

SURFICIAL GEOLOGIC MAP OF FLOYD COUNTY, IOWA

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IOWA GEOLOGICAL SURVEY
OPEN FILE MAP OFM-18-2
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INTRODUCTION TO THE SURFICIAL GEOLOGIC MAP OF FLOYD COUNTY, IOWA

Floyd County is located in north-central Iowa on the Wisconsin-age Iowan Surface (IS) landform region (Prior and Kobr, 2006). The map area is dominated by unconsolidated loamy sediments of variable thickness overlying Wisconsin-age Sheldon Creek Formation glacial sediments. Pre-Illinoian age glacial sediments, or shallow rock, significant areas of bedrock outcrop or areas with less than 5 m (16 ft) of loamy material over the bedrock are present, especially along Flood Creek, the Cedar and Little Cedar rivers and their tributaries, and portions of Burr Oak Creek and the Little Cedar River. The thickness of Quaternary deposits in Floyd County is highly variable as they are typically less than 15 m (50 ft) in the western part of the county and reach a maximum thickness of 90 m (295 ft) in a bedrock valley on the eastern side of Floyd County.

Issues arising from interactions between surficial materials and bedrock aquifers have been repeatedly investigated in Floyd County (Buchmiller et al., 1985; Libra et al., 1984; Libra et al., 1985). These studies highlighted the significance of understanding the complicated relationship between shallow rock areas that are prone to karstification and unconsolidated materials. Statewide bedrock geologic maps by Hershey (1969), and most recently by Witke and others (2010), illustrate the improved understanding of the complex distribution of geologic units at the bedrock surface across north-central Iowa, including Floyd County. Previous surficial geologic mapping completed as part of the STATEMAP project in Floyd County includes the Surficial Geologic Map of the Orchard Quadrangle (Kerr et al., 2016), the Surficial Geologic Map of the Charles City Quadrangle (Streeter et al., 2016), the Surficial Geologic Map of the Greene Quadrangle (Kerr et al., 2017a), and the Surficial Geologic Map of the Colwell Quadrangle (Kerr et al., 2017b). Mapping adjacent to the project area includes Surficial Geology of Worth County, Iowa (Quade et al., 2012), Surficial Geology of Cerro Gordo County, Iowa (Tassier-Surine et al., 2015), and the Surficial Geologic Map of Mitchell County (Tassier-Surine et al., 2016).

The map area has a rich and complex Quaternary geologic history punctuated by at least seven periods of glaciation between 2.6 million and 500 years ago (Bjellertorf, 1978a,b; Halberg, 1980, 1996). In this area, Pre-Illinoian glacial deposits and associated buried soils are overlain by much younger Pre-Late Wisconsin materials, dated from approximately 46,000 to 29,000 years before present. In Iowa, these glacial deposits are formally recognized as the Sheldon Creek Formation (Betts et al., 1996; Betts, 1997) and in earlier literature are referred to as the “Tarewell till” (Rabe, 1950). The most recent glacial advance of the Des Moines Lobe did not extend into Floyd County, but its influence is evident in the development of river valleys and periglacial alteration of the landforms.

Results from this mapping project and others in Cerro Gordo, Mitchell, and Worth counties indicate that the Sheldon Creek glacial materials extend much farther east than were previously mapped. The ice marginal position in Floyd County is based on numerous factors due to the lack of moraines. Twenty-nine new core holes helped to delineate the boundary of the Sheldon Creek Formation. The Little Cedar River, in the northern part of the county, is thought to represent an ice marginal position due to the geometry of the river not following the regional pattern of NW to SE drainage. Near the town of Colwell, the Little Cedar resumes the general parallel pattern of the rivers beyond the margin. The first order stream density, a rough estimate for relative ages of surfaces, shows a significantly different pattern to the east and west of the boundary. The density of these drainages, measured by the ratio of first order streams to area, is nearly twice that on the eastern surface when compared to the western portion indicating a longer time of drainage development and therefore an older surface. Another factor in delineating the boundary is the presence of extensive sand bodies. These deposits, especially around Flood Creek, could represent outwash deposits associated with the margin of the Sheldon Creek or colluvial deposits relating to the downcutting of the IS.

