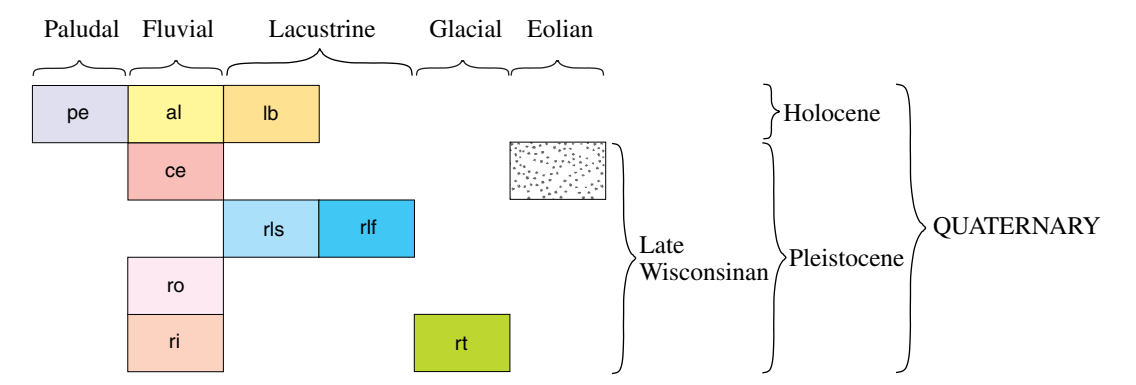


CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

This map of the Gull Lake quadrangle shows the surface distribution of Quaternary sediments. It was constructed using aerial photographs from 1977 (1:80,000 scale), U.S. Soil Conservation Service soil-survey maps for Crow Wing County (Armen and others, 1965) and Cass County (Richardson, 1997), and field work conducted during 2000 and 2001, which included observations, descriptions, and samples from shallow auger borings (generally less than 20 feet [6 m] deep), roadcuts, outcrops, and construction exposures. Additional information from previous nearby mapping projects (Schneider, 1961; Goldstein, 1985; Mooers, 1988) was used for interpretation.

HOLOCENE

- al** Floodplain alluvium—River-channel and overbank sediment deposited by the Gull River and two smaller streams; composed of stratified sand and silt. All three streams flow through peatlands; deposits may contain organic debris disseminated in the sediments and in discrete beds. Alluvium of the Gull River is distinguished from peat by old channel scars visible on aerial photographs.
- pe** Organic deposits—Shallow- and ponded-water sediments consisting of peat and organic-rich materials. Typically found in depressions, most of which were shallow lakes before filling in with peat. The depressions formed when blocks of buried stagnant ice melted.
- lb** Lake beaches—Clean sand, mostly fine- to medium-grained; includes gravel beds and minor organic deposits in places. Deposits gently slope towards lakes. The distal boundaries are commonly steeper slopes, low sand ridges parallel to shore, or the beginning of sand dunes. May include exposed lake-bottom sediment from a higher level of the lake.

PLEISTOCENE

- ce** Collapsed and stream-eroded surface sediment—Fluvial sand and gravel interstratified with silt and organic sediments along the Gull River. Best developed in the adjacent Baxter quadrangle to the south, but small areas are recognized in the Gull Lake quadrangle. Elevation is slightly higher than the Gull River floodplain, but lower than adjacent outwash and glacial lake plain surfaces. May have eroded during an earlier stage of downcutting by the Gull River.
- ris** Lacustrine deposits of Glacial Lake Brainerd (Mooers, 1988)—Well-sorted, fine- to medium-grained, noncalcareous sand. Locally contains interbedded, calcareous fine-grained sand, silt, and clay layers at depths of more than 10 feet (3 m). Deposited on and around partially buried ice blocks left by the retreating Rainy lobe. These ice blocks subsequently melted following drainage of Glacial Lake Brainerd, leaving depressions in the landscape, which are lakes and swamps today. Capped by eolian sand that commonly forms dunes (see Map Symbols). Glacial Lake Brainerd formed after active ice of the Rainy lobe retreated east of the area, but before the present day Mississippi River channel opened up—stagnant or active ice probably blocked meltwater drainage to the south.
- rff** Lacustrine deposits, fine—Sediments as described in lacustrine deposits (ris) above, but contain calcareous silt and clay layers within 5 feet (1.5 m) of the surface.
- ro** Valley train and outwash deposits—Sand and gravel deposited by meltwater streams that drained melting Rainy lobe ice. Bedding is locally disrupted because the outwash was deposited on stagnant ice in places, which later collapsed. Uncollapsed areas have relatively flat depositional surfaces ranging in elevation from 1,230 to 1,250 feet (375 to 381 m).
- ri** Ice-contact deposits—Stratified material consisting chiefly of sand and gravel (cobbles and boulders are common) sorted by meltwater in close proximity to ice; in places may contain thin layers of debris-flow till. Collapsed in places by the meltout of underlying ice. No flat depositional surfaces are recognized. Most of the occurrences of this deposit are related to the Pleasant Lake recessional moraine (Mooers, 1988).
- rt** Till—Unsorted rocky, sandy loam. Brown (7.5YR to 10YR 5/4) where oxidized. Most of the small delineations shown are based on previous soil mapping (Richardson, 1997).

