PRELIMINARY SURFICIAL GEOLOGY OF THE AKRON QUADRANGLE, COWLEY COUNTY, KANSAS

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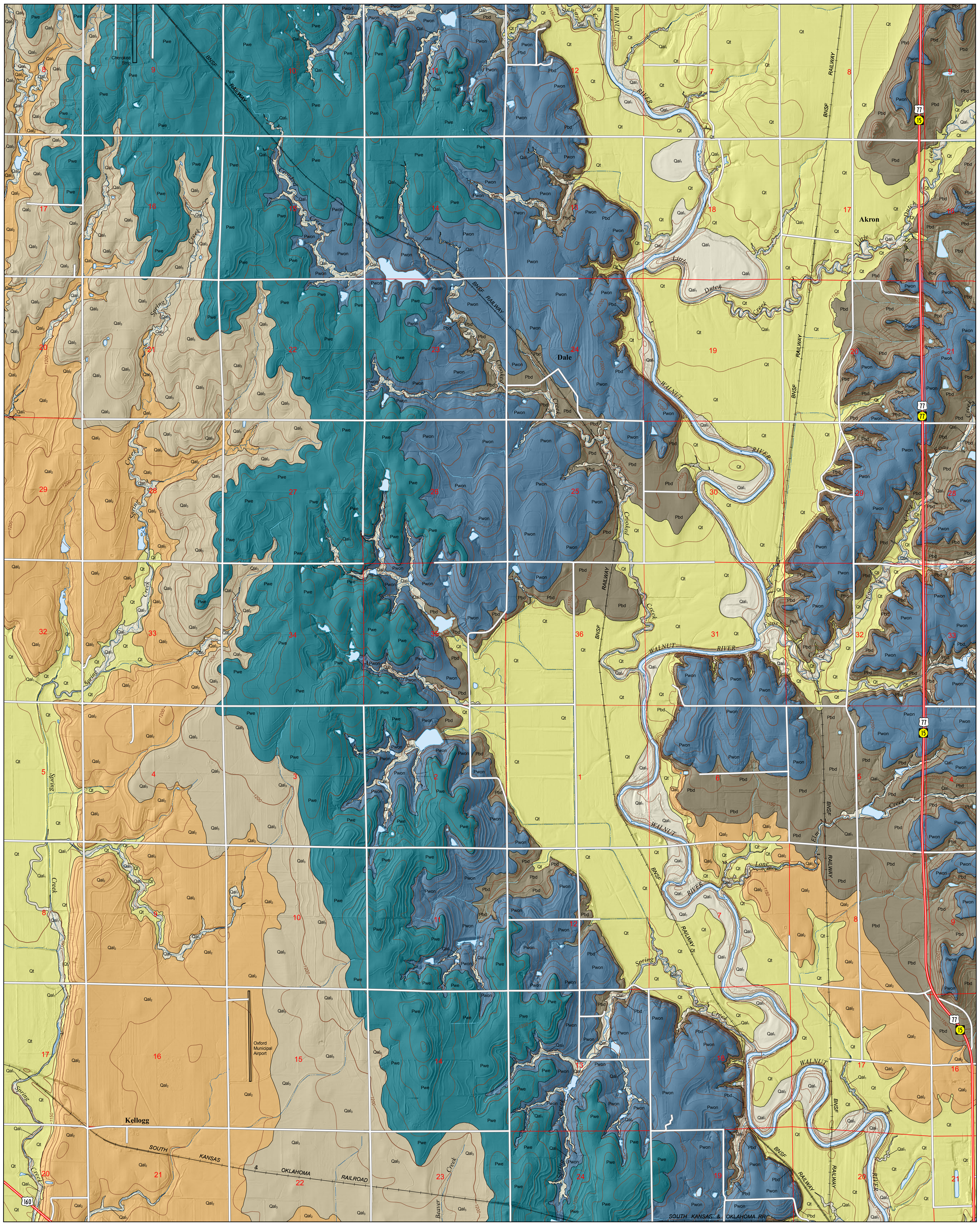

GEOLOGIC UNITS

CENOZOIC

Quaternary System
Pleistocene-Holocene

Qal1

Undifferentiated floodplain alluvium — Relatively recent alluvial deposits associated with the Arkansas River and numerous smaller streams and tributaries. Most channel systems, especially those with perennial flow, experienced entrenchment during the latter part of the Holocene, likely 1,200–1,000 years ago, with the Arkansas River and its two main tributaries actively undergoing floodplain redevelopment. Floodplain alluvium consists of silt, sand, and gravel, with only minute amounts of clay, exhibited primarily as slack water deposits. The alluvial deposits are relatively thin, probably not exceeding 20 ft (~6 m) in thickness.

