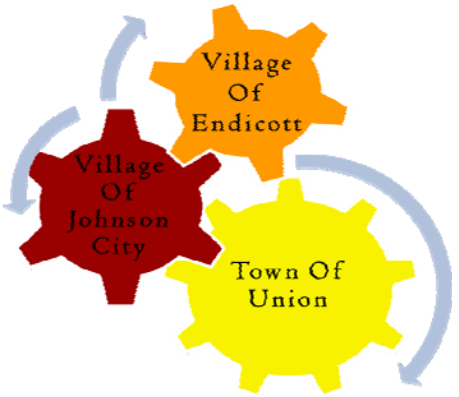
Technical Background Report



Natural Features

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NATURAL FEATURES

Introduction

Until the 1970s, the physical form of urban growth was fairly orderly and compact. Land was abundant and developers could avoid land with severe physical limitations, such as steep slopes, stream valleys, floodplains, poorly drained soils, and woodlands. During the 1950s and early 1960s development began to leapfrog over open land, but still avoided land with severe physical limitations for development. A scattered development pattern in the form of suburban sprawl became the mode. The limitations placed on development by the above mentioned natural characteristics added to the scattered nature of development since buildable land was still readily available.

As development continued, the high cost of site preparation for previously undesirable land became competitive with the high cost of buildable land. As a result of this slow change, the less desirable parcels of land were being developed, and the potential problems associated with the development of unsuitable land are becoming magnified. The Town of Union stands at the crossroads in terms of protection of its natural resource assets such as woodlands and stream valleys, and in terms of the protection of its residents and avoidance of future problems due to flooding, erosion, and septic tank failures.

This chapter is divided into two parts: an inventory and a discussion of problems associated with the development of land containing various natural characteristics. The discussion is supplemented by a slope and contours map, a Soil Associations map, a Limited Development Area map, and a description of soil types.

Climate

The Town of Union has a humid, continental type of climate, marked by extreme seasonal changes in temperature. Winters are long and cold and have frequent periods of stormy, unsettled weather. The average annual temperature is 45 degrees (F) and the average annual precipitation is 36 inches. The atmospheric flow is primarily from continental sources. Therefore, the weather usually is cold and dry when the flow is from the north or northwest, and warm and occasionally humid when the flow is from the south or southwest. From time to time, air masses from maritime sources reach the town from well-developed storms and pressure systems off the mid or north Atlantic coast. Such easterly airflow generally brings cloudy, damp, and relatively cool weather.

The movement of most weather systems toward the northeastern part of the United States makes the town's weather quite variable. Seasonal weather varies appreciably from year to year. Temperatures and other climatic conditions may vary within short

distances because of the differences in elevation, aspect of slope, and other topographic features of the area.

Geology

The rocks that underlie the town are sedimentary deposits, which were eroded from the highlands to the east. Crustal movements of the earth, generally southward, tilted the rock strata. The primary drainage system evolved from normal erosion processes and was subsequently deepened and broadened by glaciers. Rock fragments abraded by glaciers, loose gravel, sand, and other material deposited by the receding glaciers, formed outwash plains at the valley bottoms. These plains are not the principal "aquifers" or ground water sources. Aquifers in the Susquehanna Valley west of Johnson City provide an abundant supply of water and are an important natural resource of the town.

Soils

A primary consideration in assessing the suitability of areas for urban development is the drainage and slope characteristics of various soil types.

The soils in the town are as follows:

1. **Alluvial Land, 0-5 percent slope.**
   This miscellaneous soil type consists of mixed alluvial material that range in particle size from clay to large boulders. It can be found throughout the town on low terraces, bottom lands, and stream valleys. The variable texture, flood hazard and wetness are the major limitations for most uses.

2. **Chenango & Howard Gravelly Materials, 0-40 percent slope.**
   These are major soil types in the town. The soils are well-drained due to the predominance of gravel and are located predominantly along the floodplain of the Susquehanna River.

3. **Cut and Fill Lands**
   Cut and fill lands are a miscellaneous land type made by land forming operations for urban development or other construction purposes. It consists of areas that have been excavated or have been filled with soils and other geologic materials. The characteristics of this land type vary according to the soils and other materials that have been moved in land forming operations. The majority of these soils are located along the southern border of the town.

