U.S. Department of the Interior
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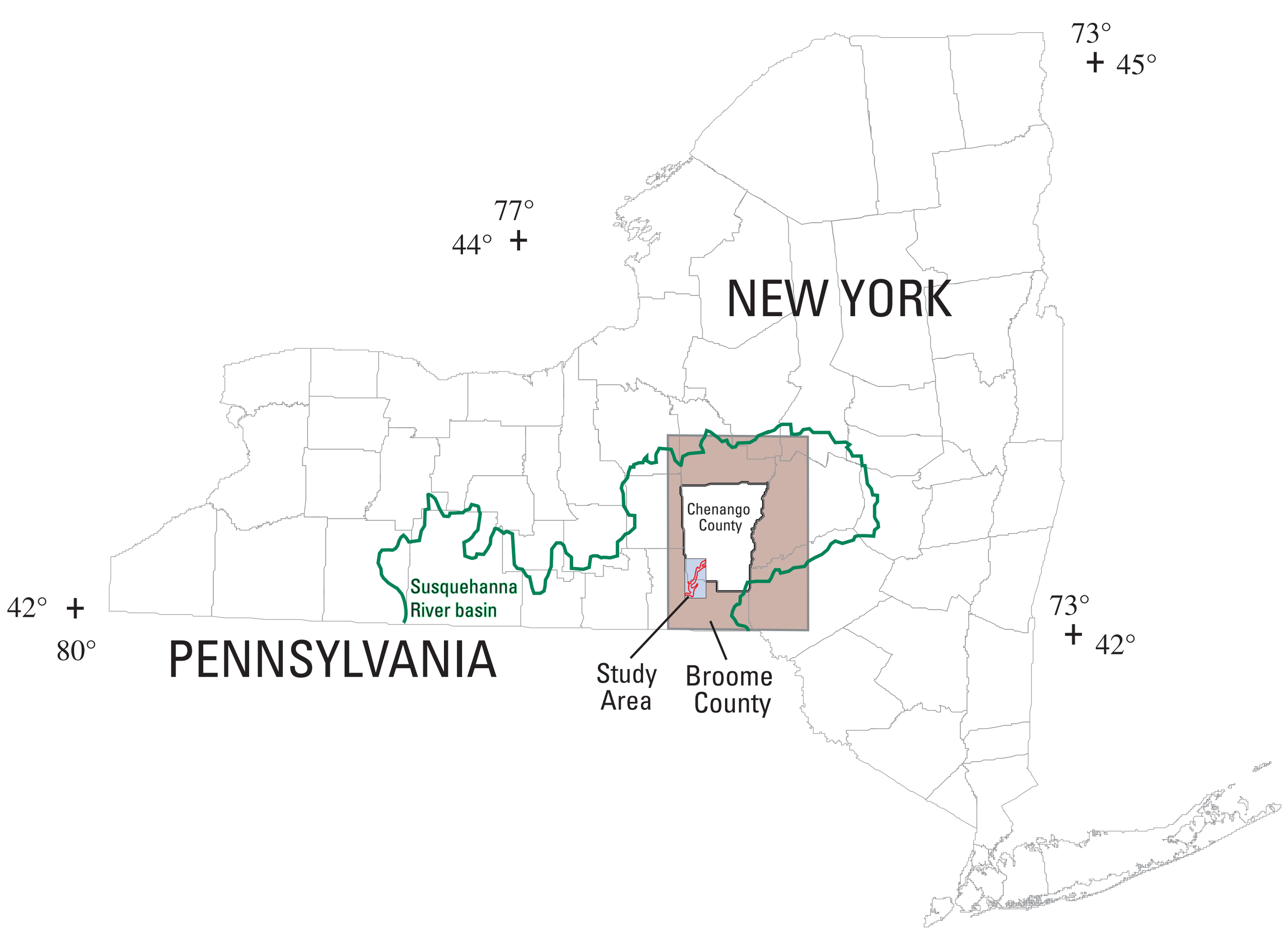
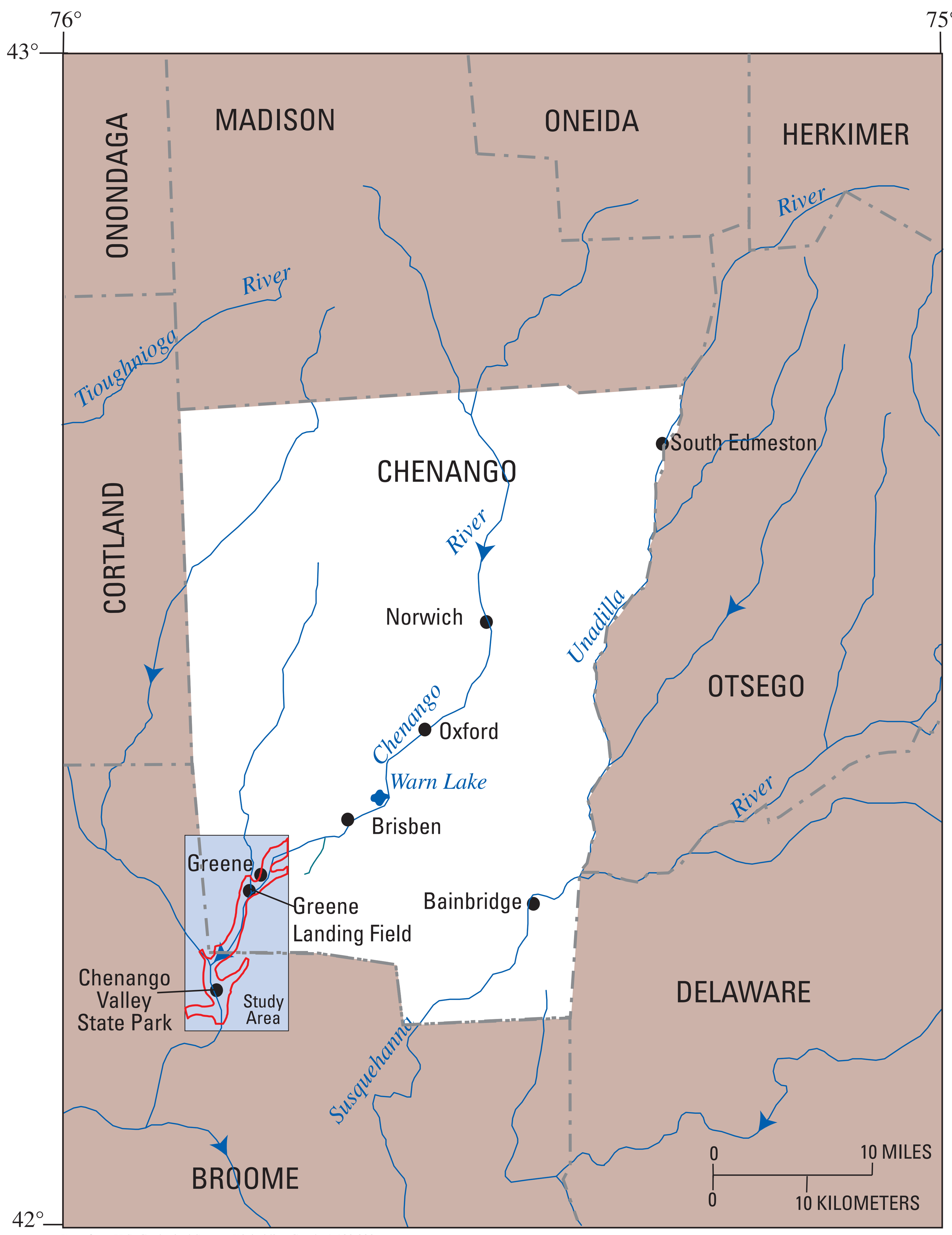
In cooperation with
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

