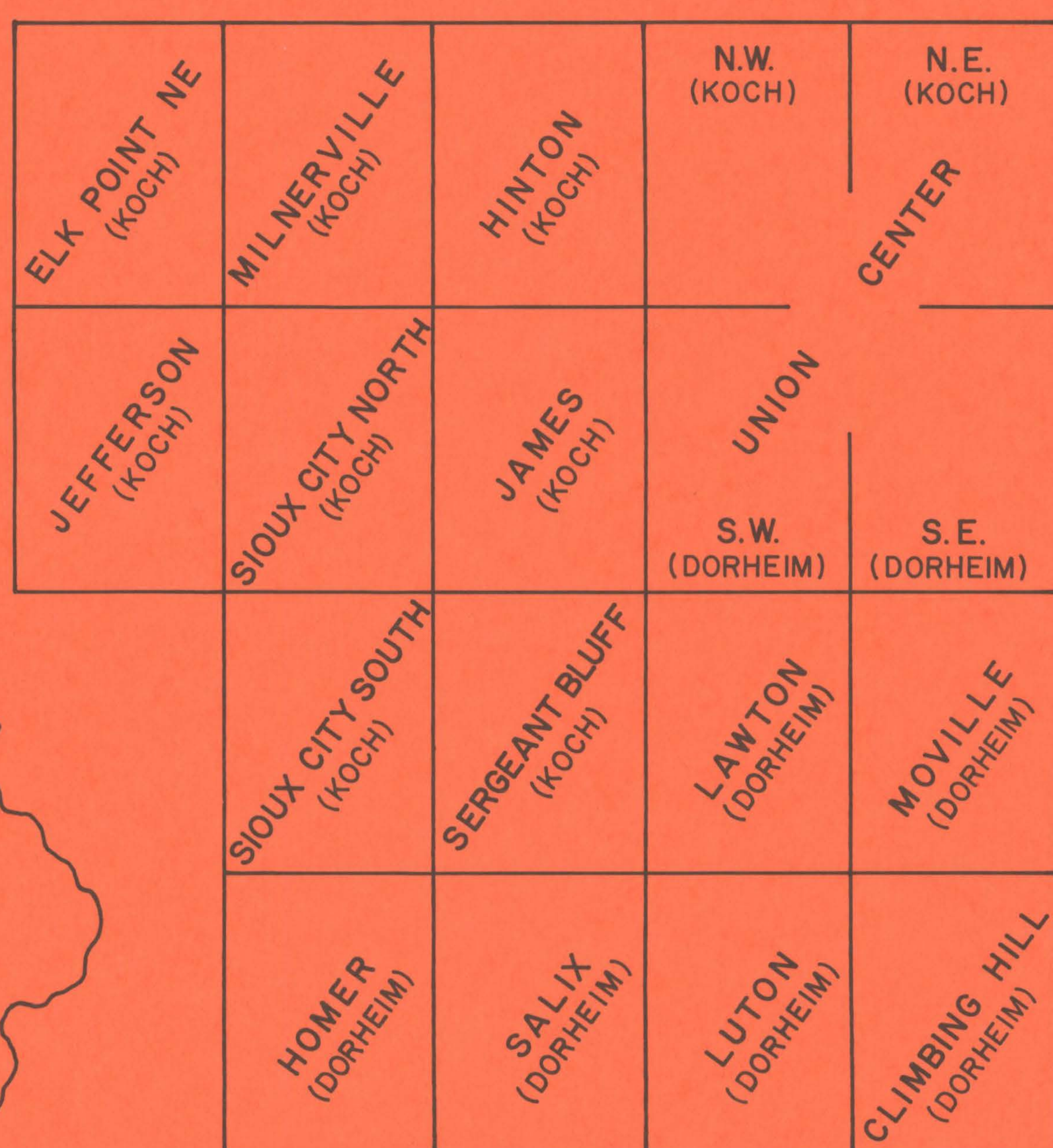
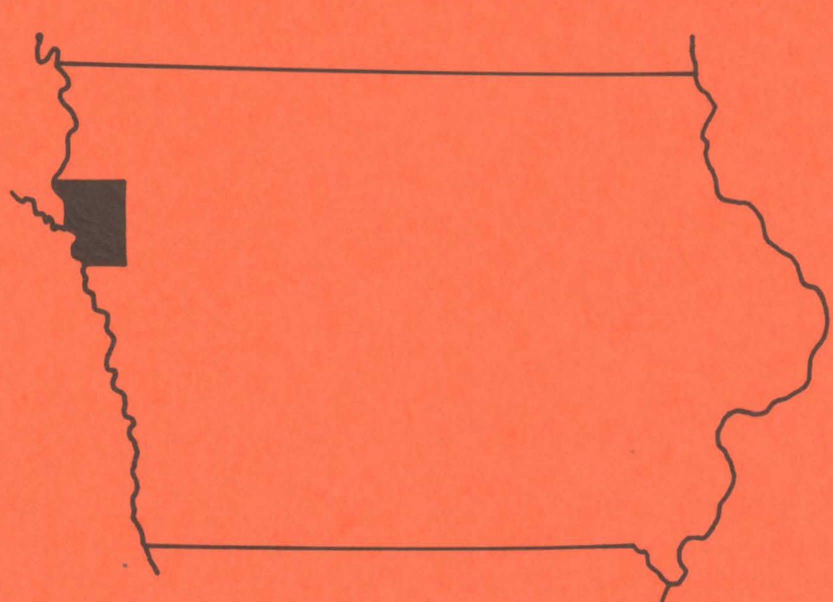
ENVIRONMENTAL GEOLOGY and LAND USE-PLANNING in the SIOUX CITY REGION, IOWA



IOWA GEOLOGICAL SURVEY
SAMUEL J. TUTHILL,
DIRECTOR AND STATE GEOLOGIST

MISCELLANEOUS MAP SERIES 2
1971



by

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MAPS

INTRODUCTION

This Atlas of maps was compiled to assist planning boards, engineers and other individuals or organizations that are involved in making decisions which affect land use. Environmental planning is especially necessary in areas that are undergoing rapid urban-industrial and agricultural growth with accompanying modification of rural regions. It was with this consideration in mind that the Sioux City Region was selected as a pilot study area.

The maps generated for this study are based on extant data. Because the amount of information available is limited and its distribution within the region is variable, the accompanying maps are very generalized. The control points are marked on the various maps. *The maps should be used only as reconnaissance aids in the first stages of land-use planning.* They do not obviate the need for site investigations. Elimination of investigations of high-risk regions can prevent unnecessary expenditures of money, time, and effort because they reduce the area of land to be considered during planning. It is to this purpose that this Atlas has been developed.

INFORMATION SOURCES AND ACKNOWLEDGMENTS

Data from well records on file at the Iowa Geological Survey were used to prepare maps that show thickness of unconsolidated sediments, elevation of the bedrock surface, and type of bedrock. Aerial photographs were used for terrain analysis and to map distribution of unconsolidated surfical materials. These interpretations were field-checked. A few locations were selected for earth-resistivity investigations in an attempt to determine depth to bedrock where the overburden is relatively thin, and to determine locations where colluvial sediments on long, low slopes extend into stream valleys and are underlain by porous and permeable stream-laid sediments. Data on soil associations is available from reports published by the Agricultural Experiment Station, Ames, Iowa and the appropriate surveys should be consulted for information on agronomy.

The names within parentheses on the quadrangle index (cover page) indicate the principal investigator for each quadrangle. Raymond R. Anderson drafted camera-ready copies of the maps for publication.

LAND-USE MAPS

Protection of water supplies from pollution should be a primary concern in a program of land-use planning. The color scheme employed on the land-use maps indicates the relative potential for pollution of surface water and groundwater supplies. Colors are used to indicate regions that have the highest potential for pollution (red), regions that have moderate pollution potential (yellow), and regions that have the least pollution potential (green).

Areas colored red mark stream valleys that contain deposits of silt, sand, and gravel, and/or regions where unconsolidated sediments above the bedrock surface are less than 75 feet in thickness. These regions are definitely unfavorable for sanitary land-fill sites, large-scale feeder lots, sewage lagoons that lack effective basal seals, or other activities that produce relatively large volumes of pollutants unless those facilities are engineered to safeguard water resources. Caution is recommended in areas that are colored yellow where moderate to severe limitations may exist. A detailed drilling program may be necessary to define the composition, thickness and lateral continuity of sediments in these regions, especially on sites that are in close proximity to the red pattern. Except for loess-covered hills with steep slopes that are naturally prone to landslides, relatively few problems exist in the portions mapped in green. We believe that most of the problems that do exist there can be overcome by rather simple engineering methods.

UNCONSOLIDATED SEDIMENTS

The unconsolidated sediments within the region studied consist of unsorted till and peat and sorted clay, silt, sand, and gravel. Thicknesses of the unconsolidated sediments are indicated using a 25-foot contour interval in the eastern portion and a 50-foot contour interval in the western portion of the region.

Loess

Loess is a wind-blown deposit composed predominantly of silt with lesser amounts of clay and sand. A thick mantle of loess is present above till over most of the region. At a few locations along the bluffs of the Big Sioux River, loess is present immediately above Cretaceous rock units with no intervening till. Loess deposits from 75 to 100 feet in thickness are common on ridge tops for a distance of three to six miles east of the bluffs of the Big Sioux and Missouri Rivers. In the eastern portion of the region the mantle of loess generally is 30 to 60 feet in thickness.

Vertical joints (cleavage) are a characteristic feature of loess where steep slopes are present. Caves sometimes are developed within the loess by enlargement of the lower parts of joint openings.

Till

Till is an unsorted mixture of clay, silt, sand, pebbles, cobbles and boulders. Clay usually forms the matrix of a till deposit and it is therefore usually a dense and only slightly permeable material. It is found beneath the loess mantle over most of the region discussed here. Small patches of till are exposed at the surface on a few sites in the Milnerville, Sioux City-North and Union Center-Northeast quadrangles. North of Riverside, along the bluffs of the Big Sioux River, the interval of till is very thin, and at a few locations loess can be observed directly overlying the bedrock. The till apparently increases in thickness a short distance east of the bluffs.

Upland Sand and Gravel Deposits

Sand and gravel was deposited by meltwaters that flowed over the region during the period in which the last continental glacier melted from this part of the midwest. Much of the flow of water was channeled down pre-existing valleys. Some of the large sand and gravel deposits now exposed along the bluff line of the Missouri River probably are of this origin.

Drill cuttings from several water wells show localities where these coarse grain-sized deposits are indentifiable for long distances east of the bluffs of the Missouri Valley. They occur between the overlying till and the underlying bedrock. The thickness of these sand and gravel deposits is greater than 50 feet at some locations. Elsewhere they are absent and till rests directly upon the bedrock surface.

Valley Clay, Silt, Sand, and Gravel Deposits (Alluvium)

Sediments deposited in extant stream channels and upon flood-plains are termed alluvium. Alluvial silt, sand, and gravel deposits are present within the valleys of the Missouri, Big Sioux, Floyd and Little Sioux Rivers. These deposits are an important source of water supply in the region.

Dredged and straightened segments of the channels of the Floyd River and Perry Creek have disrupted stream equilibrium. As a result, the channels have been deeply eroded upstream. Erosion of the channel of Perry Creek and its tributaries within the north one-half of Perry Township (James and Sioux City-North quadrangles) has exposed an interval of silty clay beds. These clay deposits appear to be laterally continuous in this area and tests to determine static load-bearing capacity will be necessary for heavy construction projects.

Colluvium

Colluvium is an incoherent sediment that has been derived from deposits at higher elevations and has been deposited near or at a break in slope or at the base of a cliff largely by falling or being washed as sheet wash for only a short distance. These deposits are shown in yellow on the surficial materials maps. The colluvium on all of the slopes is loess or till derived material, but its structural characteristics differ from those of the parent material. The colluvium varies in thickness from very thin to several feet and is distributed as a wedge-shaped apron beneath its upland sources.

Peat

Peat is a deposit composed of vegetation matter and fine grain-sized clay and silt materials that accumulated in shallow, poorly drained depressions. The only peat deposit observed in the region discussed here is in the northwestern part of the Milnerville quadrangle. There the peat occurs on a hillside and is underlain by till and coincides with a number of small springs that emerge on the hillside at the contact between the loess and the till.

BEDROCK TYPES

Rocks beneath the unconsolidated sediments consist of shale, sandstone, and limestone beds of Cretaceous age. On most of the bedrock maps, orange indicates areas where sandstone is known or thought to be the bedrock; blue is used where limestone is the expectable bedrock, and areas where shale is believed or known to be the bedrock are uncolored.

Rock exposures along the bluffs of the Sioux City-North quadrangle are indicated by a pattern of open squares. In the northern part of this quadrangle beds of limestone are present at the top of exposures with successive beds of shale and sandstone beneath; in the central and southern portion of the quadrangle sandstone or shale is exposed at the bedrock surface with alternating beds of shale and sandstone below it. Within the upland areas the bedrock may consist of any one of these three rock types. Thickness of the various types of rock mentioned are poorly known and may range from a few to several tens of feet before another type is encountered. Because of these relationships and the sparsity or absence of drill holes, the Jefferson, the northeastern Sioux City-South and the southern portions of the Elk Point quadrangles are not mapped for the rock type that is to be expected beneath the surface sediments. The uncolored portions of these quadrangles do not imply that the bedrock is shale.

LANDSLIDES

Although there is no map included in this atlas that is designed to show potential landslide areas, careful analysis of the local topography and composition of the sediments as they relate to landslide potential should be included in a regional planning program. Naturally occurring conditions within the Sioux City Region which should be evaluated as a part of an analysis of landslide potential include:

1) Thick loess deposits that overlie either till or shale units.

2) Steep loess or colluvium slopes.

3) The presence of seepage horizons along steep banks.

Where loess is underlain by either till or shale, water will move downward through the loess and then laterally along the contact with either the till or the shale. Where such a contact is exposed along a steep slope or where it is exposed by grading for a road or for building construction a condition may exist or be created that favors the occurrence of landslides.

Some factors that contribute to landslide development as an adjunct of construction are:

1) Derangement of groundwater flow by side-hill fill, diking or compaction.

2) Overloading of weak soils by fill, construction, etc.

3) Over-steepening of cuts in unstable materials. Most common is the terracing of hillsides for residential construction. Backyard slump often results.

4) Exposure, by cut, of clay or silt that may fail as a result of wetting.

5) Removal of mantle of wet soil by hillside cut; loss of lateral support will cause the soil above the cut to slide.

Loess slopes can be calculated from the topographic quadrangles. According to Lohnes and Handy (1968) the loess along the Missouri River is stable on slopes up to 51° from the horizontal. Eckel and others (1958) discuss recognition of potential landslide areas and methods of correcting them. These references should be consulted by the planners of the region.

Movement of water through the loess generally is indicated by the position of the headwaters of intermittent streams flowing out of the loess hills. The position of the water table varies from season to season. The limits of this variation are more or less within a zone extending from the headwaters of the intermittent streams to the position where these streams maintain a permanent flow.

Because the surface of bedrock and/or till underneath the loess deposits is very irregular and detailed geological data on this subject is lacking, a till thickness map is not provided. Soil borings will be needed to determine the loess-till contact at any planned construction site. For evaluations of the stability of till planners are referred to Handy (1968). In most circumstances till is a good foundation material.

WATER RESOURCES

The largest source of water supply within the Sioux City Region is available from sand and gravel deposits adjacent to the Missouri River. Production will vary with thickness and grain-size of these alluvial deposits, but it is reasonable to anticipate production in excess of 1,000 gallons per minute from relatively shallow wells.

Alluvial deposits adjacent to the Floyd and Little Sioux Rivers and some of the larger creeks provide another important source of water. Many of the farms and some of the smaller communities obtain their water from these sources. Sand points often provide enough water for individual farm wells. Gravel-pack wells are constructed where larger water supplies are needed.

A third important source of water supply, not only within the Sioux City Region but throughout most of northwest Iowa, is the Dakota Sandstone. Depth to the Dakota is variable throughout the region. It's water-bearing zones range in depth from less than fifty feet to over 400 feet. East of the Missouri River valley, production from wells completed in the Dakota Sandstone generally is ten to twenty gallons per minute. Thickness of the sandstone and the occurrence of interbedded shale affect yields significantly. Where the Dakota Sandstone is in hydraulic connection wth coarse grain-sized sediments of the Missouri River valley, production may be greater than 750 gallons per minute. Because of this occasional hydraulic connection between the sandstone and the alluvium the protection of both from sources of pollution is extremely important.

Intervals of sand and gravel within the till provide water for many farms. If these sources become polluted, deeper and more costly wells drilled into the Dakota Sandstone will be required to replace shallow supplies. In some areas the Dakota may be incapable of yielding the desired water quality and quantity, and it may be necessary to drill a well in excess of 500 feet.

ECONOMIC PRODUCTS

There are several natural resources within the Sioux City Region that have potential for economic-industrial development. These resources include: (1) Cretaceous shale; (2) loess; (3) sand and gravel; and (4) limestone.

Shale and Loess

For many years the Cretaceous shale, and to a more limited extent, loess deposits, have been utilized as raw materials for the manufacture of brick, tile and other industrial ceramic products. Currently, Cretaceous shale is the single source of raw material for this industry within the Sioux City Region. The shale is obtained from exposures along the Missouri River at Sergeant Bluff. Toward the upland areas the thickness of overburden above the Cretaceous shale increases rapidly. By studying the bedrock map in conjunction with the isopach map of unconsolidated materials, relatively shallow shale beds might be located that could be exploited economically.

Sand and Gravel

Sand and gravel are an important raw material affecting the cost of road construction and maintenance. The floodplain of the Missouri River is underlain by large amounts of sand and gravel. Some of these deposits will provide an aggregate that meets specifications for local construction.

Sand and gravel currently are produced from deposits along the valley of the Floyd River, and more pits probably can be developed there. They are economically important to the metropolitan and rural roads program. The useable deposits in reserve should be explored. Restrictive land use or zoning should evaluate their long-term economic impact before they are eliminated as sources of aggregate.

A third potential source of gravel is from deposits within the till. Examples of these deposits are exposed along the road south of the West Fork of the Little Sioux River about one mile north of Climbing Hill, and in a pit about three miles southeast of Holly Springs. An area approximately two miles south of Moville, west of the Moville-Climbing Hill road may be a potential area for gravel exploration. Gravel deposits within the till will probably produce a material suitable only for road metal.

Limestone

Limestone for road aggregate use is unavailable within the Sioux City Region. A lowgrade limestone, often referred to as marl, is found in the northern part of the region. If the demand for agricultural lime increases, this stone may become more widely marketable. Marl deposits have been worked in the past near Westfield, Akron and LeMars, and more recently, near Hinton.

SUPPLEMENTARY READING

Eckel, Edwin B., et al, 1958, Landslides and engineering practice: Highway Research Board, Special Report 29, National Academy of Sciences — National Research Council, p. 232.

Handy, R. L., 1968, The Pleistocene of Iowa — an engineering appraisal: Iowa Academy of Science Proc., v. 75, p. 210-226.

Lohnes, R. A., and Handy, R. L., 1968, Slope angles in friable loess: Journal of Geology, v. 76, p. 247-258.

LEGEND

LAND-USE MAPS

- (Red) Alluvial sand and gravel and/or areas where unconsolidated sediments above bedrock are less than 75 feet in thickness. Groundwater aquifer throughout most of area. Unfavorable for sanitary landfill, sewage disposal, or large feeder lot operations.
- (Yellow) Slopes covered with loess-derived colluvial silt. Thickness of colluvium and underlying material must be determined before land-use designation is made.
- (Green) Loess-covered hills and upland slopes with thin to thick interval of loess overlying till. Those areas with moderate slopes and thick till favorable for sanitary landfill and feeder lot operations; may require minor drainage control or other engineering modifications.

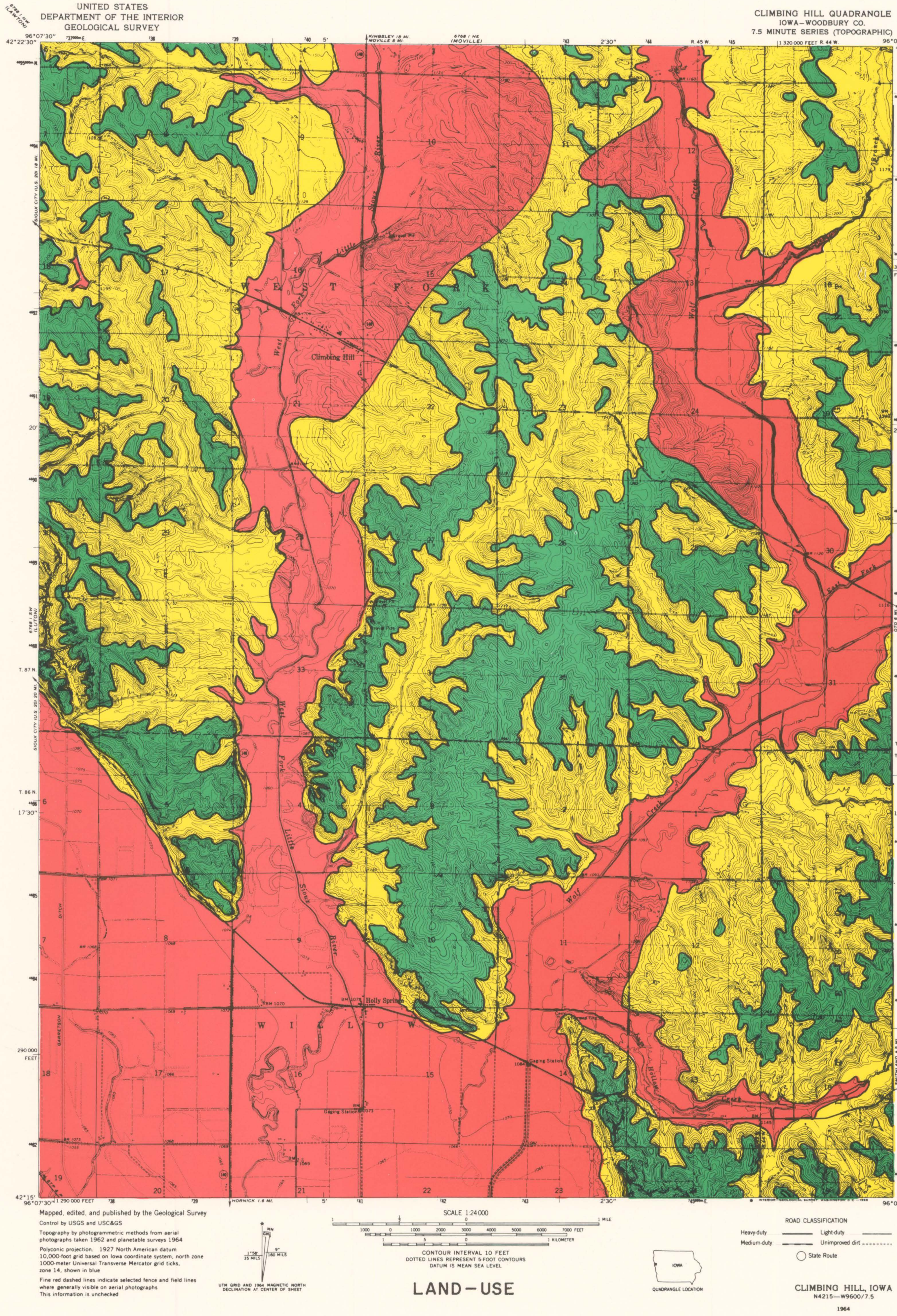
BEDROCK MAPS

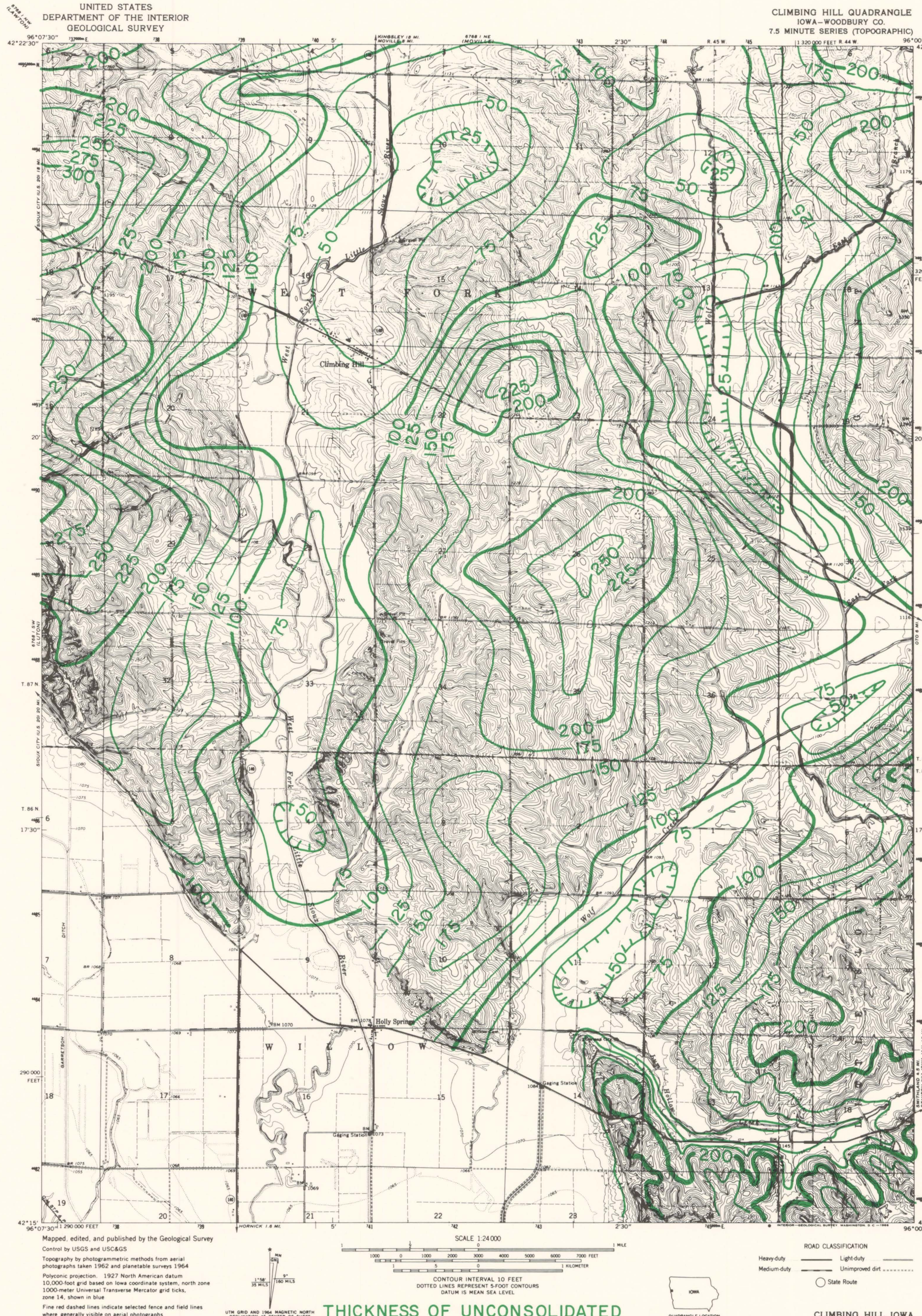
- (White) Areas where the bedrock is predominantly shale.
- (Orange) Areas where the bedrock is predominantly sandstone; the sandstone may be an aquifer.
- (Blue) Areas where the bedrock is predominantly limestone; limestone from exposure west of Hinton is used as a source of agricultural lime.

