soils for homesites

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Soils for Homesites

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Introduction

Are you planning to build that dream house, or move from a crowded city neighborhood to suburbia? If you are, learning about soils should be included in your plans.

Do you know the soil you live on, or intend to buy and build on? Virginia soils vary greatly in their desirability for building sites. You should know that soil in your back yard can be different from that in your front yard, even on a small lot. If you have never had problems with land, you will be amazed at what can happen when you run into undesirable soils. They can be expensive to keep, may cause many health hazards, and can be difficult to get rid of.

This publication points out some soil problems you may encounter (landsliding, flooding, shrinking and swelling, drainage, underlying rock) and may help you avoid future troubles.

SEE YOUR EXTENSION AGENT, AGRICULTURE, FOR HELP WITH YOUR SOIL PROBLEMS.

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LANDSLIDES

HAVE YOU READ ABOUT THE MANY LANDSLIDES that caused great damage and financial loss in California and other states? We also have landslides in Virginia, and can have many more unless we know and handle our soils properly.

There are many Virginia soils that will slide if improperly excavated. Most of the larger slides occur in the soils of the colluvial lands. Large slides have occurred in Allen soils near Narrows, Virginia along highway 400; along Interstate 81 near Hollins; in Frederick cherty soils near Clay Pool Hill; and in coastal plain sediments in Alexandria, Virginia.

Large landslides have occured in Frederick cherty soils, and small slides in Carbo and Westmoreland soils of the residual uplands. In the Piedmont and Blue Ridge Mountain regions, slides have damaged Highways in Dyke, Braddock, and Chandler soils. Several counties have regulations that prevent building on soil subject to sliding. Cost of building large buildings on sliding soils is almost prohibitive and great risks are involved.

Figure 1—This is one of several new homes which were badly damaged by a large landslide in clayey sediments in the Coastal Plain of Virginia.

Figure 2—WHAT IF YOUR HOUSE HAD BEEN HERE? This is a landslide in Frederick cherty silt loam. It covers a 360' by 365' area, and thousands of dollars were spent moving it. (See Fig. 3. below)

Figure 3—SLIDES CAN BE EXPENSIVE! Estimated cost of moving soil out of landslides in Southwest Virginia alone was about $300,000 in 1963.

Figure 4—A small landslide in Saltville, Virginia in clayey materials in a fault zone of the McCrady formation. Soil scientists prevented the spending of thousands of dollars by properly evaluating damages which could have resulted from this slide. Proper identification showed that only a small portion of the slope to be loose clay which could slide, where great damage to houses had been anticipated.

Figure 5—A LARGE LANDSLIDE IN ALLEN SOIL. NEAR HOLLINS, VA. ALONG U.S. 81. Workers have been hauling materials from this slide for many months and it is still creeping into the highway. It covers several acres and estimated cost of removal will run over $100,000.

FLOODING

YOU ASK FOR TROUBLE when building on flood-plain soils. Flood damage cost soars into the millions across the nation annually because many buildings are built on flood plains. In most places, more rolling and higher-lying soils of the uplands are well drained and better suited to homesites than are soils of the colluvial lands or flood plains. Some counties have ordinances to prevent building on flood plains and many homes have been moved off flood plains to prevent further costly damage and loss of life.

Figure 6—AN UNHEALTHY AND DANGEROUS SITUATION: the owner says this building is damaged by flooding nearly every year, but adjacent soils are too steep, stony and shallow to build on.

