UNIVERSITY OF MINNESOTA
MINNESOTA GEOLOGICAL SURVEY
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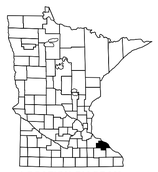
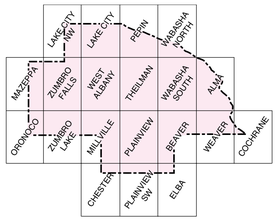
COUNTY ATLAS SERIES
ATLAS C-14, PART A
Plate 1—Data Base





INDEX TO 7.5-MINUTE QUADRANGLES

Digital base modified from 1990 Census TIGER/Line Files of U.S. Bureau of the Census (source scale 1:100,000); county border files modified from Minnesota Department of Transportation files; digital base annotation by Minnesota Geological Survey. Contours derived from the U.S. Geological Survey 30-meter grid cell digital elevation model data

Universal Transverse Mercator Projection, grid zone 15
1983 North American Datum

SCALE 1:100 000

1 0 1 2 3 4 5 MILES
1 0 1 2 3 4 5 6 7 8 KILOMETERS

CONTOUR INTERVAL 30 METERS

DATA-BASE MAP

By

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2001

EXPLANATION OF MAP SYMBOLS

- Record of water-well construction (well driller's log)
- Cutting sample
- Borehole geophysical log
- Soil boring
- Bedrock outcrop
- Textural analysis
- Seismic sounding
- Gravity station

THE DATA-BASE MAP

The types, locations, and density of information used to prepare this atlas are shown on the map. The data are described below to aid the user in assessing which types may be useful for a particular information need. The data-base map serves as a guide to the precision of the other maps in the atlas. It shows where data are sparse or lacking, and interpretation and extrapolation were required to prepare maps.

Drill-Hole Information

A **record of water-well construction (well driller's log)** is a water-well contractor's description of the geologic materials penetrated during drilling and the construction materials used to complete the well. Not all wells extend to bedrock. In areas of thick, unconsolidated Quaternary deposits, drillers usually do not have to drill through the entire thickness of overburden to find sufficient ground water. Hydrologic data, such as the static water level and test-pumping results, are commonly included. Before any driller's log can be used, the location of the well must be verified, and a geologist must interpret the log. Drillers' logs are the primary source of subsurface geologic and hydrologic data for Wabasha County; about 890 logs were used for this atlas.

Cutting samples collected during drilling and exploration provide physical evidence of subsurface geologic materials. They are the principal means of establishing the nature of the subsurface materials and are used to interpret and verify drillers' logs.

Borehole geophysical logs are made by lowering instruments down the well or drill hole and measuring the physical and chemical properties of the geologic materials through which the hole passes. Different logging techniques measure naturally occurring gamma radiation, spontaneous potential, and resistivity. Gamma logs, in graphic form, characterize the geologic formations penetrated. Spontaneous potential and resistivity are used mainly to locate water levels in wells and the depth of the well casing. An interpretive log is prepared from the geophysical log and correlated with drilling samples from the same hole, information obtained from nearby outcrops, or another nearby geophysical log. Geophysical logs can provide high-quality subsurface geologic and hydrologic information from wells for which little or no other information is available.

Soil borings are test holes drilled by the Minnesota Highway Department to obtain information about the physical properties of subsurface materials for engineering, mapping, or exploration purposes. Most terminate at very shallow depths or where bedrock is encountered. They are logged by an engineer or a geologist using a variety of classification schemes based upon particle sizes, penetration rate, moisture content, and color. Soil-boring data are limited in distribution; in Wabasha County they are concentrated along Minnesota Highway 61. These data are most useful in determining the composition of unconsolidated deposits. Some logs include the depth to bedrock and the lithology of the first bedrock encountered.

Other Information

Bedrock outcrops are exposures of solid rock at the land surface. Most are natural outcrop; however, some are exposures created during construction. They serve as reference points for mapping and for checking the accuracy of subsurface data. Bedrock at or near the surface must be considered in land-use planning decisions such as pipeline routing, sewage-system design, and excavations.

Textural analyses express the proportion of sand-, silt-, and clay-size particles that make up a sample. They are helpful in identifying and mapping unconsolidated materials, such as glacial deposits. The samples analyzed were taken from natural and artificial exposures and shallow borings.

Seismic soundings measure the time required for sound or pressure waves to travel from a source to a receiver. The density and rigidity of the geologic material through which the waves must travel affect their travel time. The Paleozoic carbonate rocks exhibit acoustic- or pressure-wave velocities from one and one-half to two and one-half times faster than those of unconsolidated, saturated Quaternary sediments. The spacing of the receivers (geophones) and the arrival times (measured in milliseconds) are used to calculate the depth to bedrock. Seismic soundings are labor intensive but can provide high-quality data when no other sources of subsurface information are available. They were done at selected localities by Todd Peterson and Jim Berg of the Minnesota Department of Natural Resources.

