Chapter 2

GEOLOGY

Geologically, the State of New Jersey is comprised of four physiographic provinces running roughly from north to south: the Appalachian Valley and Ridge, the Highlands, the Piedmont Plain, and the Coastal Plain. Chatham Township lies within the Piedmont Plain in the mid-state region (Figure 3).

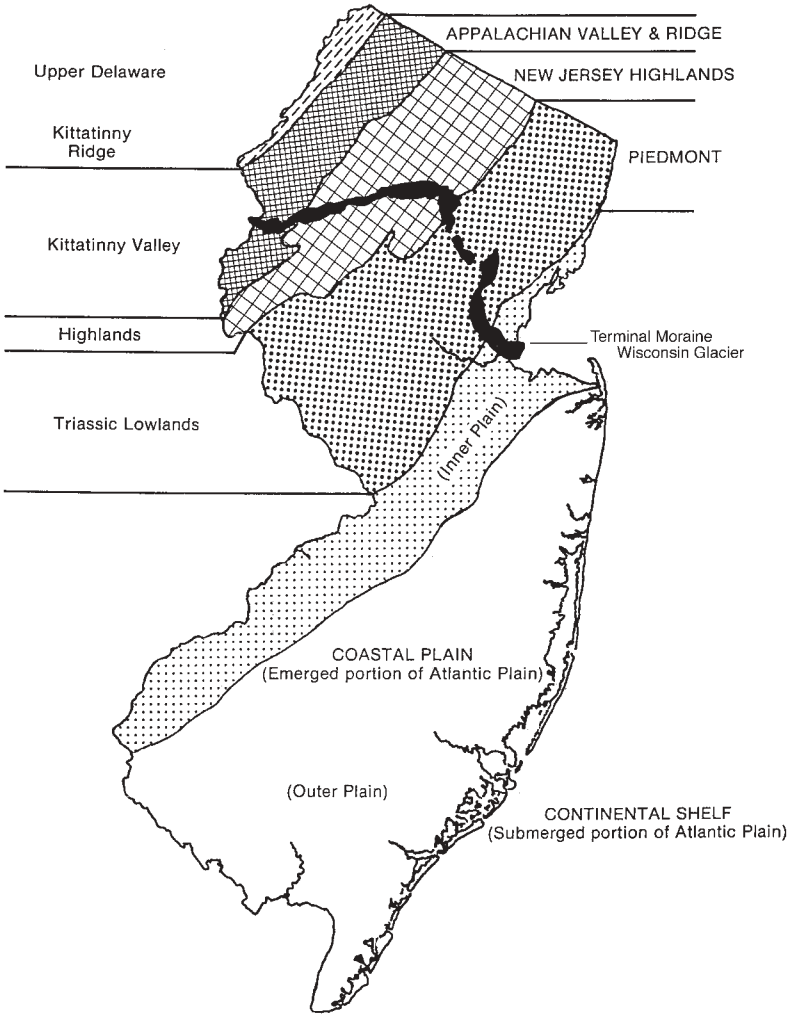

Figure 3—Physiographic Map of New Jersey

Source: Adapted from Map of Geomorphic Provinces of New Jersey, Peter E. Wolfe

Bedrock Geology

Chatham Township's physical features are dominated by Long Hill, the third and westernmost of three parallel ridges known as the Watchung Mountains, which rise from 200 to 400 feet above the neighboring terrain. These were formed during the Triassic Period of geological history. There were once extensive swamps and lakes in this area which were part of a general system extending from eastern Pennsylvania through northwestern New Jersey. Over time, thousands of feet of sediment settled in these lakes and swamps, eventually compressing into red colored sandstones and shales. From time to time, lava flowed from volcanic activity, which cooled into hard, dark colored rock called basalt, was extruded over the sedimentary material, and then was covered by more sediment. The whole complex of softer layers of sandstone and shale and harder layers of basalt were slowly uplifted

along one side so that it now slopes downward 8-10 degrees towards the northwest to a fault close to the present alignment of Route 202. The softer layers of sandstone and shale have weathered and eroded more quickly, leaving long broad valleys between the three ridges formed by the more resistant basalt. Long Hill, as it passes through Chatham Township, rises 250 to 300 feet directly and steeply up from the Passaic River floodplain, then slopes more gently down its north side toward the Great Swamp (Figure 4).

