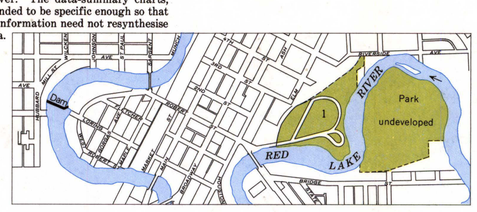
DEPARTMENT OF INTERIOR
UNITED STATES GEOLOGICAL SURVEY

PREPARED IN COOPERATION WITH THE
MINNESOTA DEPARTMENT OF CONSERVATION
DIVISION OF WATERS, SOILS, AND MINERALS

HYDROLOGIC INVESTIGATIONS
ATLAS HA–299 (SHEET 1 OF 2)

PURPOSE

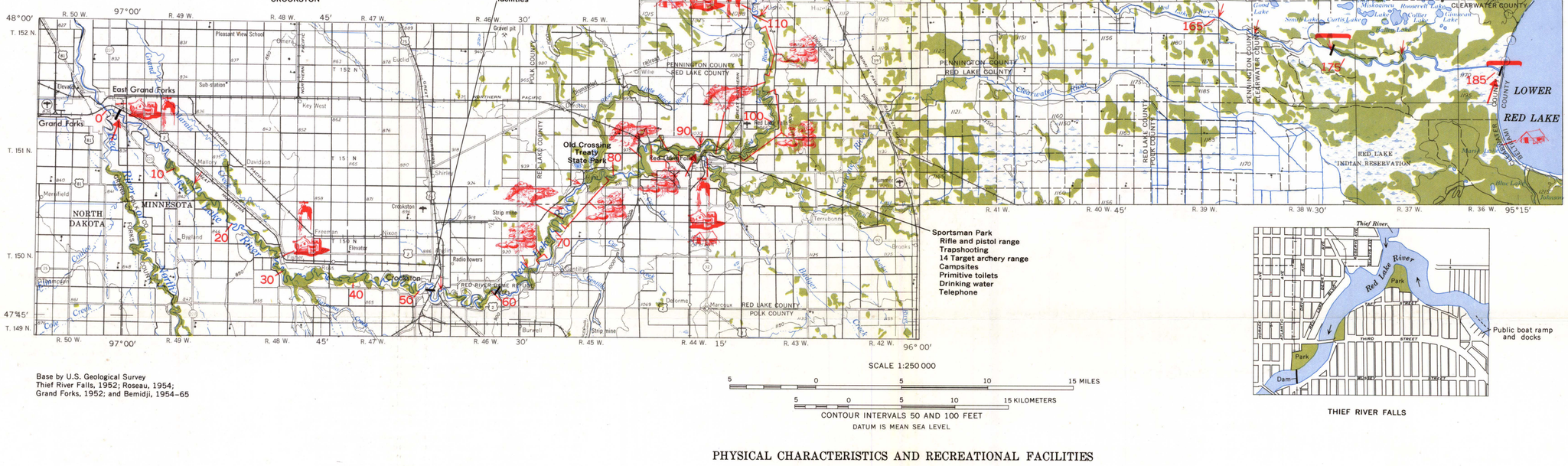
This report is intended to serve a wide range of people including educators, scientists, planners, and those who wish to enjoy travel on the river. The data-summary charts, graphs, and tables are intended to be specific enough so that users who require precise information need not resynthesise the original numerical data.



CROOKSTON

Central Park (1)
Campsites
Toilets
Bandstand
Wading pool
Childrens recreational facilities

Riverside Park
50 Campsites
6 Stone fireplaces
Firewood
Garbage disposal
12 Tables
Running water
Toilets
Swings and ground Equipment



Base by U.S. Geological Survey
Thief River Falls, 1952; Roseau, 1954;
Grand Forks, 1952; and Bemidji, 1954–65

SCALE 1:250 000

5 0 5 10 15 MILES
5 0 5 10 15 KILOMETERS

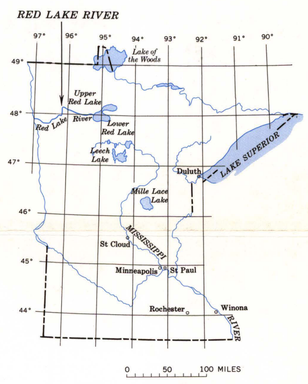
CONTOUR INTERVALS 50 AND 100 FEET
DATUM IS MEAN SEA LEVEL

THIEF RIVER FALLS

HIGH LANDING GAGING STATION

EXPLANATION

- Woods or brush
- 10 — Distance, in miles from mouth of river
- Rapids or falls
- Riffle or shoal area
- Portage
- Dam or Weir
- Supplies
- Campsites
- Drinking water
- Developed access
- Undeveloped access