A. Cut and Fill Lands, Gravelly Materials
This soil type consists of fill that came mostly from areas of Chenango and Howard soils or from leveled areas of these soils.

B. Cut and Fill Lands, loamy materials
This soil type comprises excavated areas or areas filled with soils that formed in glacial till. Most of the areas are in Mardin and Volusia soils; some in Canaseraga and Dalton soils.

C. Cut and Fill Lands, silty materials
Areas of this type are filled with alluvial materials or are graded areas of alluvial soils.

4. **Lordstown Group, 0-60 percent slope**
The depth of bedrock is the main consideration for nonfarm use of this soil. In many places the bedrock is fairly soft and can be excavated. These soils are distributed throughout the town, with a majority of these soils existing throughout the northern section of the town.

5. **Mardin Soils, 2-60 percent slope**
These soils are usually found in areas generally less than 10 acres in size and are nearly round, or in strips several hundred feet in width. These soils are suited for agricultural areas and forest on the slight sloped areas, and pasture and forest on the steeper sloped areas. Erosion is a hazard and conservation measures must be taken. Non-farm uses are limited by either slope or seasonal wetness. The Mardin soils may be found scattered throughout the town.

6. **Volusia Channery Silt Loam, 3-25 percent slope**
These soils are usually found in areas of approximately 15 acres or more in size. The areas are generally round or oblong in shape. These soils are suited to crops, pasture, or forests. Seasonal wetness and shallowness to the slowly permeable fragipan are limitations to non-farm use. The Volusia soils may be found scattered throughout the town in much the same manner as the Mardin soils.

Table 1 ~ Town of Union Soil Interpretations

		Land Use				
Map Symbol	**Soil Name**	**Septic Tank/Effluent Disposal**	**Homesites**	**Streets & Parking Lots**	**Lawns & Landscaping**	**Athletic Fields**
AcA	Alden and Chippewa soils, 0-3% slopes	**SEVERE**: Prolonged wetness; slow permeability	**SEVERE:** Prolonged wetness	**SEVERE:** Prolonged wetness	**SEVERE:** Prolonged wetness	**SEVERE**: Prolonged wetness; slow permeability
Ad	Alluvial land	**SEVERE:** Flooding; prolonged wetness	**SEVERE:** Flooding; prolonged wetness	**SEVERE:** Flooding; prolonged wetness	**SEVERE:** Flooding; prolonged wetness	**SEVERE:** Flooding; prolonged wetness; cobbles
ArD	Arnot channery silt loam, 0-25% slopes	**SEVERE:** Bedrock, slopes	**SEVERE:** Bedrock, slopes	**SEVERE:** Bedrock, slopes	**SEVERE:** Bedrock, slopes	**SEVERE:** Bedrock, slopes
CaB	Canaseraga silt loam, 3-8% slopes	**SEVERE**: Moderately slow and slow permeability	**MODERATE:** Seasonal wetness	**MODERATE:** Seasonal wetness; slopes	**SLIGHT**	**SEVERE**: Moderately slow and slow permeability
CaC	Canaseraga silt loam, 8-15% slopes	**SEVERE**: Moderately slow and slow permeability	**MODERATE:** Seasonal wetness; slopes	**MODERATE:** Slopes	**MODERATE:** Slopes	**SEVERE**: Moderately slow and slow permeability; slopes
ChA	Chenango & Howard gravelly loams, 0-5% slopes	**SLIGHT**	**SLIGHT**	**SLIGHT**	**MODERATE:** Gravel	**SEVERE:** Gravel
ChC	Chenango & Howard gravelly loams, 5-15% slopes	**MODERATE:** Slopes	**MODERATE:** Slopes	**MODERATE:** Slopes	**MODERATE:** Gravel; slopes	**SEVERE:** Gravel; slopes
ChD	Chenango & Howard gravelly loams, 15-25% slopes	**SEVERE:** Slopes	**SEVERE:** Slopes	**SEVERE:** Slopes	**SEVERE:** Slopes	**SEVERE:** Gravel; slopes
ChE	Chenango & Howard gravelly loams, 25-40% slopes	**SEVERE:** Slopes	**SEVERE:** Slopes	**SEVERE:** Slopes	**SEVERE:** Slopes	**SEVERE:** Gravel; slopes
CpB	Chippewa channery silt loam, 3-8% slopes	**SEVERE**: Prolonged wetness; slow permeability	**SEVERE:** Prolonged wetness	**SEVERE:** Prolonged wetness	**SEVERE:** Prolonged wetness	**SEVERE**: Prolonged wetness; slow permeability; sandstone fragments
Cv	Cut & fill lands, gravelly materials	**SEVERE:** Variable	**SEVERE:** Variable	**SEVERE:** Variable	**SEVERE:** Variable	**SEVERE:** Variable
Cw	Cut & fill lands, loamy materials	**SEVERE:** Variable	**SEVERE:** Variable	**SEVERE:** Variable	**SEVERE:** Variable	**SEVERE:** Variable
Cy	Cut & fill lands, silty materials	**SEVERE:** Variable	**SEVERE:** Variable	**SEVERE:** Variable	**SEVERE:** Variable	**SEVERE:** Variable
DaB	Dalton silt loam, 2-8% slopes	**SEVERE**: Slow permeability; seasonal wetness	**SEVERE**: Seasonal wetness	**SEVERE**: Seasonal wetness	**SEVERE**: Seasonal wetness	**SEVERE**: Moderately slow and slow permeability; seasonal wetness
DaC	Dalton silt loam, 8-15% slopes	**SEVERE**: Slow permeability; seasonal wetness	**SEVERE**: Seasonal wetness	**SEVERE**: Seasonal wetness; slope	**SEVERE**: Seasonal wetness; slope	**SEVERE**: Moderately slow and slow permeability; seasonal wetness; slope
LdB	Lordstown channery silt loam, 0-5% slopes	**SEVERE:** Bedrock	**SEVERE:** Bedrock	**SEVERE:** Bedrock	**MODERATE:** Bedrock; sandstone fragments	**SEVERE:** Bedrock; sandstone fragments
LdC	Lordstown channery silt loam, 5-15% slopes	**SEVERE:** Bedrock	**SEVERE:** Bedrock	**SEVERE:** Bedrock; slopes	**MODERATE:** Bedrock; sandstone fragments;	**SEVERE:** Bedrock; sandstone fragments;

