	--	--	P	--	Bear Brook W-1	Dufresne-Henry	--
AFW 9	--	3.55	6-01-79	P	--	8-1-79	Layne NE	--
AFW 10	--	14.6	11-10-64	U	--	8-64	R.E. Chapman	--
AFW 11	Obs	--	--	U	--	--	Layne, NE	84
AFW 12	Obs	15.7	8-23-89	U	--	--	--	--
AFW 13	Obs	33.8	8-24-89	U	--	--	--	--
AFW 19	--	7.7	11-10-64	U	--	7-64	R.E. Chapman	--
AFW 20	--	11.9	8-20-73	U	--	4-73	R.E. Chapman	--
AFW 21	Wsh	9.3	8-31-73	U	45	--	--	--
AFW 22	--	6.9	9-04-73	U	--	12-73	R.E. Chapman	--
AFW 23	--	10.2	9-04-73	U	--	13-73	R.E. Chapman	--
AFW 24	Wsh	11.7	10-05-71	U	20	16-71	R.E. Chapman	--
AFW 25	Wsh	19.9	10-06-71	U	10	17-71	R.E. Chapman	--
AFW 27	Gvl	12.5	4-27-84	H	20	004.0001	NHWRD	--
AFW 30	BrW	--	--	H	3	004.0005	NHWRD	107
AFW 31	BrW	20	4-25-85	H	20	004.0006	NHWRD	35
AFW 34	BrW	--	--	H	40	004.0010	NHWRD	95
AFW 41	BrW	10	11-23-86	H	15	004.0021	NHWRD	25
AFW 42	BrW	4	11-06-86	H	10	004.0022	NHWRD	22
AFW 43	Gvl	30	11-21-86	H	15	004.0023	NHWRD	95

Appendix A. Description of selected wells, auger holes, and borings in south-central New Hampshire—*Continued*

Local well No.	Latitude (° ′ ″)	Longitude (° ′ ″)	Owner or user	Year completed	Elevation above sea level (ft)	Depth of hole (ft)	Bottom of casing (ft)	Depth of well (ft)	Diameter of well (in.)	Depth to refusal (ft)
			MERRIMACK COUNTY—*Continued*							
			Allenstown—*Continued*							
AFW 44	430848	0712105	Klaubert	1987	420	--	30	323	--	--
AFW 53	430841	0712052	Scherer, D.	1988	420	--	19	280	--	--
AFW 54	430905	0712429	Caron, R.	1988	310	--	159	945	--	--
AFW 55	430848	0712449	Littlefield, D.	1988	310	--	46	465	--	--
AFW 59	430855	0712011	Petrin	1988	500	--	20	400	--	--
AFW 60	430859	0712013	Grondin Const. Inc.	1988	510	--	20	260	--	--
AFW 61	430846	0712012	Grondin Const. Inc.	1988	490	--	19	280	--	--
AFW 70	430901	0712426	Jackson, J.	1988	315	--	137	323	--	--
AFW 80	430837	0712525	Juranty, W.	1989	300	--	120	600	--	--
AFW 82	430843	0712105	Bonnett, D.	1988	400	--	54	525	--	--
AFW 88	430833	0712527	Juranty, M.	1989	290	--	121	440	--	--
AFW 90	430933	0712420	Hutchins, E.	1989	--	--	74	155	--	--
AFW 91	430845	0711945	Wasson, R.	1989	490	--	29	180	--	--
AFW 97	430817	0712544	PCMI Const. Inc.	1989	290	--	--	400	6	--
			Boscawen							
BTA 1	431922	0713718	Town of Boscawen	1979	265	75	--	--	--	--
BTA 2	431923	0713734	Town of Boscawen	1978	265	78	--	--	--	--
BTA 3	431950	0713745	Town of Boscawen	1979	280	102	--	99	--	90
BTA 4	431957	0713748	Town of Boscawen	1979	290	99	--	--	--	89
BTA 5	431958	0713743	Town of Bowcawen	1979	270	94	--	--	--	94
BTA 6	432126	0713830	Town of Boscawen	1979	285	85	--	--	--	--
BTA 7	432200	0713911	Town of Boscawen	1979	360	62	--	--	--	--
BTA 8	432223	0713922	Town of Boscawen	1979	300	14	--	--	--	14
BTA 9	431750	0713603	Marshal	1993	280	60	--	--	--	60
BTA 10	431920	0713852	Penacook-Boscawen Water Precinct	1993	390	21.5	--	--	--	21.5
BTB 3	431723	0713523	NHDOT	1958	251	61	--	--	--	--
BTW 2	431924	0713742	Town of Boscawen	1988	270	88	--	84	--	88
BTW 3	431926	0713739	Town of Boscawen	1988	270	102	93	99	2.5	102
BTW 4	431929	0713740	Town of Boscawen	1988	265	99	--	99	--	99
BTW 5	431954	0713752	Town of Boscawen	1979	290	78	--	78	--	78
BTW 6	431951	0713900	Barvenik, M.	1984	400	--	23	280	--	--
BTW 7	432159	0713856	Penacook-Boscawen Water Precinct	1994	260	52	41	51	8	--
BTW 8	432154	0713851	Penacook-Boscawen Water Precinct	1994	260	54.5	41	52	18	--
BTW 10	432157	0713853	Penacook-Boscawen Water Precinct	1993	251.42	47	42	47	2.5	47
BTW 12	432202	0713919	Penacook-Boscawen Water Precinct	1993	300.49	47.5	40	46	2.5	47.5
BTW 13	432205	0713902	Penacook-Boscawen Water Precinct	1993	262.37	40	34	40	2.5	40
BTW 14	432201	0713903	Penacook-Boscawen Water Precinct	1993	280.42	41	35	41	2.5	41

Local well No.	Type of site	Water level Depth (ft)	Water level Date (mm-dd-yy)	Use	Maximum well yield (gallons per minute)	Other identifier	Assignor of other identifier	Depth to bedrock (ft)
MERRIMACK COUNTY—*Continued*								
Allenstown—*Continued*								
AFW 44	BrW	30	5-04-87	H	50	004.0024	NHWRD	10
AFW 53	BrW	25	6-17-88	H	--	004.0035	NHWRD	6
AFW 54	BrW	20	3-25-88	C	35	004.0036	NHWRD	130
AFW 55	BrW	--	--	H	25	004.0037	NHWRD	30
AFW 59	BrW	--	--	H	75	004.0041	NHWRD	7.5
AFW 60	BrW	--	--	H	20	004.0042	NHWRD	4
AFW 61	BrW	--	--	H	50	004.0043	NHWRD	12
AFW 70	BrW	--	--	H	7	004.0052	NHWRD	100
AFW 80	BrW	--	--	H	2	004.0063	NHWRD	106
AFW 82	BrW	15	9-10-88	H	2	004.0066	NHWRD	4
AFW 88	BrW	--	--	H	6	004.0072	NHWRD	95
AFW 90	BrW	65	4-13-89	H	8	004.0074	NHWRD	55
AFW 91	BrW	25	6-07-89	H	25	004.0075	NHWRD	18
AFW 97	BrW	--	--	H	3	004.0081	NHWRD	--
Boscawen								
BTA 1	TH	--	--	U	--	12-79	R.E. Chapman	--
BTA 2	TH	--	--	U	--	1-79	R.E. Chapman	--
BTA 3	TH	2.9	6-03-88	U	--	8-79	R.E. Chapman	--
BTA 4	TH	31.2	8-23-79	U	--	10-79	R.E. Chapman	--
BTA 5	TH	--	--	U	--	11-78	R.E. Chapman	--
BTA 6	TH	--	--	U	--	2-79	R.E. Chapman	--
BTA 7	TH	10	8-15-79	U	--	3-79	R.E. Chapman	--
BTA 8	TH	--	--	U	--	4-79	R.E. Chapman	--
BTA 9	TH	24	11-24-93	U	--	12-93	D.L. Maher	--
BTA 10	TH	--	--	U	--	8-93	D.L. Maher	--
BTB 3	BB	--	--	U	--	B-7/1958	NHDOT	61
BTW 2	Obs	1.6	5-27-88	U	--	1-88	D.L. Maher	--
BTW 3	Obs	2.4	6-03-88	U	--	2-88	D.L. Maher	--
BTW 4	Obs	8.7	8-02-88	U	--	4-88	D.L. Maher	--
BTW 5	Obs	17.5	8-21-79	U	--	9-79	R.E. Chapman	--
BTW 6	BrW	--	--	H	4	026.0002	NHWRD	14
BTW 7	GPW	15.0	10-21-94	P	450	Well No. 1	D.L. Maher	--
BTW 8	GPW	14.5	10-21-94	P	450	Well No. 2	D.L. Maher	--
BTW 10	Obs	3.82	11-05-93	U	60	7-93	D.L. Maher	--
BTW 12	Obs	5.37	11-04-93	U	30	6-93	D.L. Maher	--
BTW 13	Obs	16	6-23-93	U	30	20-93	D.L. Maher	--
BTW 14	Obs	--	--	U	25	22-93	D.L. Maher	--

Appendix A. Description of selected wells, auger holes, and borings in south-central New Hampshire—*Continued*

Local well No.	Latitude (° ′ ″)	Longitude (° ′ ″)	Owner or user	Year completed	Elevation above sea level (ft)	Depth of hole (ft)	Bottom of casing (ft)	Depth of well (ft)	Diameter of well (in.)	Depth to refusal (ft)
MERRIMACK COUNTY—*Continued*										
Boscawen—*Continued*										
BTW 15	432148	0713901	Penacook-Boscawen Water Precinct	1994	281.32	26	21	26	2.5	26
BTW 16	432149	0713854	Penacook-Boscawen Water Precinct	1994	260.37	54	49	54	2.5	54
BTW 17	431749	0713554	Penacook-Boscawen Water Precinct	1993	280	85	78	84	2.5	85
BTW 19	431827	0713640	Crete, E.	1986	280	--	69	720	--	--
BTW 20	431807	0713618	Viola, A.	1986	300	--	139	320	--	--
BTW 29	431954	0713914	Kantz, E.	1987	420	--	20	355	--	--
BTW 36	431916	0713808	Bartlett, T.	1988	370	--	51	405	--	--
BTW 41	431949	0713913	Crossman, J.	1989	420	--	19	220	--	--
BTW 47	431952	0713958	Rte 4 saw mill	1979	420	34	--	--	--	34
BTW 48	432007	0714026	Rte 4 saw mill	1979	425	25	--	--	--	25
Bow										
BUA 1	430706	0713022	Saltmarsh	1990	425	42	--	--	--	--
BUB 7	431013	0713149	NHDOT	1956	223	41	--	--	--	--
BUW 11	430850	0712903	PSNH	1955	240	52	--	49	--	--
BUW 12	430844	0712907	PSNH	1955	240	95	--	69	--	--
BUW 13	430808	0712837	PSNH	1981	280	74.5	--	74.5	--	--
BUW 14	430811	0712834	PSNH	1981	260	55.5	--	55	--	55.5
BUW 15	430806	0712831	PSNH	1981	280	63	--	60.5	--	--
BUW 16	430804	0712824	PSNH	1981	300	92	--	92	--	92
BUW 17	430837	0712901	Town of Bow	1981	230	80	--	70	--	80
BUW 18	430902	0712903	Town of Bow	1981	215	55	--	55	--	55
BUW 19	430710	0713033	--	1981	385	37	--	28	2.5	--
BUW 20	430821	0712905	Town of Bow	1981	230	57	--	57	--	57
BUW 21	430835	0712944	Town of Bow	1981	330	16	--	16	2.5	16
BUW 22	430842	0712942	Town of Bow	1981	300	18	--	18	--	18
BUW 23	430909	0712951	Scouill, J.	1963	315	101	--	101	6	8
BUW 24	430914	0712930	PSNH	1981	245	55	50	50	2.5	55
BUW 55	430843	0713457	Tanguay, Y.	1985	370	--	72	225	--	--
BUW 64	430912	0713638	--	1990	--	34	--	34	--	--
BUW 86	430921	0713443	Carter	1985	365	--	86	240	--	--
BUW 87	430744	0712856	Dufresne, M.	1985	330	--	29	300	--	--
BUW 89	430834	0713451	Pike, R.	1985	420	--	104	355	--	--
BUW 96	430839	0713450	Vandermeulen, R.	1985	390	--	90	703	--	--
BUW 97	430903	0712939	Mosbeck, D.	1985	320	--	164	304	--	--
BUW 106	430850	0713451	Bardsley	1985	380	--	79	500	--	--
BUW 107	430853	0713445	Lamy, R.	1988	370	--	77	257	6	--
BUW 108	430847	0713500	Duby, E.	1985	360	--	49	480	--	--
BUW 109	430828	0712934	Westover, E.	1985	310	--	29	322	--	--
BUW 113	430834	0712842	Stevens, B.	1985	230	--	120	504	--	--
BUW 158	430842	0713437	Ridgewood Const	1986	360	--	41	162	--	--
BUW 169	430846	0712909	Wheeler, R.	1986	210	--	43	45	--	--

Local well No.	Type of site	Water level		Use	Maximum well yield (gallons per minute)	Other identifier	Assignor of other identifier	Depth to bedrock (ft)
		Depth (ft)	Date (mm-dd-yy)					
MERRIMACK COUNTY—*Continued*								
Boscawen—*Continued*								
BTW 15	Obs	16.4	6-28-94	U	--	23-93	D.L. Maher	--
BTW 16	Obs	15.5	6-29-94	U	60	21-93	D.L. Maher	--
BTW 17	Obs	21.3	12-09-93	U	55	18-93	D.L. Maher	--
BTW 19	BrW	--	--	H	6	026.0016	NHWRD	55
BTW 20	BrW	--	--	H	25	026.0017	NHWRD	126
BTW 29	BrW	--	--	H	10	026.0027	NHWRD	10
BTW 36	BrW	10	9-02-88	H	2	026.0034	NHWRD	40
BTW 41	BrW	9	3-28-89	H	3.25	026.0039	NHWRD	7
BTW 47	--	--	--	U	--	6-79	R.E. Chapman	--
BTW 48	--	--	--	U	--	7-79	R.E. Chapman	--
Bow								
BUA 1	TH	8	6-18-90	U	--	--	--	--
BUB 7	BB	--	--	U	--	--	--	41
BUW 11	GPW	--	--	N	--	--	--	52
BUW 12	GPW	--	--	N	--	--	--	95
BUW 13	Obs	31.9	10-13-81	U	--	SB-1/JB 1370-81	Soils Eng.	74.5
BUW 14	Obs	14.7	10-13-81	U	--	SB-12/JB1370-81	Soils Eng.	--
BUW 15	Obs	42	10-13-81	U	--	SB-9/JB 1370-81	Soils Eng.	60.5
BUW 16	Obs	34	10-13-81	U	--	SB-10/JB1370-81	Soils Eng.	--
BUW 17	Obs	34.2	10-27-81	U	--	1-81	D.L. Maher	--
BUW 18	Obs	5.6	10-30-81	U	--	2-81	D.L. Maher	--
BUW 19	Obs	2.9	11-13-81	U	--	3-81	D.L. Maher	37
BUW 20	Obs	1.8	11-17-81	U	--	4-81	D.L. Maher	--
BUW 21	Obs	--	--	U	--	81-A	D.L. Maher	--
BUW 22	Obs	--	--	U	--	81-C	D.L. Maher	--
BUW 23	BrW	6	1963	H	40	--	--	--
BUW 24	Wsh	5.6	10-30-81	H	75	2-81	D.L. Maher	--
BUW 55	BrW	--	--	H	12	027.0032	NHWRD	32
BUW 64	Obs	2.1	4-23-91	U	--	--	--	34
BUW 86	BrW	--	--	H	12	027.0072	NHWRD	76
BUW 87	BrW	20	10-11-85	C	1	027.0073	NHWRD	15
BUW 89	BrW	--	--	H	2	027.0075	NHWRD	59
BUW 96	BrW	--	--	H	2	027.0084	NHWRD	74
BUW 97	BrW	--	--	H	5	027.0085	NHWRD	148
BUW 106	BrW	--	--	H	1.5	027.0100	NHWRD	65
BUW 107	BrW	18	5-15-88	H	1.5	027.0415	NHWRD	70
BUW 108	BrW	--	--	H	3	027.0102	NHWRD	35
BUW 109	BrW	--	--	H	3	027.0105	NHWRD	16
BUW 113	BrW	--	--	H	1	027.0113	NHWRD	95
BUW 158	BrW	--	--	H	6.	027.0167	NHWRD	39
BUW 169	--	8	7-07-86	H	150	027.0178	NHWRD	--

Appendix A. Description of selected wells, auger holes, and borings in south-central New Hampshire—*Continued*

Local well No.	Latitude (° ′ ″)	Longitude (° ′ ″)	Owner or user	Year completed	Elevation above sea level (ft)	Depth of hole (ft)	Bottom of casing (ft)	Depth of well (ft)	Diameter of well (in.)	Depth to refusal (ft)
			MERRIMACK COUNTY—*Continued*							
			Bow—*Continued*							
BUW 216	431021	0713203	Snyder General Cont	1986	280	--	80	350	--	--
BUW 217	430853	0712916	Young Furniture Mfg Inc	1986	260	--	139	150	--	--
BUW 252	430920	0713613	Kelso, W.	1987	340	--	29	120	--	--
BUW 266	430920	0713551	Evans, J.	1987	345	--	17	175	--	--
BUW 267	430916	0713319	White Rock Water Co	1987	330	--	41	250	--	--
BUW 268	430918	0713321	White Rock Water Co	1987	330	--	20	195	--	--
BUW 270	430930	0713622	Boulay, T.	1987	360	--	35	360	--	--
BUW 297	430856	0712918	River Rd Business Bays	1987	260	--	162	263	--	--
BUW 306	430824	0712933	Champigny, N.	1988	300	--	34	205	--	--
BUW 354	430830	0712852	Stevens, B.	1988	240	--	70	600	--	--
BUW 355	430832	0712855	Stevens, B.	1988	240	--	160	400	--	--
BUW 361	430825	0712835	Phelps, L.	1988	230	--	80	420	--	--
BUW 364	431024	0713210	Bow Bank	1988	280	--	83	210	--	--
BUW 365	430809	0712920	Flagg, S.	1987	310	--	75	170	--	--
BUW 369	430712	0713041	Upton	1987	390	--	--	100	6	--
BUW 371	431015	0713204	Stevens, D.	1988	280	--	62	120	--	--
BUW 378	430946	0713621	Arneson	1987	360	--	49	172	--	--
BUW 413	430726	0713054	Rhoads, D. & C.	1989	420	--	--	100	6	--
BUW 414	431019	0713214	Concord Group	1989	280	--	80	300	--	--
BUW 422	431013	0713203	Hampton Inn	1989	270	--	94	755	--	--
BUW 423	431027	0713205	Birch Tree Association	1989	270	--	101	561	--	--
BUW 432	430812	0712911	Stevens, R.	1990	250	--	50	420	--	--
BUW 443	431011	0713203	Village Square Builders	1991	250	--	19	142	--	--
			Canterbury							
CEB 1	431723	0713513	NHDOT	1958	249	80	--	--	--	--
CEW 1	432152	0713726	Town of Canterbury	1990	390	80	--	60	2	80
CEW 2	432230	0712734	Carlson, Roger	1990	510	18	--	11	--	--
CEW 3	431950	0713638	Town of Canterbury	1990	370	117	38	40	2	--
CEW 26	432154	0713729	Blomboch, J.	1986	410	--	145	205	--	--
CEW 53	432148	0713727	Bezanson, M.	1987	410	--	110	212	--	--
CEW 55	432036	0713735	Welcome, D.	1987	280	--	50	515	--	--
CEW 63	432146	0713756	Richard, W.	1988	380	--	157	520	--	--
CEW 71	431739	0713421	Nickels, G.	1988	380	--	69	340	--	--
CEW 84	432146	0713712	Bond, M.	1988	410	--	109	400	--	--
CEW 89	431804	0713351	Carter, R.	1989	370	--	29	320	--	--
CEW 100	431746	0713507	Hafer, F.	1989	310	--	89	320	--	--
CEW 109	431719	0713516	Mastey, L.	1985	--	--	134	325	--	--
			Chichester							
CQW 2	431520	0712212	Dykstra, George	1989	365	59	50.2	52.2	2	--
CQW 3	431535	0712205	--	1990	375	29	--	18.9	--	29
CQW 47	431527	0712214	Fenton, F.	1987	340	--	63	150	--	--

Local well No.	Type of site	Water level		Use	Maximum well yield (gallons per minute)	Other identifier	Assignor of other identifier	Depth to bedrock (ft)
		Depth (ft)	Date (mm-dd-yy)					
MERRIMACK COUNTY—*Continued*								
Bow—*Continued*								
BUW 216	BrW	20	6-12-86	H	30	027.0229	NHWRD	68
BUW 217	--	40	5-19-86	H	100	027.0230	NHWRD	--
BUW 252	BrW	10.0	7-18-87	H	5	027.0273	NHWRD	13
BUW 266	BrW	3.5	7-23-87	H	7	027.0292	NHWRD	13
BUW 267	BrW	2.5	8-05-87	P	3	027.0293	NHWRD	35
BUW 268	BrW	2.5	8-19-87	P	23	027.0294	NHWRD	2.5
BUW 270	BrW	--	--	H	4	027.0298	NHWRD	18
BUW 297	BrW	--	--	H	40	027.0329	NHWRD	138
BUW 306	BrW	--	--	H	20	027.0338	NHWRD	23
BUW 354	BrW	--	--	H	20	027.0392	NHWRD	55
BUW 355	BrW	--	--	H	4	027.0393	NHWRD	135
BUW 361	BrW	20	11-09-88	H	1.5	027.0401	NHWRD	70
BUW 364	BrW	40	2-17-88	H	3	027.0404	NHWRD	76
BUW 365	BrW	48	9-17-87	H	5	027.0405	NHWRD	68
BUW 369	BrW	5	11-24-87	H	10	027.0409	NHWRD	--
BUW 371	BrW	40	1-22-88	H	10	027.0413	NHWRD	48
BUW 378	BrW	8.0	5-15-87	H	5	027.0422	NHWRD	35
BUW 413	BrW	5	9-15-89	H	20	027.0461	NHWRD	--
BUW 414	BrW	--	--	--	12	027.0462	NHWRD	70
BUW 422	BrW	35	3-14-89	H	25	027.0471	NHWRD	75
BUW 423	BrW	30	3-16-89	H	50	027.0472	NHWRD	75
BUW 432	BrW	--	--	H	100	027.0481	NHWRD	29
BUW 443	BrW	--	--	H	7	027.0502	NHWRD	9
Canterbury								
CEB 1	BB	--	--	U	--	B-2/1958	NHDOT	80
CEW 1	Obs	19	7-19-90	U	--	--	--	--
CEW 2	Obs	3	6-25-90	U	--	--	--	18
CEW 3	Obs	30	6-22-90	U	--	--	--	--
CEW 26	BrW	--	--	H	6	038.0029	NHWRD	133
CEW 53	BrW	--	--	H	5.5	038.0056	NHWRD	100
CEW 55	BrW	--	--	H	4	038.0058	NHWRD	30
CEW 63	BrW	83	4-19-88	H	3	038.0067	NHWRD	148
CEW 71	BrW	--	--	H	5	038.0076	NHWRD	45
CEW 84	BrW	--	--	H	2.5	038.0092	NHWRD	90
CEW 89	BrW	--	--	H	3	038.0101	NHWRD	9
CEW 100	BrW	--	--	H	6	038.0112	NHWRD	75
CEW 109	BrW	--	--	H	15	038.0125	NHWRD	123
Chichester								
CQW 2	Obs	28.5	12-26-89	U	--	--	--	--
CQW 3	Obs	--	--	U	--	--	--	--
CQW 47	BrW	12	5-29-87	H	18	046.0051	NHWRD	50

Appendix A. Description of selected wells, auger holes, and borings in south-central New Hampshire—*Continued*

Local well No.	Latitude (° ′ ″)	Longitude (° ′ ″)	Owner or user	Year completed	Elevation above sea level (ft)	Depth of hole (ft)	Bottom of casing (ft)	Depth of well (ft)	Diameter of well (in.)	Depth to refusal (ft)
			MERRIMACK COUNTY—*Continued*							
			Chichester—*Continued*							
CQW 66	431542	0712218	Fredette, H.	1988	340	--	63	362	--	--
CQW 70	431639	0712205	Guay, H.	1988	360	--	19	182	--	--
CQW 85	431548	0712225	Little League Field	1989	380	--	52	304	--	--
			Concord							
CVA 1	431718	0713507	Hannah's Paddles	1989	268	82	--	--	--	--
CVA 2	431239	0713207	NHDOT	1950	235	82	--	82	--	--
CVA 3	431327	0713201	Christa McAuliffe Planetarium	1988	240	52	--	--	--	52
CVA 4	431335	0713158	N.H. Technical Institute	1988	235	31.8	--	--	--	31.8
CVA 5	431147	0713237	N.H. Psychiatric Hospital	1986	295	91.5	--	--	--	--
CVA 6	431336	0713255	City of Concord	1927	230	57.5	--	--	--	--
CVA 7	431342	0713244	City of Concord	1927	230	60	--	--	--	--
CVA 8	431346	0713302	City of Concord	1927	220	66	--	--	--	--
CVA 9	431020	0713125	PSNH	1990	235	28	--	--	--	28
CVA 10	431139	0713234	City of Concord	1988	289	92	--	--	--	--
CVB 64	431405	0712815	NHDOT	1985	340	21	--	--	--	--
CVB 65	431403	0712803	NHDOT	1985	322	23.7	--	--	--	--
CVB 66	431406	0712752	NHDOT	1985	308	12.2	--	--	--	--
CVB 67	431403	0712755	NHDOT	1985	302	63.1	--	--	--	--
CVB 68	431231	0713155	NHDOT	1964	240	105	--	--	--	--
CVB 69	431231	0713147	NHDOT	1964	234	115	--	--	--	--
CVB 72	431057	0713538	NHDOT	1957	333	12	--	--	--	--
CVB 73	431307	0713128	NHDOT	1963	225	35	--	--	--	35
CVB 74	431309	0713121	NHDOT	1963	225	50	--	--	--	50
CVB 75	431331	0713029	NHDOT	1977	355	119	--	--	--	--
CVB 76	431322	0713027	NHDOT	1977	355	128	--	--	--	--
CVB 77	431340	0712943	NHDOT	1975	352	57	--	--	--	--
CVB 78	431201	0712855	NHDOT	1949	247	46.5	--	--	--	--
CVB 79	431058	0712935	NHDOT	1949	247	44	--	--	--	--
CVB 80	431342	0713212	NHDOT	1957	235	39.5	--	--	--	--
CVB 82	431324	0713207	NHDOT	1956	246	80	--	--	--	--
CVB 83	431136	0713136	NHDOT	1957	245	54.5	--	--	--	54.5
CVB 84	431259	0713205	NHDOT	1957	262	93.6	--	--	--	--
CVB 85	431256	0713215	NHDOT	1957	235	81.5	--	--	--	--
CVB 86	431412	0713223	NHDOT	1957	235	25	--	--	--	--
CVB 87	431626	0713341	NHDOT	1957	304	26	--	--	--	--
CVB 88	431728	0713434	NHDOT	1958	321	49	--	--	--	--
CVB 89	431230	0713209	NHDOT	1964	240	61	--	--	--	--
CVB 90	431253	0713223	NHDOT	1981	254	43.5	--	--	--	--
CVB 91	431047	0713155	NHDOT	1956	277	46	--	--	--	--
CVB 92	431134	0713125	NHDOT	1932	230	27	--	--	--	--
CVW 1	431524	0713454	USGS	1955	345	10.8	8.8	10.8	0.75	--