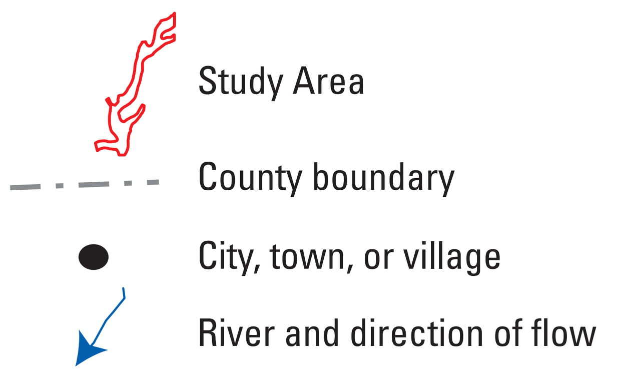
SCIENTIFIC INVESTIGATIONS MAP 2005-2914
INTRODUCTION -- PLATE 1 OF 8
Hetcher-Aguila, K.K., and Miller, T.S., 2005,
Geohydrology of the Valley-Fill Aquifers Between the Village of Greene,
Chenango County, and Chenango Valley State Park, Broome County, New York





Base from U.S. Geological Survey, Digital line Graph: 1:100,000, Universal Transverse Mercator, Zone 18, NAD83.