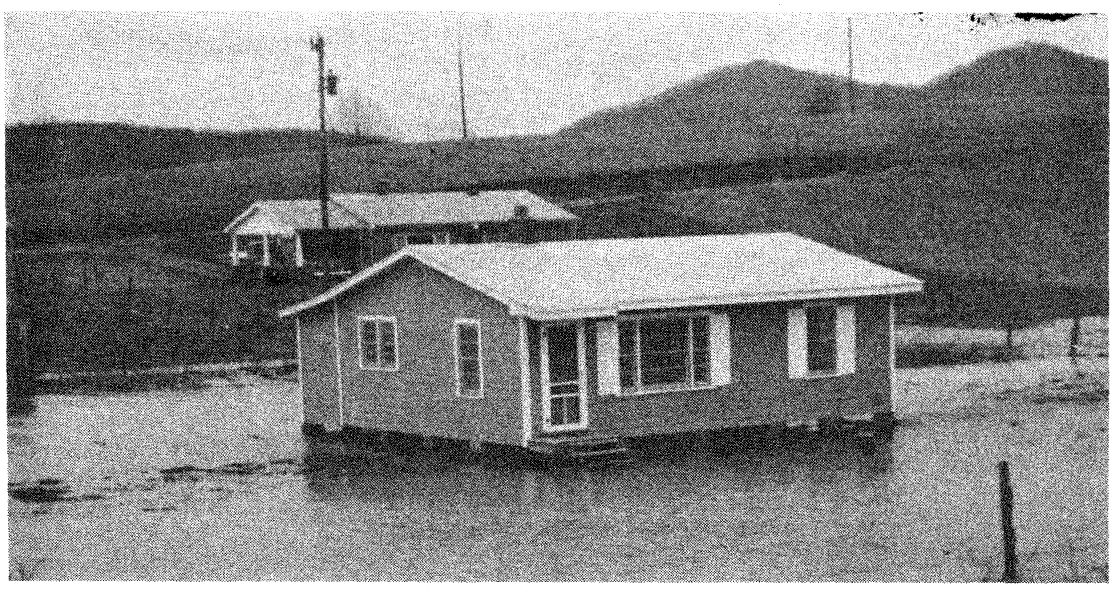

Figure 7—Soil in the foreground is the somewhat poorly drained Lindside silt loam; soil on the well-drained hill in the background is Pisgah silt loam. People down stream may receive contamination from body wastes washed out of the privy in the backyard on Lindside silt loam.

SHRINKING AND SWELLING

DO YOU KNOW THAT CERTAIN SOILS HAVE CLAYS THAT SHRINK WHEN DRY AND SWELL WHEN WET? Soils that swell and shrink require stronger and larger footings than soils with non-swelling clays. If your footings are not strong enough to resist these clays, your basement will crack, and eventually let in percolation waters and insects that may damage the entire structure. It costs hundreds of dollars to partially repair this damage, the life of a building is shortened, value is reduced, and contamination may occur where septic tank drainfields are used.

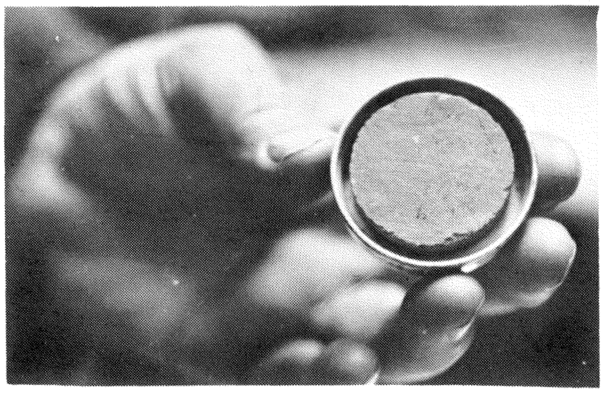

Figure 8—When it dried, this plastic clay shrank away from the edge of the container. Clays of this kind will cause damage to foundations, roads, streets, parking lots and swimming pools by shrinking when dry and swelling when wet. Some critically shrinking clays will shrink 6-7% of their volume from wet to dry and swell back when wet.

Figure 9—This foundation and wall cracked because the house foundation was not built strong enough to resist the clayey shrinking and swelling soil. A furnace in the basement was damaged and the wall had to be jacked back to close the crack and stabilize the building.

NOTE CRACKS IN THE SUBSOILS. When wet, the soil particles expand and close up the cracks. These types of soils are very slowly permeable to water and hard to work. Examples of soils with critical shrinking and swelling clay subsoils are Helena, Iredell, Kelly, White Store, Robertsville, Carbo, Bland, Elkton, Frederick, Lodi, and Orange.

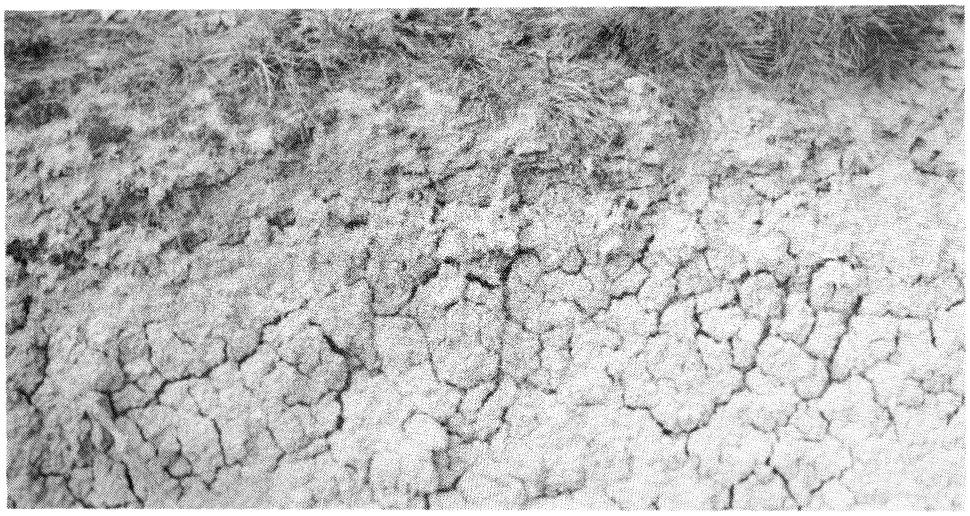

Figure 10–This is Helena fine sandy loam, which has a sandy surface and extremely plastic, sticky, clayey subsoil.