					slope	slopes
LdD	Lordstown channery silt loam, 15-25% slopes	**SEVERE:** Bedrock; slopes	**SEVERE:** Bedrock; slopes	**SEVERE:** Bedrock; slopes	**SEVERE:** Slopes	**SEVERE:** Bedrock; sandstone fragments; slope
LoE	Lordstown & Oquaga channery silt loams, 25-35% slopes	**SEVERE:** Bedrock; slopes	**SEVERE:** Bedrock; slopes	**SEVERE:** Bedrock; slopes	**SEVERE:** Slopes	**SEVERE:** Bedrock; sandstone fragments; slopes
LrF	Lordstown & Oquaga channery soils, 35-60% slopes	**SEVERE:** Bedrock; slopes	**SEVERE:** Bedrock; slopes	**SEVERE:** Bedrock; slopes	**SEVERE:** Slopes	**SEVERE:** Bedrock; sandstone fragments; slope
LsE	Lordstown & Oquaga channery extremely stony & rocky soils, 0-35% slopes	**SEVERE:** Bedrock; slope; stoniness	**SEVERE:** Bedrock; slope; stones	**SEVERE:** Bedrock; slopes	**SEVERE:** Bedrock; slope; stones	**SEVERE:** Bedrock; slope; stones
Mf	Made land, sanitary landfill	**SEVERE:** Variable	**SEVERE:** Variable	**SEVERE:** Variable	**SEVERE:** Variable	**SEVERE:** Variable
MhB	Mardin channery silt loam, 2-8% slopes	**SEVERE**: Slow permeability	**MODERATE:** Seasonal wetness; slope	**MODERATE:** Seasonal wetness; slope	**MODERATE:** Sandstone fragments	**MODERATE:** Sandstone fragments; slow permeability
MhC	Mardin channery silt loam, 8-15% slopes	**SEVERE**: Slow permeability	**MODERATE:** Seasonal wetness; slope	**SEVERE:** Slopes	**MODERATE:** Sandstone fragments; slope	**MODERATE:** Sandstone fragments; slow permeability
		Land Use				
Map Symbol	**Soil Name**	**Septic Tank/Effluent Disposal**	**Homesites**	**Streets & Parking Lots**	**Lawns & Landscaping**	**Athletic Fields**
MhD	Mardin channery silt loam, 15-25% slopes	**SEVERE**: Slow permeability; slope	**SEVERE:** Slopes	**SEVERE:** Slopes	**SEVERE:** Slopes	**SEVERE:** Slope; sandstone fragments; slow permeability
MhE	Mardin channery silt loam, 25-35% slopes	**SEVERE**: Slow permeability; slope	**SEVERE:** Slopes	**SEVERE:** Slopes	**SEVERE:** Slopes	**SEVERE:** Slope; sandstone fragments; slow permeability
MmB	Mardin channery silt loam, moderately shallow variant, 2-8% slopes	**SEVERE**: Slow permeability; bedrock	**SEVERE:** Bedrock	**SEVERE:** Bedrock	**MODERATE:** Sandstone fragments; bedrock	**SEVERE:** Bedrock; sandstone fragments; slow permeability
MnC	Mardin-Chenango channery silt loam, 5-15% slopes	**SEVERE:** Variable permeability	**MODERATE:** Slopes	**SEVERE:** Slopes	**MODERATE:** Gravel & sandstone fragments; slopes	**SEVERE:** Gravel & sandstone fragments; slopes
MrF	Mardin & Cattaraugus soils, 35-60% slopes	**SEVERE**: Slow permeability; slopes	**SEVERE:** Slopes	**SEVERE:** Slopes	**SEVERE:** Slopes	**SEVERE:** Slope; sandstone fragments; slow permeability
Ms	Middlebury silt loam	**SEVERE:** Flooding	**SEVERE:** Flooding	**SEVERE:** Flooding	**MODERATE:** Flooding	**MODERATE:** Flooding
Ta	Tioga silt loam	**SEVERE:** Flooding	**SEVERE:** Flooding	**SEVERE:** Flooding	**MODERATE:** Flooding	**MODERATE:** Flooding
Tg	Tioga gravelly silt loam, fan	**SEVERE:** Flooding	**SEVERE:** Flooding	**SEVERE:** Flooding	**MODERATE:** Gravel	**SEVERE:** Gravel
TuD	Tuller channery silt loam, 0-25% slopes	**SEVERE:** Bedrock; slope; seasonal wetness	**SEVERE:** Bedrock; slope; seasonal wetness	**SEVERE:** Bedrock; slope; seasonal wetness	**SEVERE:** Bedrock; slope	**SEVERE:** Bedrock; seasonal wetness
UnB	Unadilla silt loam, 0-5% slopes	**SLIGHT** (May be subject to high floods causing Severe	**SLIGHT** (May be subject to high floods causing Severe	**SLIGHT** (May be subject to high floods causing	**SLIGHT**	**SLIGHT**