■	Exposure of sandstone or limestone as denoted by color.
□	Exposures along bluffs of Big Sioux River; thick sequence of sandstone and shale beds; limestone at top of outcrops north of Stone State Park.
1100	Contours on bedrock surface; all elevations refer to mean sea level datum.
1065 ●	Well locations; drill cuttings available.
1045 ○	Well locations; data from drillers' logs.
T	Till exposed at land surface.
P	Peat bog.
G	Gravel exposed at land surface.
GP	Gravel pit.
⚒	Clay pit.
▲	Earth resistivity station.

ISOPACH MAPS

150	Thickness of unconsolidated material (in feet)


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
CLIMBING HILL QUADRANGLE
IOWA–WOODBURY CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
KINGSLEY 18 MI.
MOVILLE 8 MI.
6768 I NE
(MOVILLE)
Climbing Hill
Holly Springs
W I L L O W
W E S T F O R K
HORNICK 1.6 MI.
Mapped, edited, and published by the Geological Survey
Control by USGS and USC&GS
Topography by photogrammetric methods from aerial photographs taken 1962 and planetable surveys 1964
Polyconic projection. 1927 North American datum
10,000-foot grid based on Iowa coordinate system, north zone
1000-meter Universal Transverse Mercator grid ticks, zone 14, shown in blue
Fine red dashed lines indicate selected fence and field lines where generally visible on aerial photographs
This information is unchecked
UTM GRID AND 1964 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET
SCALE 1:24 000
CONTOUR INTERVAL 10 FEET
DOTTED LINES REPRESENT 5-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL
LAND–USE
QUADRANGLE LOCATION
ROAD CLASSIFICATION
Heavy-duty
Light-duty
Medium-duty
Unimproved dirt
State Route
CLIMBING HILL, IOWA
N4215—W9600/7.5
1964
AMS 6768 I SE—SERIES V876



THICKNESS OF UNCONSOLIDATED SEDIMENTS

UNITED STATES
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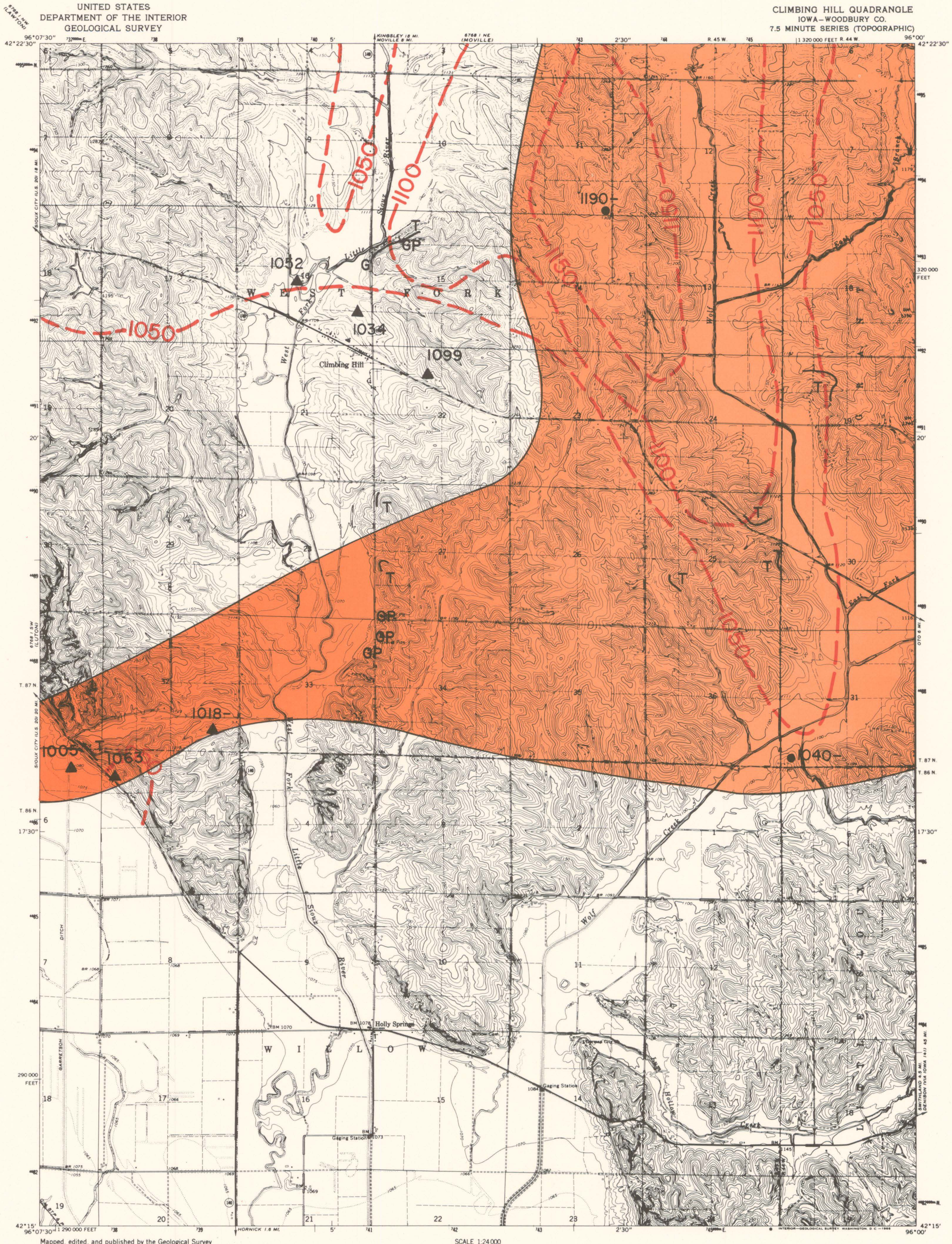
CLIMBING HILL QUADRANGLE
IOWA–WOODBURY CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)



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UTM GRID AND 1964 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 10 FEET
DOTTED LINES REPRESENT 5-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL

QUADRANGLE LOCATION

ROAD CLASSIFICATION
Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
State Route

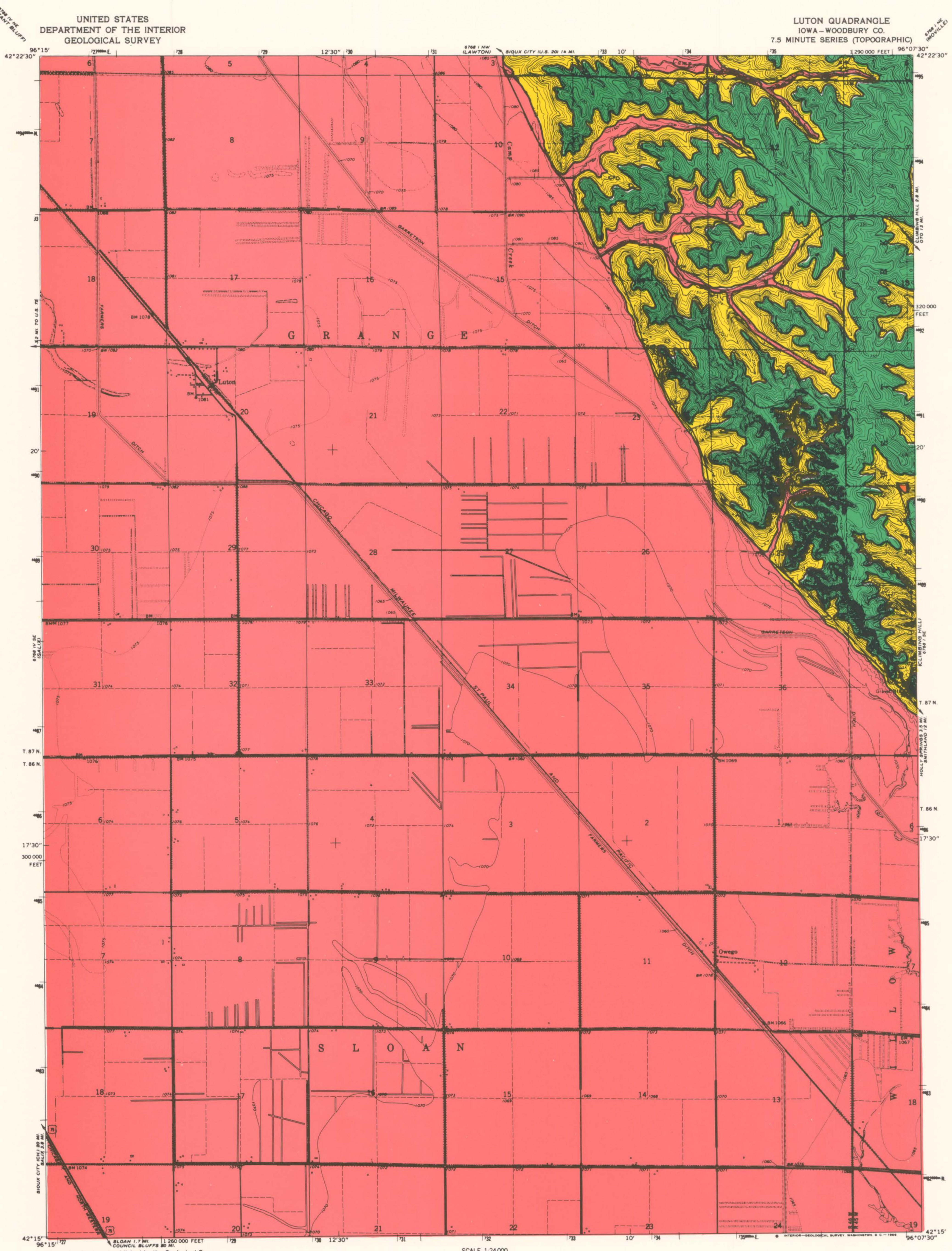
ELEVATION AND LITHOLOGY OF BEDROCK

CLIMBING HILL, IOWA
N4215—W9600/7.5
1964

AMS 6768 I SE—SERIES V876

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

LUTON QUADRANGLE
IOWA—WOODBURY CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)



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10,000-foot grid based on Iowa coordinate system, north zone
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UTM GRID AND 1964 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 10 FEET
DOTTED LINES REPRESENT 5-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL

LAND-USE

QUADRANGLE LOCATION

ROAD CLASSIFICATION

Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
U. S. Route

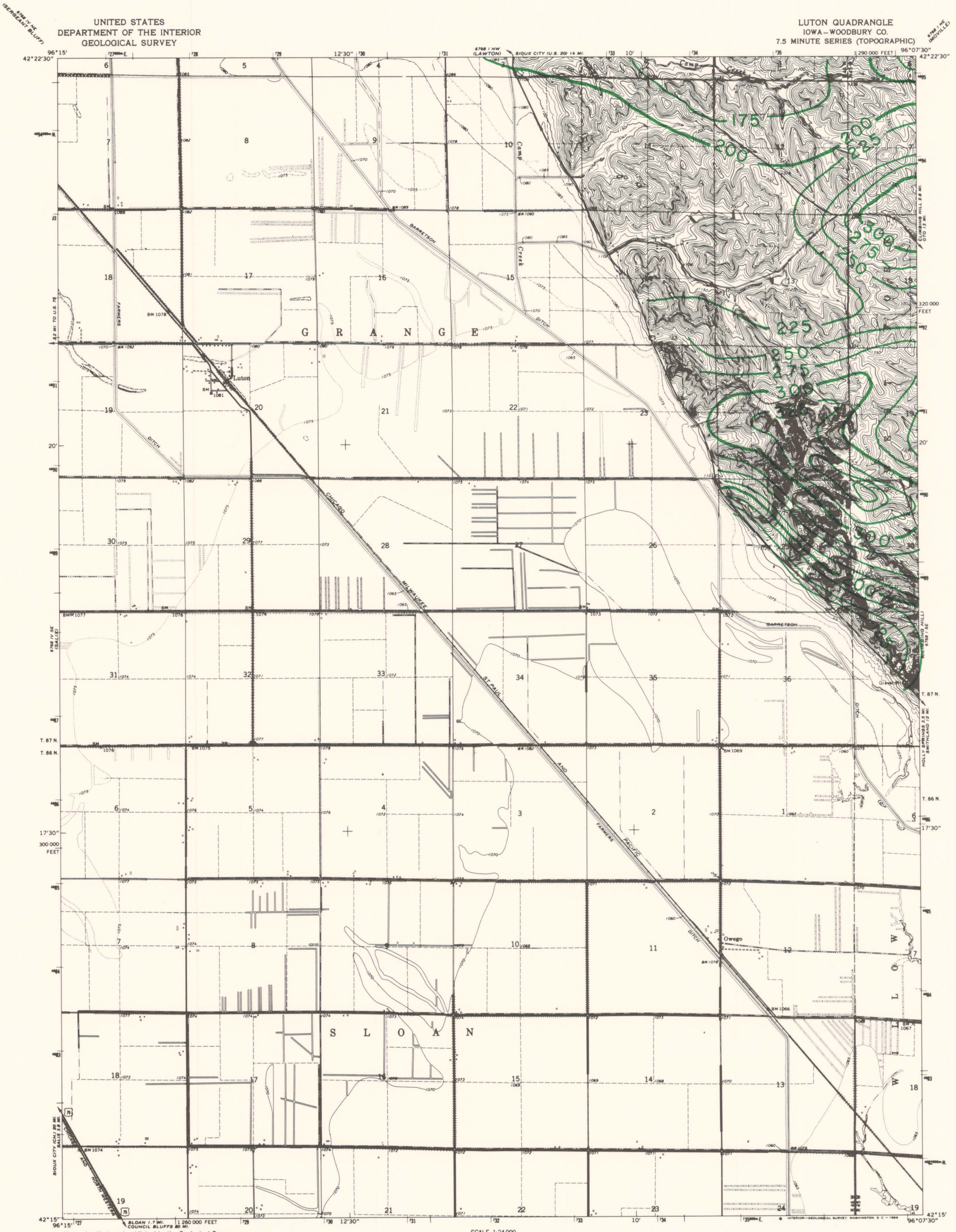
LUTON, IOWA
N4215—W960/7.5

1964

AMS 6768 I SW—SERIES V876

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

LUTON QUADRANGLE
IOWA–WOODBURY CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)



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Topography by photogrammetric methods from aerial photographs taken 1962 and planetable surveys 1964

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10,000-foot grid based on Iowa coordinate system, north zone
1000-meter Universal Transverse Mercator grid ticks, zone 14, shown in blue

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UTM GRID AND 1964 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 10 FEET
DOTTED LINES REPRESENT 5-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL

THICKNESS OF UNCONSOLIDATED SEDIMENTS

QUADRANGLE LOCATION

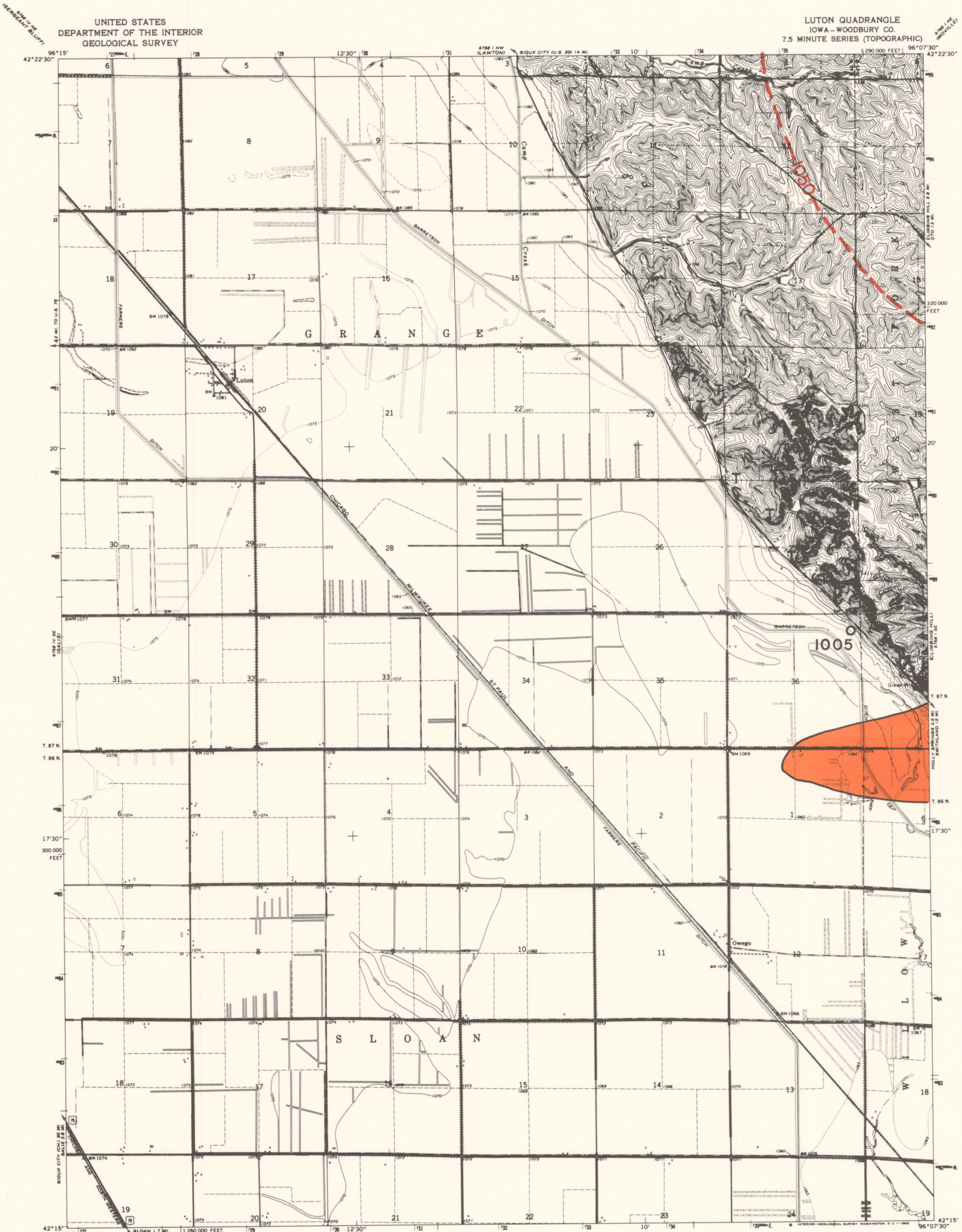
ROAD CLASSIFICATION

Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
U. S. Route

LUTON, IOWA
N4215—W960/7.5

1964

AMS 6768 I SW—SERIES V876



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SCALE 1:24 000

CONTOUR INTERVAL 10 FEET
DOTTED LINES REPRESENT 5-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL

QUADRANGLE LOCATION

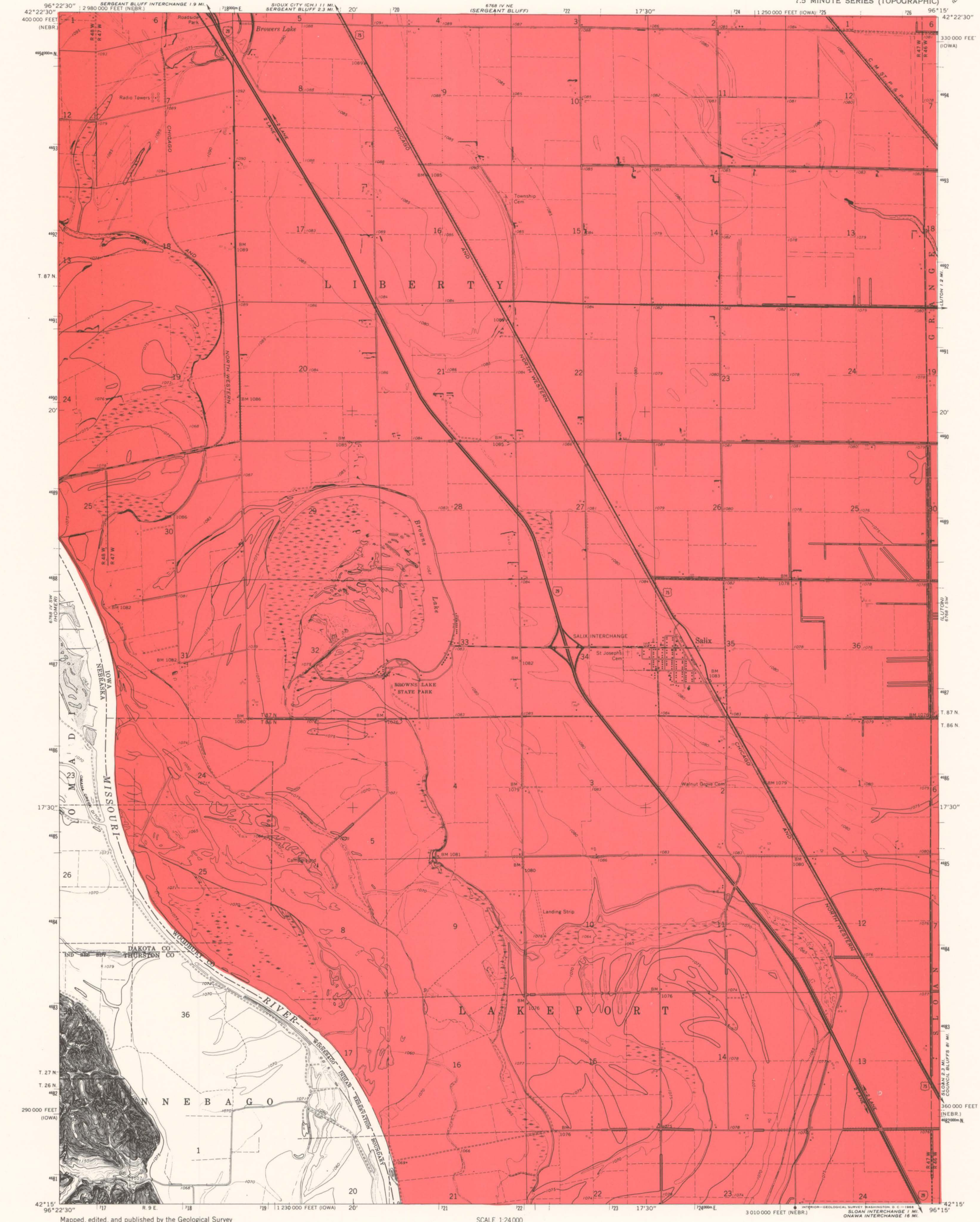
ROAD CLASSIFICATION
Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
U.S. Route

ELEVATION AND LITHOLOGY OF BEDROCK

LUTON, IOWA
N4215—W960/7.5
1964
AMS 6768 I SW—SERIES V876

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

SALIX QUADRANGLE
IOWA–NEBRASKA
7.5 MINUTE SERIES (TOPOGRAPHIC)



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Topography by photogrammetric methods from aerial photographs taken 1962 and planetable surveys 1964

Polyconic projection. 1927 North American datum
10,000-foot grids based on Iowa coordinate system, north zone, and Nebraska coordinate system, north zone
1000-meter Universal Transverse Mercator grid ticks, zone 14, shown in blue

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UTM GRID AND 1964 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 5 FEET
DATUM IS MEAN SEA LEVEL

LAND-USE

QUADRANGLE LOCATION

ROAD CLASSIFICATION

Heavy-duty · Light-duty · Medium-duty · Unimproved dirt · Interstate Route · U. S. Route

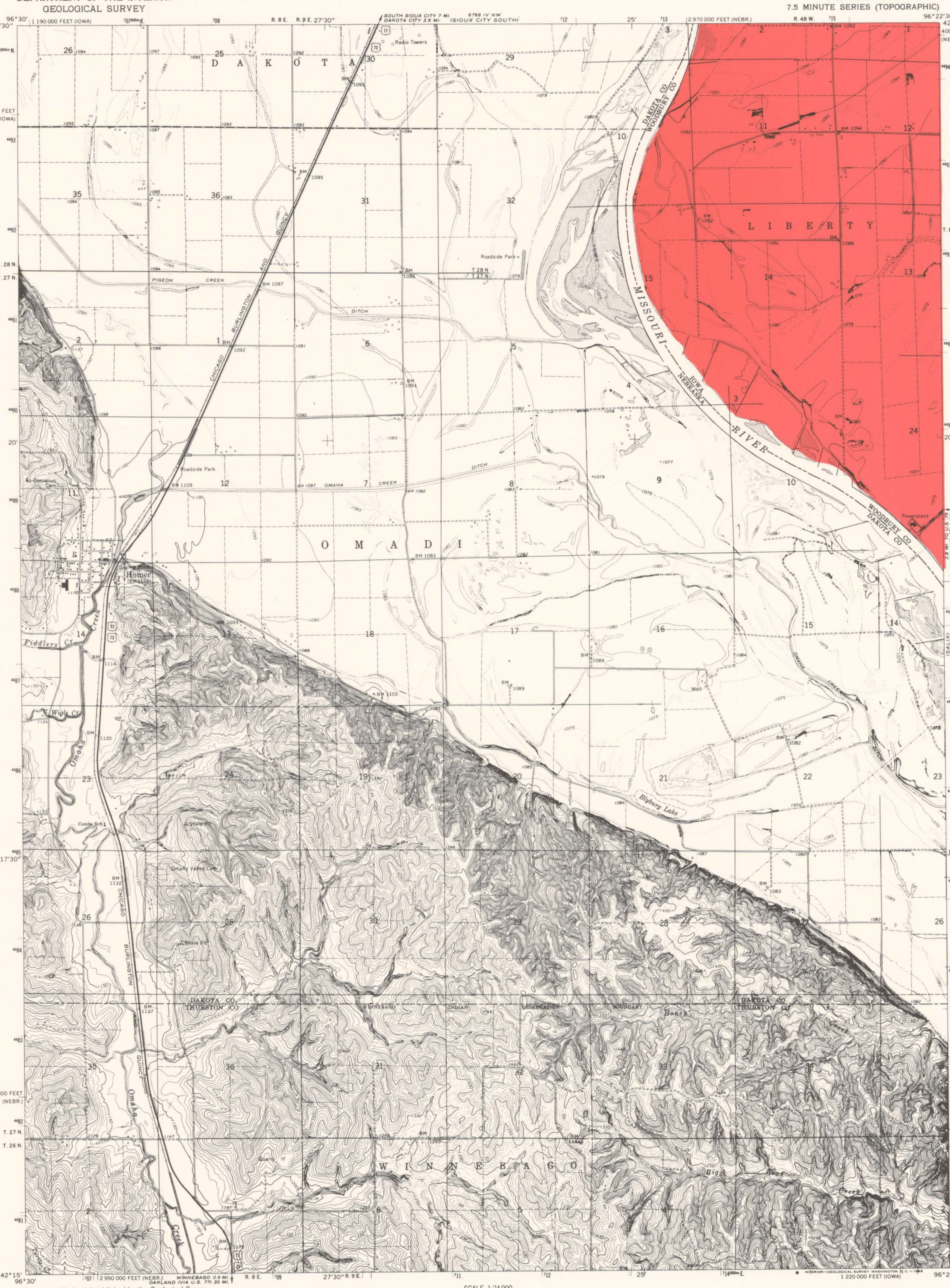
SALIX, IOWA–NEBR.
N4215—W9615/7.5

1964

AMS 6768 IV SE–SERIES V876

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

HOMER QUADRANGLE
NEBRASKA–IOWA
7.5 MINUTE SERIES (TOPOGRAPHIC)



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Topography by photogrammetric methods from aerial photographs taken 1962 and planetable surveys 1964

