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Hydrogeology of the Stratified-Drift Aquifers in the Cayuta Creek and Catatonk Creek Valleys in Parts of Tompkins, Schuyler, Chemung, and Tioga Counties, New York

Scientific Investigations Report 2012–5127

U.S. Department of the Interior
U.S. Geological Survey

Cover. Upper left—U.S. Geological Survey long-term monitoring well TI 891 (site number 421213076313301) near Spencer, New York
Lower Right—A typical field set up of a horizontal-to-vertical (H/V) ambient-noise seismic survey.

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By Todd S. Miller and Lacey M. Pitman

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KEN SALAZAR, Secretary

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Conversion Factors, Datums, and Abbreviations

Multiply	By	To obtain
	Length	
inch (in.)	2.54	centimeter (cm)
inch (in.)	25.4	millimeter (mm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
	Volume	
gallon (gal)	3.785	liter (L)
gallon (gal)	0.003785	cubic meter (m^3)
	Flow rate	
gallon per minute (gal/min)	0.06309	liter per second (L/s)
inch per year (in/yr)	25.4	millimeter per year (mm/yr)

Temperature in degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) as follows:

$$°F=(1.8×°C)+32$$

Temperature in degrees Fahrenheit (°F) may be converted to degrees Celsius (°C) as follows:

$$°C=(°F–32)/1.8$$

Vertical coordinate information is referenced to the North American Vertical Datum of 1988 (NAVD 88).

Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83).

Altitude, as used in this report, refers to distance above the vertical datum.

List of Acronyms

H/V	horizontal-to-vertical
LIDAR	light detection and ranging
NYSDEC	New York State Department of Environmental Conservation
SSURGO	Soil Survey Geographic Database
USGS	U.S. Geological Survey

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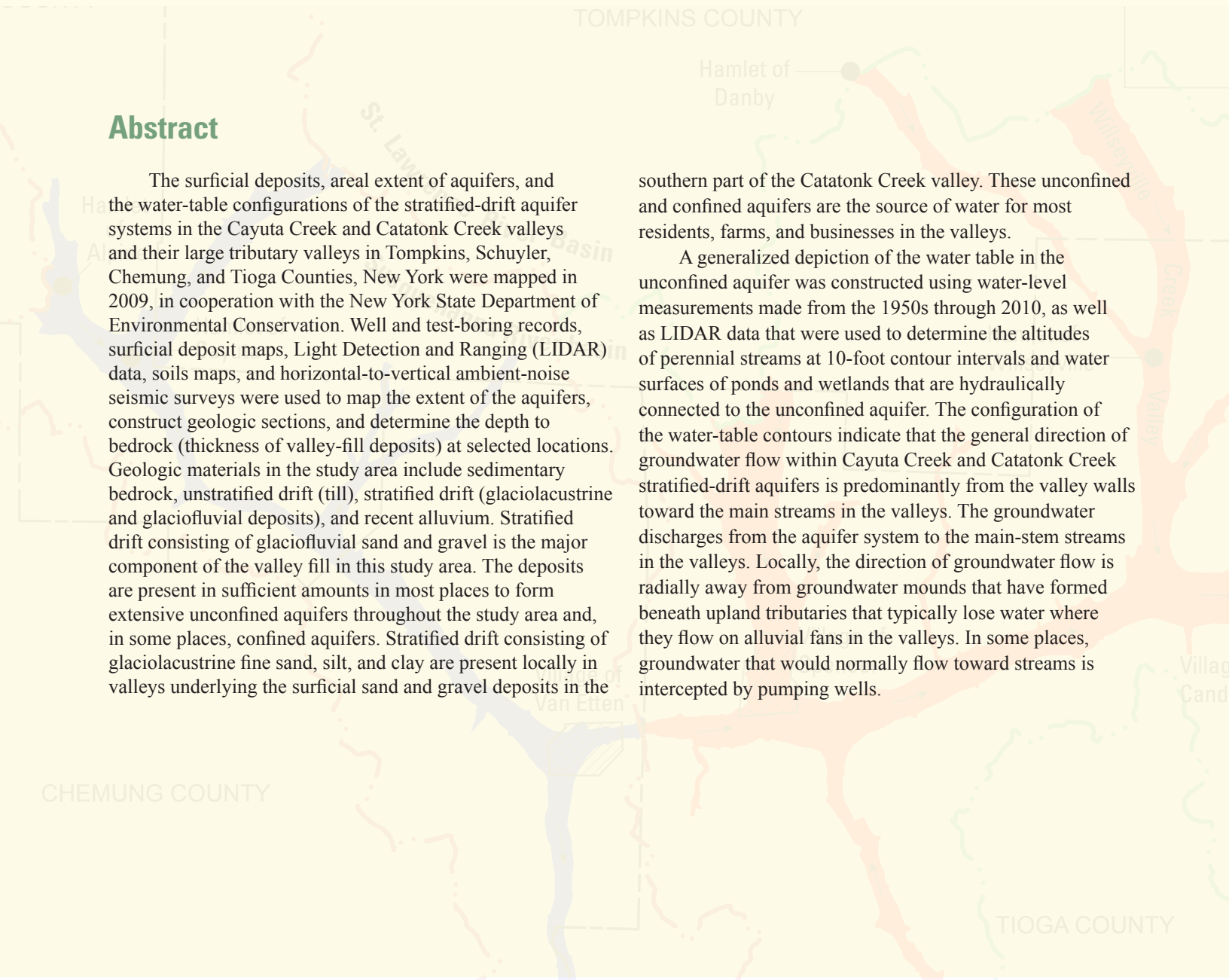


Abstract

The surficial deposits, areal extent of aquifers, and the water-table configurations of the stratified-drift aquifer systems in the Cayuta Creek and Catatonk Creek valleys and their large tributary valleys in Tompkins, Schuyler, Chemung, and Tioga Counties, New York were mapped in 2009, in cooperation with the New York State Department of Environmental Conservation. Well and test-boring records, surficial deposit maps, Light Detection and Ranging (LIDAR) data, soils maps, and horizontal-to-vertical ambient-noise seismic surveys were used to map the extent of the aquifers, construct geologic sections, and determine the depth to bedrock (thickness of valley-fill deposits) at selected locations. Geologic materials in the study area include sedimentary bedrock, unstratified drift (till), stratified drift (glaciolacustrine and glaciofluvial deposits), and recent alluvium. Stratified drift consisting of glaciofluvial sand and gravel is the major component of the valley fill in this study area. The deposits are present in sufficient amounts in most places to form extensive unconfined aquifers throughout the study area and, in some places, confined aquifers. Stratified drift consisting of glaciolacustrine fine sand, silt, and clay are present locally in valleys underlying the surficial sand and gravel deposits in the southern part of the Catatonk Creek valley. These unconfined and confined aquifers are the source of water for most residents, farms, and businesses in the valleys.

A generalized depiction of the water table in the unconfined aquifer was constructed using water-level measurements made from the 1950s through 2010, as well as LIDAR data that were used to determine the altitudes of perennial streams at 10-foot contour intervals and water surfaces of ponds and wetlands that are hydraulically connected to the unconfined aquifer. The configuration of the water-table contours indicate that the general direction of groundwater flow within Cayuta Creek and Catatonk Creek stratified-drift aquifers is predominantly from the valley walls toward the main streams in the valleys. The groundwater discharges from the aquifer system to the main-stem streams in the valleys. Locally, the direction of groundwater flow is radially away from groundwater mounds that have formed beneath upland tributaries that typically lose water where they flow on alluvial fans in the valleys. In some places, groundwater that would normally flow toward streams is intercepted by pumping wells.

Introduction

In 2009, the U.S. Geological Survey (USGS), in cooperation with the New York State Department of Environmental Conservation (NYSDEC), began an appraisal of the straitified-drift aquifers in the Cayuta Creek and Catatonk Creek valleys in Tompkins, Schuyler, Chemung, and Tioga Counties, New York (fig. 1). This study is a continuation of a series of hydrogeologic appraisals done in cooperation with the NYSDEC. These reports provide a foundation for wellhead protection programs, water-resource management and planning decisions, and groundwater remediation activites in upstate New York. In addition, horizontal drilling and hydraulic-fracturing techniques have made the Marcellus Shale and Utica Shale gas-play areas (see inset map, fig. 1) an exploitable natural gas resource in the Northeast. Gas development in New York State will initially focus in the southern part in central New York, which is underlain by the Marcellus Shale and Utica Shale gas-play areas. State, county, municipal, and other governmental agencies are requesting hydrogeologic information that will help decision makers evaluate the potential effects of gas drilling and hydraulic fracturing operations on aquifers that supply potable water. Stratified-drift aquifers, which are the major sources of potable groundwater in New York, therefore need to be delineated and their basic hydrogeologic characteristics defined.

The 27-mile (mi)-long Cayuta Creek valley and the 23-mi-long Catatonk Creek valley lie within the north-central part of the glaciated Appalachian Plateau in central New York (fig. 2). Cayuta Creek flows generally southward and enters the Susquehanna River at the Village of Waverly (fig. 1). Catatonk Creek initially flows southward from its headwaters to Spencer, then it flows eastward-northeastward from Spencer to Candor, where it then flows southeastward to the confluence with Owego Creek, which flows 2 mi southward before joining the Susquehanna River (fig. 1).

The valleys are surrounded by rounded hills of moderately high relief ranging from 300 to 700 feet (ft) above the valley floor. The preglacial valleys that were oriented along the primary direction of glacier movement (north to south), such as Catatonk Creek valley north of the Village of Spencer, Cayuta Creek valley near the hamlets of Alpine and Cayuta, and Willseyville Creek valley north of the Village of Candor (fig. 1), were widened extensively and deepened by flowing ice and subglacial meltwater. Erosion by ice truncated bedrock hillsides (spurs) resulting in nearly straight, U-shaped bedrock troughs. The Finger Lakes in central New York are examples of bedrock troughs that are common along the northern rim of the Appalachian Plateau (fig. 2), and many of these troughs extend southward from the Finger Lakes to the northern rim of the plateau (fig. 2). Clayton (1965) referred to these Finger Lakes valleys as “intrusive troughs” that were carved when ice that flowed south from the Ontario Lowlands (fig. 2) encountered a landmass of higher altitude. Glacial meltwaters and post-glacial streams deposited large amounts of stratified drift in the main valleys. The stratified drift composed of coarse-grained sediments (sand and gravel) formed extensive aquifers in the Cayuta Creek and Catatonk Creek valleys (fig. 1). These stratified-drift aquifers provide sources of water for most residents, farms, and businesses in the valleys.

Purpose and Scope

This report summarizes the hydrogeology of the straitified-drift aquifers in the Cayuta Creek and Catatonk Creek valleys in Tompkins, Schuyler, Chemung, and Tioga Counties, New York. Maps were constructed that depict aquifer extent, aquifer types, locations of wells and horizontal-to-vertical (H/V) ambient-noise seismic surveys, surficial deposits, and water-table configurations. The extents of stratified-drift aquifers, and locations of wells, test borings, and seismic-surveys are shown in plate 1. The types of surficial deposits and lines of geologic sections are shown in plate 2. The water-table configuration is shown in plate 3. Geologic sections are shown in figures and a table of well data is included in an appendix.

Data Sources and Methods

Regional-scale surficial-deposit maps by Muller and Cadwell (1986, scale 1:250,000) and R.S. Tarr (in Williams and others, 1909, scale 1:62,500) were modified for this study to construct a detailed surficial-deposits map at a scale of 1:24,000 using field mapping; and interpretations of topographic maps, soil maps (SSURGO digital soil-survey data; U.S. Department of Agriculture, 2008), and orthophotos. In addition, subsurface data including well- and test-drilling records and H/V ambient-noise seismic surveys (a geophysical method that was used to estimate the thickness of sediments over bedrock) were collected at 50 sites (plate 1). The H/V ambient-noise seismic method uses a single, broadband three-component seismometer to record ambient seismic noise. The ratio of the averaged H/V frequency spectrum is used to determine the fundamental site resonance frequency, which can be interpreted using regression equations to estimate sediment thickness and depth to bedrock (Lane and others, 2008).

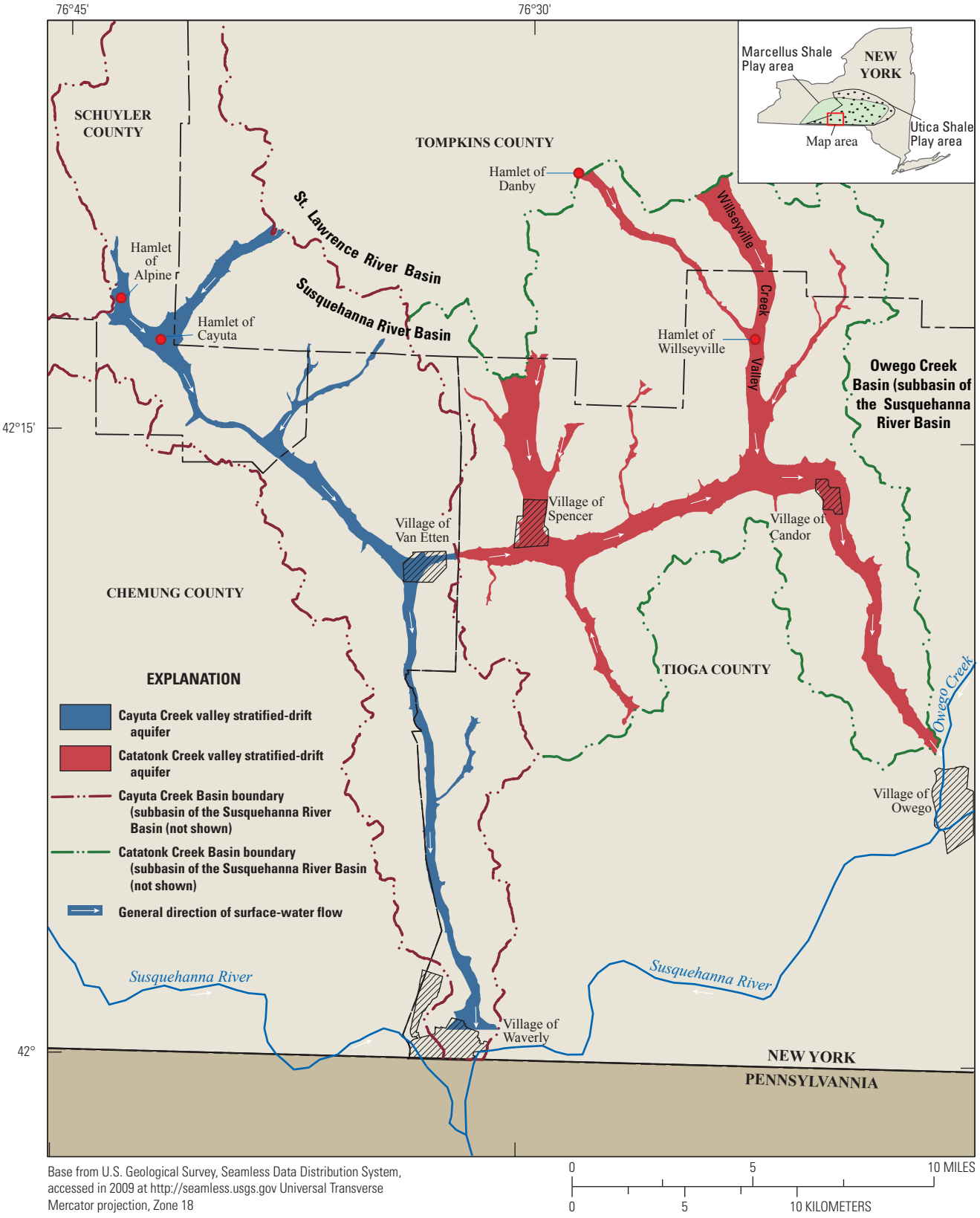


Figure 1. Location of Cayuta Creek and Catatonk Creek stratified-drift aquifers in parts of Tompkins, Schuyler, Chemung, and Tioga Counties, New York.

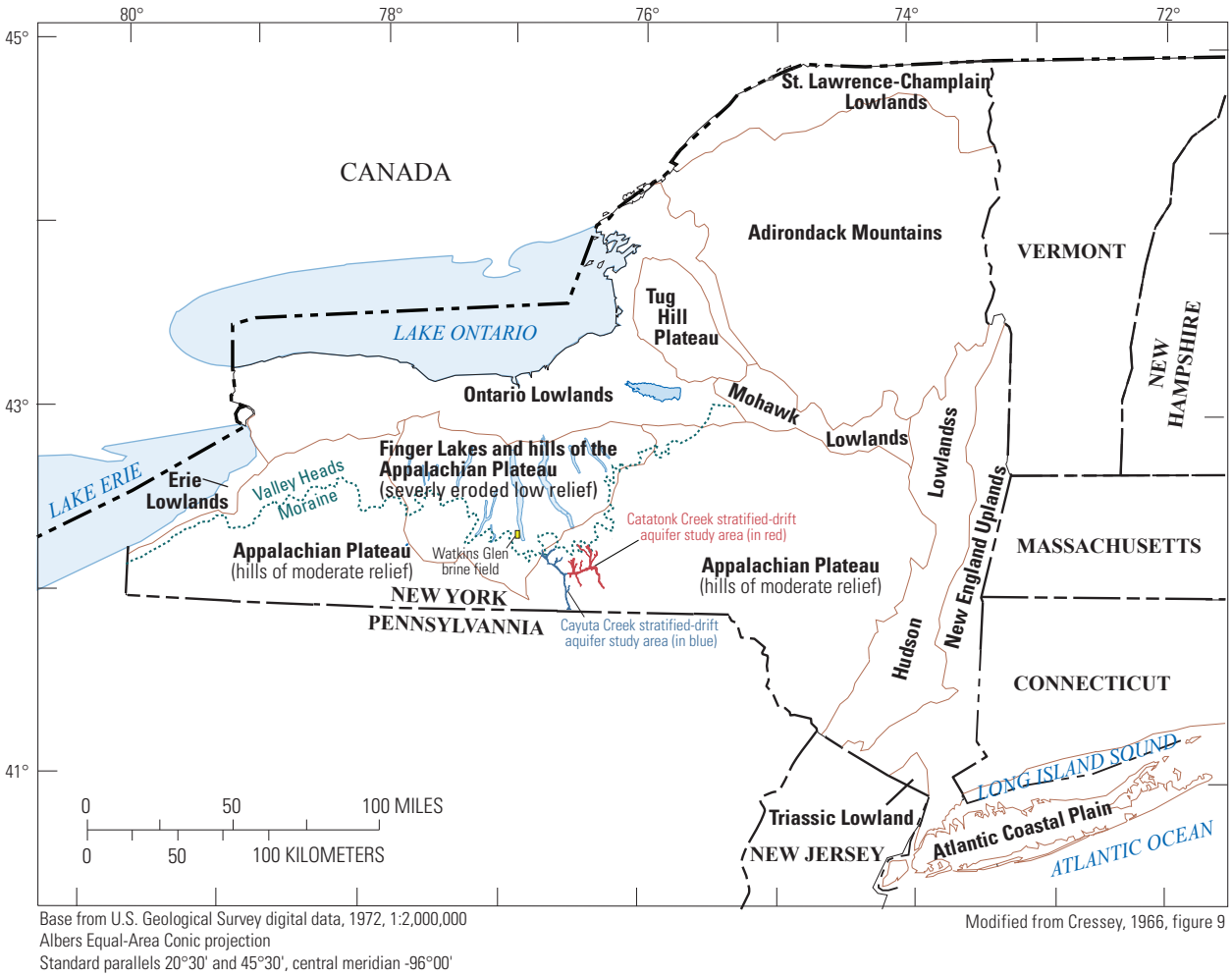


Figure 2. Physiographic features of New York and location of the Cayuta Creek and Catatonk Creek stratified-drift aquifer study areas, New York.

Sources of well and test-boring data include previous USGS groundwater studies by Wetterhall (1959), Randall (1972), McPherson and Miller (1994), and Miller and Karig (2010), the USGS National Water Information System (NWIS), the NYSDEC Water Well Drillers Registration Program (well records from 2000 to 2010), and the New York State Department of Transportation (appendix). Well, test-boring, and seismic data (plate 1), and surficial deposits data (plate 2), were used to define and map the extent of the aquifers, determine the aquifer type (unconfined, confined, or both), depict the geologic stratigraphy in 10 geohydrologic sections, and determine the depth to bedrock (thickness of unconsolidated valley-fill deposits) at selected locations. Most well and test-boring records included groundwater-level measurements that were used along with altitudes of stream channels and ponds determined from Light Detection and Ranging (LIDAR) data to construct a generalized water-table map of the aquifers (plate 3).

Wells and Well Locations

A total of 367 well and test-boring records were compiled for this study (plate 1 and appendix). A total of 111 well records and 13 test-boring records were collected and compiled for the Cayuta Creek stratified-drift aquifer study area; and 236 well records and 7 test-boring records were collected and compiled for the Catatonk Creek stratified-drift aquifer study area. The locations of wells from the NYSDEC Water Well Drillers Registration Program were field checked by USGS personnel. The altitudes of land surface at the wells were determined from LIDAR data, where available (LIDAR data are available in all of Tompkins and Chemung Counties, and in parts of Tioga County). In areas with no LIDAR data (Schuyler County and in parts of Tioga County), the altitudes of land surface at the wells were estimated from USGS 1:24,000 scale topographic contour maps. Water-level measuring points were referenced to land surface. In areas where LIDAR data (accuracy is 0.5 to 1 foot (ft)) were used, a more accurate altitude of the water table (plate 3) was constructed compared with areas where LIDAR data were not available (accuracy is plus or minus 5 ft in areas where altitudes were determined from 1:24,000 scale topographic contour maps).