Local well No.	Type of site	Water level		Use	Maximum well yield (gallons per minute)	Other identifier	Assignor of other identifier	Depth to bedrock (ft)
		Depth (ft)	Date (mm-dd-yy)					
MERRIMACK COUNTY—*Continued*								
Chichester—*Continued*								
CQW 66	BrW	--	--	H	3.50	046.0078	NHWRD	35
CQW 70	BrW	--	--	H	10	046.0082	NHWRD	8
CQW 85	BrW	--	--	--	25	046.0099	NHWRD	30
Concord								
CVA 1	TH	--	--	U	--	--	--	--
CVA 2	TH	--	--	U	--	--	--	--
CVA 3	TH	11	9-22-88	U	--	TB-B/80624.01	Miller Eng.	--
CVA 4	TH	14	8-11-88	U	--	B-2/ JB 88111	Con-Tec	--
CVA 5	TH	8.1	4-09-86	U	--	B-101/ JB 8640	Con-Tec	85.5
CVA 6	TH	--	--	U	--	--	--	--
CVA 7	TH	--	--	U	--	--	--	--
CVA 8	TH	--	--	U	--	--	--	--
CVA 9	TH	24	6-18-90	U	--	--	--	--
CVA 10	TH	--	--	U	--	HE-1	Heynen Eng.	--
CVB 64	BB	--	5-08-85	U	--	40-2-1/ NH 1-13	NHDOT	21
CVB 65	BB	--	5- -85	U	--	40-2-2/ NH 2-2	NHDOT	23.7
CVB 66	BB	--	5- -85	U	--	40-3-1/ NH 3-6	NHDOT	12.2
CVB 67	BB	--	5-31-85	U	--	40-4-1/ NH 3-23	NHDOT	63.1
CVB 68	BB	--	9- -64	U	--	19-4-1/ NH 1-A	NHDOT	105
CVB 69	BB	--	9- -64	U	--	NH-13	NHDOT	115
CVB 72	BB	--	3-25-57	U	--	A-10/ 1957	NHDOT	12
CVB 73	BB	--	10- -63	U	--	4-3-1-1/ NH 3-P	NHDOT	--
CVB 74	BB	--	10- -63	U	--	4-3-1-1/ NH 19	NHDOT	--
CVB 75	BB	36	10- -77	U	--	35-1-2/ NH 201	NHDOT	119
CVB 76	BB	40	10- -77	U	--	35-1-2/ NH 202	NHDOT	128
CVB 77	BB	--	12- -75	U	--	35-1-3/ NH 1	NHDOT	57
CVB 78	BB	--	9- -47	U	--	35-1-3/ NH 2	NHDOT	41
CVB 79	BB	--	6- -49	U	--	2-12-1-15/ NH 2	NHDOT	44
CVB 80	BB	--	--	U	--	--	--	
CVB 82	BB	--	10- -56	U	--	6-2-1/ NH C-1	NHDOT	80
CVB 83	BB	--	9- -57	U	--	6-2-1/ NH C-2	NHDOT	--
CVB 84	BB	--	9- -57	U	--	6-2-3/ NH D-3	NHDOT	93.6
CVB 85	BB	--	9- -57	U	--	6-2-4/ E-1	NHDOT	81.5
CVB 86	BB	3	9- -57	U	--	6-3-2 / A-1	NHDOT	25
CVB 87	BB	--	9- -57	U	--	7-3-1/10	NHDOT	26
CVB 88	BB	--	6- -58	U	--	8-3-1 / B-3	NHDOT	49
CVB 89	BB	--	9- -64	U	--	3-13-4-8 / B-12	NHDOT	61
CVB 90	BB	--	2- -81	U	--	2-11-2-1 / B-16	NHDOT	43.5
CVB 91	BB	--	2- -56	U	--	NH 13	NHDOT	46
CVB 92	BB	--	9- -32	U	--	NH 8	NHDOT	27
CVW 1	Obs	4.01	10-25-79	U	--	--	--	--

Appendix A. Description of selected wells, auger holes, and borings in south-central New Hampshire—*Continued*

Local well No.	Latitude (° ′ ″)	Longitude (° ′ ″)	Owner or user	Year completed	Elevation above sea level (ft)	Depth of hole (ft)	Bottom of casing (ft)	Depth of well (ft)	Diameter of well (in.)	Depth to refusal (ft)
				MERRIMACK COUNTY—*Continued*						
				Concord—*Continued*						
CVW 2	431224	0713037	USGS	1963	340	167	57	60	2	--
CVW 3	431249	0712903	USGS	1966	350	--	--	72.7	1.25	--
CVW 4	431049	0713243	USGS	1966	290	--	--	40.7	1.25	--
CVW 5	431103	0712933	Town of Pembroke	1950	238	80	--	80	--	80
CVW 6	431650	0713533	Morrill, John	1964	275	68.2	--	--	--	68.2
CVW 7	431635	0713512	Raymond, Howard	1964	258	32.5	--	--	--	32.5
CVW 8	431056	0713354	State of New Hampshire	1964	285	33.2	--	--	--	33.2
CVW 9	431109	0713340	Tilton	1964	265	73.3	--	--	--	73.3
CVW 10	431045	0713255	Cilley	1964	265	31.3	--	--	--	31.3
CVW 11	431029	0713233	Madison	1964	270	44.3	--	--	--	44.3
CVW 12	430947	0713521	City of Concord	1964	335	74.3	--	18.4	2.5	74.3
CVW 13	430943	0713523	City of Concord	1964	335	75.1	--	39	2.5	--
CVW 14	431008	0713453	City of Concord	1964	330	29.7	--	21.3	2.5	29.7
CVW 15	430953	0713529	City of Concord	1964	340	44.4	--	24	2.5	44.4
CVW 16	431239	0713020	Sprague Electric	1987	345	400	190	400	6	--
CVW 17	431220	0712857	State of New Hampshire	1985	335	62	53.1	62	2.5	--
CVW 18	431618	0713531	Beede Electric Co.	1984	363	27.5	10	25	1.5	--
CVW 19	431622	0713521	Beede Electric Co.	1984	361	38.1	23.1	32.8	1.5	--
CVW 20	431621	0713525	Beede Electric Co.	1982	358	45.6	25.5	45.5	1.5	--
CVW 21	431624	0713520	Beede Electric Co.	1982	358	21.5	6	20	1.5	--
CVW 22	431626	0713517	Beede Electric Co.	1984	291	56.7	33	56	1.5	--
CVW 23	431625	0713511	Beede Electric Co.	1984	358	134	81.3	130	1.5	--
CVW 24	431245	0713019	Sprague Electric Co.	1987	345	352	229	352	6	--
CVW 25	431248	0713011	Sprague Electric Co.	1983	346	37	31	36	2	--
CVW 26	431242	0713009	Sprague Electric Co.	1983	344	42	40.8	40.8	2	--
CVW 27	431409	0712754	Cummins	1964	330	39.3	--	--	--	39.3
CVW 28	431417	0712749	Cilley	1964	310	31.3	--	--	--	31.3
CVW 29	431247	0713019	Sprague Electric Co.	1985	345	332	--	332	6	--
CVW 30	431207	0713027	Northern Telecom	1986	335	61	--	61	--	--
CVW 31	431437	0712754	Cilley	1964	330	32.3	--	--	--	32.3
CVW 32	431204	0713117	Concord Landfill	1984	246	84	--	84	--	84
CVW 33	431158	0713108	Concord Landfill	1984	293	68	--	--	--	--
CVW 34	431216	0713106	Concord Landfill	1986	324	75	--	75	--	--
CVW 35	431212	0713054	Concord Landfill	1986	332	77	--	75	--	--
CVW 36	431212	0713119	Concord Landfill	1986	225	69	--	63	--	--
CVW 37	431302	0713136	Concord Stump Dump	1988	233	55.1	--	54	--	55.1
CVW 38	431252	0713127	Concord Stump Dump	1988	230	54.5	--	54	--	54.5
CVW 39	431256	0713123	Concord Stump Dump	1988	224	61.5	--	59	--	61.5
CVW 40	431704	0713452	City of Concord	1986	245	54.5	--	54.5	--	54.5
CVW 41	431740	0713408	City of Concord	1986	380	21	--	18	--	--
CVW 42	431310	0713131	NHDPW	1980	230	60	--	60	--	60
CVW 43	431307	0713151	NHDPW	1980	230	38	--	38	--	38
CVW 44	430937	0713559	Murphy	1985	360	--	59	180	--	--

Local well No.	Type of site	Water level Depth (ft)	Water level Date (mm-dd-yy)	Use	Maximum well yield (gallons per minute)	Other identifier	Assignor of other identifier	Depth to bedrock (ft)
MERRIMACK COUNTY—*Continued*								
Concord—*Continued*								
CVW 2	Obs	40	4-01-70	U	--	--	--	--
CVW 3	Obs	57.5	2-25-80	U	--	--	--	--
CVW 4	Obs	18.3	6-27-80	U	--	--	--	--
CVW 5	GPW	19.6	3-01-50	P	--	Pem. 13	Metcalf & Eddy	--
CVW 6	Obs	11.2	10- -64	U	--	Well 1, 10/1964	Prtr & Dsmnd	--
CVW 7	Obs	3.16	10- -64	U	--	Well 2, 10/1964	Prtr & Dsmnd	--
CVW 8	Obs	13.2	10- -64	U	--	Well 4, 10/1964	Prtr & Dsmnd	--
CVW 9	Obs	6	10- -64	U	--	Well 5, 10/1964	Prtr & Dsmnd	--
CVW 10	Obs	3.16	10- -64	U	--	Well 6, 10/1964	Prtr & Dsmnd	--
CVW 11	Obs	4	10- -64	U	--	W-7/ 1964	Prtr & Dsmnd	--
CVW 12	Obs	4.4	12- -64	U	--	W-11, 10/1964	Prtr & Dsmnd	--
CVW 13	Obs	3.1	12- -64	U	--	W-12, 12/1964	Prtr & Dsmnd	--
CVW 14	Obs	1	12- -64	U	--	W-13A, 12/1964	Prtr & Dsmnd	--
CVW 15	Obs	2.3	12- -64	U	--	W-14, 12/1964	Prtr & Dsmnd	--
CVW 16	BrW	--	--	--	25	GZ-6R	Goldberg-Zoino	161
CVW 17	Obs	53.2	2-26-85	U	--	B-1/JB 2258-85	Soils Eng.	60.8
CVW 18	Obs	--	--	U	--	B-14, D-5103	Goldberg-Zoino	25
CVW 19	Obs	12.8	8-03-84	U	--	B-10, D5103	Goldberg-Zoino	31
CVW 20	Obs	30	9-23-82	U	--	B-3, D3306	Goldberg-Zoino	--
CVW 21	Obs	20	9-27-82	U	--	B-5, D-3306	Goldberg-Zoino	--
CVW 22	BrW	.5	8-09-84	U	--	B-12, D-5103	Goldberg-Zoino	21.5
CVW 23	Obs	12	9-17-84	U	--	B-16, D-5103	Goldberg-Zoino	130
CVW 24	BrW	--	--	U	4	GZ-7R, D-20155	Goldberg-Zoino	204
CVW 25	Obs	24.9	10-18-83	U	--	B-1, D-5059	Goldberg-Zoino	--
CVW 26	Obs	30.2	10-24-83	U	--	B-4, D-5059	Goldberg-Zoino	--
CVW 27	Obs	6	12- -64	U	--	W-8/1964	Prtr & Dsmnd	--
CVW 28	Obs	2.4	12- -64	U	--	W-10a	Prtr & Dsmnd	--
CVW 29	BrW	--	--	S	125	--	--	--
CVW 30	Obs	38	5-03-86	U	--	MW-3/2410-01-01	D.L. Maher	--
CVW 31	Obs	13.3	12- -64	U	--	W-9A, 12/1964	Prtr & Dsmnd	--
CVW 32	Obs	9.76	4-09-84	U	--	MW-2D	Weston	--
CVW 33	Obs	47.8	4-09-84	U	--	MW-4	Weston	--
CVW 34	Obs	54	10- -86	U	--	MW-5/1348-19-01	Weston	--
CVW 35	Obs	54	10-02-86	U	--	MW-6/1348-19-01	Weston	--
CVW 36	Obs	.5	10-06-86	U	--	MW-8D/1348-19-1	Weston	64
CVW 37	Obs	14.7	9-30-88	U	--	RFW-1D/1348-20	Weston	--
CVW 38	Obs	9.70	9-30-88	U	--	RFW-3D/1348-20	Weston	--
CVW 39	Obs	4.83	9-30-88	U	--	RFW-40/1348-20	Weston	--
CVW 40	Obs	--	--	U	--	2-86/86-182-T	D.L. Maher	--
CVW 41	Obs	--	--	U	--	5-86/86-182-T	D.L. Maher	--
CVW 42	Obs	10.2	12-09-80	U	--	1-80	D.L. Maher	--
CVW 43	Obs	6.25	12-11-80	U	--	5-80	D.L. Maher	38
CVW 44	BrW	25.0	4-13-85	H	5	027.0041	NHWRD	55

Appendix A. Description of selected wells, auger holes, and borings in south-central New Hampshire—*Continued*

Local well No.	Latitude (° ′ ″)	Longitude (° ′ ″)	Owner or user	Year completed	Elevation above sea level (ft)	Depth of hole (ft)	Bottom of casing (ft)	Depth of well (ft)	Diameter of well (in.)	Depth to refusal (ft)
MERRIMACK COUNTY—*Continued*										
Concord—*Continued*										
CVW 45	431600	0713531	Hawkins	1984	360	--	103	400	--	--
CVW 50	431331	0712910	Real World Corp	1984	330	--	43	220	--	--
CVW 52	431644	0713341	Roberts, P.	1984	305	--	72	275	--	--
CVW 53	431622	0713326	Nadeau, J.	1984	345	--	56	365	--	--
CVW 54	431010	0713454	Baker, R.	1984	330	--	--	11	--	--
CVW 56	431719	0713327	Chase, B.	1984	340	--	99	305	--	--
CVW 61	431442	0713118	Dyment, I.	1985	530	--	37	139	--	--
CVW 63	431732	0713344	Spear, F.	1985	355	--	89	220	--	--
CVW 73	431725	0713335	Maggioncalda, D.	1985	350	--	64	160	--	--
CVW 81	430953	0712948	Aiken, E.	1985	240	--	30	361	--	--
CVW 91	431634	0713227	Harney, D.	1986	360	--	20	155	6	--
CVW 104	431736	0713357	Ice, K.	1986	365	--	85	295	--	--
CVW 106	431716	0713349	Bradley, F.	1986	385	--	122	302	--	--
CVW 109	431719	0713352	Hennessy, J.	1986	230	--	114	404	--	--
CVW 110	431327	0713051	--	--	230	--	80	413	--	--
CVW 112	431714	0713351	Robbins, K.	1986	360	--	119	402	--	--
CVW 114	431718	0713310	Kadlec, D.	1984	355	--	13	405	--	--
CVW 127	431629	0713333	Gilbreath, D.	1986	320	--	55	365	--	--
CVW 131	431712	0713504	Gagne, D.	1986	260	--	90	305	--	--
CVW 136	431345	0712838	Plummer	1987	350	--	--	175	6	--
CVW 137	431548	0713533	City of Concord	1989	365	--	15	17	--	--
CVW 148	431620	0713324	Carter, K.	1986	350	--	69	365	--	--
CVW 163	431729	0713237	Jain	1988	380	--	--	202	6	--
CVW 165	431712	0713443	SES Concord Co	1987	300	--	109	273	--	--
CVW 183	431703	0713324	Smith, B.	1988	345	--	79	300	--	--
CVW 182	431448	0713059	--	1988	330	--	--	204	6	--
CVW 184	431106	0712952	Crumb, C.	1988	280	--	106	280	--	--
CVW 185	431223	0712914	G. McCarthy Inc	1988	350	--	36	360	--	--
CVW 202	431517	0713603	Johns	1989	365	--	--	185	6	--
CVW 205	431606	0713612	Caprarello, P.	1989	350	--	61	175	--	--
CVW 220	431000	0712950	Starrett, R.	1989	270	--	63	242	--	--
CVW 221	431730	0713231	Cote	1989	380	--	--	320	6	--
CVW 223	431727	0713405	R & K Const	1989	360	--	103	325	--	--
CVW 226	431719	0713400	R & K Const	1989	380	--	109	--	--	--
CVW 227	431725	0713346	R & K Const	1989	350	--	99	605	--	--
CVW 232	431015	0713542	Cranbrook Const	1990	380	--	120	400	--	--
CVW 246	431345	0713231	Brochu, L.	1987	240	--	64	465	--	--
Epsom										
ESA 1	431210	0712256	Saturley, Howard	1989	300	15	--	--	--	--
ESA 2	431211	0712239	Saturley, Howard	1989	295	90	--	--	--	90
ESA 3	431324	0712201	Colby	1990	360	13	--	--	--	13
ESA 4	431312	0712118	Cutter, Richard	1990	345	26	--	--	--	26

Local well No.	Type of site	Water level		Use	Maximum well yield (gallons per minute)	Other identifier	Assignor of other identifier	Depth to bedrock (ft)
		Depth (ft)	Date (mm-dd-yy)					
				MERRIMACK COUNTY—*Continued*				
				Concord—*Continued*				
CVW 45	BrW	--	--	H	10	051.0002	NHWRD	91
CVW 50	BrW	10	9-15-84	H	20	051.0008	NHWRD	33
CVW 52	BrW	20	7-19-84	H	8	051.0010	NHWRD	38
CVW 53	BrW	40	7-26-84	H	15	051.0011	NHWRD	57
CVW 54	Dug	6	9-19-84	H	--	051.0012	NHWRD	--
CVW 56	BrW	--	--	H	10	051.0014	NHWRD	80
CVW 61	BrW	3	1-25-85	H	15	051.0020	NHWRD	30
CVW 63	BrW	15	3-19-85	H	8	051.0022	NHWRD	80
CVW 73	BrW	45	8-16-85	H	6	051.0032	NHWRD	55
CVW 81	BrW	40	10-19-85	H	150	051.0040	NHWRD	12
CVW 91	BrW	10	11-17-86	H	12	051.0050	NHWRD	3
CVW 104	BrW	--	--	H	3	051.0063	NHWRD	80
CVW 106	BrW	--	--	H	150	051.0065	NHWRD	115
CVW 109	BrW	--	--	H	6	051.0071	NHWRD	109
CVW 110	BrW	--	--	H	--	051.0073	NHWRD	57
CVW 112	BrW	--	--	H	20	051.0075	NHWRD	110
CVW 114	BrW	--	--	H	1	051.0081	NHWRD	6
CVW 127	BrW	25	10-10-86	H	5	051.0095	NHWRD	46
CVW 131	BrW	15	6-11-86	H	7	051.0099	NHWRD	78
CVW 136	BrW	--	--	H	20	051.0104	NHWRD	20
CVW 137	Obs	3.4	4-07-89	U	--	--	--	--
CVW 148	BrW	--	--	H	9	051.0116	NHWRD	60
CVW 163	BrW	--	--	H	5	051.0131	NHWRD	36
CVW 165	BrW	--	--	H	12	051.0133	NHWRD	78
CVW 182	BrW	4	11-22-88	H	6	051.0153	NHWRD	60
CVW 183	BrW	--	--	H	20	051.0154	NHWRD	66
CVW 184	BrW	--	--	H	20	051.0155	NHWRD	84
CVW 185	BrW	--	--	H	10	051.0156	NHWRD	14
CVW 202	BrW	6	1-26-89	H	15	051.0173	NHWRD	100
CVW 205	BrW	--	--	H	50	051.0176	NHWRD	50
CVW 220	BrW	--	--	H	75	051.0192	NHWRD	45
CVW 221	BrW	--	--	H	5	051.0193	NHWRD	16
CVW 223	BrW	10	10-30-89	H	30	051.0195	NHWRD	87
CVW 226	BrW	10	11-02-89	H	--	051.0198	NHWRD	97
CVW 227	BrW	20	11-04-89	H	3	051.0199	NHWRD	88
CVW 232	BrW	--	--	H	6	051.0205	NHWRD	100
CVW 246	BrW	8.0	5-15-87	H	50	051.0120	NHWRD	63
				Epsom				
ESA 1	TH	--	--	U	--	--	--	--
ESA 2	TH	--	--	U	--	--	--	--
ESA 3	TH	11	6-29-90	U	--	--	--	--
ESA 4	TH	12	5-14-90	U	--	--	--	--

Appendix A. Description of selected wells, auger holes, and borings in south-central New Hampshire—*Continued*

Local well No.	Latitude (° ′ ″)	Longitude (° ′ ″)	Owner or user	Year completed	Elevation above sea level (ft)	Depth of hole (ft)	Bottom of casing (ft)	Depth of well (ft)	Diameter of well (in.)	Depth to refusal (ft)
			MERRIMACK COUNTY—*Continued*							
			Epsom—*Continued*							
ESA 5	431134	0712240	Kings Towne Trailer Park	1990	305	57	--	--	--	57
ESW 1	431331	0712058	Epsom Village Water District	1957	340	--	--	43	12	--
ESW 2	431237	0712200	Epsom Village Water District	--	310	--	42	--	--	--
ESW 3	431225	0712220	Cutter, R.E.	1967	305	--	--	45	2	--
ESW 4	431207	0712213	State of New Hampshire	1989	317	51	40.8	42.8	2	51
ESW 5	431211	0712219	State of New Hampshire	1989	305	92	28.2	30.2	2	--
ESW 6	431258	0712148	Cutter, R.	1989	310	39	15.2	15	2	39
ESW 7	431444	0712151	Arvanitis, John	1989	338	66	40.3	42.3	2	66
ESW 8	431045	0712332	Town of Pembroke	1973	325	64.5	--	64	--	64.5
ESW 9	431045	0712328	Town of Pembroke	1973	325	66	--	66	--	66
ESW 10	431337	0712125	--	1990	340	35	21	21	2	35
ESW 11	431308	0712122	Cutter, Richard	1990	345	49	--	20	--	--
ESW 12	431451	0712226	--	1990	345	59	--	50	--	59
ESW 27	431437	0712207	Kelley Distributing	1985	350	--	59	180	--	--
ESW 32	431055	0712302	Hamlett, F.	1985	330	--	68	407	--	--
ESW 54	431335	0712133	McDonald's Restaurant	1986	340	--	29	703	--	--
ESW 59	431344	0712133	Tri-City Const	1986	330	--	39	560	--	--
ESW 62	431445	0712216	Hines, Hildegard	1986	340	--	69	340	--	--
ESW 72	431117	0712312	Reynolds, B.	1987	340	--	19	402	--	--
ESW 74	431318	0712154	Bowne, D.	1987	330	--	65	147	--	--
ESW 76	431446	0712209	Desrosiers, W.	1987	360	--	78	244	--	--
ESW 79	431054	0712344	Lavoie, C.	1987	350	--	53	365	--	--
ESW 80	431309	0711720	Father & Son Const	1987	520	--	59	142	--	--
ESW 85	431032	0712348	Schmitt, R.	1986	350	--	20	480	--	--
ESW 90	431408	0712145	Thompson, D.	1986	370	--	19	400	--	--
ESW 115	431333	0712149	Terry, D.	1988	370	--	41	365	--	--
ESW 130	431356	0712144	Andreottola, A.	1989	370	--	31	305	--	--
ESW 134	431456	0712154	Bartlett S.	1989	360	--	64	140	--	--
ESW 135	431055	0712320	Lona	1989	310	--	--	700	6	--
ESW 143	431459	0712159	Pike Const	1989	360	--	83	220	--	--
ESW 152	431246	0712258	D & B Realty	1990	330	--	19	165	--	--
ESW 153	431159	0712310	Town of Epsom	1989	320	--	41	160	--	--
ESW 155	431035	0712313	Turner W.	1988	320	--	49	250	--	--
ESW 165	431447	0712143	Arvanitis, J.	1988	350	--	40	185	--	--
ESW 167	431454	0712154	Arvanitis, P.	1989	360	--	81	205	--	--
			Franklin							
FKA 26	432418	0713844	Holy Cross Convent	1985	270	162	--	--	--	162
FKA 27	432421	0713840	Holy Cross Convent	1985	265	88	--	--	--	88
FKA 28	432419	0713857	Holy Cross Convent	1985	275	137	--	--	--	137
FKA 29	432444	0713905	City of Franklin	1975	272	41.6	--	--	--	--

Local well No.	Type of site	Water level: Depth (ft)	Water level: Date (mm-dd-yy)	Use	Maximum well yield (gallons per minute)	Other identifier	Assignor of other identifier	Depth to bedrock (ft)
MERRIMACK COUNTY—*Continued*								
Epsom—*Continued*								
ESA 5	TH	17	10-09-90	U	--	--	--	--
ESW 1	GPW	6	9-01-57	P	150	--	--	--
ESW 2	GPW	--	--	P	--	--	--	--
ESW 3	Obs	0	7-01-69	U	--	--	--	--
ESW 4	Obs	17.3	1-02-90	U	--	--	--	--
ESW 5	Obs	10.1	1-02-90	U	--	--	--	--
ESW 6	Obs	5.55	8-24-89	U	--	--	--	--
ESW 7	Obs	5.9	8-24-89	U	--	--	--	--
ESW 8	--	9.6	8-15-73	U	--	1-73	R.E. Chapman	--
ESW 9	--	10.7	8-16-73	U	--	2-73	R.E. Chapman	--
ESW 10	Obs	10	6-19-90	U	--	--	--	--
ESW 11	Obs	9	5-14-90	U	--	--	--	--
ESW 12	Obs	16.4	7-19-90	U	--	--	--	--
ESW 27	BrW	--	--	C	40	079.0019	NHWRD	51
ESW 32	BrW	22	6-18-85	H	10	079.0026	NHWRD	58
ESW 54	BrW	10	8-08-86	C	60	079.0055	NHWRD	10
ESW 59	BrW	--	--	H	15	079.0060	NHWRD	25
ESW 62	BrW	--	--	H	30	079.0064	NHWRD	55
ESW 72	BrW	--	--	H	1.5	079.0074	NHWRD	10
ESW 74	BrW	4.5	6-16-87	C	20	079.0076	NHWRD	32
ESW 76	BrW	--	--	H	150	079.0078	NHWRD	55
ESW 79	BrW	8	3-23-87	H	6	079.0081	NHWRD	41
ESW 80	BrW	--	--	H	15	079.0083	NHWRD	49
ESW 85	BrW	12	7-25-86	H	10	079.0089	NHWRD	7
ESW 90	BrW	12	9-11-86	H	6	079.0094	NHWRD	7
ESW 115	BrW	--	--	H	6	079.0119	NHWRD	2
ESW 130	BrW	25	4-27-89	H	60	079.0135	NHWRD	15
ESW 134	BrW	40	5-08-89	H	30	079.0139	NHWRD	55
ESW 135	BrW	2	--	H	--	079.0140	NHWRD	85
ESW 143	BrW	30	9-13-89	H	60	079.0148	NHWRD	74
ESW 152	BrW	4	8-07-90	H	30	079.0158	NHWRD	8
ESW 153	BrW	5	4-25-89	H	20	079.0159	NHWRD	25
ESW 155	BrW	25	6-30-88	H	50	079.0161	NHWRD	40
ESW 165	BrW	--	--	H	20	079.0171	NHWRD	30
ESW 167	BrW	8	5-29-89	H	10	079.0173	NHWRD	65
Franklin								
FKA 26	TH	--	--	U	--	1-85	D.L. Maher	--
FKA 27	TH	--	--	U	--	2-85	D.L. Maher	--
FKA 28	TH	--	--	U	--	3-85	D.L. Maher	--
FKA 29	TH	32.6	11-04-75	U	--	--	--	--

Appendix A. Description of selected wells, auger holes, and borings in south-central New Hampshire—*Continued*

Local well No.	Latitude (° ′ ″)	Longitude (° ′ ″)	Owner or user	Year completed	Elevation above sea level (ft)	Depth of hole (ft)	Bottom of casing (ft)	Depth of well (ft)	Diameter of well (in.)	Depth to refusal (ft)
			MERRIMACK COUNTY—*Continued*							
			Franklin—*Continued*							
FKA 30	432442	0713908	City of Franklin	1975	278	37	--	--	--	--
FKA 31	432445	0713912	City of Franklin	1975	275	26.5	--	--	--	--
FKB 1	432539	0713912	NHDOT	1952	329	27	--	--	--	--
FKW 1	432428	0713909	Holy Cross Convent	1965	285	--	49.3	52.3	2.5	--
FKW 24	432500	0713929	Rowell, V.	1962	280	--	96	203	--	--
FKW 76	432430	0713915	Holy Cross Convent	1985	285	56	--	49	125	80
FKW 77	432510	0713908	Weglarz, Joseph	1990	255	34	26	28	2	--
FKW 104	432526	0713931	Arwood Corp.	1989	295	500	--	500	10	--
			Loudon							
LSA 1	431607	0712741	Ives, Wilfred	1989	372	12	--	--	--	--
LSW 1	431523	0712717	Bullock, John	1989	318	24	20.7	22.7	2	24
LSW 2	431650	0712823	Town of Loudon	1989	375	41	19.5	22	2	41
LSW 3	431626	0712804	Ladd, Levy	1989	380	85	66.3	68.3	2	85
LSW 4	431531	0712710	Cascade Park Campground	1989	380	81	62.8	73.8	2	81
LSW 5	431450	0712713	Berwick, Ken	1989	338	40	30	17.5	2	40
LSW 6	432133	0712749	N.H. Int. Speedway	1989	480	29	--	29	--	29
LSW 7	432131	0712749	N.H. Int. Speedway	1989	475	24	--	24	--	24
LSW 8	431748	0712758	Genova	1990	380	42	--	19.6	2	42
LSW 9	431603	0712715	DeCato	1990	360	85	--	52	2	85
LSW 10	431831	0712757	Moore, R.K.	1990	390	78	--	60	--	78
LSW 11	432104	0712752	Carlson, Roger, and Hall, Earl	1990	440	56	--	40	--	56
LSW 12	431806	0712802	Moore, R.K.	1990	380	62	--	48	--	62
LSW 13	431953	0712759	Tilcon Sand and Gravel	1990	400	54	--	49	--	54
LSW 14	431836	0712814	Chesley, Bill	1990	390	58.5	--	48	--	--
LSW 15	431612	0712727	DeCato, Roger	1990	360	29	--	28.5	--	29
LSW 16	431852	0712824	Tilton Sand and Gravel	1990	400	24	--	24	--	24
LSW 17	431948	0712806	Tilton Sand and Gravel	1990	--	35	--	22.5	--	35
LSW 18	431924	0712806	Fillmore, Arthur	1990	400	41	--	30	--	41
LSW 19	431907	0712827	Gordon, M.	1984	400	--	77	220	--	--
LSW 31	431839	0712836	Preve, E.	1984	420	--	46	153	--	--
LSW 37	431715	0712816	Ward, L.	1985	380	--	40	290	--	--
LSW 42	431924	0712913	Fisk, R.	1985	440	--	29	682	--	--
LSW 44	431920	0712916	Beaudet, N.	1985	420	--	29	227	--	--
LSW 47	431915	0712824	Johnson, D.	1984	420	--	47	175	--	--
LSW 48	431904	0712837	Guertin	1985	390	--	60	342	--	--
LSW 60	431819	0712835	Poitras	1985	420	--	47	200	--	--
LSW 67	431909	0712837	Maclauchlan, H.	1985	400	--	73	261	--	--
LSW 71	431843	0712838	Olson, R.	1985	420	--	42	325	--	--
LSW 87	431717	0712748	--	--	390	114	450	--	--	
LSW 88	431902	0712845	Ceriello, F.	1985	400	--	39	360	--	--
LSW 95	431804	0712817	Duby, E.	1985	400	--	29	120	--	--

