

# SURFICIAL GEOLOGIC MAP OF THE LIME CREEK AND WALL LAKE INLET (HUC 12) WATERSHEDS, SAC AND CARROLL COUNTIES, IOWA

Stephanie Tassier-Surine and Phil Kerr

Iowa Geological Survey, IHR-Hydroscience & Engineering, University of Iowa, Iowa City, Iowa

## INTRODUCTION

The Lime Creek and Wall Lake Inlet (HUC 12) watersheds are located in Sac and Carroll counties, Iowa, and include the towns of Wall Lake and Lake View. The area is unique in that it includes three landform regions: the Des Moines Lobe (DML), Northwest Iowa Plains (NIP) and Southern Iowa Drift Plain (SIDP), as well as three different till deposits (Wisconsin Episode Dows and Sheldon Creek formations and Pre-Illinois Episode till).

Iowa was glaciated at least seven times during the Pre-Illinois Episode (0.5 Ma to 2.6 Ma). Subsequent glaciation during the Wisconsin Episode deposited two till formations, the Sheldon Creek during the Middle Wisconsin (MW; ~29-55 ka) and the Dows during the Late Wisconsin (LW; ~14-18 ka). Both of these Wisconsin glaciers advanced from the north and the terminal positions (moraines) for both are evident in the mapping area. This landscape experienced a periglacial climate (~15-26.5 ka) that impacted the northern portion of the mapping area. Permafrost and its subsequent melting resulted in significant erosion and reworking of glacial deposits. Peoria Formation loess deposits, wind-blown material sourced from glacial outwash, mantles much of the landscape and was deposited between 18-25 ka.

These glacial advances and associated processes shaped the landscape in the map area. Pre-Illinoian deposits comprise the lowermost till and these older deposits are the uppermost till in the southwestern part of the map area. Middle Wisconsin Sheldon Creek deposits overlie the Pre-Illinoian till in most of the map area, and are subsequently overlain by the Late Wisconsin Dows Formation. In the central portion of the map area, including the NIP and part of the SIDP, the Sheldon Creek is the uppermost till. Along the SIDP, these till deposits are mantled with loess, but farther north (including the NIP and DML landform regions) loess deposits are thin or absent. The NIP was heavily impacted by a periglacial environment during the Wisconsin Episode. Significant erosion and deflation occurred across this surface. The youngest advance, depositing the Dows Formation, still exhibits surface features indicative of glaciation and are designated as three different mapping units: till ridge, till plain, and till plain with discontinuous elongated hummocky ridge forms.

The close proximity to more than one glacial margin resulted in a complex geologic history for the region. Geomorphic, stratigraphic, and lithologic evidence provide insight into the sequence of events. In addition to the ordering and timing of glacial deposits, the glacial advances had a significant influence on the drainages in the map area. The Boyer River is known to have carried glacial meltwater during the last glacial advance into Iowa. Presumably, Lime Creek was also carrying meltwater at one time. These drainages were likely rearranged during the most recent glacial advance, whereby the Des Moines Lobe ice blocked drainages in the mapping area. Black Hawk Lake, which sits behind the terminal position of the Des Moines Lobe ice advance, also resulted from a blocked drainage. Eighteen cores (totaling 571') were collected in and adjacent to the mapping area.

## DESCRIPTION OF MAP UNITS

### QUATERNARY SYSTEM

#### HUDSON EPISODE

**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, stratified silty clay loam, clay loam, loam to sandy loam alluvium and colluvium in stream valleys, on hill slopes, and in closed depressions. May overlie Pre-Illinoian, Middle Wisconsin, or Late Wisconsin glacial till, Peoria Formation loess, or Noah Creek Formation sand and gravel. Associated with low-relief modern floodplains, closed depressions, modern drainageways or toeslope positions on the landscape. Seasonal high water table and potential for frequent flooding.

**Qo** - **Wetlands and Depressions** (DeForest Formation-Woden Member) Generally 2.5 to 6 m (8-20 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 gray, calcareous, loam diamiction (Dows or Sheldon Creek formations) or sand and gravel (Noah Creek Formation). Associated with low relief features that occupy depressions and riparian zones. Supports wetland vegetation and can be permanently covered by water. High water table.

