3.0 PHYSICAL FEATURES OF THE LAND

As a rural community through most of the past 200 years, Lewisboro has seen its development both dependent on and shaped by the physical features of the land. Gently sloping areas became farmland while the streams became attractive sites for mills. Land of rough terrain and extensive wetlands were left undisturbed as these areas were uneconomical for use. Through this long period two characteristices persisted. First, the land could easily support the limited population living in Lewisboro and, second, there was no incentive for man-made alteration of the landscape other than clearing of woods.

The situation began to change after 1920. Improved transportation and the beauty of Lewisboro, in particular the lake areas, made the Town an attractive site for summer homes for the urban population of New York City. Residences were constructed around the natural lakes while new lakes were made. Over time, the concentration of population in small areas lacking central water or sanitary sewer systems began to alter the balance that had long been maintained between the land's ability to sustain development and the level of development.

Today, most of Lewisboro's single-family residences continue to be directly dependent on individual wells for water supply and on-lot septic fields for sewage disposal. However, while there were 37 persons per square mile in Lewisboro in 1920, by late 1984 there were 354 persons per square mile and little likelihood that the several small central water and sewer services would be significantly expanded in the future to serve either existing or new development. Compounding this increasingly delicate environmental situation is the reality that most of the easily developed land in Lewisboro has been subdivided and developed. Future construction will of necessity be focused on the more difficult terrain that has in the past been left undisturbed. As a result, planning for Lewisboro's future must incorporate full consideration of the natural environment.

3.1 Topography and Surface Hydrology

Lewisboro is characterized by rolling, often steep hills, stream valleys and numerous wetlands. Elevations range from 200 to 940 feet above sea level. The lowest lying land is adjacent to the Muscoot Reservoir at the western edge of the Town in Goldens Bridge. The highest point is the top of a bluff on the North Salem town line in Mountain Lakes Camp, 470 feet above the surface of Lake Rippowam. The most extensive high area is the land crossed by West Lane, Elmwood Road and Stonewall Court in Vista at an average elevation of 750 feet. (This information is shown on a Topography and Surface Hydrology interpretative map which was prepared as part of the Town Plan to illustrate Lewisboro's topography in detail. The various elevations are colored in fifty foot

intervals from greens and yellows at the lower elevations to browns at the higher elevations.)

Steeply sloping lands, ridge lines and escarpment areas should be a prime development constraint. While subdivisions built on slopes between 15-25% have presented opportunities for creative architecture and site planning, densities greater than one single-family home per acre can be expected to create hazardous conditions. To prevent erosion in these areas, sufficient vegetation and tree growth must be preserved and building coverage limited. Development should be avoided where slopes exceed 25%.

Lewisboro has one major drainage divide and 12 smaller watershed areas. (This information is also shown on the Topography and Surface Hydrology map.) The major divide traverses the Town between the Connecticut state line near the Route 35/Route 123 intersection and the Pound Ridge town line near Kitchawan Road. This divide separates drainage into streams tributary to the Hudson River from drainage toward Connecticut and eventually to Long Island Sound.

All of the streams in Lewisboro eventually drain into drinking water reservoirs. Particular care will be needed in planning for future development so that the streams that flow into municipal reservoirs can be safeguarded. Drainage into Connecticut is divided between two sub-basins - the Silvermine River which drains directly into New Canaan and is part of Norwalk's water supply and the Mill River which flows through Pound Ridge into the Stamford reservoir system. The central portion of Lewisboro drains into the Cross River Reservoir in Bedford. The northernmost portion drains into the Titicus Reservoir in North Salem and the western portion of the Town drains into the Muscoot Reservoir. The Cross River, Titicus and Muscoot Reservoirs are part of the New York City reservoir system and the Croton drainage basin.

The water quality classifications of the major streams and waterbodies in Lewisboro as determined by the New York State Department of Environmental Conservation are shown on the Topography and Surface Hydrology map. The water quality standards are based on the water's quality at the time it was sampled, as well as its best recommended usage. Dissolved oxygen and bacteria levels are important considerations in the classification system. Class A and AA are suitable for drinking water; Class B is swimmable; Class C is suitable for the survival and propagation of fish; Class D is drainage, suitable for secondary contact recreation. Class D designation does not necessarily imply polluted waters. Streams are also classified as D if they have not yet been sampled or if they are extremely small or intermittent and are thus unable to support fish.