Local well No.	Type of site	Water level Depth (ft)	Water level Date (mm-dd-yy)	Use	Maximum well yield (gallons per minute)	Other identifier	Assignor of other identifier	Depth to bedrock (ft)
MERRIMACK COUNTY—*Continued*								
Franklin—*Continued*								
FKA 30	TH	29.5	11-20-75	U	--	3-D	Bay St Tst Brng	--
FKA 31	TH	--	--	U	--	4-B	Bay St Tst Brng	--
FKB 1	BB	--	--	U	--	162/099	NHDOT	--
FKW 1	Wsh	16	11-01-66	U	50	--	--	--
FKW 24	BrW	20	3-09-62	--	--	126	Glenn W. Stewart	86
FKW 76	--	14.6	8-29-85	U	--	4-85	D.L. Maher	--
FKW 77	Obs	4	10-10-90	U	17	--	--	34
FKW 104	BrW	55	3-20-89	I	115	BrW 2	D.L. Maher	58
Loudon								
LSA 1	TH	--	--	U	--	--	--	--
LSW 1	Obs	8.22	8-23-89	U	--	--	--	--
LSW 2	Obs	10.38	8-23-89	U	--	--	--	--
LSW 3	Obs	39.1	8-23-89	U	--	--	--	--
LSW 4	Obs	64.8	8-23-89	U	--	--	--	--
LSW 5	Obs	22.53	8-23-89	U	--	--	--	--
LSW 6	Obs	--	--	U	--	7A-89	D.L. Maher	--
LSW 7	Obs	--	--	U	--	4-89	D.L. Maher	--
LSW 8	Obs	7	5-15-90	U	--	--	--	--
LSW 9	Obs	14	5-15-90	U	--	--	--	--
LSW 10	Obs	32	6-26-90	U	--	--	--	--
LSW 11	Obs	1	6-25-90	U	--	--	--	--
LSW 12	Obs	25	6-27-90	U	--	--	--	--
LSW 13	Obs	8	6-27-90	U	--	--	--	--
LSW 14	Obs	8	6-28-90	U	--	--	--	--
LSW 15	Obs	13	6-28-90	U	--	--	--	--
LSW 16	Obs	5	5-18-90	U	--	--	--	--
LSW 17	Obs	10	5-18-90	U	--	--	--	--
LSW 18	Obs	5	6-26-90	U	--	--	--	--
LSW 19	BrW	6	2-13-84	H	2	143.0001	NHWRD	25
LSW 31	BrW	19	10-12-84	H	5.50	143.0019	NHWRD	40
LSW 37	BrW	30	6-22-85	H	50	143.0027	NHWRD	11
LSW 42	BrW	--	--	H	.50	143.0032	NHWRD	9
LSW 44	BrW	--	--	H	15	143.0034	NHWRD	11
LSW 47	BrW	36	12-24-84	H	6	143.0037	NHWRD	43
LSW 48	BrW	--	--	H	20	143.0038	NHWRD	30
LSW 60	BrW	--	--	H	5	143.0050	NHWRD	38
LSW 67	BrW	15	9-29-85	H	4	143.0058	NHWRD	55
LSW 71	BrW	12	7-07-85	H	2	143.0062	NHWRD	30
LSW 87	BrW	--	--	H	--	143.0078	NHWRD	78
LSW 88	BrW	--	--	H	2.5	143.0079	NHWRD	18
LSW 95	BrW	--	--	H	5	143.0087	NHWRD	20

Appendix A. Description of selected wells, auger holes, and borings in south-central New Hampshire—*Continued*

Local well No.	Latitude (° ′ ″)	Longitude (° ′ ″)	Owner or user	Year completed	Elevation above sea level (ft)	Depth of hole (ft)	Bottom of casing (ft)	Depth of well (ft)	Diameter of well (in.)	Depth to refusal (ft)
			MERRIMACK COUNTY—*Continued*							
			Loudon—*Continued*							
LSW 96	431709	0712802	Town of Loudon	1985	390	--	69	900	--	--
LSW 117	431508	0712649	Durrell, H.	1987	360	--	60	243	--	--
LSW 126	431749	0712821	Warren, J.	1987	400	--	39	285	--	--
LSW 139	431609	0712742	Ives, W.	1987	360	--	66	66	--	--
LSW 143	432104	0712800	Rondeau	1987	460	--	--	185	6	--
LSW 159	431710	0712820	Wilson, R.	1988	390	--	80	323	--	--
LSW 196	431808	0712831	Wright. W	1988	420	--	60	480	--	--
LSW 199	431700	0712758	Morin, R.	1988	390	--	79	580	--	--
LSW 208	431641	0712849	Lizotte, N.	1989	410	--	59	173	--	--
LSW 209	431839	0712752	Dube, R.	1989	420	--	83	160	--	--
LSW 212	431902	0712820	Sandoe, M.	1989	410	--	62	205	--	--
LSW 216	431759	0712817	Harvest Builders	1989	400	--	49	180	--	--
LSW 222	431930	0712901	Willis, D.	1989	430	--	49	120	--	--
LSW 227	431934	0712844	Stacey Hardware Store	1989	450	--	10.5	13.5	--	--
LSW 230	432336	0712717	Mitchell, M.	1989	540	--	39	160	--	--
LSW 232	431801	0712817	Allard, G.	1989	400	--	29	160	--	--
LSW 240	432033	0712800	Crowlley, B.	1989	420	--	81	330	--	--
LSW 241	431845	0712822	Town of Loudon	1989	420	--	79	190	--	--
			Northfield							
NRW 1	432255	0713705	Town of Northfield	1990	420	90	--	39.5	--	90
NRW 2	432225	0713704	Glions, Raymond	1990	435	66	57	59	20	66
NRW 3	432230	0713708	Morin, Leon	1990	430	59	30	32	2	59
NRW 4	432204	0713848	Colby	1994	270	50	35	38	2.5	50
NRW 5	432153	0713841	Penacook-Boscawen Water Precinct	1994	257.44	56	50	56	2.5	--
NRW 94	432245	0713706	Chambers, H.	1984	420	--	96	270	--	--
NRW 96	432333	0713807	Ricard, D.	1986	425	--	169	280	--	--
NRW 153	432307	0713656	Herbert, P.	1988	410	--	83	305	--	--
			Pembroke							
PBA 1	430851	0712556	Town of Pembroke	1949	320	13.7	--	--	--	--
PBA 2	431036	0712959	Chickering, W.	1989	230	110	--	--	--	110
PBA 3	430906	0712839	Town of Pembroke	1971	205	50	--	--	--	50
PBA 4	430912	0712846	Town of Pembroke	1971	210	76	--	--	--	76
PBA 5	430924	0712914	Town of Pembroke	1965	220	62	--	--	--	62
PBA 6	431043	0712926	Town of Pembroke	1971	301	34	--	--	--	34
PBA 7	430904	0712449	Town of Pembroke	1973	288	46	--	--	2.5	46
PBA 8	431202	0712927	Town of Pembroke	1989	250	22	--	--	--	--
PBA 9	431200	0712927	Town of Pembroke	1989	255	14	--	--	--	--
PBA 10	431157	0712933	Town of Pembroke	1989	265	39	--	--	--	--
PBA 11	431154	0712931	Town of Pembroke	1989	265	37	--	--	--	--
PBA 12	430938	0712423	NHDOT	1990	300	18	--	--	--	--
PBB 1	431411	0712739	NHDOT	1985	362	21.1	--	--	--	--
PBB 2	431425	0712730	NHDOT	1964	358	17.1	--	--	--	--
PBB 3	431248	0712849	NHDOT	1959	265	48	--	--	--	48

Local well No.	Type of site	Water level: Depth (ft)	Water level: Date (mm-dd-yy)	Use	Maximum well yield (gallons per minute)	Other identifier	Assignor of other identifier	Depth to bedrock (ft)
MERRIMACK COUNTY—*Continued*								
Loudon—*Continued*								
LSW 96	BrW	--	--	H	0.75	143.0088	NHWRD	48
LSW 117	BrW	30	4-28-87	H	4	143.0109	NHWRD	50
LSW 126	BrW	18	4-22-87	H	10	143.0120	NHWRD	28
LSW 139	BrW	20	12-01-87	H	30	143.0135	NHWRD	60
LSW 143	BrW	10	4-28-87	H	10	143.0141	NHWRD	25
LSW 159	BrW	--	--	H	60	143.0160	NHWRD	30
LSW 196	BrW	--	--	H	60	143.0198	NHWRD	35
LSW 199	BrW	--	--	H	4	143.0201	NHWRD	58
LSW 208	BrW	40	6-13-89	H	8	143.0210	NHWRD	40
LSW 209	BrW	45	6-06-89	H	8	143.0212	NHWRD	60
LSW 212	BrW	--	--	H	35	143.0215	NHWRD	50
LSW 216	BrW	--	--	H	50	143.0220	NHWRD	33
LSW 222	BrW	--	--	H	50	143.0227	NHWRD	17
LSW 227	BrW	4	12-09-89	C	10	143.0232	NHWRD	--
LSW 230	BrW	22	9-16-89	H	5	143.0235	NHWRD	20
LSW 232	BrW	--	--	H	20	143.0237	NHWRD	18
LSW 240	BrW	10	4-01-89	C	--	143.0247	NHWRD	60
LSW 241	BrW	10	11-29-89	H	5	143.0249	NHWRD	65
Northfield								
NRW 1	Obs	30	5-17-90	U	--	--	--	--
NRW 2	Obs	14	10-11-90	U	--	--	--	--
NRW 3	Obs	12	10-11-90	U	--	--	--	--
NRW 4	Obs	11.0	7-01-94	U	--	24-93	D.L. Maher	--
NRW 5	Obs	11.5	7-01-94	U	60	25-93	D.L. Maher	--
NRW 94	BrW	--	--	H	50	179.0017	NHWRD	80
NRW 96	BrW	--	--	H	15	179.0021	NHWRD	160
NRW 153	BrW	18	10-05-88	H	4	179.0086	NHWRD	65
Pembroke								
PBA 1	TH	--	--	U	--	2-1/2-in. W-1	Metcalf & Eddy	--
PBA 2	TH	--	--	U	--	--	--	110
PBA 3	TH	--	--	U	--	6-71	R.E. Chapman	--
PBA 4	TH	--	--	U	--	5-71	R.E. Chapman	--
PBA 5	TH	--	--	U	--	5-65	R.E. Chapman	--
PBA 6	TH	9.4	6-08-71	U	--	11-71	R.E. Chapman	--
PBA 7	TH	--	--	U	--	8-73	R.E. Chapman	--
PBA 8	TH	--	--	U	--	Test Well-1	Layne NE	--
PBA 9	TH	--	--	U	--	Test Well-3	Layne NE	--
PBA 10	TH	--	--	U	--	5	Layne NE	--
PBA 11	TH	--	--	U	--	Test Well-6	Layne NE	--
PBA 12	TH	--	--	U	--	--	--	18
PBB 1	BB	--	--	U	--	41-1-1/4-15	NHDOT	21.1
PBB 2	BB	--	--	U	--	41-2-1/5-4	NHDOT	17.1
PBB 3	BB	--	--	U	--	3-7-1-9/NH-12	NHDOT	--

Appendix A. Description of selected wells, auger holes, and borings in south-central New Hampshire—*Continued*

Local well No.	Latitude (° ′ ″)	Longitude (° ′ ″)	Owner or user	Year completed	Elevation above sea level (ft)	Depth of hole (ft)	Bottom of casing (ft)	Depth of well (ft)	Diameter of well (in.)	Depth to refusal (ft)
			MERRIMACK COUNTY—*Continued*							
			Pembroke—*Continued*							
PBB 4	431041	0712921	NHDOT	1954	315	28	--	--	--	28
PBW 31	431103	0712926	Town of Pembroke	1949	240	12	--	12	--	12
PBW 32	431100	0712931	Town of Pembroke	1964	230	100	--	85	--	100
PBW 33	431059	0712930	Town of Pembroke	1953	235	82	--	82	--	--
PBW 34	431034	0713003	Chickering, W.	1989	225	131	30.6	33.1	2	131
PBW 38	431100	0712927	Town of Pembroke	1949	290	77	--	77	--	77
PBW 39	430951	0712935	Plourde Sand & Gravel	1989	202	62	38.7	40.7	2	--
PBW 40	431004	0712906	Plourde Sand & Gravel	1989	300	29	18.9	20.9	2	29
PBW 41	430900	0712456	Town of Pembroke	1973	288	63.5	53	63	2.5	63.5
PBW 42	430901	0712446	Town of Pembroke	1973	285	72	60	70	2.5	72
PBW 43	431039	0712924	Town of Pembroke	1971	310	62	--	60	--	62
PBW 44	431038	0712930	Town of Pembroke	1971	279	95	--	90	--	--
PBW 45	431039	0712933	Town of Pembroke	1973	250	36	--	34	--	36
PBW 46	431152	0712902	Town of Pembroke	1971	268	42	--	42	--	--
PBW 47	431155	0712908	Town of Pembroke	1971	262	42	--	40	--	42
PBW 48	431155	0712903	Town of Pembroke	1971	260	32	--	32	--	32
PBW 49	431256	0712841	Concord Water Dept.	1963	105	37	--	37	--	--
PBW 50	431258	0712840	Concord Water Dept.	1963	108	39	--	39	--	--
PBW 51	431257	0712845	Concord Water Dept.	1963	104	48.4	--	48	--	--
PBW 52	431305	0712840	Concord Water Dept.	1963	103	40	--	40	--	--
PBW 54	431054	0712912	McCarthy & Patoine Associates	1984	340	--	41	85	--	--
PBW 102	431024	0712351	Halvorson, R.	1987	340	--	20	500	--	--
PBW 116	430843	0712543	Mills	1987	310	--	--	600	6	--
			Pittsfield							
PHA 1	431726	0711946	Jenkins, Bill	1989	490	19	--	--	--	19
			ROCKINGHAM COUNTY							
			Deerfield							
DDA 2	430740	0711959	Bear Brook State Park	1990	480	16	--	--	--	16
			Northwood							
NWW 7	431208	0711549	Edmunds, J.	1990	590	100	25	100	6	8
NWW 8	431150	0711447	Whitehouse, H.	1991	640	485	60	485	6	--
NWW 9	431148	0711445	Parenty, H.	1990	650	280	20	280	6	--

Local well No.	Type of site	Water level: Depth (ft)	Water level: Date (mm-dd-yy)	Use	Maximum well yield (gallons per minute)	Other identifier	Assignor of other identifier	Depth to bedrock (ft)
				MERRIMACK COUNTY—*Continued*				
				Pembroke—*Continued*				
PBB 4	BB	--	--	U	--	NH-6	NHDOT	--
PBW 31	--	--	--	U	--	Site No. 3	Metcalf & Eddy	--
PBW 32	--	--	--	P	--	Well No. 2	R.E. Chapman	--
PBW 33	--	--	--	P	--	Layne No.3	Layne NE	82
PBW 34	Obs	10.3	8-23-89	U	--	--	--	131
PBW 38	--	9	8-23-49	U	--	Site No. 6	Metcalf & Eddy	--
PBW 39	--	17.4	8-23-89	U	--	--	--	59
PBW 40	--	12.8	8-24-89	U	--	--	--	--
PBW 41	Wsh	7.3	8-24-73	U	60	7-73	R.E. Chapman	--
PBW 42	Wsh	5.75	8-28-73	U	60	9-73	R.E. Chapman	--
PBW 43	--	6.4	6-08-71	U	--	10-71	R.E. Chapman	--
PBW 44	--	4.8	6-09-71	U	--	12-71	R.E. Chapman	--
PBW 45	--	10.2	9-04-73	U	--	13-73	R.E. Chapman	--
PBW 46	--	2.7	5-20-71	U	--	7-71	R.E. Chapman	--
PBW 47	--	5.5	5-20-71	U	--	8-71	R.E. Chapman	--
PBW 48	--	7.25	5-21-71	U	--	9-71	R.E. Chapman	--
PBW 49	--	12.7	8-09-63	P	--	Well 1	Layne NE	--
PBW 50	--	12.3	8-26-63	P	--	Well 5	Layne NE	39
PBW 51	--	6	7-25-63	P	--	Well 7	Layne NE	--
PBW 52	--	7.75	8-06-63	P	--	Well 4	Layne NE	--
PBW 54	BrW	--	--	C	55	189.0004	NHWRD	30
PBW 102	BrW	--	--	H	5.5	189.0061	NHWRD	8
PBW 116	BrW	--	--	H	5	189.0076	NHWRD	--
				Pittsfield				
PHA 1	TH	--	--	U	--	--	--	--
				ROCKINGHAM COUNTY				
				Deerfield				
DDA 2	TH	10	6-20-90	U	--	--	--	--
				Northwood				
NWW 7	BrW	10	7-03-90	H	7	--	--	--
NWW 8	BrW	10	6-29-91	H	.75	182.0317	NHWRD	30
NWW 9	BrW	--	--	H	1.5	182.0296	NHWRD	6

APPENDIX B

Appendix B. Lithologic logs of selected wells, auger holes, and borings in south-central New Hampshire

[Local well number: First two characters are U.S. Geological Survey town codes. The third character indicates type of structure—A, borings done for hydrologic purposes; B, borings done primarily for construction purposes; W, well. Depth to top: Depth to top of each lithologic unit, in feet below land-surface datum. Depth to bottom: Depth to bottom of each lithologic unit, in feet below land-surface datum. in., inches; mm, millimeter; No., number; --, no data]

Local well No.	Depth to top (ft)	Depth to bottom (ft)	Description of material
			BELKNAP COUNTY
			Barnstead
BAA 1	0	10	Sand, very fine to coarse; some gravel; predominantly very fine sand; poorly sorted
	10	--	Bedrock
BAA 2	0	8	Sand, fine, some silt, pebbles, and cobbles, very poorly sorted
	8	16	Sand, very fine, some pebbles, predominantly fine sand, very poorly sorted
	16	--	Refusal on large boulder or bedrock
BAA 3	0	9	Sand, medium to coarse gravel; predominantly coarse sand; some cobbles; moderately sorted; brown
	9	17	Sand, medium to coarse gravel and cobbles; predominantly coarse gravel; moderately sorted; brown
	17	19	Silt to coarse gravel; predominantly fine sand; very poorly sorted; possibly a poorly sorted sandy till
	27	29	Silt to coarse gravel; some cobbles; predominantly fine sand; possibly a very poorly sorted till
	32	--	Bedrock
BAA 4	0	15	Sand, medium; well sorted; light brown
	22	24	Sand, fine to coarse gravel; predominantly fine sand; moderately sorted; light brown
	37	39	Silt to coarse gravel; predominantly medium sand; possibly very poorly sorted till
	54	--	Bedrock
BAA 5	0	10	Silt and clay, some fine sand; brown
	17	19	Silt to very fine sand; predominantly very fine sand; well sorted
	27	29	Sand, very fine; well sorted
	37	39	Silt to very fine sand; some cobbles; predominantly very fine sand; gray
	47	49	Till, sandy
	49	--	End of hole
BAW 1	0	19	Sand, fine to coarse, predominantly coarse, some pebbles, poorly sorted
	19	29	Sand, very fine, and silt, predominantly fine sand, moderately sorted
	29	30	Till
	30	--	Bedrock
BAW 2	0	4	Sand, very fine to cobbles, predominantly fine, poorly sorted
	4	6	Sand, very fine to fine, predominantly very fine
	6	17	Sand, very fine to cobbles, predominantly medium
	17	19	Sand, medium to coarse gravel, predominantly very coarse sand, moderately sorted
	27	29	Sand, very coarse to pebbles, predominantly coarse gravel
	37	39	Sand, very fine to coarse gravel, predominantly medium sand
	41	--	Bedrock
BAW 3	0	2	Sand, silt to fine predominantly very fine
	2	5	Sand, very fine to fine, predominantly fine sand
	5	8	Sand, fine to medium, some fine gravel, predominantly medium sand
	8	18	Sand, silt to very fine, predominantly very fine
	18	25	Silt, light brown, very well sorted
	27	29	Sand, fine to coarse, predominantly medium, moderately sorted
	37	39	Sand, fine to medium, predominantly medium, moderately sorted
	40	46	Till
	46	--	Bedrock

Appendix B. Lithologic logs of selected wells, auger holes, and borings in south-central New Hampshire —*Continued*

Local well No.	Depth to top (ft)	Depth to bottom (ft)	Description of material
			BELKNAP COUNTY—*Continued*
			Barnstead—*Continued*
BAW 4	0	9	Sand, fine, well sorted
	9	25	Sand, fine to coarse, predominantly medium, trace pebbles and cobbles, moderately sorted
	27	29	Sand, fine to coarse, predominantly medium, moderately sorted
	34	39	Till, sandy, very tight
	40	--	Bedrock
BAW 9	0	2	Topsoil, dark brown
	2	7	Sand, fine to very coarse, some fine to coarse gravel, predominantly medium sand, moderately sorted
	7	17	Sand, very fine to fine, predominantly very fine sand, well sorted
	17	37.4	Clay and silt, gray
	37.4	39	Sand, fine to coarse, some fine to coarse gravel, predominantly fine sand
	39	47	Sand, very fine to very coarse, and coarse gravel and pebbles, predominantly medium sand
	47	48	Till
	48	--	Bedrock
BAW 10	0	17	Sand, very fine to coarse, and pebbles and cobbles, predominantly very fine sand, very poorly sorted
	6	21	Sand, very fine to coarse, some coarse angular gravel and cobbles, predominantly very fine sand, very poorly sorted
	21	25	Till, sandy
	25	--	Bedrock
BAW 27	0	11	Gravel
	11	14	Clay
	14	15	Hardpan
	15	--	Bedrock
BAW 34	0	40	Sand
	40	60	Hardpan
	60	70	Clay
	70	--	Bedrock
BAW 104	0	4	Clay, silty
	4	5	Gravel, course
	5	11	Gravel
	11	--	Bedrock
BAW 110	0	4.5	Sand, fine
	4.5	8.5	Sand, fine, and gravel
	8.5	12.5	Gravel, coarse
	12.5	16	Clay, brown, and gravel
	16	--	End of hole
			Gilmanton
GLA 1	0	10	Sand, fine to medium; predominantly fine; well sorted; brown
	17	19	Sand, very fine to medium; predominantly fine; brown
	27	29	Sand, very fine to fine; predominantly very fine; well sorted; gray
	37	39	Sand, very fine to fine; predominantly fine; well sorted; gray
	47	49	Sand, very fine to fine; predominantly fine; well sorted; gray
	57	59	Clay, stiff; gray
	106	109	Till

Appendix B. Lithologic logs of selected wells, auger holes, and borings in south-central New Hampshire —*Continued*

Local well No.	Depth to top (ft)	Depth to bottom (ft)	Description of material
			BELKNAP COUNTY—*Continued*
			Gilmanton—*Continued*
GLA 1—*Continued*			
	109	--	Bedrock
GLW 1	0	6	Sand, medium to pebbles and cobbles; moderately sorted
	6	17	Sand, coarse to fine gravel; predominantly coarse sand
	27	29	Sand, medium to pebbles; predominantly coarse sand; moderately sorted
	37	39	Sand, fine to medium; predominantly medium; moderately sorted
	47	49	Sand, fine to medium; predominantly medium; moderately sorted
	57	59	Clay, silty
	67	69	Sand, very fine and silt; gray
	87	89	Sand, very fine to fine; predominantly fine; gray
	90	100	Till
	100	--	Bedrock
GLW 2	0	6	Sand, orange brown, medium to coarse, predominantly coarse sand
	6	27	Sand, orange brown, medium to very coarse, predominantly coarse sand
	27	37	Sand, gray, very fine sand to fine sand, predominantly very fine sand
	37	39	Sand, gray, very fine to fine, predominantly fine sand
	37	--	End of hole
GLW 3	0	7	Sand, red brown, medium, to pebbles; predominantly coarse sand; very poorly sorted
	7	8.5	Sand, brown, fine to coarse; some gravel; trace pebbles; predominantly coarse sand; very poorly sorted
	8.5	9	Sand, light brown, very fine to medium; predominantly fine sand; moderately well sorted; some red layers
	17	19	Silt, light brown, to sand, medium; predominantly fine sand; moderately sorted
	27	28.5	Sand, brown, fine to medium; predominantly medium sand; well sorted
	28.5	36	Till
	36	--	Refusal
GLW 4	0	7	Sand, red, fine to coarse; predominantly medium sand; some fine gravel; trace pebbles; very poorly sorted
	7	17	Silt, gray, to sand, fine; predominantly very fine sand; some medium sand; trace coarse sand; moderately well sorted
	17	19	Clay, blue-gray; trace silt and very fine sand; well sorted
	27	29	Silt, gray, to sand, very fine; predominantly very fine sand; very well sorted
	37	39	Clay, blue-gray; very well sorted
	47	48	Sand, gray brown, very fine to coarse; predominantly fine sand; poorly sorted
	48	53	Till, sandy, mica rich
	53	--	Refusal
GLW 52	0	80	Sand
	80	100	Clay
	100	--	Bedrock
GLW 82	0	30	Sand
	30	55	Clay and silt
	55	--	Bedrock
GLW 199	0	20	Sand
	20	50	Clay
	50	90	Bedrock, highly weathered
	90	--	Bedrock

Appendix B. Lithologic logs of selected wells, auger holes, and borings in south-central New Hampshire —*Continued*

Local well No.	Depth to top (ft)	Depth to bottom (ft)	Description of material
			MERRIMACK COUNTY
			Allenstown
AFA 3	0	2	Topsoil
	2	10	Clay, sandy, brown
	10	15	Sand, fine and clay
	15	20	Till, silt and clay
	20	--	Refusal
AFA 4	0	6	Sand, gravel, and clay
	6	15	Sand, gravel, and boulders
	15	26	Sand, brown, and gravel
	26	44	Sand, fine, brown
	44	45	Silt and clay
	45	--	Refusal
AFA 5	0	14	Clay, yellow
	14	64	Clay, blue
	64	71	Sand, fine, brown
	71	100	Sand, fine, dark brown
	100	--	Bedrock
AFA 6	0	1	Loam and sand
	1	12	Sand, fine, and clay
	12	14	Sand, fine, and sharp gravel
	14	47	Clay, soft, gray
	47	53	Silt, brown
	53	74	Clay, soft, gray
	74	87	Silt and clay
	87	91	Sand, fine, sharp gravel, and clay
	91	--	Refusal
AFA 7	0	8	Sand, medium, brown
	8	21	Sand and gravel, gray
	21	50	Silt and clay, gray
	50	80	Silt, gray
	80	86.8	Sand, gravel, and clay, brown
	86.8	--	Refusal
AFA 8	0	20	Sand, fine, brown
	20	35	Sand, fine, brown and silt
	35	50	Silt, brown
	50	67	Silt, brown, and clay
	67	--	Refusal
AFA 9	0	16	Sand, gray
	16	30	Silt, gray
	30	88	Silt, gray, and clay
	88	107	Silt, brown, and clay
	107	--	Refusal

Appendix B. Lithologic logs of selected wells, auger holes, and borings in south-central New Hampshire —*Continued*

Local well No.	Depth to top (ft)	Depth to bottom (ft)	Description of material
			MERRIMACK COUNTY—*Continued*
			Allenstown—*Continued*
AFA 11	0	3	Sand, fine to medium
	3	17	Sand, fine to medium; predominantly fine; moderately well sorted
	17	19	Clay, light brown, silty; very well sorted
	27	29	Clay, gray brown, silty; red silty bands; very well sorted
	37	39	Sand, gray brown; predominantly very fine sand; well sorted
	47	58	Sand, light brown; predominantly very fine sand; well sorted
	58	63	Till
	63	--	Refusal
AFA 12	0	17	Sand, medium to coarse sand; some pebbles and fine gravel
	17	19	Sand, reddish brown, medium to coarse; predominantly coarse sand; well sorted
	27	29	Sand, reddish tan, fine to coarse; predominantly medium sand; moderately sorted
	37	39	Sand, reddish brown, fine to coarse; predominantly medium sand; some pebbles; moderately sorted
	47	49	Sand, light brown, fine to medium; predominantly fine sand; well sorted
	57	59	Till
	61	--	Refusal
AFW 8	0	32	Gravel, medium
	32	50	Gravel, coarse
	50	56	Gravel, medium
	56	--	End of hole
AFW 9	0	1	Topsoil
	1	23	Sand, fine to medium, brown
	23	27	Sand, fine to coarse, brown
	27	53	Sand, fine to coarse, brown; gravel
	53	57	Sand, fine to coarse, brown; gravel and gray clay
	57	67	Sand, fine to coarse, brown
	67	67.5	Till
	67.5	--	End of hole
AFW 10	0	2	Loam and sand
	2	13	Sand, fine, and clay
	13	19	Clay, yellow
	19	51	Clay, firm, gray
	51	72	Sand, fine to medium, gray
	72	78	Sand, fine to medium, brown, and fine gravel
	78	--	Refusal
AFW 11	0	49	Sand, light brown
	49	63	Sand, light brown, fine
	63	84	Sand, and silt and clay, blue
	84	--	Bedrock
AFW 12	0	12	Sand, very fine to fine; predominately fine
	12	14	Sand, fine to coarse; predominately medium; moderately sorted
	17	19	Sand, very fine to medium; predominately fine; moderately sorted
	27	29	Sand, very fine to very coarse; predominately medium; little pebbles; trace cobbles; poorly sorted