Surficial Deposits and Bedrock

Geologic materials in the study area include sedimentary bedrock, unstratified drift (till), stratified drift (glaciolacustrine and glaciofluvial deposits), and recent alluvium (plate 2). Bedrock that crops out at land surface in the study area consists of Upper to Middle Devonian interfingering shales and siltstones with some fine-grained sandstones, limestones, and dolostones that were deposited in seas 416–359.2 million years ago (Rickard and Fisher, 1970). The study area lies at the transition between the thick sequence of coarse clastic rocks of the Catskill Delta facies to the east and thinner, equivalent and more laterally extensive marine rocks to the west. Bedrock crops out at land surface along the flanks of many of the valleys and on hilltops. The strata were uplifted during the Alleghenian Orogeny during the end of the Paleozoic Era about 280–320 million years ago (Isachsen and others, 1991). The regional dip of the strata is southward at 40 to 60 feet per mile (ft/mi); however, the strata are warped into shallow open folds with axes trending east to northeast, which result in local variations in dip and, in some places, reversal of dip.

Many of the valley reaches in the study area follow predominant lineaments (fig. 3), some of which reflect zones of concentrated fractures, known faults, and "suspected faults" (Jacobi, 2002; Podwysocki and others, 1982; Pohn, 1981; and Stone & Webber, 1978). These zones of concentrated fractures and faults controlled the development of the configuration of the major valleys in the study area. The drainage pattern of Catatonk Creek valley has a conspicuous reticular pattern that suggests it was controlled by lineaments and which contrasts with the dendritic drainage pattern present in the uplands where valley configuration is less influenced by lineaments. Although, the presence of concentrated fracture zones and faults in these valleys was not confirmed everywhere because of a sparsity of deep well logs, their presence was based on several other sources of data including: (1) digital contrast enhancement of several Landsat multispectral scanner images, (2) analysis of lineament patterns from a Landsat MSS-7 mosaic, (3) field mapping of bedrock joint patterns, (4) compilation and analysis of surface and subsurface structure and isopach maps, (5) collection and digital analysis of aeromagnetic data for southern New York, (6) compilation and analysis of aeromagnetic and gravity data for much of New York and Pennsylvania, and (7) analysis of seismic reflection survey lines for selected portions of New York and Pennsylvania.

Some faults and fractures result in disturbed zones of crushed rock, which locally enhance the secondary permeability of the rock. If the faulted zones were not sealed by precipitation of minerals from hydrothermal fluids, then the secondary permeabilty along these zones could act as conduits through which groundwater (as well as methane-rich fluids) may migrate (Fountain and Jacobi, 2000). Some fracture zones and faults are vertical to near-vertical and pass through gently dipping strata that act as confining units, thereby creating a local hydraulic connection between vertically-stacked geohydrologic units. For example, when a 2,900-ft-deep vertical well (well 29, Jacoby and Dellwig, 1974) at the Watkins Glen brine field (fig. 2) was hydraulically fractured, brine flowed up to land surface reportedly through a large north-south trending shear fault that has an estimated 1,200 ft horizontal displacement (Jacoby and Dellwig, 1974). Likewise, should vertical faults extend from a gas-producing formation to beneath the bottom of the stratified-drift aquifers

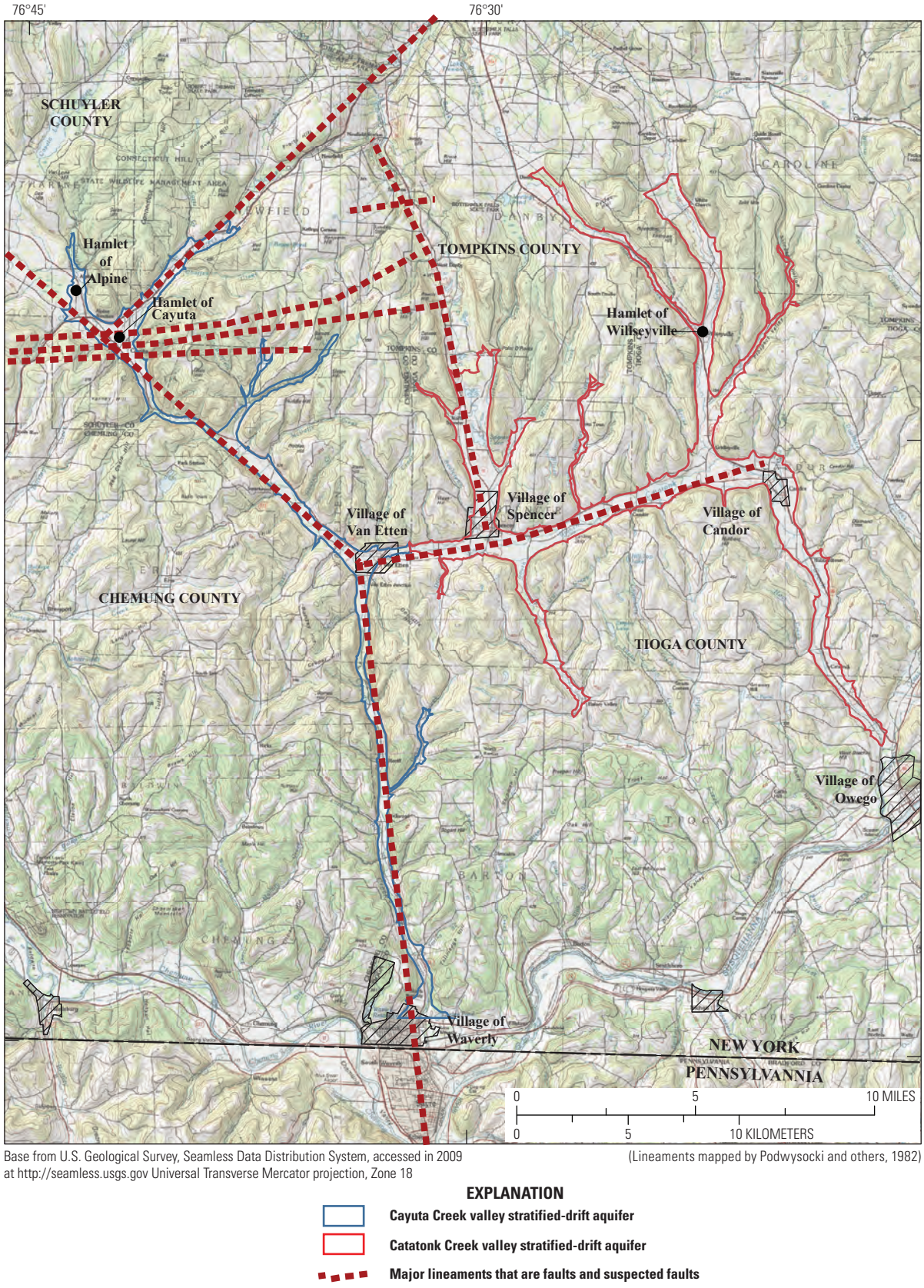


Figure 3. Location of Cayuta Creek and Catatonk Creek stratified-drift aquifers and major lineaments that are faults and suspected faults in parts of Tompkins, Tioga, Schuyler, and Chemung Counties, New York.

in the valleys, it also is possible that methane, methane-rich fluids, and fracking fluids could migrate upward via the faults during the hydrofracking of the gas-producing formation and contaminate sand and gravel aquifers. Because of the presence and nature of these fracture zones, it is important that hydrofracking operations evaluate the presence of major faults and zones of concentrated fractures in order to avoid the risk of gases and fluids migrating upward and contaminating shallow aquifers that are sources of potable water to many residents and communities.

The study area has undergone several major glaciations during the Pleistocene Epoch, commonly referred to as the Ice Age, which began 2.6 million years ago and ended 11,850 years before present, with the end date expressed in radiocarbon years (Fullerton, 1980). Most glacial sediments were deposited during the end of the most recent (Wisconsin) glacial epoch. The epoch lasted from about 95,000 to 11,850 years ago with most of the glacial sediments deposited from about 20,000 to 11,850 years ago.

The unstratified glacial drift in the study area consists of till (plate 2), which is an unsorted mixture of clay, silt, sand, gravel, and rocks that were deposited directly by glacial ice, rather than by meltwater. The larger gravel and rock clasts, which typically are embedded in a fine-grained matrix consisting of clay, silt, and very fine sand, range in size from pebbles to boulders. In most places in the uplands, a layer of till that directly overlies bedrock is the sole unconsolidated deposit. Till typically has low hydraulic conductivity and, therefore, does not form aquifers.

Stratified-drift deposits consisting of glaciofluvial, glaciolacustrine, and recent deposits (alluvial sand and gravel, and paludal swamp and marsh sediments) are present in the valleys (plate 2). Stratified sediments consisting of coarse-grained sediment (glaciolfluvial and alluvial sand and gravel) are the major components of the valley fill in the two study areas. Large amounts of fluvial sediments were deposited by glacial meltwaters as the ice retreated and by post-glacial streams. Glaciofluvial and alluvial deposits typically are found in sufficient thicknesses to form extensive unconfined aquifers throughout the study area, as well as some locally confined aquifers (fig. 4). The geologic framework that forms the aquifers and confining units are depicted in 10 geohydrologic sections at selected locations in the valleys (sections *A–A′* through *J–J′* in figures 5 through 14, respectively).

In some parts of the study area, fine-grained stratified drift consists of glaciolacustrine fine sand, silt, and clay that underlie the coarse-grained glaciofluvial and recent deposits. Glaciolacustrine sediments, as well as till have low hydraulic conductivity and form local confining units (figs. 4, 13, and 14). Glaciolacustrine sediments are more prevalent in the Catatonk Creek valley than in the Cayuta Creek valley. In the Cayuta Creek valley, glaciolacustrine sediments typically are present only where depth to bedrock is deep (more than 75 to 100 ft), such as between the hamlets of Alpine and Cayuta in the northern part of the valley. In the Catatonk Creek valley, glaciolacustrine sediments typically are present where depth to bedrock is also deep (more than 75 to 100 ft) and, locally, where the valley fill is less than 75 ft thick, such as in the southern part of the valley (fig. 13).

Recent deposits of Holocene age, including alluvium and alluvial fans, comprise a major portion of the stratified deposits in many parts of the study area (plate 2, figs. 7 and 11). The prevalence of alluvial deposits in many places indicates that post-glacial erosion of the uplands contributed a large volume of sediment that has accumulated in the valleys.

A prominent geologic feature in the northern part of the study area is the Valley Heads Moraine (plate 2), which is part of the most extensive moraine system in New York State (fig. 2) and forms the drainage divide in major valleys between the St. Lawrence and Susquehanna River Basins (fig. 1). This large moraine was deposited during a readvance of ice during the late Wisconsinan Period. Large amounts of sediment were deposited at the terminus of a stagnant ice lobe that extended several miles south from the main ice massif and into the northern part of the study area.

The thickness of unconsolidated sediments beneath the Valley Heads Moraine ranges from 150 ft to more than 200 ft. The moraine includes hummocky kames and kettles, kame terraces, and large channels that were former outwash channels and outlets for proglacial lakes that occupied the valleys to the north of the moraine (plate 2). The kame- and kettle ice-disintegration landforms and the absence of end-moraine ridges are topographic evidence indicating that the margin of the Valley Heads Moraine ice melted under stagnant ice conditions. The moraine is composed mostly of coarse-grained (sand and gravel) kame end-moraine deposits (fig. 10) that were transported by meltwaters flowing beneath, within, and on top of the ice. In some places, along the margins and on top of the kame end-moraine deposits are outwash, alluvial inwash, and recent alluvium (plate 2 and fig. 10). The stratigraphy in the deep zones beneath the moraine is unknown because there are few well data in the deep parts of the valley fill. Wells finished in the backside (north) of the moraine in the Willseyville Creek valley penetrate a complex sequence of till, glaciofluvial sand and gravel, and glaciolacustrine fine sand, silt, and clay.

In the headwaters of Catatonk Creek and Willseyville Creek valleys, the bedrock valley floor rises in altitude southward from the Finger Lake troughs (about 10 mi north of the moraine, fig. 2) to about a mile or two south of the Valley Heads Moraine (which coincided where former bedrock saddles formed preglacial drainage divides). At the former preglacial drainage divides, the bedrock floor levels off and then begins to decrease in altitude with a gentle slope to the south. The thickness of the valley-fill deposits is much less to the south of the former preglacial drainage divides (thicknesses typically range from 30 to 100 ft in the Cayuta Creek valley and from 40 to 150 ft in the Catatonk Creek valley) than it is to the north of the former preglacial drainage divides (thicknesses typically range from 200 ft to more than 300 ft).

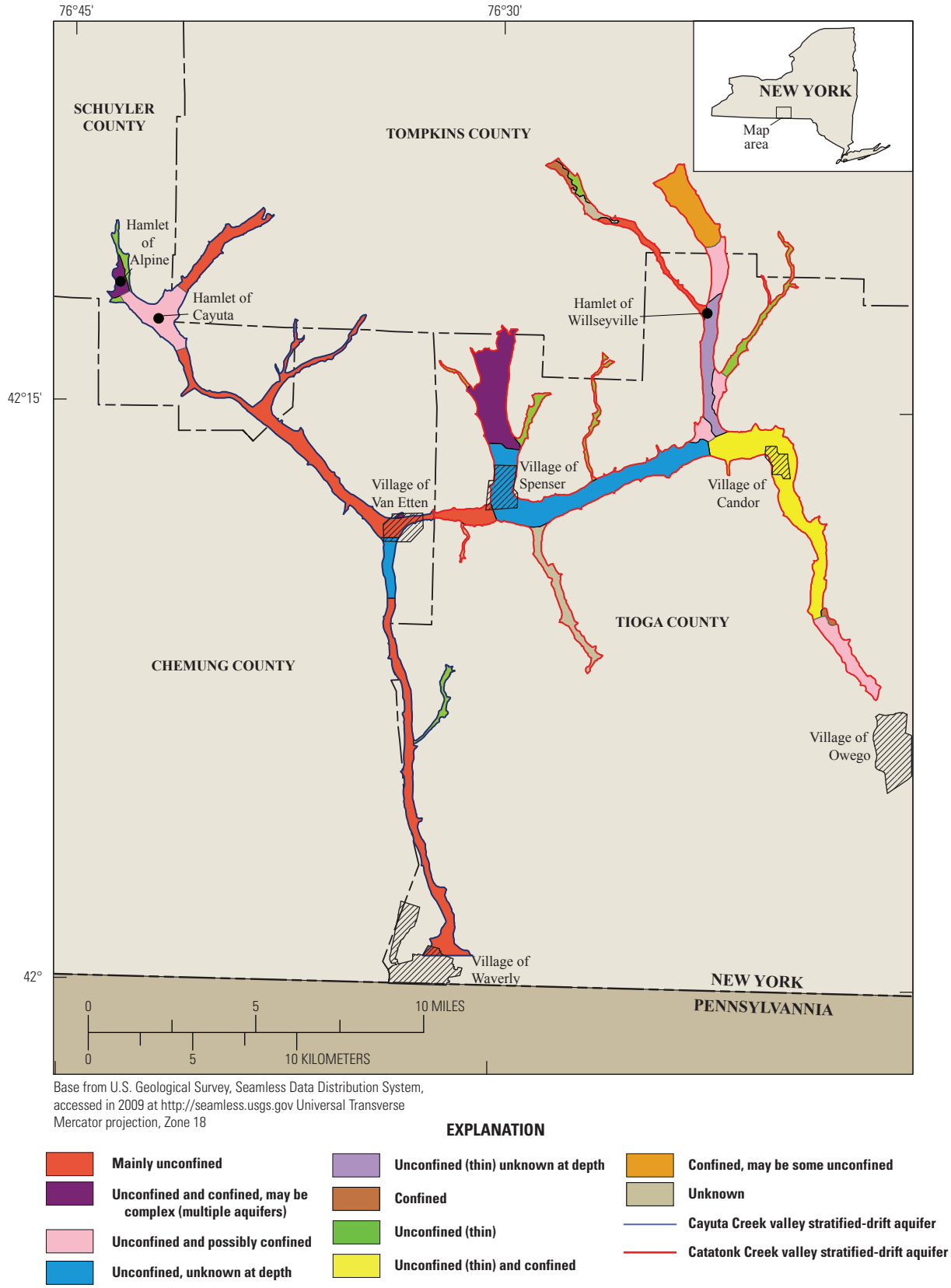
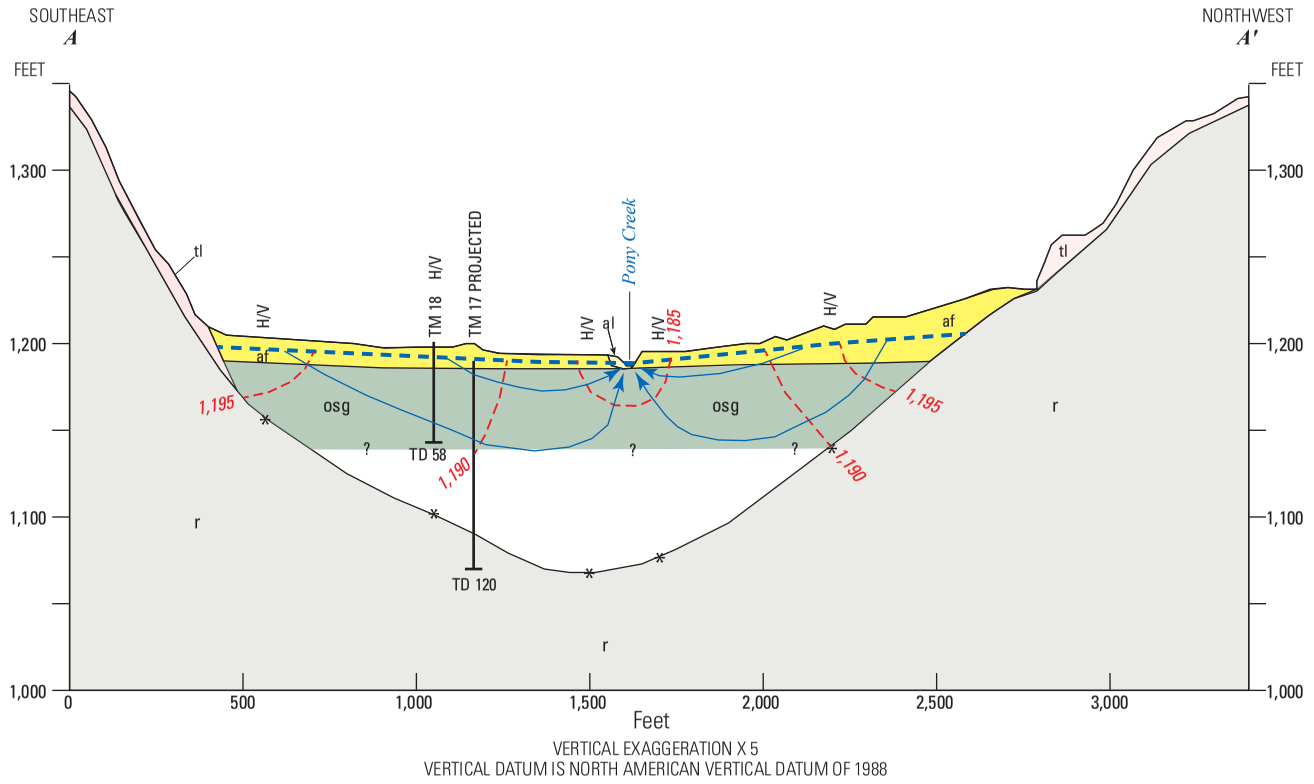


Figure 4. Types of stratified-drift aquifers in the Cayuta Creek and Catatonk Creek valleys in parts of Tompkins, Tioga, Schuyler, and Chemung Counties, New York.



EXPLANATION

Alluvial deposits of Holocene age

al — **Channel and flood-plain alluvium**—Stream-deposited gravel, sand, silt, and clay. Forms part of the unconfined aquifer

af — **Alluvial-fan deposits**—A complex of gravel, sand, silt, and clay deposited as fans by upland tributaries where they join the main valley. Forms part of the unconfined aquifer

Glaciofluvial deposits of Wisconsin age

osg — **Outwash sand and gravel**—Chiefly sand and gravel beneath terrace remnants; as valley trains and beneath outwash plains; as fans and aprons; as delta topset beds. Forms the main part of the unconfined aquifer in the valley

Till of late Wisconsin age

tl — **Ground-moraine deposits in the uplands (mostly lodgment till)**—Consists of subangular to angular clasts (fine pebbles to boulders) embedded in a matrix consisting chiefly of calcareous loam, silt loam, sandy loam, sandy clay loam, or silty clay loam

Devonian-age rocks

r — **Bedrock**—Mostly Devonian-age shales and siltstones, and with some fine-grained sandstones, limestones and dolostones units. Beds are gently folded and have a regional dip to the south from 40 to 60 feet per mile

TM 18 / TD 58 — **Well and site name**—Site name is assigned by the U.S. Geological Survey. TM = Tompkins County, number following TM is sequential well number, and TD = total depth (in feet) of well

H/V, * — **Horizontal-to-vertical ambient-noise seismic measurement**—Asterisk denotes computed depth to bedrock

Geologic contacts

——— Accurately to approximately located

? ? ? ? Unknown

Hydrologic symbols

– – – **Water table**

1,190 – – – **Potentiometric contour**—Shows altitude at which water level would have stood in tightly cased wells. Contour interval 5 feet. Datum is NAVD 88. Arrow shows general direction of groundwater flow

Figure 5. Geohydrologic section *A–A′* across the Pony Hollow valley, along Connecticut Hill Road, Tompkins County, New York.