		limitations)	limitations)	Severe limitations)		
VoB	Volusia channery silt loam, 3-8% slopes	**SEVERE**: Seasonal wetness; slow permeability	**SEVERE**: Seasonal wetness	**SEVERE**: Seasonal wetness	**MODERATE:** Seasonal wetness sandstone fragments	**SEVERE:** Sandstone fragments; slow permeability; seasonal wetness
VoC	Volusia channery silt loam, 8-15% slopes	**SEVERE**: Seasonal wetness; slow permeability	**SEVERE**: Seasonal wetness	**SEVERE**: Seasonal wetness; slope	**MODERATE:** Seasonal wetness sandstone fragments; slope	**SEVERE:** Sandstone fragments; slow permeability; seasonal wetness; slope
VoD	Volusia channery silt loam, 15-25% slopes	**SEVERE**: Seasonal wetness; slow permeability	**SEVERE**: Seasonal wetness; slope	**SEVERE**: Seasonal wetness; slope	**SEVERE**: Slope	**SEVERE:** Sandstone fragments; slow permeability; seasonal wetness; slope
Wd	Wayland silt loam	**SEVERE:** Flooding; prolonged wetness	**SEVERE:** Flooding; prolonged wetness	**SEVERE:** Flooding; prolonged wetness	**SEVERE:** Flooding; prolonged wetness	**SEVERE:** Flooding; prolonged wetness

Topography

Topographical features affect urban land uses in a variety of ways. Land forms can determine the manner in which urban development is likely to occur, the potential for the placement of certain types of development, the costs of urban services and the value of land. Topographical features may be advantageous, disadvantageous, or both. Flat land, for example, although it eases some development costs and usually affords greater accessibility, may contain drainage difficulties resulting in ponding, swamps, marshes, or lake terrain. Steeply sloping land, while providing view property, increases public and private development costs considerably. In addition, when steep land is developed with urban uses, rain water runoff is increased by impervious surfaces such as roofs and streets, thereby increasing the potential for soil erosion and flooding in low-lying areas.

