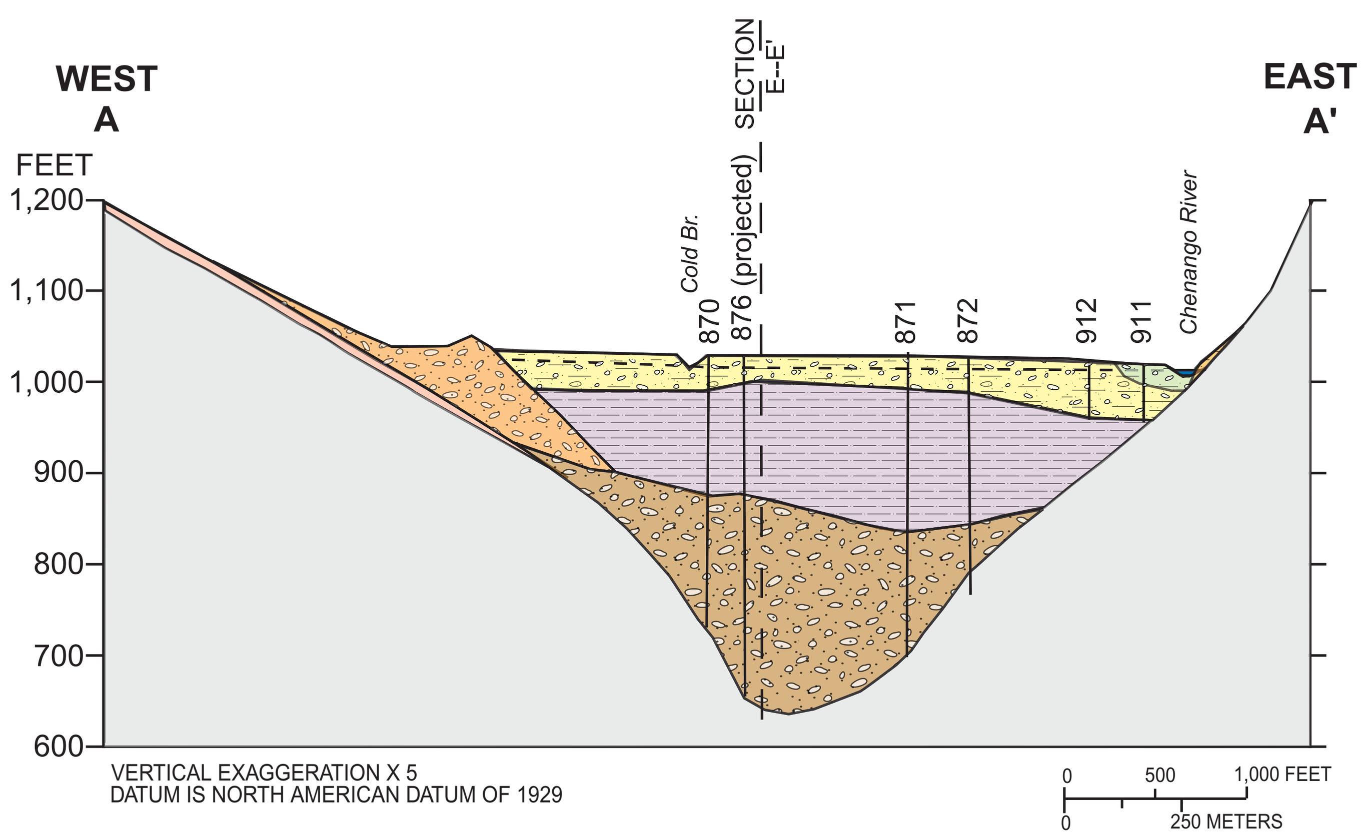
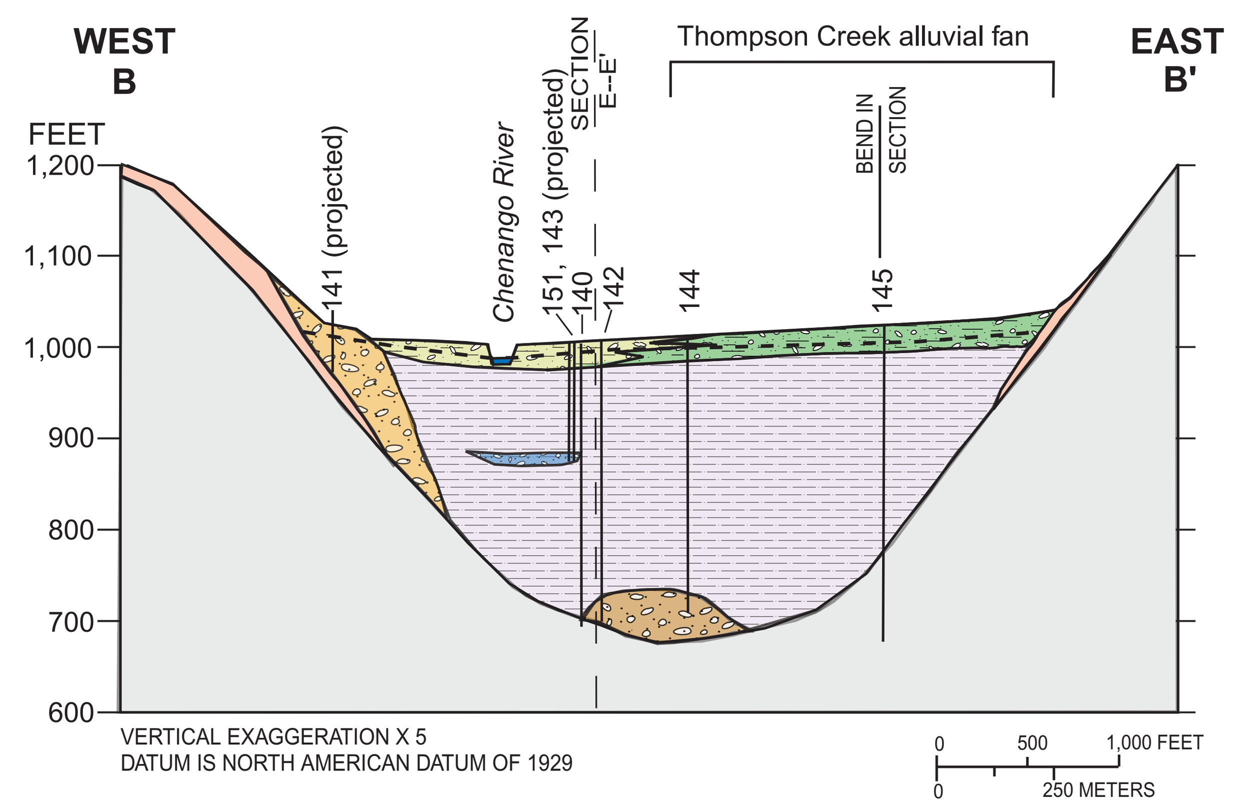
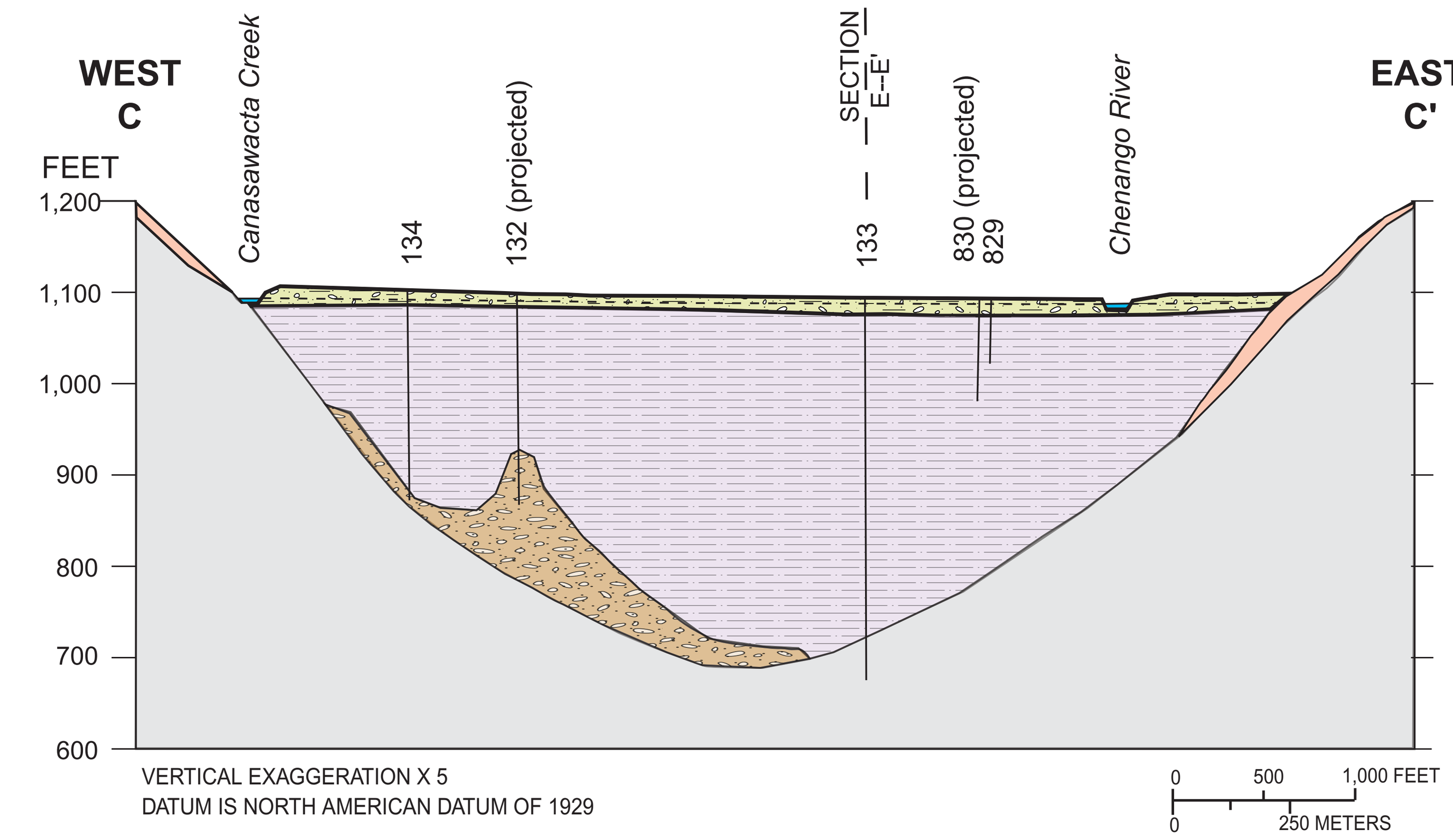
