Surficial Geology of Grayslake Quadrangle

Lake County, Illinois

Department of Natural Resources
ILLINOIS STATE GEOLOGICAL SURVEY
William W. Shilts, Chief

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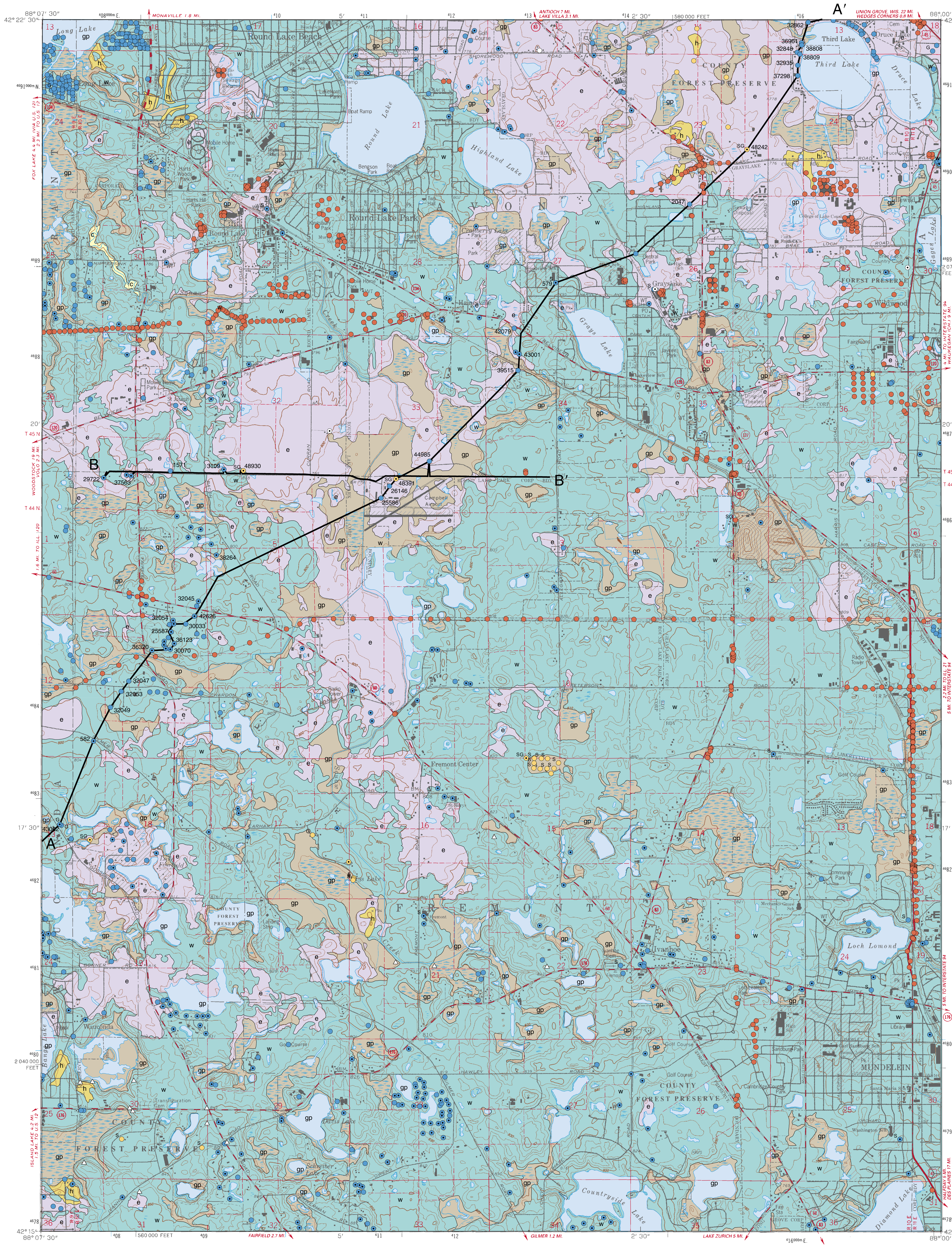
2004