In summary, topographic features can significantly affect both public and private development costs.

The Town of Union possesses a diverse topography, ranging from very steep slopes, to gently undulating hills, to the practically flat areas of the floodplains. The topography of the town is characterized by well defined valleys, steep hills, and narrow flat ridges. Elevations above sea level range from 1,548 feet in the westernmost part of the town to 820 feet in the Susquehanna floodplain, a variation of 730 feet in about two miles, or one foot in fifteen, at the steepest part.

Steep Slopes

The Town of Union, including the two villages, contains a total land area of 23,213 acres. Approximately twenty (20) percent of the land area is comprised of slopes in excess of 15 percent. Such land is generally considered too steep for most urban development. Much of this land is located in the western and northern parts of the town. This large proportion of steeply sloping land in the town will limit future urban growth by restricting possible land uses due to the problems associated with building construction and the provision of utility services. Extreme care should always be exercised on the part of municipal officials when reviewing land plan proposals in areas where slopes exceed eight percent. It is extremely difficult to visualize the effect of land development on the topography of such an area. An asset of these steep slopes is that they provide a very panoramic setting.

Stream Valleys

Many residents of the Town of Union have lived with the hazards of flash flooding, erosion, and similar storm drainage problems for many decades. Much of these characteristics are associated with the town's streams and stream valleys.

Listed below are the creeks and rivers in the Town of Union:

- Nanticoke Creek
- Finch Hollow Creek
- Brixius Creek
- Day Hollow Creek (a branch of the Nanticoke Creek)
- Little Choconut Creek
- Bradley Creek
- Patterson Creek
- Gray Creek
- Susquehanna River

Nanticoke Creek parallels the western boundary of the town and flows into the Susquehanna River. Its year-round flow is relatively constant although it is subject to seasonal flooding in the lower sections. Flooding on the southern portion of Nanticoke Creek, which affects West Corners, is primarily from the back-up of the Susquehanna River. The upper limits of Nanticoke Creek floods between Rt. 26 and Nanticoke Drive seasonally. The U.S. Soil Conservation Service constructed dams at strategic locations to control flooding. These dams still allow flooding, but on a controlled basis.

Little Choconut Creek flows through the town into the Susquehanna River near Johnson City. Its flow is variable and until corrective measures by the Soil Conservation service were taken, it was subject to severe seasonal flooding. In the mid 1960s Broome County, in cooperation with the United States Department of Agriculture - Soil Conservation Service, initiated a flood control program on Brixius, Patterson and Finch Hollow creeks under the provision of Public Law 566, "The Watershed Protection & Prevention Act of 1954". Under this program the town protected a large portion of its urbanized areas. This has been accomplished by the building of dams and flood prevention structures in strategic locations.

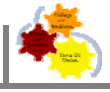
Brixius Creek is located in the west-central portion of the town following a north-south course paralleling Taft Avenue. Patterson Creek is located in the central portion of the town in close proximity to Hooper Road. It also follows a north-south course. Finch Hollow Creek is a large creek which extends the full north-south length of the town. It is located in the eastern portion of the town and has one of the largest flood control walls extending from Endwell Street north to Harry L. Drive. Gray Creek is located just east of the Fairmont Park neighborhood in the east-central portion of the town.

The Susquehanna River, the southern border of the town, is a large river with constant flow and subject to seasonal flooding. The populated areas are protected by flood control structures built after the 1972 floods caused by hurricane Agnes.

For the most part, a majority of the stream valleys are wooded areas except, in part, along the Susquehanna River where housing and light industry are prevalent. In some areas along the stream valleys, developers have utilized land close to the obviously eroding creek banks for mobile homes and other residential units as noted. This can be seen along the Nanticoke, Gray, Patterson, Brixius, and Little Choconut creeks. The land abutting creek and river banks should be reserved for lawns, play areas, and gardens. These areas must be reserved for the unimpeded conveyance of storm water runoff or residents must be prepared to face the consequence of increased flooding and erosion problems.