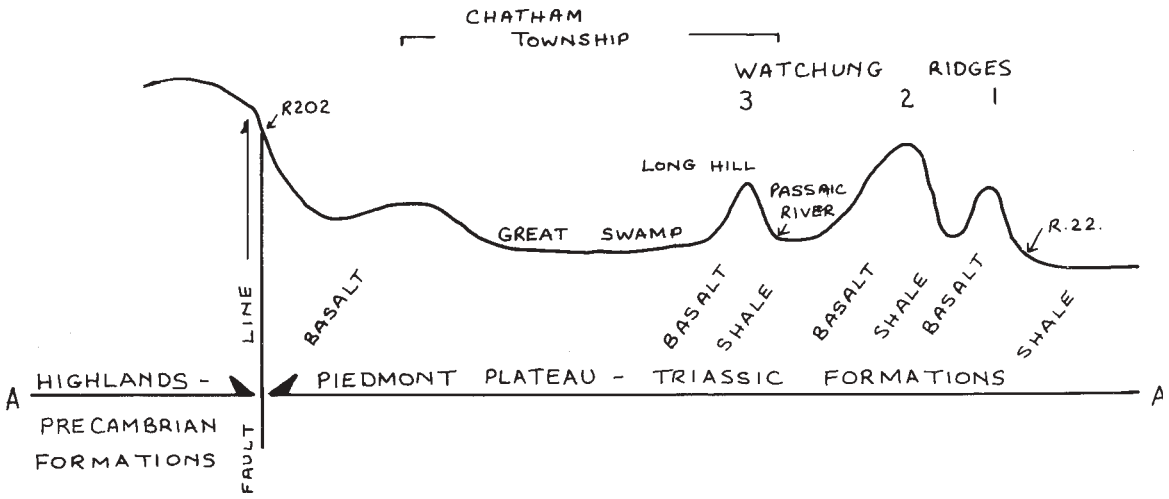

Figure 4—Geologic Cross-Section

The Wisconsin Glacier

Superimposed on this bedrock foundation of basalt, shale, and sandstone are extensive deposits left by the last glaciation. The "Wisconsin Stage" of the glacial epoch, which lasted 56,000 years, is largely responsible for much of our current topography. The Wisconsin, or most recent glacier, reached its southernmost advance in Chatham Township.

Temporary lakes were formed during this period, the largest of which was the Glacial Lake Passaic. Our Great Swamp is a vestige of this lake, which drained long ago. The forward edge of the advancing glacier brought enormous amounts of rocky rubble and finer material, which the melting ice then deposited as a long, low ridge of debris called a "moraine." Present day Route 124 now runs through Chatham Borough, Madison, and into Morris Township along, or close to, the top of this terminal moraine (Figure 5). The moraine's surface appearance is now that of a wide, gently rolling, wooded hill or ridge with occasional deep potholes, often filled with water, where glacial ice blocks melted while material was being deposited around them. Kelly's Pond, in the eastern part of the Township, is an example of such a pond.