Four organic samples collected near the base of the Sheldon Creek Formation were sent for radiocarbon dating, but returned greater than values. It is thought that the organic material was found in part bodies that were greater than 8 half-lives of ¹⁴C, and were incorporated in the base of the Sheldon Creek Formation. Other dates from previous projects in the area place the Sheldon Creek Formation in the Middle Wisconsin.

A period of intense cold occurred during the Wisconsin full glacial episode from 21,000 to 16,500 years ago (Betts, 1989). This cold episode and ensuing upland erosion led to the development of the distinctive landscape recognized as the IS (Prior, 1976). A periglacial environment prevailed during this period with intensive freeze-thaw action, solifluction, strong winds, and a host of other periglacial processes (Walters, 1996). As a result, surface soils were removed from the IS and the Sheldon Creek and Pre-Illinoian tills were significantly eroded. Thick packages of stratified loamy and sandy sediments located low in the upland landscape and adjacent to streams are remnants of solifluction lobes associated with the formation of the IS. These materials can be found along the Little Cedar River and its tributaries, along tributaries of the Shell Rock and Cedar rivers, and portions of Flood Creek.

Surficial deposits in the map area are composed of six formations: DeForest, Noah Creek, Peoria, Sheldon Creek, Wolf Creek, and Alburtus formations, as well as unnamable erosion surface sediments. Hudson age deposits associated with fine-grained alluvial, organic, and colluvial sediments include the DeForest Formation which is subdivided into the Camp Creek, Roberts Creek, Gunder, Corritong, and Woden members. The Noah Creek Formation includes coarse sand and gravel associated with outwash from the Des Moines Lobe, as well as coarse to finer grained fluvial deposits associated with local stream and river valleys. Unnamed erosion surface sediments consist of reworked till and slopewash deposits associated with periglacial activity during the Wisconsin ice advance. Areas of Peoria Formation colluvial materials are present east of the town of Floyd and intermittently mantle most other mapping units. Sheldon Creek Formation glacial deposits are un differentiated and occur in northwest and north-central Iowa. In the northwestern portion of the county, the Sheldon Creek Formation is generally the first till sheet encountered, while the Pre-Illinoian is the first in the southeastern half. Pre-Illinoian glacial deposits in Iowa consist of two formations: the younger Wolf Creek Formation and the Alburtus Formation. The Wolf Creek Formation is divided into the Winthrop, Aurora, and Hickory Hills members (oldest to youngest). The Alburtus Formation consists of several “undifferentiated” members.

Five bedrock mapping units (Cretaceous Dakota/Window Formation; Devonian Lime Creek, Shell Rock, Lithograph City, and Coralville formations) are exposed at the surface in Floyd County, with the Shell Rock and Lithograph City formations comprising most of the outcrop in the map area. Bedrock outcrops occur along most rivers and creeks in the western half of the county and occasionally along the Little Cedar River. More than 100 rock outcrops including quarries are located in the map area and were investigated in the field. The Devonian rocks are dominated by carbonates varying between limestone and dolomite, accompanied with minor shale. The Cretaceous Dakota/Window Formation is characterized as a reddish shaly sandstone with siderite pellets.

