

PRELIMINARY SURFICIAL GEOLOGY OF THE CARNEIRO QUADRANGLE, ELLSWORTH COUNTY, KANSAS

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Open-File Report 2026-7

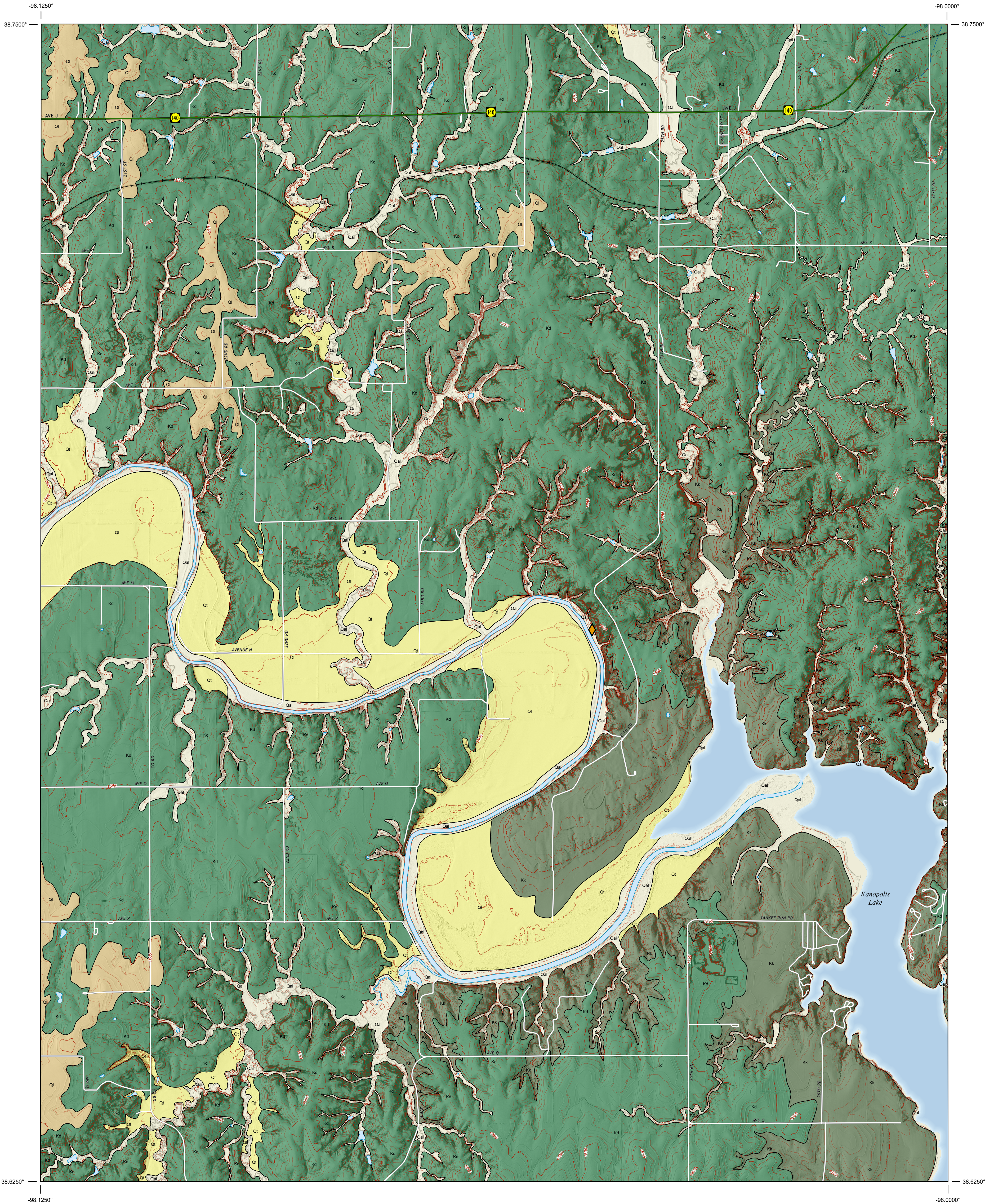
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USGS National Cooperative
Geologic Mapping Program



