U.S. Department of the Interior
National Park Service
Natural Resource Stewardship and Science Directorate
Geologic Resources Division

Delaware Water Gap National Recreation Area

GRI Ancillary Map Information Document

Produced to accompany the Geologic Resources Inventory (GRI) Digital Geologic Data for Delaware Water Gap National Recreation Area

dewa_surficial_geology.pdf

Version: 9/22/2021

Geologic Resources Inventory Map Document for Delaware Water Gap National Recreation Area

Table of Contents

Geologic Resources Inventory Map Document **1**
About the NPS Geologic Resources Inventory Program **3**
GRI Digital Maps and Source Map Citations **5**
Index Map 7
Map Unit List **9**
Map Unit Descriptions **12**
Qd - Dump (Recent) 12
Qsgp - Sand and gravel pit (Recent) 12
Qafl - Artificial fill (Holocene) 12
Qal - Alluvium (Holocene) 13
Qp - Peat (Holocene) 14
Qst2a - Stream-terrace deposits, younger and lower elevation (Holocene and late Wisconsinan) 14
Qst2 - Stream-terrace deposits, younger (Holocene and late Wisconsinan) 15
Qst - Stream-terrace deposits (Holocene and late Wisconsinan) 16
Qaf - Alluvial-fan deposits (Holocene and late Wisconsinan) 17
Qta - Talus deposits (Holocene and late Wisconsinan) 18
Qsc - Shale-chip colluvium (Holocene and late Wisconsinan) 18
Qac - Alluvium and colluvium (Holocene and late Wisconsinan) 19
Qs - Swamp and bog deposits (Holocene and late Wisconsinan) 19
Qem - End moraine (Pleistocene (Wisconsinan)) 20
Qgm - Ground moraine (Quaternary) 20
Qdm - Drumlinoid till ridges (Quaternary) 21
Qhm - Hummocky stagnation moraine (Quaternary) 21
Qlm - Lateral moraine (Quaternary) 21
Qst3 - Stream-terrace deposits, older (Holocene and late Wisconsinan) 21
Qba - Boulder accumulations (Pleistocene) 22
Qoic - Ice-contact stratified sand and gravel (Pleistocene) 22
Qokt - Kame terrace (Pleistocene) 23
Qwt - Wisconsinan till (Wisconsinan) 23
Qe - Eolian deposits (late Pleistocene) 24
Qmt - Meltwater-terrace deposits (late Wisconsinan) 24
Qv - Valley-train deposits (late Wisconsinan) 25
Qdt - Deltaic terrace (Quaternary) 26
Qod - Glacial-lake delta deposits (late Wisconsinan) 26
Qosd - Glacial-lake delta deposits from narrow sediment-dammed proglacial lakes (late Wisconsinan) 28
Qod7 - Narrow lake basin glacial-lake delta deposits, 7th successively-younger ice-contact delta (late Wisconsinan) 29
Qod6 - Narrow lake basin glacial-lake delta deposits, 6th successively-younger ice-contact delta (late Wisconsinan) 29
Qod5 - Narrow lake basin glacial-lake delta deposits, 5th successively-younger ice-contact delta (late Wisconsinan) 30
Qd2 - Glacial-lake delta deposits, 2nd successively-younger ice-contact delta (late Wisconsinan) 30
Qod4 - Narrow lake basin glacial-lake delta deposits, 4th successively-younger ice-contact delta (late Wisconsinan) 31

Qd1 - Glacial-lake delta deposits, 1st successively-younger ice-contact delta (late Wisconsinan) 32
Qod3 - Narrow lake basin glacial-lake delta deposits, 3rd successively-younger ice-contact delta (late Wisconsinan) 32
Qod2 - Narrow lake basin glacial-lake delta deposits, 2nd successively-younger ice-contact delta (late Wisconsinan) 33
Qod1 - Narrow lake basin glacial-lake delta deposits, 1st successively-younger ice-contact delta (late Wisconsinan) 33
Qlb - Glacial lake-bottom deposits (late Wisconsinan) 34
Qf - Outw ash-fan deposits (late Wisconsinan) 35
Qtq - Till derived from quartzite, quartz-pebble conglomerate and red sandstone (late Wisconsinan) 35
Qtqr - Till derived from quartzite, quartz-pebble conglomerate and red sandstone, less than 10 feet thick (late Wisconsinan) 36
Qtk - Till derived from limestone, shale and sandstone (late Wisconsinan) 36
Qtkr - Till derived from limestone, shale and sandstone, less than 10 feet thick (late Wisconsinan) 38
Qk - Kame (late Wisconsinan) 40
Qw tn - Netcong Till (late Wisconsinan) 41
Qes - Esker (Quaternary) 41
Qw bu - West Branch Papakating Creek small ice-marginal deltas, lacustrine fans, and ice-channel fillings (late Wisconsinan) 41
Qcb1 - Clove Brook deposits (late Wisconsinan) 41
Qw ku - Lake Wallkill meltw ater deposits (late Wisconsinan) 41
Qw klf - Lake Wallkill lacustrine-fan, ice-marginal delta and ice-channel filling deposits (late Wisconsinan) 42
Qw klb - Lake Wallkill lake-bottom deposits (late Wisconsinan) 42
Qw b5 - West Branch Papakating Creek fluviodelta (late Wisconsinan) 42
Qw k4 - Lake Wallkill fluviodelta, McCoys Corner Delta (late Wisconsinan) 42
Qw k3 - Lake Wallkill small ice-marginal delta (late Wisconsinan) 42
Qw b4 - West Branch Papakating Creek collapsed ice-marginal delta and fluviodelta (late Wisconsinan) 43
Qw b3 - West Branch Papakating Creek small ice-marginal deltas and lacustrine-fan deposits (late Wisconsinan) 43
Qw b2 - West Branch Papakating Creek ice-marginal delta (late Wisconsinan) 43
Qw blb - West Branch Papakating Creek lake-bottom deposits (late Wisconsinan) 43
Qw b1 - West Branch Papakating Creek small collapsed ice-channel filling (late Wisconsinan) 44
Qw tu - Wykertow n deposits (late Wisconsinan) 44
Qw tlb - Wykertow n lake-bottom deposits (late Wisconsinan) 44
Qld2 - Paulins Kill and Wallpack Valley older glacial-lake delta deposits (late Wisconsinan) 44
Qftc - Egypt Mills outw ash-fan deposits (late Wisconsinan) 44
Qfbc - Bushkill outw ash-fan deposits (late Wisconsinan) 45
Qfdb - Dry Brook outw ash-fan deposits (late Wisconsinan) 45
Qfa - Adams Creek outw ash-fan deposits (late Wisconsinan) 45
Qtm - Terminal moraine of Wisconsin ice sheet (Pleistocene (Wisconsinan)) 45
Qm - Recessional moraine (late Wisconsinan) 45
Qflm - Fairview Lake recessional moraine (late Wisconsinan) 46
Qmbm - Millbrook Village recessional moraine (late Wisconsinan) 46
Qfgm - Franklin Grove recessional moraine (late Wisconsinan) 46
Qlf - Lacustrine-fan deposits (late Wisconsinan) 46
Qcm - Colesville recessional moraine (late Wisconsinan) 47
Qlvm - Libertyville recessional moraine (late Wisconsinan) 47
Qskm - Steeny Kill Lake recessional moraine (late Wisconsinan) 47
Qw mtn - Late Wisconsinan terminal moraine deposits, Netcong Till (late Wisconsinan) 47
Qpdu - Meltw ater stream deposits, upper Papakating Creek and Dry Brook (late Wisconsinan) 48
Qw k1a - Lake Wallkill fluvialdelta, Frankford Plains Delta (late Wisconsinan) 48
Qw k2 - Lake Wallkill large ice-marginal delta, Armstrong Delta (late Wisconsinan) 48
Qw k1 - Lake Wallkill ice-marginal delta (late Wisconsinan) 48

Qbr2 - Lake Beaver Run ice-marginal deltaic deposits (late Wisconsinan) 49
Qbru - Lake Beaver Run small uncorrelated ice-marginal deltas, collapsed ice-channel, and lacustrine-fan deposits (late Wisconsinan) 49
Qbrlf - Lake Beaver Run uncorrelated lacustrine-fan deposits and collapsed deltaic sediment (late Wisconsinan) 49
Qbrlb - Lake Beaver Run lake-bottom deposits (late Wisconsinan) 49
Qbr1 - Lake Beaver Run large ice-marginal delta, Harmonyvale Delta (late Wisconsinan) 49
Qpk14 - Upper Paulins Kill ice-marginal delta and fluviodelta (late Wisconsinan) 50
Qam - Augusta recessional moraine (late Wisconsinan) 50
Qmvm - Millville recessional moraine (late Wisconsinan) 50
Qmm - Montague recessional moraine (late Wisconsinan) 50
Qdfm - Dingman Ferry recessional moraine (late Wisconsinan) 51
Qkms - Till (late Wisconsinan) 51
Qfbu - Big Flat Brook deposits (late Wisconsinan) 51
Qpk13 - Upper Paulins Kill, ice-marginal delta (late Wisconsinan) 51
Qom - Ogdensburg-Culvers Gap moraine (late Wisconsinan) 51
Qv1 - Older valley-train deposits (late Wisconsinan) 52
Qdo2 - Glacial-lake delta deposits from glacial Lake Ow assa (late Wisconsinan) 52
Qfd - Dingmans Creek outw ash-fan deposits (late Wisconsinan) 53
Qdo1 - Older glacial-lake delta deposits from glacial Lake Ow assa (late Wisconsinan) 53
Qld1 - Paulins Kill and Wallpack Valley oldest glacial-lake delta deposits (late Wisconsinan) 53
Qht - Hummock topography (late Wisconsinan) 54
Qit - Pre-Wisconsinan drift (Illinoian?) 54
Qodr - Older drift (Pleistocene (Illinoian?)) 54
QPZbr - Bedrock and thin olean till, undivided (Paleozoic and younger) 54
QPZlr - Limestone bedrock (pre-Quaternary?) 54
QPZr - Bedrock (pre-Wisconsinan) 55
QPZsr - Bedrock regolith (pre-Wisconsinan) 55
Du - Devonian rocks, undifferentiated (Devonian) 56
Dcw - Catskill Formation, Walcksville Member (Devonian) 56
Dct - Catskill Formation, Tow amensing Member (Devonian) 56
Dtr - Trimmers Rock Formation (Devonian) 56
Dmh - Mahantango Formation (Devonian) 56
Dm - Marcellus Formation (Devonian) 56

Geologic Cross Sections 57

Cross Section A-A' 57
Cross Section B-B' 57
Cross Section C-C' 57
Cross Section D-D' 58
Cross Section E-E' 58
Cross Section F-F' 58
Cross Section G-G' 59
Cross Section H-H' 59
Cross Section I-I' 59
Cross Section J-J' 60
Cross Section K-K' 60
Cross Section L-L' 60
Cross Section M-M' 61
Cross Section N-N' 61
Cross Section O-O' 62
Cross Section P-P' 62

Ancillary Source Map Information 63

Allentow n 30' x 60' Quadrangle 63
Branchville Quadrangle 63

Introduction 63
Correlation of Map Units 65
Explanation of Map Symbols 66
Figure 1 - Physiography of Northwestern New Jersey and Northeastern Pennsylvania 67
Figure 2 - Schematic Profiles of Morphosequences 68
Figure 3 - Simplified Geologic Map of Branchville Quadrangle 69
Figure 4 - Late Wisconsinan Ice-Marginal Positions 70
Figure 5 - Morphology of the Augusta Moraine 71
Table 1 - Well Records 72
Table 2 - Description of Materials Observed 73
Table 3 - Pebble Lithology 74
Bushkill Quadrangle 75
Introduction 75
Correlation of Map Units 76
Explanation of Map Symbols 77
Figure 1 - Physiography of Northwestern New Jersey and Northeastern Pennsylvania 78
Figure 2 - Late Wisconsinan Ice Margins 79
Figure 3 - Bedrock Geologic Map of Bushkill Quadrangle 80
Figure 4 - Height of Glacial and Postglacial Terraces 81
Figure 5 - Surficial Geology of the Echo Lake Lowland and Minisink Valley 82
Figure 6 - Photo of Sand Hill Sand Pit 83
Figure 7 - Description of Poxono Island 84
Culvers Gap Quadrangle 85
Introduction 85
Correlation of Map Units 86
Explanation of Map Symbols 87
Figure 1 - Physiography of Kittatinny Valley and Surrounding Area 88
East Stroudsburg Quadrangle 89
Correlation of Map Units 90
Map Legend 91
Flatbrookville Quadrangle 91
Introduction 91
Correlation of Map Units 93
Explanation of Map Symbols 94
Figure A - Physiography of Kittatinny Valley 95
Figure B - Photo of Downstream Section of Wallpack Bend 96
Figure C - Photo of Van Campens Falls 96
Figure D - Photo of Cemented Cobble-Pebble Gravel Outwash 97
Lake Maskenozha Quadrangle 97
Introduction 98
Correlation of Map Units 99
Explanation of Map Symbols 100
Figure 1 - Physiography of Northwestern New Jersey and Northeastern Pennsylvania 101
Figure 2 - Late Wisconsinan Ice Margins 102
Figure 3 - Simplified Geologic Map of Lake Maskenozha Quadrangle 103
Figure 4 - Photos from Toms Creek Shale Pit 104
Figure 5 - Photos from Buck Bar Terrace 105
Figure 6 - Color-Shaded Relief Map of Minisink Valley 106
Table 1 - Records of Selected Wells 108
Milford Quadrangle 109
Introduction 109
Correlation of Map Units 110
Explanation of Map Symbols 111
Figure A - Color-shaded Relief Map of Milford Quadrangle 112

Figure B - Photo of Lower Falls and Bridal Veil Falls ... 113
Figure C - Panorama of Raymondskill Bluff ... 114
Figure D - Photo of Stony Till ... 115
Table 1 - Records of Selected Wells ... 116
National Hydrography Dataset (2018) ... 118
New Jersey Landslides ... 118
New Jersey Surficial Geology ... 118
New York Geology, Lower Hudson Sheet ... 118
Newton West Quadrangle ... 119
Introduction ... 119
Correlation of Map Units ... 120
Explanation of Map Symbols ... 121
Figure A - Photo of Topset Beds Over Foreset Beds in Ice-Contact Delta ... 122
Figure B - Photo of Swartswood Lake ... 122
Ice-Recession and Glacial Lakes ... 123
Table 1 - Records of Wells ... 124
Pike County Geology and Mineral Resources ... 125
Correlation of Map Units ... 125
Map Legend ... 126
Report Figures ... 127
Figure 42 ... 127
Figure 43 ... 128
Figure 44 ... 129
Figure 64 ... 129
Figure 74 ... 130
Figure 75 ... 131
Figure 78 ... 132
Figure 80 ... 133
Pike County Groundwater Resources ... 133
Correlation of Map Units ... 134
Map Legend ... 134
Port Jervis South Quadrangle ... 134
Introduction ... 135
Correlation of Map Units ... 136
Explanation of Map Symbols ... 137
Figure A - Color-Shaded Relief Map of Port Jervis South Quadrangle ... 138
Figure B - Photo of Our Swamp ... 139
Figure C - Photo of Brown Quartzite-Rich Till ... 139
Figure D- Photo of Vista from High Point Monument ... 140
Table 1 - Records of Selected Wells ... 141
Stroudsburg Quadrangle ... 143
Correlation of Map Units ... 143
Map Legend ... 144
GRI Digital Data Credits ... 145

Geologic Resources Inventory Map Document

Delaware Water Gap National Recreation Area, Pennsylvania, New Jersey and New York

Document to Accompany Digital Geologic-GIS Data

dewa_surficial_geology.pdf

Version: 9/22/2021

This document has been developed to accompany the digital geologic-GIS data developed by the Geologic Resources Inventory (GRI) program for Delaware Water Gap National Recreation Area, Pennsylvania, New Jersey and New York (DEWA).

Attempts have been made to reproduce all aspects of the original source products, including the geologic units and their descriptions, geologic cross sections, the geologic report, references and all other pertinent images and information contained in the original publication.

This document contains the following information:

1) **About the NPS Geologic Resources Inventory Program** – A brief summary of the Geologic Resources Inventory (GRI) Program and its products. Included are web links to the GRI GIS data model, and to the GRI products page where digital geologic-GIS datasets, scoping reports and geology reports are available for download. In addition, web links to the NPS Data Store and GRI program home page, as well as contact information for the GRI coordinator, are also present.

2) **GRI Digital Maps and Source Citations** – A listing of all GRI digital surficial geologic-GIS maps produced for this project along with sources used in their completion. In addition, a brief explanation of how each source map was used is provided.

3) **Map Unit List** – A listing of all geologic map units present on maps for this project, generally listed from youngest to oldest.

4) **Map Unit Descriptions** – Descriptions for all geologic map units. If a unit is present on multiple source maps the unit is listed with its source geologic unit symbol, unit name and unit age followed by the unit's description for each source map.

5) **Geologic Cross Sections** – Geologic cross section graphics with source geologic cross section abbreviations.

6) **Ancillary Source Map Information** – Additional source map information presented by source map.

For each source map this may include a stratigraphic column, index map, map legend and/or map notes.

7) **GRI Digital Data Credits** – GRI digital surficial geologic-GIS data and ancillary map information document production credits.

For information about using GRI digital geologic-GIS data contact:

Stephanie O'Meara
Geologist/GIS Specialist/Data Manager
Colorado State University Research Associate, Cooperator to the National Park Service
Fort Collins, CO 80523
phone: (970) 491-6655
email: stephanie_o'meara@partner.nps.gov

About the NPS Geologic Resources Inventory Program

Background

The Geologic Resources Inventory (GRI) provides geologic map data and pertinent geologic information to support resource management and science-informed decision making in more than 270 natural resource parks throughout the National Park System. Geologic resources for management consideration include both the processes that act upon the Earth and the features formed as a result of these processes. Geologic processes include: erosion and sedimentation; seismic, volcanic, and geothermal activity; glaciation, rockfalls, landslides, and shoreline change. Geologic features include mountains, canyons, natural arches and bridges, minerals, rocks, fossils, cave and karst systems, beaches, dunes, glaciers, volcanoes, and faults.

The GRI is one of 12 inventories funded by the National Park Service (NPS) Inventory and Monitoring Program. The Geologic Resources Division of the NPS Natural Resource Stewardship and Science Directorate administers the GRI. The NPS Geologic Resources Division partners with the Colorado State University Department of Geosciences to produce GRI products. Many additional partners participate in the GRI process by contributing source maps or reviewing products.

The GRI team undertakes three tasks for each park in the Inventory and Monitoring program: (1) conduct a scoping meeting and provide a summary document, (2) provide digital geologic map data in a geographic information system (GIS) format, and (3) provide a GRI report. These products are designed and written for nongeoscientists.

Products

Scoping Meetings: These park-specific meetings bring together local geologic experts and park staff to inventory and review available geologic data and discuss geologic resource management issues. A summary document is prepared for each meeting that identifies a plan to provide digital map data for the park.

Digital Geologic Maps: Digital geologic maps reproduce all aspects of traditional paper maps, including notes, legend, and cross sections. Bedrock, surficial, and special purpose maps such as coastal or geologic hazard maps may be used by the GRI to create digital Geographic Information Systems (GIS) data and meet park needs. These digital GIS data allow geologic information to be easily viewed and analyzed in conjunction with a wide range of other resource management information data.

For detailed information regarding GIS parameters such as data attribute field definitions, attribute field codes, value definitions, and rules that govern relationships found in the data, refer to the NPS Geology-GIS Data Model document available at: https://www.nps.gov/articles/gri-geodatabase-model.htm

Geologic Reports: GRI reports synthesize discussions from the original scoping meeting, follow up conference call(s), and subsequent research. Chapters of each report discuss the geologic setting of the park, distinctive geologic features and processes within the park, highlight geologic issues facing resource managers, and describe the geologic history leading to the present-day landscape. Each report also includes a poster illustrating these GRI digital geologic-GIS data.

For a complete listing of GRI products visit the GRI publications webpage: https://go.nps.gov/gripubs. GRI digital geologic-GIS data is also available online at the NPS Data Store: https://irma.nps.gov/DataStore/Search/Quick. To find GRI data for a specific park or parks select the appropriate park(s), enter “GRI” as a Search Text term, and then select the Search button.

For more information about the Geologic Resources Inventory Program visit the GRI webpage: https://www.nps.gov/subjects/geology/gri.htm. At the bottom of that webpage is a "Contact Us" link if you need additional information. You may also directly contact the program coordinator:

Jason Kenworthy
Inventory Coordinator
National Park Service Geologic Resources Division
P.O. Box 25287
Denver, CO 80225-0287
phone: (303) 987-6923
fax: (303) 987-6792
email: Jason_Kenworthy@nps.gov

The Geologic Resources Inventory (GRI) program is funded by the National Park Service (NPS) Inventory and Monitoring (I&M) Division. Learn more about I&M and the 12 baseline inventories at the I&M webpage: https://www.nps.gov/im/inventories.htm.

GRI Digital Maps and Source Map Citations

The GRI digital surificial geologic-GIS maps for Delaware Water Gap National Recreation Area, Pennsylvania, New Jersey and New York (DEWA):

Digital Surficial Geologic-GIS Map of Delaware Water Gap National Recreation Area and Vicinity, New Jersey, Pennsylvania and New York (*GRI MapCode DEWA_surficial*)

The above GRI digital geologic-GIS map provides complete coverage for Delaware Water Gap National Recreation Area (DEWA), and was compiled from the GRI component digital geologic-GIS maps listed below. The full extent of each respective source map, listed with each component map, was used and all geologic features were captured.

Digital Surficial Geologic-GIS Map of the Branchville 7.5' Quadrangle, New Jersey (*GRI MapCode BRAV_surficial*)

Witte, R.W., 2008, Surficial Geologic Map of the Branchville Quadrangle, Sussex County, New Jersey: New Jersey Geological Survey, Geologic Map Series GMS 08-2, scale 1:24,000 (Branchville Quadrangle). (*GRI Source Map ID 75860*).

Digital Surficial Geologic-GIS Map of the part of the Bushkill 7.5' Quadrangle, New Jersey and Pennsylvania (*GRI MapCode BUSH_surficial*)

Witte, R.W., 2017, Surficial Geologic Map of Part of the Bushkill Quadrangle, Warren County, New Jersey and Monroe Counties, Pennsylvania: New Jersey Geological Survey, Open-file Map OFM 112, scale 1:24,000 (Bushkill Quadrangle). (*GRI Source Map ID 76279*).

Digital Surficial Geologic-GIS Map of the Culvers Gap Quadrangle, New Jersey and Pennsylvania (*GRI MapCode CUGP_surficial*)

Witte, R.W., and Epstein, J.B., 2005, Surficial Geologic Map of the Culvers Gap Quadrangle, Sussex County, New Jersey: New Jersey Geological Survey, Geologic Map Series GMS 04-1, scale 1:24,000 (Culvers Gap Quadrangle). (*GRI Source Map ID 73984*).

Digital Surficial Geologic-GIS Map of the East Stroudsburg 7.5' Quadrangle, Pennsylvania (*GRI MapCode EAST_surficial*)

Bucek, M.F., 1971, Surficial Geology of the East Stroudsburg 7-1/2 Minute Quadrangle, Monroe County, Pennsylvania: Pennsylvania Geological Survey, Atlas 214c, scale 1:24,000 (East Stroudsburg Quadrangle). (*GRI Source Map ID 1564*).

Digital Surficial Geologic-GIS Map of the Flatbrookville 7.5' Quadrangle, New Jersey and Pennsylvania (*GRI MapCode FLAT_surficial*)

Witte, R.W., and Epstein, J.B., 2012, Surficial Geologic Map of the Flatbrookville Quadrangle, Sussex and Warren Counties, New Jersey, and Pike and Monroe Counties, Pennsylvania: New Jersey Geological Survey, Geologic Map Series GMS 12-1, scale 1:24,000 (Flatbrookville Quadrangle). (*GRI Source Map ID 75861*).

Digital Surficial Geologic-GIS Map of the part of the Milford 7.5' Quadrangle, New Jersey and Pennsylvania (*GRI MapCode MILF_surficial*)

Witte, R.W., 2012, Surficial Geologic Map of the Milford Quadrangle, Sussex County, New Jersey, and Part of Pike County, Pennsylvania: New Jersey Geological Survey, Open-file Map OFM 96, scale 1:24,000 (Milford Quadrangle). (*GRI Source Map ID 75857*).

Digital Surficial Geologic-GIS Map of the part of the Lake Maskenozha 7.5' Quadrangle, New Jersey and Pennsylvania (*GRI MapCode LAMA_surficial*)

Witte, R.W., 2014, Surficial Geologic Map of Part of the Lake Maskenozha Quadrangle, Sussex County, New Jersey and Pike County, Pennsylvania: New Jersey Geological Survey, Open-file Map OFM 101, scale 1:24,000 (Lake Maskenozha Quadrangle). (*GRI Source Map ID 76280*).

Digital Surficial Geologic-GIS Map of the Newton West 7.5' Quadrangle, New Jersey (*GRI MapCode NEWE_surficial*)

Witte, R.W., 2012, Quaternary Geology and Geologic Material Resources of the Newton West Quadrangle, Sussex and Warren Counties, New Jersey: New Jersey Geological Survey, Open-file Map OFM90, scale 1:24,000 (Newton West Quadrangle). (*GRI Source Map ID 75988*).

Digital Surficial Geologic-GIS Map of the Port Jervis South 7.5' Quadrangle, New Jersey, Pennsylvania and New York (*GRI MapCode PJSO_surficial*)

Witte, R.W., 2013, Surficial Geologic Map of the Port Jervis South Quadrangle, Sussex County, New Jersey, and Pike County, Pennsylvania: New Jersey Geological Survey, Open-file Map OFM 99, scale 1:24,000 (Port Jervis South Quadrangle). (*GRI Source Map ID 76281*).

Digital Surficial Geologic-GIS Map of the Stroudsburg 7.5' Quadrangle, New Jersey and Pennsylvania (*GRI MapCode STRO_surficial*)

Epstein, J.B., 1969, Surficial Geology of the Stroudsburg Quadrangle, Pennsylvania and New Jersey: Pennsylvania Geological Survey, General Geology Report 57, scale 1:24,000 (Stroudsburg Quadrangle). (*GRI Source Map ID 2367*).

Additionally, the following sources were used in the GRI compilation to provide surficial geology coverage in areas where dedicated 7.5 minute surficial quadrangle mapping does not currently exist, to better define the Delaware River in areas where it was not well defined, or to provide access to New Jersey state landslide point data. Partial extents of these source maps were used, but all geologic features within their respective extents were captured.

Braun, D.D., 1996, Surficial Geology of the Allentown 30 x 60-minute Quadrangle: Pennsylvania Geological Survey, Open-file Report OF 96-48, scale 1:100,000 (Allentown 30 x 60). (*GRI Source Map ID 4501*).

Cadwell, D.H., Connally, G.G., Dineen, R.J., Fleisher, P.J., Fuller, M.L., Sirkin, Les, and Wiles, G. C., 1999, Surficial Geologic Map of New York, Lower Hudson Sheet: New York State Museum, Map and Chart Series 40, scale 1:250,000 (New York Geology, Lower Hudson Sheet). (*GRI Source Map ID 1574*).

Davis, Drew K., 1989, Groundwater Resources of Pike County, Pennsylvania: Pennsylvania Geological Survey, 4th ser., Water Resource Report 65, 63 p., plate 2 (Surficial Geologic Map), scale 1:50,000 (Pike County Groundwater Resources). (*GRI Source Map ID 5779*).

Pallis, T., and Marzulli, W., 2006, Landslides in New Jersey: New Jersey Geological Survey, Digital

Geodata Series DGS 06-3, scale 1:100,000 (New Jersey Landslides). (*GRI Source Map ID 74874*).

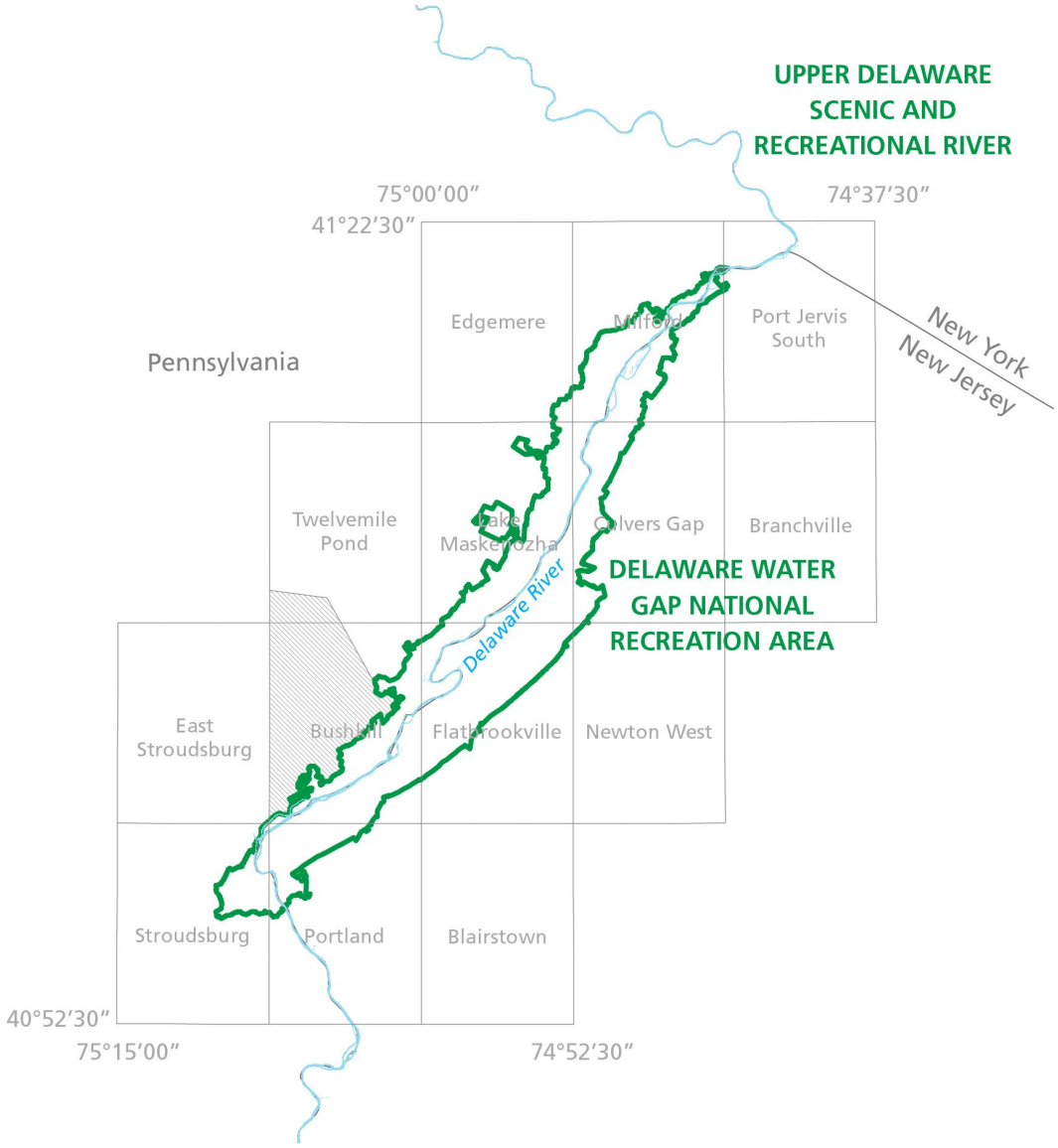
Pristas, R. P., 2007, Surficial Geology of New Jersey: New Jersey Geological Survey, Digital Geodata Series DGS 07-2, scale 1:100,000 (New Jersey Surficial Geology). (*GRI Source Map ID 74858*).

Sevon, W.D., Berg, Thomas M., Schultz, Lane D., and Crowl, George H., 1989, Geology and Mineral Resources of Pike County, Pennsylvania; Pennsylvania Geological Survey, County Report C 52, 141p., plate 2 (Surficial Geologic Map), scale 1:50,000 (Pike County Geology and Mineral Resources). (*GRI Source Map ID 4794*).

U.S. Geological Survey, 2018, USGS National Hydrography Dataset Best Resolution (NHD) for Hydrologic Unit (HU) 8: U.S. Geological Survey, scale 1:24,000 (National Hydrography Dataset (2018)). (*GRI Source Map ID 76278*).

Index Map

The following index map displays the extents of the GRI digital geologic-GIS maps produced for Delaware Water Gap National Recreation Area (DEWA). The boundary for Delaware Water Gap National Recreation Area (as of May 2021) is outlined in green. The extent of GRI digital geologic-GIS data is the same as the 7.5 minute quadrangles shown with the exception of no map coverage for the hatched portion of the Bushkill and Twelvemile Pond quadrangles.



Index map by Lucas Chappell (Colorado State University).

Map Unit List

The surficial geologic units present in the digital surficial geologic-GIS data produced for Delaware Water Gap National Recreation Area, Pennsylvania, New Jersey and New York (DEWA) are listed below. Units are listed with their assigned unit symbol and unit name (e.g., Qal - Alluvium). Units are listed from youngest to oldest. Information about each geologic unit is also presented in the GRI Geologic Unit Information (dewaunit_surficial) table included with the GRI geologic-GIS data. Some source unit symbols, names and/or ages may have been changed in this document and in the GRI digital geologic-GIS data. This was done if a unit was considered to be the same unit as one or more units on other source maps used for this project, and these unit symbols, names and/or ages differed. In this case a single unit symbol and name, and the unit's now recognized age, was adopted. Unit symbols, names and/or ages in a unit descriptions, or on a correlation of map units or other source map figure were not edited. If a unit symbol, name or age was changed by the GRI the unit's source map symbol, name and/or age appears with the unit's source map description.

Cenozoic Era

Quaternary Period

Qd - Dump
Qsgp - Sand and gravel pit
Qafl - Artificial fill
Qal - Alluvium
Qp - Peat
Qst2a - Stream-terrace deposits, younger and lower elevation
Qst2 - Stream-terrace deposits, younger
Qst - Stream-terrace deposits
Qaf - Alluvial-fan deposits
Qta - Talus deposits
Qsc - Shale-chip colluvium
Qac - Alluvium and colluvium
Qs - Swamp and bog deposits
Qem - End moraine
Qgm - Ground moraine
Qdm - Drumlinoid till ridges
Qhm - Hummocky stagnation moraine
Qlm - Lateral moraine
Qst3 - Stream-terrace deposits, older
Qba - Boulder accumulations
Qoic - Ice-contact stratified sand and gravel
Qokt - Kame terrace
Qwt - Wisconsinan till
Qe - Eolian deposits
Qmt - Meltwater-terrace deposits
Qv - Valley-train deposits
Qdt - Deltaic terrace
Qod - Glacial-lake delta deposits
Qosd - Glacial-lake delta deposits from narrow sediment-dammed proglacial lakes
Qod7 - Narrow lake basin glacial-lake delta deposits, 7th successively-younger ice-contact delta
Qod6 - Narrow lake basin glacial-lake delta deposits, 6th successively-younger ice-contact delta
Qod5 - Narrow lake basin glacial-lake delta deposits, 5th successively-younger ice-contact delta
Qd2 - Glacial-lake delta deposits, 2nd successively-younger ice-contact delta
Qod4 - Narrow lake basin glacial-lake delta deposits, 4th successively-younger ice-contact delta
Qd1 - Glacial-lake delta deposits, 1st successively-younger ice-contact delta

Qod3 - Narrow lake basin glacial-lake delta deposits, 3rd successively-younger ice-contact delta
Qod2 - Narrow lake basin glacial-lake delta deposits, 2nd successively-younger ice-contact delta
Qod1 - Narrow lake basin glacial-lake delta deposits, 1st successively-younger ice-contact delta
Qlb - Glacial lake-bottom deposits
Qf - Outwash-fan deposits
Qtq - Till derived from quartzite, quartz-pebble conglomerate and red sandstone
Qtqr - Till derived from quartzite, quartz-pebble conglomerate and red sandstone, less than 10 feet thick
Qtk - Till derived from limestone, shale and sandstone
Qtkr - Till derived from limestone, shale and sandstone, less than 10 feet thick
Qk - Kame
Qwtn - Netcong Till
Qes - Esker
Qwbu - West Branch Papakating Creek small ice-marginal deltas, lacustrine fans, and ice-channel fillings
Qcb1 - Clove Brook deposits
Qwku - Lake Wallkill meltwater deposits
Qwklf - Lake Wallkill lacustrine-fan, ice-marginal delta and ice-channel filling deposits
Qwklb - Lake Wallkill lake-bottom deposits
Qwb5 - West Branch Papakating Creek fluviodelta
Qwk4 - Lake Wallkill fluviodelta, McCoys Corner Delta
Qwk3 - Lake Wallkill small ice-marginal delta
Qwb4 - West Branch Papakating Creek collapsed ice-marginal delta and fluviodelta
Qwb3 - West Branch Papakating Creek small ice-marginal deltas and lacustrine-fan deposits
Qwb2 - West Branch Papakating Creek ice-marginal delta
Qwblb - West Branch Papakating Creek lake-bottom deposits
Qwb1 - West Branch Papakating Creek small collapsed ice-channel filling
Qwtu - Wykertown deposits
Qwtlb - Wykertown lake-bottom deposits
Qld2 - Paulins Kill and Wallpack Valley older glacial-lake delta deposits
Qftc - Egypt Mills outwash-fan deposits
Qfbc - Bushkill outwash-fan deposits
Qfdb - Dry Brook outwash-fan deposits
Qfa - Adams Creek outwash-fan deposits
Qtm - Terminal moraine of Wisconsin ice sheet
Qm - Recessional moraine
Qflm - Fairview Lake recessional moraine
Qmbm - Millbrook Village recessional moraine
Qfgm - Franklin Grove recessional moraine
Qlf - Lacustrine-fan deposits
Qcm - Colesville recessional moraine
Qlvm - Libertyville recessional moraine
Qskm - Steeny Kill Lake recessional moraine
Qwmtn - Late Wisconsinan terminal moraine deposits, Netcong Till
Qpdu - Meltwater stream deposits, upper Papakating Creek and Dry Brook
Qwk1a - Lake Wallkill fluvialdelta, Frankford Plains Delta
Qwk2 - Lake Wallkill large ice-marginal delta, Armstrong Delta
Qwk1 - Lake Wallkill ice-marginal delta
Qbr2 - Lake Beaver Run ice-marginal deltaic deposits
Qbru - Lake Beaver Run small uncorrelated ice-marginal deltas, collapsed ice-channel, and lacustrine-fan deposits
Qbrlf - Lake Beaver Run uncorrelated lacustrine-fan deposits and collapsed deltaic sediment
Qbrlb - Lake Beaver Run lake-bottom deposits
Qbr1 - Lake Beaver Run large ice-marginal delta, Harmonyvale Delta

Qpk14 - Upper Paulins Kill ice-marginal delta and fluviodelta
Qam - Augusta recessional moraine
Qmvm - Millville recessional moraine
Qmm - Montague recessional moraine
Qdfm - Dingman Ferry recessional moraine
Qkms - Till
Qfbu - Big Flat Brook deposits
Qpk13 - Upper Paulins Kill, ice-marginal delta
Qom - Ogdensburg-Culvers Gap moraine
Qv1 - Older valley-train deposits
Qdo2 - Glacial-lake delta deposits from glacial Lake Owassa
Qfd - Dingmans Creek outwash-fan deposits
Qdo1 - Older glacial-lake delta deposits from glacial Lake Owassa
Qld1 - Paulins Kill and Wallpack Valley oldest glacial-lake delta deposits
Qht - Hummock topography
Qit - Pre-Wisconsinan drift
Qodr - Older drift

Quaternary Period to Paleozoic Era
QPZbr - Bedrock and thin olean till, undivided
QPZlr - Limestone bedrock
QPZr - Bedrock
QPZsr - Bedrock regolith

Paleozoic Era

Devonian Period
Du - Devonian rocks, undifferentiated
Dcw - Catskill Formation, Walcksville Member
Dct - Catskill Formation, Towamensing Member
Dtr - Trimmers Rock Formation
Dmh - Mahantango Formation
Dm - Marcellus Formation

Map Unit Descriptions

Descriptions of all geologic map units, generally listed from youngest to oldest, are presented below. Additional information pertaining to some units may also be found for some source maps in that map's Ancillary Source Map Information section of this document.

Qd - Dump (Recent)

d - unknown unit - dump? (recent)
No description on source map. Unit interpreted by GRI to be some type of dump, perhaps mine dump, based on exposure and proximity to other mine dump units. Description from source map: Allentown 30 x 60

d - Slate dump (Recent)
Slate dump. Description from source map: Stroudsburg Quadrangle

Qsgp - Sand and gravel pit (Recent)

sgp - Sand and gravel pit (recent)
Sand and gravel pits typically have steep sides and are meters to tens of meters deep. Description from source map: Allentown 30 x 60

Qafl - Artificial fill (Holocene)

af - Artificial fill (Holocene)
Rock waste, gravel, sand, silt, and manufactured materials. As much as 25 feet thick. Not shown beneath roads, and railroads where it is less than 10 feet thick. Description from source map: Branchville Quadrangle

af - Artificial fill (Holocene)
Rock waste, soil, gravel, sand, silt, and manufactured materials put in place by man. As much as 25 feet (8m) thick. Not shown beneath roads, and railroads where it is less than 10 feet (3m) thick. Primarily used to raise the land surface, construct earthen dams, and form a solid base for roads and railways. Description from source maps: Bushkill Quadrangle, Culvers Gap Quadrangle, Flatbrookville Quadrangle, Lake Maskenozha Quadrangle, Milford Quadrangle, Port Jervis South Quadrangle

af - Artificial fill (Holocene)
No description on source map. Unit interpreted by GRI to be some type of artificial fill, perhaps an earthen dam, based on exposure of unit. Description from source map: East Stroudsburg Quadrangle

af - Artificial fill (Holocene)
Rock waste, solid waste, soil, gravel, sand, silt, and manufactured materials put in place by man. As much as 25 feet (8m) thick. Not shown beneath roads, and railroads where it is less than 10 feet (3m) thick. Primarily used to raise the land surface, construct earthen dams and sanitary landfills, and form a solid base for roads and railways. Description from source map: Newton West Quadrangle

af - Artificial fill (Holocene)
Unconsolidated, compacted mixture of rock fragments, sand, silt, and clay, or concrete that is used for roadway fill or earth dams. Generally several feet thick.

No aquifer potential. Moderately easy to excavate. Generally good slope stability; susceptible to erosion. Good foundation for heavy structures where specifically designed. No mineral resources.

Lies mostly above the water table. Not an aquifer. Description from source map: Pike County Geology and Mineral Resources

Qal - Alluvium (Holocene)

Qa - Alluvium (Quaternary)
Stratified silt, sand, and gravel, with some boulders; sub rounded to rounded clasts; contains localized lenses of silty or sandy clay; yellowish brown to yellowish red. Description from source map: Allentown 30 x 60

Qal - Alluvium (Holocene)
Stratified, well-to moderately-sorted sand, gravel, silt, and minor clay and organic material. Locally bouldery. As much as 25 feet thick. Includes planar- to crossbedded gravel and sand in channel deposits, and cross-bedded and rippled sand, massive and parallel-laminated fine sand, and silt in flood-plain deposits. In places, overlain by and interlayered with thin organic material and colluvium. Description from source map: Branchville Quadrangle

Qal - Alluvium (Holocene)
Stratified, moderately- to poorly-sorted sand, gravel, silt, and minor clay and organic material deposited by the Delaware River and its tributaries. Locally bouldery. As much as 25 feet (8m) thick. Includes planar- to cross-bedded gravel and sand, and cross-bedded and rippled sand in channel deposits, and massive and parallel-laminated fine sand, and silt in flood-plain deposits. Description from source maps: Bushkill Quadrangle, Culvers Gap Quadrangle, Lake Maskenozha Quadrangle, Milford Quadrangle, Port Jervis South Quadrangle

Qal - Alluvium (Quaternary)
Loamy Sand. Description from source map: East Stroudsburg Quadrangle

Qal - Alluvium (Holocene)
Sand, gravel, silt, and minor clay and organic material deposited by the Delaware River and its tributaries. Locally bouldery. As much as 25 feet (8m) thick. Includes planar- to cross-bedded gravel and sand, and cross-bedded and rippled sand in channel deposits, and massive and parallel-laminated fine sand, and silt in flood-plain deposits. May be interlayered with silty to silty-sandy diamicton (interpreted as a colluvium) in the upper parts of drainages. Description from source map: Flatbrookville Quadrangle

Qal - Alluvium (Holocene and late Pleistocene)
Sand, gravel, silt, minor clay and peat; reddish brown, yellowish brown, brown, gray. As much as 20 feet thick. Contains variable amounts of organic matter. Deposited in modern floodplains and channels. Description from source map: New Jersey Surficial Geology

al - Recent alluvium (Quaternary)
Oxidized fine sand to gravel, permeable,generally confined to flood plains within a valley,in larger valleys may be overlain by silt,subject to flooding, thickness 1-10 meters. Description from source map: New York Geology, Lower Hudson Sheet

Qal - Alluvium (Holocene)
Stratified, moderately- to poorly-sorted sand, gravel, silt, and minor clay and organic material deposited

by Paulins Kill, and Pequest River and their tributaries. As much as 25 feet (8m) thick. Includes planar- to cross-bedded gravel and sand, and cross-bedded and rippled sand in channel deposits, and massive and parallel-laminated fine sand, and silt in flood-plain deposits. Description from source map: Newton West Quadrangle

Qal - Alluvium (Holocene)
Unconsolidated, poorly stratified, poorly to moderately well sorted mixture of clay, silt, sand, gravel, cobbles, and some boulders. Clasts are angular and platy to well rounded; composition reflects the underlying bedrock. Alluvium has flat and smooth to very rough surfaces and occupies valley bottoms. Alluvium is a fluvial deposit in valley bottoms. Thickness is generally unknown, but most deposits are thought to be not more than several feet thick.

Locally may yield large quantities of water to wells. Easy to excavate; generally shallow depth to bedrock. Unsuitable for septic systems and construction because of the potential for flooding. No known mineral resources.

Of limited areal extent. Locally may yield large quantities of water to wells. Description from source map: Pike County Geology and Mineral Resources

Qal - Alluvium (Pleistocene to recent)
Silt, sand and gravel in river-bed and floodplain deposits of present streams. Description from source map: Stroudsburg Quadrangle

Qp - Peat (Holocene)

Qp - Peat (Holocene)
Decayed vegetation, commonly water saturated. Occurs in undrained or poorly drained natural depressions; thickly vegetated; water table is at or near the surface. Product of accumulation and partial decay of vegetation below water level. Large deposits are 10 feet thick or more.

No aquifer potential. Easy to excavate. Unsuitable for foundations, septic systems, and sanitary-landfill sites because the water table is at or near the surface. Abundant potential as soil conditioner.

Not an aquifer. Water in underlying deposits may be discolored. Description from source map: Pike County Geology and Mineral Resources

Qst2a - Stream-terrace deposits, younger and lower elevation (Holocene and late Wisconsinan)

Qst2a - Stream-terrace deposits, younger and lower elevation (Holocene and late Wisconsinan)
Stratified, well- to moderately-sorted, massive to laminated, and minor cross-bedded fine sand, and silt in terraces flanking present and late postglacial stream courses. As much as 20 feet (6m) thick. Overlies glacial and postglacial fluvial, planar to cross-bedded pebbly sand and gravel; as much as 10 feet (3m) thick. In Minisink Valley (Delaware River valley) deposits form two distinct terraces. The younger (Qst2) flanks recent and late postglacial stream courses and overlies early to late postglacial fluvial gravel and sand. It lies 20 to 35 feet (6 to 11m) above the mean annual elevation of the Delaware River and chiefly consists of as much as 20 feet (6m) of fine sand and silt overlying as much as 10 feet (6m) of pebble gravel and sand. Subscript "a" indicates elevation of terrace is slightly lower than similar nearby terraces. This lower substage has not been shown to be correlative throughout Minisink Valley at map scale. The lower elevation may be due to erosion or differences in local depositional conditions.

Description from source maps: Bushkill Quadrangle, Lake Maskenozha Quadrangle

Qst2a - Stream-terrace deposits, youngest and lower elevation (Holocene and late Wisconsinan)
Stratified, well- to moderately-sorted, massive to laminated, and minor cross-bedded fine sand, and silt as much as 20 feet (6m) thick, overlying planar to cross-bedded pebbly sand and gravel as much as 10 feet (3m) thick in terraces flanking present and late postglacial stream courses. In Minisink Valley (Delaware River valley) deposits form two distinct terraces. The youngest (Qst2) flanks recent and late postglacial stream courses and overlies early to late postglacial Fluvial gravel and sand. It lies 20 to 35 feet (6 to 11m) above the mean annual elevation of the Delaware River and chiefly consists of as much as 20 feet (6m) of fine sand and silt overlying as much as 10 feet (6m) of pebble gravel and sand. Subscript "a" indicates elevation of terrace is slightly lower than similar nearby terraces. This lower substage has not been shown to be correlative throughout Minisink Valley at map scale. The lower elevation may be due to erosion or differences in local depositional conditions. Description from source map: Milford Quadrangle

Qst2 - Stream-terrace deposits, younger (Holocene and late Wisconsinan)

Qst2 - Stream-terrace deposits, younger (Holocene and late Wisconsinan)
Stratified, well- to moderately-sorted, massive to laminated, and minor cross-bedded fine sand, and silt in terraces flanking present and late postglacial stream courses. As much as 20 feet (6m) thick. Overlies glacial and postglacial fluvial, planar to cross-bedded pebbly sand and gravel; as much as 10 feet (3m) thick. In Minisink Valley (Delaware River valley) deposits form two distinct terraces. The younger (Qst2) flanks recent and late postglacial stream courses and overlies early to late postglacial fluvial gravel and sand. It lies 20 to 35 feet (6 to 11m) above the mean annual elevation of the Delaware River and chiefly consists of as much as 20 feet (6m) of fine sand and silt overlying as much as 10 feet (6m) of pebble gravel and sand. Description from source maps: Bushkill Quadrangle, Culvers Gap Quadrangle, Lake Maskenozha Quadrangle, Milford Quadrangle

Qst2 - Stream-terrace deposits, youngest (Holocene and late Wisconsinan)
Stratified, well- to moderately-sorted, Qst3 massive to laminated, and minor cross-bedded fine sand, and silt as much as 20 feet (6m) thick, overlying planar to cross-bedded pebbly sand and gravel as much as 10 feet (3m) thick in terraces flanking present and late postglacial stream courses. In Minisink Valley (Delaware River valley) deposits form two distinct terraces. The youngest (Qst2) flanks recent and late postglacial stream courses and overlies early to late postglacial fluvial gravel and sand. It lies 20 to 35 feet (6 to 11m) above the mean annual elevation of the Delaware River and chiefly consists of as much as 20 feet (6m) of fine sand and silt overlying as much as 10 feet (6m) of pebble gravel and sand. Description from source map: Flatbrookville Quadrangle, Port Jervis South Quadrangle

og - Outwash sand and gravel (Quaternary)
Coarse to fine gravel with sand, proglacial fluvial deposition, well rounded and stratified, generally finer texture away from ice border, permeable, thickness variable (2-20 meters). Description from source map: New York Geology, Lower Hudson Sheet

Qaoo - Alluvium and olean outwash, undifferentiated (Early Holocene and Pleistocene)
Outwash consists of unconsolidated, stratified sand and gravel, and some boulders. Outwash has planar bedding and crossbedding; a large variation in clast size may occur from bed to bed; composition is dominated by Catskill Formation lithologies; occurs as valley fill in larger valleys. Alluvium consists of clay, silt, and very fine grained sand on floodplain surfaces and coarser material in stream channels. Outwash was deposited by glacial meltwater streams. Alluvium was deposited by streams not of glacial origin. Combined thickness ranges from several feet to 501 feet at Matamoras.

High infiltration capacity. Median yield of domestic wells is 22 gal/min. Water has good quality. Easy to excavate. Maintains moderate to gentle cut slopes; has potential for slumping. Generally unsuitable for septic systems because of potential for contamination of groundwater. Moderate to poor foundation for heavy structures; flooding is a potential hazard in many places. Source of coarse and fine aggregate; screening and washing are generally required, and crushing may be required; groundwater may be encountered at shallow depths in some valley bottoms.

Probably the best aquifer in the county. Nondomestic wells have reported yields up to 350 gal/min. Median specific capacity is 20 (gal/min)/ft for nondomestic wells and 1.0 (gal/min)/ft for domestic wells. Water quality is good. Description from source map: Pike County Geology and Mineral Resources

Qst - Stream-terrace deposits (Holocene and late Wisconsinan)

Qat - Alluvial terrace (Quaternary)
Stratified silt, sand, and gravel, with some boulders; yellowish brown to yellowish red; the deposits form benches running parallel to and a few meters above the present floodplain; generally 2to 5 meters thick. Underlain by glacial lake rhythmites (varves) in the stream valleys in the Saylorsburg-Stroudsburg area. Description from source map: Allentown 30 x 60

Qst - Stream-terrace deposits (Holocene and late Wisconsinan)
Stratified, well- to moderately sorted sand, and pebble gravel, and silt in terraces flanking present or former stream courses. As much as 25 feet thick. Includes planar to cross-bedded sand and gravel in stream-channel deposits, and massive to laminated fine sand and silt of overbank deposits. Description from source map: Branchville Quadrangle

Qst - Stream-terrace deposits (Holocene and late Wisconsinan)
Stratified, well- to moderately-sorted, massive to laminated, and minor cross-bedded fine sand and silt in terraces flanking present and late postglacial stream courses. As much as 20 feet (6m) thick. Overlies glacial and postglacial fluvial, planar to cross-bedded pebbly sand and gravel; as much as 10 feet (3m) thick. Description from source maps: Culvers Gap Quadrangle, Lake Maskenozha Quadrangle, Milford Quadrangle

Qst - Stream-terrace deposits (Holocene and late Wisconsinan)
Stratified, well- to moderately-sorted, massive to laminated, and minor cross-bedded fine sand, and silt as much as 20 feet (6m) thick, overlying planar to cross-bedded pebbly sand and gravel as much as 10 feet (3m) thick in terraces flanking present and late postglacial stream courses. Description from source maps: Flatbrookville Quadrangle, Port Jervis South Quadrangle

Qst - Postglacial stream terrace deposits (Holocene and late Pleistocene)
Sand, silt, pebble-to-cobble gravel; yellowish brown to reddish brown. As much as 20 feet thick. Form stream terraces with surfaces up to 40 feet above the modern floodplain. Where more than one terrace occurs, the youngest is designated Qst1; the older, higher terrace is Qst2. Laid down after late Wisconsinan glacial deposition ended. Description from source map: New Jersey Surficial Geology

Qst - Stream-terrace deposits (Holocene and late Wisconsinan)
Stratified, well- to moderately-sorted, massive to laminated, and minor cross-bedded fine sand, and silt in terraces flanking present and late postglacial stream courses. As much as 20 feet (6m) thick. Description from source map: Newton West Quadrangle

Qaf - Alluvial-fan deposits (Holocene and late Wisconsinan)

Qaf - Alluvial-fan deposits (Holocene and late Wisconsinan)
Stratified, moderately to poorly sorted sand, gravel, and silt in fan-shaped deposit. As much as 35 feet thick. Includes massively to planar-bedded sand and gravel and minor cross-bedded channelfill sand. Beds dip as much as 30° toward the trunk valley. Stratified sediment is locally interlayered with poorly sorted, sandy-silty to sandy gravel. Description from source map: Branchville Quadrangle

Qaf - Alluvial-fan deposits (Holocene and late Wisconsinan)
Stratified, moderately to poorly sorted sand, gravel, and silt in fan-shaped deposits. As much as 35 feet (11m) thick. Includes massive to planar-bedded sand and gravel and minor cross-bedded channel-fill sand. Beds dip as much as 30° toward the trunk valley. Stratified sediment is locally interlayered with poorly sorted, sandy-silty to sandy gravel. Typically graded to postglacial terraces or the modern floodplain. More rarely graded to glacial outwash terraces. Most fans dissected by modern streams. Description from source maps: Bushkill Quadrangle, Flatbrookville Quadrangle, Lake Maskenozha Quadrangle, Milford Quadrangle, Port Jervis South Quadrangle

Qaf - Alluvial-fan deposits (Holocene and late Wisconsinan)
Stratified, moderately to poorly sorted sand, gravel, and silt in fan-shaped deposits. As much as 35 feet (11m) thick. Includes massive to planar-bedded sand and gravel and minor cross-bedded channel-fill sand. Beds dip as much as 30° toward the trunk valley. Locally interlayered with poorly sorted, sandy-silty to sandy gravel. Typically graded to postglacial terraces or the modern floodplain. More rarely graded to glacial outwash terraces. Most fans are dissected by modern streams. Description from source map: Culvers Gap Quadrangle

Qaf - Alluvial fan (Quaternary)
Sand and Gravel. Fan shaped landform at mouth of tributary valleys. Description from source map: East Stroudsburg Quadrangle

Qaf - Alluvial fan deposits (Holocene and late Pleistocene, locally middle Pleistocene)
Sand, silt, pebble-to-cobble gravel; reddish brown, yellowish brown to brown. As much as 40 feet thick, locally middle Pleistocene. Contain minor amounts of organic matter. Form fans at mouths of steep streams. Description from source map: New Jersey Surficial Geology

Qaf - Alluvial-fan deposits (Holocene and late Wisconsinan)
Stratified, moderately to poorly sorted sand, gravel, and silt in fan-shaped deposits. As much as 35 feet (11m) thick. Includes massive to planar-bedded sand and gravel and minor cross-bedded channel-fill sand. Beds dip as much as 30° toward the trunk valley. Stratified sediment is locally interlayered with poorly sorted, sandy-silty to sandy gravel. Most fans dissected by modern streams. Description from source map: Newton West Quadrangle

Qaf - Alluvial fan (Holocene)
Unconsolidated, poorly stratified, poorly to moderately well sorted mixture of clay, silt, sand, gravel, cobbles, and some boulders. Clasts are angular and platy to well rounded; composition reflects the underlying bedrock. Alluvial fans have relatively smooth, fan-shaped surfaces and low to steep gradients, and occur at the mouths of tributaries. Alluvial fans are fluvial deposits at tributary mouths. Thickness is generally unknown, but most deposits are thought to be not more than several feet thick.