**Qaf** - **Alluvial fan** (DeForest Formation-Corription Member) Variable thickness of 2 to 5 m (7-16 ft) of dark brown to yellowish brown, noncalcareous, silt loam to loam with interbedded lenses of fine sand and silts. A pebble lag is commonly found at or near the fan surface. Overlies thick sand and gravel of the Noah Creek Formation. Steep angled fans occur at the base of low order drainages and colluvial slopes.

#### WISCONSIN EPISODE

**Qnw** - **Sand and Gravel** (Noah Creek Formation) Generally 3 m (10 ft) to greater than 15 m (49 ft) thick, but there may be significantly thinner coarse-grained deposits in smaller stream valleys. Yellowish brown to gray, poorly to well sorted, massive to fine stratified, coarse to fine feldspathic quartz sand, pebbly sand, and gravel. On the modern floodplain it is buried by DeForest Formation alluvium. In the map area the unit overlies middle Wisconsin-age Sheldon Creek Formation or Pre-Illinoian till. This unit encompasses outwash deposits that accumulated in valley trains during the Wisconsin Episode. Significant modification of this unit may have occurred by quarry operations in the map area.

**Qsc2** - **Periglacial Sediments Shallow to Glacial Till** (unnamed erosion surface sediment) Generally 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 2 m (6 ft) of Peoria Formation (silt or sand facies). Overlies massive, fractured, slightly fine grained till of the Sheldon Creek Formation.

**Qtr-bm** - **Till Ridge** (Dows Formation-Morgan Member) This landform is associated with the Bemis Moraine. 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 diamiction; textures can be quite variable. Overlies gray, calcareous, massive, dense loam diamiction (Dows Formation-Alden Member). The Alden Member in this mapping unit rarely extends to depths greater than 12 to 15 m (39-49 ft), and overlies the Sheldon Creek Formation diamiction. 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. Seasonal high water table.

**Qtp-bm** - **Till Plain** (Dows Formation-Morgan Member) Less than 9 m (30 ft) of yellowish brown, often calcareous and fractured, stratified loam to silt loam to sandy loam diamiction; textures can be quite variable. Overlies gray, calcareous, massive, dense loam diamiction (Dows Formation-Alden Member). The Alden Member in this mapping area is generally 8 to 20 m (26-66 ft) thick and overlies either the Sheldon Creek Formation or Pre-Illinoian diamiction. Low to moderate relief (3 to 8 m), undulating plains with irregular surface patterns. Seasonal high water table.

**Qtp1** - **Till Plain with Discontinuous Elongated Hummocky Ridge Forms** (Dows Formation-Morgan Member) Indistinct elongated hummocks are oriented transverse to glacier flow on the till plain with irregular shaped surface patterns. Ridges are predominantly low relief (less than 3 m) with some moderate relief features (3 to 8 m). Overall landform exhibits well and swale topography. Less than 4 m (13 ft) of yellowish to grayish brown, calcareous, fractured, stratified loam to silt loam to sandy loam diamiction; textures can be quite variable. Overlies gray, calcareous, massive, dense loam diamiction (Dows Formation-Alden Member). The Alden Member in this mapping area is generally 8 to 20 m (26-66 ft) thick and overlies the Sheldon Creek Formation or Pre-Illinoian diamiction. Low relief, (less than 3 m of local relief), slightly undulating plains with irregular surface patterns. Seasonal high water table.

**Qps** - **Loess** (Peoria Formation-silt facies) Generally 3 to 9 m (10-30 ft) thick, but may exceed 12 m (39 ft) in the southern portion of the map area. Yellowish to grayish brown, massive, jointed calcareous or noncalcareous silt loam. Limited areas of fine eolian sand may be present near major river valleys. Overlies a grayish brown to olive gray silty clay loam to silty clay (Pisgah Formation—eroded Farmdale Geosol) which is less than 1.5 m (5 ft) thick. The Farmdale may be welded to an older Sangamon Geosol developed in loamy glacial till of the Wolf Creek or Alburnett formations. This mapping unit encompasses upland divides, ridgetops and convex sideslopes. Well to somewhat poorly drained landscape.