ROADS AND STREETS ARE NOT ALWAYS BUILT TO FIT THE SOIL ON WHICH THEY REST. Broken roads or streets usually indicate swelling or shrinking, wetness, or poor soil conditions. Soils with poor characteristics are Calverton, Croton, and Kelly soils of the Triassic region; Colfax, Lignum, Trego, and Worsham soils of the Southern Piedmont; and Landisburg, Greendale, Melvin, and Purdy soils of the Valleys and Mountains.

Figure 11–Soil conditions were unknown when this street was built on somewhat poorly and poorly drained clayey soils.

DRAINAGE

DIG IN AND LOOK AT THE SUBSOIL COLOR. Color of the soil layers indicates drainage conditions. Wet soils or soils that have watertables near the surface during most of the year are mostly gray and occur in flat places. Well-drained soils are usually brown or red, and have gently sloping, sloping, or moderately steep slopes. Where part of the subsoil is gray and part brown, intermediate drainage and moderately high watertables are indicated.

Color of the surface doesn't tell the whole story--you must look into the subsoil and parent material.

PLANNING TO HAVE A BASEMENT? YOU MIGHT HAVE A POND INSTEAD: avoid flat, wet soils with gray colors in the subsoil. It is almost impossible to have a dry basement where the watertable rises above the basement floor. Good gardens, lawns, and shrubs are difficult to grow on wet soils. These soils are good sites for lagoons or ponds, but poor for home basements. Houses built on high watertable soil remain damp and may become moldy and unhealthy to live in.

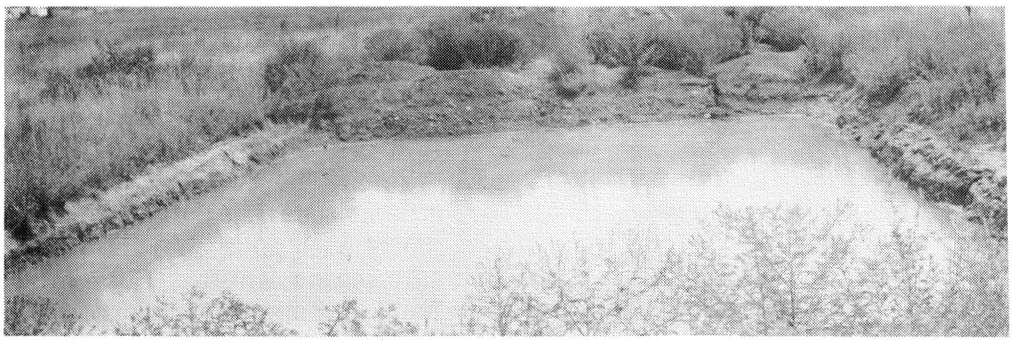

Figure 12–This land was bought for a housing development. Basements filled with water and septic tank drainage fields could not be used. The owner had to wait for trunk sewage lines, and this undesirable soil was difficult to develop and dispose of.

HIGH AND DRY BASEMENTS require good position, good drainage, watertable deep below the subsoil, and brown to reddish colors in surface and subsoil.

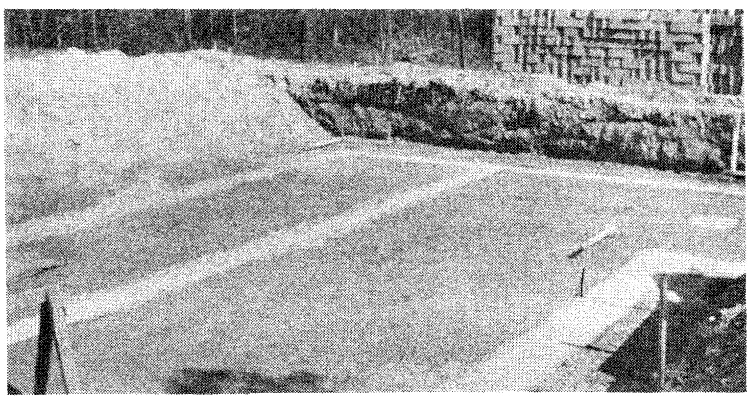

Figure 13–This basement is in well-drained Glenelg soil. This soil occurs on gently rolling slopes, is deep over hard rock, porous and easy to excavate. There are no swelling clays to crack basement walls. Soil absorbs water readily and it is good for lawns, shrubs and vegetable gardens.