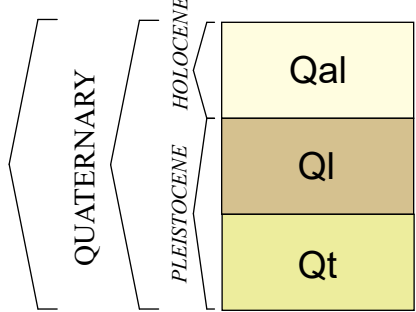
U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY



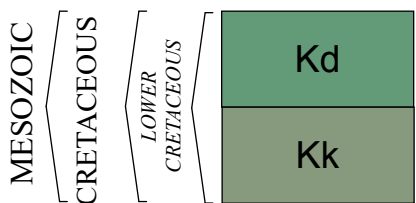
CARNEIRO QUADRANGLE
KANSAS - ELLSWORTH COUNTY
7.5-MINUTE SERIES



CORRELATION OF UNITS



UNCONFORMITY



GEOLOGIC UNITS

Floodplain and low terrace deposits

Alluvium that is beneath floodplain and low terrace surfaces is found along major river valleys and upper reaches of small tributaries that feed into the Smoky Hill River valley. Floodplain and low terrace deposits are inset against older terrace deposits (Qt) in the major river valley system, but unconformably overlie Cretaceous bedrock in the smaller tributaries. Deposits are composed of sand, silt, and clay.

Terrace deposits

Qt terrace deposits occur along major stream and river valleys of the county. In the Smoky Hill River valley, the Qt surface is approximately 15-20 ft (4.6-6.1 m) above the elevation of the modern river channel. The Qt terrace deposits are composed primarily of sand and silt with some clay. The total thickness of alluvium can be up to 50 ft (15.2 m) in the Smoky Hill River valley and 15 ft (4.6 m) in other major tributaries.

Loess

Deposits of reddish-brown loess with silt loam textures blanket hilltops and slopes. Mapped loess units typically range between 3.0-6.5 ft (1.2 m) in thickness. Previous research has identified regional loess units belonging to the Gilman Canyon Formation (44,000-24,000 years old), the Peoria Loess (25,000-12,000 years old), and the Bignell Loess (11,000-9,000 years old) (Betts et al., 2003).

Dakota Sandstone

The Dakota Fm. has historically been divided into two members in Kansas: the lower Terra Cotta Member and the upper Janssen Clay Member (Plummer and Romary, 1941). Given the difficulty in mapping the contact between the two members, they are not differentiated in this geologic map. The Dakota is composed of several lithologies including varicolored clay and mudstones to thick sandstone deposits. The varicolored mudstones and claystones represent paleosols that formed along the coastal plain. These paleosols are often dominated by kaolinitic clay and contain sphaerulitic nodules. Locally, this clay is sourced for brick manufacturing. Lignite and carbonaceous fragments are also observed, representing waterlogged, mire deposits. Abundant plant fossils have been documented throughout the Dakota Fm. including some of the earliest records of flowering plants. Sandstone deposits are typically dominated by fine-medium grained quartz representing fluvial channels. The coloring of these sandstones varies from white "clean sand" to orange-bright red due to iron staining, visible and noted at the "Red Rocks Canyon" just north of Kanopolis Reservoir. Thickness of the Dakota Fm. varies with a maximum recorded thickness of 250 ft (Betts et al., 1971). Locally, the sandstone is often calcite-cemented (historically referred to as "Lincoln quartzite") which leads to exposures such as the famous landmark: Mushroom Rock. This calcite-cemented sandstone is mined as an important aggregate resource for road construction. Moreover, the Dakota Fm. serves as one of the comprising units in the Dakota Aquifer System, an important groundwater resource in Ellsworth County and elsewhere in Kansas. Large outcrop exposures of the Dakota Fm. are visible along cutbanks of the Smoky Hill River north of the Kanopolis Reservoir while sandstone remnants cap much of the surrounding topography of the Smoky Hills region.

