SURFICIAL GEOLOGY OF THE FAIR HAVEN 7.5-MINUTE QUADRANGLE, CAYUGA AND WAYNE COUNTIES, NEW YORK

prepared by
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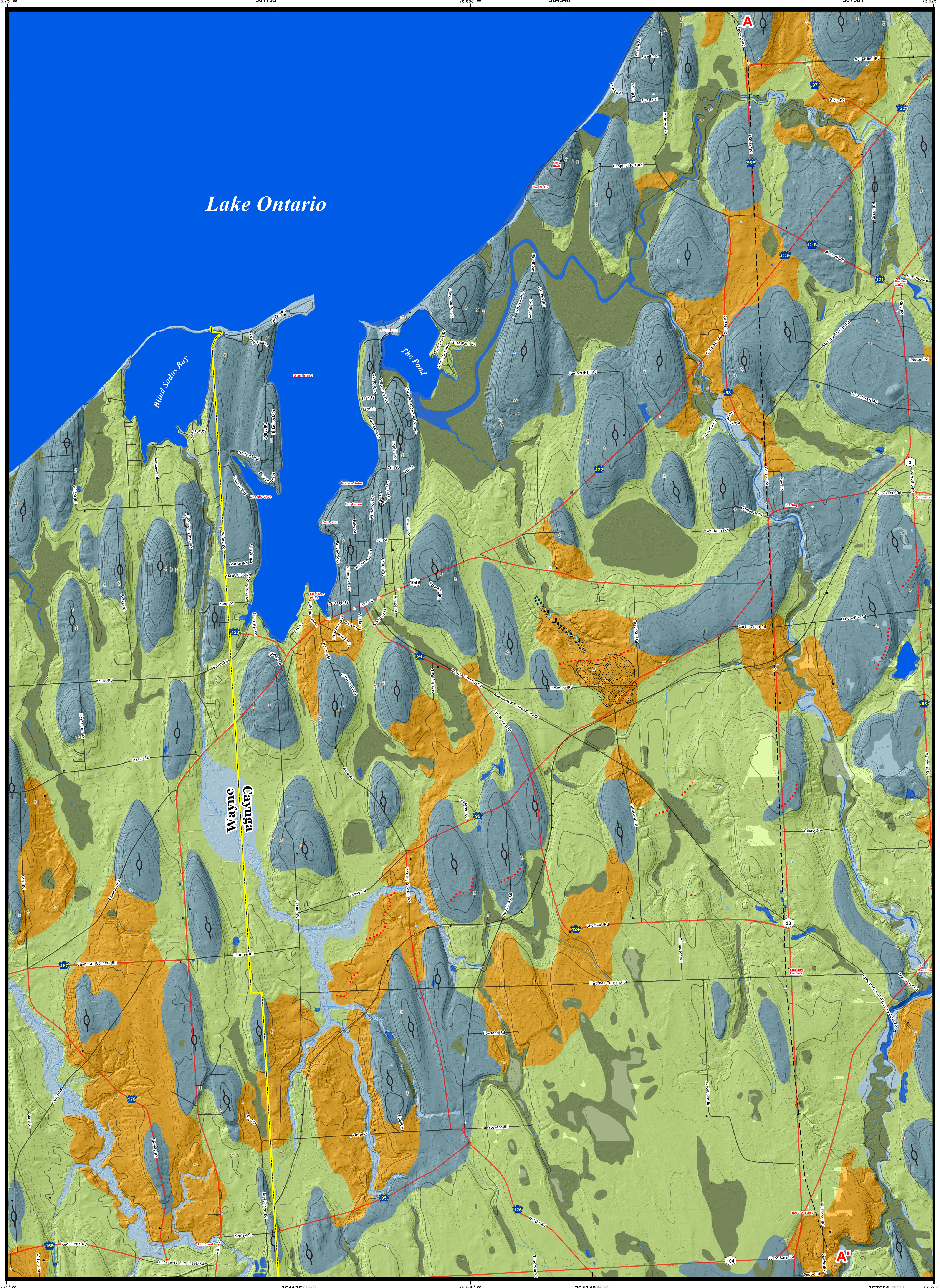