THE WAY THE SOIL HANDLES WATER THAT FALLS ON IT IS OF UTMOST IMPORTANCE AROUND YOUR HOMESITE. Water running downhill will collect in low places on the land surface. Avoid building in low-lying colluvial areas near the heads of drainageways and near the base of slopes adjacent to higher-lying uplands. Costs to have a dry lawn and house will be greater on the low-lying soils.

Figure 14—Soil on the slope is well-drained Groseclose silt loam. Soil on the low-lying colluvial foot slopes is Greendale silt loam. A basement in the Groseclose soil would naturally receive drainage water from the higher-lying Groseclose soil. Good landscaping; some soil filling, surface draining and perhaps water-proofing of basement walls would be needed to prevent dampness or wetness in the Greendale soil.

LOOK FOR MOISTURE IN PLOWED AREAS. Well-drained soils dry out first. This can be a good guide in studying an area for a satisfactory homesite--be sure to select a well-drained soil or learn enough about the soil you select to prepare it for a good homesite.

Figure 15—The light colored soil on the narrow ridge is well-drained Nason silt loam. The dark soil on the colluvial land area is somewhat poorly drained Lignum silt loam which has a fragipan layer that retards water movement in the subsoil.

WHEN LOOKING FOR A HOMESITE, OBSERVE VEGETATION. Changes in crops and native vegetation indicate changes in soil conditions.

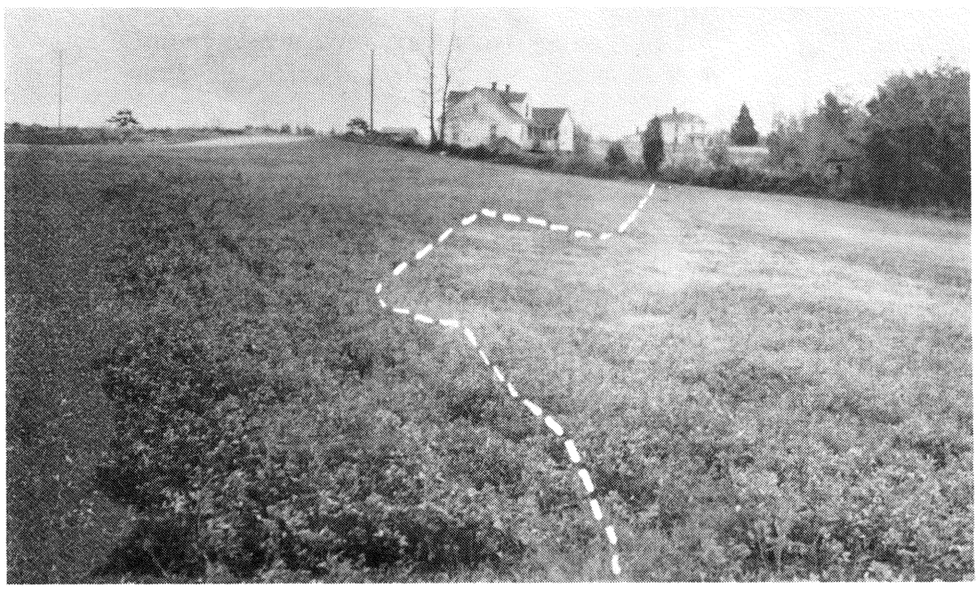

Figure 16—Good alfalfa on the ridge at the left is on well-drained Cecil fine sandy loam--a good homesite. Alfalfa dying out on the right is on moderately well-drained Vance fine sandy loam--a poor homesite.

Figure 17—The soil where bullrushes are growing is poorly drained and poorly suited to homesites, lawns, gardens, shrubs and basements. The surrounding soils are somewhat poorly to moderately well-drained and are fairly good soils but too wet for good basements or septic tank drainfields.

DO YOU KNOW THAT ABOUT 30% OF THE HOMES BUILT IN VIRGINIA DEPEND ON SOIL FOR BODY WASTE DISPOSAL THROUGH THE USE OF SEPTIC TANK DRAINFIELDS; AND THAT ILL-FUNCTIONING SEPTIC TANK DRAINFIELDS ARE COMMON HEALTH PROBLEMS IN COUNTIES ACROSS THE STATE?

If you have not previously lived beyond sanitary and storm sewer lines, there are some things you need to know. The average home with bath, laundry, and sanitary facilities uses more than 400 gallons of water per day, or 146,000 gallons per year. In town this waste water is handled by sewers--in urban or rural areas, where septic tank disposal drainage fields are commonly used, it is handled by the soil. One of your biggest problems will be to dispose of this waste water. Your neighbors down the ditch or stream below you don't want it; you don't want it overflowing on your property; and in some counties regulations won't permit it.