Illinois Preliminary Geologic Map
IPGM Grayslake-SG



QUATERNARY DEPOSITS

Geologic Material Description[1]	Unit	Occurrence and Interpretation
HUDSON EPISODE (~12,500 years before present (B. P.) to today)		
Areas of disturbed earth and/or removed earth; grain size ranges from clay to gravel, and may include waste or other rubble.	Disturbed ground	**Human-disturbed deposits** found in gravel pits, retention ponds, earthen dams, other excavations and landfills; where possible, the original underlying sediments have been identified and mapped as one of the lithostratigraphic units described below.
Silt and clay; occasional sand lenses; brown to yellowish brown; loose to compact; may be mottled and gleyed; some bedding; organic-rich in places. Typical thickness: 5 to 20 feet.	Cahokia Formation c	**Postglacial (modern) alluvial deposits** present on active floodplains, natural levees; coarse deposits in channels, point bars, and tributary streams; derived mainly from eroded loess and diamicton; may overlie lacustrine silt and clay, and/or till; locally may include silty slopewash deposits in footslope locations.
Peat, muck and organic-rich sediment that may contain interbeds of silt, clay and some fine sand; black to dark brown; soft to firm; snail shells common. Typical thickness: 1 to 10 feet.	Grayslake Peat gp	**Organic deposits** accumulated in low-lying depressions, drainage-ways, and on floodplains; may include small areas of open water; locally intertongued with modern alluvium, or lake sediment; commonly found around lakes and marshes and channels connecting bodies of water; includes some areas where thin lenses of organic-rich sediments occur at shallow depths within gleyed, silty lake sediments; locally, may include slopewash deposits.
WISCONSIN EPISODE (Late) (~25,000 years - 12,500 B.P.)		
Silt or clay; massive to bedded; dark gray to light gray; calcareous; soft to hard; compact; very fine and fine sand may occur along bedding planes; occasional inclusions and lenses of light gray to white silt; very few clasts; generally abrupt upper and lower contacts. Typical thickness: 5 to 20 feet.	Equality Formation e	**Postglacial and glacial proglacial lake deposits** that infill low-lying areas, or depressions in drainage channels and on moraines; at the surface, these sediments may interfinger or be overlain by Cahokia alluvium; in the subsurface may be intertongued with till.
Sand and gravel; massive or stratified[2]; yellow to grayish brown; calcareous; loose; sand is fine to coarse, very well to poorly sorted; gravel is very fine to coarse, very well to very poorly sorted; minor amounts of silt and clay; locally may underlie Equality Formation. Typical thickness: 5 to 15 feet.	Henry Formation h	**Proglacial outwash deposits** exposed on the surface and found in kettled terraces, deltaic fans, and floodplains; may delineate the margin of stagnant ice.
Diamicton[3]; silty clay loam to silty clay; gray to yellowish brown; calcareous; compact; pebbly with occasional cobbles and boulders; commonly contains silt and sand inclusions and sand and/or gravel lenses; may contain pebble-free, silty and clayey zones with strongly expressed laminations interbedded with the diamicton; lenses of saturated silt and very fine sand are loose and runny; may be underlain by sand of the Henry Formation (unnamed tongue). Typical thickness: 80 to 150 feet.	Wadsworth Formation w	Subglacial and ice-marginal sediment (**till**) deposited from "Wadsworth" glacial ice; sediment that melted out on top of the glacier or along the ice margin was reworked by slope processes and water; laminated sequences may be more than 40 feet thick, but their areal extent is irregular and difficult to delineate; included in this mapping unit are thin and discontinuous accumulations of silty sediment deposited postglacially along ephemeral drainage ways in hummocky topography.