76.75° W

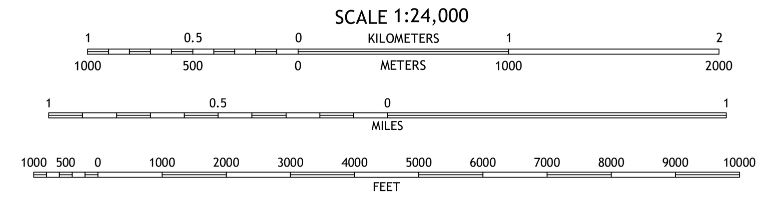
Universal Transverse Mercator, Zone 18 N
North American Datum of 1983

Hygrology, and planimetry layers from the New York State DOT Raster Quadrangle separates for Wayne, and Cayuga Counties (https://gis.ny.gov/gisdata/inventories/member.cfm?OrganizationID=108).
Geographic data layers from 2018 TIGER/Line shapes for transportation and hydrograpghy (https://www.census.gov/cgi-bin/geo/shapefiles/index.php)

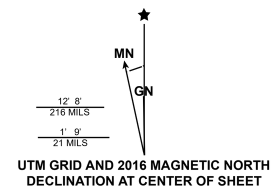
Shaded relief from FEMA's Great Lakes Oswego, Cayuga,and Wayne Counties 2-meter Lidar, and NYS 10m DEM (http://gis.ny.gov/elevation/index.cfm)

Magnetic declination from the NOAA online Declination Calculator: http://www.ngdc.noaa.gov/geomag-web/#declination

SCALE 1:24,000



Geologic mapping by B. Bird and A. Kozlowski 2013
Digital data and cartography, B. Bird and K. Backhaus, 2015 & 2018.



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2015

Introduction

The surficial geology of the Fair Haven 7 ½ minute quadrangle was mapped in 2014-15 as part of a National Cooperative Geologic Mapping Program funded StateMap project (award # G14AC00360). This map is part of a larger project of the New York Museum/New York State Geologic Survey to map all of Cayuga County, New York. The purpose of this map was to identify and delineate various surficial materials in the Fair Haven quadrangle with the intent that this information can guide municipalities in land use, environmental, and natural resource decisions.

The Fair Haven quadrangle is located in central New York along the shore of Lake Ontario at the northern border of Cayuga County. A narrow portion of the quadrangle is in Wayne County along the western boundary. Included are the towns of Sterling, Walcott, and Victory with the village of Fair Haven being the largest village. This portion of the county is rural with large tracts of forest and agriculture. Nearer the shore of Lake Ontario, many summer residences and large homes are common among large tracts of state and county owned parks and wildlife management areas.

Situated in the Ontario Lowlands physiographic province the landscape is generally subdue, rolling topography with the greatest elevation near 440 feet above sea level in the southeastern portion of the quadrangle and the Lake Ontario shore at 246 feet. Steep bluffs of glacial till mark the eroded remains of drumlins along the shore. These drumlins are testament to the glaciers that once covered the entire quadrangle, depositing accumulations of sediment in excess of 100 feet in many areas. Sediments include diamicton (interpreted as till), sorted clay, silt, sand, and gravel from glacial meltwater and glacial lakes and post glacial alluvium and wetland deposits. The lithologic units that comprise the quadrangle are highly variable in thickness and character although generally are expressed geomorphological as similar features. For instance the drumlins are generally diamicton.

No exposed bedrock was found at the surface in the Fair Haven quadrangle and according to various drilling logs the depth to bedrock ranges from 12 to 102 feet. At one location (FH13 on the map) there was a large amount of greenish gray shale exposed but the determination of whether it was an outcropping of rock or a large clast in the diamicton could not be made. The bedrock beneath the glacial sediments in the quadrangle is mapped as Ordovician and Silurian in age (Fisher et al, 1970). The northern area is underlain by undifferentiated Queenston formation of Ordovician age and Medina Group of Silurian age. The southern portion of the quadrangle is underlain by the Silurian aged Clinton Group. Drillers' logs indicate the bedrock is layered sedimentary rock ranging from shale to siltstone to sandstone and gray, green or red in color.

