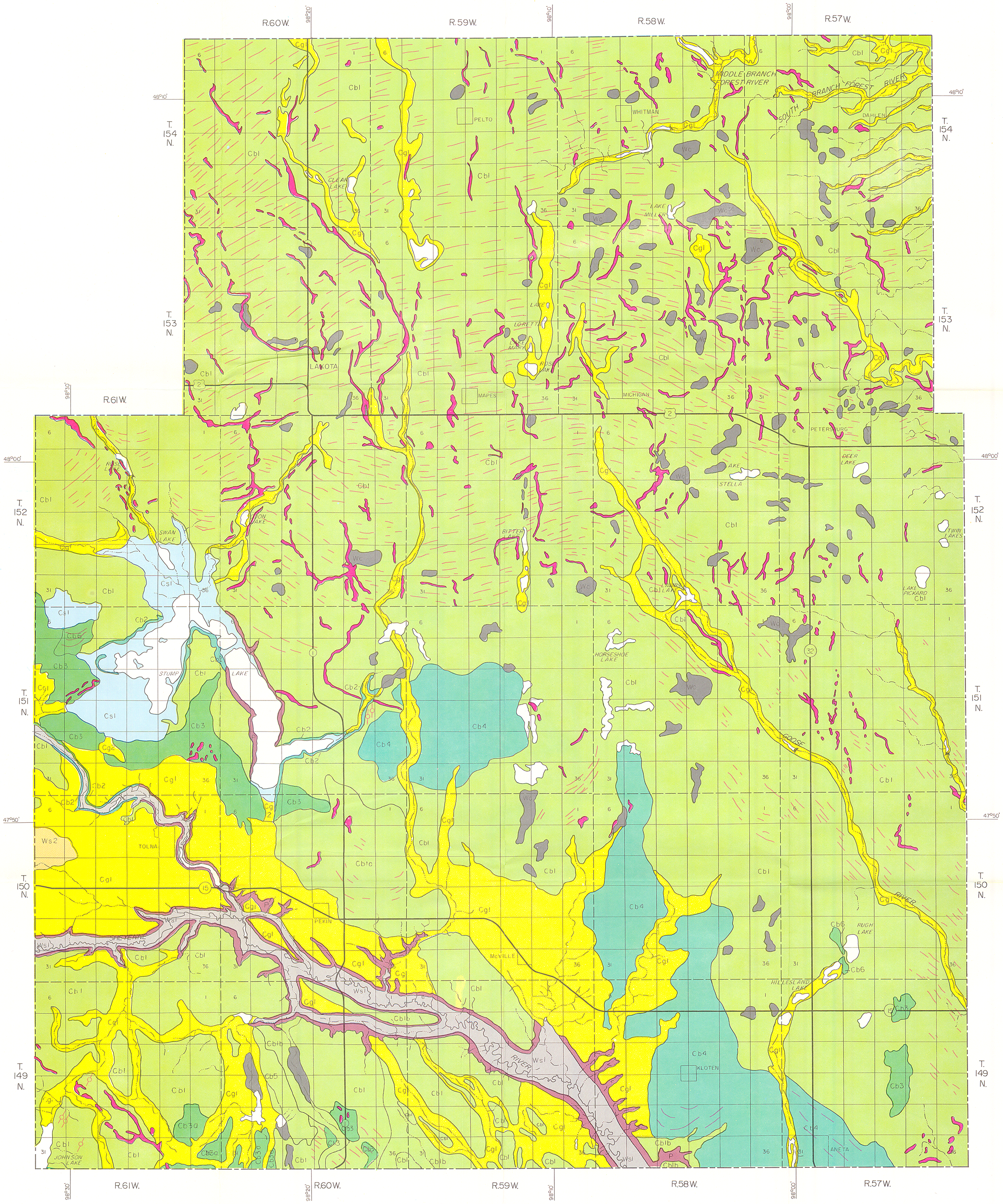
BULLETIN 57
COUNTY-GROUND WATER STUDIES 17
PART I PLATE 1

# GEOLOGY OF NELSON COUNTY, NORTH DAKOTA

By John P. Bluemle




0 1 2 3 4 5 6 MILES

PREPARED BY THE NORTH DAKOTA GEOLOGICAL SURVEY IN COOPERATION WITH THE NORTH DAKOTA STATE WATER COMMISSION, THE UNITED STATES GEOLOGICAL SURVEY AND THE NELSON COUNTY WATER MANAGEMENT DISTRICT.