The water supply reservoirs, Lake Waccabuc and Cross River have been categorized as Class A. The other large lakes, natural and man-made, are categorized as Class B.

3.2 Soils

An awareness of soil properties is an important aspect in the environmental management approach to planning. The origins and physical properties of soil have, to a great extent, determined the previous land use in given areas and have important implications for future development. Ignoring or misinterpreting the characteristics of soil cover or geological foundations may result in structural failures, higher construction and maintenance costs, or erosion and drainage problems. Consideration of the engineering properties of the soils present on a site should be an integral part of any site design.

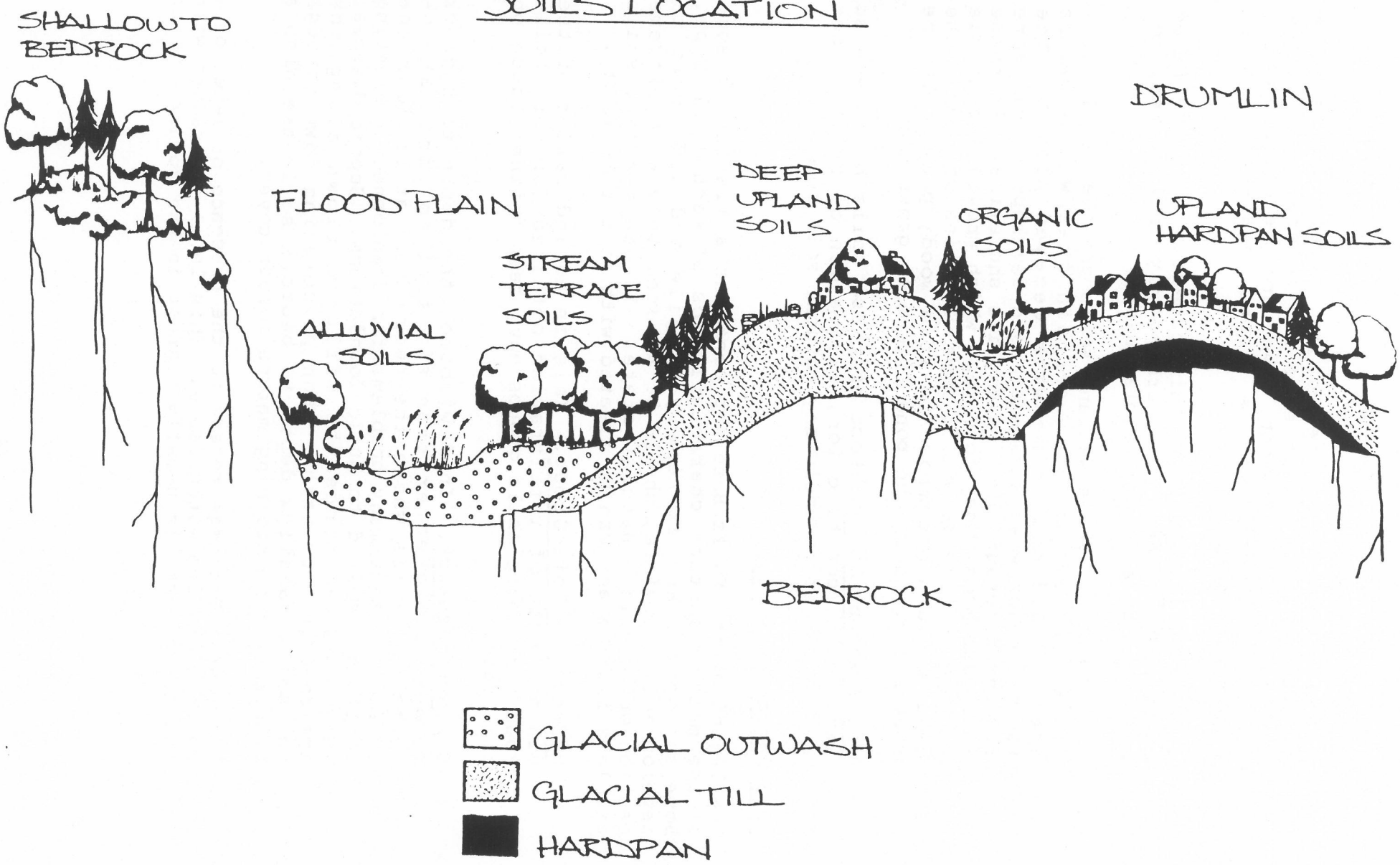
A Soils Base map has been prepared as part of the Town Plan. This map contains the most recent (December 1981) soils information provided by the Soil Conservation Service (USDA) at two-acre accuracy. The soils found in Lewisboro have been grouped by their form of origin. The general land forms where these soils occur are illustrated in Figure 2, "Soils Location." The soils categories are:

