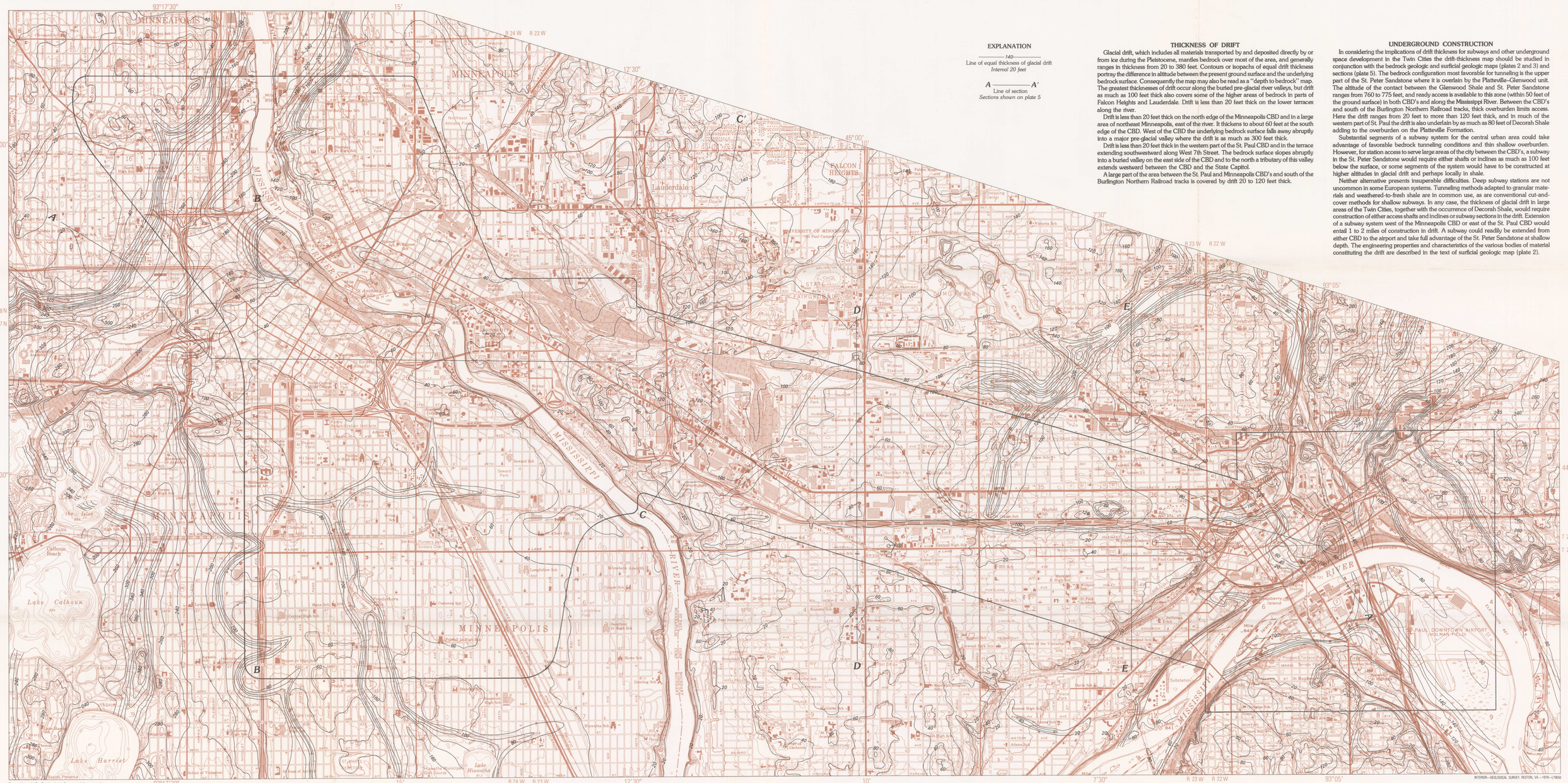
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

Prepared in cooperation with the
MINNESOTA GEOLOGICAL SURVEY
and the
UNITED STATES DEPARTMENT OF TRANSPORTATION

