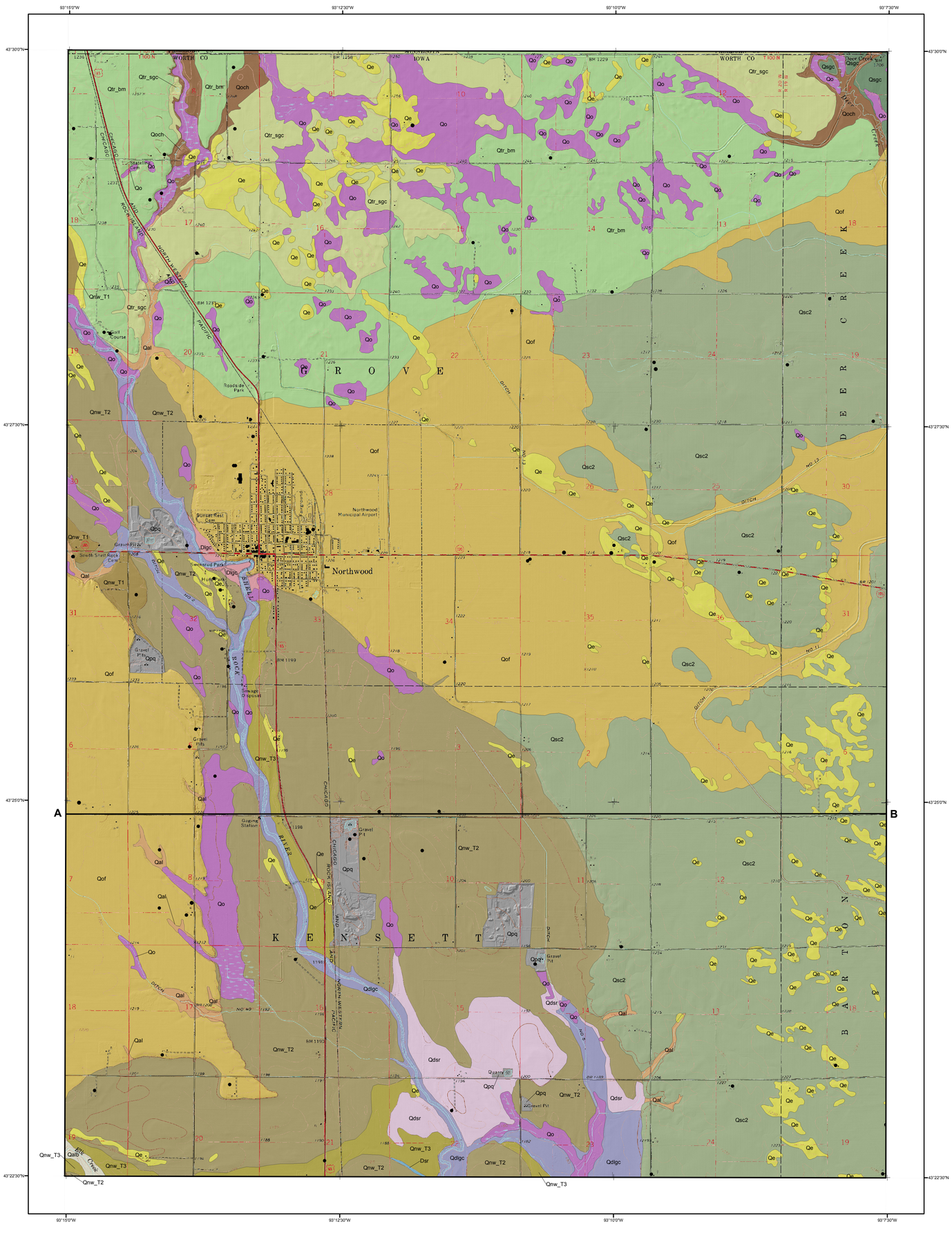
Surficial Geology of the Northwood (Iowa) 7.5' Quadrangle



LEGEND

CENOZOIC

QUATERNARY SYSTEM

HUDSON EPISODE

Qo - Depressions (DeForest Formation-Woden Mbr.) - Generally 1 to 3 m (3-20 ft) of black to very dark gray, calcareous, muck, peat and silty clay loam colluvium and organic sediments in drained and undrained closed and semi-closed depressions. Overlies Dows Formation loam diamicton, Noah Creek Fm. sand and gravel, Sheldon Creek Fm. loam diamicton or Devonian carbonate bedrock. Associated with low relief features that occupy depressions and low sags on the landscape. Supports wetland vegetation and can be permanently covered by water. High water table.

