GROUND-WATER AVAILABILITY IN THE BARRE-MONTPELIER AREA

BY

С

۲

÷

Arthur L. Hodges, Jr. and David Butterfield

Originally Printed as an Addendum to:

A RURAL COMPREHENSIVE WATER AND SEWER PLAN FOR

WASHINGTON COUNTY, VERMONT

BY

VERMONT DEPARTMENT OF WATER RESOURCES

Prepared in Cooperation with

U.S. Geological Survey, Vermont Department of Water Resources, and U.S. Department of Agriculture, Farmers Home Administration

1972

GROUND-WATER AVAILABILITY IN THE

PARRE-MONTPELIER AREA, VERMONT, 1972

ERRATA

Page 8	Line 13 - "wash borings" are EBX 1*, EBX 2
Page 8	Line 22 - "test-boring data" are EBW 47 to EBW 50
Page 11	Line 1 - "pumping-test data" is for EBW 46
Page 15	Chemical analysis is for well EBW 46. Sample collected for iron and manganese determination was on April 29, 1971.
Page 16	Line 4 - "wash boring" is MHX 1
	Line 13 - "wash boring" is MHX 3
Page 18	Line 8 - "wash boring" is BLX 1
Page 20	Line 17 - "8-inch test hole" is well NLW 13
	Line 18 - "wash-bore holes" are NLW 9 to NLW 12
Page 24	Line 7 - ''wash borings'' are NLX 1 to NLX 3
Page 26	Chemical analysis is for well NLW 13
Page 27	Insert "Lockwood, Kessler and Bartlett, Inc., 1970, Seismic refraction profiling Montpelier area, Vermont, 17p.

*Local well and boring numbers used by the U.S. Geological Survey

CONTENTS

	Page
Introduction	4
Geology	6
Exploration methods	7
Test sites and aquifer tests	8
Estimates of available water at site 1	12
Estimates of available water at site 6	22
References cited	27

•

•

-

-

•

ILLUSTRATIONS

Page Figure 1. Barre - Montpelier area -----5 2. Test site 1 -----9 ٢ , 3. Test site 2 -----14 4. Test sites 3 and 4 -----17 5. Test site 5 -----19 6. Test site 6 -----21 7. Test site 7 -----25 .

;

.

ţ

TABLES

Page

Table	1.	Chemical analysis of ground water at site 1	15
	2.	Chemical analysis of ground water at site 6	26

GROUND WATER AVAILABILITY IN THE

BARRE - MONTPELIER AREA

By

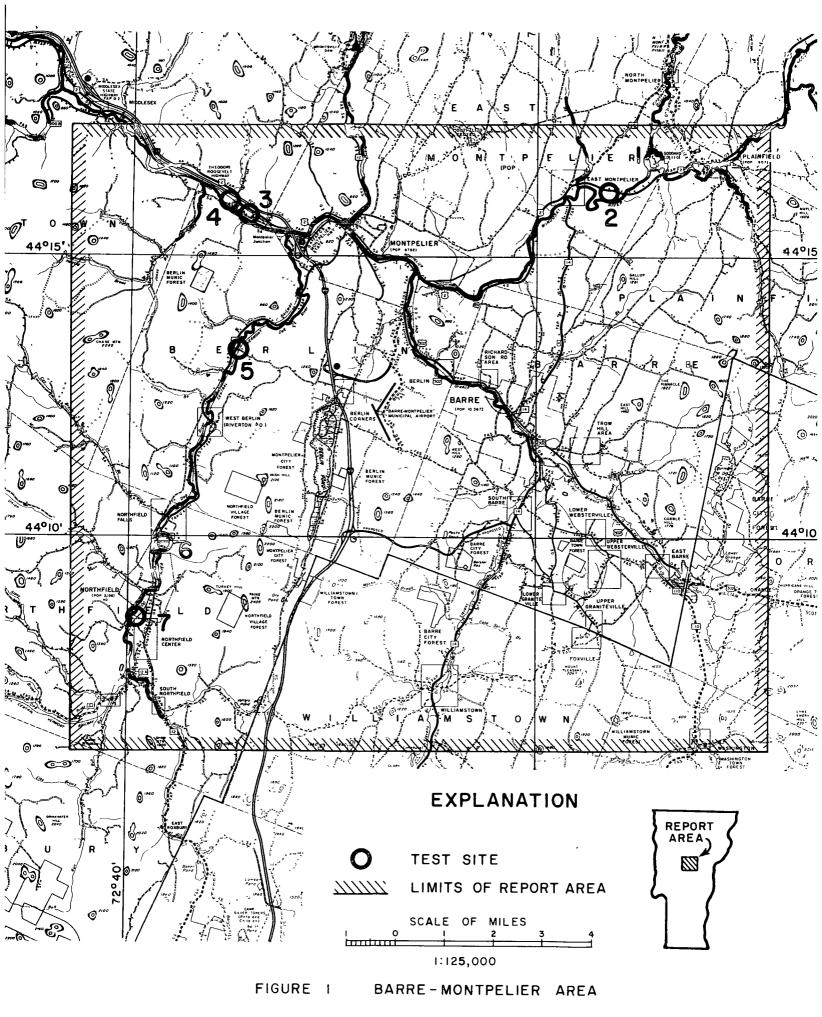
ARTHUR L. HODGES, JR., U.S. GEOLOGICAL SURVEY and DAVID BUTTERFIELD, VERMONT DEPARTMENT OF WATER RESOURCES

1

INTRODUCT ION

A study of the ground-water resources of the Barre - Montpelier area (fig. 1), Washington County, was begun in 1968 as part of a cooperative program between the Vermont Department of Water Resources and the U.S. Geological Survey. The purpose of the study is to provide technical appraisal of potential sources of water to meet the expanded needs of most towns in Washington County, as pointed out by the Rural Comprehensive Water and Sewer Plan (Vermont Department Water Resources, 1969). Funding was made available by the U.S. Department of Agriculture, Farmers Home Administration, for water-resources exploration, including the testing of the quantity and quality of the water in sand and gravel aquifers. The geology of the area was mapped, and private and municipal water supplies were inventoried in 1968.

-4-



GEOLOGY

The Barre - Montpelier area lies wholly within the drainage basin of the Winooski River. In much of the area the valley is unsuitable for development of large supplies of ground water because it is underlain by silt and clay or bedrock at shallow depth. However, saturated sand and gravel in the valley is locally more than 80 feet thick and has potential for the development of high-capacity wells. Upland areas between the river valleys are underlain by bedrock that is covered by a variable thickness of glacial till. Most wells finished in bedrock and till yield small amounts of water, and the upland area, where this material is exposed, generally is unfavorable for the development of high-capacity wells. For this reason, exploration was limited to valleys in which thick deposits of water-bearing sand and gravel are known (Hodges, 1967).

EXPLORATION METHODS

Test work was carried out in three phases. The first was seismic refraction profiling at several locations in the Winooski and Dog River valleys to determine the shape, thickness, location, and type of materials below the valley floor. The second phase was driving wash borings, $2\frac{1}{2}$ inches in diameter, to determine the permeability of the subsurface materials. Observation wells, l_{λ}^{1} inches in diameter, were installed in the wash bore holes at t^{wo} locations that were found to have potential for development as municipal water supplies. These small-diameter wells served as observation wells during the third phase of the program, during which an 8-inch well was constructed at each of the two locations and the aquifer tested. The two test wells, finished with 20 feet of wire-wrapped screen, were pumped until they were essentially sandfree, assuring good well efficiency during testing. After the wells were developed, each well was pumped for 48 hours, and measurements of drawdown and recovery were made in the pumping well and four observation wells.

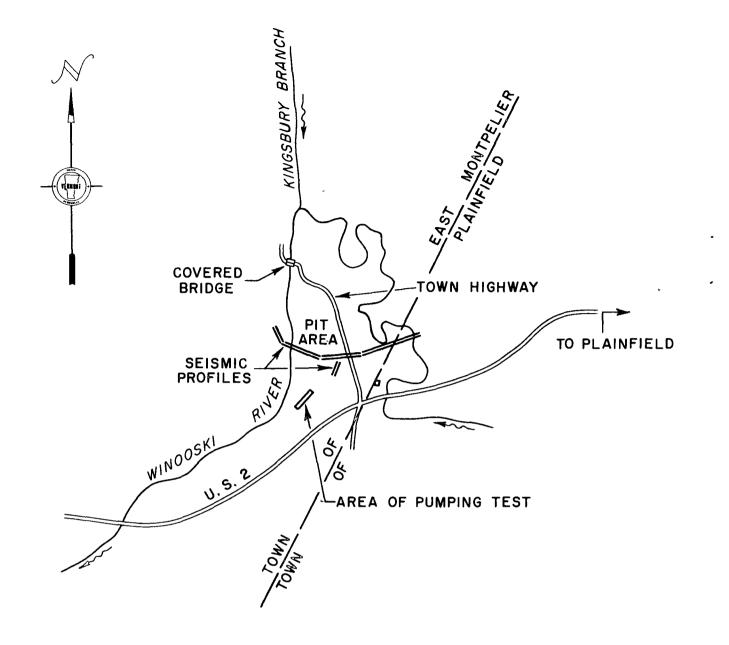
i

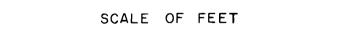
-7-

Test work was carried out at seven sites (fig. 1) within the Barre - Montpelier area.

Site 1 - East Montpelier - Plainfield town line on the properties of J. Tofani, J. E. Boudreau, and Caledonia Sand and Gravel Company (fig. 2). This site is in a broad valley at the junction of the Winooski River and Kingsbury Branch. Eastwest oriented seismic profiling across the former delta of the Kingsbury Branch, approximately half a mile south of the present mouth of the branch, indicated that bedrock is 45 to 120 feet below land surface, the deepest point being near the center of the valley. A short seismic profile perpendicular to this line showed that the bedrock surface slopes southward at about 10 degrees. Wash borings on the east-west seismic line showed that the east and central part of the valley are underlain by relatively impermeable lacustrine silt and clay. The west side of the valley, however, is occupied by an esker containing permeable gravel that extends far enough below the water table to constitute a good aquifer. Much of the sand and gravel above the water table has been removed from the core of the esker, and several water-filled pits have been produced by removing gravel from below the water table. Seismic and test-boring data indicate that the coarse sand

-8-





1000 0 1000 2000 3000 4000

FIGURE 2 TEST SITE I

,

and gravel of the esker is probably less than 800 feet wide and 60 feet deep at the mouth of Kingsbury Branch. The thickness of this material increases to the southwest in the valley of the Winooski River. The width of the coarse material to the southeast of the test site is estimated to be at least 600 feet. Farther to the southwest, several privately owned gravel wells indicate that this aquifer extends toward the town of East Montpelier. A gravel pit on the south bank of the Winooski River upstream from East Montpelier may have been dug in a remnant of the esker. Fine sand, silt, and clay flank the esker to the south and east of the test site, and, to the north, the Winooski River marks the boundary between the esker and bedrock.

Pumping-test data analyzed by methods developed by Boulton (1963), Stallman (1965), and Hurr (1966) indicate that the transmissivity of the aquifer in this area is about 40,000 square feet per day. An aquifer having an average width of 700 feet is capable of transmitting about 2 mgd (million gallons per day) of water with a hydraulic gradient of about 50 feet per mile. This is considerably less than the lowest daily mean flow of the Winooski River, estimated to be 147 mgd. If most of the pumpage is derived from infiltration through the streambed, the low flow of the river would fall below the recommended limit of 0.2 cfs per sq mi during drought. The river flows along the northwest edge of the esker at the test site and would be the major source of recharge to the underlying aquifer if withdrawal from wells was large. The pumping rate in this area is limited by the 1) low flow of the Winooski River and 2) recommended limitation on flow depletion rather than aquifer transmissivity.

Estimates of Available Water at Site 1

Practically all pumpage at this site would be derived from infiltration from the Winooski River because of small aquifer storage and scant recharge from precipitation. Calculations of discharge in the Winooski River at the test site are based on records at the Montpelier gaging station, 12.3 miles downstream. Approximately 160 square miles, or 40 percent of the drainage basin above the gaging station at Montpelier, lies above the East Montpelier test site. For the purpose of calculation, 40 percent of the water is assumed to originate above the test site. Reservoirs within the basin above the gage regulate some of the flow past the test site.

The Vermont Department of Water Resources' recommendation that 0.2 cfs per sq mi of drainage area be maintained as a base flow at all points on a stream requires a minimum flow of 32 cfs, or 20.8 mgd at the test site. Calculations based on streamflow at Montpelier indicate that the daily mean discharge past the test site is below 32 cfs on an average of 12 days per year but has been below this value for as many as 60 days in a single year (1964).

Potential pumping from this aquifer is, in part, related to streamflow adjacent to the site. If 1 mgd is pumped from wells and not returned to the river, the daily mean discharge of 32 cfs or less will occur on an average of 15 days per year. If **10** mgd is pumped from the aquifer, a daily mean flow of 32 cfs or less will occur on an

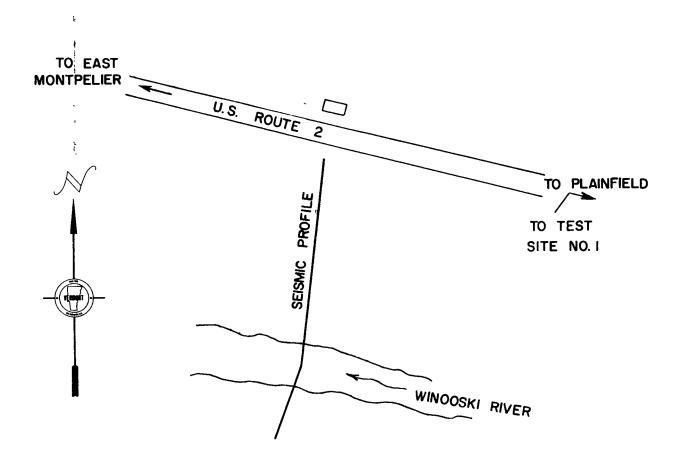
-12-

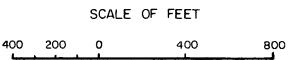
average of 44 days per year. Any practical plan to pump water from this aquifer continuously would consider adequate compensating storage to maintain the minimum recommended low flow during drought.

Analysis of the water sample taken during the pumping test at site 1 is given in table 1. The manganese content is well above the limit of 0.05 ppm (parts per million) recommended by the U.S. Public Health Service (1962) for drinking water. However, continued pumping from this aquifer may result in a decrease in manganese as river water is induced into the aquifer; however, treatment to remove manganese probably will be required to meet Public Health standards for a public water supply.

Site 2 - East Montpelier, south from U.S. Route 2, across the Winooski River, on property owned by Mrs. R. Taylor and Mrs. F. Delair (fig 3). Approximately 0.8 mile east of East Montpelier Village. A seismic profile extending from U.S. Route 2 southward across the Winooski River indicated as much as 140 feet of unconsolidated material overlying bedrock. The maximum depth to bedrock occurs approximately 100 feet south of U.S. 2, but seismic velocities suggest that the material in this area may be too fine grained and impermeable to yield water easily. Near the river, the depth to bedrock is shallower; however, seismic velocities in the unconsolidated material in this area suggest that the subsurface material may be coarse grained and, therefore, suitable for future ground-water exploration.

-13-





.,

÷,

ł

ļ



Table 1.--Chemical analysis of ground water at site 1

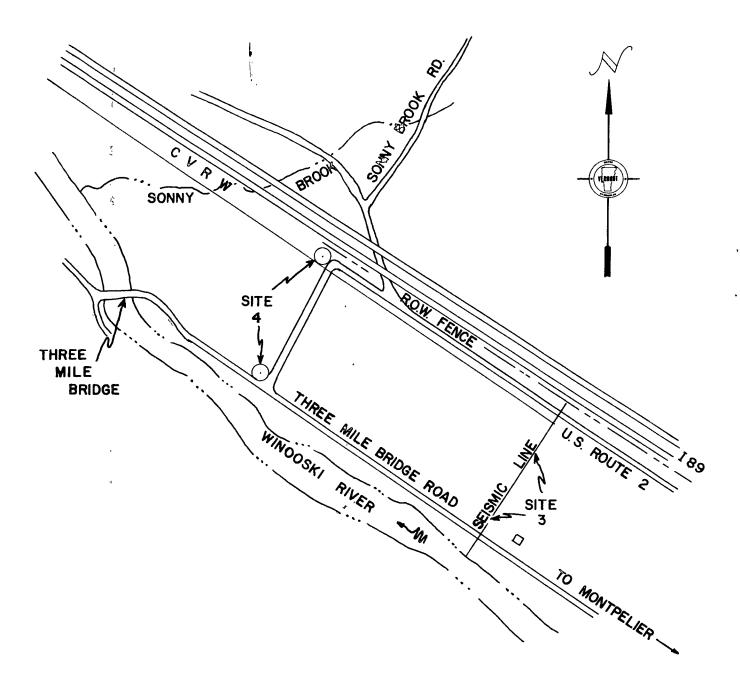
Date: January 8, 1971

Previous pumpage: 2 days

(All values in milligrams per liter)

Calcium	64	Temperature, ^O F	46.0
Magnesium	6.4	Alkalinity as CaCO ₃	179
Sodium	9.2	Color	6
Potassium	2.9	Dissolved solids at 180 ⁰ C -	232
Ammonia	.08	Dissolved solids, sum	229
Iron	.16	Hardness, Ca and Mg	186
Manganese	.43	Hardness, noncarbonate	7
Bicarbonate	218	Loss on ignition	26
Carbonate	0	Nitrate as N	.00
Sulfate	19	Nitrite as N	.01
Chloride	20	Nitrogen, NH ₄ as N	.06
Fluoride	.0	рн	7.9
Nitrite	.05	Silica	.12
Nitrate	.00	Specific conductance	413

- Site 3 Middlesex, south from U.S. Route 2 to the Winooski River on property owned by DuBois Construction Company (fig. 4). Unconsolidated material overlying bedrock at this site is a maximum of 47 feet thick. A wash boring near the north bank of the Winooski River penetrated 28 feet of fine sand and clay overlying 12 feet of coarse sand and gravel. The lower material has sufficient permeability to produce water, but is too thin to be developed by high-capacity wells using standard well-construction methods. This area could be explored in the future for development as a well field.
- Site 4 Middlesex, near U.S. Route 2 underpass beneath Interstate 89 on property owned by the Town of Middlesex (see fig. 4). A single wash boring was driven in the delta of Sanny Brook. Thirty-one feet of sand and gravel were found underlying 56 feet of fine sand and clay. The sand and gravel yields little water.

