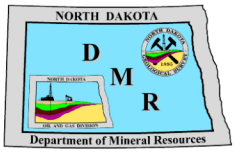




Offshore Glaciolacustrine Deposits of Glacial Lake Agassiz: The Brenna Formation in Grand Forks County, North Dakota



Fred J. Anderson

2023

LOCATIONS OF DRILLHOLES

This map displays the locations of drillholes in Grand Forks County consisting of test holes, water wells, and deep foundation borings, used to map the geologic extent of the Brenna Formation in the shallow subsurface. The Brenna Formation consists of smectitic clay that was deposited as offshore deep-water sediment into glacial Lake Agassiz during latest Wisconsinan time. Lithologically, the Brenna Formation in Grand Forks County contains, on average, 87% clay, 12% silt, with minor (~1%) amounts of sand (Figure 1). It was only deposited in the eastern part of the county and covers an area of 414 mi² (1,072 km²). It is more laterally extensive north of the city of Grand Forks and less extensive to the west and south of the city. The smectitic clay mineralogy of the Brenna Formation results in a soft and expansive clay that is problematic for surface engineered works as it has low, load-bearing characteristics.

- Drillhole Locations
- Test Hole
 - Observation Wells
 - NDDOT Geotechnical Borings
 - Private Well
 - Brenna Extent

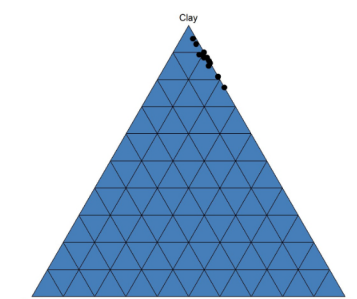
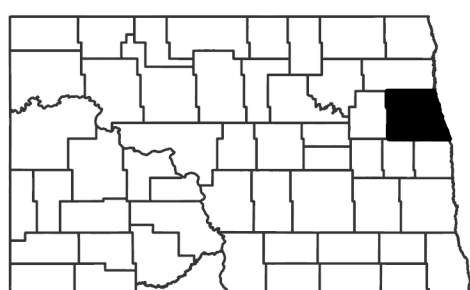
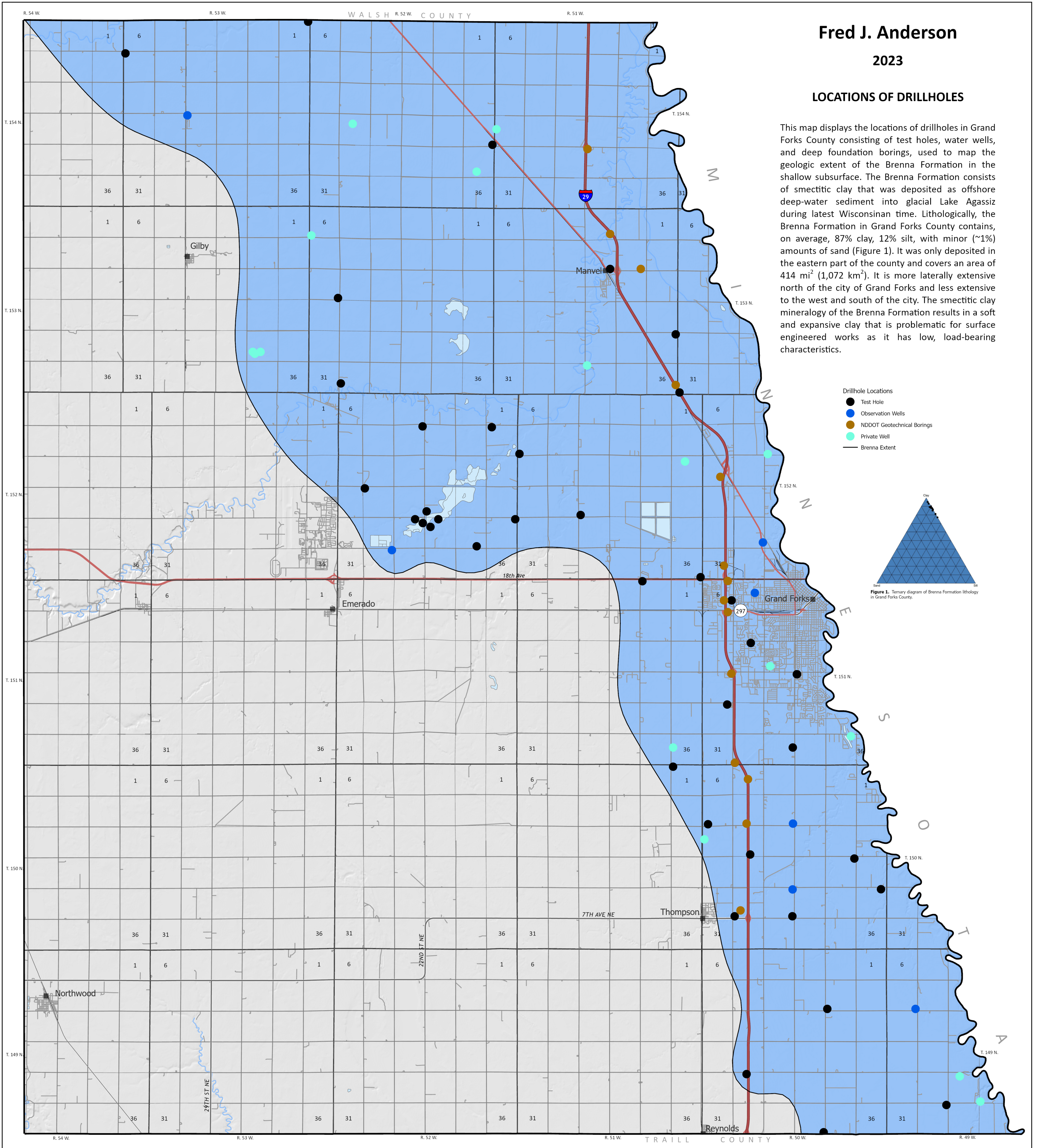
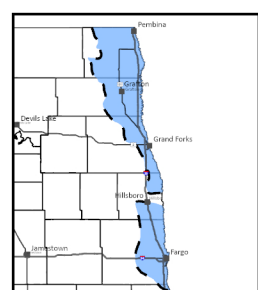