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 silty clay loam, clay loam, loam to sandy loam alluvium and colluvium in stream valleys, on hillslopes and in closed depressions. May overlie Noah Creek Formation, Sheldon Creek formation, Wolf Creek or Alburnett formations or fractured Devonian carbonate bedrock. Associated with low-relief modern floodplain, closed depressions, modern drainageways or toeslope positions on the landscape. Seasonal high water table and potential for frequent flooding.

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. May overlie yellowish-brown coarse-grained sand and gravel (Noah Creek Fm.), yellowish to grayish brown, usually calcareous and fractured, stratified loam to silt loam; stratified sands and gravels to sandy loam diamicton (Dows Fm.-Morgan Mbr. or yellowish to grayish brown, usually calcareous, stratified loam to silt loam to sandy loam diamicton (Sheldon Creek Fm.). Usually restricted to a narrow belt along major river valley bottoms or adjacent uplands on the Des Moines Lobe. Off the Des Moines Lobe this unit is not restricted to dunes along valley axes and may occur as sand stringers overlying unnamed erosion surface loamy sediments.

Qdsr - Loamy Sediments Shallow to Limestone, Dolomitic, and Shale (DeForest-Noah Creek-Shell Rock Formation) - 1 to 2 m (3-7 ft) of yellowish brown to gray, massive to weakly stratified, well to poorly sorted loamy, sandy and silty alluvial sediment that overlies the Upper Devonian bedrock surface, usually within a thickness of 12 to 18 m (40-60 ft) and it occurs in the southern part of the quad. It is characterized by fossiliferous carbonates with some shale. Layers with abundant subspherical and tubular stromatoporoids, which may be replaced by calcite crystal masses, commonly occur in the lower part of the formation. Around southwest part of the quad, this formation is dominated by argillaceous dolomite and dolomitic limestone, and the thickness can be up to 30 m (100 ft).

Qdlgc - Loamy Sediments Shallow to Dolomitic, Limestone, and Shale (DeForest-Noah Creek-Lithographic City Formation) - 1 to 2 m (3-7 ft) of yellowish brown to gray, massive to weakly stratified, well to poorly sorted loamy, sandy and silty alluvial sediment that overlies the Middle to Upper Devonian bedrock surface. This formation is the major top bedrock unit in the quad, the maximum thickness of this map unit is up to 33 m (110 ft), consisting of dolomite and dolomitic limestone, partially characterized by interbeds of unfossiliferous to sparsely fossiliferous laminated lithographic and sublithographic limestone and dolomitic limestone, in part argillaceous or with slight shale. "Birdseye" carbonate fabric is common in some layers.

WISCONSIN EPISODE

Qnw_T3 - Sand and Gravel, Terrace 3 (Noah Creek Formation) - 1 m (3 ft) to more than 3 m (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. This unit encompasses deposits that accumulated in stream valleys during the Wisconsin Episode. Terrace 3 occupies the lowest terrace position and is located adjacent to Elk Creek and the Shell Rock River.

Qnw_T2 - Sand and Gravel, Terrace 2 (Noah Creek Formation) - 3 m (10 ft) to more than 6 m (20 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 places mantled with 1m (3 ft) of fine to medium, well sorted sand derived from wind reworking of the alluvium. This unit encompasses deposits that accumulated in stream valleys during the Wisconsin Episode. Terrace 2 is at an elevation approximately 1.5 m (5 ft) above Terrace 3. This terrace has limited eolian deposits.