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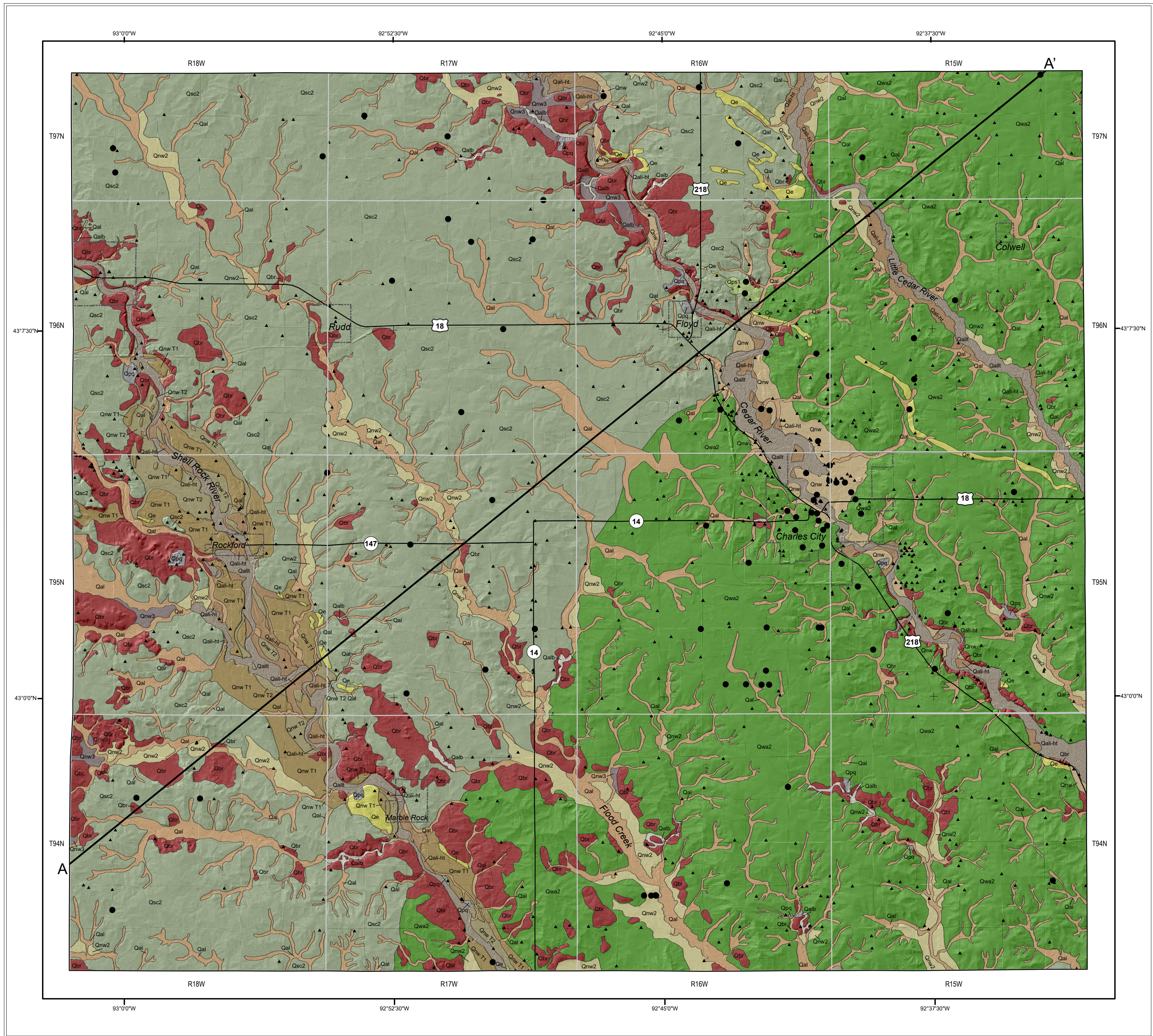
Base map from Iowa DOT Road Map Layers 2006. Shaded relief from Iowa Lidar Project 2007-2011.

Iowa Geological Survey digital cartographic file Floyd_Co_SurficialGeology.mxd, version 6/30/18 (ArcGIS 10.5)

Map projection and coordinate system based on Universal Transverse Mercator (UTM) Zone 15 N, datum NAD83.

The map and cross-section are based on interpretations of the best available information at the time of mapping. Map interpretations are not a substitute for detailed site specific studies.

