North Dakota Geological Survey
24K: Hksn - sg

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Geology of the Hickson Quadrangle, North Dakota

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EXPLANATION

GEOLOGIC UNITS IN MAP AREA

QUATERNARY PERIOD

ANTHROPOCENE

ANTHROPOGENIC DEPOSITS

Af — **FILL DEPOSITS:** Cut and fill materials consisting dominantly of clays, silts, and sands from adjacent nearsurface formations placed by artificial means. Used in construction of highway crossover ramps, wastewater ponds, and flood control embankments associated with the Fargo -Moorhead Diversion.

HOLOCENE EPOCH

GEOHAZARDS

Hlsa — **LANDSLIDE AREAS (ACTIVE):** A mass of material that has moved downslope. Includes earthflows, riverbank slumps, and areas of soil creep along the Wild Rice and Red Rivers mapped from the differencing of LiDAR elevation datasets collected in 2008 and 2020.

Hls — **LANDSLIDE AREAS:** A mass of material that has moved downslope. Includes earth flows, riverbank slumps, and areas of soil creep along the Wild Rice and Red River.

OAHE FORMATION

UNCONSOLIDATED AND GLACIAL SURFICIAL DEPOSITS

Hal — **ALLUVIUM:** Clay, silt, sand, and disseminated organic debris, obscurely bedded, black to brown-gray, associated with sand and gravel of older river channel sediment. Glaciofluvial and modern fluvial deposits associated with the Red and Wild Rice Rivers and ancient rivers on the Lake Agassiz plain.

Hfr — **FLUVIAL SEDIMENT (RECENT):** Black-brown, clay and silt with organics common. Generally, one to three feet in depth. Washed sediments deposited in recent drainages.

Hs — **SHERACK FORMATION:** Glaciolacustrine, yellow gray, thinly laminated silt, clay, and silty clay. Generally, the most common surface lithostratigraphic unit within the quadrangle. Deposited as offshore sediments of Glacial Lake Agassiz. Ranges in thickness from 15 to 35 feet (4.6 to 10.7 m).

PLEISTOCENE EPOCH

COLEHARBOR GROUP

Qb — **BRENNA FORMATION:** Brown to very dark-gray, slightly laminated to unbedded clay and silty clay, soft white and pink calcareous nodules present , slickensides common, soft to very stiff. Deposited as offshore sediments of Glacial Lake Agassiz. Commonly more than 30 feet (9.1 m) thick at depths ranging from 15 to 35 feet (4.6 to 10.7 m) below land surface.

Qcr — **SUBGLACIAL TILL:** Gray to dark-gray and olive silty clay with sand and coarse to fine gravel (undifferentiated). Sediment deposited by glacial ice of Late Wisconsinan age. Multiple till formations are likely within this group. The Red Lake Falls Formation is the uppermost till (diamicton) in this area.

Ql — **LACUSTRINE CLAY:** Grey silty clay, in some places containing laminae of sand. Up to 15 feet (4.6 m) thick. Localized pre-Agassiz lake deposits.

Qcs — **SAND & GRAVEL:** Fine gravel to fine sand with shale pebbles and gray clay common. Unconsolidated deposits of the West Fargo Aquifer.

-Unconformity-

CRETACEOUS BEDROCK

BEDROCK

Ku — **SHALE (undifferentiated):** Dark-gray to gray-brown, clayey carbonaceous shale with interbedded silt and fine sand. Erosional remnants in excess of 40 feet (12 m) in thickness are occasionally present.

-Nonconformity-

PRECAMBRIAN BASEMENT

p€ — **WEATHERED GRANITE:** Green-gray to pink-white, clayey with granite pebbles and fragments. Occasional angular quartz grains. Depth of weathered zone inferred from drillhole lithologic logs.

p€ — **GRANITIC ROCKS:** Archaen age basement rocks of the Superior Province.