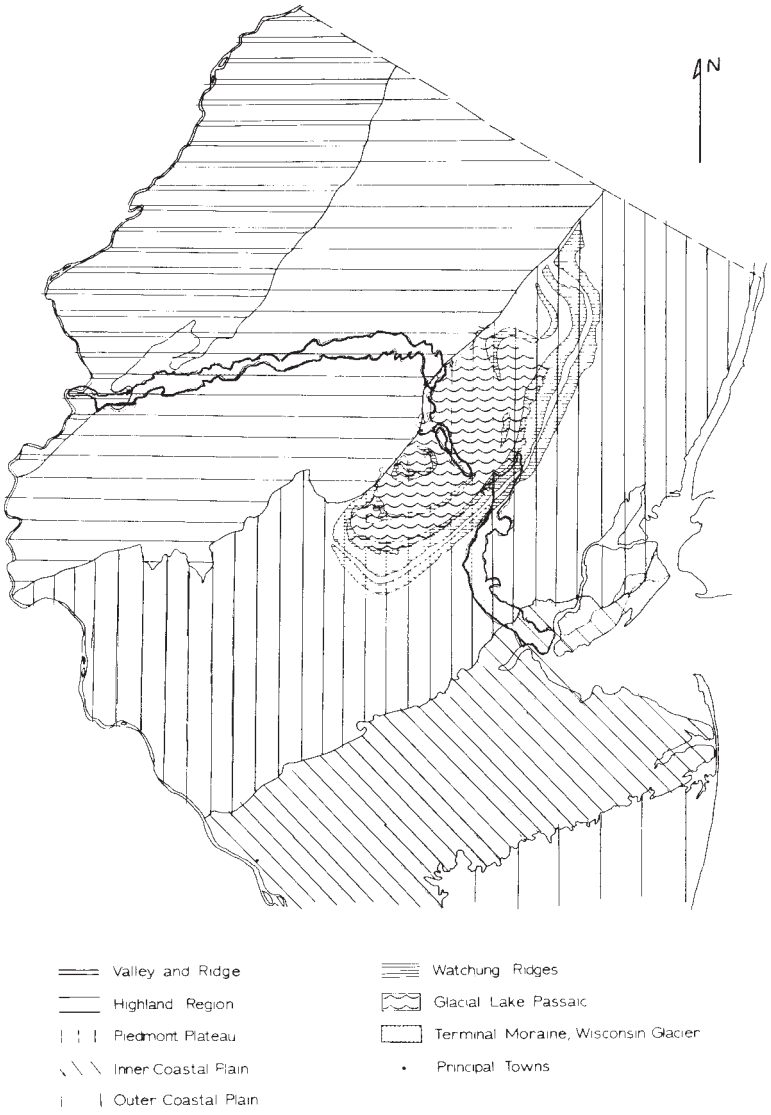

Figure 5—Geologic Map of Northern New Jersey

The meltwater of the glacier washed material from the terminal moraine into the basin to the west, now known as the Great Swamp. Coarser stones and sands were deposited in irregularly shaped patches and mounds near the moraine. The meltwater was caught in a natural basin formed by the Second Watchung Ridge and eventually filled in. For thousands of years the region was inundated by a lake whose size and depth fluctuated with time. Fine particles of sediment carried by the water settled to the bottom of the lake, forming a thick layer of clay (Figure 6).