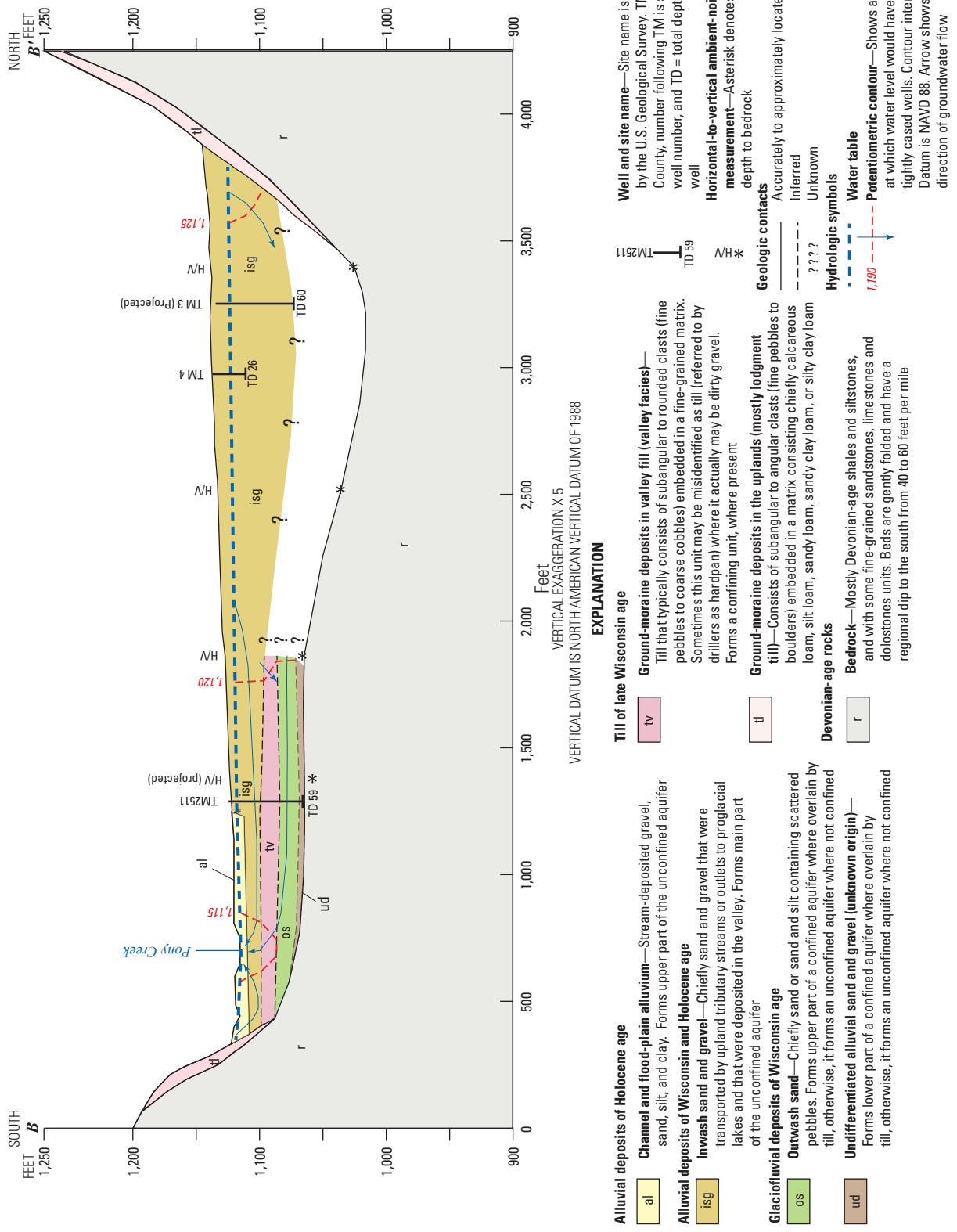
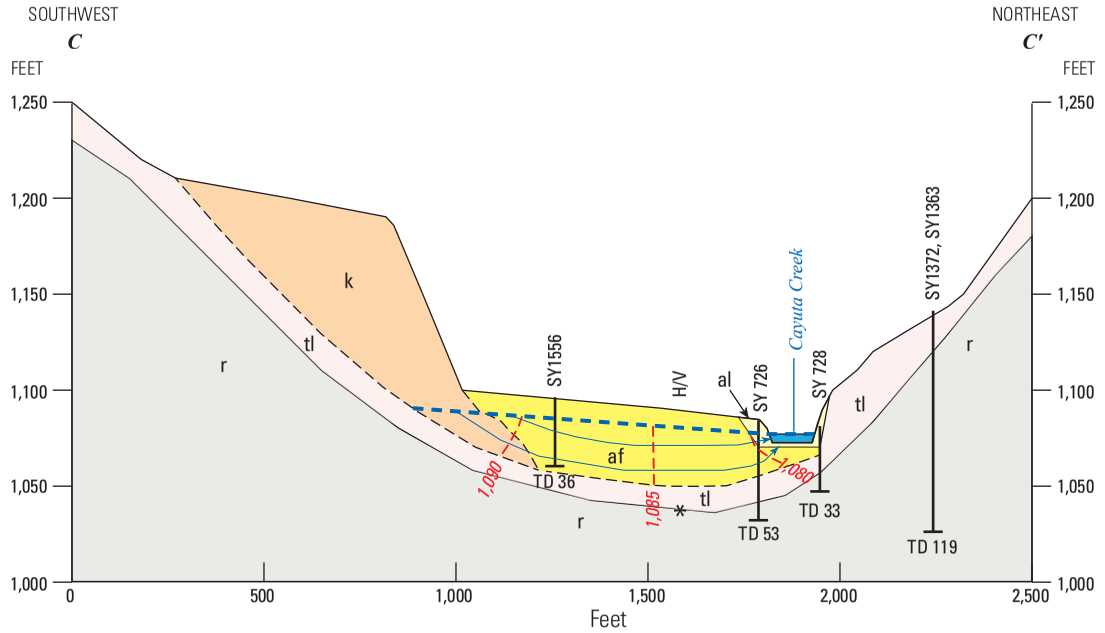


Figure 6. Geohydrologic section *B*–*B′* across Pony Hollow valley, along Cayuta Road, Tompkins County, New York.



EXPLANATION

Alluvial deposits of Holocene age

al — **Channel and flood-plain alluvium**—Stream-deposited gravel, sand, silt, and clay. Forms upper part of the unconfined aquifer

af — **Alluvial-fan deposits**—A complex of gravel, sand, silt, and clay deposited as fans by upland tributaries where they join the main valley. The lower portion of the unit may be comprised of outwash sand and gravel. Forms main part of the unconfined aquifer

Glaciofluvial deposits of Wisconsin age

k — **Ice-contact (kame) sand and gravel**—Chiefly in kames, interlobate moraines, kame deltas, kame fans, eskers, and ice-fracture fillings. Hummocks, mounds, ridges, and knobs typically characterize the landscape. Ice-block depressions are common in some areas. Forms part of the unconfined aquifer along the valley wall

Till of late Wisconsin age

tl — **Ground-moraine deposits in the uplands (mostly lodgment till)**—Consists of subangular to angular clasts (fine pebbles to boulders) embedded in a matrix consisting chiefly of calcareous loam, silt loam, sandy loam, sandy clay loam, or silty clay loam

Devonian-age rocks

r — **Bedrock**—Mostly Devonian-age shales and siltstones, and with some fine-grained sandstones, limestones and dolostones units. Beds are gently folded and have a regional dip to the south from 40 to 60 feet per mile

SY 726 / TD 53 — **Well and site name**—Site name is assigned by the U.S. Geological Survey. SY = Schuyler County, number following SY is sequential well number, and TD = total depth (in feet) of well

H/V — **Horizontal-to-vertical ambient-noise seismic measurement**—Asterisk denotes computed depth to bedrock

Geologic contacts

Accurately to approximately located

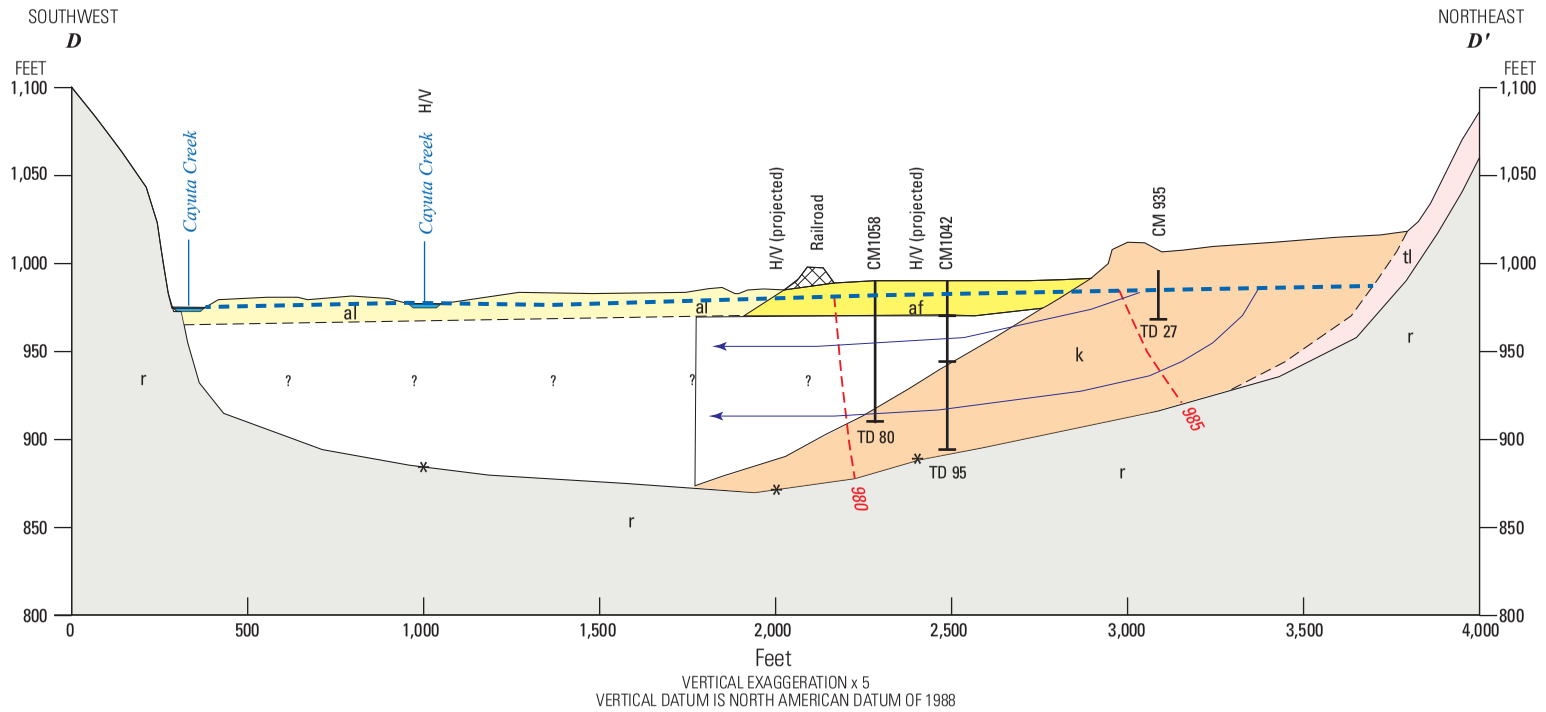
Inferred

Hydrologic symbols

Water table

1,080 — **Potentiometric contour**—Shows altitude at which water level would have stood in tightly cased wells. Contour interval 5 feet. Datum is NAVD 88. Arrow shows general direction of groundwater flow

Figure 7. Geohydrologic section *C–C′* across Cayuta Creek valley, 1.9 miles south of Cayuta, Schuyler County, New York.



EXPLANATION

Man-made land—Artificial fill

Alluvial deposits of Holocene age

al — **Channel and flood-plain alluvium**—Stream-deposited gravel, sand, silt, and clay. Forms upper part of the unconfined aquifer

af — **Alluvial-fan deposits**—A complex of gravel, sand, silt, and clay deposited as fans by upland tributaries where they join the main valley. The lower portion of the unit may be comprised of outwash sand and gravel. Forms upper part of the unconfined aquifer

Glaciofluvial deposits of Wisconsin age

k — **Ice-contact (kame) sand and gravel**—Chiefly in kames, interlobate moraines, kame deltas, kame fans, eskers, and ice-fracture fillings. Hummocks, mounds, ridges, and knobs typically characterize the landscape. Ice-block depressions are common in some areas. Forms main part of the unconfined aquifer

Till of late Wisconsin age

tl — **Ground-moraine deposits in the uplands (mostly lodgment till)**—Consists of subangular to angular clasts (fine pebbles to boulders) embedded in a matrix consisting chiefly of calcareous loam, silt loam, sandy loam, sandy clay loam, or silty clay loam

Devonian-age rocks

r — **Bedrock**—Mostly Devonian-age shales and siltstones, and with some fine-grained sandstones, limestones and dolostones units. Beds are gently folded and have a regional dip to the south from 40 to 60 feet per mile

CM1058 / TD 80 — **Well and site name**—Site name is assigned by the U.S. Geological Survey. CM = Chemung County, number following CM is sequential well number, and TD = total depth (in feet) of well

H/V * — **Horizontal-to-vertical ambient-noise seismic measurement**—Asterisk denotes computed depth to bedrock

Geologic contacts

Accurately to approximately located

Inferred

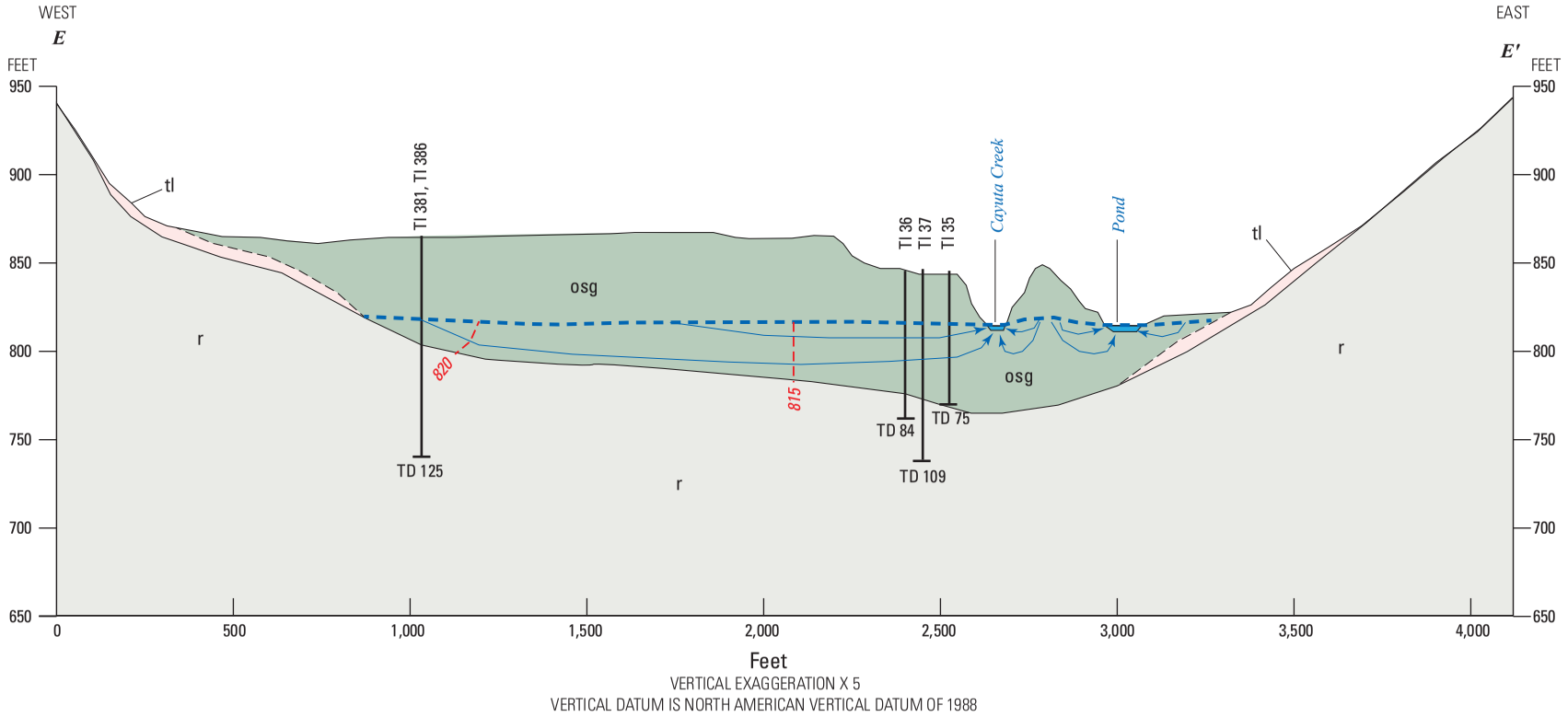
? ? ? ? Unknown

Hydrologic symbols

Water table

980 — **Potentiometric contour**—Shows altitude at which water level would have stood in tightly cased wells. Contour interval 5 feet. Datum is NAVD 88. Arrow shows general direction of groundwater flow

Figure 8. Geohydrologic section *D–D′* across Cayuta Creek valley at Van Etten, Chemung County, New York.



EXPLANATION

Glaciofluvial deposits of Wisconsin age

osg — **Outwash sand and gravel**—Chiefly sand and gravel beneath terrace remnants; as valley trains and beneath outwash plains; as fans and aprons; as delta topset beds. Forms main part of the unconfined aquifer

Till of late Wisconsin age

tl — **Ground-moraine deposits in the uplands (mostly lodgment till)**—Consists of subangular to angular clasts (fine pebbles to boulders) embedded in a matrix consisting chiefly of calcareous loam, silt loam, sandy loam, sandy clay loam, or silty clay loam

Devonian-age rocks

r — **Bedrock**—Mostly Devonian-age shales and siltstones, and with some fine-grained sandstones, limestones and dolostones units. Beds are gently folded and have a regional dip to the south from 40 to 60 feet per mile

TI 36 / TD 84 — **Well and site name**—Site name is assigned by the U.S. Geological Survey. TI = Tioga County, number following TI is sequential well number, and TD = total depth (in feet) of well

Geologic contacts

Accurately to approximately located

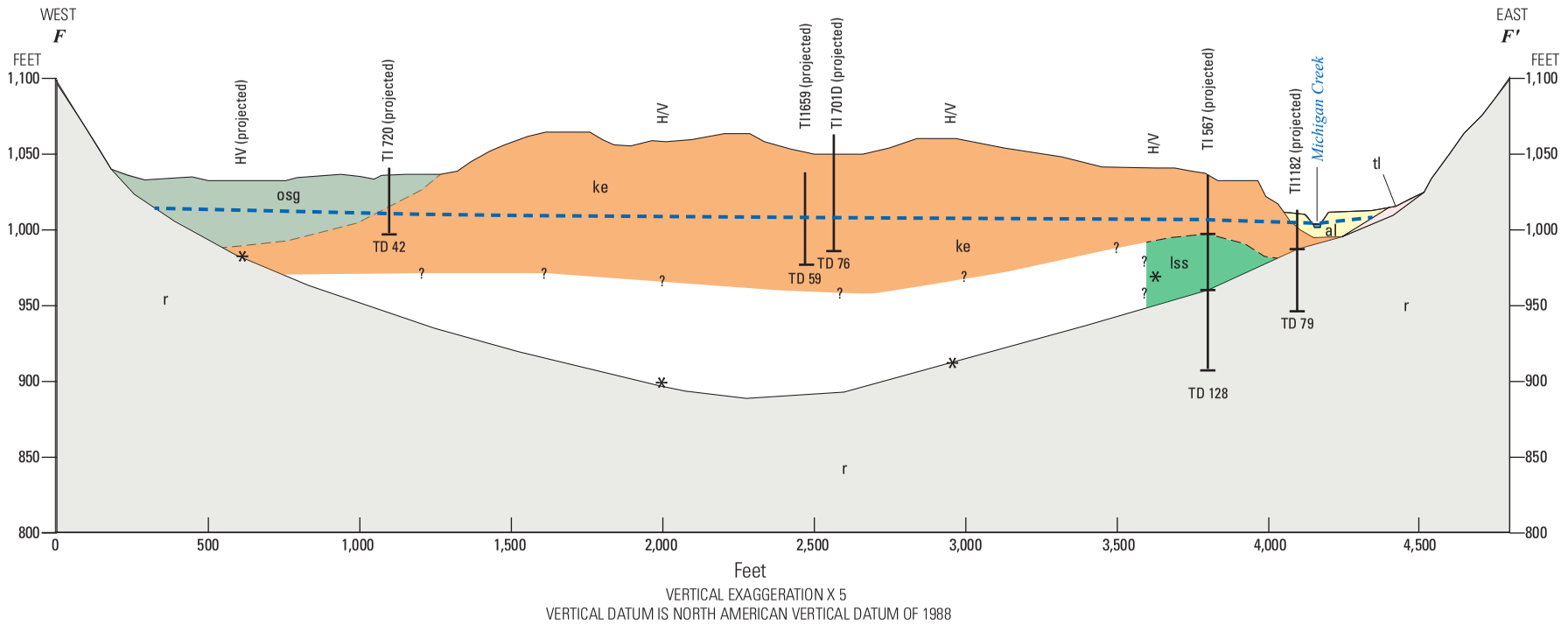
Inferred

Hydrologic symbols

Water table

815 — **Potentiometric contour**—Shows altitude at which water level would have stood in tightly cased wells. Contour interval 5 feet. Datum is NAVD 88. Arrow shows general direction of groundwater flow

Figure 9. Geohydrologic section *E–E′* across Cayuta Creek valley at North Waverly, Tioga County, New York.