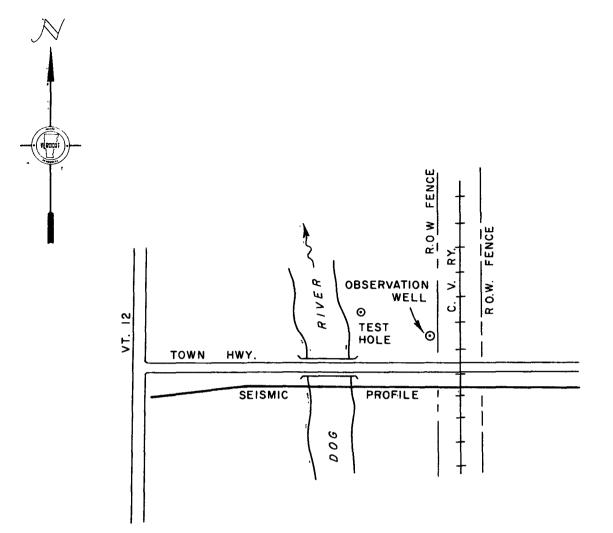


SCALE OF FEET

400	200	0	400	800
L	A. 1	1 1	I	

FIGURE 4 TEST SITES 3 and 4

Site 5 - Berlin, east from Vermont Route 12 across the Dog River and the Central Vermont Railroad on property owned by A.L. Granger (fig. 5). Rock walls confine the Dog River at this site to a narrow valley. Subsurface information from seismic profiling shows that, contrary to expectations, no deep buried channel exists below the present river level. The maximum depth to bedrock is 60 feet below the present channel of the river. A wash boring in the area of maximum depth penetrated only sand and silt that was too fine grained and impermeable to yield large supplies of water.



•

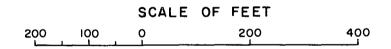


FIGURE 5 TEST SITE 5

- 19 -

۰.

Site 6 - Northfield, 0.4 mile south of Northfield Falls in a gravel pit owned by J. R. Covey, approximately 400 feet east of Vermont Route 12 (fig. 6). A rock ridge under and along the east edge of the highway separates the aquifer in a gravelfilled bedrock channel at the site from direct connection with the Dog River to the west. This ridge also would prevent movement of discharge from the Northfield Sewage Treatment Plant into the aquifer at the test site. Aquifer material beneath the site is recharged by precipitation and groundwater underflow from the east and south. Potential recharge may be available by induced infiltration from the Dog River 1,200 feet south of the test site. The actual cross-sectional area of the aquifer was not determined by seismic profiling because fuel-oil tanks are located within the pit, however, it is probably about 500 feet wide. Wash borings in the pit penetrated 49 feet of water-bearing sand and gravel having a static ground-water level 4 feet below land surface. An 8-inch test hole adjacent to the wash-bore holes penetrated 99 feet of sand and gravel. Casing was installed with screen between 75 and 95 feet below land surface, and, after 48 hours of pumping, the specific capacity was about 300 gallons per minute per foot of drawdown. Transmissivity of the aquifer estimated by extension of a method described by Hurr (1966) is approximately 65,000 square feet per day.

-20-

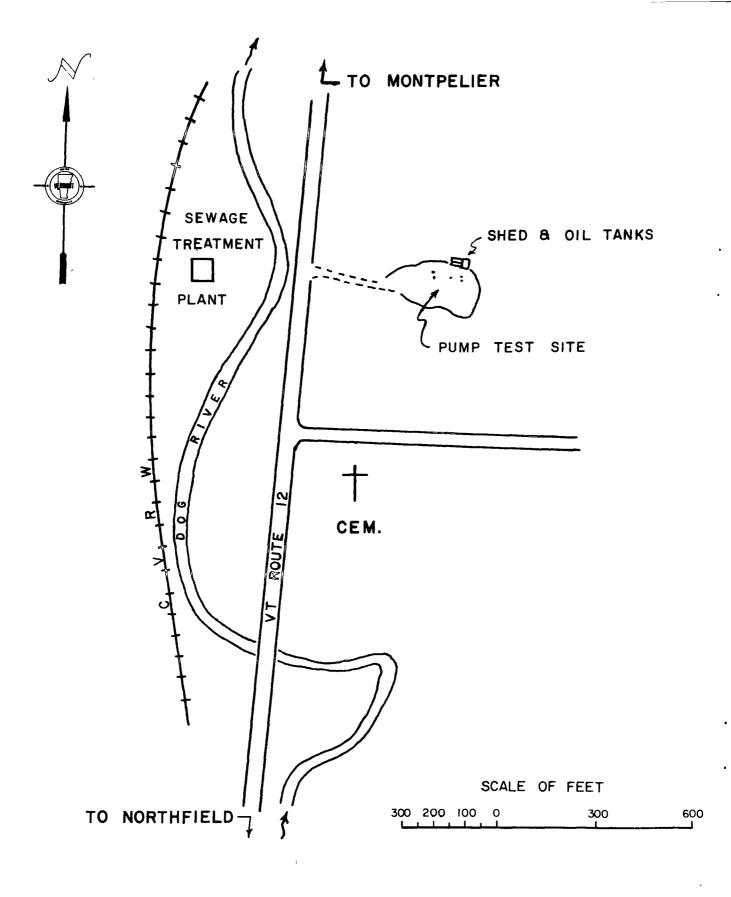


FIGURE 6 TEST SITE 6

- 21 -

Estimates of Available Water at Site 6

Calculations based on a transmissivity of 65,000 square feet per day indicate that the 500-foot cross section of aquifer is capable of transmitting about 2.5 mgd (million gallons per day) with a hydraulic gradient of about 50 feet per mile. Most of the recharge to the aquifer comes from precipitation on about 2 square miles of unconsolidated sediments east of the test site. It is estimated that half the yearly precipitation, or about 1 mgd, recharges the ground-water reservoir in sand and gravel.

The rate at which water would move from the Dog River into the underlying aquifer, once pumping lowers the water table beneath the river, depends on several factors: (1) the area of the streambed affected by well pumpage, (2) the vertical hydraulic gradient across the streambed, (3) the vertical permeability of the streambed, and (4) the temperature of the stream water. Estimates of average vertical streambed infiltration made by Rosenshein and others (1968) in Rhode Island, Randall and others (1966) in Connecticut, and Norris and Fidler (1969) in Ohio indicated that the average streambed infiltration rate ranged from about 17 gallons per day per square foot to 50 gallons per day per square foot with 1 foot of vertical head. No testing was done on the Dog River to determine streambed infiltration rates, but, based on the findings of the above studies, a value of 25 gallons per day per square foot seems to be reasonable.

-22-

Infiltration from the Dog River would probably occur south of the test site between the well and the river along a 500-foot reach of the stream that has an average width of 25 feet during low flow. The minimum area of infiltration, therefore, is about 12,500 square feet. At the estimated rate of infiltration of 25 gpd per sq ft, approximately 300,000 gpd, or 0.5 cfs, may be induced into the aquifer from the Dog River during low flow. This volume is less than 7 percent of the lowest daily flow of record at the Northfield gage.

Average annual discharge of the Dog River adjacent to test site 6 is about 92 cfs from a drainage area of 61 square miles. Low flow based on State recommendations should not be less than 12 cfs. Estimates of low flow based on data for the Northfield gaging station indicate that streamflow adjacent to the test site is 12 cfs or less on an average of 40 days per year. Infiltration of streamflow of 300,000 gpd caused by pumping would reduce streamflow at the site below the recommended limit for periods longer than 40 days per year.

In summary, a well or group of properly constructed wells favorably located to intercept most recharge, could dependably yield about 1 mgd with little streamflow depletion resulting from infiltration.

-23-

An analysis of water collected from the test well at site 6 is given in table 2. All chemical constituents were found to be well below limits recommended by the Public Health Service for a public water supply and, therefore, the water should be usable without treatment other than chlorination.

Site 7 - Northfield, east side of Dog River on property owned by Norwich University (fig. 7). Three wash borings were driven between the campus of Norwich University and the Dog River. Depth to bedrock ranged from 24 feet to 65 feet below land surface. Subsurface material ranged from fine sand and clay to coarse gravel mixed with silt. Gravel layers below a depth of 35 feet were tested by pumping, but they contained sufficient silt to make the permability low. Shallow gravel adjacent to the Dog River, however, may be a potential aquifer that can be developed by infiltration galleries, groups of well points, or collector wells.

- 24 -

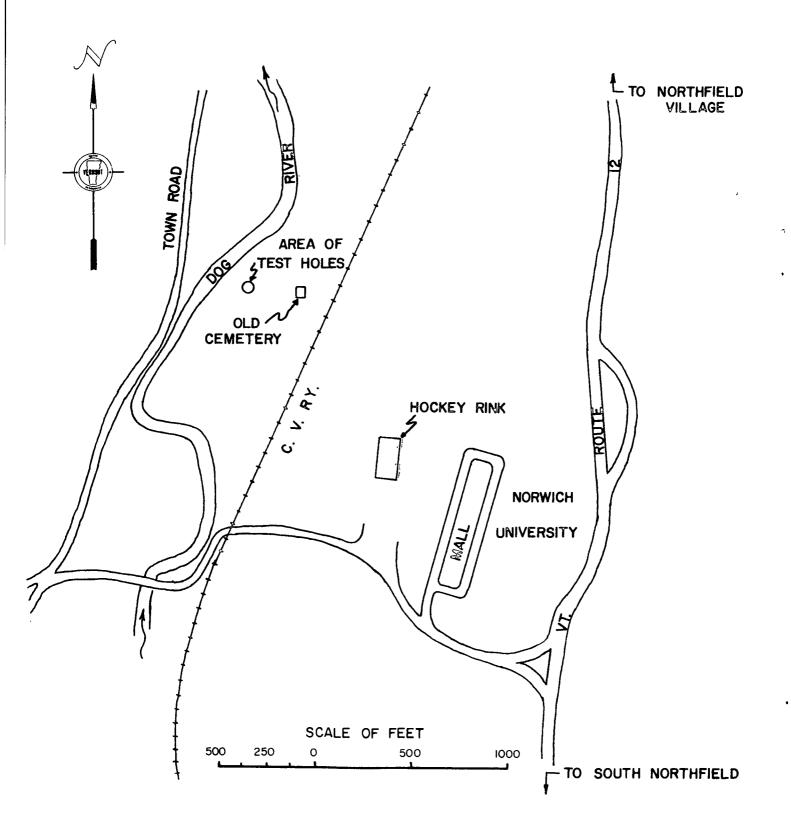


FIGURE 7 TEST SITE 7

Table 2.--Chemical analysis of ground water at site 6

1

Date: March 18, 1971

c

L

Previous pumpage: 2 days

(All values in milligrams per liter)

Calcium	22	Temperature, ^o F	45.5
Magnesium	3.9	Alkalinity as ĊaCO ₃	43
Sodium	7.8	Color	2
Potassium	.9	Dissolved solids at 180 ⁰ C-	140
Ammonia	.02	Dissolved solids, sum	104
Iron	.10	Hardness, Ca and Mg	71
Manganese	.00	Hardness, noncarbonate	28
Bicarbonate	53	Loss on ignition	38
Carbonate	0	Nitrate as N	1.0
Sulfate	14	Nitrite as N	.11
Chloride	18	Nitrogen, NH ₄ as N	.02
Fluoride	.0	рН	6.8
Nitrite	.37	Silica	6.4
Nitrate	4.6	Specific conductance	191

REFERENCES CITED

- Boulton, N.S., 1963, Analysis of data from non-equilibrium pumping tests allowing for delayed yield from storage: Inst. Civil Engineers Proc. (British), v. 26, p. 469-482.
- Hodges, 1967, Ground water favorability map of the Winooski River basin, Vermont: Vermont Department of Water Resources.
- Hurr, R.T., 1966, A new approach for estimating transmissibility from specific capacity: Water Resources Research, v. 2, no. 4, p. 657-664.
- Norris, S.E., and Fidler, R.E., 1969, Hydrologeology of the Scioto River valley near Piketon, south-central Ohio: U.S. Geol. Survey Water-Supply Paper 1872, 70[.] p.
- Randall, A.D., Thomas, M.P., Thomas, C.E., Jr., Baker, J.A., 1966, Water resources inventory of Connecticut, Part 1, Quinebaug River basin: Conn. Water Resources Bull. no. 8, 102 p.
- Rosenshein, J.S., Gonthier, J.B., and Allen, W.B., 1968, Hydrologic characteristics and sustained yield of principal ground-water units, Potowomut-Wickford area, Rhode Island: U.S. Geol. Survey Water-Supply Paper 1775, 38 p.
- Stallman, R.W., 1965, Effects of water-table conditions on water-level changes near pumping wells: Water Resources Research, v. 1, no. 2, p. 295-312.
- U.S. Public Health Service, 1962, Public Health Service drinking water standards: U.S. Dept. Health, Education, and Welfare, Public Health Service, pub. no. 956, 61 p.
- Vermont Department of Water Resources, 1969, A rural comprehensive water and sewer plan for Washington County, Vermont: Vt. Dept. Water Res., 120 p., 8 pl., 5 maps, 22 figs.

-27-

PLATE 1. OCCURRENCE OF WATER IN BEDROCK, BARRE-MONTPELIER AREA, VERMONT BEDROCK GEOLOGY OF THE BARRE-MONTPELIER AREA QUALITY OF WATER

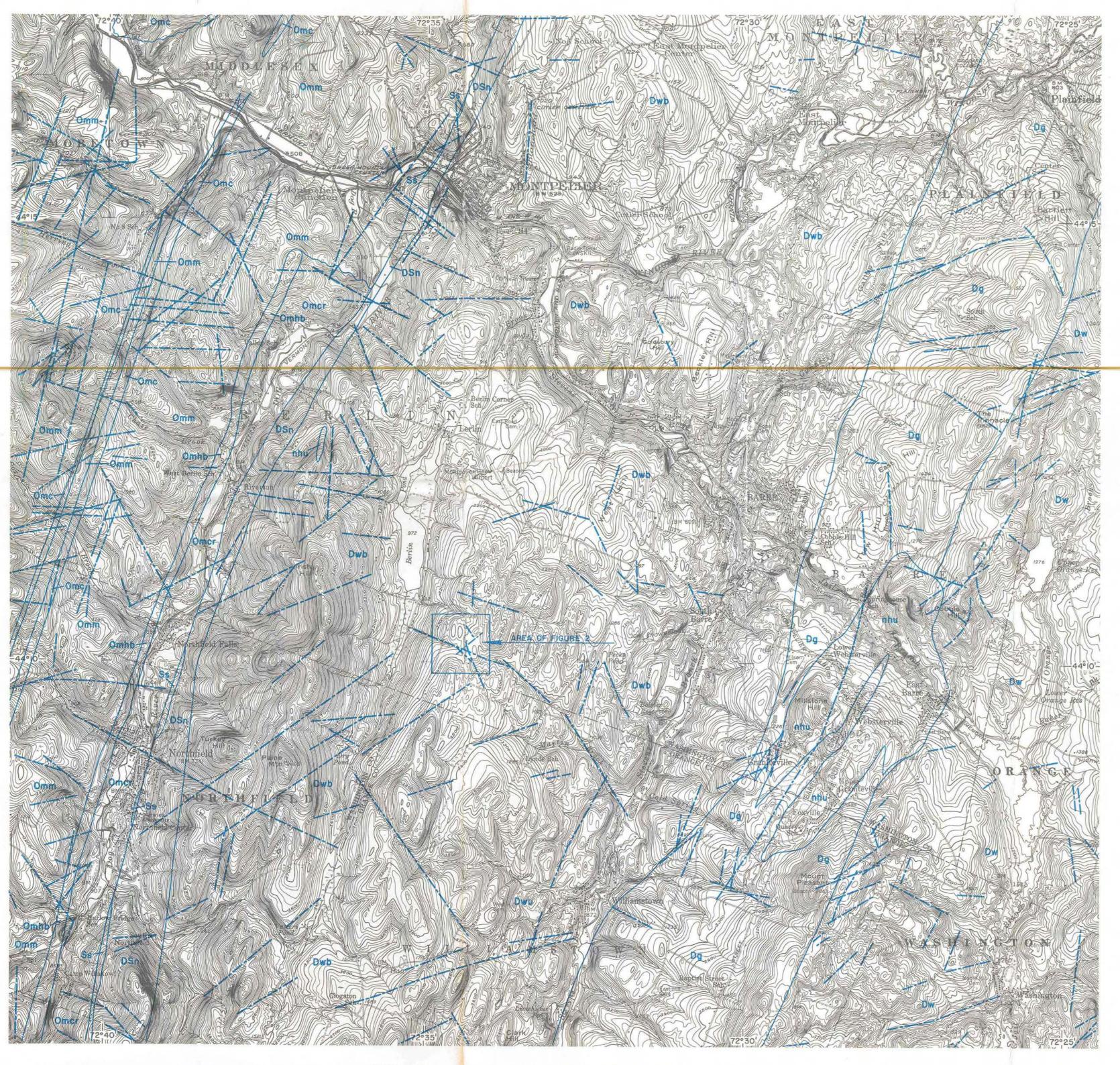


FIGURE 1, - - BEDROCK GEOLOGY OF THE BARRE-MONTPELIER AREA

BEDROCK AQUIFERS

Bedrock formations in the Barre-Montpelier area consist mainly of varying amounts of phyllite and schist. Differences in bedrock lithology are responsible for variations in resistance to weathering, structural competence, and yield to wells.

