

# Bedrock Geology of the Nora Springs (Iowa) 7.5' Quadrangle

## BEDROCK GEOLOGY OF THE NORA SPRINGS 7.5' QUADRANGLE, CERRO GORDO, MITCHELL AND FLOYD COUNTIES, IOWA

Iowa Geological Survey  
Open File Map OFM-14-2  
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### Introduction to the Bedrock Geology of Nora Springs 7.5' Quadrangle, Cerro Gordo, Mitchell, and Floyd Counties, Iowa

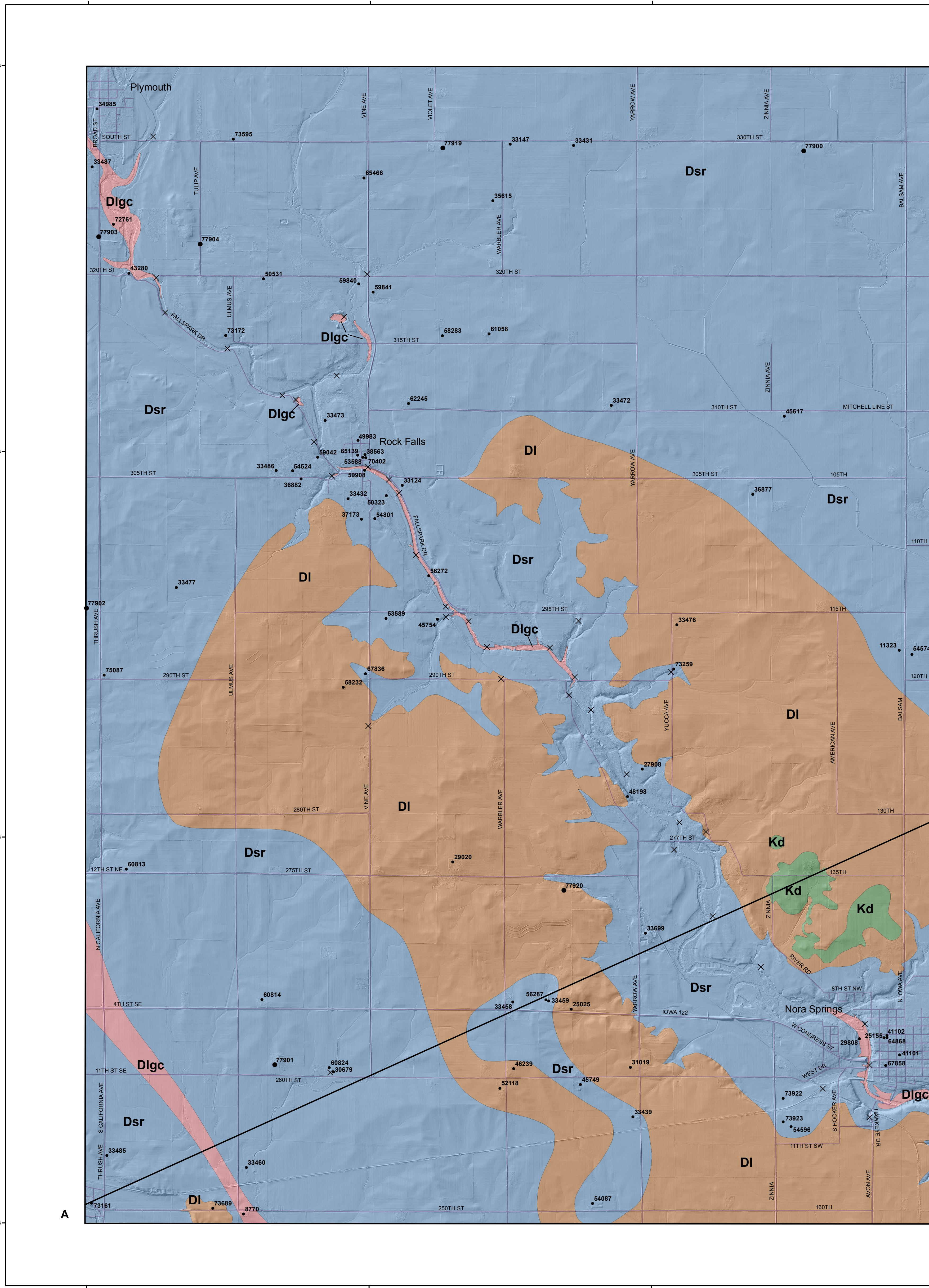
The Nora Springs quad lies in the Iowa Surface landform region, which was modified by various episodes of erosion before Wisconsin glacial events, and is close to the Des Moines Lobe landform region, which was the last area covered by a Quaternary glacial advance in Iowa (Prior, 1991). Due to extensive glacial and erosional activities, the land surface in this area is relatively low topographic relief except the Shell Rock River valley which extends from northwest to southeast through the quad.