## EXPLANATION

| | | LITHOLOGY | MAP SYMBOL | ORIGIN |
|---|---|---|---|---|
| WALSH FORMATION | CLAY FACIES | Clay, highly organic, vague horizontal bedding; ranges from tough and black to soft, bluish or greenish. | Wc | Slough deposits. |
| | GRAVEL FACIES | Sandy gravel, some gravelly sand; poorly sorted; rude horizontal bedding; pebbles are 25 to 95 percent shale. | Wg | Colluvial deposits in front of steep slopes such as the Pembina escarpment. |
| | SAND AND SILT FACIES | Dark brown, gray or black silty clay, clayey silt, or sandy silt; vague horizontal bedding; shells and wood; bones; oxidized. | Ws1 | River alluvium beneath modern floodplains. |
| | | Silt and very fine sand; nonstratified; oxidized; vague horizontal color banding; considerable black silt in places; occasionally well-sorted, fine sand with frosted grains. | Ws2 | Wind-blown deposits. |
| COLEHARBOR FORMATION | TILL FACIES | Till typically consists of a nonsorted, nonstratified mixture of angular, subangular and rounded blocks of rock, gravel and sand in a stiff matrix of silt and clay; various size grades occur in all possible proportions. | Cb | Materials that were deposited directly from glacier ice. |
| | | | Cb1 | Material that was deposited at the base of the moving glacier along with mudflow deposits that formed on ablation of the glacier; disintegration features are generally lacking; grades to Cb4 in places; washboard moraines are common in places. |
| | | Commonly very bouldery; patches of sand and gravel in places. | | Cb1a–Surface of Cb1 that has been washed by wave action along the shore of a lake; beach remnants occur in places. |
| | | Commonly very bouldery; patches of sand and gravel in places. | | Cb1b--Surface of Cb1 that has been washed by running water. |
| | | Till with a high percentage of sand. | | Cb1c--Reworked sand (glacial outwash?) deposit; probably Cg1 that was overridden by ice. |
| | | Commonly very bouldery; slopes are debris-covered in places. | Cb2 | Eroded slopes along major valleys such as the Sheyenne River valley. |
| | | Commonly contains high percentages of sand and gravel; rather bouldery in places. | Cb3 | Materials deposited primarily at the ice margin; may represent seasonal or significant pauses in the recession of the ice margin or slight readvances of the glacier. |
| | | Contains high percentages of silt and sand; remnants of bedding can be seen in places. | | Cb3a–Lake deposits that were overridden by the glacier and redeposited at the ice margin. |
| | | Commonly contains high percentages of sand and gravel; rather bouldery. | Cb4 | Materials deposited during glacial stagnation; consists mainly of superglacial materials that were irregularly let down from the surface of the glacier and from within the glacier as the ice melted; mainly mudflow deposits; looks like Cb1 in the field; recognized primarily from air photos on which disintegration features are apparent. |
| | | | Cb5 | Veneer of till on preexisting nonglacial topography. |
| | | Till surface with a core of bedrock, till or other glacial drift. | Cb6 | Large block of material that has been moved from nearby by the glacier resulting in an anomalous hill; in many cases depressions are located "up-ice" from the hills, apparently marking the location from which the block was taken. |
| | SAND AND GRAVEL FACIES | Gravel, gravelly sand, sand, silty sand and sandy silt. | Cg | Materials that were deposited by running water or along the shores of lakes. |