Kiowa Formation

The Kiowa Formation is present along the shoreline of the Kanopolis Reservoir. Researchers previously noted the contact between the Kiowa Fm. and the underlying Permian units as being located near the base of the reservoir dam, but it has since been covered by rip-rap stabilization. Thickness of the Kiowa Fm. varies with a maximum recorded thickness of 150 ft (Betts et al., 1971). Lithologies vary from dark grey shale and siltstones to fine-grained, quartz dominated sandstones and are interpreted as marine deposits. Cone-in-cone limestones are often present with the shale units as well as shell "trash" or coquina deposits consisting of bivalves and Turritella sp. gastropod shells. Thickness of sandstone deposits varies drastically from lateral sheets less than 1.5 ft (0.5 m) to massive deltaic sandstone deposits measuring over 40 ft (12 m) near the Horsechief Canyon boat ramp at the Kanopolis Reservoir. Locally, some of these sandstones are calcite-cemented while other areas consist of easily weathered sandstones that can contain barite roses.

SOURCES

Barker, W. L., 1989, Soil Survey of Ellsworth County, Kansas: Washington, D.C., U.S. Department of Agriculture, Soil Conservation Service and Kansas Agricultural Experiment Station, 100 p.

Bayne, C. K., Franks, P. C., and Ives, W., 1971, Geology and ground-water resources of Ellsworth County, central Kansas: Kansas Geological Survey, Bulletin 201, 84 p.

Betts, E. A., Muhs, D. R., Roberts, H. M., and Winkle, A. G., 2003, Last Glacial loess in the conterminous USA: Quaternary Science Reviews, v. 22, p. 1907-1946.

Hartin, D. E., 1965, Stratigraphy of the Graneros Shale (Upper Cretaceous) in central Kansas: Kansas Geological Survey, Bulletin 178, 83 p.

Kansas Geological Survey, 2022, "Water Well Completion Records (WWC) Database." <http://www.ksgeosurvey.com/Magellan/WaterWell/index.html>.

Plummer, N. and Romary, J. F., 1947, Kansas Clay, Dakota Formation: Kansas Geological Survey, Bulletin 67, 243 p. <https://doi.org/10.17161/ksgeobulletin.no.67.2.1986>.

Elevation contours are included for general reference. They are used in the U.S. Geological Survey's current US Topo 1:24,000-scale topographic map series. Elevation contours were generated from hydrographically-improved 1/3 arc-second National Elevation Dataset (NED) data and smoothed during processing for use at a 1:24,000 scale. In some places, the contours may be more generalized than the base data used for compilation of geologic outcrop patterns. Outcrop patterns on the map typically reflect topographic variation more accurately than the associated contour lines. Repeated fluctuation of an outcrop line across a contour line is an indication that the mapped rock unit is maintaining a relatively constant elevation along a generalized contour.