Surficial Map Units

The Fair Haven quadrangle is covered by a variety of sediment types deposited by the glacier directly, meltwater from the glacier or post-glacial streams and lakes. These can be grouped into five major categories including diamicton, sand and gravel, fine sand, silt and clay, recent organic deposits, and recent sand and gravel deposits. Fine grained sand, silt and clay cover the largest percentage of the quadrangle with diamicton and sand and gravel comprising the bulk of the rest.

Pdmm

This unit is a mixture of unsorted sediment ranging from clay to boulders. In the Fair Haven quadrangle all diamicton encountered is interpreted to be glacial till, sediment deposited directly by the glacier and can be upwards of 120 feet thick (Figure 1). Where exposed the diamicton is matrix supported with some stratification. Drillers' logs support this observation with notes of sand and silt layers within the diamicton. Color ranges from red to reddish brown to reddish gray to gray. Color seem somewhat dependent on depth as hand auger or surface samples are red to brownish red while the gray variants are deeper. Exposures along the buff exposures. Hand auger samples generally are sandier and less compact than bluff exposures which are very hard, over compacted with a larger percentage of fine silt and clay. This unit is associated with the drumlins in the area and research in this area supports the diamicton is till (Gentoso et al, 2012, Hopkins et al, 2014).

Plsc

This unit of bedded fine sand, silt, and clay covers about 40 percent of the quadrangle. The thickness of this unit is highly variable where drill logs indicate that this unit can be as thick as 45 feet while hand auger samples have encountered areas as thin as 2 feet thick over diamicton. It is interpreted that this material was deposited in glacial Lake Iroquois which would have flooded the entire landscape as the glacier retreated northward (Bird and Kozlowski, 2014). Fine sediment suspended in the lake would have settled across the area with thickest accumulations in the low areas between drumlins, thinning on the drumlins. When dry this unit can be classified as dense to very dense (stiff to very stiff for clay areas).

Psg

Although less abundant than the fine grained material the sand a gravel unit is widely distributed across the area (Figure 2). Characterized by stratified sand and gravel with occasional cobbles this unit is interpreted to be deposited by glacial meltwater at or very near the glacier and can be upwards of 80 feet thick. An esker/fan complex can be found between NY Route 104a and Simmons Road in the town of Sterling. This marks an area where the ice front would have stalled for some period of time and subglacial meltwater would have discharged from underneath depositing sand and gravel in the subglacial channel forming the esker and ahead of the glacier forming the fan. Other areas of stratified sand and gravel likely represent a similar environment without a well preserved esker/fan complex. Barrow pits are common in this unit with very limited large scale gravel mining

Ha and Hw

Post glacial sediments occupy the low areas and along the shoreline Engineering borings indicate this unit can be 25 feet thick in some areas. The organic sediments (Hw) are coincident with wetlands across the area while the alluvium (Hs) is associated with fluvial processes along Red Creek, Blind Sodus Creek, Sterling Creek, and Sterling Valley Creek. The modern shoreline is also classified as alluvium and ranges from sand to gravel to cobbles with occasional boulders. Large gravel, cobbles, and boulders eroded from the diamicton bluff are dominantly sedimentary in origin but do include some igneous and metamorphic. Shifting beach sands and gravels have formed baymouth bars across low areas between bluffs in turn creating wetlands separated from Lake Ontario. The spit partially across Little Sodus Bay is heavily

Conclusions

The pattern and character of surficial sediments in the Fair Haven quadrangle are a result of a retreating glacier across the area. The diamicton was deposited directly by the ice during advance and subsequent retreat of the glacier in the process forming drumlins. On the final retreat across the area copious amounts of meltwater flooded much central New York creating glacial Lake Iroquois. Wave action of glacial Lake Iroquois effectively eroded the drumlins nearer to shore and resulted in streamlined landforms with a flat top. The drumlins to the north were below wave base and escaped the erosive wave action. Fine sand, silt and clay washed into the lake from wave erosion of the drumlins and also from subglacial meltwater which then settled on the bottom of the lake. Large tracts of stratified sand and gravel deposits stretch across the quadrangle. These deposits likely were deposited as subglacial meltwater exited from beneath the glacier. South of Pond Hundred, east of Fair Haven, an esker/fan complex marks a location where ice stagnated for a period of time. Ice marginal positions on the map are better described as grounding lines as the margin was in contact with glacial Lake Iroquois. After the ice margin retreated and glacial Lake Iroquois drained, organic deposits began to build in the low, wet areas which still persist today.