EXPLANATION

Alluvial deposits of Holocene age

al — **Channel and flood-plain alluvium**—Stream-deposited gravel, sand, silt, and clay. Forms upper part of the unconfined aquifer

Glaciofluvial deposits of Wisconsin age

osg — **Outwash sand and gravel**—Chiefly sand and gravel beneath terrace remnants; as valley trains and beneath outwash plains; as fans and aprons; as delta topset beds. Forms upper part of the unconfined aquifer along the western part of the valley

ke — **Kame end-moraine deposits**—Chiefly sand and gravel deposits that form (1) linear or arcuate, ridges; (2) kame complex accumulations of ice-contact deposits in mounds, knobs, and hummocks; or (3) ice-contact deposits in belts of any or all of the latter landforms. The sediments were deposited at or near a stagnating glacial ice margin. Forms main part of the unconfined aquifer

Glaciolacustrine (lake) deposits of Wisconsin age

lss — **Silt and sand**—Chiefly off-shore and near-shore deposits of former glacial and postglacial lakes; some deposits are in small separate basins. Forms the lower part of the unconfined aquifer in the eastern part of the valley. Extent is unknown elsewhere

Till of late Wisconsin age

tl — **Ground-moraine deposits in the uplands (mostly lodgment till)**—Consists of subangular to angular clasts (fine pebbles to boulders) embedded in a matrix consisting chiefly of calcareous loam, silt loam, sandy loam, sandy clay loam, or silty clay loam

Devonian-age rocks

r — **Bedrock**—Mostly Devonian-age shales and siltstones, and with some fine-grained sandstones, limestones and dolostones units. Beds are gently folded and have a regional dip to the south from 40 to 60 feet per mile

TI1659 / TD 59 — **Well and site name**—Site name is assigned by the U.S. Geological Survey. TI = Tioga County, number following TI is sequential well number, and TD = total depth (in feet) of well

H/V * — **Horizontal-to-vertical ambient-noise seismic measurement**—Asterisk denotes computed depth to bedrock

Geologic contacts

———— Accurately to approximately located

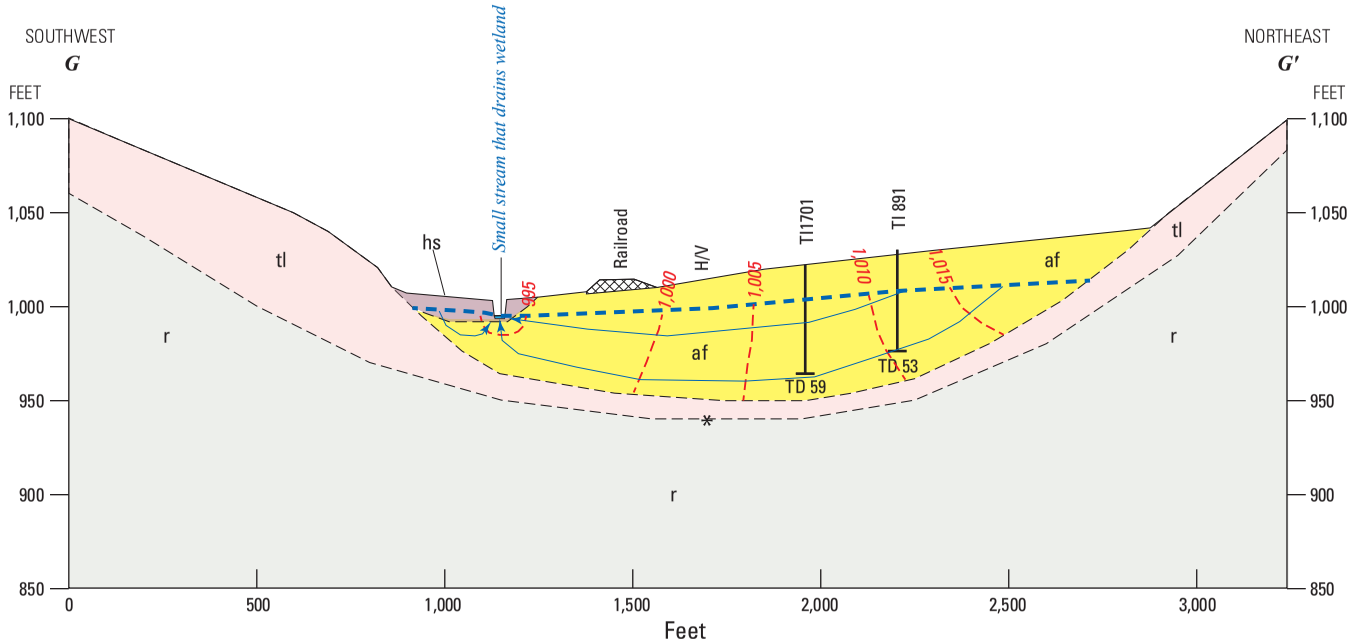
– – – – – – Inferred

???? Unknown

Hydrologic symbols

Water table

Figure 10. Geohydrologic section *F–F'* across Catatonk Creek valley near Spencer Lake, Tioga County, New York.



EXPLANATION

Man-made land—Artificial fill

Swamp deposits of Holocene age

hs — **Fresh-water swamp deposits**—Chiefly (1) muck, mucky peat, and organic residues mixed with fine sand, silt, and clay or (2) organic debris, muck, and, locally, peat mixed with fine sand, silt, and clay in areas that intermittently are covered by standing water

Alluvial deposits of Holocene age

af — **Alluvial-fan deposits**—A complex of gravel, sand, silt, and clay deposited as fans by upland tributaries where they join the main valley. The lower portion of the unit may be comprised of outwash or kame sand and gravel. Forms main part of the unconfined aquifer

Till of late Wisconsin age

tl — **Ground-moraine deposits in the uplands (mostly lodgment till)**—Consists of subangular to angular clasts (fine pebbles to boulders) embedded in a matrix consisting chiefly of calcareous loam, silt loam, sandy loam, sandy clay loam, or silty clay loam

Devonian-age rocks

r — **Bedrock**—Mostly Devonian-age shales and siltstones, and with some fine-grained sandstones, limestones and dolostones units. Beds are gently folded and have a regional dip to the south from 40 to 60 feet per mile

TI 891 / TD 53 — **Well and site name**—Site name is assigned by the U.S. Geological Survey. TI = Tioga County, number following TI is sequential well number, and TD = total depth (in feet) of well

H/V * — **Horizontal-to-vertical ambient-noise seismic measurement**—Asterisk denotes computed depth to bedrock

Geologic contacts

Accurately to approximately located

Inferred

Hydrologic symbols

Water table

1,000 — **Potentiometric contour**—Shows altitude at which water level would have stood in tightly cased wells. Contour interval 5 feet. Datum is NAVD 88. Arrow shows general direction of groundwater flow

Figure 11. Geohydrologic section *G–G′* across Catatonk Creek valley, 0.6 mile east of the border between Tioga and Chemung Counties, New York.

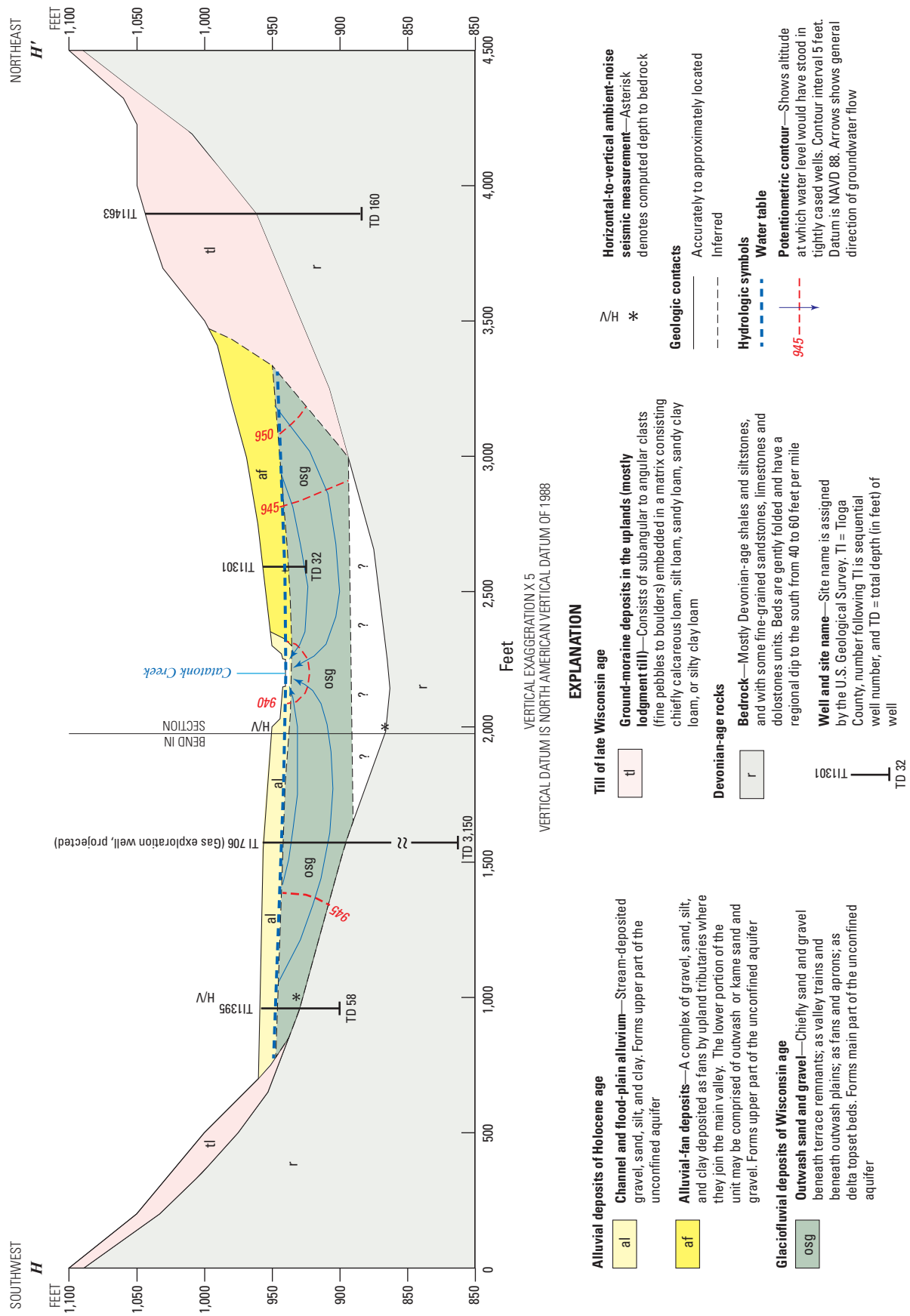
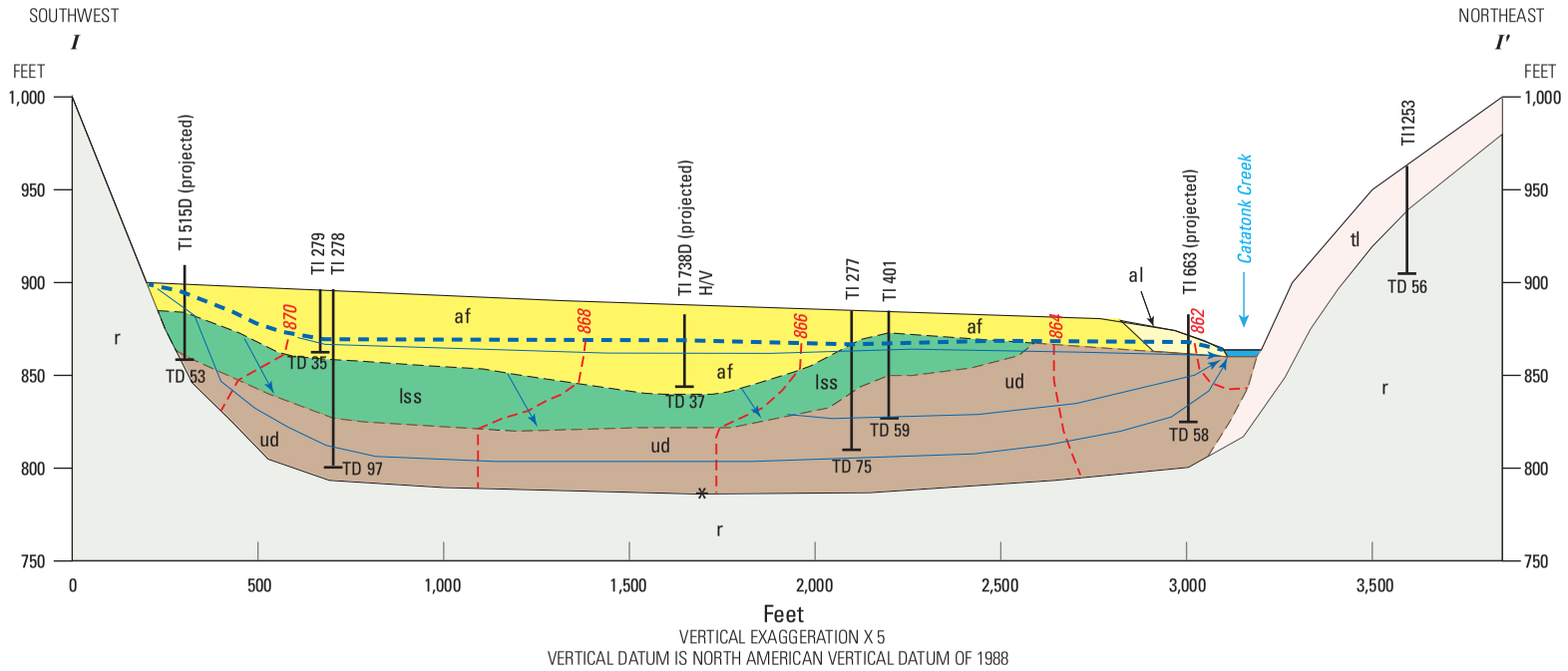


Figure 12. Geohydrologic section *H–H′* across Catatonk Creek valley, along West Candor Road, Town of Candor, Tioga County, New York.



EXPLANATION

Alluvial deposits of Holocene age

al — **Channel and flood-plain alluvium**—Stream-deposited gravel, sand, silt, and clay. Forms upper part of the unconfined aquifer

af — **Alluvial-fan deposits**—A complex of gravel, sand, silt, and clay deposited as fans by upland tributaries where they join the main valley. The lower portion of the unit may be comprised of outwash or kame sand and gravel. Forms main part of the unconfined aquifer

Glaciolacustrine (lake) deposits of Wisconsin age

lss — **Silt and sand**—Chiefly off-shore and near-shore deposits of former glacial and postglacial lakes; some deposits are in small separate basins. The deposits are thin and discontinuous in some areas. Forms a confining unit where composed mostly of silt and a semi-confining unit where composed mostly of sand

Glaciofluvial deposits of Wisconsin age

ud — **Undifferentiated glaciofluvial sand and gravel (unknown origin)**—Forms a confined aquifer where overlain by glaciolacustrine silt and sand, however it forms an unconfined aquifer where not confined in the east part of the valley

Till of late Wisconsin age

tl — **Ground-moraine deposits in the uplands (mostly lodgment till)**—Consists of subangular to angular clasts (fine pebbles to boulders) embedded in a matrix consisting chiefly of calcareous loam, silt loam, sandy loam, sandy clay loam, or silty clay loam

Devonian-age rocks

r — **Bedrock**—Mostly Devonian-age shales and siltstones, and with some fine-grained sandstones, limestones and dolostones units. Beds are gently folded and have a regional dip to the south from 40 to 60 feet per mile

H/V
* — **Horizontal-to-vertical ambient-noise seismic measurement**—Asterisk denotes computed depth to bedrock

TI 727
TD 75 — **Well and site name**—Site name is assigned by the U.S. Geological Survey. TI = Tioga County, number following TI is sequential well number, and TD = total depth (in feet) of well

Geologic contacts

Accurately to approximately located

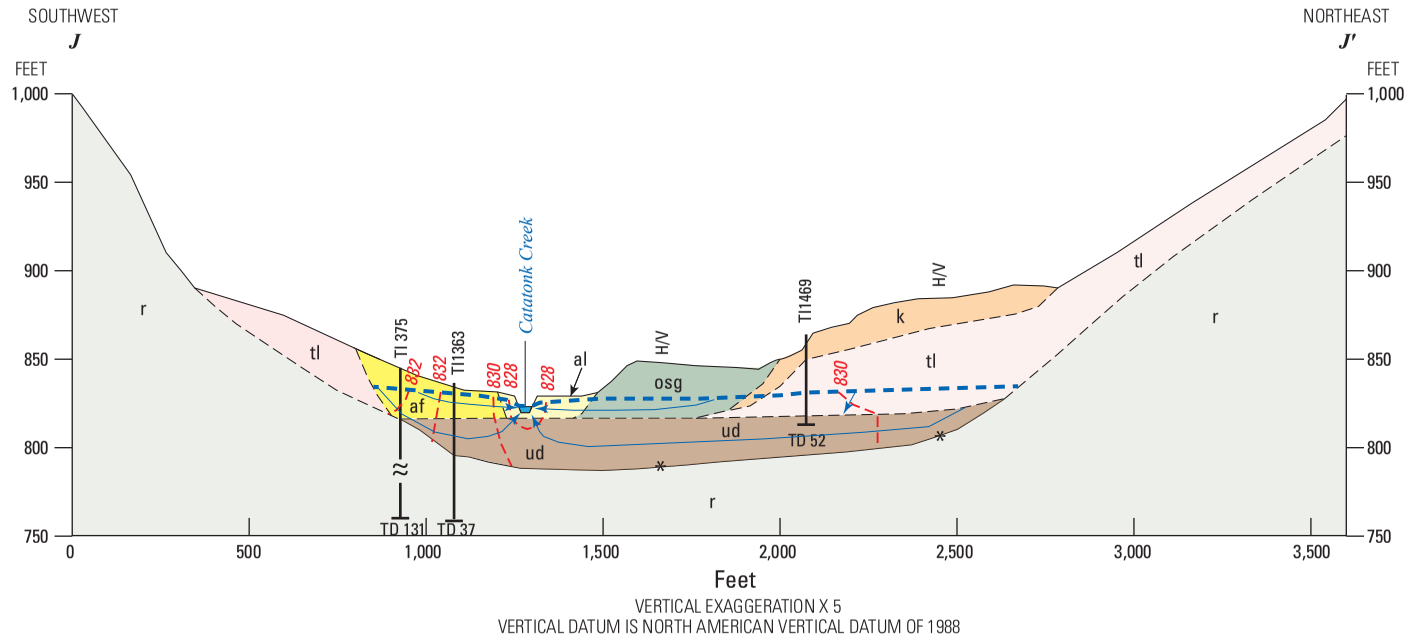
Inferred

Hydrologic symbols

Water table

866 — **Potentiometric contour**—Shows altitude at which water level would have stood in tightly cased wells. Contour interval 2 feet. Datum is NAVD 88. Arrows shows general direction of groundwater flow

Figure 13. Geohydrologic section *I–I′* across Catatonk Creek, 1.5 miles south of Village of Candor, Tioga County, New York.



EXPLANATION

Alluvial deposits of Holocene age

al — **Channel and flood-plain alluvium**—Stream-deposited gravel, sand, silt, and clay. Forms upper part of the unconfined aquifer

af — **Alluvial-fan deposits**—A complex of gravel, sand, silt, and clay deposited as fans by upland tributaries where they join the main valley. The lower portion of the unit may be comprised of outwash or kame sand and gravel. Forms upper part of the unconfined aquifer

Glaciofluvial deposits of Wisconsin age

osg — **Outwash sand and gravel**—Chiefly sand and gravel beneath terrace remnants; as valley trains and beneath outwash plains; as fans and aprons; as delta topset beds. Forms upper part of the unconfined aquifer

k — **Ice-contact (kame) sand and gravel**—Chiefly in kames, interlobate moraines, kame deltas, kame fans, eskers, and ice-fracture fillings. Hummocks, mounds, ridges, and knobs typically characterize the landscape. Ice-block depressions are common in some areas. The unit is probably mostly unsaturated or seasonally saturated

Glaciofluvial deposits of Wisconsin age (continued)

ud — **Undifferentiated glaciofluvial sand and gravel (unknown origin)**—Forms main part of the unconfined aquifer in the west part of the valley and of the confined aquifer in the east part of the valley

Till of late Wisconsin age

tl — **Ground-moraine deposits in the uplands (mostly lodgment till)**—Consists of subangular to angular clasts (fine pebbles to boulders) embedded in a matrix consisting chiefly of calcareous loam, silt loam, sandy loam, sandy clay loam, or silty clay loam

Devonian-age rocks

r — **Bedrock**—Mostly Devonian-age shales and siltstones, and with some fine-grained sandstones, limestones and dolostones units. Beds are gently folded and have a regional dip to the south from 40 to 60 feet per mile

H/V
* — **Horizontal-to-vertical spectral ambient-noise measurement**—Asterisk denotes computed depth to bedrock

TI 363
TD 37 — **Well and site name**—Site name is assigned by the U.S. Geological Survey. TI = Tioga County, number following TI is sequential well number, and TD = total depth (in feet) of well

Geologic contacts

Accurately to approximately located

Inferred

Hydrologic symbols

Water table

830 — **Potentiometric contour**—Shows altitude at which water level would have stood in tightly cased wells. Contour interval 2 feet. Datum is NAVD 88. Arrows shows general direction of groundwater flow

Figure 14. Geohydrologic section *J*–*J′* across the Catatonk Creek valley, 1.2 miles south of Catatonk, Tioga County, New York.

In the northern part of the study area, the drainage divide in the major valleys (Pony Hollow, headwaters of Cayuta Creek near Alpine, Catatonk Creek north of the Village of Spencer and headwaters of Willseyville Creek) crosses broad valleys whose valley floors slope gently to the south from the divide. In front (south) of the Valley Heads Moraine, meltwaters deposited large amounts of outwash sand and gravel in the Cayuta Creek and Catatonk Creek valleys. These outwash deposits form the largest aquifer units in the study area. The outwash deposits are coarsest and thickest (as much as 100 ft thick) close to the front of the Valley Heads Moraine, which was near the source of the sediment and where the stream gradient of meltwaters was steepest. The thickness of the outwash and the grain sizes of clasts decrease with increasing distance southward from the moraine.

In the 27-mi-long Cayuta Creek valley, outwash, kame, and recent alluvial sediments are the predominant deposits (plate 2 and figs. 5–9). In the 23-mi-long Catatonk Creek valley, the northern valley reaches (Michigan Creek/Catatonk Creek valley north of the Village of Spencer and the northern part of the Willseyville Creek valley) contain predomintly kame moraine and outwash deposits (plate 2 and fig. 10), the middle part of the valley (the east-west segment of the valley) contains predomintly alluvium and alluvial fan deposits at land surface that are underlain by outwash (plate 2 and fig. 12), and the southern part of the valley (the segment from the Village of Candor to the mouth of the valley) contains predomintly outwash, alluvial, glaciolacustrine sediments (fine sand, silt, and clay), and till; (plate 2 and figs. 13 and 14).

Water Table and Conceptual Model of Groundwater Flow

The recharge that meets the water table (below which the soil is saturated) can move both vertically and horizontally. Groundwater levels provide a measure of the depth to the water table and the hydraulic head in the stratified-drift aquifers in the study area (plate 3, and figs. 5–14). Hydraulic head is a measure (in units of feet above a datum) of the potential to cause flow due to gravity and water pressure. A map that depicts the water-table contour lines (plate 3) was constructed to show which direction groundwater flows horizontally and geohydrologic cross sections that depict flow nets (figs. 5–14) were constructed in selected areas to show which direction groundwater flows vertically. Groundwater flows from high to low hydraulic head and perpendicular to water-table contours and equipotential lines.