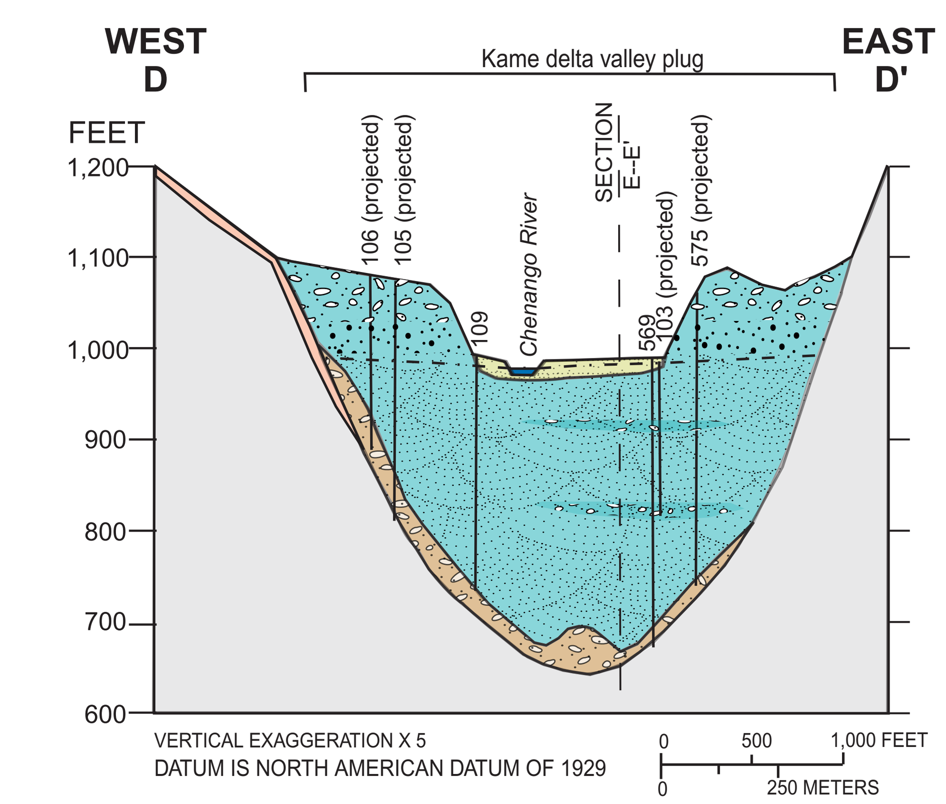
Kari K. Hetcher, Todd S. Miller, James D. Garry, and Richard J. Reynolds
Geohydrology of the Valley-Fill Aquifer in the Norwich-Oxford-Brisben Area, Chenango County, New York:
U.S. Geological Survey, Open-File Report 03-242, 7 plates, 1:24,000 scale.