The Missisquoi Formation has four members. Those of most significance are the older Moretown Member, a quartzite and quartz-plagioclase granulite that forms the highest topographic features in the report area, and the younger Cram Hill Member, consisting of slate with some felsic and mafic volcanic rocks that have been deeply eroded and now form the valley of the Dog River.

The Northfield Formation is a predominantly slate unit that occupies the east side of the Dog River valley. It is not deeply weathered, and, because it is cleanly broken by fractures, it has been extensively quarried.

The Waits River and Gile Mountain Formations, lying east of the Northfield Formation, are composed of interbedded quartzose and micaceous crystalline limestone and quartz-muscovite phyllite and schist. The boundary between these two formations is arbitrary and is based on the relatively larger percentages of calcareous materials in the Waits River Formation, where impure limestone and quartzite constitute as much as 60 percent of the formation. Solution enlargement of joints and fractures in the limestone beds of the Waits River Formation has contributed to a higher average yield per foot of well depth in this formation than in the Gile Mountain Formation (table 1).

YIELD OF BEDROCK WELLS

A comparison of the average yield and depth of selected wells (table 1) shows that, although the average yield of all wells in bedrock is 18 gal/min (1 1/s), there are substantial variations between average yields of different formations. The Barton River Member of the Waits River Formation and the Northfield Formation have the highest average yields of all bedrock formations. The remaining bedrock units have relatively lower average yields.

A comparison of yield versus depth drilled (table 1) shows that the Northfield Formation not only has the highest average yield, but also has the highest average yield per foot drilled. The Gile Mountain Formation has the lowest average yield per foot. It is approximately half that of the Northfield Formation. Differences in average yields and yields per foot drilled are affected by differences in overburden thickness, rock competence, and size, number, orientation, and degree of interconnection of fractures.

Recent studies in Delaware (Woodruff and others, 1972) show that yields of rock wells are related to their position with respect to zones of rock fractures, termed "lineaments". In the Delaware study, lineaments were identified and subsequently drilled. Those wells drilled along the strike of the lineaments had yields substantially greater than the average yield of wells drilled in the same rock unit but offset from the lineaments. Because identification of lineaments may provide information that could be used to locate sites for development of potentially high-yield

EXPLANATION

	ROCK UNITS		
	IGNEOUS		
		2	
nhu	GRANITE, UNDIFFERENTIATED OF NEW HAMPSHIRE PLUTONIC SERIES	>	DEVONIAN
)	
	METAMORPHIC		
)	
Dg	GILE MOUNTAIN FORMATION QUARTZ MUSCOVITE PHYLLITE OR SCHIST		
Dw	WAITS RIVER FORMATION QUARTZOSE AND MICACEOUS CRYSTALLINE LIMESTONE	7	DEVONIAN
	NORTZUSE AND MICACEOUS CRISTALLINE LIMESTONE	Î	
	WAITS RIVER FORMATION - BARTON RIVER MEMBER	1	
Dwb	SILICEOUS LIMESTONE AND PHYLLITE	ĺ	
	NORTHFIELD FORMATION	1	
DSn	QUARTZ - SERICITE SLATE OR PHYLLITE	7	SILURIAN
Ss	SHAW MOUNTAIN FORMATION QUARTZOSE LIMESTONE AND CALCAREOUS QUARTZITE		
		J	
Omer	MISSISQUOI FORMATION - CRAM HILL MEMBER)	
Jiner	PHYLLITE SLATE, MAFIC VOLCANICS		
	MISSISQUOI FORMATION - HARLOW BRIDGE QUARTZITE MEMBER		
Omhb	QUARTZITE WITH QUARTZITIC PHYLLITE		
		7	ORDOVICIAN
Omm	MISSISGUOI FORMATION - MORETOWN MEMBER QUARTZITE AND QUARTZ - PLAGIOCLASE GRANULITE		
Omc	MISSISQUOI FORMATION		
onio	CARBONACEOUS PHYLLITE AND SLATE	J	
/	CONTACT BETWEEN FORMATIONS		
_	FAULT - INFERRED		
_	LINEAMENT		

0.5 0 2 MILES 3000 0 3000 6000 9000 FEET I 0.5 0 I 2 KILOMETERS CONTOUR INTERVAL 20 FEET DATUM IS MEAN SEA LEVEL BASE FROM U.S. GEOLOGICAL SURVEY TOPOGRAPHIC QUADRANGLES MONTPELIER 1919, PLAINFIELD 1953, BARRE, EAST BARRE 1957

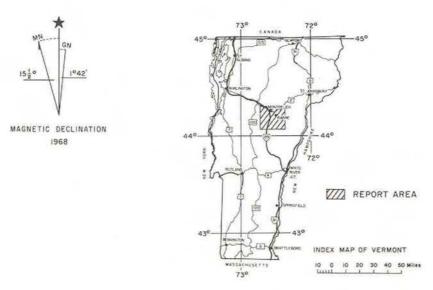


TABLE 1. - - AVERAGE YIELD AND DEPTH OF SELECTED WELLS

Type of Well	Number of Wells	Average Yield (gal/min)	Average Depth (feet)	Average Yield/Foot Drilled
Wells in Bedrock	421	18	185	0.097
Granite	3	*	*	*
Gile Mountain Formation	47	11	221	.050
Waits River Formation	21	12	165	.073
Waits River Formation				
Barton River Member	267	18	182	. 099
Northfield Formation	10	19	147	.129
Shaw Mountain Formation	0	~	•	r
Missisquoi Formation,				
Cram Hill Member	18	11	177	.062
Missisquoi Formation,				
Harlow Bridge Quartzite Member	3	*	*	*
Missisquoi Formation,				
Phyllite and slate	2	*	*	*
Missisquoi Formation,				
Moretown Member	50	13	197	.066
lells in unconsolidated				
material	61	87	53	1.642

* Numbers of wells insufficient to calculate meaningful average

higher yields of bedrock wells to proximity of lineaments.

A. L. HODGES, JR., D. BUTTERFIELD, J. W. ASHLEY

CONVERSION FACTORS The following table may be used to convert English units to International System of Units (SI).

Multiply English units	Ву	To obtain SI units
inches (in)	25.4	millimetres (mm)
feet (ft)	.3048	metres (m)
gallons per minute (gal/min)	.06309	litres per second (1/s)
million gallons per day (Mgal/day)	3785	cubic metres per day (cm ³ /day)

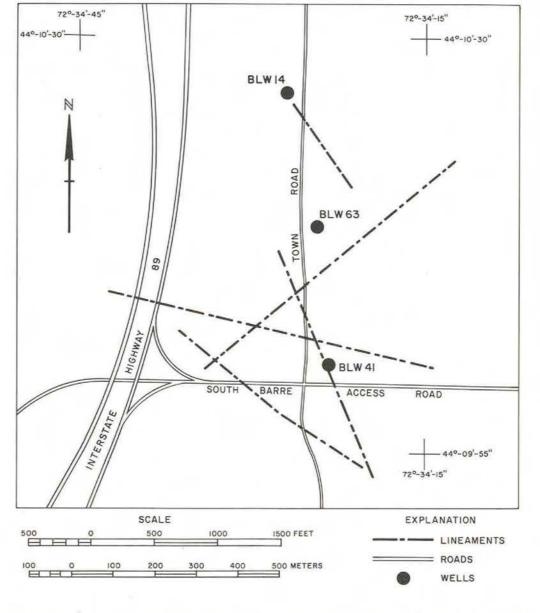


FIGURE 2, - - INVESTIGATION SITE OF BEDROCK WELL YIELDS

rock wells, interpretations of topographic maps and aerial photos were used to map lineaments in the Barre-Montpelier area. Lineaments appear on maps and photos as straight lines or narrow zones of marked topographic or tonal change that in some places mark dryer or wetter conditions along the lineaments than on either side of the lineaments. These interpretations also suggest that major drainageways in the report area are in large-scale lineament zones.

A small area in the town of Berlin (figs. 1 and 2) was mapped in detail to estimate the relationship of lineaments to well yield. This area was selected for its shallow bedrock cover and because records had been obtained on several wells. All lineament zones mapped in the study area were of limited width (less than 100 ft or 30 m and appeared as straight lines on aerial photographs. Because of the relatively narrow width of the lineaments and rough terrain, field identification was generally only possible with the assistance of the photographs. Of the three wells in the lineament study area, two (wells BLW 14 and 41) have yields of 60 and 90 gal/min (4 and 6 1/s), respectively, and were located on or adjacent to mapped lineaments. The third well (BLW 63) is about 300 ft (92 m) from the nearest lineament and has a yield of only 10 gal/min (0.6 1/s). The study area is underlain by the Barton River Member of the Waits River Formation, for which table 1 shows an average yield of 10 gal/min (0.6 1/s). The scant data suggest correlation of

CHEMICAL QUALITY OF WATER

Ten analyses of ground water, and one analysis of water from the Winooski River were made by the Geological Survey during the study. In addition, data are available from numerous partial analyses of water from several streams in the area, which were made as part of a river classification study by the Vermont Department of Water Resources. These analyses are shown in tables 2 and 3, and the location of the sampling points are shown on Plate 3.

The effects of ground water movement through materials of different composition are evident in the analyses. The Winooski River above the East Montpelier test site (Plate 2, figure 2) drains an area underlain. in part, by the Waits River Formation, which is composed of silicious metamorphosed limestone. As a result, water moving through material derived from this formation is alkaline (pH more than 7.0) and calcium, bicarbonate, hardness, alkalinity, and dissolved solids concentrations are relatively high (wells EBW 46 and 100). The Dog River drains an area predominantly underlain by the noncarbonaceous Northfield and Missisquoi Formations. Ground water in the Dog River drainage area is, therefore, slightly acidic (pH less than 7.0), and concentrations of calcium, bicarbonate, hardness, alkalinity, and dissolved solids (well NLW 13) are less than those found in the Winooski Drainage in East Montpelier.

Ground water at the Northfield test site (well NLW 13) is chemically suitable for public supply with respect to all components listed. Ground water from the East Montpelier test site (wells EBW 46 and 47), however, contains iron and manganese concentrations that approach or exceed Vermont Department of Health and U.S. Public Health Service (1962) recommended limits for public drinking water supplies. Reduction or removal of these constituents from such water used for public supply, therefore, would be necessary to meet State standards.

	AL LL BER	DATE OF SAMPLE	TEM- PERA- TURE (C)	SILICA (SIO2) (MG/L)	IRON (FE) (UG/L)	MAN- GANESE (MN) (UG/L)	CAL- CIUM (CA) (MG/L)	MAGNE- SIUM (MG) (MG/L)	SODIUM (NA) (MG/L)	POTAS- SIUM (K) (MG/L)	BICAR- BONATE (HCO3) (MG/L)	(CO3)	SUL- FATE (SO4) (MG/L)	CHLO- RIDE (CL) (MG/L)	FLUO- RIDE (F) (MG/L)	TRATE (NO3)	SOLIDS		HARD- NESS (CA, MG) (MG/L)	NON- CAR- BONATE HARD- NESS (MG/L)		SPECIFIC CONDUCT- ANCE (MICRO- MHOS)	РН С		SOURCE OF DATA
											B	ARRE TO	WN (BF)												
W	34	04-09-53		13	50-	.00	40	9.8	16	1.7	162	0	24	14	0.4	0.3		202	140	7		336	7.6	2	А
											EAST	MONTPE	LIER (E	B)								4. N. A.			
W W W W	46 46 47 100	01-06-71 01-07-71 01-08-71 04-28-71 11-07-72		12 12 .1 	 160 83	 430 16	65 65 64	6.4 6.4 6.4	10 9.3 9.2 4.0	3.2 3.1 2.9	220 215 218	0 0 	19 19 19 	18 18 20 5	0.0 0.1 0.0	0.0 0.2 0.0	242 239 229	238 222 232 209	189 189 186 182	8 12 7 	180 176 179 	419 415 413 	7.9 8.0 7.9 7.2	3 2 6 10	A A A B
											M	ONTPELI	ER (MM)												
W	2	04-19-67		8.9	20	40	94	13	83	6.5	179	0	52	176	.1	23	544	615	288	142		993	7.0	3	А
											N	ORTHFIE	LD (NL)												
W W W	2 13 13 13	05-09-66 03-16-71 03-17-71 03-18-71	7.5	12 6.4 6.4 6.4	0 10 10 10	0 0 0	14 22 22 22	2.2 3.8 3.8 3.9	5.6 7.6 7.8 7.8	.4 .9 .9	35 53 54 53	0 0 0	13 14 14 14	10 18 18 18	.0 .1 .0 .0	.7 4.3 4.6 4.6	75 103 104 104	76 142 140 140	44 70 70 71	16 27 26 27	43 44 43	123 188 190 191	7.0 6.9 7.2 6.8	4 1 1 2	A A A A