Polyconic projection. 1927 North American datum
10,000-foot grids based on Nebraska coordinate system, north zone, and Iowa coordinate system, north zone
1000-meter Universal Transverse Mercator grid ticks, zone 14, shown in blue

Fine red dashed lines indicate selected fence and field lines where generally visible on aerial photographs. This information is unchecked

UTM GRID AND 1964 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 10 FEET
DOTTED LINES REPRESENT 5-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL

LAND-USE

NEBRASKA
QUADRANGLE LOCATION

ROAD CLASSIFICATION

Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
U. S. Route

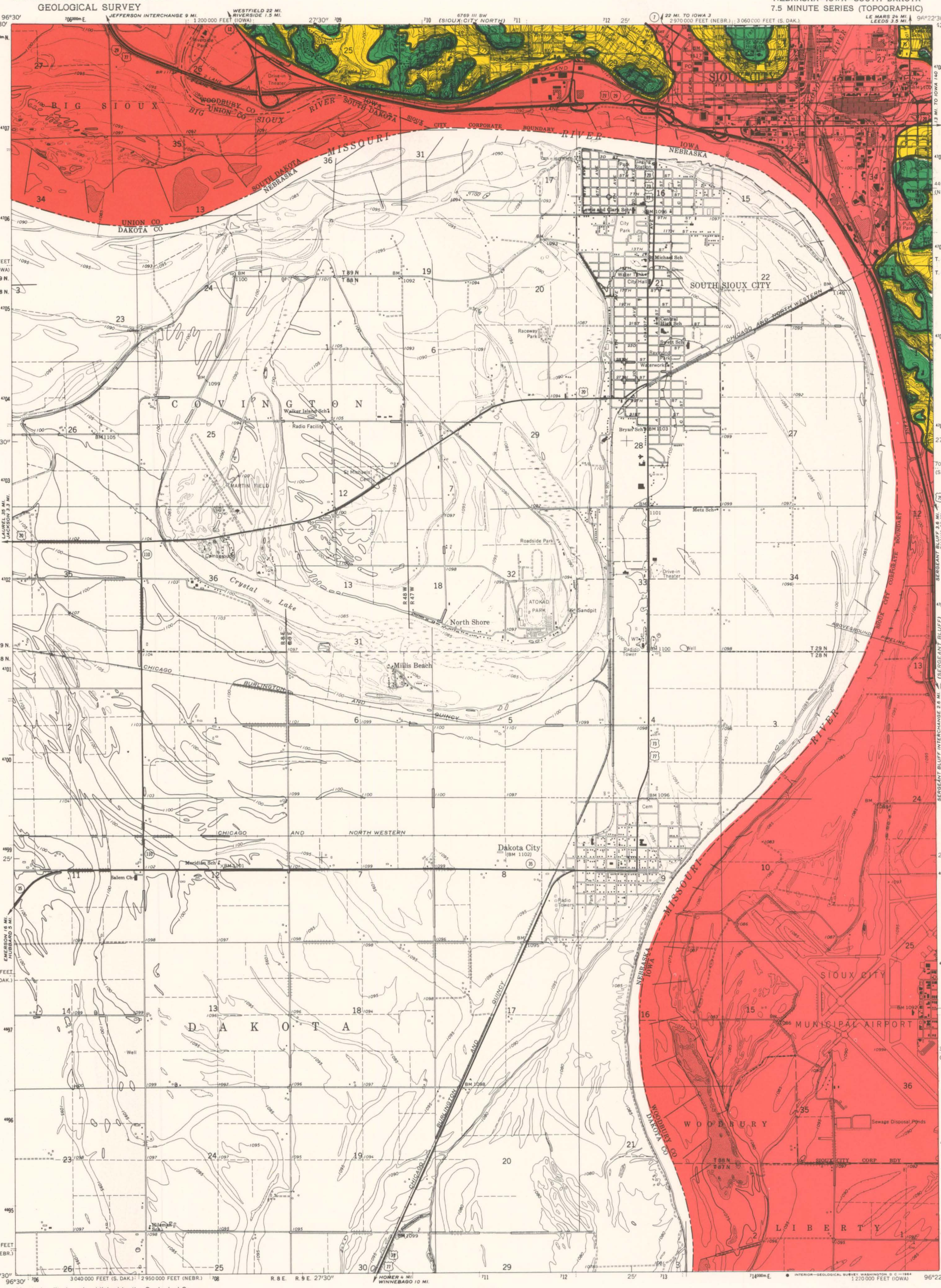
HOMER, NEBR.—IOWA
N4215—W9622.5/7.5

1964

AMS 6768 IV SW—SERIES V875

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

SIOUX CITY SOUTH QUADRANGLE
NEBRASKA–IOWA–SOUTH DAKOTA
7.5 MINUTE SERIES (TOPOGRAPHIC)



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Planimetry by photogrammetric methods from aerial photographs taken 1961. Topography by planetable surveys 1963

Polyconic projection. 1927 North American datum
10,000-foot grids based on Nebraska coordinate system, north zone, Iowa coordinate system, north zone, and South Dakota coordinate system, south zone
1000-meter Universal Transverse Mercator grid ticks, zone 14, shown in blue

Red tint indicates areas in which only landmark buildings are shown

Fine red dashed lines indicate selected fence and field lines where generally visible on aerial photographs. This information is unchecked

UTM GRID AND 1963 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 5 FEET
DATUM IS MEAN SEA LEVEL

LAND-USE

ROAD CLASSIFICATION

Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
Interstate Route — U. S. Route — State Route

NEBRASKA
QUADRANGLE LOCATION

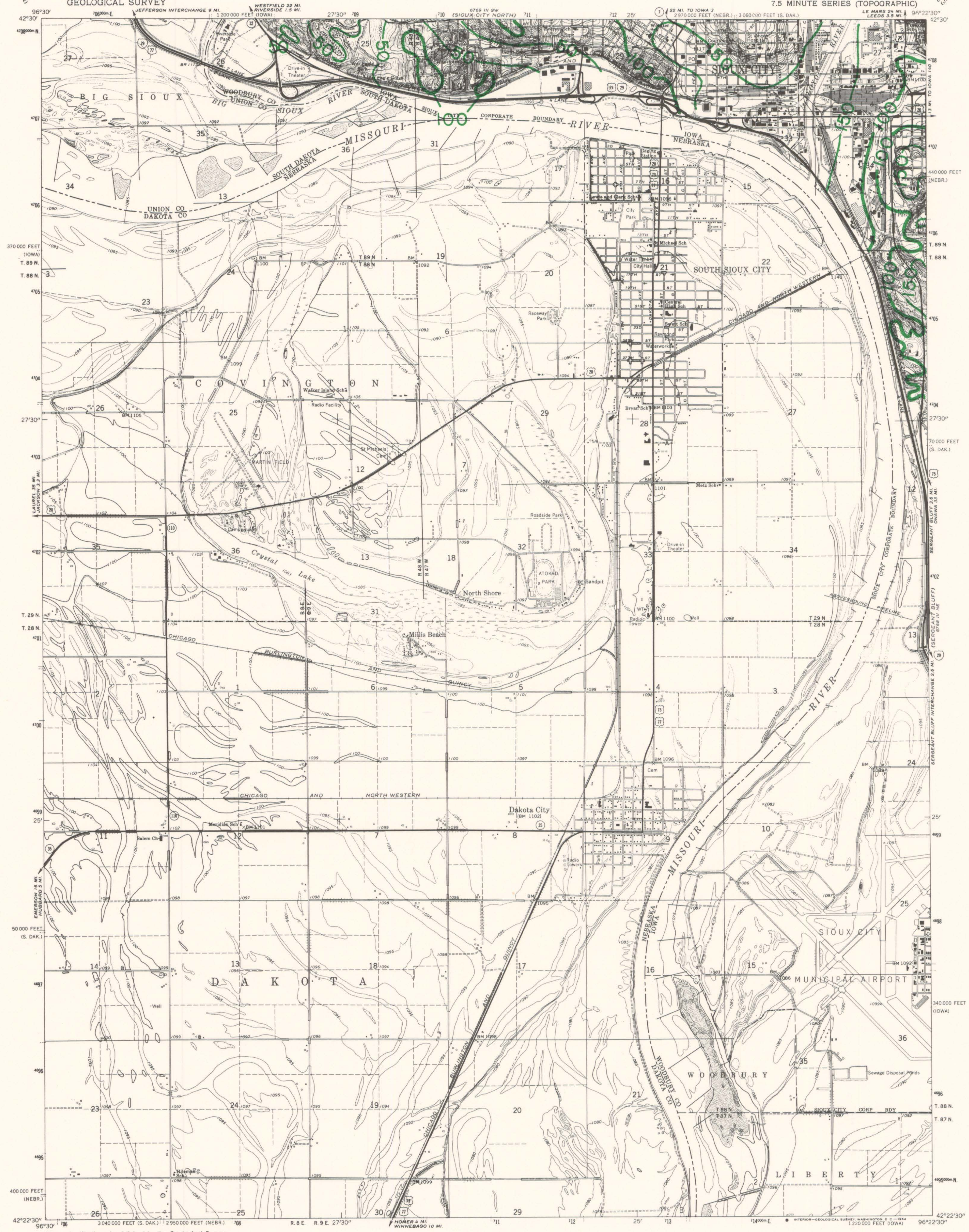
SIOUX CITY SOUTH, NEBR.–IOWA–S. DAK.
N4222.5—W9622.5/7.5

1963

AMS 6768 IV NW–SERIES V875

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

SIOUX CITY SOUTH QUADRANGLE
NEBRASKA–IOWA–SOUTH DAKOTA
7.5 MINUTE SERIES (TOPOGRAPHIC)



Mapped, edited, and published by the Geological Survey

Control by USGS, USC&GS, and USCE

Planimetry by photogrammetric methods from aerial photographs taken 1961. Topography by planetable surveys 1963

Polyconic projection. 1927 North American datum
10,000-foot grids based on Nebraska coordinate system, north zone, Iowa coordinate system, north zone, and South Dakota coordinate system, south zone
1000-meter Universal Transverse Mercator grid ticks, zone 14, shown in blue

Red tint indicates areas in which only landmark buildings are shown

Fine red dashed lines indicate selected fence and field lines where generally visible on aerial photographs. This information is unchecked

UTM GRID AND 1963 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 5 FEET
DATUM IS MEAN SEA LEVEL

THICKNESS OF UNCONSOLIDATED SEDIMENTS

QUADRANGLE LOCATION

ROAD CLASSIFICATION

Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
Interstate Route — U. S. Route — State Route

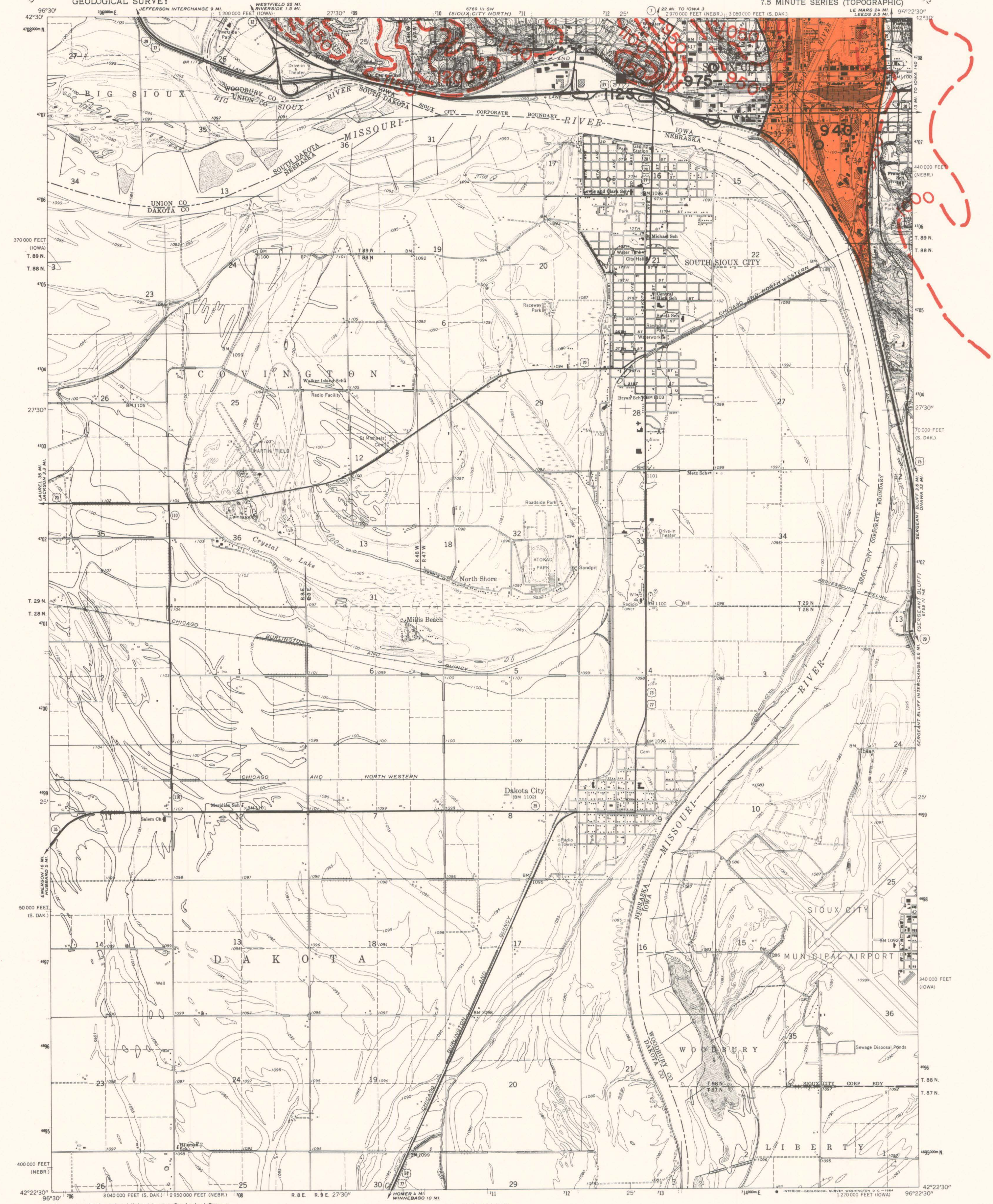
SIOUX CITY SOUTH, NEBR.–IOWA–S. DAK.
N4222.5—W9622.5/7.5

1963

AMS 6768 IV NW—SERIES V875

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

SIOUX CITY SOUTH QUADRANGLE
NEBRASKA–IOWA–SOUTH DAKOTA
7.5 MINUTE SERIES (TOPOGRAPHIC)



Mapped, edited, and published by the Geological Survey

Control by USGS, USC&GS, and USCE

Planimetry by photogrammetric methods from aerial photographs taken 1961. Topography by planetable surveys 1963

Polyconic projection. 1927 North American datum
10,000-foot grids based on Nebraska coordinate system, north zone, Iowa coordinate system, north zone, and South Dakota coordinate system, south zone
1000-meter Universal Transverse Mercator grid ticks, zone 14, shown in blue

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UTM GRID AND 1963 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 5 FEET
DATUM IS MEAN SEA LEVEL

ELEVATION AND LITHOLOGY OF BEDROCK

QUADRANGLE LOCATION

ROAD CLASSIFICATION

Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
Interstate Route — U. S. Route — State Route

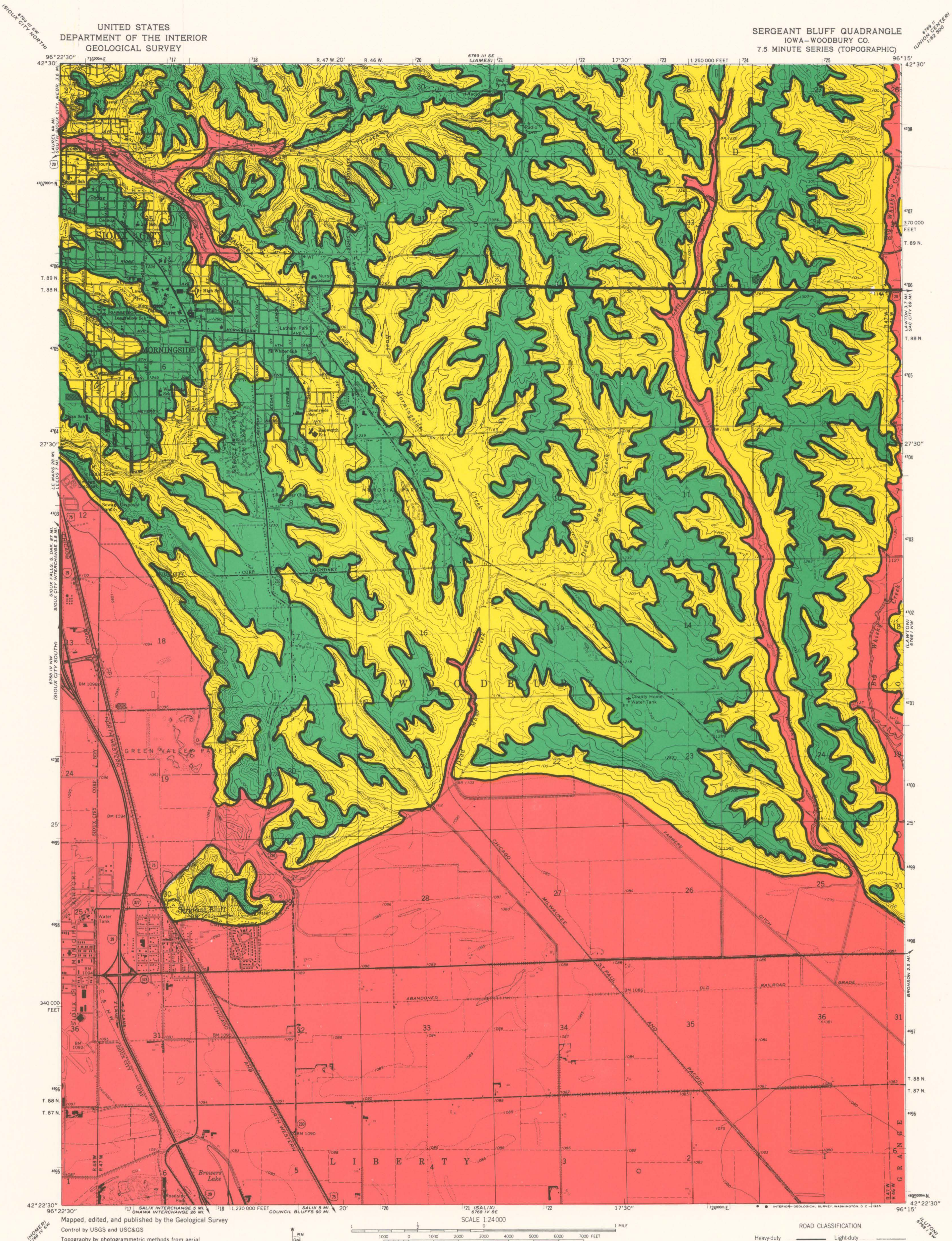
SIOUX CITY SOUTH, NEBR.–IOWA–S. DAK.
N4222.5—W9622.5/7.5

1963

AMS 6768 IV NW–SERIES V875

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

SERGEANT BLUFF QUADRANGLE
IOWA—WOODBURY CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)



Mapped, edited, and published by the Geological Survey

Control by USGS and USC&GS

Topography by photogrammetric methods from aerial photographs taken 1961 and planetable surveys 1964

Polyconic projection. 1927 North American datum
10 000-foot grid based on Iowa coordinate system, north zone
1000-meter Universal Transverse Mercator grid ticks, zone 14, shown in blue

Red tint indicates areas in which only landmark buildings are shown

Fine red dashed lines indicate selected fence and field lines where generally visible on aerial photographs. This information is unchecked

UTM GRID AND 1964 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

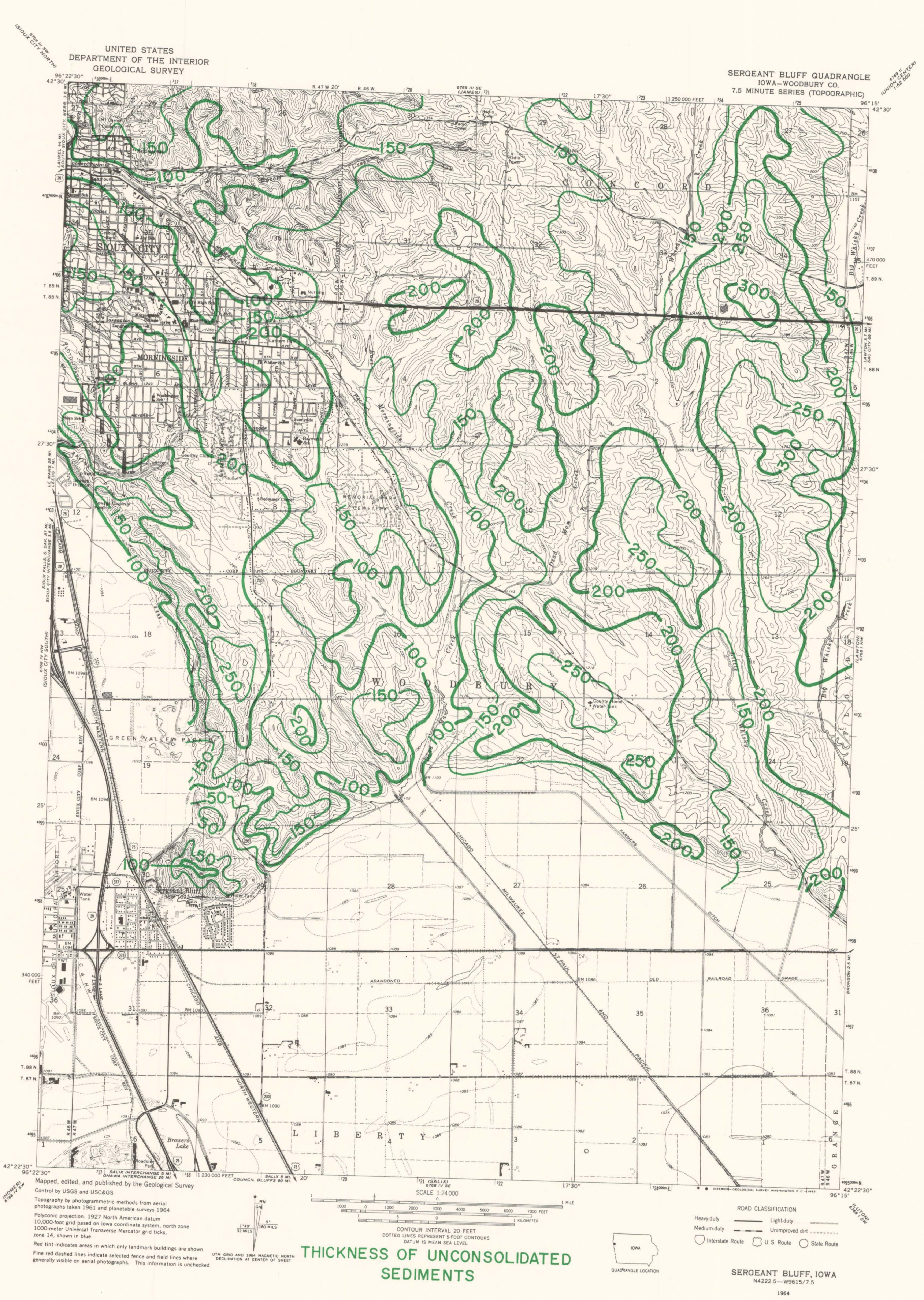
CONTOUR INTERVAL 20 FEET
DOTTED LINES REPRESENT 5-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL

LAND-USE

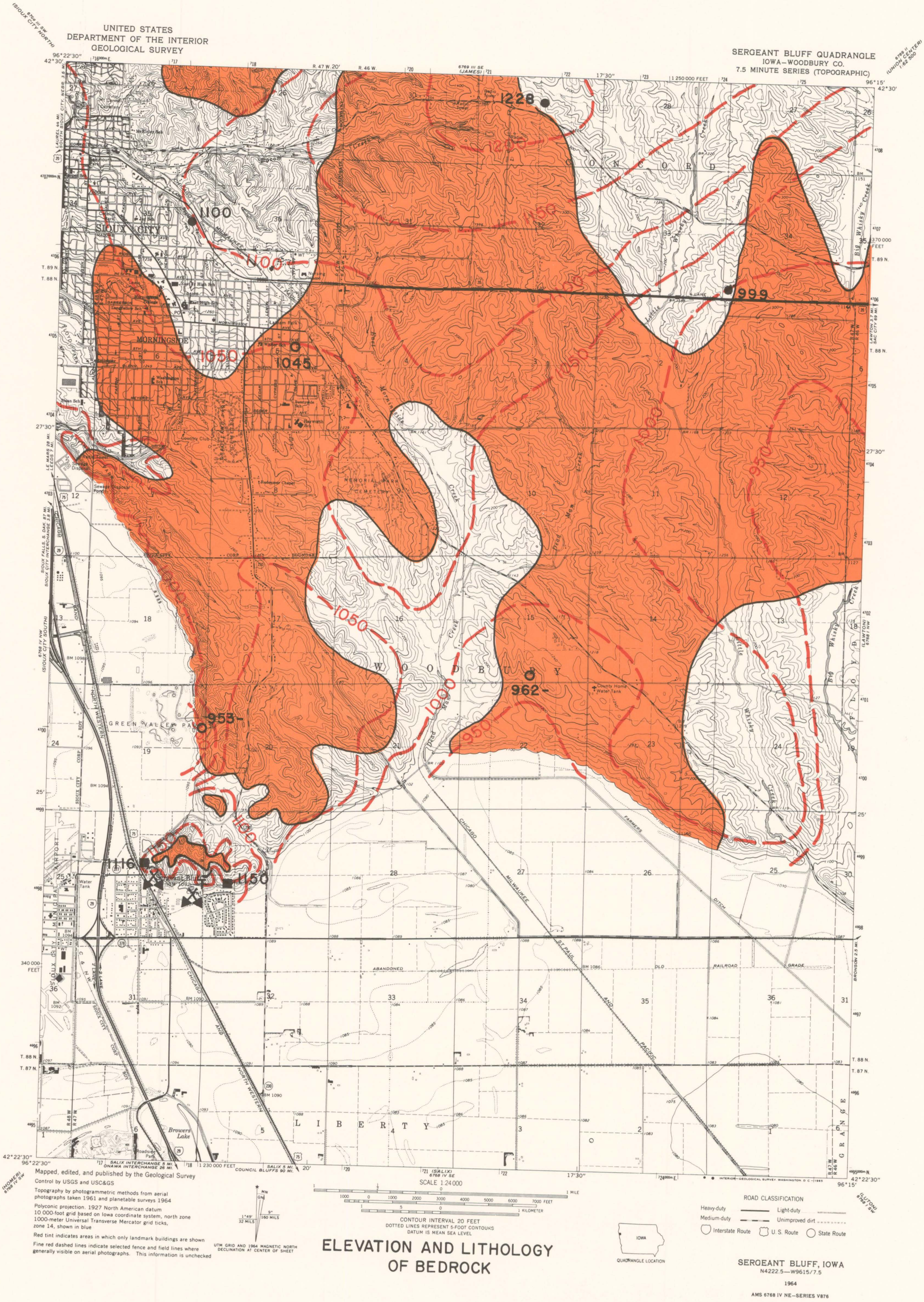
QUADRANGLE LOCATION

ROAD CLASSIFICATION
Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
Interstate Route — U.S. Route — State Route