The land surface of the Nora Springs quad is mostly covered by Quaternary deposits. The undifferentiated Quaternary deposits are usually less than 15 m (50 ft) thick, but can be 30 m (100 ft) thick in some local bedrock depressions. Bedrock outcrops are common along the Shell Rock River. Few rock quarries and gravel pits are also located along the river. A total of 38 bedrock outcrops and quarries within the quad were investigated in the field, and the information was used for the geologic mapping. Subsurface geologic information was mostly derived from the analysis of water well cutting samples repositated at the Iowa Geological Survey (IGS). Lithologic and stratigraphic information from these samples are stored in the online GEOSAM database of the IGS. A total of 85 private and public wells within the mapping area were studied, and geologic information from these wells was also used for bedrock geologic mapping purposes. Shallow bedrock information from the soil surveys in Cerro Gordo County (DeWitt, 1988), Mitchell County (Voy & Highland, 1975), and Floyd County (Voy, 1995) was used for identifying potential bedrock outcrops in the field. Stratigraphic information from the surrounding area, including bedrock outcrops, quarries, and well samples, was also utilized for this mapping project.

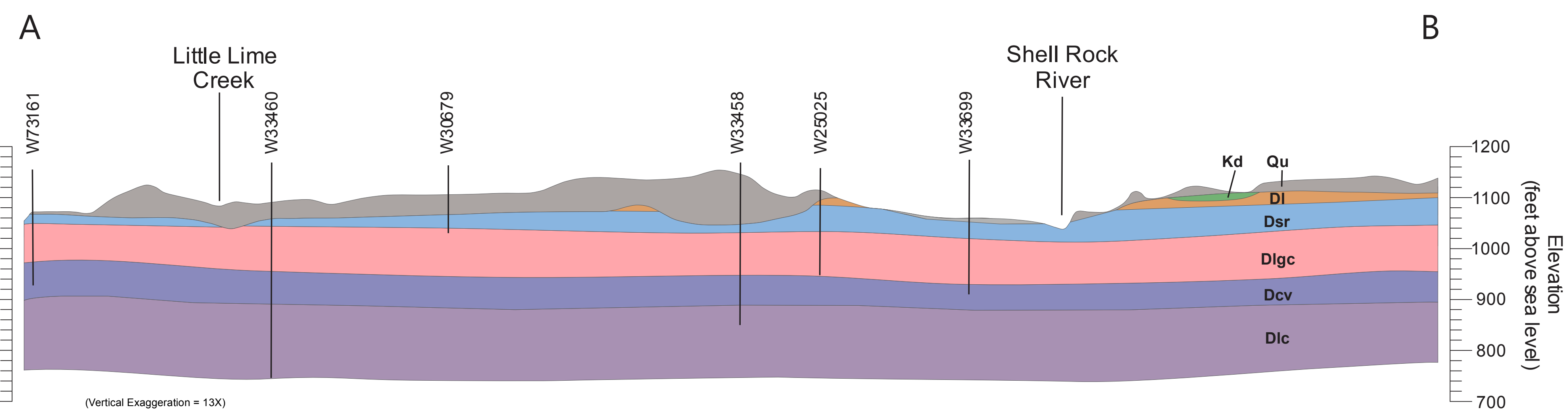
Paleogeographically, the mapping area is within the northern portion of the Devonian Iowa Basin, a region of thickened shelf carbonate and shale deposits. Middle and lower Upper Devonian rocks form the major bedrock surface and upper bedrock aquifer in this area. Due to its stratigraphic completeness, the stratigraphy and depositional environments of the Devonian Iowa Basin have been intensively studied (e.g., Bolanski, 1927, 1928). The type sections of two stratigraphic members, the Mason City Member and the Nora Member of the Shell Rock Formation, are located in this quad (Koch, 1970) although the latter is no longer exposed. Recent geologic and stratigraphic studies of the Devonian Iowa Basin include Witke and Bunker (1984), Anderson (1984), Bunker and others (1986), Witke and others (1988), Bunker (1995), Anderson and Bunker (1998), Groves and others (2008), and McKay and Liu (2012). Bedrock geology of the surrounding area was recently mapped by Witke and others (2010) and Liu and others (2010a & b, 2011a & b, 2012, 2013). Results from these studies and bedrock mapping projects provide an important stratigraphic framework for this bedrock geologic map. The bedrock stratigraphic nomenclature and correlation for this map follows the stratigraphic framework proposed by Witke and others (1988).

