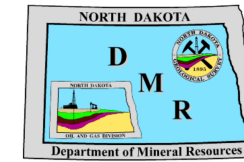




Offshore Glaciolacustrine Deposits of Glacial Lake Agassiz: The Brenna Formation in Walsh County, North Dakota



Fred J. Anderson

2024

LOCATIONS OF DRILLHOLES

This map displays the locations of drillholes in Walsh 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 Cass County contains, on average, 83% clay, 17% silt, with minor (0.3%) amounts of sand (Figure 1). It was only deposited in the eastern part of the county and covers an area of 839 mi² (2,173 km²). 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 properties.

Drillhole Locations

- Test Hole
- Observation Well
- NDDOT Geotechnical Borings
- Private Well
- Brenna Formation

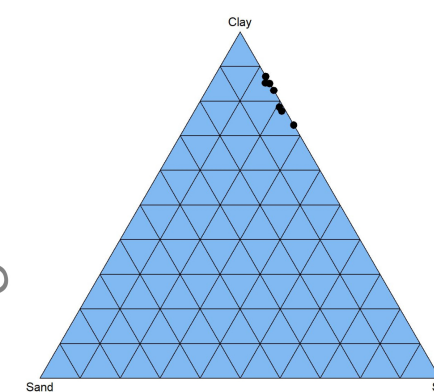
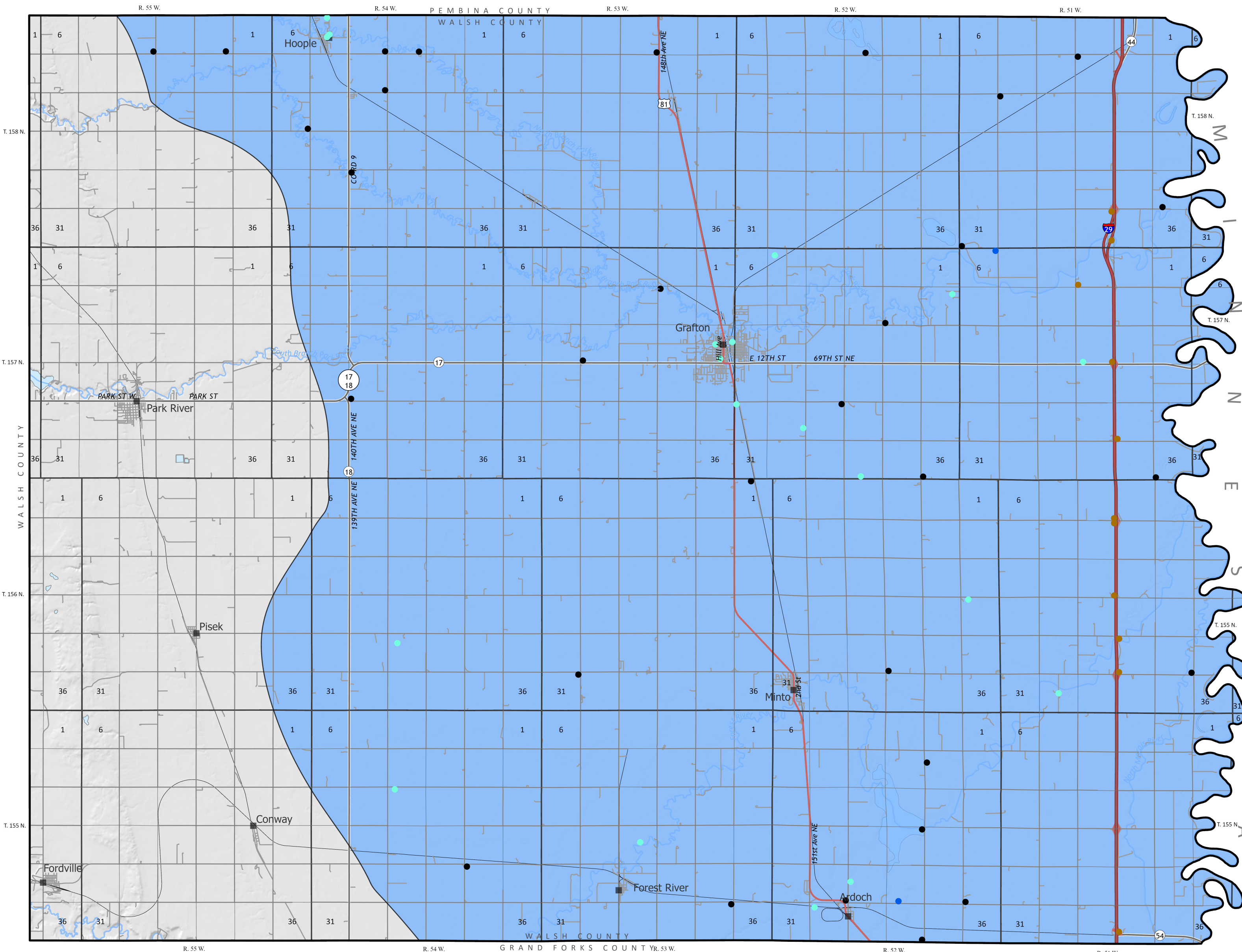
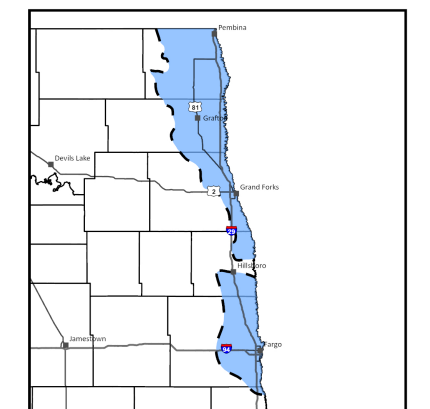