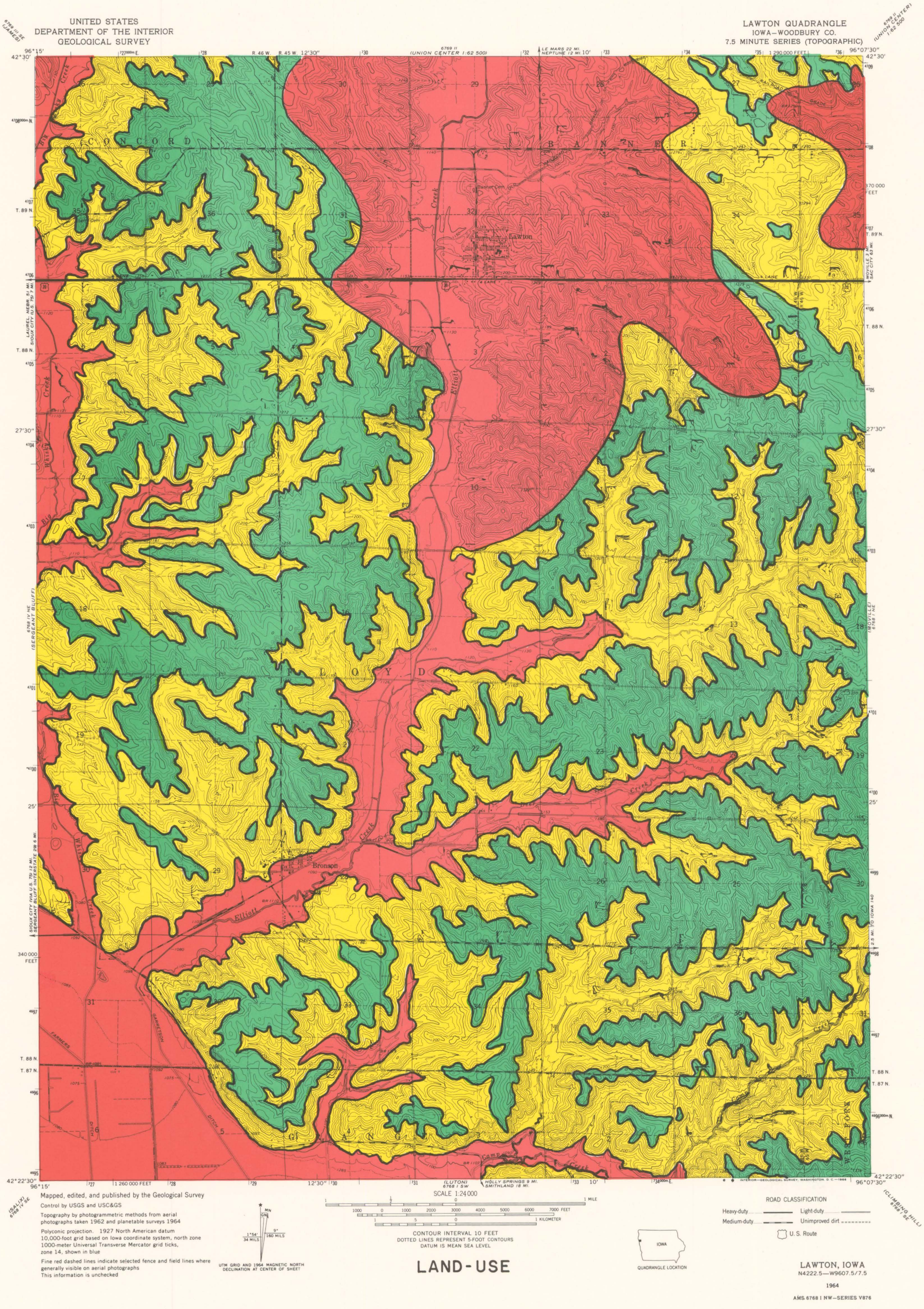
SERGEANT BLUFF, IOWA
N4222.5—W9615/7.5
1964
AMS 6768 IV NE—SERIES V876



THICKNESS OF UNCONSOLIDATED SEDIMENTS



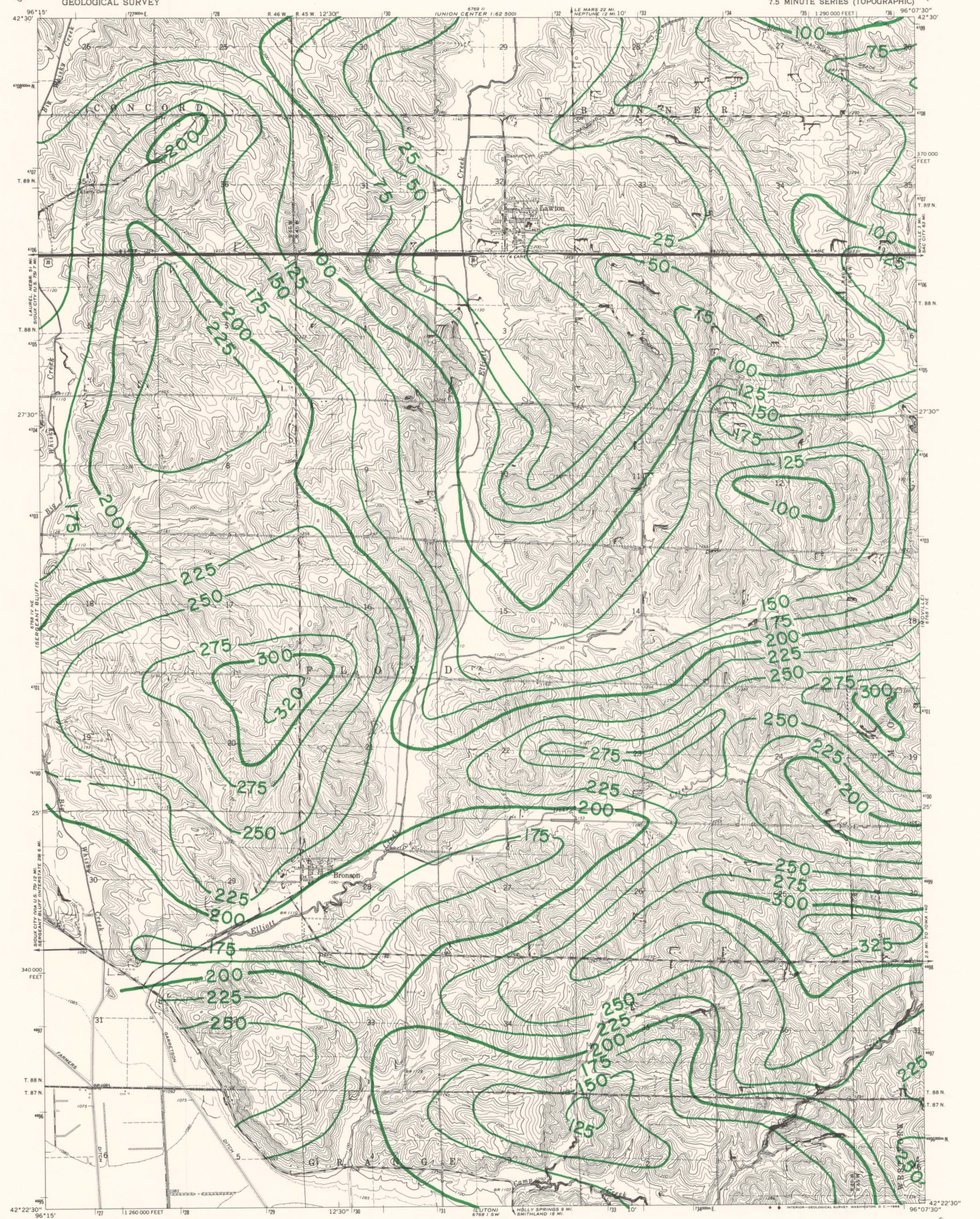
ELEVATION AND LITHOLOGY OF BEDROCK



UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
LAWTON QUADRANGLE
IOWA–WOODBURY CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
CONCORD
BANNER
Lawton
LLOYD
Bronson
Elliott Creek
GRANGE
Mapped, edited, and published by the Geological Survey
Control by USGS and USC&GS
Topography by photogrammetric methods from aerial photographs taken 1962 and planetable surveys 1964
Polyconic projection. 1927 North American datum
10,000-foot grid based on Iowa coordinate system, north zone
1000-meter Universal Transverse Mercator grid ticks, zone 14, shown in blue
Fine red dashed lines indicate selected fence and field lines where generally visible on aerial photographs
This information is unchecked
UTM GRID AND 1964 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET
SCALE 1:24 000
CONTOUR INTERVAL 10 FEET
DOTTED LINES REPRESENT 5-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL
LAND-USE
QUADRANGLE LOCATION
ROAD CLASSIFICATION
Heavy-duty
Light-duty
Medium-duty
Unimproved dirt
U. S. Route
LAWTON, IOWA
N4222.5—W9607.5/7.5
1964
AMS 6768 I NW—SERIES V876

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

LAWTON QUADRANGLE
IOWA–WOODBURY CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)



Mapped, edited, and published by the Geological Survey

Control by USGS and USC&GS

Topography by photogrammetric methods from aerial photographs taken 1962 and planetable surveys 1964

Polyconic projection. 1927 North American datum
10,000-foot grid based on Iowa coordinate system, north zone
1000-meter Universal Transverse Mercator grid ticks, zone 14, shown in blue

Fine red dashed lines indicate selected fence and field lines where generally visible on aerial photographs
This information is unchecked

UTM GRID AND 1964 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 10 FEET
DOTTED LINES REPRESENT 5-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL

ROAD CLASSIFICATION
Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
U. S. Route

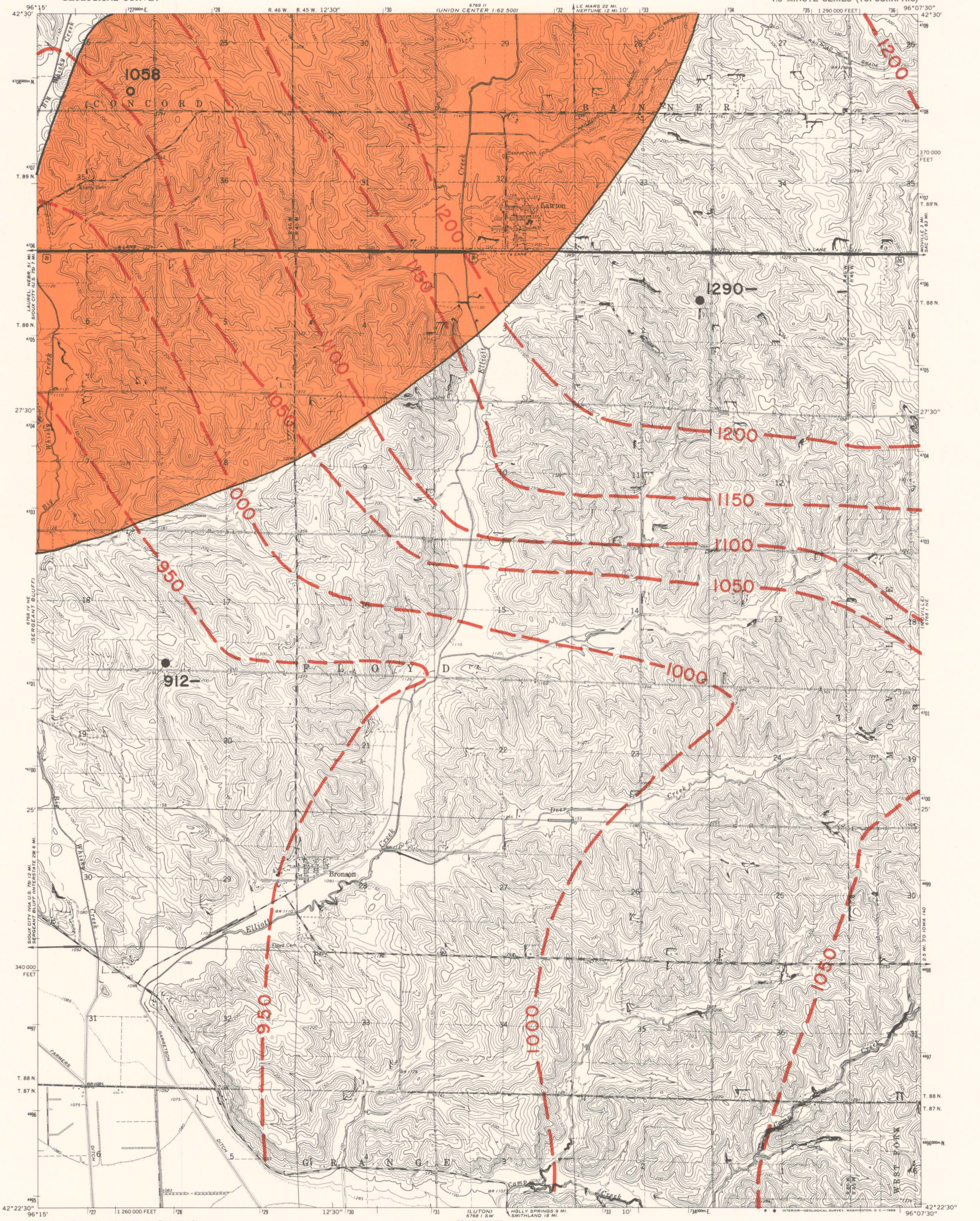
QUADRANGLE LOCATION

THICKNESS OF UNCONSOLIDATED SEDIMENTS

LAWTON, IOWA
N4222.5—W9607.5/7.5
1964
AMS 6768 I NW—SERIES V876

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

LAWTON QUADRANGLE
IOWA—WOODBURY CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)



Mapped, edited, and published by the Geological Survey

Control by USGS and USC&GS

Topography by photogrammetric methods from aerial photographs taken 1962 and planetable surveys 1964

Polyconic projection. 1927 North American datum
10,000-foot grid based on Iowa coordinate system, north zone
1000-meter Universal Transverse Mercator grid ticks, zone 14, shown in blue

Fine red dashed lines indicate selected fence and field lines where generally visible on aerial photographs
This information is unchecked

UTM GRID AND 1964 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 10 FEET
DOTTED LINES REPRESENT 5-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL

QUADRANGLE LOCATION

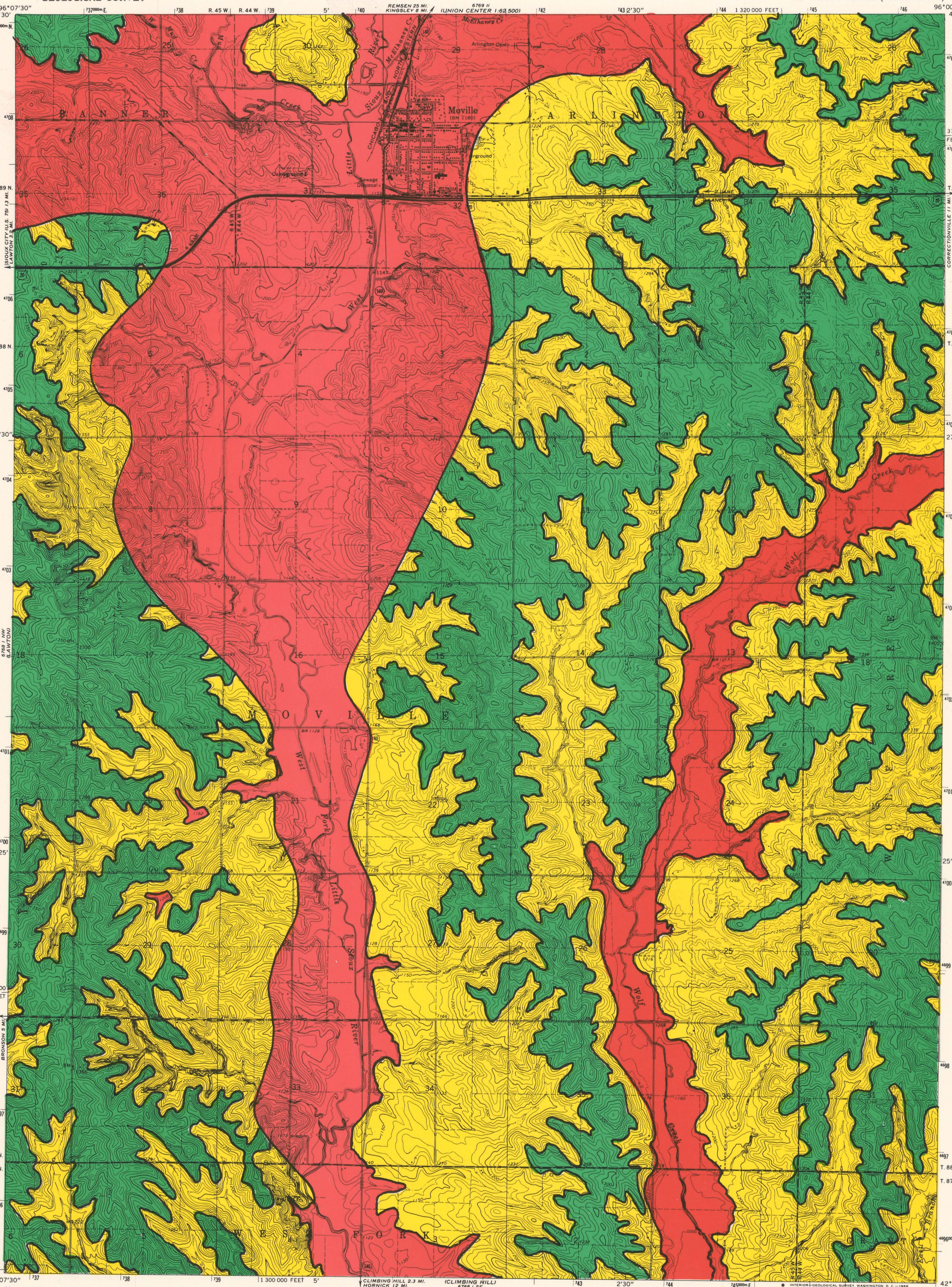
ROAD CLASSIFICATION
Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
U. S. Route

ELEVATION AND LITHOLOGY OF BEDROCK

LAWTON, IOWA
N4222.5—W9607.5/7.5
1964
AMS 6768 I NW—SERIES V876

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

MOVILLE QUADRANGLE
IOWA—WOODBURY CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)



Mapped, edited, and published by the Geological Survey

Control by USGS and USC&GS

Topography by photogrammetric methods from aerial photographs taken 1962. Field checked 1964

Polyconic projection. 1927 North American datum
10,000-foot grid based on Iowa coordinate system, north zone
1000-meter Universal Transverse Mercator grid ticks, zone 14, shown in blue

Fine red dashed lines indicate selected fence and field lines where generally visible on aerial photographs
This information is unchecked

UTM GRID AND 1964 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL

LAND —USE

ROAD CLASSIFICATION

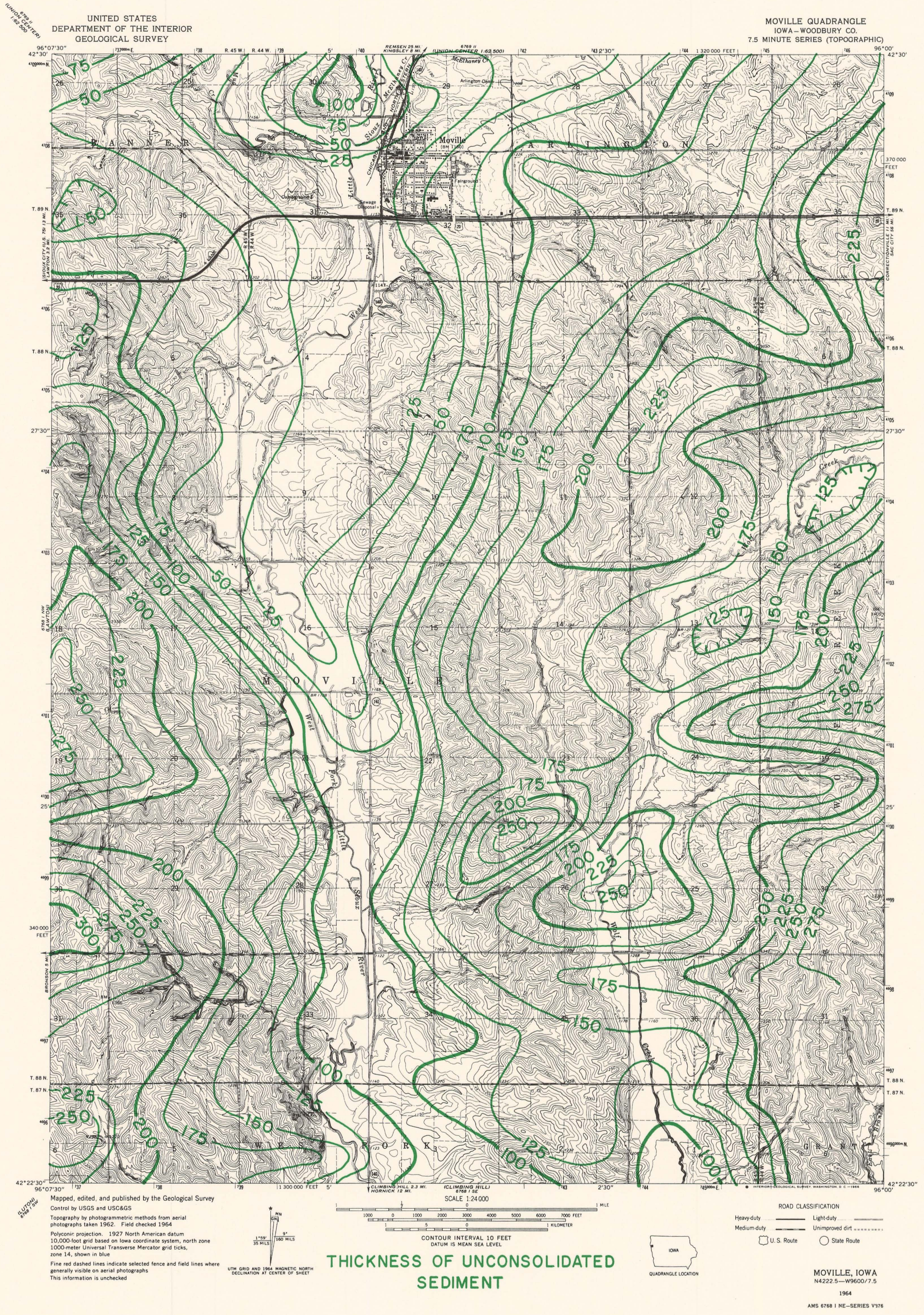
Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
U. S. Route — State Route

QUADRANGLE LOCATION

MOVILLE, IOWA
N4222.5—W9600/7.5

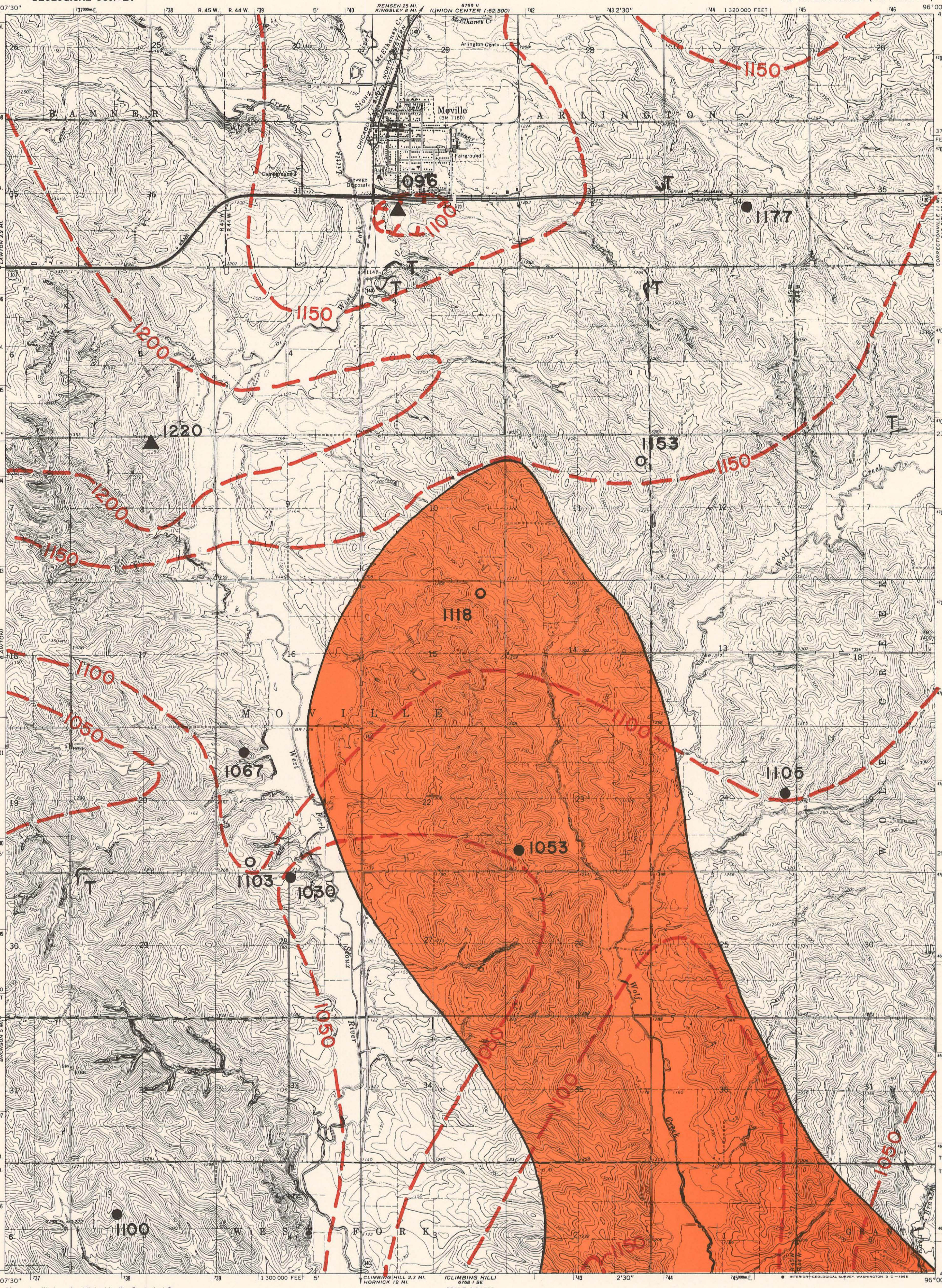
1964

AMS 6768 I NE—SERIES V376


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MOVILLE QUADRANGLE
IOWA–WOODBURY CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
Moville
BANNER
ARLINGTON
MOVILLE
WEST FORK
GRANT
Little Sioux River
West Fork
Mapped, edited, and published by the Geological Survey
Control by USGS and USC&GS
Topography by photogrammetric methods from aerial photographs taken 1962. Field checked 1964
Polyconic projection. 1927 North American datum
10,000-foot grid based on Iowa coordinate system, north zone
1000-meter Universal Transverse Mercator grid ticks, zone 14, shown in blue
Fine red dashed lines indicate selected fence and field lines where generally visible on aerial photographs
This information is unchecked
UTM GRID AND 1964 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET
SCALE 1:24000
CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL
THICKNESS OF UNCONSOLIDATED SEDIMENT
ROAD CLASSIFICATION
Heavy-duty
Light-duty
Medium-duty
Unimproved dirt
U. S. Route
State Route
QUADRANGLE LOCATION
MOVILLE, IOWA
N4222.5—W9600/7.5
1964
AMS 6768 I NE–SERIES V376