WATER	MAP NO.	SOURCE OF DATA	DATE OF SAMPLE	TEM- PERA- TURE (C)	CALCIUM (CA) (MG/L)	MAG- NESIUM (MG) (MG/L)	CHLORIDE (CL) (MG/L)	ALKA- LINITY CACO3 (MG/L)	HARD- NESS (CA,MG) (MG/L)	РН	TUR- BIDITY (STD. UNITS)	COLOR (STD. UNITS)	SUSPEN- DED SOLIDS (MG/L)	TOTAL SOLIDS (MG/L)	DIS- SOLVED OXYGEN (MG/L)	TOTAL COLIFORM BACTERIA PER 100 MILLILITERS
Winooski River	1	A	7/1/55	23.0	84	12	3.77	84	96	8.05	8	25	2	103	8.20	15,000
Winooski River	2	A	8/2/54	24.0	14	49	3.47	14	63	8.00	0	5	14	38	8.30	250
Winooski River	3	A	7/1/55	23.0	87	16	4.12	86	103	8.20	8	30	3	141	8.20	9,500
Winooski River	4	A	7/1/55	23.5	92	24	3.44	92	116	8.00	12	35	4	140	7.00	45,000
Winooski River	5	A	7/1/55	22.0	94	19	3.44	95	113	7.85	10	30	7	146	7.60	15,000
Winooski River	6	A	7/15/55	22.5	88	18	2.06	96	106	8.07	18	25	7	161	9.10	2,500
Winooski River	7	A	7/15/55	25.0	82	12	2.75	90	94	8.25	14	20	Ó	131	8.50	9,500
Winooski River	8	A	7/15/55	24.5	82	12	3.43	90	94	8.26	13	20	õ	131	8.90	4,500
Winooski River	9	A	9/3/53	26.0	100	28	4.85	114	128	8.15	0	10	9	135	9.10	2,000
Winooski River	10	A	7/15/55	20.5	78	16	3.43	88	94	7.85	14	25	0	127	6.60	2,500
Winooski River	11	B*	9/10/71	18.5	35	3	7.40		100	7.30				118		
Winooski River	12	A	7/15/55	21.5	64	8	0.69	68	72	8.54	9	20	0	109	9.80	9,500
Great Brook	13	A	9/3/53	19.0	104	20	4.24	112	124	8.22	0	0	1	125	9.00	450
Winooski River	14	A	7/15/55	21.0	68	10	3.43	72	78	7.86	14	30	3	111	10.90	45,000
Dog River	15	A	6/30/55	18.5	44	14.	5.50	48	58	7.50	7	15	2	85	7.75	0
Dog River	16	A	6/30/55	18.0	44	12	5.50	46	56	7.70	8	15	1	84	9.30	4,500
Dog River	17	A	9/4/53	22.5	50	12	15.8	48	62	7.75	1	5	0	94	9.00	
Dog River	18	A	6/30/55	20.5	44	10	5.50	48	54	8.60	15	15	2	88	12.55	20,000
Cox Brook	19	A	6/30/55	19.5	18	8	2.06	22	26	8.00	2	5	0	35	9.00	4,500
Dog River	20	A	6/30/55	18.5	48	10	3.44	54	58	7.85	40	15	9	96	8.55	250,000
Union Brook	21	A	6/30/55	22.5	22	4	3.75	28	26	7.45	16	25	7	55	8.10	150,000
Dog River	22	A	6/30/55	17.0	50	3	3.75	46	58	7.85	2	5	0	78	10.00	15,000
Sunny Brook	23	A	6/30/55	19.0	96	18	4.12	102	114	8.20	4	10	1	135	9.40	2,500
Bull Run Stony Brook	24 25	A	6/30/55 6/30/55	19.5 23.0	18 18	8	1.37	20	26	7.75	6	15	0	43	9.10	150
Dog River	26	A	6/30/55	17.0	22	6 10	2.75	22	24	7.75	2	10	0	34	9.05	150
North Branch	28	A A	7/11/55	24.5	30	6	0.0	22	32	7.55	2	5	2	53	9.40	200
North Branch	29	Δ	7/11/55	27.5	19	4	1.03	23	36	6.81	19	30	10	81	4.00	450,000
Berlin Pd. Br.	30	Δ	8/29/55	13.5	15		2.0	22 109	23	7.43	7	35	2	58	7.50	9,500
Stevens Branch	31	A	6/27/55	21.5	127	33	7.56	128	160	7.38	19	40	7	174	4.75	1,500
Stevens Branch	32	A	6/27/55	21.0	128	20	7.21			7.85	48	30	18	207	7.60	250,000
Stevens Branch	33	A	6/27/55	21.0	131	17	7.21	124 118	148	7.35	52	30	47	289	6.40	450,000
Stevens Branch	34	A	6/27/55	18.5	131	21	4.47	132	148	7.708.30	84	25	52	245		L,400,000+
Stevens Branch	35	A	6/27/55	18.0	127	19	3.78	124	146	8.55	9	10 10	4	180	10.80	95,000
Stevens Branch	36	A	6/27/55	16.0	129	17	4.12	126	146	8.40	6	10	9	172	10.00	25,000
Stevens Branch	37	A	6/27/55	15.5	121	21	4.12	120	142	8.40	4	10	3	172	10.85	45,000
Stevens Branch	38	A	6/27/55	15.5	114	35	2.40	117	149	8.55	5	10	2	158	10.30 9.60	4,500
Stevens Branch	39	A	6/27/55	18.0	100	28	2.75	103	128	8.25	8	20	õ	145 137	9.35	150,000 2,500
Jail Branch	40	A	6/28/55	20.5	113	24	4.81	109	137	8.60	38	15	31	211	10.30	4,500
Jail Branch	41	A	6/28/55	21.0	110	17	3.44	113	127	8.40	7	15	6	161	9.20	4,500
Jail Branch	42	A	6/28/55	19.5	110	17	4.47	115	127	8.15	3	10	4	162	9.20	9,500
Jail Branch	43	A	6/28/55	18.5	95	19	2.06	106	114	7.95	7	10	5	143	8.90	2,500
Orange Branch	44	A	6/28/55	17.5	82	17	1.03	90	99	7.95	4	10	3	121	7.65	150
Jail Branch	45	A	6/28/55	16.0	107	16	1.03	112	123	8.50	24	15	12	172	9.40	45,000
Kingsbury Branch	46	A	9/3/53	22.5	92	34	7.27	116	126	7.85	1	15	4	124	6.80	9,500

UNITED STATES DEPARTMENT OF THE INTERIOR GEOLOGICAL SURVEY

PREPARED IN COOPERATION WITH STATE OF VERMONT AGENCY OF ENVIRONMENTAL CONSERVATION, DEPARTMENT OF WATER RESOURCES

Surface water analyses show less contrast between the two areas (table 3) because samples of water from the streams represent a mixture of ground water and overland runoff. Analyses 11-14 were made on samples taken above the East Montpelier site, and analyses 20-26 were made on samples taken upstream from the Northfield test site. Calcium, hardness, dissolved solids, and pH are generally higher in water from the East Montpelier group than from the Northfield group, but the effects of differences in rock composition between the two groups are less obvious in the surface water analyses than in the ground water analyses.

REFERENCES

- Cady, Wallace M., 1956, Bedrock geology of the Montpelier quadrangle, Vermont: U.S. Geol. Survey Geol. Quad. Map GW-79.
- Doll, Charles G., 1961, Centennial geologic map of Vermont: Vermont Geol. Survey.
- Konig, Ronald H., 1961, Geology of the Plainfield quadrangle, Vermont: Vermont Geol. Survey Bull. no. 16.
- Murthy, Varanasi R., 1957, Bedrock geology of the East Barre area, Vermont: Vermont Geol. Survey Bull. no. 10.
- U.S. Public Health Service, 1962 (revision), Public Health Service drinking water standards: U.S. Dept. Health, Education and Welfare, Public Health Service, pub. no. 956, 61p.
- Woodruff, K. D., Miller, J. D., Jordan, R. R., Spoljaric, N., and Pickett, T. E., 1972, Geology and ground water: University of Delaware, Newark, Delaware, 40p.

TABLE 2. - - CHEMICAL ANALYSES OF GROUND-WATER IN THE BARRE-MONTPELIER AREA SOURCE OF DATA: A, U. S. GEOLOGICAL SURVEY; B, VERMONT DEPARTMENT OF HEALTH

TABLE 3. - - CHEMICAL ANALYSES OF SURFACE-WATER IN THE BARRE-MONTPELIER AREA

SOURCE OF DATA: A, VERMONT DEPARTMENT OF WATER RESOURCES; B, U. S. GEOLOGICAL SURVEY

PLATE 2, OCCURRENCE OF WATER IN UNCONSOLIDATED DEPOSITS IN THE BARRE-MONTPELIER AREA, VERMONT THICKNESS OF UNCONSOLIDATED DEPOSITS GROUND-WATER AVAILABILITY IN UNCONSOLIDATED DEPOSITS GROUND-WATER LEVELS

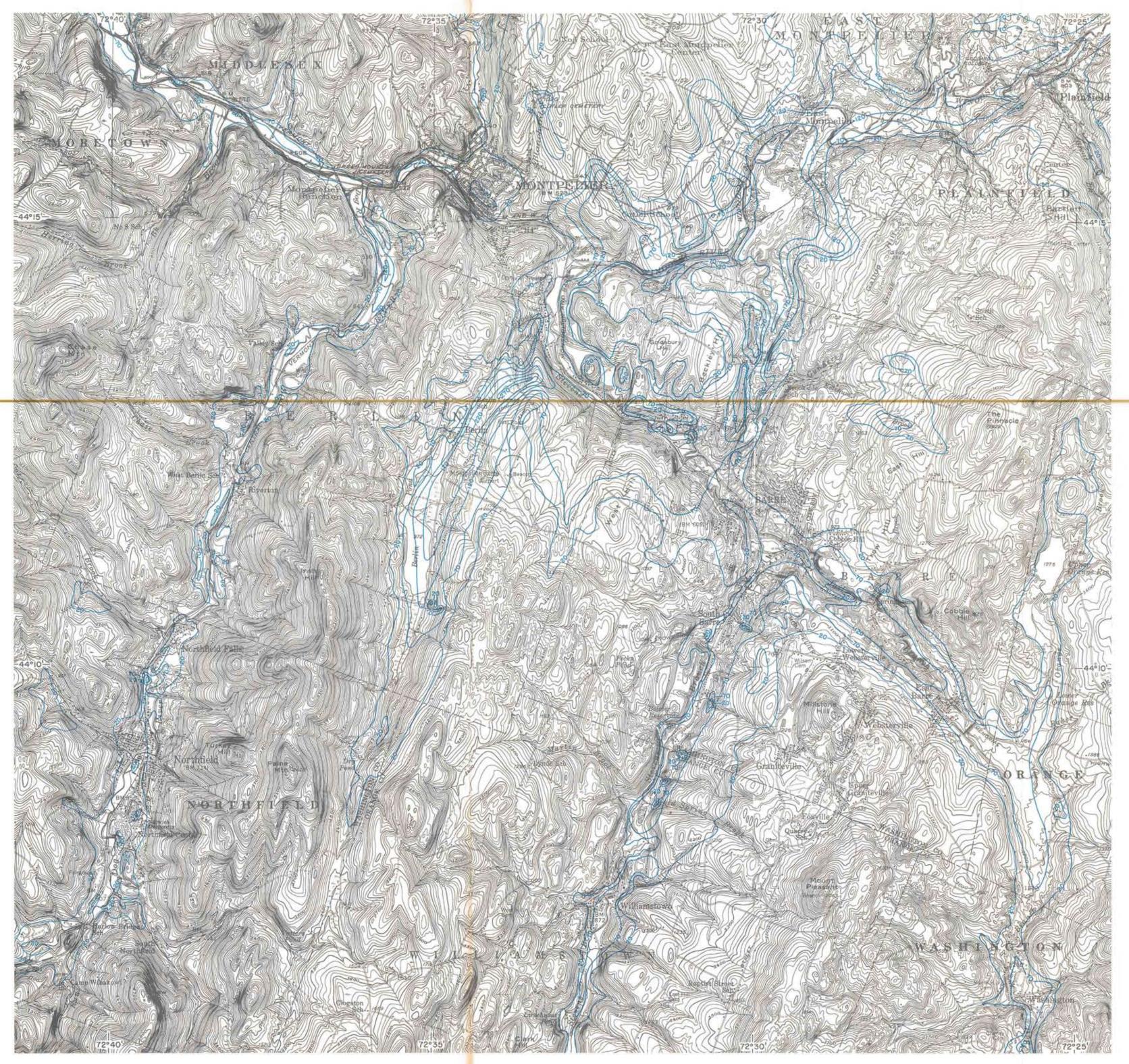


FIGURE 1, - - THICKNESS OF UNCONSOLIDATED DEPOSITS

THICKNESS OF THE UNCONSOLIDATED DEPOSITS

The thickness of the unconsolidated deposits overlying bedrock in the Barre-Montpelier area is illustrated in figure 1. Thickness ranges from zero on the many rock outcrops in the area to 303 ft (92 m) in Berlin (well BLW 17). Thickness and texture of these deposits is important because it affects their water-yielding properties and it may affect the yield and the cost of constructing bedrock wells. Thick deposits of clay or till may restrict the movement of recharge into bedrock fractures that are not part of a widespread fracture system, resulting in bedrock wells of low sustained yield. Conversely, thick deposits of sand and gravel may act as large storage reservoirs and, if connected with underlying bedrock fractures, could result in high sustained yields for bedrock wells. The cost of construction of a bedrock well is, in part, determined by the length of steel casing used to seal off overlying unconsolidated deposits. Knowledge of the length of casing required for a proposed well is useful in estimating the cost of the well.

SAND AND GRAVEL AQUIFERS

Deposits of sand and gravel have a higher permeability than any other subsurface materials in the Barre-Montpelier Area. At places where these deposits contain water, are sufficiently thick, and are connected to a source of recharge, they are capable of yielding large quantities of water to properly constructed wells (Hodges, 1969). Extensive beds

of coarse gravel were deposited in the valley now drained by the Kingsbury Branch, the Winooski River, Gunners Brook, Stevens Branch, and the Second Branch of the White River. Locations of sand and gravel aquifers having sufficient water-saturated thickness to yield large quantities of water are shown on figure 2. In addition, deposits of sand and gravel with sufficient saturated thickness to yield the quantities of water necessary for domestic, commercial, or light industrial use are shown on the same figure.

Pumping tests of the aquifer in East Montpelier show that the transmissivity is about 45,000 ft²/day (4,000 m²/day). It is estimated that the potential sustained yield is about 1 Mgal/day (4,000 m³/day). Additional information on aquifer testing is given in an earlier report, "Ground water availability in the Barre-Montpelier area, Vermont" (Hodges and Butterfield, 1972).

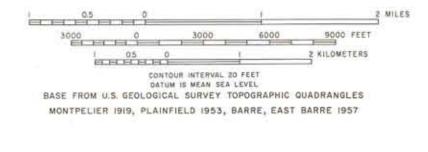
WATER IN FINE-GRAINED SEDIMENTS

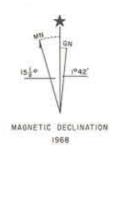
Deposits of fine sand, silt, and clay cover much of the Barre-Montpelier area below an altitude of 1,300 ft (400 m). The most prominent areas include the valley of Berlin Pond, part of Stevens Branch, and much of the Winooski River valley between Montpelier and Plainfield. These deposits (fig. 2) have low potential for ground water development. Even where saturated, they yield water at a very low rate because of their low permeability. Occasional intercalated lenses of coarser-grained materials may increase the yield of wells in these deposits.

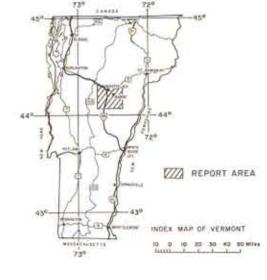
GROUND WATER RESOURCES OF THE BARRE-MONTPELIER AREA, VERMONT

EXPLANATION

_____ EO ____ LINE OF EQUAL THICKNESS OF UNCONSOLIDATED DEPOSITS 50 FOOT CONTOUR INTERVAL (15 METRES)







GROUND WATER IN TILL

Two types of till have been described in the Barre-Montpelier area by Stewart and MacClintock (1969). Basal till is a compact, gray mixture of material ranging in size from clay to boulders. It is often fissile, suggesting a subglacial origin. Ablation till is a loose mixture of brown sand, cobbles, and boulders containing minor amounts of silt and clay. Stewart and MacClintock ascribe the formation of this material to slow settling of supraglacial debris during ice-wasting. Water velocities were assumed to be only fast enough to remove clay and silt, while leaving the larger particles undisturbed. Thickness of the till ranges from less than 10 ft (3 m) in the uplands to many tens of feet (several tens of metres) in the valleys underlying the water-sorted sediments.

Most of the water taken from the till aquifer in the project area comes from large-diameter dug wells. Those wells penetrating basal till yield small quantities of water. Permeability of basal till is usually low because of the high percentage of the clay-silt component. If the well reaches the top of the underlying bedrock, however, a thin layer of permeable, water-bearing till is often found at the till-bedrock interface.

Dug wells finished in ablation till may yield adequate quantities of water for domestic use. Because ablation till has a low percentage of clay and silt, a loose matrix structure, and intercalated lenses of sand, its permeability is higher than that of basal till.

Almost all dug wells supplying water from till are located on hillsides or hilltops above the major stream valleys. Unless permeable zones in the till are directly connected to perennial streams, recharge is dependent upon local precipitation, and during drought, yield may become inadequate to meet domestic demand.