GEOLOGIC UNITS IN CROSS SECTION

Potential Channel Neck Cutoffs: Locations where continued cutbank erosion may lead to meander loop cutoff and creation of new oxbows.

Geologic contact

15′ Depth Contour (feet) on the top of the Brenna Formation

20′ Isopach (thickness) Contour (feet) on the top of the Brenna Formation

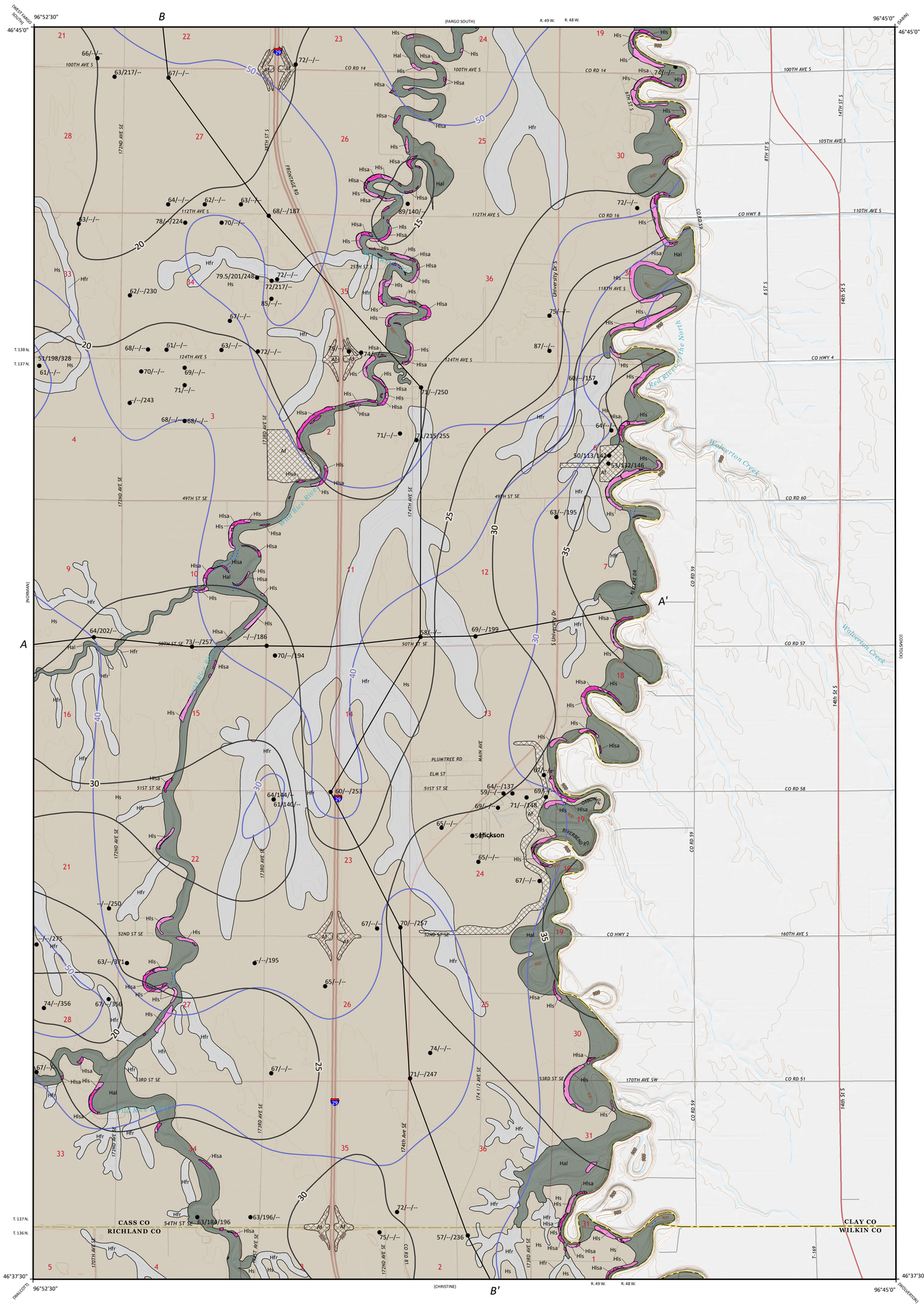
A A′ Line of Cross-Section

GEOLOGIC UNIT DEPTHS
(feet)