Qt

Alluvial terrace deposits — Terrace deposits occur along the Arkansas River and smaller streams and tributaries. The Arkansas River valley in Cowley County has a well-expressed broad terrace, primarily on the east side of the channel and is traceable into upstream counties, where it has been radiocarbon and luminescence dated to a maximum age of 35,000 years ago, with younger ages from the late Holocene being derived in relatively close proximity to the modern channel. Terrace deposits of the Arkansas River consist primarily of silt, sand, and gravel and are exposed in multiple cut-bank exposures along the east side. Terrace deposits of the Walnut River, Grouse Creek, and their tributaries are finer-grained (clay, silt, fine sand) as a result of originating in the Permian and Pennsylvanian shales. The thickest deposits of up to 70 ft (21 m) occur in the Arkansas River valley, but thicknesses range down to only a few feet in tributaries.

Qal2

Upland alluvium — Mid-level upland alluvium is extensive and approximately parallel to and east of the modern Arkansas River bottomland at 60–70 ft (18–21 m) above the modern channel. Unit thickness averages ~10 ft (3 m), but varies significantly due to surface erosion. The alluvium varies in color but is mostly reddish gray to reddish brown and consists of silt, sand, and cherty gravel, with very little clay, and an arkosic composition, reflecting its Rocky Mountain source. There are also local indications of incision of Qal_3.

Qal3

Upland alluvium — This high-level alluvium is very similar to that of Qal_2, except that it appears to contain more clay. It is still dominated by sand and gravel and is arkosic in composition. The average height of the terrace above the modern channel is about 95 ft (29 m), and maximum thickness of the unit exceeds 15 ft (4.5 m).

MESOZOIC

Permian System
Leonardian Series

Pwe

Wellington Formation — The Wellington Formation is the only formation of the Permian Sumner Group exposed in Cowley County. The Wellington Formation is about 80 ft (24 m) thick but is upwards of 650 ft (198 m) thick elsewhere in Kansas. It is composed primarily of gray to greenish-gray shales with some thin-bedded and argillaceous limestone, dolomite, siltstone, gypsum, and anhydrite. Members of the Wellington include, in ascending order, the Hollenberg Limestone Member, Carlton Limestone Member, Hutchinson Salt Member, and Milan Limestone Member as well as two unnamed members (Sawin et al., 2008). The Wellington weathers easily and tends to form gentle slopes rather than vertical outcrops. With a lack of exposures revealing the contact between the uppermost Milan Limestone Member and the overlying distinctive reddish-gray Ninnescah Shale, it is difficult to ascertain stratigraphic situation within the Wellington. The Wellington is locally overlain by loess, but the two have similar soil profiles and topography, making them difficult to distinguish.

Pwon

Winfield Limestone, Odell Shale, and Nolans Limestone — In ascending order, these are the upper three formations of the Permian Chase Group cropping out in Cowley County. The Winfield Limestone ranges up to 30 ft (~9 m) in thickness and is composed of massive beds of light-blue to gray limestone with thin shale partings. The Winfield weathers white to light gray and forms steep outcrops. Though composed of three members elsewhere, only the uppermost Cresswell Limestone Member is recognized in Cowley County and the upper contact with the Odell Shale is nearly always covered. The Odell Shale is approximately 40 ft (~12 m) thick and is composed of calcareous shale that is predominantly gray with dark blue-gray streaks. The Odell commonly underlies vegetation-covered slopes between the scarp-forming Winfield Limestone and the Herington Limestone Member of the Nolans Limestone. The Nolans Limestone is the uppermost formation of the Chase Group and has a total thickness in Cowley County of approximately 40 ft (~12 m). In ascending order, the formation is composed of the Krider Limestone Member, Paddock Shale Member, and Herington Limestone Member. The Krider Limestone Member, commonly less than 10 ft (~3 m) thick, consists of two limestone beds separated by a 1 ft (~0.3 m), yellow-brown shale. The Paddock Shale Member is an ~10 ft (~3 m) bed of gray calcareous shale. The Herington Limestone Member averages 15 ft (4.5 m) in thickness and is a yellow-tan, dolomitic limestone. In northern Cowley County, the upper portion of the Herington is granular in texture, and the lower is blocky and ledge forming, marking the boundary with the overlying Wellington Formation. The Herington is more massive to the south with abundant chert nodules in the upper part and calcite geodes in the lower.