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LEGEND

CENOZOIC

QUATERNARY SYSTEM

- Qal** - **Alluvium** (DeForest Formation - Undifferentiated) - Variable thickness of less than 1 to 5 m (3-16 ft) of very dark gray to brown, noncalcareous to calcareous, massive to stratified silt clay loam, clay loam, loam to sandy loam alternating and colluvium in stream valleys, on hillslopes and in closed depressions. May overlie the Noah Creek, Sheldon Creek, Wolf Creek/Alburtus formations, or fractured Devonian and Carboniferous bedrock. Associated with low-relief modern floodplain, closed depressions, modern drainage or isotope positions on the landscape. Seasonal high water table and potential for frequent flooding.
- Qalb** - **Alluvium Shallow to Bedrock** (DeForest Formation - Undifferentiated) - Variable thickness of less than 1 to 5 m (3-16 ft) of very dark gray to brown, noncalcareous to calcareous, massive to stratified silt clay loam, clay loam, loam to sandy loam alternating and colluvium in stream valleys, on hillslopes and in closed depressions. May overlie the Noah Creek, Sheldon Creek, Wolf Creek/Alburtus formations, or fractured Devonian and Carboniferous bedrock. Bedrock surface is within 1 m (3 ft) of the land surface. Associated with low-relief modern floodplain, closed depressions, modern drainage or isotope positions on the landscape. Seasonal high water table and potential for frequent flooding.
- Qallt** - **Low Terrace** (DeForest Formation - Camp Creek and Roberts Creek members) - Variable thickness of less than 1 to 5 m (3-16 ft) of very dark gray to brown, noncalcareous, stratified silt clay loam, loam, or clay loam. Occurs on the Devonian bedrock. Occupies the lower positions on the floodplains, i.e., modern channel belt in the Shell Rock, Cedar, and Little Cedar river valleys. Seasonal high water table and frequent flooding potential.
- Qall-ht** - **Intermediate to High Terrace** (DeForest Formation - Camp Creek, Roberts Creek, and Gunder members) - Variable thickness of less than 1 to 5 m (3-16 ft) of very dark gray to brown, noncalcareous, stratified silt clay loam to loam that overlie the Noah Creek Formation/Devonian bedrock. Occupies the intermediate to high terrace position in the Shell Rock, Cedar, and Little Cedar river valleys. Seasonal high water table and low to moderate flooding potential.

HUDSON AND WISCONSIN EPISODE

- Qe** - **Sand Dunes and Sand Sheets** (Peoria Formation - sand facies) - Generally less than 3 m (10 ft) of yellowish brown, massive, calcareous loamy sand to fine sand. It occurs as sand ridges or dunes overlying Wisconsin age outwash, unnamable erosion surface loamy sediments, or bedrock.
- Qnw2** - **Sand and Gravel** (Noah Creek Formation) - 2 to 12 m (7-40 ft) of yellowish brown to gray, poorly to well sorted, massive to well stratified, coarse to fine feldspathic quartz sand, pebbly sand and gravel. In the map area this unit usually overlies Devonian carbonates, but may overlie dominantly of the Sheldon Creek, Wolf Creek or Alburtus formations in isolated areas. This unit encompasses outwash deposits that accumulated in valleys during the Wisconsin Episode in the Cedar River.