A. L. HODGES, JR., D. BUTTERFIELD, J. W. ASHLEY

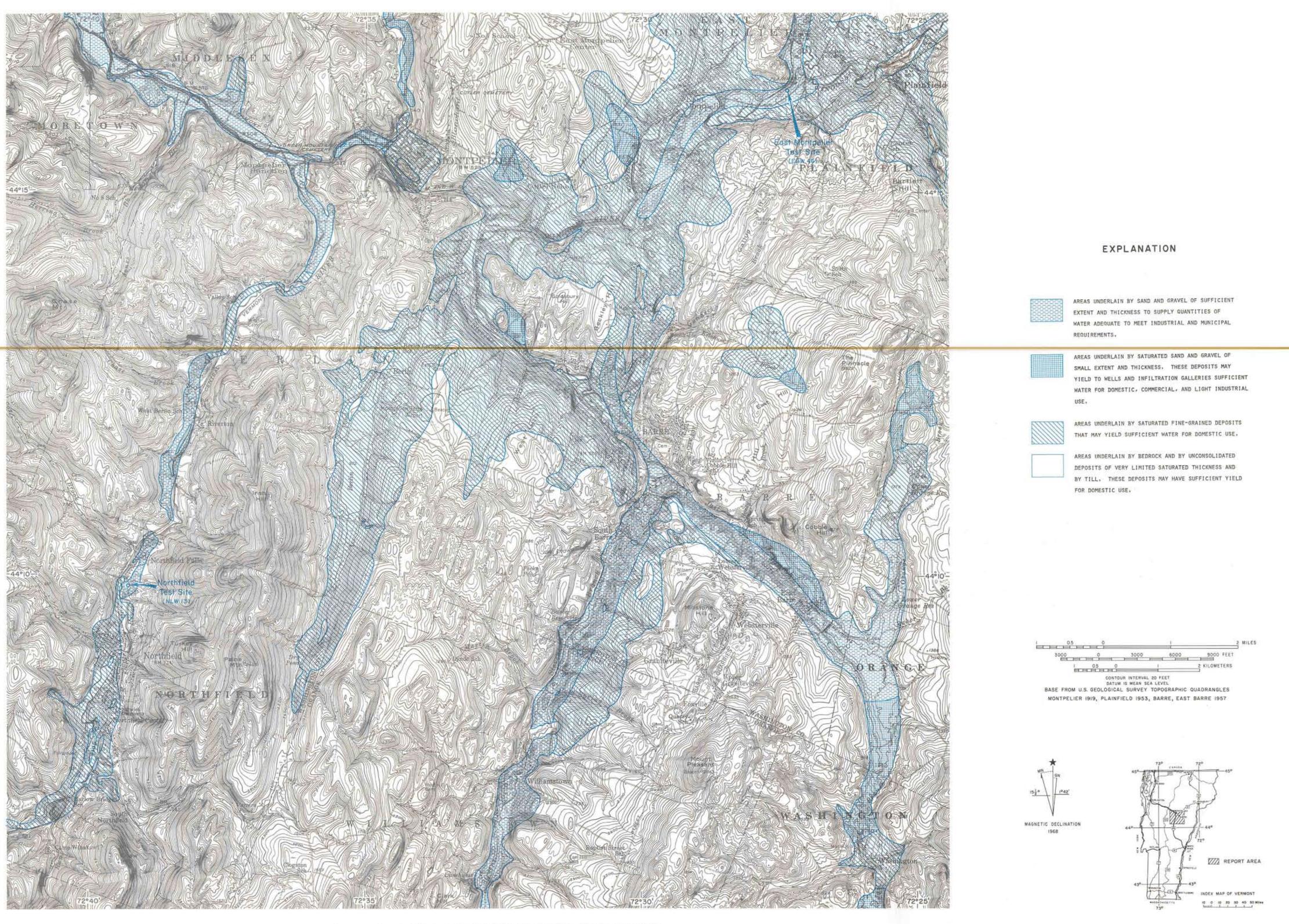


FIGURE 2, - - GROUND-WATER AVAILABILITY IN UNCONSOLIDATED DEPOSITS

RECHARGE AND DISCHARGE

Water movement into and out of the project area can be expressed by the following equation:

 $P = R + ET + \triangle S$

where P = precipitation R = runoff

ET = evapotranspiration

 $\triangle S = change in storage$

Inflow as precipitation is equal to runoff and evapotranspiration adjusted for changes of water in storage, largely as ground water.

Precipitation measured at the Barre-Montpelier Airport averages 34 in (860 mm) per year, and is somewhat greater during summer than during winter. Average yearly snowfall is 94.4 in (2400 mm) per year, but accumulations are greater at higher altitudes.

Evapotranspiration returns 14 in (360 mm) to the atmosphere each year through direct evaporation of surface water and snow, and through transpiration of living organisms. Evapotranspiration is greatest during the spring and summer growing season. Ground water storage and levels decline during this period (fig. 3), as trees and plants remove water from the soil and release it to the atmosphere as water vapor. Killing frosts in September or October end the yearly growth cycle, and, as transpiration declines, ground water storage increases and water levels begin to rise.

Approximately 20 in (510 mm) leaves the area each year as runoff; runoff includes water that runs directly over the land surface and water that seeps into the ground, recharges ground water bodies, and moves to points of discharge in the streams. Ground water discharge to streams forms a significant proportion of total streamflow and sustains streamflow during drought and periods of below freezing temperature.

When water in a stream is at a higher level than the water table in adjacent permeable materials, stream water may move into the materials, raising the water table. Wells adjacent to a river commonly have high sustained yields because pumping lowers the water table and induces water to flow from the river into the ground.

Monthly measurements of water levels in seven wells in the Barre-Montpelier area (fig. 3) reflect the continuous change of storage in the ground water body. All the wells measured are in unconfined aquifers and, therefore, respond rapidly to local recharge. Normally, water levels are highest in March or April, coinciding with melting of the snow pack and breakup of ice in the rivers, and lowest in September and October, at the end of the growing season. This sequence, however, can be modified substantially by excessive rainfall or prolonged drought.

REFERENCES

Hodges, A. L., Jr., 1969, Drilling for water in New England: New England Water Works Assoc. Jour., v. 82, no. 4, p. 287-315.

Hodges, A. L., Jr., and Butterfield, David, 1972, Ground-water availability in the Barre-Montpelier area, Vermont, addendum to "A rural comprehensive water and sewer plan for Washington County, Vermont, 1969": Vermont Department of Water Resources.

Stewart, D. P., and MacClintock, Paul, 1969, The surficial geology and Pleistocene history of Vermont: Vermont Geol. Survey Bull no. 31.

UNITED STATES DEPARTMENT OF THE INTERIOR GEOLOGICAL SURVEY

PREPARED IN COOPERATION WITH STATE OF VERMONT AGENCY OF ENVIRONMENTAL CONSERVATION, DEPARTMENT OF WATER RESOURCES

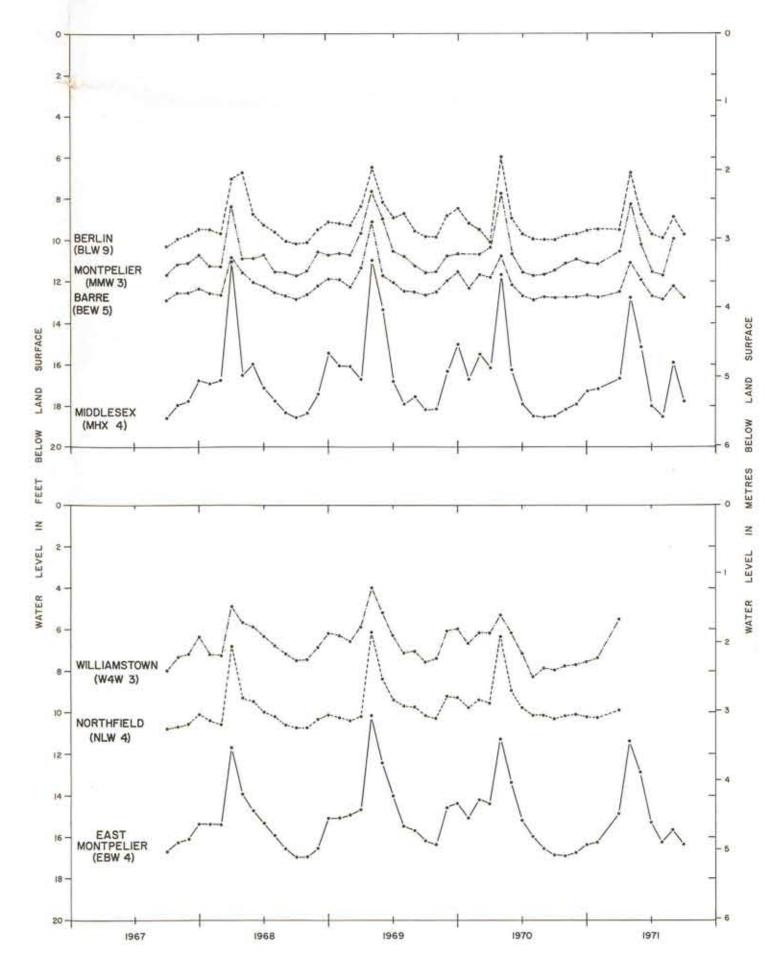


FIGURE 3, - - GROUND-WATER LEVELS IN THE BARRE-MONTPELIER AREA

PLATE 3. BASIC DATA FOR THE BARRE-MONTPELIER AREA, VERMONT LOCATION OF DATA POINTS TEST BORING INFORMATION DESCRIPTION OF SELECTED WELLS