Appendix B. Lithologic logs of selected wells, auger holes, and borings in south-central New Hampshire —*Continued*

Local well No.	Depth to top (ft)	Depth to bottom (ft)	Description of material
			MERRIMACK COUNTY—*Continued*
			Allenstown—*Continued*
AFW 12—*Continued*			
	37	39	Sand, fine to very coarse; predominately coarse; some fine to coarse gravel; little pebbles and cobbles; moderately sorted
	47	49	Sand, medium to very coarse; predominately medium; little fine to coarse gravel; moderately sorted
	57	59	Sand, medium to very coarse; predominately coarse; trace fine gravel; moderately sorted; loose matrix
	67	69	Sand, medium to very coarse; predominately coarse; little fine to coarse gravel; moderately sorted; loose matrix
	77	79	Sand, fine to coarse; predominatley medium to coarse; little fine to coarse gravel; trace cobbles; moderately sorted
	80	86.5	Till, sandy
	86.5	--	Bedrock
AFW 13	0	35	Sand, medium to very coarse; predominately coarse; somefine to coarse gravel
	37	39	Sand, medium to very coarse; and gravel fine to coarse;predominately coarse sand; moderately sorted
	47	49	Sand, medium to very coarse; and gravel and pebbles; predominately coarse sand; moderately sorted
	57	59	Sand, medium to very coarse; predominately medium to coarse; some fine to coarse gravel; moderately sorted
	67	69	Sand, medium to very coarse; predominately medium to coarse; some fine to coarse gravel; moderately sorted
	77	79	Sand, fine to very coarse; predominatley medium; some fine to coarse gravel; poorly sorted
	79	82.5	Till
	82.5	--	Bedrock
AFW 19	0	6	Sand
	6	31	Sand, hard packed, and gravel
	31	45	Sand, fine to medium
	45	49	Till
	49	--	Refusal
AFW 20	0	20	Sand, medium, brown; and gravel
	20	38	Sand, brown, and gravel
	38	50	Silt, fine, brown
	50	57	Silt, brown, and clay
	57	--	Refusal
AFW 21	0	22	Sand and gravel, brown
	22	42	Clay, gray
	42	52.5	Sand and gravel, brown
	52.5	61	Sand and gravel, gray
	61	63	Till
	63	--	Refusal
AFW 22	0	15	Sand and gravel, gray
	15	25	Silt and clay, gray
	25	30	Sand and gravel, light brown
	30	51	Sand and gravel, brown
	51	55	Sand, fine, brown
	55	57	Till
	57	--	Refusal

Appendix B. Lithologic logs of selected wells, auger holes, and borings in south-central New Hampshire —*Continued*

Local well No.	Depth to top (ft)	Depth to bottom (ft)	Description of material
			MERRIMACK COUNTY—*Continued*
			Allenstown—*Continued*
AFW 23	0	12	Sand and gravel, gray
	12	23	Silt and clay, gray
	23	34	Sand and gravel, brown
	34	36	Till
	36	--	Refusal
AFW 24	0	20	Sand, fine, brown, and boulders
	20	30	Sand, fine to medium, and gravel, brown
	30	38	Sand, brown, and gravel
	38	44	Sand, brown, and gravel, angular
	44	--	Refusal
AFW 25	0	15	Sand, and gravel, and boulders, brown
	15	25	Sand, fine, and fine gravel, brown
	25	33	Sand, and gravel, brown, angular
	33	40	Sand, and gravel, brown
	40	45	Sand, and gravel, sharp
	45	--	Refusal
AFW 43	0	125	Sand
	125	130	Clay
	130	135	Gravel
	135	--	End of hole
AFW 55	0	10	Sand
	10	30	Hardpan
	30	--	Bedrock
AFW 80	0	15	Sand
	15	80	Silt
	80	106	Till
	106	--	Bedrock
AFW 90	0	20	Gravel
	20	55	Clay
	55	--	Bedrock
			Boscawen
BTA 1	0	21	Sand, brown, and small gravel
	21	28	Sand, brown, and small gravel, trace clay
	28	32	Sand, brown to gray
	35	42	Sand, gray, and clay
	42	56	Sand, fine, silty, gray, and clay
	56	65	Sand, fine, silty; and clay, gray
	65	70	Sand, fine, silty
	70	75	Sand, fine, silty
	75	--	End of hole

Appendix B. Lithologic logs of selected wells, auger holes, and borings in south-central New Hampshire —*Continued*

Local well No.	Depth to top (ft)	Depth to bottom (ft)	Description of material
			MERRIMACK COUNTY—*Continued*
			Boscawen—*Continued*
BTA 2	0	14	Sand and gravel; trace of clay
	14	21	Sand and clay
	21	28	Clay, brown
	28	35	Clay, brown and gray
	35	42	Sand and clay, brown
	42	70	Sand and till
	70	--	End of hole
BTA 3	0	14	Sand, fine to medium
	14	21	Sand, fine to medium; trace clay
	21	23	Sand, fine to coarse, and gravel
	23	35	Clay, gray
	35	89	Clay, gray, firm
	89	90	Till
	90	--	Refusal in till
BTA 4	0	14	Sand, fine to coarse; some gravel
	14	28	Clay, sandy
	28	35	Sand and brown clay
	35	42	Clay, gray
	42	56	Sand, fine, and clay
	56	70	Sand, fine to coarse, gray, and gravel
	70	77	Sand, fine to coarse, brown
	77	84	Sand, fine to medium, and silt
	84	89	Till
	89	--	Refusal in till
BTA 5	0	14	Sand, fine to coarse, some gravel
	14	21	Sand, fine to medium
	21	28	Sand, fine to medium, silt and clay
	28	42	Sand, fine, and silt, trace clay
	42	56	Sand, fine, and silt, and clay
	56	65	Sand, fine, and silt, and gray clay
	65	77	Clay, gray
	77	94	Sand, fine, and silt, and clay
	94	--	Refusal
BTA 6	0	7	Sand and small gravel
	7	14	Sand, brown, and traces of clay
	14	21	Sand, brown; traces of clay
	21	28	Sand, brown, and clay
	28	77	Sand, fine, and silt, and clay
	77	80	Sand, fine, and silt
	80	85	Sand, fine to coarse, gray, and till
	85	--	End of hole
BTA 7	0	14	Sand, brown, and small gravel
	14	28	Sand, fine to medium, and silt, brown
	28	35	Sand, fine to medium, and silt, brown; trace clay

Appendix B. Lithologic logs of selected wells, auger holes, and borings in south-central New Hampshire —*Continued*

Local well No.	Depth to top (ft)	Depth to bottom (ft)	Description of material
			MERRIMACK COUNTY—*Continued*
			Boscawen—*Continued*
BTA 7—*Continued*			
	35	42	Sand, fine to coarse; trace clay
	42	49	Sand, fine to coarse, brown; trace clay
	49	56	Sand, fine to coarse; trace clay
	56	62	Sand, fine to coarse; some fine gravel
	62	--	End of hole
BTA 8	0	7	Sand and boulders
	7	14	Till
	14	--	Refusal in till
BTA 9	0	4	Sand, fine, brown, and silt
	4	12	Sand, fine to coarse, brown; some gravel
	12	22	Sand, fine, brown; some medium sand
	22	46	Sand, fine to medium, brown
	46	47	Silt and fine sand, brown
	47	54	Sand, fine, brown; some silt and coarse sand
	54	60	Sand, fine to medium; broken gravel
	60	--	Refusal
BTA 10	0	19	Sand, fine to coarse, brown; some gravel; trace of silt
	19	21.5	Sand, fine, brown; sharp, broken gravel,silt
	21.5	--	Refusal
BTB 3		9	Sand, fine to medium
	9	45	Sand, fine; well sorted
	45	55	Sand, fine to medium
	55	61	Till, silt, gravel and sand
	61	--	Bedrock
BTW 2	0	20	Topsoil, fine gray sand, peat, and silt
	20	23	Sand, fine to coarse, gray; some gravel
	26	46	Sand, fine, and clay; gray
	46	58	Sand, fine, gray
	58	65	Sand, fine to medium, gray; some coarse tan sand
	65	83	Sand, fine to coarse, tan, and gravel
	83	88	Sand, fine to coarse, tan
	88	--	Refusal
BTW 3	0	4	Sand, fine to coarse, brown
	4	12	Sand, medium to coarse, and medium gravel, brown
	12	20	Sand, very fine to fine, brown
	20	32	Sand, fine, some coarse sand, brown
	32	102	Sand, and coarse gravel, reddish brown sand and black gravel, very angular
	102	--	Refusal
BTW 4	0	1	Topsoil
	1	12	Sand, fine to coarse, predominantly fine, brown
	12	25	Sand, fine to coarse, and fine gravel, some silt
	25	66	Sand, fine, gray; some clay

Appendix B. Lithologic logs of selected wells, auger holes, and borings in south-central New Hampshire —*Continued*

Local well No.	Depth to top (ft)	Depth to bottom (ft)	Description of material
			MERRIMACK COUNTY—*Continued*
			Boscawen—*Continued*
BTW 4—*Continued*			
	66	72	Sand, fine to coarse, gray, and fine gravel, some silt
	72	99	Sand, fine to coarse, and fine gravel
	99	--	Refusal
BTW 5	0	14	Sand, fine to medium, and clay
	14	21	Sand, fine to medium, brown, and clay
	21	28	Sand, fine to medium, gray-brown, and clay
	28	35	Sand, fine to medium, brown, and gray clay
	35	56	Sand, fine to coarse, brown
	56	70	Sand, fine to coarse, brown, and gravel
	70	77	Sand, fine to coarse, brown
	77	78	Till
	78	--	Refusal in till
BTW 7	0	24	Silt
	24	25	Silt and silt, gray-brown; some gravel and cobbles
	25	36	Sand, coarse, and gravel, brown; some boulders
	36	41	Sand, fine to coarse, and gravel, medium to coarse, brown; some cobbles
	41	44	Sand, medium to coarse, and gravel, medium to coarse, gray-brown; cobbles
	44	51	Sand, medium to coarse, gray-brown, and coarse gravel; cobbles
	51	52	Sand, fine to coarse, gray-brown and gravel, medium to coarse
	52	--	End of hole
BTW 8	0	16	Sand, fine, brown
	16	20	Sand, fine, silty, gray-brown
	20	25	Sand, fine to medium, brown
	25	30	Sand, fine to medium, red-brown, and medium gravel
	30	40	Sand, medium to coarse, red-brown, silty, and medium to coarse gravel; some cobbles
	40	44	Sand and gravel, fine to coarse, red-brown
	44	48	Sand, fine to medium, brown, and medium to coarse gravel
	48	52	Sand, medium to coarse, gray-brown, and coarse gravel; some cobbles
	52	54.5	Sand, fine to medium, silty, brown, and medium to coarse gravel; some cobbles
	54.5	--	End of hole
BTW 10	0	14	Sand and gravel, brown
	14	21	Hardpan(?)
	21	27	Clay, gray, firm
	27	37	Clay, gray, soft, and silt
	37	47	Sand and gravel, brown
	47	--	Refusal
BTW 12	0	20	Sand, fine to medium, brown
	20	40	Sand, fine, brown
	40	47.5	Sand, fine, brown and coarse gravel
	47.5	--	Refusal
BTW 13	0	18	Sand, fine, brown
	18	30	Sand, fine to medium, brown

Appendix B. Lithologic logs of selected wells, auger holes, and borings in south-central New Hampshire —*Continued*

Local well No.	Depth to top (ft)	Depth to bottom (ft)	Description of material
			MERRIMACK COUNTY—*Continued*
			Boscawen—*Continued*
BTW 13—*Continued*			
	30	34	Sand, fine to medium, brown; some coarse sand
	34	40	Sand, fine to coarse, brown; broken gravel; trace of silt
	40	--	Refusal
BTW 14	0	5	Sand, fine, brown; boulders
	5	20	Sand, fine, brown; some medium sand
	20	40	Sand, fine, brown
	40	41	Sand, fine, brown; some medium to coarse sand
	41	--	Refusal
BTW 15	0	3	Topsoil
	3	25	Sand, fine, brown; some medium sand and silt
	25	26	Sand, fine, brown; some medium to coarse sand, gravel and silt
	26	--	Refusal
BTW 16	0	29	Sand, fine to coarse, brown; trace of silt
	29	40	Sand, fine to coarse, gray; some gravel
	40	49	Sand, fine to medium, gray; some coarse sand and gravel
	49	54	Sand, fine to coarse, and gravel, gray
	54	--	Refusal
BTW 17	0	6	Silt and fine to medium sand, brown
	6	15	Clay and fine sand, gray, mixed
	15	55	Clay, gray
	55	59	Sand, fine to coarse, brown
	59	64	Sand, fine, brown
	64	75	Sand, fine to coarse, brown
	75	82	Sand, fine to medium, brown; some coarse sand and sharp gravel; trace of silt
	82	85	Gravel, broken
	85	--	Refusal
BTW 36	0	20	Clay and silt
	20	40	Gravel
	40	--	Bedrock
			Bow
BUA 1	0	3	Topsoil, dark brown
	3	17	Sand, very fine to medium, some silt, pebbles and cobbles, very poorly sorted
	17	27	Sand, very fine to very coarse, some silt and pebbles, predominantly fine sand
	27	37	Sand, very fine to coarse, trace cobbles, predominantly fine sand, very poorly sorted
	37	42	Till
	42	--	End of hole
BUB 7	0	34	Sand, fine, loose
	34	40	Sand, medium; well sorted
	40	41	Sand, fine
	41	--	Bedrock

Appendix B. Lithologic logs of selected wells, auger holes, and borings in south-central New Hampshire —*Continued*

Local well No.	Depth to top (ft)	Depth to bottom (ft)	Description of material
			MERRIMACK COUNTY—*Continued*
			Bow—*Continued*
BUW 11	0	49	Sand, medium, and fine gravel
	49	52	Till
	52	--	Bedrock
BUW 12	0	65	Sand, medium and fine gravel
	65	95	Sand, very fine with silt and clay stringers
	95	--	Bedrock
	65	95	Sand, very fine with silt and clay stringers
BUW 13	5	6.5	Sand, medium, gray
	10	11.5	Sand, medium coarse, dark gray and light brown
	15	16.5	Sand, medium; few pebbles; light red-brown
	20	21.5	Sand, medium, dark gray-brown
	25	26.5	Sand, interbedded fine and coarse, with pebbles, red-brown
	30	31.5	Sand, very fine to coarse, predominantly coarse, poorly sorted; dark brown
	35	36.5	Sand, coarse, and gravel; red-brown
	40	41.5	Sand, very coarse, and gravel
	45	46.5	Gravel, medium
	50	51.5	Sand, fine to very fine; dark brown
	55	56.5	Sand, fine to very fine; overlying lens of medium to coarse gravel
	60	61.5	Sand, fine to very fine; dark to light gray
	65	66.5	Sand, fine to very fine; light gray
	70	71.5	Sand, very fine to very coarse, and pebbles; light gray
	74.5	--	Bedrock
	30	31.5	Sand, very fine to coarse, predominantly coarse, poorly sorted; dark brown
BUW 14	3.5	4	Sand, fine, loamy, black
	10	11.8	Sand, fine, and silt and clay, gray and brown
	18	19.7	Gravel, silty, clayey, gray
	20	53	Sand, medium to coarse, brown; some layers of fine gravel
	53	55.5	Weathered rock and gravel
	55.5	--	Refusal (probably bedrock)
BUW 15	5	6.5	Gravel, and medium to fine sand; pebbles at least 0.75 in. diameter; medium dark brown
	10	16.5	Sand, fine, well sorted; light red-brown
	20	21.5	Sand, very fine to fine; well sorted; light red brown
	25	26.5	Sand, fine to medium; moderately sorted; some silt; medium dark brown
	30	31.5	Sand, fine to medium with few pebbles; medium red brown
	35	36.5	Gravel, and fine to medium sand; red brown
	40	41.5	Gravel, and fine to medium sand, well sorted, light red brown
	45	46.5	Sand, medium to fine; brown
	50	60.5	Sand, medium; brown
	60.5	63	Bedrock, weathered
	63	--	Bedrock
BUW 16	5	6.5	Sand, very fine and silt; some pebbles
	10	11.5	Sand, very fine and silt; some pebbles; gray

Appendix B. Lithologic logs of selected wells, auger holes, and borings in south-central New Hampshire —*Continued*

Local well No.	Depth to top (ft)	Depth to bottom (ft)	Description of material
			MERRIMACK COUNTY—*Continued*
			Bow—*Continued*
BUW 16—*Continued*			
	15	16.5	Sand, medium; pebbles; very dark brown
	20	21.5	Gravel, and medium to fine sand; light gray brown
	25	26.5	Sand, fine to medium, with pebbles; and gravel; brown
	30	31.5	Sand, very fine, and silt; poorly sorted; dense; gray; not very permeable
	35	36.5	Sand, and silt; poorly sorted; dense; gray
	40	46.5	Gravel and fine to medium sand; poorly sorted brown
	50	51.5	Sand, very coarse; well sorted; red brown
	55	56.5	Sand, coarse with few pebbles; moderately well sorted; red brown
	60	66.5	Sand, medium to coarse; moderately well sorted; red brown
	70	76.5	Gravel, and fine to medium sand; brown
	80	81.5	Gravel, and very fine to fine sand; dense and compact; red brown
	85	86.5	Gravel and very fine to fine sand; dense compact, very poorly sorted; light red brown
	90	91.5	Till
	92	--	Refusal (bedrock or boulder)
BUW 17	0	21	Sand, fine to coarse, brown, and fine to medium gravel and broken gravel
	21	28	Sand, fine to coarse, brown, and fine gravel
	28	42	Sand, fine to coarse, brown, and fine to medium gravel, and broken gravel
	42	49	Sand, fine, brown
	49	55	Sand, fine to medium, brown
	55	63	Sand, fine to coarse, brown, and fine to medium gravel
	63	70	Sand, fine to coarse, brown, and fine gravel
	70	80	Sand, fine to medium, gray; some coarse sand
	80	92	Till
	92	--	Refusal
BUW 18	0	42	Sand, fine to coarse, brown, and fine gravel, some medium gravel; broken gravel;
	42	55	Sand, fine to coarse, brown, and fine to medium gravel, broken gravel
	55	--	Refusal
BUW 20	0	35	Sand, fine to coarse, brown, fine to medium gravel and broken gravel
	35	42	Sand, medium to coarse, brown, fine to medium gravel
	42	49	Sand, fine to medium, brown; some coarse sand
	49	57	Sand, fine to coarse, brown, fine gravel and broken gravel
	57	--	Refusal
BUW 21	0	16	Sand, medium, and cobbles and boulders
	16	--	Refusal on boulders
BUW 22	0	18	Boulders and peat
	18	--	Refusal on boulders
BUW 24	0	55	Sand, fine to coarse, brown; gravel, fine to medium
	55	--	Refusal
BUW 64	0	4	Sand, fine to coarse, mostly medium, brown
	7	9	Sand, fine to coarse, mostly coarse, poorly sorted, brown

Appendix B. Lithologic logs of selected wells, auger holes, and borings in south-central New Hampshire —*Continued*

Local well No.	Depth to top (ft)	Depth to bottom (ft)	Description of material
			MERRIMACK COUNTY—*Continued*
			Bow—*Continued*
BUW 64—*Continued*			
	17	18	Sand, fine to medium, mostly medium, traces of pebbles, poorly sorted, brown
	34	--	Refusal on bedrock
BUW 89	0	40	Sand
	40	59	Till
	59	100	Bedrock, very soft, caving ledge (highly weathered)
	100	--	Bedrock , solid
BUW 97	0	112	Sand
	112	148	Gravel
	148	--	Bedrock
BUW 169	0	45	Gravel
	45	--	End of hole
BUW 217	0	140	Sand, gravel
	140	--	End of hole
BUW 297	0	100	Sand
	100	138	Clay and silt, fine
	138	--	Bedrock
BUW 361	0	60	Sand
	60	70	Clay
	70	--	Bedrock
BUW 371	0	10	Sand
	10	48	Clay
	48	--	Bedrock
			Canterbury
CEB 1	0	9	Sand, fine; well sorted
	9	17	Sand, fine to medium
	17	46	Sand, fine to coarse
	46	50	Sand, fine to medium
	50	55	Sand, fine to coarse and silt
	55	72	Sand, fine; well sorted
	72	80	Till
	80	--	Bedrock
CEW 1	0	2	Silt, dark brown and sand, loam
	2	17	Sand, light brown, medium to very coarse; predominantly coarse sand; some fine gravel; moderately sorted
	17	19	Sand, light brown, medium to coarse; predominantly coarse sand; trace fine gravel; moderately sorted
	27	29	Sand, light brown, fine to coarse; predominantly medium sand; well sorted
	37	39	Sand, brown, medium to coarse; predominantly medium sand; some fine and coarse gravel; moderately sorted
	47	49	Gravel, brown, coarse, and pebbles
	57	59	Sand, gray, medium to coarse; predominantly coarse sand; some fine and coarse gravel; moderately sorted

Appendix B. Lithologic logs of selected wells, auger holes, and borings in south-central New Hampshire —*Continued*

Local well No.	Depth to top (ft)	Depth to bottom (ft)	Description of material
			MERRIMACK COUNTY—*Continued*
			Canterbury—*Continued*
CEW 1—*Continued*			
	67	69	Sand, gray, fine to medium; predominantly fine sand; well sorted
	77	79	Sand, gray, medium to coarse; predominantly coarse sand; some pebbles and cobbles; moderately sorted
	80	--	Refusal on clayey till
CEW 2	0	8	Sand, brown-gray, very fine to very coarse; predominantly medium sand; some boulders; very poorly sorted
	8	12	Silt, gray, and sand; predominantly medium sand; some gravel and pebbles; very poorly sorted
	12	18	Till
	18	--	Refusal in weathered bedrock
CEW 3	0	3	Topsoil
	3	15	Sand, fine, brown, very well sorted
	15	16	Sand, very fine to fine, mostly fine, very well sorted
	16	20	Sand, fine, brown
	20	23	Sand, fine to medium, brown, mostly fine , very well sorted
	23	32	Sand, very fine to fine, gray-brown, mostly very fine, well sorted
	32	35	Silt to very fine sand, gray, mostly very fine sand, very well sorted
	35	45	Sand, very fine to fine, mostly very fine, well sorted
	45	55	Silt, gray; some clay, well sorted
	55	65	Silt, gray to very fine sand; mostly very fine, very well sorted
	65	101	Clay, gray, stiff
	101	--	Till; end of hole at 117 feet
CEW 26	0	100	Sand
	100	133	Till
	133	--	Bedrock
CEW 63	0	50	Sand
	50	148	Till
	148	--	Bedrock
			Chichester
CQW 2	0	9	Sand, medium; well sorted; light brown
	9	22	Sand, fine to medium; predominantly medium; light brown
	22	37	Sand, fine to medium; predominantly fine; light brown
	37	39	Sand, very fine to fine; predominantly very fine; well sorted; light brown
	47	49	Sand, very fine to medium; predominantly fine; poorly sorted; light brown
	53	59	Till, silt to gravel; predominantly very fine, very compact; gray
	59	--	Till
CQW 3	0	5	Sand, rusty orange brown, fine; well sorted
	5	7	Sand, rusty orange-brown, medium, some pebbles; predominantly coarse sand; poorly sorted
	7	9	Sand, brown, medium to coarse; some pebbles; poorly sorted
	17	19	Sand, light brown; layers of very fine to very coarse sand
	21	29	Till
	29	--	Refusal
CQW 47	0	30	Till and clay
	30	32	Sand
	32	44	Gravel

Appendix B. Lithologic logs of selected wells, auger holes, and borings in south-central New Hampshire *—Continued*

Local well No.	Depth to top (ft)	Depth to bottom (ft)	Description of material
			MERRIMACK COUNTY—*Continued*
			Chichester—*Continued*
CQW 47—*Continued*			
	44	50	Till and clay
	50	--	Bedrock
CQW 66	0	25	Sand
	25	35	Clay
	35	--	Bedrock
			Concord
CVA 1	0	9	Sand, fine to medium; predominantly medium; moderately sorted; brown
	9	17	Sand, very fine to medium; predominantly fine; gray
	17	29	Clay, and silt; some fine sand; gray
	37	57.4	Clay, gray, stiff
	57.4	59	Sand, very fine to fine; predominantly very fine; brown
	67	69	Sand, very fine; well sorted; gray
	70	82	Till
	82	--	End of hole
CVA 2	0	78	Silt, and fine sand and clay
	78	82	Sand and gravel
	82	--	End of hole
CVA 3	2	4	Sand, fine, brown; little organic silt
	5	7	Sand, fine, brown-gray, and silt
	10	12	Sand, very fine and silt, brown, gray, and orange (laminated)
	15	17	Silt, and sand, gray; little clay
	20	22	Silt, and clay, gray; trace very fine sand
	25	27	Silt, gray, and clay; trace very fine sand
	30	37	Silt, and clay, gray; trace very fine sand
	40	47	Sand, fine to medium, gray; some gravel and silt; trace clay
	52	--	Refusal
CVA 4	0	2	Silt, brown; trace fine sand
	5	7	Silt, light brown; trace fine sand
	10	12	Silt, light brown
	15	17	Silt, light brown; trace fine sand
	20	22	Sand, medium to fine, light brown; trace fine gravel
	25	27	Silt, gray, stiff; little clay
	30	31.1	Silt, gray, medium stiff; little clay
	31.7	--	Auger refusal
CVA 5	1	3	Topsoil
	5	7	Sand, fine to medium, light brown
	10	12	Sand, fine to medium, and silt, light brown and gray
	15	17	Silt, gray; trace clay
	20	22	Silt, light gray; trace clay in thin (2-5 mm) layers
	40	42	Silt, light gray; trace clay in thin (2-5 mm) layers
	45	47	Silt, light gray; trace fine sand and gray clay
	50	52	Sand, fine light gray; trace silt; trace clay in 2-10 mm layers
	60	62	Sand, fine, light gray; trace fine to medium gravel; trace silt; trace clay in thin (2-10 mm) layers

Appendix B. Lithologic logs of selected wells, auger holes, and borings in south-central New Hampshire —*Continued*

Local well No.	Depth to top (ft)	Depth to bottom (ft)	Description of material
			MERRIMACK COUNTY—*Continued*
			Concord—*Continued*
CVA 5—*Continued*			
	65	85.5	Till; silt, sand, and gravel
	85.5	--	Refusal on bedrock
CVA 6	0	29	Sand, fine, light gray
	29	34	Sand, fine to coarse, gray
	34	49	Silt, gray
	49	57.5	Silt and very fine sand, gray
	57.5	--	End of hole
CVA 7	0	20	Sand, medium, brown
	20	35	Sand, fine to coarse, predominantly medium; gray
	35	60	Silt and clay
	60	--	End of hole
CVA 8	0	20	Sand, fine, brown
	20	27	Sand, fine to medium, gray
	27	66	Silt and clay
	66	--	End of hole
CVA 9	0	3	Topsoil
	3	18	Sand, brown, medium to coarse; predominantly medium sand; moderately sorted
	18	28	Sand, brown, fine to medium; predominantly medium sand; coarsening with depth
	28	--	Refusal
CVA 10	0	1	Topsoil
	1	5	Sand, fine, brown, trace silt
	5	20	Sand, fine, gray, some silt
	20	21	Sand, fine, gray, some silt, trace clay
	21	25	Sand, fine, gray, trace silt
	25	30	Silt, gray, little fine sand
	30	35	Silt, gray, trace fine sand and clay
	35	40	Silt, gray, trace clay
	40	45	Silt, gray, trace fine sand
	45	50	Silt, gray, trace clay
	50	87	Silt, gray, trace fine sand
	87	92	Sand, fine, brown to gray, some silt
	92	--	End of hole
CVB 64	0	2	Topsoil and sand; some organics
	2	7	Sand, fine to medium; trace silt; light brown
	7	12	Sand, medium to coarse; little gravel; dark brown
	17	21	Sand, fine to coarse; some gravel; dark brown
	21	--	Bedrock
CVB 65	0	4	Sand, fine to medium; some silt; trace coarse sand; light brown
	4	10	Sand, fine to medium; some gravel and silt; trace coarse sand; light brown-gray
	10	15	Sand, fine to coarse; some gravel; little silt; brown

Appendix B. *Lithologic logs of selected wells, auger holes, and borings in south-central New Hampshire —Continued*

