DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

MISCELLANEOUS GEOLOGIC INVESTIGATIONS
MAP I–795 (SHEET 1 OF 2)

INTRODUCTION

Union County is in the Piedmont province of the Appalachian Highlands. The major topographic features of the Piedmont province in Union County are: (1) the Watchung Mountains, two basaltic ridges (maximum altitudes about 550 feet) trending parallel to the northwestern boundary of the county; and (2) a gently rolling plain sloping from an altitude of about 100 feet to 150 feet along the eastern side of the Watchung Mountains to sea level at Arthur Kill. Rocks of the Newark Group, of Triassic age, which underlie Union County include the Brunswick Formation and Watchung Basalt. Deposits of Pleistocene age overlie the Triassic bedrock surface and vary greatly in thickness within short distances. The irregularity of the relief of the Triassic bedrock surface causes much of the variation in the thickness of the Pleistocene age sediments. Sand and gravel deposits of Pleistocene age, valley-fill in stream valleys cut in Triassic consolidated rocks, are an important aquifer system in Union County. Yields in excess of 650 gpm (gallons per minute) are not uncommon from properly developed and constructed large-diameter wells penetrating the thicker parts of these aquifers. Because the distribution of the valley-fill aquifers is controlled by the configuration of the bedrock surface, delineation of the buried-valley system is essential for development and management of the ground-water resources of the area.

PREVIOUS STUDIES

Previous studies (Thompson, 1932; Bonini and Hickok, 1958; Gill, Vecchioli, and Bonini, 1965; Gill and Vecchioli, 1965; Vecchioli and Nichols, 1966; Vecchioli, Nichols, and Nemickas, 1967; Nichols, 1968a) demonstrated the existence of deep buried bedrock valleys in Morris County and northern New Jersey containing highly productive sand and gravel aquifers northwest of Union County. Herpers and Barksdale (1951) and Nichols (1968b) delineated a deep valley cut in the bedrock in the Newark area northeast of Union County. The depth to bedrock in the buried valley ranges from 125 feet to more than 190 feet in Newark and as much as 300 feet in Harrison. Nemickas (1973) presented maps and stratigraphic data on the extent, thickness, and distribution of Pleistocene sediments in Union County.

BEDROCK TOPOGRAPHY

Contours showing the configuration of the bedrock surface are drawn on the basis of water-well, test-hole, and boring data presented in the previous studies mentioned above and from the files of the Trenton office of the U.S. Geological Survey.

Before the last glaciation, the rivers draining Union County cut deep valleys into the Brunswick Formation. Subsequently the valleys were filled and buried by glacial material. The thickness of the glacial deposits is controlled largely by the underlying bedrock topography. These buried channels underlie parts of Hillside, Union, Springfield, Clark, and Scotch Plains Townships, and the boroughs of Mountainside, New Providence, and Kenilworth and the cities of Summit and Rahway.

The Kenilworth-Newark valley extends from Newark, Essex County, where the altitude of the bedrock channel bottom is as much as 220 feet below sea level, southwest to Kenilworth Borough where the altitude of the channel bottom is 90 feet below sea level. The Summit valley is located in Summit City and New Providence Borough; the altitude of the bedrock channel bottom is as low as 17 feet above sea level. The Union valley is located in Union and Springfield Townships; the altitude of the channel bottom is 3 feet below sea level. Rahway valley trends east-southeast from Scotch Plains Township to Rahway; the altitude of the bedrock channel bottom is as much as 26 feet below sea level in Rahway and 10 feet below sea level in Scotch Plains Township.

The Kenilworth-Newark valley is the main stem of the drainage in Union County. The bedrock configuration indicates that the Summit and Union valleys are tributaries to the Kenilworth-Newark valley and drained eastward to Newark.

QUATERNARY DEPOSITS

Unconsolidated sediments deposited by glaciers and by glacial melt water during the Pleistocene Epoch mantle the bedrock surface in Union County. These deposits consist of clay, silt, sand, gravel, and boulders. They are glacial, glaciolacustrine (deposited by glacial melt water in lakes), or glaciofluvial (deposited by glacial melt water in streams) in origin. The Pleistocene sediments fall into three general classes: (1) end moraine—a moraine formed across the course of a glacier at its farthest advance; (2) ground moraine—the material carried forward in and beneath the ice and finally deposited from its under surface; and (3) stratified drift—deposits from glacial melt water exhibiting both sorting and stratification. The stratified drift includes lacustrine (deposited in lakes) and fluviatile (deposited in streams) sands and clays.

The Pleistocene sediments in the bedrock channels consist of unstratified and stratified clay, silt, sand, and gravel. Only the sand and gravel deposits of the stratified drift will yield large quantities of water to wells.

The thickness of the Pleistocene sediments in the valleys range from about 50 feet to a maximum of 230 feet. The thickness of the valley-fill material in the Kenilworth-Newark valley is about 230 feet at Newark, 102 feet in Hillside Township, 131 feet in Union Township, and 180 feet in Kenilworth Borough. In the Summit valley, the valley fill is about 223 feet thick at Summit. In the Union valley, the valley fill is about 91 feet thick in Union and Springfield Townships. In Rahway valley, the valley fill is about 56 feet thick at Rahway and 70 feet thick in Scotch Plains Township.

Wells (6 inches or greater in diameter) in the stratified drift deposits yield from 180 to 690 gpm (gallons per minute). The specific capacity of these wells range from 4.0 to 69 gpm per foot of drawdown and average 19 gpm per foot of drawdown. High-yielding wells in the stratified drift deposits are located primarily in the valley-fill deposits in the bedrock valleys.