Stratified-Drift Aquifers and Confining Units

Unconfined aquifers are present throughout the Cayuta Creek and Catatonk Creek valleys, whereas unconfined aquifers that are underlain by confined aquifers are present in some places (fig. 4). Relatively thin unconfined aquifers also are present in the large tributary valleys, but their extent is not well known because few well data are available for those areas. The unconfined aquifers are composed of coarse-grained stratified deposits, such as alluvial and glaciofluvial sand and gravel. Most wells in the study area tap the unconfined aquifers.

In most places in the unconfined aquifers, the groundwater system is hydraulically connected to the main-stem streams in the valleys. In these areas, the yields from the aquifers are potentially large because water withdrawals from large pumping wells could be supplemented by water induced from the streams. Yields from the aquifers, however, may be less in anomalous geohydrologic settings at four headwater valleys in the study area. Typically, drainage divides follow the crests of ridges and headwater streams descend steep slopes on each side of the divide. In these four headwater valleys (Pony Hollow valley, Danby Creek valley, Willseyville Creek valley, and Cayuta Creek valley), the drainage divide crosses broad relatively flat valleys. In these areas, scouring by ice removed the former (preglacial) bedrock cols (a high, narrow pass or depression in upland areas, generally across a ridge or through a divide, or between two adjacent hills) that once formed the major surface-water divide between the St. Lawrence River Basin and the Susquehanna River Basin. The bedrock cols that had formed the divides have been replaced by an accumulation of more than 100 ft of glacial drift—mostly Valley Heads Moraine deposits. These anomalous features are called “through valleys” by Tarr (1905) (plates 2 and 3). Although through valleys resemble major stream valleys, they differ in that they are drained by small streams that are ephemereal or flow seasonally (typically during the spring freshet) and become dry during the summer when the water table drops below the bottom of the stream channel. During periods when there is no flow in the channel, groundwater flows downvalley as underflow rather than discharge into the stream. Also, because there are periods when the streams have little flow or are dry there would be little or no induced infiltration into these headwater aquifers and the potential yield would be smaller than from valley-fill aquifers that have a large perennial stream in which large pumping wells could induce large amounts of water to flow from the stream to the well throughout the year (Randall and others, 1988).

The confining units are composed of relatively impermeable fine-grained deposits (till and glaciolacustrine silt and clay). Although there is a confined aquifer in the southern part of the Catatonk Creek valley and possibly in the southern part of the Willseyville Creek valley (fig. 4), the confining unit may not extend completely across the valley in some places (figs. 13 and 14), therefore there is hydraulic connection in many places between the unconconfined and confined aquifers. There are no reported artesian flowing wells in the study area.

Because of the lack of well logs in the deeper parts of the valley fill, specifically in the 7-mi reach of Catatonk Creek

from Spencer to the confluence with Willseyville Creek Valley and in the 2-mi reach of Cayuta Creek that is downstream of the Village of Van Etten, the presence of aquifers at depth is unknown (fig. 4). It can be assumed, however, that a basal confined aquifer is present in most places on top of bedrock because such deep aquifers are common in other glaciated valleys in central New York (Miller and Karig 2010; Miller, 2009; Miller and others, 1998; and Miller, 1988).

Recharge, Discharge, Water Table, and Direction of Groundwater Flow

The ultimate source of recharge is from precipitation, in which the study area receives from 35 to 39 inches per year (in/yr) (Kontis and others, 2004). The amount of recharge to stratified-drift aquifers is a key determinant of the long-term availability of groundwater. More recharge is potentially available to unconfined aquifers than to confined aquifers. In general, recharge enters the stratified-drift aquifers primarily by direct infiltration of precipitation (rain and snow melt) where the aquifer crops out at land surface, surface runoff and subsurface flow from adjacent unchanneled upland areas that recharges the aquifer along the valley walls, leakage from tributary streams on their alluvial fans, and upward leakage from the underlying bedrock and leakage from adjacent fine-grained confining units, that may be induced by pumping. The importance of tributary streamflow infiltration as a source of recharge to stratified-drift aquifers has been documented in the Appalachian Plateau by Crain (1966), Randall (1978), and Williams (1991). Streamflow losses chiefly occur where upland streams descend from adjacent uplands and cross alluvial-fan deposits in the main valley.

Most groundwater discharges into Cayuta and Catatonk Creeks. Lesser amounts of groundwater are discharged to pumping wells. Most of the water pumped from domestic wells is returned to the aquifers through septic systems, whereas most of the water pumped from municipal wells that is treated is discharged into the streams rather than returned to the aquifer. Transpiration decreases available recharge when water vapor escapes from living vegetation back into the atmosphere, and in some areas, induces discharge directly from the aquifer where roots extend below the water table. This reduction in recharge happens mostly during the spring when the ground is saturated and the water table is close to or at land surface. In the study area, evapotranspiration is estimated to range between 18 to 19 in/yr (Kontis and others, 2004, plate 1) or roughly one-half of the annual precipitation in this area (35 to 39 in/yr).

A generalized depiction of the water table in the unconfined aquifer is shown in plate 3. The water table was constructed from water-level measurements made in wells from the 1950s to 2010 and LIDAR data (where available) that were used to determine altitudes of perennial streams at 10-ft intervals and altitudes of large ponds and wetlands. Where LIDAR data were unavailable, topographic contours (scale 1:24,000 USGS topographic quadrangles) that crossed major streams at 10-ft altitude intervals were used. LIDAR altitudes of land surface and topographic contours from quadrangles could be used to define the water table because major surface-water bodies and groundwater are hydraulically connected to the unconfined aquifers.

The portion of groundwater that moves laterally flows roughly perpendicular to water-table contours in the unconfined aquifers. The configuration of the water-table contours indicates that the general direction of groundwater flow within the Cayuta Creek and Catatonk Creek stratified-drift aquifers is predominantly from the valley walls toward the main streams in the valleys, where most groundwater discharges from the aquifer system (plate 3). Sections *A–A′* to *J–J′* (figs. 5 to 14, respectively) include conceptual potentiometric contours and flow lines that show recharge at land surface and groundwater discharge into the streams. Where upland tributary streams lose water over the alluvial fans in the valleys, a localized groundwater mound forms beneath the stream (plate 3) and the direction of groundwater flow is radially away from the tributary channel and toward the main stream in the valley (figs. 5, 7, and 11). In addition, some groundwater that flows toward major streams is intercepted by pumping wells. There are three municipal well fields in the study area (Villages of Van Etten, Candor, and Waverly), with wells that have large-diameter casings, well screens, and pumps that are capable of withdrawing water at a rate of several hundred gallons per minute. There also are several industrial and commercial wells that withdraw relatively large amounts of water in the study area. In addition, there are 10 trailer parks that withdraw groundwater from the aquifer system.

Although groundwater-level measurements were recorded from the 1950s to 2010, the average annual fluctuation of the water table in the stratified-drift aquifers in the Cayuta Creek and Catatonk Creek valleys is only expected to range from 5 to 10 ft with the lowest range of fluctuation (about 5 ft) occurring near discharge areas, such as streams, and the highest range of fluctuation (about 10 ft) expected where large amounts of recharge occur, such as along the valley walls and beneath alluvial fans. In areas adjacent to gaining streams and large surface-water bodies such as lakes, ponds, and wetlands, the altitude of the water table is controlled by the water level of the surface-water body. The groundwater level is slightly higher (typically 1 to 3 ft) than that of the water level in the stream and wetland, and fluctuates similarly to the water level in these surface-water bodies (about 3 to 7 ft). However, in distal areas from the gaining streams, lakes, ponds, and wetlands, the water table is more than several feet (typically 3 to 10 ft) higher than the major surface-water bodies, and annual water-level trends are affected by fluctuations in variations in the amounts of recharge, such as precipitation.

Water-level data from USGS long-term monitoring well TI 891 (operating since December 2003) finished in the stratified-drift aquifer near Spencer, N.Y. (plate 1, appendix) indicate that the average annual water-table fluctuation was 8.9 ft from January 1, 2004, to September 30, 2010 (fig. 15). An annual fluctuation of 5 ft or less is common in other USGS long-term monitoring wells that also were finished in sand and gravel stratified-drift aquifers in the surrounding counties. Because the annual fluctuation of groundwater level ranges from 5 to 10 ft in most places and the contour interval of the water-table map is 10 ft (plate 3), the configuration of the water table is probably a reasonable representation of long-term and average-annual groundwater levels and the general directions of groundwater-flow in the aquifer. The water-table map, however, should not be used for precise or site-specific determination of groundwater levels and directions of flow. A synoptic set of groundwater-level measurements from wells whose measuring point altitudes are known would be needed to represent the water table more accurately than what has been done for this study.

In the Catatonk Creek stratified-drift aquifer, the altitude of the water table ranged from 1,220 ft near the hamlet of Danby to 810 ft at the mouth of Catatonk Creek (plate 3)—a total decrease in hydraulic head of 410 ft over 21 mi and an average horizontal hydraulic gradient of 19.5 ft/mi (0.0037 foot per foot (ft/ft)). In the Cayuta Creek stratified-drift aquifer, the altitude of the water table ranged from 1,205 ft at the surface-water divide in Pony Hollow valley to 810 ft near the mouth of Cayuta Creek at Waverly (plate 3)—a total

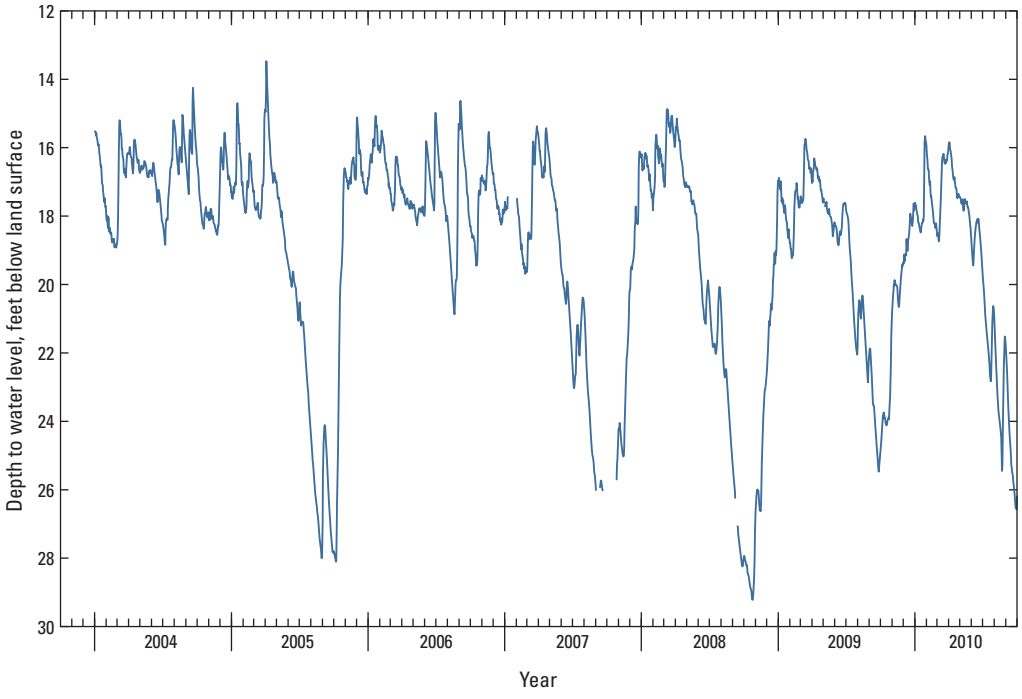


Figure 15. Groundwater levels from January 1, 2004, to September 30, 2010, in well TI 891 (site number 421213076313301) near Spencer, New York. Location of well shown in plate 1.

decrease in hydraulic head of 395 ft over 27 mi and an average horizontal hydraulic gradient of 14.6 ft/mi (0.0028 ft/ft).

Summary

The location of wells, stratified-drift aquifer extents, surficial deposits, and groundwater levels in the Cayuta Creek and Catatonk Creek valleys and their large tributary valleys were mapped in 2009, in cooperation with the New York State Department of Environmental Conservation in Tompkins, Schuyler, Chemung, and Tioga Counties, New York. Geologic materials in the study area include sedimentary bedrock, unstratified drift (till), stratified drift (glaciolacustrine and glaciofluvial deposits), and recent alluvium. Stratified drift consisting of sand and gravel is the major component of the valley fill in the study area—it is present in sufficient amounts in most places to form extensive unconfined aquifers throughout the study area and to form locally confined aquifers. Stratified deposits consisting of fine-grained sediment (glaciolacustrine fine sand, silt, and clay) are present locally in valleys underlying the glaciofluvial and recent alluvial sand and gravel deposits in the southern part of the Catatonk Creek and Willseyville Creek valleys. These unconfined and confined aquifers are the source of water for most residents, farms, and businesses in the valleys.

The configuration of the contours of the water table indicate that the general direction of groundwater flow within Cayuta Creek and Catatonk Creek stratified-drift aquifers is predominantly from the valley walls toward the main stream in each valley, where most groundwater discharges from the aquifer system. Locally, where upland tributary streams lose water over the alluvial fans in the valleys, a groundwater mound has formed beneath the stream, and the direction of groundwater flow is radially away from the tributary channel. Pumping wells intercept some groundwater that normally would discharge to streams.

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Appendix 1. Records of selected wells in Cayuta Creek and Catatonk Creek valleys in parts of Tompkins, Chemung, Schuyler and Tioga Counties, New York.

[ft, feet; in, inches; NAVD 88 in ft, North American Vertical Datum of 1988, in feet: gal/min, gallons per minute; gal/d, gallons per day; S&G, sand and gravel; --, no data; WL, water level; mg/L, milligrams per liter; PWS, Public Water Supply well]

Site number	Site name	Date drilled	Well depth (ft)	Depth of casing (ft)	Casing diameter (in)	Altitude land surface (NAVD 88, in ft)	Aquifer type	Water level below land surface (ft)	Altitude water level (NAVD 88, in ft)	Date water level measured	Depth to bedrock (ft)	Altitude top of bedrock (NAVD 88, in ft)	Reported yield (gal/min)	Remarks
Cayuta Creek valley stratified-drift aquifer–Chemung County														
421158076330501	CM 23	6/1/1964	54	54	6	1,017	S&G	--	--	--	--	--	25	
421153076331201	CM 260	12/1/1964	69	69	6	1,013	S&G	29	984	12/1/1964	--	--	25	0–20 gravel, 20–60 fine sand, 60–69 ft gravel.
421159076331001	CM 264	8/1/1965	64	64	6	1,024	S&G	36	992	8/1/1965	--	--	--	Ends in sandy pebble gravel.
421201076325801	CM 267	5/1/1966	59	59	6	1,012	S&G	18	994	5/1/1966	--	--	40	Gas reported at 50 ft.
421202076325701	CM 268	9/1/1966	57	57	6	1,012	S&G	18	994	9/1/1966	--	--	7	Gas reported at 49 ft.
421202076325801	CM 269	8/1/1965	61	61	6	1,014	S&G	24	990	8/1/1965	--	--	50	--
421204076325501	CM 270	6/1/1967	61	61	6	1,009	S&G	12	997	6/1/1967	--	--	30	10 gal/min from sand or gravel at 48 ft, gas reported.
421206076332201	CM 271	7/1/1963	51	51	6	1,033	S&G	38	995	7/1/1963	--	--	--	WL 50 ft Aug. 1964.
421208076332301	CM 272	7/1/1963	312	95	6	1,036	Shale	27	1,009	7/1/1963	95	941	1	Silty gravel and hardpan above bedrock, a little water at 40 ft.
421209076331701	CM 273	6/1/1964	165	36	6	1,040	Shale	8	1,032	6/1/1964	36	1,004	6	Hardness 103 mg/L.
421313076354301	CM 280	6/1/1964	104	30	--	1,042	Shale	6	1,036	11/1/1964	30	1,012	3	Drillled to 263 ft, salt water at 256 ft, plugged to 104 ft.
421328076363601	CM 283	6/1/1941	55	--	6	1,056	Shale	--	--	--	--	--	--	--
421415076370101	CM 286	1/1/1953	250	--	6	1,076	Shale	35	1,041	1/1/1953	20	1,056	1	Depth approximate; salt water; gas entered near bottom. Abandoned, casing pulled out due to poor yield.
421418076370701	CM 287	6/1/1947	125	30	6	1,110	Shale	52	1,058	6/1/1964	28	1,088	--	WL 32 ft in 1947.
421155076332601	CM 387	1939	80	80	8	1,016	S&G	--	--	4/17/1956	--	--	50	--
421224076351801	CM 412	--	75	15	6	1,037	Shale	15	1,022	6/12/1956	12	1,025	12	--
421151076330701	CM 644	4/29/1981	49	--	--	1,033	S&G	31	1,002	4/29/1981	47	986	--	0–47 silty gravel, 46–49 ft shale.
421254076355401	CM 816	8/7/2000	140	19	6	1,030	Shale	30	1,000	8/7/2000	10	1,020	50	0–9 till, 9–10 gravel, 10–130 shale (3 gal/min), 130–140 fractured shale (50 gal/min).
421213076321901	CM 878	9/6/2001	95	95	6	1,047	Shale	37	1,010	9/6/2001	31	1,016	8	0–31, dirty gravel, 31–95 ft shale.
421203076330801	CM 906	2/8/2002	58	58	6	1,028	S&G	28	1,000	2/8/2002	--	--	20	0–40 dirty gravel, 40–58 ft S&G. Used for car wash.

Appendix 1. Records of selected wells in Cayuta Creek and Catatonk Creek valleys in parts of Tompkins, Chemung, Schuyler and Tioga Counties, New York.—Continued

[ft, feet; in, inches; NAVD 88 in ft, North American Vertical Datum of 1988, in feet: gal/min, gallons per minute; gal/d, gallons per day; S&G, sand and gravel; --, no data; WL, water level; mg/L, milligrams per liter; PWS, Public Water Supply well]

Site number	Site name	Date drilled	Well depth (ft)	Depth of casing (ft)	Casing diameter (in)	Altitude land surface (NAVD 88, in ft)	Aquifer type	Water level below land surface (ft)	Altitude water level (NAVD 88, in ft)	Date water level measured	Depth to bedrock (ft)	Altitude top of bedrock (NAVD 88, in ft)	Reported yield (gal/min)	Remarks
Cayuta Creek valley stratified-drift aquifer–Chemung County—Continued														
421157076335001	CM 935	8/15/2010	27	27	6	996	S&G	13	983	8/15/2002	--	--	20	0–27 ft S&G.
421327076363001	CM 936	8/17/2002	43	43	6	1,047	S&G	31	1,016	8/17/2002	--	--	12	0–35 dirty gravel, 35–43 ft S&G.
421208076330701	CM1037	10/21/2003	119	17	6	1,063	Shale	49	1,013	10/21/2003	15	1,047	6	0–15 dirty gravel, 15–119 ft grey shale.
421151076335101	CM1040	4/9/2004	80	70	10	989	S&G	8	981	4/9/2004	--	--	100	0–20 dirty gravel, 20–46 sand, 46–80 ft S&G.
421151076335102	CM1042	12/16/2003	80	80	6	989	S&G	6	983	12/16/2003	--	--	50	0–20 dirty gravel, 20–46 sand, 46–95 ft S&G.
421149076334901	CM1046	12/19/2003	81	81	6	991	S&G	9	983	12/19/2003	--	--	35	0–30 silty gravel, 30–81 ft S&G.
421149076334902	CM1058	4/27/2004	80	70	10	991	S&G	9.6	982	4/27/2004	--	--	50	0–30 silty gravel, 30–40 S&G, 40–80 ft S&G.
421001076333001	CM1063	4/16/2004	105	55	6	956	Shale	15	941	4/16/2010	54	905	4	0–10 S&G, 10–45 till, 45–54 cemented gravel, 54–105 ft shale.
421311076360601	CM1211	2/9/2007	41	21	6	1,020	Shale	5	1,015	2/9/2007	21	999	8	0–21 sand and gravel, 21–41 ft shale.
421125076332401	CM1232	8/13/2007	50	19	6	1,010	Shale	9	1,001	8/13/2007	10	1,000	15	0–10 till, 10–50 ft shale.
421348076364501	CM1277	5/16/2008	30	30	6	1,036	S&G	8	1,028	5/16/2008	--	--	15	0–30 ft S&G.
421045076335501	CM1290	7/22/2008	70	70	6	974	Shale	10	963	7/22/2008	49	924	35	0–40 silty gravel, 40–49 till, 49–70 ft grey shale.
421350076362401	CM1293	8/5/2008	220	29	6	1,079	Shale	35	1,043	8/5/2008	15	1,063	2	0–15 till, 15–220 ft shale.
421413076365201	CM2288	6/4/1999	41	--	--	1,071	Shale	--	--	6/4/1999	30	1,041	--	Test boring. 0–5 sand, 5–10 silt, 10–15 gravel, 15–30 silt, 30–41 ft shale.
421239076350001	CM2289	12/8/1998	21	--	--	1,039.1	Shale	6	1,036.1	12/8/1998	15	1,024	--	Test boring. 0–5 sand, 5–15 silt, 15–21 ft shale.
421203076332301	CM2290	5/5/1999	52	--	--	1,029	Sand	--	--	5/5/1999	--	--	--	Test boring. 0–25 silt, 25–35 sand, 35–40 silt, 40–45 sand, 45–50 silt, 50– 52 ft sand.
421430076373501	CM2292	10/26/2005	21	--	--	1,093	Silt	--	--	10/26/2005	--	--	--	Test boring. 0–5 gravel, 5–21 ft silt.