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

MOVILLE QUADRANGLE
IOWA—WOODBURY CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)



Mapped, edited, and published by the Geological Survey

Control by USGS and USC&GS

Topography by photogrammetric methods from aerial photographs taken 1962. Field checked 1964

Polyconic projection. 1927 North American datum
10,000-foot grid based on Iowa coordinate system, north zone
1000-meter Universal Transverse Mercator grid ticks, zone 14, shown in blue

Fine red dashed lines indicate selected fence and field lines where generally visible on aerial photographs
This information is unchecked

UTM GRID AND 1964 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL

ELEVATION AND LITOLOGY OF BEDROCK

QUADRANGLE LOCATION

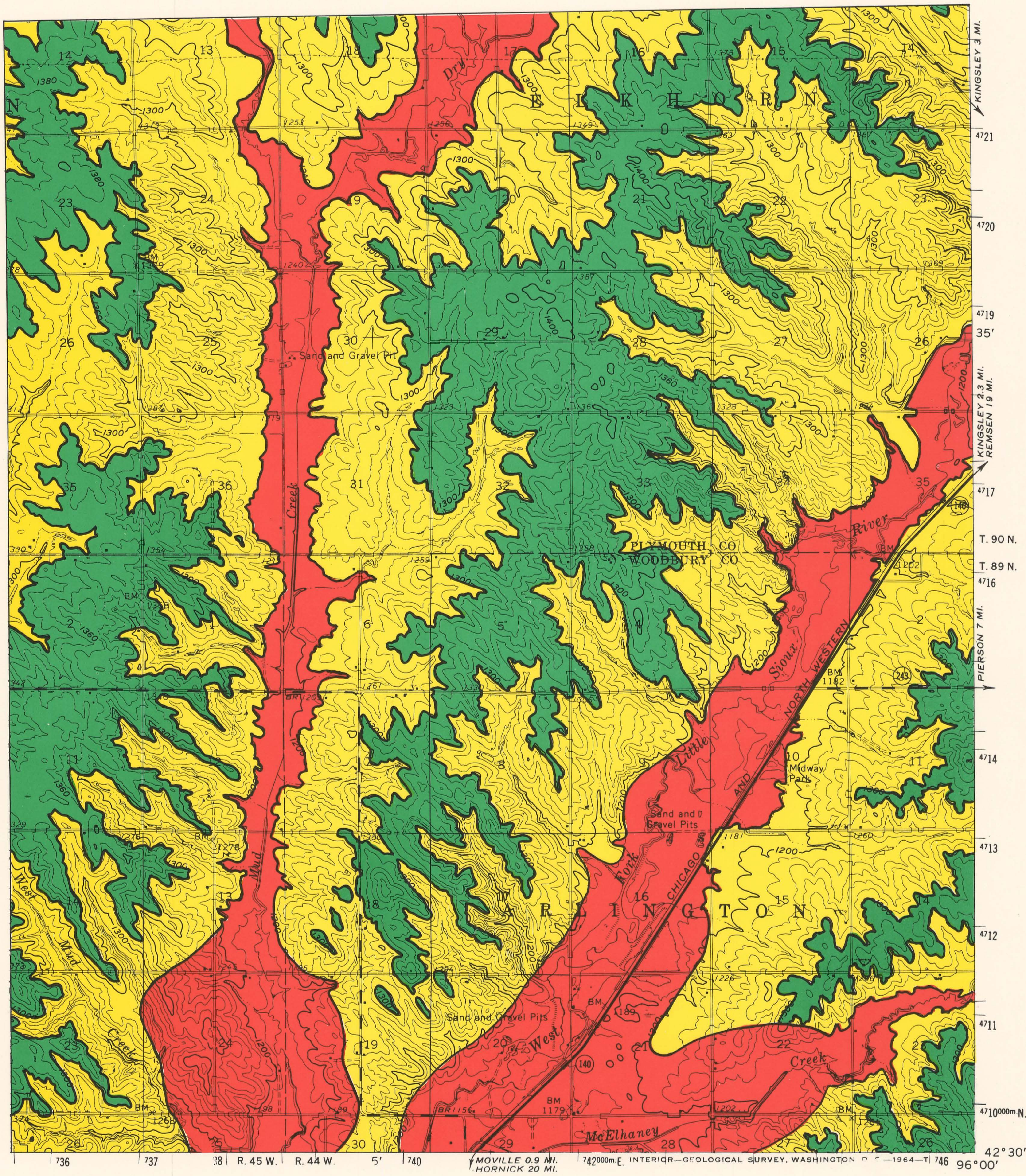
ROAD CLASSIFICATION

Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
U. S. Route — State Route

MOVILLE, IOWA
N4222.5—W9600/7.5

1964

AMS 6768 I NE—SERIES V376



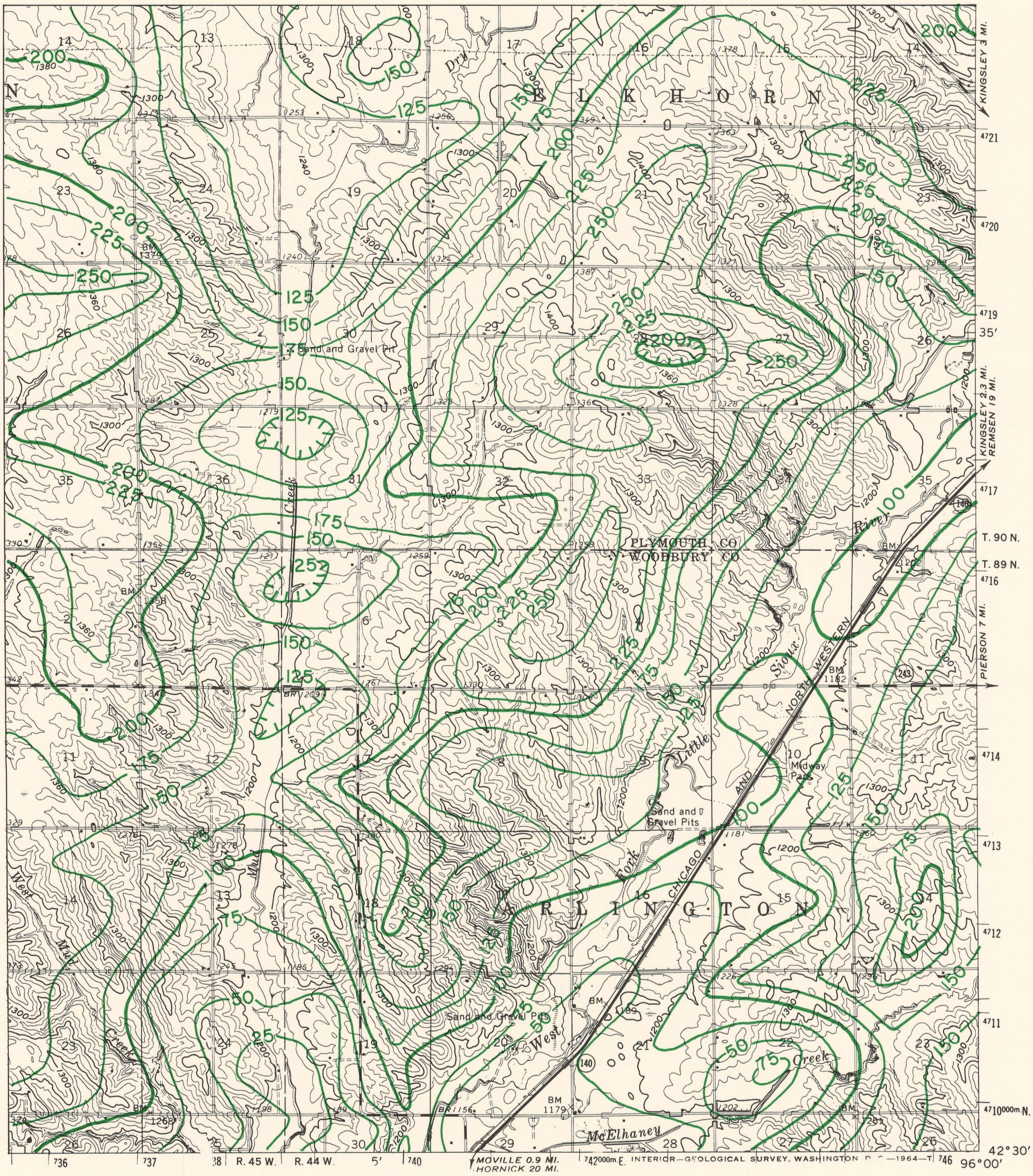
0 1 2 3 miles

SCALE
1:62500

LAND-USE

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

UNION CENTER
SOUTHEAST,
IOWA



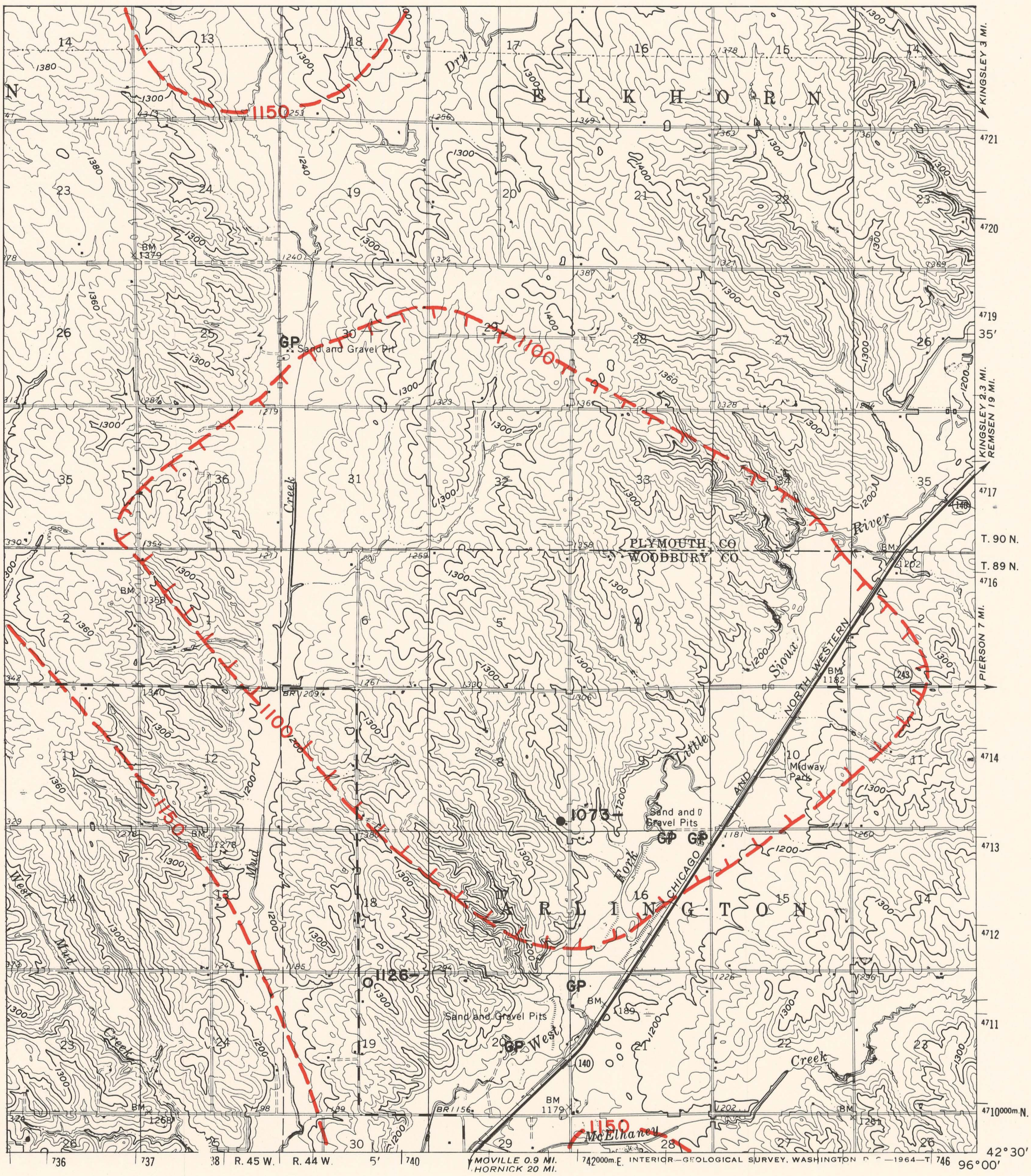
0 1 2 3 miles

SCALE
1:62500

THICKNESS OF UNCONSOLIDATED SEDIMENTS

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

UNION CENTER SOUTHEAST, IOWA



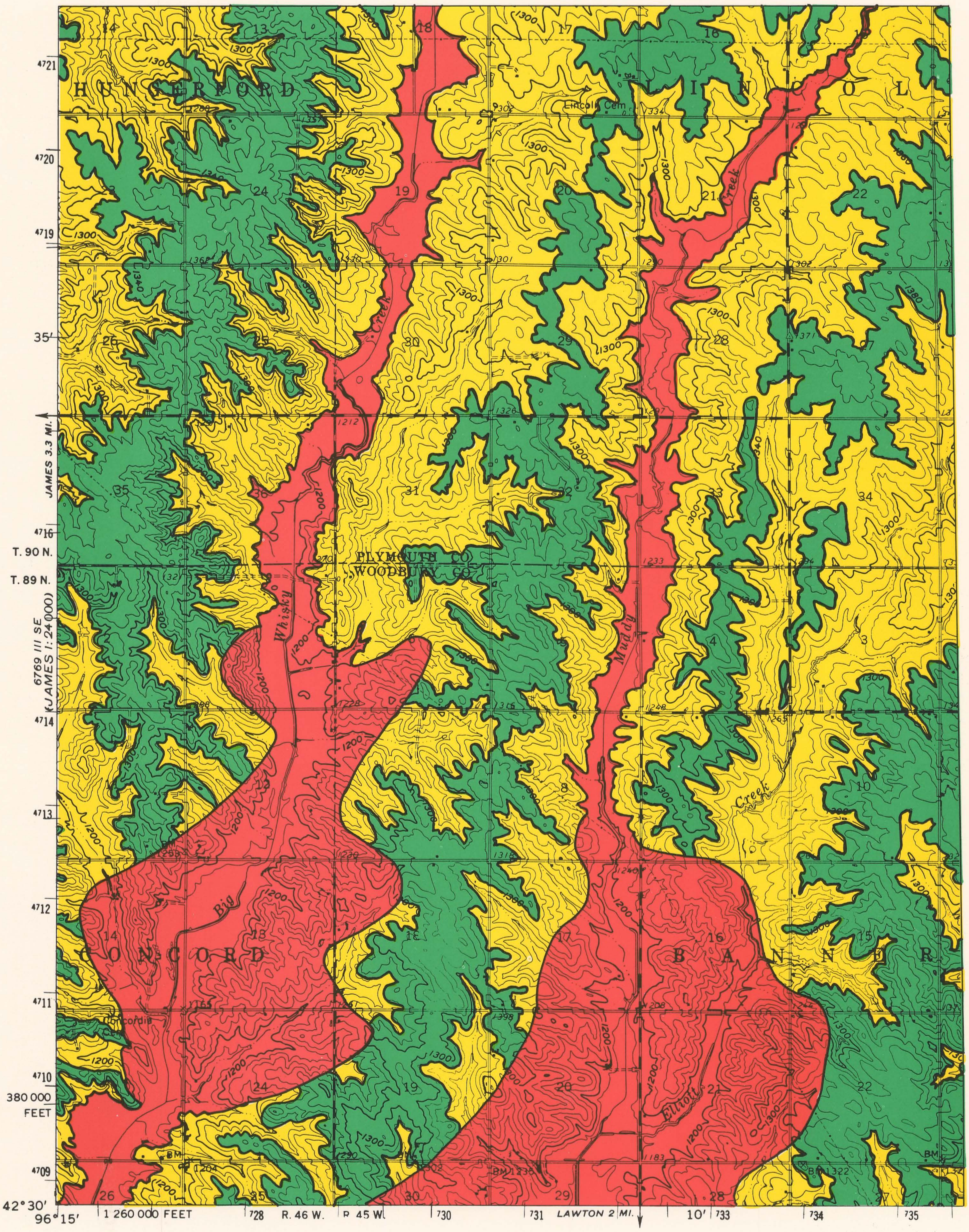
0 1 2 3 miles

SCALE
1:62500

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

ELEVATION AND LITHOLOGY OF BEDROCK

UNION CENTER SOUTHEAST, IOWA

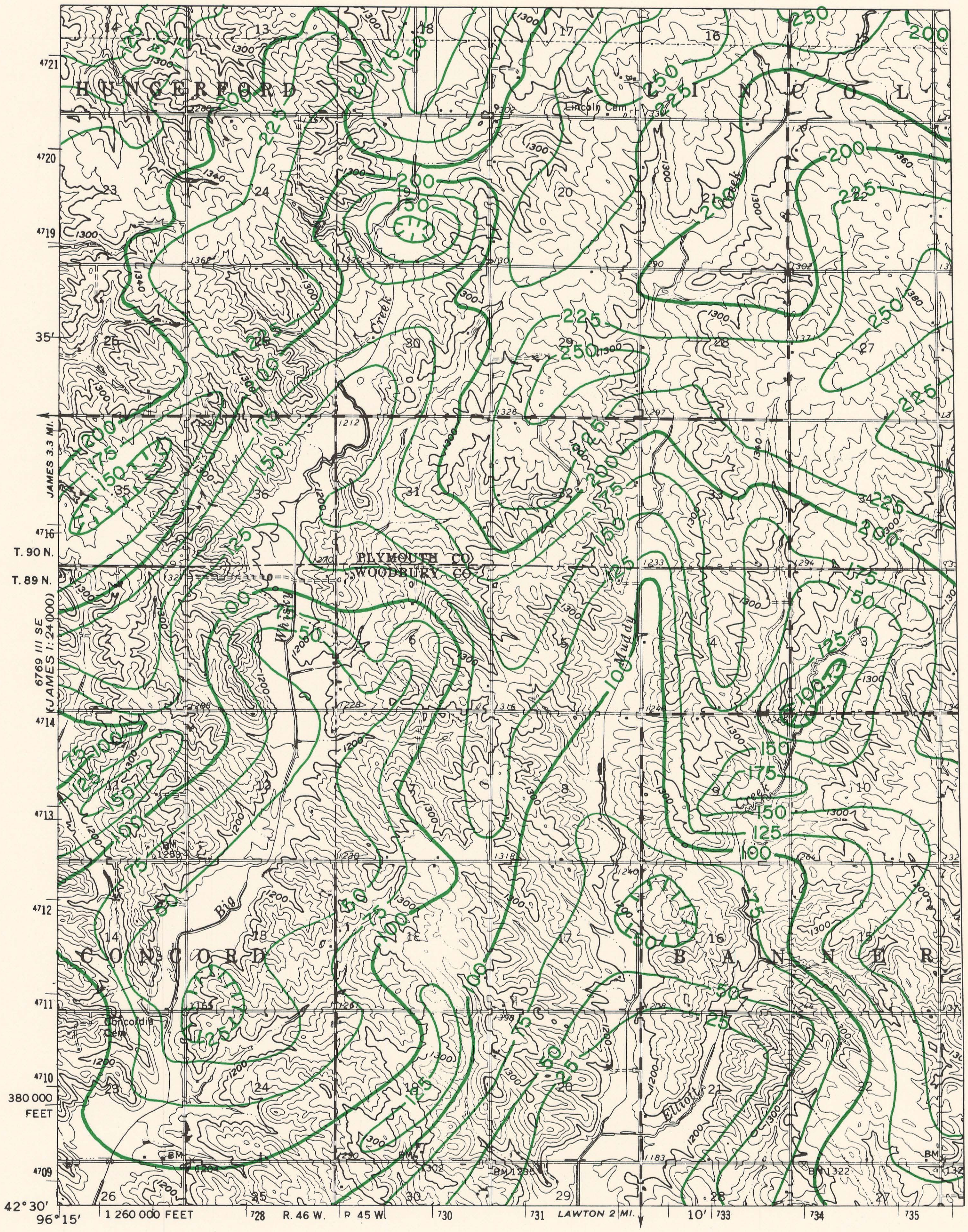


SCALE
1:62500

LAND-USE

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

UNION CENTER
SOUTHWEST,
IOWA



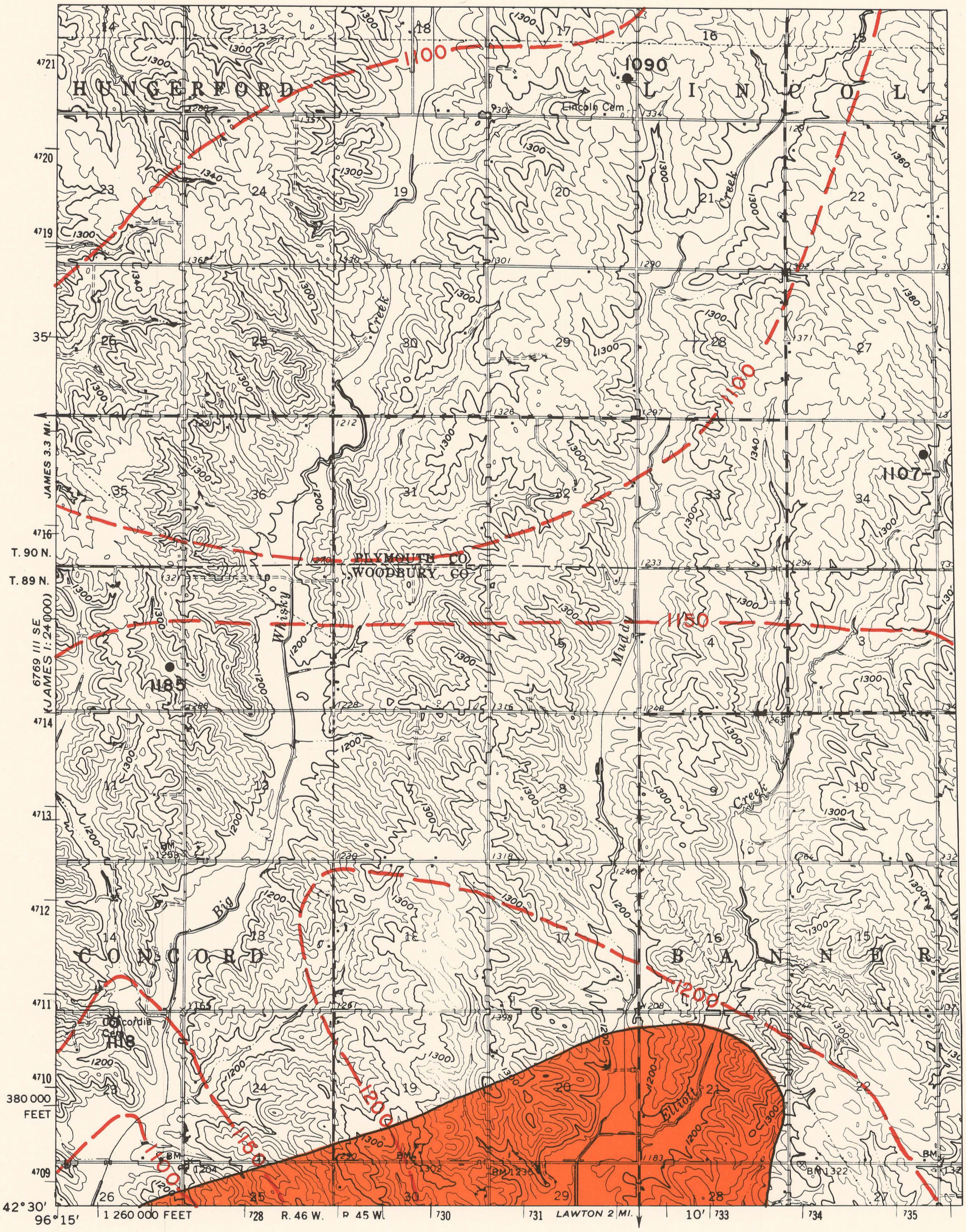
0 1 2 3 miles

SCALE
1:62500

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

THICKNESS OF UNCONSOLIDATED SEDIMENTS

UNION CENTER SOUTHWEST, IOWA



0 1 2 3 miles

SCALE
1:62500

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

ELEVATION AND LITHOLOGY OF BEDROCK

UNION CENTER SOUTHWEST, IOWA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

JAMES QUADRANGLE
IOWA
7.5 MINUTE SERIES (TOPOGRAPHIC)

Mapped, edited, and published by the Geological Survey

Control by USGS, USC&GS, and USCE

Topography by photogrammetric methods from aerial photographs taken 1961. Field checked 1964

Polyconic projection. 1927 North American datum
10,000-foot grid based on Iowa coordinate system, north zone
1000-meter Universal Transverse Mercator grid ticks, zone 14, shown in blue

Red tint indicates area in which only landmark buildings are shown

Fine red dashed lines indicate selected fence and field lines where generally visible on aerial photographs. This information is unchecked

UTM GRID AND 1964 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 20 FEET
DOTTED LINES REPRESENT 10-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL

LAND-USE

QUADRANGLE LOCATION

ROAD CLASSIFICATION

Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
U. S. Route — State Route

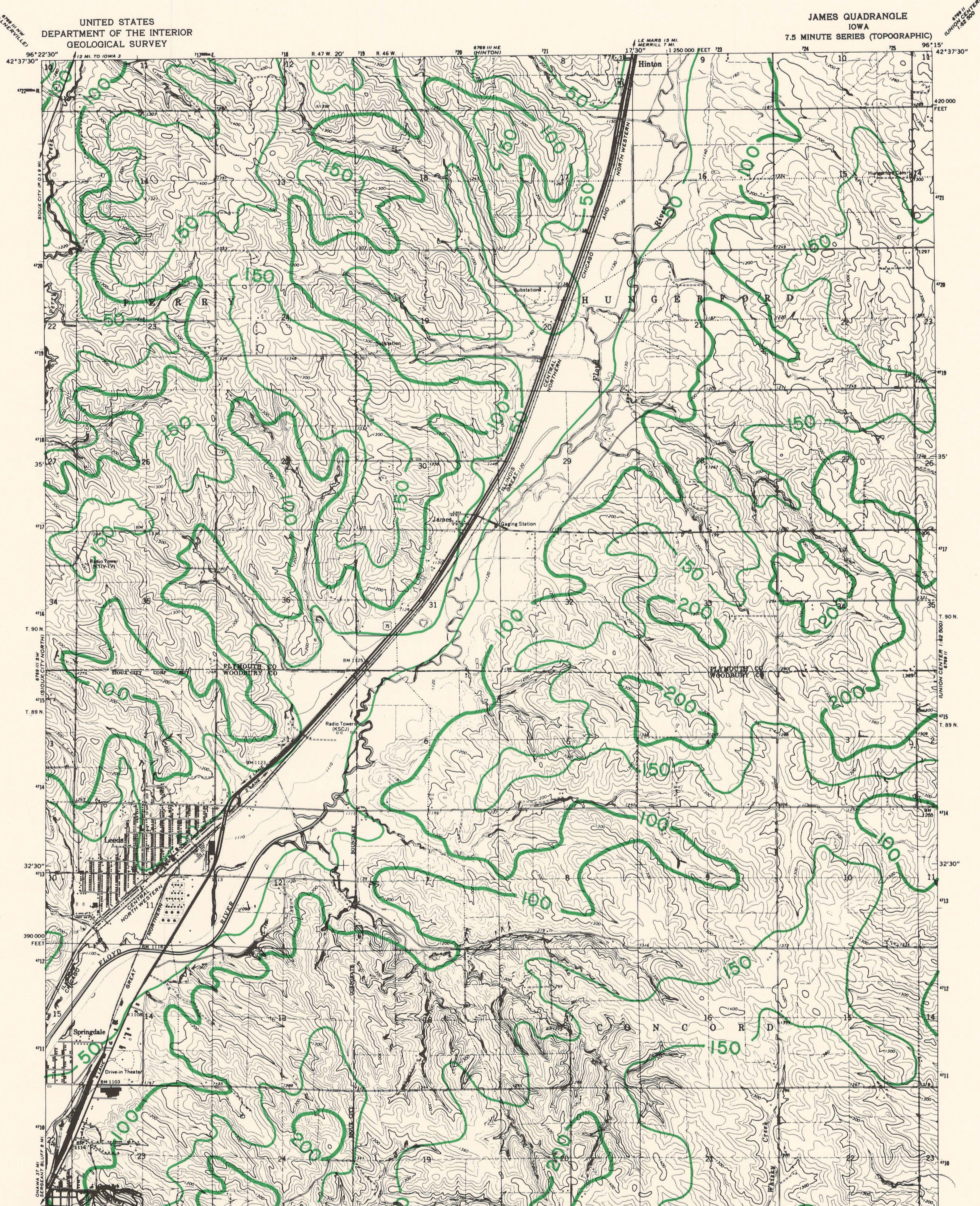
JAMES, IOWA
N4230—W9615/7.5

1964

AMS 6769 III SE—SERIES V876

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

JAMES QUADRANGLE
IOWA
7.5 MINUTE SERIES (TOPOGRAPHIC)