Locally may yield large quantities of water to wells. Easy to excavate; generally shallow depth to bedrock. Unsuitable for septic systems and construction because of the potential for flooding. No known mineral resources.

Of limited areal extent. Locally may yield large quantities of water to wells. Description from source

map: Pike County Geology and Mineral Resources

Qaf - Alluvial fan deposits (Pleistocene to recent)
Fan-shaped sand and gravel deposits at mouths of streams. Description from source map: Stroudsburg Quadrangle

Qta - Talus deposits (Holocene and late Wisconsinan)

Qta - Talus (Quaternary)
Angular to subangular rock fragments, dominantly boulder-size, generally no interstitial material; in places containing pockets of matrix between clasts especially the bottom of the deposit; at bases of cliff aces or steep slopes, typically at angle of repose; 2 to 10 meters thick. Description from source map: Allentown 30 x 60

Qta - Talus (Holocene and late Wisconsinan)
Angular boulders, as much as 15 feet long, cobbles and smaller rock fragments that lie at the base of bedrock cliffs and steep slopes. As much as 20 feet thick. In places may include colluviated till at its downslope termination. Description from source map: Branchville Quadrangle

Qta - Talus deposits (Holocene and late Wisconsinan)
Unsorted, nonstratified, angular boulders as much as 15 feet (4m) long, cobbles, and smaller fragments of quartzite and quartz-pebble conglomerate forming aprons over rock and till at the base of bedrock cliffs and steep hillslopes on Kittatinny Mountain. As much as 20 feet (6m) thick. Description from source maps: Bushkill Quadrangle, Culvers Gap Quadrangle, Flatbrookville Quadrangle, Lake Maskenozha Quadrangle, Newton West Quadrangle, Port Jervis South Quadrangle

Qta - Talus (Holocene and late Pleistocene)
Angular blocks and boulders of gneiss, quartzite, or diabase (depending on location) with little or no matrix material; gray, white, and reddish-purple. As much as 20 feet thick. Forms steep aprons at the base of cliffs. Deposited by rockfall after retreat of the late Wisconsinan glacier. Description from source map: New Jersey Surficial Geology

Qta - Talus (Pleistocene to recent)
Accumulation of angular blocks of Shawangunk quartzite and conglomerate at base of south slope of Kittatinny and Blue Mountains. Scattered occurrences elsewhere not mapped. Description from source map: Stroudsburg Quadrangle

Qsc - Shale-chip colluvium (Holocene and late Wisconsinan)

Qsc - Shale-chip colluvium (Holocene and late Wisconsinan)
Thin to thickly bedded, noncompact, poorly sorted light yellowish-brown (10YR 6/4) to brownish-yellow (10YR 7/6) or light olive-brown (2.5Y 5/2) framework-supported, shale chip gravel, containing as much as 80 percent unweathered to lightly weathered angular to subangular shale chips, and minor tabular pebbles and cobbles of siltstone and sandstone. Interstitial material consists of silty sand. Forms aprons below cliffs and some steep slopes on the west side of Minisink Valley; as much as 20 feet (3m) thick. Beds dip as much as 25° toward valley. In places the distal (downslope) beds are interlayered with wind-blown sand and alluvium. Graded to glacial and postglacial stream terraces in valley. Description from source maps: Culvers Gap Quadrangle, Flatbrookville Quadrangle, Lake Maskenozha Quadrangle, Port Jervis South Quadrangle

Qsc - Shale-chip colluvium (Holocene and late Wisconsinan)
Shale-chip colluvium (Holocene and late Wisconsinan) -- Thin to thickly bedded, noncompact, poorly sorted light yellowish-brown (10YR 6/4) to brownish-yellow (10YR 7/6) or light olive-brown (2.5Y 5/2) framework-supported, shale-chip gravel, containing as much as 80 percent unweathered to lightly weathered angular to subangular shale chips, and minor tabular pebbles and cobbles of siltstone and sandstone. Interstitial material consists of silty sand. Forms aprons below cliffs and some steep slopes on the west side of Minisink Valley; as much as 20 feet (3m) thick. Beds dip as much as 25° toward valley. In places the distal (downslope) beds are interlayered with wind-blown sand and alluvium. Graded to glacial and postglacial stream terraces in valley. Description from source map: Milford Quadrangle

Qac - Alluvium and colluvium (Holocene and late Wisconsinan)

Qcal - Colluvium and alluvium (Holocene and late Wisconsinan)
Sand, silt, and gravel in thin sheets occupying small valleys and basins in upland areas. Thinly bedded and poorly to moderately sorted. Locally underlain by and interlayered with silty to silty-sandy diamicton; as much as 15 feet thick. Includes lag boulders and cobbles in small upland valleys. Description from source map: Branchville Quadrangle

Qac - Alluvium and colluvium (Holocene and late Wisconsinan)
Stratified, poorly to moderately sorted, brown to yellowish-brown, gray sand, silt and minor gravel; as much as 20 feet (6m) thick. Interlayered with or overlying, massive to crudely layered, poorly sorted sand, silt, and minor gravel. Description from source map: Bushkill Quadrangle, Lake Maskenozha Quadrangle, Milford Quadrangle, Port Jervis South Quadrangle

Qac - Alluvium and colluvium, undifferentiated (Holocene and late Wisconsinan)
Stratified, thinly bedded, moderately to poorly sorted sand, silt, and minor gravel in thin sheets laid down on the floors of small upland tributaries and the lower parts of adjacent slopes. Interlayered with and overlying silty to silty-sandy diamicton (interpreted as a mass-flow deposit). Locally shaly. As much as 15 feet (5m) thick. Description from source maps: Culvers Gap Quadrangle, Newton West Quadrangle

Qs - Swamp and bog deposits (Holocene and late Wisconsinan)

Qs - Wetland (Quaternary)
Area with standing water for part of each year; underlain by peat, clay, silt, sand, or some combination of those materials. Description from source map: Allentown 30 x 60

Qs - Swamp deposits (Holocene and late Wisconsinan)
Peat of reed, sedge, and woody origin, and muck underlain by laminated organic-rich silt and clay. As much as 25 feet thick. Locally interbedded with alluvium and thin colluvium. In areas underlain by carbonate rock, marl as much as 20 feet thick, typically underlies peat and muck. Description from source map: Branchville Quadrangle

Qs - Swamp and bog deposits (Holocene and late Wisconsinan)
Dark brown to black, partially decomposed remains of mosses, sedges, trees and other plants, and muck underlain by laminated organic-rich silt and clay. Accumulated in kettles, shallow postglacial lakes, poorly-drained areas in uplands, and hollows in ground moraine. As much as 25 feet (8m) thick. Locally interbedded with alluvium and thin colluvium. Description from source maps: Bushkill Quadrangle , Culvers Gap Quadrangle, Lake Maskenozha Quadrangle

Qpb - Peat bog (Quaternary)

Peat. Fill in undrained depressions. Description from source map: East Stroudsburg Quadrangle

Qs - Swamp and bog deposits (Holocene and late Wisconsinan)
Dark brown to black peat, partially decomposed remains of mosses, sedges, trees and other plants, and muck underlain by laminated organic-rich silt and clay. Accumulated in kettles, shallow postglacial lakes, poorly-drained areas in uplands, and hollows in ground moraine. As much as 25 feet (8m) thick. Locally interbedded with alluvium and thin colluvium. Description from source maps: Flatbrookville Quadrangle, Milford Quadrangle, Port Jervis South Quadrangle

Qs - Swamp And marsh deposits (Holocene and late Pleistocene)
Peat and organic clay, silt, and minor sand; gray, brown, black. As much as 40 feet thick. Deposited in modern freshwater wetlands. Description from source map: New Jersey Surficial Geology

Qs - Swamp and bog deposits (Holocene and late Wisconsinan)
Dark brown to black, partially decomposed remains of mosses, sedges, trees and other plants, and muck underlain by laminated organic-rich silt and clay, and in places marl. Accumulated in kettles, shallow postglacial lakes, poorly-drained areas in uplands, hollows in ground and end moraine, and in abandoned channels on flood plains. As much as 25 feet (8m) thick. Locally interbedded with alluvium and thin colluvium. Description from source map: Newton West Quadrangle

Qs - Swamp deposits (Holocene)
Unconsolidated clay, silt, and sand mixed with partly decomposed organic material; may contain cobbles and boulders. Occurs in shallow, undrained areas that commonly have standing water and a thick overstory of trees. Most deposits are thought to be less than 6 feet thick.

No aquifer potential. Easily excavated. Unsuitable for foundations, septic systems, and sanitary-landfill sites because of the high water table. No known mineral resources.

Not an aquifer. Description from source map: Pike County Geology and Mineral Resources

Qs - Swamp deposits (Pleistocene to recent)
Organic matter and clay, probably with disseminated silt and sand, in poorly drained areas. Description from source map: Stroudsburg Quadrangle

Qem - End moraine (Pleistocene (Wisconsinan))

Qem - End moraine (Pleistocene (Wisconsinan))
Belt-like accumulation of till with low linear ridges and depressions, believed to mark an ice-front position. Description from source map: Stroudsburg Quadrangle

Qgm - Ground moraine (Quaternary)

Qgm - Ground moraine (Quaternary)
Till. Sheet-like, undulating; mostly controlled by bed rock topography. Description from source map: East Stroudsburg Quadrangle

Qgm - Ground moraine (Pleistocene (Wisconsinan))
Mantle of till of variable thickness having irregular topography of low relief which is devoid of linear elements. Contains minor stratified sand and gravel that may be abundant locally. Description from source map: Stroudsburg Quadrangle

Qdm - Drumlinoid till ridges (Quaternary)

Qdm - Drumlinoid till ridges (Quaternary)
Till. Streamlined, drumlin-like ridges and intervening depressions. Description from source map: East Stroudsburg Quadrangle

Qhm - Hummocky stagnation moraine (Quaternary)

Qhm - Hummocky stagnation moraine (Quaternary)
Till. “Knob and Kettle” topography with numerous undrained depressions. Description from source map: East Stroudsburg Quadrangle

Qlm - Lateral moraine (Quaternary)

Qlm - Lateral moraine (Quaternary)
Till. Longitudinal ridges along valley sides. Description from source map: East Stroudsburg Quadrangle

Qst3 - Stream-terrace deposits, older (Holocene and late Wisconsinan)

Qst3 - Stream-terrace deposits, older (Holocene and late Wisconsinan)
Stratified, well- to moderately-sorted, massive to laminated, and minor cross-bedded fine sand, and silt in terraces flanking present and late postglacial stream courses. As much as 20 feet (6m) thick. Overlies glacial and postglacial fluvial, planar to cross-bedded pebbly sand and gravel; as much as 10 feet (3m) thick. In Minisink Valley (Delaware River valley) deposits form two distinct terraces. The older (Qst3) flanks late glacial and early postglacial stream courses and overlies glacial outwash and early postglacial fluvial sand and gravel. It lies 40 to 50 feet (12 to 15m) above the river and consists of as much as 10 feet of fine sand and medium sand. Description from source maps: Bushkill Quadrangle, Lake Maskenozha Quadrangle

Qst3 - Stream-terrace deposits, older (Holocene and late Wisconsinan)
Stratified, well- to moderately-sorted, massive to laminated, and minor cross-bedded fine sand and silt in terraces flanking present and late postglacial stream courses. As much as 20 feet (6m) thick. Overlies glacial and postglacial fluvial, planar to cross-bedded pebbly sand and gravel; as much as 10 feet (3m) thick. In Minisink Valley (Delaware River valley) deposits form two distinct terraces. The older (Qst3) flanks late glacial and early postglacial stream courses and overlies glacial outwash and early postglacial fluvial sand and gravel. It lies 40 to 50 feet above the river and consists of as much as 10 feet of fine and medium sand. Description from source map: Culvers Gap Quadrangle

Qst3 - Stream-terrace deposits, oldest (Holocene and late Wisconsinan)
Stratified, well- to moderately-sorted, Qst3 massive to laminated, and minor cross-bedded fine sand, and silt as much as 20 feet (6m) thick, overlying planar to cross-bedded pebbly sand and gravel as much as 10 feet (3m) thick in terraces flanking present and late postglacial stream courses. In Minisink Valley (Delaware River valley) deposits form two distinct terraces. The oldest (Qst3) flanks late glacial and early postglacial stream courses and overlies glacial outwash and early postglacial fluvial sand and gravel. It lies 40 to 50 feet above the river and consists of as much as 10 feet of fine sand and medium sand. Description from source map: Flatbrookville Quadrangle

Qst3 - Stream-terrace deposits, oldest (Holocene and late Wisconsinan)
Stratified, well- to moderately-sorted, massive to laminated, and minor cross-bedded fine sand, and silt as much as 20 feet (6m) thick, overlying planar to cross-bedded pebbly sand and gravel as much as 10 feet (3m) thick in terraces flanking present and late postglacial stream courses. In Minisink Valley (Delaware River valley) deposits form two distinct terraces. The oldest (Qst3) flanks late glacial and early postglacial stream courses and overlies glacial outwash and early postglacial fluvial sand and gravel. It lies 40 to 50 feet above the river and consists of as much as 10 feet of fine sand and medium sand. Description from source maps: Milford Quadrangle, Port Jervis South Quadrangle

Qba - Boulder accumulations (Pleistocene)

Qba - Boulder accumulations (Pleistocene)
Unsorted, unconsolidated mixture of angular to rounded boulders up to 6 feet or more in diameter, but generally less than 3 feet. Mainly sandstone having relatively flat to very rough surfaces. Occurs in open flats, below ledges, in small drainages, around the margins of peat deposits, and on swamp surfaces. Deposits result from glaciation and/or colluviation. Thickness is unknown, but appears to range from 1 foot to several feet.

No aquifer potential. Moderately difficult to excavate. Generally unsuitable for foundations. Unsuitable for septic systems and sanitary landfill sites. Potential source of riprap.

Not an aquifer. Description from source map: Pike County Geology and Mineral Resources

Qoic - Ice-contact stratified sand and gravel (Pleistocene)

Qud - Undifferentiated ice-contact deposits and till (Quaternary)
Till, Gravel, Sand. Unsystematic mixture of ridges, mounds and depressions. Description from source map: East Stroudsburg Quadrangle

Qoic - Olean ice-contact stratified sand and gravel (Pleistocene)
Unconsolidated, stratified sand and gravel, commonly containing large boulders. Abrupt textural changes between beds and lenses; composition reflects underlying bedrock of the region. Deposited by fluvial action in close proximity to stagnant ice. Thickness is variable and generally unknown, ranging from several feet to more than 200 feet.

High infiltration capacity. Median yield of domestic wells is 20 gal/min. Water has good quality. Generally easy to excavate; large boulders may be encountered. Maintains only moderate to gentle cut slopes; potential for slumping. Generally unsuitable for septic systems and sanitary landfills because sand and gravel afford little or no attenuation of chemical and bacterial contaminants. Poor to unsuitable foundation for heavy structures. Source of coarse and fine aggregate; crushing, screening, and washing are generally required; groundwater may be encountered in valley bottoms.

An excellent aquifer. Non-domestic wells have reported yields up to 350 gal/min. Median specific capacity is 3.3 (gal/min)/ft for nondomestic wells and 0.59 (gal/min)/ft for domestic wells. Water is soft and of good quality. Description from source map: Pike County Geology and Mineral Resources

Qokt - Kame terrace (Pleistocene)

Qkt - Kame terrace (Quaternary)
Sand, Gravel. Flat-topped terrace. Description from source map: East Stroudsburg Quadrangle

Qokt - Olean kame terrace (Pleistocene)
Unconsolidated, stratified sand and gravel, commonly containing large boulders. Abrupt textural changes between beds and lenses; composition reflects underlying bedrock of the region; includes valley-bottom and valley-side kames and kame terraces, and some upland kames. Forms hummocky surface topography; kames have undrained depressions; kame terraces have undulating sloping surfaces. Deposited by fluvial action in close proximity to stagnant ice. Thickness is variable and generally unknown, ranging from several feet to more than 200 feet.

High infiltration capacity. Median yield of domestic wells is 20 gal/min. Water has good quality. Generally easy to excavate; large boulders may be encountered. Maintains only moderate to gentle cut slopes; potential for slumping. Generally unsuitable for septic systems and sanitary landfills because sand and gravel afford little or no attenuation of chemical and bacterial contaminants. Poor to unsuitable foundation for heavy structures. Source of coarse and fine aggregate; crushing, screening, and washing are generally required; groundwater may be encountered in valley bottoms.

An excellent aquifer. Non-domestic wells have reported yields up to 350 gal/min. Median specific capacity is 3.3 (gal/min)/ft for nondomestic wells and 0.59 (gal/min)/ft for domestic wells. Water is soft and of good quality. Description from source map: Pike County Geology and Mineral Resources

Qkt - Kame terrace deposits (Pleistocene (Wisconsinan))
Gravel, sand, and silt with some clay of variable sorting and stratification in flat-topped deposits against valley walls. Some fine sand, silt, and clay probably deposited in temporary ponds. Description from source map: Stroudsburg Quadrangle

Qwt - Wisconsinan till (Wisconsinan)

Qwt - Wisconsinan till (Quaternary, Wisconsinan)
Till; poorly sorted, unstratified diamict with a clayey, silty, or sandy matrix depending on the local source bedrock; common cobble and boulder clasts; typically occurs as fairly smooth landform with a bouldery surface and no clear constructional topography; upper meter is often colluviated; thickness typically 3 to 5 meters, in places may exceed 10meters in thickness. Description from source map: Allentown 30 x 60

t - Till (Quaternary)
Variable texture (boulders to silt), usually poorly sorted sand-rich diamict, deposition beneath glacier ice, permeability varies with compaction, thickness variable (1-50 meters). Description from source map: New York Geology, Lower Hudson Sheet

Qot - Olean till (Pleistocene)
Unsorted and nonstratified mixture of clay, silt, sand, pebbles, cobbles, and boulders. Reddish brown in most of the county; brown to gray where it overlies the Trimmers Rock and Mahantango Formations; moderately cohesive; composition reflects underlying bedrock; shallow soil profiles; occurs mainly on lower slopes or in valley bottoms. Deposited as lodgment till at the base of ice or as ablation till by melting ice. Thickness ranges from 6 feet to over 200 feet.

Moderate to high infiltration capacity. Four domestic wells have a median yield of 28 gal/min. Water has good quality. Moderately easy to excavate; some problems due to large boulders. Generally fast drilling rates. Generally maintains gentle to moderate cut slopes; susceptible to landslide failure where water

saturated. Poor to good foundation for heavy structures. Not suitable for septic systems. Suitable in some places for sanitary-landfill sites. Useful as artificial fill.

Apparently a good aquifer; median yield is 28 gal/min for four domestic wells, and median specific capacity is 0.92 (gal/min)/ft for four domestic wells. No data are available for nondomestic wells. Water quality is good. Description from source map: Pike County Geology and Mineral Resources

Qe - Eolian deposits (late Pleistocene)

Qed - Sand dunes (late Wisconsinan)
Well sorted, thinly bedded, yellowish brown (10YR 5/4) and brown (10Y R 5/3) fine sand and very fine sand in low mounds and ridges on outwash deposits in Minisink Valley. As much as 10 feet thick (3m). Description from source map: Culvers Gap Quadrangle

Qes - Wind-blown sand (late Wisconsinan)
Well sorted, massively bedded, yellowish-brown (10 YR 5/4) and brown (10YR 5/3) fine sand and very fine sand in thin sheets, low mounds, and ridges in Minisink Valley and on the western slopes of Wallpack Ridge. As much as 10 feet thick (3m). Description from source map: Milford Quadrangle

Qe - Eolian deposits (late Pleistocene, locally of early to middle Pleistocene and Pliocene age on uplands)
Windblown fine sand and silt; very pale brown, yellowish brown. As much as 15 feet thick. Form sand sheets and, locally, dunes. Description from source map: New Jersey Surficial Geology

Qmt - Meltwater-terrace deposits (late Wisconsinan)

Qmt - Meltwater terrace deposits (late Wisconsinan)
Pebble gravel and sand, and pebbly sand as much as 10 feet. Description from source map: Branchville Quadrangle

Qmt - Meltwater-terrace deposits (late Wisconsinan)
Stratified, well- to moderately-sorted sand, cobble-pebble to pebble gravel, and minor silt deposited by meltwater streams as terraces incised in valley-train, glacial lake delta deposits, and other meltwater-terrace deposits. As much as 20 feet (6m) thick. Sediment and bedforms similar to the downstream, distal part of valley-train deposits. Includes bouldery strath terraces cut in till along meltwater stream courses in uplands. May also include the distal part of valley-train deposits where they have cut into older valley-train deposits downvalley. Description from source map: Bushkill Quadrangle, Culvers Gap Quadrangle, Flatbrookville Quadrangle, Lake Maskenozha Quadrangle, Milford Quadrangle, Port Jervis South Quadrangle

Qwft - Late Wisconsinan glaciofluvial terrace deposits (late Pleistocene, late Wisconsinan)
Sand, pebble-to-cobble gravel, minor silt; yellowish brown to reddish brown. As much as 40 feet thick. Form terraces deposited by glacial streams during the late Wisconsinan glaciation. Description from source map: New Jersey Surficial Geology

Qmt - Meltwater-terrace deposits (late Wisconsinan)
Stratified, well- to moderately-sorted sand, cobble-pebble to pebble gravel, and minor silt deposited by meltwater streams as terraces incised in valley-train, glacial lake delta deposits, and other meltwater-terrace deposits. As much as 20 feet (6m) thick. Sediment and bedforms similar to the downstream, distal part of valley-train deposits. Includes bouldery strath terraces cut in till along meltwater stream

courses in uplands. Description from source map: Newton West Quadrangle

Qv - Valley-train deposits (late Wisconsinan)

Qv - Valley-train deposits (late Wisconsinan)
Stratified, well- to moderately-sorted sand, boulder-cobble to pebble gravel, and minor silt deposited by meltwater streams at and extending well beyond (greater than five miles (8 km)) the glacier's margin. As much as 100 feet (30m) thick. The proximal part of the deposit consists of massive to horizontally-bedded and imbricated coarse gravel and sand, and planar to tabular and trough cross-bedded, fine gravel and sand in bars, and channel-lag deposits with minor cross-bedded sand in channel-fill deposits. Clasts generally are smaller downstream, sand is more abundant, and trough and planar cross-bedding, and graded beds are more common. In Minisink Valley forms shingled sets of outwash terraces. Based on well records, may overlie glacial lake deposits previously laid down in sediment-dammed proglacial lakes. In places overlain by nonlayered, well-sorted, very fine sand and fine sand presumed to be eolian; as much as 5 feet (2m) thick. Description from source map: Bushkill Quadrangle

Qv2 - Valley-train deposits (late Wisconsinan)
Stratified, well- to moderately sorted sand, boulder-cobble to pebble gravel, and minor silt deposited by meltwater streams at and extending well beyond (greater than five miles (8 km)) the glacier's margin As much as 100 feet (30m) thick. The proximal part of the deposit consists of massive to horizontally bedded and imbricated coarse gravel and sand, and planar to tabular and trough cross-bedded, fine gravel and sand in bars, and channel-lag deposits with minor cross-bedded sand in channel-fill deposits. Clasts generally are smaller downstream, where sand is more abundant, and trough and planar crossbedding, and graded beds are more common. Based on well records, overlies glacial lake deposits previously laid down in sediment-dammed proglacial lakes. In places overlain by nonlayered, well-sorted, very fine sand and fine sand presumed to be eolian; as much as 5 feet (2m) thick. In Minisink Valley forms shingled sets of outwash terraces. This unit is the younger of two units from this map with Qv1 being older. Description from source map: Culvers Gap Quadrangle

Qvt - Valley Train (Quaternary)
Sand, Grave. Flat-topped terrace bordering Brodhead and Marshall Creeks. Description from source map: East Stroudsburg Quadrangle

Qv - Valley-train deposits (late Wisconsinan)
Stratified, well- to moderately-sorted sand, boulder-cobble to pebble gravel, and minor silt deposited by meltwater streams at and extending well beyond (greater than five miles (8 km)) the glacier's margin. As much as 100 feet (30m) thick. The proximal part of the deposit consists of massive to horizontally-bedded and imbricated coarse gravel and sand, and planar to tabular and trough cross-bedded, fine gravel and sand in bars, and channel-lag deposits with minor cross-bedded sand in channel-fill deposits. Clasts generally are smaller downstream, sand is more abundant, and trough and planar cross-bedding, and graded beds are more common. Based on well records overlies glacial lake deposits previously laid down in sediment-dammed proglacial lakes. In places overlain by nonlayered, well-sorted, very fine sand and fine sand presumed to be eolian; as much as 5 feet (2m) thick. In Minisink Valley forms shingled sets of outwash terraces. Description from source maps: Flatbrookville Quadrangle, Lake Maskenozha Quadrangle

Qv - Valley-train deposits (late Wisconsinan)
Stratified, well- to moderately-sorted sand, boulder-cobble to pebble gravel, and minor silt deposited by meltwater streams in Minisink Valley from ice-recessional positions at and extending well beyond (greater than five miles (8 km)) the glacier margin. As much as 100 feet (30m) thick. The proximal part of the deposit consists of massive to horizontally-bedded and imbricated coarse gravel and sand, and

planar to tabular and trough cross-bedded, fine gravel and sand in bars, and channel-lag deposits with minor cross-bedded sand in channel-fill deposits. Clasts generally are smaller downstream, sand is more abundant, and trough and planar cross-bedding, and graded beds are more common. In places overlies glacial lake deposits previously laid down in sediment-dammed proglacial lakes. In places overlain by nonlayered, well-sorted, very fine sand and fine sand presumed to be eolian; as much as 10 feet (3m) thick. In Minisink Valley forms shingled sets of outwash terraces. Description from source map: Milford Quadrangle

Qv - Valley-train deposits (late Wisconsinan)
Stratified, well- to moderately-sorted sand, boulder-cobble to pebble gravel, and minor silt deposited by meltwater streams in Minisink Valley from ice-recessional positions at and extending well beyond (more than five miles (8 km)) the stagnant glacier margin. As much as 100 feet (30m) thick. The proximal part of the deposit consists of massive to horizontally-bedded and imbricated coarse gravel and sand, and planar to tabular and trough cross-bedded, fine gravel and sand in bars, and channel-lag deposits with minor cross-bedded sand in channel-fill deposits. Clasts generally are smaller downstream, sand is more abundant, and trough and planar cross-bedding, and graded beds are more common. Based on well records overlies glacial lake deposits previously laid down in sediment-dammed proglacial lakes. In places overlain by nonlayered, well-sorted, very fine sand and fine sand presumed to be eolian; as much as 5 feet (2m) thick. In Minisink Valley forms shingled sets of outwash terraces. Description from source map: Port Jervis South Quadrangle

Qdt - Deltaic terrace (Quaternary)

Qdt - Deltaic terrace (Quaternary)
Sand, Gravel. Flat-topped landform, deposited in glacial lake west of Marshall Creek. Description from source map: East Stroudsburg Quadrangle

Qod - Glacial-lake delta deposits (late Wisconsinan)

Qod - Glacial-lake delta deposits (late Wisconsinan)
Stratified sand, gravel, and silt deposited by meltwater streams in proglacial lakes at and beyond the stagnant glacier margin. Includes well sorted sand and boulder-cobble to pebble gravel in planar to cross-bedded glaciofluvial topset beds that are as much as 25 feet (8m) thick. Overlies and grades into foreset beds that dip 20° to 35° basinward and consist of well- to moderately-sorted, rhythmically-bedded cobble-pebble and pebble gravel and sand. These beds grade downward and outward into ripple cross-laminated and parallel-laminated, sand, silt and pebble gravel that dip less than 20°. Lower foreset beds grade into gently inclined prodelta bottomset beds of rhythmically-bedded, ripple cross-laminated to graded fine sand and silt with minor clay drapes. Thickness may be as much as 100 feet (30m). Qod deposits were laid down in narrow sediment-dammed proglacial lakes in Minisink Valley. Deposits are extensively kettled, and in long, narrow lake basins, topset beds are extensively aggraded in their upstream sections. In subsurface only. Description from source map: Bushkill Quadrangle

Qd - Ice-dammed glacial-lake delta deposits (late Wisconsinan)
Stratified, sand, gravel, and silt deposited by meltwater streams in proglacial lakes at and beyond the stagnant glacier margin. Includes well sorted sand and boulder-cobble to pebble gravel in planar to cross-bedded glaciofluvial topset beds that are as much as 25 feet (8m) thick. Overlies and grades into foreset beds that dip 20° to 35° basinward and consist of well- to moderately-sorted, rhythmically-bedded cobble-pebble and pebble gravel and sand. These beds grade downward and outward into ripple cross-laminated and parallel-laminated, sand, silt and pebble gravel that dip less than 20°. Lower foreset beds grade into gently inclined prodelta bottomset beds of rhythmically-bedded, ripple cross-laminated to

graded fine sand and silt with minor clay drapes. Thickness may be as much as 100 feet (30m). Qd deposits were laid down in small ice-dammed lakes in tributaries of the Paulins Kill. Deposits are extensively kettled. In long, narrow lake basins, topset beds are extensively aggraded in their upstream sections. Description from source map: Flatbrookville Quadrangle

Qod - Glacial-lake delta deposits (late Wisconsinan)
Stratified sand, gravel, and silt deposited by meltwater streams in proglacial lakes at and beyond the stagnant glacier margin. Includes well sorted sand and boulder-cobble to pebble gravel in planar to cross-bedded glaciofluvial topset beds that are as much as 25 feet (8m) thick. Overlies and grades into foreset beds that dip 20° to 350 basinward and consist of well- to moderately-sorted, rhythmically-bedded cobble-pebble and pebble gravel and sand. These beds grade downward and outward into ripple cross-laminated and parallel-laminated, sand, silt and pebble gravel that dip less than 200 Lower foreset beds grade into gently inclined prodelta bottomset beds of rhythmically-bedded, ripple cross-laminated to graded fine sand and silt with minor clay drapes. Thickness may be as much as 100 feet (30m). Qod deposits were laid down in narrow sediment-dammed proglacial lakes in Paulins Kill and Wallpack Valleys. Deposits are extensively kettled, and in long, narrow lake basins, topset beds are extensively aggraded in their upstream sections. Description from source map: Lake Maskenozha Quadrangle

Qd - Glacial-lake delta deposits (late Wisconsinan)
Stratified, sand, gravel, and silt deposited by meltwater streams in proglacial lakes at and beyond the stagnant glacier margin. Includes well sorted sand and boulder-cobble to pebble gravel in planar to cross-bedded glaciofluvial topset beds that are as much as 25 feet (8m) thick. Overlies and grades into foreset beds that dip 20° to 35° basinward and consist of well- to moderately-sorted, rhythmically-bedded cobble-pebble and pebble gravel and sand. These beds grade downward and outward into ripple cross-laminated and parallel-laminated, sand, silt and pebble gravel that dip less than 20°. Lower foreset beds grade into gently inclined prodelta bottomset beds of rhythmically-bedded, ripple cross-laminated to graded fine sand and silt with minor clay drapes. Thickness may be as much as 100 feet (30m). Qd deposits were laid down in Shimers Brook basin. Many of the deposits are extensively kettled, showing deposition on and around stagnant ice. In long lake basins, topset beds are extensively aggraded in their upstream sections. Description from source map: Milford Quadrangle

Qwde - Late Wisconsinan glacial delta deposits (late Pleistocene, late Wisconsinan)
Sand, pebble-to-cobble gravel, minor silt; yellowish brown, reddish brown, light gray. As much as 150 feet thick. Deposited in deltas and other ice-contact landforms in glacial lakes during the late Wisconsinan glaciation. Description from source map: New Jersey Surficial Geology

Qd - Glacial-lake delta deposits (late Wisconsinan)
Stratified, sand, gravel, and silt deposited by meltwater streams in proglacial lakes at and beyond the stagnant glacier margin. Includes massive to horizontally-bedded and imbricated coarse gravel and sand, and planar to tabular and trough cross-bedded, fine gravel and sand in bars, and channel-lag deposits with minor cross-bedded sand in channel-fill deposits in glaciofluvial topset beds that are as much as 25 feet (8m) thick. Overlies and grades into foreset beds that dip 200 to 350 basinward and consist of well- to moderately-sorted, rhythmically-bedded cobble-pebble and pebble gravel and sand. These beds grade downward and outward into ripple cross-laminated and parallel-laminated, sand, silt and pebble gravel that dip less than 200. Lower foreset beds grade into gently inclined prodelta bottomset beds of rhythmically-bedded, ripple cross-laminated to graded fine sand and silt with minor clay drapes. Fluvial topset beds may have been extensively aggraded and deposit may have once filled the valley from wall to wall. Thickness may be as much as 100 feet (30m). In places deposits are extensively collapsed indicating their deposition over and against stagnant ice. Description from source map: Newton West Quadrangle

Qd - Delta deposits (Pleistocene (Wisconsinan))
Gravel, sand, silt, and some clay that generally coarsen upwards in flat-topped deposits, generally

having lobate distal slopes and ice-contact proximal slopes that may include an esker (Qe), and with topset and foreset bedding that generally grades into bottomsets (lake-bottom deposits); deposited in temporary glacial lakes. Some deposits appear to lack ice-contact proximal slopes, but kettle holes suggest the former existence of buried ice blocks. Description from source map: Stroudsburg Quadrangle

Qosd - Glacial-lake delta deposits from narrow sediment-dammed proglacial lakes (late Wisconsinan)

Qod - Glacial-lake delta deposits (late Wisconsinan)
Stratified sand, gravel, and silt deposited by meltwater streams in proglacial lakes at and beyond the stagnant glacier margin. Includes well sorted sand and boulder-cobble to pebble gravel in planar to cross-bedded glaciofluvial topset beds that are as much as 25 feet (8m) thick. Overlies and grades into foreset beds that dip 20° to 35° basinward and consist of well- to moderately-sorted, rhythmically-bedded cobble-pebble and pebble gravel and sand. These beds grade downward and outward into ripple cross-laminated and parallel laminated sand, silt and pebble gravel that dip less than 20°. Lower foreset beds grade into gently inclined prodelta bottomset beds of rhythmically-bedded, ripple cross-laminated to graded fine sand and silt with minor clay drapes. Thickness may be as much as 100 feet (30m). Number following unit label indicates relative age of unit in glacial lake basin. Lower numbers represent older deposits. Qod deposits were laid down in narrow sediment-dammed proglacial lakes in Paulins Kill and Wallpack Valleys. Deposits are extensively kettled, and in long lake basins, topset beds are extensively aggraded in their upstream sections. Description from source map: Culvers Gap Quadrangle

Qod - Sediment-dammed glacial-lake delta deposits (late Wisconsinan)
Stratified, sand, gravel, and silt deposited by meltwater streams in proglacial lakes at and beyond the stagnant glacier margin. Includes well sorted sand and boulder-cobble to pebble gravel in planar to cross-bedded glaciofluvial topset beds that are as much as 25 feet (8m) thick. Overlies and grades into foreset beds that dip 20° to 35° basinward and consist of well- to moderately-sorted, rhythmically-bedded cobble-pebble and pebble gravel and sand. These beds grade downward and outward into ripple cross-laminated and parallel-laminated, sand, silt and pebble gravel that dip less than 20°. Lower foreset beds grade into gently inclined prodelta bottomset beds of rhythmically-bedded, ripple cross-laminated to graded fine sand and silt with minor clay drapes. Thickness may be as much as 100 feet (30m). Qod deposits were laid down in narrow sediment-dammed proglacial lakes in Paulins Kill and Wallpack Valleys. Deposits are extensively kettled. In long, narrow lake basins, topset beds are extensively aggraded in their upstream sections. Description from source map: Flatbrookville Quadrangle

Qod - Glacial-lake delta deposits from narrow sediment-dammed proglacial lakes (late Wisconsinan)
Stratified, sand, gravel, and silt deposited by meltwater streams in proglacial lakes at and beyond the stagnant glacier margin. Includes well sorted sand and boulder-cobble to pebble gravel in planar to cross-bedded glaciofluvial topset beds that are as much as 25 feet (8m) thick. Overlies and grades into foreset beds that dip 20° to 35° basinward and consist of well- to moderately-sorted, rhythmically-bedded cobble-pebble and pebble gravel and sand. These beds grade downward and outward into ripple cross-laminated and parallel-laminated, sand, silt and pebble gravel that dip less than 20°. Lower foreset beds grade into gently inclined prodelta bottomset beds of rhythmically-bedded, ripple cross-laminated to graded fine sand and silt with minor clay drapes. Thickness may be as much as 100 feet (30m). Qod deposits were laid down in narrow sediment-dammed proglacial lakes in Flat Brook, Raymondskill Creek, and Sawkill Creek Valleys. Many of the deposits are extensively kettled, showing deposition on and around stagnant ice. In long lake basins, topset beds are extensively aggraded in their upstream sections. Description from source map: Milford Quadrangle

Qod - Narrow lake basin glacial-lake delta deposits (late Wisconsinan)
Stratified, sand, gravel, and silt deposited by meltwater streams in proglacial lakes at and beyond the stagnant glacier margin. Includes massive to horizontally-bedded and imbricated coarse gravel and sand, and planar to tabular and trough cross-bedded, fine gravel and sand in bars, and channel-lag deposits with minor cross-bedded sand in channel-fill deposits in glaciofluvial topset beds that are as much as 25 feet (8m) thick. Overlies and grades into foreset beds that dip 20° to 35° degrees basinward and consist of well- to moderately-sorted, rhythmically-bedded cobble-pebble and pebble gravel and sand. These beds grade downward and outward into ripple cross-laminated and parallel-laminated, sand, silt and pebble gravel that dip less than 20°. Lower foreset beds grade into gently inclined prodelta bottomset beds of rhythmically-bedded, ripple cross-laminated to graded fine sand and silt with minor clay drapes. Qod deposit laid down in a very narrow lake basin. Fluvial topset beds may have been extensively aggraded and deposit may have once filled the valley from wall to wall. Thickness may be as much as 100 feet (30m). In places deposits are extensively collapsed indicating their deposition over and against stagnant ice. Sequentially numbered units in the Paulins Kill and Pequest Valleys define successively-younger ice-contact deltas that delineate local ice-retreat positions (see text for a detailed description of the lake's history). Description from source map: Newton West Quadrangle

Qod7 - Narrow lake basin glacial-lake delta deposits, 7th successively-younger ice-contact delta (late Wisconsinan)

Qod7 - Narrow lake basin glacial-lake delta deposits, 7th successively-younger ice-contact delta (late Wisconsinan)
Stratified, sand, gravel, and silt deposited by meltwater streams in proglacial lakes at and beyond the stagnant glacier margin. Includes massive to horizontally-bedded and imbricated coarse gravel and sand, and planar to tabular and trough cross-bedded, fine gravel and sand in bars, and channel-lag deposits with minor cross-bedded sand in channel-fill deposits in glaciofluvial topset beds that are as much as 25 feet (8m) thick. Overlies and grades into foreset beds that dip 20° to 35° basinward and consist of well- to moderately-sorted, rhythmically-bedded cobble-pebble and pebble gravel and sand. These beds grade downward and outward into ripple cross-laminated and parallel-laminated, sand, silt and pebble gravel that dip less than 20°. Lower foreset beds grade into gently inclined prodelta bottomset beds of rhythmically-bedded, ripple cross-laminated to graded fine sand and silt with minor clay drapes. Qod deposit laid down in a very narrow lake basin. Fluvial topset beds may have been extensively aggraded and deposit may have once filled the valley from wall to wall. Thickness may be as much as 100 feet (30m). In places deposits are extensively collapsed indicating their deposition over and against stagnant ice. Sequentially numbered units in the Paulins Kill and Pequest Valleys define successively-younger ice-contact deltas that delineate local ice-retreat positions. Description from source map: Newton West Quadrangle

Qod6 - Narrow lake basin glacial-lake delta deposits, 6th successively-younger ice-contact delta (late Wisconsinan)

Qod6 - Narrow lake basin glacial-lake delta deposits, 6th successively-younger ice-contact delta (late Wisconsinan)
Stratified, sand, gravel, and silt deposited by meltwater streams in proglacial lakes at and beyond the stagnant glacier margin. Includes massive to horizontally-bedded and imbricated coarse gravel and sand, and planar to tabular and trough cross-bedded, fine gravel and sand in bars, and channel-lag deposits with minor cross-bedded sand in channel-fill deposits in glaciofluvial topset beds that are as much as 25 feet (8m) thick. Overlies and grades into foreset beds that dip 20° to 35° basinward and consist of well- to moderately-sorted, rhythmically-bedded cobble-pebble and pebble gravel and sand. These beds grade downward and outward into ripple cross-laminated and parallel-laminated, sand, silt and pebble gravel

that dip less than 20°. Lower foreset beds grade into gently inclined prodelta bottomset beds of rhythmically-bedded, ripple cross-laminated to graded fine sand and silt with minor clay drapes. Qod deposit laid down in a very narrow lake basin. Fluvial topset beds may have been extensively aggraded and deposit may have once filled the valley from wall to wall. Thickness may be as much as 100 feet (30m). In places deposits are extensively collapsed indicating their deposition over and against stagnant ice. Sequentially numbered units in the Paulins Kill and Pequest Valleys define successively-younger ice-contact deltas that delineate local ice-retreat positions. Description from source map: Newton West Quadrangle

Qod5 - Narrow lake basin glacial-lake delta deposits, 5th successively-younger ice-contact delta (late Wisconsinan)

Qod5 - Narrow lake basin glacial-lake delta deposits, 5th successively-younger ice-contact delta (late Wisconsinan)
Stratified, sand, gravel, and silt deposited by meltwater streams in proglacial lakes at and beyond the stagnant glacier margin. Includes massive to horizontally-bedded and imbricated coarse gravel and sand, and planar to tabular and trough cross-bedded, fine gravel and sand in bars, and channel-lag deposits with minor cross-bedded sand in channel-fill deposits in glaciofluvial topset beds that are as much as 25 feet (8m) thick. Overlies and grades into foreset beds that dip 20° to 35° basinward and consist of well- to moderately-sorted, rhythmically-bedded cobble-pebble and pebble gravel and sand. These beds grade downward and outward into ripple cross-laminated and parallel-laminated, sand, silt and pebble gravel that dip less than 20°. Lower foreset beds grade into gently inclined prodelta bottomset beds of rhythmically-bedded, ripple cross-laminated to graded fine sand and silt with minor clay drapes. Qod deposit laid down in a very narrow lake basin. Fluvial topset beds may have been extensively aggraded and deposit may have once filled the valley from wall to wall. Thickness may be as much as 100 feet (30m). In places deposits are extensively collapsed indicating their deposition over and against stagnant ice. Sequentially numbered units in the Paulins Kill and Pequest Valleys define successively-younger ice-contact deltas that delineate local ice-retreat positions. Description from source map: Newton West Quadrangle

Qd2 - Glacial-lake delta deposits, 2nd successively-younger ice-contact delta (late Wisconsinan)

Qd2 - Older glacial-lake delta deposits (late Wisconsinan)
Stratified, sand, gravel, and silt deposited by meltwater streams in proglacial lakes at and beyond the stagnant glacier margin. Includes well sorted sand and boulder-cobble to pebble gravel in planar to cross-bedded glaciofluvial topset beds that are as much as 25 feet (8m) thick. Overlies and grades into foreset beds that dip 20° to 35° basinward and consist of well- to moderately-sorted, rhythmically-bedded cobble-pebble and pebble gravel and sand. These beds grade downward and outward into ripple cross-laminated and parallel-laminated, sand, silt and pebble gravel that dip less than 20°. Lower foreset beds grade into gently inclined prodelta bottomset beds of rhythmically-bedded, ripple cross-laminated to graded fine sand and silt with minor clay drapes. Thickness may be as much as 100 feet (30m). In the Shimers Brook basin, Qd deposits are labeled “1” and “2” to denote ages with “1” the oldest delta. Qd deposits were laid down in Shimers Brook basin. Many of the deposits are extensively kettled, showing deposition on and around stagnant ice. In long lake basins, topset beds are extensively aggraded in their upstream sections. Description from source map: Milford Quadrangle

Qd2 - Glacial-lake delta deposits, 2nd successively-younger ice-contact delta (late Wisconsinan)
Stratified, sand, gravel, and silt deposited by meltwater streams in proglacial lakes at and beyond the stagnant glacier margin. Includes massive to horizontally-bedded and imbricated coarse gravel and sand,

and planar to tabular and trough cross-bedded, fine gravel and sand in bars, and channel-lag deposits with minor cross-bedded sand in channel-fill deposits in glaciofluvial topset beds that are as much as 25 feet (8m) thick. Overlies and grades into foreset beds that dip 20° to 35° basinward and consist of well- to moderately-sorted, rhythmically-bedded cobble-pebble and pebble gravel and sand. These beds grade downward and outward into ripple cross-laminated and parallel-laminated, sand, silt and pebble gravel that dip less than 20°. Lower foreset beds grade into gently inclined prodelta bottomset beds of rhythmically-bedded, ripple cross-laminated to graded fine sand and silt with minor clay drapes. Fluvial topset beds may have been extensively aggraded and deposit may have once filled the valley from wall to wall. Thickness may be as much as 100 feet (30m). In places deposits are extensively collapsed indicating their deposition over and against stagnant ice. Sequentially numbered units in the Paulins Kill and Pequest Valleys define successively-younger ice-contact deltas that delineate local ice-retreat positions. Description from source map: Newton West Quadrangle

Qod - Glacial-lake delta deposits (late Wisconsinan)
Stratified, sand, gravel, and silt deposited by meltwater streams in narrow proglacial lakes at and beyond the stagnant glacier margin. Includes well sorted sand and boulder-cobble to pebble gravel in planar to cross-bedded glaciofluvial topset beds that are as much as 25 feet (8m) thick. Overlies and grades into foreset beds that dip 20° to 35° basinward and consist of well- to moderately-sorted, rhythmically-bedded cobble-pebble and pebble gravel and sand. These beds grade downward and outward into ripple cross-laminated and parallel-laminated, sand, silt and pebble gravel that dip less than 20°. Lower foreset beds grade into gently inclined prodelta bottomset beds of rhythmically-bedded, ripple cross-laminated to graded fine sand and silt with minor clay drapes. Thickness may be as much as 100 feet (30m). Deposits were laid down in glacial Lake Mill Brook and a narrow arm of glacial Lake Wallkill. Many of them are extensively kettled, showing deposition on and around stagnant ice. In places, topset beds may be extensively aggraded in their upstream sections. Description from source map: Port Jervis South Quadrangle

Qod4 - Narrow lake basin glacial-lake delta deposits, 4th successively-younger ice-contact delta (late Wisconsinan)

Qod4 - Narrow lake basin glacial-lake delta deposits, 4th successively-younger ice-contact delta (late Wisconsinan)
Stratified, sand, gravel, and silt deposited by meltwater streams in proglacial lakes at and beyond the stagnant glacier margin. Includes massive to horizontally-bedded and imbricated coarse gravel and sand, and planar to tabular and trough cross-bedded, fine gravel and sand in bars, and channel-lag deposits with minor cross-bedded sand in channel-fill deposits in glaciofluvial topset beds that are as much as 25 feet (8m) thick. Overlies and grades into foreset beds that dip 20° to 35° basinward and consist of well- to moderately-sorted, rhythmically-bedded cobble-pebble and pebble gravel and sand. These beds grade downward and outward into ripple cross-laminated and parallel-laminated, sand, silt and pebble gravel that dip less than 20°. Lower foreset beds grade into gently inclined prodelta bottomset beds of rhythmically-bedded, ripple cross-laminated to graded fine sand and silt with minor clay drapes. Qod deposit laid down in a very narrow lake basin. Fluvial topset beds may have been extensively aggraded and deposit may have once filled the valley from wall to wall. Thickness may be as much as 100 feet (30m). In places deposits are extensively collapsed indicating their deposition over and against stagnant ice. Sequentially numbered units in the Paulins Kill and Pequest Valleys define successively-younger ice-contact deltas that delineate local ice-retreat positions. Description from source map: Newton West Quadrangle

Qd1 - Glacial-lake delta deposits, 1st successively-younger ice-contact delta (late Wisconsinan)

Qd1 - Oldest glacial-lake delta deposits (late Wisconsinan)
Stratified, sand, gravel, and silt deposited by meltwater streams in proglacial lakes at and beyond the stagnant glacier margin. Includes well sorted sand and boulder-cobble to pebble gravel in planar to cross-bedded glaciofluvial topset beds that are as much as 25 feet (8m) thick. Overlies and grades into foreset beds that dip 20° to 35° basinward and consist of well- to moderately-sorted, rhythmically-bedded cobble-pebble and pebble gravel and sand. These beds grade downward and outward into ripple cross-laminated and parallel-laminated, sand, silt and pebble gravel that dip less than 20°. Lower foreset beds grade into gently inclined prodelta bottomset beds of rhythmically-bedded, ripple cross-laminated to graded fine sand and silt with minor clay drapes. Thickness may be as much as 100 feet (30m). In the Shimers Brook basin, Qd deposits are labeled “1” and “2” to denote ages with “1” the oldest delta. Qd deposits were laid down in Shimers Brook basin. Many of the deposits are extensively kettled, showing deposition on and around stagnant ice. In long lake basins, topset beds are extensively aggraded in their upstream sections. Description from source map: Milford Quadrangle

Qd1 - Glacial-lake delta deposits, 1st successively-younger ice-contact delta (late Wisconsinan)
Stratified, sand, gravel, and silt deposited by meltwater streams in proglacial lakes at and beyond the stagnant glacier margin. Includes massive to horizontally-bedded and imbricated coarse gravel and sand, and planar to tabular and trough cross-bedded, fine gravel and sand in bars, and channel-lag deposits with minor cross-bedded sand in channel-fill deposits in glaciofluvial topset beds that are as much as 25 feet (8m) thick. Overlies and grades into foreset beds that dip 20° to 35° basinward and consist of well- to moderately-sorted, rhythmically-bedded cobble-pebble and pebble gravel and sand. These beds grade downward and outward into ripple cross-laminated and parallel-laminated, sand, silt and pebble gravel that dip less than 20°. Lower foreset beds grade into gently inclined prodelta bottomset beds of rhythmically-bedded, ripple cross-laminated to graded fine sand and silt with minor clay drapes. Fluvial topset beds may have been extensively aggraded and deposit may have once filled the valley from wall to wall. Thickness may be as much as 100 feet (30m). In places deposits are extensively collapsed indicating their deposition over and against stagnant ice. Sequentially numbered units in the Paulins Kill and Pequest Valleys define successively-younger ice-contact deltas that delineate local ice-retreat positions. Description from source map: Newton West Quadrangle

Qod3 - Narrow lake basin glacial-lake delta deposits, 3rd successively-younger ice-contact delta (late Wisconsinan)

Qod3 - Narrow lake basin glacial-lake delta deposits, 3rd successively-younger ice-contact delta (late Wisconsinan)
Stratified, sand, gravel, and silt deposited by meltwater streams in proglacial lakes at and beyond the stagnant glacier margin. Includes massive to horizontally-bedded and imbricated coarse gravel and sand, and planar to tabular and trough cross-bedded, fine gravel and sand in bars, and channel-lag deposits with minor cross-bedded sand in channel-fill deposits in glaciofluvial topset beds that are as much as 25 feet (8m) thick. Overlies and grades into foreset beds that dip 20° to 35° basinward and consist of well- to moderately-sorted, rhythmically-bedded cobble-pebble and pebble gravel and sand. These beds grade downward and outward into ripple cross-laminated and parallel-laminated, sand, silt and pebble gravel that dip less than 20°. Lower foreset beds grade into gently inclined prodelta bottomset beds of rhythmically-bedded, ripple cross-laminated to graded fine sand and silt with minor clay drapes. Qod deposit laid down in a very narrow lake basin. Fluvial topset beds may have been extensively aggraded and deposit may have once filled the valley from wall to wall. Thickness may be as much as 100 feet (30m). In places deposits are extensively collapsed indicating their deposition over and against stagnant ice. Sequentially numbered units in the Paulins Kill and Pequest Valleys define successively-younger

ice-contact deltas that delineate local ice-retreat positions. Description from source map: Newton West Quadrangle

Qod2 - Narrow lake basin glacial-lake delta deposits, 2nd successively-younger ice-contact delta (late Wisconsinan)

Qod2 - Narrow lake basin glacial-lake delta deposits, 2nd successively-younger ice-contact delta (late Wisconsinan)
Stratified, sand, gravel, and silt deposited by meltwater streams in proglacial lakes at and beyond the stagnant glacier margin. Includes massive to horizontally-bedded and imbricated coarse gravel and sand, and planar to tabular and trough cross-bedded, fine gravel and sand in bars, and channel-lag deposits with minor cross-bedded sand in channel-fill deposits in glaciofluvial topset beds that are as much as 25 feet (8m) thick. Overlies and grades into foreset beds that dip 20° to 35° basinward and consist of well- to moderately-sorted, rhythmically-bedded cobble-pebble and pebble gravel and sand. These beds grade downward and outward into ripple cross-laminated and parallel-laminated, sand, silt and pebble gravel that dip less than 20°. Lower foreset beds grade into gently inclined prodelta bottomset beds of rhythmically-bedded, ripple cross-laminated to graded fine sand and silt with minor clay drapes. Qod deposit laid down in a very narrow lake basin. Fluvial topset beds may have been extensively aggraded and deposit may have once filled the valley from wall to wall. Thickness may be as much as 100 feet (30m). In places deposits are extensively collapsed indicating their deposition over and against stagnant ice. Sequentially numbered units in the Paulins Kill and Pequest Valleys define successively-younger ice-contact deltas that delineate local ice-retreat positions. Description from source map: Newton West Quadrangle

Qod1 - Narrow lake basin glacial-lake delta deposits, 1st successively-younger ice-contact delta (late Wisconsinan)