EXPLANATION



ABSTRACT

This set of maps and geohydrologic sections depicts the geology and hydrology of valley-fill aquifers in the 14-mile reach of the Chenango River valley between the Village of Greene and the Chenango Valley State Park, N.Y. It depicts the aquifers; locations of domestic, production, and test wells; surficial geology; water-table altitude; potentiometric-surface altitude; generalized saturated thickness of the unconfined (water-table) aquifer; generalized thickness of the confined aquifer; and includes three geohydrologic sections.

The valley fill in the Chenango River valley consists primarily of (1) glaciofluvial deposits comprised of stratified coarse-grained sediment (sand and gravel) that were deposited by meltwater streams flowing on, below, and in front of a glacier; (2) lacustrine sediments consisting of stratified fine-grained sediment (very fine sand, silt, and clay) that were deposited in proglacial lakes that formed at the front of a glacier; and (3) recent alluvium consisting of alluvial fan deposits (sand, silt, and gravel), floodplain sediments (fine-to-medium sand and silt), and channel deposits (sand and gravel).

The Chenango River valley contains an unconfined valley-fill aquifer throughout much of the study area, and a confined valley-fill aquifer in the area between the northern edge of the Chenango Valley State Park and the Village of Greene. The unconfined aquifer consists predominantly of alluvial and outwash sand and gravel. The water table was mapped using water-level measurements obtained from wells completed in the unconfined aquifer, and from altitudes of lakes, ponds, and streams as indicated on U.S. Geological Survey 1:24,000-scale topographic maps. The depth to the water table typically ranges from 5 to 15 feet below land surface, but can locally be as much as 100 feet, such as in the ice-contact deposits in the Chenango Valley State Park.

The confined aquifer is widely used by people living and working in the Chenango River valley. The confined aquifer consists of ice-contact sand and gravel, typically overlies bedrock, and underlies a confining unit consisting of lacustrine fine sand, silt, and clay. The confining unit is typically more than 100 feet thick in the central parts of the valley between Greene Landing Field and along the northern edge of the Chenango Valley State Park. The thickness of the confined aquifer is more than 40 feet near the Greene Landing Field.

INTRODUCTION

The residents, farms, and commercial facilities in the 14-mile reach of the Chenango River valley from the Village of Greene, N.Y., to the area south of Chenango Valley State Park obtain their water supply from an unconfined valley-fill aquifer, a confined valley-fill aquifer, and the underlying bedrock aquifer. These aquifers are a water source for about 2,200 residents (U.S. Census Bureau, 2000) including the Village of Greene and several businesses, mobile home parks, and small industries. Approximately 1,800 of these people are served by the Village of Greene municipal supply well (U.S. Environmental Protection Agency, 2003); the rest get their water from domestic wells. Residential areas, commercial, and industrial development are concentrated near the Village of Greene and in the valley south of Chenango Valley State Park. The remainder of the valley is sparsely populated and land is primarily agriculture.

Shallow depths to the water table and permeable surficial deposits make the unconfined aquifer vulnerable to contamination from surface sources such as landfills, road salt, fuel-storage tanks and septic systems, and urban and agricultural runoff. This aquifer is the major source of potable ground water in parts of the study area, such as south of the Chenango Valley State Park; thus, its protection is of vital importance to the residents who live within this reach of the Chenango River valley.

The confined aquifer is widely used by people living and working in the Chenango River valley. Because this aquifer is commonly overlain by more than 100 feet of fine-grained sediment, it is much less susceptible than the unconfined aquifer to contamination. However, this fine-grained sediment is locally absent, including near the edges of the valley where tributary streams enter and lose water by seepage into the aquifer; therefore, contaminated water in these tributaries could in time reach the confined aquifer. In several places throughout the valley, the unconfined aquifer is very thin or absent, making the confined aquifer the only valley-fill aquifer available. Therefore, wells need to be drilled to the confined sand and gravel aquifer or bedrock aquifer.

Approximately one-third of the wells within the Chenango River valley tap the bedrock aquifer below the valley-fill deposits, typically along the edges of the valley where the unconsolidated materials thin and pinch out, or in the main part of the valley where the valley-fill aquifers are thin or are not present. These wells are less susceptible to surficial contamination than the valley-fill aquifers; however, they are most often only used as domestic water sources because the bedrock aquifer does not generally supply large quantities of potable water.