Many soils in Virginia are unfavorable for septic tank disposal systems because they do not have the ability to absorb water or septic tank effluent rapidly enough. On the other hand, there are some soils that let waste water travel to extreme depths rapidly or follow along rock ledges, and in these conditions contamination of wells and springs creates a dangerous health hazard. If you have to use septic tank drainfields on your homesite, be sure to select a good, well-drained soil that will absorb 300 to 400 gallons of water per day.

Figure 18—Well-drained porous Norfolk loamy fine sandy (left) is good for septic tank drainfields. Iredell silt loam (right) has impermeable extremely plastic swelling clay subsoil-a poor soil for septic tank drainfields.

IT PAYS TO LOOK AROUND WHERE YOU INTEND TO BUY OR BUILD. Rows of tall grass growing over old septic tank lines usually shows drainfields are not draining satisfactorily. Where septic drain lines are installed properly, in good soils, lines don't show in the vegetative cover.

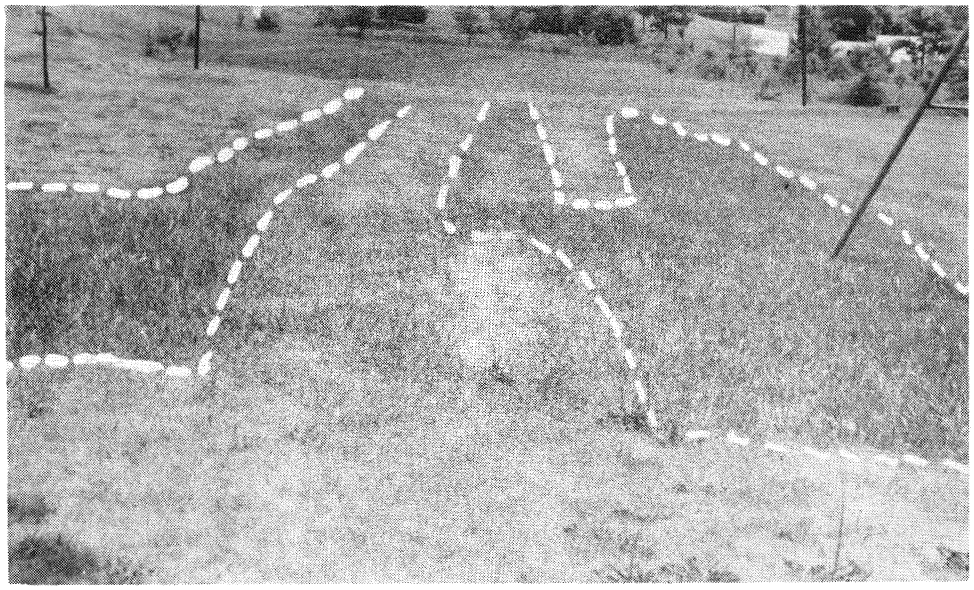

Figure 19—The soils in this area are Greendale Landisburg, and Lodi, considered questionable for septic tank drainfields. Most septic tanks in these soils have to be cleaned every 2 or 3 years when bad odors develop in the homes. The life of a drainfield in such soils is usually less than 10 years.

Figure 20—A COMPLETE FAILURE. The tall fescue is growing on a septic tank drainfield that is running over on the surface. This happens frequently in shallow to bedrock shales or in soils that have slowly permeable subsoils. This drainfield was abandoned soon after the picture was taken.