MAP SYMBOLS

- Geologic contact**—Approximately located. Established from aerial photographs, geomorphology, soil maps, well logs, borings, and examination of surficial materials.
- Broad irregular trough**—Interpreted as a buried subglacial drainage channel (tunnel valley) or a buried, pre-existing subaerial valley. Ticks point down slope.
- Eolian sand dunes**—Fine- to medium-grained sand that forms dunes and blowouts. Boundaries mapped from aerial photos and are more diffuse than shown on the map.
- Soil boring**—Power auger borings described and sampled by the Minnesota Geological Survey. Most borings are less than 20 feet (6 m) in depth.
- Material sample**—Outcrop, roadcut, and construction-site exposures examined, described and sampled during the course of field work.
- Field observation**—Outcrop, roadcut, and construction site-exposures examined and described during the course of field work.
- Record of water-well construction**—Location of a water well for which there is a log prepared by a well driller. A geologist (either the author or a predecessor) has interpreted the information in the log and verified the well location.

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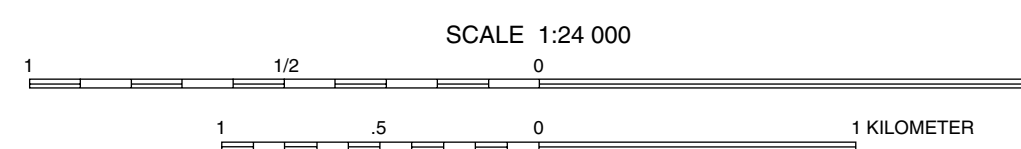
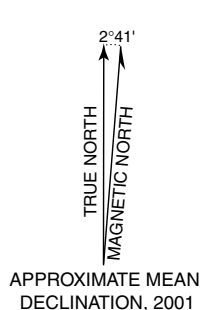
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Base from U.S. Geological Survey Gull Lake 1:24,000 quadrangle, 1973, revised 1994.  
Universal Transverse Mercator grid, zone 15  
1927 North American Datum

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.

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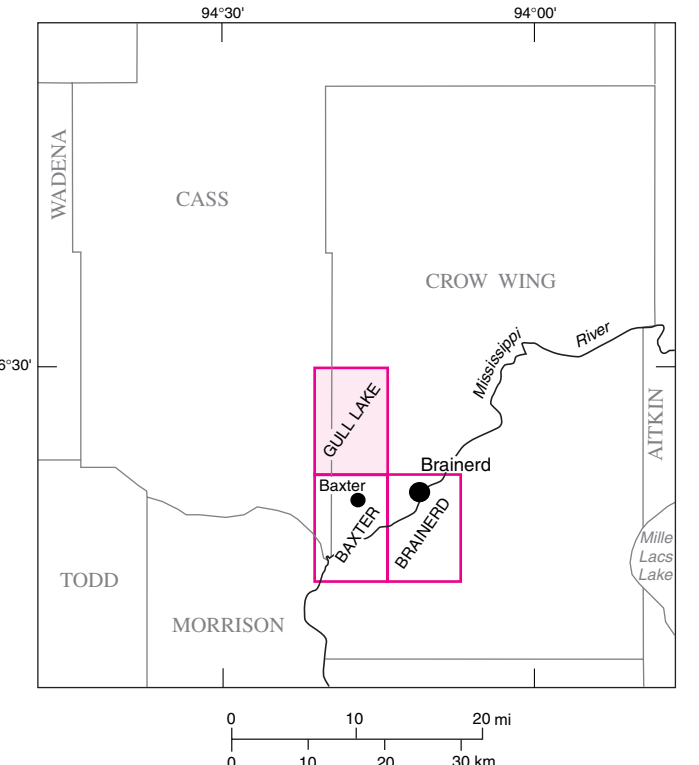


SCALE 1:24 000  
CONTOUR INTERVAL 10 FEET  
NATIONAL GEODETIC VERTICAL DATUM OF 1929



GIS compilation and cartography by  
Joyce Meints and Philip Heywood  
Edited by Lori Robinson

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STATEMAP QUADRANGLES IN THE  
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**SURFICIAL GEOLOGY OF THE GULL LAKE QUADRANGLE,  
CASS AND CROW WING COUNTIES, MINNESOTA**

by  
**Howard C. Hobbs**  
2001