Qod1 - Narrow lake basin glacial-lake delta deposits, 1st successively-younger ice-contact delta (late Wisconsinan)
Stratified, sand, gravel, and silt deposited by meltwater streams in proglacial lakes at and beyond the stagnant glacier margin. Includes massive to horizontally-bedded and imbricated coarse gravel and sand, and planar to tabular and trough cross-bedded, fine gravel and sand in bars, and channel-lag deposits with minor cross-bedded sand in channel-fill deposits in glaciofluvial topset beds that are as much as 25 feet (8m) thick. Overlies and grades into foreset beds that dip 20° to 35° basinward and consist of well- to moderately-sorted, rhythmically-bedded cobble-pebble and pebble gravel and sand. These beds grade downward and outward into ripple cross-laminated and parallel-laminated, sand, silt and pebble gravel that dip less than 20°. Lower foreset beds grade into gently inclined prodelta bottomset beds of rhythmically-bedded, ripple cross-laminated to graded fine sand and silt with minor clay drapes. Qod deposit laid down in a very narrow lake basin. Fluvial topset beds may have been extensively aggraded and deposit may have once filled the valley from wall to wall. Thickness may be as much as 100 feet (30m). In places deposits are extensively collapsed indicating their deposition over and against stagnant ice. Sequentially numbered units in the Paulins Kill and Pequest Valleys define successively-younger ice-contact deltas that delineate local ice-retreat positions. Description from source map: Newton West Quadrangle

Qlb - Glacial lake-bottom deposits (late Wisconsinan)

Qlb - Glacial lake-bottom deposits (late Wisconsinan)
Parallel-laminated, irregularly to rhythmically-bedded silt, clay, and very fine sand; and minor cross-laminated silt, fine sand, and minor clay deposited on the floor of glacial lakes chiefly by density currents and settling of fines. As much as 100 feet (30m) thick. Qlb deposits were laid down in narrow sediment-dammed proglacial lakes in Minisink Valley. In subsurface only. Description from source map: Bushkill Quadrangle

Qlb - Glacial lake-bottom deposits (late Wisconsinan)
Parallel-laminated, irregularly to rhythmically-bedded silt, clay, and very fine sand; and minor cross-laminated silt, fine sand, and minor clay deposited on the floor of glacial lakes chiefly by density currents and settling of fines. As much as 100 feet (30m) thick. In subsurface only, form thick deposits beneath Qs deposits and modern lakes in glacial Lake Owassa basin, Kittatinny Valley. Thin deposits presumed to be in subsurface in Paulins Kill, Wallpack, and Minisink Valleys. Description from source map: Culvers Gap Quadrangle

Ql - Lacustrine deposits (Quaternary)
Varved clay, Silt, Sand. Fill in local ponds. Description from source map: East Stroudsburg Quadrangle

Qlb - Glacial lake-bottom deposits (late Wisconsinan)
Parallel-laminated, irregularly to rhythmically-bedded silt, clay, and very fine sand; and minor cross-laminated silt, fine sand, and minor clay deposited on the floor of glacial lakes chiefly by density currents and settling of fines. As much as 100 feet (30m) thick. In subsurface only, thick deposits beneath Qs deposits and modern lakes in glacial Lake Owassa basin, Kittatinny Valley. Thin deposits presumed to be in subsurface in Paulins Kill, Wallpack, and Minisink Valleys. Description from source maps: Flatbrookville Quadrangle, Lake Maskenozha Quadrangle

Qlb - Glacial lake-bottom deposits (late Wisconsinan)
Parallel-laminated, irregularly to rhythmically-bedded silt, clay, and very fine sand; and minor cross-laminated silt, fine sand, and minor clay deposited on the floor of glacial lakes chiefly by density currents and settling of fines. As much as 100 feet (30m) thick. Description from source map: Milford Quadrangle

Qwlb - Late Wisconsinan glacial lake-bottom deposits (late Pleistocene, late Wisconsinan)
Silt, clay, fine sand; gray, brown, yellowish brown, reddish brown. As much as 200 feet thick. Deposited on the bottom of glacial lakes during the late Wisconsinan glaciation. Description from source map: New Jersey Surficial Geology

Qlb - Glacial lake-bottom deposits (late Wisconsinan)
Parallel-laminated, rhythmically-bedded, alternating layers of thin clay and very fine silt, and silt and very fine sand deposited from suspension; and minor cross-laminated silt, and fine sand deposited on the floor of glacial lakes chiefly by subaqueous flows. As much as 100 feet (30m) thick. Thick deposits lie beneath Qs deposits in Newton Meadows. Description from source map: Newton West Quadrangle

Qlb - Glacial lake-bottom deposits (late Wisconsinan)
Parallel-laminated, irregularly to rhythmically-bedded silt, clay, and very fine sand; and minor cross-laminated silt, fine sand, and minor clay deposited on the floor of glacial lakes chiefly by density currents and settling of fines. As much as 100 feet (30m) thick. Description from source map: Port Jervis South Quadrangle

Ql - Glacial lake-bottom deposits (Pleistocene (Wisconsinan))
Varved clay, silt, and fine sand deposited on floor of temporary glacial lake; some interbedded coarser

sand and gravel. Description from source map: Stroudsburg Quadrangle

Qf - Outwash-fan deposits (late Wisconsinan)

Qf - Outwash-fan deposits (late Wisconsinan)
Stratified, well- to moderately-sorted sand, cobble-pebble gravel, and minor silt deposited largely by meltwater streams in fan-shaped deposits at the mouth of tributaries in Minisink Valley. As much as 60 feet (18m) thick. Includes massive to planar-bedded sand and gravel, and minor cross-bedded and channel-fill sand. Bedding generally dips towards the trunk valley by as much as 10°. Fan deposits are graded to valley-train deposits. Description from source maps: Bushkill Quadrangle, Lake Maskenozha Quadrangle, Port Jervis South Quadrangle

Qop - Outwash plain (Quaternary)
Sand, Gravel. Flat-topped terrace bordering Brodhead and Marshall Creeks. Description from source map: East Stroudsburg Quadrangle

Qf - Outwash-fan deposits (late Wisconsinan)
Stratified, well- to moderately-sorted sand, cobble-pebble gravel, and minor silt deposited by meltwater streams in fan-shaped deposits at the mouth of large tributaries in Minisink Valley. As much as 60 feet (18m) thick. Includes massive to planar-bedded sand and gravel, and minor cross-bedded and channel-fill sand. Bedding generally dips towards the trunk valley by as much as 10°. Fan deposits are graded to valley-train deposits. Description from source map: Milford Quadrangle

Qwfv - Late Wisconsinan glaciofluvial plain deposits (late Pleistocene, late Wisconsinan)
Sand, pebble-to-cobble gravel, minor silt; yellowish brown to reddish brown. As much as 80 feet thick. Form plains deposited by glacial streams during the late Wisconsinan glaciation. Description from source map: New Jersey Surficial Geology

Qo - Outwash deposits (Pleistocene (Wisconsinan))
Predominantly cross-bedded to planar-bedded sand and gravel deposited by melt-water streams in valleys (valley train deposits). May include or grade into deltaic deposits where the site of deposition in the stream valley was temporarily dammed by ice. Description from source map: Stroudsburg Quadrangle

Qtq - Till derived from quartzite, quartz-pebble conglomerate and red sandstone (late Wisconsinan)

Qkmq - Till derived from quartzite and quartz-pebble conglomerate (late Wisconsinan)
Slightly compact to compact, unstratified, poorly sorted yellowish-brown (10YR 5/4), brown (10YR 5/3, 7.5 YR 5/4) to light olivebrown (2.5Y 5/4) silty sand and sand containing 10 to 20 percent gravel. As much as 50 feet thick. Locally overlain by thin, discontinuous, noncompact, poorly sorted and layered, sand and minor silty sand, similar in color to lower till, that contains as much as 35 percent gravel, and minor thin beds of well- to moderately-sorted sand and pebbly sand. Clasts chiefly consist of unweathered quartzpebble conglomerate, quartzite, red sandstone, and red shale. The matrix is a varied mixture of quartz, rock fragments, silt, minor feldspar, and clay. Derived chiefly from quartzite, and quartzpebble conglomerate. Description from source map: Branchville Quadrangle

Qtq - Till derived from quartzite, quartz-pebble conglomerate and red sandstone (late Wisconsinan)
Scattered patches of noncompact to slightly compact, bouldery "upper till" overlying a blanket-like

compact "lower till" deposited chiefly on bedrock and locally some older pre-Wisconsinan surficial deposits. Slightly compact to compact, unstratified, poorly sorted yellowish-brown (10YR 5/4), brown (10YR 5/3, 7.5 YR 5/4) to light olive-brown (2.5Y 5/4) and reddish-brown (5YR 4/3) silty sand and sand containing 10 to 20 percent gravel. As much as 50 feet (15m) thick. Locally overlain by thin, discontinuous, non-compact, poorly sorted and layered, sand and minor silty sand, similar in color to lower till, that contains as much as 35 percent gravel, and minor thin beds of well- to moderately-sorted sand and pebbly sand. Clasts chiefly consist of unweathered quartz-pebble conglomerate, quartzite, red sandstone, and red shale. Matrix is a varied mixture of quartz, rock fragments, silt, minor feldspar, and clay. Till derived chiefly from quartzite, quartz-pebble conglomerate, and red sandstone bedrock on Kittatinny Mountain. Description from source maps: Bushkill Quadrangle, Culvers Gap Quadrangle, Flatbrookville Quadrangle, Lake Maskenozha Quadrangle, Milford Quadrangle, Newton West Quadrangle , Port Jervis South Quadrangle

Qtqr - Till derived from quartzite, quartz-pebble conglomerate and red sandstone, less than 10 feet thick (late Wisconsinan)

Qkmqr - Till derived from quartzite and quartz-pebble conglomerate, less than 10 feet thick (late Wisconsinan)
Slightly compact to compact, unstratified, poorly sorted yellowish-brown (10YR 5/4), brown (10YR 5/3, 7.5 YR 5/4) to light olive brown (2.5Y 5/4) silty sand and sand containing 10 to 20 percent gravel. As much as 50 feet thick. Locally overlain by thin, discontinuous, noncompact, poorly sorted and layered, sand and minor silty sand, similar in color to lower till, that contains as much as 35 percent gravel, and minor thin beds of well- to moderately-sorted sand and pebbly sand. Clasts chiefly consist of unweathered quartzpebble conglomerate, quartzite, red sandstone, and red shale. The matrix is a varied mixture of quartz, rock fragments, silt, minor feldspar, and clay. Derived chiefly from quartzite, and quartzpebble conglomerate. Description from source map: Branchville Quadrangle

Qtqr - Till derived from quartzite, quartz-pebble conglomerate and red sandstone, less than 10 feet thick (late Wisconsinan)
Scattered patches of noncompact to slightly compact, bouldery "upper till" overlying a blanket-like compact "lower till" deposited chiefly on bedrock and locally some older pre-Wisconsinan surficial deposits. Slightly compact to compact, unstratified, poorly sorted yellowish-brown (10YR 5/4), brown (10YR 5/3, 7.5 YR 5/4) to light olive-brown (2.5Y 5/4) and reddish-brown (5YR 4/3) silty sand and sand containing 10 to 20 percent gravel. As much as 50 feet (15m) thick. Locally overlain by thin, discontinuous, non-compact, poorly sorted and layered, sand and minor silty sand, similar in color to lower till, that contains as much as 35 percent gravel, and minor thin beds of well- to moderately-sorted sand and pebbly sand. Clasts chiefly consist of unweathered quartz-pebble conglomerate, quartzite, red sandstone, and red shale. Matrix is a varied mixture of quartz, rock fragments, silt, minor feldspar, and clay. Till derived chiefly from quartzite, quartz-pebble conglomerate, and red sandstone bedrock on Kittatinny Mountain. Description from source maps: Bushkill Quadrangle, Culvers Gap Quadrangle, Flatbrookville Quadrangle, Lake Maskenozha Quadrangle, Milford Quadrangle, Newton West Quadrangle , Port Jervis South Quadrangle

Qtk - Till derived from limestone, shale and sandstone (late Wisconsinan)

Qkv - Till derived from slate, graywacke, dolomite and limestone (late Wisconsinan)
Compact, unstratified, poorly sorted yellowish-brown (10YR 5/4), light yellowish-brown (2.5Y 6/4), light olive-brown (2.5Y 5/4) to grayishbrown (2.5Y 5/2), gray (5Y 5/1) to olive-gray (5Y 5/2) noncalcareous to calcareous silt and sandy silt that typically contains 5 to 15 percent gravel. As much as 100 feet thick. Locally overlain by thin, discontinuous, noncompact to slightly compact, poorly sorted, indistinctly

layered, yellow-brown (10YR 5/6-8) to light yellowish-brown (10YR 6/4) sandy silt that contains as much as 30 percent gravel, and minor thin beds of well- to moderately sorted sand, gravel, and silt. Clasts chiefly consist of unweathered slate, siltstone and sandstone, dolomite, limestone, chert, minor quartzite, and quartz-pebble conglomerate. The matrix is a varied mixture of unweathered quartz, rock fragments, and silt; minor constituents include feldspar and clay. Derived chiefly from slate, graywacke, dolomite, and minor limestone in Kittatinny Valley, and limestone, argillaceous limestone, shale, and sandstone in Minisink Valley. Near New Jersey Highlands, additional minor constituents include mica, heavy minerals, and fragments of gneiss. Description from source map: Branchville Quadrangle

Qtk - Till derived from limestone, shale and sandstone (late Wisconsinan)
Scattered patches of noncompact to slightly compact, bouldery "upper till" overlying a blanket-like compact "lower till" deposited chiefly on bedrock and locally some older pre-Wisconsinan surficial deposits. Compact, unstratified, poorly sorted yellowish-brown (10YR 5/4), light yellowish-brown (2.5Y 6/4), light olive-brown (2.5Y 5/4) to grayish-brown (2.5Y 5/2), gray (5Y 5/1) to olive-gray (5Y 5/2) noncalcareous to calcareous silt and sandy silt that typically contains 5 to 15 percent gravel. As much as 200 feet (61m) thick. Locally overlain by thin, discontinuous, non-compact to slightly compact, poorly sorted, indistinctly layered yellow-brown (10YR 5/6-8), light yellowish-brown (10YR 6/4) sandy silt that contains as much as 30 percent gravel, and minor thin beds of well- to moderately- sorted sand, gravel, and silt. Clasts chiefly consist of unweathered slate, siltstone and sandstone, dolomite, limestone, chert, minor quartzite, and quartz-pebble conglomerate. Matrix is a varied mixture of unweathered quartz and rock fragments, and silt; minor constituents include feldspar and clay. Till derived chiefly from limestone, argillaceous limestone, shale, and sandstone bedrock in Minisink Valley. Description from source maps: Bushkill Quadrangle, Lake Maskenozha Quadrangle

Qtk - Till derived from slate, graywacke, dolomite and minor limestone (late Wisconsinan)
Scattered patches of noncompact to slightly compact, bouldery "upper till" overlying a blanket-like compact "lower till" deposited chiefly on bedrock and locally some older pre-Wisconsinan surficial deposits. Compact, unstratified, poorly sorted yellowish-brown (10YR 5/4), light yellowish-brown (2.5Y 6/4), light olive brown (2.5Y 5/4) to grayish-brown (2.5Y 5/2), gray (5Y 5/1) to olive gray (5Y 5/2) noncalcareous to calcareous silt and sandy silt that typically contains 5 to 15 percent gravel. As much as 200 feet (61m) thick. Locally overlain by thin, discontinuous, noncompact to slightly compact, poorly sorted, indistinctly layered yellow-brown (10YR 5/6-8), light yellowish-brown (10YR 6/4) sandy silt that contains as much as 30 percent gravel, and minor thin beds of well- to moderately sorted sand, gravel, and silt. Clasts chiefly consist of unweathered slate, siltstone and sandstone, dolomite, limestone, chert, minor quartzite, and quartz-pebble conglomerate. Matrix is a varied mixture of unweathered quartz, rock fragments, and silt; minor constituents include feldspar and clay. Till derived chiefly from slate, graywacke, dolomite, and minor limestone bedrock in Kittatinny Valley, and limestone, argillaceous limestone, shale, and sandstone bedrock in Minisink Valley. Description from source maps: Culvers Gap Quadrangle, Flatbrookville Quadrangle

Qtk - Till derived from limestone, shale, and sandstone (late Wisconsinan)
Scattered patches of noncompact to slightly compact, bouldery "upper till" overlying a blanket-like compact "lower till" deposited chiefly on bedrock and locally some older pre-Wisconsinan surficial deposits. Compact, unstratified, poorly sorted yellowish-brown (10 YR 5/4), light yellowish-brown (2.5Y 6/4), light olive-brown (2.5Y 5/4) to grayish-brown (2.5Y 5/2), gray (5Y 5/1) to olive-gray (5Y 5/2) noncalcareous to calcareous silt and sandy silt that typically contains 5 to 15 percent gravel. As much as 200 feet (61m) thick. Locally overlain by thin, discontinuous, non-compact to slightly compact, poorly sorted, indistinctly layered yellow-brown (10 YR 5/6-8), light yellowish-brown (10 YR 6/4) sandy silt that contains as much as 30 percent gravel, and minor thin beds of well- to moderately sorted sand, gravel, and silt. Clasts chiefly consist of unweathered slate, siltstone and sandstone, dolomite, limestone, chert, minor quartzite, and quartz-pebble conglomerate. Matrix is a varied mixture of unweathered quartz, rock fragments, and silt; minor constituents include feldspar and clay. Till derived chiefly from limestone, argillaceous limestone, shale, and sandstone from area west of Kittatinny Mountain.

Description from source maps: Milford Quadrangle, Port Jervis South Quadrangle

Qwtk - Kittatinny Mountain Till (late Pleistocene, late Wisconsinan)
Clayey silt to silty sand with some to many pebbles and cobbles and few to many boulders; olive brown, brown, gray, reddish brown. As much as 150 feet thick, generally less than 40 feet thick. Deposited directly from glacial ice during the late Wisconsinan glaciation. Description from source map: New Jersey Surficial Geology

Qtk - Till derived from slate, graywacke, dolomite and limestone (late Wisconsinan)
Scattered patches of noncompact to slightly compact, bouldery "upper till" overlying a blanket-like compact "lower till" deposited chiefly on bedrock and locally some older pre-Wisconsinan surficial deposits. Compact, unstratified, poorly sorted yellowish-brown (10YR 5/4), light yellowish-brown (2.5Y 6/4), light olive-brown (2.5Y 5/4) to grayish-brown (2.5Y 5/2), gray (5Y 5/1) to olive-gray (5Y 5/2) noncalcareous to calcareous silt and sandy silt that typically contains 5 to 15 percent gravel. As much as 100 feet (30m) thick. Locally overlain by thin, discontinuous, non-compact to slightly compact, poorly sorted, indistinctly layered yellow-brown (10YR 5/6-8), light yellowish-brown (10YR 6/4) sandy silt that contains as much as 30 percent gravel, and minor thin beds of well- to moderately sorted sand, gravel, and silt. Clasts chiefly consist of unweathered slate, siltstone and sandstone, dolomite, limestone, chert, minor quartzite, and quartz-pebble conglomerate. Matrix is a varied mixture of unweathered quartz, rock fragments, and silt; minor constituents include feldspar and clay. Till derived chiefly from slate, graywacke, dolomite, and minor limestone bedrock in Kittatinny Valley. Description from source map: Newton West Quadrangle

Qtkr - Till derived from limestone, shale and sandstone, less than 10 feet thick (late Wisconsinan)

Qkvr - Till derived from slate, graywacke, dolomite and limestone, less than 10 feet thick (late Wisconsinan)
Compact, unstratified, poorly sorted yellowish-brown (10YR 5/4), light yellowish-brown (2.5Y 6/4), light olive-brown (2.5Y 5/4) to grayishbrown (2.5Y 5/2), gray (5Y 5/1) to olive-gray (5Y 5/2) noncalcareous to calcareous silt and sandy silt that typically contains 5 to 15 percent gravel. As much as 100 feet thick. Locally overlain by thin, discontinuous, noncompact to slightly compact, poorly sorted, indistinctly layered, yellow-brown (10YR 5/6-8) to light yellowish-brown (10YR 6/4) sandy silt that contains as much as 30 percent gravel, and minor thin beds of well- to moderately sorted sand, gravel, and silt. Clasts chiefly consist of unweathered slate, siltstone and sandstone, dolomite, limestone, chert, minor quartzite, and quartz-pebble conglomerate. The matrix is a varied mixture of unweathered quartz, rock fragments, and silt; minor constituents include feldspar and clay. Derived chiefly from slate, graywacke, dolomite, and minor limestone in Kittatinny Valley, and limestone, argillaceous limestone, shale, and sandstone in Minisink Valley. Near New Jersey Highlands, additional minor constituents include mica, heavy minerals, and fragments of gneiss. Description from source map: Branchville Quadrangle

Qtkr - Till derived from limestone, shale and sandstone, less than 10 feet thick (late Wisconsinan)
Scattered patches of noncompact to slightly compact, bouldery "upper till" overlying a blanket-like compact "lower till" deposited chiefly on bedrock and locally some older pre-Wisconsinan surficial deposits. Compact, unstratified, poorly sorted yellowish-brown (10YR 5/4), light yellowish-brown (2.5Y 6/4), light olive-brown (2.5Y 5/4) to grayish-brown (2.5Y 5/2), gray (5Y 5/1) to olive-gray (5Y 5/2) noncalcareous to calcareous silt and sandy silt that typically contains 5 to 15 percent gravel. As much as 200 feet (61m) thick. Locally overlain by thin, discontinuous, non-compact to slightly compact, poorly sorted, indistinctly layered yellow-brown (10YR 5/6-8), light yellowish-brown (10YR 6/4) sandy silt that contains as much as 30 percent gravel, and minor thin beds of well- to moderately- sorted sand, gravel,

and silt. Clasts chiefly consist of unweathered slate, siltstone and sandstone, dolomite, limestone, chert, minor quartzite, and quartz-pebble conglomerate. Matrix is a varied mixture of unweathered quartz and rock fragments, and silt; minor constituents include feldspar and clay. Till derived chiefly from limestone, argillaceous limestone, shale, and sandstone bedrock in Minisink Valley. Description from source map: Bushkill Quadrangle

Qtkr - Till derived from slate, graywacke, dolomite and minor limestone, less than 10 feet thick (late Wisconsinan)
Scattered patches of noncompact to slightly compact, bouldery "upper till" overlying a blanket-like compact "lower till" deposited chiefly on bedrock and locally some older pre-Wisconsinan surficial deposits. Compact, unstratified, poorly sorted yellowish-brown (10YR 5/4), light yellowish-brown (2.5Y 6/4), light olive brown (2.5Y 5/4) to grayish-brown (2.5Y 5/2), gray (5Y 5/1) to olive gray (5Y 5/2) noncalcareous to calcareous silt and sandy silt that typically contains 5 to 15 percent gravel. As much as 200 feet (61m) thick. Locally overlain by thin, discontinuous, noncompact to slightly compact, poorly sorted, indistinctly layered yellow-brown (10YR 5/6-8), light yellowish-brown (10YR 6/4) sandy silt that contains as much as 30 percent gravel, and minor thin beds of well- to moderately sorted sand, gravel, and silt. Clasts chiefly consist of unweathered slate, siltstone and sandstone, dolomite, limestone, chert, minor quartzite, and quartz-pebble conglomerate. Matrix is a varied mixture of unweathered quartz, rock fragments, and silt; minor constituents include feldspar and clay. Till derived chiefly from slate, graywacke, dolomite, and minor limestone bedrock in Kittatinny Valley, and limestone, argillaceous limestone, shale, and sandstone bedrock in Minisink Valley. Description from source maps: Culvers Gap Quadrangle, Flatbrookville Quadrangle

Qtkr - Till derived from limestone, shale and sandstone, less than 10 feet thick (late Wisconsinan)
Scattered patches of noncompact to slightly compact, bouldery "upper till" overlying a blanket-like compact "lower till" deposited chiefly on bedrock and locally some older pre-Wisconsinan surficial deposits. Compact, unstratified, poorly sorted yellowish-brown (10YR 5/4), light yellowish-brown (2.5Y 6/4), light olive-brown (2.5Y 5/4) to grayish-brown (2.5Y 5/2), gray (5Y 5/1) to olive-gray (5Y 5/2) noncalcareous to calcareous silt and sandy silt that typically contains 5 to 15 percent gravel. As much as 200 feet (61m) thick. Locally overlain by thin, discontinuous, non-compact to slightly compact, poorly sorted, indistinctly layered yellow-brown (10YR 5/6-8), light yellowish-brown (10YR 6/4) sandy silt that contains as much as 30 percent gravel, and minor thin beds of well- to moderately sorted sand, gravel, and silt. Clasts chiefly consist of unweathered slate, siltstone and sandstone, dolomite, limestone, chert, minor quartzite, and quartz-pebble conglomerate. Matrix is a varied mixture of unweathered quartz, rock fragments, and silt; minor constituents include feldspar and clay. Till derived chiefly from limestone, argillaceous limestone, shale, and sandstone bedrock in Minisink Valley. Description from source map: Lake Maskenozha Quadrangle

Qtkr - Till derived from limestone, shale, and sandstone, less than 10 feet thick (late Wisconsinan)
Scattered patches of noncompact to slightly compact, bouldery "upper till" overlying a blanket-like compact "lower till" deposited chiefly on bedrock and locally some older pre-Wisconsinan surficial deposits. Compact, unstratified, poorly sorted yellowish-brown (10 YR 5/4), light yellowish-brown (2.5Y 6/4), light olive-brown (2.5Y 5/4) to grayish-brown (2.5Y 5/2), gray (5Y 5/1) to olive-gray (5Y 5/2) noncalcareous to calcareous silt and sandy silt that typically contains 5 to 15 percent gravel. As much as 200 feet (61m) thick. Locally overlain by thin, discontinuous, non-compact to slightly compact, poorly sorted, indistinctly layered yellow-brown (10 YR 5/6-8), light yellowish-brown (10 YR 6/4) sandy silt that contains as much as 30 percent gravel, and minor thin beds of well- to moderately sorted sand, gravel, and silt. Clasts chiefly consist of unweathered slate, siltstone and sandstone, dolomite, limestone, chert, minor quartzite, and quartz-pebble conglomerate. Matrix is a varied mixture of unweathered quartz, rock fragments, and silt; minor constituents include feldspar and clay. Till derived chiefly from limestone, argillaceous limestone, shale, and sandstone from area west of Kittatinny Mountain.

Description from source maps: Milford Quadrangle, Port Jervis South Quadrangle

Qtkr - Till derived from slate, graywacke, dolomite and limestone, less than 10 feet thick (late Wisconsinan)
Scattered patches of noncompact to slightly compact, bouldery "upper till" overlying a blanket-like compact "lower till" deposited chiefly on bedrock and locally some older pre-Wisconsinan surficial deposits. Compact, unstratified, poorly sorted yellowish-brown (10YR 5/4), light yellowish-brown (2.5Y 6/4), light olive-brown (2.5Y 5/4) to grayish-brown (2.5Y 5/2), gray (5Y 5/1) to olive-gray (5Y 5/2) noncalcareous to calcareous silt and sandy silt that typically contains 5 to 15 percent gravel. As much as 100 feet (30m) thick. Locally overlain by thin, discontinuous, non-compact to slightly compact, poorly sorted, indistinctly layered yellow-brown (10YR 5/6-8), light yellowish-brown (10YR 6/4) sandy silt that contains as much as 30 percent gravel, and minor thin beds of well- to moderately sorted sand, gravel, and silt. Clasts chiefly consist of unweathered slate, siltstone and sandstone, dolomite, limestone, chert, minor quartzite, and quartz-pebble conglomerate. Matrix is a varied mixture of unweathered quartz, rock fragments, and silt; minor constituents include feldspar and clay. Till derived chiefly from slate, graywacke, dolomite, and minor limestone bedrock in Kittatinny Valley. Description from source map: Newton West Quadrangle

Qk - Kame (late Wisconsinan)

Qwic - Wisconsinan ice-contact stratified drift (Quaternary, Wisconsinan)
Unconsolidated, stratified sand and gravel with some boulders; some internal slump structures; gently sloping upper surfaces with few closed depressions; generally not more than 10 meters thick. Description from source map: Allentown 30 x 60

Qk - Kame (late Wisconsinan)
Stratified, well- to poorly-sorted sand, boulder- to pebble-gravel, silt, and interbedded flowtill in small collapsed hills and ridges overlying till. Presumed to be ice-hole and crevasse fillings. As much as 50 feet (15m) thick. Attitude of bedding is highly variable. Description from source map: Bushkill Quadrangle , Culvers Gap Quadrangle, Flatbrookville Quadrangle, Lake Maskenozha Quadrangle, Milford Quadrangle , Newton West Quadrangle, Port Jervis South Quadrangle

Qk - Kame (Quaternary)
Sand, Gravel. Variety of mounds and ridges. Description from source map: East Stroudsburg Quadrangle

Qwic - Ice-contact deposits (late Pleistocene, late Wisconsinan)
Sand, pebble-to-cobble gravel, few to some boulders, minor silt; yellowish brown to reddish brown. As much as 150 feet thick. Form knolls and ridges higher than adjacent glacial-lake levels or glaciofluvial plains. Deposited in ice-walled basins during the late Wisconsinan glaciation. Description from source map: New Jersey Surficial Geology

k - Kame deposits (Quaternary)
Coarse to fine gravel and/or sand, includes kames, eskers, kame terraces, kame deltas, ice contact, or ice cored deposition, lateral variability in sorting, texture and permeability, may be firmly cemented with calcareous cement, thickness variable (10-30 meters). Description from source map: New York Geology, Lower Hudson Sheet

Qk - Kame deposits (Pleistocene (Wisconsinan))
Connected and isolated conical or irregularly shaped hills of variably sorted and stratified sand, gravel, silt, and clay; associated with kettles. Some deposits are linear ridges that lie athwart a valley (linear

kame or kame moraine). Some fine material probably deposited in small temporary lakes. Description from source map: Stroudsburg Quadrangle

Qwtn - Netcong Till (late Wisconsinan)

Qwtn - Netcong Till (late Pleistocene, late Wisconsinan)
Silty sand to sandy silt with some to many pebbles and cobbles and some to many boulders; pale brown, yellowish brown, light gray. As much as 200 feet thick, generally less than 30 feet thick. Deposited directly from glacial ice during the late Wisconsinan glaciation. Description from source map: New Jersey Surficial Geology

Qes - Esker (Quaternary)

Qe - Esker (Quaternary)
Sand, Gravel. Variety of mounds and ridges. Description from source map: East Stroudsburg Quadrangle

Qe - Esker (Pleistocene (Wisconsinan))
Gravel, sand, silt, and some clay that generally coarsen upwards in flat-topped deposits, generally having lobate distal slopes and ice-contact proximal slopes that may include an esker (Qe), and with topset and foreset bedding that generally grades into bottomsets (lake-bottom deposits); deposited in temporary glacial lakes. Some deposits appear to lack ice-contact proximal slopes, but kettle holes suggest the former existence of buried ice blocks. Description from source map: Stroudsburg Quadrangle

Qwbu - West Branch Papakating Creek small ice-marginal deltas, lacustrine fans, and ice-channel fillings (late Wisconsinan)

Qwbu - West Branch Papakating Creek small ice-marginal deltas, lacustrine fans, and ice-channel fillings (late Wisconsinan)
Small uncorrelated ice-marginal deltas, lacustrine fans, and ice-channel fillings as much as 45 thick (estimated) in the West Branch drainage basin. Description from source map: Branchville Quadrangle

Qcb1 - Clove Brook deposits (late Wisconsinan)

Qcb1 - Clove Brook deposits (late Wisconsinan)
Ice-marginal delta as much as 80 feet thick (estimated) approximately 5000 feet east of Libertyville. Laid down in small proglacial lake that occupied a north-draining valley in the Clove Brook drainage basin; elevation of delta-plain surface is estimated at 665 feet. The delta is extensively collapsed and graded to a spillway at its south end; elevation 655 feet. Description from source map: Branchville Quadrangle

Qwku - Lake Wallkill meltwater deposits (late Wisconsinan)

Qwku - Lake Wallkill meltwater deposits (late Wisconsinan)
Small, uncorrelated, meltwater deposits, presumably of glaciodeltaic origin, laid down in the Lake

Wallkill drainage basin; as much as 45 feet thick (estimated). Description from source map: Branchville Quadrangle

Qwklf - Lake Wallkill lacustrine-fan, ice-marginal delta and ice-channel filling deposits (late Wisconsinan)

Qwklf - Lake Wallkill lacustrine-fan, ice-marginal delta and ice-channel filling deposits (late Wisconsinan)
Uncorrelated lacustrine-fan deposits, and extensively collapsed small ice-marginal deltas and ice-channel fillings as much as 80 feet thick (profile A-A', I-I' in GRI data) laid down in Lake Wallkill. These deposits form small knolls and hillocks that protrude up through lake-bottom deposits. Description from source map: Branchville Quadrangle

Qwklb - Lake Wallkill lake-bottom deposits (late Wisconsinan)

Qwklb - Lake Wallkill lake-bottom deposits (late Wisconsinan)
Lake-bottom deposits as much as 65 feet thick (profile A-A', I-I' in GRI data) laid down in Lake Wallkill. Chiefly fill lake basin northeast of the Armstrong delta. Description from source map: Branchville Quadrangle

Qwb5 - West Branch Papakating Creek fluviodelta (late Wisconsinan)

Qwb5 - West Branch Papakating Creek, fluviodelta (late Wisconsinan)
Fluviodelta as much as 80 feet thick (profile C-C', G-G' in GRI data) north of Woodbourne; elevation of delta-plain surface varies between 575 and 565 feet (estimated), suggesting that the lake's outlet was over drift or ice. The delta appears to consist of outwash transported downstream along the deglaciated reach of West Branch and an unnamed south-draining tributary valley. Erosional channels and surfaces, downcut into the delta plain to elevations between 635 and 625 feet, are probably graded to the surface of the McCoys Corner Delta, and suggest that during the later stages of deposition the lake emptied. Description from source map: Branchville Quadrangle

Qwk4 - Lake Wallkill fluviodelta, McCoys Corner Delta (late Wisconsinan)

Qwk4 - Lake Wallkill, fluviodelta McCoys Corner Delta (late Wisconsinan)
Fluviodelta, as much as 100 feet thick (profile C-C', G-G' in GRI data). Delta consists of outwash from the West Branch Papakating Creek valley; elevation of delta-plain surface is estimated at 525 feet. The distal margin of the delta lacks lobate geometry, therefore, it presumably was deposited against ice, or it may have been eroded by postglacial streams. Description from source map: Branchville Quadrangle

Qwk3 - Lake Wallkill small ice-marginal delta (late Wisconsinan)

Qwk3 - Lake Wallkill, small ice-marginal delta (late Wisconsinan)
Small ice-marginal delta as much as 45 feet thick on the west slope of Papakating Creek valley, southwest of McCoys Corner; elevation of delta-plain surface estimated at 520 feet. This suggests that the level of Lake Wallkill at this time was probably controlled by the Augusta spillway, which is

approximately 5 miles to the southwest. Description from source map: Branchville Quadrangle

Qwb4 - West Branch Papakating Creek collapsed ice-marginal delta and fluviodelta (late Wisconsinan)

Qwb4 - West Branch Papakating Creek collapsed ice-marginal delta and fluviodelta (late Wisconsinan)
Extensively collapsed ice-marginal delta and fluviodelta, each as much as 150 feet thick (profile C-C', G-G' in GRI data) east of Plumbsock; elevation of delta-plain surfaces ranges between 675 and 625 feet. The altitude of glacial lake was initially controlled by a spillway approximately 5000 feet northwest of Woodbourne at an elevation 665 feet. The fluviodeltaic part of the sequence was laid down by outwash transported downstream along the deglaciated reach of West Branch valley. These deposits have been extensively eroded by later meltwater and postglacial streams. Description from source map: Branchville Quadrangle

Qwb3 - West Branch Papakating Creek small ice-marginal deltas and lacustrine-fan deposits (late Wisconsinan)

Qwb3 - West Branch Papakating Creek small ice-marginal deltas and lacustrine-fan deposits (late Wisconsinan)
Small ice-marginal deltas, and lacustrine-fan deposits as much as 65 feet thick (estimated) northwest of Plumbsock; elevation of delta-plain surfaces is estimated at 730 feet. A spillway over a local drainage divide approximately 1 mile to the south at an elevation 705 feet, seems too low to have controlled the level of this lake. Presumably it was blocked by ice or drift. Description from source map: Branchville Quadrangle

Qwb2 - West Branch Papakating Creek ice-marginal delta (late Wisconsinan)

Qwb2 - West Branch Papakating Creek ice-marginal delta (late Wisconsinan)
Ice-marginal delta as much as 80 feet thick (estimated) north of Beemerville that filled a small lake basin; elevation of delta-plain surface is estimated at 765 feet. The delta is graded to a spillway approximately 1000 feet west of the village of Beemerville, elevation 755 feet. Description from source map: Branchville Quadrangle

Qwblb - West Branch Papakating Creek lake-bottom deposits (late Wisconsinan)

Qwblb - West Branch Papakating Creek, lake-bottom deposits (late Wisconsinan)
Lake-bottom deposits as much as 50 feet thick (profile C-C', G-G' in GRI data) laid down in small proglacial lakes in the West Branch drainage basin. Lies chiefly in subsurface beneath Qwb2, Qwb3, and Qwb4 deltaic deposits. Description from source map: Branchville Quadrangle

Qwb1 - West Branch Papakating Creek small collapsed ice-channel filling (late Wisconsinan)

Qwb1 - West Branch Papakating Creek small collapsed ice-channel filling (late Wisconsinan)
Small collapsed ice-channel filling, as much as 35 feet thick (estimated), northwest of Beemerville laid down between the margin of the ice lobe and the valley wall. Description from source map: Branchville Quadrangle

Qwtu - Wykertown deposits (late Wisconsinan)

Qwtu - Wykertown deposits (late Wisconsinan)
Chiefly cobble pebble gravel, pebble gravel and sand; and pebbly sand, sand, and minor silt and clay in ice-marginal deltas, fluviodeltas, and possibly ice-channel fillings; as much as 45 feet thick (estimated). Deposits laid down in small, unnamed stream valleys in the Wykertown area; elevations range between 705 and 675 feet. One exposure, and similarity between elevations of deposits and low points on nearby drainage divides, suggest that these are deltaic deposits laid down in small proglacial lakes. This shows that drainage to Papakating Creek valley was blocked by ice and/or drift. Description from source map: Branchville Quadrangle

Qwtlb - Wykertown lake-bottom deposits (late Wisconsinan)

Qwtlb - Wykertown lake-bottom deposits (late Wisconsinan)
Lake-bottom deposits as much as 40 feet thick laid down in small glacial lakes near Wykertown. Chiefly in subsurface beneath Qwtu deposits. Description from source map: Branchville Quadrangle

Qld2 - Paulins Kill and Wallpack Valley older glacial-lake delta deposits (late Wisconsinan)

Qod2 - Paulins Kill and Wallpack Valley older glacial-lake delta deposits (late Wisconsinan)
Stratified sand, gravel, and silt deposited by meltwater streams in proglacial lakes at and beyond the stagnant glacier margin. Includes well sorted sand and boulder-cobble to pebble gravel in planar to cross-bedded glaciofluvial topset beds that are as much as 25 feet (8m) thick. Overlies and grades into foreset beds that dip 20° to 35° basinward and consist of well- to moderately-sorted, rhythmically-bedded cobble-pebble and pebble gravel and sand. These beds grade downward and outward into ripple cross-laminated and parallel laminated sand, silt and pebble gravel that dip less than 20°. Lower foreset beds grade into gently inclined prodelta bottomset beds of rhythmically-bedded, ripple cross-laminated to graded fine sand and silt with minor clay drapes. Thickness may be as much as 100 feet (30m). Number following unit label indicates relative age of unit in glacial lake basin. Lower numbers represent older deposits. Qod deposits were laid down in narrow sediment-dammed proglacial lakes in Paulins Kill and Wallpack Valleys. Deposits are extensively kettled, and in long lake basins, topset beds are extensively aggraded in their upstream sections. Description from source map: Culvers Gap Quadrangle

Qftc - Egypt Mills outwash-fan deposits (late Wisconsinan)

Qftc - Egypt Mills outwash-fan deposits (late Wisconsinan)
Stratified, well- to moderately-sorted sand, cobble-pebble gravel, and minor silt deposited by meltwater streams in fan-shaped deposits at the mouth of large tributaries in Minisink Valley. As much as 60 feet

(18m) thick. Includes massive to planar-bedded sand and gravel, and minor cross-bedded and channel-fill sand. Bedding generally dips towards the trunk valley by as much as 10°. Fan deposits are graded to valley-train deposits. Description from source map: Flatbrookville Quadrangle

Qfbc - Bushkill outwash-fan deposits (late Wisconsinan)

Qfbc - Bushkill outwash-fan deposits (late Wisconsinan)
Stratified, well- to moderately-sorted sand, cobble-pebble gravel, and minor silt deposited by meltwater streams in fan-shaped deposits at the mouth of large tributaries in Minisink Valley. As much as 60 feet (18m) thick. Includes massive to planar-bedded sand and gravel, and minor cross-bedded and channel-fill sand. Bedding generally dips towards the trunk valley by as much as 10°. Fan deposits are graded to valley-train deposits. Description from source map: Flatbrookville Quadrangle

Qfdb - Dry Brook outwash-fan deposits (late Wisconsinan)

Qfdb - Dry Brook outwash-fan deposits (late Wisconsinan)
Stratified, well- to moderately-sorted sand, cobble pebble gravel, and minor silt deposited by meltwater streams in fan-shaped deposits at the mouth of large tributaries in Minisink Valley. As much as 60 feet (18m) thick. Includes massive to planar-bedded sand and gravel, and minor cross-bedded and channel-fill sand. Bedding generally dips towards the trunk valley by as much as 10°. Fan deposits are graded to valley-train deposits. Description from source map: Culvers Gap Quadrangle

Qfa - Adams Creek outwash-fan deposits (late Wisconsinan)

Qfa - Adams Creek outwash-fan deposits (late Wisconsinan)
Stratified, well- to moderately-sorted sand, cobble pebble gravel, and minor silt deposited by meltwater streams in fan-shaped deposits at the mouth of large tributaries in Minisink Valley. As much as 60 feet (18m) thick. Includes massive to planar-bedded sand and gravel, and minor cross-bedded and channel-fill sand. Bedding generally dips towards the trunk valley by as much as 10°. Fan deposits are graded to valley-train deposits. Description from source map: Culvers Gap Quadrangle

Qtm - Terminal moraine of Wisconsin ice sheet (Pleistocene (Wisconsinan))

Qtm - Terminal moraine of Wisconsin ice sheet (Pleistocene (Wisconsinan))
Conspicuous beltlike ridge of till with some sand and gravel deposited in front of the Wisconsin glacier; up to 300 feet high, with many depressions and linear elements of topography. Description from source map: Stroudsburg Quadrangle

Qm - Recessional moraine (late Wisconsinan)

Qm - Recessional moraine (late Wisconsinan)
Unstratified to poorly stratified sand, gravel, and silt. As much as 30 feet (9m) thick. Consist of poorly compact, stony till, silty-sandy compact till, and minor lenses and layers of water-laid sand, gravel, and silt, in small, uncorrelated, hummocky transverse ridges. Description from source map: Culvers Gap Quadrangle

Qflm - Fairview Lake recessional moraine (late Wisconsinan)

Qflm - Fairview Lake recessional moraine (late Wisconsinan)
Unstratified to poorly stratified sand, gravel, and silt deposited at the active margin of the Kittatinny and Minisink Valley ice lobes. As much as 80 feet (24m) thick. Consists of poorly compact, stony till, silty-sandy compact till, and minor lenses and layers of water-laid sand, gravel, and silt, in discontinuous, bouldery, chiefly cross-valley segmented ridges marking the former lobate glacier margin. Overlies "lower till" in uplands and locally outwash in river valleys. Description from source map: Flatbrookville Quadrangle

Qmbm - Millbrook Village recessional moraine (late Wisconsinan)

Qmbm - Millbrook Village recessional moraine (late Wisconsinan)
Unstratified to poorly stratified sand, gravel, and silt deposited at the active margin of the Kittatinny and Minisink Valley ice lobes. As much as 80 feet (24m) thick. Consists of poorly compact, stony till, silty-sandy compact till, and minor lenses and layers of water-laid sand, gravel, and silt, in discontinuous, bouldery, chiefly cross-valley segmented ridges marking the former lobate glacier margin. Overlies "lower till" in uplands and locally outwash in river valleys. Description from source map: Flatbrookville Quadrangle

Qfgm - Franklin Grove recessional moraine (late Wisconsinan)

Qfgm - Franklin Grove recessional moraine (late Wisconsinan)
Unstratified to poorly stratified sand, gravel, and silt deposited at the active margin of the Kittatinny and Minisink Valley ice lobes. As much as 80 feet (24m) thick. Consists of poorly compact, stony till, silty-sandy compact till, and minor lenses and layers of water-laid sand, gravel, and silt, in discontinuous, bouldery, chiefly cross-valley segmented ridges marking the former lobate glacier margin. Overlies "lower till" in uplands and locally outwash in river valleys. Description from source map: Flatbrookville Quadrangle

Qlf - Lacustrine-fan deposits (late Wisconsinan)

Qlf - Lacustrine-fan deposits (late Wisconsinan)
Stratified, sand, gravel, and silt deposited by meltwater streams in proglacial lakes at and beyond the stagnant glacier margin. Consists of foreset beds that dip 20° to 35° basinward and consist of well- to moderately-sorted, rhythmically-bedded cobble-pebble and pebble gravel and sand. These beds grade downward and outward into ripple cross-laminated and parallel-laminated sand, silt and pebble gravel that dip less than 20°. Lower foreset beds grade into gently inclined prodelta bottomset beds of rhythmically-bedded, ripple cross-laminated to graded fine sand and silt with minor clay drapes. Thickness may be as much as 100 feet (30m). Interpreted to have been deposited at the mouth of a glacial meltwater tunnel. In places deposits are extensively collapsed indicating their deposition over and against stagnant ice. Differentiated from deltas by their lack of topset beds. Description from source map: Flatbrookville Quadrangle

Qwlf - Late Wisconsinan glacial lacustrine-fan deposits (late Pleistocene, late Wisconsinan)
Sand, pebble-to-cobble gravel, minor silt; yellowish brown, reddish brown, light gray. As much as 200

feet thick. Form knolls and ridges on former glacial-lake bottoms. Deposited in lacustrine fans at the mouths of, or within, subglacial meltwater tunnels during the late Wisconsinan glaciation. Description from source map: New Jersey Surficial Geology

Qcm - Colesville recessional moraine (late Wisconsinan)

Qcm - Colesville recessional moraine (late Wisconsinan)
Unstratified to poorly stratified sand, gravel, and silt deposited at the active margin of the Kittatinny and Minisink Valley ice lobes. As much as 80 feet (24m) thick. Consists of poorly compact, stony till, silty-sandy compact till, and minor lenses and layers of water-laid sand, gravel, and silt, in discontinuous, bouldery, chiefly cross-valley segmented ridges marking the former lobate glacier margin. Overlies "lower till" in uplands and locally outwash in river valleys. Description from source map: Port Jervis South Quadrangle

Qlvm - Libertyville recessional moraine (late Wisconsinan)

Qlm - Libertyville Moraine (late Wisconsinan)
Small morainal ridge 0.5 mile north of Libertyville; as much as much as 45 feet thick (estimated). Description from source map: Branchville Quadrangle

Qlm - Libertyville recessional moraine (late Wisconsinan)
Unstratified to poorly stratified sand, gravel, and silt deposited at the active margin of the Kittatinny and Minisink Valley ice lobes. As much as 80 feet (24m) thick. Consists of poorly compact, stony till, silty-sandy compact till, and minor lenses and layers of water-laid sand, gravel, and silt, in discontinuous, bouldery, chiefly cross-valley segmented ridges marking the former lobate glacier margin. Overlies "lower till" in uplands and locally outwash in river valleys. Description from source map: Port Jervis South Quadrangle

Qskm - Steeny Kill Lake recessional moraine (late Wisconsinan)

Qskm - Steeny Kill Lake recessional moraine (late Wisconsinan)
Unstratified to poorly stratified sand, gravel, and silt deposited at the active margin of the Kittatinny and Minisink Valley ice lobes. As much as 80 feet (24m) thick. Consists of poorly compact, stony till, silty-sandy compact till, and minor lenses and layers of water-laid sand, gravel, and silt, in discontinuous, bouldery, chiefly cross-valley segmented ridges marking the former lobate glacier margin. Overlies "lower till" in uplands and locally outwash in river valleys. Description from source map: Port Jervis South Quadrangle

Qwmtn - Late Wisconsinan terminal moraine deposits, Netcong Till (late Wisconsinan)

Qwmtn - Late Wisconsinan terminal moraine deposits, Netcong Till (late Pleistocene, late Wisconsinan)
Netcong Till as in unit Qwtn forming moraine ridges and knolls. As much as 150 feet thick. Deposited directly from glacial ice along the terminal ice margin during the late Wisconsinan glaciation. Description from source map: New Jersey Surficial Geology

Qpdu - Meltwater stream deposits, upper Papakating Creek and Dry Brook (late Wisconsinan)

Qpdu - Meltwater stream deposits, upper Papakating Creek and Dry Brook (late Wisconsinan)
Cobble-pebble gravel and sand, and pebble gravel and sand as much as 40 feet thick (estimated) in uncorrelated and undifferentiated meltwater deposits laid down along the upper reaches of Papakating Creek, and Dry Brook. Deposits are graded to the surface of sequences Qpk14 and Qwk1a. Description from source map: Branchville Quadrangle

Qwk1a - Lake Wallkill fluvialdelta, Frankford Plains Delta (late Wisconsinan)

Qwk1a - Lake Wallkill fluvialdelta, Frankford Plains Delta (late Wisconsinan)
Fluviodelta, as much as 100 feet thick. Derived from outwash transported down a small tributary valley northwest of the deposit; elevation of delta plain is estimated at 530 feet and a topset-foreset contact exposed in a soil-test pit near Frankford Plains Church revealed 12 feet of fine gravel-and-sand topset beds overlying sand and fine-gravel foreset beds. The delta has a digitate front and is partially built over the collapsed head-of-outwash of sequence Qwk1. This is shown by exposures in a small sand and gravel pit found approximately 3000 feet southwest of Frankford Plains Church where sand and fine-gravel foreset beds of the delta overlie collapsed sand and coarse-gravel foreset beds of sequence Qwk1. Sequence Qwk1a consists of glaciofluvial sediment along the upper reaches of Papakating Creek. Description from source map: Branchville Quadrangle

Qwk2 - Lake Wallkill large ice-marginal delta, Armstrong Delta (late Wisconsinan)

Qwk2 - Lake Wallkill large ice-marginal delta, Armstrong Delta (late Wisconsinan)
Large ice-marginal delta, as much as 80 feet thick (profile A-A', I-I' in GRI data) near Armstrong, elevation of topset-foreset contact is estimated at 525 feet, based on exposures in a sand and gravel pit. The northern part of the delta is extensively collapsed and appears to have been deposited in an ice-walled channel. The main part of the delta is generally flat-topped. However, it was in part laid down on and against stagnant ice that occupied the lake basin south and west of the deposit. The Armstrong Delta is correlated with smaller ice marginal deltas and lacustrine-fan deposits that are as much as 45 feet thick (estimated), and located on the west side of Papakating Creek valley, west of Pellettown and Armstrong. Description from source map: Branchville Quadrangle

Qwk1 - Lake Wallkill ice-marginal delta (late Wisconsinan)

Qwk1 - Lake Wallkill ice-marginal delta (late Wisconsinan)
Ice-marginal delta, as much as 95 feet thick (profile A-A', well 8, I-I' in GRI data) north of the Augusta Moraine; elevation of delta plain is estimated at 525 feet. The delta is extensively collapsed and appears to have filled most of the small lake basin north of the moraine. Based on the elevation of the delta plain, it may be graded to the surface of sequence Qpk14. Description from source map: Branchville Quadrangle

Qbr2 - Lake Beaver Run ice-marginal deltaic deposits (late Wisconsinan)

Qbr2 - Lake Beaver Run ice-marginal deltaic deposits (late Wisconsinan)
Ice-marginal deltaic deposits as much as 80 feet thick (estimated) near Harmonyvale laid down in a small lake ponded between the margin of the ice lobe and the Harmonyvale Delta. Altitudes of delta-plain surfaces are estimated to be 590 feet. This shows that the elevation of the small lake was controlled by a spillway cut through sequence Qbr1, elevation 575 feet, and that a lower outlet, 0.5 miles north of Harmonyvale, was covered by ice. Description from source map: Branchville Quadrangle

Qbru - Lake Beaver Run small uncorrelated ice-marginal deltas, collapsed ice-channel, and lacustrine-fan deposits (late Wisconsinan)

Qbru - Lake Beaver Run small uncorrelated ice-marginal deltas, collapsed ice-channel, and lacustrine-fan deposits (late Wisconsinan)
Small uncorrelated ice-marginal deltas, collapsed ice-channel deposits, and lacustrine-fan deposits as much as 35 feet thick (estimated) laid down in Lake Beaver Run. Description from source map: Branchville Quadrangle

Qbrlf - Lake Beaver Run uncorrelated lacustrine-fan deposits and collapsed deltaic sediment (late Wisconsinan)

Qbrlf - Lake Beaver Run uncorrelated lacustrine-fan deposits and collapsed deltaic sediment (late Wisconsinan)
Uncorrelated lacustrine fan deposits and collapsed deltaic sediment as much as 65 feet thick (estimated) laid down in Lake Beaver Run. Description from source map: Branchville Quadrangle

Qbrlb - Lake Beaver Run lake-bottom deposits (late Wisconsinan)

Qbrlb - Lake Beaver Run lake-bottom deposits (late Wisconsinan)
Lake-bottom deposits laid down in Lake Beaver Run; as much as 50 feet thick (estimated). Chiefly in the subsurface, and overlain by swamp deposits or deltaic sediment. Description from source map: Branchville Quadrangle

Qbr1 - Lake Beaver Run large ice-marginal delta, Harmonyvale Delta (late Wisconsinan)

Qbr1 - Lake Beaver Run large ice-marginal delta, Harmonyvale Delta (late Wisconsinan)
Large ice-marginal delta as much as 90 feet thick (profile B-B', H-H' in GRI data) that partially fills the Beaver Run Valley south of Harmonyvale; elevation of the delta-plain surface is estimated to be 585 feet. A till-floored spillway at the south end of the Crooked Swamp basin in the Newton East quadrangle controlled the level of Lake Beaver Run. The spillway has since been lowered by erosion. Description from source map: Branchville Quadrangle

Qpk14 - Upper Paulins Kill ice-marginal delta and fluviodelta (late Wisconsinan)

Qpk14 - Upper Paulins Kill ice-marginal delta and fluviodelta (late Wisconsinan)
Ice-marginal delta and fluviodelta as much as 90 feet thick (profile A-A', I-I' in GRI data) laid down in a proglacial lake dammed by sequence Qpk13 and by older recessional deposits downvalley in the Newton West quadrangle. Altitudes of delta-plain in the Augusta area ranges from 530 to 510 feet. The Qpk14 deposits in the small valley east of Branchville have been extensively aggraded to an elevation above that of deltaic deposits in the valley. Description from source map: Branchville Quadrangle

Qfa - unit not defined on source map but correlates spatially with Qpk14 on Branchville quad from same author (late Wisconsinan)
Stratified, well- to moderately-sorted sand, cobble pebble gravel, and minor silt deposited by meltwater streams in fan-shaped deposits at the mouth of large tributaries in Minisink Valley. As much as 60 feet (18m) thick. Includes massive to planar-bedded sand and gravel, and minor cross-bedded and channel-fill sand. Bedding generally dips towards the trunk valley by as much as 10°. Fan deposits are graded to valley-train deposits. Description from source map: Culvers Gap Quadrangle

Qam - Augusta recessional moraine (late Wisconsinan)

Qam - Augusta Moraine (late Wisconsinan)
Eleven morainal segments in Kittatinny Valley and on Kittatinny Mountain; as much as 23 feet thick near Augusta (profile A-A', I-I' in GRI data), and on Kittatinny Mountain estimated to be as much as 65 feet thick (profile C-C', G-G' in GRI data). Correlative with Montague Moraine in Minisink Valley (Witte, 1991a). Description from source map: Branchville Quadrangle