Qnw_T1 - Sand and Gravel Terrace 1 (Noah Creek Formation) - 3 m (10 ft) to more than 23 m (75 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 places mantled with 1 to 3 m (3-10 ft) of fine to medium, well sorted sand derived from wind reworking of the alluvium. This unit encompasses deposits that accumulated in stream valleys during the Wisconsin Episode. Terrace 1 represents the oldest and highest elevation of the Noah Creek Formation terraces. Terrace 1 is at an elevation approximately 3m (10 ft) above Terrace 2.

Qoch - Valley train outwash (Noah Creek Formation) - Generally 3 m (10 ft) to less than 8 m (26 ft) of dark gray, dark grayish brown, dark brown to dark yellowish brown medium to coarse sand, gravelly sand to pebbly gravel. Overlies gray, calcareous, massive, dense loam diamicton (Dows Fm.-Alden Mbr.). In valley positions, it is at the land surface of older terraces. On the modern floodplain it is buried by DeForest Fm. alluvium. Low-relief landforms expressed as broad terraces; long, narrow longitudinal terraces or cuspate/shaped point terraces. Terraces associated with the major valleys are benched on a gray, calcareous, massive, dense loam diamicton (Dows Fm-Alden Mbr.).

Qof - Outwash fan (Noah Creek Formation) - Thickness can be quite variable from 3 to 12 m (10-39 ft) of yellowish-brown coarse-grained sand and gravel. May overlie yellowish to grayish brown usually calcareous, stratified loam to silt loam to sandy loam diamicton or gray, calcareous, massive, dense loam diamicton (Sheldon Creek Fm.) or non calcareous silty deposits associated with the Pisgah Formation-Farmdale Geosol or clay loam to sandy clay loam deposits associated with Pre-Illinoan Wolf Creek or Alburnett Formation loam diamicton or unnamed Pre-Wisconsin age alluvium. Narrow lower relief apron that gently slopes away from the moraine front. Seasonal high water table.

Qtr_sgc - Supraglacial complex (Dows Formation-Pilot Knob Mbr.-Morgan Mbr.) - Greater than 3 m (10 ft) but less than 15 m (49 ft) of yellowish brown, often calcareous and fractured, stratified sand and gravel with interbedded stratified loam diamicton. Collapse features are usually evident. In depressions and sags on upland surfaces, the sand and gravel may be buried by DeForest Fm-Woden Mbr. Overlies gray, calcareous, massive, dense loam diamicton (Dows Fm. - Alden Mbr.). Moderate relief 3m (10 ft) hummocks, and associated linked drainages on upland surfaces. Area of complex glacial deposits on the Bemis Moraine. Seasonal high water table.

Qtr_bm - Till ridge (Dows Formation-Morgan Mbr.) - Generally 3 to 5 m (10-16 ft) of yellowish to grayish brown, usually calcareous and fractured, stratified loam to silt loam; stratified sands and gravels to sandy loam diamicton; textures can be quite variable. Overlies gray, calcareous, massive, dense loam diamicton (Dows Fm-Alden Mbr.). The Alden Mbr. in this mapping unit rarely extends to depths greater than 12 to 15 meters; and overlies the Sheldon Creek Formation diamicton. At the DML margin, this landform may be mantled with a thin layer of Peoria Formation silt. Low to moderate relief hummocky landform features exceed 3 to 5 m (10-16 ft) of local relief. This landform is associated with the Bemis Moraine. The surface pattern is irregularly shaped patterns. Seasonal high water table.

Qsc2 - Loamy Sediments Shallow to Glacial Till (Unmamed erosion surface sediment) - 1 to 3 m (3-10 ft) of yellowish brown to gray, massive to weakly stratified, well to poorly sorted loamy, sandy and silty erosion surface sediment. Map unit includes some areas mantled with less than 1 m (3 ft) of Peoria Formation (silt or sand facies). Overlies massive, fractured, slightly firm glacial till of the Sheldon Creek Formation.

Qsc - Glacial Till (Sheldon Creek Formation-undiff.) - Generally 3 to 15 m (10-50 ft) of a yellowish brown to gray, calcareous fractured to massive clay loam; at depth this unit can be variably textured and contain significant sand and gravel bodies. Pierre Shale clasts may be present in ore samples. This unit may not be present on relatively steep sideslopes near valleys. This unit overlies Pre-Illinois diamicton and is only shown on the cross-section.