Methods

For this map multiple methods were used to gather surface and subsurface data. For field mapping a two meter long hand auger was used to collect samples below the soil to refusal in 26 locations and another 21 samples were collected from excavated areas such as drainage ditches, road and stream cuts, and construction sites. Each of these locations was recorded with a global positioning system (Garmin 72H in NAD 81 UTM 18N coordinates) and the sediment encountered was noted. A field map of this information was created and is included as part of NYSGS Open File number 2gk478.

Water wells(30 total wells) from the Department of Environmental Conservation (NYDEC), New York Department of Transportation (NYDOT) borings(10) and engineering borings(8) from a proposed power plant site (Dames and Moore, 1977) were also used to decipher the subsurface of the Fair Haven quadrangle.

Working with the NYDEC water well records, the sediment lithologies were simplified from drillers' descriptions to more concise, uniform descriptions. The thickness of each lithology and bedrock depth was recorded and the location plotted. The uppermost layer under the topsoil was used to delineate the surficial geology while the stratigraphy was used to create a geologic cross section which extends north-south along the eastern margin of the map from A to A'. The same process was followed for the NYDOT and engineering borings.

Field data were digitized in ArcMap 10.2. Polygons were created based upon the lithology of the surface material and the sample and boring locations were plotted. The cross section was created using Adobe Illustrator CS6 with a topographic profile from ArcMap and wells and

Acknowledgments

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DESCRIPTION OF MAP UNITS

Holocene

Ha — **Stratified silt, sand and gravel (Ha)**
Sorted and stratified silt, sand, and gravel, deposited by rivers and streams. May include cobbles and boulders. Inferred as post-glaical alluvium and includes modern channel, over-bank and fan deposits

Hw — **Wetland Deposit (Hw)**
Peat, muck, marl, silt, clay or sand deposited in association with wetland environments. Various sediments can be present at transitional boundaries from one facies to another

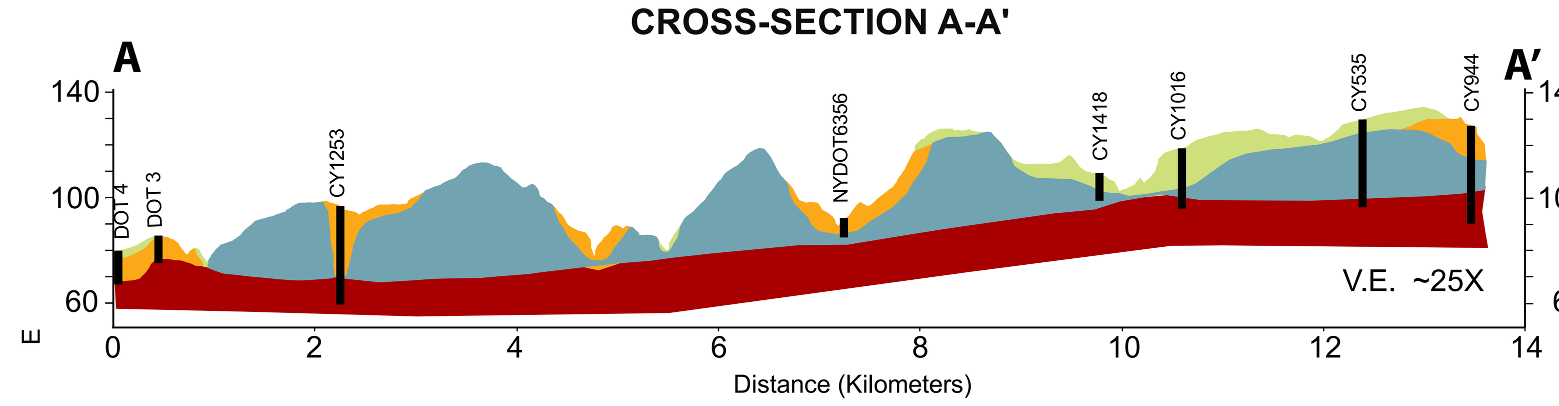
Pleistocene

Plsc — **Silt and Clay (Psc)**
Stratified, fine-grained sediment consisting of fine sand, silt and clay size particles. Inferred to be deposited in mid shore to deepwater settings of glacial lakes. May include marl, rythmites, and varves.