Floodplains and Flooding

Flash floods caused by spring thaws, summer thunderstorms, or fall downpours can create major hazards to the residents and property of the town. In their steep short plunges to the Susquehanna River, the usually docile creeks of the town have, without warning, repeatedly become raging torrents of destruction. There are several variables among the natural physical features of an area which may cause or contribute to flooding. In some areas, climatological factors such as precipitation are significant. Rate and frequency of precipitation are directly related to the problem of flooding. Although average monthly precipitation in the Town of Union is fairly uniform, melting snow in the springtime months, supplemented by rainfall, occasionally causes flooding. The heaviest precipitation occurs in the months from April to September. Heavy rains in the summer months in the form of thunderstorms can



also produce flooding.

The topographic characteristics of the town are a major determinant of the flooding problem. The steep slopes of the town encourage urban development in the level or gently sloping areas, much of which is floodplain and subject to seasonal flooding.

Most of the level or nearly level land in the town, which is ideal for building, is located in the floodplain areas adjoining the major watercourses - the Susquehanna River, Nanticoke Creek, Brixius Creek, Patterson Creek, and Little Choconut Creek. It is the existing urban development in these areas that has exacerbated the flooding problems and created the need for intensive flood prevention controls.

Land form also influences the propensity for flooding and the flood characteristics such as extent and duration of inundation. Larger areas of land are potentially subject to flooding where the topography is flat. They may also be subject to longer periods of standing surface water. Conversely, in areas of steep topography a more restricted area may be subject to flooding; however, rapid runoff from steep slopes also contributes to inundation. Topographic features of an area will also directly influence the rate of flow of the flood water. High velocity flood waters, for example, are more hazardous to life, property, and soils than slower currents.

A third variable which contributes to the problem of flooding is soil and its related drainage characteristics. Infiltration of precipitation into the soil reduces the amount of surface water runoff. The amount of water that soaks into the ground is determined by soil moisture conditions and by soil porosity and permeability. A greater amount of moisture is absorbed by soil after a period of little or no rainfall than by soil saturated as a result of heavy rainfall. Dense, impervious soils absorb much smaller quantities of water than do loosely packed, pervious soils.

The Limited Development Area map outlines the 100-year flood zones. These delineations were created by the U.S. Army Corps of Engineers in the text Floodplain Information - Broome County, N.Y. - Susquehanna & Chenango Rivers.

According to The National Flood Insurance Program, “The term "100-year flood" is misleading. It is not the flood that will occur once every 100 years. Rather, it is the flood elevation that has a 1- percent chance of being equaled or exceeded each year. Thus, the 100-year flood could occur more than once in a relatively short period of time. The 100-year flood, which is the standard used by most Federal and state agencies, is used by the National Flood Insurance Program (NFIP) as the standard for floodplain management and to determine the need for flood insurance. A structure located within a special flood hazard area shown on an NFIP map has a

26 percent chance of suffering flood damage during the term of a 30-year mortgage." (Source: http://www.fema.gov/about/programs/nfip/index.shtm)

Watershed Areas

There are three primary watershed areas in the town. The westernmost part of the town is in the Nanticoke Creek watershed area; the central part drains by means of the Patterson, Brixius, and Gray creeks watershed area; and the eastern part of the town drains through Finch Hollow Creek, Little Choconut Creek, and Trout Brook watershed area. All of these watersheds eventually drain into the Susquehanna River flowing along the southern town boundary from east to west.

Soil Drainage

All soils on glacial till in the Town of Union have restricted permeability-due to one of three factors: a slowly permeable fragipan (this layer slows percolation of water, inhibits penetration of roots and makes excavation difficult), a dense basal till in the substratum, or bedrock near the surface.

Well drained soils occupy convex slopes where runoff accelerates down slope. Consequently, the soils absorb only part of the total rainfall, and free water stands above slowly permeable layers for only short periods of time. Moderately well drained soils occupy upper parts of uniform slopes and small convex knolls on uniform slopes. Water runs off rapidly but does not accelerate greatly. Though precipitation is partly lost as runoff, free water stands near the surface for several months of the year.