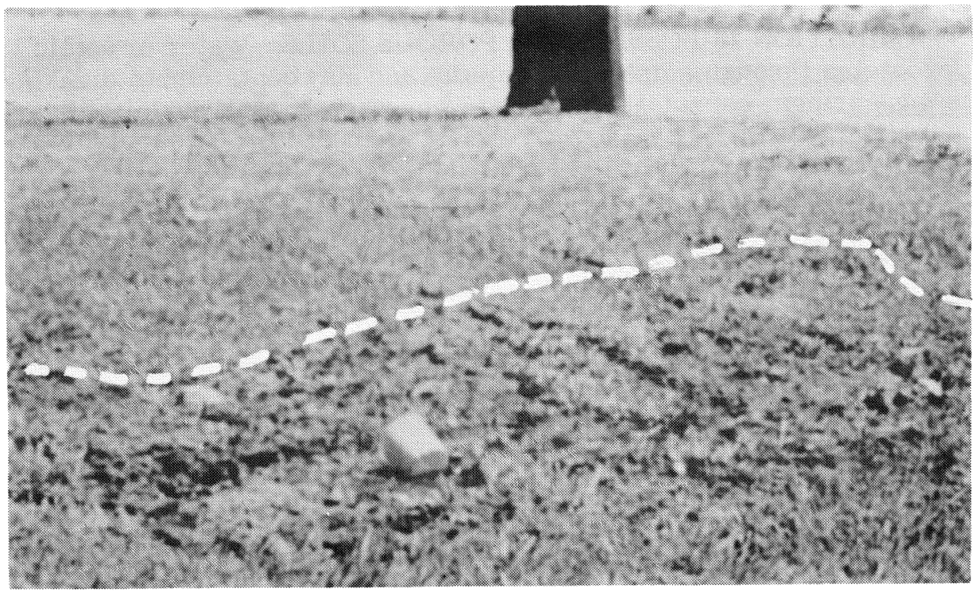

Figure 21—ANOTHER FAILURE IN CITY LIMITS. Note overflowing septic effluent around cup in the front yard. This is an extreme health hazard that is in the Beltsville loam soil of the Coastal Plain Area. It has a fragipan in the subsoil.

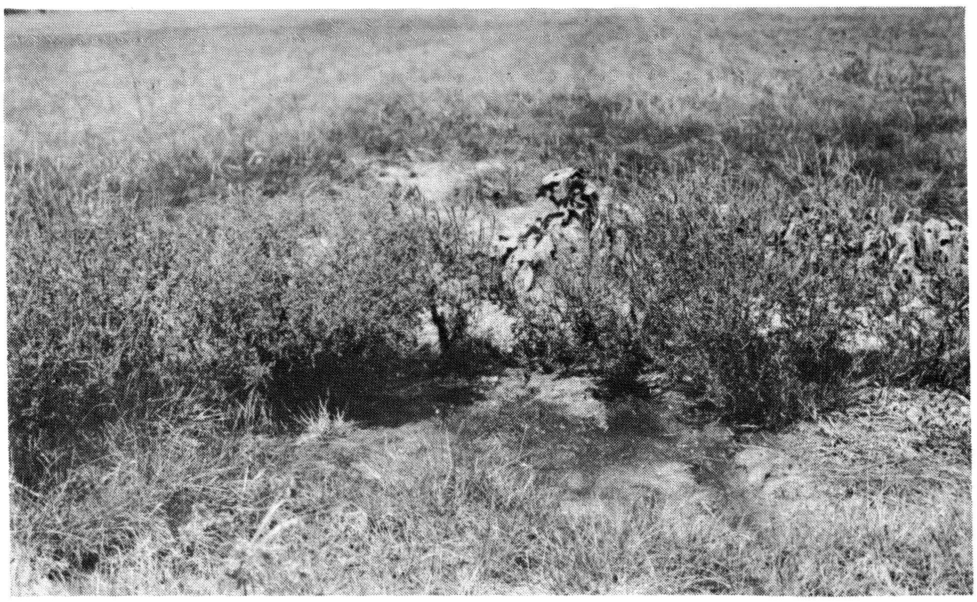

Figure 22—Effluent from over running septic drainfield in Calverton silt loam. Effluent has killed broad leaf plants.

CONTAMINATION IS POSSIBLE IN POROUS SOILS. Water or septic tank effluent percolates through some soils rapidly and may contaminate drinking water in wells or springs, especially in areas where septic tank drainfields are common.

Manor soil for example, is excessively drained and porous. It can be dug by hand to 10' or 20' or more, is brown, is highly micaceous throughout, and lets water percolate very deeply. Characteristics of this soil are similar to those formed in the Chandler, Louisa, Glenelg, and Watauga soils of the Piedmont and Blue Ridge Mountains. Galestown, Klej, Lakeland, and Molena, and sandier Norfolk soils are also very porous.