| | | Mainly sandy gravel; some gravel and gravelly sand; vague horizontal bedding; poor sorting; high shale percentages in areas underlain by Cretaceous shale formations. | Cg1 | Materials washed out from the glacier by meltwater; includes alluvium of Pleistocene age that is present on terraces along trenches cut by glacial meltwater and on the floors of such trenches where it may be overlain by modern alluvium in many places. |
| | | Sandy, shaly gravel and gravelly sand; some silt; vague to excellent horizontal and contorted (slumped and faulted) bedding; poor sorting. | Cg2 | Alluvium and outwash materials that were deposited on stagnant ice and subsequently collapsed on melting of the stagnant ice. |
| | | Gravelly sand and sandy gravel with small amounts of silts; good sorting and graded bedding. | Cg3 | Sediments deposited along shores of lakes; individual beach ridges are shown by symbol (see below). |
| | | Sandy gravel; some gravel and gravelly sand; minor sandy silt and till; vague bedding plains; poor sorting; high shale percentages in areas underlain by Cretaceous shale formations. | Cg4 | Disintegration features such as eskers and kames deposited in contact with glacial ice. |
| | | Mainly sandy, shaly gravel, silty at the surface; vague to good horizontal bedding. | Cg5 | Materials deposited in streams either shortly after Lake Agassiz drained or during the interval between Agassiz I and II; differential settling of gravel and nearby lake silts when area dried resulted in a ridge of fluvial sediment. |
| | SILT AND CLAY FACIES | Clay, silty clay, clayey silt, silt and fine sand; horizontal bedding in places; structureless in places. | Cs | Materials deposited in proglacial lakes. |
| | | | Cs1 | Veneer of lake sediments on till surface; materials deposited in proglacial or post glacial lakes. |
| | | Mainly silty clay. | Cs2 | Offshore lake deposits with abundant surface lineations caused by floe ice dragging on the lake floor. |
| | | Mainly silty clay. | | Cs2a–Offshore lake deposits with polygonal surface markings caused either by the settling of large ice blocks into the materials on the lake floor or by permafrost. |
| | | Mainly clayey silt. | Cs3 | Offshore lake deposits with abundant surface lineations caused by floe ice dragging on the lake floor. |
| | | | | Cs3a–Offshore lake deposits with a smooth surface. |
| | | Mainly silt with some sand. | Cs4 | Nearshore lake deposits with a few vague beach ridges. |
| | | Mainly silt with some sand and gravel, especially near the surface. | Cs5 | Nearshore, still water lake deposits, apparently deposited in an embayment between the ice margin and the Pembina escarpment. |
| PIERRE FM. | | Gray to black shale with gray marl and numerous beds of bentonite; noncalcareous to calcareous; slumps in places. | | Marine shales. |
| NIOBRARA FM. | | Yellow-orange marl and calcareous shale. | | Marine shales. |
| COMPOSITE LANDFORM SYMBOLS | | | | Washboard moraines; low, linear ridges, either straight or arcuate in plan; present only on areas of Cb; best seen on air photos. |
| | | | | Lineations; narrow, streamlined ridges of varying height, width and length present on areas of Cb; best seen on air photos; formed by moving glaciers; long axes parallel the presumed direction of ice flow. |
| | | | | Beaches; low ridges, generally less than 10 feet high commonly associated with areas of Cg3 but also found in association with Cgs and Cs. |
| | | | | Scarp (tic marks on downslope side); many are wave-cut features that mark a former shoreline of a proglacial lake. |
| | | | | Geologic contact; separates areas of differing lithology and/or origin. |
| | | | | Perennial or intermittent streams. |
| | | | | Lakes. |