Drillhole Location — Clay Till (Diamicton)
64/202/315
Bedrock (Shale) — Basement (Weathered/Granite)
-- Not Available

CORRELATION OF UNITS IN MAP AND CROSS-SECTION

Glacial	Glaciolacustrine	Fluvial	Geohazards	Anthropogenic	Marine	Cratonic	Geochronology		
Subglacial	*Offshore*	*Channel & Overbank*	*Landslide*	*Fill*	*Offshore*	*Superior Province*	Epoch	Period	Era
		Hal Hfr	Hls Hlsa	Af			Holocene	Quaternary	Cenozoic
	Hs						Pleistocene		
	Qb								
Qct Qcs	Ql						*-Unconformity-*		
							Cretaceous		Mesozoic
					Ku		*-Nonconformity-*		
						p€	Archean		Precambrian
						p€			



2°50′ MN
2019 Magnetic North
Declination at Center of Sheet

Scale 1:24,000

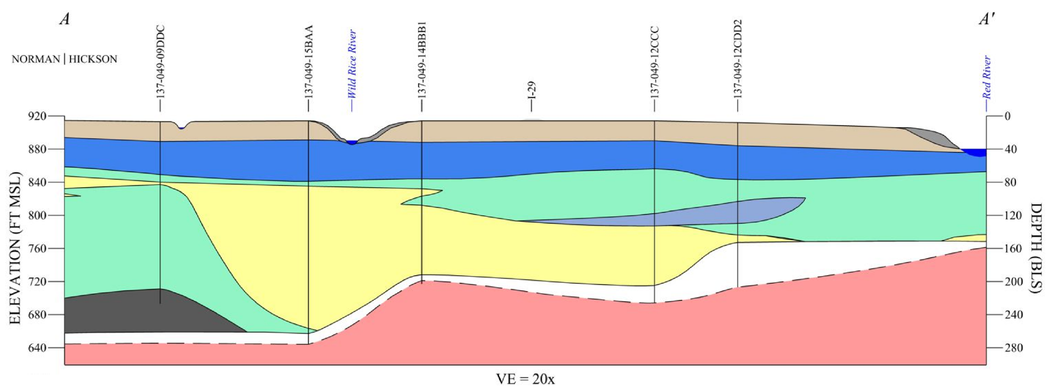
0 0.25 0.5 1 Miles
0 1,000 2,000 4,000 Feet
0 0.25 0.5 1 Kilometers

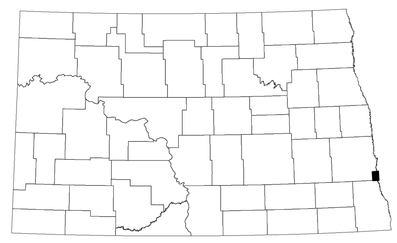
Lambert Conformal Conic Projection
North American 1983 Datum
USGS 7.5 Minute Topo Map