Sand; massive or stratified; light reddish brown to grayish brown; calcareous; sand is typically fine-grained; contains some silt beds; moderately well sorted; sometimes water-bearing. Typical thickness: 10 to 40 feet.	Henry Formation unnamed tongue (cross sections only) h(w)	**Proglacial outwash** deposited in front of "Wadsworth" glacial ice; the unit is discontinuous throughout the area.
Diamicton; very cobbly sandy loam to silty loam; yellowish brown to brown; calcareous; hard; commonly underlain by sand and gravel of the Henry Formation (Beverly tongue). Typical thickness: 0 to 50 feet.	Haegar Member Lemont Formation (cross sections only) l-h	Subglacial and ice-marginal sediment (**till and reworked sediment**) deposited during the advance of "Haegar" glacial ice; locally, the upper contact is difficult to distinguish when overlain by outwash of the Henry Formation; locally eroded, or intertongued with Henry Formation (Beverly tongue).
Sand and gravel; massive or stratified; light brown to grayish brown; calcareous; sand is typcially medium-grained; well sorted; commonly water-saturated; often diffuse and grades into sandy diamicton or laminated sand, silt and clay. Typical thickness: 20 to 80 feet.	Beverly Tongue Henry Formation (cross sections only) h-b	**Proglacial outwash** deposited in front of "Haegar" glacial ice; may lie adjacent to or intertongue with Haegar Member till and Equality sediments; unit thins towards the south and east; very productive aquifer.
Silt and clay; bedded to massive; dark gray to light brown; calcareous; typically medium to hard, but softer when moist; compact; contains beds of very fine to fine sand; some dropstones; some intervals are glacier deformed; generally abrupt upper and lower contacts. Typical thickness: 5 to 80 feet.	Equality Formation unnamed tongue (cross sections only) e(l-h)	Glacial **proglacial lake deposits** that were deposited in front of "Haegar" or "Tiskilwa" glacial ice; may lie adjacent to or intertongued with outwash of the Henry Formation (Beverly tongue); locally eroded.
Diamicton; pebbly loam to clay loam; light reddish brown to dark gray; calcareous; hard; some cobbles and boulders; contains discontinuous beds of stratified sand, silt, or clay. Typical thickness: 5 to 40 feet.	Tiskilwa Formation (cross sections only) t	Subglacial and ice-marginal sediments (**till and reworked sediment**) deposited from "Tiskilwa" glacial ice; discontinuous unit in the subsurface; where present, it lies either directly on bedrock or older sediments.
WISCONSIN AND SANGAMON EPISODES (~130,000 - ~25,000 years B.P.)		
Sand, gravel, diamicton, or silt; pebbly; sandy loam to silty clay loam; light reddish brown to grayish brown; calcareous; composite unit very variable in texture and character; compact and hard; silt is massive to crudely stratified with some pebbles; sand and gravel is mostly composed of dolomite clasts with some "exotic"[4] igneous pebbles. Typical thickness: 5 to 30 feet.	Older sediment undifferentiated (cross sections only) os	Includes stratified glacial lake sediments, older diamicton and outwash, and weathered bedrock.