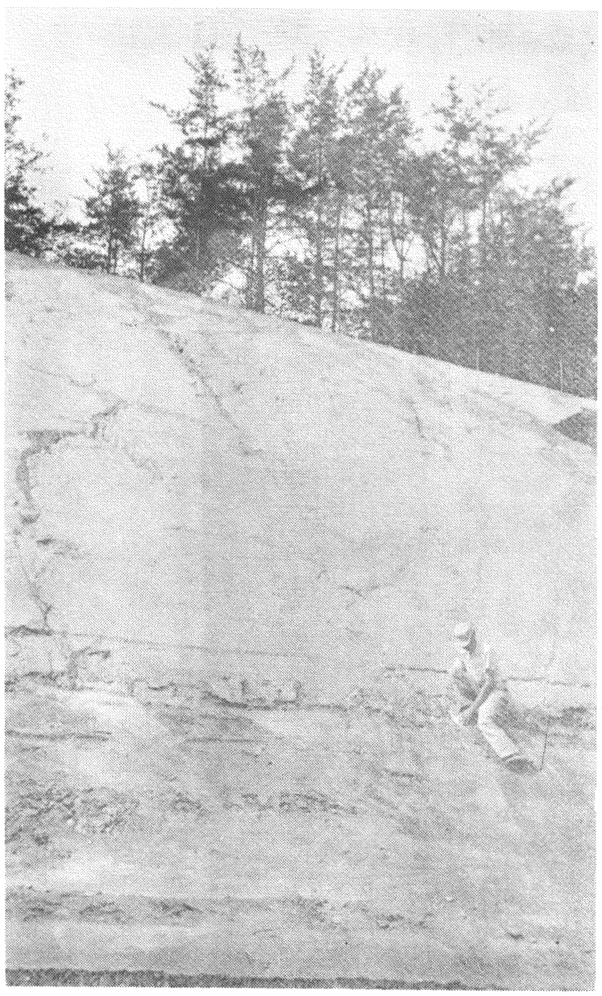

Figure 23—Tree roots are growing to depths of 20' or more in this excessively drained porous Manor silt loam.

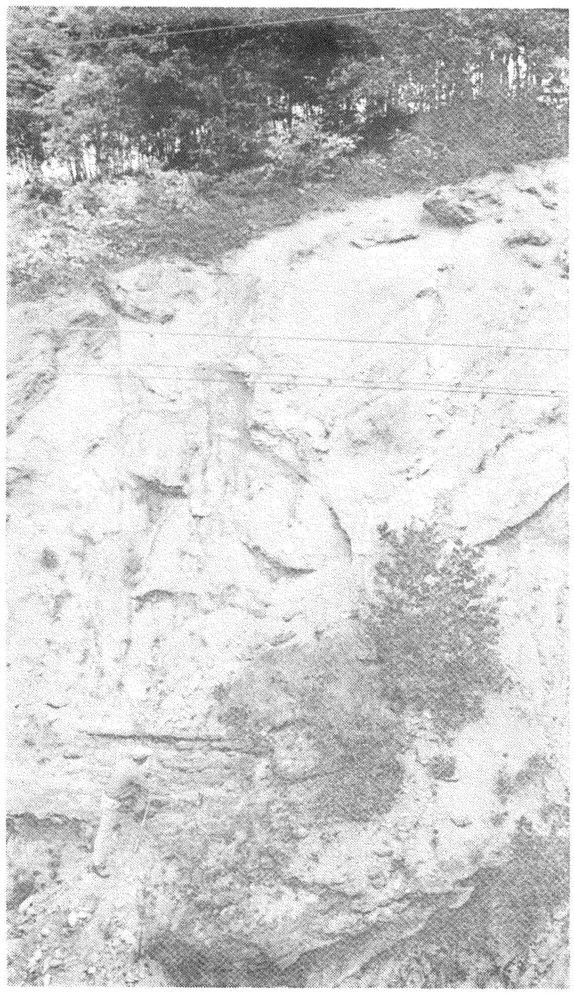

Figure 24—Water percolates rapidly and deeply in this weathered porous breccia rock material underneath the Pedlar soil.

UNDERLYING ROCK

DEPTH TO AND KIND OF BEDROCK ARE IMPORTANT. There are 2 main kinds of rock materials that greatly affect the use of land for homesites--fixed bedrock and loose rocks or stone.

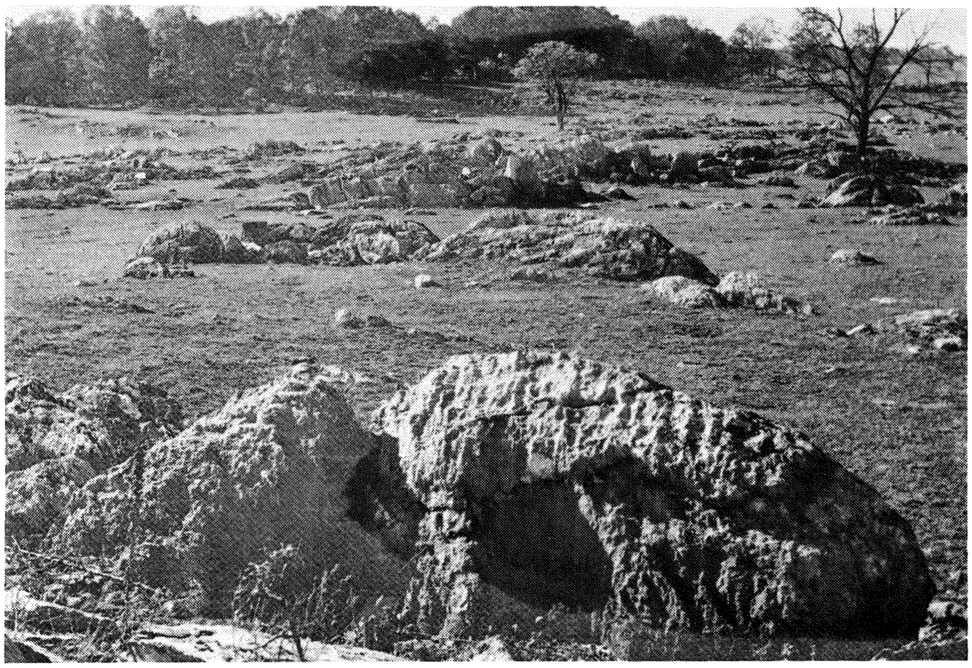

Figure 25—FIXED ROCK: These are ledges of fixed high Calcic limestone with very little to no shallow Frederick-like soils among them. More than half of the surface is covered with ledges which extend several feet above the ground surface.