Standard Parallels 48°0′0″N, 48°7′30″N
NGVD 1988

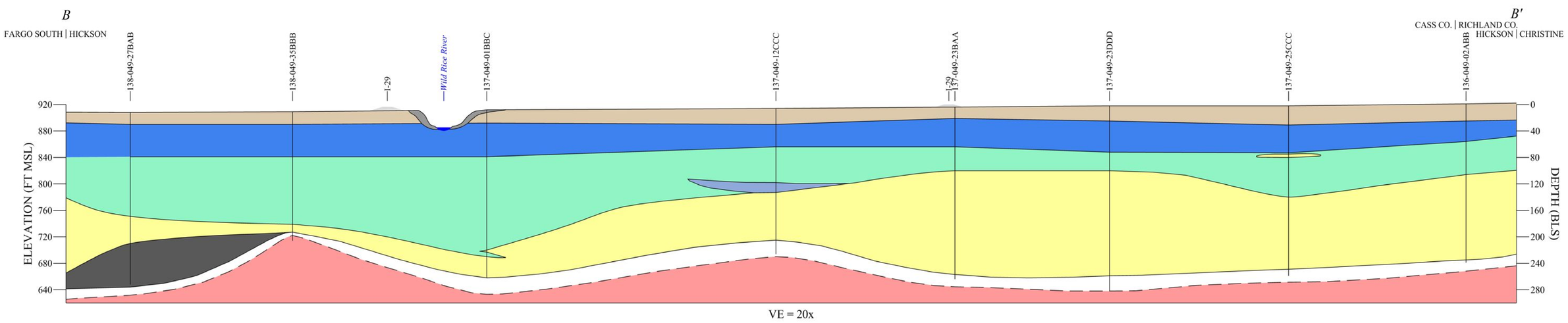
LIDAR Data Originator:
International Water Institute, 2010,
Red River Basin Mapping Initiative 2008-2010.
NRCS-Bismarck and ND State Water Commission, 2017,
James River Basin LiDAR QL2.

Index to Adjacent 7.5 Quadrangles





Hickson Quadrangle, North Dakota



GEOLOGY OF THE HICKSON QUADRANGLE

The geology in the Hickson areas consists of flat-lying offshore glaciolacustrine sediments deposited within the former Glacial Lake Agassiz along with recent fluvial and overbank sediments from along the Wild Rice and Red Rivers and their tributary drainages. The Red River, the largest of the two flows along a highly circuitous meandering path of 19.2 river miles (30.9 - km) along a 9.8-mile (15.8-km) reach and drops approximately 10 -feet (3-m) from an elevation of 894-ft (272.5-m) in the south to an elevation of 884 -ft (269.4-m) in the north. The Red River in this quadrangle has a sinuosity ratio of 1.96 indicating a highly meandering river (Charlton, 2008). The Wild Rice River flows along a less circuitous path of 16.9 river miles (27.2-km) along a 9.7-mile (15.6-km) reach and drops approximately 12 -feet (3.6-m) from an elevation of 902-feet (274.9-m) in the south, to an elevation of 890-feet (271.3-m) in the north. In the southern two-thirds of the quadrangle the Wild Rice River flows along a much straighter path with a sinuosity ratio of 1.3, which is indicative of a generally sinuous stream, but increases its sinuosity in the northern third of the quadrangle to a highly meandering value of 2.1 as it approaches its confluence with the Red River near Briarwood, south of Fargo. This area is subject to seasonal flooding along the Wild Rice and Red Rivers. There are several locations in this quadrangle where the inter-channel distance between meanders is approaching neck cutoff stage which will result in the creation of new oxbow lakes and resultant smoothing of the main channels. Topography is minimal in this quadrangle with local relief of 12 feet (3.6 m) over 9.5 miles (15.3 km) from the southwest corner to the northeast corner of the quadrangle and is essentially flat to the ground observer. Anthropogenic fill deposits consisting of levees, berms, roadway embankments, and flow control structures recently constructed as a part of the Fargo Diversion project to control seasonal flooding in the area.

In the shallow subsurface (i.e., the uppermost 100 feet (30.5 m) the Sherack and Brenna Formations are the two dominant glaciolacustrine units in the quadrangle. The Sherack Formation commonly consists of tan to gray laminated silts and clays which overlay the dark gray, soft and expansive clays of the Brenna Formation. The Brenna Formation contains smectitic clays which when saturated result in a soft and expansive clay which deforms easily when placed under load. Slumping along rivers and creeks is common and ongoing within these units. LiDAR differencing analysis (2008 to 2020) indicates that there are 136 areas where continued slumping and erosion has been occurring. Over 129 areas have experienced some form of historical erosion or slumping due to continued seasonal fluctuations in water levels and nearly annual flooding.