PRE-QUATERNARY DEPOSITS

Geologic Material Description	Unit	Occurrence and Interpretation
SILURIAN PERIOD (~443 to 416 million years B.P.)		
Rock; predominantly dolomite overlain locally by shale; upper surface is commonly fractured with crevices and solution cavities; some oil staining.	Bedrock (cross sections only)	**Bedrock** buried by ~180 to 320 feet of Quaternary sediments.

[1] within each unit, the components are listed in order of decreasing abundance.
[2] ***stratified*** deposits are those formed, arranged, or laid down in layers or strata.
[3] ***diamicton*** is a name for a unsorted or poorly sorted sedimentary deposit that contains a wide range of particle sizes, such as a till, which is composed of clay, silt, sand, gravel, cobbles, and boulders.
[4] ***exotic*** is a term used to describe rock fragments of a lithology that is unrelated to the local bedrock where they are found. They have been transported by glaciers and/or glacial meltwaters from their outcrop locality. In this instance, these pebbles were carried by glaciers and meltwater from their source rock outcropping to the northeast.

Data Type

- △ Outcrop in field notes (ISGS archives)
- Stratigraphic boring
- Water well
- Engineering boring
- Other boring
- SG Boring with samples (S) or geophysical log (G); dot indicates to bedrock
- Contact
- Inferred contact
- A—A′ Line of cross section
- Water

Note: Numeric labels indicate the county number, a portion of the 12-digit API number on file at the ISGS Geological Records Unit.

Base map compiled by Illinois State Geological Survey from digital data provided by the United States Geological Survey. Topography compiled from aerial photographs taken 1958. Field checked 1960. Revised from aerial photographs taken 1988. Field checked 1992. Map edited 1993.

North American Datum of 1983 (NAD 83)
Projection: Transverse Mercator
10,000-foot ticks: Illinois State Plane Coordinate system, east zone (Transverse Mercator)
1,000-meter ticks: Universal Transverse Mercator grid system, zone 16

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Stumpf, A.J., 2004, Surficial Geology of Grayslake Quadrangle, Lake County, Illinois: Illinois State Geological Survey, Illinois Preliminary Geologic Map, IPGM Grayslake-SG, 1:24,000.

SCALE 1:24,000
1 1/2 0 1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 .5 0 1 KILOMETER

BASE MAP CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

Released by the authority of the State of Illinois: 2004

Mapping based on the analysis of soils data and driller's logs, fieldwork by A. Stumpf and M. Barnhardt completed between 2002–2004, and ISGS archived field notes submitted from 1934–1969.

Less than 10% of map polygons field-checked.

Digital cartography by M. Barrett, Illinois State Geological Survey.

This Illinois Preliminary Geologic Map (IPGM) is a lightly edited product, subject to less scientific and cartographic review than our Illinois Geological Quadrangle (IGQ) series. It will not necessarily correspond to the format of IGQ series maps, or to those of other IPGM series maps. Whether or when this map will be upgraded depends on the resources and priorities of the ISGS.

CENTRAL GREAT LAKES GEOLOGIC MAPPING COALITION

ILLINOIS DEPARTMENT OF NATURAL RESOURCES

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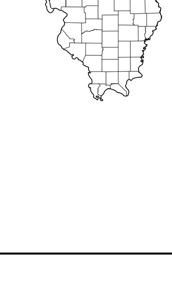

1	2	3
4		5
6	7	8

ADJOINING QUADRANGLES
1 Fox Lake
2 Antioch
3 Wadsworth
4 Wauconda
5 Libertyville
6 Barrington
7 Lake Zurich
8 Wheeling

2½°
TRUE NORTH
MAGNETIC NORTH
APPROXIMATE MEAN DECLINATION, 2004

ROAD CLASSIFICATION

- Primary highway, hard surface
- Secondary highway, hard surface
- Light-duty road, hard or improved surface
- Unimproved road
- 64 Interstate Route
- 50 U.S. Route
- 158 State Route

Introduction

The surficial geology map of the Grayslake 7.5-minute Quadrangle, Lake County was developed for the United States Geological Survey's "STATEMAP", National Cooperative Geologic Mapping Program with support from the Central Great Lakes Geologic Mapping Coalition (CGLMGC). The initial purpose of this mapping is to provide geological information for Illinois land use development and management. The Grayslake Quadrangle is located in northeastern Illinois and encompasses part of Lake County that includes the city of Mundelein, the villages of Grayslake, Round Lake Beach, Round Lake Park and Wauconda, and also unincorporated areas. The map area is located within the watersheds of the Des Plaines and Fox River systems.

The surficial geology map and accompanying cross sections delineate geologic materials (formally called lithostratigraphic units) that are classified by their lithology (sediment type or rock type) and stratigraphy position. The stratigraphic nomenclature used here is from Willman and Frye (1970) and Hansel and Johnson (1996). Lithostratigraphic units in northeastern Illinois have a complex but mappable pattern of occurrence. The surficial geology map shows the distribution of geologic units at the land surface that occur in a specific, or stratigraphic, succession in the subsurface.