Pbd

Barneston Limestone and Doyle Shale — In ascending order, these are the lower two formations of the Permian Chase Group cropping out in Cowley County. The Barneston Limestone is about 80 ft (24 m) thick, thinning to the south in Cowley County, and buff to gray in color, with blue-gray chert occurring in the lower Florence Limestone Member. Echinoid and other fossils occur throughout, with fusulinids near the base. The overlying Oketo Shale Member is generally absent in southeastern Kansas. The upper Fort Riley Limestone Member gradually transitions to the overlying Doyle Shale. The Doyle Shale is about 90 ft (27 m) at its thickest, and is composed of, in ascending order, the Holmesville Shale Member, Towanda Limestone Member, and the Gage Shale Member. The Holmesville Shale Member is an ~30 ft (9 m) thick greenish gray to red, unfossiliferous shale. The Towanda Limestone Member, averaging ~10 ft (~3 m) in thickness, is a resistant gray to yellow, brecciated limestone that often forms a bench between the lower Barneston and overlying Winfield formations. The Gage Shale Member is a red, green, and brown calcareous shale ~45 ft (~14 m) thick and characterized by a concretion zone. It forms steep slopes below the overlying Winfield Limestone.

CITED REFERENCE

Sawin, R. S., Franseen, E. K., West, R. R., Ludvigson, G. A., and Watney, W. L., 2008, Clarification and changes in Permian stratigraphic nomenclature in Kansas; *in*, Current Research in Earth Sciences: Kansas Geological Survey, Bulletin 254, part 2. http://www.kgs.ku.edu/Current/2008/Sawin/index.html.

ADDITIONAL SOURCES

Bass, N. W., 1929, The geology of Cowley County, Kansas: Kansas Geological Survey, Bulletin 12, 203 p.

Bayne, C. K., 1960, Geology and ground-water resources of Harper County, Kansas: Kansas Geological Survey, Bulletin 143, 183 p.

Bayne, C. K., 1962, Geology and ground-water resources of Cowley County, Kansas: Kansas Geological Survey, Bulletin 158, 219 p.

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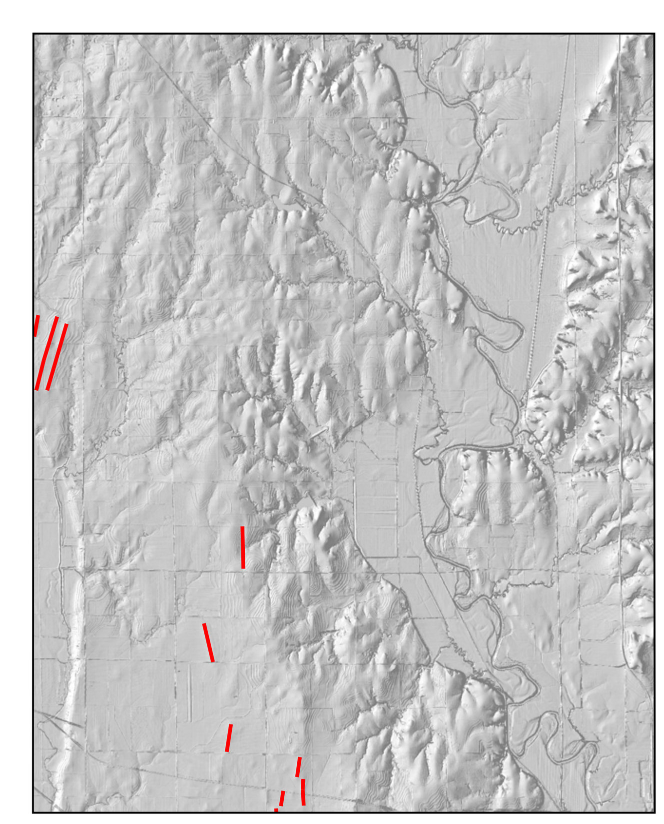


Inset showing mapped lineaments as potential surface expressions of structural features (e.g., faults, folds, joints, ridges). South-central Kansas, like other parts of the central and eastern United States, resides in a region of relatively low historical and instrumentally recorded seismicity. Despite this, the state has experienced approximately 3,500 earthquakes since 2013, with more than 130 of the events recorded as magnitude 3.0 or greater. This recent spate of seismicity raises concerns about the potential risk that structural features (faults, folds, joints, and ridges) may pose for moderate to large earthquakes. Investigations into the size or extent of these faults include mapping previously unrecognized surface features, such as lineaments, that may reflect more deeply seated structural features.