- Deep Upland Soils in Glacial Till. These soils are fairly coarse in texture and are formed in till, which is a mixture of clay, silt, sand, gravel and boulders deposited by the retreating glacier. Although some of these soils form wetland areas, most are well-drained with rapid permeability. In the past, most of these deep till soils have been farmed.

- Upland Hardpan Soils. Hardpans are present in upland soils that are formed over compact glacial till. An impervious clay layer makes water penetration beyond a foot or two very difficult. These soils are thus poorly suited for septic field development. These hardpan soils are typically associated with drumloidal formations. Drumlins are cigar-shaped hills left behind by the glaciers. They were formed when an advancing glacier met with a physical impediment. In overriding this impediment, the ice sheet left behind a wake of glacial till. The northern end is usually stepper and blunter than the southern end. The ridge tops of drumlins have usually been cultivated in the past while the steeper slopes have been used for pasture or left in forest.

- Upland Soils Shallow in Depth to Bedrock. These soils are thin, rocky and generally underlain by bedrock within two feet of the surface. Rock outcrops are frequently associated with these soils.

Figure 2


SOILS LOCATION
SHALLOW TO BEDROCK
DRUMLIN
FLOOD PLAIN
DEEP UPLAND SOILS
ORGANIC SOILS
UPLAND HARDPAN SOILS
STREAM TERRACE SOILS
ALLUVIAL SOILS
BEDROCK
GLACIAL OUTWASH
GLACIAL TILL
HARDPAN

- Glacial Stream Terrace Soils. These soils were deposited by glacial streams and generally offer few impediments to development. They are present in several areas, primarily on gentle slopes adjacent to lakes, streams and wetlands.

- Alluvial Soils. Soils in this category form the flood plains along rivers. They are poorly drained wetlands that flood on a fairly regular basis.

- Organic Soils. These wetland soils are the result of a natural process in which certain freshwater bodies become filled over time with decayed plants. The process begins when a lake or pond develops a thin zone of water tolerant plants along its shoreline. As these plants decompose they form peat which provides a stable platform for the growth of some varieties of trees. The trees in turn decompose to form woody peat. As the process continues, the pond literally grows shut.

- Miscellaneous Soils. Most of these soils have been so disturbed by construction, excavation or filling that they no longer resemble any natural soil type.

3.3 Soil Characteristics

The legend of the Soils Base map contains a listing of some of the most important characteristics of each soil type. Some soil types are extremely fragile and difficult to develop and, therefore, should be altered only with extreme caution or left in a natural state. In other areas, soils are less fragile and can be treated with more flexibility.

- Hydrologic Soil Group. This is an indication of the minimum rate of infiltration obtained for bare soil. Four hydrologic soils groups have been defined based on this rate.

- Depth to Bedrock. In Lewisboro, the depth to bedrock ranges from greater than six feet to right at the surface. Soils where the bedrock is at or near the surface present many problems for development. Blasting is often required to build foundations. Septic disposal is a problem since the effluent flows along the impermeable rock rather than percolating down through the soil. Shallow depth to bedrock soils are also a problem for maintaining mature forest cover.

- Drainage. Drainage refers to the presence or level of a seasonally high water table. This level fluctuates with the seasons and is usually highest in the spring due to

the influence of melting snow. In soils that are well drained, there is no indication of a seasonal high water table within three feet of the surface. In very poorly drained soils, it is at or near the surface for prolonged periods. In moderately well drained soils, the presence of the seasonal high water table within 1-1/2 to 3 feet of the surface is often caused by an impermeable layer below the surface. Figure 3 illustrates drainage characteristics.