Qam - Augusta recessional moraine (late Wisconsinan)
Unstratified to poorly stratified sand, gravel, and silt deposited at the active margin of the Kittatinny and Minisink Valley ice lobes. As much as 80 feet (24m) thick. Consists of poorly compact, stony till, silty-sandy compact till, and minor lenses and layers of water-laid sand, gravel, and silt, in discontinuous, bouldery, chiefly cross-valley segmented ridges marking the former lobate glacier margin. Overlies "lower till" in uplands and locally outwash in river valleys. Description from source map: Port Jervis South Quadrangle

Qmvm - Millville recessional moraine (late Wisconsinan)

Qmvm - Millville recessional moraine (late Wisconsinan)
Unstratified to poorly stratified sand, gravel, and silt deposited at the active margin of the Kittatinny and Minisink Valley ice lobes. As much as 80 feet (24m) thick. Consists of poorly compact, stony till, silty-sandy compact till, and minor lenses and layers of water-laid sand, gravel, and silt, in discontinuous, bouldery, chiefly cross-valley segmented ridges marking the former lobate glacier margin. Overlies "lower till" in uplands and locally outwash in river valleys. Description from source map: Milford Quadrangle

Qmm - Montague recessional moraine (late Wisconsinan)

Qmm - Montague recessional moraine (late Wisconsinan)
Unstratified to poorly stratified sand, gravel, and silt deposited at the active margin of the Kittatinny and Minisink Valley ice lobes. As much as 80 feet (24m) thick. Consists of poorly compact, stony till, silty-sandy compact till, and minor lenses and layers of water-laid sand, gravel, and silt, in discontinuous,

bouldery, chiefly cross-valley segmented ridges marking the former lobate glacier margin. Overlies "lower till" in uplands and locally outwash in river valleys. Description from source maps: Milford Quadrangle, Port Jervis South Quadrangle

Qdfm - Dingman Ferry recessional moraine (late Wisconsinan)

Qdfm - Dingmans Ferry recessional moraine (late Wisconsinan)
Unstratified to poorly stratified sand, gravel, and silt deposited at the active margin of the Kittatinny and Minisink Valley ice lobes. As much as 80 feet (24m) thick. Consists of poorly compact stony till, silty-sandy compact till, and minor lenses and layers of water-laid sand, gravel, and silt, in discontinuous, bouldery, chiefly cross-valley segmented ridges marking the former lobate glacier margin. Overlies "lower till" in uplands and locally, outwash in river valleys. Description from source maps: Culvers Gap Quadrangle, Milford Quadrangle

Qkms - Till (late Wisconsinan)

Qkms - Till (late Wisconsinan)
Slightly compact to compact, unstratified, poorly sorted reddish-brown (5YR 5-4/3) noncalcareous sandy silt to silty sand containing 10 to 20 percent gravel. As much as 25 feet thick. Clasts chiefly consist of unweathered red sandstone, and red shale, some quartzite, quartz-pebble conglomerate, and minor carbonate rock, calcareous siltstone, and sandstone. The matrix is a varied mix of non-weathered quartz, rock fragments, silt, and minor clay. Restricted to the subsurface, beneath unit Qkmq (profile C-C', G-G' in GRI data). Description from source map: Branchville Quadrangle

Qfbu - Big Flat Brook deposits (late Wisconsinan)

Qfbu - Big Flat Brook deposits (late Wisconsinan)
Uncorrelated and undifferentiated outwash as much as 40 feet thick (estimated) deposited in the Big Flat Brook drainage basin. Description from source map: Branchville Quadrangle

Qpk13 - Upper Paulins Kill, ice-marginal delta (late Wisconsinan)

Qpk13 - Upper Paulins Kill ice-marginal delta (late Wisconsinan)
Ice-marginal delta as much as 50 feet thick (estimated) laid down in a small proglacial lake dammed by older recessional deposits downvalley in the Newton West quadrangle. The altitude of the delta-plain surface is estimated at 530 feet. Description from source map: Branchville Quadrangle

Qom - Ogdensburg-Culvers Gap moraine (late Wisconsinan)

Qom - Ogdensburg-Culvers Gap Moraine (late Wisconsinan)
Two morainal segments on Kittatinny Mountain southwest of Sunrise Mountain; as much as 60 feet thick (estimated). Correlative with Dingmans Ferry Moraine in Minisink Valley (Witte, 1991a). Description from source map: Branchville Quadrangle

Qom - Ogdensburg-Culvers Gap recessional moraine (late Wisconsinan)

Unstratified to poorly stratified sand, gravel, and silt deposited at the active margin of the Kittatinny and Minisink Valley ice lobes. As much as 80 feet (24m) thick. Consists of poorly compact stony till, silty-sandy compact till, and minor lenses and layers of water-laid sand, gravel, and silt, in discontinuous, bouldery, chiefly cross-valley segmented ridges marking the former lobate glacier margin. Overlies "lower till" in uplands and locally, outwash in river valleys. Description from source map: Culvers Gap Quadrangle

Qom - Ogdensburg-Culvers Gap recessional moraine (late Wisconsinan)
Unstratified to poorly stratified sand, gravel, and silt deposited at the active margin of the Kittatinny and Minisink Valley ice lobes. As much as 80 feet (24m) thick. Consists of poorly compact, stony till, silty-sandy compact till, and minor lenses and layers of water-laid sand, gravel, and silt, in discontinuous, bouldery, chiefly cross-valley segmented ridges marking the former lobate glacier margin. Overlies "lower till" in uplands and locally outwash in river valleys. Qom description does not appear on source however the unit is labeled on the map. Identity of unit interpreted by the GRI from adjacent maps. Description is from similar units on source map: Milford Quadrangle

Qom - Ogdensburg-Culvers Gap moraine (late Wisconsinan)
Unstratified to poorly stratified sand, gravel, and silt deposited at the active margin of the Kittatinny Valley ice lobe. As much as 80 feet (24m) thick. Consists of poorly compact stony till, silty-sandy compact till, and minor lenses and layers of water laid sand, gravel, and silt in discontinuous, bouldery, chiefly cross-valley segmented ridges that mark the former glacier margin. Overlies till (Qtk and Qtq) in uplands and locally outwash in valleys. Description from source map: Newton West Quadrangle

Qv1 - Older valley-train deposits (late Wisconsinan)

Qv1 - Older valley-train deposits (late Wisconsinan)
Stratified, well- to moderately sorted sand, boulder-cobble to pebble gravel, and minor silt deposited by meltwater streams at and extending well beyond (greater than five miles (8 km)) the glacier's margin. As much as 100 feet (30m) thick. The proximal part of the deposit consists of massive to horizontally bedded and imbricated coarse gravel and sand, and planar to tabular and trough cross-bedded, fine gravel and sand in bars, and channel-lag deposits with minor cross-bedded sand in channel-fill deposits. Clasts generally are smaller downstream, where sand is more abundant, and trough and planar crossbedding, and graded beds are more common. Based on well records overlies glacial lake deposits previously laid down in sediment-dammed proglacial lakes. In places overlain by nonlayered, well-sorted, very fine sand and fine sand presumed to be eolian; as much as 5 feet (2m) thick. In Minisink Valley forms shingled sets of outwash terraces. Number after unit label indicates relative age of unit in valley. Lower numbers represent older deposits. Description from source map: Culvers Gap Quadrangle

Qdo2 - Glacial-lake delta deposits from glacial Lake Owassa (late Wisconsinan)

Qd2 - Glacial-lake delta deposits from glacial Lake Owassa (late Wisconsinan)
Stratified sand, gravel, and silt deposited by meltwater streams in proglacial lakes at and beyond the stagnant glacier margin. Includes well sorted sand and boulder-cobble to pebble gravel in planar to cross-bedded glaciofluvial topset beds that are as much as 25 feet (8m) thick. Overlies and grades into foreset beds that dip 20° to 35° basinward and consist of well- to moderately-sorted, rhythmically-bedded cobble-pebble and pebble gravel and sand. These beds grade downward and outward into ripple cross-laminated and parallel laminated sand, silt and pebble gravel that dip less than 20°. Lower foreset beds grade into gently inclined prodelta bottomset beds of rhythmically-bedded, ripple cross-laminated to graded fine sand and silt with minor clay drapes. Thickness may be as much as 100 feet (30m). Number

following unit label indicates relative age of unit in glacial lake basin. Lower numbers represent older deposits. Qd deposits were laid down in glacial Lake Owassa, Kittatinny Valley. Deposits are extensively kettled, and in long lake basins, topset beds are extensively aggraded in their upstream sections. Numbered units refer to successively younger valley-outwash deltas laid down in Wallpack Valley. Description from source map: Culvers Gap Quadrangle

Qfd - Dingmans Creek outwash-fan deposits (late Wisconsinan)

Qfd - Dingmans Creek outwash-fan deposits (late Wisconsinan)
Stratified, well- to moderately-sorted sand, cobble pebble gravel, and minor silt deposited by meltwater streams in fan-shaped deposits at the mouth of large tributaries in Minisink Valley. As much as 60 feet (18m) thick. Includes massive to planar-bedded sand and gravel, and minor cross-bedded and channel-fill sand. Bedding generally dips towards the trunk valley by as much as 10°. Fan deposits are graded to valley-train deposits. Description from source map: Culvers Gap Quadrangle

Qdo1 - Older glacial-lake delta deposits from glacial Lake Owassa (late Wisconsinan)

Qd1 - Older glacial-lake delta deposits from glacial Lake Owassa (late Wisconsinan)
Stratified sand, gravel, and silt deposited by meltwater streams in proglacial lakes at and beyond the stagnant glacier margin. Includes well sorted sand and boulder-cobble to pebble gravel in planar to cross-bedded glaciofluvial topset beds that are as much as 25 feet (8m) thick. Overlies and grades into foreset beds that dip 20° to 35° basinward and consist of well- to moderately-sorted, rhythmically-bedded cobble-pebble and pebble gravel and sand. These beds grade downward and outward into ripple cross-laminated and parallel laminated sand, silt and pebble gravel that dip less than 20°. Lower foreset beds grade into gently inclined prodelta bottomset beds of rhythmically-bedded, ripple cross-laminated to graded fine sand and silt with minor clay drapes. Thickness may be as much as 100 feet (30m). Number following unit label indicates relative age of unit in glacial lake basin. Lower numbers represent older deposits. Qd2 deposits were laid down in glacial Lake Owassa, Kittatinny Valley. Deposits are extensively kettled, and in long lake basins, topset beds are extensively aggraded in their upstream sections. Description from source map: Culvers Gap Quadrangle

Qld1 - Paulins Kill and Wallpack Valley oldest glacial-lake delta deposits (late Wisconsinan)

Qod1 - Paulins Kill and Wallpack Valley oldest glacial-lake delta deposits (late Wisconsinan)
Stratified sand, gravel, and silt deposited by meltwater streams in proglacial lakes at and beyond the stagnant glacier margin. Includes well sorted sand and boulder-cobble to pebble gravel in planar to cross-bedded glaciofluvial topset beds that are as much as 25 feet (8m) thick. Overlies and grades into foreset beds that dip 20° to 35° basinward and consist of well- to moderately-sorted, rhythmically-bedded cobble-pebble and pebble gravel and sand. These beds grade downward and outward into ripple cross-laminated and parallel laminated sand, silt and pebble gravel that dip less than 20°. Lower foreset beds grade into gently inclined prodelta bottomset beds of rhythmically-bedded, ripple cross-laminated to graded fine sand and silt with minor clay drapes. Thickness may be as much as 100 feet (30m). Number following unit label indicates relative age of unit in glacial lake basin. Lower numbers represent older deposits. Qod deposits were laid down in narrow sediment-dammed proglacial lakes in Paulins Kill and Wallpack Valleys. Deposits are extensively kettled, and in long lake basins, topset beds are extensively aggraded in their upstream sections. Description from source map: Culvers Gap Quadrangle

Qht - Hummock topography (late Wisconsinan)

Qm - Hummock topography (late Wisconsinan)
Small areas of hummocky topography underlain by till; origin uncertain. Description from source map: Branchville Quadrangle

Qit - Pre-Wisconsinan drift (Illinoian?)

Qig - Till and meltwater sediment (Pre-Wisconsinan (Illinoian))
In subsurface only (profile C-C', G-G' in GRI data). Undifferentiated till and possibly meltwater sediment beneath late Wisconsinan glacial drift on Kittatinny Mountain. May form the core of some thick drumlins in Kittatinny Valley. Description from source map: Branchville Quadrangle

Qi?t - Pre-Wisconsinan drift (Illinoian?)
Unstratified to poorly stratified sand, gravel, and silt; presumably Illinoian till. Shown only in subsurface on cross-section beneath late Wisconsinan drift. Description from source maps: Culvers Gap Quadrangle, Flatbrookville Quadrangle

Qodr - Older drift (Pleistocene (Illinoian?))

Qod - Older drift (Pleistocene (Illinoian?))
Deeply leached and oxidized muddy till lacking constructional topography. Description from source map: Stroudsburg Quadrangle

QPZbr - Bedrock and thin olean till, undivided (Paleozoic and younger)

br - Bedrock and thin olean till, undivided (Paleozoic and younger)
Rock exposures and till less than 6 feet thick. Includes rock ledges having steep faces up to several feet high; broken rock is common at the base of ledges. Unvegetated, gently dipping rock surfaces adjacent to ledges may have scattered large boulders and glacially striated surfaces.

Till has no aquifer potential because of inadequate thickness. Thin till is easily excavated. Till thickness is inadequate for septic systems and sanitary-landfill sites. Till may be used for artificial fill. Description from source map: Pike County Geology and Mineral Resources

QPZlr - Limestone bedrock (pre-Quaternary?)

lr - Limestone bedrock (pre-Quaternary?)
Matrix dominated diamict derived from the underlying bedrock of gray limestone or dolostone with variable amounts of chert and limonite; clasts are typically matrix supported and become more common with depth; yellowish-brown to yellowish-red matrix; commonly thicker than 2 meters in depressions. Description from source map: Allentown 30 x 60

QPZr - Bedrock (pre-Wisconsinan)

sr - Slate or shale bedrock (pre-Quaternary?)
Clast-rich diamict derived from the underlying bedrock of gray (occasionally red) slate interbedded with some gray wacke in places; yellowish-brown matrix; clasts are a few centimeters long and less than a centimeter thick. Description from source map: Allentown 30 x 60

bedrock - Bedrock (Pre-Wisconsinan (Illinoian))
Extensive outcrops, minor regolith, and scattered erratics. Description from source map: Branchville Quadrangle, Culvers Gap Quadrangle, Flatbrookville Quadrangle, Lake Maskenozha Quadrangle, Newton West Quadrangle

r - Bedrock (pre-Wisconsinan)
Extensive outcroppings, minor regolith, and scattered erratics. Description from source map: Bushkill Quadrangle

br - Bedrock (Quaternary)
Bedrock, more than 30% covered by till with thickness less than 1 meter. Description from source map: East Stroudsburg Quadrangle

bedrock - Bedrock (pre-late Wisconsinan)
Extensive outcrops, minor frost-shattered rock, talus, and sparse erratics. Description from source map: Milford Quadrangle

r - Bedrock (pre-Quaternary?)
Exposed or generally within 1 meter of surface, in some areas saprolite is preserved. Description from source map: New York Geology, Lower Hudson Sheet

r - Bedrock (pre-late Wisconsinan)
Extensive outcrops, minor frost-shattered rock, talus, and sparse erratics. Description from source map: Port Jervis South Quadrangle

b - Area of Bedrock Exposure (Pre-Quaternary)
Areas of bedrock exposure, bedrock float, or bedrock mantled with thin drift. Description from source map: Stroudsburg Quadrangle

QPZsr - Bedrock regolith (pre-Wisconsinan)

sr - Bedrock regolith (pre-Wisconsinan)
Regolith; chiefly rock waste on steep hillslopes and ridge crests, minor talus, scattered erratics, and a few small outcrops. Description from source map: Bushkill Quadrangle, Culvers Gap Quadrangle, Newton West Quadrangle

sr - Bedrock regolith (pre-late Wisconsinan)
Regolith; chiefly rock waste on steep hillslopes and ridge crests, minor talus, scattered erratics, and a few small outcrops. Description from source maps: Flatbrookville Quadrangle, Lake Maskenozha Quadrangle, Port Jervis South Quadrangle

Du - Devonian rocks, undifferentiated (Devonian)

D-undif - Devonian undifferentiated (Devonian)
No description on source map: East Stroudsburg Quadrangle

Dcw - Catskill Formation, Walcksville Member (Devonian)

Dcw - Catskill Formation, Walcksville Member (Devonian)
No description on source map: East Stroudsburg Quadrangle

Dct - Catskill Formation, Towamensing Member (Devonian)

Dct - Catskill Formation, Towamensing Member (Devonian)
No description on source map: East Stroudsburg Quadrangle

Dtr - Trimmers Rock Formation (Devonian)

Dtr - Trimmers Rock Formation (Devonian)
No description on source map: East Stroudsburg Quadrangle

Dmh - Mahantango Formation (Devonian)

Dmh - Mahantango Formation (Devonian)
No description on source map: East Stroudsburg Quadrangle

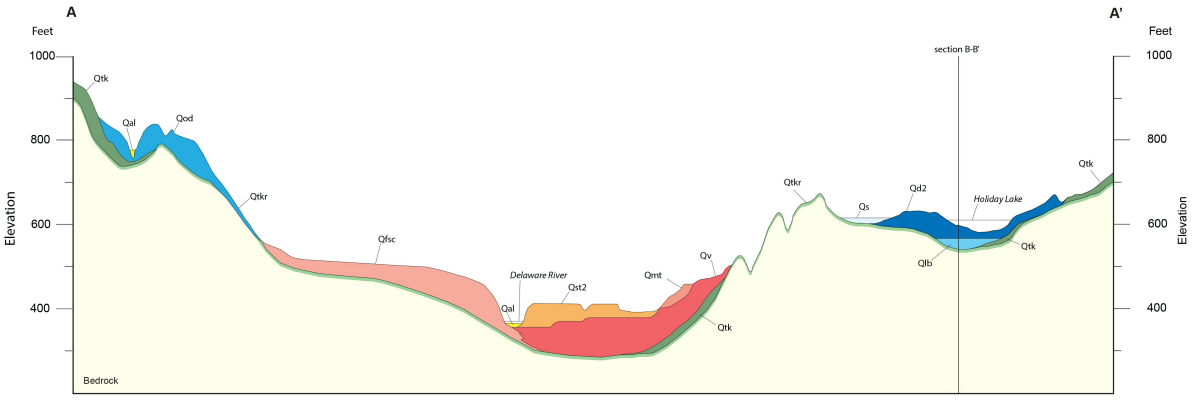
Dm - Marcellus Formation (Devonian)

Dm - Marcellus Formation (Devonian)
No description on source map: East Stroudsburg Quadrangle

Geologic Cross Sections

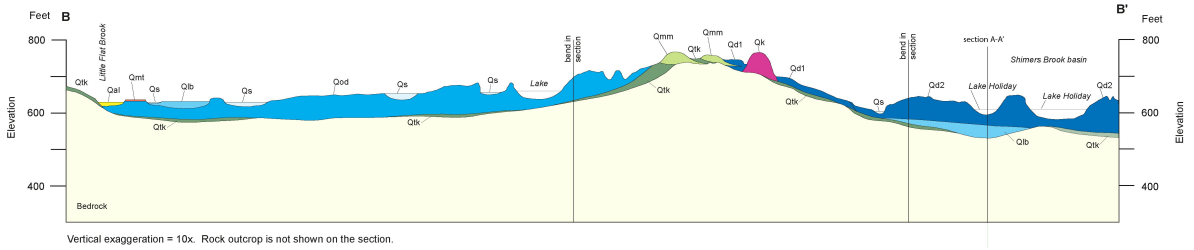
The geologic cross sections present in the GRI digital surficial geologic-GIS data produced for Delaware Water Gap National Recreation Area, Pennsylvania, New Jersey and New York (DEWA) are presented below. Note that some cross section abbreviations (e.g., A - A') may have been changed from their source map abbreviation in the GRI data so that each cross section abbreviation in the GRI data is unique. Cross section graphics were scanned at a high resolution and can be viewed in more detail by zooming in (if viewing the digital format of this document).

Cross Section A-A'



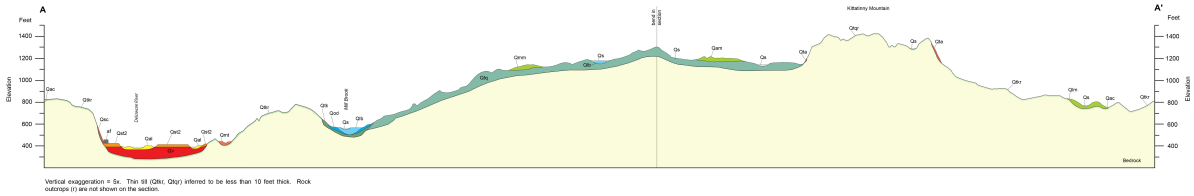
Graphic from source map: Milford Quadrangle.

Cross Section B-B'



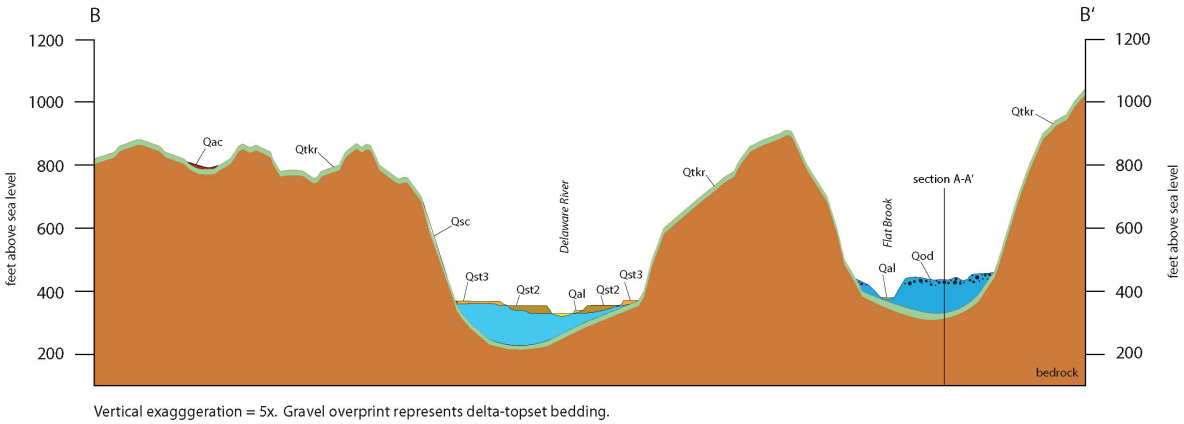
Graphic from source map: Milford Quadrangle.

Cross Section C-C'



Graphic from source map: Port Jervis South Quadrangle. Cross section A-A' on source map.

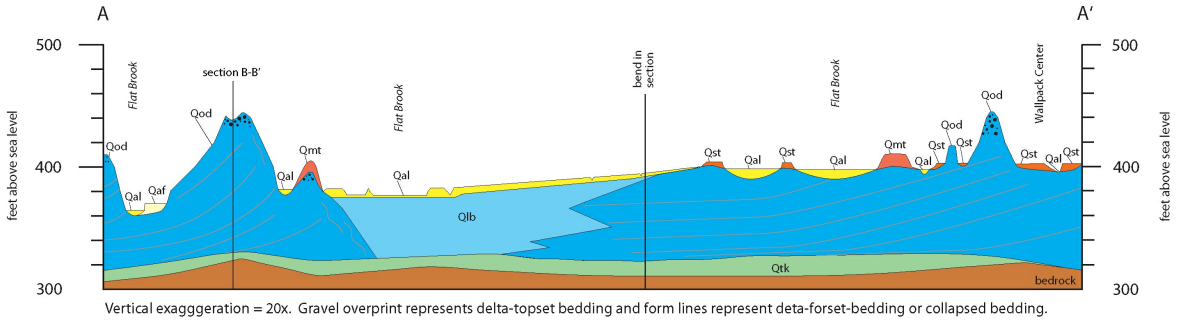
Cross Section D-D'



Vertical exagggeration = 5x. Gravel overprint represents delta-topset bedding.

Graphic from source map: Lake Maskenozha Quadrangle. Cross section B-B' on source map.

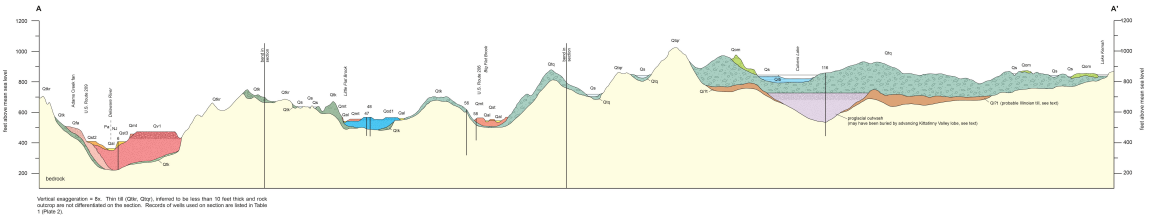
Cross Section E-E'



Vertical exagggeration = 20x. Gravel overprint represents delta-topset bedding and form lines represent deta-forset-bedding or collapsed bedding.

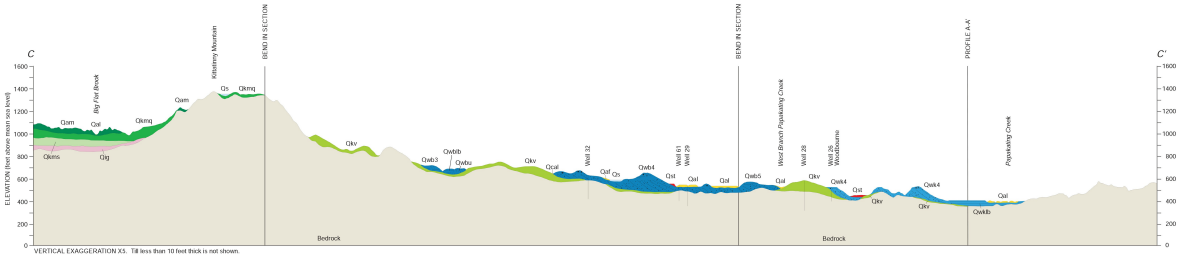
Graphic from source map: Lake Maskenozha Quadrangle. Cross section A-A' on source map.

Cross Section F-F'



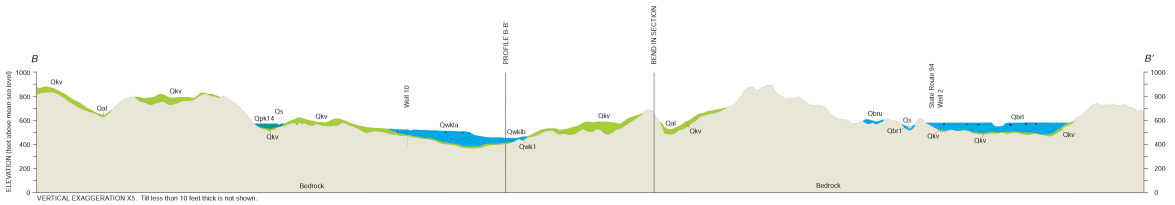
Graphic from source map: Culvers Gap Quadrangle. Cross section A-A' on source map.

Cross Section G-G'



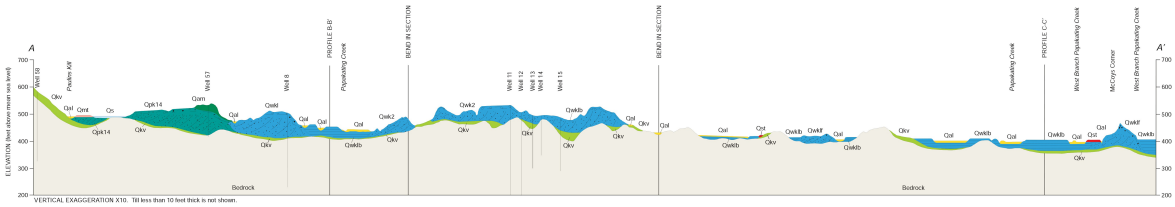
Graphic from source map: Branchville Quadrangle. Cross section C-C' on source map.

Cross Section H-H'



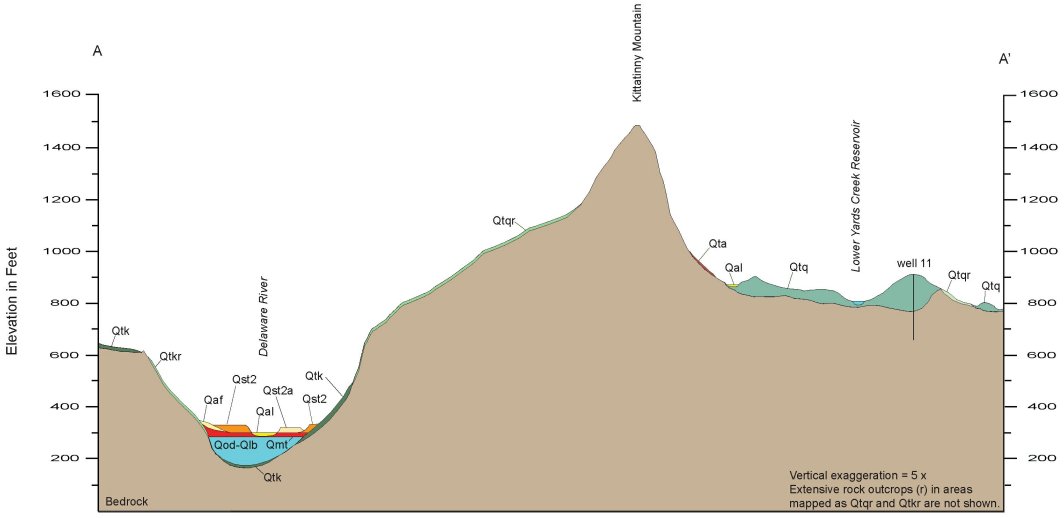
Graphic from source map: Branchville Quadrangle. Cross section B-B' on source map.

Cross Section I-I'



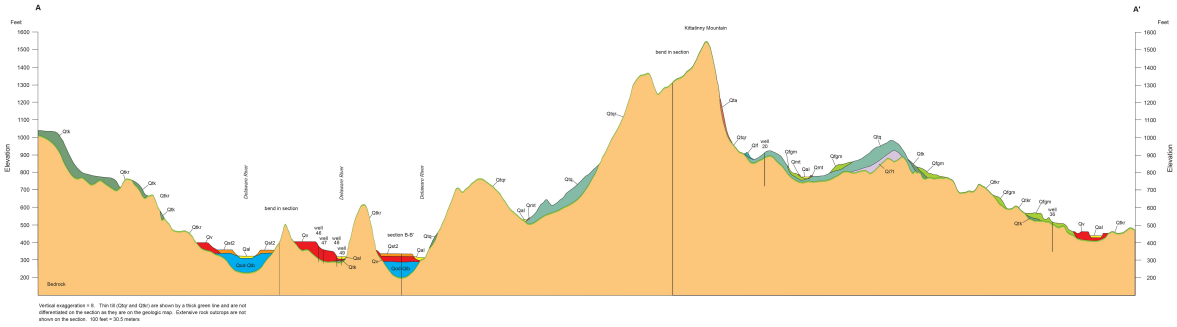
Graphic from source map: Branchville Quadrangle. Cross section A-A' on source map.

Cross Section J-J'



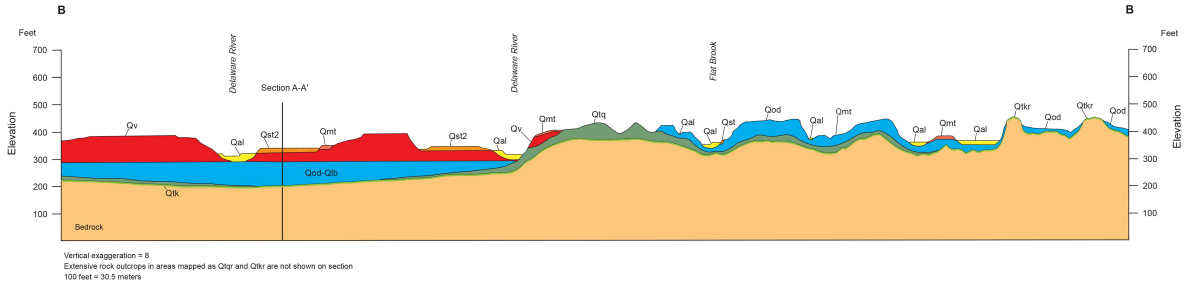
Graphic from source map: Bushkill Quadrangle. Cross section A-A' on source map.

Cross Section K-K'



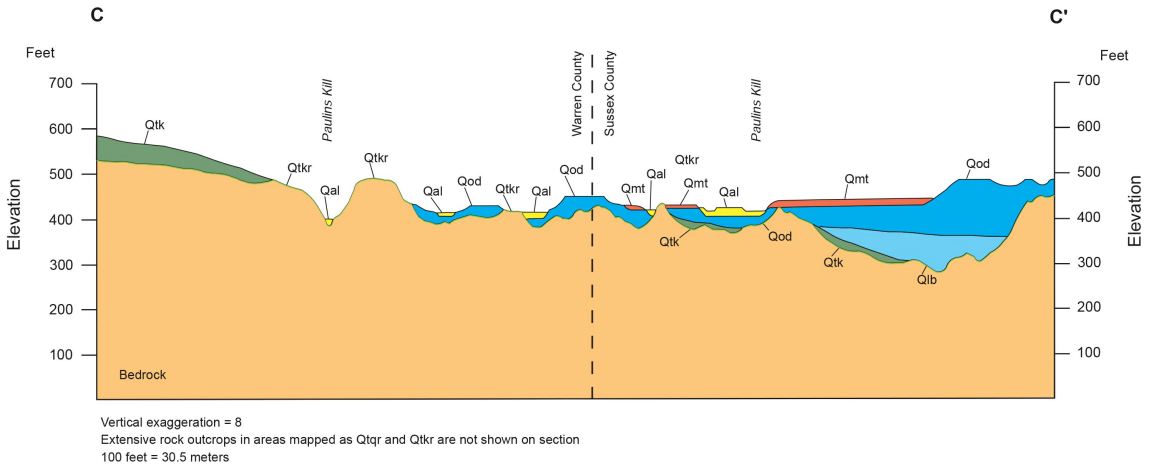
Graphic from source map: Flatbrookville Quadrangle. Cross section A-A' on source map.

Cross Section L-L'



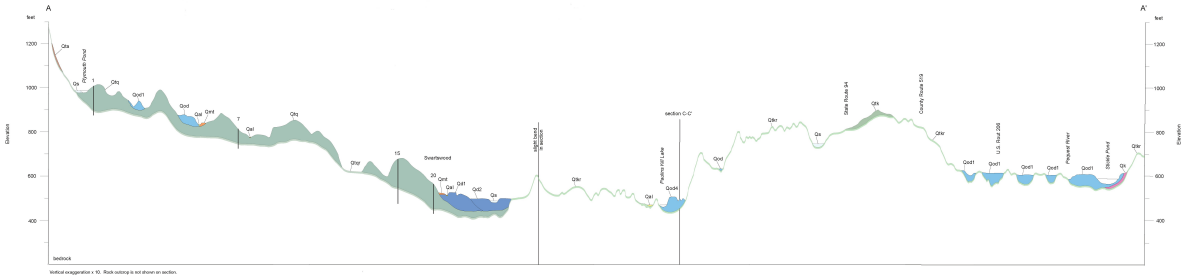
Graphic from source map: Flatbrookville Quadrangle. Cross section B-B' on source map.

Cross Section M-M'



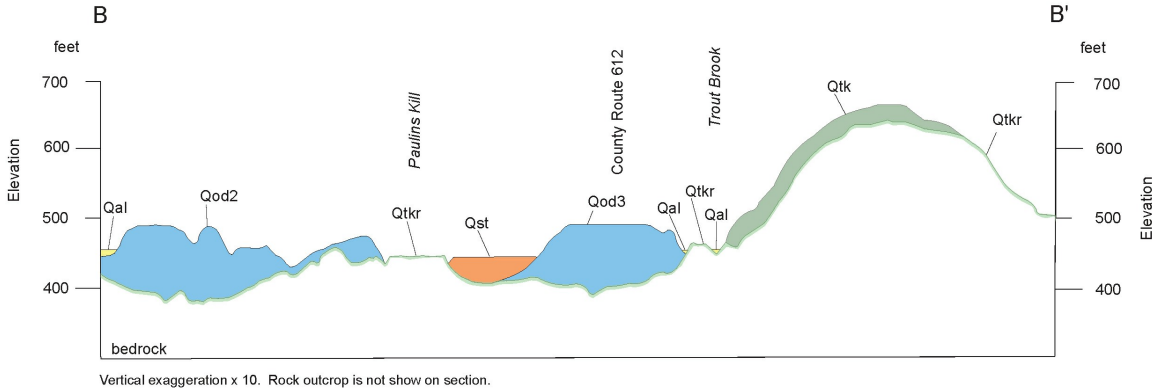
Graphic from source map: Flatbrookville Quadrangle. Cross section C-C' on source map.

Cross Section N-N'



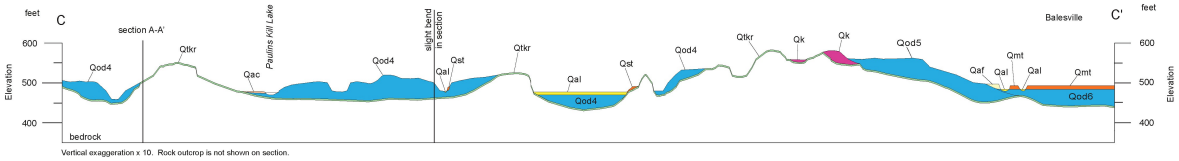
Graphic from source map: Newton West Quadrangle. Cross section A-A' on source map.

Cross Section O-O'



Graphic from source map: Newton West Quadrangle. Cross section B-B' on source map.

Cross Section P-P'



Graphic from source map: Newton West Quadrangle. Cross section C-C' on source map.

Ancillary Source Map Information

The following sections present ancillary source map information associated with sources used for this project.

Allentown 30' x 60' Quadrangle

The formal citation for this source.

> Braun, D.D., 1996, Surficial Geology of the Allentown 30 x 60-minute Quadrangle: Pennsylvania Geological Survey, Open-file Report OF 96-48, scale 1:100,000 (*GRI Source Map ID 4501*).

Click here to view the entire publication including a text report discussing the geology of the Allentown 30 x 60 Quadrangle.

Branchville Quadrangle

The formal citation for this source.

> Witte, R.W., 2008, Surficial Geologic Map of the Branchville Quadrangle, Sussex County, New Jersey: New Jersey Geological Survey, Geologic Map Series GMS 08-2, scale 1:24,000 (*GRI Source Map ID 75860*).

In addition to information contained in this document the published Surficial Geologic Map of the Branchville Quadrangle contains additional text, table and figures that might me useful in understanding the geology for this quadrangle.

Prominent graphics and text associated with this source.

Introduction

Description of Units
Map units denote unconsolidated materials more than 5 feet thick. Color designations, based on Munsell Color Company (1975), were determined from naturally moist samples. Numbers after a map symbol (for example Qbr1) identify a morphosequence, which is a meltwater deposit or suite of meltwater deposits laid down at and beyond the glacier margin, and associated with a unique ice-recessional position. Higher numbers represent younger morphosequences, and the letter "u" indicates an uncorrelated deposit. Numbering for the Paulins Kill deposits follow sequentially from Witte (1988).

Recessional Moraine (late Wisconsinan)
Unstratified to poorly stratified sand, gravel, and silt deposited at the margin of a glacier. As much as 80 feet (24m) thick. Consist of poorly compact, stony till, silty-sandy compact till, and minor lenses and layers of water-laid sand, gravel, and silt, in discontinuous, bouldery, chiefly crossvalley segmented ridges marking the former lobate glacier margin.

Recessional moraine deposits on Branchville Quadrangle: Qom, Qam, Qlm, Qm

Deposits of meltwater streams (late Wisconsinan)
Ice-marginal and non-ice-marginal fluvial morphosequences.

Meltwater stream deposits on Branchville Quadrangle: Qpdu, Qmt

Deposits of glacial lakes (late Wisconsinan)
Ice-marginal and non-ice-marginal lacustrine, fluvial-lacustrine, and lacustrine-fluvial morphosequences.

Glacial lake deposits on Branchville Quadrangle are divided into the following groups:

Lake Beaver Run deposits
Ice-marginal deltas, lacustrine-fan and lake-bottom deposits laid down in Lake Beaver Run. Deltas consist of cobble gravel, cobble-pebble gravel, and sand topset beds near collapsed heads of outwash to cobble-pebble, pebble gravel, and sand topset beds downstream. Topset beds overlie pebble gravel and sand, pebbly sand, sand, and silt foreset beds that overlie and grade laterally in subsurface, and interfinger with lake-bottom deposits in southwestern part of lake basin. Lacustrine fan deposits lack topset beds.

Lake Beaver Run deposits on Branchville Quadrangle: Qbr1, Qbr2, Qbrlf, Qbru, Qbrlb

Lake Wallkill deposits
Ice-marginal deltas, fluviodeltas, lacustrine fans, and lake-bottom deposits laid down in Lake Wallkill. Sequences Qwk1, Qwk1a, and Qwk2 were deposited during the Frankford Plains phase of Lake Wallkill, based on the estimated elevation of topset-foreset contacts. The lake's spillway during the Frankford Plains phase was over the Augusta Moraine and morphosequence Qpk14. It was situated as much as 25 feet higher than the stable Augusta spillway. Deltas consist chiefly of cobble gravel, cobble-pebble gravel, and sand topset beds near heads-of-outwash to pebble gravel and sand topset beds downstream. These overlie pebble gravel and sand, pebbly sand, and sand-silt foreset beds that overlie and grade laterally in subsurface, and interfinger with, lakebottom deposits. Lacustrine fan deposits have similar textures but lack topset beds.

Lake Wallkill deposits on Branchville Quandrangle: Qwk1, Qwk1a, Qwk2, Qwk3, Qwk4, Qwklf, Qwku, Qwklb

West Branch Papakating Creek deposits
Ice-marginal deltas, fluviodeltas, ice-channel fillings, and lake-bottom deposits laid down in small, successively lowering, unnamed glacial lakes in the West Branch drainage basin. Deltaic deposits chiefly consist of cobble gravel, cobblepebble gravel, and sand topset beds at collapsed heads-of-outwash to pebble gravel and sand downstream. Topset beds overlie foreset beds of pebble gravel and sand, pebbly sand, and sand with minor silt and clay. Foreset beds overlie and grade laterally, and interfinger with, lake bottom deposits in the subsurface.

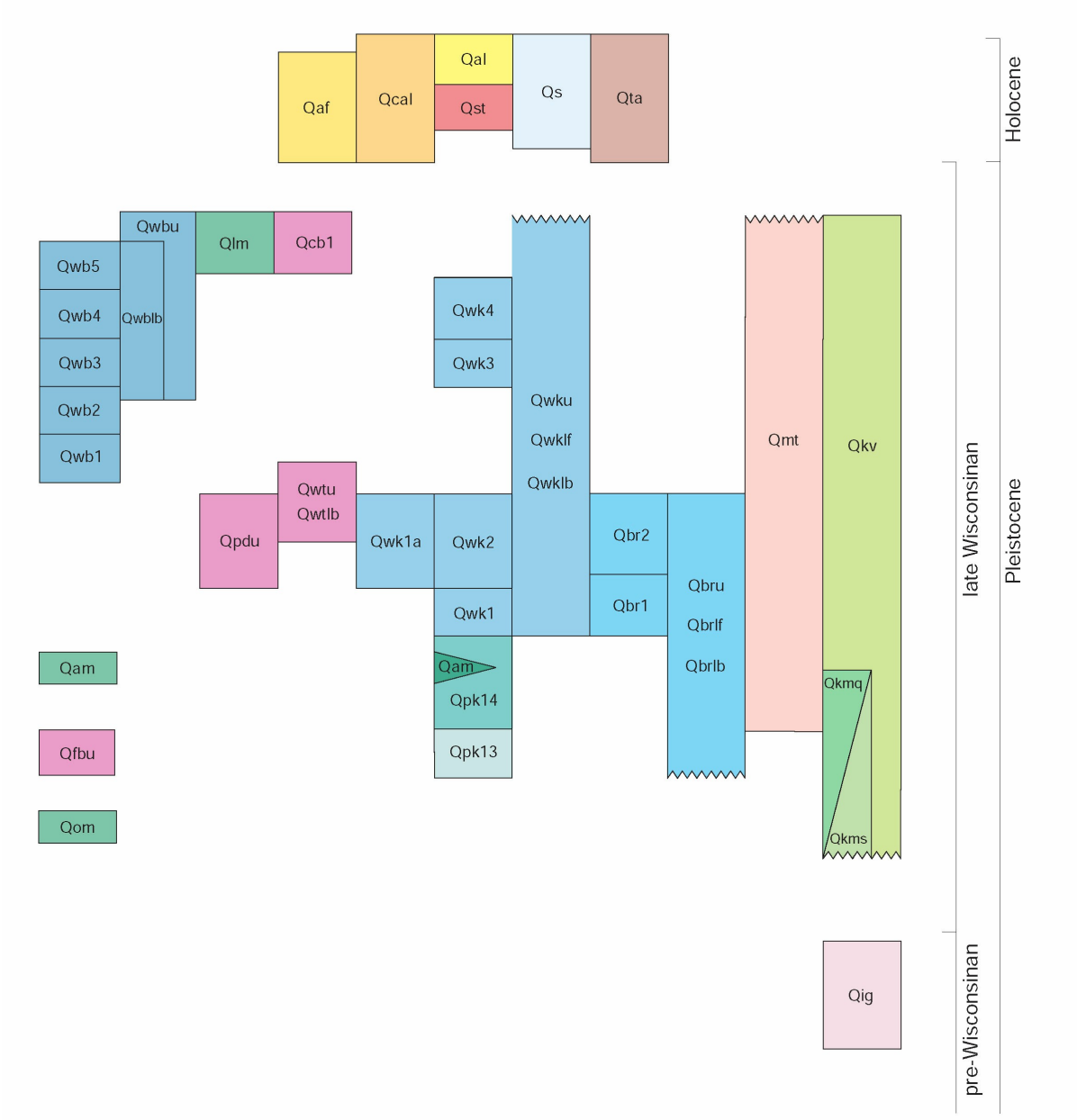
West Branch Papakating Creek deposits on Branchville Quandrangle: Qwb1, Qwb2, Qwb3, Qwb4, Qwb5 , Qwbu, Qwblb

Upper Paulins Kill Valley deposits
Ice-marginal deltas, fluviodeltas, and lake-bottom deposits laid down in small drift-dammed lakes in the upper Paulins Kill Valley.

Upper Paulins Kill Valley deposits on Branchville Quandrangle: Qpk13, Qpk14

Text from source map: Branchville Quadrangle

Correlation of Map Units



Graphic from source map: Branchville Quadrangle

Explanation of Map Symbols

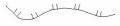

Contacts, dashed where inferred.

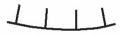


Elevation of the bedrock surface, shown in valleys where depth to rock exceeds 50 feet.


Morainal ridge.

Meltwater-cut scarp.


Man-made scarp in a sand & gravel pit.


Position of ice margin. Tics point toward former ice sheet.

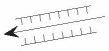
Fluvial scarp, tics point upslope.

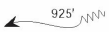

Large kettle in glacial outwash or moraine.


Drumlin, denotes long axis.

Striation, measurement at tip of arrow.


Small meltwater channel.


Large meltwater channel.



Glacial-lake spillway with estimated elevation of its floor.


Direction foreset beds are dipping.


Active sand and gravel pit.


Inactive sand and gravel pit.


Active quarry.


Inactive quarry.



Well or boring. Geologic log in Table 1.


Gneiss erratic.

12
Description of materials observed in sand and gravel pits, excavations, and soil test pits in Table 2, Plate 2.



Location of pebble sample, composition shown in Table 3, Plate 2.

Graphic from source map: Branchville Quadrangle

Figure 1 - Physiography of Northwestern New Jersey and Northeastern Pennsylvania

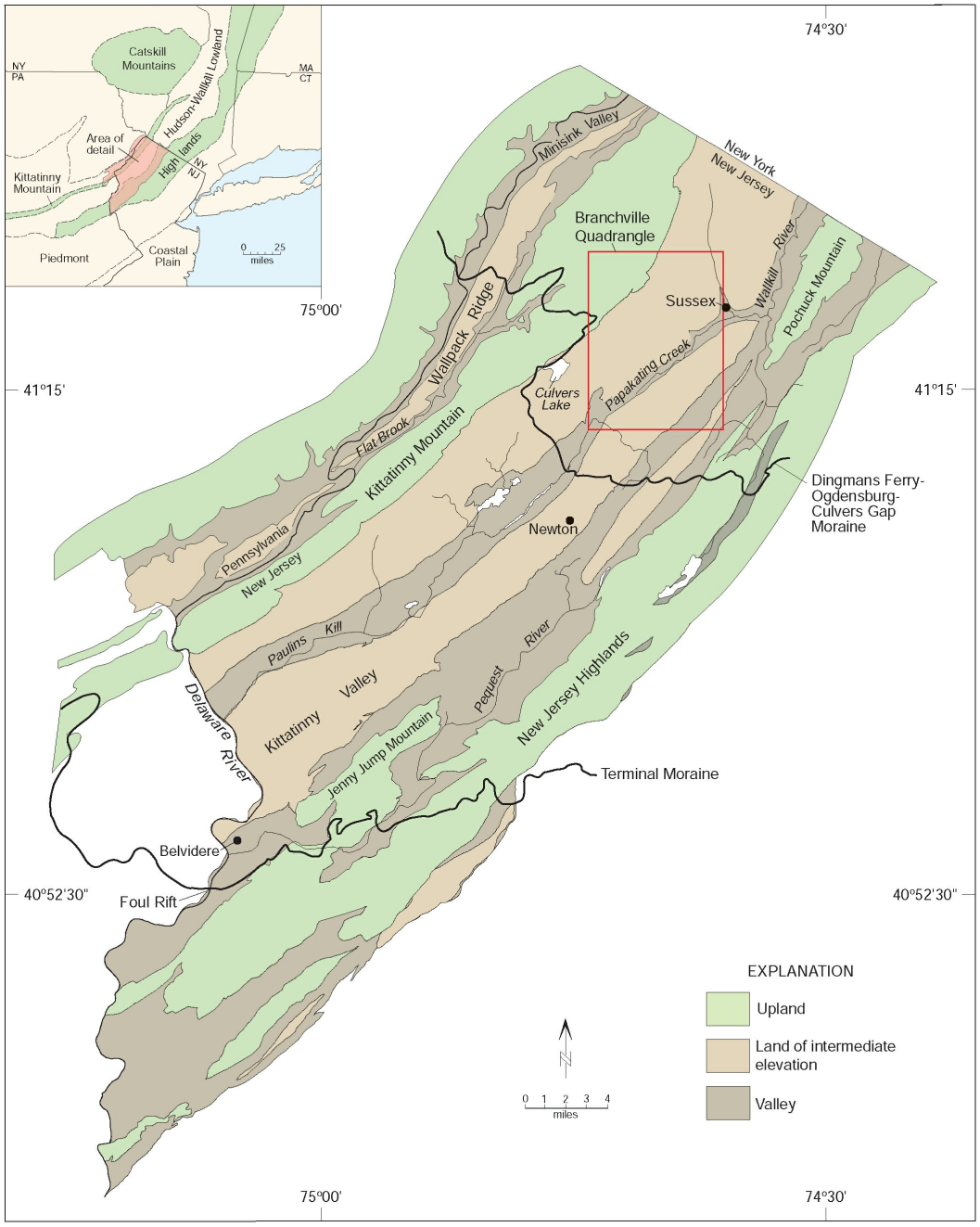


Figure 1. Physiography of northwestern New Jersey and northeastern Pennsylvania, and location of the Branchville quadrangle. Kittatinny Valley is a local geographic name for the southwest continuation of the Hudson-Wallkill lowland.

Graphic from source map: Branchville Quadrangle

Figure 2 - Schematic Profiles of Morphosequences

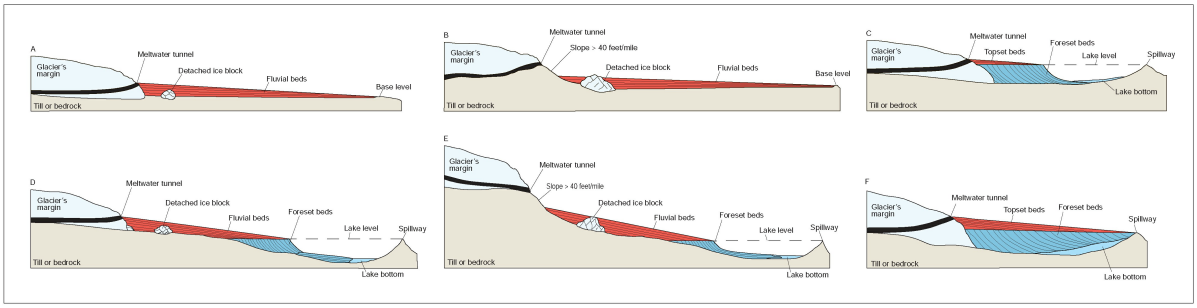


Figure 2. Schematic profiles of morphosequences; A. ice-marginal fluvial, B. non-ice-marginal fluvial, C. ice-marginal lacustrine, D. ice-marginal fluvial-lacustrine, E. non-ice-marginal fluvial-lacustrine, and F. ice-marginal lacustrine-fluvial. Modified from Koteff and Pessl, 1982, figure 1, p. 7.

Graphic from source map: Branchville Quadrangle

Figure 3 - Simplified Geologic Map of Branchville Quadrangle

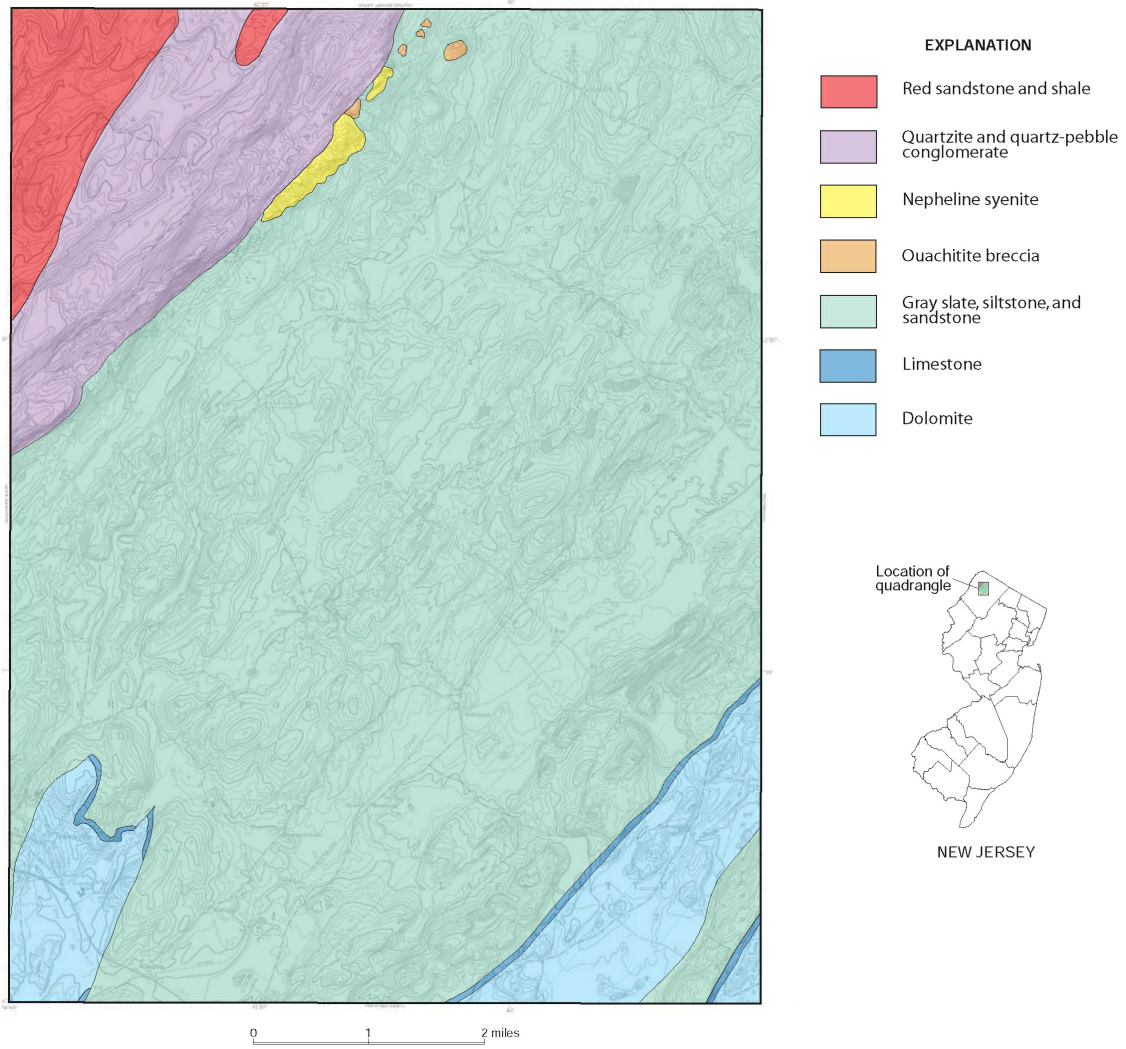


Figure 3. Simplified bedrock geologic map of the Branchville Quadrangle (modified from Drake and others, 1996).