INDEX MAP OF MINNESOTA

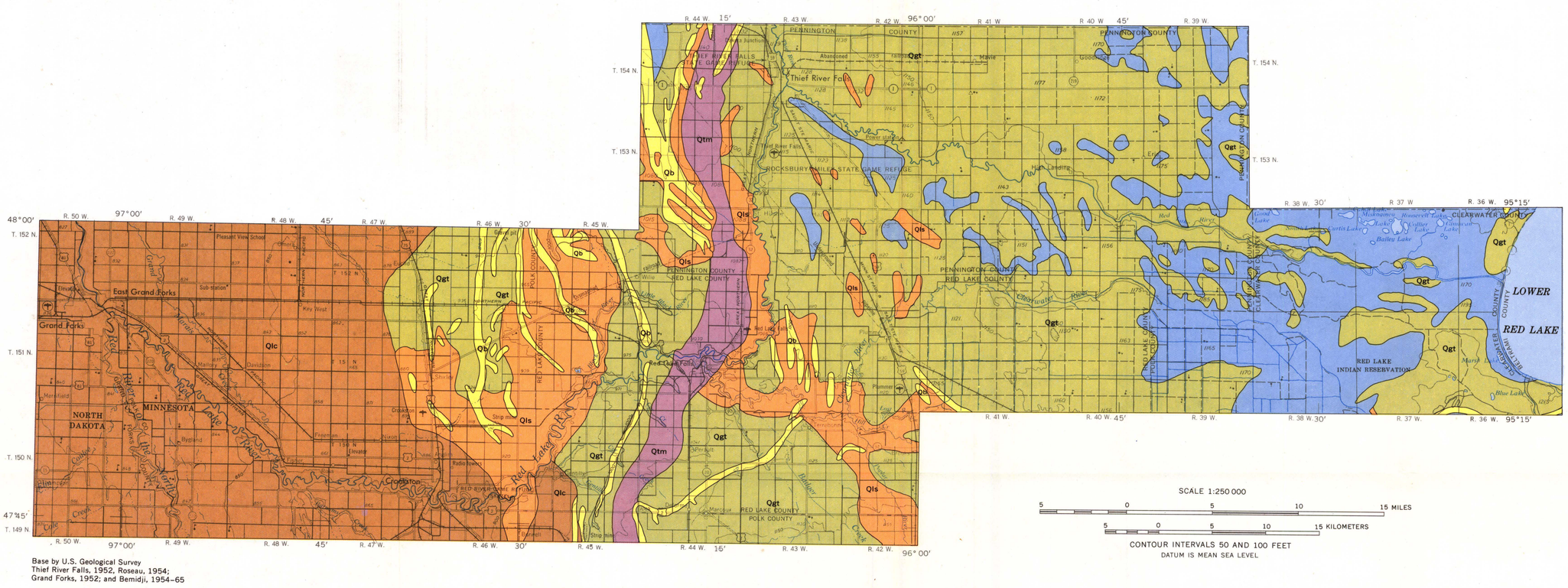
PHYSICAL CHARACTERISTICS AND RECREATIONAL FACILITIES

EXPLANATION

Pleistocene — Wisconsin — QUATERNARY

- Swamp deposits — *Peat and muck found in swamps, most of which are still in existence*
- Qb — Beach sand and gravel — *Beaches formed along the shores of Lake Agassiz at several stages. Lake level was determined by glacial ice dams at the outlets*
- Qlc — Lacustrine clay — *Lake bottom deposits of fine clay and silt. At maximum size, Lake Agassiz was more than 600 feet deep and only the finest sediments were deposited*
- Qls — Lacustrine sand — *Lake bottom sediments deposited near shore in shallow water of Lake Agassiz*
- Qgt — Clayey and stony till — *The till was submerged and reworked by shallow waters of Lake Agassiz*
- Qtm — Terminal moraines of Kewatin Ice — *Moraines consisting of sand, gravel, and till formed at the edge of the Des Moines ice lobe*

Contact



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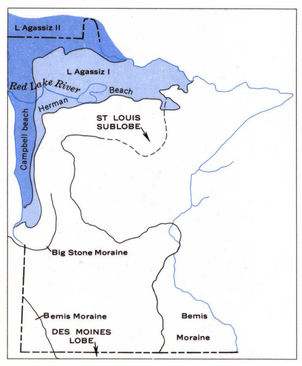
CONTOUR INTERVALS 50 AND 100 FEET
DATUM IS MEAN SEA LEVEL

SURFICIAL GEOLOGIC MAP (AFTER LEVERETT, 1932)

GEOLOGY

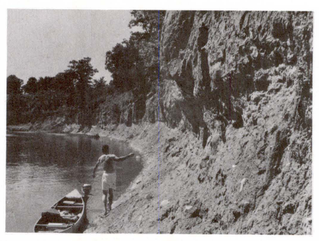


GLACIAL MAP OF MINNESOTA

Glacial drift, rock material deposited as a direct result of glacial ice advancing over Minnesota, covers the entire Red Lake River valley. On top of these deposits are lake sediments. Although glaciation occurred over a period of one million years, the most recent glaciation is the one which had the greatest effect on the present shape of the valley. This is called the WISCONSIN glaciation. In Minnesota, it is now subdivided according to advance and retreat of the major ice lobes or tongues that flowed south out of Canada and east out of Lake Superior. The DES MOINES LOBE advanced into southern Minnesota two times, the BEMIS phase 14,000 years ago, and the MANKATO phase 13,000 years ago. Both these advances covered the Red Lake River valley. LAKE AGASSIZ, which formed behind a dam of ice of the Des Moines lobe, existed at two periods, the more extensive 11,000 years ago, the second 9,000 to 7,000 years ago.