Fifty four **gravity stations** were added to the pre-existing gravity coverage (Chandler and Schaap, 1991) during the fall of 1999. These stations were located in the southwestern and northwestern parts of the county to investigate two possible valleys cut into bedrock that were buried by glacial deposits. The mass difference between high-density Paleozoic rocks and low density glacial deposits produces small anomalies in the earth's gravity field. The gravity–geologic method was applied to the new and pre-existing gravity data. This method incorporates geologic control from drill holes and seismic soundings to isolate the residual gravity signature of the glacial fill and bedrock variations from the much larger effect of deep, intrabasement (Precambrian) sources. The residual signature can be converted to estimate bedrock elevation and the thickness of glacial deposits. These estimates were used to help trace the buried bedrock valleys north of Elgin in the south-central part of the county and south of Oak Center in the northwestern part of the county.

INTRODUCTION

The public health and economic development of Wabasha County are directly dependent on the wise use and management of its land and water resources. Geologic and hydrologic information is essential before decisions are made that affect natural resources. Although the amount of geologic information required for making specific decisions can vary, the information will not be used at all if it is not available when it is needed, or if it is available only in a highly technical form or scattered in many different maps and reports.

County atlases, prepared jointly by the Minnesota Geological Survey and the Minnesota Department of Natural Resources, Division of Waters, present detailed geologic and hydrologic information in an interpretive as well as descriptive form. Maps and texts either summarize basic geologic and hydrologic conditions at a county scale or interpret these conditions in terms of the impacts of possible land-use and water-use decisions. Site-specific information is also available at a greater level of technical detail than shown on the maps of this atlas. The data are too voluminous to present in the atlas but have been incorporated into readily accessible files housed at the Minnesota Geological Survey.

Several sources commonly provide information about an area or an individual property, but they may use different classification schemes to describe the same geologic materials. As a result, discrepancies in interpreting the data may arise or the different sources may appear to contradict each other. For example, water-well drillers may describe glacial till as "clay," but engineering records will describe it as a "clayey sand." Both descriptions are acceptable for their original purpose of describing the physical attributes of the material. "Clay," the term used by well drillers, defines the general inability of the till to yield ground water to a well. "Clayey sand," the term from the engineering record, defines the physical composition of the till relative to particle size and engineering properties. The geologist must take the analysis one step further and define the material in terms of how it formed rather than how it is to be used. In this example, till consists of an unsorted mixture of rock fragments ranging in size from clay to cobbles and boulders, and it is interpreted by the geologist as having been deposited directly by glacial ice.

All of the types of data described on this plate had to be interpreted by geologists or hydrogeologists before they were meaningful for mapping purposes. The 1:100,000 scale of the maps in this atlas was chosen because it can show the geologic and topical studies of the county while keeping the physical size of each plate to a manageable level. As a result, some detailed information that was gained by data interpretation and mapping cannot be shown on these maps or discussed in the texts.

Whether to use the atlas alone, or in combination with the data bases, depends on the amount of detail needed. Generally, data-base information must be used to evaluate site-specific conditions.

DATA-BASE MANAGEMENT

All of the data shown on the maps were plotted on 7.5-minute topographic quadrangle maps or highway alignment maps, and inventory numbers were assigned to all data sources except some soil borings. Automated data bases and a few manual files were developed to provide easy access and rapid retrieval of site-specific data. The data may be obtained from the Minnesota Geological Survey.

Computer storage and retrieval systems are better than manual files for manipulating large amounts of data. Automated geologic data bases may also be designed to interact with other computer files, such as land-use data. Such interaction permits more efficient assessment of cause-and-effect relationships concerning natural resources than is commonly possible with manual files.

Wabasha County Data Bases

Computerized files were developed for point-source data in Wabasha County. They use Public Land Survey descriptions, and Universal Transverse Mercator (UTM) and latitude-longitude coordinates as location criteria; thus, they are compatible with the natural-resource data bases housed at the Minnesota Land Management Information Center (LMIC). The computerized data bases developed for Wabasha County by the Minnesota Geological Survey are County Well Index (CWI) and Test Borings Data Base (TESTHOLE).

County Well Index (CWI). Information from water-well records and exploration holes was entered into this statewide data base. Each well log is assigned a six-digit unique number that is also used by state agencies and the Water Resources Division of the U.S. Geological Survey. Elevations, expressed in feet above sea level, were determined from topographic maps (see the index map to 7.5-minute quadrangles). The street address of each well is also included whenever possible to provide data users with a well-location system that is compatible with local regulatory programs. Software at the Minnesota Geological Survey is used to display and tabulate many of the data elements contained on the original well log.