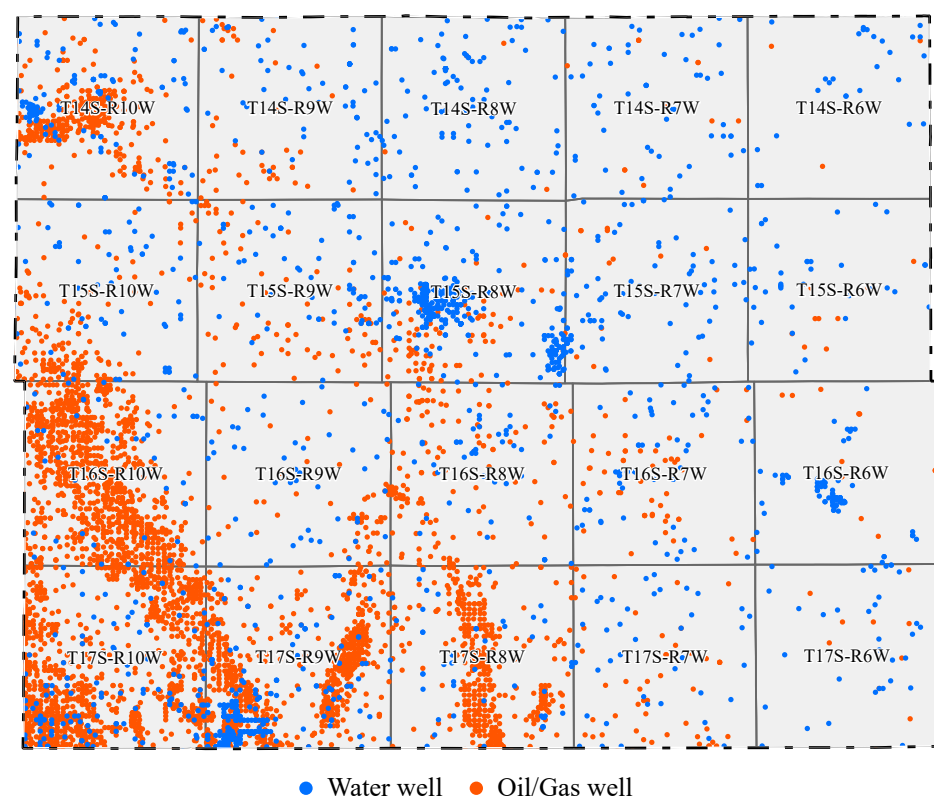
References used in the digital mapping include 1-meter LIDAR hillshades and 1-meter 2020 U.S. Department of Agriculture - Farm Services Agency (USDA-FSA) National Agriculture Imagery Program (NAIP) digital imagery, USGS 7.5-min 1:24,000-scale topographic maps, USDA Natural Resources Conservation Service (NRCS) soil surveys, and other geologic maps and bulletins were used as supplementary references. Roads and highways are shown on the base map as represented by data from the Kansas Department of Transportation (KDOT), U.S. Census Bureau, and other sources. Additionally, USDA-FSA NAIP imagery was used to check road locations.

Shaded relief is based on 1-meter hydroflattened bare-earth DEMs from the state of Kansas LIDAR database. The DEM images, in ERDAS IMAGINE format, were mosaicked into a single output DEM and reprojected to decimal degrees. The output DEM was then converted to a hillshade, a multidirectional shaded-relief image using angles of illumination from 0°, 225°, 270°, and 315° azimuths, each 45° above the horizon, with a 4x vertical exaggeration.

This map was funded in part by the USGS National Cooperative Geologic Mapping Program, STATEMAP award number G25AC00518 (FY2025).

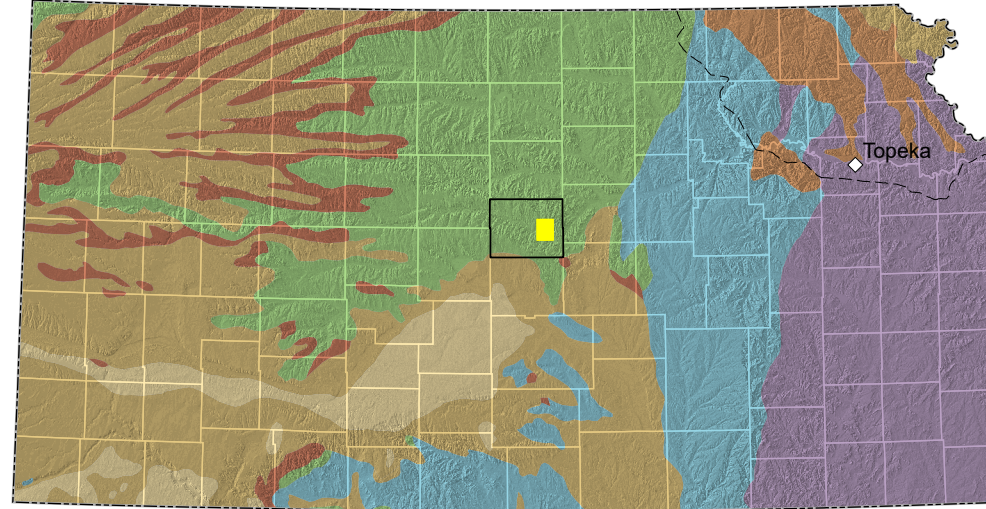
This map was produced using ArcGIS® software by Esri. ArcGIS® is the intellectual property of Esri and is used herein under license. Copyright © Esri. All rights reserved. This map is a preliminary product and has had less scientific and cartographic review than the Kansas Geological Survey's M-series geologic maps. The KGS does not guarantee this map to be free from errors or inaccuracies and disclaims any responsibility or liability for interpretations made from the map or decisions based thereon.