The surficial geology map, together with information on the subsurface distribution of geologic materials, is necessary to identify opportunities and limitations for future development as well as determining likely consequences of past and future land-use decisions. The unique value of a surficial geology map springs from the wide variety of relevant interpretations that it supports for addressing societal and scientific issues. The surficial geology map is a basis upon which other derivative maps are produced for specific purposes such as assessment of groundwater resource potential, mineral resources, and geologic hazards.

Regional Setting

The Quaternary geology of the Grayslake Quadrangle is predominantly the result of continental glaciers and glacial meltwater of the last (Wisconsin Episode) glaciation. The Quaternary deposits, ranging from 140 to 350 feet thick, represent at least three major glacier advances that occurred between about 25,000 and 12,500 yr. B.P. (radiocarbon years before present). Lithologically distinct diamictons interpreted to be tills comprise units of the Tiskilwa, Lemont (Haeger Member), and Wadsworth Formations that were deposited by the Lake Michigan lobe during three events (Hansel and Johnson 1996). Meltwater generated from the glaciers drained through subglacial channels or in rivers flowing away from the ice. Where glaciers or sediment blocked drainage in front of and on top of the ice, the meltwater was ponded forming lakes. The proglacial fluvial deposits present between the tills of the three events are classified as tongues of the Henry Formation (fig. 1).

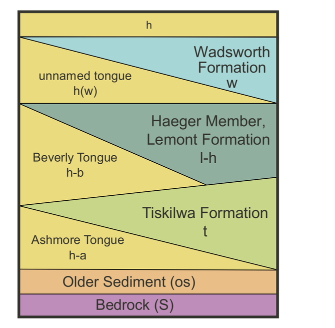

Figure 1 Stratigraphic framework for Lake County displaying the intertonguing between Henry Formation outwash (yellow) and Wisconsin episode till units (green).

Mapping Techniques

The surficial geology map is based largely on digitized soil maps (1:15,840-scale) for Lake County (NRCS 2004). Initially, mapping involved grouping individual soil series according to their parent material following a classification key in Soils of Illinois (Fehrenbacher et al. 1984). Following extensive fieldwork and data analysis, the parent material classes were then grouped into more general geologic material classes, comprising five surficial geology mapping units, following Hansel and Johnson (1996). This process reduced the number of map units to a level that would be discernable on a 1:24,000-scale map (greater than 5 acres in size).

Fieldwork undertaken for this mapping included describing natural and man-made exposures, drilling of test stratigraphic boreholes and hand-augering, and undertaking geophysical surveys and gamma-logging. Continuous cores to depths ranging from 20 to 311 feet were acquired at 21 sites on a variety of geomorphic positions to examine landform-sediment relationships. Natural gamma logs collected in eleven drill holes (including ISGS stratigraphic boreholes, engineering structural test holes and private water wells) provide a semi-quantitative measure of the texture and mineralogy of unconsolidated sediments lying above bedrock. Over three line-miles of seismic reflection data (see cross section B–B') was acquired to determine the nature of near-surface deposits and depth to bedrock. These data were augmented with geologic information from drilling logs of engineering and water-well borings, previously completed maps, LIDAR elevation data, a wetland survey (Lake County Illinois GIS, 1993), and aerial photographs to validate the surficial mapping units.

It is assumed that the thickness of each surficial geologic unit is at least 5 feet (the minimum depth that soil mappers auger), unless drilling, field observations, or records suggest otherwise. The map legend provides additional information on the character, thickness, and occurrence of materials encountered in different geologic mapping units.