Local well No.	Depth to top (ft)	Depth to bottom (ft)	Description of material
			MERRIMACK COUNTY—*Continued*
			Concord—*Continued*
CVB 65—*Continued*			
	15	23.7	Sand, fine to coarse ;and gravel; trace silt; brown
	23.7	--	Bedrock
CVB 66	0	3	Artificial fill; cobbles, boulders, sand, and gravel
	3	7	Sand, fine to medium; some gravel; little silt and coarse sand; light brown
	7	12.2	Sand, fine to medium; some silt and gravel
	12.2	--	Bedrock
CVB 67	0	2	Sand, fine to medium; trace silt; brown
	2	10	Sand, fine to medium; little gravel; brown
	10	15.5	Sand, fine sand; some silt; light brown
	15.5	20	Sand, fine to coarse; trace gravel; light brown
	20	34.5	Sand, fine to coarse; some gravel; dark brown
	34.5	40	Sand, medium to coarse; light brown
	40	61	Sand, fine to coarse; little gravel; brown
	61	63.1	Till, gray
	63.1	--	Bedrock
CVB 68	0	10	Artificial fill, sandy
	10	23	Sand, fine
	23	96	Silt and little clay
	96	105	Till, sandy
	105	--	Bedrock
CVB 69	0	2	Topsoil
	2	20	Sand, fine
	20	45	Sand, medium to coarse
	45	50	Silt and clay
	51	80	Silt and little clay
	80	105	Sand, fine and silt
	105	115	Till, sandy
	115	--	Bedrock
CVB 72	0	4	Sand, medium; compact
	4	5	Boulder
	5	12	Sand, fine; very compact
	12	--	Bedrock
CVB 73	0	3	Sand, and loam
	3	10	Sand, medium to coarse
	10	25	Silt and clay; trace sand
	25	35	Till, sand, silt and rock
	35	--	Refusal
CVB 74	0	5	Sand, fine
	5	10	Sand, coarse
	10	15	Sand, fine; angular
	15	42	Silt and clay

Appendix B. Lithologic logs of selected wells, auger holes, and borings in south-central New Hampshire —*Continued*

Local well No.	Depth to top (ft)	Depth to bottom (ft)	Description of material
			MERRIMACK COUNTY—*Continued*
			Concord—*Continued*
CVB 74—*Continued*			
	42	50	Till, sandy
	50	--	Refusal
CVB 75	0	45	Sand, fine; trace silt
	45	64	Silt and fine sand
	64	75	Sand, fine; trace silt
	75	95	Silt and fine sand
	95	119	Clay and silt
	119	--	Bedrock
CVB 76	0	29	Sand, fine; trace silt
	63	93	Sand, fine; trace silt
	93	119	Clay and silt; trace fine sand
	119	128	Till, sandy
	128	--	Bedrock
CVB 77	0	1	Topsoil
	1	9	Sand, fine, and pebbles
	9	35	Sand, fine, and silt
	35	40	Sand, fine
	40	46	Sand, fine, and pebbles
	46	50	Sand, fine
	50	57	Till, sandy
	57	--	Bedrock
CVB 78	0	3.5	Sand and gravel
	3.5	20	Sand, fine; well sorted
	20	23	Sand, coarse; some fine gravel
	23	38	Sand, medium; well sorted
	38	41	Sand, coarse
	41	--	Bedrock
CVB 79	0	12	Sand, fine
	12	22	Sand, medium; well sorted
	22	44	Sand, medium, and gravel; well sorted
	44	--	Bedrock
CVB 80	0	7	Sand, fine
	7	12	Sand, coarse, little gravel
	12	32	Sand, medium, firm
	32	37	Sand and gravel, firm
	37	39.5	Till
	39.5	--	Bedrock
CVB 82	0	32	Artificial fill
	32	52	Sand, fine
	52	70	Silt and clay
	70	80	Till

Appendix B. Lithologic logs of selected wells, auger holes, and borings in south-central New Hampshire —*Continued*

Local well No.	Depth to top (ft)	Depth to bottom (ft)	Description of material
			MERRIMACK COUNTY—*Continued*
			Concord—*Continued*
CVB 82—*Continued*			
	80	--	Bedrock
CVB 83	0	2.5	Fill, loam, sand and gravel
	2.5	5	Sand, fine; loose
	5	10	Sand, fine; firm
	10	14	Sand, coarse; little gravel; firm
	14	50	Sand, very fine; little clay; soft
	50	54.5	Till
	54.5	--	Refusal
CVB 84	0	5	Loam and sand
	5	12	Sand, medium; loose
	12	18	Sand, coarse; little gravel
	18	88.5	Sand, very fine; little clay; soft
	88.5	93.6	Till, sandy
	93.6	--	Bedrock
CVB 85	0	10	Sand, medium; little gravel
	10	79.5	Sand, very fine; little soft clay
	79.5	81.5	Till, sandy
	81.5	--	Bedrock
CVB 86	0	1	Loam
	1	5	Sand, fine; loose
	5	12	Sand, coarse; little gravel; firm
	12	23	Clay, blue; little fine sand
	23	25	Sand, medium; loose
	25	--	Bedrock
CVB 87	0	1	Loam
	1	7	Sand; some gravel and silt
	7	26	Till, sandy
	26	--	Bedrock
CVB 88	0	5	Sand, fine to medium
	5	20	Silt and fine sand
	20	32	Silt and clay
	32	39	Sand, fine to coarse
	39	49	Till, sand, silt, and gravel
	49	--	Bedrock
CVB 89	0	5	Artificial fill
	5	20	Sand, coarse to medium
	20	42	Silt and clay
	42	46	Sand, fine, and silt
	46	61	Till, sandy
	61	--	Bedrock

Appendix B. Lithologic logs of selected wells, auger holes, and borings in south-central New Hampshire —*Continued*

Local well No.	Depth to top (ft)	Depth to bottom (ft)	Description of material
			MERRIMACK COUNTY—*Continued*
			Concord—*Continued*
CVB 90	0	1	Loam
	1	6	Sand, fine, light brown, very loose
	6	12	Sand, fine; trace silt; light brown
	12	18	Sand, fine; some silt; brown
	18	24	Sand, fine to medium; some silt; brown
	24	26	Sand, fine to medium
	26	28	Sand, fine to coarse
	28	32	Sand, fine to medium; light brown
	32	34	Sand, fine to coarse
	34	38	Silt, trace clay
	38	40	Silt, trace sand
	40	43.5	Till, sandy
	43.5	--	Bedrock
CVB 91	0	1	Topsoil
	1	23	Sand, fine
	23	30	Sand, fine to medium
	30	40	Sand, fine
	40	46	Till, sandy
	46	--	Bedrock
CVB 92	0	26	Sand, fine; some silt
	26	27	Till
	27	--	Bedrock
CVW 2	0	7	Sand and gravel, fine to medium sand , yellow brown, poorly sorted
	7	12	Sand, fine to coarse, gray brown, poorly sorted
	12	42	Sand, fine to medium, yellow brown, moderately sorted
	42	71	Sand, fine to coarse, well sorted, brown
	71	97	Sand, fine to medium, little small gravel, brown
	97	105	Sand, very fine to medium, gray
	105	122	Sand, very fine to fine, gray
	122	167	Sand, very fine to medium, gray
	167	--	End of hole
CVW 5	0	1	Topsoil
	1	14	Sand, fine, light tan
	14	18	Sand, coarse, red
	18	19	Clay, gray-green
	19	20	Clay, trace sand
	20	24	Sand, gray and clay
	24	39	Sand, fine, brown
	39	40	Sand and gravel
	40	52	Sand, fine, brown
	52	53	Gravel, coarse and sand
	53	80	Sand, coarse and gravel
	80	--	Refusal

Appendix B. Lithologic logs of selected wells, auger holes, and borings in south-central New Hampshire —*Continued*

Local well No.	Depth to top (ft)	Depth to bottom (ft)	Description of material
			MERRIMACK COUNTY—*Continued*
			Concord—*Continued*
CVW 6	0	1.3	Loam
	1.3	16.2	Sand and gravel, clay, boulders
	16.2	35	Sand, fine, gray, and clay; some sharp gravel
	25	68.2	Clay, brown, sharp gravel, fine sand
	68.2	--	Refusal
CVW 7	0	3.3	Topsoil
	3.3	12.2	Sand, brown, and gravel, boulders
	12.2	25	Sand, coarse gray, and sharp gravel
	25	32.5	Sand, fine to medium, gray, and sharp gravel
	32.5	--	Refusal
CVW 8	0	1.2	Topsoil
	1.2	20.1	Sand, coarse to medium, brown, gravel, some boulders
	20.1	33.2	Sand, medium to coarse, brown; trace clay
	33.2	--	Refusal
CVW 9	0	1	Topsoil
	1	14.2	Sand, brown, and gravel, clay, boulders
	14.2	64.5	Sand, fine, gray, and clay
	73.3	--	Refusal
CVW 10	0	1.3	Loam
	1.3	8.3	Gravel, clay and sand
	8.3	16.3	Sand, brown, and gravel and clay
	16.3	26	Sand, fine to coarse, brown; clay
	26	31.3	Sand, fine to coarse, brown; clay
	31.3	--	Refusal
CVW 11	0	5.3	Sand, fine, brown
	5.3	40.3	Sand, fine, gray, and clay
	40.3	44.3	Sand, coarse, gray, and sharp gravel, clay
	44.3	--	Refusal
CVW 12	0	18.3	Sand, fine to medium, brown; trace clay
	18.3	35	Sand, fine gray-brown, and clay
	35	48.3	Sand, fine, gray, and clay
	48.3	60.4	Sand, fine to medium, gray, and clay, trace gravel
	60.4	74.3	Sand, fine to medium, gray, and clay; trace sharp gravel
	74.3	--	Refusal
CVW 13	0	15.3	Sand, fine to medium, brown; trace gravel
	15.3	31.3	Sand, coarse to medium, grayish, and gravel, boulders; trace clay
	15.3	39	Sand, medium to coarse, brown, and gravel
	39	48	Sand, fine to medium, and clay; trace gravel
	48	68.3	Sand, fine to medium, and clay
	68.3	75.1	Sand, fine to medium, grayish, and clay
	75.1	--	End of hole

Appendix B. Lithologic logs of selected wells, auger holes, and borings in south-central New Hampshire —*Continued*

Local well No.	Depth to top (ft)	Depth to bottom (ft)	Description of material
			MERRIMACK COUNTY—*Continued*
			Concord—*Continued*
CVW 14	0	16.3	Sand, medium, brown
	16.3	21.3	Sand, fine to medium, brown; trace clay
	21.3	29.7	Sand, fine to medium, brown; trace clay
	29.7	--	Refusal
CVW 15	0	24	Sand, medium, brown; trace clay
	24	35.3	Sand, fine to medium, brown; trace clay
	35.3	44.4	Sand, fine to medium, brown; trace clay
	44.4	--	Refusal
CVW 16	0	33	Sand, fine, brown
	33	96	Silt, gray
	96	140	Till
	140	161	Silt and clay; sand, fine
	161	178	Bedrock; granite, weathered and fractured
	178	182	Pegmatite
	182	189	Granite, soft
	189	400	Granite, light gray, hard, fine to medium grained
	400	--	End of hole
CVW 17	0	4.5	Topsoil; dark brown sandy loam
	4.5	10	Missing log
	10	12	Sand, fine to medium, light brown; trace silt
	15	42	Sand, fine to medium, light brown, with layers of silt; some oxidized layers, rust colored
	45	46.5	Sand, fine to medium, light brown; with layers of silt; trace gravel
	50	60.8	Sand, fine to coarse, and gravel; cobbles; some boulders
	60.8	--	Refusal on bedrock
CVW 18	0	0.5	Topsoil
	0.5	2	Sand, dense, medium to coarse, brown; some silt; trace of gravel
	2	9	Sand, very dense, fine to coarse, tan; traces of fine gravel and silt
	9	15	Silt, very dense, tan; some fine sand; stratifications with dark staining (wet)
	15	15.5	Silt, very stiff, and clay, grayish-brown; trace of fine sand
	15.5	15.9	Sand, very dense, fine, tan; some silt
	15.9	19	Boulder
	19	25	Sand, very dense, fine to coarse, tan; trace of fine gravel; some silt
	25	--	Quartz monzonite, slightly weathered, moderately fractured, light gray; iron and pyrolusite stained fractures
CVW 19	0	0.3	Topsoil
	0.3	2	Sand, loose, fine to coarse, tan; traces of fine gravel and silt
	2	15.5	Sand, dense, fine to medium, tan, traces of fine gravel and silt
	15.5	26	Silt, very dense, grayish-brown; occasional seams of fine sand and clayey silt
	26	31	Sand, very dense, fine to coarse, and gravel, tan; some silt and clay
	31	--	Quartz monzonite, slightly to moderately weathered, highly fractured, light gray; numerous iron stains
CVW 20	0	30	Sand, dense, very fine, light brown; some silt
	30	33	Sand, very dense, fine, light brown, orange layers; trace of silt
	33	45.6	Sand, very dense, fine, light brown to red; gravel, fine to coarse; traces of silt
	45.6	--	End of hole

Local well No.	Depth to top (ft)	Depth to bottom (ft)	Description of material
			MERRIMACK COUNTY—*Continued*
			Concord—*Continued*
CVW 21	0	0.5	Topsoil, very loose, dark brown; Sand, fine to medium; some silt; trace of roots and organics
	0.5	1.7	Subsoil, very loose, fine sand, orange; trace of silt, roots and organics
	1.7	9	Sand, dense, fine to medium, light brown; trace of silt
	9	21.5	Sand, dense to very dense, fine to very fine, light brown; Silt, very dense, light gray-brown, trace of dried clay, moist
	21.5	--	End of hole
CVW 22	0	4	Peat; some medium sand; wood fragments
	4	21.5	Sand, dense to very dense, fine, tan; traces of silt in 1/8 in. to 1/4 in. seams
	21.5	23.1	Schist, very dense, weathered
	23.1	25	Basalt, slightly weathered, dark gray
	25	28.2	Quartz monzonite, slightly weathered, light gray, biotite muscovite, highly fractured, high-angle iron and pyrolusite stain
	28.2	31.8	Schist, slightly weathered, gray muscovite; quartzite, micaceous, slightly fractured, horizontal and high-angle iron stains
	31.8	55.8	Quartz monzonite, slightly weathered, gray biotite-muscovite, highly fractured, low- to high-angle iron stains
	55.8	--	Quartzite, slightly weathered, greenish-gray, micaceous, low-angle, slicken-sided fractures, low- to high-angle iron stains
CVW 23	0	37	Sand, dense, fine, some coarse, tan to gray; trace of silt
	37	55	Sand, dense to very dense, fine, tan; silt, very stiff, grayish brown, clayey
	55	63	Sand, dense, fine , tan; trace of silt
	63	77	Sand, dense to very dense, fine to medium, tan; traces of silt and coarse sand
	77	130	Sand, very dense, fine to medium, tan; traces of silt and fine gravel
	130	--	Bedrock (cored 4 feet)
CVW 24	0	75	Sand, fine, brown
	75	103	Silt; clay; trace of fine sand
	103	145	Till
	145	204	Silt; clay; some fine sand
	204	215	Granite, weathered and fractured
	215	223	Granite, moderately hard to soft
	223	--	Granite, hard, fine to medium grained, light gray
CVW 25	0	0.3	Topsoil, very loose, loamy, brown to orange-brown; some fine to medium sand
	0.3	8	Sand, dense, fine to coarse, orange-brown; trace of fine gravel
	8	37	Sand, loose to dense, fine, light brown to red, some iron staining; trace of gray silt, 1/4 in. lenses
	37	--	End of hole
CVW 26	0	12	Sand, very loose to dense, fine to coarse, light brown to orange brown; traces of gravel and silt
	12	28	Sand, dense, fine, light brown, some iron staining; trace of silt, slightly stratified
	28	42	Sand, dense, fine to medium, gray-brown; trace of silt
	42	--	End of hole
CVW 27	0	4	Sand, fine, brown
	4	11.3	Sand, fine to coarse, brown, gravel, boulders, trace clay
	11.3	15.3	Sand, fine to coarse, brown, gravel, boulders; trace clay
	15.3	25.3	Sand, fine to medium, brown, gravel, boulders

Appendix B. Lithologic logs of selected wells, auger holes, and borings in south-central New Hampshire —*Continued*

Local well No.	Depth to top (ft)	Depth to bottom (ft)	Description of material
			MERRIMACK COUNTY—*Continued*
			Concord—*Continued*
CVW 27—*Continued*			
	25.3	37	Sand, medium to coarse, and gravel, boulders; trace clay
	39.3	--	Refusal
CVW 28	0	27.5	Sand, coarse to medium, brown, and boulders
	27.5	31.3	Sand, coarse, brown, and angular gravel, boulders
	31.3	--	Refusal
CVW 30	0	4	Artificial fill
	4	6	Sand, fine to medium, orange-brown; trace medium gravel
	9	11	Sand, fine to medium; trace iron stain
	19	21	Sand, fine to medium, tan; trace iron stain
	24	26	Sand, fine to medium, lenses of fine sand, tan; trace iron stain
	43	45	Sand, fine to medium, gray, firm
	45	58	Sand, fine to medium, tan to brown; little fine to medium gravel
	58	61	Sand, fine; some silt; little to trace clay; thin layers of silt and clay
	61	--	End of hole
CVW 31	0	15.3	Sand, fine to coarse, brown, and gravel, boulders; trace clay
	15.3	32.3	Sand, medium to coarse, brown, gravel, boulders; trace clay
	32.3	--	Refusal
CVW 32	0	3	Topsoil
	5	12	Sand, fine, dense, brown; trace silt; some bedding
	15	22	Sand, fine, dense, gray; trace silt; minor bedding
	25	27	Sand, fine, gray, dense; little silt; minor bedding
	30	37	Sand, fine, gray, and silt, dense gray-blue laminated clay
	40	42	Silt, gray; some sand; clay laminae (3-5 mm)
	45	47	Silt, gray and sand; clay laminae
	50	57	Silt and clay, gray
	60	62	Silt and clay, gray; predominantly silt
	65	67	Silt and clay, gray; predominantly silt; trace sand
	70	82	Silt and clay, gray; predominantly silt
	84	--	Refusal
CVW 33	5	7	Sand, gray and tan, with debris
	10	12	Sand and silt, gray and brown; with debris
	15	22	Sand and silt, gray brown; with debris
	30	32	Clay, gray; trace sand and silt with decaying roots
	40	42	Sand, fine silty, gray with pieces of wood-organics
	45	47	Sand, silty fine, gray
	50	55	Sand, fine and silty, brown
	68	--	End of hole
CVW 34	0	16	Sand, fine to coarse, light brown; trace fine gravel and silt
	16	26	Sand, fine to coarse, light tan; some silt; slight iron staining
	26	35	Sand, fine to medium, light tan; trace coarse sand and fine gravel; little silt; some iron stained layers
	35	36.5	Clay, gray, and silt; some fine sand
	36.5	44	Sand, fine, and silt, light tan; slightly stratified

Appendix B. Lithologic logs of selected wells, auger holes, and borings in south-central New Hampshire —*Continued*

Local well No.	Depth to top (ft)	Depth to bottom (ft)	Description of material
			MERRIMACK COUNTY—*Continued*
			Concord—*Continued*
CVW 34—*Continued*			
	44	51	Sand, very fine to fine, slightly stratified, light tan; some to little silt
	51	55	Sand, very fine to fine, slightly stratified, light tan; some to little silt; some iron-stained layers
	55	68	Sand, fine to medium, well stratified, light brown; lenses of coarse sand; some silt and silt lenses
	68	75	Sand, fine to medium, well stratified; lenses of coarse sand; some silt and silt lenses; some iron staining
	75	--	End of hole
CVW 35	0	4	Topsoil, dark brown
	4	5	Sand, fine to coarse, light brown; trace silt and fine gravel
	5	15	Sand, medium to coarse, light tan; little fine sand; trace fine gravel
	15	26	Sand, fine to medium, light tan; little to trace silt; some red iron stained layers
	26	30	Sand, medium to coarse, dark orange brown; some fine sand; little silt; some red iron staining
	30	35	Sand, fine to medium, light tan, slightly stratified; little silt; some red, iron stained layers
	35	40	Sand, fine, light brown; some silt; trace medium sand
	40	51	Sand, fine, slightly stratified, light tan; some silt; red-brown iron stained layers
	51	66	Sand, fine, slightly stratified, light tan; some silt, with some red-brown iron stained layers
	66	76	Sand, fine, slightly stratified, light gray; some silt;trace medium sand; thin silt lenses
	76	77	Sand, very fine, light gray and silt
	77	--	End of hole
CVW 36	0	6	Sand, very fine, gray and clayey silt, poorly sorted
	6	11	Sand, fine, light, gray; some silt
	11	17	Sand, fine, gray, light; some medium sand; some silt
	17	23	Sand, fine, light gray; some medium sand; some silt
	23	29	Sand, medium to coarse, light gray; some fine sand; little silt; trace fine gravel
	29	55	Clay, silty, gray to blue
	55	64	Sand, very fine, gray, and silt
	64	--	Bedrock
CVW 38	0	1.5	Demolition fill; light brown silt; little fine sand
	1.5	16.5	Silt, tan and very fine to fine sand
	16.5	19	Silt, gray and fine to very fine sand
	19	21.5	Sand, fine, tan; trace silt
	21.5	26	Sand, medium to coarse, tan
	26	34	Clay, gray and silt
	34	50.5	Silt, gray and clay
	50.5	51	Till; gray medium to very coarse sand; some silt; some medium to coarse gravel
	50.5	54.5	Till; gray medium to very coarse sand; some silt; little medium to coarse gravel
	54.5	--	Refusal
CVW 40	0	1	Topsoil
	1	21	Sand, fine, brown; some coarse sand, fine gravel, and silt
	21	47.5	Clay, gray and silty sand
	47.5	50	Sand, fine, gray; some coarse sand, gravel, and silt
	50	54.5	Till; gray fine to coarse sand, sharp and broken gravel, some silt
	54.5	--	Refusal

Appendix B. Lithologic logs of selected wells, auger holes, and borings in south-central New Hampshire —*Continued*

Local well No.	Depth to top (ft)	Depth to bottom (ft)	Description of material
			MERRIMACK COUNTY—*Continued*
			Concord—*Continued*
CVW 41	0	14	Peat and fine sand
	14	18	Sand, fine
	18	21	Clay
	21	--	End of hole
CVW 42	0	25	Sand, medium to coarse, brown; some medium gravel
	25	50	Clay, gray and silt
	50	60	Till; gray clay and medium
	60	--	Refusal
CVW 43	0	21	Sand, fine, brown
	21	25	Clay, gray
	25	38	Till
	38	--	Refusal on bedrock
CVW 73	0	15	Sand
	15	55	Clay, blue
	55	--	Bedrock
CVW 104	0	20	Sand
	20	70	Hardpan
	70	80	Clay
	80	--	Bedrock
CVW 109	0	63	Sand
	63	70	Gravel
	70	115	Hardpan
	115	--	Bedrock
CVW 112	0	20	Sand
	20	83	Hardpan
	83	100	Sand
	100	110	Hardpan
	110	--	Bedrock
CVW 127	0	8	Sand
	8	46	Gravel
	46	--	Bedrock
CVW 131	0	20	Sand and gravel
	20	65	Sand and clay
	65	78	Gravel
	78	--	Bedrock
CVW 205	0	30	Till
	30	50	Clay
	50	--	Bedrock
			Epsom
ESA 1	0	9	Sand, very fine to coarse, and cobbles; some fine to coarse gravel; poorly sorted
	9	15	Silt to coarse sand and cobbles; some fine to coarse gravel; poorly sorted; predominantly medium sand
	15	--	Refusal on boulders

Appendix B. Lithologic logs of selected wells, auger holes, and borings in south-central New Hampshire —*Continued*

Local well No.	Depth to top (ft)	Depth to bottom (ft)	Description of material
			MERRIMACK COUNTY—*Continued*
			Epsom—*Continued*
ESA 2	0	7	Silt and very fine sand; well sorted; dark brown
	17	19	Sand, very fine to fine; predominantly very fine; well sorted; brown
	27	29	Sand, fine; well sorted; gray
	37.5	38.5	Sand, fine; gray
	38.5	39	Clay, gray
	47	49	Clay and silt; predominantly gray clay
	57	59	Clay and silt; predominantly gray clay
	67	69	Clay and silt; predominantly gray clay
	77	78	clay and silt
	78	79	Sand, fine; gray
	80	90	Till, sandy
	90	--	Refusal
ESA 3	0	10	Sand, light brown, medium to very coarse; some coarse gravel, pebbles, cobbles and boulders; predominantly medium sand
	10	13	Till, sandy, olive brown
	13	--	Refusal
ESA 4	0	6	Sand, light brown, fine to medium; predominantly medium sand; well sorted
	6	17	Sand, light brown, medium to coarse; some coarse gravel and cobbles; predominantly medium sand; moderately sorted
	17	19	Silt, olive brown to sand, very fine; some cobbles; poorly sorted
	26	--	Refusal
ESA 5	0	19	Sand, fine, brown, well sorted
	19	29	Clay, stiff, gray, some interfingering with layers of very coarse sand and pebbles
	39	57	Sand and gravel, very fine sand to coarse gravel and pebbles, mostly fine sand, very poorly sorted
	57	--	Refusal
ESW 4	0	14	Silt and clay; interfingering with very fine sand
	14	29	Sand, very fine to fine; well sorted; brown
	37	38.5	Sand, very fine to fine; predominantly very fine
	38.5	39	Sand, medium to coarse; predominantly medium
	47	48.5	Sand, very fine to fine; predominantly very fine
	48.5	51	Till, sandy
	51	--	Refusal
ESW 5	0	10	Sand, fine to coarse gravel; predominantly coarse sand
	10	17	Sand, medium to very coarse, little silt and gravel; predominantly coarse sand; moderately sorted
	17	19	Sand, fine to very coarse, trace fine gravel; predominantly coarse sand; moderately sorted
	27	29	Sand, fine to coarse, trace fine gravel; predominantly medium sand; moderately to well sorted
	37	39	Sand, fine to coarse; predominantly medium; well sorted
	47	49	Sand, fine to coarse; predominantly medium to coarse; well sorted; light brown
	57	59	Sand, fine to medium; predominantly fine; well sorted; light brown
	67	69	Sand, fine to medium; predominantly fine; well sorted; light brown
	77	92	Sand, very fine; well sorted; gray
	92	--	End of hole

Appendix B. Lithologic logs of selected wells, auger holes, and borings in south-central New Hampshire —*Continued*

Local well No.	Depth to top (ft)	Depth to bottom (ft)	Description of material
			MERRIMACK COUNTY—*Continued*
			Epsom—*Continued*
ESW 6	0	7	Sand, silt to medium; predominantly fine
	7	9	Sand, medium to coarse; little fine to coarse gravel; trace pebbles; predominantly medium sand; well sorted
	12	15	Sand, fine to very coarse; some pebbles; little fine to coarse gravel; predominantly medium sand; moderately sorted
	17	19	Sand, very fine to fine; predominantly fine; well sorted
	22	24	Sand, very fine to fine; predominantly fine; well sorted
	27	29	Sand, very fine to medium; predominantly fine; well sorted
	27	33	Sand, very fine to fine
	33	39	Till, sandy
	39	--	Refusal
ESW 7	0	4	Sand, fine to medium; predominantly medium
	4	17	Silt to very fine sand; predominantly silt; brown
	17	19	Sand, fine to very coarse; predominantly fine sand
	27	29	Sand, very fine to pebbles; predominantly coarse; highly stratified; moderately sorted in individual layers
	37	39	Sand, fine to pebble gravel; predominantly coarse; highly stratified; moderately sorted in individual layers
	47	49	Silt to fine sand; predominantly very fine sand; well sorted; olive brown
	57	59	Sand, very fine to medium; predominantly fine; moderately sorted
	66	--	Refusal
ESW 8	0	10	Sand and clay, brown
	10	25	Sand, fine, brown; some small gravel
	25	40	Silt, brown
	40	60	Sand, medium, brown, and silt
	60	64.5	Sand, medium, brown, and small gravel
	64.5	--	Refusal
ESW 9	0	10	Sand and small gravel, brown
	10	30	Sand, fine, brown
	30	60	Silt, brown
	60	66	Sand, silty, and sharp gravel
	66	--	Refusal
ESW 10	0	4	Topsoil
	4	15	Sand, brown, fine to medium; mostly fine sand; well sorted
	17	18	Sand, brown, fine to coarse; mostly medium sand; well sorted
	18	19	Sand, gray, fine; very well sorted
	27	28	Sand, fine to coarse; predominantly medium sand; trace cobbles; poorly sorted
	28	29	Till
	35	--	Refusal
ESW 11	0	3	Topsoil
	3	9	Sand, light brown, medium to coarse; some pebbles and cobbles; moderately sorted
	9	19	Sand, light brown, medium to very coarse; some pebbles; predominantly coarse sand; moderately sorted
	27	29	Sand, light to rust brown, very fine; well sorted
	37	49	Till, gray, sandy
	49	--	End of hole
ESW 12	0	4	Topsoil, brown
	4	13	Sand, reddish, fine, to gravel, coarse; predominantly coarse sand; trace pebbles; very poorly sorted