OIL/GAS AND WATER WELL DENSITY FOR ELLSWORTH COUNTY

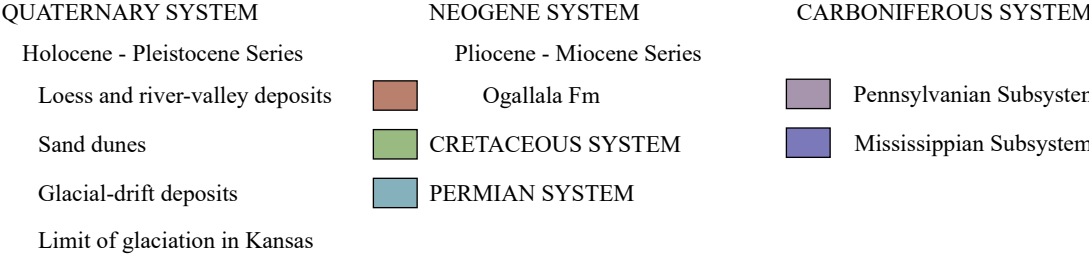


Water well Oil/Gas well

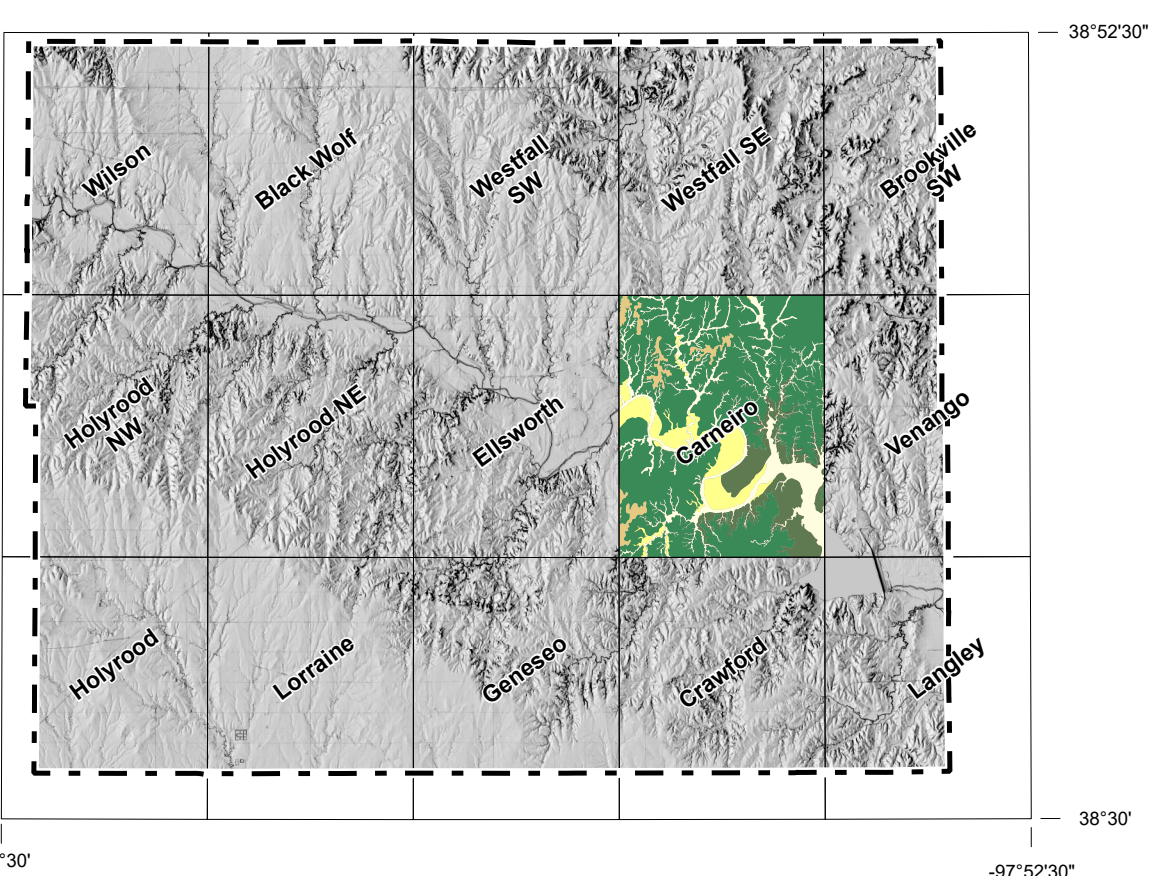
MAP LOCATION



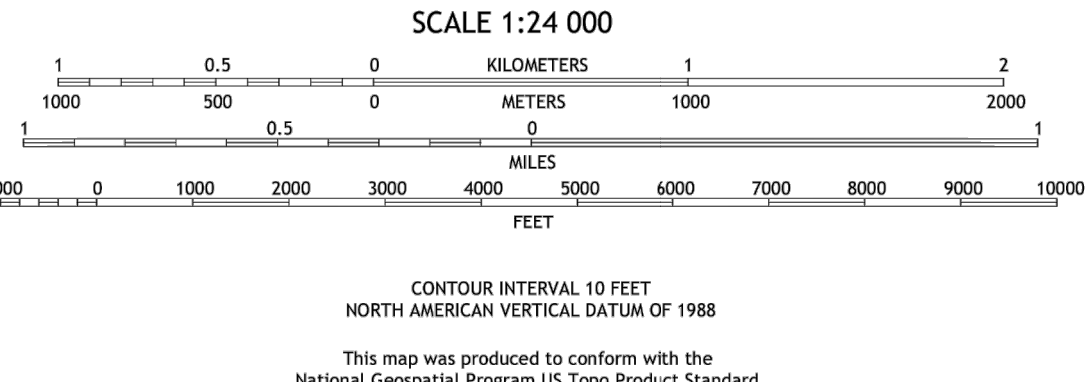
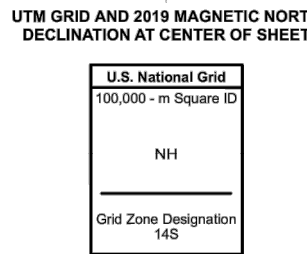
GENERALIZED GEOLOGY OF KANSAS



QUADRANGLE INDEX MAP FOR ELLSWORTH COUNTY

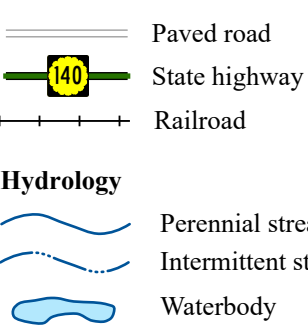


Produced by the United States Geological Survey
North American Datum of 1983 (NAD83)
World Geodetic System of 1984 (WGS84). Projection and
1:60-meter grid/Universal Transverse Mercator, Zone 14S.
This map is not a legal document. Boundaries may be
generalized for this map scale. Private lands with government
reservations may not be shown. Obtain permission before
entering private lands.
Imagery.....MAP, August 2017 - September 2017
Roads.....U.S. Census Bureau, 2015 2018
Names.....GNIS, 1978 2019
Hydrography.....National Hydrography Dataset, 2009 2018
Contours.....National Elevation Dataset, 2014
Boundaries.....Multiple sources; see metadata file 2019 2023
Public Land Survey System.....BLM, 2018
Wetlands.....FWS National Wetlands Inventory 1985 - 1985

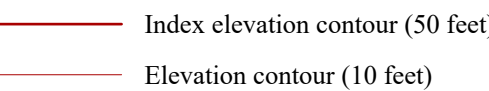


EXPLANATION

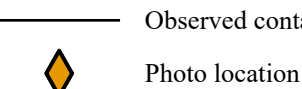
Transportation



Topography



Geology



SUGGESTED REFERENCE TO THE MAP

Andrzejewski, K. A., 2026, Preliminary surficial geology of the Carneiro quadrangle, Ellsworth County, Kansas: Kansas Geological Survey, Open-File Report 2026-7, scale 1:24,000, unpublished.