Mapped, edited, and published by the Geological Survey

Control by USGS, USC&GS, and USCE

Topography by photogrammetric methods from aerial photographs taken 1961. Field checked 1964

Polyconic projection. 1927 North American datum
10,000-foot grid based on Iowa coordinate system, north zone
1000-meter Universal Transverse Mercator grid ticks, zone 14, shown in blue

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UTM GRID AND 1964 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 20 FEET
DOTTED LINES REPRESENT 10-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL

THICKNESS OF UNCONSOLIDATED SEDIMENTS

QUADRANGLE LOCATION

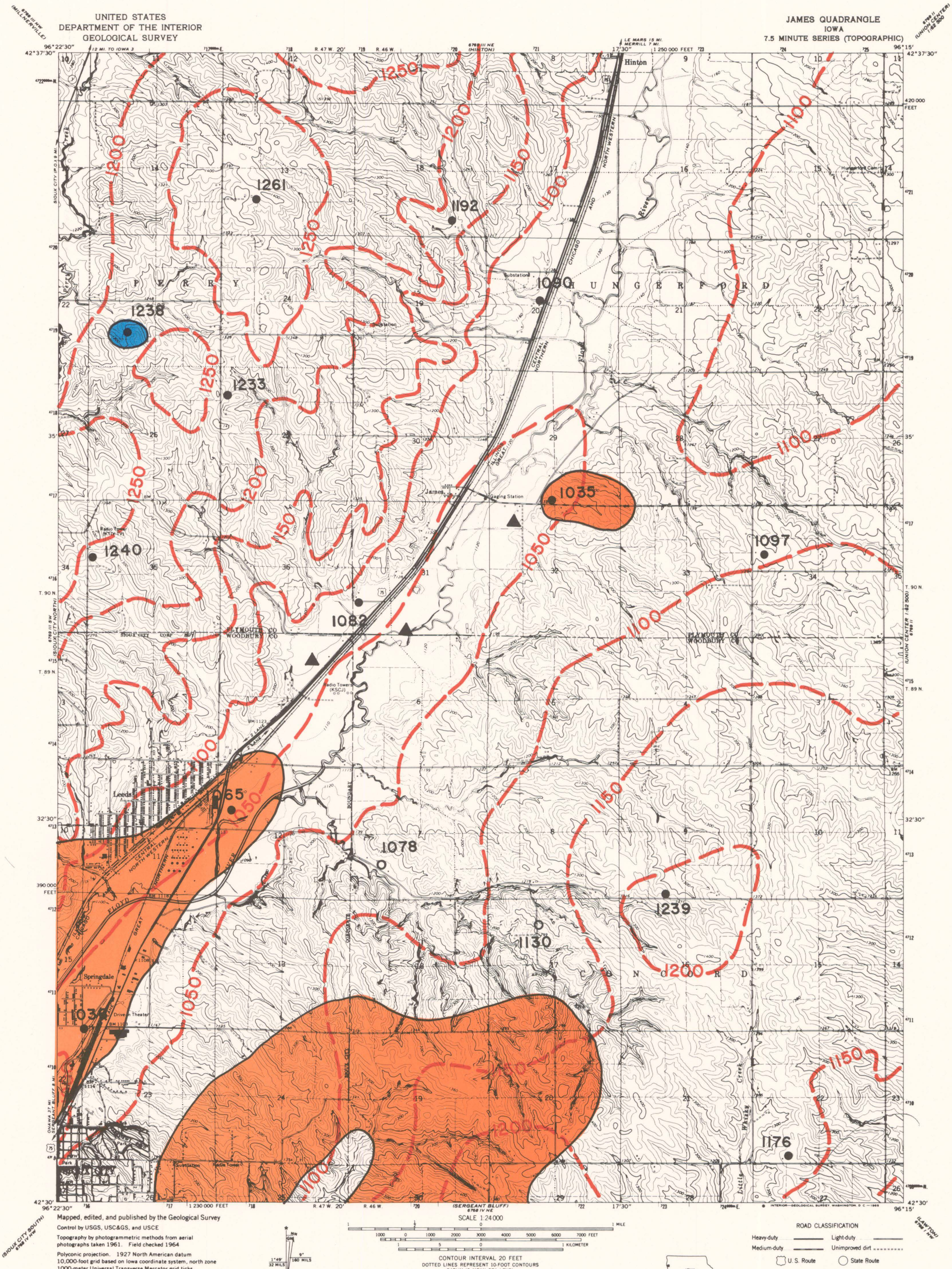
ROAD CLASSIFICATION

Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
U. S. Route — State Route

JAMES, IOWA
N4230—W9615/7.5

1964

AMS 6769 III SE—SERIES V876



ELEVATION AND LITHOLOGY OF BEDROCK

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

SIOUX CITY NORTH QUADRANGLE
IOWA–SOUTH DAKOTA
7.5 MINUTE SERIES (TOPOGRAPHIC)

Mapped, edited, and published by the Geological Survey

Control by USGS and USC&GS

Topography by photogrammetric methods from aerial photographs taken 1961 and planetable surveys 1963

Polyconic projection. 1927 North American datum
10,000-foot grids based on Iowa coordinate system, north zone and South Dakota coordinate system, south zone
1000-meter Universal Transverse Mercator grid ticks, zone 14, shown in blue

Red tint indicates areas in which only landmark buildings are shown

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UTM GRID AND 1963 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 20 FEET
DOTTED LINES REPRESENT 5 FOOT CONTOURS
DATUM IS MEAN SEA LEVEL

LAND-USE

QUADRANGLE LOCATION

ROAD CLASSIFICATION

Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
Interstate Route — U. S. Route — State Route

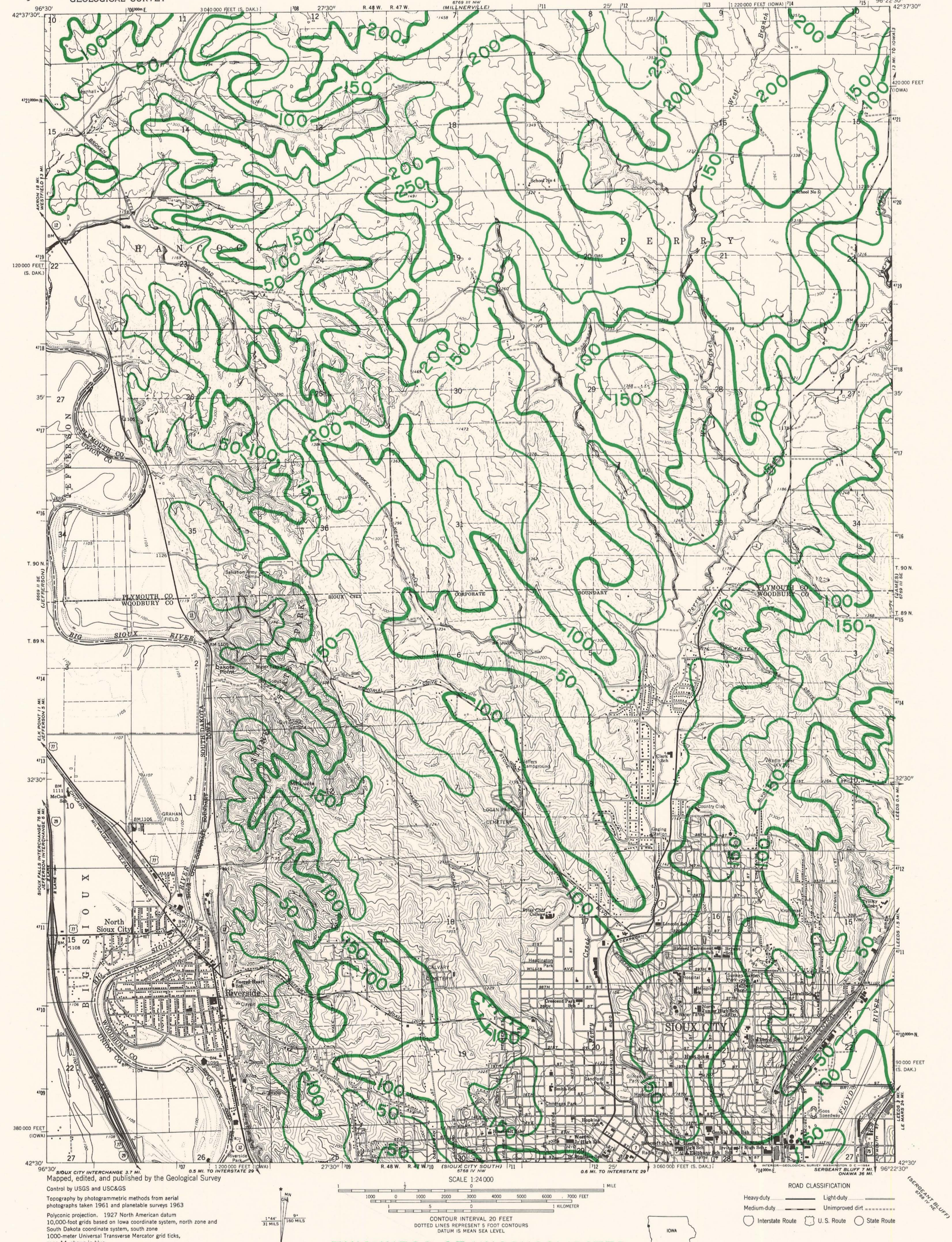
SIOUX CITY NORTH, IOWA–S. DAK.
N4230—W9622.5/7.5

1963

AMS 6769 III SW—SERIES V876

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

SIOUX CITY NORTH QUADRANGLE
IOWA–SOUTH DAKOTA
7.5 MINUTE SERIES (TOPOGRAPHIC)



Mapped, edited, and published by the Geological Survey

Control by USGS and USC&GS

Topography by photogrammetric methods from aerial photographs taken 1961 and planetable surveys 1963

Polyconic projection. 1927 North American datum
10,000-foot grids based on Iowa coordinate system, north zone and South Dakota coordinate system, south zone
1000-meter Universal Transverse Mercator grid ticks, zone 14, shown in blue

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UTM GRID AND 1963 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24000

CONTOUR INTERVAL 20 FEET
DOTTED LINES REPRESENT 5 FOOT CONTOURS
DATUM IS MEAN SEA LEVEL

THICKNESS OF UNCONSOLIDATED SEDIMENTS

QUADRANGLE LOCATION

ROAD CLASSIFICATION

Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
Interstate Route — U. S. Route — State Route

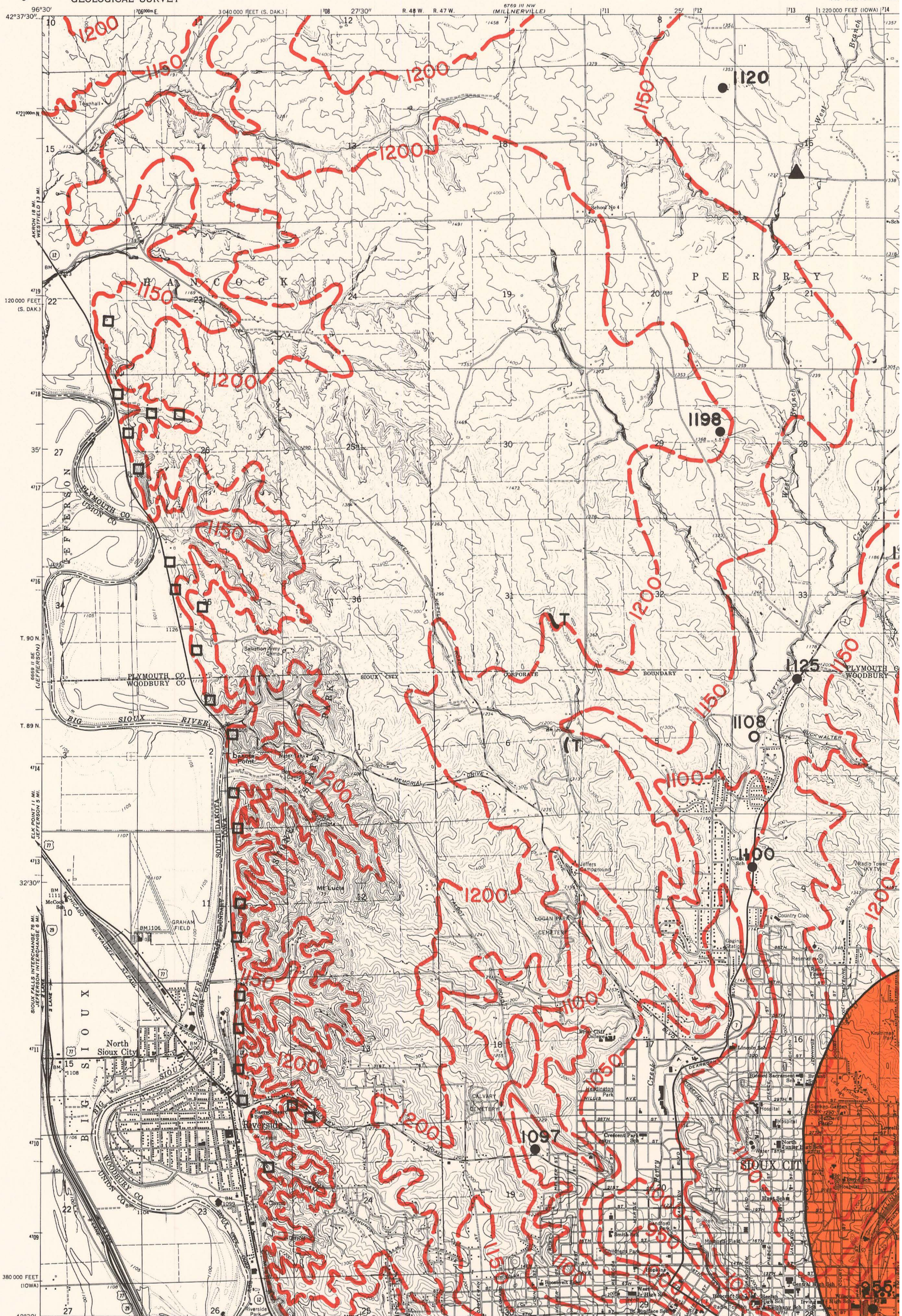
SIOUX CITY NORTH, IOWA–S. DAK.
N4230—W9622.5/7.5

1963

AMS 6769 III SW–SERIES V876

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

SIOUX CITY NO
IOWA–SO
7.5 MINUTE SER



Mapped, edited, and published by the Geological Survey

Control by USGS and USC&GS

Topography by photogrammetric methods from aerial photographs taken 1961 and planetable surveys 1963

Polyconic projection. 1927 North American datum
10,000-foot grids based on Iowa coordinate system, north zone and South Dakota coordinate system, south zone
1000-meter Universal Transverse Mercator grid ticks, zone 14, shown in blue

Red tint indicates areas in which only landmark buildings are shown

Fine red dashed lines indicate selected fence and field lines where generally visible on aerial photographs. This information is unchecked

UTM GRID AND 1963 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 20 FEET
DOTTED LINES REPRESENT 5 FOOT CONTOURS
DATUM IS MEAN SEA LEVEL

QUADRANGLE LOCATION

ELEVATION AND LITHOLOGY OF BEDROCK

SIOUX CITY NO
N4230-

AMS 6769 II


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
JEFFERSON QUADRANGLE
SOUTH DAKOTA–NEBRASKA–IOWA
7.5 MINUTE SERIES (TOPOGRAPHIC)
JEFFERSON
BIG SIOUX
CIVIL BEND
ST JOHNS
COVINGTON
MISSOURI RIVER
SOUTH DAKOTA
NEBRASKA
UNION CO
DAKOTA CO
Jefferson
North Sioux City
Montagne Sch
Civil Bend Cem
Civil Bend Sch
Island Sch
Gibson Sch
Park Jefferson Racetrack
Sewage Disposal
Mapped, edited, and published by the Geological Survey
Control by USGS and USC&GS
Topography by photogrammetric methods from aerial photographs taken 1961 and planetable surveys 1963
Polyconic projection. 1927 North American datum
10,000-foot grids based on South Dakota coordinate system, south zone, Nebraska coordinate system, north zone, and Iowa coordinate system, north zone
1000-meter Universal Transverse Mercator grid ticks, zone 14, shown in blue
Fine red dashed lines indicate selected fence and field lines where generally visible on aerial photographs. This information is unchecked
Certain land lines are omitted because of insufficient data
UTM GRID AND 1963 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET
SCALE 1:24000
CONTOUR INTERVAL 5 FEET
DATUM IS MEAN SEA LEVEL
LAND-USE
SOUTH DAKOTA
QUADRANGLE LOCATION
ROAD CLASSIFICATION
Heavy-duty
Light-duty
Medium-duty
Unimproved dirt
Interstate Route
U. S. Route
State Route
JEFFERSON, S. DAK.–NEBR.–IOWA
N4230—W9630/7.5
1963
AMS 6669 II SE–SERIES V873
INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D. C.—1964

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

JEFFERSON QUADRANGLE
SOUTH DAKOTA–NEBRASKA–IOWA
7.5 MINUTE SERIES (TOPOGRAPHIC)

Mapped, edited, and published by the Geological Survey

Control by USGS and USC&GS

Topography by photogrammetric methods from aerial photographs taken 1961 and planetable surveys 1963

Polyconic projection. 1927 North American datum
10,000-foot grids based on South Dakota coordinate system, south zone, Nebraska coordinate system, north zone, and Iowa coordinate system, north zone
1000-meter Universal Transverse Mercator grid ticks, zone 14, shown in blue

Fine red dashed lines indicate selected fence and field lines where generally visible on aerial photographs. This information is unchecked

Certain land lines are omitted because of insufficient data

UTM GRID AND 1963 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 5 FEET
DATUM IS MEAN SEA LEVEL

THICKNESS OF UNCONSOLIDATED SEDIMENT

QUADRANGLE LOCATION

ROAD CLASSIFICATION

Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
Interstate Route — U. S. Route — State Route

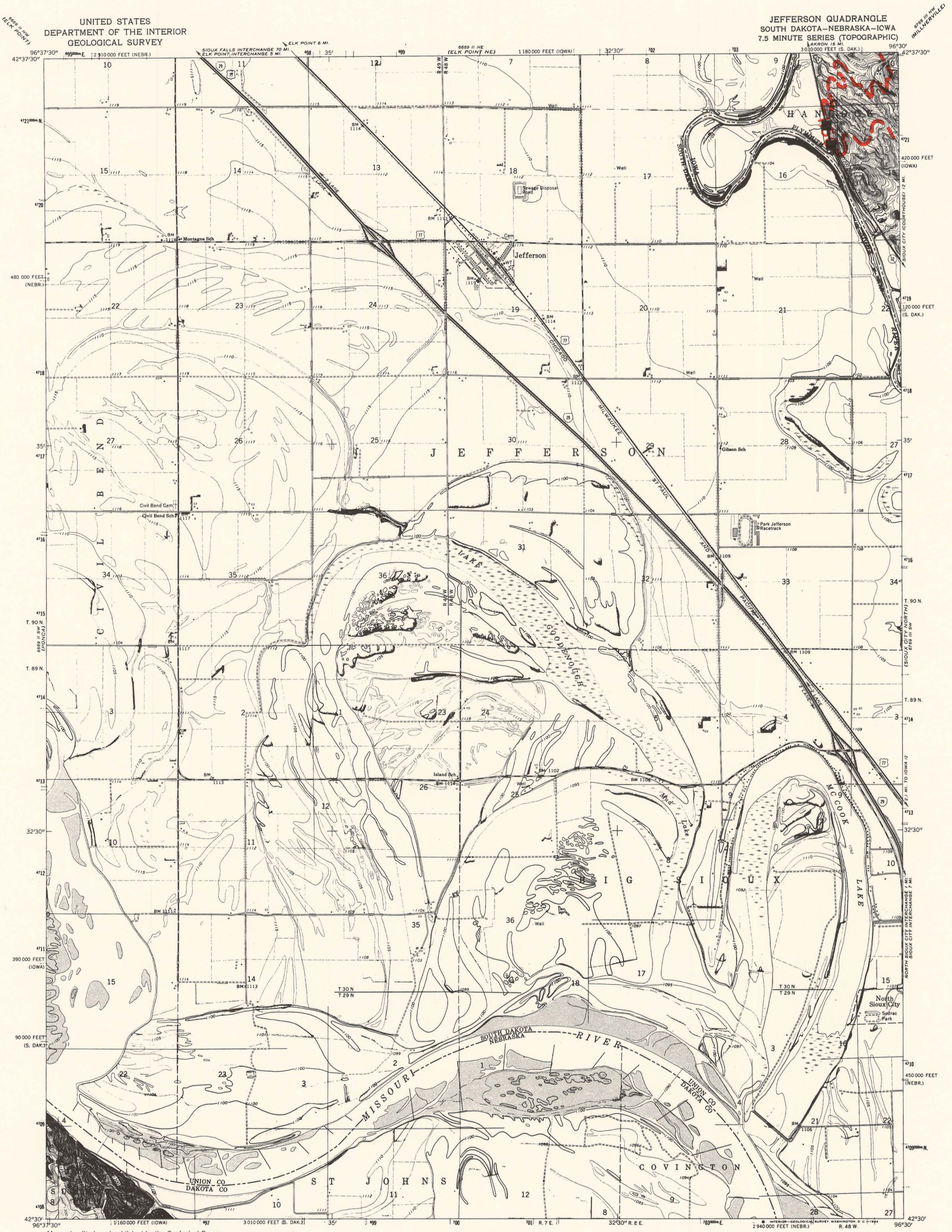
JEFFERSON, S. DAK.–NEBR.–IOWA
N4230—W9630/7.5

1963

AMS 6669 II SE–SERIES V873

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

JEFFERSON QUADRANGLE
SOUTH DAKOTA–NEBRASKA–IOWA
7.5 MINUTE SERIES (TOPOGRAPHIC)



Mapped, edited, and published by the Geological Survey

Control by USGS and USC&GS

Topography by photogrammetric methods from aerial photographs taken 1961 and planetable surveys 1963

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UTM GRID AND 1963 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 5 FEET
DATUM IS MEAN SEA LEVEL

ELEVATION AND LITHOLOGY OF BEDROCK

SOUTH DAKOTA
QUADRANGLE LOCATION

ROAD CLASSIFICATION

Heavy-duty ... Light-duty
Medium-duty ... Unimproved dirt
Interstate Route U. S. Route State Route

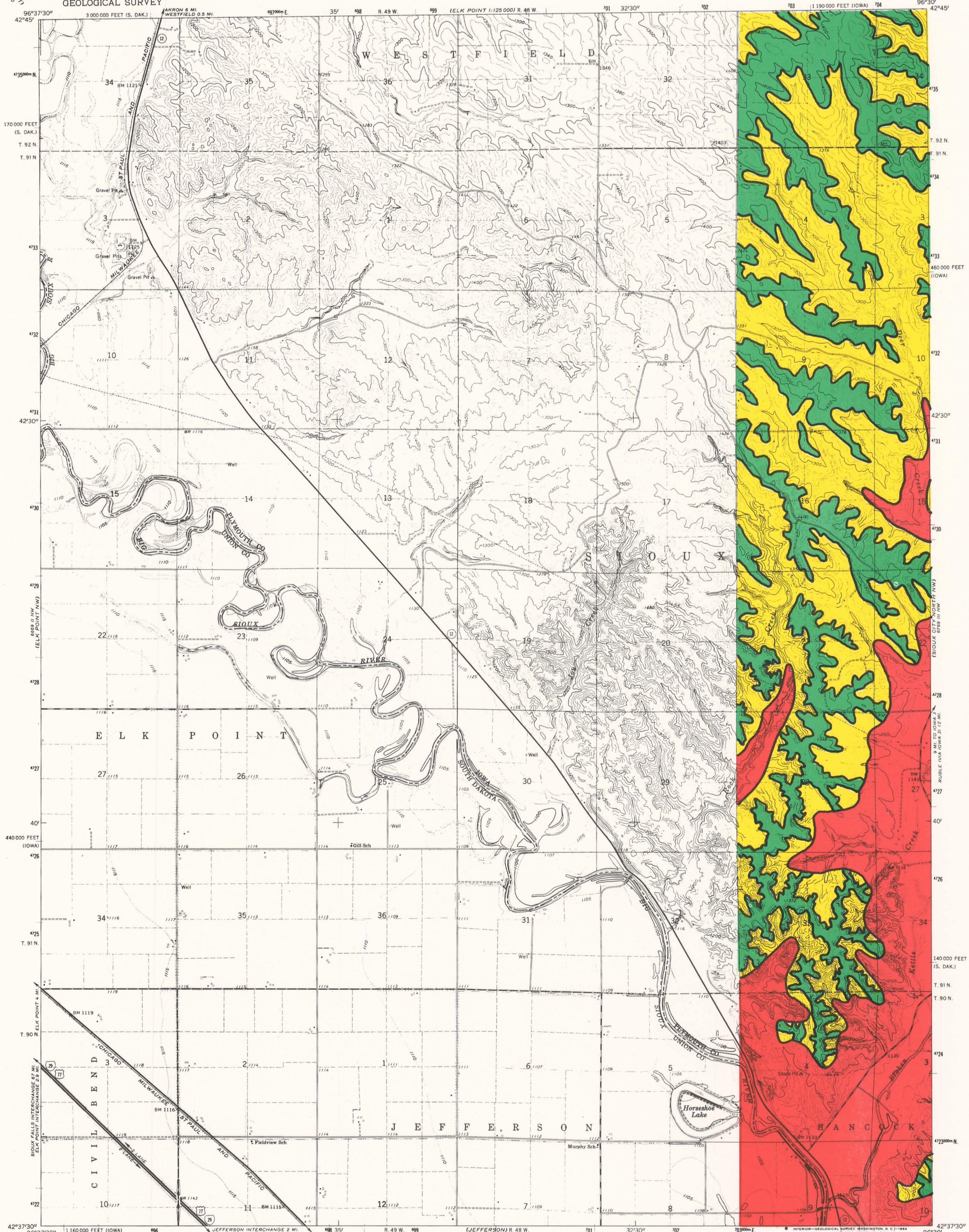
JEFFERSON, S. DAK.–NEBR.–IOWA
N4230—W9630/7.5