PRE-ILLINOIS EPISODE

Qwa3 - Till (Wolf Creek or Alburnett Formations) - Generally 3 to 23 m (10-75 ft) of very dense, massive, fractured, loamy glacial till of the Wolf Creek or Alburnett formations. This mapping unit can be buried by glacial sediments (Sheldon Creek Fm.), unnamed erosion surface sediments, loess or alluvium and is shown only in the cross-section.

PALEOZOIC

DEVONIAN SYSTEM

Dsr - Limestone, Dolomite, and Shale (Shell Rock Formation) Upper Devonian. This map unit usually has a thickness of 12 to 18 m (40-60 ft), and occurs in the southern part of the quad. The unit is characterized by fossiliferous carbonates, with some grey to light green shale. Layers containing abundant subspherical and tubular stromatoporoids commonly occur in the lower part of the unit. Brachiopods, bryozoans, corals, and crinoids are abundant in some intervals.

Dlgc - Dolomite, Limestone, and Shale (Lithograph City Formation) Middle to Upper Devonian. This map unit forms the major upper most bedrock in the quad, with a maximum thickness of up to 33 m (110 ft). This unit consists of dolomite and dolomitic limestone, partially characterized by interbeds of laminated lithographic and sublithographic limestone and dolomitic limestone, in part argillaceous or with slight shale. "Birdseye" structures are common. Some intervals are fossiliferous and stromatoporoid-rich.

Dcv - Limestone and Dolomite (Coralville Formation) Middle Devonian. The thickness of this map unit varies between 10 and 18 m (35-60 ft), and it is dominated by limestone, dolomitic limestone, and dolomite, in part laminated and argillaceous. Brachiopods and corals usually occur in the limestone facies.

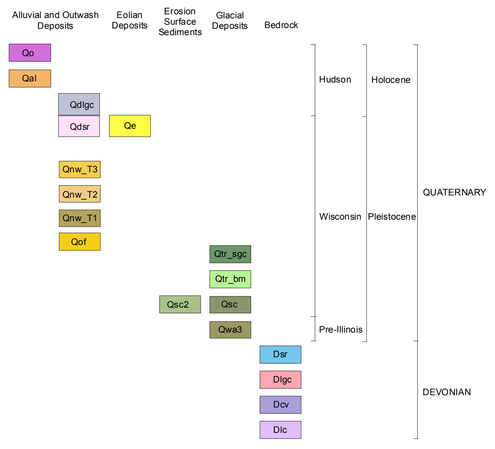
Dlc - Dolomite and Limestone (Little Cedar Formation) Middle Devonian. The thickness of this map unit ranges from 27 to 35 m (90-115 ft) in the study area. The unit is dominated by slightly argillaceous to argillaceous dolomite and dolomitic limestone, usually vuggy and partially laminated and/or cherty. This unit is commonly fossiliferous, and brachiopods are especially abundant in the lower portion. This unit is shown only on the cross-section, not on the map.

Qpq - Pits and Quarries Sand and gravel pits and rock quarries. Extent mapped as shown in county soil surveys and as identified on aerial imagery.