WISCONSIN EPISODE

- Qps1** - **Loess and Interbedded Eolian Sand** (Peoria Formation - silt facies) - Generally 2 to 5 m (7-16 ft) of yellowish brown to gray, massive, fractured, noncalcareous grading downward to calcareous, silt loam and interbedded fine to medium, well sorted, sand. Occasional massive, loamy glacial till of the Sheldon Creek, Wolf Creek or Alburtus formations with or without the intervening clayey Farmdale-Saugus loess. This unit is found mainly to the east of the Cedar River.
- Qnw** - **Sand and Gravel** (Noah Creek Formation) - Up to 20 m (66 ft) of yellowish brown to gray, poorly to well sorted, massive to well stratified, coarse to fine feldspathic quartz sand, pebbly sand and gravel. In the map area this unit usually overlies Devonian carbonates, but may overlie dominantly of the Sheldon Creek, Wolf Creek or Alburtus formations in isolated areas. This unit encompasses outwash deposits that accumulated in valleys during the Wisconsin Episode in the Cedar River.
- Qnw T2** - **Sand and Gravel** (Noah Creek Formation) - Up to 10 m (33 ft) of yellowish brown to gray, poorly to well sorted, massive to well stratified, coarse to fine feldspathic quartz sand, pebbly sand and gravel. In the map area this unit usually overlies Devonian carbonates, but may overlie dominantly of the Sheldon Creek, Wolf Creek or Alburtus formations in isolated areas. This unit encompasses outwash deposits that accumulated in valleys during the Wisconsin Episode in the Shell Rock River Valley.
- Qnw T1** - **Sand and Gravel** (Noah Creek Formation) - Up to 17 m (56 ft) of yellowish brown to gray, poorly to well sorted, massive to well stratified, coarse to fine feldspathic quartz sand, pebbly sand and gravel. In the map area this unit usually overlies Devonian carbonates, but may overlie dominantly of the Sheldon Creek, Wolf Creek or Alburtus formations in isolated areas. This unit encompasses outwash deposits that accumulated in valleys during the Wisconsin Episode on the Shell Rock River Valley. This unit represents the older, higher terrace and generally sits 3 m (10 ft) above the lower terrace and 10 m (33 ft) above the modern channel.
- Qnw3** - **Sand and Gravel Shallow to Bedrock** (Noah Creek Formation) - 1 to 3 m (3-10 ft) of yellowish brown to gray, poorly to well sorted, massive to well stratified, coarse to fine feldspathic quartz sand, pebbly sand and gravel. May be overlain by up to 2 m (7 ft) of Peoria Formation (silt or sand facies). Formed as dunes and other erosive massive, fractured, slightly fine-grained till of the Sheldon Creek Formation. This unit is absent in southwestern portion of Floyd County.
- Qsc2** - **Loamy Sediments Shallow to Glacial Till** (Unnamed erosion surface sediments) - 1 to 6 m (3-20 ft) of yellowish brown to gray, massive to weakly stratified, with poorly sorted sandy, silty and clayey erosion surface sediments. Map unit includes some areas mantled with less than 1 m (3 ft) of Peoria Formation (silt or sand facies). Overlies massive, fractured, slightly fine-grained till of the Sheldon Creek Formation. This unit is absent in southwestern portion of Floyd County.
- Qsc** - **Glacial Till** (Sheldon Creek Formation - Undifferentiated) - Generally 1 to 15 m (3-50 ft) of yellowish brown to gray, calcareous, fractured to massive clay loam, at depth this unit varies in texture and contains significant sand and gravel bodies with thickness generally ranging from 2 to 7 m (7-20 ft). The upper 1 to 10 m (3-30 ft) may be periglacially altered. This unit overlies Pre-Illinoian dunes, Devonian carbonate bedrock or Carboniferous sandstone and mudstone and is only shown on the map area. This unit is absent in southwestern portion of Floyd County.
- Qwa2** - **Loamy Sediments Shallow to Glacial Till** (Unnamed erosion surface sediments) - 1 to 6 m (3-20 ft) of yellowish brown to gray, massive to weakly stratified, with poorly sorted sandy, silty and clayey erosion surface sediments. Map unit includes some areas mantled with less than 1 m (3 ft) of Peoria Formation (silt or sand facies). Overlies massive, fractured, slightly fine-grained till of the Wolf Creek or Alburtus formations in the eastern and southwestern portions of Floyd County.