The youngest bedrock unit within the mapping area is the Cretaceous Dakota/Window Formation, which usually occurs as a few meters thick erosional outliers represented by iron-rich shaly sandstone in north-central Iowa. The Devonian rocks are dominated by carbonates and shales. Based on lithologic features and fossils, the Devonian rocks are stratigraphically subdivided into, in descending order, the Lime Creek, Shell Rock, and Lithograph City Formations. The Lime Creek Formation comprises most of the bedrock surface in the southern part of the mapping area. This formation is usually characterized by calcareous shales in the lower part and carbonates in the upper part. Only the lower part of the formation occurs in the quad, represented as bluish gray to greenish yellow shale. Thickness of the Lime Creek Formation varies between 0 and 22 m (73 ft) in the mapping area. The Shell Rock Formation forms most of the bedrock surface of the Nora Springs quad, and is comprised of fossiliferous limestone, dolomitic limestone and dolomite, with minor shale. Commonly, a coarse-grained stromatolite-rich biostrome facies occurs near the base of the formation in this area. Shaly and/or argillaceous carbonates dominate the middle and upper portions of the Shell Rock Formation. Thickness of the Shell Rock Formation is normally about 12.18 m (40.0 ft). The Lithograph City Formation is characterized by laminated lithologic and sublitologic limestone and dolomite. "Birdseye," vugs, and calcite vug-fills are common in this formation. Some layers of this formation are fossiliferous with brachiopods, corals, and stromatopora. The Lithograph City Formation only occurs at the bedrock surface within a bedrock valley in the southwest corner of the quad and places along the Shell Rock River and its tributaries. The maximum thickness of the Lithograph City Formation is about 34 m (110 ft) in this area. Underlying Coralville and Little Cedar formations of the Middle Devonian are found in wells only and do not occur at the bedrock surface in the Nora Springs quad.

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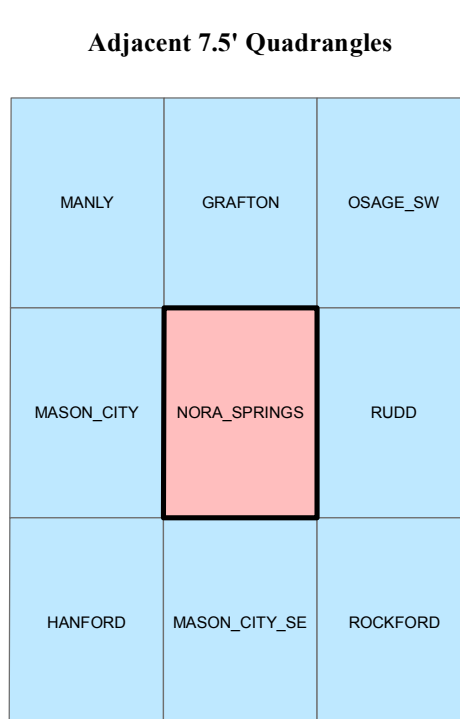