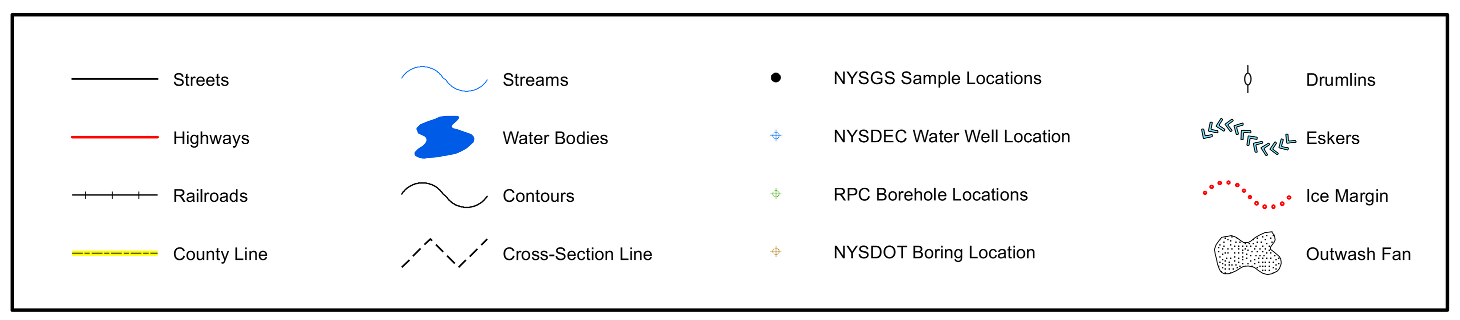
Psg — **Stratified sand and gravel (Psg)**
Well-sorted and stratified sand and gravel. May include cobbles and boulders. Inferred to be delta, fan or lag deposits in glacial channels or near ice margins.

Pdmm — **Diamicton (Pdmm)**
An admixture of unsorted sediment ranging from clay to boulders. Generally matrix supported, massive and clast-rich.

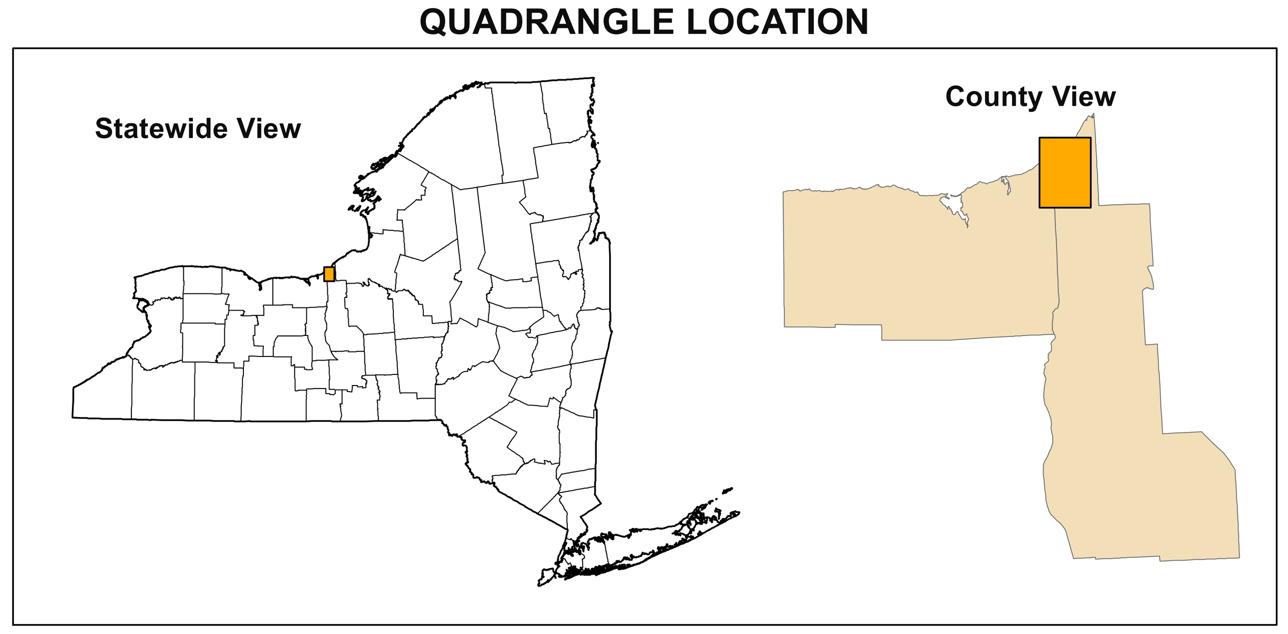
CROSS-SECTION A-A'