TABLE 1. - - DESCRIPTION OF SELECTED WELLS, TEST WELLS, AND BORINGS

	THE PARTY DATES OF DEPENDENCE OF	and a second										
WELL OR BORING NUMBER: LET A - U. S. GEOLOGICAL SURVEY	AUGER BORING.		J	erlin (BL) Continued		East	Montpelier (EB)Continued	17 Suma View 17 Mark	City of	Montpeller (MM) Continued		
X - MISCELLANEOUS TEST BORI W - WELL, OR TEST WELL, T.D TOTAL DEPTH REACHED	DEPTHS IN FEET BELOW LAND SURFACE	GRANGER PROPERTY			CALEDONIA SAND 6		CLAY AND SILT (FILL AND SLUMP)	S MINTER STREET	0 - 2	CLAY	NORWICH UNIVERSITY	
	CITY OF BARRE (BE)		21 - 35	SANDY GRAVEL, BROWN TO GRAY, WII'S SILT AND SOME CLAY	N - 50	7 - 14	SAND, CLAY AND SILT MEDIUM TO COARSE SAND, YELLOW-BROWN, WITH SUE-	0.718	7 - 14	SAND # CLAY GRAVEL AND SAND	X + 1	21 - 42
SANITARY LANDFILL	COLUMN AND LES		35 - 42 41 - 55	SILTY PERSIEV SAND, GRAY, BRONN STLTY YEAR FINE AND FIRE SAND, AY-BRONN TERY FIRE SALE AND FIRE, BRONN		28 - 35	ANGULAR STONES SAND AND GRAVEL, GRAY-BROWN		14 - 29	STICKY GRAY ELAY GRADING TO MEDIUM AND COALSE GRAVEL		47 + 49
A = 1 0 - 1	6 FILL, T.D. ON REUROCK ON BOULDER			AST MONTPELLER (EB)	TOFANI MEADOW	35 - 63	LUMESE GRAVEL GRAV	MONTPELIER RECEEAT	29	T. D. ON BEDROCE OR POULDER		49 - 55
SMITH, MHITCOMB & COOK COMP.		ROBERT MORSE FAILM			X - 1	0 - 21	FINE SAND AND SILT NITH SOME CLAY AND VERY	R + 3	10% AREA 0 - 2	5011-		55 - 04
K - 5 0 -	7 FINE SAND, GRAVEL, BROWN, DRY	A - 1	D = 8 8	SAND AND GRAVEL T.D. ON BEDROCK OR BOULDER		21 - 23	SHARP PERSLES VERY FINE SAND TO CLAY, GRAY WITH SOME FINE		$\frac{1}{10} - \frac{10}{17}$	CRAVEL VERY FINE SAND, BROWN, WET	X - 2	0 · 7 7 · 20
7 - 1	GRAY, DRY	Λ = 2	0 - J	FINE SAND, YELLOW-SHORN SILTY FINE SAND, GRAY-BROWN, WET		28 : 35 35 : 77	TO MUDIUM SAND AND SOME SHARP PERRIES AND STOMES FINE SAND TO CLAY, GRAY VERY FINE SAND AND SILT, GRAY		$\frac{17}{22} - \frac{22}{27}$ $\frac{27}{27} - \frac{30}{30}$	FINE SAND, BROWN, NET FINE & SOME MERIUM SAND, BROWN, WET MEDIUM SAND, BROWN, RET		7 0 - 228 201 - 228 228 - 425 35 - 455 429
17 - 3 34 - 6	4 MEDIUM & COARSE SAND, MINOR GRAVEL, GRAY, WET 0 GRAVEL, WET		$\frac{2}{17} - \frac{17}{27}$ $\frac{17}{27} - \frac{17}{46}$	SILTY FINE SAND, GRAY, WET		77 -1165	VERY FINE SAND AND SILY, GRAY WITH A FEW SHARP FRACEENTS OF ROCE (NOSTLY PHYLLITE)		30 - 57	TILL, GLAY, DRY		28 - 35 35 - 42
60 - 6	5 TILL, GRAY, T.D. ON DEDROCK OR BOULDER BARRE TOWN (BP)		46 - 60 60 - 63	TILL OR GRAVEL REDROCK OR BOULDER			MEDIUM AND COARSE SAND. T.D. WITH WASHROD	CARLIERS DUTING THE		NORTHFIELD (NL)		49 - 56 56 - 65
KINGS PIT	DAGAE (UNA (AF)	A - 3	0 · 2 2 · 7	SOIL VERY FINE & FINE SAND, BROWN, DRY	X = 2	0 = 21 21 - 40	TO CLAY, GRAY NITH SOME SHARP STONES	NORWICH UNIVERSITY		SAND & GRAVEL, DRY, T.D. ON BOULDER		
A - 1 0 - 1			7 - 0	CLAY, BROWN, MOIST		40 - 65	STICKY CLAY, GRAY WITH VERY FINE SAND LAYERS WITH COARSE SUB-ANGULAR TO ROUNDED SAND GRAINS	A - 2		SAND & GRAVEL, DRY, T.D. ON BOULDER	X + 3	8 - 24
2 - 5 5 - 10 10 - 13	D TILL, GRAY, DAY		0 - 12 12 - 27 27 - 58	SILT & MINOR VERY FINE SAND, BROWN, WET SILTY VERY FINE SAND, BROWN, WET		05 - 79	AND PEBSLES VERY FINE SAND TO CLAY, MARD, BLUE-GRAY, WITH	A = 3		SAND & GRAVEL, DRY, T.D. ON BOULDER	LEON TUCKER FARM	
SNOWBRIDGE ROAD RIGHT-OF-WAY		MORRIS C. WYMAN FARM	58 - 61	TILL, T.D. ON BEDROCK OR BOOLDER		70	LARGE SHARP PRADUENTS OF LIMESTONE AS FUVLLITE (PROBABLY TILL) T.D. WITH MASHROD	Δ = 4	0 - 3	EOBLORES WITH SAND & GRAVEL VERY FINE SAND, REDNN, DRY	A + 1	0 - 1
A - I 0 - 4	FILL	A - 4	0 - 2	SOIL		1.9	MIDDLESEX (MH)		7 - 12	FINE SAND, SOME MEDTUH SAND, GRAY, DRY COARSE SAND, SOME GRAVEL, BROWN, MET		11 - 1
4 - 17 17 - 55	FINE TO VERY FINE SAND, GRAY-BROAN, MINOR		2 - 7	SILTY CLAY, CRAY-BROWN	SUNNY BROOK ROAD I	EXTENSION	Transformer (1997)		24 - 25	TILL, T.D. ON REDROCK ON BOULDER	EAST BARRE DAM FLO	OWAGE AREA
59 - 61	SILT, MINOR COARSE SAND TILL, GRAY		$\frac{22}{36} - \frac{36}{42}$	SILT, GRAY, SOUFY TILL	A = 2	0 - 7 7 - 17	TOP SOIL 4 SANDY SILT, BROWN FINE SAND TO SILT, BROWN, SOME STONES, WET	A - 5	1 - 8	SAND AND GRAVIL, DRY VERY FINE SAND AND SILT FINE SAND, ERONS, ULT	Λ + 2	2 - 1
A - 3 0 - 3	7 SILT AND FINE SAND, BROWN	A - 5	0 - 7	SOIL FINE SAND, MROWN		17 - 32	VERY FINE & FINE SAND, BROWN, MINOR MEDIUM TO COARSE SAND, SOME SILT		12 - 17 12 - 20 20 - 27 27 - 35	SAND # CRAVEL		$ \begin{array}{r} 10 & -1 \\ 17 & -3 \\ 30 & -3 \end{array} $
7 - 41	MINOR SILT & STONES, YELLOW-BROWN		7 - 17	CLAY, BROWN, MOIST CLAY & SILT, BROWN, MET		32 - 49 49 - 60	MEDIUN TO COARSE SAND WITH FINE TO COARSE	40 G	35 - 36%		A - 3	
41 = 25 86 - 83	SCATTERED GRAVEL		27 + 50 50 - 60 60 - 65	CLAY, SILT & FINE SAND, BROWN, MET FINE & MEDIUM SAND, BROWN		60 - 65	GRAVEL, RED-BROWN, HIGH IRON CONTENT GRAVELLY TILL, GRAY	Λ - 6	0 - 2	SILTY CLAY SILTY SAND & FINE GRAVEL, DRY		5 - 1
33 - 92	SAMDY TILL, GRAY		65 - 70	VERY FINE GRAY SAND TILL, BLUE & GRAY, DRY	A - 2	0 · 17 17 · 22	SILTY VERY FIRE & FINE SAND, BROWN		9 - 10 10 - 50 50 - 55	GRAVEL MEDIUM SAND, SOME GRAVEL, SOME SILT		12 - 2
92 -103 105 -106	5 TILL, GRAY. T.D. GN REDROCE OR BOULDER		0 - 2 2 - 15	SOIL SAND, SOME GRAVEL, BRONN		$\frac{72}{42} - \frac{42}{52}$	SILTY SAND AND GRAVEL, BRONN, WEY FINE & MEDIUM SAND, GRAY-BROWN, MINON COARSE		55 - 59 50 - 60	VERY FINE SAND, WROND, SCHE FINE SAND & SHIT TILL, RED BROWN, WITH MASHED TILL SURFACE	$\Lambda = \Lambda$	9 - 1
ALEX LAFERRIER PROPERTY	TOP SOIL		15 - 57 37 - 67	CLAY, BROWN, STICKY SILT 4 VERY PINE SAND, BROWN, WIT		\$2 - 57 57 - 77	SAND SAME HITH STREARS OF CLAY, GRAY COARSE SAND, GRAY, SOME FINE SAND, SOME COARSE	A = 7	0 - 4	FINE SAND, BROWN, AND SILT		12 - 1 17 - 1
A = 4 0 = 2 2 = 22			67 - 27 77 - 86 86 - 97	VERY FIRE SAND, BROKN, HET FIRE SAND, SOME MEDIUM SAND, GRAY, WET TILL, HLUE & CRAY, DRY			GRAVEL TILL, GRAY, T.D. ON MEDROCK OR MOULDER		$\frac{4}{10} = \frac{10}{27}$	SILTY COARSE GRAVEL, BROWN, WEIT AT 10 FEET SILTY AND FINE SAND, BROWN, MINOR COARSE SAND TO FINE GRAVEL (SHARP) FRAGENTS SILTY FINE SAND TO FINE GRAVEL, BROWN		31 - 4
22 - 23	7 VERY FINE SAND, YELLOW-BRONN, SILT AND CLAY, MOIST TO MET.		8 - 2	501L	ON 3-MILE BRIDGE		the source of source of sources		$\frac{27}{37} = \frac{37}{40}$	SILTY FINE SAME TO FINE GRAVEL, BROWN WEATHERED TILL, BROWN	LORD'S GRAVEL PIT	
27 - 55			$ \begin{array}{ccccccccccccccccccccccccccccccccc$	FINE SAND, BROWN, DRY CLAY, BROWN & GRAY, NOIST	X + 1	0 - 21	TOPSOIL OVER SANDY SILT, YELLOW-BROWN, WITH SOME FINE SAND AND PERSLES		48 - 42	PRESS TILL, LIGHT GRAY, T.D. ON REPROCE OR NOULDER	n - a	7 - 1
59 - 75 70 - 85	YELLON-BROWN, MOIST			SILTY CLAY, ERONN & GRAY, HOIST SILT, BROWN & GRAY, MET SILTY VERY FINE SAMD, BROWN-GRAY, MET		21 - 55	FINE AND MEDIUM SAND WITH A FEW PEBBLES, YELLOW-BRONN	A - 8	8 - 5	SILTY CRAVEL, BROWN, CMAY BE FILL),		12 - 1 17 - 2 22 - 3
A + 5 0 + 1	Address of the second se	1	11 -115	TILL, BLUE-GRAY, BRY		35 + 43	FINE SANDY GRAVEL, YELLON TO GRAY-BROWN, WITH SHARP FRACMENTS AND SILT TO FINE SAND.	A = 9	9 - 2	T.B. ON MEDROCK OR MOULDER SILTY FINE SAND, BROND		30 - 3
17 - 2	MINOR STONES 2 SILT AND VERY FINE SAND, GRAY-BROWN	MILLIAM MORAN PROPER					T.D. ON REDROCK OR BOULDER	0 T 2	2 - 6	COARSE GRAVEL DAY BE FILL) SILT, TELLOW-BROWN, WITH FIME SAND AND COARSE	A = 6.	
22 + 2	GRAVEL AT 24 FEET		$ \begin{array}{c} 0 & = & 2 \\ 1 & = & 7 \\ 7 & = & 15 \end{array} $	TOP SOIL SILTY VERY FINE SAND, MOIST, BROWN COMESE SAND, GRAY-BROWN, MET	FORMER U. S. ROUT				24 - 27	SAND FRADENTS SANDY TILL, SECTO		12 - 1
27 - 6	TIONS		15 - 27 27 - 47	SILT & VERY FINE SAND, GRAY NITH SHARP BLACK	X - 5	1	FILL. T.D. ON OLD ROAD FILL AND BOULDERS HARD COMPACT FILL AND BOULDERS	A - 10	0 - 5	SILT AND VERY FINE SAND, BRONN SILTY GRAVEL, BRONN	Α - Τ	0 -
42 < 8	SAND TO PEBBLES 7 SILTY GRAVEL, GRAY-BROWN		47 = 52	ROCE FRAGMENTS INCREASING WITH DEPTH	A = 3	4 - 23	SILT AND VERY FINE SAND, BROWN, SOME STONES AND PERSLES		5 - 7 7 - 12 12 - 77	SILTY FINE SAND, GRAY-BROWN, SOME FINE GRAVEL SILTY FINE SAND, GRAY-BROWN, WITH SOME CLAY		7 - 1
87 - 9	FRACHENTS	A: + 9	0 - 2	VERY FINE SAND AND SILT, BROWN, DRY		21 - 35	AND PEBBLES		77 - 88	AND SOME COARSE SAND PARTICLES SILTY SANDY TILL	CONDARD COLLEGE RE	ECREATION
92 -10 102 -10	2 SILTY SAND, BROWN, TILL 7 SANDY, SILTY CLAYEY TILL, BROWN		$\frac{2}{7} - \frac{7}{17}$	FILL, WET FINE AND VERY FINE SAND, GRAY			FINE TO MEDIUM SAND, GRAY, WITH SILT AND CLAY, BECOMING COARSER WITH DEPTH FINE TO COARSER SAND, GRAY		85 - 92	and the second se	A - 1	0 -
SPRINGHOUSE SCHOOL		Λ - 10	5 - 7	SILT AND VERY FINH SAND, BRONN, DRY SILT, BROWN & GRAY, NET		70 - 87	MEDIUM TO COARSE SAND, GRAY, T.D. WITH WASHROD	Λ - 11		SOIL VERY FINE SAND WITH COBBLES & BOOLDERS, BROWN SAND & GRAVEL, BROWN, WHT		7 : 1
A - 6 9 - 9		67 - 6220		VERY FINE SAND & SILT, BROWN & GRAY			ITY OF MONTPELIER (MM)		12 - 52	VERY FINE SAND TO CLAY, GRAY, WET VERY FINE SAND, GRAY, WET		15 - 4 40 - 4
A - 7 0 - 40 A - 8 0 - 1	b BOULDERT SAND AND GRAVEL 5 BOULDERY SAND AND GRAVEL		10 - 17	SILT, BRONN SAND & GRAVEL, BRORN, WITH SILT VERY FIME SAND, GRAY WITH SILT	MONTPELIER RECREAT		STITE VERY STUD CIVE BOTH		70 - 75	TILL, T.B. ON REDROCK OR BOULDER		45 - 6
200000 20 11	7 BOULDERY SAND AND GRAVEL	MOREIS C. WYMAN FARM		TEAT FARE DAMP, MEAT NALL SALT	A - 1	7 = 10	SILTY VERY FINE SAND, MEONN SILTY VERY FINE SAND, WET FILL, GRAY-CREEN, T.D. ON MEDROCK ON BOULDER	W = 8	4 11	BOULDURS FINE SAND, SOME COARSE, GRAY-BROWN, DRY FINE TO COARSE SAND, SOME GRAVEL, BROWN, WIT	A = 2	0 - 1 10 - 1
100-00 BL	HERLIN (BL)	W - 4	0 · 2 2 · 7	5011	A - 1	0 = 8	NAME AND GRAVEL, SOME COBBLES, DRY		28 4 29	TILL. T.D. ON BEDROCK OR BOULDER		15 - 2 21 - 2
JORDAN-MILTON COMPANY			7 - 17 17 - 27	SAND, SILT & CLAY, BROWN, HOIST SILTY VERY FINE SAND, BROWN, SOUPY SILTY CLAY, BROWN, SOUPY		12 - 28	FINE SAND, BROWN, WET FINE 5 MEDIUM SAND, BROWN, WET	JOHN COVEY GRAVEL				27 - 41
	7 FINE BAND, BROWN AND GRAY GRAVEL WITH BROWN SAND & SILT		27 - 37 37 - 42	SILT, BROWN, SOUPY SILTY VERY FINE SAND, CRAY MET		35 - 38	COARSE SAND & GRAVEI SAND BOULDERY TILL	W - 9	0 = 28 28 + 35	SILTY GRAVEL, GRAV-BROWN, WITH SHARP TO SUB- ANGLUAR PEBBLES COARSE GRAVEL, GRAY-BROWN, WITH SHARP TO SOME-		
37 + 4	1 VERY FINE SAND, GRAY, SOUPY 3 REBROCK OF BOULDER		42 - 53 53 - 58	FINE & MEDIRI SAND, BROWS, WET SAND & GRAVEL OF WASHED TILL	A - 3	0 - 2	SOIL		35 + 40	MAAT ROUNDED FRACHENTS SILTY FINE SAND, GRAY-BROWN, WITH SOME PEBBLES.	WASHINGTON SCHOOL	4
STATE HIGHWAY DEPARTMENT HE		CALEDONIA SAND 5 GRA		TILL		2 - 6 6 - 10	COBBLES CLAY, BROWN & GRAY, LAMINATED			T.D. WITH MASHROD	A + 1	2 3
A - 7 0 -		17 - 46		SILT		$\frac{10}{22} - \frac{22}{27}$	SILTY FINE SAND, BROWN, WET FINE SAND, BROWN, MET FINE & MEDIUM SAND, BROWN, WET	K = 11	0 - 28	SHARP FRACHENTS		10 - 1
17 1 1	2 SAND, FIRE TO MEDIUM, GAAY-BRONN, KET 7 CLAY, GRAY, SOUPY, MINOR SAND		4 - 11	FINE SAND AND GRAVEL BROWN		34 - 47	MASUB TILL MARD TILL, CRAY		28 - 35 35 - 42 42 - 49	DEDULT TO COARSE SLITY SAND COARSE SAND TO FINE CHAVEL WITH SILT FINE TO COARSE SAND, SOME SLIT.		
27 - 5	n CLAY, GRAY, MOIST TO NET 0 TILL, SANDY, NLDE-GRAY		194 - 32 32 - 57	SAND AND GRAVEL, BROSH COARSE SAND AND ERAVEL, GRAY BOULBERS	A - 4	0 - 2	SOIL		48	T.D. IN MARD SILTY FIXE SAND	LACILLADE LUMMER C	COMPANY
CENTRAL VERMONT RAILWAY, IN				COARSE GRAVEL AND BOULDERS		$\frac{2}{10} - \frac{10}{13}$	COBBLES SILT, SAND & MINOR GRAVEL, BROWN, WET	W - 30	21 - 42		17 + 3	8 - 1
W - W 2 2		¥ - 47	0 - 14 14 - 21	CLAY, SAND AND STONE (FILL AND SLURE) FINE TO MEDIUM SAND TO FINE GRAVIE.		24 - 47	WASHED TILL & HARD TILL	W		MARD SILT AND CLAY, GRAY-BROWN. MATERIAL SUMMLAR TO THAT OF OTHER HOLES,		8 - 1 17 - 7 22 - 5 51 - 7
7 - 1	11 FINE SAND, SOME COARSE SAND AND GRAVEL, GRAY, MOIST		21 - 28	FINE TO MEDIUM SAND, YELLON-BRONN WITH GRAVEL,	A - 5	2 - 10	SOIL CLAY, GRAY	e - 44	2 C N	(FOR PURPOSE OF SETTING DELAYED BRAINAGE ONSERVATION WELL)		70 8
12 - 1	FINE SAND, GRAY, SOME MEDIUM SAND		28 - 37 57 - 624	FINE SAND, GRAY, WITH A FEW PERSIES SAND, GRAY AND COANSE GRAVEL, T.D. ON BOULDER		$ \begin{array}{r} 10 - 15 \\ 13 - 18 \\ 18 - 30 \end{array} $	FINE SAND, BROWN, MET	1 - 15		HEDILE SAND AND CRAVEL, GRAY	TOWN OF MARRS PIT	
22 = 3 37 = 4 42 = 5	12 FINE SAND, SOME MEDIUM SAND, GRAY	W - 49	9 2 1	CLAY, SAND AND GRAVEL (FILL AND SLUMP) FINE TO COARSE GRAVEL	DUTTON CONCRETE CO				60 - 67	MEDIUS SAND AND GRAVEL, GRAY MITH LAYERS OF FINE SAND AND SILT FINE SAND AND SILT, YELLOW- MEDMAN WITH BOME	A = 1	0 - 1 12 - 2
51 - 5	TILL, T.D. ON AMMROCK OR BOULDER		14 - 624	COARSE GRAVEL WITH LITTLE SAMP	A = 6	0 6 7	FILL, SANDY		67 - 72	THEFT SAND AND STATE, THEFT NEWS WITH SOLE THEFTUL SAND AND GRAVEL MEDIUM SAND AND GRAVEL WITH SOME FINE SAND		$\frac{12}{23} = \frac{2}{4}$
						0 - 35 35 - 45	FILL BOULDERY CRAVEL CLAY, SILTY, CRAY-BROWN, MOIST TO MET TILL		76 - 98	AND SILT MEDICAL TO COARSE GRAVEL WITH SOME FIRE TO	A ~ Z	a - 1
					$\lambda = \tau$	0 . 2	#flr			COARSE SAND. T.B. IN SLATE BEDBOCK		17 - 1 17 - 1
					(provide the second	2 - 11 11 - 15	VERY FINE SAME & SILT, BROEN, MOIST CONELTS CLAY, GRAY, SOURY					11 - 1
						15 : 37 37 : 44	TILL, GRAY, DRY, T.D. ON MEDROCK ON BOULDER					

FIGURE 1. - - LOCATION OF DATA POINTS

EXPLANATION

- WELL FINISHED IN BEDROCK
- O MELL FINISHED IN UNCONSOLIDATED DEPOSITS

RADING: A - AUSER, X - MISCELLANEOUS

PUBLIC WATER SUPPLY WELL

- ORSERVATION WELL
- SURFACE WATER QUALITY SAMPLING STATION

NUMBER INDICATES NUMBER OF WELL, BORING (PLATE 3. TABLES | AND 2) OR WATER QUALITY SAMPLING STATION (PLATE |, TABLES | AND 2)

3000 0 3000 6000 9000 FEET CONTOUR INTERVAL 20 FEET DATUM IS MEAN SEA LEVEL BASE FROM U.S. GEOLOGICAL SURVEY TOPOGRAPHIC QUADRANGLES MONTPELIER 1919, PLAINFIELD 1953, BARRE, EAST BARRE 1957

15 0 1042 MAGNETIC DECLINATION 1968



Northfield (NL) Continued									
NORVICH 1	INTVERSITY								
	X + 1	.0 21	â	21 42	SILT AND VERY FINE SAND WITH LAYERS OF PERBLES SILT AND VERY FINE SAND WITH MEDIUM TO COARSE				
		42	÷	49	SAND, SAND PORTION INCREASES WITH DEPTH SILTY FINE SAND, GRAY-BROWN, WITH SOME MEDIUM				

49 - 55 SILTY HEDION TO COARSE SAND TO FINE GRAVEL, CRAY-BRONN 55 - 64 SILTY FINE SAND TO FINE AND MEDIUM ROUNDED GRAVEL. T.D. REFUSAL WITH WASHEDD

X - 2
 C - 7
 TOP SOIL OVER CLAY AND SILT
 7 - 20
 SILT AND COARSE SAND VITH SHARP PEA-SILED STONES
 21 - 28
 SILTY COARSE SAND
 23 - 35
 SILTY FINE TO COARSE SAND
 35 - 42
 SILTY FINE TO COARSE SAND
 35 - 42
 SILTY FINE TO COARSE SAND
 42 - 51LTY VERY FINE TO COARSE SAND
 43 - 56
 SILTY FINE SAND TO FINE GRAVEL, BRONN-GRAY
 64 - 65
 CLAYEY, SILTY FINE SAND TO FINE GRAVEL, BRONN-GRAY

X + 3 # - 24 FILL, LOSS, ETC.