Uncolored squares represent lithologies found in Walsh County, but not in Nelson County.

BULLETIN 57
COUNTY-GROUND WATER STUDIES 17
PART I PLATE 2

# GEOLOGY OF WALSH COUNTY, NORTH DAKOTA

By John P. Bluemle

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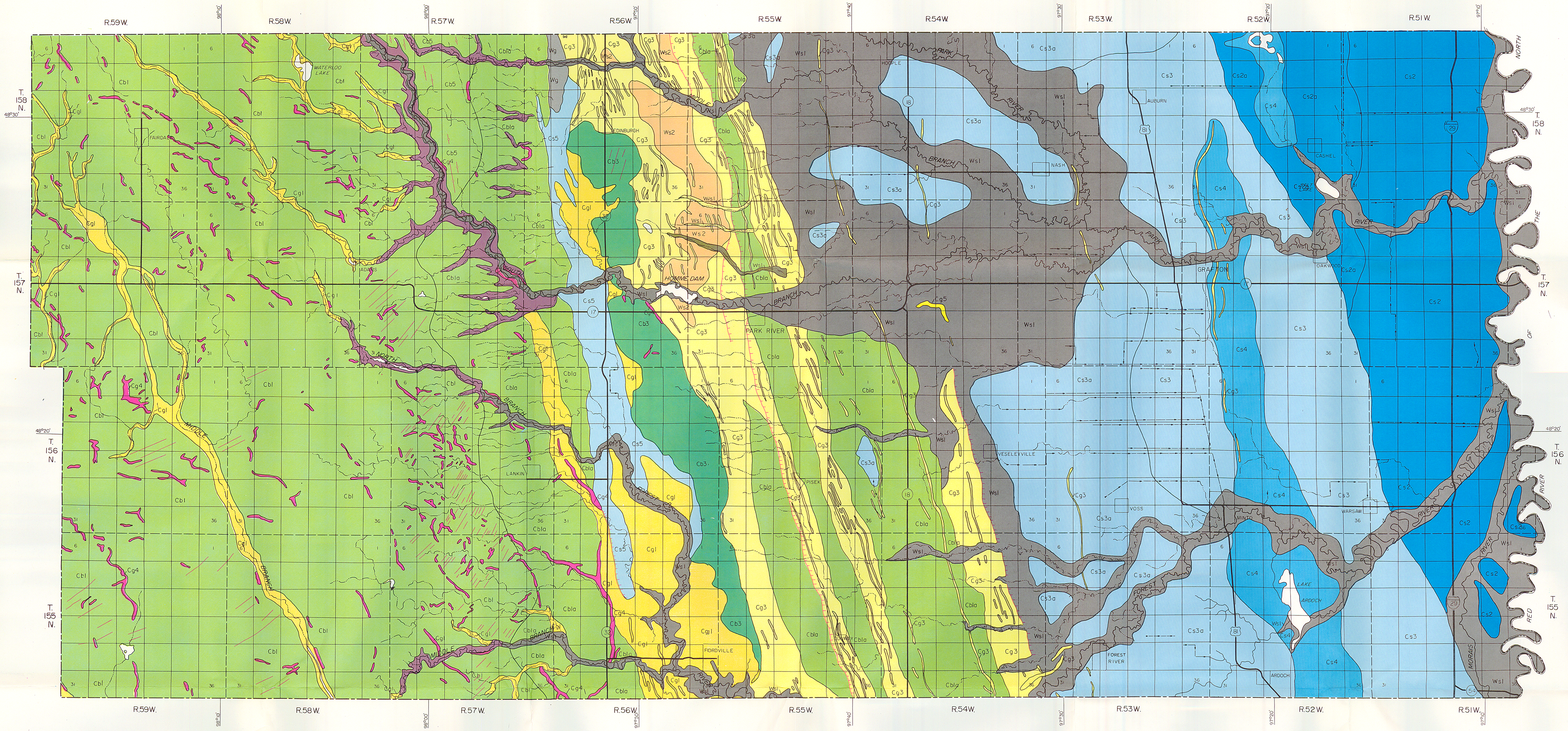


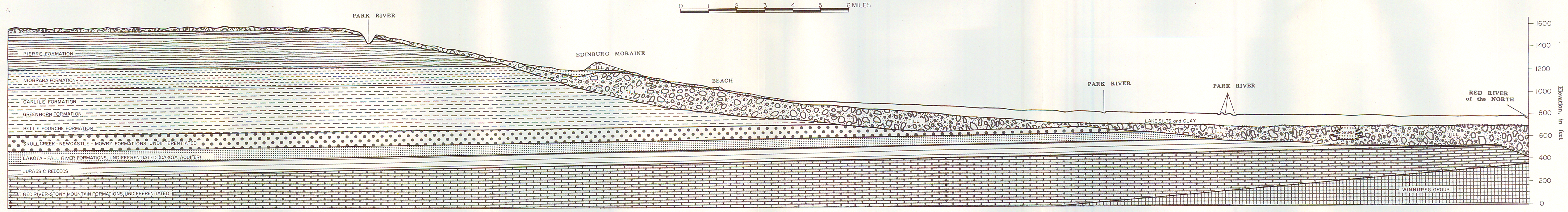


Pleistocene Sediments, Coleharbor Fm.

TEJAS
- Lake deposits, silt and clay
- Sand
- Glacial sediment, till

Cretaceous Rocks

ZUNI
- Pierre Fm., shale
- Niobrara Fm., shale

Cretaceous Rocks (cont.)

ZUNI
- Carlile, Greenhorn, Belle Fourche Fms., undiff. mainly shale
- Skull Creek, Newcastle, Mowry Fms., undiff. shale and sandstone
- Lakota-Fall River interval, undiff.

Jurassic Rocks
- Redbeds

Devonian, Silurian and Ordovician Rocks

KASKASKIA-TIPPECANOE
- Carbonates and shales, undiff.
- Winnipeg Group, shale and sandstone

GENERALIZED CROSS-SECTION THROUGH NORTHERN WALSH CO., N.D.
by Joe S. Downey, U.S.G.S.