PRE-ILLINOIAN EPISODE

- Qwa3** - **Glacial Till** (Wolf Creek or Alburtus formation) - Generally 1 to 15 m (3-50 ft) of yellowish brown to gray, calcareous, fractured to massive clay loam, at depth this unit varies in texture and contains significant sand and gravel bodies with thickness generally ranging from 2 to 7 m (7-20 ft). The upper 1 to 10 m (3-30 ft) may be periglacially altered by unnamable erosion surface outwash, outwash, alluvium or younger glacial sediments (Sheldon Creek Fan) in the western portion of the mapping area. This unit is shown only on the cross-section.
- Qbr** - **Low to Medium Sediments to Dolomite, Limestone, Shale and Sandstone** (DeForest, Noah Creek, Peoria, Sheldon Creek, Wolf Creek and Alburtus formations) - 1 to 2 m (3-7 ft) of yellowish brown to gray, silty to sandy siltstone, silty sand, silty shale, silty clay, silty claystone, silty sandstone, sandstone, shale, and sandstone. This unit is shown only on the cross-section and may be identified on the bedrock map of the Floyd County with the following description:

MESOZOIC

CRETACEOUS SYSTEM

- Kd** - **Sandstone, Mudstone, and Siderite Pellets** (Dakota/Window Formation) "Mg" Concretion. This map unit occurs as scattered erosional outcrops and is mostly identified by the soil survey in the western part of the mapping area. This unit consists of a non-marine fluvial and pedogenic facies succession characterized by a variety of lithologies, which are commonly dominated by quartzite sandstone with subordinate chert concretionary conglomerates, in part cemented by iron oxides. Thickness of this unit is variable, but is usually less than 6 m (20 ft) when present in the mapping area.