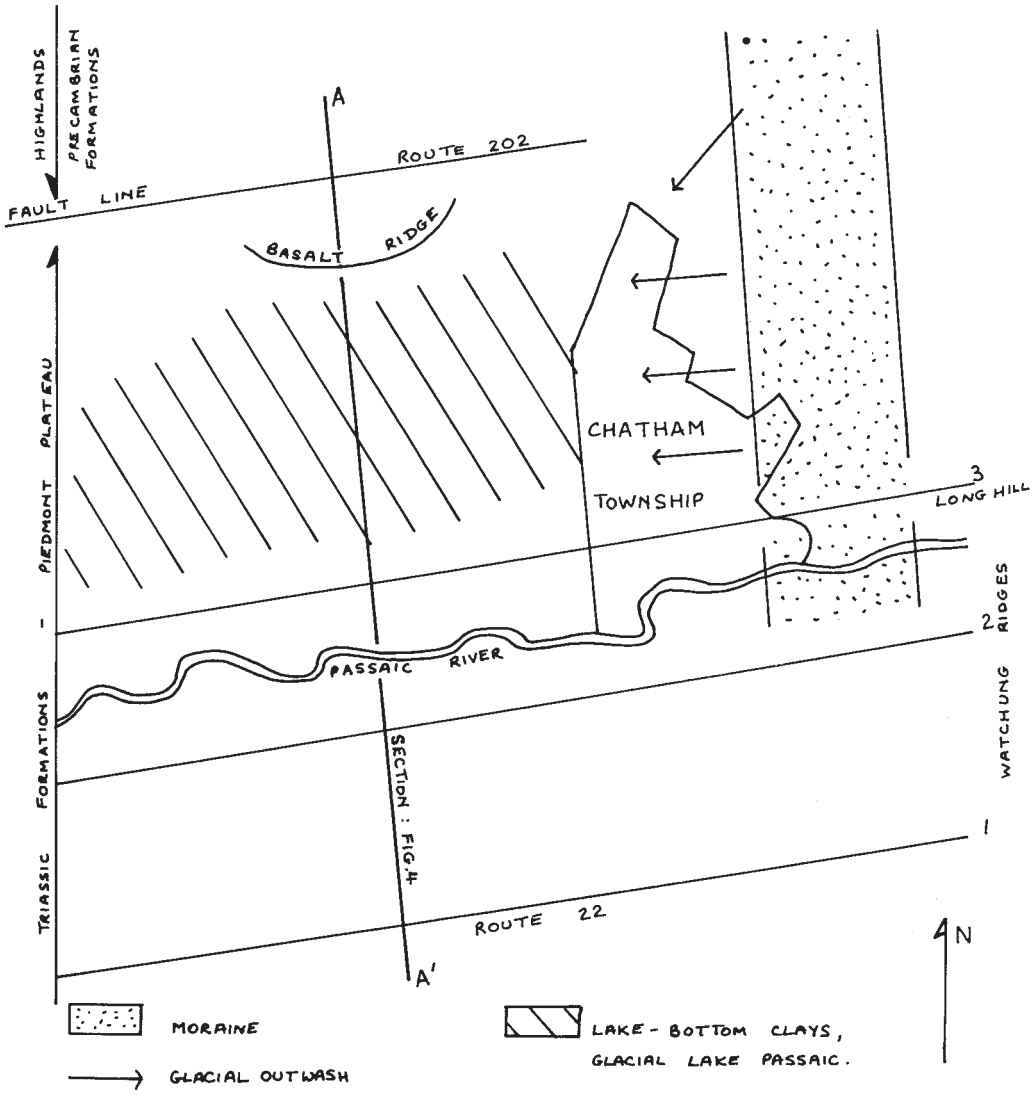

Figure 6—Geologic Map of Chatham Township

These geologic occurrences have determined the shape and form of the local landscape. The flow and storage of water on and beneath the surface of the land and the physical properties of the local soils also result from them.

Buried Valley Aquifer

Chatham Township is one of the thirty-one towns that are in the 80 square mile area of the Buried Valley Aquifer. This is one of the valley fill aquifers created by glacial action. The valley aquifer systems are composed of buried, pre-glacial valleys filled with sediments of glacial and postglacial origin that contain large quantities of water. (See Figure 7.) This aquifer system is extremely productive. As of 1996, pumpage from the system amounted to over 40 billion gallons per year.

Because over half a million people, or ninety percent of the thirty-one municipalities in the Buried Valley Aquifer region, rely on the aquifer for their water supply, the U.S. Environmental Protection Agency designated it as a sole source aquifer. This designation recognizes the primary dependence of these towns on this drinking water source. Towns depending on the Buried Valley Aquifer include Madison, Chatham Borough, Florham Park, and East Orange.