Graphic from source map: Branchville Quadrangle

Figure 4 - Late Wisconsinan Ice-Marginal Positions

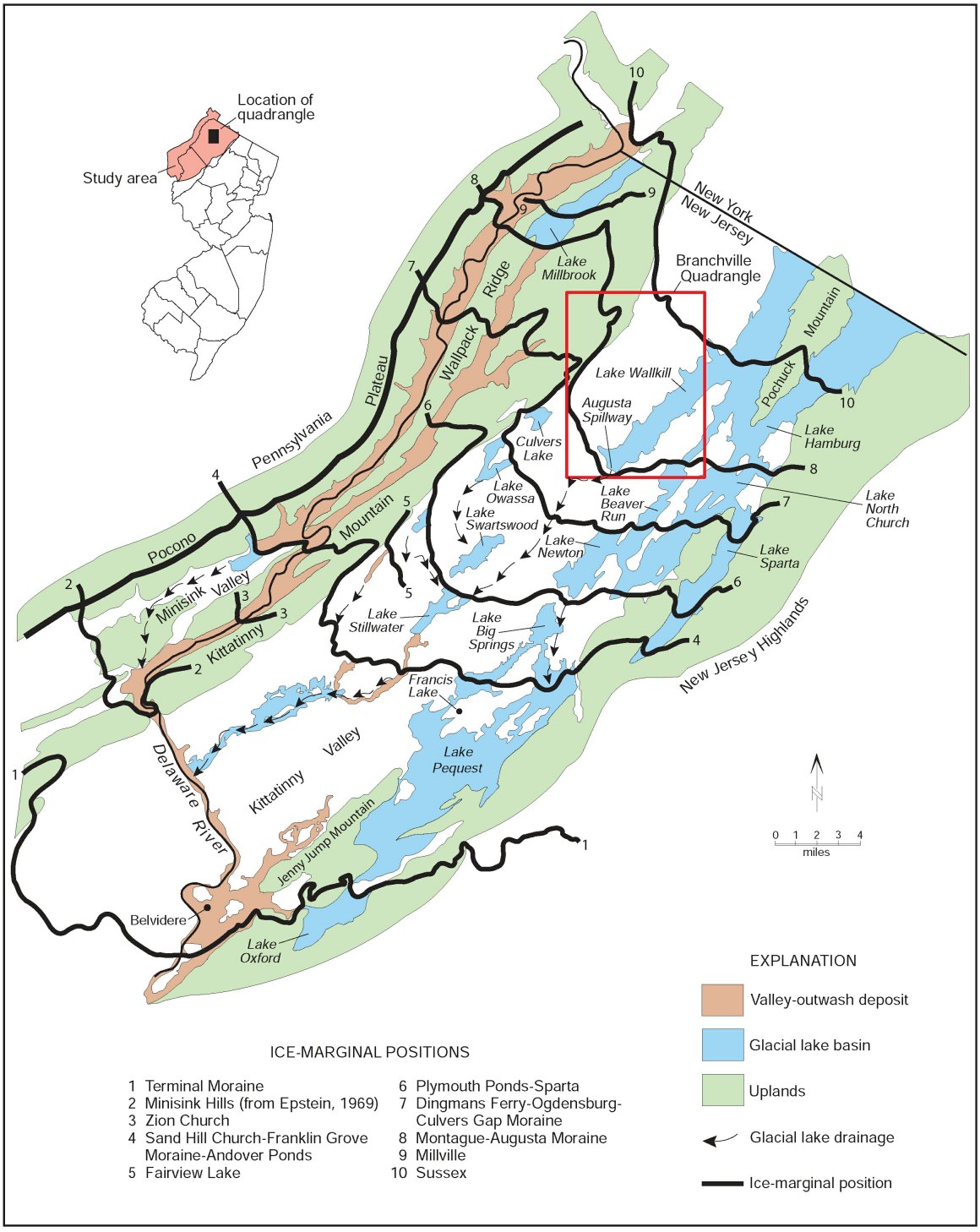


Figure 4. Late Wisconsinan ice-marginal positions of the Kittatinny and Minisink Valley ice lobes, and location of large glacial lakes, extensive valley-outwash deposits, and the Branchville 7.5 minute topographic quadrangle, in northwestern New Jersey, and northeastern Pennsylvania. Modified from Witte, 1991a.

Graphic from source map: Branchville Quadrangle

Figure 5 - Morphology of the Augusta Moraine

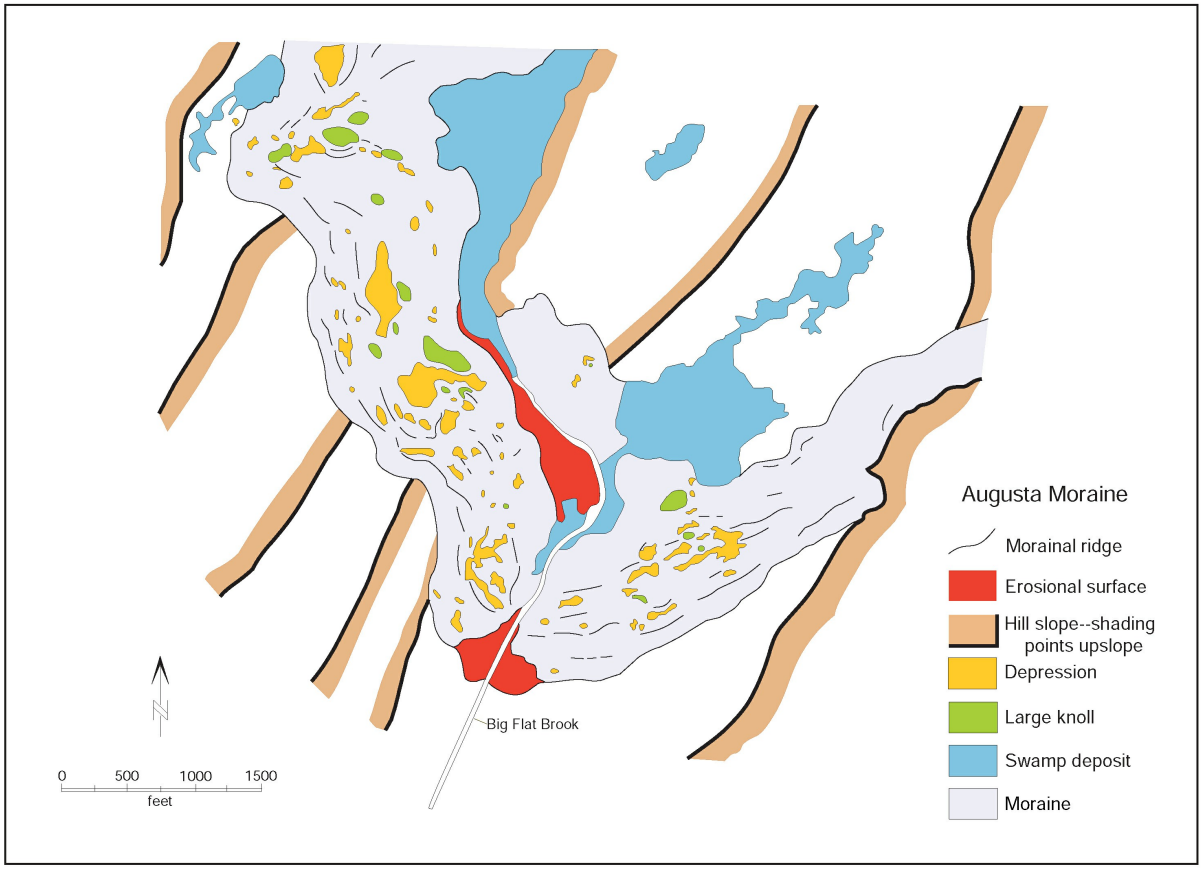


Figure 5. Morphology of the Augusta Moraine, where it crosses Big Flat Brook valley Kittatinny Mountain, Sussex County, New Jersey. Morainal landform elements collectively define areas of ridge-and-trough, and knob-and-kettle topography.

Graphic from source map: Branchville Quadrangle

Table 1 - Well Records

Well no.	Surface altitude (feet)	NJDEP well permit no.	Depth (feet)	Driller's Log	Yield (gpm)	Stratigraphic correlation
1	570	22-8948	0-15	overburden, sand, clay		Qbr1
			-53	sand, clay		Qbr1 & Qbrlb
			-122	black, white limestone	45	OCk
2	585	22-5776	0-74	clay and sand		Qbr1
			-86	limestone	45	OCk
3	580	22-14487	0-17	boulder		Qbr1
			-43	heavy gravel		Qbr1
			-59	gravel, clay		Qkv
			-79	limestone	40	OCk
4	575	22-18849	0-90	sand, clay, gravel overburden		Qbr1/ Qkv ?
			-174	limestone	20	OCk
5	580	22-12139	0-22	sand, gravel		Qbr1
			-65	limestone	15	OCk
6	560	22-21831	0-18	sand, gravel		Qwku
			-173	shale	10	Om
7	590	22-20855	0-45	clay and gravel overburden		Qkv
			-325	slate rock	20	Om
8	505	22-22077	0-95	clay and gravel overburden		Qwk1
			-275	slate rock	15	Om
9	515	22-21258	0-22	sand and gravel		Qwk1
			-222	shale bedrock	3	Om
10	525	22-21276	0-43	gravel and sand		Qwk1a/Qkv
			-145	shale	20	Om
11	530	22-19412	0-61	clay and gravel		Qwk2/Qkv?
			-550	slate	15	Om
12	510	22-22282	0-32	clay and gravel overburden		Qwk2
			-500	slate rock	3	Om
13	495	22-22284	0-51	sand, clay gravel		Qwk2/Qkv
			-198	slate	5	Om
14	495	22-21453	0-18	sand and gravel		Qwk2
			-145	shale bedrock	25	Om
15	485	22-20337	0-65	sand and gravel		Qwk2/Qkv
			-290	shale	10	Om
16	415	22-11048	0-80	sand and gravel overburden	100	Qwklf
			-82	slate		Om
17	455	22-13020	0-60	sand and gravel overburden		Qwk4a
			-477	slate	100	Om
18	660	22-19119	0-65	clay and gravel overburden		Qkv
			-199	slate	6	Om
19	525	22-20339	0-30	overburden with gravel, sand, and water		Qpk14
			-273	limestone	5	OCk
20	520	22-3214	0-14	boulders & stones		Qal/Qpk14
			-52	clay and stones		Qpk14/ Qkv?
			-170	hard gray rock	350	OCk ?
21	570	22-2379	0-25	hardpan & boulders		Qkv
			-50	hardpan, boulders, and gravel		Qkv
			-65	gravel & very fine		proglacial sand
			-95	limestone	25	OCk
22	530	22-21109	0-18	overburden with gravel		Qpk14
			-273	limestone	15	OCk
23	585	22-21625	0-86	clay and gravel overburden		Qkv
			-147	lime rock	6	OCk
24	580	22-21976	0-70	clay and gravel overburden		Qwk1a/ Qkv
			-300	slate rock	4	Om
25	480	22-25610	0-15	sand, clay and gravel overburden		Qkv
			-150	slate rock	8	Om
26	525	22-4852	0-90	clay and gravel		Qwk4a/ Qkv
			-130	slate rock	9	Om
27	560	22-20635	0-65	clay and boulders		Qkv
			-330	shale	2	Om
28	590	22-22803	0-115	clay and gravel overburden		Qkv
			-275	slate rock	5	Om
29	550	22-19819	0-68	sand and gravel overburden		Qal/ Qwb5
			-185	slate rock	50	Om
30	615	22-13621	0-133	sand and gravel overburden		Qwb4
			-275	slate rock	3	Om
31	610	22-20387	0-81	sand and gravel	10	Qwb4
			-122	shale		Om
32	645	22-14874	0-64	sand and gravel overburden		Qwb4
			-224	slate rock	25	Om
33	635	22-22627	0-96	clay and stones		Qkv
			-260	shale	10	Om
34	645	22-26132	0-105	sand, clay and gravel overburden		Qkv
			-250	slate rock	8	Om
35	650	22-16804	0-115	sand and gravel overburden		Qkv
			-149	slate rock	30	Om
36	730	22-22642	0-32	sandy loam		Qkv
			-300	shale bedrock	4	Om
37	775	22-5640	0-40	clay and gravel overburden		Qkv
			-257	slate rock	4	Om
38	695	22-7990	0-150	clay and gravel overburden		Qal/ Qkv
			-222	slate rock	1	Om
39	710	22-7819	0-155	overburden to coarse gravel	14	Qkv/ proglacial outwash
40	650	22-15091	0-33	sand and gravel overburden		Qkv
			-112	slate rock	12	Om
41	680	22-11195	0-71	sand and gravel overburden		Qkv
			-123	slate rock	6	Om
42	665	22-22471	0-100	clay and gravel overburden		Qcb1/ Qkv
			-300	slate rock	2	Om
43	710	22-7318	0-25	clay overburden		Qwb3/Qkv?
			-210	slate rock	15	Om
44	935	22-8756	0-132	sandy hardpan to coarse gravel	7	Qkv/ outwash?
45	790	22-9406	0-30	sand, gravel and clay overburden		Qkv
			-207	slate rock	5	Om
46	725	22-5029	0-110	clay and gravel overburden (gravel well)	6	Qkv/ proglacial outwash ?
47	735	22-14952	0-50	sand and clay		Qkv
			-133	slate	3	Om
48	730	22-26215	0-15	sand, clay and gravel overburden		Qkv
			-225	slate rock	7	Om
49	750	22-18933	0-21	clay and gravel overburden		Qkv
			-525	slate	5	Om
50	710	22-20487	0-81	clay and boulders		Qkv
			-147	bedrock shale	5	Om
51	890	22-22961	0-30	clay and gravel overburden		Qkv
			-325	slate rock	10	Om
52	925	22-20982	0-38	clay and sand		Qkv
			-222	gray shale	4	Om
53	845	22-20014	0-2	overburden		Qkv
			-85	clay and gravel		Qkv
			-95	brown shale		Om
			-225	blue shale	9	Om
54	850	22-21502	0-42	clay and gravel overburden		Qkv
			-350	slate rock	2	Om
55	665	22-21827	0-18	clay overburden		Qkv
			-98	shale bedrock	10	Om
56	665	22-21068	0-5	overburden		Qkv
			-22	clay and gravel		Qkv
			-32	big gravel & water		proglacial outwash
			-223	blue shale	5	Om
57	530	NJGS obs well 7	0-23	poorly compact, stony diamicton interlayered with gravel and sand		Qam
			-35	cobble gravel inter-layered with pebble gravel		Qpk14
			-50	pebbly sand, sand interlayered with pebble gravel		
			-65	fine gravel and fine sand		
			-90	pebbly sand to sand to clayey silt		
			-110	gray clayey silt		Qpklb
			-115	dary gray siltstone		Om
58	570	22-21457	0-30	clay and hardpan		Qkv
			-260	slate	5	Om
59	800	22-20743	0-68	sand and gravel		Qkv
			-423	shale	10	Om
60	550	22-7485	0-60	clay and gravel overburden		Qal/ Qwb5
			-136	slate rock	9	Om

Table 1. The listed wells were drilled for private and public water supply, monitoring and exploration. Wells listed with a NJDEP permit number are from the files of the Bureau of Water Allocation, Division of Water Resources, New Jersey Department of Environmental Protection. Well locations are based on tax-parcel maps. Well locations plotted on Plate 1 are generally accurate to within 200 feet of their actual location. Yield listed as gallons per minute. Suffixes used: number after meltwater deposit refers to a morphosequence, (lf) indicates a lacustrine fan, (u) indicates uncorrelated morphosequence, and (lb) indicates lake-bottom deposit. Altitude of wells estimated from contours on base map. Slash () indicates that unit on left side lies over unit to the right, and question mark (?) indicates uncertain stratigraphic correlation.

Graphic from source map: Branchville Quadrangle

Table 2 - Description of Materials Observed

Section No.	Unit	Description
1	Qwk1	3 feet pg and s topset beds / > 15 feet pg and s, pbs, and s foreset beds.
2	Qwk1a	10 feet pg and s topset beds / 4 feet pbs and s foreset beds.
3	Qwk1a /Qwk1	> 20 feet pg and s, pbs, and fs foreset bed > 5 feet cpg and s collapsed foreset beds interlayered with flowtill.
4	Qwk2	> 10 feet of highly collapsed pg and s, pbs, s and m foreset beds interlayered with flowtill / > 5 feet laminated, crossbedded s and m with dropstones interlayered with cpg and s, and pg and s sediment-grain flow deposits.
5	Qwklf	> 20 feet pg and s, pbs, s, and m foreset beds inter-layered with flowtill.
6	Qwklf	> 10 feet cpg, pg and s, pbs, and s foreset beds.
7	Qbr1	> 30 feet of very poorly exposed, collapsed cg, cpg and sand foreset beds.
8	Qrbu	> 10 feet cs to fs foreset beds, topset beds have been removed by excavation.
9	Qrb2	> 40 feet pg and s, pbs, s, and m foreset beds.
10	Qwk4	> 15 feet collapsed cs to fs foreset beds interlayered with pg and s sediment-grain flow deposits.
11	Qwtu	> 15 feet collapsed pg and s, pbs, and s foreset beds.
12	Qwk2	3 to 4 feet cpg and s topset beds / > 25 feet pg and s, pbs, s, and m foreset beds.
13	Qwk2	> 30 feet pg and s, pbs, and s foreset beds interlayered with flowtill.
14	Qwbu	Poorly sorted, crudely stratified cg, cpg and s interlayered with flowtill.
15	Qwb2	2 feet cpg and s topset beds / > 40 feet cpg, pg and s, pbs, and s foreset beds, partially collapsed.
16	Qwb2	> 15 feet crudely stratified cg, cpg, pg and s (collapsed foreset beds?) / 1.5 feet compact clayey silty till / slate.
17	Qwbu	> 8 feet massively bedded cg, cpg, pg and sand glacio-fluvial deposits, slightly collapsed.
18	Qwb4	2 feet of poorly compacted sandy silty flowtill / > 15 feet pg and s, and pbs foreset beds.
19	Qwb4	massive bcg and s topset beds as much as 8 feet thick / > 15 feet pg and s, pbs, and s foreset beds, partially collapsed.
20	Qwb4	3 feet pg and s topset beds / 10 feet pbs and s foreset beds.
21	Qwb4	> 10 feet cpg, pg and s, pbs and s foreset beds inter-layered with flowtill and poorly sorted sediment-grain flow deposits and poorly sorted sediment-grain flow deposits.
Key to abbreviations: bcg -- boulder-cobble gravel, cg -- cobble gravel, cpg -- cobble-pebble gravel, pg -- pebble gravel, pbs -- pebbly sand, cs -- coarse sand, fs -- fine sand, s -- sand, m -- silt, / -- overlies, > -- more than, ? -- unit interpretation uncertain.		

Table 2. Abbreviated description of materials observed in sand and gravel pits, excavations, and soil-test pits.

Graphic from source map: Branchville Quadrangle

Table 3 - Pebble Lithology

Sample	Surficial deposit	Percentage							
		gneiss and granite	dolomite, limestone, and chert	slate and graywacke	sandstone	quartzite and conglomer-ate	red sandstone	syenite and lampro-phyre	vein quartz
1	Qwbu	0	0	58	39	3	0	0	0
2	Qm	0	1	58	38	2	0	1	0
3	Qkv	1	2	13	81	3	0	0	0
4	Qwb2	2	0	26	59	4	0	0	0
5	Qwbu	1	0	45	54	1	0	0	0
6	Qwb2	3	2	58	24	11	0	2	1
7	Qwb4	4	2	41	42	9	2	1	1
8	Qcb1	0	30	69	0	1	0	0	0
9	Qkvr	2	2	40	53	2	1	0	0
10	Qwb4	0	0	64	35	1	0	0	0
11	Qwb4	0	0	56	33	11	1	0	0
12	Qwk4	0	0	66	25	7	1	0	0
13	Qwtu	0	3	66	25	4	0	1	1
14	Qwklf	2	2	76	16	4	0	0	1
15	Qwklf	0	2	81	11	5	2	0	0
16	Qwk2	0	0	76	21	4	0	0	0
17	Qbr2	0	2	80	13	2	1	1	1
18	Qbr2	1	46	32	12	7	1	0	1
19	Qbru	0	3	83	9	4	0	0	1
20	Qbru	0	57	27	13	3	0	0	0
21	Qbr1	0	67	19	7	6	0	0	2
22	Qbru	0	3	80	15	3	0	0	0
23	Qbru	0	1	94	3	2	0	0	0
24	Qwk1a	0	2	65	28	4	1	0	1
25	Qwk1	1	1	83	7	9	0	0	0
26	Qam	2	0	62	24	9	2	0	1
27	Qkv	2	1	47	45	4	1	1	0
28	Qkv	0	0	60	25	11	1	3	0

Table 3. Lithology of pebbles from glacial deposits in the Branchville Quadrangle, Sussex County, New Jersey. Percentage is based on 100 to 150 pebbles, one to three inches in diameter, collected at a depth of at least four feet.

Graphic from source map: Branchville Quadrangle

Bushkill Quadrangle

The formal citation for this source.

> Witte, R.W., 2017, Surficial Geologic Map of Part of the Bushkill Quadrangle, Warren County, New Jersey and Monroe Counties, Pennsylvania: New Jersey Geological Survey, Open-file Map OFM 112, scale 1:24,000 (*GRI Source Map ID 76279*).

In addition to information contained in this document the published Surficial Geologic Map of Part of the Bushkill Quadrangle contains additional text, table and figures that might me useful in understanding the geology for this quadrangle.

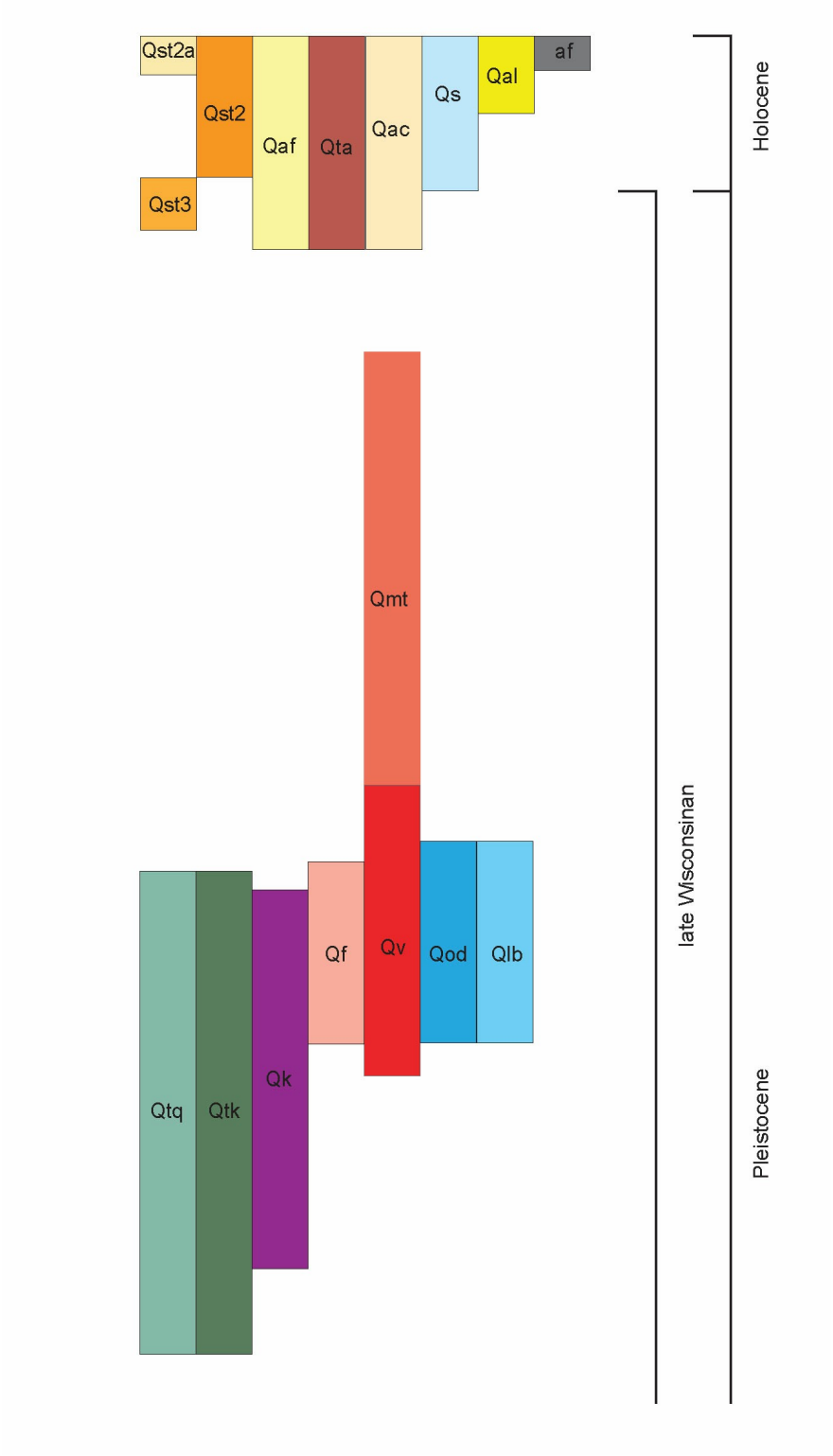
Prominent graphics and text associated with this source.

Introduction

Description of Map Units
Industrial, commercial, and residential expansion in New Jersey and Pennsylvania have promoted the increased use of surficial geologic data for land-use planning, for identification, management and protection of groundwater resources, siting of solid waste disposal sites, locating and developing sources of geologic aggregate, and delineation of geologic hazards. Surficial deposits in the Bushkill quadrangle are lithologically diverse, cover most of the bedrock surface, and are found in many types of landscape settings. They include glacial drift of late Wisconsinan age, and alluvium, swamp and bog deposits, hillslope deposits, and wind-blown sediment laid down in postglacial time. Collectively, these deposits may be as much as 200 feet (61m) thick and they form the parent material on which soils form. They are defined by their lithic characteristics, stratigraphic position, location on the landscape, and are further delineated by genetic and morphologic criteria. Map units denote unconsolidated deposits more than 5 feet (1.5m) thick. Color designations are based on Munsell Soil Color Charts (1975), and were determined from naturally moist samples. The western edge of the mapped area in Pennsylvania is mostly coincident with the boundary of the Delaware Water Gap National Recreation Area.

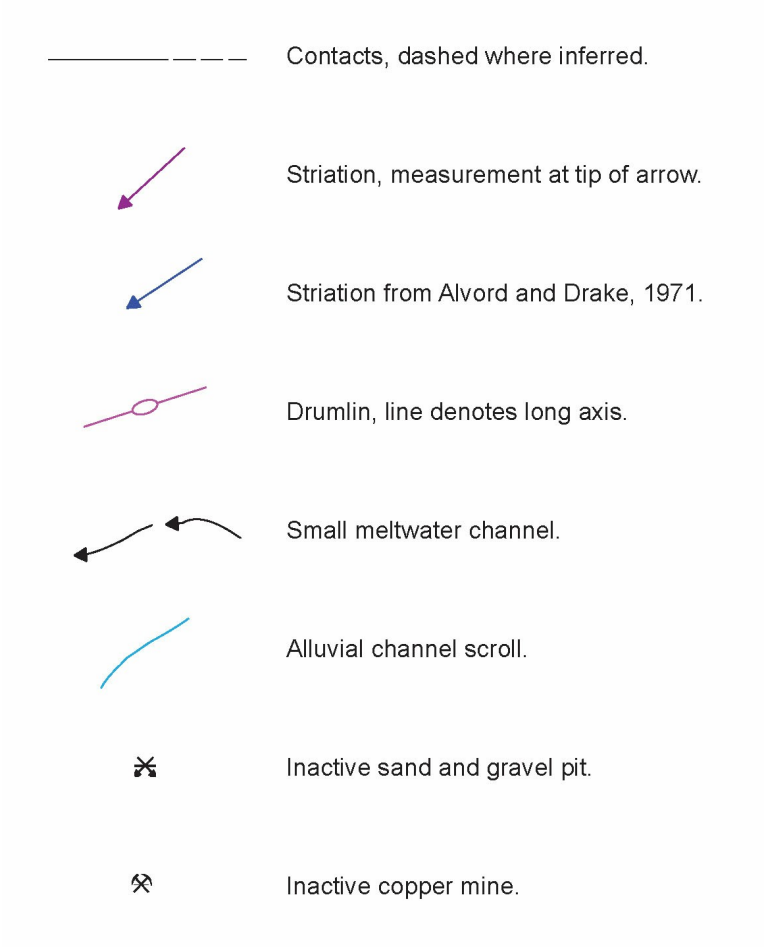
Text from source map: Bushkill Quadrangle

Correlation of Map Units



Graphic from source map: Bushkill Quadrangle

Explanation of Map Symbols



Graphic from source map: Bushkill Quadrangle

Figure 1 - Physiography of Northwestern New Jersey and Northeastern Pennsylvania

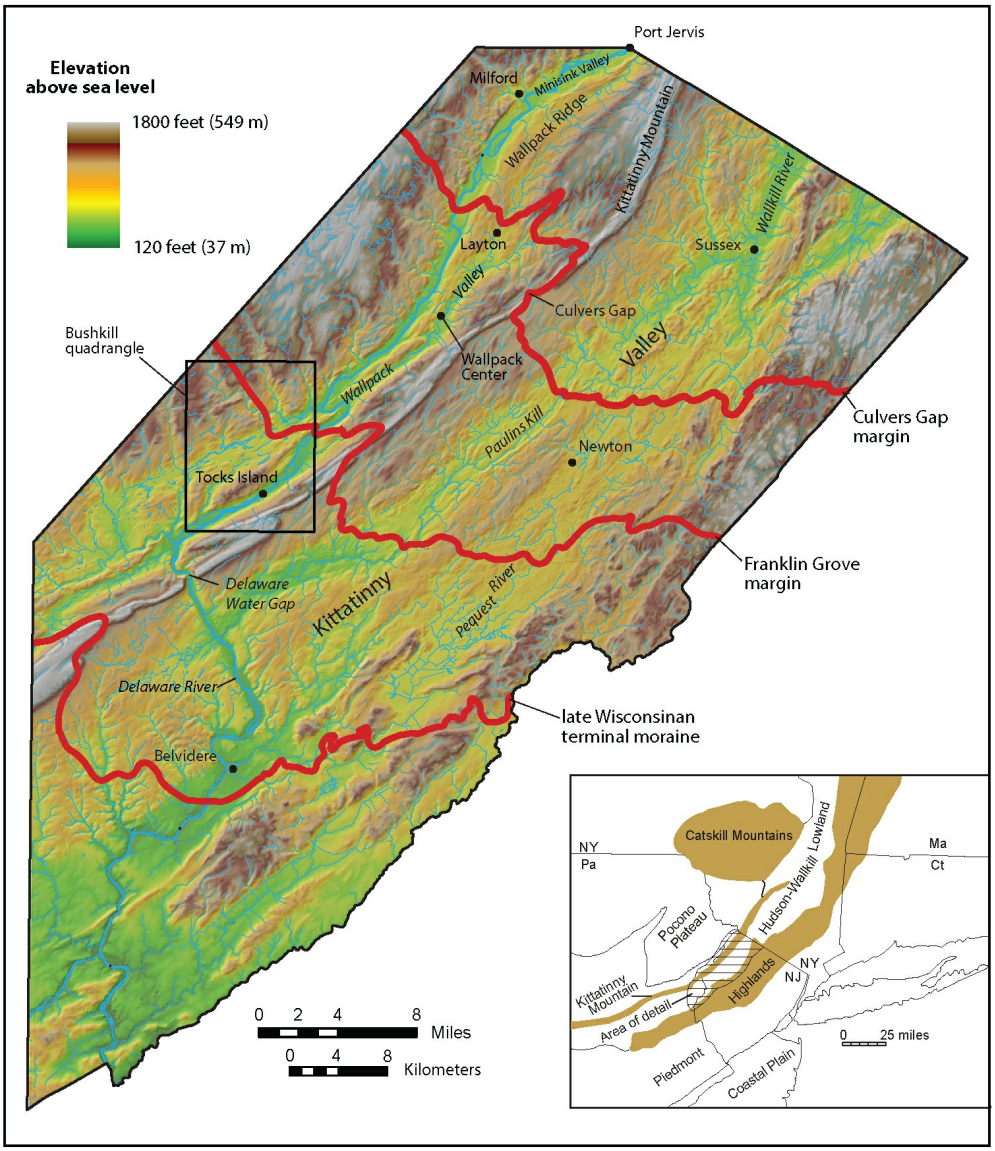


Figure 1. Physiography of northwestern New Jersey and part of northeastern Pennsylvania and location of the Bushkill PA-NJ quadrangle. Minisink Valley is a local geographic name for the Delaware River valley from Delaware Water Gap to Port Jervis, New York.

Graphic from source map: Bushkill Quadrangle

Figure 2 - Late Wisconsinan Ice Margins

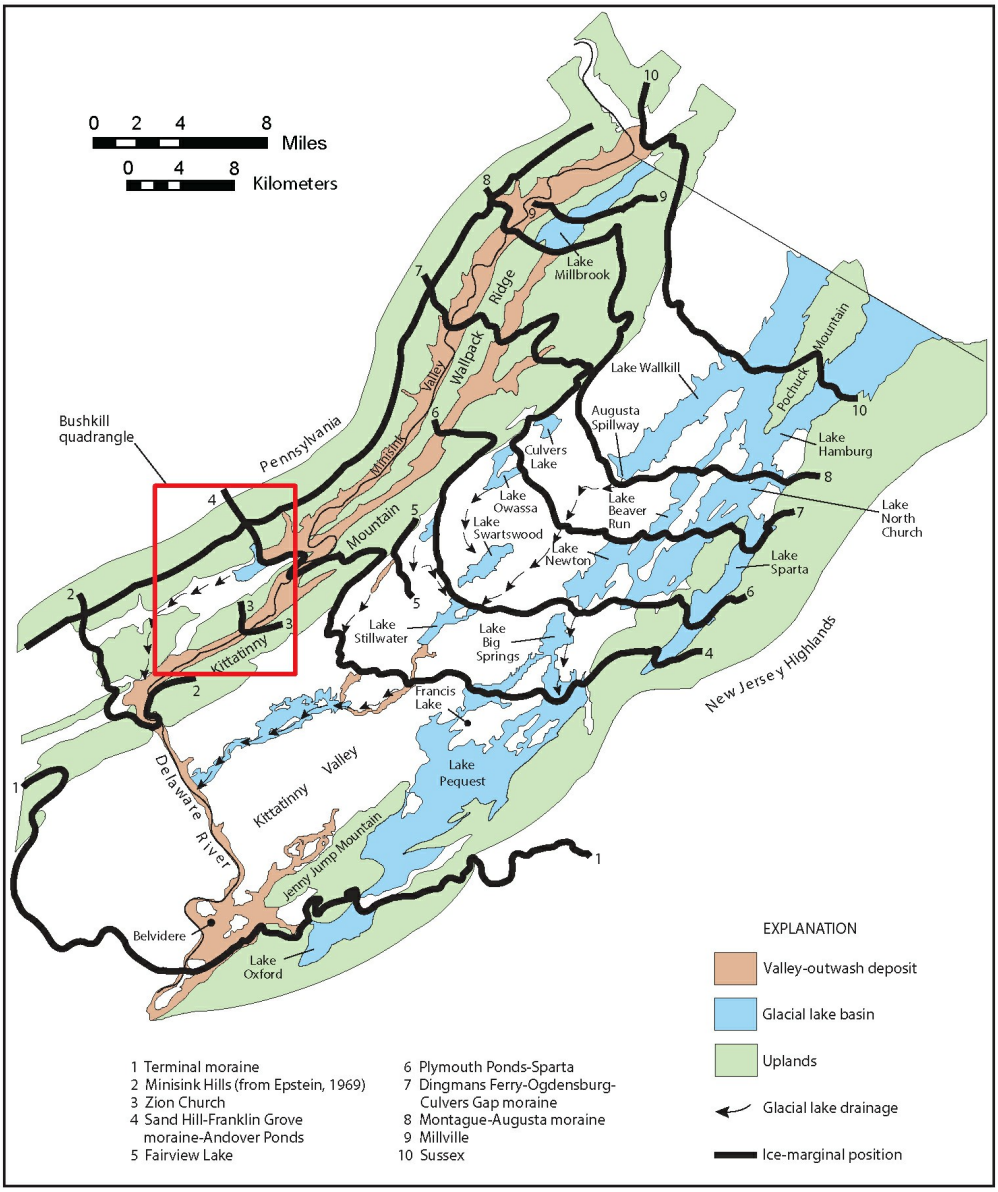


Figure 2. Late Wisconsinan ice margins of the Kittatinny and Minisink Valley ice lobes, and location of large glacial lakes, extensive valley-outwash deposits, and Bushkill PA-NJ quadrangle. Modified from data by Crowl (1971), Epstein (1969), Minard (1961), Ridge (1983), and Witte (1997).

Graphic from source map: Bushkill Quadrangle

Figure 3 - Bedrock Geologic Map of Bushkill Quadrangle

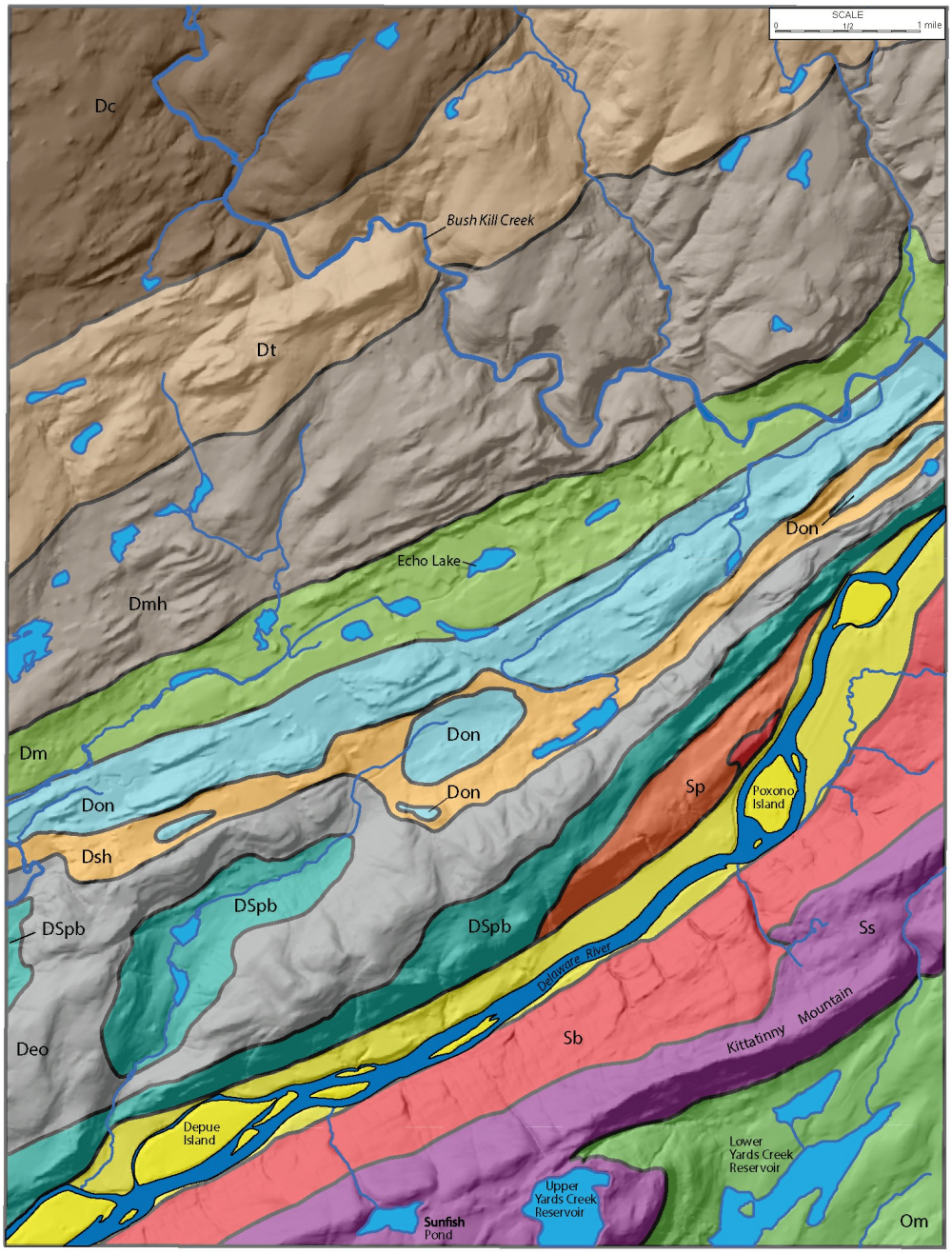


Figure 3. Bedrock geologic map of the Bushkill PA-NJ quadrangle (modified from Alvord and Drake, 1971). List of units: Om - Martinsburg Fm., Ss - Shawangunk Conglomerate, Sb - Bloomsburg Red Beds, Sp - Poxono Island Fm., DSpb - Port Ewen Shale, Minisink Limestone, New Scotland Fm., Coeymans Fm., Rondout and Decker Fms., and Bossardville Limestone, Deo - Esopus Fm. and Oriskany Fm., Dsh - Schohaire Fm., Don - Onondaga Limestone, Dm - Marcellus Shale, Dmh - Mahantango Fm., Dt - Trimmers Rock Fm., and Dc - Catskill Fm. Yellow area along the Delaware River represents alluvium and glacial outwash terraces. Base map derived from the Bushkill 7.5 minute digital elevation model (10m DEM), http://www.pasda.psu.edu/.

Graphic from source map: Bushkill Quadrangle

Figure 4 - Height of Glacial and Postglacial Terraces

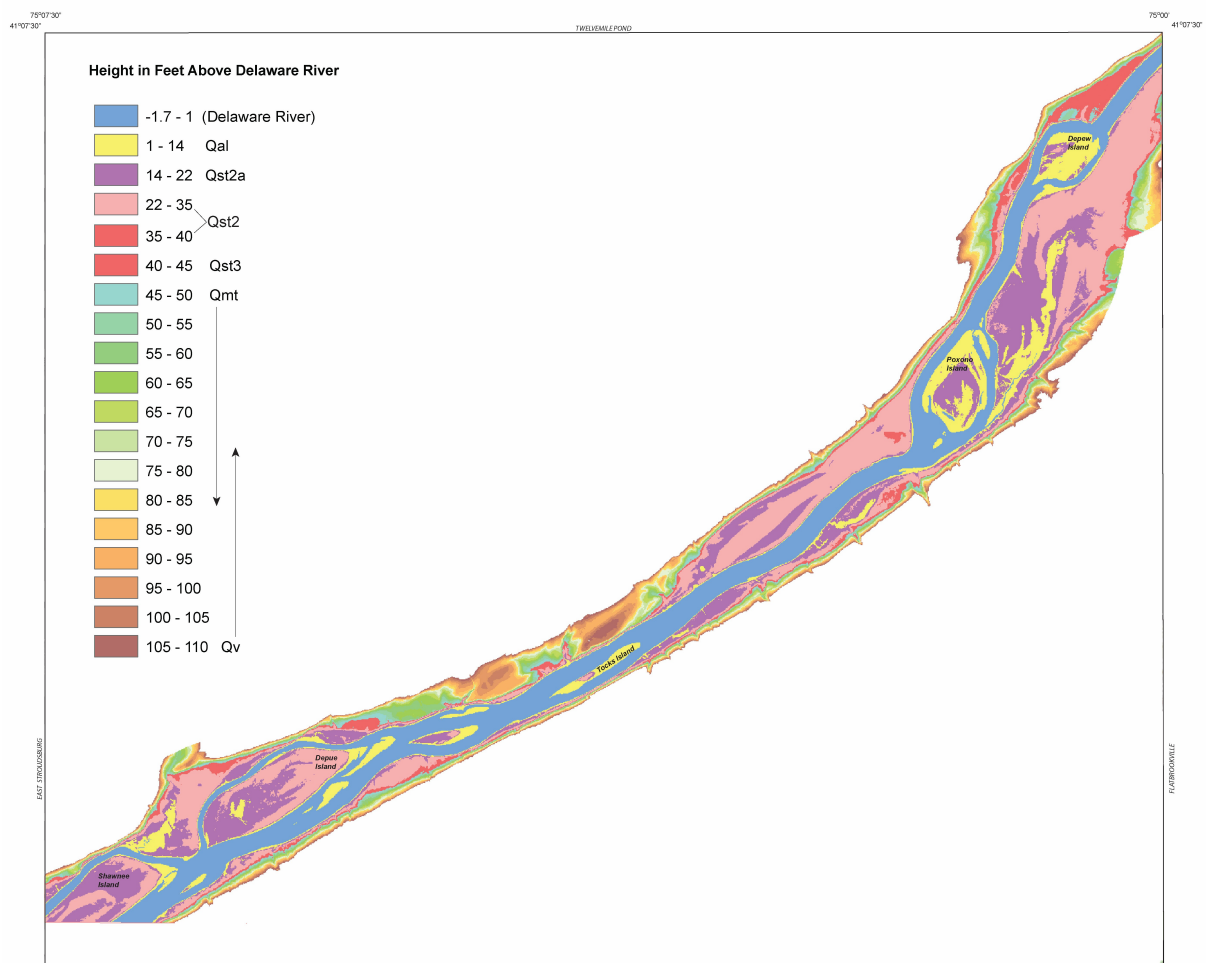


Figure 4. Height of glacial and postglacial terraces above the Delaware River. Terrace height determined from a Relative Elevation Model (REM) created from 3.2 feet Digital Elevation Model (DEM). REM methodology from Olson and others (2014) and DEM from PAMAP LIDAR, PA Dept. of Conservation and Natural Resources, Bureau of Topographic and Geologic Survey. Terrace height intervals have been correlated to map units. There is some overlap between units Qv and Qmt because Qvin places was deposited over and around stagnant ice and has subsequently collapsed. Negative height for the Delaware River is an artifact of the REM methodology.

Graphic from source map: Bushkill Quadrangle

Figure 5 - Surficial Geology of the Echo Lake Lowland and Minisink Valley

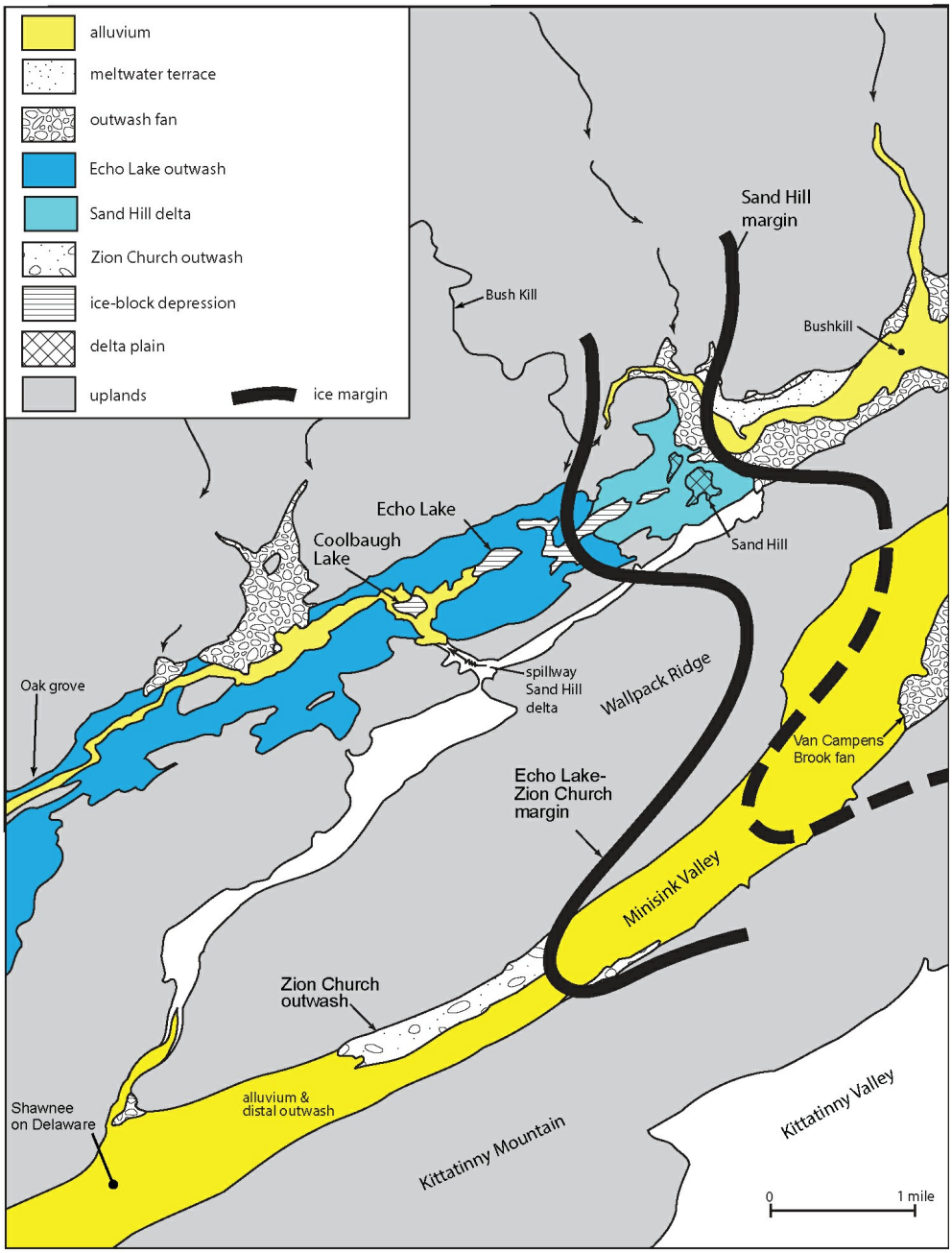


Figure 5. Surficial geology of the Echo Lake lowland and Minisink Valley, Bushkill PA-NJ quadrangle. Because the bedrock floor of the Echo Lake Lowland slopes northeast from Oak Grove, glacial retreat into the lowland resulted in the formation of a small proglacial lake. Two morphosequences, represented by the Echo Lake outwash and Sand Hill delta delineate two ice retreat positions. Following retreat from the Sand Hill margin through the Bush Kill valley to Minisink Valley, meltwater streams abandoned the Echo Lake Lowland and flowed directly to the Minisink. In Minisink Valley, the Zion Church outwash was laid down from an ice-retreatal position located about midvalley. It is correlated with the Echo Lake outwash. The Sand Hill equivalent deposits have not been recognized in Minisink Valley. Figure modified from Witte (2001a).

Graphic from source map: Bushkill Quadrangle

Figure 6 - Photo of Sand Hill Sand Pit

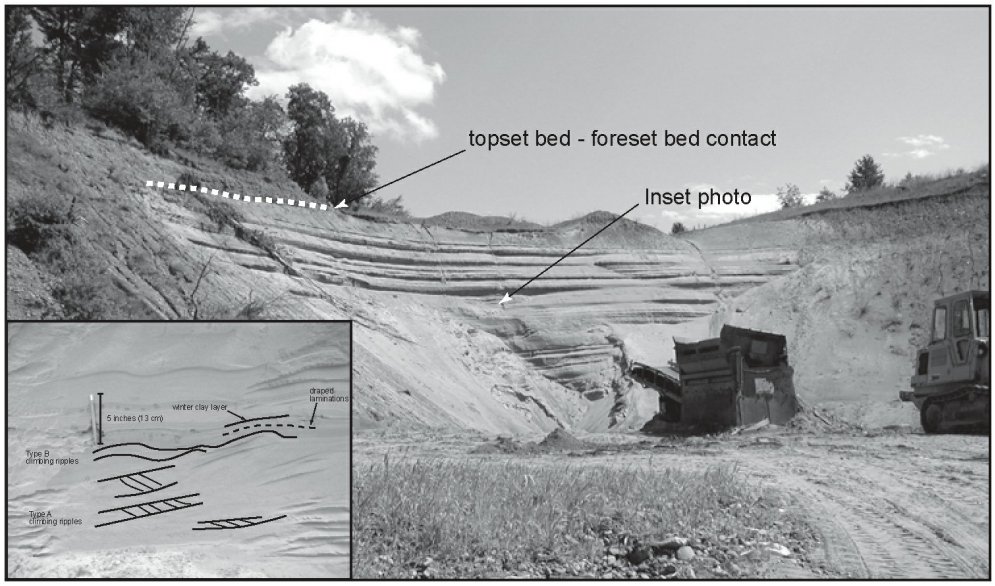


Figure 6. Sand Hill delta sand pit looking southward showing sandy foreset bedding. Approximate height of pit face is 60 feet (18m). Inset photo shows climbing ripple sequences in foreset beds. This sequence is repeated many times throughout the pit and forms the bulk of the low-angle sandy foreset beds that make up this part of the Sand Hill delta. The winter-clay layer is often absent from the upper part of the sequence showing that the climbing ripple sequences were also deposited during the summer season. Photos modified from Witte (2001a).

Graphic from source map: Bushkill Quadrangle

Figure 7 - Description of Poxono Island

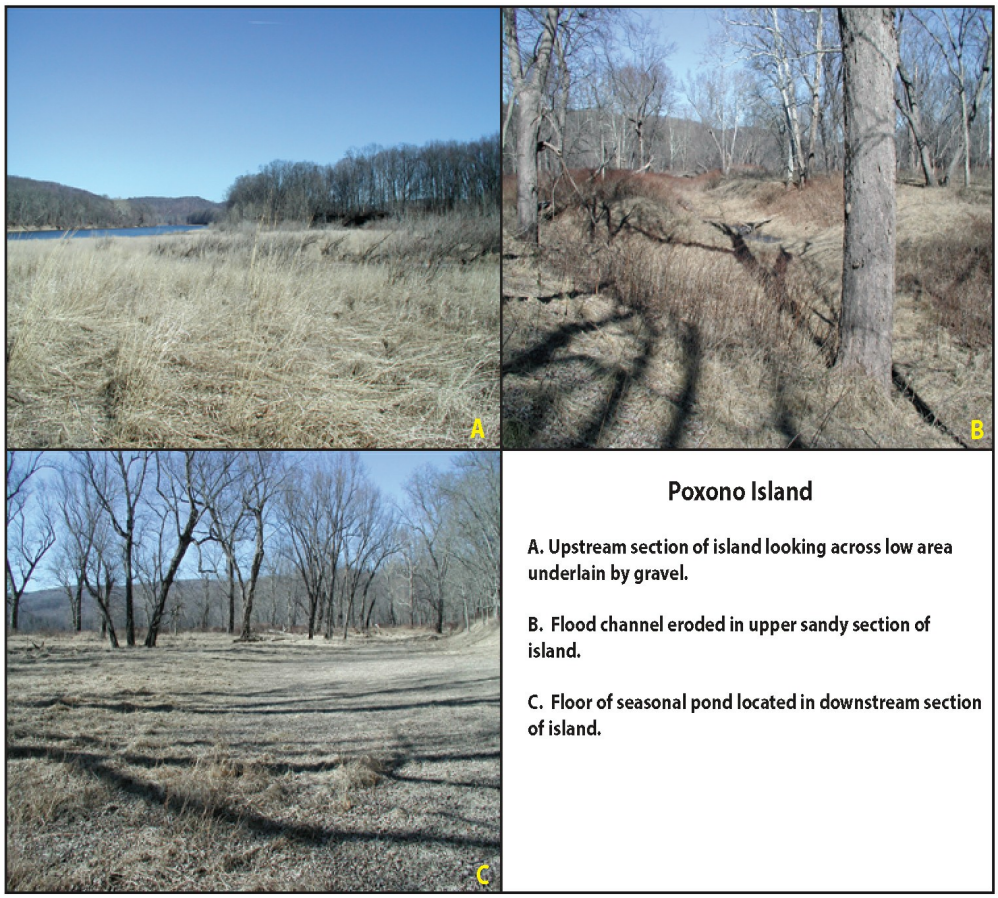


Figure 7. Poxono Island, at one time part of the mainland, formed after a channel was cut along the island's eastern side sometime during the middle to late Holocene. The color-contour map, aerial photos, and photos (a, b, and c) show extensive channelization of the island and transport of eroded sediment (sand), which resulted in downstream island growth. Upstream, gravel forms the island's nose. Some of this material appears to have been deposited by accretion, which indicates an upstream growth component. Elsewhere, the gravel was exposed by erosion of the island's upstream side. Poxono Island photos by R. Witte.