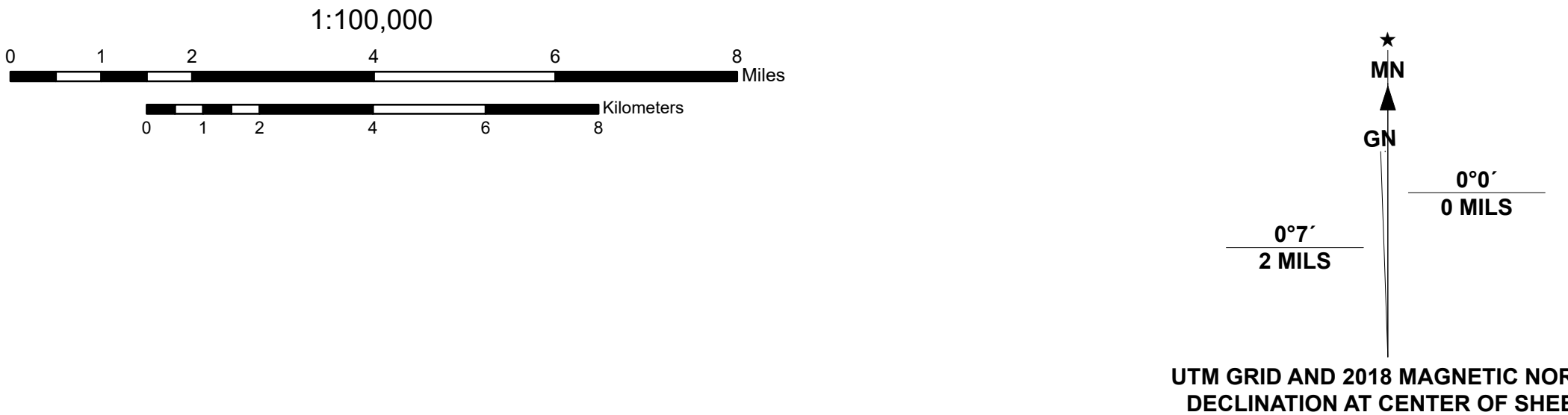
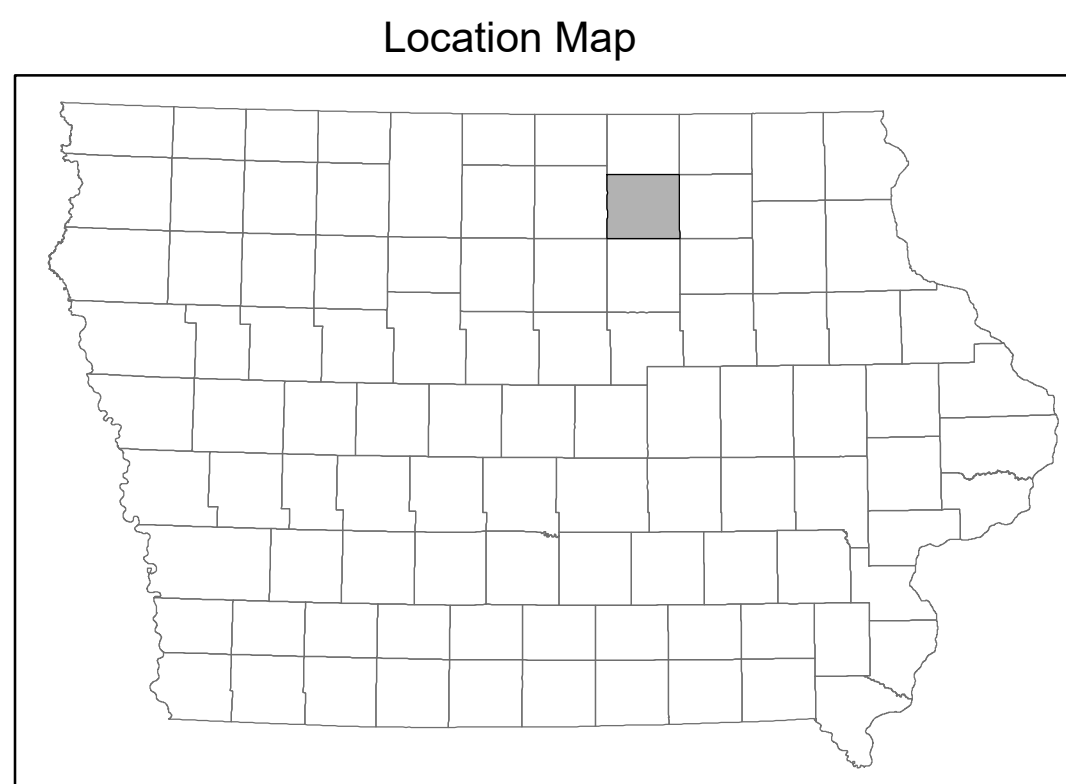
PALEOZOIC