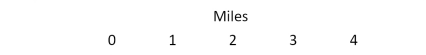
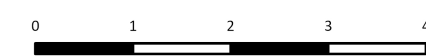
Figure 1. Ternary diagram of Brenna Formation lithology in Walsh County.



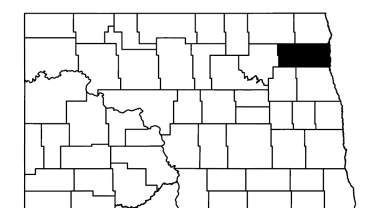
Location and extent of the offshore lake clays of the Brenna Formation in the Red River Valley of North Dakota.



Scale 1:125,000



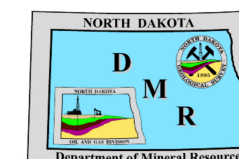
Mercator Projection
Standard Parallel 48°11'15"N
North American 1983 Datum
Central Meridian 97°45'0"W



Walsh County, North Dakota



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



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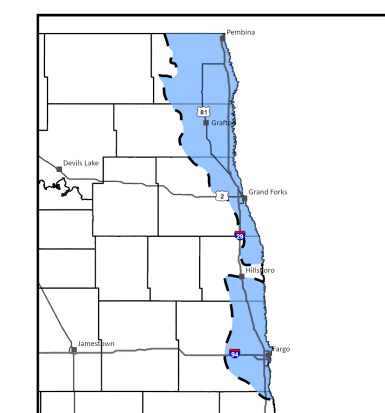
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DEPTH TO BRENNIA FORMATION

This map depicts the depth of the Brenna Formation in the shallow subsurface in Walsh County. Depth to the top of the Brenna Formation is shown as colored depth contour intervals modeled from test, hole, water well, and deep foundation drilling data. The Brenna Formation was only deposited in the eastern half of the county and covers an area of 839 mi² (2,173 km²). The Brenna Formation is generally found at depths between 10 and 20 feet (3 to 6.1 m) but may be as deep as 30 feet (9.1 m) in the southeastern portion of the county along the Red River.

Depth Contour (feet bls)

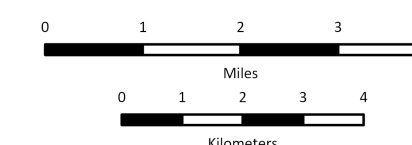
- < 10
- 10 - 20
- 20 - 30
- 30 - 40



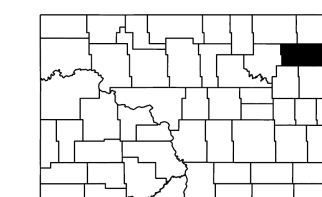
Location and extent of the offshore lake clays of the Brenna Formation in the Red River Valley of North Dakota.



Scale 1:125,000



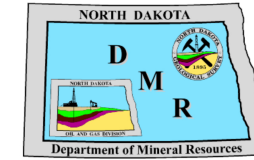
Mercator Projection
Standard Parallel 48°11'15"N
North American 1983 Datum
Central Meridian 97°45'0"W