GENERALIZED GEOHYDROLOGIC SECTIONS

Geologic logs from well and test borings and surficial geology maps were used to construct the five geohydrologic sections showing aquifer thickness, stratigraphic relations among valley-fill deposits, and the water table in the unconfined aquifers. Only the northern part of the study area had sufficient data for construction of geohydrologic sections. The lines of these sections are shown on plates 3, 5, and 6.

Section A-A' (North Norwich)

Most of the subsurface data in this area are from test drilling at a pharmaceutical company. The well data indicate that the thickest outwash and alluvium (as much as 58 ft) in the study area are in the eastern part of the valley at North Norwich and have a saturated thickness of as much as 50 ft. The outwash deposits in the middle part of the valley are thinner (typically 15 to 30 ft thick) and saturated thickness ranges from 10 to 20 ft. The saturated thickness may increase near the west valley wall, where kame-terrace deposits 20 to 80 ft thick might extend to bedrock; however, the data from this area are insufficient to accurately delineate this unit. A glaciolacustrine unit consisting of mostly clay in the central part of the valley underlies the outwash and alluvial deposits and is as much as 160 ft thick. This unit overlies basal kame deposits of sand and gravel, which form a confined aquifer. The basal confined aquifer is highly variable in thickness, extent, and degree of sorting. Several wells in the central and east-central part of section A-A' penetrate this aquifer, which is more than 200 ft thick but consists mostly of silty gravel with some well-sorted zones.

Data from along the west side of the valley were insufficient to indicate the degree of hydraulic connection between the kame-terrace deposits along the west valley wall and the basal confined aquifer in the central part of the valley. The similarity of hydraulic heads in the confined aquifer to those in the unconfined aquifer indicates that the two units may be hydraulically connected.

Section B-B' (about 1 mi north of the city of Norwich)

Most of the subsurface data from this area are from test drilling at a pharmaceutical company and a chemical company. The geohydrologic setting is similar to that shown in section A-A' near North Norwich, with a few minor differences. The alluvial flood-plain deposits of the Chenango River on the western part of the valley floor, and the alluvial-fan deposits of Thompson Creek in the eastern part of the valley, form a thin, unconfined aquifer that is typically less than 25 ft thick, with a saturated thickness of about 10 ft in most places. The saturated thickness may increase near the west valley wall, where kame-terrace deposits 20 to 100 ft thick presumably extend to bedrock. The data from this area are insufficient to delineate this unit, however. These kame deposits probably become increasingly confined by glaciolacustrine material with distance from the valley wall.

A fine-grained glaciolacustrine unit as much as 30 ft thick in the central part of the valley underlies the alluvial deposits. It consists mostly of clay but contains a small sand and gravel lens in the west-central part of the valley. Two wells (CN 143 and CN 151) are finished in this sand and gravel lens at depths between 130 and 150 ft below land surface. The glaciolacustrine unit also confines a basal sand and gravel aquifer.

The confined basal sand and gravel aquifer is highly variable in thickness and extent and appears to be mostly limited to the central and deepest part of the valley. Wells near the deepest part of the valley did not penetrate the basal aquifer and are finished in bedrock. As in section A-A', the similarity of hydraulic heads in the confined aquifers to those in the unconfined aquifer indicate that the two units may be hydraulically connected in some places.

Section C-C' (southern part of the city of Norwich)

No kame deposits are exposed above the valley floor in this area, and the unconfined aquifer consists entirely of alluvial sediment deposited by Canasawacta Creek in the western part of the valley and by the Chenango River in the eastern part. The alluvial deposits are typically 15 to 25 ft thick and have a saturated thickness of 5 to 15 ft. A massive glaciolacustrine unit that consists mostly of clay occupies most of the valley and is as much as 350 ft thick in the central part. This unit underlies the unconfined aquifer and confines a basal sand and gravel aquifer in the western part of the valley; elsewhere it overlies bedrock. The thickness of the confined aquifer is unknown because no well fully penetrates this unit.

Section D-D' (halfway between Norwich and Oxford)

This relatively narrow segment of the valley contains a long, thin deposit of alluvium in the center of the valley that overlies, and is bordered laterally by, a kame delta that plugs the entire valley. This plug dammed meltwater from the front of the retreating glacier and resulted in the formation of a deep proglacial lake that filled with fine-grained glaciolacustrine sediment (sections A-A', B-B', and C-C'). The kame delta is capped by cobbly sand and gravel several tens of feet thick and becomes increasingly fine-grained with depth; its lower parts consist mostly of fine- to medium-grained sand with some sand and gravel lenses. The deltaic sediments are as much as 300 ft thick in the central part of the valley and overlie basal sand and gravel that appears to be extensive and overlies bedrock across the valley. Wells drilled in this segment of the valley are finished in either the sand and gravel zones within the deltaic deposits or in the basal sand and gravel.