The County Well Index is currently stored in an data base that consists of nine related tables. The tables contain information such as well depths, well construction, addresses, aquifers, dates drilled, static water levels, and pumping test data. They also contain alternate well identifiers such as permit numbers or emergency-services numbers and the well stratigraphy—the geologic materials encountered during drilling.

CWI application software developed by the Minnesota Department of Health provides for two types of reports:

1. WELL LOG contains all of the information about the well as it was reported by the contractor. There may also be additional location information, land-surface elevations, aquifer designations, and remarks about the drill holes (Fig. 1).
2. WELL STRATIGRAPHY contains the geologic log with a geologist's stratigraphic interpretations based on her or his knowledge and understanding of the geology of Wabasha County. Only drill holes with verified locations will have stratigraphic attributes assigned to them (Fig. 2).

Test Borings Data Base (TESTHOLE). Information from soil borings and engineering test holes is stored in this data base. Descriptions of the types of geologic materials penetrated and the soils classification system used are entered, together with specific field and laboratory tests. The most common tests are blow counts, liquid and plastic limits, water content, and dry density. The depth to the water table is entered if available. Each test hole receives a unique number, and the location is digitized from the site plan.

FUTURE DATA COLLECTION

A data-base map is out of date even before it is printed, because additional information is continually generated as new water wells are drilled, construction activities expose more bedrock, or additional wells are tested for water quality. The library of geologic information prepared for Wabasha County is flexible so that old data can be reevaluated in light of new information, and new forms of data can be added if required. The need to manage ground water and other natural resources wisely will never become outdated. Future demands on these resources will require current data to assess the impacts.

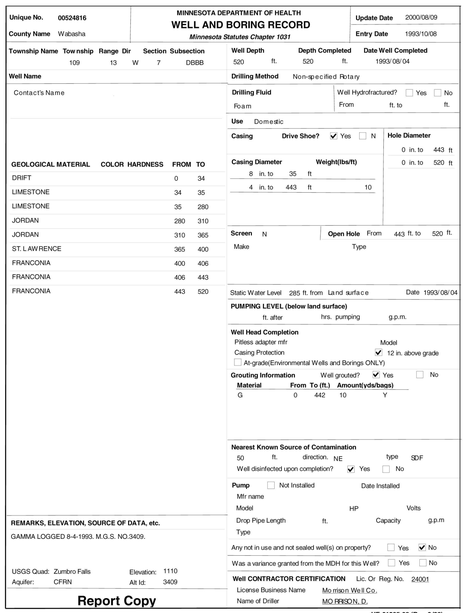
ACKNOWLEDGMENTS

Local water-well contractors, landowners, and the staff at the offices of the Wabasha County Environmental Services Department and the Environmental Health Department of Community Health Services of Goodhue and Wabasha Counties provided invaluable assistance.

REFERENCE CITED

Chandler, V.W., and Schaap, B.D., 1991, compilers, Bouguer gravity anomaly map of Minnesota: Minnesota Geological Survey State Map Series S-16, scale 1:500,000.

Every reasonable effort has been made to ensure the accuracy of the factual data on which this map interpretation is based; however, the Minnesota Geological Survey does not warrant or guarantee that there are no errors. Users may wish to verify critical information; sources include both the references listed here and information on file at the offices of the Minnesota Geological Survey in St. Paul. In addition, effort has been made to ensure that the interpretation conforms to sound geologic and cartographic principles. No claim is made that the interpretation shown is rigorously correct, however, and it should not be used to guide engineering-scale decisions without site-specific verification.



Unique No. 00524816 — MINNESOTA DEPARTMENT OF HEALTH — Update Date 2000/08/09
County Name Wabasha — WELL AND BORING RECORD — Minnesota Statutes Chapter 1031 — Entry Date 1993/10/08

Township Name	Township	Range	Dir	Section	Subsection
	109	13	W	7	DBBB

Well Depth 520 ft. — Depth Completed 520 ft. — Date Well Completed 1993/08/04
Well Name
Drilling Method Non-specified Rotary
Contact's Name
Drilling Fluid Foam — Well Hydrofractured? Yes No — From ft. to ft.
Use Domestic
Casing — Drive Shoe? Yes N — Hole Diameter: 0 in. to 443 ft; 0 in. to 520 ft
Casing Diameter — Weight(lbs/ft): 8 in. to 35 ft; 4 in. to 443 ft 10
Screen N — Open Hole From 443 ft. to 520 ft.
Make — Type
Static Water Level 285 ft. from Land surface — Date 1993/08/04
PUMPING LEVEL (below land surface) ft. after hrs. pumping g.p.m.
Well Head Completion: Pitless adapter mfr — Model; Casing Protection: 12 in. above grade; At-grade(Environmental Wells and Borings ONLY)
Grouting Information — Well grouted? Yes No