1963

AMS 6669 II SE–SERIES V873

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

ELK POINT NE QUADRANGLE
IOWA–SOUTH DAKOTA
7.5 MINUTE SERIES (TOPOGRAPHIC)



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UTM GRID AND 1963 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 20 FEET
DOTTED LINES REPRESENT 5-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL

LAND-USE

QUADRANGLE LOCATION

ROAD CLASSIFICATION

Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
Interstate Route — U. S. Route — State Route

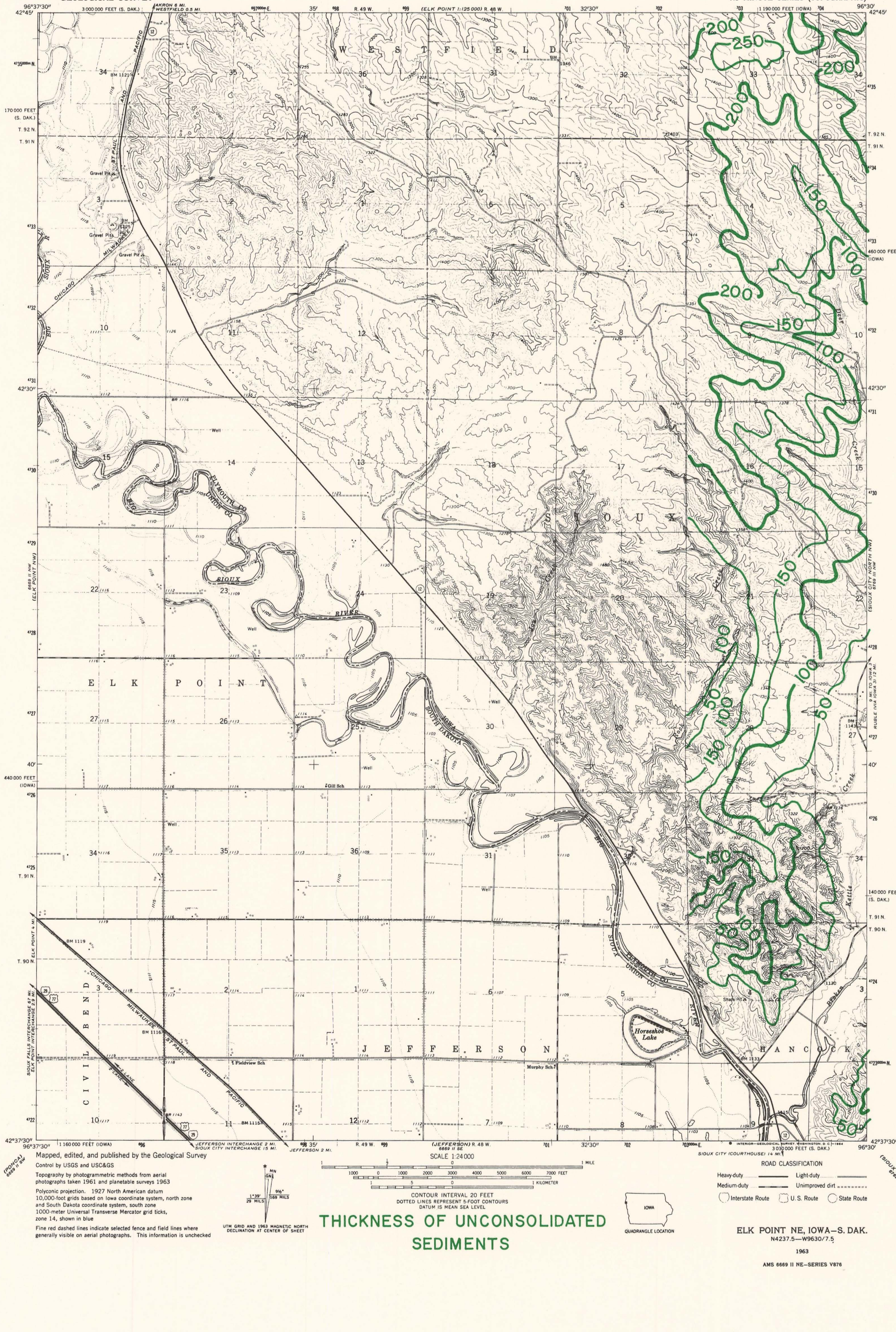
ELK POINT NE, IOWA–S. DAK.
N4237.5—W9630/7.5

1963

AMS 6669 II NE–SERIES V876

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

ELK POINT NE QUADRANGLE
IOWA–SOUTH DAKOTA
7.5 MINUTE SERIES (TOPOGRAPHIC)



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UTM GRID AND 1963 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 20 FEET
DOTTED LINES REPRESENT 5-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL

THICKNESS OF UNCONSOLIDATED SEDIMENTS

QUADRANGLE LOCATION

ROAD CLASSIFICATION

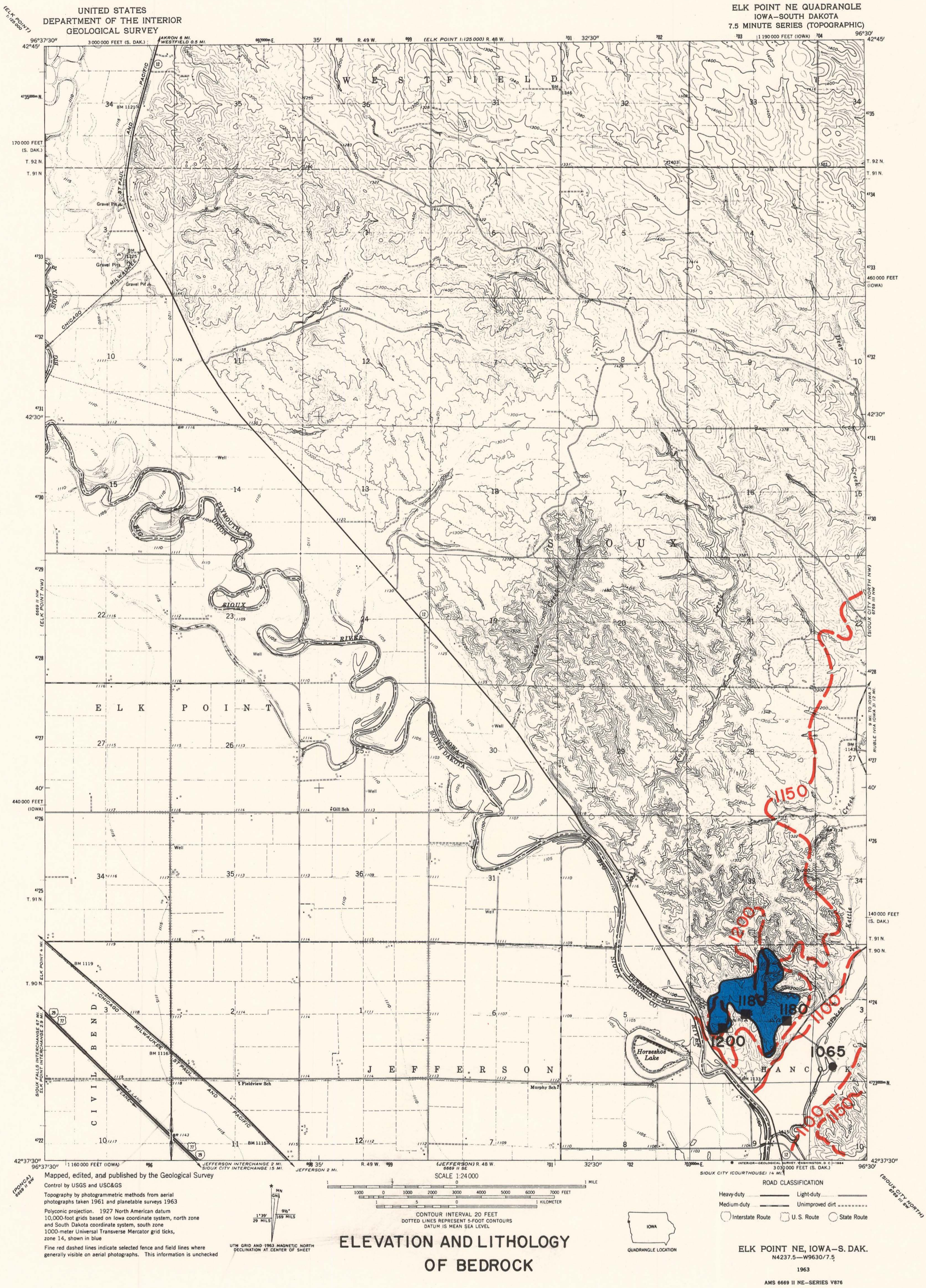
Heavy-duty — Light-duty
Medium-duty — Unimproved dirt

Interstate Route — U. S. Route — State Route

ELK POINT NE, IOWA–S. DAK.
N4237.5—W9630/7.5

1963

AMS 6669 II NE—SERIES V876



ELEVATION AND LITHOLOGY OF BEDROCK

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

MILLNERVILLE QUADRANGLE
IOWA–PLYMOUTH CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

(JEFFERSON)
6669 II SE

Mapped, edited, and published by the Geological Survey

Control by USGS and USC&GS

Topography by photogrammetric methods from aerial photographs taken 1961. Field checked 1964

Polyconic projection. 1927 North American datum
10,000-foot grid based on Iowa coordinate system, north zone
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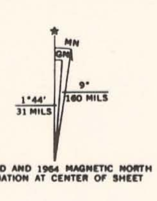


UTM GRID AND 1964 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

LAND — USE

(JAMES)
6769 III SE

ROAD CLASSIFICATION

Medium-duty .... Light-duty ....
Unimproved dirt

QUADRANGLE LOCATION

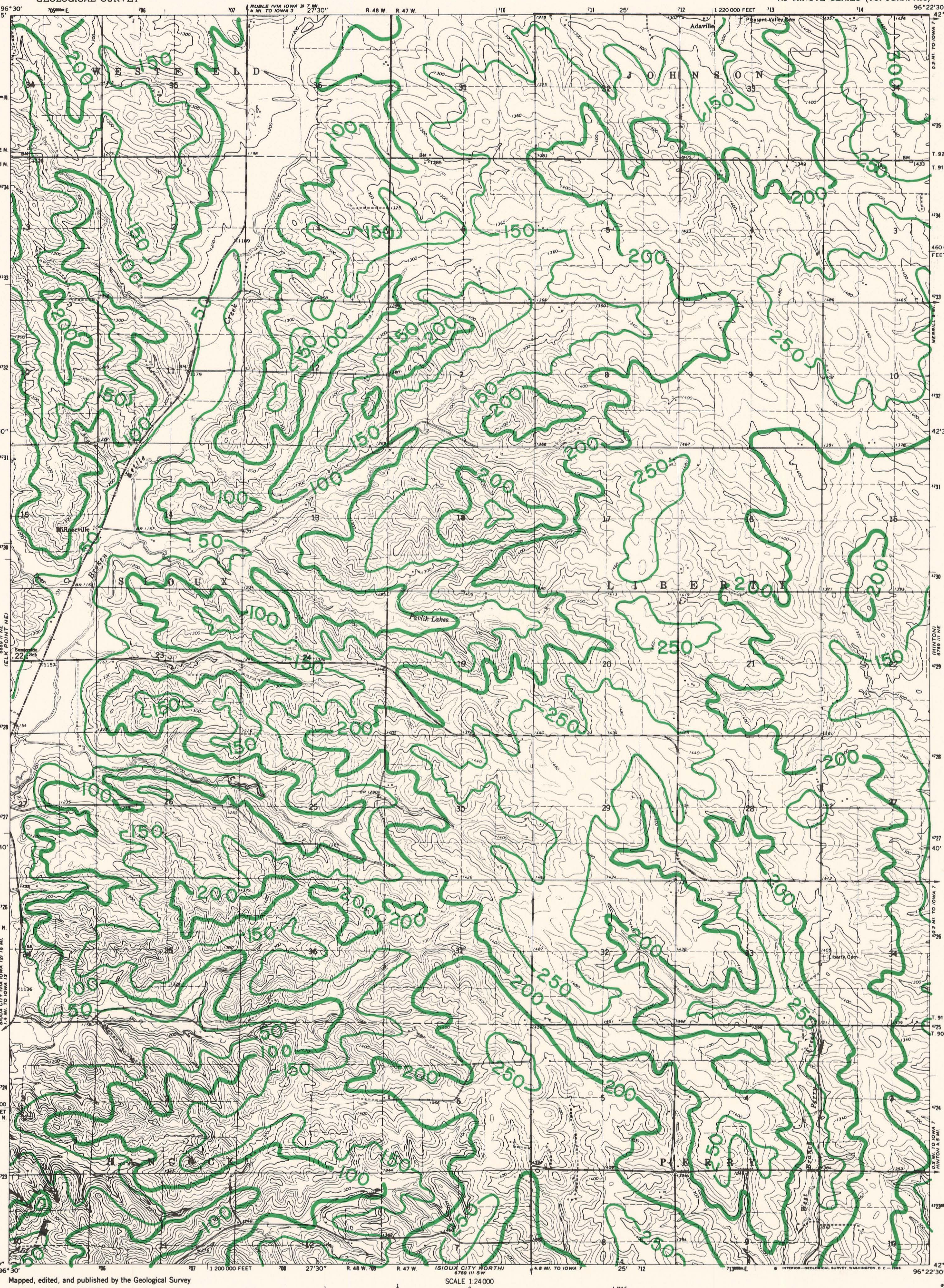
MILLNERVILLE, IOWA
N4237.5—W9622.5/7.5

1964

AMS 6769 III NW—SERIES V876

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

MILLNERVILLE QUADRANGLE
IOWA—PLYMOUTH CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)



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UTM GRID AND 1964 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

THICKNESS OF UNCONSOLIDATED SEDIMENTS

QUADRANGLE LOCATION

ROAD CLASSIFICATION

Medium-duty ——— Light-duty ———
Unimproved dirt - - - - - -

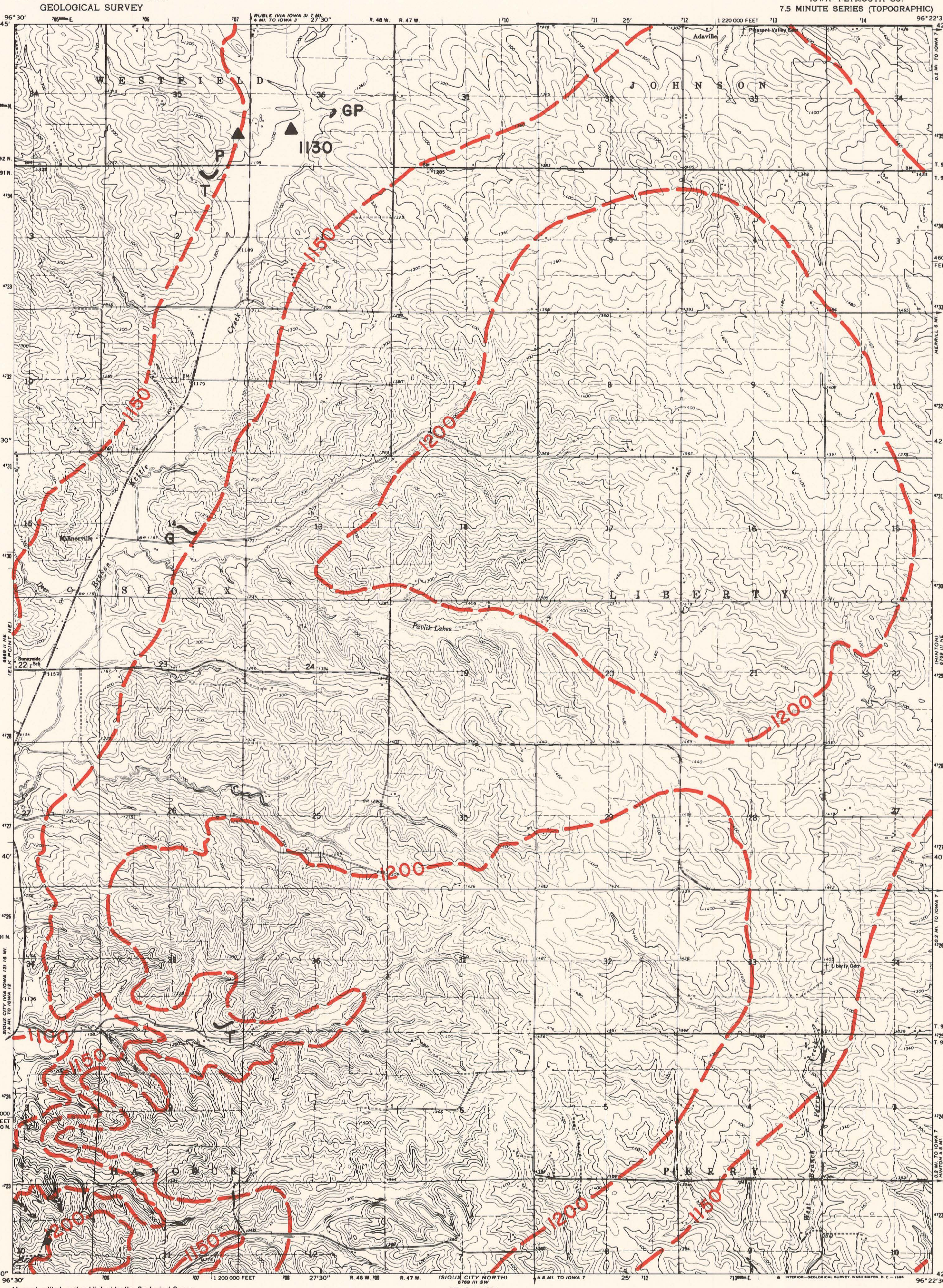
MILLNERVILLE, IOWA
N4237.5—W9622.5/7.5

1964

AMS 6769 III NW—SERIES V876

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

MILLNERVILLE QUADRANGLE
IOWA–PLYMOUTH CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)



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UTM GRID AND 1964 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

ELEVATION AND LITHOLOGY OF BEDROCK

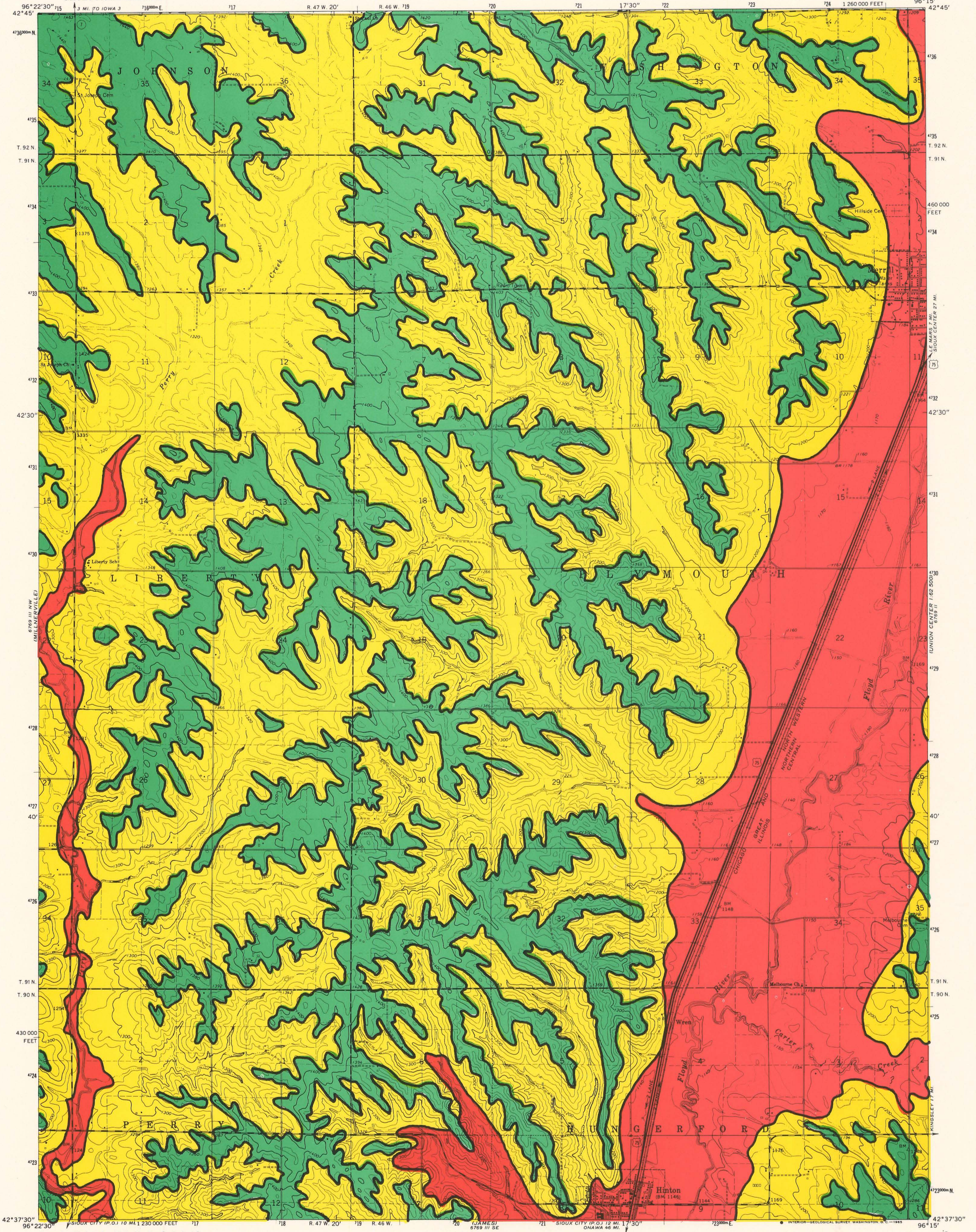
QUADRANGLE LOCATION

ROAD CLASSIFICATION
Medium-duty — Light-duty —
Unimproved dirt - - - - -

MILLNERVILLE, IOWA
N4237.5—W9622.5/7.5
1964
AMS 6769 III NW—SERIES V876

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

HINTON QUADRANGLE
IOWA–PLYMOUTH CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)



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UTM GRID AND 1964 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24000

CONTOUR INTERVAL 20 FEET
DOTTED LINES REPRESENT 10-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL

LAND–USE

QUADRANGLE LOCATION

ROAD CLASSIFICATION

Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
U. S. Route — State Route

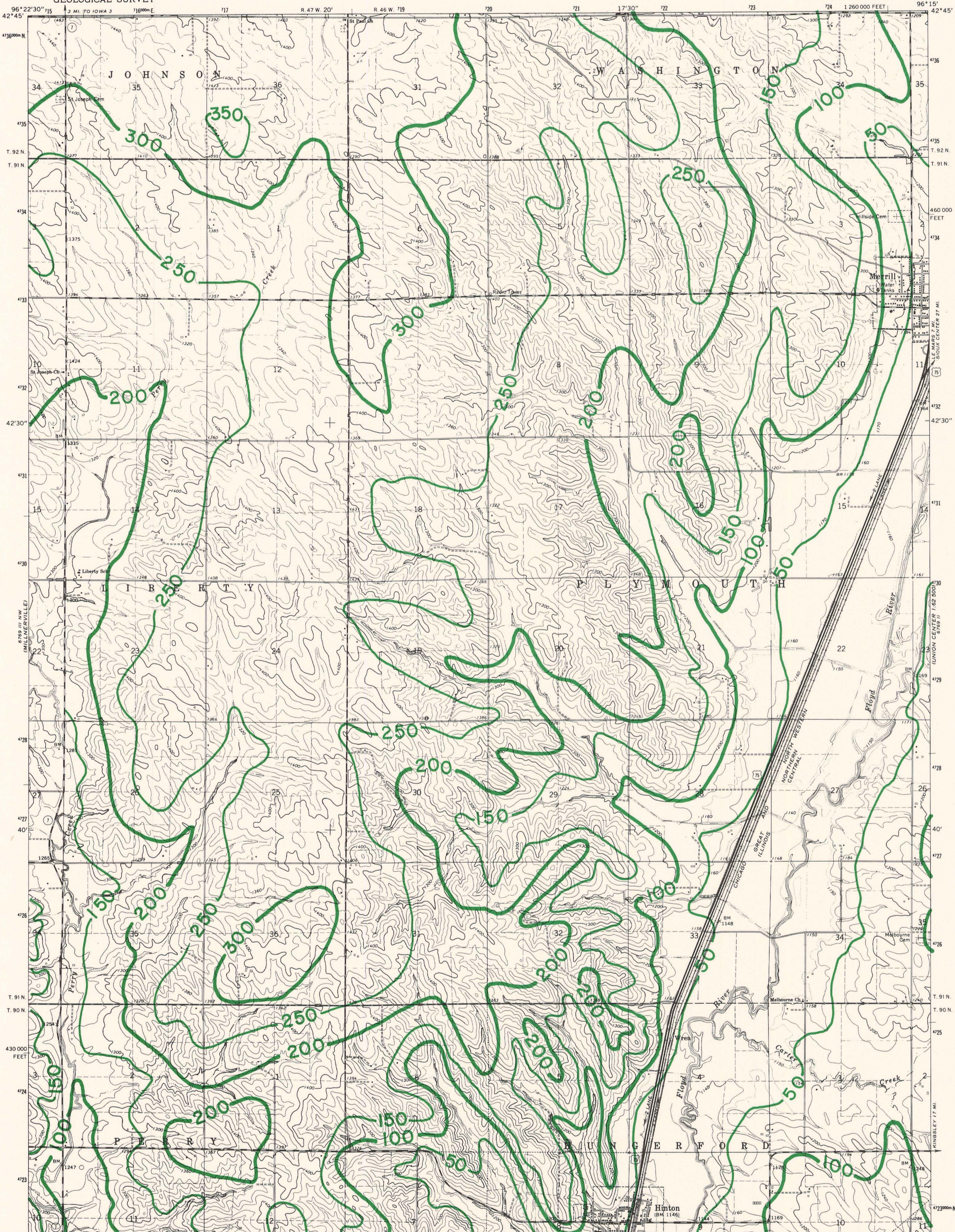
HINTON, IOWA
N4237.5—W9615/7.5

1964

AMS 6769 III NE—SERIES V876

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

HINTON QUADRANGLE
IOWA—PLYMOUTH CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)



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UTM GRID AND 1964 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