**Qps-sc** - **Loess** (Peoria Formation-silt facies) Generally 3 to 9 m (10-30 ft) thick, but may exceed 12 m (39 ft) in the southern portion of the map area. Yellowish to grayish brown, massive, jointed calcareous or noncalcareous silt loam to silty clay loam. Limited areas of fine eolian sand may be present near major river valleys. The Farmdale may be welded to an older Sangamon Geosol developed in loamy glacial till of the Sheldon Creek Formation. This mapping unit encompasses upland divides, ridgetops and convex sideslopes. Well to somewhat poorly drained landscape.

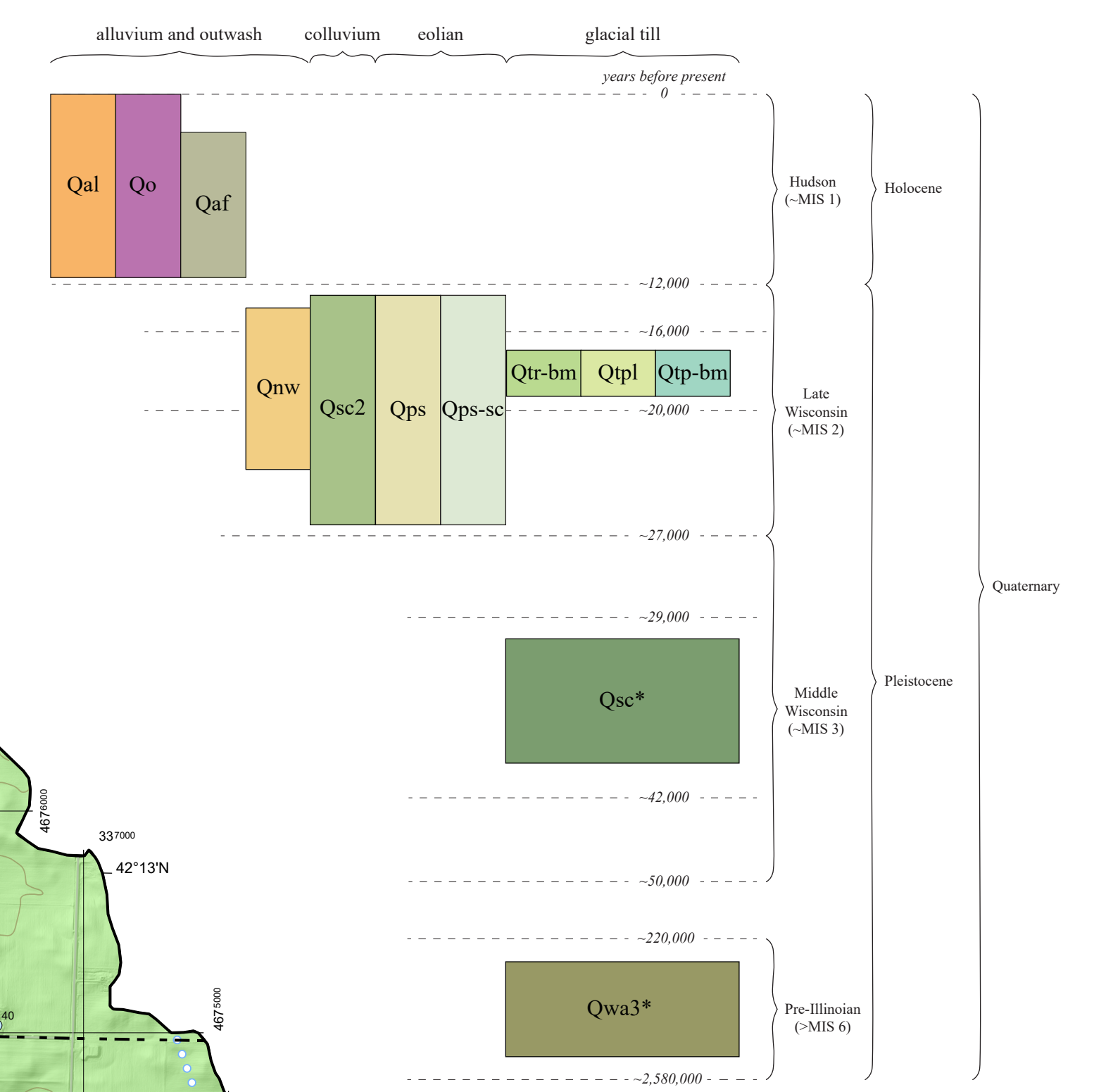
#### MIDDLE WISCONSIN EPISODE

**Qsc** - **Glacial Till** (Sheldon Creek Formation-Undifferentiated) Generally 3 to 15 m (10-49 ft) of 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. The presence of Pierre Shale clasts is common. This unit overlies Pre-Illinoian diamiction and is only shown on the cross-section.