Drill Holes

Water Well Logs

Correlation of Map Units



Adjacent 7.5' Quadrangles

1:24,000

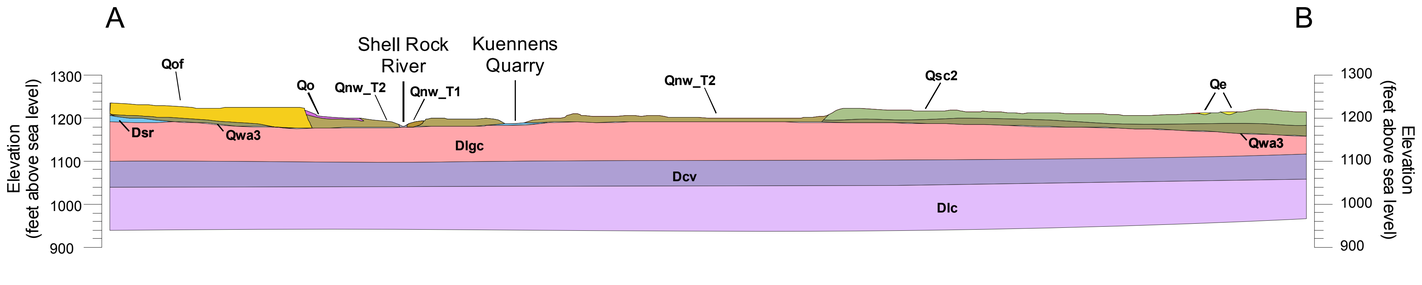
0 0.5 1 2 3 4 Miles

0 0.5 1 2 3 4 Kilometers

Location Map

N

GEOLOGIC CROSS-SECTION A-B



SURFICIAL GEOLOGY OF THE NORTHWOOD 7.5' QUADRANGLE, WORTH COUNTY, IOWA

Iowa Geological and Water Survey
Open File Map OFM-11-06
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prepared by

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Introduction to the Surficial Geology of the Northwood, 7.5' Quadrangle

The Northwood Quadrangle is located in Worth County in north-central Iowa. The mapping area straddles the eastern margin of the Late Wisconsin-age Des Moines Lobe Landform (DML), the most recently glaciated region of the state and the Wisconsin-age Iowan Erosion Surface (IES) Landform Region (Prior and Kohrt, 2006). Generally speaking, in the northern portion of the map area, the DML consists of a complex suite of depositional landforms and sediment sequences related to supraglacial, subglacial, and proglacial sedimentation. The Des Moines Lobe is characterized by hummocky terrain that forms arcuate belts of moraine complexes and undulating plains with thick increments of supraglacial sediment (>3 m). In the map area, the most noteable feature of the DML is the the Bemis Moraine, the terminal moraine of the DML is dated at approximately 14,500 to 14,000 years before present. Supraglacial and proglacial sediments (coarse-grained glaciofluvial, ice-contact sediments associated with hummocky terrain, outwash fans, and channel deposits) encompass a large area of the eastern flank of the DML and are extensively mapped at the former ice margin and in the Shell Rock and Elk Creek valleys. The central portion of the map area is dominated by outwash deposits associated with the Shell Rock River. The valley is younger than the Bemis Moraine and was cut approximately 12,500 years before present during the catastrophic drainage of the younger Algona Moraine. The eastern portion of the map area consists of unnamed loamy sediments (IES materials) of variable thickness overlying Wisconsin-age Sheldon Creek Fm. glacial sediments, Pre-Illinoian glacial sediments or shallow rock. These deposits are regionally extensive. Significant areas of bedrock outcrop or areas with less than 15 feet of loamy material over rock are present, especially along the Shell Rock River valley.

Williams (1899) described and mapped the Quaternary and Paleozoic bedrock geology of the county and discussed the stratigraphy of Devonian strata that were exposed at the land surface. He also noted the extreme thinness of the "drift" along the the Winnebago River and nearby Shell Rock River and the remarkable difference in surface features between the eastern and western portions of Worth County. Statewide bedrock geologic maps by Hershey (1969), and most recently by Witzke, Anderson, and Pope (2010), depict the increased understanding of the complex distribution of geologic units at the bedrock surface across this region, including Worth County. The only regional surficial map of the area consists of the Des Moines 4° x 6° Quadrangle at a scale of 1:1,000,000 (Hallberg et al., 1991).