Appendix B. Lithologic logs of selected wells, auger holes, and borings in south-central New Hampshire —*Continued*

Local well No.	Depth to top (ft)	Depth to bottom (ft)	Description of material
			MERRIMACK COUNTY—*Continued*
			Epsom—*Continued*
ESW 12—*Continued*			
	13	17	Sand, reddish, medium, to gravel, coarse; predominantly coarse sand; some pebbles
	17	19	Sand, gray, fine, to gravel, coarse; predominantly coarse sand; some pebbles and cobbles
	27	28	Sand, fine, to pebbles; predominantly very coarse sand; very poorly sorted
	28	29	Sand, coarse to very coarse; well sorted
	37	38.6	Sand, gray-brown, fine, to gravel, coarse; predominantly coarse sand; some pebbles; moderately sorted
	38.6	39	Sand, gray-brown, very fine, to gravel, coarse; predominantly coarse sand; some pebbles; very poorly sorted
	47	48.4	Sand, gray-brown, fine, to gravel, fine; predominantly coarse sand; moderately sorted
	48.4	49	Sand, reddish-brown, fine to very coarse; predominantly coarse sand; moderately sorted
	57	58.5	Sand, light brown, very fine to coarse; predominantly coarse sand; moderately sorted
	58.5	59	Till
	59	--	Refusal
ESW 74	0	20	Gravel
	20	25	Clay
	25	32	Hardpan
	32	--	Bedrock
ESW 134	0	50	Sand
	50	55	Gravel
	55	--	Bedrock
ESW 143	0	35	Sand
	35	55	Clay
	55	60	Gravel
	60	74	Sand
	74	--	Bedrock
			Franklin
FKA 26	0	2	Topsoil
	2	22.5	Sand, fine, brown; traces of silt
	22.5	28	Sand and gravel, brown; with gray and brown clay
	28	60	Clay, gray and silt
	60	162	Sand, silty, gray and clay
	162	--	Refusal on till
FKA 27	0	2	Topsoil
	2	22	Sand, fine, brown
	22	29	Sand, fine to coarse and fine to medium gravel, brown
	29	36	Sand and gravel, brown, mixed with gray and brown clay
	36	77	Clay and silt, gray
	77	88	Sand, silty, gray; some clay
	88	--	Refusal on till
FKA 28	0	2	Topsoil
	2	21.5	Sand, fine, brown
	21.5	26	Sand and gravel mixed with clay, brown and gray
	26	70	Silt and clay, gray
	70	106	Sand, silty, gray; some gray clay
	106	137	Sand, fine, gray; some medium sand and clay
	137	--	Refusal on till

Appendix B. Lithologic logs of selected wells, auger holes, and borings in south-central New Hampshire —*Continued*

Local well No.	Depth to top (ft)	Depth to bottom (ft)	Description of material
			MERRIMACK COUNTY—*Continued*
			Franklin—*Continued*
FKA 29	0	2	Topsoil, loamy
	2	6.5	Sand, fine, dark brown
	6.5	19	Sand, fine, light brown
	19	41.5	Sand, fine to coarse; gravel, fine to coarse
	41.5	--	End of hole
FKA 30	0	2	Topsoil, loamy, sandy
	2	27	Sand, fine to medium, brown to dark brown
	27	33	Sand, fine to coarse, reddish-brown; gravel, fine to coarse; some small cobbles
	33	37	Sand, fine to coarse, gray; gravel, fine to coarse
	37	--	End of hole
FKA 31	0	2	Topsoil, loamy, sandy
	2	17	Sand, fine, brown
	17	26.5	Sand, fine to coarse, reddish-brown; gravel fine to coarse, some small cobbles
	26.5	--	End of hole
FKB 1	0	7	Sand, medium, silty
	7	27	Sand, very fine and silt; some clay
	27	--	End of hole
FKW 1	0	52.3	Sand and gravel
	52.3	--	End of hole
FKW 76	0	2	Topsoil
	2	10	Sand, fine, brown
	10	19	Sand, fine; some coarse sand and gravel mixed with silt; brown
	19	27	Sand, fine to medium, brown; some coarse sand and fine gravel
	27	38	Sand, fine to medium; some coarse sand; brown
	38	50	Sand, fine to coarse, and fine gravel; brown
	50	52	Sand, fine to medium; some coarse sand and fine gravel; reddish brown
	52	56	Sand, fine; some fine gravel; brown
	56	--	End of hole
FKW 77	0	7	Cobbles and sand, medium brown sand to pebbles and cobbles, predominantly medium sand, moderately sorted
	7	17	Sand and gravel, very fine sand to gravel, pebble and cobbles, predominantly fine sand, very poorly sorted
	17	19	Sand, fine, brown, well sorted
	19	34	Sand and gravel
	34	--	Refusal on bedrock
			Loudon
LSA 1	0	10	Sand, medium to pebbles and cobbles; predominantly coarse sand; light brown
	10	--	Sand, medium to pebbles and cobbles; predominantly coarse sand; light brown; refusal on boulder
LSW 1	0	6	Sand, very fine to fine; predominantly fine; well sorted; dark brown
	17	19	Sand, very fine; well sorted; brown
	24	--	Refusal
LSW 2	0	10	Sand, fine, well sorted
	10	17	Sand, medium to coarse, well sorted
	17	27	Sand, red brown, fine to very coarse, predominantly coarse sand, and pebbles, moderately sorted

Appendix B. Lithologic logs of selected wells, auger holes, and borings in south-central New Hampshire —*Continued*

Local well No.	Depth to top (ft)	Depth to bottom (ft)	Description of material
			MERRIMACK COUNTY—*Continued*
			Loudon—*Continued*
LSW 9—*Continued*			
	27	37	Sand, medium to coarse, predominantly medium sand, well sorted
	37	41	Till
	41	--	Refusal
LSW 2	0	10	Sand, fine to medium
	37	39	Sand, very fine to fine; predominantly fine; well sorted
	47	49	Sand, medium; well sorted; brown
	57	59	Sand, fine to medium; predominantly fine; well sorted
	67	69	Sand, medium to coarse; predominantly coarse; moderately sorted; gray-brown
	77	79	Sand, coarse to very coarse; some fines at tip of spoon
	80	85	Till
	85	--	Refusal
LSW 4	0	10	Sand, medium to very coarse
	67	69	Sand, medium to coarse; predominantly medium; moderately sorted
	77	79	Till
	81	--	Refusal
LSW 5	0	29	Sand, fine to medium, predominantly medium sand
	29	40	Sand, very fine to fine, predominantly fine sand
	40	--	Refusal
LSW 6	0	6	Fill
	6	9	Peat
	9	13	Sand, fine to coarse, brown, and fine to medium gravel
	13	28	Sand, medium to coarse, gravel, fine to medium; brown
	28	29	Sand, medium to coarse, gravel; brown; some silt
	29	--	Refusal on till
LSW 7	0	11	Sand, fine to coarse and fine to medium gravel; brown
	11	16	Sand, fine to coarse, predominantly fine; some silt
	16	20	Sand, fine to coarse, gravel and silt; brown-gray
	20	24	Sand, fine to medium, predominantly fine; some gravel
	24	--	Refusal on till
LSW 8	0	5	Sand, medium, to cobbles, very coarse; predominantly coarse; very tightly packed
	17	19	Sand, medium to coarse; some coarse pebbles; broken rock fragments
	27	29	Sand, very fine to pebbles, coarse, and rock fragments; predominantly very coarse sand; poorly sorted; dirty
	37	39	Sand, very fine to granular pebbles, and small rocks; very dirty
	42	--	Refusal
LSW 9	0	19	Sand, very fine to medium; predominantly fine
	27	29	Sand, very fine to coarse; predominantly coarse; moderately well sorted
	37	39	Sand, coarse to granular; predominantly very coarse sand; moderately sorted
	47	49	Sand, coarse to gravel, coarse; some pebbles; poorly sorted; clean
	67	69	Sand, very fine to medium; predominantly fine
	77	79	Silt, gray to sand, very fine; well sorted
	79	85	Till
	85	--	Refusal

Appendix B. Lithologic logs of selected wells, auger holes, and borings in south-central New Hampshire —*Continued*

Local well No.	Depth to top (ft)	Depth to bottom (ft)	Description of material
			MERRIMACK COUNTY—*Continued*
			Loudon—*Continued*
LSW 10	0	10	Sand, red brown, fine to coarse; predominantly medium sand; many cobbles and pebbles; some gravel; very poorly sorted
	10	14	Sand, yellow brown, fine to medium; predominantly medium sand; some very coarse sand and fine gravel; moderately sorted
	14	24	Sand, yellow brown, fine to medium; predominantly fine sand; well sorted
	24	32	Sand, yellow brown, fine to very coarse; predominantly medium sand; some gravel and pebbles
	32	34	Silt, brown to sand, fine; predominantly very fine sand; well sorted; some iron staining
	37	39	Sand, very fine to coarse; predominantly fine sand; poorly sorted
	47	49	Silt, brown to sand, fine; predominantly very fine sand; well sorted
	57	59	Sand, brown, very fine to medium; predominantly fine sand; some coarse and very coarse sand; moderately sorted
	72	78	Till
	78	--	Refusal
LSW 11	0	7	Silt, dark brown to cobbles and boulders; predominantly coarse sand; very poorly sorted
	7	9	Sand, dark brown, very fine to cobbles; predominantly medium sand; very poorly sorted
	17	19	Sand, gray, fine to gravel, coarse and cobbles; predominantly medium sand; very poorly sorted
	27	29	Sand, fine to cobbles; predominantly coarse sand; very poorly sorted
	37	39	Sand, fine to cobbles; predominantly medium sand; moderately sorted
	47	56	Till, sandy, olive brown
	56	--	Refusal
LSW 12	0	14	Sand, orange brown, fine to pebbles; predominantly medium sand; very poorly sorted
	14	17	Sand, orange brown, fine to coarse; predominantly medium sand; some very coarse sand and fine gravel; poorly sorted
	17	19	Sand, light brown, medium to very coarse; predominantly coarse sand; some fine gravel; well sorted
	27	28	Sand, orange brown, fine to coarse; predominantly coarse sand; some fine and coarse gravel; moderately sorted
	28	29	Silt, tan, to sand, fine; predominantly very fine sand; well sorted
	47	48	Sand, brown, fine to very coarse; predominantly coarse sand; some coarse gravel and pebbles; poorly sorted
	48	49	Sand, brown, fine to medium; predominantly fine sand; well sorted
	58	62	Till
	62	--	Refusal
LSW 13	0	3	Topsoil; many pebbles and cobbles
	3	12	Sand, dark brown, fine, to gravel, coarse; predominantly coarse sand; some pebbles and cobbles; very poorly sorted
	12	14	Sand, gray-brown, very fine to medium; predominantly medium sand; trace coarse sand; moderately well sorted
	17	19	Sand, gray-brown, fine to very coarse; predominantly coarse sand; trace fine and coarse gravel; moderately sorted
	27	29	Sand, brown, fine, to gravel, fine; predominantly very coarse sand; trace coarse gravel and pebbles; very poorly sorted
	37	39	Sand, brown, very fine, to gravel, fine; predominantly coarse sand; some pebbles; very poorly sorted
	48.5	48.8	Sand, brown, fine, to pebbles; predominantly coarse sand; very poorly sorted
	48.8	49	Sand, brown, fine, to pebbles; predominantly pebbles; very poorly sorted
	49	54	Till
	54	--	Refusal

Appendix B. Lithologic logs of selected wells, auger holes, and borings in south-central New Hampshire —*Continued*

Local well No.	Depth to top (ft)	Depth to bottom (ft)	Description of material
			MERRIMACK COUNTY—*Continued*
			Loudon—*Continued*
LSW 13—*Continued*			
LSW 14	0	7	Sand, red brown, fine to very coarse; predominantly medium sand; some gravel and pebbles; poorly sorted
	7	9	Sand, brown, fine to gravel, fine; predominantly very coarse sand; some coarse gravel and pebbles
	17	19	Sand, brown, medium to very coarse; predominantly coarse sand; some gravel; trace fine sand and pebbles; moderately sorted
	27	29	Sand, gray-brown, fine to very coarse; predominantly coarse sand; trace gravel and pebbles; moderately sorted
	37	39	Sand, red-orange, fine to coarse; predominantly medium sand; trace gravel and pebbles; moderately sorted
	47	48.5	Sand, brown, fine to coarse; predominantly coarse sand; some gravel; moderately well sorted
	48	58.5	Till
	58.5	--	Refusal
LSW 15	0	13	Sand, orange-brown, fine to coarse; predominantly medium sand; some very coarse sand and gravel; trace pebbles; mod. well sorted
	13	17	Sand, orange-brown, fine to coarse; predominantly coarse sand; trace very coarse sand; moderately well sorted
	18	18.5	Sand, orange-brown, very fine to medium; predominantly medium sand; trace coarse sand and gravel; moderately well sorted
	18.5	19	Silt, gray, to sand, very fine; very well sorted
	27	28.5	Sand, dark brown, fine to coarse; predominantly coarse sand; trace very coarse sand; moderately sorted
	28.5	29	Till
	29	--	Refusal
LSW 16	0	17	Sand, medium, to gravel; predominantly coarse sand; moderately well sorted
	17	19	Sand, medium, to pebbles; predominantly coarse sand; moderately well sorted
	22	24	Till
	24	--	Refusal
LSW 17	0	17	Sand, fine, to gravel; predominantly medium sand; poorly sorted; dirty
	17	19	Sand, gray, medium to coarse; predominantly medium sand; very well sorted
	26	35	Till (or broken rock)
	35	--	Refusal
LSW 18	0	7	Sand, brown, fine to coarse; predominantly medium sand; some fine and coarse gravel; very poorly sorted
	7	9	Sand, brown, fine to very coarse; predominantly coarse sand; some gravel and pebbles; poorly sorted
	17	19	Sand, red brown
	27	29	Sand, red brown, very fine, to gravel, coarse; predominantly medium sand; some pebbles and cobbles; very poorly sorted
	37	39	Sand, red brown, fine to pebbles; predominantly medium sand; very poorly sorted
	41	--	Refusal
LSW 42	0	4	Gravel
	4	7	Bolder
	7	9	Hardpan
	9	--	Bedrock
LSW 44	0	6	Sand
	6	8	Boulder
	8	11	Gravel
	11	--	Bedrock

Appendix B. Lithologic logs of selected wells, auger holes, and borings in south-central New Hampshire —*Continued*

Local well No.	Depth to top (ft)	Depth to bottom (ft)	Description of material
			MERRIMACK COUNTY—*Continued*
			Loudon—*Continued*
LSW 67	0	40	Sand
	40	55	Gravel
	55	--	Bedrock
LSW 87	0	6	Gravel
	6	68	Sand
	68	78	Hardpan
	78	--	Bedrock
LSW 208	0	20	Gravel
	20	40	Clay
	40	--	Bedrock
LSW 209	0	18	Gravel
	18	60	Clay
	60	--	Bedrock
LSW 222	0	10	Gravel
	10	17	Till
	17	--	Bedrock
			Northfield
NRW 1	0	2	Black organic mat; aeolian mantle
	2	27	Sand, light brown, fine to coarse; predominantly medium sand; well sorted
	27	32	Sand, light brown, fine to medium; predominantly fine sand; well sorted
	32	34	Sand, light brown, very fine; well sorted
	37	39	Sand, light brown, very fine to fine; predominantly fine sand; well sorted
	47	49	Sand, brown, very fine; well sorted
	57	59	Sand, brown, very fine to fine; predominantly very fine sand; well sorted
	67	69	Silt, rust brown, to sand, very fine; predominantly very fine sand; well sorted
	78	90	Till, sandy
	90	--	Refusal
NRW 2	0	2	Topsoil, dark brown, organic rich
	2	19	Sand, medium, light brown, well sorted
	19	29	Sand, very fine sand to pebbles and cobbles, predominantly fine sand, very poorly sorted
	29	47	Sand, very fine to fine, predominantly very fine sand, well sorted
	47	57	Sand, fine, light brown, well sorted
	57	62	Sand, coarse to coarse gravel, rounded pebbles and cobbles, predominantly coarse sand, moderately sorted
	62	66	Till, sandy
	66	--	Refusal
NRW 3	0	19	Sand, medium to coarse sand, predominantly medium sand, moderately sorted
	19	33	Sand and gravel, coarse to very coarse sand, some coarse gravel and pebbles, moderately sorted
	33	39	Sand, fine to medium, predominantly fine sand, well sorted
	39	55	Sand, very fine brown sand, well sorted
	55	59	Till, sandy
	59	--	Refusal
NRW 4	0	18	Silt and fine sand, brown
	18	25	Sand, fine to medium; some coarse sand, brown

Appendix B. Lithologic logs of selected wells, auger holes, and borings in south-central New Hampshire —*Continued*

Local well No.	Depth to top (ft)	Depth to bottom (ft)	Description of material
			MERRIMACK COUNTY—*Continued*
			Northfield—*Continued*
NRW 4—*Continued*			
	25	38	Sand, fine to coarse, brown, and gravel
	38	46	Silt and fine sand, gray
	46	50	Sand, fine to coarse, gray; angular gravel
	50	--	Refusal
NRW 5	0	12	Sand, fine, brown
	12	25	Sand, fine to medium, brown
	25	30	Sand, fine to medium; some coarse sand, brown
	30	36	Sand, fine; some medium sand, brown
	36	50	Sand, fine to medium,; some coarse sand, brown
	50	56	Sand, fine to coarse, gray; some gravel
	56	--	End of hole
			Pembroke
PBA 1	0	5	Clay
	5	10	Clay
	10	13.7	Clay, sand, and gravel
	13.7	--	Refusal on boulders
PBA 2	0	12	Sand, very fine, brown
	12	17	Sand, very fine to medium, predominantly very fine, gray
	17	27	Sand, fine to medium, trace coarse, predominantly fine
	27	37	Sand, fine to very coarse, predominantly medium, trace pebbles, gray-brown
	37	47	Sand, fine to very coarse, predominantly coarse, gray-brown
	47	67	Sand, fine to very coarse, and coarse gravel, predominantly coarse sand, well sorted, gray
	67	77	Sand, medium to coarse, predominantly medium, well sorted, gray
	77	97	Sand, very fine to fine, predominantly very fine, well sorted, gray
	97	108	Sand, very fine, well sorted
	108	110	Till
	110	--	Bedrock
PBA 3	0	2	Topsoil
	2	10	Sand and gravel, brown
	10	20	Clay, blue
	20	30	Clay, blue
	30	40	Silt and blue clay
	40	45	Clay, silty, blue
	45	50	Silt and clay
	50	--	Refusal
PBA 4	0	5	Sand, fine
	5	10	Clay, fine sandy
	10	15	Clay and fine silty sand, brown
	15	20	Clay, fine sandy, brown
	20	25	Clay, fine sandy, brown
	25	30	Sand, medium; trace clay
	30	35	Sand, medium, brown, and clay
	35	40	Sand, medium to coarse, and gray clay
	40	45	Sand, medium to coarse, and gray clay

Appendix B. Lithologic logs of selected wells, auger holes, and borings in south-central New Hampshire —*Continued*

Local well No.	Depth to top (ft)	Depth to bottom (ft)	Description of material
			MERRIMACK COUNTY—*Continued*
			Pembroke—*Continued*
PBA 4—*Continued*			
	45	55	Clay and silt, gray
	55	65	Clay and silt and fine sand, gray
	65	75	Clay and silt, and fine sand, gray
	75	76	Till
	76	--	Refusal
PBA 5	0	9	Sand and gravel
	9	39	Sand, medium and fine gravel
	39	62	Silt and clay
	62	--	Refusal
PBA 6	0	10	Sand, fine, brown
	10	20	Sand, fine, brown, and small gravel
	20	25	Sand, fine , brown, and brown clay
	25	30	Sand, fine, brown, and brown clay
	30	34	Sand, fine, silty
	34	--	Refusal
PBA 7	0	20	Sand, fine, and clay, brown
	20	35	Sand and silt, gray
	35	44	Sand, fine, gray
	44	46	Till
	46	--	Refusal
PBA 8	0	22	Sand, fine to medium, and gravel, some cobbles, brown
	22	--	End of hole
PBA 9	0	14	Boulders
	14	--	Refusal on boulders
PBA 10	0	23	Sand, fine to medium, and gravel and cobbles, brown
	23	31	Sand, fine, silty, gray
	31	39	Sand, fine, silty, gray; trace of clay
	39	--	End of hole
PBA 11	0	17	Sand and broken sharp gravel
	17	37	Slit, gray, and blue clay
	37	--	End of hole
PBA 12	0	18	Sand, very fine to fine, light brown with iron staining, well sorted
	18	--	Bedrock
PBB 1	0	3	Topsoil
	3	17	Sand, fine to coarse, and gravel, some cobbles, trace silt, very dense
	17	21.1	Till
	21.1	--	Bedrock
PBB 2	0	2	Sand, fine to coarse, some gravel, dark brown
	2	6	Sand, medium to coarse, some gravel, trace silt, light brown
	6	17.1	Sand, fine to medium, some silt and gravel, little cobbles, brown
	17.1	--	Bedrock

Appendix B. Lithologic logs of selected wells, auger holes, and borings in south-central New Hampshire —*Continued*

Local well No.	Depth to top (ft)	Depth to bottom (ft)	Description of material
			MERRIMACK COUNTY—*Continued*
			Pembroke—*Continued*
PBB 3	0	6	Sand, fine
	6	9	Gravel
	9	46	Sand, coarse
	46	48	Till, sandy
	48	--	Refusal
PBB 4	0	1	Loam
	1	4	Sand, fine and silt
	4	6	Silt
	6	28	Sand, medium to coarse and gravel
	28	--	Refusal
PBW 31	0	3	Topsoil
	3	6	Gravel, red
	6	11	Sand, white
	11	12	Gravel, white
	12	--	Refusal
PBW 32	0	20	Sand, coarse
	20	50	Sand, coarse
	50	87	Sand, fine
	87	100	Sand and gravel, hard packed
	100	--	Refusal
PBW 33	0	30	Sand and gravel
	30	45	Sand, coarse and fine gravel
	45	68	Sand, coarse and fine gravel
	68	78	Sand, coarse; some fine gravel
	78	82	Sand, fine
	82	--	Refusal
PBW 34	0	10	Sand, very fine, and silt, dark brown
	10	13	Sand, fine to medium, predominantly fine, brown
	13	17	Sand, medium to very coarse, predominantly coarse, moderately sorted, brown
	17	19	Sand, medium to very coarse, predominantly very coarse, moderately sorted
	19	39	Sand, medium to very coarse, predominantly coarse, moderately sorted, gray
	39	69	Sand, fine to medium, predominantly medium, well sorted, gray
	69	79	Sand, medium to very coarse, predominantly coarse, moderately sorted, gray
	79	109	Sand, medium to coarse, predominantly medium, well sorted, pieces of fractured rock and pebbles
	109	131	Sand, very fine to fine, predominantly very fine, well sorted, gray
	131	--	Bedrock
PBW 38	0	8	Clay, sandy, yellow
	8	16	Gravel, light
	16	20	Gravel
	20	41	Gravel, coarse, dark
	41	63	Sand, brown
	63	77	Clay, fine, silty, red
	77	--	Refusal

Appendix B. Lithologic logs of selected wells, auger holes, and borings in south-central New Hampshire —*Continued*

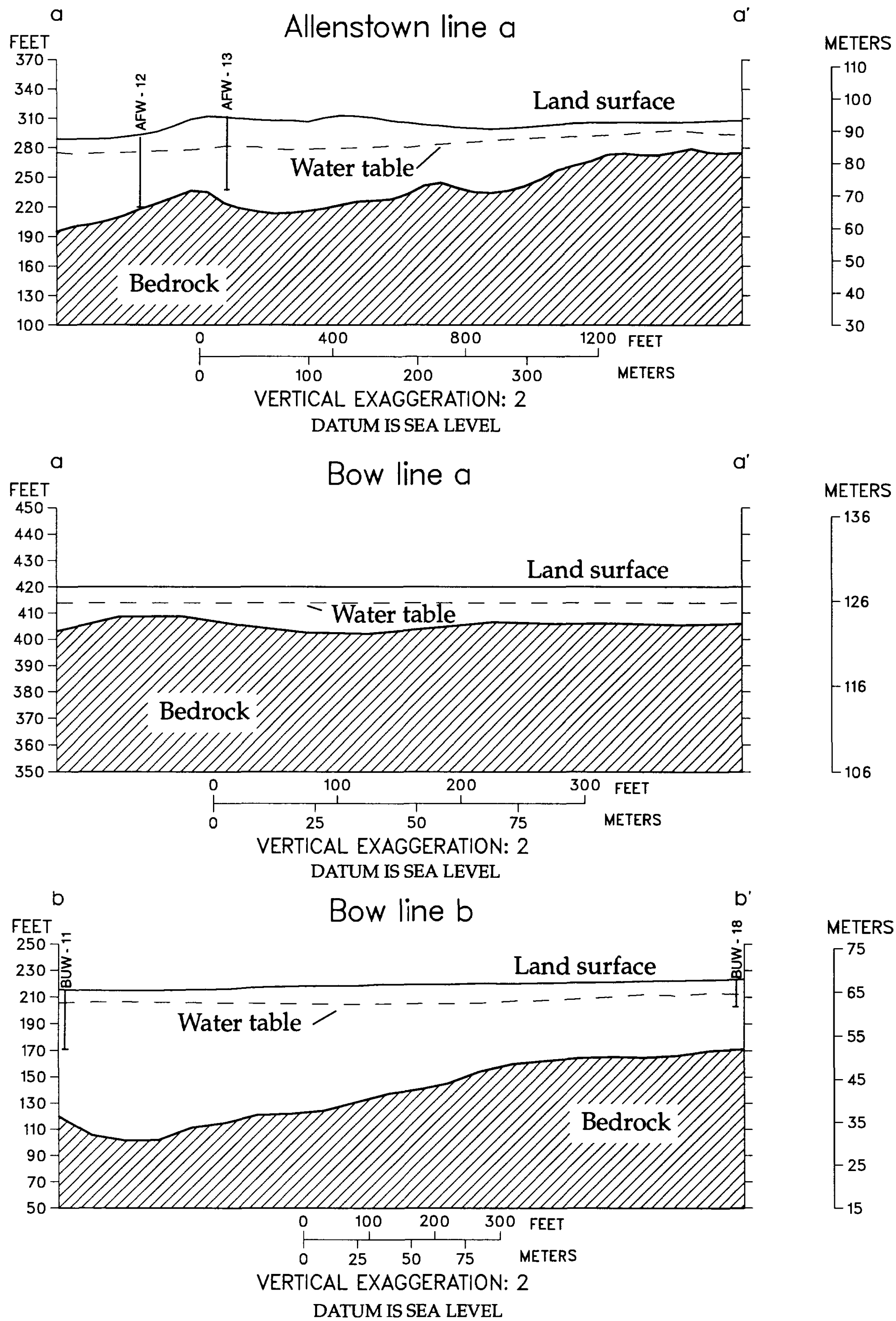
Local well No.	Depth to top (ft)	Depth to bottom (ft)	Description of material
			MERRIMACK COUNTY—*Continued*
			Pembroke—*Continued*
PBW 39	0	12	Sand, fine to coarse; some cobbles, predominantly fine sand; red-brown
	12	16	Silt to medium sand, predominantly very fine sand; well sorted; red-brown
	17	19	Silt to medium sand, predominantly fine sand; moderately sorted; red-brown
	22	24	Sand, fine, well sorted; red-brown
	27	29	Sand, fine to medium, predominantly medium; well sorted; light brown
	37	39	Sand, fine to very coarse; some fine gravel; little pebbles; predominantly medium to coarse sand; moderately sorted; brown
	47	49	Sand, medium to very coarse; some fine gravel; predominantly coarse sand; moderately sorted; light brown
	57	59	Sand, coarse and coarse gravel with pebbles; moderately sorted
	59	62	Bedrock, weathered quartzite
	62	--	Bedrock, quartzite
PBW 40	0	9	Sand, fine to coarse gravel; predominantly coarse sand; poorly sorted; dark brown
	9	17	Sand, fine to coarse; with clay stringers; little coarse gravel; poorly sorted; dark brown
	17	19	Sand, fine to coarse gravel; predominantly very coarse sand; moderately sorted; light brown
	27	29	Till, sandy; olive brown
	29	--	Refusal
PBW 41	0	20	Sand and gravel, brown
	20	30	Sand, fine, gray
	30	50	Sand, medium, gray
	50	63.5	Sand and gravel, gray
	63.5	--	Refusal
PBW 42	0	7	Sand and gravel, brown
	7	19	Clay, firm, blue
	19	44	Silt and clay, gray
	44	68	Sand and gravel, gray
	68	72	Sand, trace gravel, brown
	72	--	Refusal
PBW 43	0	10	Sand, fine, brown
	10	20	Sand, fine, brown
	20	25	Sand, medium coarse; trace brown clay
	25	30	Sand, medium coarse; trace brown clay
	30	35	Sand, medium coarse, brown, small gravel; trace brown clay
	35	40	Sand, medium coarse, clay, small gravel
	40	45	Sand, medium coarse, clay, small gravel
	45	50	Sand, medium coarse, brown, and small gravel
	50	55	Sand, fine to medium, brown
	55	60	Sand, fine to medium, brown, and small gravel
	60	62	Sand, silty, brown
	62	--	Refusal
PBW 44	0	10	Sand, medium coarse, and small gravel
	10	15	Sand, fine, brown, and gray clay
	15	20	Clay, gray
	20	25	Clay, gray
	25	30	Sand, fine, and clay