Section E-E' (north-south longitudinal section in line with thalweg of the Chenango River valley)

This section depicts part of a morphological sequence, which Koteff and Pessl (1981) define as a body of stratified drift laid down by meltwater, layer by layer, at and beyond the margin of the glacier, in successive stages. The depositional environments of morphological sequences (fluvial, lacustrine, or both) are controlled by a base level (for fluvial environments) or a spillway (for lake environments), which may be a bedrock high point in a valley or a moraine or delta that plugs a valley. The base level in section E-E' is the point where there was a stillstand of the ice front about 4 mi south of Norwich, where its sediment-laden meltwater deposited a kame delta (consisting of mostly sand with some gravel zones) that plugs this relatively narrow segment of the valley. The northward retreat of the ice front from the delta that dammed the valley 4 mi south of Norwich allowed the valley segment between the ice front and the delta to fill with meltwater and become a lake. The lake level was controlled by an outlet on the delta. The lake expanded northward in the path of the retreating ice front as far as the next major stillstand, which is marked by a kame moraine across the Chenango River valley and the northern end of a morphological sequence about 1 mi north of North Norwich, just beyond the northern boundary of the study area (not shown).

The subglacial meltwater flow system consisted of several conduits (ice tunnels) through which large amounts of sand and gravel were transported and deposited. Meltwater flowing through the subglacial tunnel system probably discharged at the base of the ice into the proglacial lake, where it formed beds of coarse-grained deposits (sand and gravel) at the point of discharge, and finer grained lake-bottom deposits (fine sand, silt, and clay) farther out in the lake. The melting of the conduits left a sinuous, possibly discontinuous, esker of sand and gravel on the bedrock, mostly in the central (deepest) part of the valley.

The lake remained after the ice front had retreated from the study area; therefore, continuous settling of fine-grained particles from suspension (mostly silt and clay) eventually resulted in the accumulation of thick lake-bottom sediment that is as much as 300 ft thick. The period of lacustrine deposition ended when the lake became filled with sediment and(or) the lake outlet became lowered by erosion and allowed the lake to drain. The valley has undergone fluvial deposition and reworking of valley-fill deposits since the lake drained. Deposition by recent streams has left a layer of alluvial material that is typically 20 to 30 ft thick over the valley floor and locally thicker where upland tributaries have deposited alluvial fans at the edges of the valley.

REFERENCES CITED

Koteff, Carl, and Pessl, Fred, Jr., 1981, Systematic ice retreat in New England: U.S. Geological Survey Professional Paper 1179, 20 p.

EXPLANATION

QUATERNARY PERIOD

HOLOCENE

- ALLUVIAL FAN – stratified sand,silt, and gravel deposited where a stream undergoes an abrupt decrease in slope at transition from uplands onto valley flats
- ALLUVIAL FLOOD-PLAIN AND CHANNEL DEPOSITS – stratified sand and gravel with silt deposited by postglacial streams in flood plains and channels
- SWAMP DEPOSITS – silt, organic muck, and peat

PLEISTOCENE

- OUTWASH – well-sorted sand and gravel deposited by meltwater streams
- GLACIOLACUSTRINE DEPOSITS – stratified fine sand, silt, and clay deposited in a proglacial lake
- KAME DELTA – coarse sand and gravel (topset beds) in upper part, grades with depth to pebbly sand (foreset beds) then to fine to medium sand with some layers of sand and gravel; deposited by meltwater at the edge of a proglacial lake. Often extends toward center of the valley. Deltaic deposits form a valley plug 4 miles south of Norwich.
- KAME DEPOSITS – hummocks of poorly to well-sorted silt, sand, and gravel deposited by streams on top of or alongside glacial ice.
- SUBGLACIAL MELTWATER DEPOSITS – poorly sorted silt, sand, and gravel
- UNDIFFERENTIATED SAND AND GRAVEL – origin uncertain
- TILL – poorly sorted clay, silt, sand, cobbles, and boulders

DEVONIAN

- BEDROCK – shale and siltstone

141 WELL – number assigned by USGS; prefix CN for Chenango County is omitted.

GENERALIZED WATER TABLE ALTITUDE IN UNCONFINED AQUIFER

Locations of geohydrologic sections are depicted in plates 3, 5, and 6

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Plate 7 - Geohydrologic Sections

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