#### PRE-ILLINOIS EPISODE

**Qwa3** - **Till** (Wolf Creek or Alburnett formations) Over 50 m (164 ft) of very dense, massive, fractured, loamy glacial till of the Wolf Creek or Alburnett formations. This unit is buried by diamiction of the Sheldon Creek, Dows, or Peoria formations and is shown only on the cross-section.

## CORRELATION OF MAP UNITS



\*Map unit is not represented at surface and underlies other units across the map area. Unit is shown only on the cross-section.

## LEGEND

### Map Symbols

- Water well with total depth
- Stratigraphic core
- Unit contact
- Elevation contour
- Cross-section
- Water body
- River/stream

### Glacial Features

- Glacial limit, certain with name of glaciation
- Glacial limit, location inferred with name of glaciation
- Meltwater flow
- Cutbanks of glacial meltwater
- 'Washboard' moraine
- Moraine ridge

### Road Classification

- U.S. Route
- State Route
- Local road

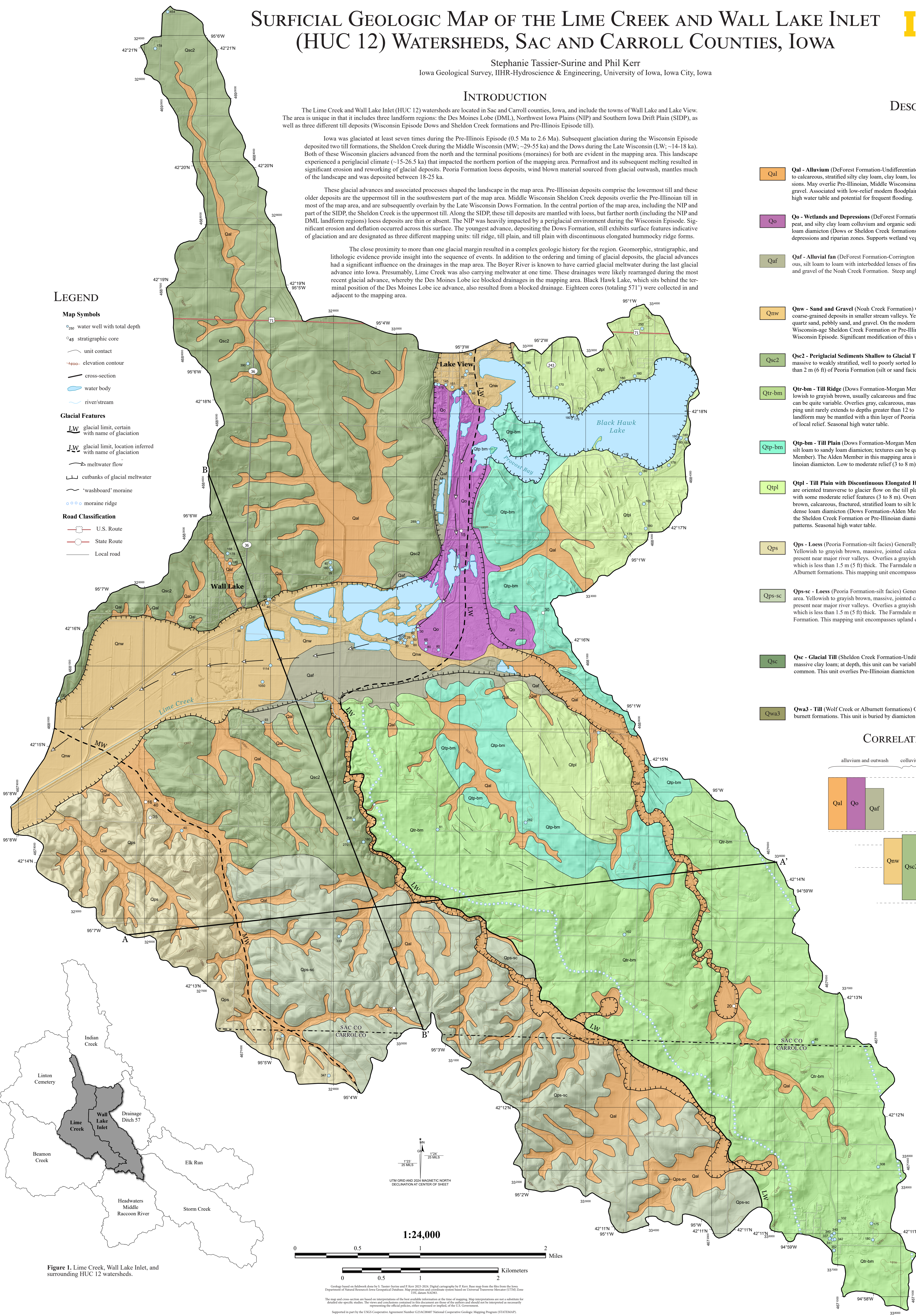


Figure 1. Lime Creek, Wall Lake Inlet, and surrounding HUC 12 watersheds.

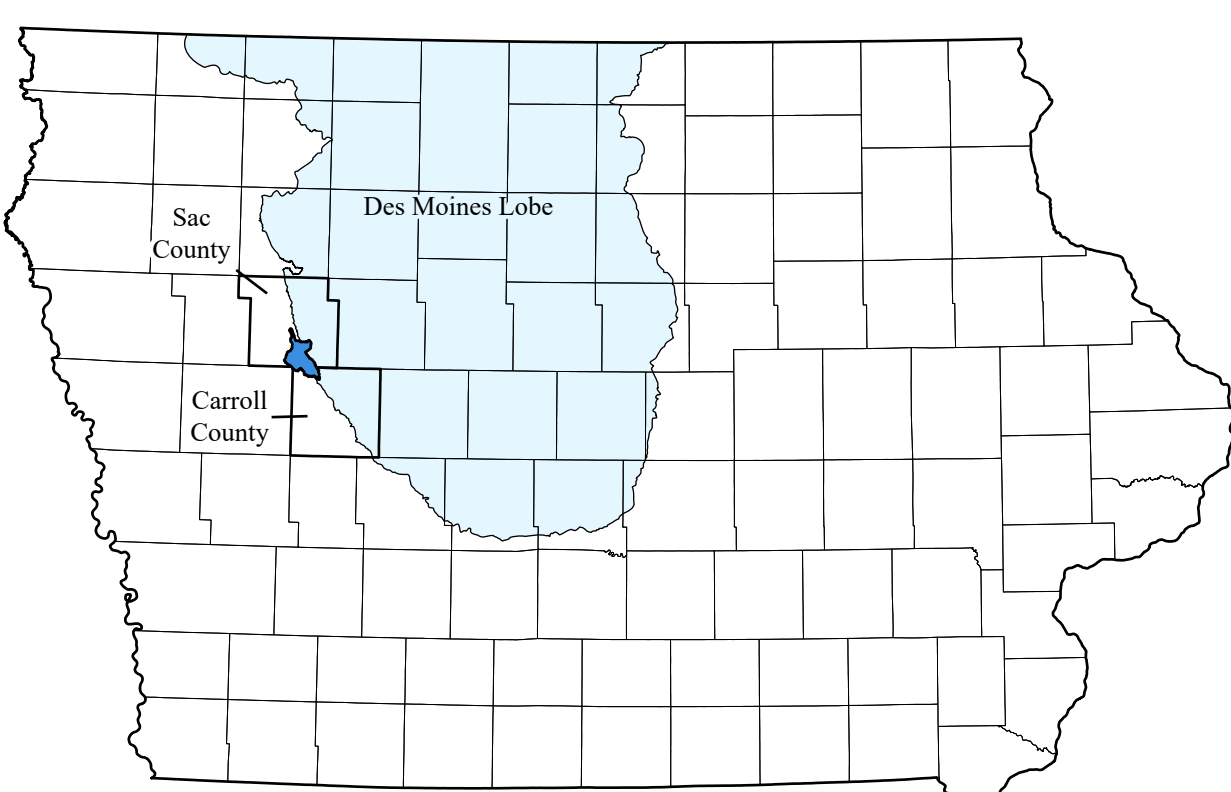
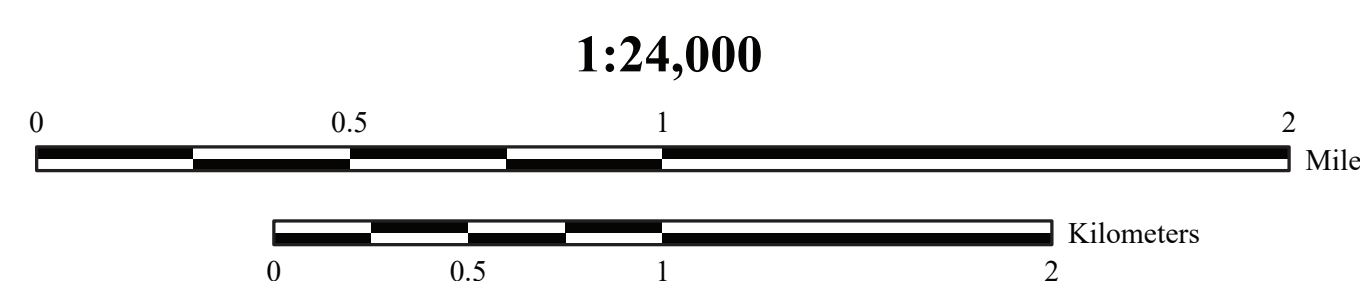