Walsh County, North Dakota



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

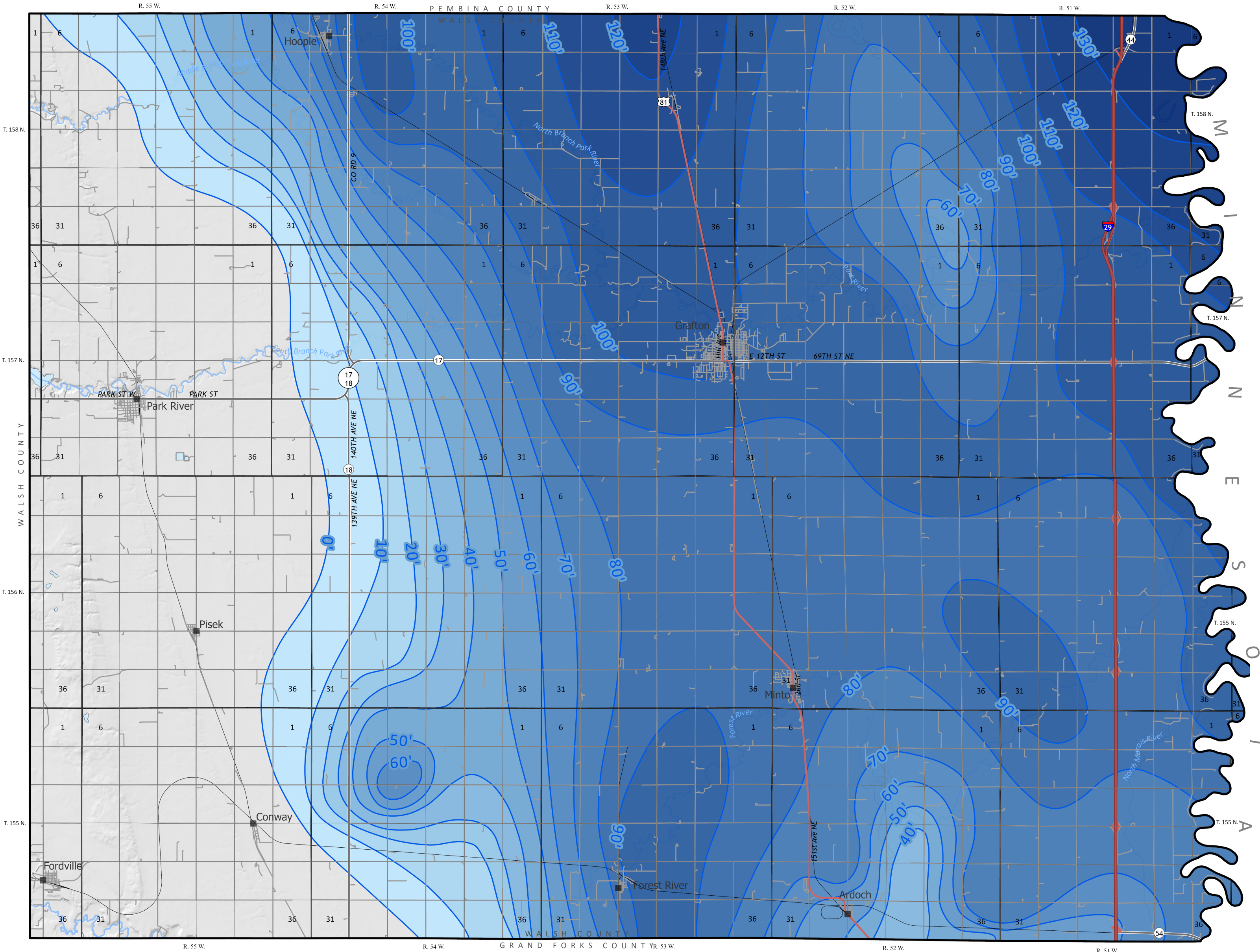


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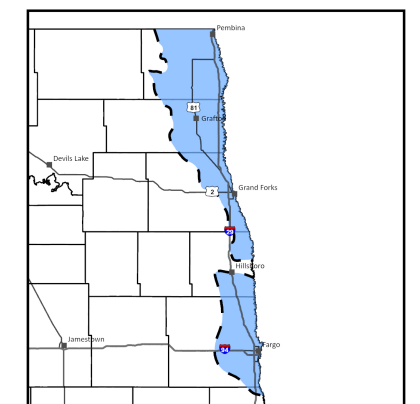
BRENNA FORMATION ISOPACH

This map depicts the thickness of the offshore clay of the Brenna Formation in Walsh 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 half of the county and covers an area of 839 mi² (2,173 km²). The Brenna Formation thickens from west to east and is commonly over 80 feet (24.4 m) thick across the county from four miles west of Grafton to the Red River.

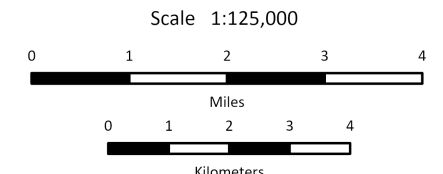


Brenna Formation Isopach Contour (feet)

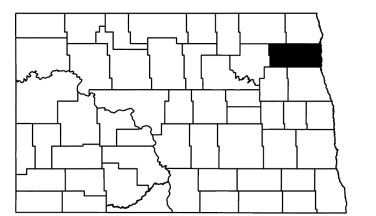
< 10	70 - 80
10 - 20	80 - 90
20 - 30	90 - 100
30 - 40	100 - 110
40 - 50	110 - 120
50 - 60	120 - 130
60 - 70	> 130



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



Mercator Projection
Standard Parallel 48°11'15"N
North American 1983 Datum
Central Meridian 97°45'0"W



Walsh County, North Dakota