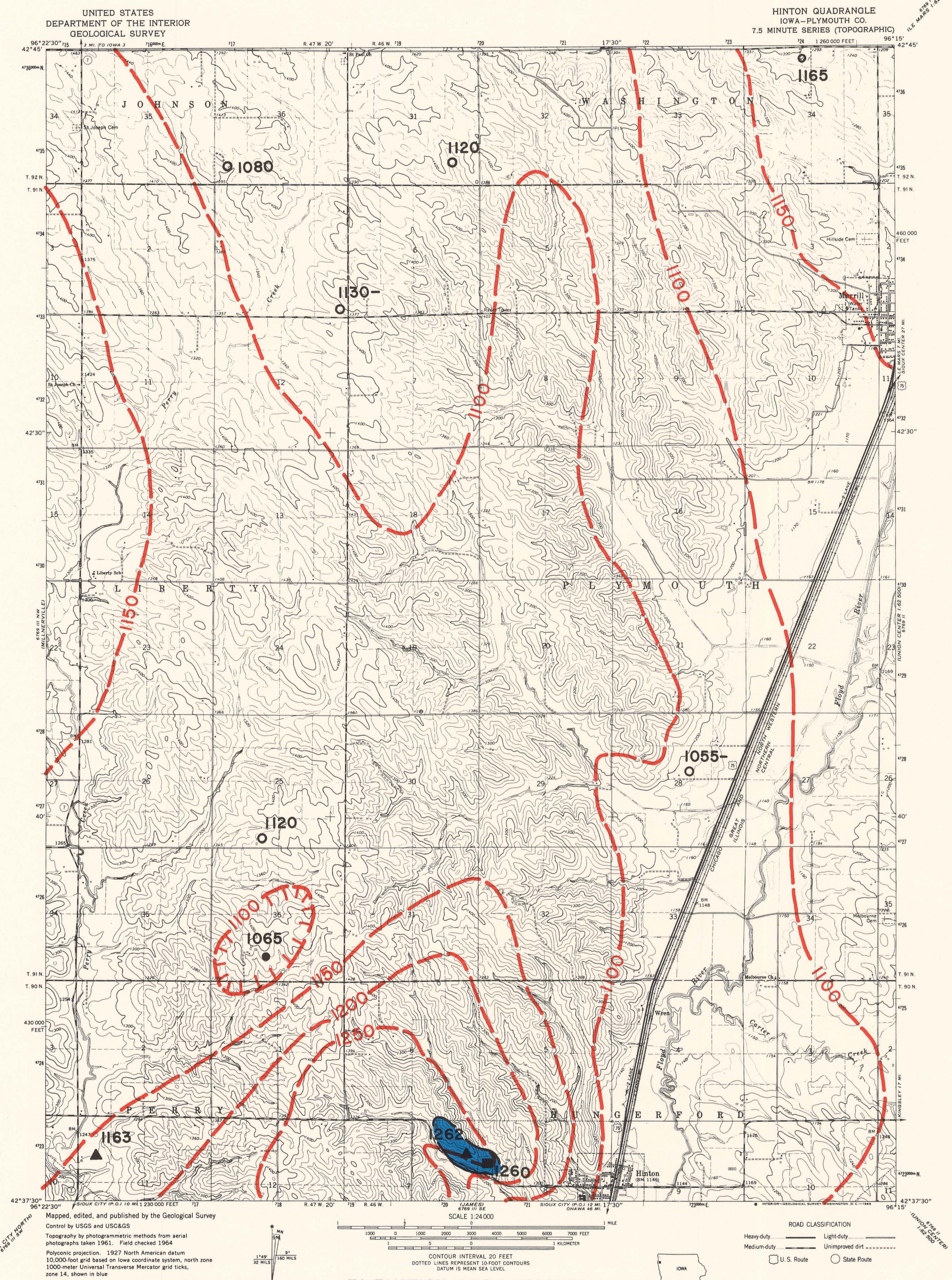
CONTOUR INTERVAL 20 FEET
DOTTED LINES REPRESENT 10-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL

THICKNESS OF UNCONSOLIDATED SEDIMENTS

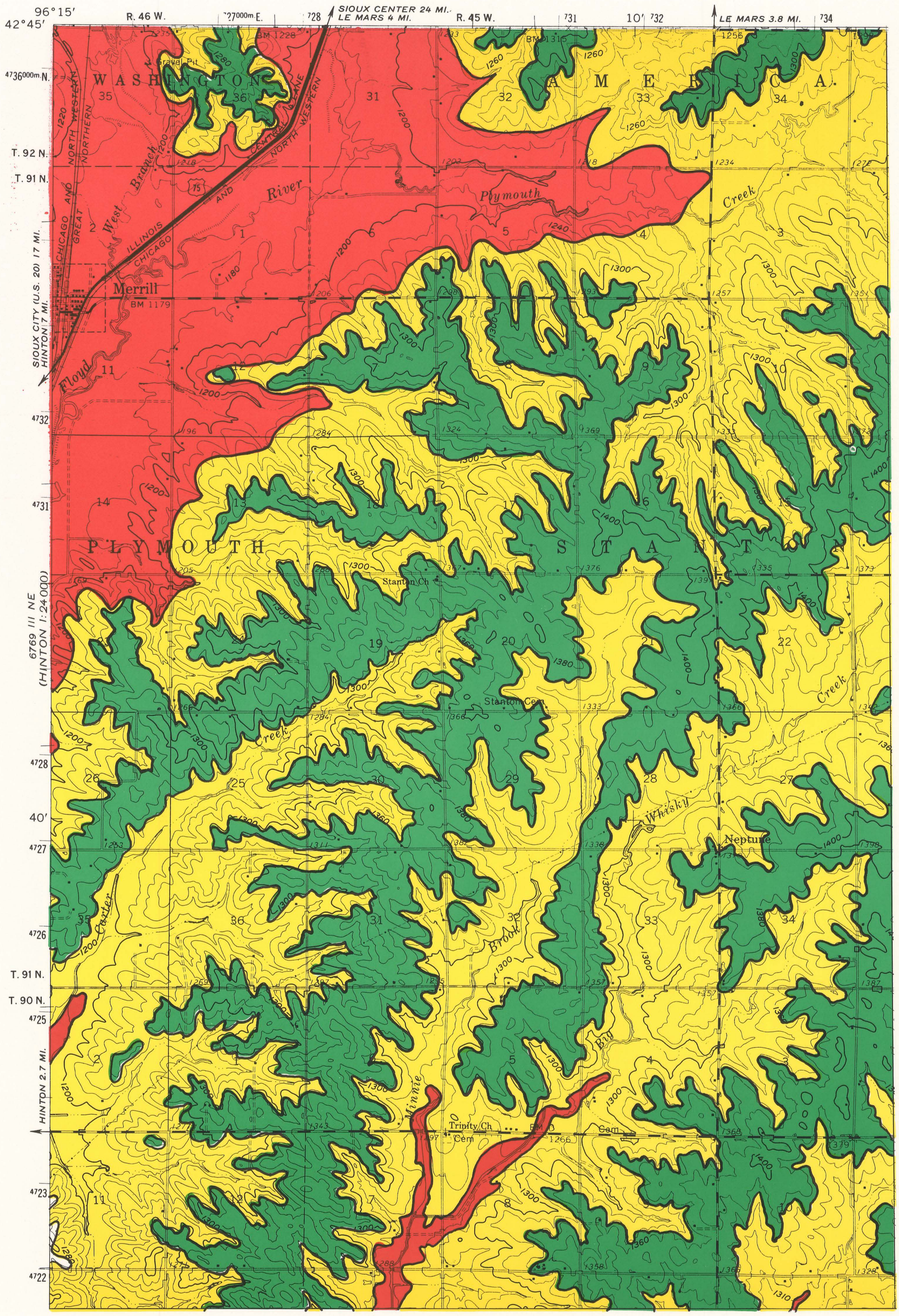
QUADRANGLE LOCATION

ROAD CLASSIFICATION
Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
U. S. Route — State Route

HINTON, IOWA
N4237.5—W9615/7.5
1964
AMS 6769 III NE—SERIES V876



ELEVATION AND LITHOLOGY OF BEDROCK



0 1 2 3 miles

SCALE

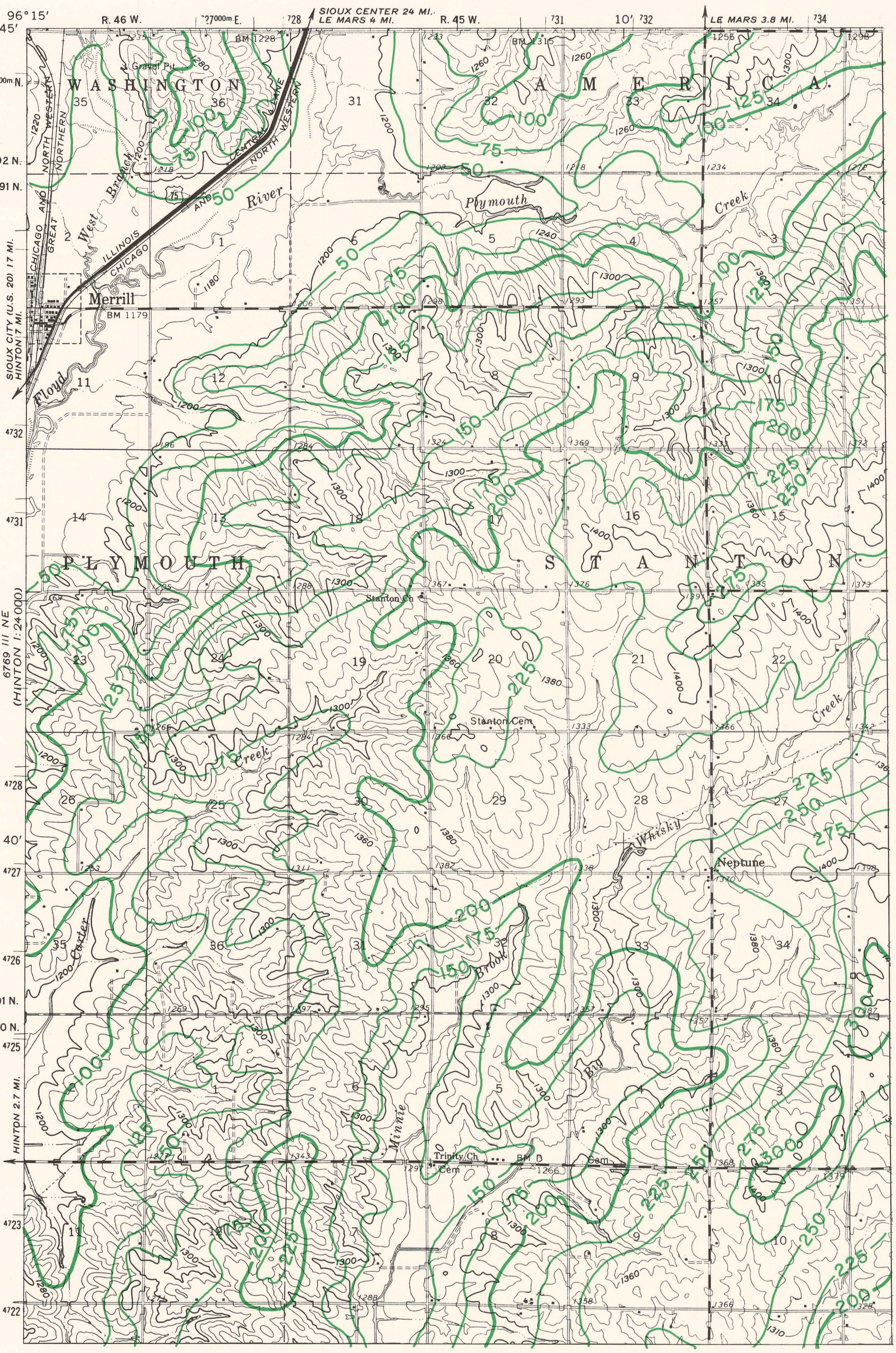
1:62500

LAND-USE

CONTOUR INTERVAL 20 FEET

DATUM IS MEAN SEA LEVEL

UNION CENTER
NORTHWEST
IOWA



0 1 2 3 miles

SCALE

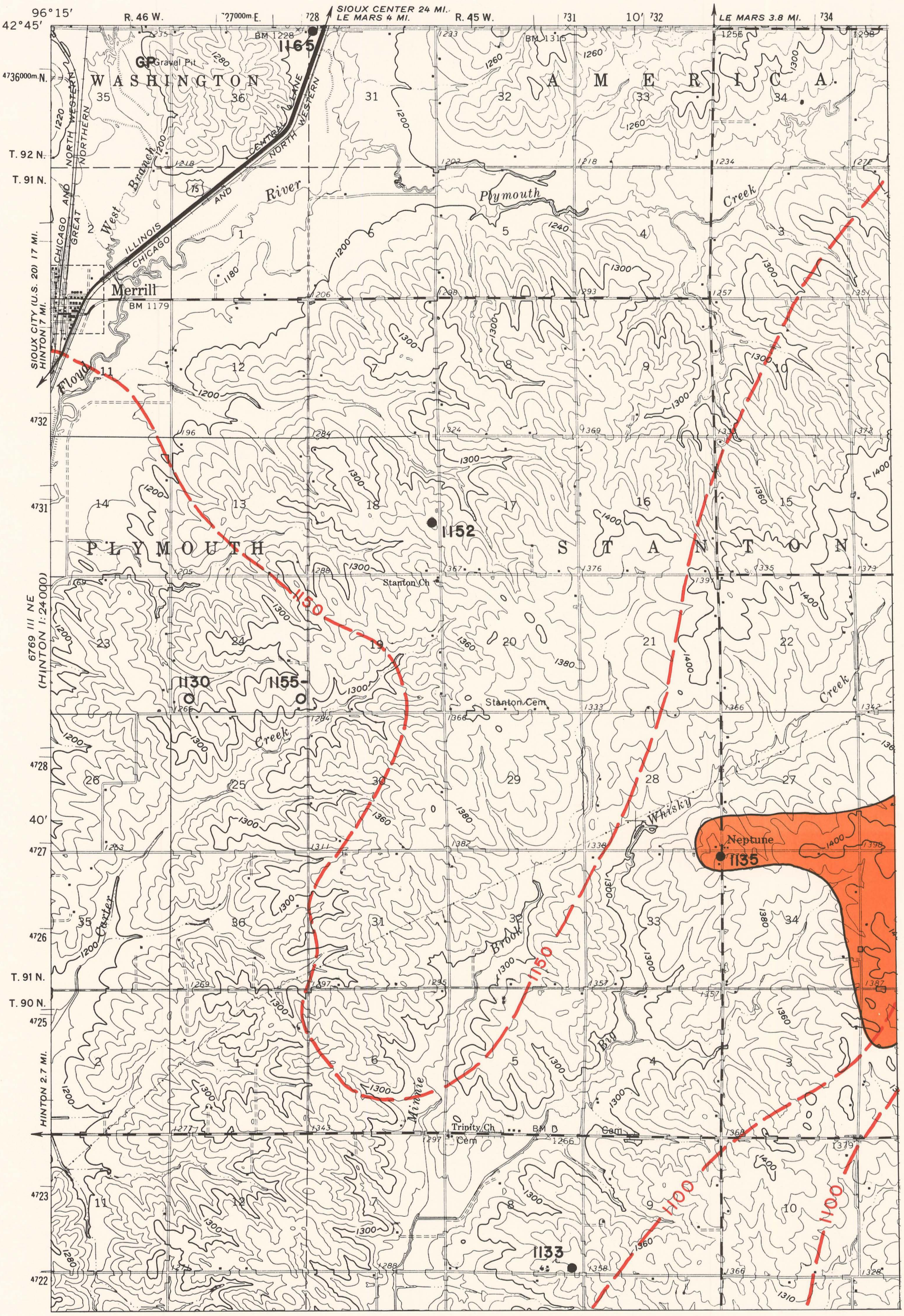
1:62500

CONTOUR INTERVAL 20 FEET

DATUM IS MEAN SEA LEVEL

THICKNESS OF UNCONSOLIDATED SEDIMENTS

UNION CENTER NORTHWEST IOWA



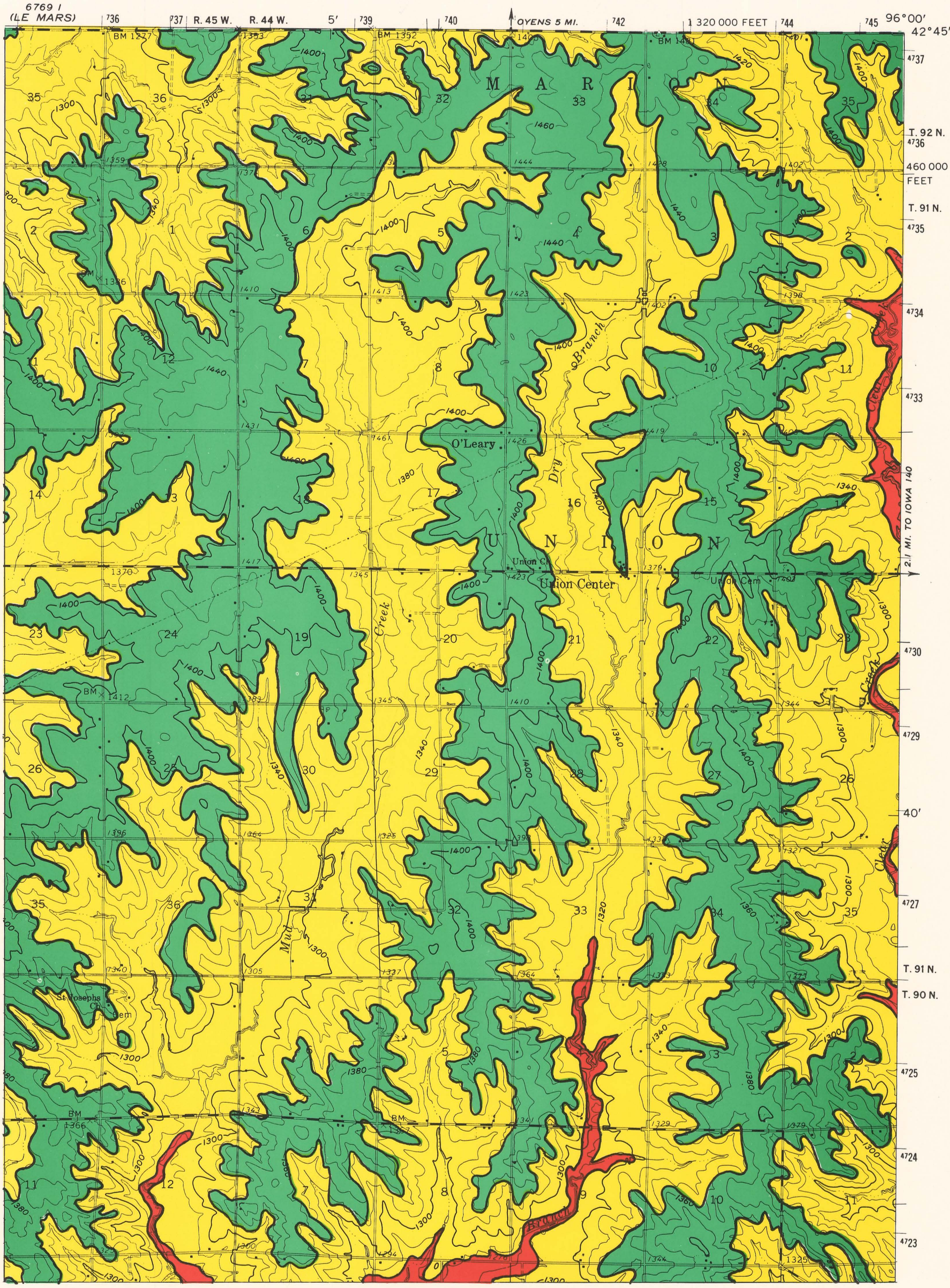
0 1 2 3 miles

SCALE
1:62500

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

ELEVATION AND LITHOLOGY OF BEDROCK

UNION CENTER NORTHWEST IOWA



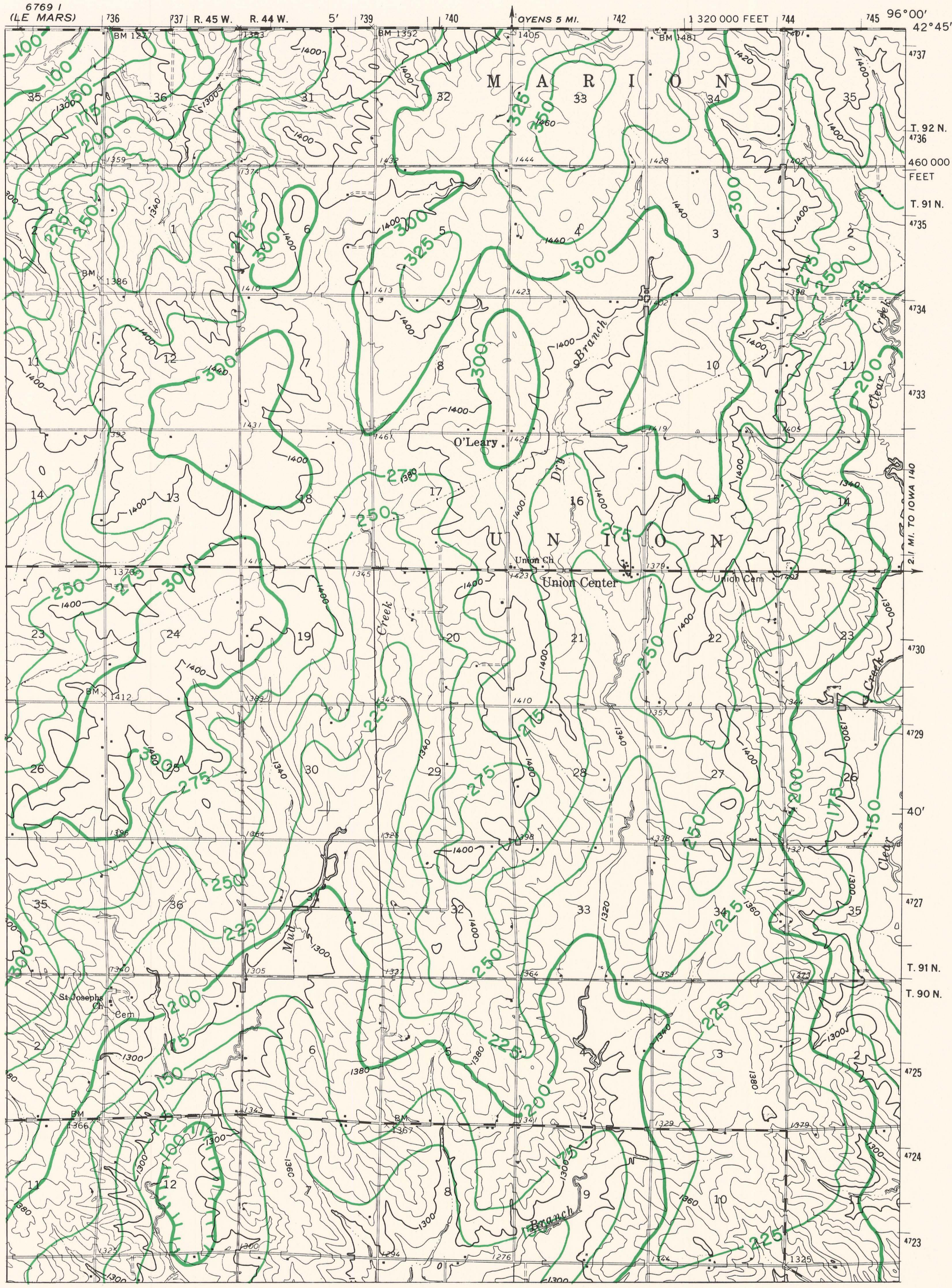
0 1 2 3 miles

SCALE
1:62500

LAND-USE

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

UNION CENTER
NORTHEAST,
IOWA



0 1 2 3 miles

SCALE
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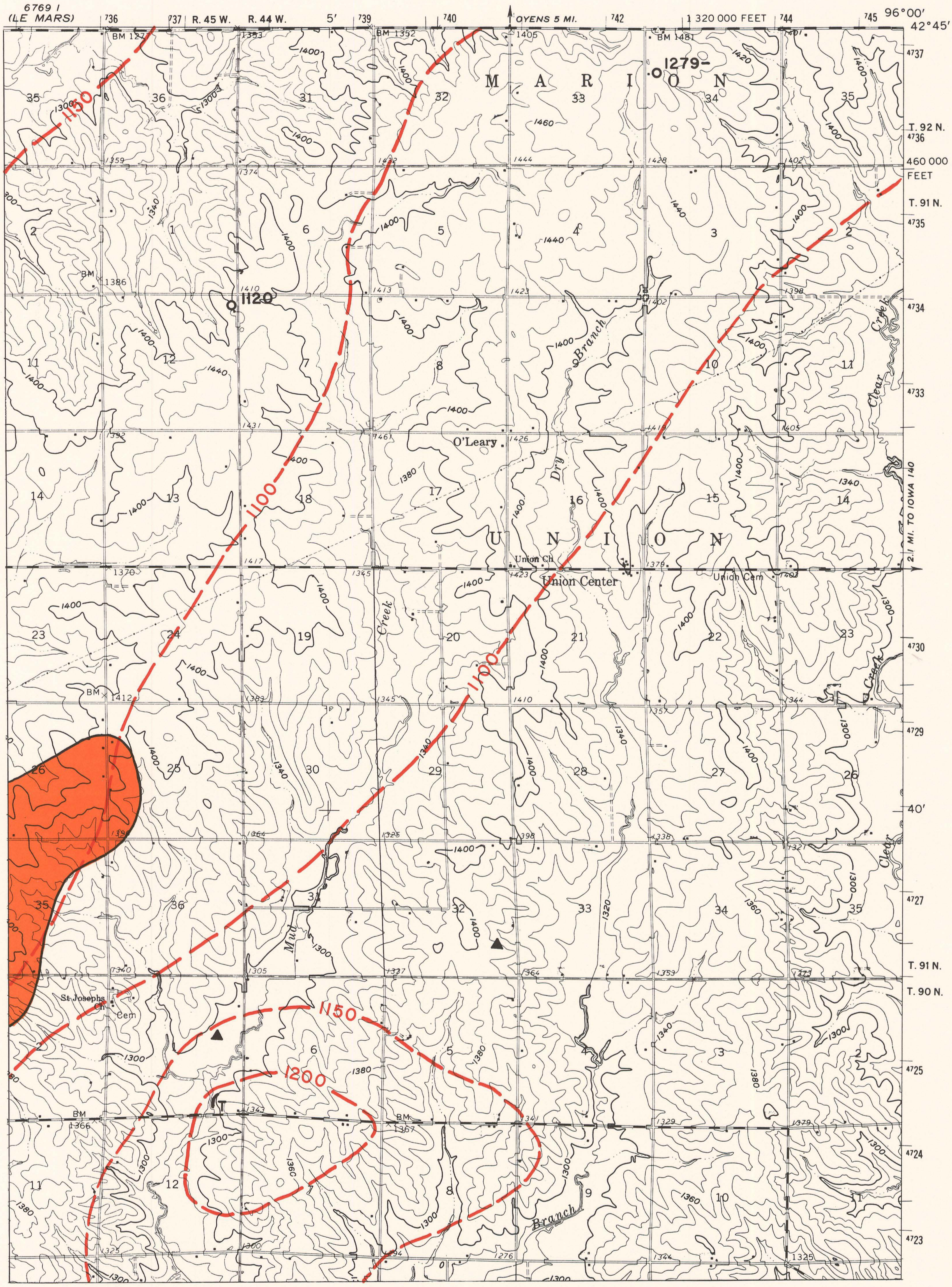
THICKNESS OF UNCONSOLIDATED SEDIMENTS

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

UNION CENTER NORTHEAST, IOWA



0 1 2 3 miles

SCALE
1:62500

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

ELEVATION AND LITHOLOGY OF BEDROCK

UNION CENTER NORTHEAST, IOWA