Local well No.	Depth to top (ft)	Depth to bottom (ft)	Description of material
			MERRIMACK COUNTY—*Continued*
			Pembroke—*Continued*
PBW 44—*Continued*			
	30	35	Sand, fine, and gray clay
	35	40	Sand, medium, brown; trace brown clay
	40	45	Sand, medium coarse, brown; trace brown clay
	45	50	Sand, medium coarse, brown, and brown clay
	50	60	Sand, fine to medium; some silt and small gravel
	60	70	Sand, medium, and small sharp gravel
	70	80	Sand, fine to medium, and small sharp gravel
	80	90	Sand, medium, brown
	90	95	Sand, fine, silty, brown
	95	--	End of hole
PBW 45	0	12	Sand, gray, and gravel
	12	23	Silt, gray and clay
	23	34	Sand, brown, and gravel
	34	36	Till
	36	--	Refusal
PBW 46	0	10	Sand, medium coarse, brown, and boulders
	10	15	Sand, medium coarse
	15	20	Sand, medium coarse
	20	25	Sand, medium coarse; some silt
	25	30	Sand, fine to coarse and silt
	30	35	Sand, medium coarse, brown
	35	37	Sand, medium, brown and fine, firm sand
	37	42	Sand, fine, brown, and silt
	42	--	End of hole
PBW 47	0	10	Sand, fine to medium, brown
	10	15	Sand, medium, brown, and boulders
	15	20	Sand, medium coarse, brown, and small gravel
	20	25	Sand, medium coarse, red-brown
	25	30	Sand, medium coarse, red-brown
	30	35	Sand, medium, red-brown
	35	40	Sand, fine to medium, light brown
	40	42	Sand, fine, silty
	42	--	Refusal
PBW 48	0	10	Sand, fine, brown
	10	15	Sand, medium to coarse
	15	20	Sand, coarse, and small sharp gravel
	20	25	Sand, coarse, and gravel
	25	32	Sand, medium to coarse, red-brown, and small gravel
	32	--	Refusal
PBW 49	0	5	Silt, clay, and sand
	5	20	Sand, coarse, red
	20	34	Sand, coarse, light brown
	34	37	Sand, medium to coarse, dark brown
	37	--	End of hole

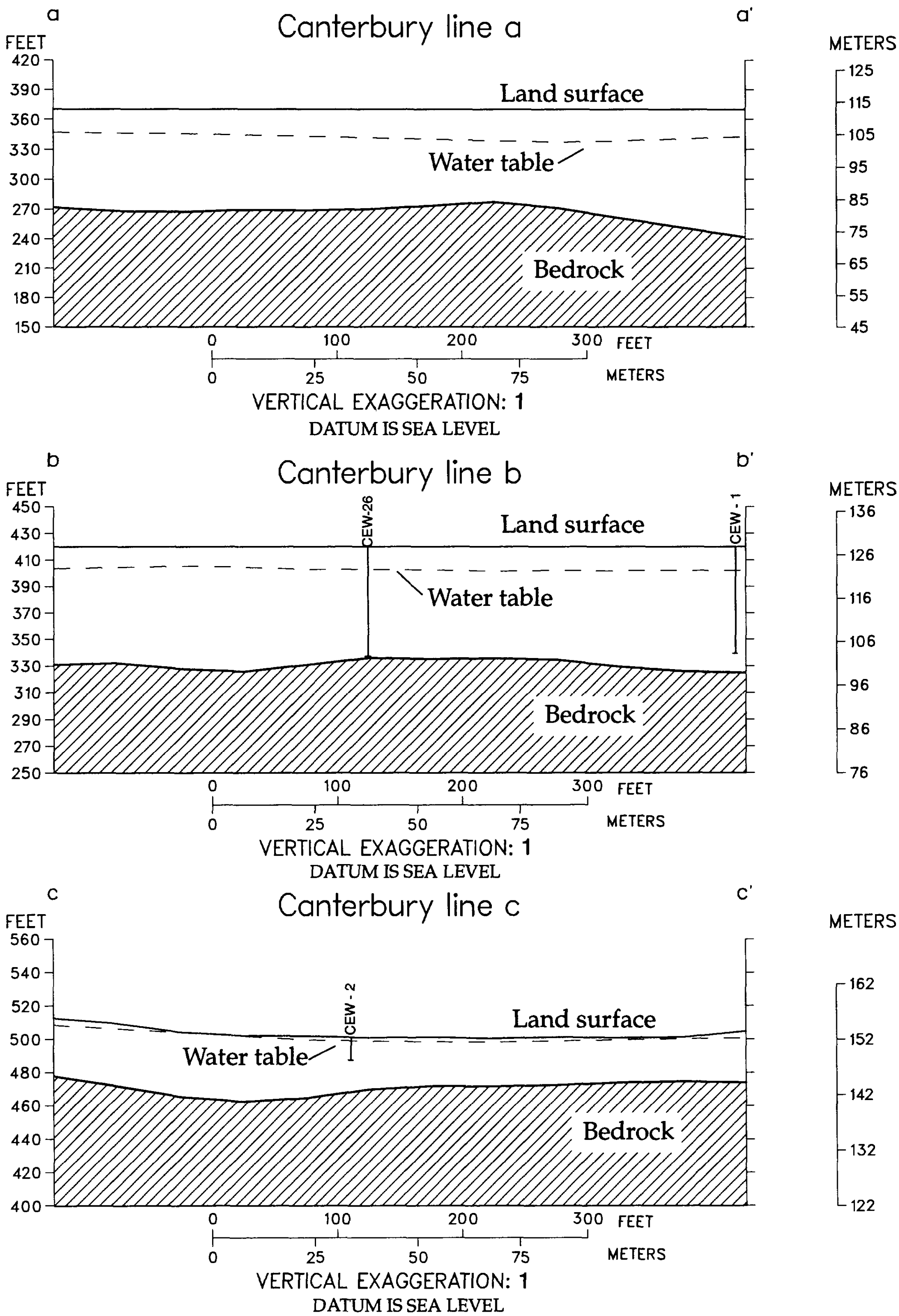
Appendix B. Lithologic logs of selected wells, auger holes, and borings in south-central New Hampshire —*Continued*

Local well No.	Depth to top (ft)	Depth to bottom (ft)	Description of material
			MERRIMACK COUNTY—*Continued*
			Pembroke—*Continued*
PBW 50	0	4	Clay, silt, and sand
	4	10	Gravel, coarse, light brown
	10	15	Sand, coarse, and gravel; light brown
	15	35	Gravel, coarse, and cobbles
	35	39	Sand, coarse, and gravel; red brown
	39	--	Refusal on bedrock
PBW 51	0	4	Topsoil and clay
	4	20	Sand, fine to medium, light brown
	20	30	Gravel, course to medium
	30	40	Sand, medium to coarse
	40	48	Sand, coarse, trace gravel
	48	48.4	Sand, coarse
	48.4	--	End of hole
PBW 52	0	5	Clay, silt, and sand
	5	10	Silt and sand, brown
	10	15	Gravel, coarse, brown
	15	30	Sand, medium to coarse, brown
	30	35	Gravel, coarse, light brown
	35	40	Sand, medium to coarse, light brown
	40	--	End of hole
			Pittsfield
PHA 1	0	2	Topsoil
	2	7	Sand, light brown, very fine to pebbles; predominantly fine sand; very poorly sorted
	7	19	Till, sandy
	19	--	Refusal
			ROCKINGHAM COUNTY
			Deerfield
DDA 2	0	7	Sand, yellow brown, very fine to fine; predominantly fine sand; trace pebbles; well sorted
	7	16	Sand, reddish, fine to coarse; predominantly medium sand; trace pebbles; moderately well sorted
	16	--	Refusal
			Northwood
NWW 8	0	30	Clay, silt, and sand
	30	--	Bedrock, gray granite
NWW 9	0	6	Gravel
	6	--	Bedrock

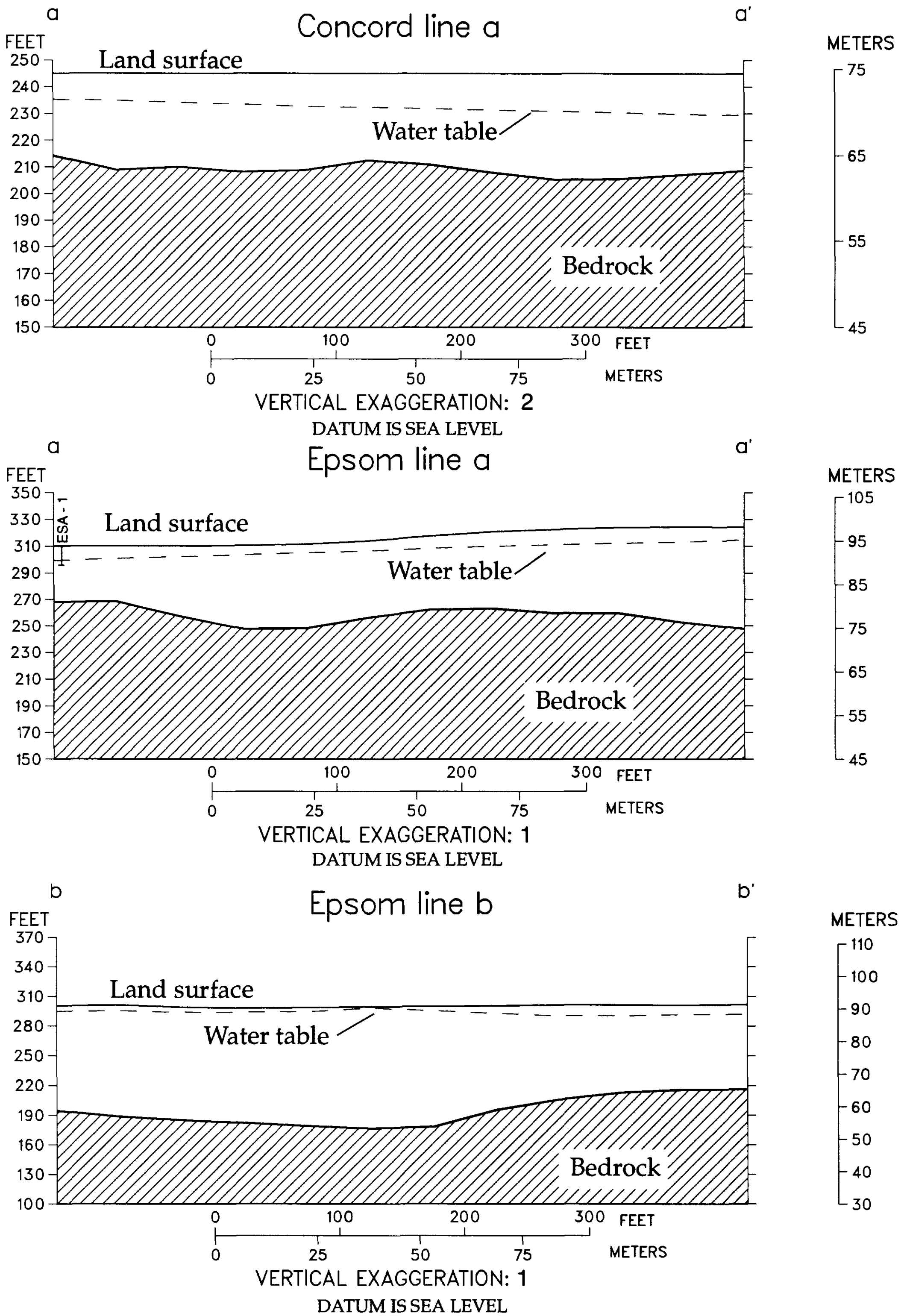
APPENDIX C



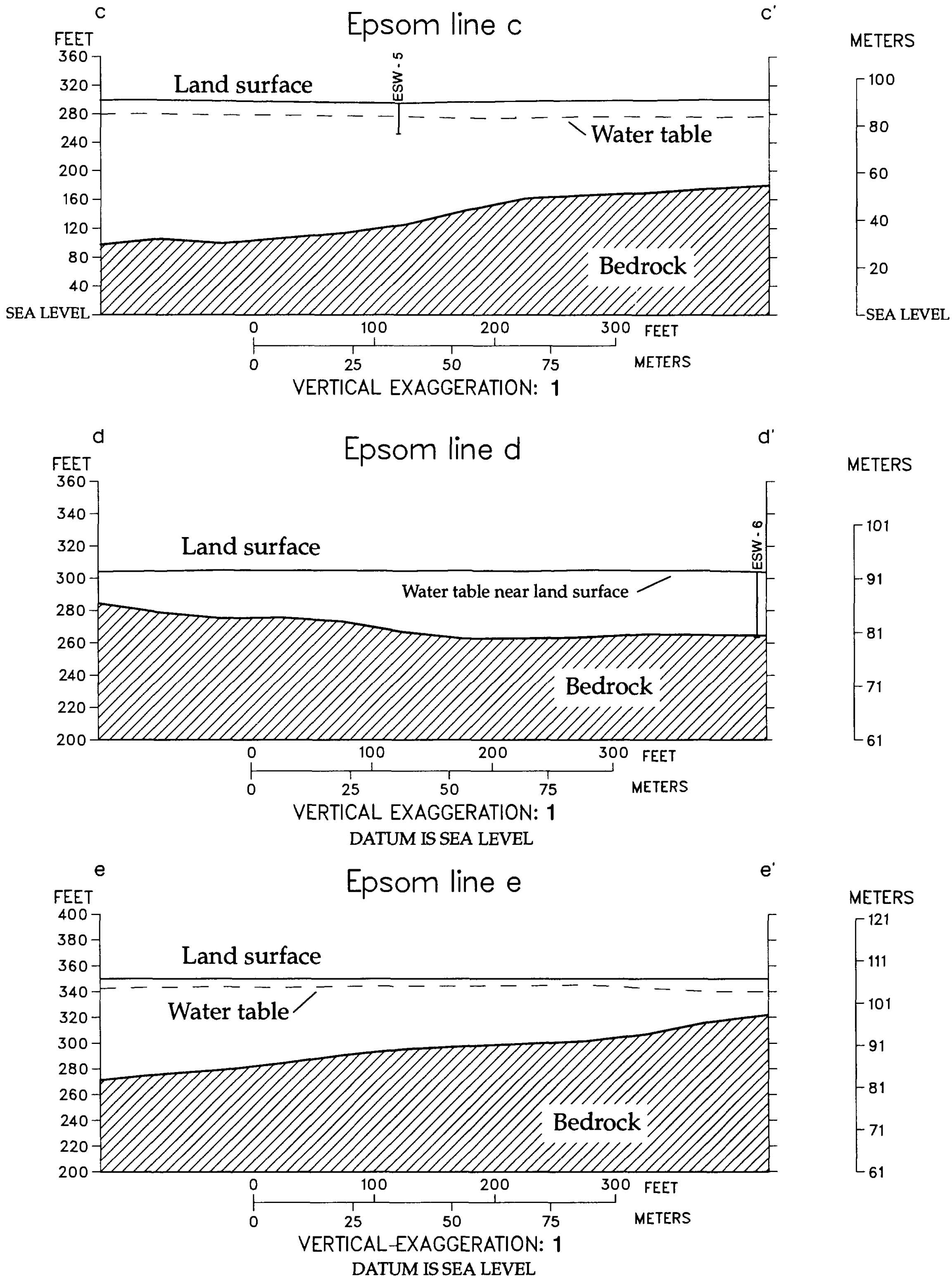
Appendix C1. Geohydrologic sections interpreted from seismic-refraction data for Allenstown line a-a' (location shown on plate 2), and Bow lines a-a' and b-b', south-central New Hampshire (locations shown on plate 1).



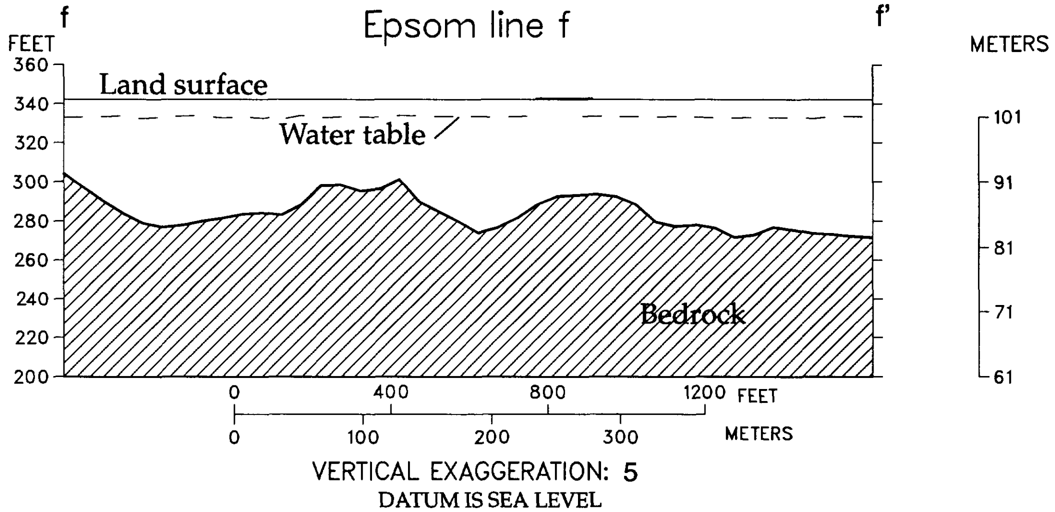
Appendix C2. Geohydrologic sections interpreted from seismic-refraction data for Canterbury lines a-a', b-b', and c-c', south-central New Hampshire (locations shown on plate 4).

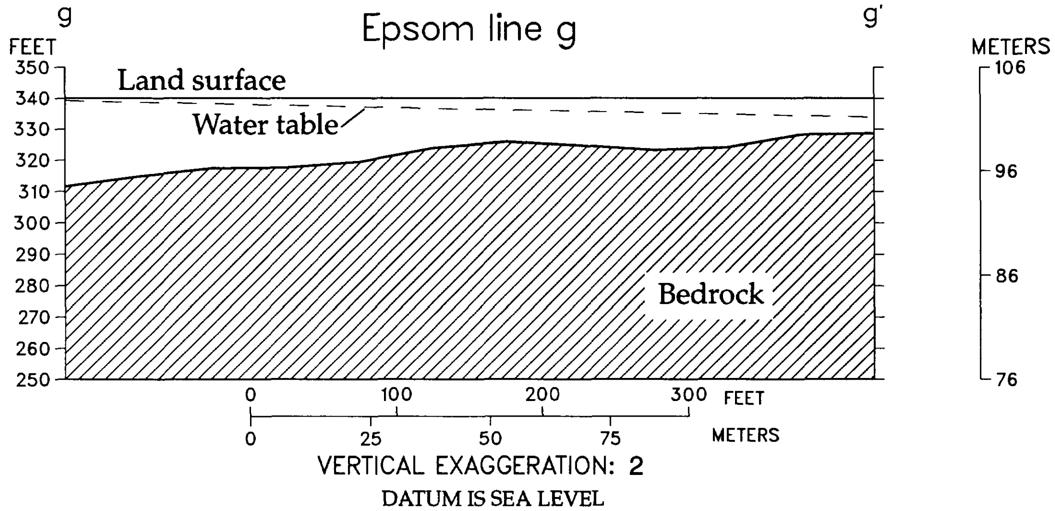


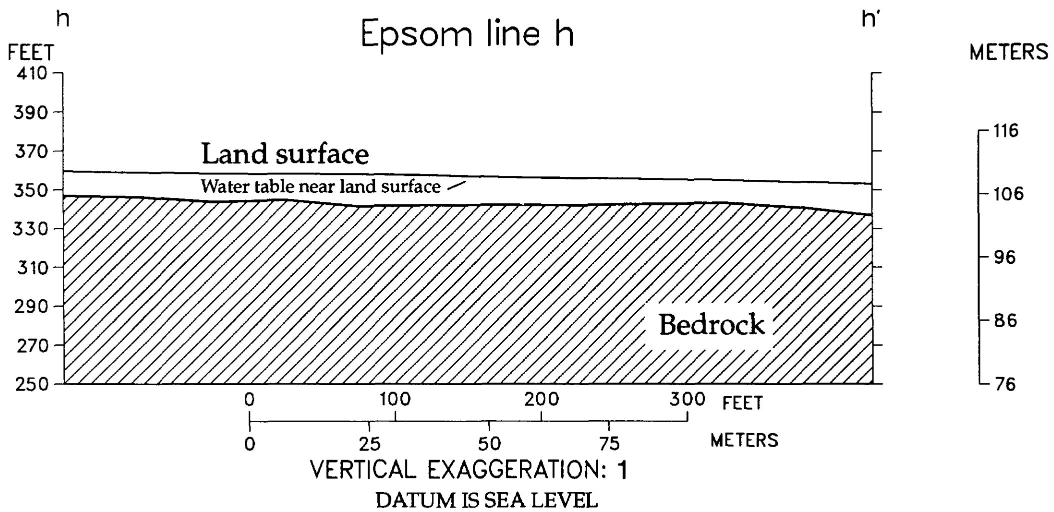
Appendix C3. Geohydrologic sections interpreted from seismic-refraction data for Concord line a-a' (location shown on plate 1), and Epsom lines a-a' and b-b', south-central New Hampshire (locations shown on plate 2).



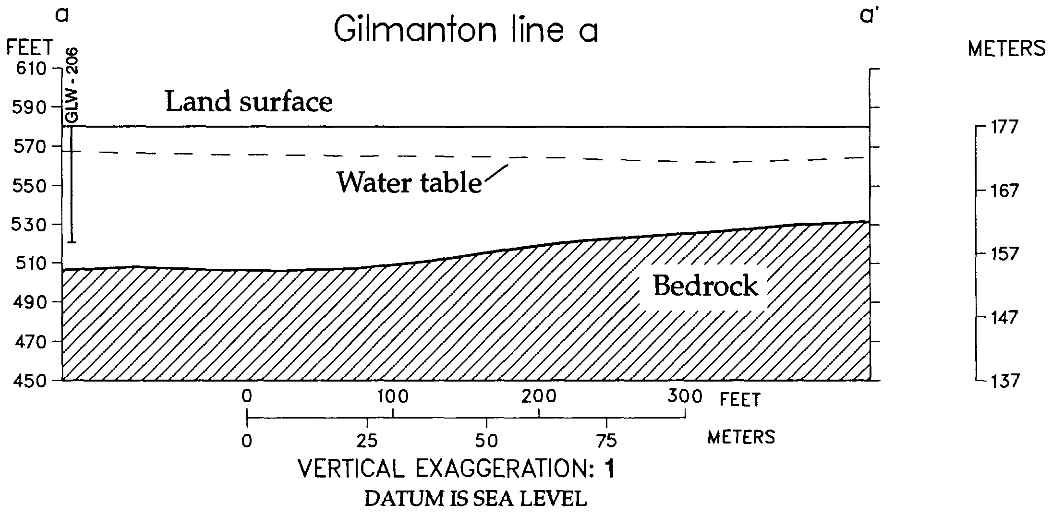
Appendix C4. Geohydrologic sections interpreted from seismic-refraction data for Epsom lines c-c', d-d' and e-e', south-central New Hampshire (locations shown on plate 2).

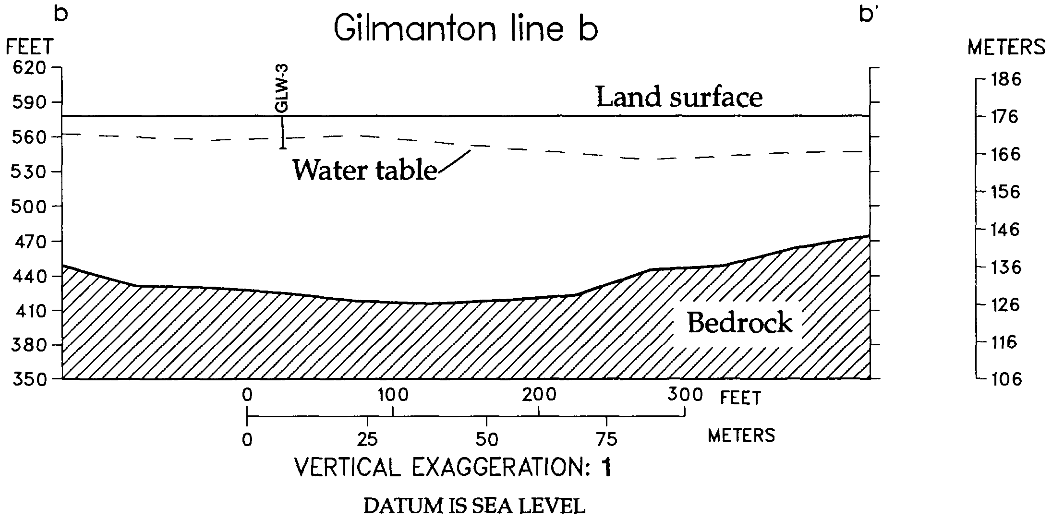


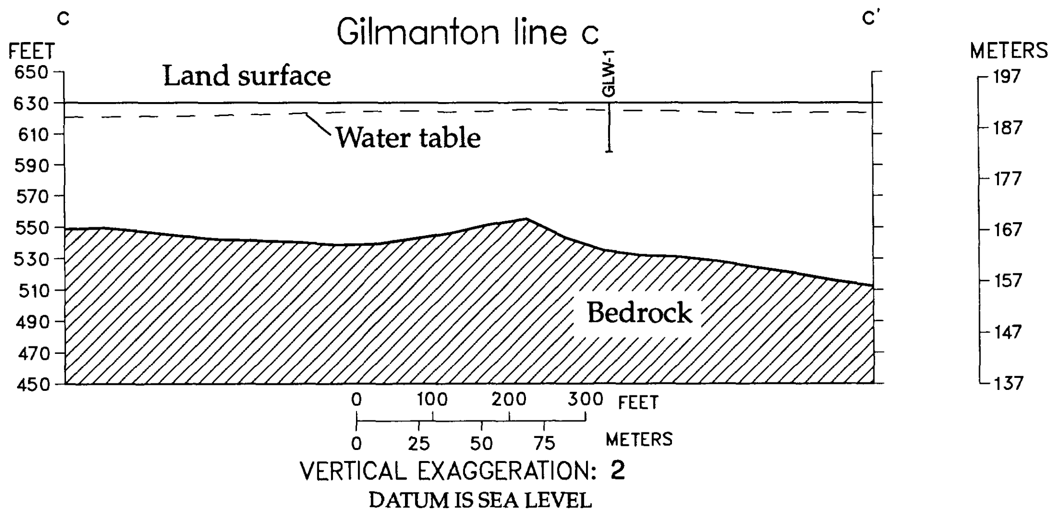




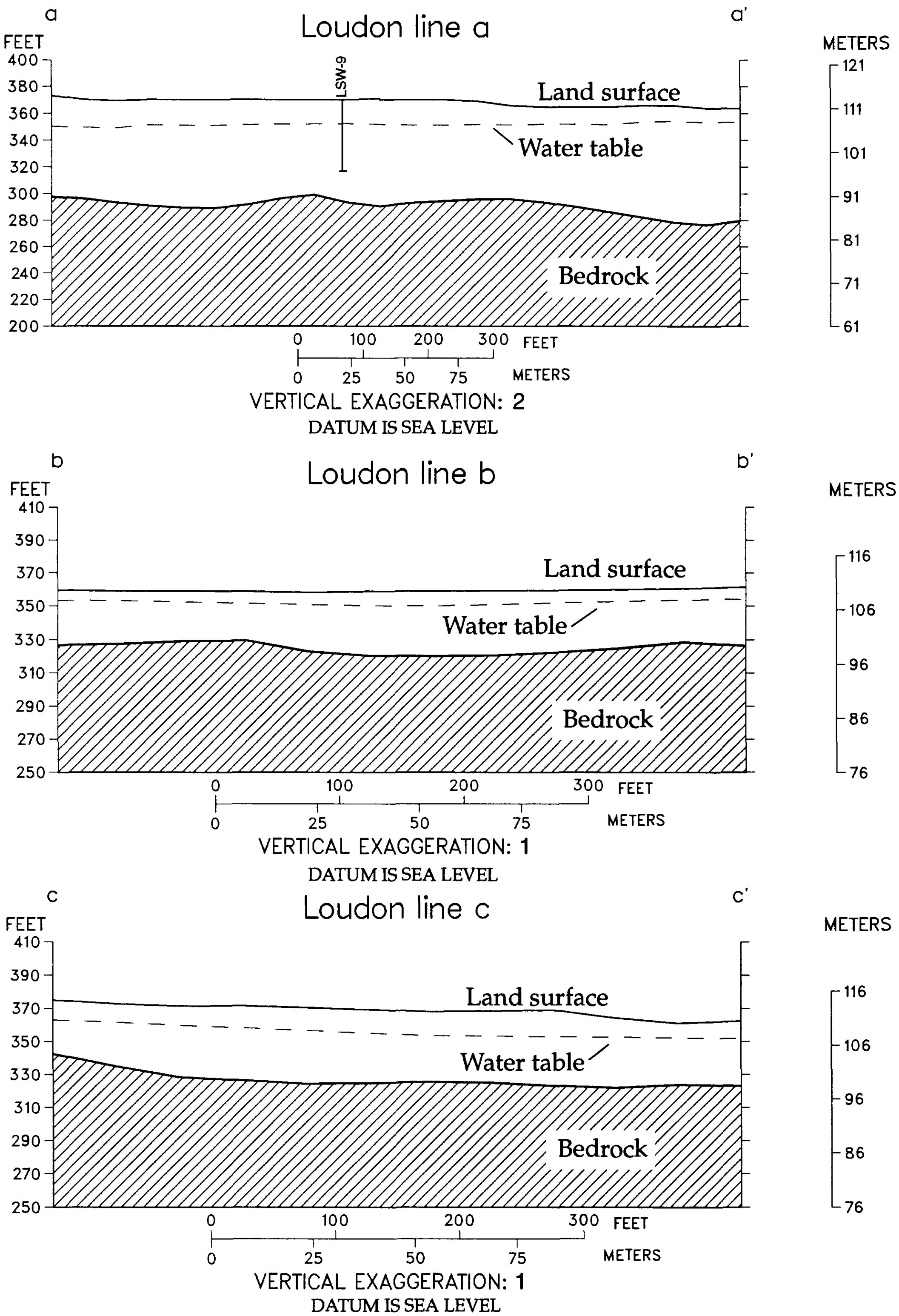
Appendix C5. Geohydrologic sections interpreted from seismic-refraction data for Epsom lines f-f', g-g', and h-h', south-central New Hampshire (locations shown on plate 2).