Appendix 1. Records of selected wells in Cayuta Creek and Catatonk Creek valleys in parts of Tompkins, Chemung, Schuyler and Tioga Counties, New York.—Continued

[ft, feet; in, inches; NAVD 88 in ft, North American Vertical Datum of 1988, in feet: gal/min, gallons per minute; gal/d, gallons per day; S&G, sand and gravel; --, no data; WL, water level; mg/L, milligrams per liter; PWS, Public Water Supply well]

Site number	Site name	Date drilled	Well depth (ft)	Depth of casing (ft)	Casing diameter (in)	Altitude land surface (NAVD 88, in ft)	Aquifer type	Water level below land surface (ft)	Altitude water level (NAVD 88, in ft)	Date water level measured	Depth to bedrock (ft)	Altitude top of bedrock (NAVD 88, in ft)	Reported yield (gal/min)	Remarks
Cayuta Creek valley stratified-drift aquifer—Schuyler County														
421623076411501	SY 3	--	28	--	6	1,100	S&G	--	--	--	--	--	--	--
421642076413701	SY 8	--	--	--	6	1,110	--	--	--	--	--	--	--	--
421729076415501	SY 16	--	60	--	6	1,130	S&G	--	--	--	--	--	--	--
421731076420501	SY 19	6/6/1960	82	75	6	1,175	Shale	57	1,118	--	--	--	20	--
421733076423201	SY 22	--	40	--	6	1,160	S&G	--	--	--	--	--	--	--
421733076432701	SY 23	--	70	--	6	1,150	Shale	--	--	--	20	1,130	--	--
421734076425801	SY 24	1958	50	--	6	1,115	S&G	--	--	--	--	--	--	--
421734076431801	SY 25	--	80	--	6	1,150	Shale	--	--	--	30	1,120	--	--
421734076432301	SY 26	8/31/1948	32	32	6	1,153	S&G	8	1,145	7/1/1967	--	--	10	--
421735076424101	SY 27	--	28	--	--	1,100	S&G	--	--	--	--	--	--	--
421737076425201	SY 29	--	40	--	6	1,100	S&G	--	--	--	--	--	--	--
421756076431801	SY 42	--	38	--	6	1,160	S&G	--	--	--	--	--	--	--
421811076430901	SY 46	1945	24	--	6	1,145	S&G	--	--	--	--	--	--	0–17 till, 17–24 ft S&G.
421836076431801	SY 67	8/24/1960	24	24	6	1,150	S&G	--	--	--	--	--	12	0–18 ft gravel and clay, 18–24 ft S&G.
421836076432201	SY 68	1966	16	--	6	1,155	S&G	--	--	--	--	--	--	--
421836076432701	SY 70	9/29/1965	21	21	6	1,159	S&G	16	1,143	9/30/1965	--	--	7	Chiefly silt and clay with coarse sand grains, pebbly.
421839076432301	SY 75	1972	30	--	6	1,157	Gravel	14	1,143	1/01/1972	20	1,137	--	0–15 clay, 15–18 ft gravel.
421840076432301	SY 76	1972	30	--	6	1,155	Shale	10	1,145	8/8/1980	24	1,131	--	clay 0–12, gravel 12–24, shale 24–30 ft.
421840076432401	SY 77	--	85	--	6	1,165	S&G	--	--	--	28	1,137	--	--
421850076432501	SY 99	1979	20	--	6	1,155	S&G	5	1,150	8/13/1980	--	--	7	0-20 ft S&G.
421724076423601	SY 694	8/23/1999	62	--	--	1,109.9	S&G	3.2	1,106.7	8/23/1999	--	--	--	Test boring. 0–25 silt, 25–45 sand, 45–55 silt, 55–60 clay, 60–62 ft gravel.
421237076424401	SY 723	6/27/1984	51	--	--	1,113	S&G	7	1,106	6/27/1984	--	--	--	Test boring. 0–16 gravely silt, 16–30 sandy gravel, 30–53 ft S&G.

Appendix 1. Records of selected wells in Cayuta Creek and Catatonk Creek valleys in parts of Tompkins, Chemung, Schuyler and Tioga Counties, New York.—Continued

[ft, feet; in, inches; NAVD 88 in ft, North American Vertical Datum of 1988, in feet: gal/min, gallons per minute; gal/d, gallons per day; S&G, sand and gravel; --, no data; WL, water level; mg/L, milligrams per liter; PWS, Public Water Supply well]

Site number	Site name	Date drilled	Well depth (ft)	Depth of casing (ft)	Casing diameter (in)	Altitude land surface (NAVD 88, in ft)	Aquifer type	Water level below land surface (ft)	Altitude water level (NAVD 88, in ft)	Date water level measured	Depth to bedrock (ft)	Altitude top of bedrock (NAVD 88, in ft)	Reported yield (gal/min)	Remarks
Cayuta Creek valley stratified-drift aquifer—Schuyler County—Continued														
421642076413301	SY 724	9/5/1991	73	--	--	1,104	Gravel	9	1,095	9/5/1991	--	--	--	Test boring. 0–6 gravely silt , 6–51 coarse gravel, 51–61 sand, 61–73 ft gravel.
421609076405701	SY 725	8/25/1981	33	--	--	1,086.5	S&G	2	1,084	8/25/1981	--	--	--	Test boring. 0–5 silt, 5–33 ft S&G.
421522076402901	SY 726	7/1/1981	53	--	--	1,084	Shale	6	1,077	7/1/1981	43	1,041	--	Test boring. 0–28 silty gravel, 28–43 compact silty gravel (till?), 43–53 ft shale.
421440076375601	SY 727	3/13/1981	39	--	--	1,074	S&G	11	1,063	3/13/1981	--	--	--	Test boring. 0–39 ft silty gravel.
421522076402801	SY 728	7/1/1981	33	--	--	1,081	Shale	4	1,077	7/1/1981	22	1,059	--	Test boring. 0–11 S&G, 11–22 compact silty gravel, 22–33 ft shale.
421523076362501	SY 914	11/28/2000	44	40	6	1,127	S&G	14	1,113	11/28/2000	41	1,086	--	0–41 S&G, 41–44 ft shale.
421926076433301	SY 919	3/7/2001	115	18	6	1,227	Shale	65	1,162	3/7/2001	7	1,220	12	0–7 till, 7–20 soft (weathered) shale, 20–115 ft shale.
421823076431201	SY 957	9/23/2001	20	20	6	1,150	S&G	3	1,147	9/23/2001	--	--	20	0–20 ft gravel.
421706076420201	SY1013	6/4/2002	68	62	8	1,107	S&G	12	1,095	6/4/2002	--	--	100	0–35 gravel, 35–62 clay and gravel, 62–68 ft S&G. Production well. Screened 63–68 ft.
421651076413901	SY1026	8/20/2002	42	38	6	1,110	S&G	20	1,090	8/20/2002	--	--	100	0–18 dirty gravel, 18–37 S&G, 37–44 ft gravel.
421705076425401	SY1095	5/22/2003	58	58	6	1,111	S&G	20	1,091	5/22/2003	--	--	30	0–48 S&G, 48–55 clay and grave (dirty gravel or till), 55–58 ft S&G.
421713076413601	SY1120	8/11/2003	38	38	6	1,121	S&G	--	--	--	--	--	15	0–38 ft S&G.
421823076432301	SY1175	4/3/2004	82	82	6	1,180	S&G	--	--	--	--	--	--	--
421912076434201	SY1211	8/20/2004	100	30	6	1,225	Shale	40	1,185	8/20/2004	0	1,225	8	0–100 ft shale (depth to rock questionable).
421516076400501	SY1249	3/17/2005	130	18	6	1,107	Shale	--	--	--	15	1,092	4	0–15 till, 15–130 ft shale.
421526076402701	SY1363	11/15/2006	130	25	6	1,143	Shale	69	1,074	11/15/2006	25	1,118	11	0–8 till, 8–25 dirty gravel, 25–130 ft shale.

Appendix 1. Records of selected wells in Cayuta Creek and Catatonk Creek valleys in parts of Tompkins, Chemung, Schuyler and Tioga Counties, New York.—Continued

[ft, feet; in, inches; NAVD 88 in ft, North American Vertical Datum of 1988, in feet: gal/min, gallons per minute; gal/d, gallons per day; S&G, sand and gravel; --, no data; WL, water level; mg/L, milligrams per liter; PWS, Public Water Supply well]

Site number	Site name	Date drilled	Well depth (ft)	Depth of casing (ft)	Casing diameter (in)	Altitude land surface (NAVD 88, in ft)	Aquifer type	Water level below land surface (ft)	Altitude water level (NAVD 88, in ft)	Date water level measured	Depth to bedrock (ft)	Altitude top of bedrock (NAVD 88, in ft)	Reported yield (gal/min)	Remarks
Cayuta Creek valley stratified-drift aquifer—Schuyler County—Continued														
421526076402702	SY1372	2/7/2007	119	19	6	1,140	Shale	62	1,078	2/7/2007	19	1,121	20	0–19 till, 19–119 ft grey shale.
421813076450801	SY1452	5/19/2008	38	38	6	1,290	S&G	5	1,185	5/19/2008	--	--	24	0–30 clay and gravel, 30–37.5 ft S&G.
421650076414501	SY1500	2/20/2009	33	33	6	1,106	S&G	9	1,097	2/20/2009	--	--	20	0–32 dirty gravel or gravelly till, 32–33 ft gravel.
421855076433001	SY1507	4/20/2009	100	20	6	1,195	Shale	15	1,180	4/20/2009	10	1,185	4	0–8 till, 8–10 dirty gravel, 10–100 ft shale.
421525076404001	SY1556	3/19/2010	36	36	6	1,093	S&G	11	1,082	3/19/2010	--	--	15	0–18 hardpan (dirty gravel?), 18–36 ft S&G.
Cayuta Creek valley stratified-drift aquifer—Tioga County														
420108076312401	TI 35	1945	75	75	6	846	S&G	35	811	Aug-45	--	--	25	--
420111076312401	TI 36	Jun-56	84	69	6	845	Shale	33	812	Jun-56	69	776	12	--
420107076312501	TI 37	1965	109	70	6	847	Shale	36	811	12/1/1965	70	777	22	Original depth 65 ft, finished in S&G. Deepened in 1965.
420049076304801	TI 301	8/15/2000	33	33	6	828	Gravel	13	815	8/15/2000	--	--	20	0–15 hardpan, 15–33 ft gravel.
420604076324101	TI 327	6/29/2000	33	33	6	1,033	S&G	23	1,010	6/29/2000	--	--	10	0–12 coarse dirty gravel, 12–25 till, 25–33 ft dirty gravel.
420158076314301	TI 343	8/15/2000	120	19	6	844	Shale	12	832	8/15/2000	18	826	8	0–18 S&G, 18–120 ft shale.
420616076323601	TI 358D	9/15/2000	54	54	6	896	S&G	29	867	9/15/2000	--	--	10	0–48 dirty gravel, 48–54 ft gravel.
420604076324701	TI 371	10/10/2000	87	87	6	920	Gravel	9	911	10/10/2000	--	--	20	0–29 dirty gravel, 29–85 cemented gravel, 85–87 ft gravel.
420113076314301	TI 381	10/30/2000	125	63	6	865	Shale	55	810	10/30/2000	63	802	15	0–22 dirty gravel, 22–63 cemented gravel, 63–68 brown rock, 68–125 ft gray rock.
420109076314301	TI 386	12/4/2000	103	62	6	867	Shale	58	809	12/4/2000	62	805	9	0–62 gravel, 62–103 ft shale.
420729076314201	TI 425	5/9/2001	55	54	6	1,049	Shale	15	1,034	5/9/2001	54	995	15	0–20 gravel, 20–54 sandy clay, 54–55 ft shale.
420220076313401	TI 440	8/17/2001	77	79	6	876	S&G	40	836	8/17/2001	--	--	20	0–77 ft S&G.

Appendix 1. Records of selected wells in Cayuta Creek and Catatonk Creek valleys in parts of Tompkins, Chemung, Schuyler and Tioga Counties, New York.—Continued

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Site number	Site name	Date drilled	Well depth (ft)	Depth of casing (ft)	Casing diameter (in)	Altitude land surface (NAVD 88, in ft)	Aquifer type	Water level below land surface (ft)	Altitude water level (NAVD 88, in ft)	Date water level measured	Depth to bedrock (ft)	Altitude top of bedrock (NAVD 88, in ft)	Reported yield (gal/min)	Remarks
Cayuta Creek valley stratified-drift aquifer—Tioga County—Continued														
420049076314002	TI 530	2/22/2002	60	60	6	810	Shale	--	--	--	52	760	--	Test well. 0–17 gravel, 17–47 sand, 47–52 S&G, 52–60 ft shale.
420950076182901	TI 589D	--	--	--	--	--	--	--	--	--	--	--	--	--
420045076304601	TI 622	10/15/2002	108	72	6	824	Shale	22	802	10/15/2002	72	752	15	0–35 gravel, 35–60 clay and stone, 60–72 cement gravel, 72–108 ft shale.
420511076330001	TI 626	10/2/2002	28	28	6	889	Gravel	13	876	10/2/2002	--	--	15	0–28 ft gravel.
420049076314001	TI 650	11/23/2002	50	40	16	810	S&G	14	798	11/11/2002	--	--	1,000	PWS. Screened 40–50 ft. 0–6 sandy clay, 6–50 S&G, 50–51 ft till.
420410076324101	TI 706D	7/23/2003	39	39	6	979	S&G	19	960	7/23/2003	--	--	15	0–39 ft S&G.
420222076314501	TI 733D	3/11/2004	98	42	6	859	Shale	24	835	3/11/2004	42	819	17	0–18 hardpan, 18–42 dirty gravel, 42–98 ft gray rock.
421728076204401	TI 736D	9/9/2003	60	49	6	1,068	Shale	20	1,019	9/9/2003	49	1,048	20	0–18 gravel, 18–30 till, 30–49 S&G, 49–60 ft shale.
421718076224401	TI 755D	10/31/2003	28	28	6	946	S&G	12	934	10/31/2003	--	--	15	0–28 ft sand and gravel.
420857076333101	TI 770	12/8/1998	42	--	--	959	Silt	--	--	12/8/1998	--	--	--	0–30 silt, 30–40 gravel, 40–42 ft silt.
421723076224201	TI 782	4/5/2004	29	29	6	948	S&G	10	938	4/5/2004	--	--	12	0–29 ft sand and gravel.
421348076292001	TI 795	6/8/2004	72	72	6	1,015	Shale	20	995	6/8/2004	70	945	--	Test well. 0–19 S&G, 19–28 cemented gravel, 28–48 clay and stones, 48–70 S&G, 70–72 ft shale.
421343076293201	TI 796	6/3/2004	40	40	6	1,015	S&G	19	996	6/3/2004	--	--	20	0–30 S&G, 30–38 sand, clay, and gravel, 38–40 ft S&G.
420724076313901	TI1022	7/12/2004	100	40	6	1,046	Shale	15	1,031	7/12/2004	40	1,006	10	0–40 till, 40–100 ft shale.
420417076323901	TI1026	7/21/2004	50	52	6	891	Gravel	19	872	7/21/2004	--	--	25	0–50 ft gravel.
420533076325701	TI1206	3/20/2006	35	35	6	895	S&G	11	884	3/20/2006	--	--	15	0–18 dirty gravel, 18–25 gravel, 25–35 ft S&G.
420725076314101	TI1284	8/28/2006	35	32	6	1,050	S&G	0	1,050	8/28/2006	32	1,018	10	0–28 till and clay, 28–32 S&G, 32–35 ft shale.
420120076312601	TI1728	12/13/2010	58	58	6	848	S&G	36	812	12/13/2010	--	--	20	0–18 hardpan (dirty gravel or till?), 18–54 cemented gravel, 54–58 ft S&G.

Appendix 1. Records of selected wells in Cayuta Creek and Catatonk Creek valleys in parts of Tompkins, Chemung, Schuyler and Tioga Counties, New York.—Continued

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Site number	Site name	Date drilled	Well depth (ft)	Depth of casing (ft)	Casing diameter (in)	Altitude land surface (NAVD 88, in ft)	Aquifer type	Water level below land surface (ft)	Altitude water level (NAVD 88, in ft)	Date water level measured	Depth to bedrock (ft)	Altitude top of bedrock (NAVD 88, in ft)	Reported yield (gal/min)	Remarks
Cayuta Creek valley stratified-drift aquifer- Tompkins County														
421739076414001	TM 3	6/1/1964	60	--	6	1,134	S&G	--	--	12/30/1899	--	--	--	--
421739076414001	TM 4	6/1/1980	26	26	6	1,136	S&G	18.5	1,118	8/9/1980	--	--	--	--
421808076405101	TM 6	5/1/1959	14	14	2	1,159	S&G	10	1,149	6/21/1967	--	--	6	Well located in cellar 8 ft below land surface.
421834076402101	TM 15	5/31/1960	41	41	6	1,168	S&G	4	1,164	6/1/1967	--	--	50	--
421841076401601	TM 16	6/1/1967	38	38	6	1,173	S&G	5	1,168	4/21/1981	--	--	30	--
421849076400501	TM 17	Late 1800s	120	100	6	1,188	Shale	15	1,173	4/21/1981	100	1,088	30	--
421854076395901	TM 18	6/1/1962	58	58	6	1,200	S&G	30	1,170	6/1/1967	--	--	18	3.5 gal/min at 56.5 ft, 18 gal/min at 58 ft.
421925076392901	TM 22	4/24/1968	24	24	6	1,221	S&G	9	1,212	4/24/1968	--	--	15	All gravel except 19–20 ft medium to coarse sand.
421927076392601	TM 23	6/1/1938	59	59	6	1,222	S&G	32	1,190	8/15/1967	--	--	--	Original well depth was 33 ft. Well went dry in 1938 and was redrilled to depth of 59 ft.
421932076385601	TM 24	5/5/1981	41	41	1	1,224	S&G	29.5	1,195	5/5/1981	--	--	--	0–20 gravel, 20–22 silty gravel, 22–35 gravel, 35–42 ft silty gravel.
421944076394501	TM 26	6/1/1979	160	80	6	1,242	Shale	60	1,182	6/1/1979	80	1,168	5	0–80 till (“clay with stones”), 80–160 ft shale.
421944076394502	TM 27	6/1/1979	70	70	6	1,242	S&G	40	1,202	12/30/1899	--	--	30	Well dries up in August.
421949076381601	TM 28	6/1/1965	85	85	6	1,245	S&G	40	1,205	5/5/1981	--	--	--	0–85 ft gravel, high yield.
421833076403901	TM1365	9/18/2001	38	38	6	1,164	S&G	12	1,152	9/18/2001	--	--	20	0–20 dirty gravel, 20–38 ft S&G.
421833076403801	TM1366	9/10/2001	47	47	6	1,150	S&G	15	1,135	9/10/2001	--	--	15	0–47 ft S&G.
421732076411701	TM2511	5/13/2008	59	59	6	1,125	Sand	9	1,116	5/13/2008	--	--	12	0–25 gravel. 25–41 till, 41–58 sand, 58–59 ft coarse sand.
421656076293401	TM2607	10/27/2008	92	23	6	1,103	Shale	37	1,066	10/27/2008	23	1,079	9	0–23 S&G, 23–92 ft shale.
421921076393701	TM2812	10/12/2010	30	30	6	1,214	S&G	10	1,204	10/12/2010	--	--	3	0–30 ft S&G.

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Catatonk Creek valley stratified-drift aquifer—Tompkins County—Continued														
421914076222401	TM 21	6/1/1962	45	45	6	981	S&G	--	--	--	--	--	--	Depth estimated 40-50 ft.
422030076233101	TM 32	10/7/1980	77	--	--	988	S&G	15	968	10/7/1980	--	--	--	USGS test boring. 0–6 silt, 6–16 silt with pebbles (till?), 16–33 gravel, 33–53 silty gravel, 53–71 silty sand, 71–77 clay (laminated), 77–77.5 ft till.
422103076241801	TM 562	--	63	--	--	1,040	S&G	--	--	--	--	--	--	--
422120076235501	TM 563	--	24	--	--	985	S&G	--	--	--	--	--	--	--
422018076234201	TM 564	--	127	--	--	1,035	Shale	--	--	--	--	--	--	--
422119076234601	TM 565	--	74	--	--	1,000	S&G	--	--	--	--	--	--	--
421934076231501	TM 567	4/15/1991	83	30	6	1,090	Shale	--	--	4/15/1991	30	1,025	--	--
421926076230801	TM 568	--	120	--	--	1,080	Shale	--	--	--	--	--	--	--
421932076231401	TM 569	--	150	--	--	1,090	Shale	--	--	--	--	--	--	--
421925076250001	TM 618	--	133	--	--	1,175	Shale	--	--	--	--	--	--	--
421938076264101	TM 936	--	128	--	--	1,295	Shale	--	--	--	--	--	--	--
421937076264001	TM1023	10/15/1971	128	17	8	1,305	Shale	15	1,290	10/15/1971	17	1,288	15	0–17 till, 17–128 shale.
421938076263601	TM1024	2/2/1994	200	18	6	1,275	Shale	45	1,230	2/2/1994	15	1,260	8	0–15 till, 15–200 ft shale.
421934076263701	TM1025	--	180	18	6	1,309	Shale	30	1,279	2/5/1994	5	1,304	--	0–5 till, 5–180 shale.
421934076251002	TM1035	11/5/2008	88	81	6	1,159	Shale	6	1,153	11/5/2008	68	1,085	2	0–18 silty gravel, 18–22 silt w/ some gravel, 22–32 S&G, 32–44 till, 44–48 sand, 48–68 till, 68–88 ft shale.
422048076242901	TM1251	8/18/2000	179	46	6	1,097	Shale	40	1,057	8/18/2000	44	1,053	--	0–44 gravel, 44–180 ft shale.
421915076225201	TM1260	10/7/2000	26	26	5	1,045	S&G	10	1,035	10/7/2000	--	--	--	0–26 ft S&G.
421917076225501	TM1296	11/22/2000	75	51	5	1,042	S&G	22	1,020	11/22/2000	51	991	10	0–51 till, 51–75 ft shale.
422032076241801	TM1380	9/6/2001	199	30	6	1,115	Shale	--	--	9/6/2001	26	1,089	3	0–26 till, 26–199 ft shale.
422053076244301	TM1408	5/7/2003	90	90	6	1,128	S&G	--	--	--	91	1,037	8	Bedrock at 91 ft.
422040076230701	TM1590	9/6/2002	120	52	6	1,091	Shale	32	1,059	9/6/2002	49	1,042	10	0–49 till, 49–120 ft shale.
422031076230201	TM1611	10/9/2002	280	21	6	1,082	Shale	25	1,057	10/9/2002	8	1,074	2	0–8 till, 8–280 ft shale.
421925076250101	TM1654	2/20/2003	41	42	6	1,174	S&G	26	1,148	2/20/2003	--	--	10	0–38 silty gravel, 38–41 ft S&G.