Unit Characterization and Stratigraphic Relationships

The surface diamicton unit in the map area, the Wadsworth Formation, forms a hummocky morainal upland comprising segments of the Valparaiso Morainic System and the Tinley Moraine west of Lake Michigan (fig. 2). The diamicton is fairly uniform, however, it can also be comprised of interbeds of sorted material (glacial river and lake sediments), suggesting that materials deposited by debris-rich ice were significantly reworked at the margin and under the ice sheet. Although predominantly fine-grained, the upper part of the diamicton may have a sandier texture, especially at the base of slopes or in depressions on the uplands, where it has been modified by slope processes or water.

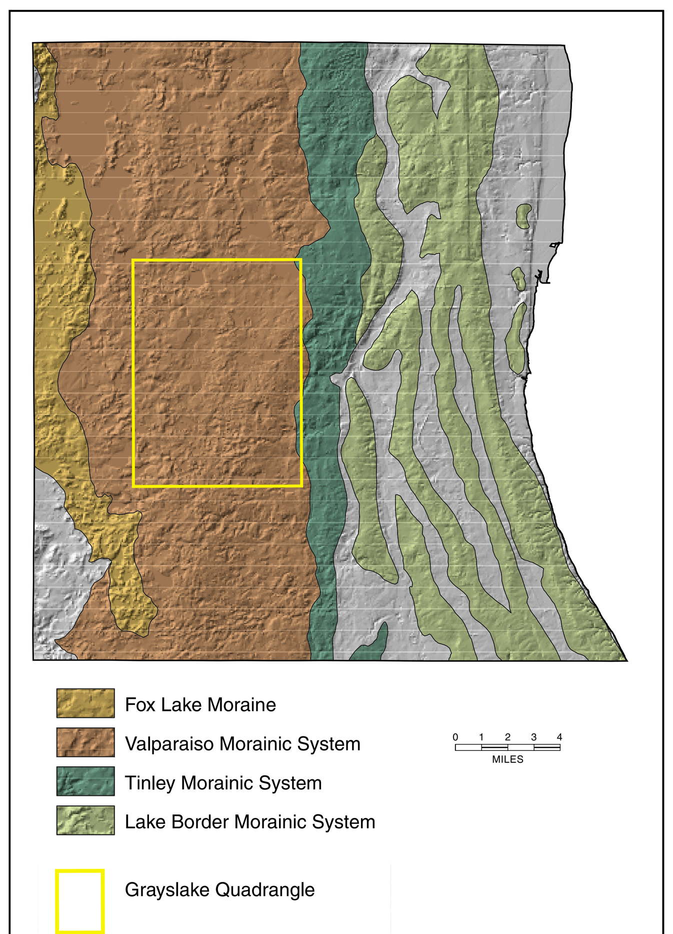

Figure 2 Surface topography and moraines of Lake County.

Outwash sand and gravel (Henry Formation) and modern river and stream sediments (Cahokia Formation) comprise the terrace and floodplain deposits along some of the larger streams in the county, but river deposits are generally sparse on this quadrangle.

Stratified silt or silty clay sediments are found on the land surface occupying broad low-lying areas along active/inactive drainageways connecting many of the lakes, and locally in shallow depressions or drainage channels on the morainal uplands. These laminated and bedded deposits, classified to the Equality Formation, are representative of sediments deposited in glacial lakes that developed during late glacial and postglacial times.

Sediments similar in character to Equality Formation deposits present at land surface were also encountered in the subsurface below diamicton of the Haegar Member. Here, these sediments are intertongued with this diamicton (fig. 3) and, also tongues of Henry Formation outwash. These deposits delineate areas where the drainage was blocked and meltwater ponded during either the advance of Haegar ice or the melting of Tiskilwa ice.

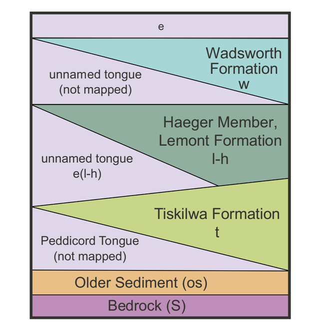

Figure 3 Stratigraphic framework for Lake County displaying the intertonguing between Equality Formation lacustrine (purple) and Wisconsin episode till units (green).