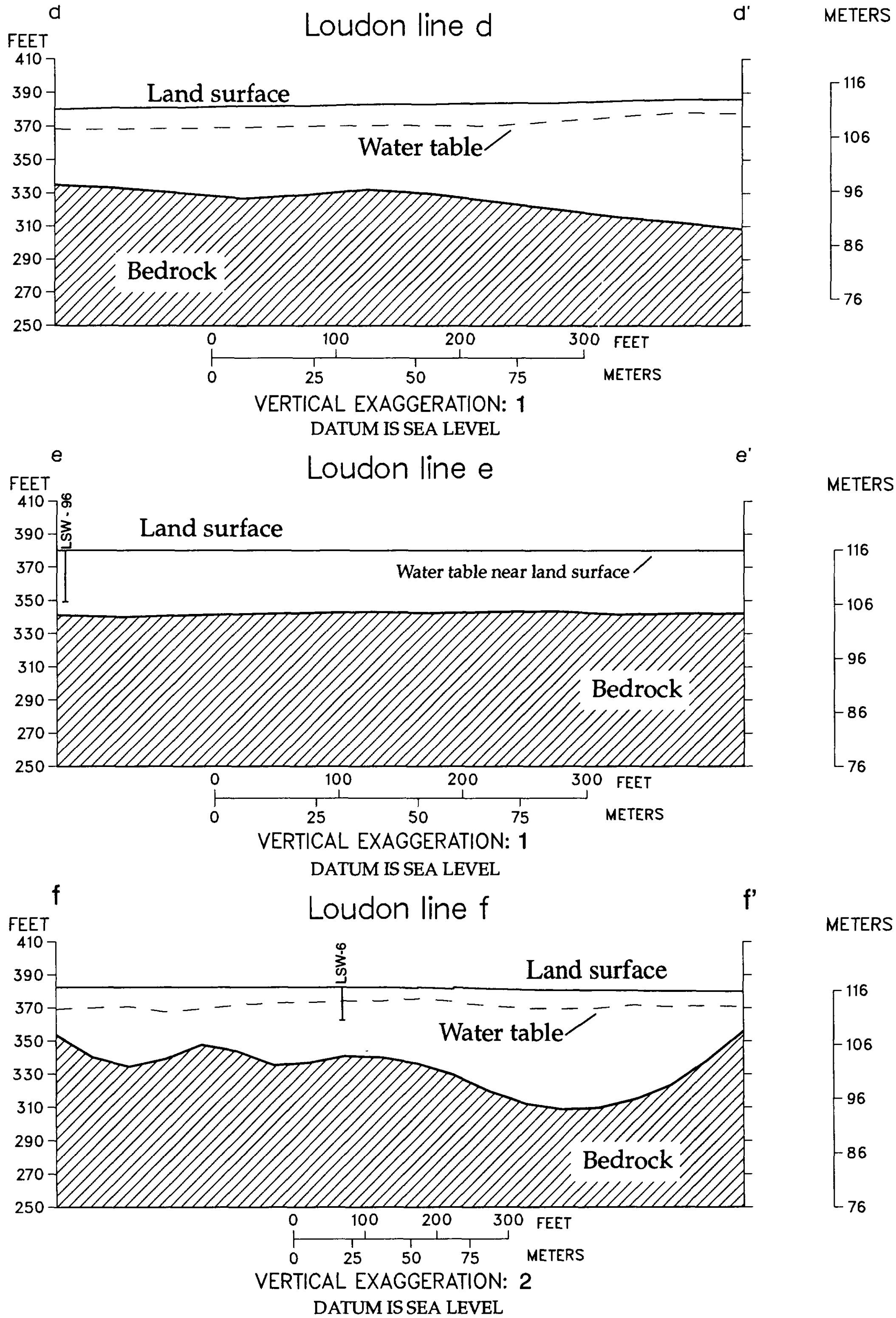




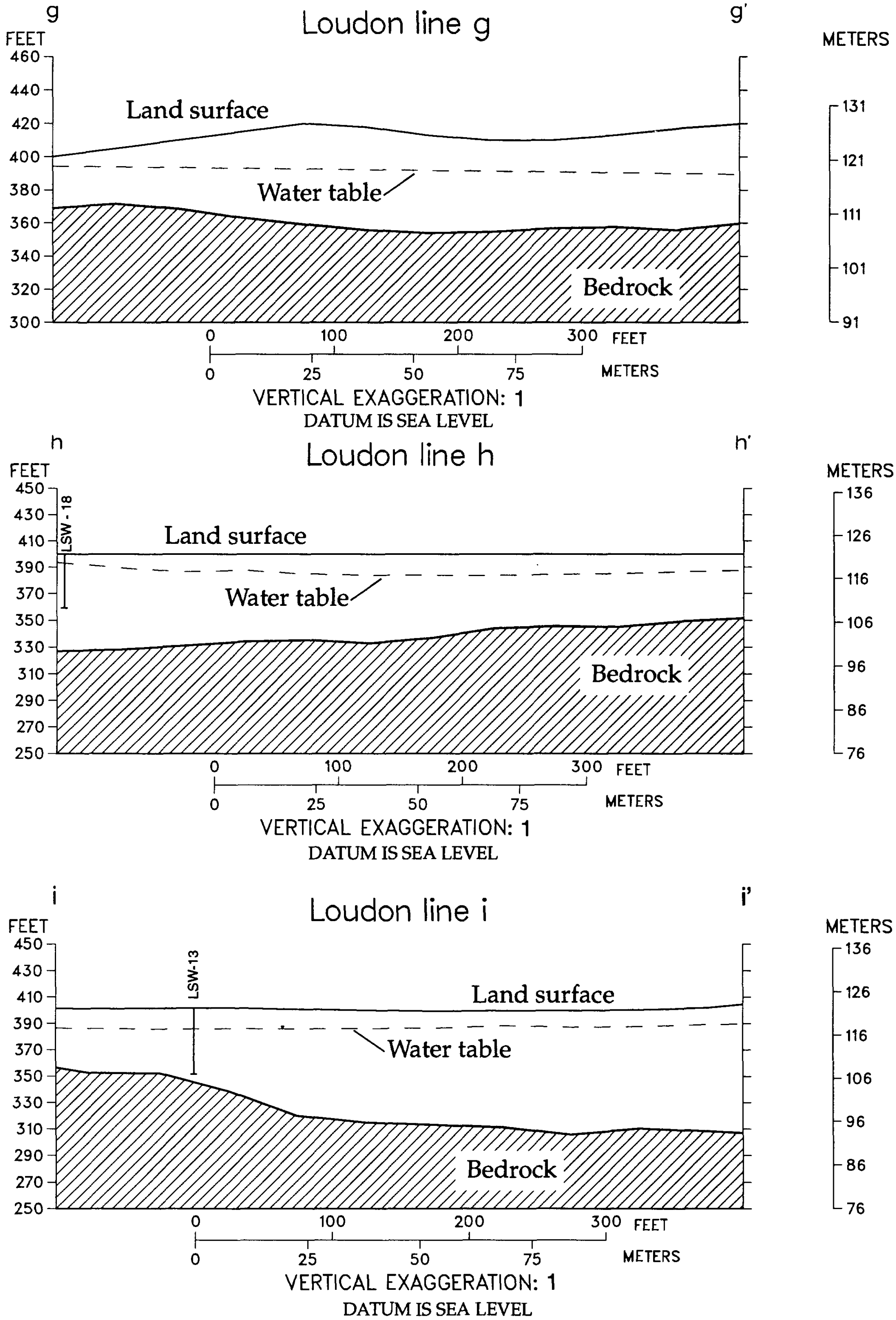
Appendix C6. Geohydrologic sections interpreted from seismic-refraction data for Gilmanton lines a-a', b-b', and c-c', south-central New Hampshire (locations shown on plate 3).



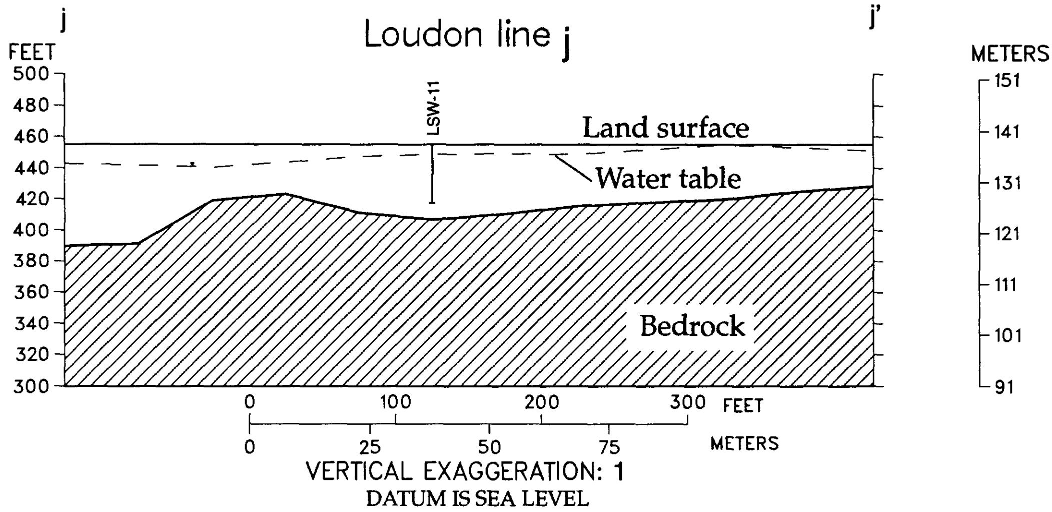
Appendix C7. Geohydrologic sections interpreted from seismic-refraction data for Loudon lines a-a', b-b', and c-c', south-central New Hampshire (locations shown on plate 4).

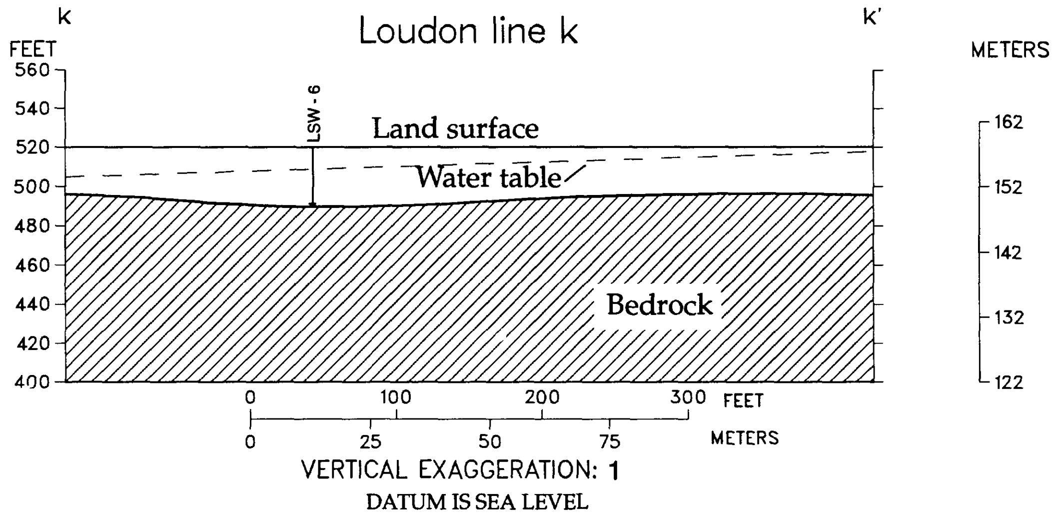


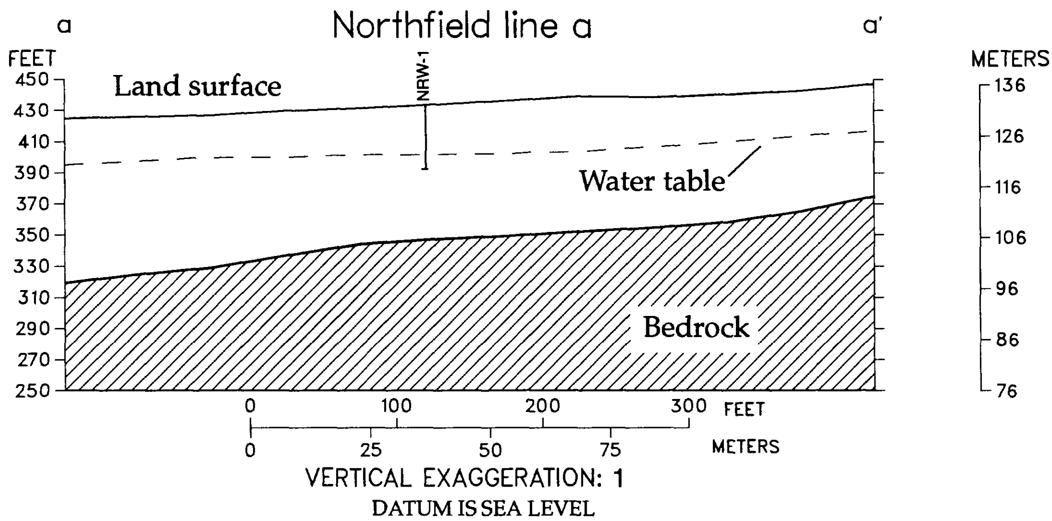
Appendix C8. Geohydrologic sections interpreted from seismic-refraction data for Loudon lines d-d', e-e', and f-f', south-central New Hampshire (locations shown on plate 4).



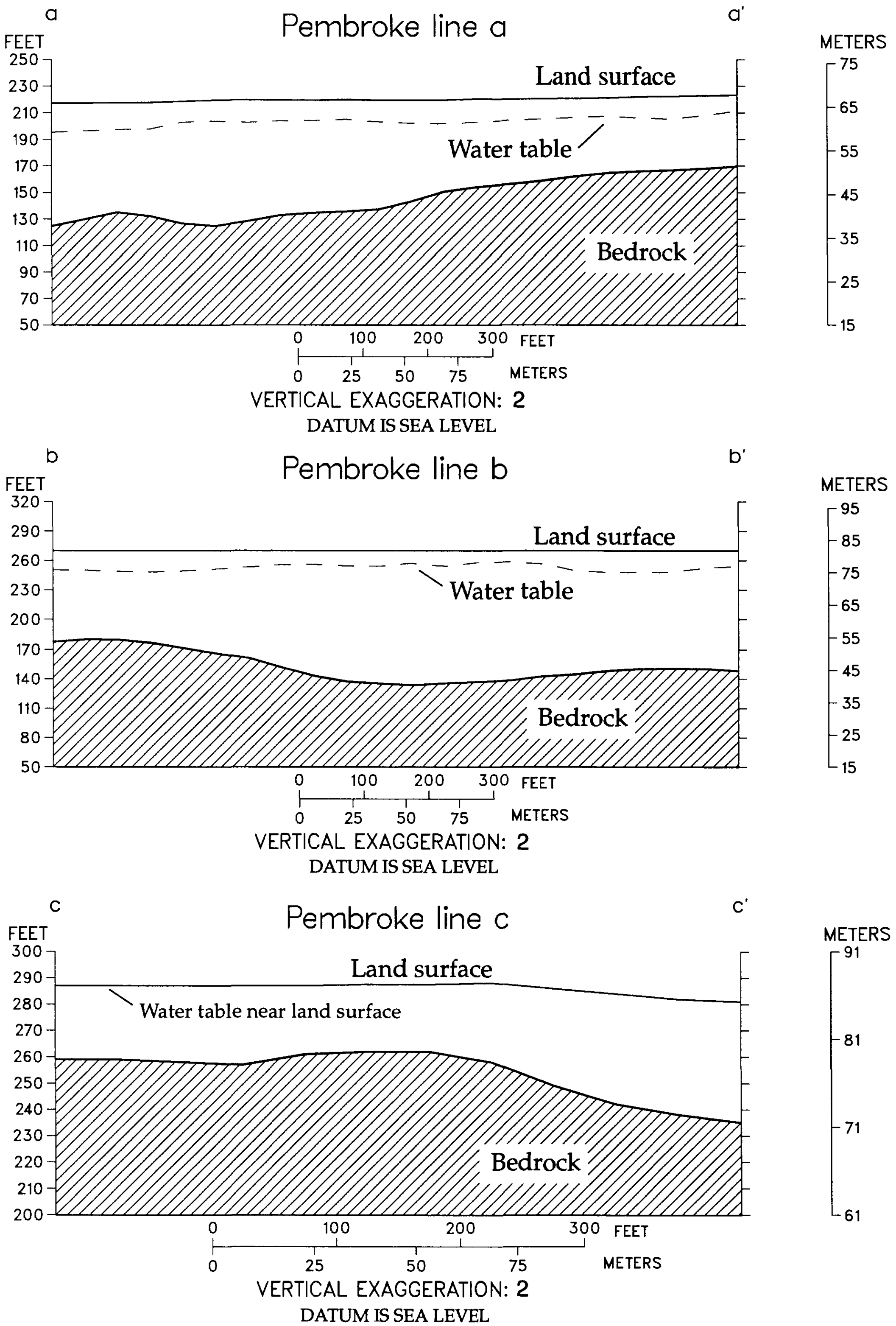
Appendix C9. Geohydrologic sections interpreted from seismic-refraction data for Loudon lines g-g', h-h', and i-i', south-central New Hampshire (locations shown on plate 4).







Appendix C10. Geohydrologic sections interpreted from seismic-refraction data for Loudon lines j-j' and k-k', and Northfield line a-a', south-central New Hampshire (locations shown on plate 4).



Appendix C11. Geohydrologic sections interpreted from seismic-refraction data for Pembroke lines a-a', b-b', and c-c', south-central New Hampshire (locations shown on plate 1).

APPENDIX D

Appendix D. Low-flow data from streamflow measurements in the Upper Merrimack River Basin, south-central New Hampshire

[mi^2, square mile; ft^3/s, cubic feet per second; ft, feet; lat., latitude; long., longitude; no., number]

Stream	Tributary to	Location	Drainage area (mi^2)	Informal site no.	Measurements	
					Date	Discharge (ft^3/s)
Soucook River	Soucook River	Lat. 42°23′44″, long. 71°27′20″, Merrimack County, 30 ft downstream from bridge on Harmony Lane, 250 ft west of Route 106, 2,600 ft south of Belknap County line.	6.2	1	9-12-89	0.32
New Pond Brook	Soucook River	Lat. 43°23′22″, long. 71°27′26″, Merrimack County, 250 ft west of Route 106, 2,100 ft south of Harmony Lane, 600 ft northwest of confluence with Suncook River.	7.7	2	9-12-89	.09
Soucook River	Soucook River	Lat 43°21′29″, long. 71°26′48″, Merrimack County, 20 ft downstream from bridge on Corner Road, 8,100 ft northeast of Pearl's Corner, 4,400 ft east of Loudon Speedway.	22.9	3	9-12-89	.85
Soucook River	Soucook River	Lat. 43°21′10″, long. 71°27′02″, Merrimack County, 75 ft upstream from old foot bridge at end of Wood Road, 500 ft east of Corner Road, 6,000 ft northeast of Pearl's Corner.	23.5	4	9-12-89	.87
Soucook River	Soucook River	Lat. 43°20′56″, long. 71°27′25″, Merrimack County, 200 ft downstream from bridge on Corner Road, 4,000 ft northeast of Pearl's Corner, 2,000 ft downstream from confluence with Bumfagon Brook.	28.9	5	9-12-89	1.35
Gues Meadow Brook	Soucook River	Lat. 43°21′51″, long. 71°27′53″, Merrimack County, 100 ft upstream from bridge on Route 106, west side of highway, 1,500 ft northwest of Loudon Speedway.	2.8	6	9-12-89	.21
Soucook River	Merrimack River	Lat. 43°20′32″, long. 71°27′54″, Merrimack County, 75 ft downstream from bridge on Clough Hill Road, 200 ft downstream from confluence with Gues Meadow Brook, 800 ft east of intersection with Route 106.	33.9	7	9-12-89	3.2
Soucook River	Merrimack River	Lat. 42°18′36″, long. 71°27′58″, Merrimack County, 20 ft downstream from bridge on Currier Road, 2,500 ft northeast of intersection with Route 106.	54.1	8	9-12-89	6.9
Soucook River	Merrimack River	Lat. 43°16′36″, long. 71°28′07″, Merrimack County, at northern end of sand and gravel pit off Indian Point Road, 1,800 ft west of Route 106, 4,300 ft southwest of intersection of Routes 128 and 106.	57.2	9	9-12-89	8.6
Pine Island Brook	Soucook River	Lat. 43°17′00″, long. 71°28′46″, Merrimack County, 10 ft downstream from culvert on Oak Hill Road, 1,700 ft south of intersection with School Street, 3,500 ft upstream from confluence with Soucook River.	3.9	10	9-12-89	.44
Pine Island Brook	Soucook River	Lat. 43°16′32″, long. 71°28′46″, Merrimack County, 40 ft downstream from bridge on Loudon Village Road, known as N.H. Snowmobile Trail No. 15, 200 ft northwest from confluence with Soucook River.	4.3	11	9-12-89	.50
Bee Hole Brook	Soucook River	Lat. 43°16′32″, long. 71°28′26″, Merrimack County, under bridge on Chichester Road, 1,500 ft northwest of intersection with Rider Road, 6,900 ft southeast of Route 106.	7.6	12	9-12-89	.50
Soucook River	Merrimack River	Lat. 43°15′21″, long. 71°27′17″, Merrimack County, 50 ft upstream from bridge on Depot Road, 800 ft from intersection with Route 106, 3,200 ft west of intersection with Rider Road.	76	13	9-12-89	10.1

Appendix D. Low-flow data from streamflow measurements in the Upper Merrimack River Basin, south-central New Hampshire—*Continued*

Stream	Tributary to	Location	Drainage area (mi^2)	Informal site no.	Measurements Date	Measurements Discharge (ft^3/s)
Soucook River	Merrimack River	Lat. 43°11′08″, long. 71°29′30″, Merrimack County, 1,200 ft upstream from bridge on Route 3, 2,900 ft northwest of intersection of Routes 106 and 3.	79.3	14	9-12-89	13.2
Soucook River	Merrimack River	Lat. 43°13′52″, long. 71°28′50″, Merrimack County, 25 ft upstream from bridge on Pembroke Road, 800 ft east of intersection with Route 106, 6,000 ft west of intersection with Borough Road.	84.9	15	9-12-89	15.4
Soucook River	Merrimack River	Lat. 43°13′52″, long. 71°28′04″, Merrimack County, 3,500 ft downstream of bridge on Routes 4, 202, and 9 in Concord.	91.1	16	9-12-89	17.1
Soucook River	Merrimack River	Lat. 43°10′41″, long. 71°30′04″, Merrimack County, 1,200 ft from most southerly powerline crossing at northwest corner of hay field.	92.2	17	9-12-89	16.8
Soucook River	Merrimack River	Lat. 43°09′03″, long. 71°29′38″, Merrimack County, 150 ft upstream from railroad bridge, 400 ft upstream from confluence with Merrimack River, 7,100 ft southwest of intersection of Routes 106 and 3.	94.4	18	9-13-89	18.1
Suncook River	Merrimack River	Lat. 43°20′25″, long. 71°15′46″, Merrimack County, 50 ft upstream from bridge on Route 28, 150 ft north of confluence with Perry Brook, 500 ft northwest of Barnstead.	71.0	19	9-13-89	4.4
Big River	Suncook River	Lat. 43°19′52″, long. 71°13′16″, Merrimack County, at culvert on New Rochester Road, 150 ft southeast of intersection of New Road, Vail Road, and New Rochester Road.	17.8	20	9-13-89	0
Unnamed Brook	Big River	Lat. 43°19′57″, long. 71°13′35″, Merrimack county, at culvert on New Road, 1,900 ft west of intersection of New Road, Vail Road, and New Rochester Road.	1.1	21	9-13-89	0
Little River	Big River	Lat. 43°18′22″, long. 71°11′53″, Merrimack County, 50 ft upstream from bridge on Route 126, 2,350 ft southwest of Leighton Corners.	4.0	22	9-13-89	.08
Little River	Big River	Lat. 43°18′53″, long. 71°12′37″, 50 ft upstream from bridge on Welch Road, 2,000 ft southwest of New Rochester Road, 1,800 ft northeast of Route 126.	5.6	23	9-13-89	.16
Little River	Big River	Lat. 43°19′29″, long. 71°13′19″, Merrimack County, 250 ft upstream from bridge on Sam Clark Road, 1,500 ft southwest of New Rochester Road, 3,900 ft northeast of Route 126.	6.3	24	9-13-89	.33
Big River	Big River	Lat. 43°19′53″, long. 71°14′22″, Merrimack County, 200 ft downstream from bridge on Colbath Road, 3,000 ft northeast of intersection of Route 126 and Colbath Road.	68.4	25	9-13-89	2.8
Suncook River	Merrimack River	Lat. 43°16′43″, long. 71°20′43″, Merrimack County, 150 ft upstream from bridge on Webster's Mill Road, 4,800 ft southeast of intersection of Route 28 and Webster's Mill Road.	140	26	9-13-89	12.7

Appendix D. Low-flow data from streamflow measurements in the Upper Merrimack River Basin, south-central New Hampshire—*Continued*

Stream	Tributary to	Location	Drainage area (mi^2)	Informal site no.	Measurements Date	Measurements Discharge (ft^3/s)
Sanborn Brook	Perry Brook	Lat. 43°17′03″, long. 71°21′32″, 20 ft downstream from bridge on Webster's Mill Road, 1,150 ft southeast of intersection of Route 28 and Webster's Mill Road, 3,400 ft northeast of confluence with Perry Brook.	6.5	27	9-13-89	1.1
Sanborn Brook	Perry Brook	Lat. 43°16′38″, long. 71°21′57″, Merrimack County, 30 ft east of Route 28, 100 ft upstream of confluence with Perry Brook, 3,500 ft south of intersection of Route 28 and Webster's Mill Road, 400 ft northeast of confluence with Perry Brook.	6.8	28	9-13-89	.58
Perry Brook	Suncook River	Lat. 43°16′34″, long. 71°21′56″, Merrimack County, 150 ft downstream from Route 28 bridge, 3,500 ft south of intersection of Route 28 and Webster's Mill Road, 50 ft southeast of confluence with Sanborn Brook.	10.0	29	9-13-89	.69
Suncook River	Merrimack River	Lat 43°15′25″, long. 71°22′12″, Merrimack County, 500 ft downstream from bridge on Depot Road, 750 ft east of intersection of Route 28 and Depot Road, 1,300 ft southwest of North Chichester Cemetery.	154	30	9-13-89	15
Little Suncook River	Suncook River	Lat. 43°13′23″, long. 71°20′27″, Merrimack County, 3,100 ft upstream from confluence with Lockes Brook, 2,200 ft from Epsom, 200 ft south of Route 4.	35	31	9-13-89	2.42
Little Suncook River	Suncook River	Lat. 43°13′17″, long. 71°19′47″, Merrimack County, at bridge on Center Hill Road, 800 ft southeast of Epsom, 150 ft south of Route 4.	35	32	9-13-89	2.49
Lockes Brook	Little Suncook River	Lat. 43°13′25″, long. 71°20′25″, Merrimack County, 50 ft downstream from Route 4 bridge, 2,150 ft west of Epsom, 5,700 ft east of Epsom circle.	3.6	33	9-13-89	.30
Little Suncook River	Suncook River	Lat. 43°13′26″, long. 71°20′48″, Merrimack County, 10 ft downstream from bridge on Black Hall Road, 6,400 ft northeast of Epsom School, 300 ft south of Route 4.	39	34	9-13-89	2.86
Suncook River	Suncook River	Lat. 43°12′09″, long. 71°22′59″, Merrimack County, 300 ft upstream from bridge on New Rye Road, 1,400 ft east of Route 28, 20 ft north of confluence with Marden Brook.	208	35	9-13-89	22