M.F. HOLT

MISCELLANEOUS INVESTIGATIONS SERIES
MAP I–1157
PLATE 4



Base from U.S. Geological Survey, Minneapolis North, Minneapolis South, New Brighton, St. Paul East and St. Paul West 1:24,000, 1967
Photorevision as of 1972

SCALE 1:24 000
1 0 ½ 0 1 MILE
1 0 .5 0 1 KILOMETER
CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

INTERIOR—GEOLOGICAL SURVEY, RESTON, VA.—1979—L79036

EXPLANATION

140
Line of equal thickness of glacial drift
Interval 20 feet

A ——— A'
Line of section
Sections shown on plate 5

THICKNESS OF DRIFT

Glacial drift, which includes all materials transported by and deposited directly by or from ice during the Pleistocene, mantles bedrock over most of the area, and generally ranges in thickness from 20 to 380 feet. Contours or isopachs of equal drift thickness portray the difference in altitude between the present ground surface and the underlying bedrock surface. Consequently the map may also be read as a "depth to bedrock" map. The greatest thicknesses of drift occur along the buried pre-glacial river valleys, but drift as much as 100 feet thick also covers some of the higher areas of bedrock in parts of Falcon Heights and Lauderdale. Drift is less than 20 feet thick on the lower terraces along the river.

Drift is less than 20 feet thick on the north edge of the Minneapolis CBD and in a large area of northeast Minneapolis, east of the river. It thickens to about 60 feet at the south edge of the CBD. West of the CBD the underlying bedrock surface falls away abruptly into a major pre-glacial valley where the drift is as much as 300 feet thick.

Drift is less than 20 feet thick in the western part of the St. Paul CBD and in the terrace extending southwestward along West 7th Street. The bedrock surface slopes abruptly into a buried valley on the east side of the CBD and to the north a tributary of this valley extends westward between the CBD and the State Capitol.

A large part of the area between the St. Paul and Minneapolis CBD's and south of the Burlington Northern Railroad tracks is covered by drift 20 to 120 feet thick.

UNDERGROUND CONSTRUCTION

In considering the implications of drift thickness for subways and other underground space development in the Twin Cities the drift-thickness map should be studied in conjunction with the bedrock geologic and surficial geologic maps (plates 2 and 3) and sections (plate 5). The bedrock configuration most favorable for tunneling is the upper part of the St. Peter Sandstone where it is overlain by the Platteville–Glenwood unit. The altitude of the contact between the Glenwood Shale and St. Peter Sandstone ranges from 760 to 775 feet, and ready access is available to this zone (within 50 feet of the ground surface) in both CBD's and along the Mississippi River. Between the CBD's and south of the Burlington Northern Railroad tracks, thick overburden limits access. Here the drift ranges from 20 feet to more than 120 feet thick, and in much of the western part of St. Paul the drift is also underlain by as much as 80 feet of Decorah Shale adding to the overburden on the Platteville Formation.

Substantial segments of a subway system for the central urban area could take advantage of favorable bedrock tunneling conditions and thin shallow overburden. However, for station access to serve large areas of the city between the CBD's, a subway in the St. Peter Sandstone would require either shafts or inclines as much as 100 feet below the surface, or some segments of the system would have to be constructed at higher altitudes in glacial drift and perhaps locally in shale.

Neither alternative presents insuperable difficulties. Deep subway stations are not uncommon in some European systems. Tunneling methods adapted to granular materials and weathered-to-fresh shale are in common use, as are conventional cut-and-cover methods for shallow subways. In any case, the thickness of glacial drift in large areas of the Twin Cities, together with the occurrence of Decorah Shale, would require construction of either access shafts and inclines or subway sections in the drift. Extension of a subway system west of the Minneapolis CBD or east of the St. Paul CBD would entail 1 to 2 miles of construction in drift. A subway could readily be extended from either CBD to the airport and take full advantage of the St. Peter Sandstone at shallow depth. The engineering properties and characteristics of the various bodies of material constituting the drift are described in the text of surficial geologic map (plate 2).

THICKNESS OF DRIFT

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Minnesota Geological Survey
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GEOLOGIC AND HYDROLOGIC ASPECTS OF TUNNELING IN THE TWIN CITIES AREA, MINNESOTA