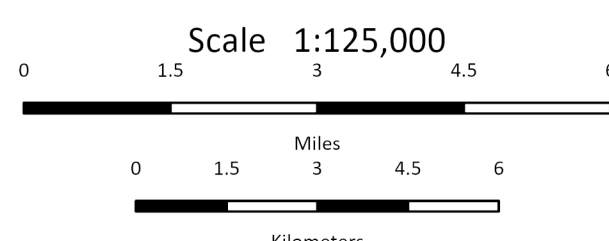
Figure 1. Ternary diagram of Brenna Formation lithology in Grand Forks County.



Grand Forks County, North Dakota



Location and extent of the offshore lake clays of the Brenna Formation in the Red River Valley of North Dakota.

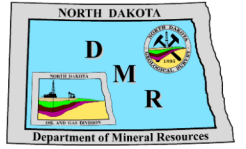


Scale 1:125,000
Mercator Projection
Standard Parallel 47°41'15"N
North American 1983 Datum
Central Meridian 97°26'15"W





Offshore Glaciolacustrine Deposits of Glacial Lake Agassiz: The Brenna Formation in Grand Forks County, North Dakota



Fred J. Anderson

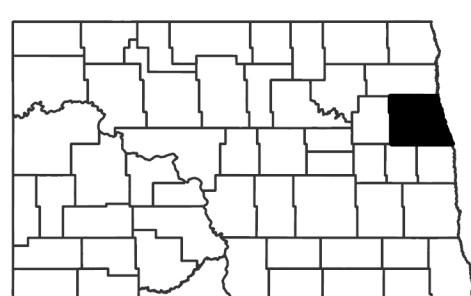
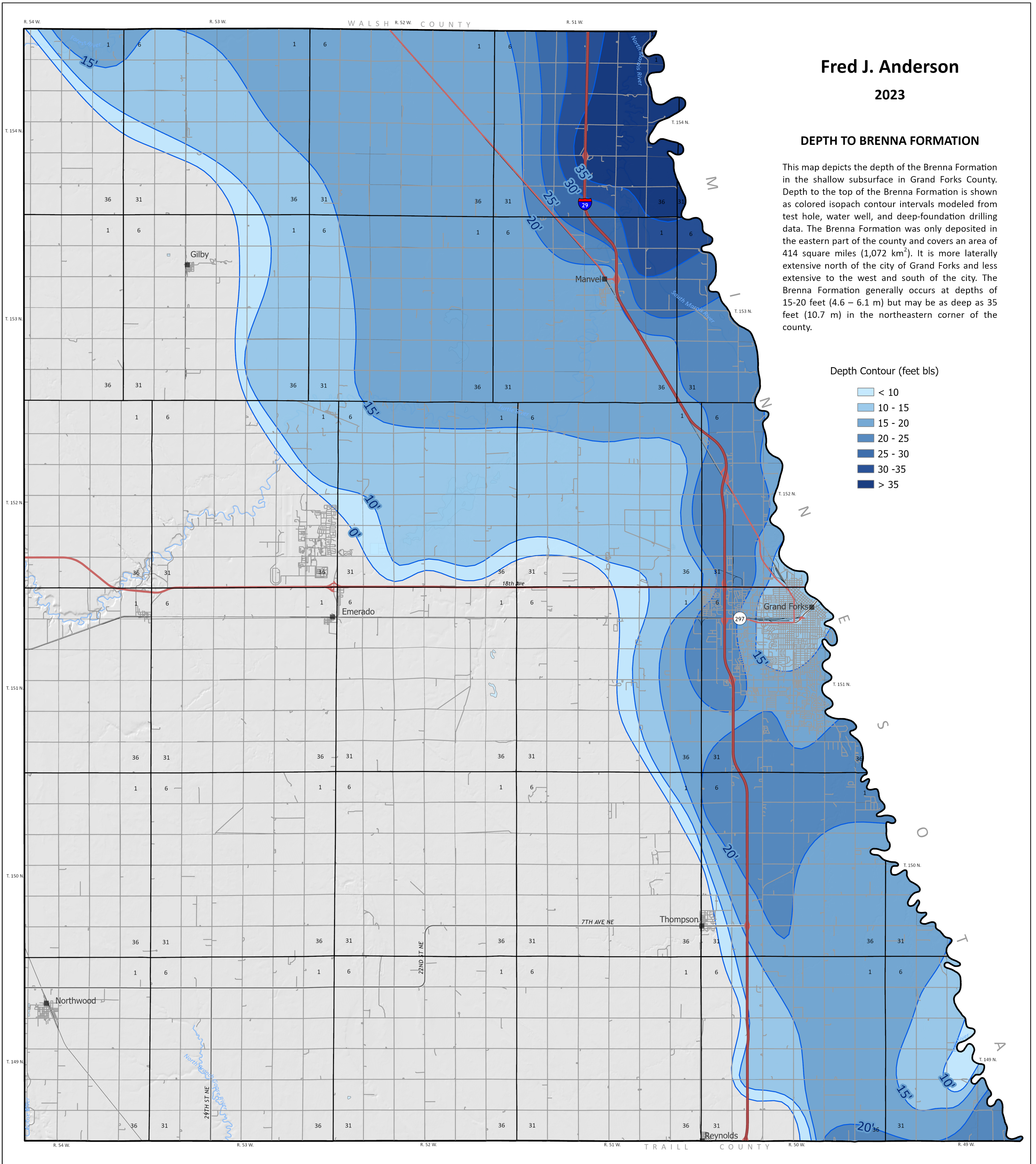
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DEPTH TO BRENNA FORMATION

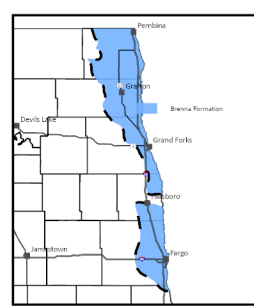
This map depicts the depth of the Brenna Formation in the shallow subsurface in Grand Forks County. Depth to the top of the Brenna Formation is shown as colored isopach contour intervals modeled from test hole, water well, and deep-foundation drilling data. The Brenna Formation was only deposited in the eastern part of the county and covers an area of 414 square miles (1,072 km²). It is more laterally extensive north of the city of Grand Forks and less extensive to the west and south of the city. The Brenna Formation generally occurs at depths of 15-20 feet (4.6 – 6.1 m) but may be as deep as 35 feet (10.7 m) in the northeastern corner of the county.