Material	From	To (ft.)	Amount(yds/bags)
G	0	442	10 Y

Nearest Known Source of Contamination: 50 ft. direction NE type SDF
Well disinfected upon completion? Yes No
Pump Not Installed — Date Installed
Mfr name — Model — HP — Volts
Drop Pipe Length ft. — Capacity g.p.m
Type
Any not in use and not sealed well(s) on property? Yes No
Was a variance granted from the MDH for this Well? Yes No
Well CONTRACTOR CERTIFICATION — Lic. Or Reg. No. 24001
License Business Name Morrison Well Co.
Name of Driller MORRISON, D.

GEOLOGICAL MATERIAL	COLOR	HARDNESS	FROM	TO
DRIFT			0	34
LIMESTONE			34	35
LIMESTONE			35	280
JORDAN			280	310
JORDAN			310	365
ST. LAWRENCE			365	400
FRANCONIA			400	406
FRANCONIA			406	443
FRANCONIA			443	520

REMARKS, ELEVATION, SOURCE OF DATA, etc.
GAMMA LOGGED 8-4-1993. M.G.S. NO.3409.

USGS Quad: Zumbro Falls — Elevation: 1110
Aquifer: CFRN — Alt Id: 3409

Report Copy — HE-01205-06 (Rev. 9/96)

Figure 1. An example of a WELL LOG record, showing all the information about the well as reported by the well driller.

Unique No. 00524816 — MINNESOTA DEPARTMENT OF HEALTH — Update Date 2001/01/08
County Name Wabasha — WELL AND BORING RECORD — Minnesota Statutes Chapter 1031 — Entry Date 1993/10/08

Township Name	Township	Range	Dir	Section	Subsection	Well Depth		Depth Completed		Date Well Complet
	109	13	W	7	DBBB	520	ft.	520	ft.	1993/08/04

Well Name — Lic. Or Reg. No. 24001 — Name of Driller MORRISON, D.
USGS Quad Zumbro Falls — Elevation 1110 — Aquifer CFRN — Alternate Id 3409

GEOLOGICAL MATERIAL	COLOR	HARDNESS	FROM	TO	STRAT	LITH PRIM	LITH SEC	LITH MINOR
DRIFT			0	34	QUUU	DRFT		
QUUU = Quaternary Undiff.		DRFT = Drift						
LIMESTONE			34	35	QUUU	DRFT		
QUUU = Quaternary Undiff.		DRFT = Drift						
LIMESTONE			35	280	OPDC	DLMT		
OPDC = Prairie Du Chien Group		DLMT = Dolomite						
JORDAN			280	310	OPDC	DLMT		
OPDC = Prairie Du Chien Group		DLMT = Dolomite						
JORDAN			310	365	CJDN	SNDS		
CJDN = Jordan		SNDS = Sandstone						
ST LAWRENCE			365	400	CJDN	SNDS		
CJDN = Jordan		SNDS = Sandstone						
FRANCONIA			400	406	CSTL	SLSN	DLMT	SHLE
CSTL = St.Lawrence		SLSN = Siltstone			DLMT = Dolomite		SHLE = Shale	
FRANCONIA			406	443	CSTL	SLSN	DLMT	
CSTL = St.Lawrence		SLSN = Siltstone			DLMT = Dolomite			
FRANCONIA			443	520	CFRN	SNDS	SHLE	DLMT
CFRN = Franconia		SNDS = Sandstone			SHLE = Shale		DLMT = Dolomite	

Figure 2. The WELL STRATIGRAPHY record is a geologist's interpretation of the geologic materials listed by the driller in the WELL LOG record (Fig. 1). The headings (**GEOLOGICAL MATERIAL**, **COLOR**, **HARDNESS**, etc.) pertain to information in the first line of each entry; the second line contains explanations of the four-letter codes used in the first line. The first word (in capital letters) in each entry is the well driller's original description for that interval. Color and hardness were not determined for geologic material from this hole. All depths are measured in feet. Heading abbreviations: **STRAT**, stratigraphy (the name of the stratigraphic unit—for example, CFRN for the Franconia Formation); **LITH PRIM**, primary lithology (rock type—for example, DLMT for dolomite or SNDS for sandstone); **LITH SEC**, secondary lithology; **LITH MINOR**, minor lithology.