Graphic from source map: Bushkill Quadrangle

Culvers Gap Quadrangle

The formal citation for this source.

> Witte, R.W., and Epstein, J.B., 2005, Surficial Geologic Map of the Culvers Gap Quadrangle, Sussex County, New Jersey: New Jersey Geological Survey, Geologic Map Series GMS 04-1, scale 1:24,000 (*GRI Source Map ID 73984*).

In addition to information contained in this document the published Surficial Geologic Map of the Culvers Gap Quadrangle contains additional text, table and figures that might me useful in understanding the geology for this quadrangle.

Prominent graphics and text associated with this source.

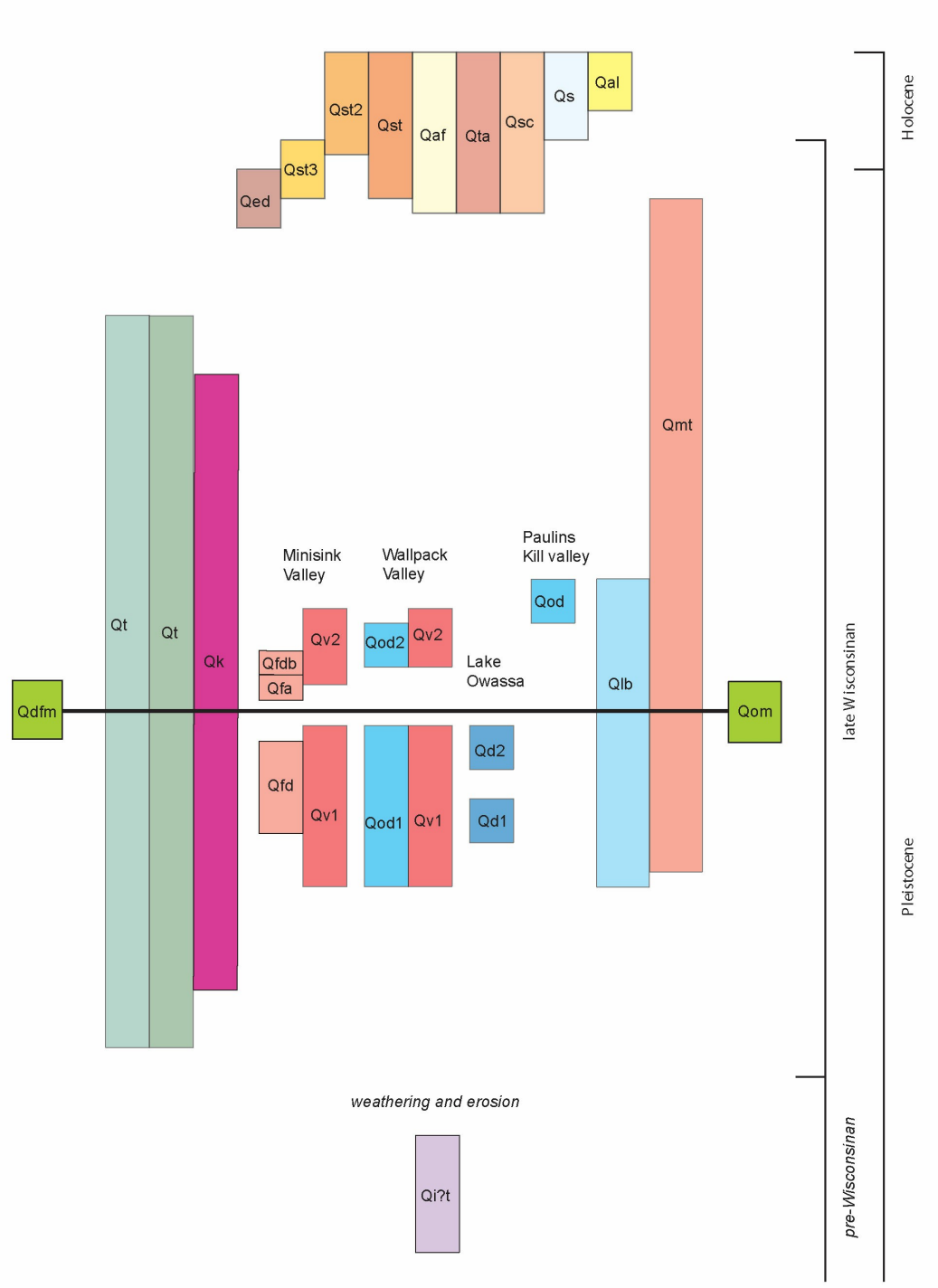
Introduction

Industrial, commercial, and residential expansion in New Jersey and Pennsylvania have promoted the increased use of surficial geologic data for land-use planning, for identification, management and protection of ground water resources, siting of solid-waste disposal sites, locating and developing sources of geologic aggregate, and delineation of geologic hazards. Surficial deposits in the Culvers Gap quadrangle are lithologically diverse, cover most of the bedrock surface, and are found in many types of landscape settings. They include glacial drift of late Wisconsinan age, and alluvium, swamp and bog deposits, hillslope deposits, and wind-blown sediment laid down in postglacial time. Collectively, these deposits may be as much as 340 feet (104m) thick and they form the parent material on which soils form. They are defined by their lithic characteristics, stratigraphic position, location on the landscape, and further delineated by genetic and morphologic criteria. Geologic history, detailed observations on surficial materials, and a list of references are in the accompanying booklet.

Description of Map Units
Map units denote unconsolidated deposits more than 5 feet (1.5m) thick. Color designations are based on Munsell Soil Color Charts (1975), and were determined from naturally moist samples. Numbered stream-terrace deposits indicate relative ages of units based on heights of terraces in valley. Lower numbers indicate younger deposits. Numbered meltwater deposits indicate relative age of units based on morphosequence model of Koteff and Pessl (1981). Lower numbers represent older deposits.

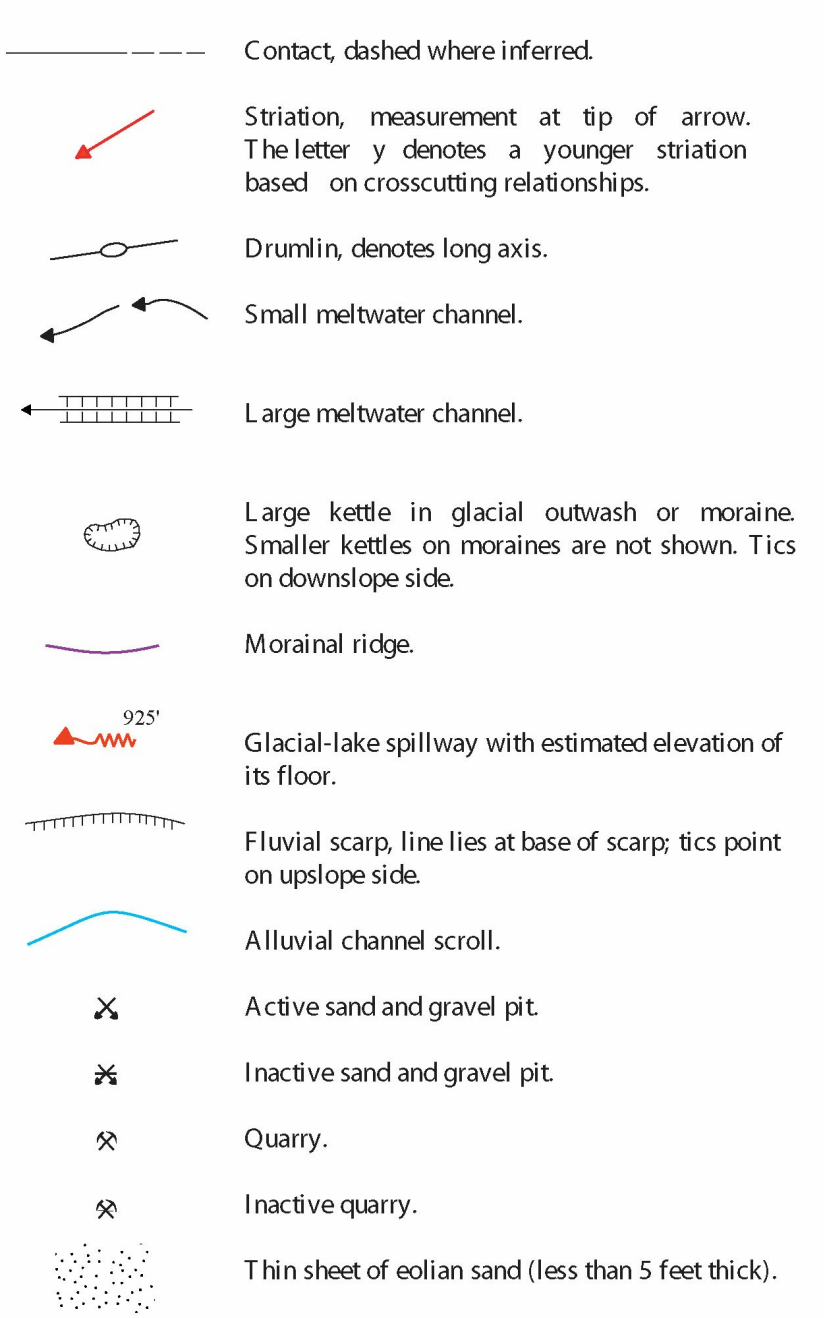
Text from source map: Culvers Gap Quadrangle

Correlation of Map Units



Graphic from source map: Culvers Gap Quadrangle

Explanation of Map Symbols



Graphic from source map: Culvers Gap Quadrangle

Figure 1 - Physiography of Kittatinny Valley and Surrounding Area

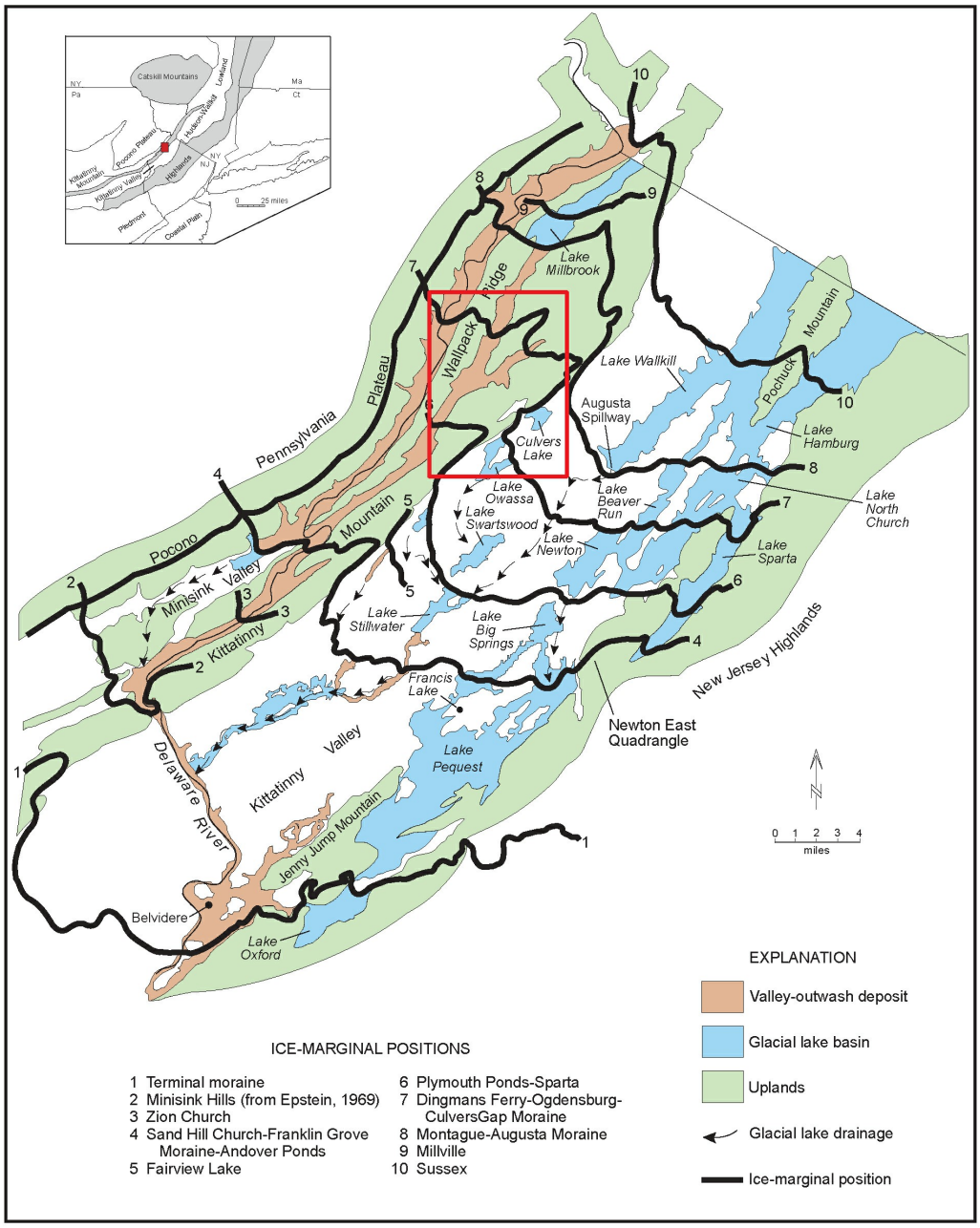


Figure 1. Physiography of Kittatinny Valley and surrounding area. Location of late Wisconsinan ice-margin positions of the Kittatinny and Minisink Valley ice lobes, large glacial lakes, extensive valley-outwash deposits, and Culvers Gap topographic quadrangle. Modified from Crowl (1971), Epstein (1969), Minard (1961), Ridge (1983), and Witte (1997a).

Graphic from source map: Culvers Gap Quadrangle

East Stroudsburg Quadrangle

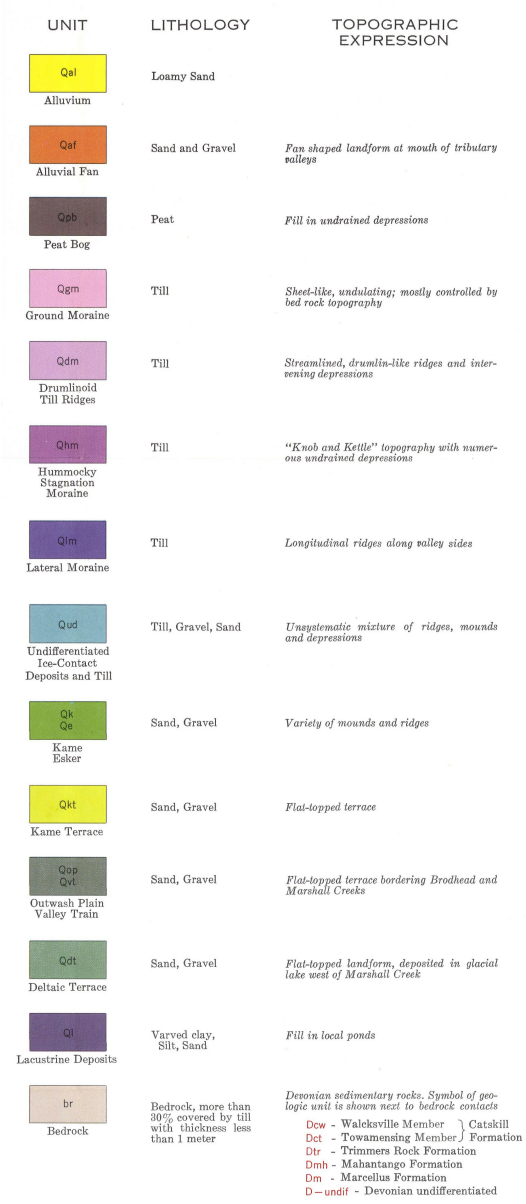
The formal citation for this source.

> Bucek, M.F., 1971, Surficial Geology of the East Stroudsburg 7-1/2 Minute Quadrangle, Monroe County, Pennsylvania: Pennsylvania Geological Survey, Atlas 214c, scale 1:24,000 (*GRI Source Map ID 1564*).

In addition to information contained in this document the published Surficial Geology of the East Stroudsburg 7-1/2 Minute Quadrangle contains additional text, table and figures that might me useful in understanding the geology for this quadrangle.

Prominent graphics and text associated with this source.

Correlation of Map Units

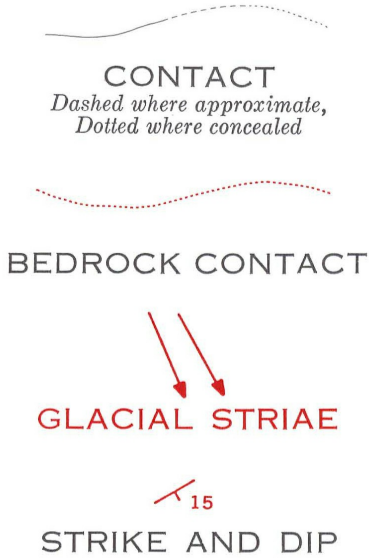


UNIT	LITHOLOGY	TOPOGRAPHIC EXPRESSION
Qal Alluvium	Loamy Sand	
Qaf Alluvial Fan	Sand and Gravel	*Fan shaped landform at mouth of tributary valleys*
Qpb Peat Bog	Peat	*Fill in undrained depressions*
Qgm Ground Moraine	Till	*Sheet-like, undulating; mostly controlled by bed rock topography*
Qdm Drumlinoid Till Ridges	Till	*Streamlined, drumlin-like ridges and intervening depressions*
Qhm Hummocky Stagnation Moraine	Till	*"Knob and Kettle" topography with numerous undrained depressions*
Qlm Lateral Moraine	Till	*Longitudinal ridges along valley sides*
Qud Undifferentiated Ice-Contact Deposits and Till	Till, Gravel, Sand	*Unsystematic mixture of ridges, mounds and depressions*
Qk Qe Kame Esker	Sand, Gravel	*Variety of mounds and ridges*
Qkt Kame Terrace	Sand, Gravel	*Flat-topped terrace*
Qop Qvt Outwash Plain Valley Train	Sand, Gravel	*Flat-topped terrace bordering Brodhead and Marshall Creeks*
Qdt Deltaic Terrace	Sand, Gravel	*Flat-topped landform, deposited in glacial lake west of Marshall Creek*
Ql Lacustrine Deposits	Varved clay, Silt, Sand	*Fill in local ponds*
br Bedrock	Bedrock, more than 30% covered by till with thickness less than 1 meter	*Devonian sedimentary rocks. Symbol of geologic unit is shown next to bedrock contacts*

Dcw - Walcksville Member } Catskill
Dct - Towamensing Member } Formation
Dtr - Trimmers Rock Formation
Dmh - Mahantango Formation
Dm - Marcellus Formation
D—undif - Devonian undifferentiated

Graphic from source map: East Stroudsburg Quadrangle

Map Legend



Graphic from source map: East Stroudsburg Quadrangle

Flatbrookville Quadrangle

The formal citation for this source.

> Witte, R.W., and Epstein, J.B., 2012, Surficial Geologic Map of the Flatbrookville Quadrangle, Sussex and Warren Counties, New Jersey, and Pike and Monroe Counties, Pennsylvania: New Jersey Geological Survey, Geologic Map Series GMS 12-1, scale 1:24,000 (*GRI Source Map ID 75861*).

In addition to information contained in this document the published Surficial Geologic Map of the Flatbrookville Quadrangle contains additional text, table and figures that might me useful in understanding the geology for this quadrangle.

Prominent graphics and text associated with this source.

Introduction

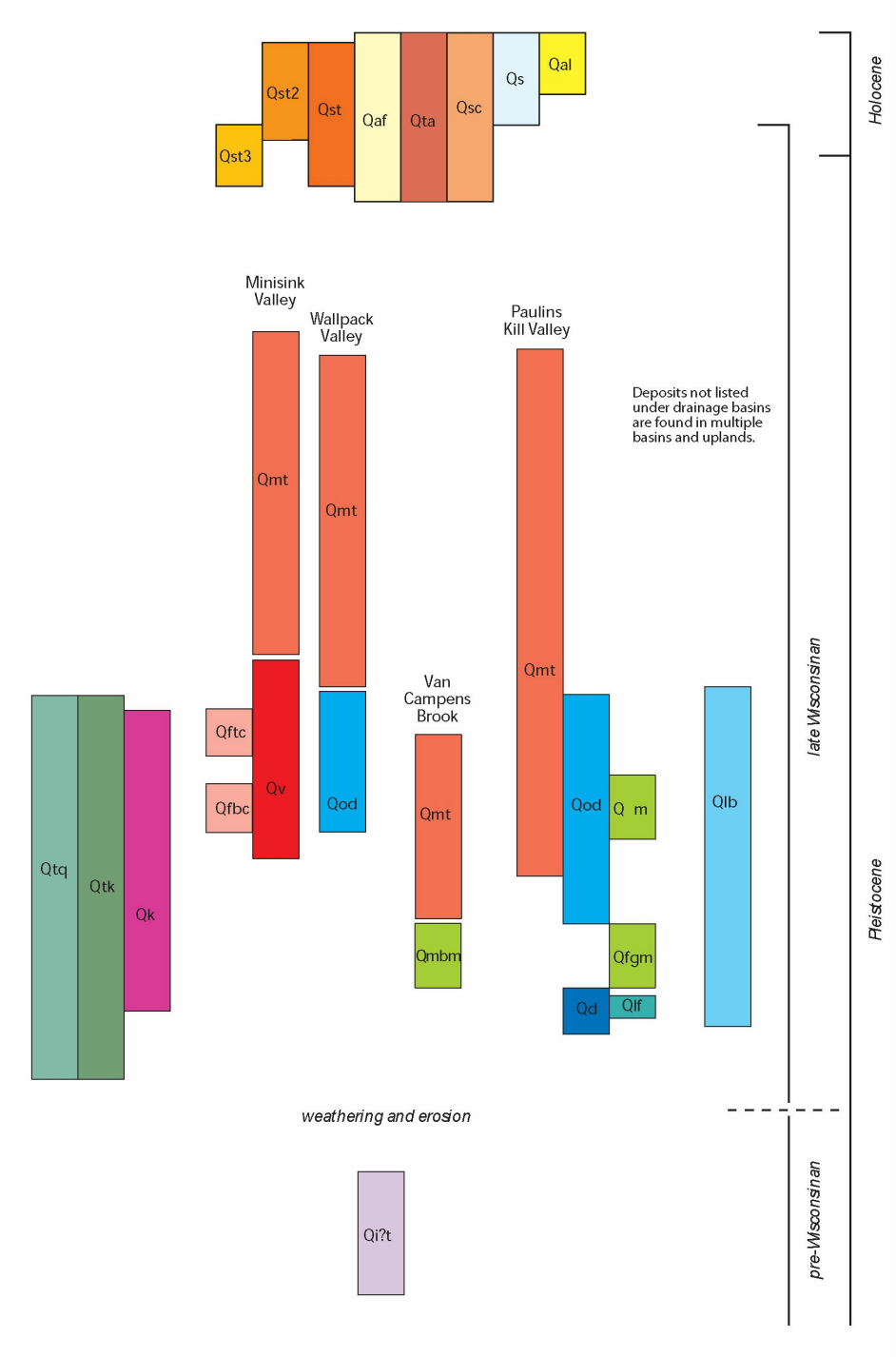
Industrial, commercial, and residential expansion in New Jersey and Pennsylvania has promoted the increased use of surficial geologic data for land-use planning, for identification, management and protection of ground water resources, siting of solid waste disposal sites, locating and developing sources of geologic aggregate, and delineation of geologic hazards. Surficial deposits in the Flatbrookville quadrangle are lithologically diverse, cover most of the bedrock surface, and are found in many types of landscape settings. They include glacial drift of late Wisconsinan age and alluvium, swamp and bog deposits, hillslope deposits, and wind-blown sediment laid down in postglacial time. These deposits may be as much as 200 feet (61m) thick and they form the parent material on which soils form. They are defined by their lithic characteristics, stratigraphic position, location on the

landscape, and further delineated by genetic and morphologic criteria. Geologic history, detailed observations on surficial materials, figures, tables, and a list of references are found in the accompanying booklet.

Description of Map Units
Map units denote unconsolidated deposits more than 5 feet (1.5m) thick. Color designations are based on Munsell Soil Color Charts (1975), and were determined from naturally moist samples. Numbered stream-terrace deposits indicate relative ages of units based on heights of terraces in valley.

Text from source map: Flatbrookville Quadrangle

Correlation of Map Units



Graphic from source map: Flatbrookville Quadrangle

Explanation of Map Symbols

Contact, dashed where approximately located or gradational.



Striation, measurement at tip of arrow. Multiple striations show two well de□ned directions of ice □ow with the more westerly direction the youngest.



Drumlin, line on crest, ellipse on summit.



Meltwater channel.



Glacial-lake spillway with estimated elevation of its □oor.



Alluvial channel scroll.



Inactive sand and gravel pit.



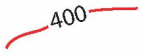
Inactive quarry.



Pebble-count sample location, composition listed in Table 1 (accompanying booklet).



Well location, geologic record listed in Table 2 (accompanying booklet).



Bedrock-surface contour beneath valley □ll. Contour interval 50 feet.



Well location on cross-section. Geologic record listed in Table 2 (accompanying booklet).



Nephelene syenite erratic.

Graphic from source map: Flatbrookville Quadrangle

Figure A - Physiography of Kittatinny Valley

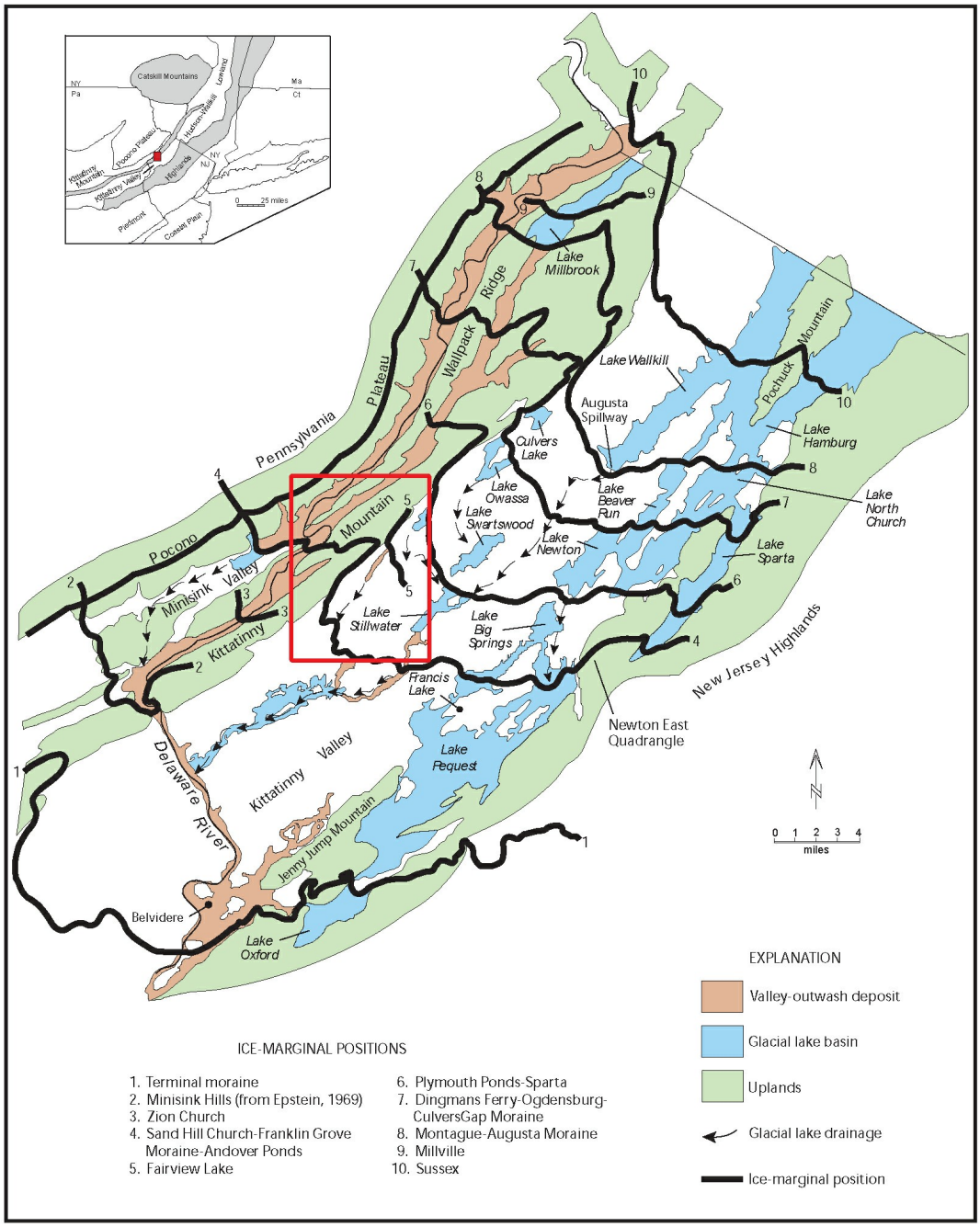


Figure A. Physiography of Kittatinny Valley and surrounding area. Late Wisconsinan ice-margin positions of the Kittatinny and Minisink Valley ice lobes, and location of large glacial lakes, extensive valley-outwash deposits, and Flatbrookville 7.5-minute topographic quadrangle. Modified from data by Crowl (1971), Epstein (1969), Minard (1961), Ridge (1983), and Witte (1997).

Graphic from source map: Flatbrookville Quadrangle

Figure B - Photo of Downstream Section of Wallpack Bend



Figure B. Downstream section of Wallpack Bend looking southwest from the confluence with Flat Brook. The Delaware River flows from right to left in photo. This large s-shaped meander may have formed during an early glaciation when the Echo Lake Lowland became blocked by outwash during deglaciation. Meltwater, which could no longer flow down the old course of the Delaware River, diverted through a low col across Wallpack Ridge into a preglacial valley cut by Flat Brook, establishing its present course.

Graphic from source map: Flatbrookville Quadrangle

Figure C - Photo of Van Campens Falls

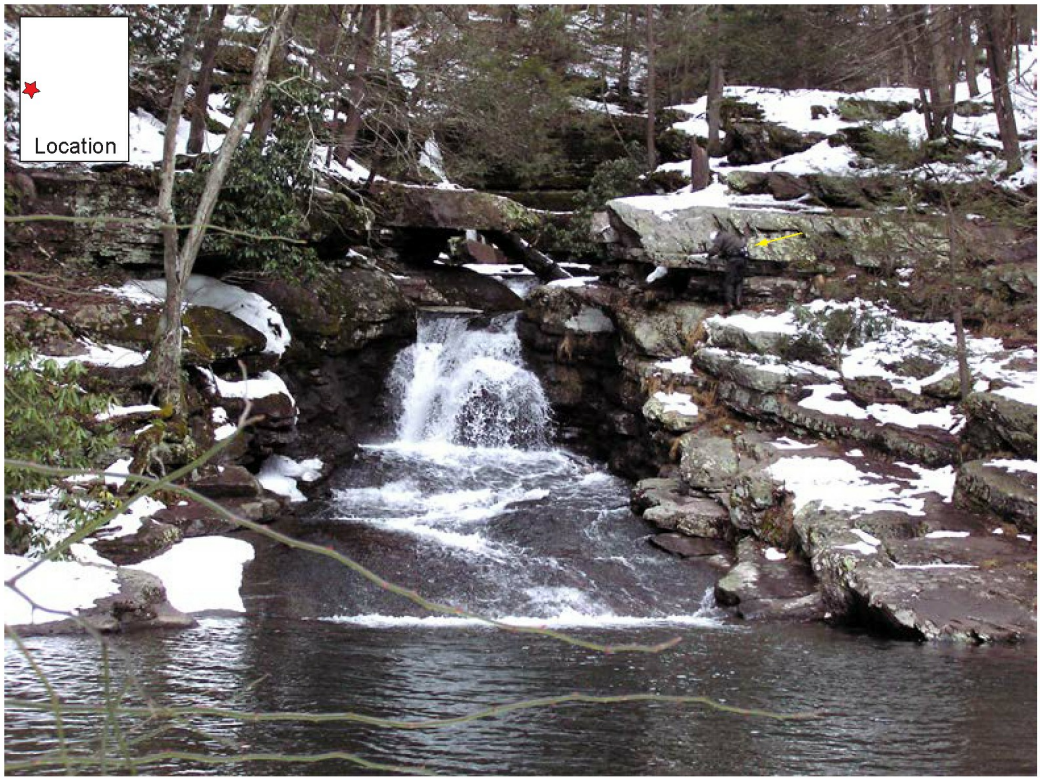


Figure C. Van Campens Falls, Van Campens Glen, Hardwick Township, New Jersey. The falls consists of low cascades and glides over southeast dipping beds of shale, siltstone, and sandstone of the High Falls Formation. The falls are located about 4000 feet (1.2 km) upstream from the Delaware River valley.

The upstream migration of the falls, a process called knick-point retreat, is related to the lowering of base level in the Delaware Valley by glacial erosion. The thick notched bed above the geologist (yellow arrow) is the former lip of a higher cascade that has since been breached by postglacial erosion.

Graphic from source map: Flatbrookville Quadrangle

Figure D - Photo of Cemented Cobble-Pebble Gravel Outwash



Figure D. Cemented cobble-pebble gravel outwash (Qod) just north of Flatbrookville along the west side of County Route 615 overlying limestone of the Rondout Formation.

Graphic from source map: Flatbrookville Quadrangle

Lake Maskenozha Quadrangle

The formal citation for this source.

> Witte, R.W., 2014, Surficial Geologic Map of Part of the Lake Maskenozha Quadrangle, Sussex County, New Jersey and Pike County, Pennsylvania: New Jersey Geological Survey, Open-file Map OFM 101, scale 1:24,000 (*GRI Source Map ID 76280*).

In addition to information contained in this document the published Surficial Geologic Map of Part of the Lake Maskenozha Quadrangle contains additional text, table and figures that might me useful in understanding the geology for this quadrangle.

Prominent graphics and text associated with this source.

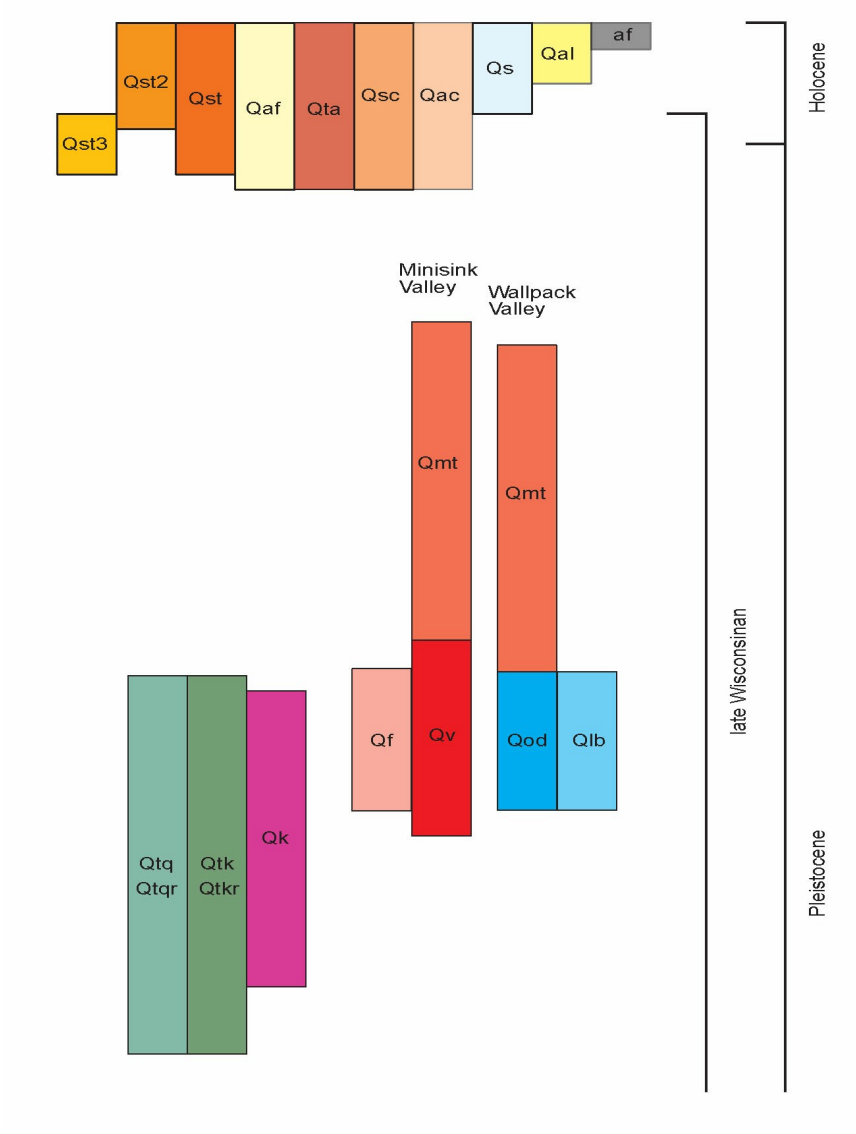
Introduction

Description of Map Units

Industrial, commercial, and residential expansion in New Jersey and Pennsylvania have promoted the increased use of surficial geologic data for land-use planning, for identification, management and protection of groundwater resources, siting of solid waste disposal sites, locating and developing sources of geologic aggregate, and delineation of geologic hazards. Surficial deposits in the Lake Maskenozha quadrangle are lithologically diverse, cover most of the bedrock surface, and are found in many types of landscape settings. They include glacial drift of late Wisconsinan age, and alluvium, swamp and bog deposits, hillslope deposits, and wind-blown sediment laid down in postglacial time. Collectively, these deposits may be as much as 200 feet (61m) thick and they form the parent material on which soils form. They are defined by their lithic characteristics, stratigraphic position, location on the landscape, and further delineated by genetic and morphologic criteria. Map units denote unconsolidated deposits more than 5 feet (1.5m) thick. Color designations are based on Munsell Soil Color Charts (1975), and were determined from naturally moist samples. The western edge of the mapped area in Pennsylvania is largely coincident with the boundary of the Delaware Water Gap National Recreation Area.

Text from source map: Lake Maskenozha Quadrangle

Correlation of Map Units



Graphic from source map: Lake Maskenozha Quadrangle

Explanation of Map Symbols

Contacts, dashed where inferred.



Striation, measurement at tip of arrow.



Drumlin, denotes long axis.



Small meltwater channel.



Large kettle in glacial outwash or moraine. Smaller kettles on moraines are not shown. Tics point downslope.



Fluvial scarp, line lies at base of scarp. Tics point upslope.



Alluvial channel scroll.



Inactive sand and gravel pit.



Inactive quarry.



Boundary of large sand and gravel pit.



Boundary of large shale pit.



Thin sheet of eolian sand.



Approximate elevation of bedrock surface beneath thick valley fill. Based on well records, location of rock outcrop, and data in adjoining quads (Witte and Epstein, 2004; 2012). Contour interval 50 feet.



Well or boring with log in Table 1.



Radiocarbon date on charcoal sampled from stream-terrace deposits with error and lab identification. Depths of samples: Beta-322870 (51.5",130.8 cm), Beta-322869 (58.0", 147.3 cm), Beta-322871 (81.5", 207.0 cm), Beta-232850 (72.8", 185 cm), GX-20691(20.9", 53 cm), GX-20692 (63.4", 161 cm).



Location of photographs in Figures 4 and 5.

Graphic from source map: Lake Maskenozha Quadrangle

Figure 1 - Physiography of Northwestern New Jersey and Northeastern Pennsylvania

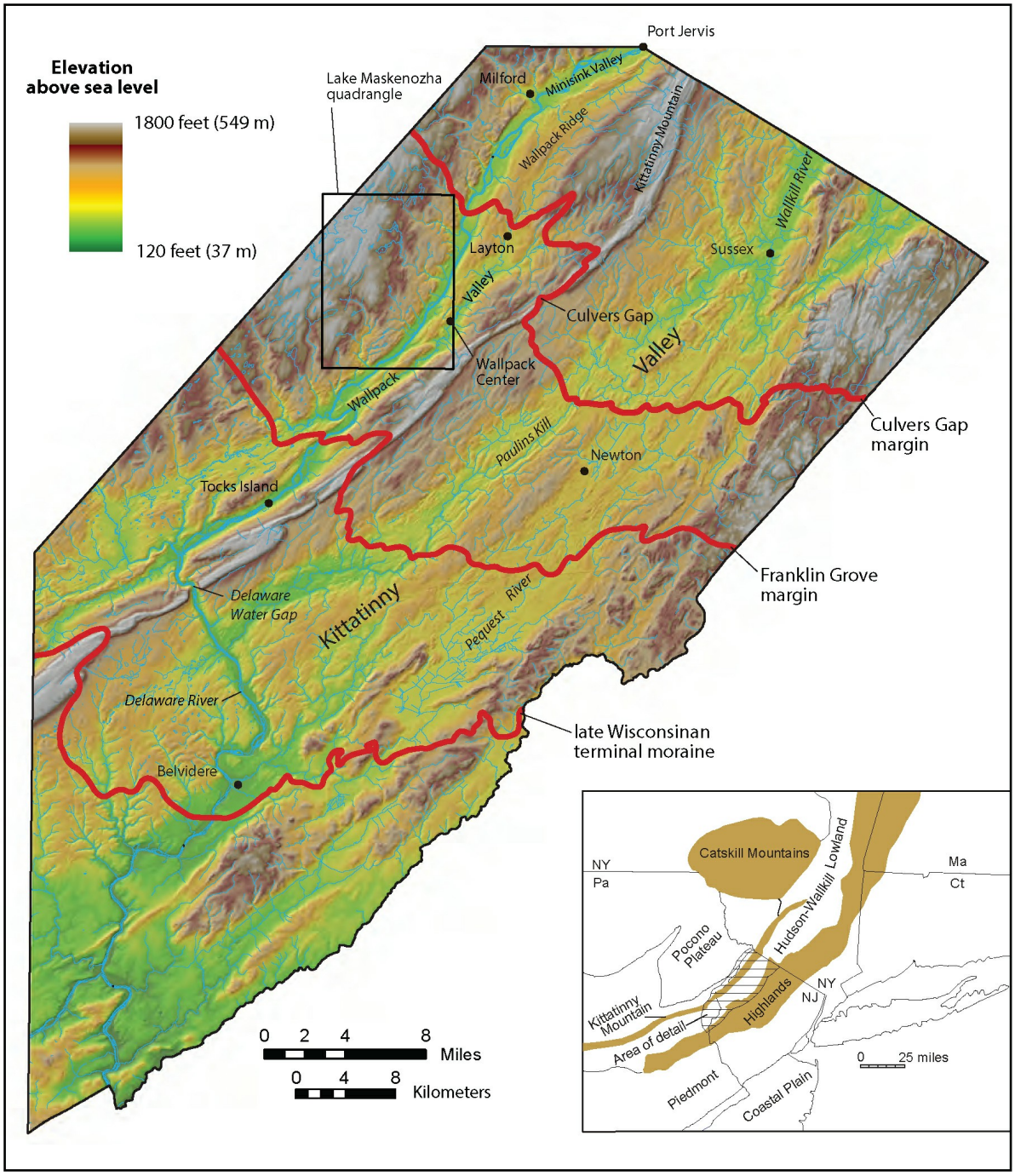


Figure 1. Physiography of northwestern New Jersey and northeastern Pennsylvania and location of the Lake Maskenozha 7.5 minute topographic quadrangle. Minisink Valley is a local geographic name for the Delaware River valley from Delaware Water Gap to Port Jervis, New York and Wallpack Valley is a local geographic name for the Flat Brook valley.

Graphic from source map: Lake Maskenozha Quadrangle

Figure 2 - Late Wisconsinan Ice Margins

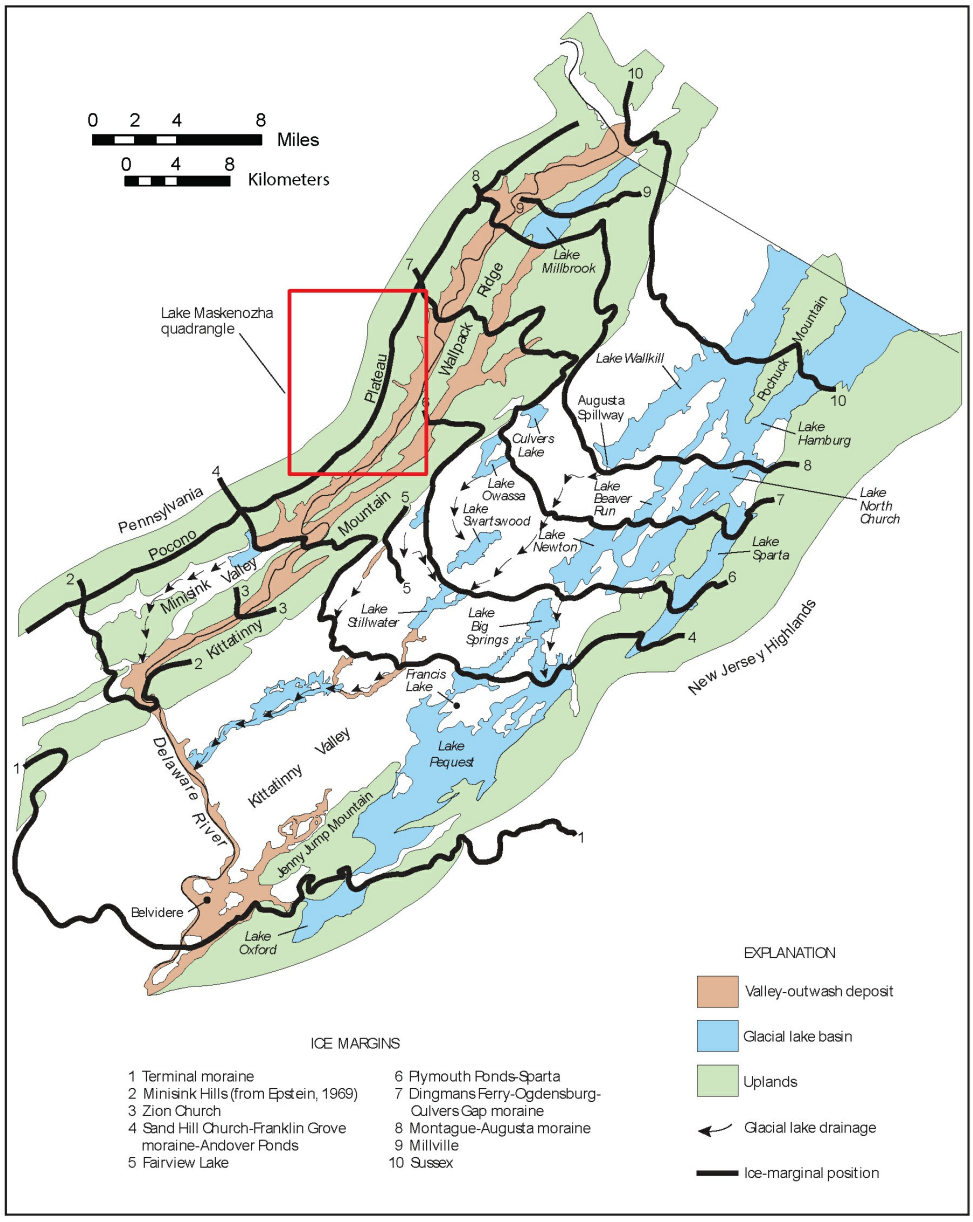


Figure 2. Late Wisconsinan ice margins of the Kittatinny and Minisink Valley ice lobes, and the location of large glacial lakes, extensive valley-outwash deposits, and the Lake Maskenozha 7.5 minute topographic quadrangle. Modified from data by Crowl (1971), Minard (1961), Epstein (1969), Ridge (1983), and Witte (1997, 2001b).

Graphic from source map: Lake Maskenozha Quadrangle

Figure 3 - Simplified Geologic Map of Lake Maskenozha Quadrangle

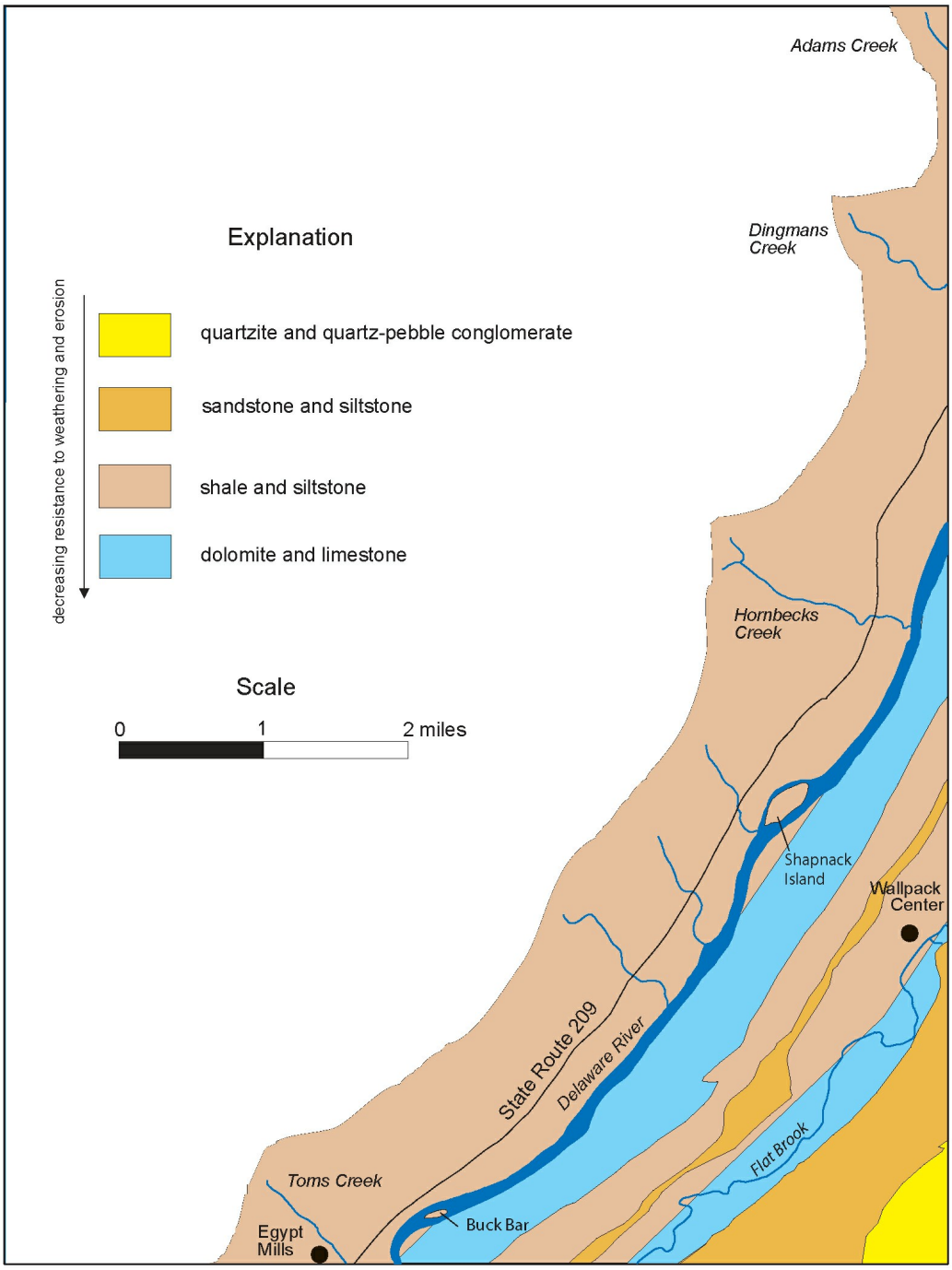


Figure 3. Simplified bedrock geology of part of the Lake Maskenozha quadrangle. Modified from Monteverde (1992) and Sevon and others (1989).

Graphic from source map: Lake Maskenozha Quadrangle

Figure 4 - Photos from Toms Creek Shale Pit

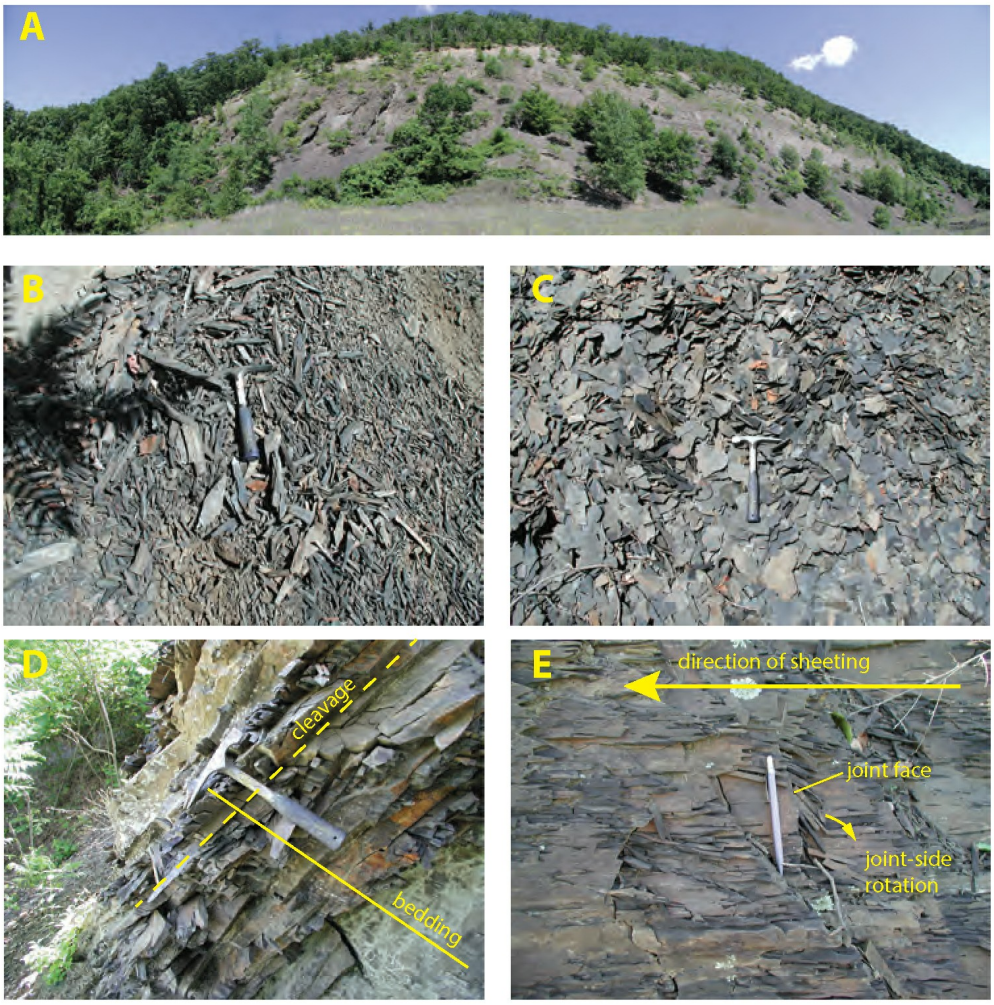


Figure 4. Toms Creek shale pit (inset A). The top of the pit scarp lies about 300 feet (91m) above Route 209 (Minisink Valley floor). About 400,000 cubic yards of shale-chip rubble were mined from this pit. The rubble, well described in Sevon and others (1989), consists of angular, elongated, platy, prismatic and bladed clasts of the Mahantango Formation (inset B and C). Average clast length varies between one and six inches. Larger clasts, up to boulder size, may be interspersed throughout the deposit. Typically, the rubble has very little matrix, although many of the clasts exhibit a thin coating of clay. The few beds that do have a substantial matrix component displayed a coarsening upwards of shale clasts, suggesting it was deposited as a slurry flow. Bedding is slope parallel, and averages between one to four inches thick. However, in many places the homogeneity of the rubble makes it difficult to discern bedding. Most of the elongated fragments are oriented down slope.