- o Permeability. The permeability of a given soil layer is the characteristic that describes its ability to transmit water. Soils with "hardpan" layers have slow permeability. A "hardpan" is an impervious clay layer that blocks or slows the downward movement of water. Hardpan soils present severe limitations for the construction of septic fields. Septic effluent flows along the hardpan rather than filtering into the soil. It may run off into streams or travel to the surface if the hardpan layer is shallow enough.

- o Erodibility. Erodibility is an inherent property of any given soil. Some soils are naturally more erodible than others. This is also true for the different layers of each soil. The inherent erodibility is often modified by slope in that, in many cases, it increases with increased slope. Erodibiilty is an important soil limitation to consider in any development decision because it can affect the area to be developed as well as adjacent lands. In easily erodible areas, rainwater runoff can carry away topsoil and deposit excessive amounts of it in streams. This increase in sediment in streams lowers the quality of the stream water.

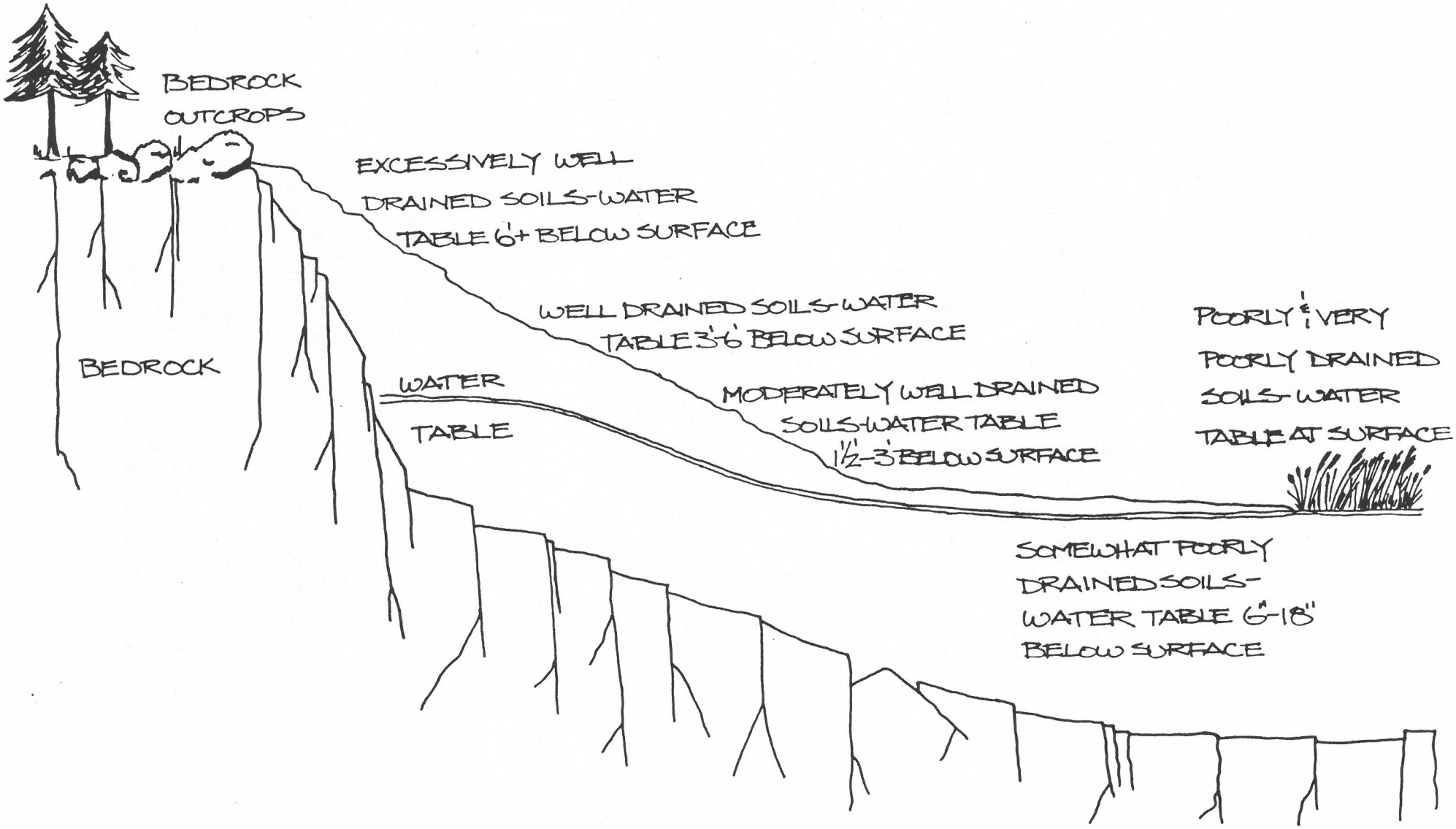
2.4 Wetland Functions

Wetlands are generally defined in this Plan as land as having somewhat poorly, poorly and very poorly drained soils by the Soil Conservation Service (USDA). Actual field determination of wetlands requires in addition a review of characteristic plants. The wetlands in Lewisboro are an integral part of the Town's drainage patterns. Individual wetlands are not isolated entities but part of a larger wetland and drainage system. Upland wetlands play a major role in maintaining the functions and integrity of downstream wetlands and flood plains. Several important functions are served by wetlands. These include:

- o Wetlands act as natural sponges, retaining runoff during storms. This water then leaves the wetland with considerably slowed velocity thus minimizing downstream flooding problems. This capacity is not unlimited. Prolonged changes in the water level of wetlands can alter their vegetative patterns.

Figure 3

DRAINAGE CHARACTERISTICS



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- Wetlands serve as erosion control areas. They trap sediment carried from upland areas before it reaches streams, ponds and drinking water reservoirs. If this sediment were allowed to reach the waterbodies and water courses it would result in a deterioration in water quality and erosion of stream banks. However, excess sediment can also adversely impact the wetland.