LEON THEKE FARM A - 1 0 - 11 FILL, BOULDERS TO CLAY 11 - 15 GRAVEL 15 - 21 TILL, GRAY

A - 4 0 - 2 SOIL 2 - 12 FINE 4 MEDIUM SAND GRAY 13 - 17 COARSE SAND 4 GRAVEL 17 - 51 CLAY, GRAY, WET 31 - 42 TILL, GRAY, DRY

A - 5 0 - 7 SAND, GRAVEL & BOULDERS, DRY 7 - 12 FINE SAND, REDUX, DBY 12 - 17 FINE SAND, BROWN, DRY 17 - 22 FINE & MEDIUM SAND, BROWN, DRY 17 - 23 SILTY FINE SAND AND SOME FINE GRAVEL, REDWN, WET 10 - 34 SANDY TILL, GRAY, T.B. ON REDROCK OR BOULDER A - 6 0 - 7 SAND & BOULDERS, BROWN, DRY 7 - 12 COBBLES, DRY 12 - 21 SANDY TILL, GRAY, DBY, T.B. ON REDROCK OR POULDER A - 7 0 - 7 SAND & COLORY, DRY, 12 - 21 SANDY COMPLY, DRY, T.B. ON REDROCK OR POULDER

A - 7 0 - 7 SAND & GRAVEL, SROWN 7 - 16 SANDY TILL, GRAY, T.D. ON BEDROCK OR BOULDER

NOT 1.2. GRAYWASHINGTON SCHOOLA + 102SOTL710FINE SAND, WET, GRAY-BRONN1017TILL, GRAY1017TILL, GRAYWILLIAMSTONN (W4)LACILLADE LUMMER COMPANYW = 3008SAND § GRAVEL, GRAY, SILTY, WET1017SAND § GRAVEL, GRAY, SILTY, WET1017SAND § GRAVEL, GRAY, SILTY, WET1722FINE SAND, GDAY, WET1223FINE SAND § GRAVEL, GRAY, SILTY, WET1722FINE SAND § GRAVEL, GRAY, SILTY, WET1722FINE SAND § GRAVEL, BOULDERS7095%TILL, CLATEY, HEW FERBLES, T.D. ON BEDROCKOR ROLLEUROR ROLLEURTOWN OF MARKE PITA - 1A - 10- 1312- 25FINE SAND TO CRAVEL, BRONN, DRY23- 4112- 25FINE SAND TO PUBLIES, GRAY, BUY, T.J. ON REDROCK OR BOULDERSA - E627713WERP FINE SAND TO PUBLIES, BRUNG, DRY12- 1312- 1312- 1312- 1312- 1312- 1312- 1312- 1312- 1312- 1312- 1312- 1312- 1312- 1412