Occupying similar positions on the landscape as the Equality Formation sediments are deposits of peat, muck, and organic-rich silt. These deposits, mapped as Grayslake Peat, often compose thin lenses of organic material that lie above or are interfingered with gleyed silt and clay deposits of the Equality Formation. The Grayslake Peat also is present on morainal uplands adjacent to lakes and in deeper depressions where sediment and organic material has accumulated.

Acknowledgments

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Many individuals associated with this and other mapping projects in Lake County provided important information and services to the author including field assistance and drilling support, management of project databases, processing of digital data and compilation of basemaps, data entry, and technical review. ISGS staff V. Amacher, J. Aud, M. Barnhardt, M. Barrett, A. Dixon Warren, J. Domier, A. Hansel, J. Hutmacher, T. Larson, D. Luman, A. Pugin, S. Sargent, B. Stiff, C. Stohr, S. Wildman and C. Wilson, and undergraduate students K. Massey and G. Sanchez provided important information and services to the author to complete this mapping. The GIS and Mapping and Public Health Departments of Lake County, the USDA-NRCS, STS Consultants, Limited and Commonwealth Edison, Incorporated, provided access to digital databases and geologic data. The Lake County Forest Preserve and private landowners provided access to property for drilling.

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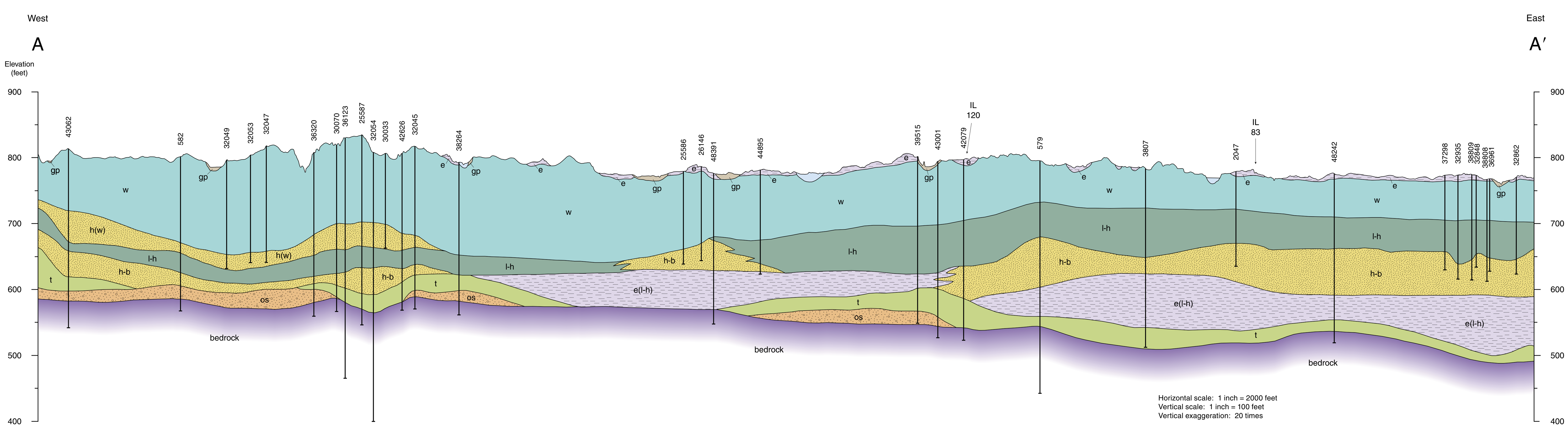