Depth and Isopach (thickness) contours drawn on the Brenna Formation are also depicted on this map. The Brenna Formation is generally between 15 and 35 feet (4.6 to 10.7 m) below land surface (bls), getting slightly deeper from west to east and ranges between 30 to 50 feet (9.1 to 15.2 m) in thickness, generally thinning to the west and east from the central portion of the Red River Valley. Underlying the offshore glaciolacustrine sediments of Lake Agassiz are multiple glacial till (diamicton) units from multiple advances of glacial ice in the Red River Valley (Harris, et. al, 2020). The uppermost till is most likely the Red Lake Falls Formation which consists of a sandy, silty, clay mix with carbonate and metamorphic very-coarse sand lithologies. Shale bedrock ranges in depth from 113 to 238 feet (34.4 to 72.5 m) bls. Depth to Precambrian basement rocks ranges from 137 to 371 feet (41.7 to 113 m) bls.

REFERENCES

Anderson, F.J., 2020, Geology of the Mapleton Quadrangle, North Dakota, North Dakota Geological Survey, 1:24,000, 24K Mptn – sg.

Anderson, F.J., 2011, Depth to Bedrock in the Fargo Area, North Dakota, North Dakota Geological Survey, Geologic Investigations No. 142, 1:48,000.

Anderson, F.J., 2008, Surface geology of the West Fargo South Quadrangle, North Dakota Geological Survey, 1:24,000.

Anderson, F.J., 2007, Surface geology of the Fargo South Quadrangle, North Dakota Geological Survey, 1:24,000.

Arndt, M.B., 1977, Stratigraphy of Offshore Sediment Lake Agassiz, North Dakota, Report of Investigation No. 60, North Dakota Geological Survey, 58 p.

Cass Co., 2018, Cass County Comprehensive & Transportation Plan, https://www.casscountynd.gov/home/showdocument?id=5508 , 137 p.

Charlton, R., 2008, Fundamentals of Fluvial Geomorphology, Routledge, 234 p.

Harris, K.L., Manz, L.A., and Lusardi, B.A., 2020, Quaternary Stratigraphic Nomenclature, Red River Valley, North Dakota and Minnesota: An Update, North Dakota Geological Survey, Miscellaneous Series No. 95, 249 p.

Harris, K.L., 1987, Surface geology of the Sheyenne River Map Area, Map AS-15-1, North Dakota, Geological Survey, 1:250,000.

Harris, K.L., Moran, S.R., and Clayton, L., 1974, Late Quaternary Stratigraphic Nomenclature, Red River Valley, North Dakota and Minnesota, North Dakota Geological Survey, Miscellaneous Series 52.

Klausing, R.L., 1968, Geology and Ground Water Resources of Cass County, North Dakota, Part I Geology, Bulletin 47, North Dakota Geological Survey, 39 p.

MFDA, 2022. FM Area Diversion Public Web Map. Scale not given, generated August 23, 2022, https://ae2s.maps.arcgis.com/apps/webappviewer/index.html?id=540df59eb678439686656ec99f15a6bb

Schwert, 2003, A Geologist's Perspective on the Red River of the North: History, Geography, and Planning/Management Issues, Proceedings 1st International Water Conference, Red River Basin Institute, Moorhead, MN, 16 p.

Thorleifson, H., Harris, K., Berg, J., Tipping, R., Malolepsky, Z., Lusardi, B., Setterholm, D., and Anderson, F.J., 2005, Geological Mapping and 3D model of deposits that host ground-water systems in the Fargo-Moorhead region, Minnesota and North Dakota: a report submitted to the U.S. Bureau of Reclamation, Minnesota Geological Survey, 155 p.

Cartographic Compilation: Navin Thapa

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