The map area has a rich and complex geologic history punctuated by at least seven periods of glaciation between 2.2 million to 500,000 years ago (Boellstorff, 1978a,b; Hallberg, 1980, 1986). In this area, Pre-Illinois Episode glacial deposits and associated buried soils are overlain by much younger Wisconsin-age glacial deposits. During earlier and mid Wisconsin-age, ice advances dating from approximately 40,000 to 26,000 years before present were deposited throughout the map area. In Iowa, this glacial deposit is formally recognized as the Sheldon Creek Formation (Bettis et al., 1996, Bettis, 1997) and in earlier literature is referred to as the "Tazewell till" (Ruhe, 1950). A period of intense cold occurred during the Wisconsin full glacial episode from 21,000 to 16,500 years ago (Bettis, 1989). This cold episode and ensuing upland erosion led to the development of the distinctive landform recognized as the IES (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). The result was that surface soils were removed from the IES, and the Sheldon Creek and Pre-Illinois till surface was significantly eroded, resulting in the development of a region-wide colluvial lag deposit referred to as a "stone line." Shortly, following the IES formation the southern edge of the Laurentide Ice Sheet split into several lobes that each flowed down regional topographic lows. The Des Moines Lobe extended from central Canada through the Dakotas and Minnesota into Iowa, terminating at what is now the City of Des Moines. The Des Moines Lobe was active in Iowa between about 15,000 and 12,000 RCYBP, about 5,000 to 8,000 years later than glacial lobes to the east made their southernmost maximum advance (Johnson, 1986; Fullerton, 1986). The Lobe advance occurred well into a period of regional warming and was thus climatically out of equilibrium (Kemmis et al., 1994). Ice thickness reconstructions indicate that the lobe was probably thin and gently sloping (Mathews, 1974; Clark, 1992; Brevik, 2000; Hooyer and Iverson, 2002). Clark (1992) reconstructed the Lobe's thickness near Ames, Iowa, at ~80 m. More recently, ice reconstructions by Hooyer and Iverson (2000) were based on a model assuming the Bemis Moraine was ice-cored, which yielded ice thickness estimates of ~250 m. Despite these variations, all agree that the Des Moines Lobe ice sheet was extremely thin and gently sloping. This ice advance was rapid and episodic, and was most likely fueled by basal lubrication; in other words, a warm-based, non-deforming bed glacier. These assumptions are backed up by evidence of numerous plants (Baker et al., 1986) and trees (Bettis et al., 1996) found near the base of the DML package. Furthermore, the complex landform sediment assemblages found on the DML in Iowa seem more indicative and explained by regional stagnation caused by a surging-type glacier, not rapid recession.

Surficial deposits of the map area are composed of seven formations: DeForest, Dows, Noah Creek, Peoria, Sheldon Creek, Wolf Creek, and Alburnett formations, as well as unnamed 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, Corrington, Flack, and Woden members. The Dows Formation consists of upland glacial deposits and is subdivided into the Alden, Lake Mills, Morgan and Pilot Knob Members. The Noah Creek Formation includes coarse sand and gravel associated with outwash from the Des Moines Lobe. The Noah Creek Formation includes 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 eolian materials are present along the the Shell Rock River valley as well as stringers on the IES surface. Eolian materials may also be intermittently present mantling most other mapping units, and are more abundant near stream valleys. Sheldon Creek Formation glacial deposits are undifferentiated and occur in northwest and north-central Iowa. The full extent of these deposits is still not fully understood. Pre-Illinoian glacial deposits in Iowa consist of two formations: the younger Wolf Creek Formation and the Alburnett Formation. The Wolf Creek is divided into the Winthrop, Aurora, and Hickory Hills members (oldest to youngest). The Alburnett Formation consists of several "undifferentiated" members.

Two bedrock mapping units (Devonian Shell Rock and Lithograph City) are exposed as outcrop in the map area. Bedrock outcrops occur along the Shell Rock River. The Devonian rocks are dominated by carbonates varying between limestone and dolomite, accompanied with minor shale. Based on lithologic features and fossils, uppermost bedrock of Devonian in the mapping area can be subdivided into, in descending order, the Shell Rock, Lithograph City, and Coralville formations (Witzke et al., 2010).

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Base map from USGS Northwood 7.5' Digital Raster Graphic (IGS GIS file DRGB29.TIF) which was scanned from the Northwood7.5' Topographic Quadrangle map, published by US Geological Survey in 1972
Topographic contours and land features based on 1971 aerial photography, field checked in 1972
Land elevation contours (10' interval).

Iowa Geological and Water Survey digital cartographic file Northwood_SurficialGeology2010.mxd, version 9/28/11 (ArcGIS 10.0)
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.