- Some wetlands are underlain by pervious sands and gravels and occur over water-bearing bedrock formations. Water from the wetland can percolate through the gravel and recharge the underground aquifer. If the aquifer is sufficiently thick, the water it maintains can be substantial. Water which percolates through wetlands gravels can also travel through cracks in the bedrock to other aquifers.

- Many pollutants are carried into wetlands by storm water runoff. Wetlands serve to trap lead and other by-products of automobile combustion. They also trap nitrates and phosphates that are washed from fertilized lawns. Wetland plants consume phosphates, thus preventing them from fertilizing the water in downstream lakes and streams and helping to keep those waterbodies free of algae.

- Wetlands are productive areas which serve as a source of nutrients for freshwater fish. Wetlands provide breeding, nesting and feeding grounds, and cover for many forms of wildlife, waterfowl and songbirds. While not necessarily containing endangered plant species, wetlands may contain plant species that are unusual or uncommon in a particular area. Wetlands provide recreational areas for fishing, hiking and bird watching. They are also unique and interesting areas for environmental education purposes.

3.5 Aquifers

Any underground geological formation that yields a significant amount of water is called an aquifer. Marble or limestone is the most productive type of bedrock, particularly in lowland areas where it is overlain by water-bearing deposits of outwash. Studies have indicated that two significant bands of marble exist in central Lewisboro. One band generally encircles the Ward Pound Ridge Reservation running parallel to the Waccabuc River for a short distance and the other follows the Mill River north to Pumping Station Swamp on the border of Ridgefield and then extends to the west through the Lake Rippowam-Lake Waccabuc basin and finally southwest to Cross River Reservoir.

A second source of ground water is till. Till consists of unstratified glacial deposits consisting of intermingled clay, sand, gravel and boulders. Deposits of till having a

wide range in thickness are extensively distributed in Lewisboro particularly on the uplands but also in some valley areas. Till has a realtively low permeability and, except where it contains sandy lenses, yields only a few gallons of water per minute to dug wells. Till overlays the majority of Lewisboro bedrock and can be expected to limit ground water quantity in surficial deposits to small domestic supplies. Till may be overlain by swamps containing organic soils or strains of alluvial soils and may function as a confining layer over some bedrock aquifers.