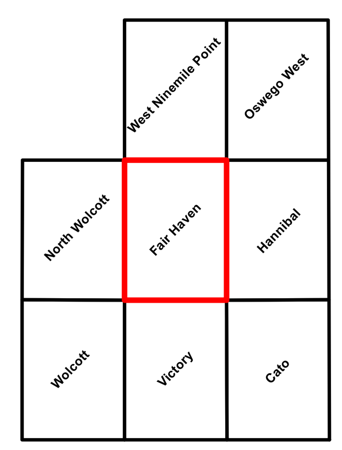
SYMBOLS



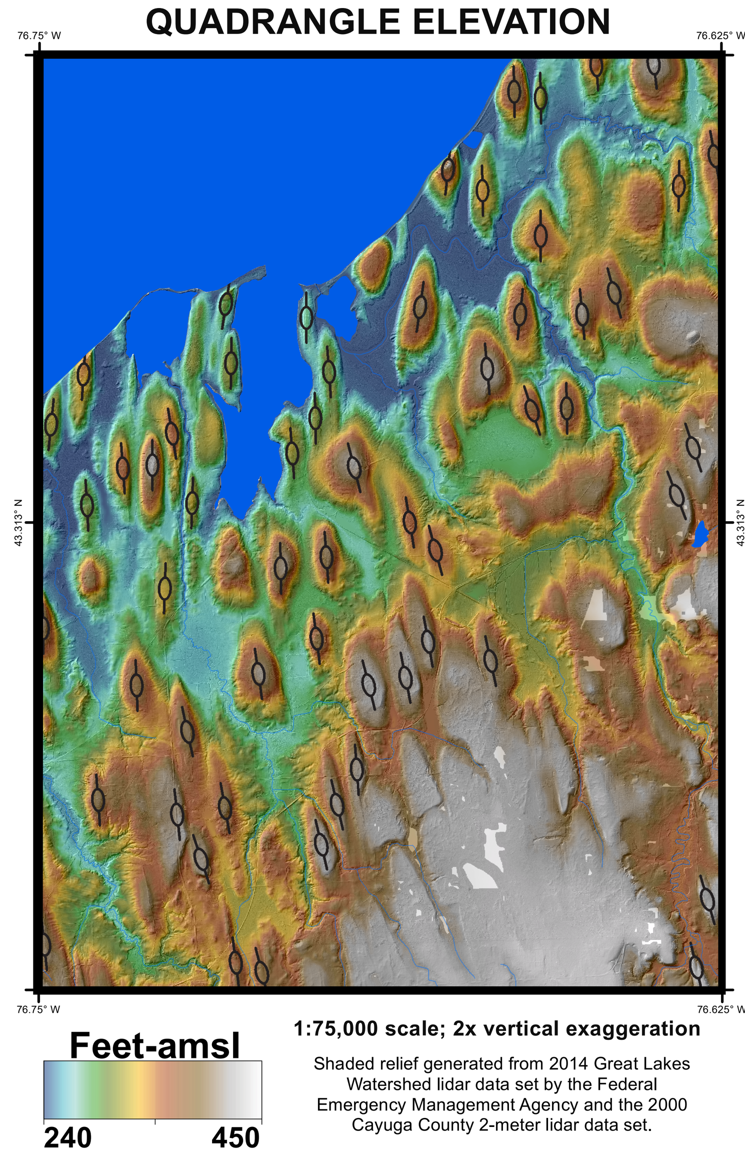
QUADRANGLE LOCATION



ADJOINING QUADRANGLES



QUADRANGLE ELEVATION



1:75,000 scale; 2x vertical exaggeration
Shaded relief generated from 2014 Great Lakes Watershed lidar data set by the Federal Emergency Management Agency and the 2000 Cayuga County 2-meter lidar data set.

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