Shale-chip rubble is the product of intense frost shattering along the cliff face. The size and shape of the fragments and rate of fragmentation is controlled by the attitude and spacing of cleavage, joints, and bedding and grain size. Bedding (N64°E 32°NW) and cleavage (N70°E 54°SE) largely control the shape of the fragments (inset D). In places where cleavage is closely spaced and bedding is thin, fragments will be bladed to prismatic. In places where cleavage is more widely spaced, platy fragments are more common. Grain size also controls size and shape of fragments. The finer-grained shale and siltstone beds form thinner fragments, while the coarser, sandstone beds form thicker fragments. The subvertical, nonpenatrative, cross-strike joints found throughout the Mahantango Formation hasten rubble formation

by providing additional surface area and access to cleavage partings. This results in the disintegration of rock by cross-cliff sheeting, a step-like removal of rock away from the joint face (inset E). Shallow joints result in the weathering of thinner sheets, while deeper joints result in the weathering of larger sheets. At times, large joint blocks also become dislodged from the cliff. Several of these may be seen throughout the pit, either partially buried in the excavated rubble or lying on the modern rubble apron, which formed after the pit was abandoned. Up close, rock fragments are loosened individually or in small aggregates. Typically, there is a joint-side downward rotation of the fragment (inset E). Eventually, the tilted fragment dislodges and falls to the apron's surface. Another form of small-scale fragmentation includes flaking, a process where small rock chips and flakes on the exposed cleavage face become dislodged. This type of fragmentation occurs around shallow surface fractures, many of which were glacially formed. Bedding, sorting, and clast orientation of the rubble suggests that most of this material, after it has fallen off the outcrop and accumulated at the top of the apron, moves downslope as a massive sheetflow. Bedding and grading show that this downslope transport is episodic and in some cases may have involved water.

Graphic from source map: Lake Maskenozha Quadrangle

Figure 5 - Photos from Buck Bar Terrace



Figure 5. Buck Bar terrace (Qst2) looking upstream (inset A). Measured section (inset B and C) is just to the photo's left on a low bluff overlooking the Delaware River. Dates determined from charcoal fragments presumed to have been derived from an Amerind hearth. 440 +/- 30 BP (Beta-322870, depth = 58.5" (148.6 cm), 1,210 +/- 30 BP (Beta - 322869, depth = 51.5" (130.8 cm). Samples collected in thick paleosol (dark gray horizon) with knife tip at lower sample. Third sample collected just upstream from section yielded a date of 1,900 +/- 30 BP (Beta-322871, depth = 81.5" (207.0 cm). Paleosols are common in these overbank deposits representing periods of minimal sedimentation and landscape stability. Stewart (1991) has shown that some paleosols are chronosequences that are traceable throughout the Delaware Valley. Others have a decidely more local origin. Work by Stinchcomb and

others (2012) near this site show that lower paleosols have older dates of 9.3 ka and 6.7 ka indicating a nearly 10,000 year alluvial history has been preserved in this part of Minisink Valley.

Graphic from source map: Lake Maskenozha Quadrangle

Figure 6 - Color-Shaded Relief Map of Minisink Valley

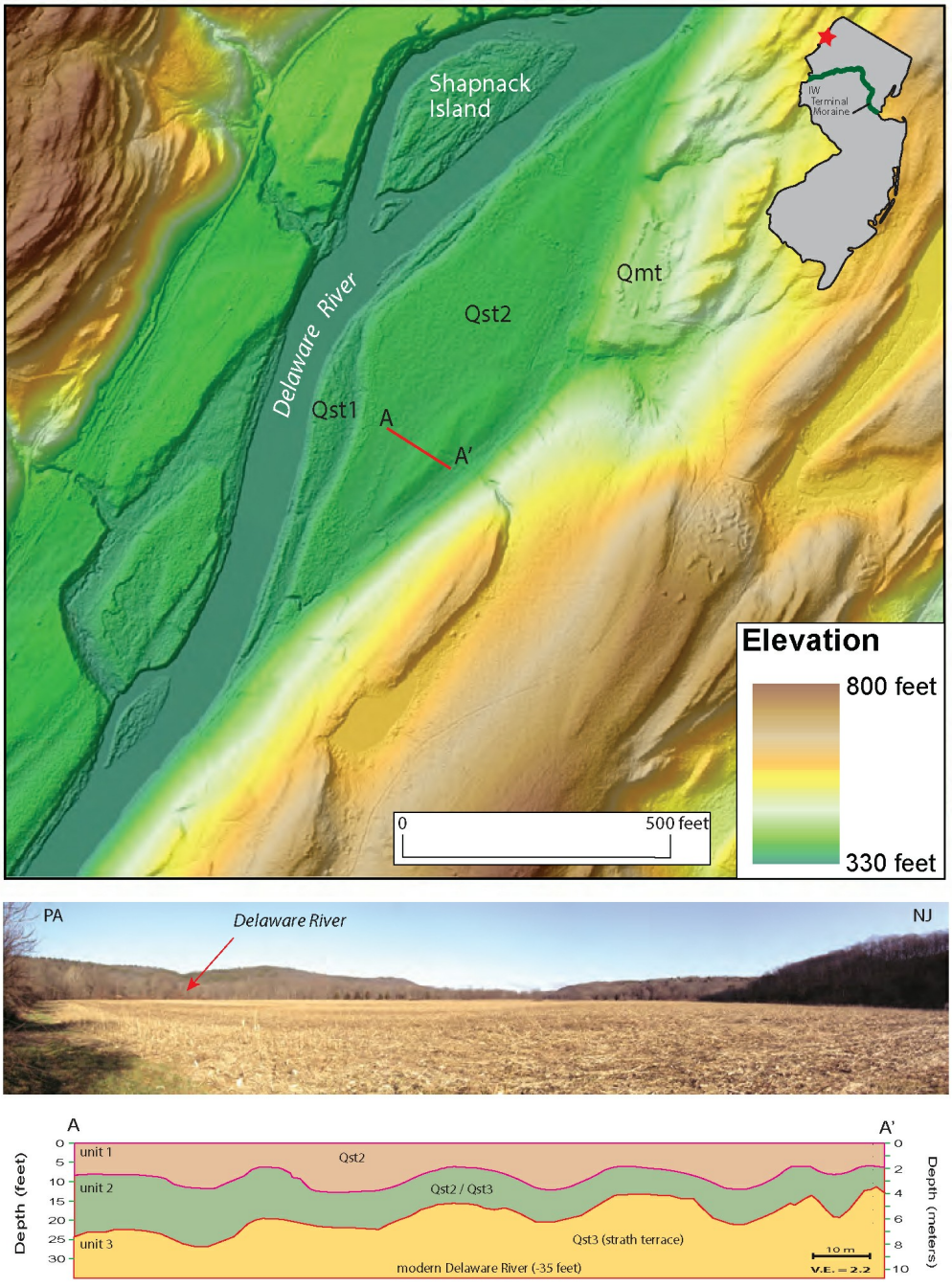


Figure 6. Color-shaded relief map (CSRM) of Minisink Valley in the vicinity of Shapnack Island, Delaware

Water Gap National Recreation Area and location of profile A-A? Panoramic view is looking upstream across the Qst2 surface near profile A-A? CSRM constructed from PAMAP Program 3.2 ft. Digital Elevation model tiles (PAMAP Program, PA Department of Conservation and Natural Resources, Bureau of Topographic and Geologic Survey). Dark to light green areas (lowest to highest elevation) represent postglacial and glacial stream terraces laid down from Late Wisconsinan to modern time. The formation of postglacial terraces is related to incision of the postglacial Delaware River In response to isostatic rebound and large decreases in stream discharge and sediment load during the late Pleistocene and Holocene (Witte, 2001b). Because the valley is narrow most flood-plain sediment was deposited through vertical accretion (especially the upper part of the Qst2 terrace). Profile A-A (modified from Bitting, 2013) represents a cross-sectional profile of postglacial stream deposits downstream from Shapnack Island. The profile was constructed from GPR data and Geoprobe borings taken along the profile line. Unit 3 is interpreted as a late glacial to early postglacial strath terrace developed on glacial outwash. It represents the former position of the Delaware River (10 to 20 feet above the modern river) during late Pleistocene time. These strath terraces are found elsewhere in Minisink Valley (Witte, 2001b) and they represent the former position of the Delaware River as it evolved into a modern river. Unit 2 is transitional, representing flood-plain deposition during the earlier stage of river incision. Unit 1 consists largely of vertically accreted flood deposits laid down during the middle to latter part of the Holocene when the river was at or near its present elevation. The profile surface has not been corrected for elevation changes. The elevation at A is about 6 feet lower than A. The slightly elevated area along the profile (seen on the CSRM) is probably a terrace remnant formed by flood scour. GPR and boring data do not show a separate, older terrace.

Graphic from source map: Lake Maskenozha Quadrangle

Table 1 - Records of Selected Wells

Well number	NJDEP permit number or well id. (Davis, 1989)	Accuracy of well location	Discharge reported by drillers in gpm	Depth in feet	Driller's geologic log
1	21-235	S	20	0-59	Overburden (casing depth)
2	21-1045	F	25	0-120	Overburden (casing depth)
3	21-4960	S	4	0-2	Overburden
				2-12	Clay and boulders
				12-40	Sand and heavy gravel
				40-60	Clay (dry)
				60-100	Clay and water
				100-165	Clay
				165-167	Soft brown limestone
				167-171	Brown limestone
				171-197	Limestone
4	22-1261	F	3	0-137	Overburden (casing depth)
5	21-3696	F	15	0-65	Overburden (casing depth)
				65-186	Limestone
6	411 Pike Co.	F	10	0-229	Qoic
7	292 Pike Co.	F	-----	0-80	Qaoo
8	302 Pike Co.	F	-----	0-75	Qoic

Table 1. Records of selected wells in the Lake Maskenozha quadrangle, Sussex County, New Jersey, and Pike County, Pennsylvania. The wells listed were drilled for private and public water supply, and exploration. Wells listed with a NJDEP permit number are from the files of the Bureau of Water Allocation, Division of Water Supply and Geosciences, New Jersey Department of Environmental Protection. Wells noted in the table as "Pike Co." are from Davis (1989) and are preceded by an identification number that was used in the report. Location accuracy and some discharge measurements were unavailable for "Pike Co." wells. Accuracy in plotting well locations is listed as S, or F (100 or 500 feet of actual location). Locations are based on property maps, NJDEP atlas sheet coordinates, and driller's site maps. Key to driller's log for wells listed in Davis (1989); Qaoo - alluvium and Olean outwash, and Qoic - Olean ice-contact stratified sand and gravel.

Graphic from source map: Lake Maskenozha Quadrangle

Milford Quadrangle

The formal citation for this source.

> Witte, R.W., 2012, Surficial Geologic Map of the Milford Quadrangle, Sussex County, New Jersey, and Part of Pike County, Pennsylvania: New Jersey Geological Survey, Open-file Map OFM 96, scale 1:24,000 (*GRI Source Map ID 75857*).

In addition to information contained in this document the published Surficial Geologic Map of the Milford Quadrangle contains additional text, table and figures that might me useful in understanding the geology for this quadrangle.

Prominent graphics and text associated with this source.

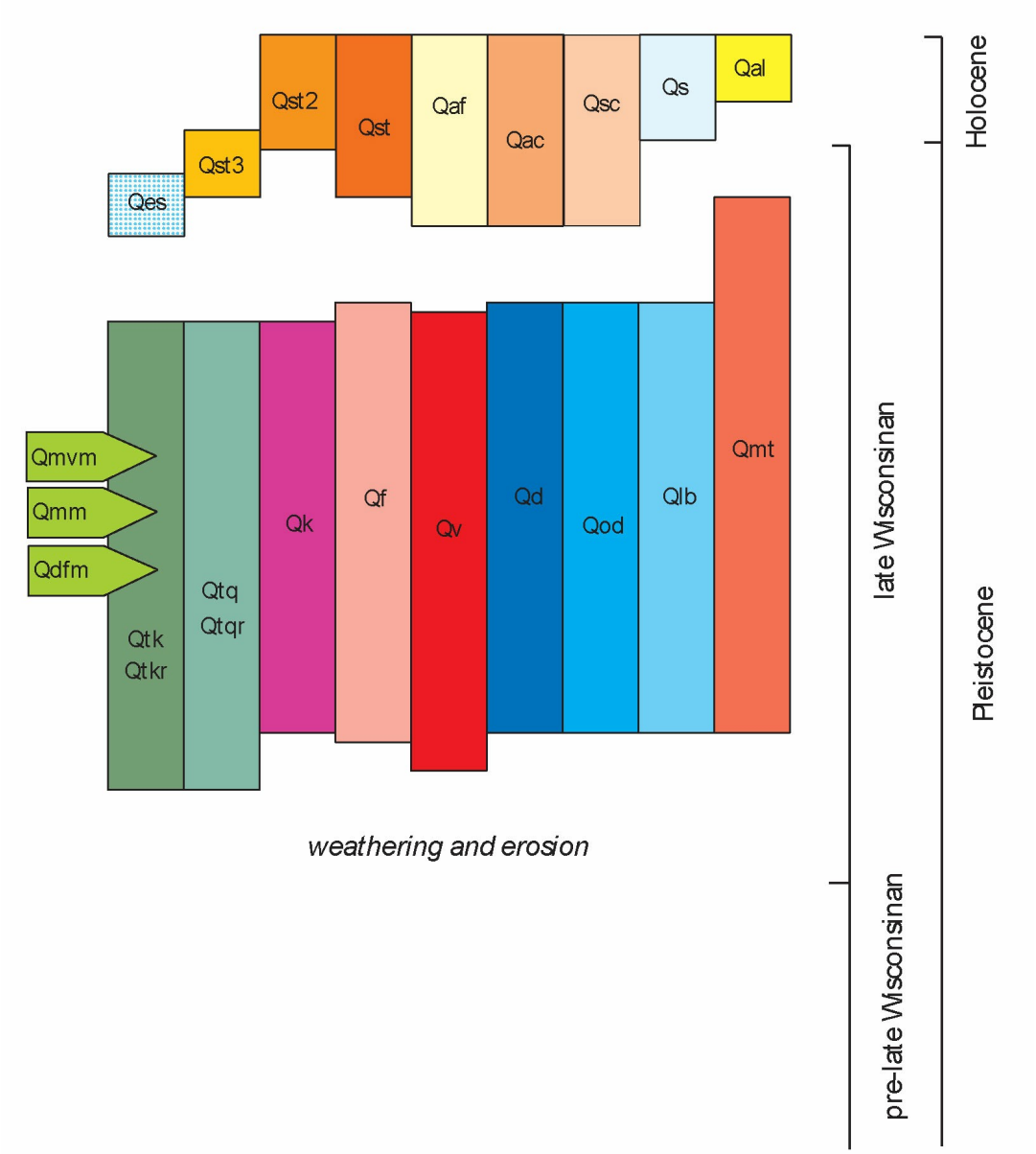
Introduction

Industrial, commercial, and residential expansion in New Jersey have promoted the increased use of surficial geologic data for land-use planning, for identification, management, and protection of groundwater resources, siting of solid-waste-disposal sites, locating and developing sources of geologic aggregate, and delineation of geologic hazards. Surficial deposits in the Milford quadrangle are lithologically diverse, cover most of the bedrock surface, and occur in many types of landscape settings. They include glacial drift of late Wisconsinan age, and alluvium, swamp and bog deposits, hillslope deposits, and wind-blown sediment laid down in postglacial time. Collectively, these deposits may be as much as 340 feet (104m) thick and they form the parent material on which soils form. They are defined by their lithic characteristics, stratigraphic position, location, and further delineated by genetic and morphologic criteria. Geologic history, detailed observations on surficial materials, and a list of references are in the accompanying booklet.

Description of Map Units
Map units denote unconsolidated deposits more than 5 feet (1.5m) thick. Color designations are based on Munsell Soil Color Charts (1975), and were determined from naturally moist samples.

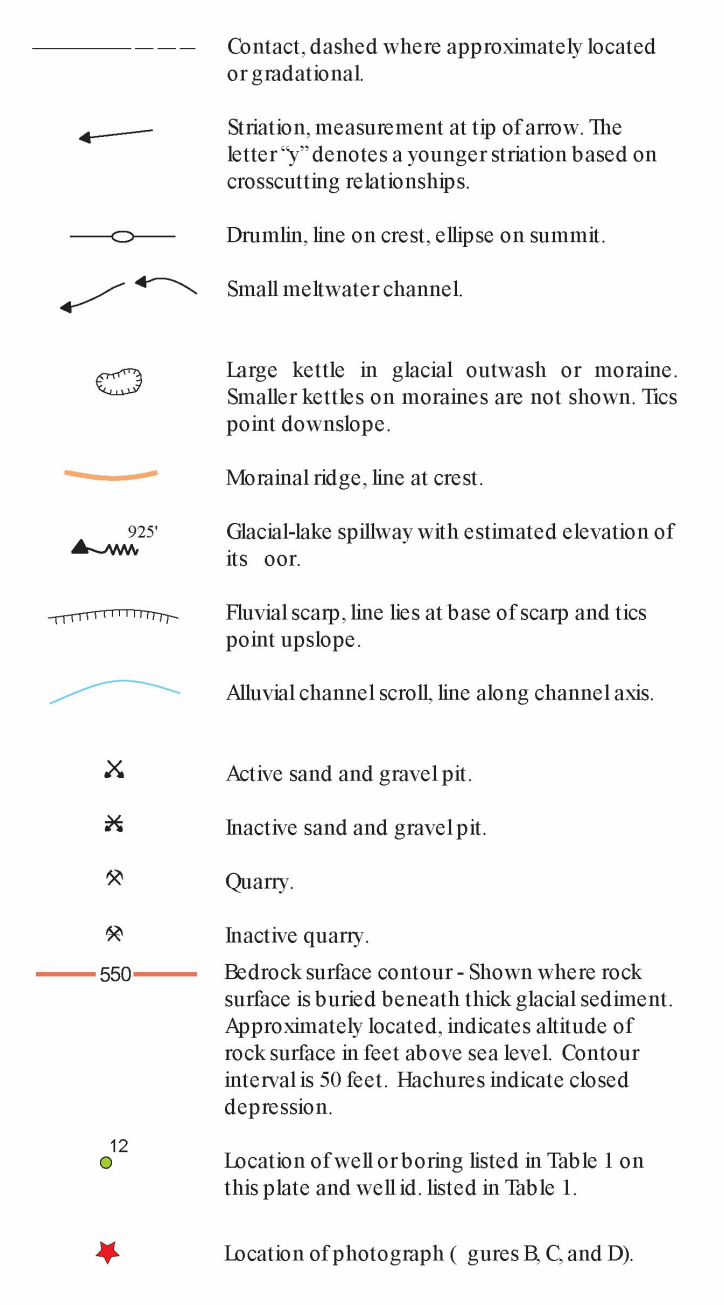
Text from source map: Milford Quadrangle

Correlation of Map Units



Graphic from source map: Milford Quadrangle

Explanation of Map Symbols



Graphic from source map: Milford Quadrangle

Figure A - Color-shaded Relief Map of Milford Quadrangle

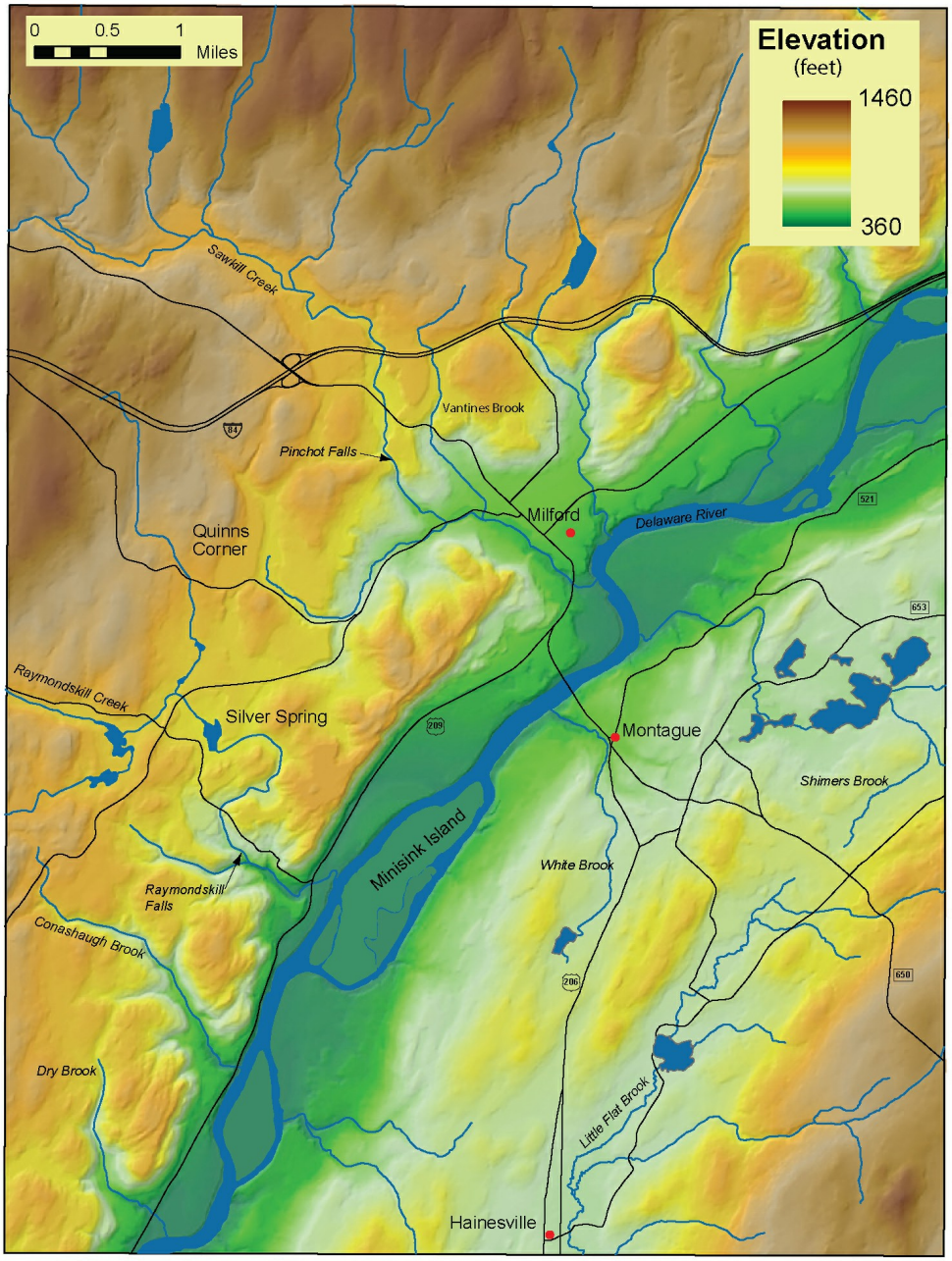


Figure A. Color-shaded relief map of the Milford quadrangle.

Graphic from source map: Milford Quadrangle

Figure B - Photo of Lower Falls and Bridal Veil Falls



Figure B. Lower falls (right) and Bridal Veil Falls (left), Raymondskill Falls, Pike County, Pennsylvania. The upper falls (upper right of photo) has retreated about 250 feet from the lower falls. At one time, Raymondskill Falls may have existed as one large cataract more than 150 feet in height. Erosion, largely by meltwater streams of greatly varying discharge during the Illinoian and late Wisconsinan glaciations has cut back the falls to their present form.

Graphic from source map: Milford Quadrangle

Figure C - Panorama of Raymondskill Bluff

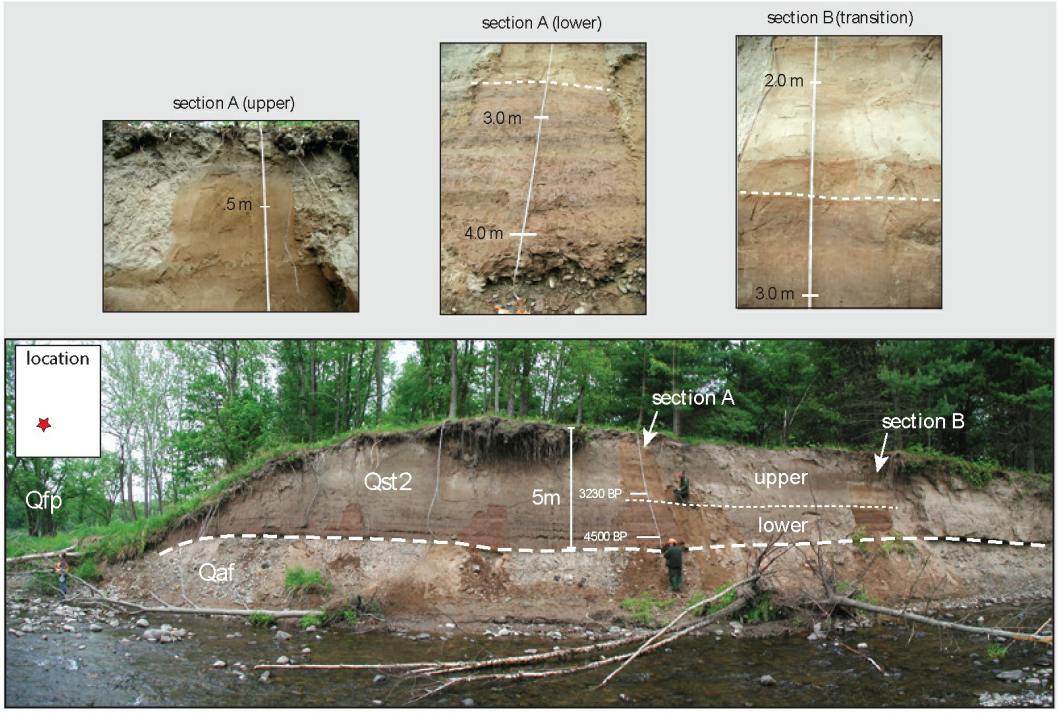


Figure C. Panorama of Raymondskill bluff with inset photographs showing close-ups of alluvial strata and buried paleosols. The bluff exposes coarse gravel of an older alluvial fan (Qaf) overlain by about 5 m of overbank sediment. Radiocarbon dates 4500+/- 40 yr B.P. (GX-28162-AMS) and 3230 +/- 40 yr B.P. (GX-28163-AMS) were determined from charcoal that was collected from charcoal-enriched alluvial stratum. The oldest date suggests that the Qst2 stream terrace may be as old as 5000 years, an age that represents the last half of the Holocene. Cultural periods represented by the bluff include the Late Archaic (6000 to 4000 yr B.P.), Terminal Archaic (4000 to 3000 yr B.P.), Woodland (3000 to 400 yr B. P.) and Historic cultural periods. Qfp is the modern flood plain and it is equivalent to Qal on the surficial geologic map. Figure from Witte and Wright (2001).

Graphic from source map: Milford Quadrangle

Figure D - Photo of Stony Till



Figure D. Stony till exposed in a foundation cut-face dug in the Montague moraine. The Montague moraine is a recessional moraine deposited at the margin of the Minisink Valley ice sublobe. Recessional moraines in the Milford quadrangle consist largely of till with minor pockets and lenses of stratified sediment. Entrenching shovel for scale near top left of photo.

Graphic from source map: Milford Quadrangle

Table 1 - Records of Selected Wells

well number	NJDEP permit number	Location code	Discharge in gallons per minute	Depth in feet	Driller's log
1	22-21893	S	10	0-25	overburden
				25-158	shale
2	21-6360	S	7	0-46	sand and gravel
				46-225	shale
3	21-367	F	20	0-20	hardpan
				20-30	hardpan and boulders
				30-33	sand and water
				33-125	limestone
				125-140	rotten limestone
4	21-454	S	4	0-41	casing depth (well depth = 198 feet)
5	21-319	S	20	0-74	casing depth (well depth = 95 feet)
6	22-23428	F	4	0-30	clay and gravel overburden
				30-400	slate
7	21-5503	S	100	0-122	sand and gravel
				122-225	slate
8	22-2709	F	27	0-25	hardpan and boulders
				25-40	sandy loam, gravel, and water
				40-52	gravel and broken rock
				52-100	blue lime rock
				100-132	yellow lime rock
				132-151	brown sandstone
				151-187	yellow lime rock
				187-225	lime rock
				225-235	brown sandstone
9	21-6712	F	none	0-40	sandy loam
				40-310	shale
10	21-2700	F	15	0-15	hardpan and cobbles
				15-25	lime rock, broken up
				25-72	lime rock
				72-89	yellow lime rock
				89-128	lime rock
				128-150	brown sandstone
				150-340	lime rock
				340-375	brown sandstone
11	21-1040	F	6	0-25	hardpan
				25-50	hardpan, boulders, and gravel
				50-65	gravel, sand, and water
				65-165	shale
12	21-3752	T	22	0-50	hardpan and boulders
				50-70	sand, gravel, and water
				70-86	sand, gravel, and blue clay
				86-97	blue clay and broken up rock
				97-172	black lime rock
				172-210	shale rock
				210-262	hard gray rock
				262-280	brown sandstone
13	21-307	S	20	0-20	hardpan and boulders
				20-25	gravel and sand
				25-50	black shale
				50-70	gray rock
				70-98	shale and water
14	21-2302	F	56	0-20	hardpan
				20-50	lime rock, broken up
				50-70	lime rock, sand, and water
				70-112	blue lime rock
				112-118	yellow lime rock
				118-128	brown rock with quartz
15	21-3605	F	5	0-25	hardpan and boulders
				25-50	clay, gravel, and water
				50-62	blue clay
				62-131	blue shale rock
				131-200	hard gray rock
				200-289	blue shale rock
16	21-1372	F	35	0-50	hardpan and boulders
				50-75	gravel and blue clay
				75-100	sand, gravel, and water
				100-118	blue clay
				118-175	black lime rock
				175-250	limestone
				250-278	yellow limestone
17	21-1497	F	40	0-42	casing depth (well depth = 104 feet)
18	21-1455	F	22	0-25	hardpan
				25-42	hardpan and broken rock
				42-114	limestone
				114-135	soft yellow limestone
19	soil boring	S	none	0-2	brown silt and little fine sand
				2-4	brown sand
				4-12	brown silt and very fine sand
				12-30	brown fine sand and some silt
				30-35	gray clay and silt
				35-40	brown silt, sand, and some fine gravel
				40-41	brown to tan clay over dark gray
20	soil boring	S	none	0-6	brown clay and silt
				6-32	brown sand, some silt, and trace of clay
				32-40	gray clay and silt, trace of fine sand
				40-50	gray fine sand, trace of silt and clay
				50-52	sand and fine gravel
				52-57	gray clay and silt, some fine sand
21	soil boring	S	none	0-18	brown fine sand, silt, and fine gravel
				18-22	coarse gravel
				22-31	brown clay to fine sand
				31-33	brown silt to fine sand
				33-34	coarse gravel
				34-40	brown clay to fine sand, some fine gravel
				40-50	brown fine sand and silt
				50-55	gray to brown fine sand and silt
				55-70	gray to brown silt, some very fine sand
				70-75	gray to brown silt, trace of sand, and clayey seams
				75-82	gray to brown very fine sand and silt
22	soil boring	S	none	0-8	gravel, silt, some sand, and trace of gravel
				8-13	brown silt and clay, trace of sand
				13-16	brown sand and some silt
				16-17	gravel, little silt and fine sand
				17-31	brown sand, trace of fine gravel and silt
				31-75	brown sand and trace of silt
				75-84	brown to gray clay and gray silt
				84-85	weathered bedrock
23	soil boring	S	none	0-50	clay, boulders and gravel
				50-100	gravel and red clay
				100-132	gravel
				132-150	red rock
				150-250	gray rock
				250-350	red rock
				350-450	brown sandstone
24	21-1849	F	300	0-60	casing depth (well depth = 250 feet)
25	soil boring	S	none	0-1	black silt
				1-22	brown sand, trace of silt
				22-27	brown silty clay
				27-50	brown sand, trace of silt
				50-51	hard gray clay and silt
				51-52	weathered limestone
26	soil boring	S	none	0-1	black silt
				1-3	brown silt, some sand, trace of fine gravel
				3-7	brown sand, trace of clay, silt and fine gravel
				7-14	brown silt, trace of sand, and fine gravel
				14-18	brown sand and some silt
				18-20	brown clayey silt, some fine gravel
				20-21	gravel, some fine sand
				21-25	compact brown clayey silt, trace of gravel and sand
				25-26	weathered limestone
27	soil boring	S	none listed	0-3	brown silt, little sand, and trace of fine gravel
				3-8	brown clay, little sand and silt, and trace of fine gravel
				8-21	brown clay, little fine gravel, and trace of silt
				21-75	brown clay and silt, little sand, and trace of fine gravel
				75-86	brown clay, little sand and silt
				86-91	red brown clay, some brown fine sand, and trace of black gravel
				91-92	black shale
28	21-3652	S	75	0-130	sand, gravel, and boulders
				130-165	red rock
29	21-6248	F	30	0-120	sand and gravel
				120-188	red rock
30	21-6249	F	30	0-95	sand and gravel
				95-188	red rock
31	21-5456	S	20	0-112	boulders, sand, and gravel
				112-180	red rock
32	21-6410	F	20	0-90	sand and gravel
				90-208	red rock
33	21-6322	S	30	0-94	sand, gravel, and boulders
				94-280	red rock
34	21- 6878	S	none listed	0-50	boulders and gravel
				50-71	large gravel and sand
				71-208	red rock
35	21-5841	S	12	0-29	sand, clay, and gravel
				29-100	red shale
36	21-6075	S	50	0-65	gravel and boulders
				65-125	red rock
37	21-5525	S	6	0-70	gravel and boulders
				70-208	red rock
38	21-3847	S	5	0-50	sand, gravel, and boulders
				50-290	red rock
39	21-5500	S	10	0-55	boulders and gravel
				55-350	red rock
40	21-5914	S	6	0-15	gravel and boulders
				15-188	red rock
41	21-5375	S	4	0-68	boulders
				68-290	red rock
42	21-5989	S	25	0-83	cobbles, stones, and sand
				83-250	red rock
43	21-4984	S	30	0-100	gravel, sand, and boulders
				100-130	rock
44	21-6499	S	12	0-12	loam and boulders
				12-35	gravel and sand
				35-208	red rock
45	21-6422	S	15	0-80	overburden
				80-175	red rock
46	21-6155	S	75	0-48	gravel and boulders
				48-180	red rock
47	21-5110	S	12	0-40	overburden
				40-208	red rock
48	21-6331	S	30	0-80	sand and gravel
				80-145	red rock
49	22-20658	S	16	0-73	overburden (casing depth)
				73-125	red rock
50	21-1295	FT	6	0-25	hardpan and boulders
				25-50	hardpan and gravel
				50-90	gravel, sand, and water
				90-95	blue clay and rock
				95-175	lime rock
				175-184	brown sandstone
				184-225	hard blue limestone
				225-235	yellow limestone
51	21-6946	S	15	0-43	sand, clay, and gravel overburden
				43-175	slate
52	21-6642	S	? (artesian)	0-15	overburden
				15-200	shale
53	21-5744	S	5	0-70	boulders and gravel
				70-135	limestone
54	21-6936	S	12	0-50	sand, clay, and gravel overburden
				50-200	slate rock
55	21-1727	F	10	0-50	hardpan and boulders
				50-100	yellow clay and gravel
				100-130	gravel and water
56	21-5114	F	20	0-60	sand and coarse gravel
				60-165	rock
57	21-6676	S	75	0-50	gravel, sand, and some boulders
				50-166	red rock
58	21-7123	S	50	0-98	clay with some gravel
				98-310	shale
59	21-6912	F	20	0-48	clay, gravel, and water
				48-175	blue shale
60	21-5617	S	50	0-12	sandy loam
				12-290	shale
61	21-4785	S	10	0-55	casing depth
62	21-6153	S	10	0-55	sandy loam / limestone
63	21-5735	S	15	0-55	sand
				55-57	boulder
				57-63	sand and gravel
				63-123	shale
64	21-6978	S		0-75	sand, gravel, and boulders
				75-125	limestone
65	21-6724	S	none	0-15	silty gravel
				15-125	limestone
66	21-5872	S	20	0-15	overburden
				15-150	shale
67	22-23423	S	20	0-55	sand, clay, and gravel overburden
				55-125	red shale
68	21-7095	F	50	0-106	sand and gravel with some boulders
				106-145	red rock
69	21-2009	F	20	0-84	casing depth (well depth = 130 feet)
70	21-6100	S/F	5	0-42	sand and gravel overburden
				42-149	red shale rock
71	21-828	F	20	0-52	casing depth (well depth = 101 feet)
72	21-516	S	30	0-126	casing depth (well depth = 139 feet)
73	21-364	FT	40	0-35	casing depth (well depth = 87 feet)
74	21-893	F	30	0-54	casing depth (well depth = 166 feet)
75	21-642	FT	20	0-145	casing depth (well depth = 185 feet)
76	21-316	T	20	0-130	casing depth (well depth = 130 feet)
77	Pike - 231			0-136	Quic
78	Pike - 104			0-131	Quic
79	Pike - 233			0-145	Quic
80	Pike - 232			0-130	Quic
81	Pike - 299			0-125	Quic
82	Pike - 227			0-214	Quic
83	Pike - 229			0-206	Quic
84	Pike - 103			0-90	Quic
85	Pike - 102			0-123	Quic
86	Pike - 101			0-108	Quic
87	Pike - 104			0-104	Quic
88	Pike - 32			0-160	Quic
89	Pike - 117			0-145	Quic
90	Pike - 142			0-40	Quic
91	Pike - 141			0-58	Quic

Table 1. Records of selected wells in the Milford quadrangle, Sussex County, New Jersey, and Pike County, Pennsylvania. The wells listed were drilled for private and public water supply, and exploration. Wells Listed with a NJDEP permit number are from the files of the Bureau of Water Allocation, Division of Water Resources, New Jersey Department of Environmental Protection. Wells without a NJDP permit

number are from Davis (1989) and noted in the table as "Pike " followed by an identification number that was used in the report. Location accuracy and discharge were unavailable for "Pike" wells. Additional wells listed as "soil borings" are from Cerenzio and Panaro, P. C. (written comun. 1991). Accuracy in plotting well locations is listed as S F, or T(100, 500, or 1000 feet of actual location). Locations are based on property maps, NJDEP atlas sheet coordinates, and driller's site maps. Key to driller's log for wells listed in Davis (1989); Qaoo - alluvium and Olean outwash, and Qoic - Olean ice-contact stratified sand and gravel.

Graphic from source map: Milford Quadrangle

National Hydrography Dataset (2018)

The formal citation for this source.

U.S. Geological Survey, 2018, USGS National Hydrography Dataset Best Resolution (NHD) for Hydrologic Unit (HU) 8: U.S. Geological Survey, scale 1:24,000 (*GRI Source Map ID 76278*).

Click here to learn more about and find links to download USGS National Hydrography data products.

New Jersey Landslides

The formal citation for this source.

Pallis, T., and Marzulli, W., 2006, Landslides in New Jersey: New Jersey Geological Survey, Digital Geodata Series DGS 06-3, scale 1:100,000 (*GRI Source Map ID 74874*).

Click here to access the complete New Jersey landslide dataset including metadata.

New Jersey Surficial Geology

The formal citation for this source.

Pristas, R. P., 2007, Surficial Geology of New Jersey: New Jersey Geological Survey, Digital Geodata Series DGS 07-2, scale 1:100,000 (*GRI Source Map ID 74858*).

Click here to access the complete New Jersey surficial geology dataset including metadata.

New York Geology, Lower Hudson Sheet

The formal citation for this source.

Cadwell, D.H., Connally, G.G., Dineen, R.J., Fleisher, P.J., Fuller, M.L., Sirkin, Les, and Wiles, G. C., 1999, Surficial Geologic Map of New York, Lower Hudson Sheet: New York State Museum, Map and Chart Series 40, scale 1:250,000 (*GRI Source Map ID 1574*).

Click here to access the complete New York Lower Hudson surficial geology dataset including metadata.

Newton West Quadrangle

The formal citation for this source.

> Witte, R.W., 2012, Quaternary Geology and Geologic Material Resources of the Newton West Quadrangle, Sussex and Warren Counties, New Jersey: New Jersey Geological Survey, Open-file Map OFM90, scale 1:24,000 (*GRI Source Map ID 75988*).

In addition to information contained in this document the published Quaternary Geology and Geologic Material Resources of the Newton West Quadrangle contains additional text, table and figures that might me useful in understanding the geology for this quadrangle.

Prominent graphics and text associated with this source.

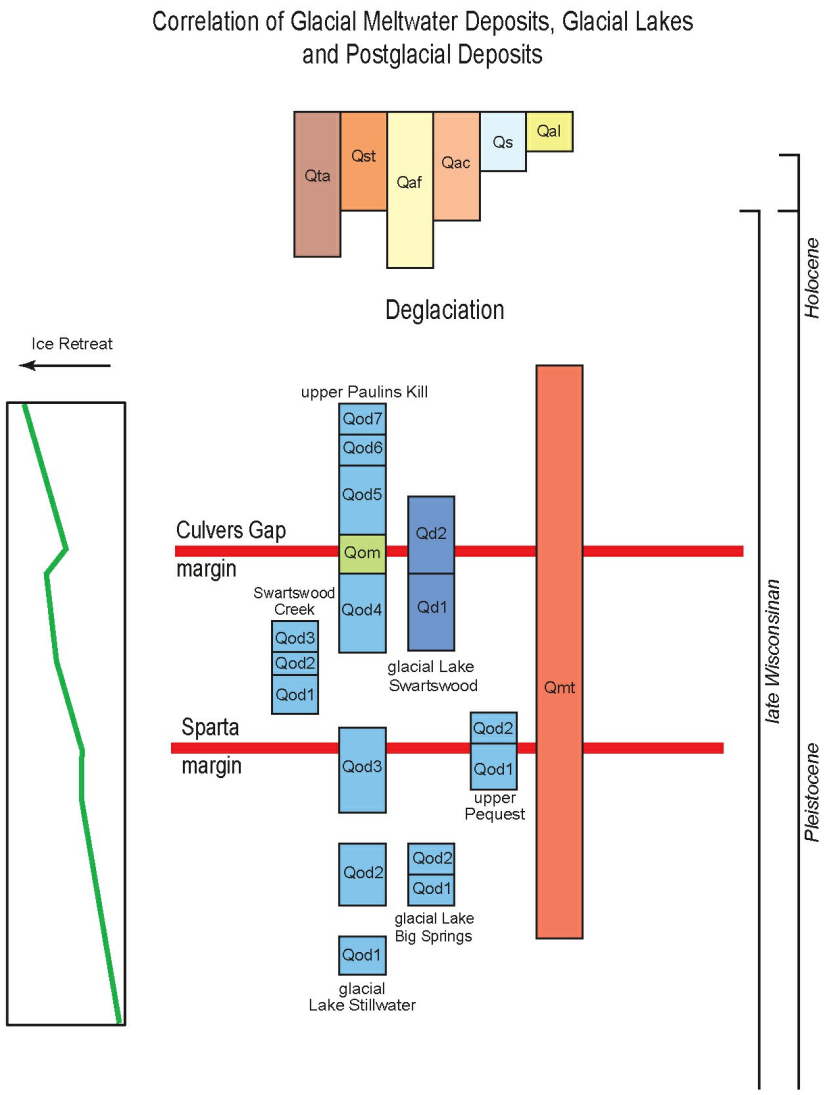
Introduction

Industrial, commercial, and residential expansion in New Jersey has promoted the increased use of surficial geologic data for 1) land-use planning, 2) identification, management and protection of ground water resources, 3) locating and developing sources of geologic aggregate, and 4) delineation of geologic hazards. Surficial deposits in Newton West quadrangle are lithologically diverse, cover much of the bedrock surface, and are found in many types of landscape settings. They include glacial drift of late Wisconsinan age, and alluvium, swamp and bog deposits, hillslope deposits, and wind-blown sediment laid down in postglacial time. Collectively, these deposits may be as much as 250 feet (87m) thick and they form the parent material on which soils form. They are defined by their lithic characteristics, stratigraphic position, and location on the landscape, and further delineated by genetic and morphologic criteria. Geologic history, detailed observations on surficial materials, and list of references are found in the accompanying booklet.

Description of Map Units
Map units denote unconsolidated deposits more than 5 feet (1.5m) thick. Color designations are based on Munsell Soil Color Charts (1975), and were determined from naturally moist samples.

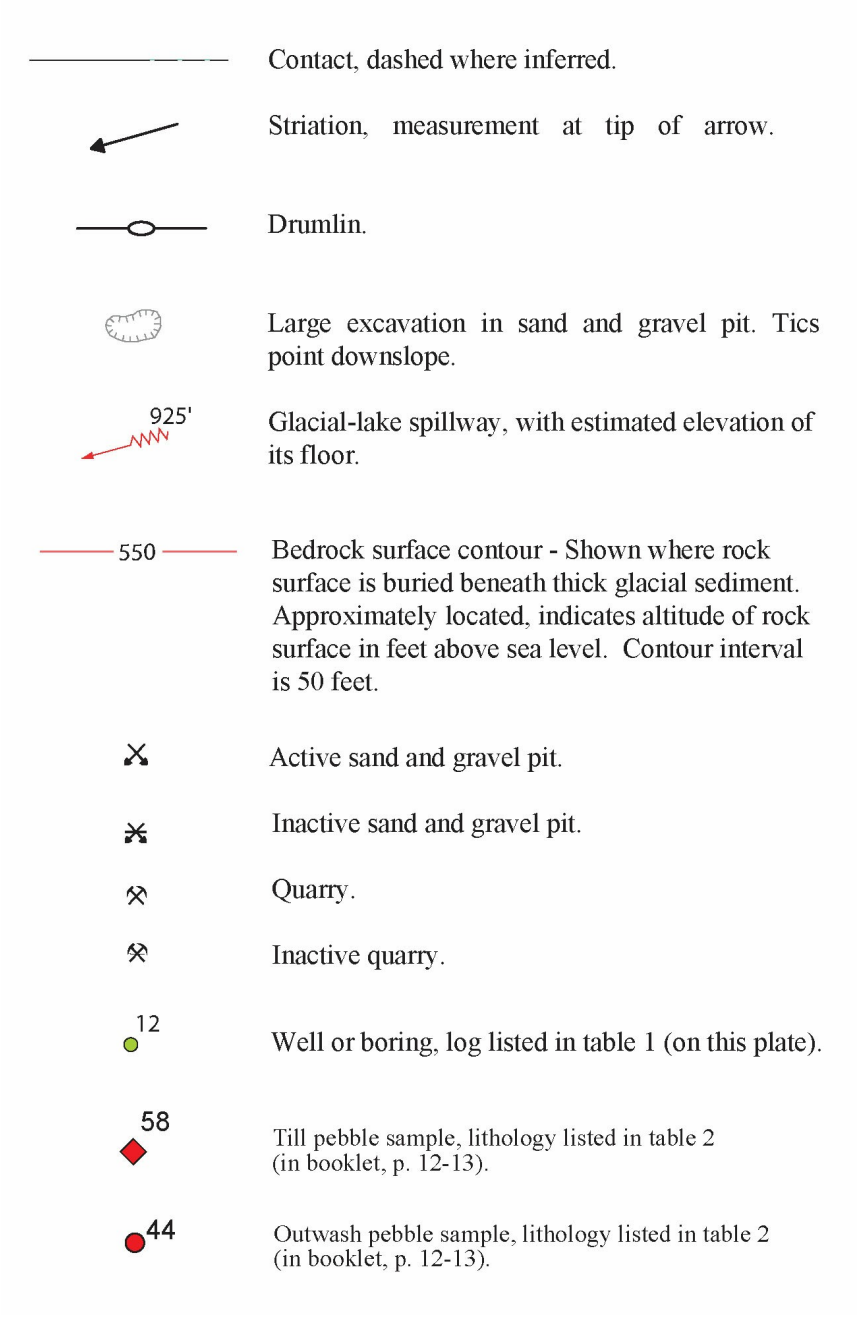
Text from source map: Newton West Quadrangle

Correlation of Map Units



Graphic from source map: Newton West Quadrangle

Explanation of Map Symbols



Graphic from source map: Newton West Quadrangle

Figure A - Photo of Topset Beds Over Foreset Beds in Ice-Contact Delta



Figure A. Delta topset beds (planar-bedded cobble-pebble gravel) over foreset beds (inclined beds of sand and pebbly sand) in an ice-contact delta, near Myrtle Grove. The horizontal contact between the units represents the former surface of a glacial lake. Reconstructed lake levels are used by geologists to help decipher glacial-lake and ice-retreat histories and measure isostatic rebound. Location of photograph shown on inset box and labeled on geologic map.

Graphic from source map: Newton West Quadrangle

Figure B - Photo of Swartswood Lake

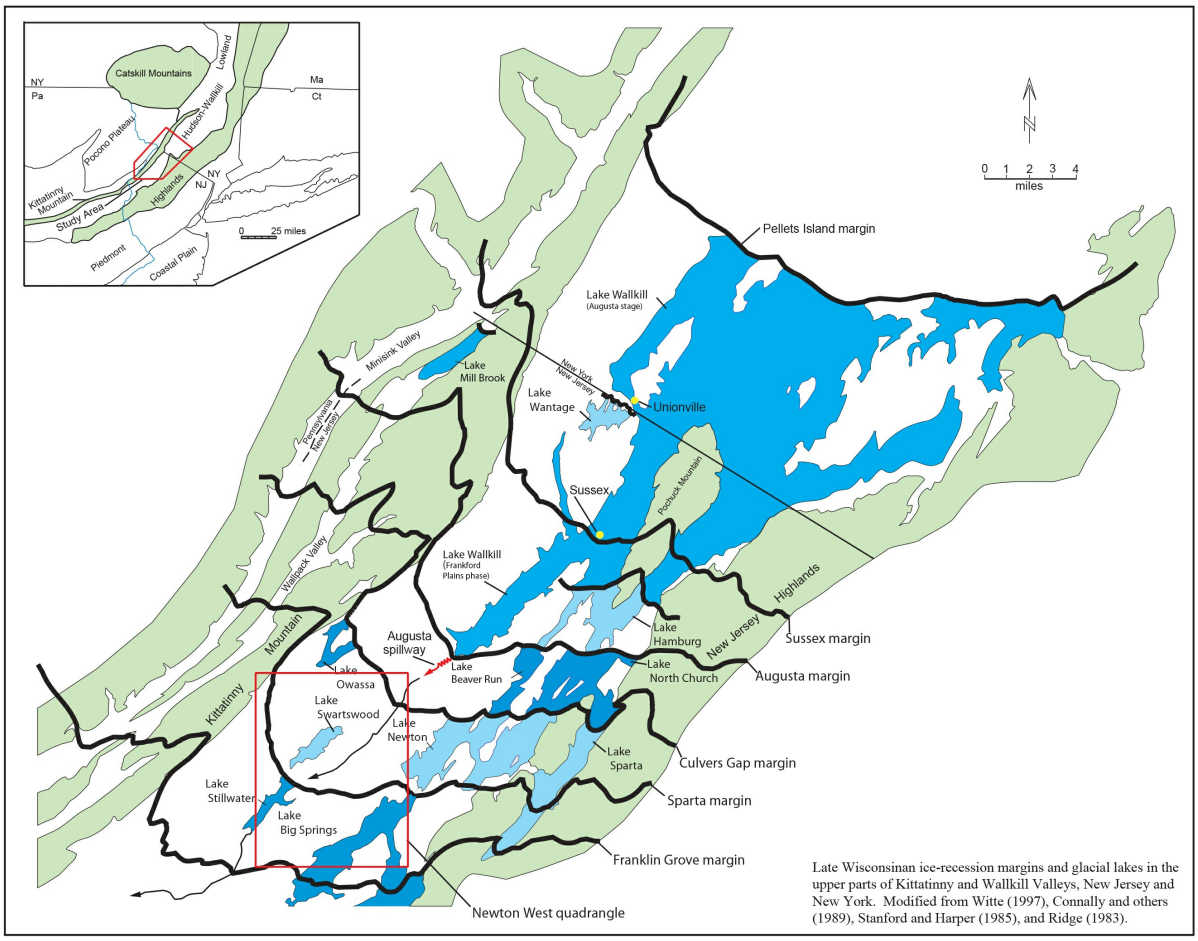


Figure B. Swartswood Lake looking northeast from its outlet. It is estimated that glacial lake Swartswood was as much as 30 feet higher than the modern lake. During the Late Wisconsinan glaciation, a thick plug of till at the lake's outlet blocked drainage in this south-draining tributary of the Paulins Kill. During deglaciation the glacial lake expanded along the retreating glacial margin eventually inundating an area that included Swartswood Lake and Little Swartswood Lake. Over time the till plug

was eroded by the lake's discharge, lowering lake level. Multiple levels of glacial deltas located along the lake's northern shoreline record this history. In modern time, a low dam was constructed at the lake's outlet to increase the lake's recreational value. Location of photograph shown on inset box and labeled on geologic map.