Somewhat poorly drained soils occupy the major portion of uniform slopes, where large amounts of water are received both as seepage and as runoff from higher land. The excess water is removed slowly, and water may stand near the surface for more than six months of the year. Poorly and very poorly drained soils occupy concave slopes and depressions where large amounts of excess water accumulate and water commonly stands near the surface for most of the year.

Well drained soils in glacial outwash or kame deposits do not restrict permeability. These soils occur on uniform and convex slopes of outwash and kame terraces and on steeply sloping kames where excess water is removed very rapidly. Water stands near these surfaces only a few days each year. Moderately well and imperfectly drained soils in glacial outwash occupy level areas or depressions in poorly assorted glaciofluvial deposits. Permeability is restricted by a fragipan or by other slowly permeable layers, and water is removed slowly. Free water may be near the surface for several months of the year.

Well drained soils on fine grained, well sorted sediments in the Town of Union have no layer that restricts permeability. They occupy uniform slopes and knolls on high terraces, where excess water is removed rapidly, and free water stands near the surface for only short periods of time. Moderately well drained soils on fine grained, well sorted sediments have restricted permeability caused either by a slowly permeable fragipan or by slowly permeable strata of silt and clay. They occupy positions where water is received from surrounding slopes, and free water may stand near the surface for several months of the year. Poorly drained soils occupy level areas and depressions where excess water runs off very slowly, and water may be near the surface for more than half the year.

Soils on recent alluvium have no layer that restricts permeability, although high water may prevent rapid percolation. All are subject to annual floods. Well drained soils are found on knolls on the flood plain and on natural levees. Flood waters recede from these areas very quickly, and water remains near the surface for only a month or two during the year. Poorly and very poorly drained soils lie in depressions and backwater areas of the floodplain. Flood waters recede from these areas very slowly, and water may be near the surface for more than half the year. Moderately well drained soils are found between well drained and poorly drained soils in positions from which flood waters recede relatively slowly and where water stands near the surface for several months of the year.

Woodlands

One of the most significant forms of undeveloped land is woodlands. It is an essential part of the ecological makeup of the town and adds an aesthetic quality to the landscape. Woodlands are typically defined as large stands of trees without scrub vegetation.

Many of the lands classified as woodlands are found within close proximity to streams and generally reflect the unsuitability of soils and/or slope in such areas for farming activities. As such, these stream valley woodlands often possess aesthetic qualities which commend them for preservation as permanent open space. This can be seen along the Nanticoke, Patterson, and Little Choconut creeks. Woodlands are also found along the Tioga County border and other northern parts of the town. Much of this woodland is quite mature and the topography attests to the undesirable nature of the land for farming and urban development.

Limited Development Areas

The various geological and topological characteristics of the town such as steep slopes, woodland, floodplains, and soils are interrelated. Together these factors present significant obstacles to development in vast areas of the town. In order to ensure appropriate land usage, proper relationships must be maintained between the type and density of development and the various characteristics mentioned above. A composite of these characteristics is shown on the Limited Development Area map.

Steep Slopes

Urban and suburban development occurring on steep slope lands represents an inappropriate type of land use. This development causes difficulties in providing the appropriate services to the developments such as streets, water mains, and sewer lines. They also trigger unstable conditions on the landscape typified by seepage, erosion, hillside slump, and excessive cut and fill areas.

Generally speaking, lands where slopes exceed 15 percent should be maintained in open space or very low density development. Lands in the 8 to 15 percent range can be utilized for medium density land use if proper precautions and sensitive design practices are followed. Urban densities should be restricted to lands possessing less than an eight percent slope.

Moreover, development that proves too intense for the slope conditions frequently triggers an unstable condition which is expensive to maintain, is not easy to overcome, and can only be avoided by encouraging the proper relationship between density and slope. Development that proves too dense for the topography configurations of the land also creates aesthetically undesirable areas and necessitates the construction of steep embankments with their inherent maintenance problems. In urban environments, buildings can be built into the topography by taking advantage of the natural features, however, the impediments to the circulation system are more difficult to overcome. There are a number of recently developed areas where the density and slope characteristics have not been kept in their proper relationship. Portions of Taft Heights and Nanticoke Valley subdivisions have been developed on slopes that are too steep for proper development.