GROUND WATER RESOURCES OF THE BARRE-MONTPELIER AREA, VERMONT A. L. HODGES, JR., D. BUTTERFIELD, J. W. ASHLEY 1976

TABLE 2, LOGS OF SELECTED WELLS, TEST	WELLS, AND BORINGS		
LDCAL WELL NUMBER: LETTER PREFIX INDICATESA, U.S. GEOLOGICAL SURVEY AUG M, MELL OR TEST WELL I X, MISCELLANEOUS TEST BORING. LATITUDE-LONGITUDE: NUMBER FOLLOWING DECIMAL POINT IS & SEQUENTIAL NUMBER		LOCAL ALTI- WELL LATITUDE- NUMMER LONGITUDE ALTI- NUMMER LONGITUDE OF LSD UNER OR USER METHOD DIAM-IFIN-IDEPTHIUSE TO BEARING LEVELIDATE IUSE VIELDI OD ITIME LOG OW DRILLED ETER IISH I I DED- MATERIAL IMEAS-I I I (IN) I (FT) ROCK (FT) IURED I (GPMIIIFTII(HR) BERLIN (BL)CONTINUED	LOCAL ALTI- VEAR/ WELL FEET WATER- WATER PUMPAGE WELL LATITUDE- TUDE OWNER OR USER METHOD DIAM-IFIN-IDEPTHIUSE TO BEARING LEVELIDATE IUSE VIELDI OD ITIME LOG OW NUMBER LONGITUDE OF LSD DRILLED ETER ISH I BED- MATERIAL IMEAS-I I I (FT) (IN) I IFTII ROCK (FT) IURED I (GPHILIFT)I(HR) HIDDLESEX (HH)CONTINUED
ALTITUDE OF LAND-SURFACE DATUM: ALTITUDES ARE EXPRESSED IN FEET ABOVE HEAN SEA LEVEL; METHOD DRILLED: A, AIR-ROTARY; B, BORED OR AUGERED; C, CABLE TOOL; D, DUG; H, HYDRAULIC-ROTARY; J, JETTED; P, AIR- PERCUSSION; R, REVERSE-ROTARY; T, TRENCHED; V, DRIVEN; H, DRIVE-WASH. WELL FINISH: C, PORDUS CONCRETE; F, GRAVEL WALL WITH PERFORATED OR SLOTTED CASING; G, GRAVEL WALL WITH CONMERCIAL SCREEN; H, HORIZONTAL GALLERY OR COLLECTOR; O, OPEN EMD; P, PERFORATED OR SLOTTED CASING; S, SCREEN; T, SAND POINT; W, WALLED OR SHORED; X, OPEN HOLE IN AQUIFER (GENERALLY CASED TO AQUIFER).		<pre># 2% 441427N0723222.1 550 01N0EHS HUT 1957 - 6 % 85 * 5 3 -57 C 7 # 2% 441522N072357.1 540 LASCELLES # 1955 C 8 % 208 * 4 5 -555 # 15 # 2% 441255N0723459.1 1040 LAW MBS T 1967 # 6 % 70 * 8 CO 12 7-07 # 15 1 0 - # 2# 441255N0723459.1 960 MESSIEH JOSEPH 1967 # 6 % 100 * 22 F 12+67 # 12 0 - * 29 441413N0723558.1 550 STILLVELL JOHN 1967 # 6 % 100 * 15 5 -67 H 3 2 D - * 30 441425N0723220.1 550 OLSEN & 1968 # 6 % 250 * 51 10 7-68 # 6 2 D - * 31 441425N0723220.1 550 OLSEN & 1968 # 6 % 250 * 51 10 7-68 # 6 2 D - * 32 441347N0723318.1 550 ROGEN BONALD C 1955 C 6 % 180 * 100 F -55 C 12 C</pre>	W 29 44153800723648.1 520 RICH & PERD OIL 1969 A 6 0 51 K R C 50 0 - W 31 44155900723739.1 500 NICHOLS LEO 1970 P 6 X 142 K 41 10 10-70 H 10 0 - W 32 44165200723628.1 1160 NELSON 1970 P 6 X 245 K 111 LN 6 10-70 H 2 0 - W 33 44711M0724032.1 1660 NELSON 1970 P 6 X 245 K 111 LN 6 10-70 H 2 0 - W 33 44711M0724032.1 500 LAUMDRY CHESLEY 1972 P 6 X 165 K 85 50 12 1-72 H 20 0 - W 35 441527M0723700.1 500 ESULTOK THOMAS 1972 P 6 X 1455 K 40 LN 8
WELL DEPTH: DEPTH OF FINISHED WELL, IN FEET BELOW LAND SURFACE. WELL USE: A, ANODE: D. DRAINAGE: G. SEISMIC HOLE: H. HEAT RESERVOIR: D. D U. UNUSED: W. WATER WITHDRAWAL: X. WASTE DISPOSAL: Z. DESTROYED. WATER-BEARING MATERIAL: PRINCIPAL WATER-BEARING ZONE.	BSERVATION: P. DIL OR GAS: R. RECHARGE: T. TEST:	H 34 441354N0723357.1 930 HOSE ROBERT 1966 P 6 8 130 H 17 30 8-68 H 1 1 0 H 35 441351N0723702.1 550 SEAHS WALTER 1968 P 6 A 115 H 15 6 H 1.5 0 H 36 441255N0723427.1 970 SOMERS FRED 1968 P 6 X 195 H 60 H 10 0 H 37 441307N0723417.1 970 TURKER RAY W 38 441305N0723417.1 960 VT REGIONALLIE 1968 P 6 X 130 H 30 12 10-67 H 20 1 0 W 38 441305N0723417.1 960 VT REGIONALLIE 1968 P 6 X 130 H 30 12 10-67 H 20 1 0	X 3 441603N0723729.3 520 US GEOL SURVEY 1970 ¥ 2 0 87 T U U 6 - MONTPELIER CITY (MM) A 1 441646N0723423.2 530 US GEOL SURVEY 1967 B 4 X 12 T U U G - A 2 441646N0723423.3 530 US GEOL SURVEY 1967 B 4 X 41 T U 0 G - A 3 441646N0723423.4 530 US GEOL SURVEY 1967 B 4 X 50 T U G - A 3 441646N0723423.4 530 US GEOL SURVEY 1967 B 4 X 50 T U G -
I VERY FINE GRAINED 2 FINE GRAINED 3 HEDIUM GRAINED 4 COARSE GRAINED 5 VERY COARSE GRAINED 6 CLAYEY 7 SILIY 8 SANDY 9 GRAVELLY 0 CAVERNOUS A ARGILLACEDUS 9 ROULDERY 1 C CALCAREDUS 1 D DENSE 1 C CALCAREDUS 1 D DENSE 1 C CALCAREDUS 2 C CALCAREDUS 3 D DENSE 1 C CALCAREDUS 3 D DENSE 4 C GRANULAR 1 INTERBEDBED 3 JOINTED OR FRACTURED 4 COLUMNAR 4 L LAMINATED OR BANDED 5 MONCALCAREDUS 1 O ORGANIC 9 PODRLY SORTED 0 ORGANIC 9 PODRLY SORTED 1 NEDBED 1 D DENSE 1 D D DENSE 1 D D D D D D D D D D D D D D D D D D D	ITHOLOGY ISECOND CHARACTER) ALLUVIUM SEDIMENTARY ROCK, UNCLASSIFIED CONGLOMERATE DOLOMITE GYPSUM DR ANHYDRITE SHALE GRAVEL IGNEOUS, GRANUTE, ETC.1 IGNEOUS, GRANUTE, ETC.1 IGNEOUS, APHANITIC DR GLASSY (BASALT, ETC.) IGNEOUS, UNCONSOLIDATED (TUFF, VULCANIC ASH) SAPROLITE LIMESTONE MARL OR SHELL MARL METAMORPHIC, COARSE GRAINED IGNEISS, MARBLE, OUGARTITE1 METAMORPHIC, FINE GRAINED ISCHIST, SLATE1 CLAY SILT OR LOESS SAND AND GRAVEL SAND ILL UNCONSOLIDATED SEDIMENT	<pre> Y 19 4414158407232547.1 530</pre>	A 4 441640723423.5 530 US GEOL SURVEY 1967 H 4 X 47 T U 0 - A 6 4414284072323.1 540 US GEOL SURVEY 1967 H 4 X 45 T
T "SALT AND PEPPER" & W UNCONSOLIDATED X V SEMICONSOLIDATED X	SADSTONE SILTSTONE SILTY SAND CLAYEY GRAVEL OTHER	* 66 44130540723327.3 1000 8E9LIN NUMSING 1969 P 6 X 295 * 14 CO 15 6-69 T 40 2 0 - * 67 441320N0723358.1 950 ARMORY BERLIN 1969 P 6 X 448 * 140 0 T 4 T 4	w 26 441553N0723329.1 B40 TRACEY H A 1968 P 6 X 170 w 6 CO 45 11-68 H 60
Y SHALY OR SLATY I WEATHERED WATER LEVEL: LEVELS ARE GIVEN IN FEET BELOW LAND SURFACE; "+*" INDICATES W. FLOWING WELL. WATER USE: A. AIR CONDITIONING: B. BOTTLING: C. COMMERCIAL: D. DEWATERING H. DOHESTIC; I. IRRIGATION: M. MEDICINAL: N. INDUSTRIAL (INCLUDES MINING T. INSTITUTIONAL: U. UNUSED; V. REPRESSURIZATION; W. RECHARGE: X. DESALIN SUPPLIES. PUMPAGE/YIELD: IN GALLONS PER MINUTE (GAL/MIN). PUMPAGE/TARAWDOWN: THE DIFFERENCE BETWEEN STATIC WATER LEVEL AND PUMPING LI SUPPLIES. PUMPAGE/TIME: THE FOLLOWING CODES ARE USED FOR PUMPING PERIODS OF LESS TH SO MINUTES; C. 31 TO 45 MINUTES; D. 46 TO 59 MINUTES. LOG: D. DRILLER'S LOG: E. ELECTRIC LOG: G. GEOLOGIST'S LOG (*LOG AVAILABLU QW) TYPE OF CHEMICAL ANALYSIS AVAILABLE IN TABLE 2, PLATE 1. C. COMPLET L. CHLORIDE; M. MULTIPLE (INCLUDES ONE COMPLETE AND DNE OR MORE PARTIAL)	I E, POWER GENERATION: F, FIRE PROTECTION: D: P, PUBLIC SUPPLY; R, RECREATION: S, STOCK: MATIONPUBLIC SUPPLIES: Y, DESALINATIONOTHER EVEL. IN 1 HOUR: A, THROUGH 15 MINUTES; B, 16 TO E IN TABLE 20-	<pre># 71 44125140723550.1 1170 ANDEHSON GEORGE 1968 P 6 X 395 ¥ 18 H 6 0 # 72 44133040723218.1 680 SCHOOL 7 DAY AD 1965 F 6 X 175 ¥ 91 CO H 40 0 # 74 4413740723282.1 660 WUZY HEROLD 1960 F 6 X 495 ¥ 30 SO F 11-60 H 6 0 # 75 44140940723355.1 8+0 DAVID LYNN 1970 F 6 X 130 ¥ 80 SO 20 2-70 H 5 0 # 75 44140940723551.1 1060 STIEGLES HEYCE 1970 F 6 X 135 ¥ 14 SO 15 2-70 H 5 0 # 75 4414054072355.1 8+0 DAVID LYNN 1970 F 6 X 135 ¥ 14 SO 15 2-70 H 40 0 # 75 4414054072355.1 8+0 DAVID LYNN 1970 F 6 X 135 ¥ 14 SO 15 2-70 H 40 0 # 77 4413124072351.1 1060 SHITH RICHER 1970 F 6 X 135 ¥ 14 SO 15 2-70 H 40 0 # 78 4412554072351.1 1060 SHITH RICHER 1970 F 6 X 135 ¥ 14 SO 15 2-70 H 40 0 # 78 4412554072351.1 1060 SHITH RICHER 1970 F 6 X 135 ¥ 14 SO 15 2-70 H 40 0 # H 4413124072332.2 940 AMCARE 1970 F 6 X 175 ¥ 2 CO 15 4-70 H 20 0 # H 4413124072332.2 940 AMCARE 1970 F 6 X 175 ¥ 2 CO 16 F 4-70 T 65 0 # H 4413124072332.2 940 AMCARE 1970 F 6 X 100 ¥ 220 CO F 4-70 T 60 0 # H 4413124072332.2 940 AMCARE 1970 F 6 X 100 ¥ 220 CO F 4-70 T 65 0 # H 4413124072332.2 940 AMCARE 1970 F 6 X 100 ¥ 220 CO F 4-70 T 65 0 # H 4413124072332.1 1020 SPRAUE ROBERT 1969 F 6 X 144 ¥ 17 CO 10 11-59 H 6 0 # R 4414054072345.1 1060 SPRAUE ROBERT 1969 F 6 X 144 ¥ 17 CO 10 11-59 H 6 0 # R 4414054072345.1 1060 SPRAUE ROBERT 1969 F 6 X 120 ¥ 200 0 # R 4414054072345.1 1060 SPRAUE ROBERT 1969 F 6 X 120 ¥ 220 CO 5 9-70 H 200 0 # R 4414054072345.1 1080 SPRAUE ROBERT 1970 F 6 X 80 ¥ 3 CO 10 10-70 H 6 0 # R 4414054072345.1 1080 SPRAUE ROBERT 1970 F 6 X 125 ¥ 22 211-70 H 5 0 # R 5 441954072345.1 1080 SPRAUE ROBERT 1970 F 6 X 105 ¥ 3 CO 10 10-70 H 8 0 # R 5 441954072345.1 1080 SPRAUE ROBERT 1970 F 6 X 105 ¥ 3 CO 10 10-70 H 8 0 # R 5 441954072353.1 1020 SPRAUE 1970 F 6 X 105 ¥ 3 CO 10 10-70 H 8 0 # R 5 4419540723548</pre>	x 31 441541N0723252.1 1000 HOWES MADDLO 1072 0 x 160 x 15 HO 14 7-72 H 30
LOCAL ALTI- YEAR/ WELL FE WELL LATITUDE- TUDE OWNER OR USER METHOD DIAM-IFIN-IDEPTHIUSE	ET WATER- WATER PUMPAGE	w 91 44133140723204.1 740 CLARK FRED 1976 P 6 X 195 w 15 CD 40 11-70 H 5 2 D - w 92 44113240723300.1 1150 CYM 1976 P 6 X 160 W 4 CD 30 8-70 M 6 2 D - w 93 441140407238300.1 150 CYM 1970 P 6 X 162 W 14 CD 50 H 3 1 D - w 94 4411310723815.1 690 MAKYEY HUGLEY 1970 P 6 X 165 w 78 CD 12 8-70 M 15 2 D - w 96 44133530723455.1 1090 BETTIS #000ER 1970 P 6 X 155 W 13 CO 15 8-70 H 4 1	A 4 460R28N0723952.2 730 US GEOL SURVEY 1967 B A 25 T U U
Construct Construct Or CSU DRILLED ETER HISH 1 BE Intervention Intervention Intervention Intervention Intervention Intervention Intervention Inte	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	w 97 441509W0723713.1 900 ARMSTRONG JEAN 1970 µ 6 x 205 w 17 CO 4 12-70 H 2 1 0 - w 98 441212N0723742.1 740 BADGEH JOHN 1970 µ 6 x 165 w 20 CO 4 B-70 H 2 B D w 90 441111N0723413.1 1350 DOE ALIDA 1970 P 6 X 105 w 20 CO 4 B-70 H 2 B D - w 101 4413540723426.1 580 COHP PHILLIP 1970 P 6 X 105 w 2 CO 6 9-70 H 4 B D H 30 B D B D H 104 4412480723420.1 1140 PEARE HOWARD 1971 P 6 X 175 W <td< td=""><td>A 9 440942N0723928.3 675 US GEOL SURVEY 1969 8 4 X 92 T U</td></td<>	A 9 440942N0723928.3 675 US GEOL SURVEY 1969 8 4 X 92 T U
 3 441026N0722944.3 1070 OUARRY MILL DEV 1965 P 6 X 300 W 441307N0722940.1 735 BAILEY CIFTON 1967 P 6 X 175 W 5 441128N0722930.1 1045 BOLLES FRAMK 1967 P 6 X 280 W 7 441000N0722933.1 1210 CARPENTER PETER 1967 P 6 X 145 W 8 441225N0722333.1 1210 CARPENTER PETER 1967 P 6 X 145 W 9 4409936N0722333.1 1210 CARPENTER PETER 1967 P 6 X 145 W 9 440936N0722333.1 1210 CARPENTER PETER 1967 P 6 X 145 W 9 440936N0722333.1 1290 COREY FRAMK 1968 P 6 X 205 W 10 441214N0722834.1 090 DAVIS MRS DEAN 1967 P 6 X 160 W 10 441214N0722834.1 960 DAVIS MRS DEAN 1967 P 6 X 160 W 11 441345N0722934.1 960 DAVIS MRS DEAN 1967 P 6 X 160 W 12 440942N0723252.1 1220 ELDER MUSH 1965 P 6 X 265 W 100 W 13 4403900722934.1 960 DAVIS MRS DEAN 1967 P 6 X 260 W 14 441345N0722934.1 1210 MULL ROBERT 1967 P 6 X 260 W 15 441318N0722947.1 860 MARCEAU WILLIAM 1960 P 5 X 226 W 1 16 440945N0723250.1 1220 MARTIN GLENW H 1967 P 6 X 160 W 17 441228N072291.1 120 MARTIN GLENW H 1967 P 6 X 160 W 17 441228N0722927.1 800 MARTIN GLENW H 1966 P 6 X 130 W 19 441348N0722927.1 900 MUSCRDA WILLIAM 1966 P 6 X 145 W 19 441348N0722927.1 900 PEPIN RAVIE 1967 P 6 X 145 W 19 441348N0722927.1 900 PEPIN RAVIE 1966 P 6 X 145 W 19 441348N0722927.1 900 PEPIN RAVIE 1966 P 6 X 145 W 	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	* 113 44122/M0723331.1 100 ALPOPT TRACTOP 1071 P 6 X 200 * 17 C 0 20 10-71 C 15 D * 116 4412320072331.1 110 X X X X X X X X X X X X X X X X X	x 15 441047N0724025.1 6400 COLSON CHESTER 1907 P 6 X 105 4 20 0 - x 15 440055A0724055.1 0400 DUKTTE BAYMON 1077 P 6 X 105 x 20 R 0 R 0 R 0 R 0 R 0 R 0 0 R 0 0 R 1.5 0 R 1.5 R 0 R 0 0 R 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
24 441244N0722955.1 1240 VALLIENE ROLAND 1967 P 6 X 260 w 25 441334N0722955.1 800 WILKINS HARRY J 1967 P 6 X 175 w 26 441334N0722955.1 800 WILKINS HARRY J 1967 P 6 X 175 w 27 441028N0722809.1 810 WILLISM HARRY J 1967 P 6 X 175 w 28 44115N0722728.1 1400 LAMBERTI CARLOW 1967 P 6 X 105 w 30 441211N0722723.1 1425 PEAKE HOMER 1968 P 6 X 105 30 44131N0722304.1 1050 BOND AUTO PARTS 1954 C 6 X 344 32 44117N0723124.1 1050 BOND AUTO PARTS 1956 C 8 X 526 # 33 44130N0723041.1 960 MOLKSTRY 1950 C 8 X 105 34 440865N0722853.1 1380 ROCK O	95 20 10-67 H 12 1 0 - 70 80 9-67 H 30 1 0 - 71 H 12 D - 72 H 12 D - 72 H 12 D - 73 H 12 D - 74 CO 50 6-66 H 8 1 0 - 74 CO 50 6-66 H 8 1 0 - 75 0 2H 0 N 40 D - 79 12 2-54 H 20 70 2H 0 6-69 H 8 0 - 71 0 2H 0 N 40 71 0 2H 0 N 40 72 0N 10 6-69 H 8 0 - 73 0N 15 5-69 H 25 74 0N H 75 0N 10 6-70 H 15 74 0N 10 6-70 H 15 75 0N 10 8-70 H 15 70 - 70 0N 20 12-70 H 25 0 - 70 0N 10 8-70 H 15 70 0 0N 10 10 -70 H 25 0 - 70 0N 10 8-70 H 25 70 0 0N 10 10 -70 H 25 70 0 - 70 0N 10 10 -70 H 25 70 0 - 70 0N 10 10 -70 H 25 0 - 70 0 0N 10 10 -70 H 25 0 - 70 0 0N 10 10 -70 H 25 0 - 70 0 0N 10 10 -70 H 25 0 - 70 0 0N 10 10 -70 H 25 0 - 70 0 0N 10 10 -70 H 25 0 - 70 0 0N 10 10 -70 H 25 0 - 70 0 0N 10 10 -70 H 25 0 - 70 0 0N 10 10 -70 H 25 0 - 70 0 0N 10 10 -70 H 25 0 - 70 0 0N 10 10 -70 H 25 0 - 70 0 0N 10 10 -70 H 25 0 - 70 0 0 0N 10 10 -70 H 25 0 - 70 0 0N 10 10 -70 H 25 0 - 8 0N 10 10 -70 H 25 0 - 8 0N 10 10 -70 H 2 1 0 - 8 0N 10 10 -70 H 2 1 0 - 8 0N 10 10 -70 H 2 1 0 - 8 0N 10 10 -70 H 2 1 0 - 8 0N 10 10 -70 H 2 1 0 - 8 0N 10 10 -70 H 2 1 0 - 8 0N 10 10 -70 H 2 1 0 - 8 0N 10 10 -70 H 2 1 0 - 9 0 0 0N 10 0 0 0 1 2 0 - 9 0 0 0N	A f 441616400722820.2 675 US GEOL SURVEY 1967 8 4 x 10 11	* 46 460 3400724012.1 1000 % H BULLDEWS 1071 P 6 x 100 200 8-71 N 5 1 D * 50 4400340723011.1 600 PVLLI, 1971 P 6 X 100 % 6 77.2 P 6 X 100 % 6 0 20 97.71 H 4 10
x 74 44105IN0722936.1 940 BROWN DOUGLAS 1969 P 6 X 235 W x 76 441135N0722915.1 1200 PERANTONI ED0 1969 P 6 X 115 W x 77 441400N0722915.1 860 FINDSEN DALE 1969 P 6 X 145 W x 77 441400N0722915.1 1860 FINDSEN DALE 1969 P 6 X 145 W x 77 441400N0722904.1 1808 MORAN 1969 P 6 X 166 W y 79 441400N0722925.1 910 CANADJAN CLUB 1968 P 6 X 150 W	13 0N 45 8-70 5 6 2 0 - 12 0N 35 8-70 5 10 2 0 - 12 0N 15 8-70 5 10 2 0 - 12 0N 15 4-70 5 6 2 0 - 14 10 8 12-70 H 6 1 0 - 6 YM 150 10-70 H 200 0 - 5 0N 10 3-71 H 4 0 - 30 0N 10 3-71 H 4 0 - 50 0N 10 3-71 H 3 0 - 50 0N 10 3-71 H 4 0 - 50 0N 10 3-71 H 4 <t< th=""><th># 45 444642007227210.1 690 CALCO 1093 V 1 T 25 4 R 12 N 15 R 12 N 15 R 1 <t< th=""><th>A 1 441628N072281241 1660 US GEOL SURVEY 1969 B 4 X 60 T T T U U T C C</th></t<></th></t<>	# 45 444642007227210.1 690 CALCO 1093 V 1 T 25 4 R 12 N 15 R 12 N 15 R 1 <t< th=""><th>A 1 441628N072281241 1660 US GEOL SURVEY 1969 B 4 X 60 T T T U U T C C</th></t<>	A 1 441628N072281241 1660 US GEOL SURVEY 1969 B 4 X 60 T T T U U T C C
W #0 441012N0722943.1 1130 MILLER BLDG CO 1971 P 6 X 190 # W #1 44011N722952.1 1120 MILLER BLDG CO 1971 P 6 X 190 # W #3 440935N0722352.1 1120 MILLER BLDG CO 1971 P 6 X 190 # W #3 440947N0723252.1 1100 MILLER BLDG CO 1971 P 6 X 190 # W #3 440947N0723052.1 1100 MILLER BLDG CO 1972 P 6 X 190 # 191 P 6 X 190 # 115 W # 44097N072307.1 1220 JEMOME STEPHEN 1971 P 6 X 190 # 190 # 190 # 190 # 190 # 190 # 190 # 190 # 190 # 191 P 6 X 190 # 190 <th>30 0N 20 $3-71$ H 1 $$ 0 $-$ 10 0N 10 -72 H 15 $$ 0 $-$ 10 0N 10 -72 H 15 $$ 0 $-$ 10 0N 12 $5-71$ H 2 $$ 0 $-$ 40 0N 12 $5-71$ H 2 $$ 0 $-$ 10 0N F $5-71$ H 2 $$ 0 $-$ 10 0N F $5-71$ H 2 $$ 0 $-$ 10 0N F $8-71$ H 10 $$ 0 $-$ 50 0N F $8-71$ H 3 $$ 0 $-$ 50 0N 22 $$ H 8 $$ 0 $-$ 50 0N 22 $$ H</th> <th>• 68 +4171840723014.1 1060 DAY ROBERT 1071 P 6 X 102 X 2 CO 20 3-71 H 20 1 D 2 D 1 D 1 D 1 D 1 D 1 D 1 D D 1 D D D D D D </th> <th><pre>x 4 446070200722108.1 1640 PHILBEDOK CHAD 1960 P 6 X 105 X 7 C0 20 7 469 H 10 1 0 1 0 1 0 1 0 1 0 1 0 1 0 0 1 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0</pre></th>	30 0N 20 $3-71$ H 1 $$ 0 $-$ 10 0N 10 -72 H 15 $$ 0 $-$ 10 0N 10 -72 H 15 $$ 0 $-$ 10 0N 12 $5-71$ H 2 $$ 0 $-$ 40 0N 12 $5-71$ H 2 $$ 0 $-$ 10 0N F $5-71$ H 2 $$ 0 $-$ 10 0N F $5-71$ H 2 $$ 0 $-$ 10 0N F $8-71$ H 10 $$ 0 $-$ 50 0N F $8-71$ H 3 $$ 0 $-$ 50 0N 22 $$ H 8 $$ 0 $-$ 50 0N 22 $$ H	• 68 +4171840723014.1 1060 DAY ROBERT 1071 P 6 X 102 X 2 CO 20 3-71 H 20 1 D 2 D 1 D 1 D 1 D 1 D 1 D 1 D D 1 D D D D D D	<pre>x 4 446070200722108.1 1640 PHILBEDOK CHAD 1960 P 6 X 105 X 7 C0 20 7 469 H 10 1 0 1 0 1 0 1 0 1 0 1 0 1 0 0 1 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0</pre>
 V 102 441229N0723025.1 1030 BRASSARD 8 1972 P 6 X 70 V V 103 44123N0722722.1 1420 OULLETTE DR J 1972 P 6 X 210 V V 104 440840N0722801.1 1510 FR05T EUBERN JR 1972 P 6 X 200 V V 105 441326N0722802.1 1000 MARTIN ERI 1971 P 6 X 210 V V 106 441354N0723020.1 1000 MARTIN ERI 1971 P 6 X 210 V V 107 441364N0723020.1 1000 MARTIN ERI 1971 P 6 X 240 V V 108 441108N072302.1 1000 BODTH GORDON 1971 P 6 X 240 V V 108 441108N072302.1 1000 GRDIN 1971 P 6 X 240 V V 108 441108N072302.1 920 BODTH GORDON 1971 P 6 X 240 V V 108 441108N072304.1 930 US GEOL SURVEY 1967 B 4 X 43 T A 2 441358N0723317.1 640 US GEOL SURVEY 1967 B 4 X 43 T A 441302N0723341.1 980 CTR VT HOSPITAL 1966 P 6 X 240 V V 2 441303N0723341.2 980 CTR VT HOSPITAL 1966 P 6 X 240 V V 3 441303N0723350.1 980 CTR VT HOSPITAL 1966 P 6 X 375 V 1 V 4 441426N0723542.1 530 USESTON KENNETH 3 3 - 50 V V 5 441320723545.2 530 WESTON KENNETH 3 3 - 50 V V 6 44132N0723545.1 510 US GEOL SURVEY 1967 B 1 T 35 O V 6 44132N0723545.1 510 US GEOL SURVEY 1967 B 1 T 35 O V 6 44132N0723380.1 515 WESTON KENNETH 3 - 50 V V 6 44132N0723380.1 515 WESTON KENNETH 3 - 50 V V 6 44132N0723542.1 510 US GEOL SURVEY 1967 B 1 T 35 O V 6 44132N0723380.1 515 WESTON KENNETH 6 K 126 W V 10 441149N0723403.1 1100 GAONON RAYMOND 1966 P 6 X 126 W V 11 44109N0723722.1 550 US GEOL SURVEY 1967 B 1 T 35 O V 10 441149N0723403.1 1100 BAOKN RAYMOND 1966 P 6 X 126 W V 11 441025N0723722.1 550 US GEOL SURVEY 1967 B 1 T 35 O V 11 441025N0723722.1 550 US GEOL SURVEY 1967 B 1 T 35 O V 11 441025N0723722.1 550 US GEOL SURVEY 1967 B 1 T 35 O V 11 441025N0723722.1 550 US GEOL SURVEY 1967 B 1 T 35 O V 12 441116N072330.1 1100 BAOKN RAYMO	10 0N 12 $1-72$ H 8 $$ 0 $-$ 39 00 5 $8-72$ H 10 $$ 1 0 $-$ 2 0N 5 $31-72$ H 2 $$ 0 $-$ 11 0N 10 $8-71$ H 30 $$ 0 $-$ 16 0N 30 $10-71$ H 50 $$ 0 $-$ 16 0N 35 $11-71$ H 8 $$ 0 $-$ 16 0N 35 $11-71$ H 8 $$ 0 $-$ 16 0N 35 $11-71$ H 8 $$ 0 $-$ 16 0N 35 $11-71$ H 8 $$ 0 $-$ 16 0N 25 $11-71$ H 8 $$ 0 $-$ 16 0L F $5-66$ T 50 $$	<pre> * #6 #4459M0722913.1 #86 #TLS FLOYD 1971 # 6 X 135 * 60 CC0 f 10-71 # 25 - 1 0 - * 0 4447720072335.1 10-0 #FL*ELT-450 1972 # 6 X 255 * 6 5 CC0 0 1 - 1 0 - * 0 9 4447720072355.1 10-0 #FL*ELT-450 1972 # 6 X 255 * 6 5 CC0 0 1 - 1 0 0 - * 0 9 4447720072355.1 10-0 #FL*ELT-450 1972 # 6 X 255 * 6 0 C0 20 20 5 -727 # 15 - 1 0 - * 0 9 44577207205.1 7*0 #FL*ELT-450 1972 # 6 X 255 * 60 C0 50 8-727 # 1.5 - 1 0 - * 0 9 445772072117.1 10-0 #FL*ELT-450 1972 # 6 X 255 * 60 C0 50 8-727 # 1.5 - 1 0 - * 0 9 445772050.1 7*0 #FL*ELT-450 1972 # 6 X 265 * 60 C0 50 8-772 # 1.5 - 1 0 - * 0 9 445772050.1 1200 UTTA# C480.1 10 1972 # 6 X 265 * 100 C0 12 6-727 # 1.5 - 1 0 - * 0 9 4457721315.1 1120 UTTA# C480.1 10 1972 # 6 X 205 * 10 C0 12 6-727 # 1.5 - 1 0 - * 0 9 445773135.1 1130 SVAZY 1072 # 6 X 100 * 10 0 12 6-72 # 6 0 - * 0 9 445773135.1 1130 SVAZY 1072 # 6 X 100 * 10 0 12 6-72 # 6 0 - * 0 9 445773135.1 1130 SVAZY 1072 # 6 X 100 * 10 0 12 6-72 # 6 0 - * 0 9 445773135.1 1130 SVAZY 1072 # 6 X 100 * 10 0 12 6-72 # 6 0 - * 0 9 445774173135.1 1130 SVAZY 1072 # 6 X 100 * 10 0 12 6-72 # 6 0 - * 0 9 445774173135.1 1130 SVAZY 1072 # 6 X 100 * 10 0 12 6-72 # 6 0 - * 0 0 0 - * 0 0 0 0 - * 0 0 000ABD C0LLEGE 1062 # 6 X 270 * 70 0 - * 0 0 0 - * 0 0 000ABD C0LLEGE 1062 # 6 X 200 * 0 - * 0 0</pre>	<pre>1 12 #407109720971 1 103</pre>

UNITED STATES DEPARTMENT OF THE INTERIOR GEOLOGICAL SURVEY

PREPARED IN COOPERATION WITH STATE OF VERMONT AGENCY OF ENVIRONMENTAL CONSERVATION, DEPARTMENT OF WATER RESOURCES

1