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Catatonk Creek valley stratified-drift aquifer—Tompkins County—Continued														
422055076243901	TM1671	4/29/2003	135	126	6	1,112	Shale	60	1,052	4/29/2003	126	986	5	0–100 till, 100–126 black sand, 126–135 ft shale.
422033076241101	TM1677	4/28/2003	240	29	6	1,077	Shale	--	--	4/28/2003	22	1,055	2	0–22 till, 22–240 ft shale.
422104076240501	TM1983	4/15/2005	220	220	6	1,002	S&G	10	992	4/15/2005	--	--	6	0–16 till, 16–26 S&G, 26–65 till, 65–70 gravel, 70–95 fine sand, 95–185 clay, 185–204 sand, 204–220 ft silty sand.
422104076240401	TM2005	4/22/2005	30	30	6	1,002	S&G	12	990	4/22/2005	--	--	12	0–14 gravel, 14–27 till, 27–30 ft S&G. Drwadown = 4 ft at 12 gal/min, Specific capacity = 3 gallons per foot.
422003076224301	TM2188	4/4/2006	150	20	6	1,085	Shale	30	1,055	4/4/2006	19	1,066	8	0–19 till, 19–150 ft gray shale.
422122076234901	TM2269	8/30/2006	160	116	6	1,017	Shale	90	927	8/30/2006	115	902	1	0–10 gravel, 10–34 fine sand, 34–35 S&G, 35–115 silty clay, 100–115 till, 115–160 ft shale.
422123076235101	TM2315	11/16/2006	40	85	6	1,020	S&G	26	994	11/16/2006	--	--	5	Casing perforated 37–40 ft. 0–20 gravel, 20–34 fine sand, 34–42 S&G, 42–84 ft clay.
422056076242901	TM2360	4/24/2007	108	108	6	1,089	S&G	80	1,009	4/24/2007	--	--	7	0–13 till, 13–18 gravel, 18–105 hardpan and some gravel, 105–108 ft S&G.
422003076233501	TM2381	6/11/2007	140	60	6	1,062	Shale	30	1,032	6/11/2007	60	1,002	10	0–24 till, 24–25 S&G, 25–40 till, 40–60 dirty S&G, 60–140 ft grey shale.
422052076273102	TM2589	10/27/2008	100	89	6	1,207	Shale	5	1,202	10/27/2008	87	1,120	0.1	0–15 silty gravel, 15–18 fine sand, 18–24 clay, 24–31 coarse S&G. 31–43 till, 43–46 fine sand, 46–87 till, 87–100 ft shale.
421934076251001	TM2590	11/5/2008	27	27	6	1,159	S&G	10.4	1,149	11/5/2008	0	--	20	0–18 silty gravel, 18–22 silt with some gravel, 22–27 ft S&G.
422052076273101	TM2591	11/12/2008	27	27	6	1,207	S&G	9	1,198	11/12/2008	--	--	20	0–15 silty gravel, 15–18 fine sand, 18–24 clay with some silt, 24–27 ft S&G.

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Catatonk Creek valley stratified-drift aquifer—Tioga County														
421318076254801	TI 17	12/8/2000	29	--	--	960	S&G	10	950	12/8/2000	--	--	--	--
421159076192101	TI 19	3/22/2001	35	--	--	880	S&G	18	862	3/22/2001	--	--	--	--
420747076163501	TI 251	--	63	63	5	831	S&G	--	--	--	--	--	--	--
420724076164401	TI 252	1945	72	72	6	860	S&G	--	--	--	--	--	--	--
420759076165701	TI 253	6/1/1965	61	61	5	829	S&G	8	821	6/1/1965	--	--	30	0–4 dirty gravel, 4–55 clay and silt, 55–61 ft fine–coarse sand.
420759076170001	TI 254	1964	149	86	5	844	Gravel	18	826	1964	--	--	8	--
420756076170801	TI 255	1/1/1949	63	63	6	865	S&G	18	847	1/1/1949	--	--	6	0–63 ft S&G, some water at 30 ft.
420902076180601	TI 267	5/1/1965	16	13	1	842	S&G	9	833	5/1/1965	--	--	--	Perforated.
420931076183101	TI 268	--	33	33	6	919	S&G	11	908	--	--	--	--	--
420955076183701	TI 269	1963	55	55	5	880	S&G	--	--	--	--	--	--	--
420952076190001	TI 270	10/1/1962	120	17	5	877	Gravel	36	841	10/1/1962	--	--	8	0–17 ft gravel.
420955076193901	TI 271	1/1/1957	132	21	5	945	Shale	25	920	1/1/1957	21	924	--	First water at 51 ft, maybe some salt or iron in water.
421056076195401	TI 273	8/1/1967	65	65	5	1,100	S&G	--	--	8/1/1967	--	--	3	0–64 till or dense clay, 64–65 ft gravel, supplies home, flowed 7 ft above grade Dec. 1967 at 7 gal/min.
421105076184601	TI 274	6/1/1962	66	66	5	877	S&G	10	867	6/1/1962	--	--	10	Fine sediment, “soupy” 0–50 ft; till, 50–66 ft gravel.
421139076184701	TI 275	8/1/1965	76	76	6	879	S&G	22	857	8/1/1965	--	--	--	0–20 gravel, 20–75 blue clay, 75–76 ft gravel.
421201076190301	TI 276	7/1/1965	55	55	0	893	S&G	25	868	7/1/1965	--	--	--	--
421225076193001	TI 277	05/01/1956	75	75	6	885	S&G	18	867	05/01/1956	--	--	15	0–75 mostly clayey gravel and or till, 75 ft gravel.
421216076194501	TI 278	9/1/1964	97	97	5	897	S&G	30	867	9/1/1964	104	793	--	Fine sand, 70–104 water, bedrock 104–178, 3 gal/min, much gas; pulled casing back to 97 ft after 6 weeks.

Appendix 1. Records of selected wells in Cayuta Creek and Catatonk Creek valleys in parts of Tompkins, Chemung, Schuyler and Tioga Counties, New York.—Continued

[ft, feet; in, inches; NAVD 88 in ft, North American Vertical Datum of 1988, in feet: gal/min, gallons per minute; gal/d, gallons per day; S&G, sand and gravel; --, no data; WL, water level; mg/L, milligrams per liter; PWS, Public Water Supply well]

Site number	Site name	Date drilled	Well depth (ft)	Depth of casing (ft)	Casing diameter (in)	Altitude land surface (NAVD 88, in ft)	Aquifer type	Water level below land surface (ft)	Altitude water level (NAVD 88, in ft)	Date water level measured	Depth to bedrock (ft)	Altitude top of bedrock (NAVD 88, in ft)	Reported yield (gal/min)	Remarks
Catatonk Creek valley stratified-drift aquifer—Tioga County—Continued														
421216076194502	TI 279	7/1/1963	35	31	1	897	S&G	16	881	7/1/1963	--	--	40	Water level 31 ft Aug. 1964 (below suction lift). Casing perforated 31–35 ft.
421240076270701	TI 280	8/1/1961	50	50	6	970	S&G	6	964	8/1/1961	--	--	30	Replaced contaminated driven well; another 21 ft driven well nearby.
421225076274501	TI 281	7/1/1965	15	12	1	972	S&G	4	968	7/1/1965	--	--	5	12–15 ft perforated or slotted casing.
421223076281701	TI 282	1950	22	19	1	979	S&G	16	963	1950	--	--	--	Perforated from 19 to 22 ft.
421257076293601	TI 283	1/1/1961	53	53	6	1,000	S&G	17	983	1/1/1961	--	--	40	--
421220076301501	TI 284	6/1/1962	38	38	--	990	S&G	8	982	6/1/1962	--	--	35	--
421255076295801	TI 285	7/1/1964	38	38	6	1,003	S&G	22	981	7/1/1964	--	--	20	--
421241076300701	TI 286	5/1/1965	54	54	6	997	S&G	12	985	05/01/1695	--	--	45	--
421248076301001	TI 287	10/1/1948	46	46	6	1,011	S&G	33	987	10/1/1948	--	--	20	--
421220076301501	TI 288	1/1/1954	30	30	6	995	S&G	12	983	1/1/1954	--	--	--	Well penetrates gravel, ends in black sand.
421319076200001	TI 291	2/1/1967	66	--	8	895	S&G	14	881	2/1/1967	--	--	183	0–29 clay & gravel, 29–60 clay, 60–66 S&G, 66–90 ft clay & gravel. 80% clay.
421320076200101	TI 292	2/1/1967	80	70	2	895	S&G	11	884	2/1/1967	--	--	50	0–8 S&G, 8–28 clay & gravel, 28–52 gray clay & gravel, 52–88 gravel, 70–80 ft screened.
421321076200901	TI 293	--	33	23	8	888	S&G	13	875	3/1/1967	--	--	250	0–18 clay & gravel, 18–33 S&G, 33–55 ft gray clay, screened 23–33 ft.
421322076200901	TI 294	1/1/1967	36	0	2	890	S&G	13	877	1/1/1967	--	--	50	0–5 clay and gravel, 5–36 ft S&G. Screened.
421333076201101	TI 295	1938	44	44	8	890	S&G	12	878	1938	--	--	165	Supplied 50,000 gal/d for creamery in 1946.
421359076201101	TI 296	--	93	53	8	900	Gravel	--	--	--	--	--	100	--
421344076201501	TI 297	3/1/1962	68	68	6	898	S&G	5	893	3/1/1962	--	--	40	--
421324076201801	TI 298	--	71	--	--	890	Shale	--	--	--	--	--	--	--

Appendix 1. Records of selected wells in Cayuta Creek and Catatonk Creek valleys in parts of Tompkins, Chemung, Schuyler and Tioga Counties, New York.—Continued

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Site number	Site name	Date drilled	Well depth (ft)	Depth of casing (ft)	Casing diameter (in)	Altitude land surface (NAVD 88, in ft)	Aquifer type	Water level below land surface (ft)	Altitude water level (NAVD 88, in ft)	Date water level measured	Depth to bedrock (ft)	Altitude top of bedrock (NAVD 88, in ft)	Reported yield (gal/min)	Remarks
Catatonk Creek valley stratified-drift aquifer—Tioga County—Continued														
421349076201801	TI 299	7/1/1968	66	56	8	898	S&G	4	894	7/1/1968	--	--	350	53–63 ft screened.
421748076231801	TI 306	4/28/2000	39	39	6	1,020	S&G	7	1,013	4/28/2000	--	--	12	0–39 ft S&G.
420933076270901	TI 309D	11/9/2000	240	59	6	1,111	Shale	45	871	11/9/2000	55	1,056	5	0–20 till, 20–55 cemented gravel, 55–240 ft shale.
421716076224501	TI 329	6/30/2000	28	28	6	949	S&G	15	934	6/30/2000	--	--	15	0–28 ft S&G.
420823076173501	TI 354D	9/19/2000	33	33	6	850	Gravel	20	830	9/19/2000	--	--	--	0–33 ft gravel.
420829076174401	TI 375	12/1/2000	131	131	6	845	Shale	29	816	12/1/2000	28	817	--	0–28 gravel, 28–131 ft shale.
420747076164001	TI 390	12/15/2000	35	35	6	827	S&G	12	158	12/15/2000	--	--	--	0–35 ft gravel.
421856076242301	TI 395	2/7/2001	85	29	6	1,107	Shale	9	1,098	2/9/2001	49	1,058	20	0–15 till, 15–23 gravel, 23–47 clay and stone, 47–49 gravel, 49–85 ft shale.
421335076233101	TI 400	5/2/2001	320	86.5	6	855	Shale	30	825	5/2/2001	85	770	2	0–30 till, 30–85 sandy clay, 85–320 ft shale.
421228076193001	TI 401	4/24/2001	59	--	--	885	S&G	20	865	4/24/2001	--	--	--	0–12 gravel, 12–35 sand & clay, 35–55 cemented gravel, 54–59 ft S&G.
421232076283801	TI 414D	4/26/2001	70	27	6	989	Shale	20	869	4/26/2001	26	963	9	0–26 gravel, 26–70 ft shale.
421215076271001	TI 427D	5/19/2001	320	31	6	1,166	Shale	140	1,026	5/19/2001	27	1,139	4	0–27 till, 27–320 ft shale.
421328076291401	TI 431	7/20/2001	30	30	6	998	S&G	12	986	7/20/2001	--	--	15	0–30 ft S&G.
421346076294901	TI 461	8/31/2001	39	39	6	1,018	S&G	24	994	8/31/2001	--	--	20	0–39 ft gravel.
421731076223701	TI 473	10/12/2001	28	28	6	938	S&G	15	923	10/12/2001	--	--	20	0–28 ft S&G.
421304076263501	TI 475D	10/17/2001	81	27	6	978	Shale	20	958	10/17/2001	27	945	20	0–27 gravel, 27–81 ft shale.
421416076222901	TI 506D	6/13/2001	38	38	6	930	Gravel	20	910	6/13/2001	--	--	15	0–38 ft gravel.
421224076290701	TI 508D	6/18/2001	36	36	6	978	S&G	6	972	6/18/2001	--	--	15	0–36 ft S&G.
421233076281501	TI 510D	1/16/2002	88	22	6	1,000	Shale	40	960	1/18/2002	22	988	17	0–22 gravel, 22–88 ft shale.
421219076195401	TI 515D	2/12/2002	53	53	6	911	S&G	12	899	2/12/2002	--	--	20	0–28 gravel, 28–40 sand and clay, 40–50 sand, 50–53 ft S&G.
421253076293701	TI 528D	1/24/2002	30	30	6	996	Gravel	15	981	1/24/2002	--	--	15	0–30 ft gravel.
421343076294301	TI 553	5/13/2002	45	45	6	1,015	S&G	21	994	5/13/2002	--	--	15	0–22 S&G, 22–44 sand, 44–45 ft S&G.

Appendix 1. Records of selected wells in Cayuta Creek and Catatonk Creek valleys in parts of Tompkins, Chemung, Schuyler and Tioga Counties, New York.—Continued

[ft, feet; in, inches; NAVD 88 in ft, North American Vertical Datum of 1988, in feet: gal/min, gallons per minute; gal/d, gallons per day; S&G, sand and gravel; --, no data; WL, water level; mg/L, milligrams per liter; PWS, Public Water Supply well]

Site number	Site name	Date drilled	Well depth (ft)	Depth of casing (ft)	Casing diameter (in)	Altitude land surface (NAVD 88, in ft)	Aquifer type	Water level below land surface (ft)	Altitude water level (NAVD 88, in ft)	Date water level measured	Depth to bedrock (ft)	Altitude top of bedrock (NAVD 88, in ft)	Reported yield (gal/min)	Remarks
Catatonk Creek valley stratified-drift aquifer—Tioga County—Continued														
421336076232601	TI 561	6/14/2002	103	28	6	940	Shale	20	920	6/14/2002	26	914	7	0–26 S&G, 26–103 ft shale.
421418076293601	TI 567	7/6/2002	128	74	6	1,036	S&G	38	998	7/11/2002	74	962	10	0–40 S&G, 40–68 sand and clay, 68–74 gravel, 74–128 ft shale.
421232076292301	TI 587D	7/28/2002	30	30	6	986	Gravel	10	976	7/28/2002	--	--	15	0–30 ft gravel.
421449076285001	TI 589D	8/8/2002	22	22	6	1,036	S&G	3	1,033	8/8/2002	--	--	15	0–22 ft S&G.
421319076255301	TI 593	4/16/1985	22	--	--	955	S&G	8	947	4/16/1985	--	--	--	Test boring. 0–22 ft S&G.
421316076254001	TI 594	4/1/1985	90	--	--	955	S&G	5	950	4/1/1985	--	--	--	Test boring. 0–42 S&G, 42–63 silty sand, 63–83 silt and clay, 83–90 ft S&G with some silty clay (till?).
421439076222801	TI 595	11/3/1983	93	--	--	955	S&G	5	950	11/3/1983	--	--	--	Test boring. 0–25 S&G, 25–50 silt and sand, 50–78 silty sand with clay and pebbles (till?), clay and gravel, 78–93 ft silty S&G.
421403076203101	TI 596	7/6/1982	73	--	--	903	S&G	12	891	7/6/1982	--	--	--	Test boring. 0–22 silty S&G, 22–46 silt, 46–73 ft S&G.
421235076293301	TI 597	4/12/2004	97	--	--	989	S&G	--	--	--	--	--	--	Test boring. 0–25 gravelly silt, 25–30 S&G, 40–60 gravelly silt, 40–60 S&G, 60–85 layered clay and silt, 85–90 S&G, 90–97 ft till.
420950076182901	TI 598D	10/10/2002	126	126	6	945	S&G	105	840	10/10/2002	--	--	--	0–25 till, 25–62 gravel and clay, 62–74 till. 74–97 silt, 97–118 clay & gravel, 118–126 ft S&G.
421659076224301	TI 598	9/28/1998	100	--	--	938	S&G	--	--	--	--	--	--	0–10 sandy silt, 10–35 S&G, 35–65 sand, silt and clay, 65–80 clay, 80–90 silty sand, 90–95 clay, 95–101 ft S&G.
421546076223401	TI 599	4/22/2004	61	--	--	935	S&G	--	--	--	--	--	--	0–25 gravelly silt, 25–35 sand and silt, 35–61 ft gravelly sand and silt.

Appendix 1. Records of selected wells in Cayuta Creek and Catatonk Creek valleys in parts of Tompkins, Chemung, Schuyler and Tioga Counties, New York.—Continued

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Catatonk Creek valley stratified-drift aquifer—Tioga County—Continued														
420045076304601	TI 622	10/15/2002	108	72	6	822	Shale	22	800	10/15/2002	72	750	15	0–35 gravel, 35–60 clay and stones, 60–72 cemented gravel, 72–108 ft shale.
421110076310501	TI 631	10/7/2002	60	38	6	1,125	Shale	10	1,115	10/7/2002	37	1088	10	0–37 till, 37–60 ft shale.
421235076294701	TI 636	10/23/2002	38	38	6	989	Sand	15	974	10/23/2002	--	--	15	0–25 gravel, 25–38 ft sand.
421635076212101	TI 636	--	--	--	--	1,027	--	--	--	--	--	--	--	--
421523076305701	TI 646	11/4/2002	75	62	6	1,084	Shale	25	1,059	11/4/2002	62	1,022	10	0–40 S&G, 40–60 sand & clay, 60–62 sand, 62–75 ft shale.
421236076293601	TI 652	11/27/2002	29	29	6	993	S&G	15	978	11/27/2002	--	--	15	0–29 ft sand and fine gravel.
421239076271301	TI 654	12/2/2002	29	29	6	972	S&G	9	963	12/2/2002	--	--	15	0–29 ft S&G.
421243076193101	TI 663	2/7/2003	58	58	6	882	S&G	15	867	2/7/2003	--	--	14	0–15 sand and gravel, 15–55 cemented gravel, 55–58 ft S&G.
421308076263801	TI 664	10/28/2003	65	19	6	975	Shale	11	964	10/28/2003	12	963	9	0–12 gravel, and 12–65 ft shale.
421248076295101	TI 671	3/12/2003	27	27	6	999	Gravel	17	982	3/12/2003	--	--	20	0–27 ft gravel.
421635076212101	TI 686	5/15/2003	65	17	6	1,037	Shale	13	1,024	5/15/2003	4	1,033	9	0–4 till, 4–65 ft shale.
421250076293701	TI 691	5/21/2003	27	27	6	996	S&G	19	977	5/21/2003	--	--	15	0–18 S&G, 18–25 sand, 25–27 ft S&G.
421424076211301	TI 698	7/3/2003	110	110	6	912	S&G	25	887	7/3/2003	--	--	13	0–18 gravel, 18–60 sand clay, 60–98 clay, 98–105 sand, 105–110 ft S&G.
421334076201901	TI 700	1967	94	93	7	888	Shale	--	--	--	93	795	--	0–4 clay, 4–15 clay & gravel, 15–93 gray clay, 93–94 ft shale.
421336076202001	TI 701	8/1/1949	96	96	6	890	S&G	14	876	8/1/1949	--	--	--	Well not used. Low yield. Also have a driven well 18 ft deep that supplied farm prior to 1949.
421427076300201	TI 701D	7/22/2003	76	76	6	1,062	S&G	56	1,006	7/22/2003	--	--	20	0–18 sandy clay, 18–68 till, 68–73 dirty gravel, 73–76 ft fine gravel.