DEVONIAN SYSTEM

- Di** - **Shale, Limestone, and Dolomite** (Lime Creek Formation) Upper Devonian. This map unit occurs on the bedrock surface in the western part of the mapping area. Thickness of this unit is usually less than 3 m (10 ft) when present, but can be thicker than 35 m (115 ft) along the western border of the county. The formation consists of calcareous shales in the lower portion and limestone, dolomite, limestone, and dolomite in the upper portion. Some layers are fossiliferous and pyritic.
- Dsr** - **Limestone, Dolomite, and Shale** (Shell Rock Formation) Upper Devonian. This map unit occurs on the bedrock surface mainly in the western part of the county. It usually has a thickness of 9 to 20 m (30-65 ft), but there are outliers and toward the east of the mapping area. This formation is characterized by limestone, dolomite, limestone and dolomite, with some gray to light green shale and/or argillaceous carbonates. Fossiliferous layers, especially characterized by abundant bryozoans, brachiopods, and stromatolites, commonly occur in the lower part of the unit.
- Dlgs** - **Limestone, Dolomite, and Shale** (Lithograph City Formation) Middle Devonian. As the dominating bedrock unit, this formation comprises most of the bedrock surface of the mapping area. The general thickness of this unit is around 21 to 27 m (70-90 ft), but can be thicker than 35 m (115 ft) in the mapping area. The unit consists of limestone, dolomite, limestone, dolomite, and some shaly dolomite. It is usually characterized by interbedded lithologic and stratigraphic limestone and dolomite, in part laminated and argillaceous. "Bridgely" structures, intraclastic fabrics, vugs and calcareous vugs are common. Some intervals are fossiliferous and argillaceous.
- Dvc** - **Limestone and Dolomite** (Coralville Formation) Middle Devonian. This map unit occurs at the bedrock surface mainly along a bedrock valley in the eastern part of the map. The thickness of this unit usually varies between 14 and 20 m (45-65 ft), but can be 23 m (77 ft) thick in the mapping area. This formation consists of limestone, dolomite, limestone, and dolomite, in part argillaceous or shaly. Laminated and brecciated textures may occur. Brachiopods, corals, brachiopods and corals usually occur in the limestone facies.
- Dlc** - **Dolomite, Limestone, and Shale** (Little Cedar Formation) Middle Devonian. This formation dominates the bedrock surface of the deep bedrock valley in the eastern part of the mapping area. The thickness of this formation usually ranges from 24 to 37 m (80-120 ft), but can be 46 m (150 ft) thick in the mapping area. This unit is dominantly a slightly argillaceous to argillaceous dolomite and dolomitic limestone, usually suggy and partially cherty. A shaly layer above 3 to 8 m (10-25 ft) thick commonly occurs in the upper part of the formation. This unit is usually fossiliferous, and brachiopods are especially abundant in the lower portion.
- Dpr** - **Dolomite and Dolomitic Limestone** (Peoria Ridge Formation) Middle Devonian. This map unit occurs at the bedrock surface along the deep bedrock valley in the northeast part of the map. This formation consists of dolomite and dolomitic limestone, with varying textures (shaly, laminated, brecciated, sandy, and/or cherty). The thickness of this unit usually ranges from 6 to 8 m (20-45 ft). Compared to other Devonian strata in the mapping area, this formation is usually well-sorted.
- Dsp** - **Dolomite** (Sperdy Formation) Middle Devonian. This map unit only occurs at the bedrock surface within the deep bedrock valley in the northwest part of the map. This unit is dominated by medium to thick bedded dolomite with scattered abundant fossils. Thickness of this formation usually varies between 12 and 21 m (40-70 ft), with a maximum thickness of approximately 30 m (100 ft) in the mapping area. Its bed part, therefore, is variably sandy, shaly, and/or conglomeratic with cross-bedded Devonian chert clasts.

OTHER FEATURES

- Qpq** - **Pits and Quarries** - Sand and gravel pits and rock quarries. Except mapped as shown on the county soil survey and as identified on aerial imagery.
- Incorporated city boundary
- Roads
- ICG drill holes for this map project
- ICG GEOSAM data points - records available at www.iowageologicalsurvey.org
- Well used for geologic cross-section



CORRELATION OF MAP UNITS

	Iowan Surface						
	Wisconsinan Till Plain	Pre-Illinoian Till Plain	Shallow Rock		Episode	Series	System
Alluvium	Qal	Qallt	Qal	Qall-ht	Qalb		Hudson
Eolian and Colluvium		Qe					Hudson and Wisconsin
Outwash	Qnw2	Qps1	Qnw2	Qps1			Pre-Illinoian
Erosion Surface and Glacial Till	Qnw T2	Qnw		Qnw3			Pre-Illinoian
	Qnw T1		Qwa2				Pre-Illinoian
		Qsc2					Pre-Illinoian
		Qsc*					Pre-Illinoian
		Qwa3*					Pre-Illinoian
		Kd*					Cretaceous
		Di*					Devonian
		Dsr*					Devonian
		Dlgs*					Devonian
		Dvc*					Devonian
		Dlc*					Devonian
		Dpr*					Devonian
		Dsp*					Devonian

GEOLOGIC CROSS-SECTION A-A'