Figure 2. The mapping area (dark blue), Iowa counties, and the Des Moines Lobe.



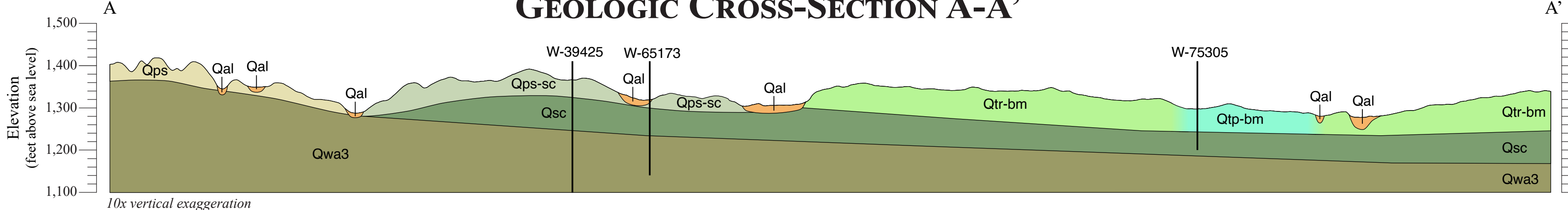
UTM GRID AND 2011 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

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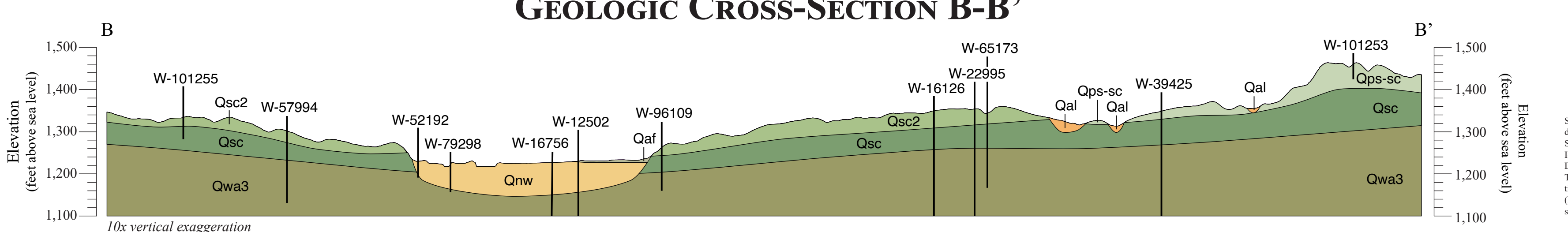
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## GEOLOGIC CROSS-SECTION A-A'



## GEOLOGIC CROSS-SECTION B-B'



**Cross-Section Legend**  
W-75305 GeoSams sampling point  
Contact  
Gradual lateral contact

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