Lineaments were mapped using aerial photography and bare-earth LiDAR Digital Elevation Models (DEMs), based on one or more of the following criteria: (1) Visible offset in marker beds; (2) relatively low- to high-relief linear ridges that are not obvious geomorphic features due to erosion, slumping, subsidence, or dune formation; (3) linear ridges that cross drainage divides; (4) ridges that display curvilinear or backstepping (en echelon) configurations; (5) rectilinear or parallel drainage patterns; and (6) linear drainage patterns that align across drainage divides.

Elevation contours are presented for general reference. Used in the U.S. Geological Survey's current US Topo 1:24,000-scale topographic map series, they were generated from hydrographically improved 1/3 arc-second National Elevation Dataset (NED) data and smoothed during processing for use at 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 will typically reflect topographic variation more accurately than the associated contour lines. Repeated fluctuation of an outcrop line across a contour line should be interpreted as an indication that the mapped rock unit is maintaining a relatively constant elevation along a generalized contour.

1-meter LiDAR hillshades and 1-meter U.S. Department of Agriculture – Farm Services Agency (USDA-FSA) National Agriculture Imagery Program (NAIP) 2017 digital imagery were used as references in the digital mapping. USGS 7.5-minute 1:24,000-scale topographic maps, USDA Natural Resources Conservation Service (NRCS) soil surveys, and other geologic maps and bulletins were used to supplement the mapping. Roads and highways are shown on the base map as represented by data from the U.S. Census Bureau. U.S. Department of Agriculture – Farm Services Agency (USDA-FSA) National Agriculture Imagery Program (NAIP) imagery also 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, downsampled to 2-meter resolution, 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.

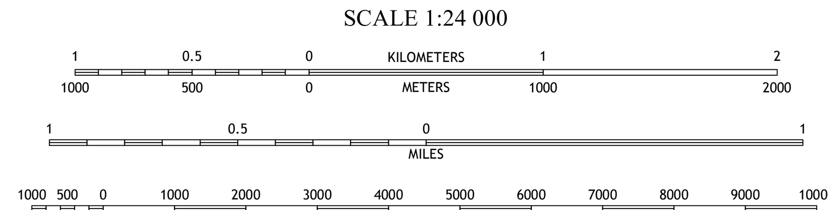
This geologic map was funded in part by the USGS National Cooperative Geologic Mapping Program, award number G17AC00261 (FY2017).

This map was produced using the ArcGIS system developed by Esri (Environmental Systems Research Institute, Inc.).

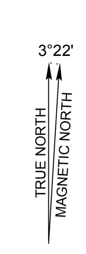
SUGGESTED REFERENCE TO THE MAP

Johnson, W. C., Schlagel, N. A., and Dunham, J. W., 2018, Preliminary surficial geology of the Akron quadrangle, Cowley County, Kansas: Kansas Geological Survey, Open-File Report 2018-4, scale 1:24,000, unpublished.

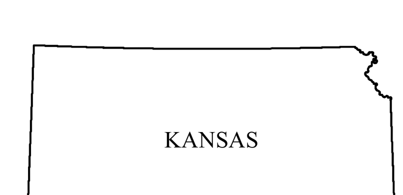
SCALE 1:24 000



UNIVERSAL TRANSVERSE MERCATOR PROJECTION, ZONE 14
NORTH AMERICAN DATUM OF 1983



APPROXIMATE MEAN DECLINATION, 2018



QUADRANGLE LOCATION

Mulvane	Udall	Wilmot
Oxford	Akron	New Salem
Adamsville	Hackney	Winfield

ADJOINING 7.5' QUADRANGLES

EXPLANATION

Boundaries and Locations

Township/range line

Section line

Transportation

U.S. and state highway

U.S. highway

Local road

Railroad

Airport runway

Hydrology

Perennial stream

Intermittent stream

Water body

Geologic Unit Boundaries

Observed contact

Topography

1200 Elevation contour (50-foot interval)

Elevation contour (10-foot interval)

Depression contour (10-foot interval)