### GEOLOGIC CROSS-SECTION A-B

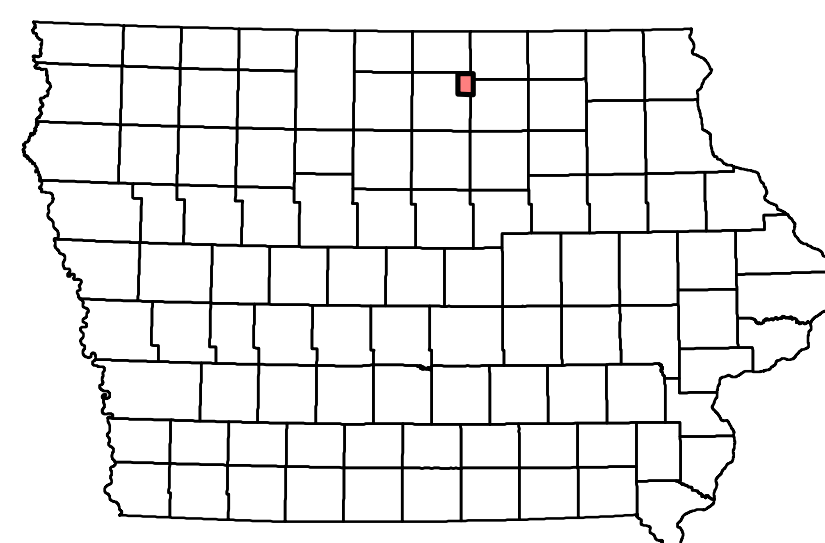


### Correlation of Map Units

AGE (Ma)	SYSTEM	SERIES	STAGE	MAP UNIT
2.588	QUATERNARY			Qu
145.0	CRETACEOUS			Kd
	DEVONIAN	Upper	Frasnian	DI
382.7			Givetian	Dsr
				Dlgc
387.7				Dcv
	Middle	Eifelian	Dlc	
393.3				



### Location Map



- LEGEND**
- QUATERNARY SYSTEM**
- Qu - Undifferentiated Quaternary Alluvium: Consists of fans with developed or incised, alluvial fans and alluvium of variable thickness and alluvial fans and fans. Deposits of this system represent a complex of depositional units on the map. The sandstone unit in the map.
- CRETACEOUS SYSTEM**
- Kd - Dakota, Shinarump, and Shell Rock (Dakota/Window) Formations: This map unit covers an erosional outlier and is only found north-central Iowa. The formation is characterized by reddish-brown shaly sandstone with shaly parting. The thickness of this unit is 10-15 m (30-50 ft) in the mapping area.
- DEVONIAN SYSTEM**
- DI - Middle Devonian and Shinarump (Lithograph City-Fertile) Formations: This map unit covers the bedrock surface in the western part of the quad. The formation is characterized by limestone and dolomite. The thickness of this unit is 12.18 m (40.0 ft) in the mapping area.
  - Dsr - Lower Devonian, Shellock, and Shell Rock (Shellock Stage) Formations: This map unit covers the bedrock surface with a thickness between 12 and 15 m (40 to 50 ft) in the mapping area. The formation is characterized by limestone and dolomite. The thickness of this unit is 12.18 m (40.0 ft) in the mapping area.
  - Dlgc - Middle Devonian, Shellock, and Shell Rock (Shellock Stage) Formations: This map unit covers the bedrock surface with a thickness between 12 and 15 m (40 to 50 ft) in the mapping area. The formation is characterized by limestone and dolomite. The thickness of this unit is 12.18 m (40.0 ft) in the mapping area.
  - Dcv - Middle Devonian, Shellock, and Shell Rock (Shellock Stage) Formations: This map unit covers the bedrock surface with a thickness between 12 and 15 m (40 to 50 ft) in the mapping area. The formation is characterized by limestone and dolomite. The thickness of this unit is 12.18 m (40.0 ft) in the mapping area.
  - Dlc - Middle Devonian and Shellock (Lithograph City-Fertile) Formations: This map unit covers the bedrock surface in the western part of the quad. The formation is characterized by limestone and dolomite. The thickness of this unit is 12.18 m (40.0 ft) in the mapping area.
- NEW 800 DOTS FOR THIS MAP PROJECT**
- 77900 - Change
  - 77171 - IGS GEOSAM Data Files - records available at www.igswater.gov
  - Bedrock

Base map from Iowa DOT Road map Layers 2006. Shaded relief from Iowa LIDAR Project 2007-2011.  
 Iowa Geological Survey digital cartographic file: *NoraSprings\_BedrockGeology.mxd*, version 9/15/14 (AOZ05 10.1).  
 Map projection and coordinate system based on Universal Transverse Mercator (UTM) Zone 15, 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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