Depth Contour (feet bls)

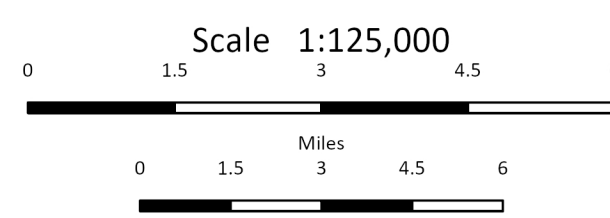
- < 10
- 10 - 15
- 15 - 20
- 20 - 25
- 25 - 30
- 30 - 35
- > 35



Grand Forks County, North Dakota



Location and extent of the offshore lake clays of the Brenna Formation in the Red River Valley of North Dakota.

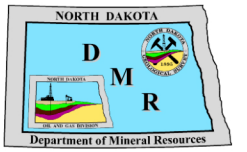


Scale 1:125,000
Mercator Projection
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North American 1983 Datum
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Offshore Glaciolacustrine Deposits of Glacial Lake Agassiz: The Brenna Formation in Grand Forks County, North Dakota



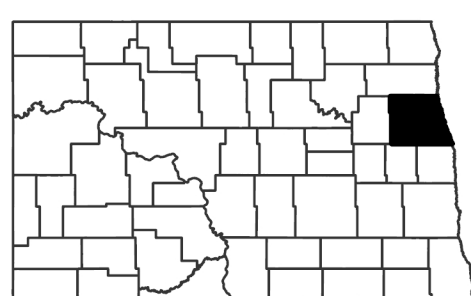
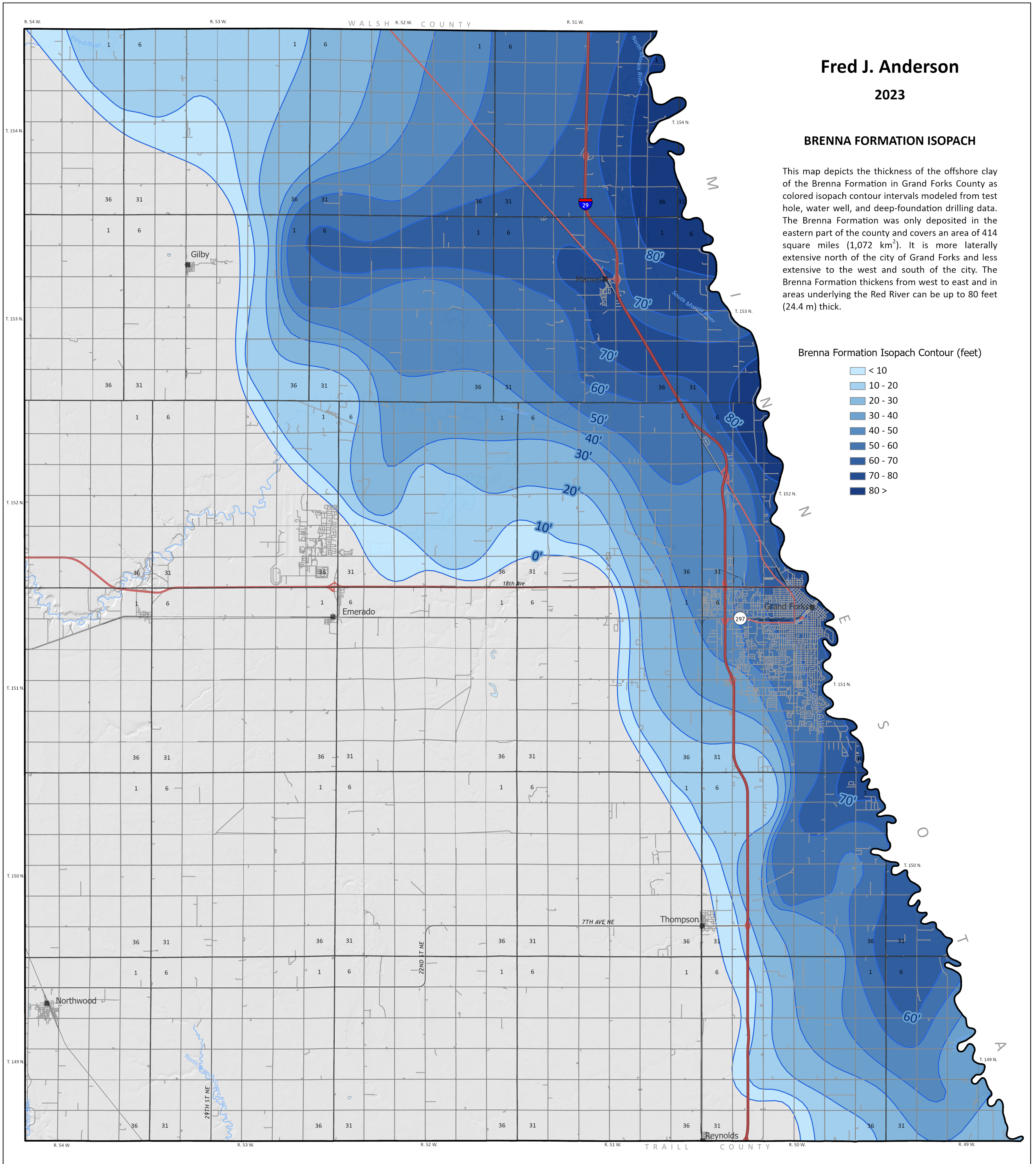
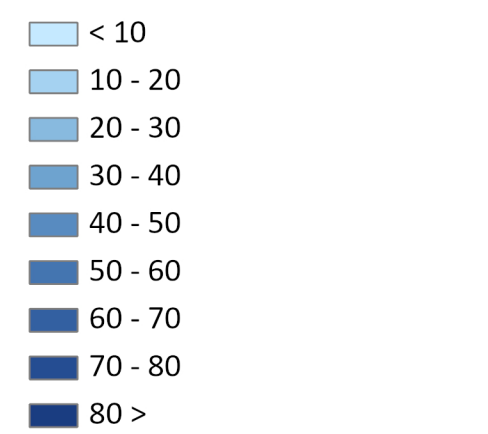
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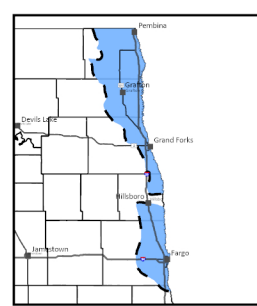
BRENNA FORMATION ISOPACH

This map depicts the thickness of the offshore clay of the Brenna Formation in Grand Forks County as colored isopach contour intervals modeled from test hole, water well, and deep-foundation drilling data. The Brenna Formation was only deposited in the eastern part of the county and covers an area of 414 square miles (1,072 km²). It is more laterally extensive north of the city of Grand Forks and less extensive to the west and south of the city. The Brenna Formation thickens from west to east and in areas underlying the Red River can be up to 80 feet (24.4 m) thick.

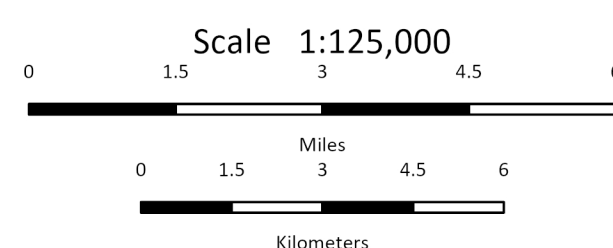
Brenna Formation Isopach Contour (feet)



Grand Forks County, North Dakota



Location and extent of the offshore lake clays of the Brenna Formation in the Red River Valley of North Dakota.



Mercator Projection
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