## EXPLANATION

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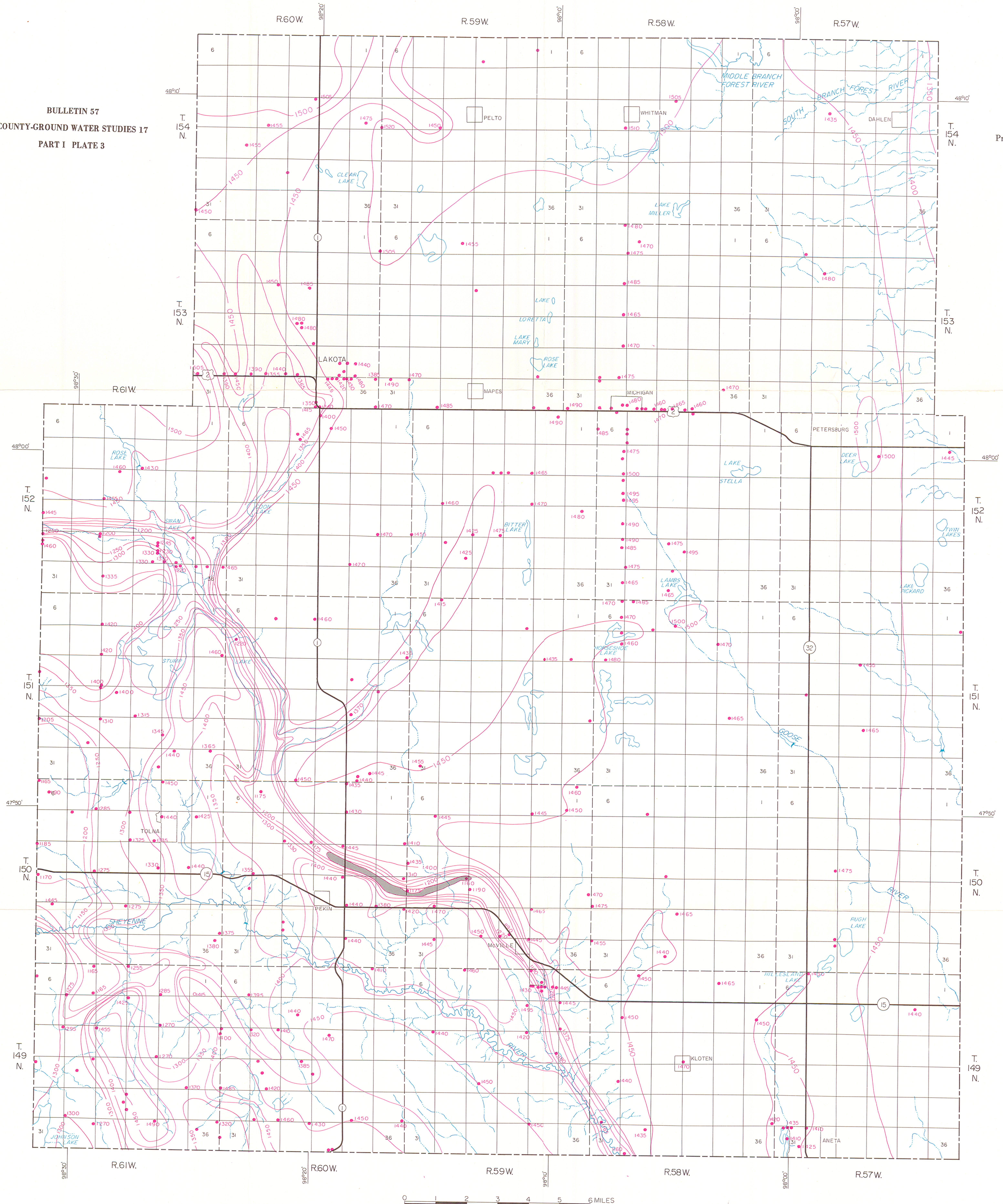
# BEDROCK TOPOGRAPHY AND GEOLOGY OF NELSON COUNTY, NORTH DAKOTA

BULLETIN 57
COUNTY-GROUND WATER STUDIES 17
PART I PLATE 3

Prepared by Joe S. Downey
U.S. Geological Survey

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EXPLANATION

Contour on surface of bedrock, interval 50 feet
Datum is mean sea level.

Test hole

1000 Test hole with elevation of bedrock to nearest 5 feet

Pierre Formation

Niobrara Formation

BULLETIN 57
COUNTY-GROUND WATER STUDIES 17
PART I PLATE 4

# BEDROCK TOPOGRAPHY AND GEOLOGY OF WALSH COUNTY, NORTH DAKOTA

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EXPLANATION

Contour on surface of bedrock, interval 50 feet
Datum is mean sea level.

Test hole

1000 Test hole with elevation of bedrock to nearest 5 feet

Contact between geological formations

Prepared by Joe S. Downey
U.S. Geological Survey