The rock materials in glaciers are carried predominantly in the lower part of the ice. The deposition of the rock material carried takes place in many forms. The most common deposit is TILL, a heterogeneous mixture of clay, silt, sand, pebbles, cobbles, and boulders. This till is deposited as GROUND MORAINE, a flat featureless cover over the existing landscape. TERMINAL or END MORAINE is a piling up of the till that takes place when the forward motion of the glacial ice is just equal to the rate of melting. The ice carries rock material up to a fixed line and drops it there as the ice melts. LAKE CLAY was deposited on the bottom of glacial Lake Agassiz as fine material that was carried far from shore by deep lake currents. Near shore, BEACH SANDS and other coarse grained shoreline features were deposited.

For its entire length, the Red Lake River flows on the ancient lake bed of glacial Lake Agassiz, a lake once larger than all the present Great Lakes combined. In its upper reaches, where the river flows



GRAY TILL VALLEY WALLS BELOW RED LAKE FALLS

through the Red Lake Indian Reservation, it flows on a very flat floor of thin peat deposits. Flowing slowly, almost due west, toward the junction with the Thief River, the channel is little affected by geologic changes. However, west of the reservation boundary there are few swamps. Here the banks are dark clayey glacial till and occasional large sandbars are located in the channel.

The Thief River, a tributary of the Red Lake River, flows south parallel to a series of morainal hills that were deposited by the late Wisconsin Des Moines lobe moving south out of Canada into the Lake Agassiz basin. Red Lake River and Thief River join at Thief River Falls and flow south parallel to the moraines to St. Hilaire. From here the valley swings west again and the Red Lake River flows through a canyon-like area. The steep valley walls are hard, light-gray till of the Des Moines lobe, (see photograph), and stand as nearly vertical cliffs as much as 100 feet in height. The steep drop to the ancient shore of a shallow stage of Lake Agassiz results in almost continuous rapids to Huot. Here the river banks change abruptly to low, dark silty clay, bottom sediments of Lake Agassiz.

The uniform mudbank channel varies little in appearance across these lake sediments to the mouth of the river at Grand Forks. Severe erosion of these clay banks by recent floods is evident. In many places several hundred yards of bank as much as an eighth of a mile from the river has been recently eroded. This lake clay material is not easily protected from severe water erosion and channel migration is a severe problem. These banks tend to be poor campsites as the clay holds large quantities of water during rainy periods.

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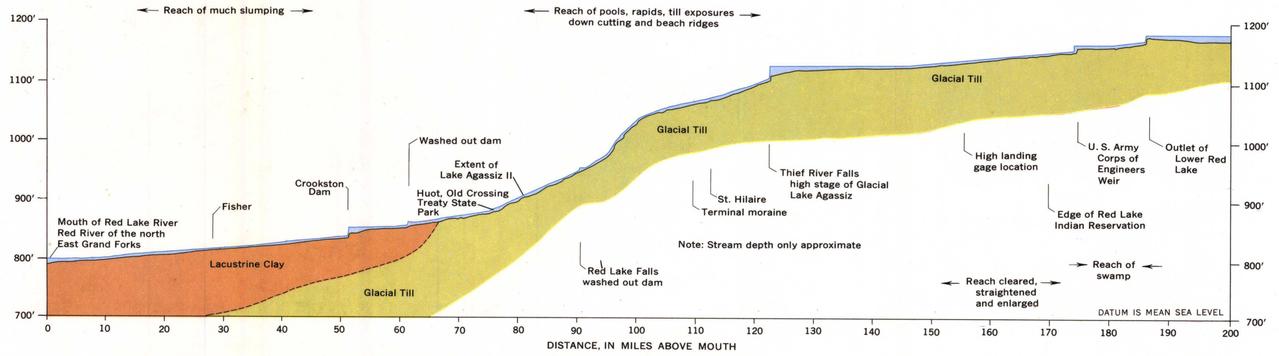
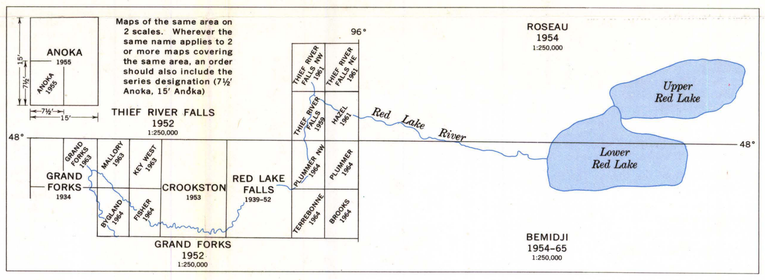


PROFILE OF RED LAKE RIVER

TOPOGRAPHIC MAPS



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RECONNAISSANCE OF THE RED LAKE RIVER, MINNESOTA

By
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1969

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