PURPOSE AND SCOPE

In 2003, the U.S. Geological Survey (USGS), in cooperation with the New York State Department of Environmental Conservation (NYSDEC), compiled information from five publications (MacNish and Randall, 1982; Randall, 1972; McPherson, 1993; Cadwell, 1981; and Cadwell, 1972) and from recent field studies on the surficial geology and geohydrology of the valley-fill aquifers in the 14-mile reach of the Chenango River valley between the Village of Greene and the southern part of Chenango Valley State Park. This report concentrates on the valley-fill deposits above the bedrock, specifically, the confined and unconfined aquifers that are the predominant source of drinking water throughout the study area. The extent of the relation between unconfined and confined valley-fill aquifers was mapped to provide information about ground-water availability and aquifer susceptibility to contamination.

Geohydrologic information of the study area is presented on eight plates: Plate 1 depicts the principal geographic features of the study area; Plate 2 depicts the location of selected wells and test holes; Plate 3 depicts the surficial geology; Plate 4 depicts the generalized water-table altitude in the unconfined aquifer; Plate 5 depicts the generalized potentiometric-surface altitude in the confined aquifer; Plate 6 depicts the generalized saturated thickness of the unconfined aquifer; Plate 7 depicts the generalized thickness of the confined aquifer; and Plate 8 includes three generalized geohydrologic sections.

Water levels from wells previously drilled in the valley and two wells drilled for this investigation, were used to map the water-table altitude and the potentiometric surface in the aquifers. These water levels were historical values taken from driller reports and provide only a generalized representation of the water table and potentiometric surface; a more detailed study of the water levels would require measurements taken within the same season at each of the wells, and determination of precise ground-level altitudes at each of the wells.

HYDROLOGIC SETTING

The study area is in the valley of the Chenango River, which is a tributary to the Susquehanna River. The unconfined valley-fill aquifer consists of alluvial, outwash, and ice-contact sand and gravel; the confined valley-fill aquifer consists of buried ice-contact sand and gravel. This buried aquifer is confined above by a fine-grained lacustrine unit (silt and clay) and below by shale and siltstone of Devonian age. Most deep wells in the valley north of the Chenango Valley State Park are finished in the confined aquifer, which indicates that the aquifer is generally continuous in the study area. However, there are large parts of the study area where there is no information, and therefore, the extent of the confined aquifer is uncertain in these areas.

Recharge to the unconfined valley-fill aquifer is from (1) infiltration of precipitation that falls directly over the unconfined aquifer; (2) ground-water seepage from adjacent bedrock along the edges of the valley; and (3) upland sources including surface runoff, either as small streams that lose water to the aquifer or as unchanneled runoff from hillside adjacent to the valley that seeps into the aquifer along the bases of the hillsides. Typically, in upland areas, precipitation and snowmelt during the late winter and spring seep into the top several feet of soil until this layer is saturated, whereupon all excess water moves downslope as unchanneled runoff or through small openings (such as burrows, root tubes, and frost cracks) in the soil and eventually recharges the unconfined aquifer. Upland tributaries recharge the unconfined aquifer when they lose water as they flow over their alluvial fans in to the valley. Ground water from bedrock that recharges the unconfined aquifer along the edges of the valley is difficult to quantify because the flow in fractured bedrock here is little understood (Lyford and Cohen, 1988), but it is considered to be negligible in relation to other sources of recharge (MacNish and Randall, 1982; Randall and others, 1988; Morrissey and others, 1988). Most of the water in the unconfined aquifer discharges to the Chenango River, with lesser amounts discharging to ponds, springs, swamps, and pumping wells.

Streams may gain or lose water through the bed material, depending on whether the water level in the stream is above or below the water table. Reaches where the water level in the stream is higher than the local water table lose water to the aquifer, and reaches where the water table is higher than the water level in the stream gain water from the aquifer. The Chenango River typically gains water from the aquifers, whereas the tributaries typically gain water in the uplands but lose some or all of it through leakage on alluvial fans upon entering the Chenango River valley (Ku and others, 1975; Randall, 1978; Morrissey and others, 1988). Alluvial fans are major recharge areas for valley-fill aquifers (Randall, 1978; MacNish and Randall, 1982) because stream water can rapidly infiltrate to the underlying aquifer. A description of this process is given on plate 4, in the section “Water-Table Altitude.”

The confined valley-fill aquifer is recharged by ground-water seepage from adjacent bedrock, and along the edges of the valley where it is hydraulically connected to the unconfined aquifer. The confined aquifer is also connected to and discharges to the unconfined aquifer near the northern edge of the Chenango Valley State Park where layers of fine-grained deposits intermingle with layers of coarse-grained ice-contact deposits.

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INTRODUCTION AND LOCATION OF STUDY AREA BETWEEN VILLAGE OF GREENE AND CHENANGO VALLEY STATE PARK, NEW YORK

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