Graphic from source map: Newton West Quadrangle

Ice-Recession and Glacial Lakes



Graphic from source map: Newton West Quadrangle

Table 1 - Records of Wells

Well no.	NJDEP Permit	Location	Discharge in gallons per minute	Depth in feet	Driller's log
1	21-670	F	9	0-30 30-50 50-88 88-103 103-130	Clay and hardpan Hardpan Sand and gravel Clay Slate
2	21-2252	F	5	0-40 40-200 200-225	Sandy clay Clay and gravel slate
3	21-837	F	5	0-100 100-208 208-262	Clay and gravel Clay Slate
4	21-166	F	7	0-2 2-22 22-51 51-180 180-190	Clay Hardpan Gravel Clay Slate
5	21-703	F	7	0-15 15-53 53-120 120-147	Clay Clay and gravel Sand and gravel Slate
6	21-990	F	20	0-75 75-109 109-127 127-157 157-180	Clay and hardpan Clay and gravel Clay and sand Clay Slate
7	21-746	F	10	0-30 30-60 60-66 66-85	Clay and hardpan Sand and gravel Clay Slate
8	21-1209	F	5	0-30 30-96 96-155	Clay and gravel Clay and sand Slate
9	21-2859	F	3	0-108 108-280	Sand and gravel slate
10	21-568	F	na	0-20 20-93 93-101 101-106 106-116	Clay and gravel Sand and gravel Gravel Clay Slate
11	21-5055	S	50	0-60 60-90	Clay and boulders Some gravel
12	21-4084	F	3	0-50 50-131 131-166	Clay and gravel Sand and gravel Slate
13	21-4989	F	10	0-30 30-136 136-137 137-148	Overburden Blue shale Soft white and blue shale Blue shale
14	21-5060	F	5	0-140 140-250	Clay and gravel Lime rock
15	21-5622	F	10	0-180 180-200	Clay, gravel, and boulders Limestone
16	21-445	F	10	0-20 20-50 50-120 120-123	Clay Sand and clay Clay Gravel
17	21-5279	F	15	0-98 98-250	Clay and gravel Lime rock
18	21-704	F	10	0-35 35-72 72-82	Clay and hardpan Clay and gravel Limestone
19	21-1077	F	20	0-75 75-96 96-123	Clay and sand Clay Limestone
20	21-1297	F	15	0-105 105-130	Clay and gravel Limestone
21	21-929	F	12	0-80 80-108	Clay, sand, and hardpan Limestone
22	21-1386	F	na	0-52 52-70 70-100	Clay and gravel Clay Limestone
23	21-497	F	2	0-40 40-112	Sand Sand and gravel
24	21-637	F	5	0-53 53-68 68-75	Gravel Sand Gravel
25	21-924	F	20	0-22 22-46 46-61 61-73	Overburden Sand and clay Gravel and clay Limestone
26	21-5319	F	5	0-14 14-800	Overburden Limestone
27	21-4054	S	10	0-76 76-150	Clay and gravel Slate
28	21-4275	F	3	0-140 140-274	Sand, clay, and gravel Slate
29	21-994	S	8	0-51	Gravel
30	22-22596	S	15	0-35 35-175	Clay and gravel Limestone
31	22-21891	S	25	0-8 8-60 60-100	Gravel Sand Limestone
32	22-22313	F	10	0-10 10-355	Sand Limestone
33	22-3984	S	10	0-25 25-150 150-182	Hardpan and broken limestone Limestone Brown sandstone
34	22-21896	S	50	0-17 17-19 19-175	Overburden Boulder Limestone
35	22-18960	F	20	0-25 25-149	Overburden Limestone
36	21-5351	S	20	0-21 21-175	Clay overburden Slate
37	21-564	F	15	0-42	Gravel
38	21-2976	F	30	0-30 30-50 50-100	Clay and gravel Sand and gravel Slate
39	21-1171	F	15	0-34 34-60	Gravel and sand Limestone
40	21-284	F	10	0-11 11-89 89-94	Gravel Sandy loam Gravel
41	21-507	F	2	0-25 25-53 53-160	Gravel Clay Slate
42	21-1804	F	3	0-32 32-215	Clay Slate
43	21-4674	S	10	0-13 13-148	Clay and gravel Limestone
44	21-523	F	20	0-6 6-120 120-126	Gravel Clay Gravel
45	21-855	F	30	0-8 8-48 48-98 98-163 163-170	Gravel Sand and clay Clay and sand Clay Gravel
46	21-2882	F	na	0-10 10-50 50-65 65-75 75-130	Dirt and rock fill Soft silt Fine broken clean gravel Broken shale mixed with some silt Shale

Table 1. Records of water wells and exploration wells in the Newton West quadrangle. NJDEP permit numbers are from the files of the Bureau of Water Allocation and Well Permitting, New Jersey Department of Environmental Protection. Well locations are based on property tax maps or site maps supplied with the NJDEP well record. The letters “S” and “F” indicate that the well location shown on geologic map is accurate to 200 or 500 feet of actual location, respectively.

Graphic from source map: Newton West Quadrangle

Pike County Geology and Mineral Resources

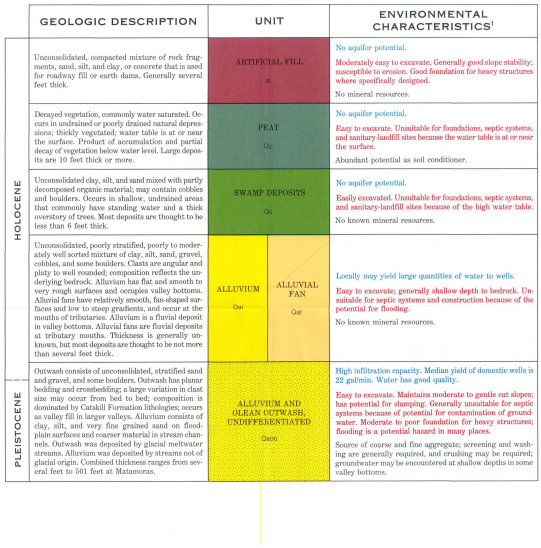
The formal citation for this source.

> Sevon, W.D., Berg, Thomas M., Schultz, Lane D., and Crowl, George H., 1989, Geology and Mineral Resources of Pike County, Pennsylvania; Pennsylvania Geological Survey, County Report C 52, 141p., plate 2 (Surficial Geologic Map), scale 1:50,000 (*GRI Source Map ID 4794*).

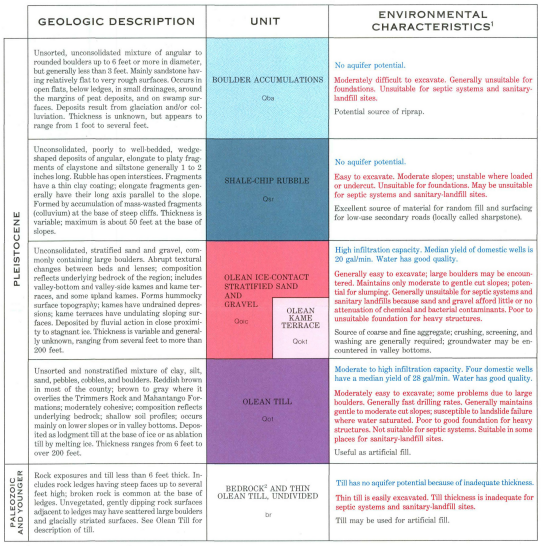
In addition to information contained in this document the published Geology and Mineral Resources of Pike County contains additional text, table and figures that might me useful in understanding the geology for this quadrangle.

Prominent graphics and text associated with this source.

Correlation of Map Units



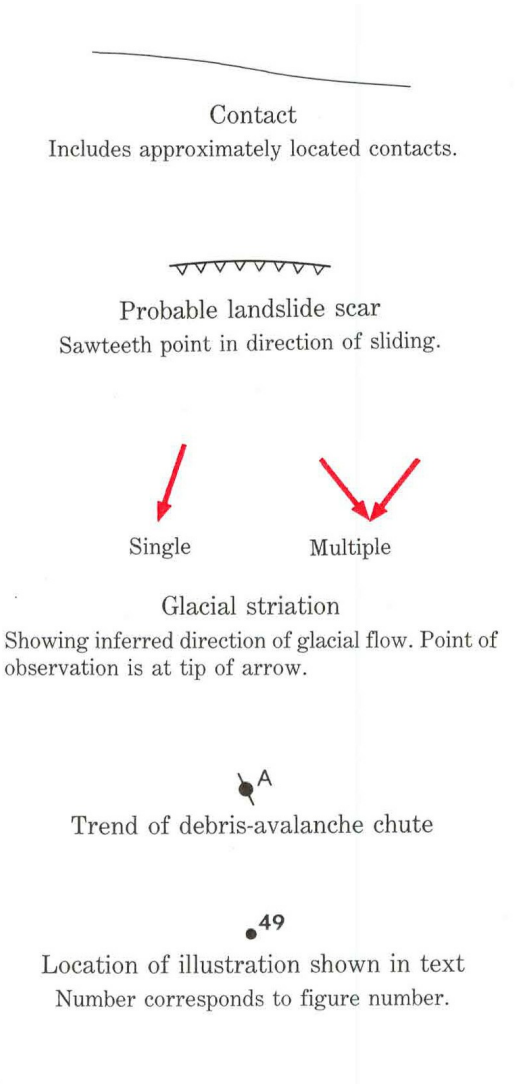
	GEOLOGIC DESCRIPTION	UNIT	ENVIRONMENTAL CHARACTERISTICS[1]
HOLOCENE	Unconsolidated, compacted mixture of rock fragments, sand, silt, and clay, or concrete that is used for roadway fill or earth dams. Generally several feet thick.	ARTIFICIAL FILL af	No aquifer potential. Moderately easy to excavate. Generally good slope stability; susceptible to erosion. Good foundation for heavy structures where specifically designed. No mineral resources.
	Decayed vegetation, commonly water saturated. Occurs in undrained or poorly drained natural depressions; thickly vegetated; water table is at or near the surface. Product of accumulation and partial decay of vegetation below water level. Large deposits are 10 feet thick or more.	PEAT Qp	No aquifer potential. Easy to excavate. Unsuitable for foundations, septic systems, and sanitary-landfill sites because the water table is at or near the surface. Abundant potential as soil conditioner.
	Unconsolidated clay, silt, and sand mixed with partly decomposed organic material; may contain cobbles and boulders. Occurs in shallow, undrained areas that commonly have standing water and a thick overstory of trees. Most deposits are thought to be less than 6 feet thick.	SWAMP DEPOSITS Qs	No aquifer potential. Easily excavated. Unsuitable for foundations, septic systems, and sanitary-landfill sites because of the high water table. No known mineral resources.
	Unconsolidated, poorly stratified, poorly to moderately well sorted mixture of clay, silt, sand, gravel, cobbles, and some boulders. Clasts are angular and platy to well rounded; composition reflects the underlying bedrock. Alluvium has flat and smooth to very rough surfaces and occupies valley bottoms. Alluvial fans have relatively smooth, fan-shaped surfaces and low to steep gradients, and occur at the mouths of tributaries. Alluvium is a fluvial deposit in valley bottoms. Alluvial fans are fluvial deposits at tributary mouths. Thickness is generally unknown, but most deposits are thought to be not more than several feet thick.	ALLUVIUM Qal / ALLUVIAL FAN Qaf	Locally may yield large quantities of water to wells. Easy to excavate; generally shallow depth to bedrock. Unsuitable for septic systems and construction because of the potential for flooding. No known mineral resources.
PLEISTOCENE	Outwash consists of unconsolidated, stratified sand and gravel, and some boulders. Outwash has planar bedding and crossbedding; a large variation in clast size may occur from bed to bed; composition is dominated by Catskill Formation lithologies; occurs as valley fill in larger valleys. Alluvium consists of clay, silt, and very fine grained sand on floodplain surfaces and coarser material in stream channels. Outwash was deposited by glacial meltwater streams. Alluvium was deposited by streams not of glacial origin. Combined thickness ranges from several feet to 501 feet at Matamoras.	ALLUVIUM AND OLEAN OUTWASH, UNDIFFERENTIATED Qaoo	High infiltration capacity. Median yield of domestic wells is 22 gal/min. Water has good quality. Easy to excavate. Maintains moderate to gentle cut slopes; has potential for slumping. Generally unsuitable for septic systems because of potential for contamination of groundwater. Moderate to poor foundation for heavy structures; flooding is a potential hazard in many places. Source of coarse and fine aggregate; screening and washing are generally required, and crushing may be required; groundwater may be encountered at shallow depths in some valley bottoms.



	GEOLOGIC DESCRIPTION	UNIT	ENVIRONMENTAL CHARACTERISTICS[1]
PLEISTOCENE	Unsorted, unconsolidated mixture of angular to rounded boulders up to 6 feet or more in diameter, but generally less than 3 feet. Mainly sandstone having relatively flat to very rough surfaces. Occurs in open flats, below ledges, in small drainages, around the margins of peat deposits, and on swamp surfaces. Deposits result from glaciation and/or colluviation. Thickness is unknown, but appears to range from 1 foot to several feet.	BOULDER ACCUMULATIONS Qba	No aquifer potential. Moderately difficult to excavate. Generally unsuitable for foundations. Unsuitable for septic systems and sanitary-landfill sites. Potential source of riprap.
	Unconsolidated, poorly to well-bedded, wedge-shaped deposits of angular, elongate to platy fragments of claystone and siltstone generally 1 to 2 inches long. Rubble has open interstices. Fragments have a thin clay coating; elongate fragments generally have their long axis parallel to the slope. Formed by accumulation of mass-wasted fragments (colluvium) at the base of steep cliffs. Thickness is variable; maximum is about 50 feet at the base of slopes.	SHALE-CHIP RUBBLE Qsr	No aquifer potential. Easy to excavate. Moderate slopes; unstable where loaded or undercut. Unsuitable for foundations. May be unsuitable for septic systems and sanitary-landfill sites. Excellent source of material for random fill and surfacing for low-use secondary roads (locally called sharpstone).
	Unconsolidated, stratified sand and gravel, commonly containing large boulders. Abrupt textural changes between beds and lenses; composition reflects underlying bedrock of the region; includes valley-bottom and valley-side kames and kame terraces, and some spland kames. Forms hummocky surface topography; kames have undrained depressions; kame terraces have undulating sloping surfaces. Deposited by fluvial action in close proximity to stagnant ice. Thickness is variable and generally unknown, ranging from several feet to more than 200 feet.	OLEAN ICE-CONTACT STRATIFIED SAND AND GRAVEL Qoic / OLEAN KAME TERRACE Qokt	High infiltration capacity. Median yield of domestic wells is 20 gal/min. Water has good quality. Generally easy to excavate; large boulders may be encountered. Maintains only moderate to gentle cut slopes; potential for slumping. Generally unsuitable for septic systems and sanitary landfills because sand and gravel afford little or no attenuation of chemical and bacterial contaminants. Poor to unsuitable foundation for heavy structures. Source of coarse and fine aggregate; crushing, screening, and washing are generally required; groundwater may be encountered in valley bottoms.
	Unsorted and nonstratified mixture of clay, silt, sand, pebbles, cobbles, and boulders. Reddish brown in most of the county; brown to gray where it overlies the Trimmers Rock and Mahantango Formations; moderately cohesive; composition reflects underlying bedrock; shallow soil profiles; occurs mainly on lower slopes or in valley bottoms. Deposited as lodgment till at the base of ice or as ablation till by melting ice. Thickness ranges from 6 feet to over 200 feet.	OLEAN TILL Qot	Moderate to high infiltration capacity. Four domestic wells have a median yield of 28 gal/min. Water has good quality. Moderately easy to excavate; some problems due to large boulders. Generally fast drilling rates. Generally maintains gentle to moderate cut slopes; susceptible to landslide failure where water saturated. Poor to good foundation for heavy structures. Not suitable for septic systems. Suitable in some places for sanitary-landfill sites. Useful as artificial fill.
PALEOZOIC AND YOUNGER	Rock exposures and till less than 6 feet thick. Includes rock ledges having steep faces up to several feet high; broken rock is common at the base of ledges. Unvegetated, gently dipping rock surfaces adjacent to ledges may have scattered large boulders and glacially striated surfaces. See Olean Till for description of till.	BEDROCK[2] AND THIN OLEAN TILL, UNDIVIDED br	Till has no aquifer potential because of inadequate thickness. Thin till is easily excavated. Till thickness is inadequate for septic systems and sanitary-landfill sites. Till may be used for artificial fill.

Graphic from source map: Pike County Geology and Mineral Resources

Map Legend

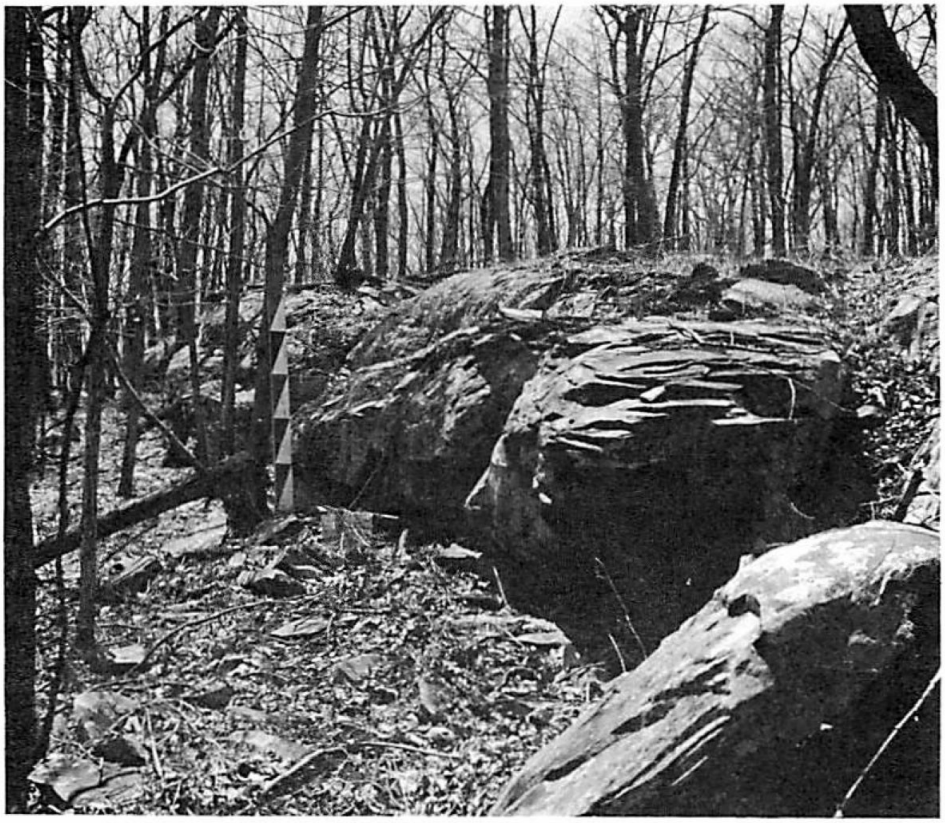


Graphic from source map: [Pike County Geology and Mineral Resources]

Report Figures

The following figures are referenced in the Geologic Observation Localities feature class of the GRI GIS data.

Figure 42



Ledge of sandstone in the Delaware River Member of the Catskill Formation having a small accumulation of boulder debris at its base. The ledge occurs about 2.2 miles south-southeast of Twelvemile Pond at 41°08'37 "N/75°04'49"W. The scale is divided in feet.

Graphic from source map: Pike County Geology and Mineral Resources

Figure 43



Olean Till overlying the striated surface of a sandstone in the Delaware River Member of the Catskill Formation. The till is less than 3 feet thick, and the area has been mapped as bedrock and thin Olean Till. The striae are oriented N23°E. The exposure is located 1.5 miles south-southeast of Gold Key Lake at 41°17'36"N/74°55'35"W. The scale is divided in inches and centimeters.

Graphic from source map: Pike County Geology and Mineral Resources

Figure 44



Ledge of sandstone in the Delaware River Member of the Catskill Formation and a large detached block. The width of the block is controlled by joints originally oriented N12°E. The ledge occurs along the south side of Snow Hill Road about 0.6 mile south of Twelvemile Pond at 41°10'05"N/ 75°05'38"W.

Graphic from source map: Pike County Geology and Mineral Resources

Figure 64



Rippled Olean ice-contact stratified sand exposed on the northeast bank of Rattlesnake Creek about 0.3 mile north-northwest of Sunrise Lake at 41°19'36"N/74°57'58'W. The scale is divided in 1-foot intervals.

Graphic from source map: Pike County Geology and Mineral Resources

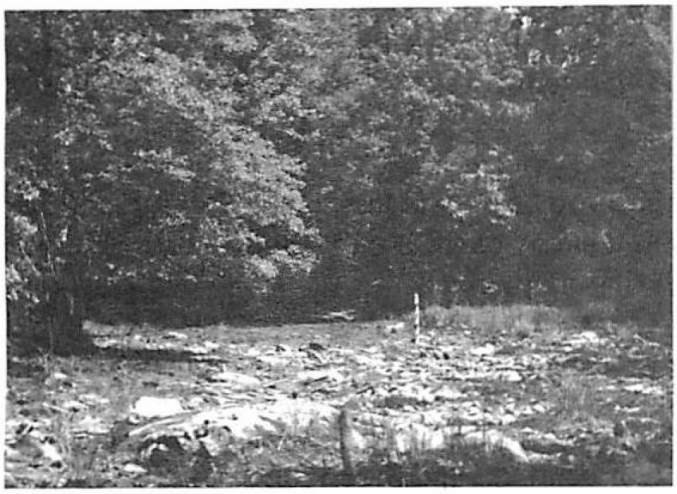
Figure 74



Accumulation of sandstone boulders occurring in a topographic low between adjacent slopes about 2.3 miles south-southeast of Twelvemile Pond at 41°08'42"N/ 75°04'15"W. The scale is divided in feet.

Graphic from source map: Pike County Geology and Mineral Resources

Figure 75



Accumulation of platy sandstone boulders occurring on a flat area about 1.7 miles southwest of McCartys Corner at 41°16'48"N/ 74°53'28"W. The scale is divided in feet.

Graphic from source map: Pike County Geology and Mineral Resources

Figure 78



Part of an accumulation of sandstone boulders occurring in a topographic low between adjacent slopes. The accumulation is mounded in the center and has intermittent streams along both sides. The stream course along the east side occurs just to the left of the scale, which is divided in feet. The accumulation is 2.4 miles south-southeast of Twelvemile Pond at 41°08'47"N/75°04'28"W.

Graphic from source map: Pike County Geology and Mineral Resources

Figure 80



Surface of a swamp deposit having skunk cabbage and other wet-area plants. Note the relative absence of boulders. The surface is usually damp, and has standing water only during the wetter parts of the year. The swamp is about 2.5 miles south of Twelvemile Pond at 41°08'51"N/75°04'12"W. The scale is divided in inches and 0.5-foot intervals.

Graphic from source map: Pike County Geology and Mineral Resources

Pike County Groundwater Resources

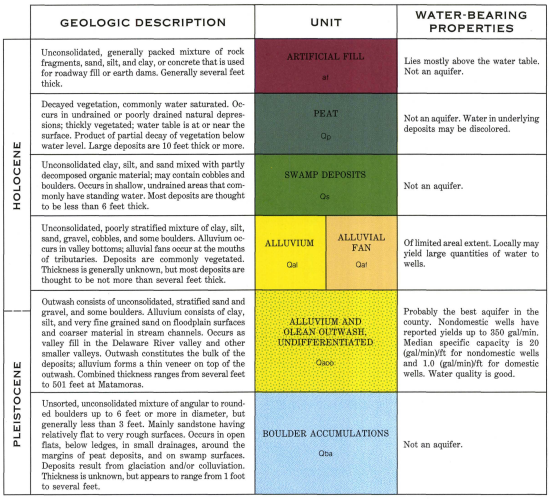
The formal citation for this source.

> Davis, Drew K., 1989, Groundwater Resources of Pike County, Pennsylvania: Pennsylvania Geological Survey, 4th ser., Water Resource Report 65, 63 p., plate 2 (Surficial Geologic Map), scale 1:50,000 (*GRI Source Map ID 5779*).

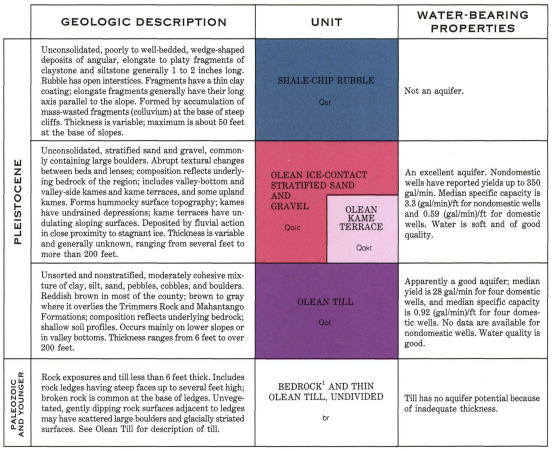
In addition to information contained in this document the published Groundwater Resources of Pike County contains additional text, table and figures that might me useful in understanding the geology for this quadrangle.

Prominent graphics and text associated with this source.

Correlation of Map Units



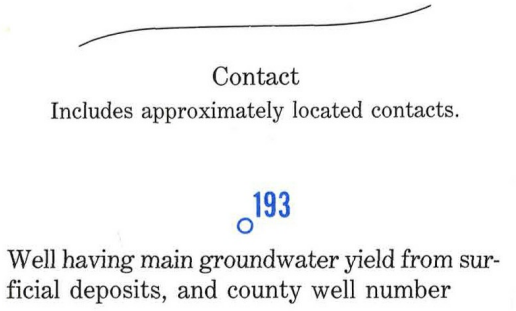
	GEOLOGIC DESCRIPTION	UNIT	WATER-BEARING PROPERTIES
HOLOCENE	Unconsolidated, generally packed mixture of rock fragments, sand, silt, and clay, or concrete that is used for roadway fill or earth dams. Generally several feet thick.	ARTIFICIAL FILL af	Lies mostly above the water table. Not an aquifer.
HOLOCENE	Decayed vegetation, commonly water saturated. Occurs in undrained or poorly drained natural depressions; thickly vegetated; water table is at or near the surface. Product of partial decay of vegetation below water level. Large deposits are 10 feet thick or more.	PEAT Qp	Not an aquifer. Water in underlying deposits may be discolored.
HOLOCENE	Unconsolidated clay, silt, and sand mixed with partly decomposed organic material; may contain cobbles and boulders. Occurs in shallow, undrained areas that commonly have standing water. Most deposits are thought to be less than 6 feet thick.	SWAMP DEPOSITS Qs	Not an aquifer.
HOLOCENE	Unconsolidated, poorly stratified mixture of clay, silt, sand, gravel, cobbles, and some boulders. Alluvium occurs in valley bottoms; alluvial fans occur at the mouths of tributaries. Deposits are commonly vegetated. Thickness is generally unknown, but most deposits are thought to be not more than several feet thick.	ALLUVIUM Qal / ALLUVIAL FAN Qaf	Of limited areal extent. Locally may yield large quantities of water to wells.
PLEISTOCENE	Outwash consists of unconsolidated, stratified sand and gravel, and some boulders. Alluvium consists of clay, silt, and very fine grained sand on floodplain surfaces and coarser material in stream channels. Occurs as valley fill in the Delaware River valley and other smaller valleys. Outwash constitutes the bulk of the deposits; alluvium forms a thin veneer on top of the outwash. Combined thickness ranges from several feet to 501 feet at Matamoras.	ALLUVIUM AND OLEAN OUTWASH, UNDIFFERENTIATED Qaco	Probably the best aquifer in the county. Nondomestic wells have reported yields up to 350 gal/min. Median specific capacity is 20 (gal/min)/ft for nondomestic wells and 1.0 (gal/min)/ft for domestic wells. Water quality is good.
PLEISTOCENE	Unsorted, unconsolidated mixture of angular to rounded boulders up to 6 feet or more in diameter, but generally less than 3 feet. Mainly sandstone having relatively flat to very rough surfaces. Occurs in open flats, below ledges, in small drainages, around the margins of peat deposits, and on swamp surfaces. Deposits result from glaciation and/or colluviation. Thickness is unknown, but appears to range from 1 foot to several feet.	BOULDER ACCUMULATIONS Qba	Not an aquifer.



	GEOLOGIC DESCRIPTION	UNIT	WATER-BEARING PROPERTIES
PLEISTOCENE	Unconsolidated, poorly to well-bedded, wedge-shaped deposits of angular, elongate to platy fragments of claystone and siltstone generally 1 to 2 inches long. Rubble has open interstices. Fragments have a thin clay coating; elongate fragments generally have their long axis parallel to the slope. Formed by accumulation of mass-wasted fragments (colluvium) at the base of steep cliffs. Thickness is variable; maximum is about 50 feet at the base of slopes.	SHALE-CHIP RUBBLE Qsr	Not an aquifer.
PLEISTOCENE	Unconsolidated, stratified sand and gravel, commonly containing large boulders. Abrupt textural changes between beds and lenses; composition reflects underlying bedrock of the region; includes valley-bottom and valley-side kames and kame terraces, and some upland kames. Forms hummocky surface topography; kames have undrained depressions; kame terraces have undulating sloping surfaces. Deposited by fluvial action in close proximity to stagnant ice. Thickness is variable and generally unknown, ranging from several feet to more than 200 feet.	OLEAN ICE-CONTACT STRATIFIED SAND AND GRAVEL Qoic / OLEAN KAME TERRACE Qokt	An excellent aquifer. Nondomestic wells have reported yields up to 350 gal/min. Median specific capacity is 3.3 (gal/min)/ft for nondomestic wells and 0.59 (gal/min)/ft for domestic wells. Water is soft and of good quality.
PLEISTOCENE	Unsorted and nonstratified, moderately cohesive mixture of clay, silt, sand, pebbles, cobbles, and boulders. Reddish brown in most of the county; brown to gray where it overlies the Trimmers Rock and Mahantango Formations; composition reflects underlying bedrock; shallow soil profiles. Occurs mainly on lower slopes or in valley bottoms. Thickness ranges from 6 feet to over 200 feet.	OLEAN TILL Qot	Apparently a good aquifer; median yield is 28 gal/min for four domestic wells, and median specific capacity is 0.92 (gal/min)/ft for four domestic wells. No data are available for nondomestic wells. Water quality is good.
PALEOZOIC AND YOUNGER	Rock exposures and till less than 6 feet thick. Includes rock ledges having steep faces up to several feet high; broken rock is common at the base of ledges. Unvegetated, gently dipping rock surfaces adjacent to ledges may have scattered large boulders and glacially striated surfaces. See Olean Till for description of till.	BEDROCK[1] AND THIN OLEAN TILL, UNDIVIDED br	Till has no aquifer potential because of inadequate thickness.

Graphic from source map: Pike County Groundwater Resources

Map Legend



Graphic from source map: Pike County Groundwater Resources

Port Jervis South Quadrangle

The formal citation for this source.

> Witte, R.W., 2013, Surficial Geologic Map of the Port Jervis South Quadrangle, Sussex County, New Jersey, and Pike County, Pennsylvania: New Jersey Geological Survey, Open-file Map OFM 99, scale 1:24,000 (*GRI Source Map ID 76281*).

In addition to information contained in this document the published Surficial Geologic Map of the Port Jervis South Quadrangle contains additional text, table and figures that might me useful in understanding the geology for this quadrangle.

Prominent graphics and text associated with this source.

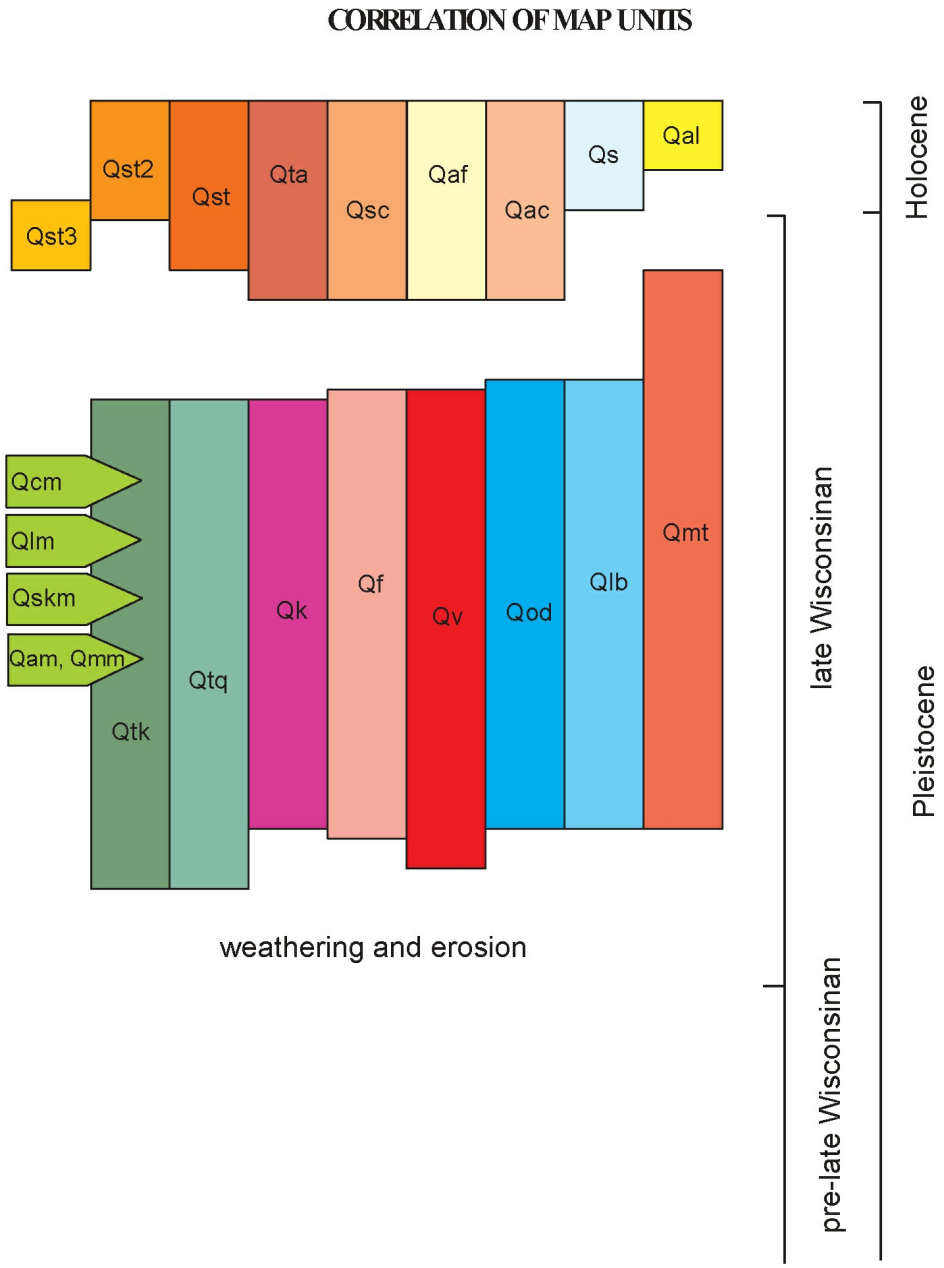
Introduction

Industrial, commercial, and residential expansion in New Jersey has promoted the increased use of surficial geologic data for land-use planning, for identification, management, and protection of groundwater resources, siting of solid-waste-disposal sites, locating and developing sources of geologic aggregate, and delineation of geologic hazards. Surficial deposits in the Port Jervis South quadrangle are lithologically diverse, cover most of the bedrock surface, and occur in many types of landscape settings. They include glacial drift of late Wisconsinan age, and alluvium, swamp and bog deposits, hillslope deposits, and wind-blown sediment laid down in postglacial time. Collectively, these deposits may be as much as 340 feet (104m) thick and they form the parent material on which soils form. They are defined by their lithic characteristics, stratigraphic position, location, and further delineated by genetic and morphologic criteria. Geologic history, detailed observations on surficial materials, and a list of references are in the accompanying booklet.

Description of Map Units
Map units denote unconsolidated deposits more than 5 feet (1.5m) thick. Color designations are based on Munsell Soil Color Charts (1975), and were determined from naturally moist samples.

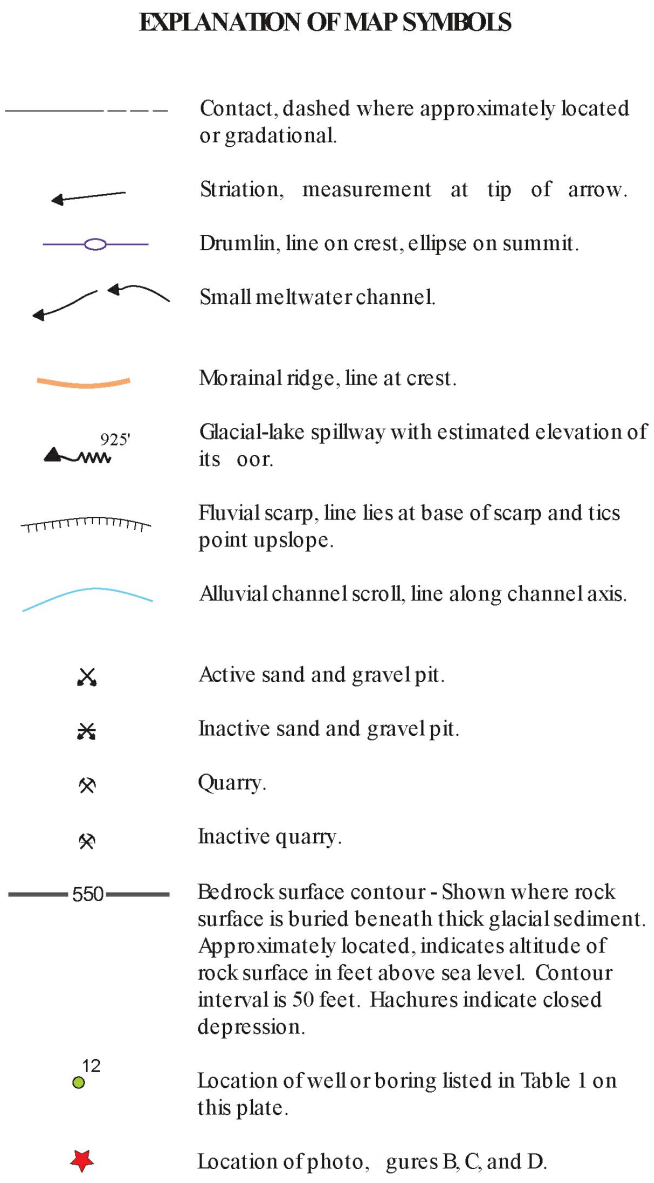
Text from source map: Port Jervis South Quadrangle

Correlation of Map Units



Graphic from source map: Port Jervis South Quadrangle

Explanation of Map Symbols



Graphic from source map: Port Jervis South Quadrangle

Figure A - Color-Shaded Relief Map of Port Jervis South Quadrangle

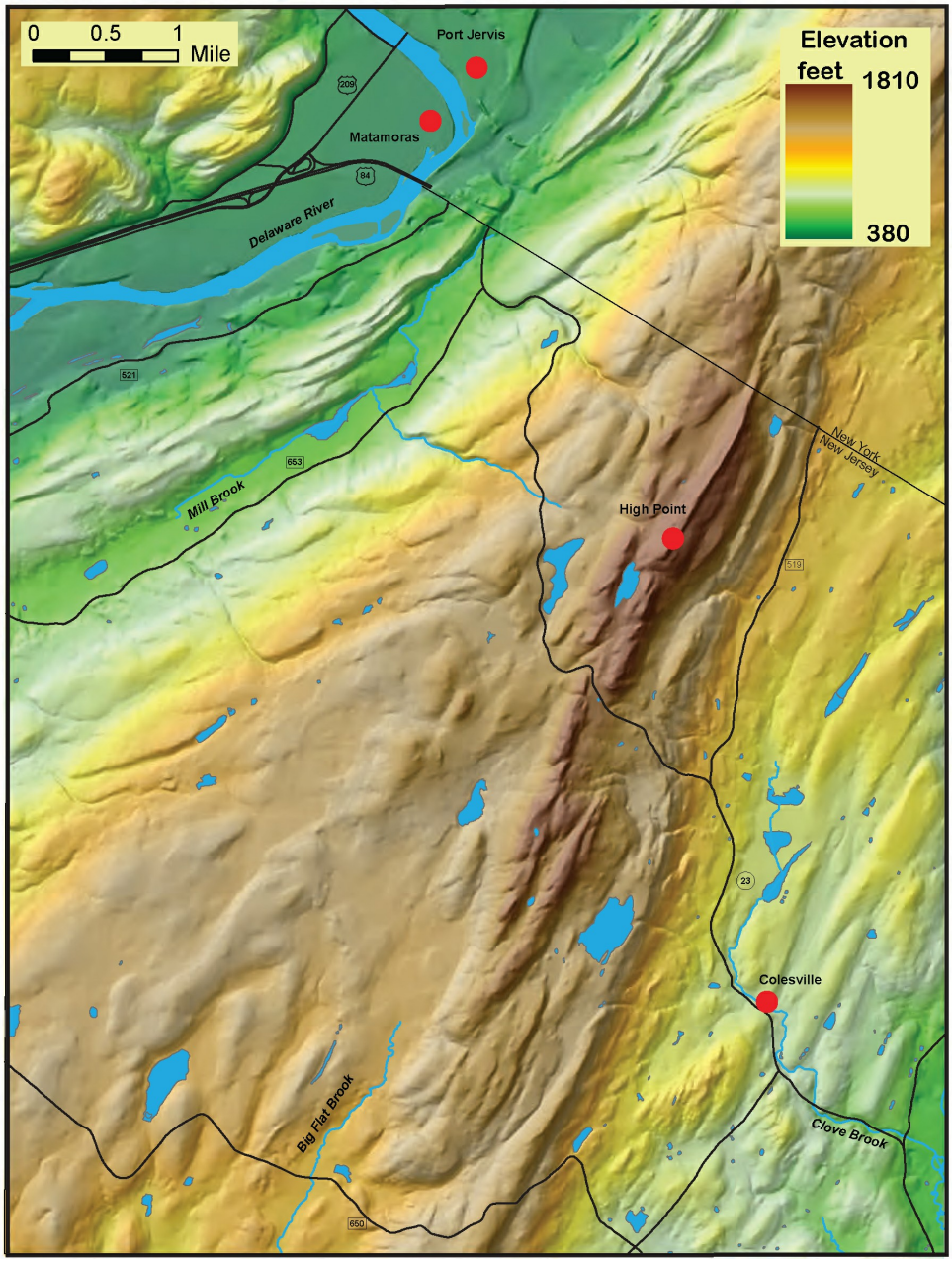


Figure A. Color-shaded relief map of the Port Jervis South quadrangle.

Graphic from source map: Port Jervis South Quadrangle

Figure B - Photo of Our Swamp



Figure B. "Our Swamp", High Point State Park, Sussex County, New Jersey. Formerly a shallow glacial lake dammed behind the Montague recessional moraine (Qmm).

Graphic from source map: Port Jervis South Quadrangle

Figure C - Photo of Brown Quartzite-Rich Till



Figure C. Brown quartzite-rich till overlying reddish-brown red sandstone rich till exposed along the face

of a small slump located along the upper reach of Clove Brook, High Point State Park, Sussex County, New Jersey. The reddish-brown till, largely derived from the Bloomsburg Red Beds, represents a more southerly flow across Kittatinny Mountain. The brown till, largely derived from the Shawangunk Formation, represents a southwesterly to westerly flow. This change in till provenance is consistent other indicators of ice flow (drumlins, striae, erratic dispersal) that show a more regional southerly flow superceded by a southwesterly to westerly flow during deglaciation.

Graphic from source map: Port Jervis South Quadrangle

Figure D- Photo of Vista from High Point Monument

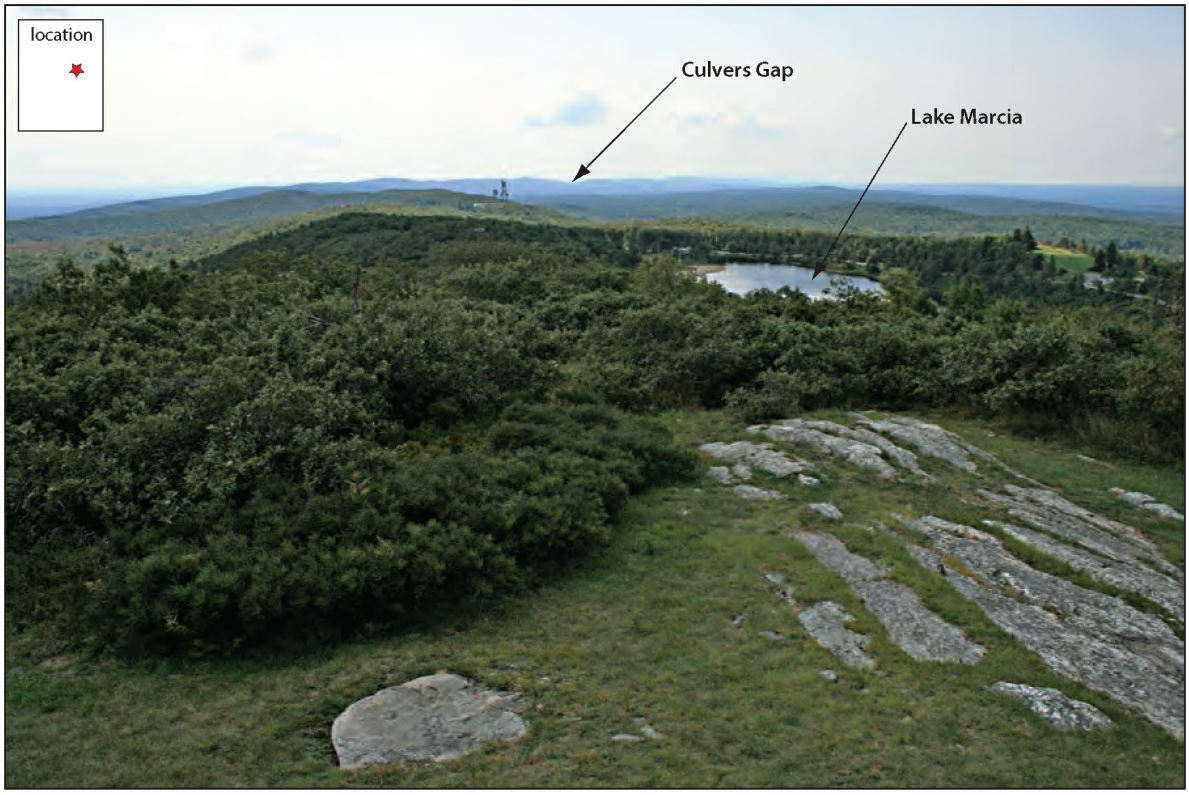


Figure D. Vista from High Point Monument, High Point State Park, Sussex County, New Jersey looking southwestward along the curving ridgeline of Kittatinny Mountain. The small notch along the ridge's midline is Culvers Gap, a wind gap cut by the ancestral Raritan or Delaware Rivers millions of years ago and prior to the onset of continental glaciation in North America.

Graphic from source map: Port Jervis South Quadrangle

Table 1 - Records of Selected Wells

well number	NJDEP permit number	Location code	Discharge in gpm	Depth in feet	Driller's log
1	22-24721	S	20	0-90 90-150	sand, clay, and gravel overburden slate
2	22-13450	S	3	0-84 cd 84-495	sand and gravel overburden slate
3	22-23096	S	2	0-77 77-500	clay and gravel overburden slate
4	22-13057	S	2	0-72 cd 72-224	sand and gravel overburden slate
5	22-7322	F	8	0-31 cd 31-80	clay and gravel overburden slate
6	22-21125	F	3	0-8 8-175	clay overburden slate
7	22-25812	S	20	0-35 35-110	sand, clay, and gravel overburden slate
8	22-11599	S	5	0-51 51-186	casing depth slate
9	22-22422	S	6	0-30 30-247	clay and gravel overburden slate
10	22-19214	S	25	0-55 55-230	clay and gravel overburden slate
11	22-20326	F	15	0-15 15-131	clay and boulders shale
12	22-15966	S	3	0-57 57-280	casing depth slate
13	22-23541	S	2	0-10 10-350	clay overburden slate
14	22-15554	S	2	0-7 7-98	overburden shale
15	22-24202	S	25	0-176 176-275	sand, clay, and gravel overburden slate
16	22-24203	S	4	0-180 180-325	sand, clay, and gravel overburden slate
17	22-7887	F	2	0-21	casing depth
18	22-13972	F	1	0-22 22-500	casing depth slate
19	22-14074	S	6	0-54 cd 54-62	overburden shale
20	22-16408	F	18	0-22 22-70	casing depth slate
21	22-26177	S	none recorded	0-7 7-300	overburden shale
22	22-7869	F	8	0-20 cd 20-260	clay and gravel overburden slate
23	22-25023	S	5	0-12 12-322	clay and overburden shale
24	22-7360	F	12	0-67 cd 67-68	clay and gravel overburden slate
25	22-11705	F	3	0-30 cd 30-298	sand and gravel overburden slate
26	22-10298	F	20	0-21 cd 21-283	sand and gravel overburden slate
27	22-8410	F	18	0-23 cd 23-95	clay and gravel overburden slate
28	22-23488	S	8	0-28 28-95	clay and gravel overburden lime rock
29	22-20814	S	50	0-45 45-55 55-62	sand gravel shale
30	22-20944	S	6	0-100 100-188	sand shale
31	22-20945	S	15	0-92 92-145	sand shale
32	22-22169	S	20	0-32 32-125	sand limestone
33	22-25507	S	8	0-31 31-300	sand, clay, and gravel overburden slate
34	22-7271	F	30	0-65 cd 65-80	clay and gravel overburden limestone rock
35	22-21936	S	100	0-21 21-65 65-175	gravel and sand sand shale
36	22-25562	S	2	0-45 45-330	sandy loam and some gravel shale
37	22-24853	S	40	0-15 15-125	sandy loam black rock
38	22-12491	S	40	0-90 cd 90-122	sand and gravel overburden slate
39	22-26974	S	30	0-60 60-125	sand, clay, and gravel overburden slate
40	22-26054	S	20	0-90 90-150	sand, clay, and gravel overburden limestone
41	22-25422	S	30	0-69 69-225	sand, clay, and gravel overburden limestone
42	22-25824	S	8	0-110 110-160	sand, clay, and gravel overburden slate
43	22-19308	S	8	0-15 15-35 35-45 45-130	gravel and boulders sand and gravel boulders sand and gravel
44	22-18711	S	12	0-20 20-65 65-85 85-123	sand, clay, and water gray silt clay limestone
45	22-20584	S	30	0-105 105-200	sand and gravel overburden slate
46	22-21070	S	30	0-70 70-135	clay and gravel overburden slate
47	22-18713	S	20	0-20 20-50 50-80 80-146	large gravel and sand silt clay slate
48	22-24637	S	40	0-80 80-150	sand, clay, and gravel overburden red shale
49	22-21520	S	20	0-20 20-89 89-123	sand, gravel, clay, and boulders sand, gravel, and clay red rock
50	22-23324	S	15	0-136 136-275	clay and gravel overburden red slate
51	22-16232	S	2	0-15 15-50 50-80 80-100 100-135 135-141 141-148	gravel, clay, and water sand and boulders clay and sand hardpan with gravel hard-packed clay with gravel hardpan with water hardpan with gravel
52	22-25736	S	none recorded	0-15 15-186	overburden red rock
53	22-22215	S	3	0-50 50-64	clay and gravel overburden red slate
54	22-25491	S	30	0-51 51-125	sand, clay, and gravel overburden slate
55	22-24096	S	30	0-79 79-125	overburden limestone
56	22-23822	S	20	0-10 10-41 41-125	overburden boulders rock
57	22-13946	F	60	0-84	gravel
58	22-21871	S	12	0-10 10-105	overburden limestone
59	22-24573	S	12	0-12 12-125	loam red rock
60	22-25921	S	3	0-23 23-300	sand, clay, and gravel overburden slate
61	22-24488	S	4	0-61 61-275	sand, clay, and gravel overburden red slate
62	Pike - 223			0-84	alluvium and glacial outwash
63	Pike - 83			0-69	alluvium and glacial outwash
64	Pike - 13			0-68	alluvium and glacial outwash
65	Pike - 226			0-115	ice-contact stratified drift

Table 1. Records of selected wells in the Port Jervis South quadrangle, Sussex County, New Jersey, and Pike County, Pennsylvania. The listed wells were drilled for private and public-water supply, and exploration. Wells listed with a NJDEP permit number are from the files of the Bureau of Water Allocation, Division of Water Resources, New Jersey Department of Environmental Protection. If the NJDEP permit number is not listed the well record is from Davis (1989) and noted in the table as "Pike" followed by an identification number that was used in the report. A few geologic records were compiled

from New Jersey Geological Survey Permanent Notes, on file at the New Jersey Geological and Water Survey, PO Box 420, Trenton, New Jersey 08625. The location of wells listed with NJDEP permit number are based on property maps, and are generally accurate to 200 feet (S) and 500 feet (F) of their actual location. "cd" indicates thickness of unconsolidated material is based on casing length.

Graphic from source map: Port Jervis South Quadrangle

Stroudsburg Quadrangle

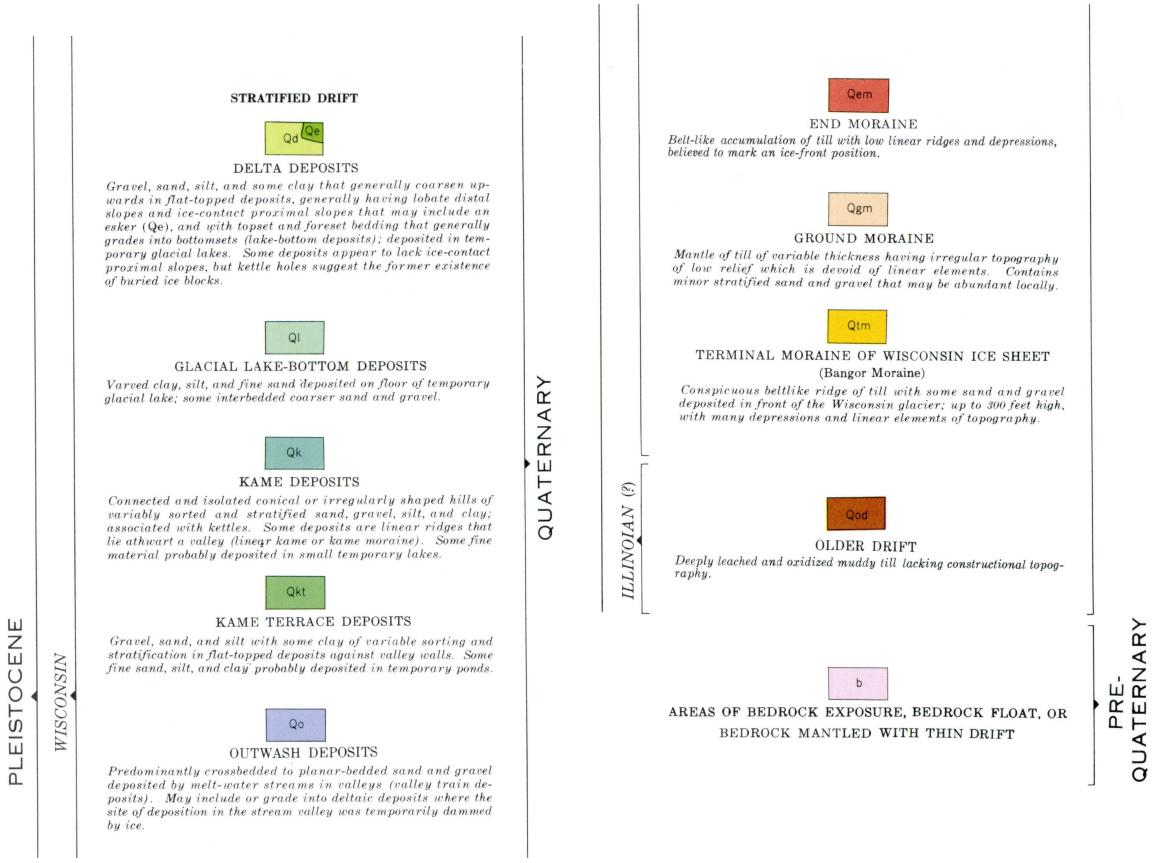
The formal citation for this source.

> Epstein, J.B., 1969, Surficial Geology of the Stroudsburg Quadrangle, Pennsylvania and New Jersey: Pennsylvania Geological Survey, General Geology Report 57, scale 1:24,000 (*GRI Source Map ID 2367*).

In addition to information contained in this document the published Surficial Geology of the Stroudsburg Quadrangle contains additional text, table and figures that might me useful in understanding the geology for this quadrangle.

Prominent graphics and text associated with this source.

Correlation of Map Units



Graphic from source map: Stroudsburg Quadrangle

Map Legend



Contact
Dashed where transitional or approximately located.



Scarp between similar deposits of different age
Line is at base of scarp, hachure points toward older deposits.
Dashed where approximately located.



Limit of Wisconsin ice-contact drift
Dashed where approximately located.



Glacial grooves and striae
Indicates inferred direction of glacial flow. Point of observation is at tip of arrow.



Melt-water channel



Inferred position of active or stagnant ice front during deglaciation phase
Number is keyed to phases of deglaciation described in text.



Erratic
Maximum diameter generally greater than 10 feet.



Sand and gravel pit

Thickness of drift, in feet



Thickness of drift reported in water well, in feet



Sample locality



Station locations along U.S. Route 209 described in figure 6



Graphic from source map: Stroudsburg Quadrangle

GRI Digital Data Credits

This document was developed and completed by Kajsa Holland-Goon and Lucas Chappell (Colorado State University) for the NPS Geologic Resources Division (GRD) Geologic Resources Inventory (GRI) Program. Quality control of this document by James Chappell and Stephanie O'Meara (Colorado State University).

The information in this document was compiled from GRI source maps, and is intended to accompany the digital surficial geologic-GIS maps and other digital data for Delaware Water Gap National Recreation Area, Pennsylvania, New Jersey and New York (DEWA) developed by James Chappell, Jake Suri, Stephanie O'Meara and James Winter (see the GRI Digital Maps and Source Map Citations section of this document for all sources used by the GRI in the completion of this document and related GRI digital surficial geologic-GIS maps).

GRI finalization by James Chappell and Stephanie O'Meara (Colorado State University).

GRI program coordination and scoping provided by Bruce Heise, Jason Kenworthy and Tim Connors (NPS GRD, Lakewood, Colorado).