The Limited Development Area map delineates steep slopes which are defined as slope over 20 percent grade. For the most part, the sloped areas align themselves in a north-south pattern creating the major stream valleys of the town. The Limited Development Area map indicates that much of the vacant land in the town is too steep for responsible development.

Recommendations for avoiding the repetition of these inappropriate land uses would include steep slope overlay regulations on the town and village zoning maps and requiring advance design concepts as part of site plan and subdivision review procedures.

Woodlands

Woodlands are defined as large stands of trees and not areas of open fields which contain scrub type vegetation. The primary reason for questioning the suitability of woodland areas for development is due to several factors, such as the possible unsuitability of soils, steep slope, and the close proximity to streams subject to periodic flooding. The very fact that-the woodland areas still exist in the town is indicative of the unsuitability for development or for agriculture. The woodland areas themselves pose no serious problem for development, but the fact that the wooded areas have other geological and/or topographical problems do pose serious

problems for development. As development consumes acreage in close proximity to urban areas, the woodland areas possess aesthetic qualities which commend them for preservation as permanent open space. The wooded areas of the town serve to break the monotonous stream of urban development, softening the hard edges of development. The wooded areas, especially those on steep slopes and in stream valleys preserve these areas from erosion and other damage by controlling runoff and water absorption.

For the reasons mentioned above, woodlands should be preserved and building or development in these areas should be carefully evaluated. Any approved development shall be monitored.

Stream Valleys and Floodplains

Development is a problem in stream valleys only if measures to control runoff are not taken and development occurs too close to the stream. With regard to the suitability of stream valleys to development, often the problem of slope is compounded by the problem of seasonal flooding in some areas.

Several factors are evident in the relationship between the flooding problem and land development. Development of land for either agricultural or urban uses generally has disrupted the natural drainage process and increased the amount of surface water run-off from a given storm. Areas of virgin soils, native grass, or heavy vegetative cover generally absorb a greater amount of rainfall and have a smaller amount of surface water runoff than similar areas which are intensively used.

In urban areas, where impermeable buildings, streets, and parking lots cover much of the land, very little precipitation is absorbed by the soil and runoff is high. Except in instances where adequate storm sewers have been provided, this situation causes flooding. Some soil types which are otherwise suitable for urban development because of their favorable drainage features lie in the floodplains of the Susquehanna and the major creeks.

Much of the land development in the town has taken place on the floodplains and other poorly drained land. In many instances, intensive development in these areas should have been avoided. Development of floodplains and poorly drained land presents financial burdens to the individual property owners, to the villages, to the town, and to the county as evidenced by the millions of tax dollars recently spent to acquire properties and demolish structures in the flood hazard areas. An added factor is that development in the floodplains frequently results in the constriction of the stream channels and an increase in upstream flood problems. Constriction is caused primarily by the filling of stream channels, trash dumping, and the construction of bridges with inadequate openings.

For the Limited Development Area map, the areas designated as the 100-year flood zone were defined as being unsuitable for development. The areas defined as 500-year flood zone are suitable for development if proper design criteria are followed. The 100-year flood zones are along the Susquehanna River and the lower reaches of Nanticoke Creek. The 500-year flood zone up until recent flood events was larger than any flood area of the past. These areas parallel the 100-year flood zones along Nanticoke Creek from Route 26 to Nanticoke Drive. Along the Susquehanna River, the area includes almost all of West Endicott, south Endwell, and Westover.

The land along the other creeks in the town are also excluded from development in order to control erosion along the banks and to preserve the aesthetic qualities associated with creeks and streams left in their natural state.

Soils

There are a number of soil characteristics which render various portions of the town less than desirable for development. Land use planning must recognize these conditions if a poor selection of land use is to be avoided.

The criteria used in determining suitability for building according to soil conditions takes into consideration slope, flooding, prolonged and seasonal wetness, surface texture, depth of bedrock, permeability, stability, and fragipan. The affect of these features on various land uses are provided in this report. A majority of the soils in the town are not suitable for septic tanks, except with major engineering measures and other costly devices. Even with access to public sewers, a vast majority of the vacant land in the town has severe limitations for residential and other urban development. These poor soil conditions reflect the steepness of the land and the high water table and flooding mentioned previously.