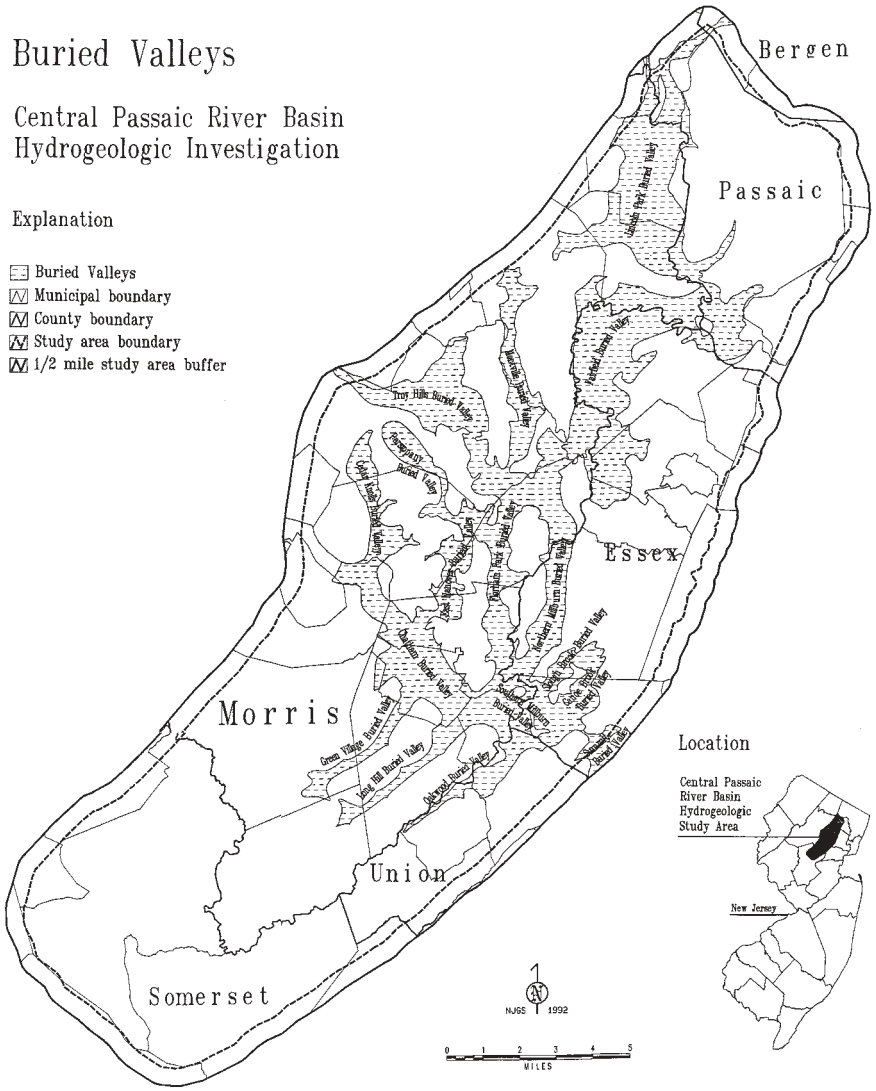

Figure 7 — Buried Valleys

Recharge for the Buried Valley Aquifer

In the early 1990's, the New Jersey Geologic Survey conducted studies to locate the recharge area where precipitation infiltrates the surface for the Buried Valley Aquifer. Locally, the Survey identified, as a prime recharge area, a band of land running roughly across the northerly part of Chatham Township

between Southern Boulevard and Shunpike Road, extending to the west, on either side of Woodland Road. (See Figure 8.)

Chatham Township and Madison have designated a 50 acre tract of land bounded by Woodland Road and Loantaka Way as the “Loantaka Moraine” that is located in the recharge zone. The area contains recharge soils as well as wetlands and both towns have worked for its preservation. The twenty-six acres in Madison was purchased by the Morris County Park Commission. The twenty-four acres in Chatham Township remain in private hands as of 1999.

Figure 8 - Recharge Area, Buried Valley Aquifer

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