Appendix 1. Records of selected wells in Cayuta Creek and Catatonk Creek valleys in parts of Tompkins, Chemung, Schuyler and Tioga Counties, New York.—Continued

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Catatonk Creek valley stratified-drift aquifer—Tioga County—Continued														
421400076204801	TI 702	3/1/1967	79	69	8	898	S&G	4	894	3/1/1967	69	829	250	0–10 clay, 10–19 clay and gravel, 19–55 gray clay, 55–68 fine S&G, 68–79 S&G, 79–85 ft clay and gravel.
421201076301601	TI 702D	7/17/2003	29	29	6	989	S&G	8	981	7/17/2003	--	--	25	0–21 sandy clay, 21–29 ft S&G.
421359076210601	TI 703	1963	149	116	--	922	Shale	--	--	--	116	806	--	0–30 S&G, 30–116 silt & very fine sand, 116–149 ft shale.
421338076215801	TI 704	2/1/1965	170	70	5	968	Shale	30	938	2/1/1965	--	--	5	Water contains gas.
421354076221501	TI 705	10/1/1959	96	96	5	936	S&G	23	913	10/1/1959	--	--	--	Black sand (possible rock?) 90–96 ft water has sulfur odor.
421317076251301	TI 706	1947	3,150	--	--	958	Shale	--	--	--	63	895	--	0–63 gravel, 63–3,150 ft shale, fresh water at 5 ft & 123 ft, gas at 250 ft.
421307076295701	TI 707	11/1/1965	42	40	2	1,001	S&G	16	985	11/1/1965	--	--	--	40–42 ft sand.
421308076295701	TI 708	11/1/1962	48	38	6	999	S&G	12	987	11/1/1962	--	--	--	38–48 ft screened.
421421076203501	TI 713	12/1/1964	36	36	6	915	S&G	20	895	12/1/1964	--	--	12	--
421401076204801	TI 714	1/1/1967	85	75	2	900	S&G	5	895	1/1/1967	110	790	30	0–5 brown sandy clay & gravel, 5–15 S&G, 15–60 sand, 60–73 gray S&G, 73–85 gravel, 85–96 gray sand, 96–110 gray clay and gravel, 110–112 ft grey shale.
421401076214101	TI 715	8/1/1965	24	24	5	922	S&G	22	900	8/1/1965	--	--	15	0–25 S&G, 25–45 ft fine–grained sediment; casing pulled back to 24 ft.
421442076222601	TI 716	1964	72	72	5	930	S&G	--	--	--	--	--	--	--
421432076285301	TI 717	12/1/1953	43	43	6	1,068	S&G	26	1,042	12/1/1953	--	--	27	--
421409076302001	TI 718	4/1/1947	43	43	6	1,028	S&G	18	1,010	4/1/1947	--	--	40	--
421454076302501	TI 719	4/1/1947	42	42	6	1,044	S&G	24	1,020	4/1/1947	--	--	30	--
421443076302601	TI 720	7/1/1957	42	42	0	1,040	S&G	29	1,011	7/1/1957	--	--	25	--

Appendix 1. Records of selected wells in Cayuta Creek and Catatonk Creek valleys in parts of Tompkins, Chemung, Schuyler and Tioga Counties, New York.—Continued

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Catatonk Creek valley stratified-drift aquifer—Tioga County—Continued														
421519076283201	TI 722	1/1/1966	67	62	6	1,063	Shale	8	1,055	1/1/1966	--	--	60	--
421522076284001	TI 723	9/1/1949	50	16	6	1,074	Shale	10	1,064	9/1/1949	--	--	11	--
421550076300401	TI 724	8/1/1965	41	41	6	1,038	S&G	12	1,026	8/1/1965	--	--	45	Ends in bright pebbly coarse sand; fine silty above; some water at 22 ft.
421550076300402	TI 725	--	27	24	--	1,037	S&G	--	--	--	--	--	--	Supplied house until 1965, water iron–bearing and hard, 24–27 ft perforated or slotted casing.
421523076303001	TI 726	9/1/1965	46	46	6	1,045	S&G	26	1,019	9/1/1965	--	--	25	--
421526076303001	TI 727	07/01/1965	52	52	6	1,054	S&G	32	1,022	7/1/1965	--	--	24	--
421534076303101	TI 728	4/4/1946	42	42	6	1,059	S&G	20	1,039	4/1/1946	--	--	25	--
421553076313601	TI 729	8/1/1963	42	42	6	1,172	Shale	12	1,160	1/1/1963	--	--	--	--
421557076315001	TI 730	8/1/1954	45	21	6	1,196	Shale	18	1,178	8/1/1954	--	--	12	--
421458076285801	TI 731D	9/3/2004	30	30	6	1,041	S&G	6	1,035	9/4/2004	--	--	25	0–30 ft gravel.
421404076300801	TI 735	9/3/2003	50	50	6	1,024	S&G	25	999	9/3/2003	--	--	25	0–50 ft S&G.
421635076213201	TI 736	1964	72	34	5	1,015	Shale	--	--	--	--	--	--	--
421728076204401	TI 736D	9/5/2003	60	49	6	1,065	Shale	20	1,045	9/9/2003	49	1,016	20	0–18 gravel, 18–30 till, 30–49 gravel, 49–60 ft shale.
421624076223601	TI 737	1/1/1968	118	118	5	939	S&G	12	927	1/1/1968	--	--	--	0–16 fine sand, 16–17 gravel, 17–25 sand, 25–110 silt and very fine sand, 110–118 ft sand.
421645076225201	TI 738	11/1/1957	156	156	5	935	S&G	1	934	11/1/1957	--	--	100	--
421219076193101	TI 738D	9/092003	37	37	6	882	S&G	12	870	9/10/2003	--	--	14	0–32 S&G, 32–37 ft gravel.
421620076293901	TI 739	8/1/1964	113	48	5	1,080	Shale	48	1,032	8/1/1964	--	--	--	--
420944076185601	TI 739D	7/8/2003	200	50	6	884	Shale	46	838	7/8/2003	50	834	7	0–50 till, 50–200 ft shale.
421605076295201	TI 740	11/1/1964	64	64	5	1,079	S&G	59	1,020	11/1/1964	--	--	--	--
421607076304401	TI 741	11/1/1965	96	79	6	1,081	Shale	63	1,018	11/1/1965	79	1,002	25	--
421737076224501	TI 746	6/1/1965	115	115	5	965	S&G	12	953	6/1/1965	--	--	10	0–25 gravel, 25–90 fine sand & silt, 90–115 ft gravel. Supplies house and barn.

Appendix 1. Records of selected wells in Cayuta Creek and Catatonk Creek valleys in parts of Tompkins, Chemung, Schuyler and Tioga Counties, New York.—Continued

[ft, feet; in, inches; NAVD 88 in ft, North American Vertical Datum of 1988, in feet: gal/min, gallons per minute; gal/d, gallons per day; S&G, sand and gravel; --, no data; WL, water level; mg/L, milligrams per liter; PWS, Public Water Supply well]

Site number	Site name	Date drilled	Well depth (ft)	Depth of casing (ft)	Casing diameter (in)	Altitude land surface (NAVD 88, in ft)	Aquifer type	Water level below land surface (ft)	Altitude water level (NAVD 88, in ft)	Date water level measured	Depth to bedrock (ft)	Altitude top of bedrock (NAVD 88, in ft)	Reported yield (gal/min)	Remarks
Catatonk Creek valley stratified-drift aquifer—Tioga County—Continued														
421853076222601	TI 750	6/16/1966	83	83	5	1,005	S&G	--	--	--	--	--	--	--
421839076222701	TI 751	--	120	--	--	1,015	Shale	--	--	--	--	--	--	--
421837076222801	TI 752	--	110	--	--	1,010	Shale	--	--	--	--	--	--	--
421809076234201	TI 753	--	18	16	2	1,040	S&G	13	1,027	1940	--	--	--	--
421233076295901	TI 753D	10/20/2003	51	51	6	989	S&G	10	979	10/30/2003	--	--	15	0–28 S&G, 28–45 clay and sand, 45–51 ft. S&G.
421812076234201	TI 754	4/1/1966	63	63	5	1,055	S&G	8	1,047	4/1/1966	--	--	--	--
421718076224401	TI 755	10/30/2003	28	28	6	946	S&G	12	934	10/31/2003	--	--	--	0–28 ft S&G.
421905076222701	TI 757	--	30	--	--	970	S&G	--	--	--	--	--	--	--
421903076222901	TI 758	--	30	--	--	970	S&G	--	--	--	--	--	--	--
421252076293301	TI 769	10/28/2003	27	27	6	999	S&G	17	982	10/28/2003	--	--	15	0–27 ft S&G.
421723076224201	TI 782	4/5/2004	29	29	6	947	S&G	10	937	4/5/2004	--	--	--	0–29 ft S&G.
421238076300001	TI 790	5/25/2004	25	25	6	992	S&G	8	984	5/25/2004	--	--	--	0–15 gravel, 15–20 sand, 20–25 ft gravel.
421223076304101	TI 794	5/27/2004	120	31	6	1,023	Shale	30	993	5/27/2007	25	998	6	0–15 gravel, 15–25 till. 25–120 ft shale.
421348076292001	TI 795	6/4/2004	72	70	6	1,014	Shale	20	994	6/8/2004	70	944	--	0–19 silty gravel, 19–28 cemented gravel, 28–48 clay and stone, 48–70 S&G, 70–72 ft shale.
421342076293101	TI 796	6/1/2004	40	40	6	1,016	S&G	21	995	6/3/2004	--	--	20	0–30 dirty gravel, 30–38 sand clay and gravel, 38–40 ft sand & fine gravel.
421213076313301	TI 891	11/19/2003	53	48	2	1,030	S&G	19	1,011	6/1/2009	--	--	--	0–10 gravel, 10–45 silty gravel, 45–53 ft gravel. Screened 48–53 ft.
421319076240401	TI1014	6/17/2004	30	30	6	960	S&G	15	945	6/18/2004	--	--	12	0–30 ft S&G.
421244076262201	TI1015	7/8/2004	31	31	6	960	S&G	3	957	7/8/2004	--	--	20	0–31 ft gravel.
421340076292701	TI1016	7/2/2004	40	40	6	1,001	S&G	10	991	7/2/2004	--	--	25	Test well. 0–40 ft S&G.
421315076292401	TI1017	7/7/2004	40	40	6	996	S&G	10	984	7/7/2004	--	--	25	Test well. 0–12 S&G, 12–28 cemented gravel, 28–40 ft sand and fine gravel.

Appendix 1. Records of selected wells in Cayuta Creek and Catatonk Creek valleys in parts of Tompkins, Chemung, Schuyler and Tioga Counties, New York.—Continued

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Catatonk Creek valley stratified-drift aquifer—Tioga County—Continued														
421416076285801	TI1018	7/16/2004	69	27	6	1,028	Shale	16	1,012	7/20/2004	27	1,001	6	0–27 S&G, 27–69 ft shale.
421231076272301	TI1019	7/9/2004	29	29	6	972	S&G	10	962	7/9/2004	--	--	20	0–29 ft S&G.
421359076202801	TI1030	9/21/2004	53	53	6	900	S&G	13	887	9/21/2004	--	--	25	0–22 gravel, 22–50 sandy clay and stone, 50–53 ft coarse sand.
421424076285801	TI1050	11/3/2004	47	27	6	1,027	Shale	9	1,018	11/3/2004	27	1,000	10	0–27 S&G, 27–40 ft shale.
421431076284801	TI1077	4/22/2005	200	38	6	1,099	Shale	50	1,049	4/22/2005	36	1,063	7	0–36 till, 36–200 ft shale.
421412076293001	TI1081	3/30/2005	31	31	6	1,020	S&G	13	1,007	3/30/2005	--	--	20	0–12 hardpan, 12–28 dirty gravel, 28–31 ft fine gravel.
421322076241801	TI1090	5/13/2005	54	54	6	951	S&G	12	939	5/13/2005	--	--	5	0–16 S&G, 16–40 clay & gravel, 40–49 S&G, 49–51 clay & gravel, 51–54 ft S&G.
421208076185601	TI1098	5/25/2005	45	45	6	920	S&G	15	905	5/25/2005	--	--	12	0–45 ft S&G.
421406076233801	TI1101	5/23/2005	160	78	6	1,086	Shale	60	1,026	5/24/2005	75	1,011	10	0–15 till, 15–18 gravel, 18–45 clay, 45–47 dirty gravel, 47–75 clay, 75–160 ft shale.
421732076223901	TI1102	11/7/2005	104	104	6	954	S&G	12	942	11/9/2005	--	--	--	0–6 cinder block pit, 6–23 clayey gravel, 23–34 S&G, 34–38 clay and gravel, 38–103 silt, 103–104 S&G.
421259076294301	TI1110	7/19/2005	35	35	6	1,000	S&G	18	982	7/19/2005	--	--	10	0–5 till, 5–25 gravel, 25–35 ft gravel.
421409076230301	TI1144	9/19/2005	36	36	6	930	S&G	12	918	9/19/2005	--	--	25	0–15 gravel, 15–30 clay & gravel, and 30–36 ft fine gravel.
421433076211501	TI1145	10/4/2005	304	153	6	1,000	Shale	90	910	10/4/2005	153	847	1	0–153 till, 153–304 ft shale.
421428076211201	TI1150	10/7/2007	124	124	6	931	S&G	24	907	10/7/2007	--	--	25	0–64 gravel, 64–105 clay, 105–118 sand and clay, 118–122 sand, 122–124 ft fine gravel.
421246076264601	TI1152	10/12/2005	40	40	6	964	S&G	5	959	10/12/2005	--	--	25	0–40 ft S&G.

Appendix 1. Records of selected wells in Cayuta Creek and Catatonk Creek valleys in parts of Tompkins, Chemung, Schuyler and Tioga Counties, New York.—Continued

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Catatonk Creek valley stratified-drift aquifer—Tioga County—Continued														
421424076211701	TI1154	10/18/2005	134	134	6	913	Shale	15	898	10/18/2005	133	780	20	0–25 gravel, 25–50 clay & gravel, 50–130 sandy clay, 130–133 fine gravel, 133–134 ft. shale.
421041076183501	TI1164	10/28/2005	57	57	6	870	S&G	14	856	10/28/2005	--	--	8	0–5 gravel, 5–32 clay and gravel, 32–43 silt, 43–51 silt and gravel, 51–57 ft S&G.
421419076293401	TI1182	12/15/2005	79	26	6	1,013	Shale	10	1,003	12/15/2005	24	989	13	0–24 S&G, 24–79 ft shale.
421418076225001	TI1211	3/28/2006	57	57	6	952	S&G	45	907	3/28/2006	--	--	15	0–57 ft S&G.
420818076263201	TI1250	6/9/2006	137	137	6	1,129	S&G	116	1,013	6/9/2006	--	--	15	0–50 till, 50–85 cemented gravel, 85–135 sandy gravel, 135–137 ft coarse sand.
421238076191801	TI1253	7/26/2006	56	56	6	960	Shale	--	--	7/26/2006	19	941	13	Flows. 0–19 till, 19–56 ft shale.
421423076212001	TI1256	6/30/2006	134	134	6	913	S&G	16	897	6/30/2006	--	--	20	0–30 gravel, 30–120 till, 120–130 sandy clay and stone, 130–134 ft S&G.
420930076182801	TI1270	7/18/2006	32	32	6	857	S&G	22	835	7/18/2006	--	--	10	0–32 ft S&G.
420958076183701	TI1272	8/4/2006	38	38	6	868	S&G	23	845	8/4/2006	--	--	11	0–14 S&G, 14–22 silt, 22–38 ft S&G.
421327076293201	TI1273	7/27/2006	30	30	6	997	S&G	10	987	7/27/2006	--	--	25	Irrigation well. 0–30 ft S&G.
421245076192901	TI1285	9/18/2006	54	54	6	889	S&G	15	876	9/18/2006	--	--	--	0–25 dirty gravel, 25–52 cemented gravel, 52–54 ft sand and gravel.
421333076244401	TI1301	10/13/2006	32	32	6	957	S&G	17	940	10/13/2006	--	--	10	0–32 ft gravel.
420839076175701	TI1304	10/31/2006	200	22	6	864	Shale	35	829	10/31/2006	9	855	6	0–9 till, 9–200 ft shale.
421252076255601	TI1307	10/19/2006	30	30	6	971	S&G	12	959	10/19/2006	--	--	--	0–9 S&G, 9–24 clay and gravel, 34–30 ft S&G.
421310076245701	TI1309	11/21/2006	140	38	6	1,007	Shale	65	942	11/21/2006	38	969	10	0–38 gravel, 38–140 ft shale.
421208076284101	TI1316	12/19/2006	60	60	6	980	Shale	--	--	--	183	797	100	Test well. 0–58 gravel, 58–66 silty sand, 66–71 sand, 71–167 S&G, 167–172 till, 172–183 clay, 183–218 ft shale.

Appendix 1. Records of selected wells in Cayuta Creek and Catatonk Creek valleys in parts of Tompkins, Chemung, Schuyler and Tioga Counties, New York.—Continued

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Catatonk Creek valley stratified-drift aquifer—Tioga County—Continued														
421423076211701	TI1339	4/5/2007	131	131	6	911	Shale	20	891	4/5/2007	131	780	30	0–25 gravel, 30–127 sandy clay, 127–131 gravel, 131–132 ft shale.
421160076295801	TI1353	5/15/2007	60	28.5	6	1,033	Shale	20	1,013	5/15/2007	20	1,013	15	0–20 dirty gravel and boulders, 20–60 ft shale.
421220076304701	TI1359	8/9/2007	160	33	6	1,004	Shale	20	984	8/9/2007	32	972	3	0–27 dirty gravel, 27–160 ft shale.
421221076304101	TI1360	8/10/2007	100	19	6	1,008	Shale	19	989	8/10/2007	6	1,002	4	0–6 gravel, 6–100 ft shale.
420829076174201	TI1363	6/29/2007	79	41	6	837	Shale	20	817	6/29/2007	32	805	10	0–13 gravel, 13–20 clay and gravel, 20–32 S&G, 32–79 ft shale.
420952076190501	TI1366	5/21/2007	200	55	6	869	Shale	6	863	5/21/2007	48	821	5	0–8 gravel, 8–48 till, 48–200 ft shale.
421424076211401	TI1372	6/27/2007	98	98	6	913	S&G	80	833	6/27/2007	--	--	20	0–15 gravel, 15–28 S&G, 28–96 clay, 96–98 ft gravel.
421422076213301	TI1394	10/12/2007	90	92	6	910	Gravel	20	890	10/17/2007	--	--	15	0–13 till, 13–50 S&G, 50–87 clay & stone (till?), 87–90 ft gravel.
421316076245001	TI1395	9/6/2007	58	27	6	958	Shale	15	943	9/6/2007	27	931	20	0–27 gravel, 27–58 ft shale.
421751076231701	TI1412	10/19/2007	52	52	6	1,022	S&G	32	990	10/19/2007	--	--	15	0–12 hardpan (till?), 12–52 ft S&G.
421646076213001	TI1417	10/11/2007	45	45	6	1,022	S&G	17	1,005	10/11/2007	--	--	--	0–42 dirty gravel, 42–45 ft fine gravel.
421221076311901	TI1418	10/15/2007	240	19	6	1,080	Shale	15	1,065	10/15/2007	3	1,076	2	0–3 till, 3–240 ft shale.
421248076295901	TI1425	12/19/2007	36	36	6	1,001	S&G	17	984	12/19/2007	--	--	15	0–2 till, 2–36 ft S&G.
421428076285601	TI1428	11/15/2007	30	30	6	1,037	S&G	10	1,027	11/15/2007	--	--	20	0–4 gravel, 4–10 clay, 10–30 ft gravel.
421222076211401	TI1432	11/19/2007	144	133	6	909	Shale	80	829	11/19/2007	133	776	12	0–22 gravel, 22–34 gray silt and gravel, 34–133 grey silt, 133–144 ft shale.
421257076300201	TI1438	11/30/2007	51	51	6	1,011	S&G	30	981	11/30/2007	--	--	15	0–51 ft S&G.
421202076295201	TI1440	12/5/2007	260	28	6	1,025	Shale	34	991	12/6/2007	21	1,004	2	0–21 gravel, 21–260 ft shale.

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Catatonk Creek valley stratified-drift aquifer—Tioga County—Continued														
421745076231501	TI1443	12/21/2007	47	47	6	1,015	S&G	0	1,015	12/21/2007	--	--	15	0–38 S&G, 38–44 clay and gravel (till?), 44–47 ft S&G.
420936076183401	TI1462	3/26/2008	32	32	6	860	S&G	22	838	3/26/2008	--	--	10	0–9 S&G, 9–24 clay and gravel, 24–32 ft S&G.
421339076245301	TI1463	3/18/2008	160	82	6	1,044	Shale	40	1,004	3/18/2003	82	942	10	0–60 till, 60–65 clay, 65–82 till, 82–160 ft shale.
420837076173301	TI1469	5/15/2008	52	52	6	864	S&G	37	827	5/15/2008	--	--	8	0–15 gravel, 15–26 clay and gravel, 26–46 silty clay and gravel, 46–52 ft S&G.
421751076231801	TI1484	6/13/2008	56	56	6	1,022	Gravel	6	1,016	6/13/2008	--	--	15	0–18 S&G, 18–54 cemented gravel (till?), 54–56 ft S&G.
421257076300201	TI1487	12/28/2007	51	51	6	1,011	S&G	20	991	12/28/2007	--	--	8	0–51 ft gravel, clay, and till.
420832076174801	TI1488	7/11/2008	149	60	6	853	Shale	70	783	7/25/2008	60	793	60	0–15 gravel, 15–45 clay and gravel (till?), 45–149 ft shale.
421229076272701	TI1494	6/30/2008	38	38	6	979	Gravel	18	961	6/30/2008	--	--	25	0–38 ft gravel.
421305076294801	TI1526	10/22/2008	28	28	6	998	Gravel	14	984	10/22/2008	--	--	15	0–28 ft gravel.
421358076231401	TI1530	10/24/2008	35	35	6	940	S&G	19	921	10/24/2008	--	--	15	0–22 gravel, 22–33 clay and gravel (till?), 33–35 ft S&G.
421245076308101	TI1532	10/28/2008	49	41	5	1,005	Shale	10	995	10/282008	41	960	20	0–41 ?, 41–49 ft shale.
421423076284801	TI1551	2/23/2009	80	30	6	1,113	Shale	17	1,096	2/23/2009	30	1,083	10	0–30 till, 30–80 ft shale.
421245076300901	TI1555	3/13/2009	35	35	6	1,008	S&G	21	987	3/13/2009	--	--	15	0–18 gravel, 18–28 sand, 28–35 ft fine gravel.
421853076235401	TI1571	5/12/2009	59	59	6	1,085	S&G	44	1,041	5/12/2009			12	0–20 till, 20–40 silty gravel, 40–57 till, 57–59 ft shale.
421322076240301	TI1585	6/8/2009	35	35	6	955	S&G	15	940	6/8/2009	--	--	--	0–35 ft S&G.
421442076300301	TI1659	4/21/2010	59	59	6	1,037	S&G	26	1,011	4/21/2010	--	--	20	0–15 hardpan (till or dirty gravel?), 15–42 sand and gravel, 42–55 till, 55–59 ft sand and gravel.
421211076312401	TI1701	9/16/2010	59	59	8	1,026	S&G	36	990	9/16/2010	--	--	52	0–15 till, 15–55 dirty gravel, 55–59 ft gravel.
420120076312601	TI1728	12/13/2010	58	58	6	848	S&G	36	812	12/13/2010	--	--	20	0–18 hardpan (dirty gravel or till?), 18–54 cemented gravel, 54–58 ft S&G.

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