Water in the stratified drift occurs under both unconfined and confined conditions. Unconfined ground water is found where sand and gravel deposits are not covered by clay, silt, or glacial till. The unconfined aquifers are recharged directly from precipitation on the outcrop area. Confined and semi-confined ground water occurs where sand and gravel deposits have been covered by lacustrine clay or silt, or by glacial till. These coarse deposits in the buried valleys are not visible at the surface and, therefore, their regional extent and distribution are not readily apparent. The confined and semi-confined deposits are recharged by leakage through overlying confining beds. Some recharge may also be derived from the underlying and adjacent Brunswick Formation.

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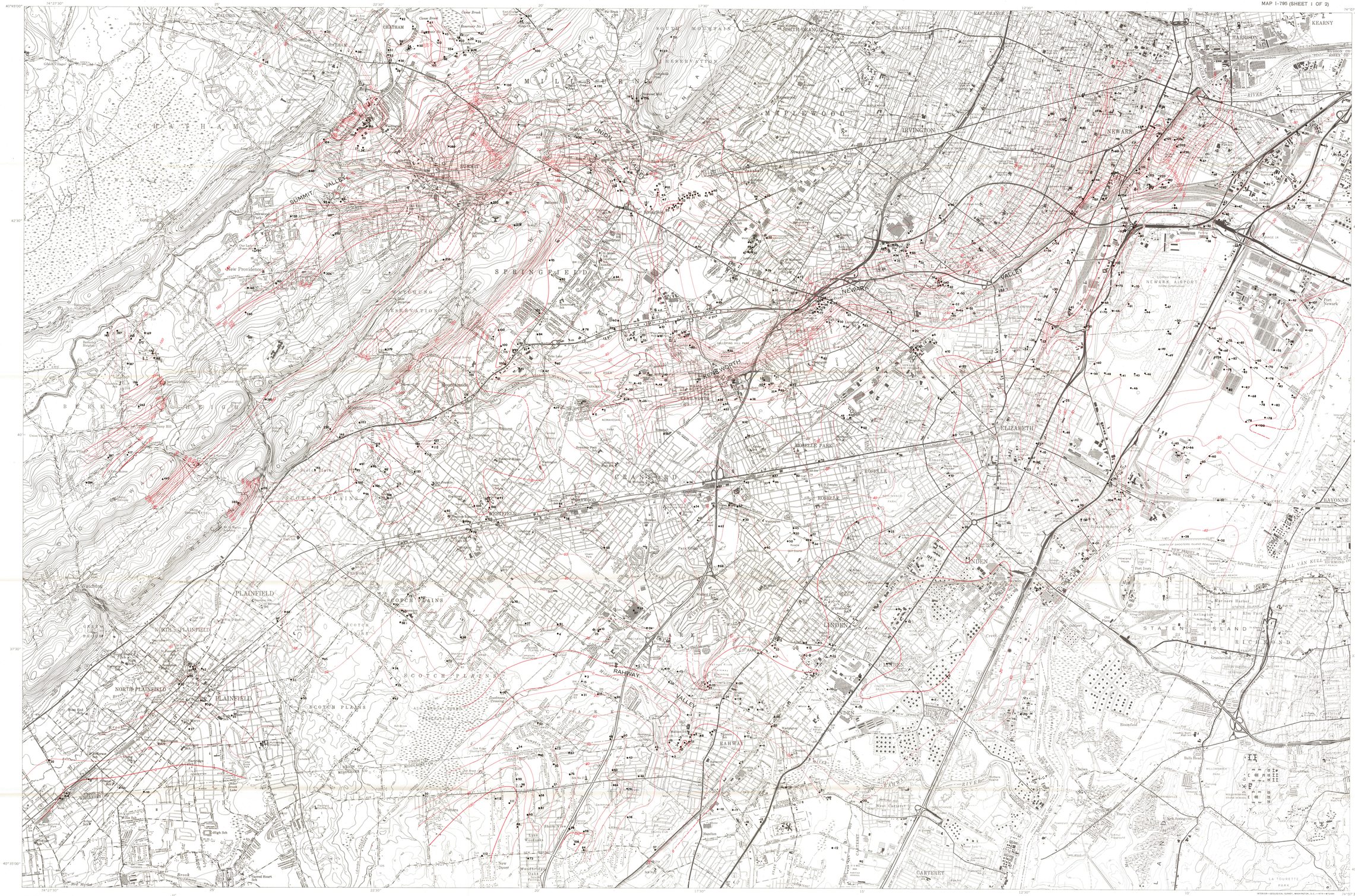

Base from U.S. Geological Survey: Arthur Kill, Chatham, Elizabeth, Plainfield, Roselle, 1955; Perth Amboy, 1956.

APPROXIMATE MEAN DECLINATION, 1973

SCALE 1:24 000

1 MILE 0 1 KILOMETER

CONTOUR INTERVALS 10 AND 20 FEET
DEPTH CURVE AND SOUNDINGS IN FEET—DATUM IS MEAN LOW WATER
SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER
THE MEAN RANGE OF TIDE IS APPROXIMATELY 5.3 FEET

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BEDROCK TOPOGRAPHY AND THICKNESS OF PLEISTOCENE DEPOSITS IN UNION COUNTY AND ADJACENT AREAS, NEW JERSEY

By
Bronius Nemickas

1974

MAP LOCATION

EXPLANATION

•27 WELL OR BORING — Number indicates altitude of bedrock surface, in feet above or (–) below) mean sea level

BEDROCK CONTOUR — Shows altitude of bedrock surface. Dashed where approximately located. Contour interval 20 feet. Datum is mean sea level

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