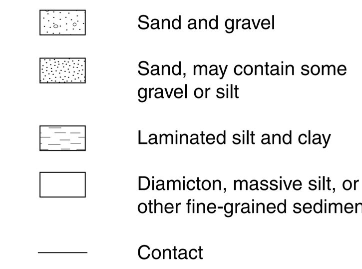

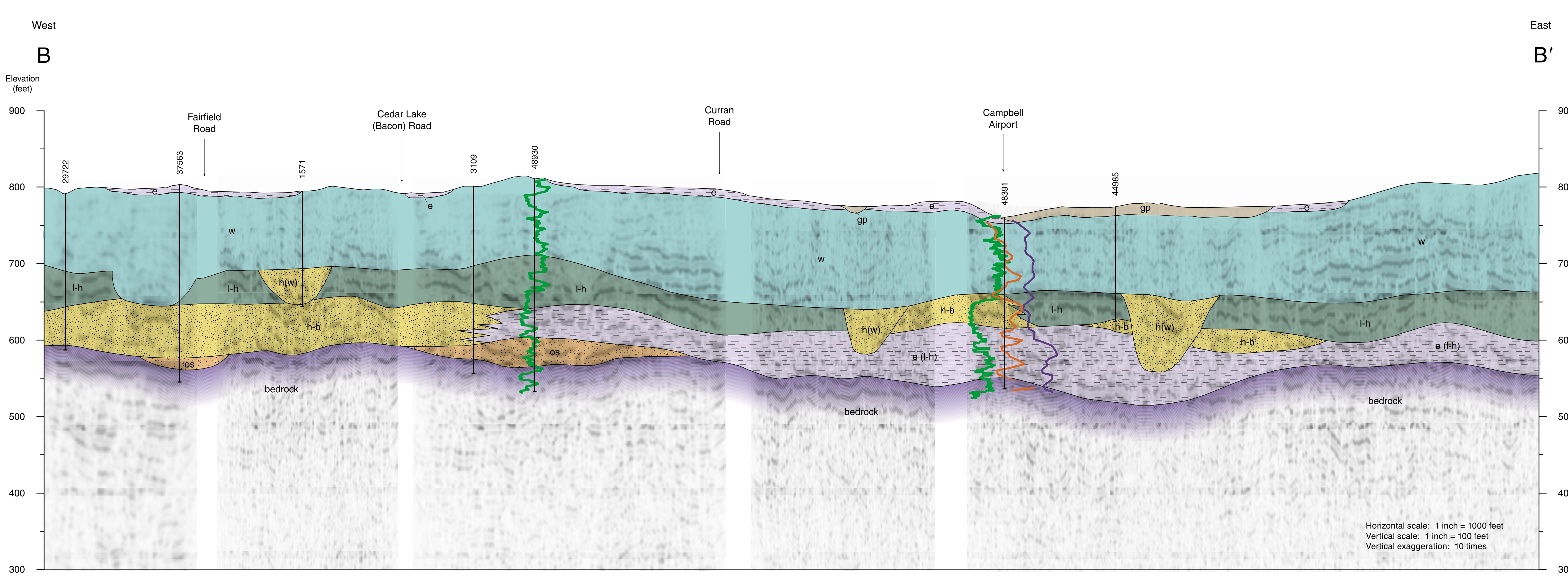

Surface geophysical profiling was completed in the Grayslake Quadrangle and included a vertical compressive wave (P-wave) seismic reflection survey along a 3½ mile stretch of Townline Road and velocity logs in one borehole using a three-component downhole geophone. Acquisition and processing of the P-wave seismic reflection data was accomplished using a 24-channel land-streamer. The velocity logs, S-wave (blue) and P-wave (red) provide essential time-to-depth conversion factors for the seismic reflection profiles. This calibration has been extended by correlating the seismic horizons with natural gamma logs (green) and existing, location verified, boreholes present near the seismic line.

The seismic section shows the presence of two major reflective surfaces that are calibrated as the top of bedrock (the average depth of which is greater than 200 ft) and the top of a till unit (Haegar Member, Lemont Formation) at a depth of about 100 ft. The surface of the Haegar till is truncated by trough-shaped erosional features that may be related either to the collapse of dead ice or the presence of tunnel channels. These troughs are filled with sand and gravel of the Henry Formation or diamicton and fine-grained sediment of the Wadsworth Formation.