A third source of ground water is stratified drift which consists of interbedded layers of sand, gravel, silt and clay deposited in stream valleys and lowlands by the meltwater of receeding glaciers. The greatest well yields can be derived from the sand and gravel portions of stratified drift deposits near large streams. The same factors which make such areas valuable as water sources make them susceptible to contamination. Stratified drift deposits are covered by soils with high percolation rates which allow rainfall and runoff to easily recharge the groundwater. Unfortunately, these soils also easily transmit water containing pollutants. Because groundwater moves very slowly, contaminants may go undetected for some time. Even after pollutants have been discovered it may not be possible to rectify the situation. It is, therefore, important to prevent contamination to aquifers by controlling land use activities above their recharge areas. Protection of the primary and secondary recharge areas is particularly important. Any land use which would result in solid waste leachate, road salt, petroleum, domestic or industrial water percolating into groundwater should be strictly controlled and, if possible, prohibited in aquifer recharge areas. It is also important to keep these areas open so that the aquifer can be recharged.

Several small areas of stratified drift have been identified in Lewisboro. These include: the swamp lands adjacent to Route 35 west of Ridgefield Avenue, the area draining toward Lake Kitchawan south of Cross Pond Road, the land north of Petitt Road, the wetland northeast of the South Salem Fire House and the land between Lakes Waccabuc and Oscaleta.

A ground water development potential study was prepared for the Town of Lewisboro in 1975. This study concluded that, "both the present and projected daily water demands usage by the town will be more than adequately met by the total ground water development potential for the foreseeable future for both normal and drought years." While the study results are reassuring, the research was limited to available topographic information. The report noted that, "a paucity of pumping information under controlled conditions...precludes a more detailed evaluation of the aquifer characteristics..." and concluded by recommending that additional field analyses be conducted and that existing central water supply wells be fully instrumented and routinely monitored.

While the work undertaken in preparing this Plan has produced comprehensive information on soils and slope conditions, data on aquifers and water resources remains only sketchy. As Lewisboro continues to develop, the need for accurate, detailed information on water resources is increasingly important.

3.6 Development Limitations Summary

A Development Limitations Summary map has been prepared as part of this Town Plan. The map is a summary analysis of the slope and soil characteristics present in the Town of Lewisboro and the development constraints associated with them. Over-riding slope and soil characteristics were used to categorize soils as presenting very severe, severe, moderate and slight limitations to development.

- Very Severe. Lands described as possessing very severe development limitations are generally unsuited for development. Wetlands and extremely steep hillsides are included in this category. (Somewhat poorly, poorly and very poorly drained soils, permanently flooded soils, slopes 25% and over.)

- Severe. Areas with severe limitations present major problems when development is attempted. Unless development proceeds with extreme caution and at low densities on such sites, serious adverse environmental impacts can result. They may occur directly on the site or elsewhere, perhaps involving the siltation of a neighboring waterbody when a highly erodible area is developed. Severe limitations are most frequently associated with rocky upland areas. (Slopes 15-25%, soils with average slopes greater than 15%, moderately well-drained soils, soils with slow permeability, soils shallow to bedrock.)

- Moderate. The moderate limitations category delineates lands with environimental constraints which can be overcome if proper precautions are taken. Sites with these limitations are found primarily in areas of gentle rolling hills. (Slopes 8-15% with high subsoil erodibility, unstable slopes 8-15%, remaining stony soils.)

- Slight. The areas which possess slight limitations present relatively few constraints to development. Since a few of these soils are moderately erodible and occur on 8 to 15 percent slopes, precautions to mitigate such problems as increased erosion and runoff should be taken. (Remaining upland soils, glacial stream terrace soils.)

While presenting overall categories of severity, the Development Limitations Summary map also contains descriptions of the severity of the various soils for particular uses. These are:

- Septic Field Limitations. Septic field limitations are based on a combination of soil characteristics - drainage, slope, depth to bedrock, permeability (hardpan) and stoniness. Severe septic limitations are associated with slopes over 15%, wetlands (poorly drained areas), shallow depth to bedrock and slow permeability (hardpan soils). Moderate limitations are typically associated with mild slope and stony conditions.

- Dwellings with Basements. Limitations for the construction of dwellings with basements are based on flooding, drainage, depth to bedrock, slope and shrink-swell potential.

- Local Roads and Streets. Limitations for the construction of local roads and streets are based on depth to bedrock, drainage, slope and bearing capacity.