Figure 26—LOOSE STONE AND BOULDERS: in Hayler stony loam. These kinds of stones can be moved with heavy machinery. A common stony condition in limestone valleys and mountain regions.

WHEN SOIL IS HARD TO DIG, COSTS GO UP! Do you know that it costs 5 to 7 times as much to dig a basement where the soil is thin over bedrock? You should know about the depth to bedrock before you buy a lot or plan to build.

A good soil map or soil auger borings could save you money by locating a stone-free soil for your house basement. In many soils, underlying rock is soft enough to be moved easily by heavy machinery; in others, blasting is needed.

Figure 27—This is Pisgah rocky silt loam, where hard fixed limestone rock is exposed on the surface and bedded beneath a shallow soil mantle. Damage to digging equipment is always a possibility in such soils.

Watch depth of soils, especially in steep areas. Most soils on steep and very steep slopes are shallow to bedrock, droughty, low in productivity, and poor for homesites.

Figure 28—This is a thin, steep Muskingum rocky fine sandy loam over hard resistant sandstones. It is best suited for forest or recreational uses. Cost of home construction on such soils is high and lawn, shrubs, and trees are difficult to grow and maintain.

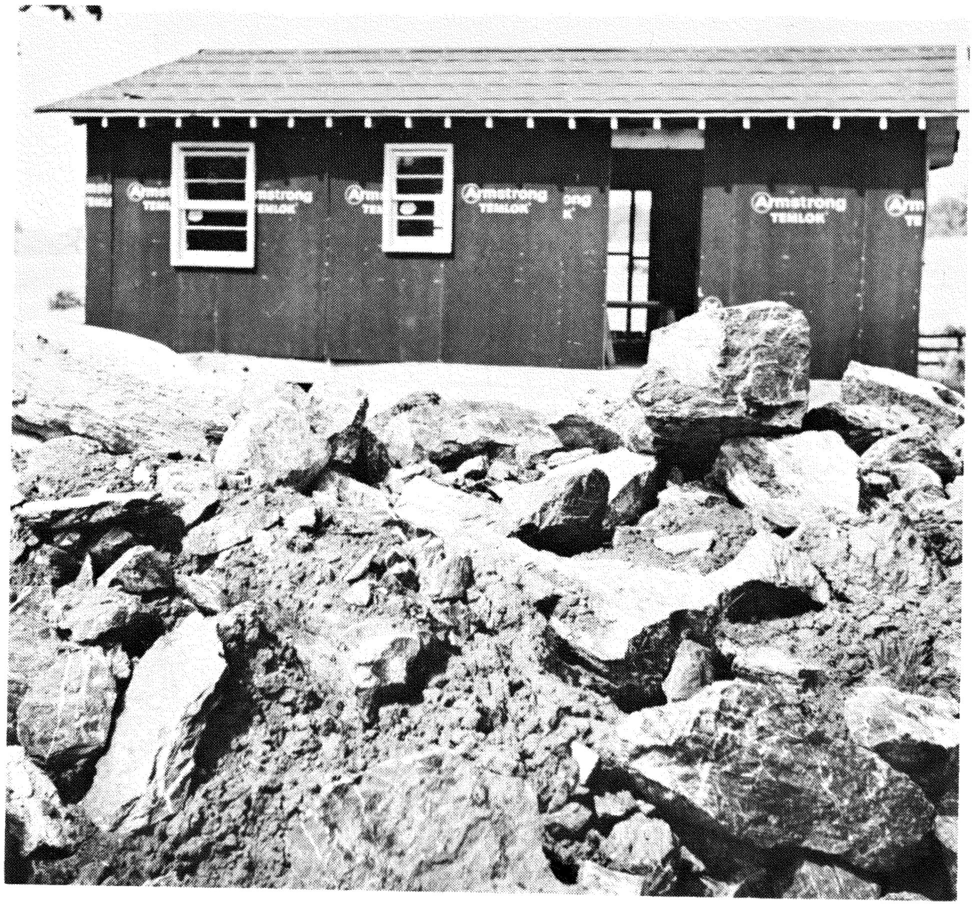

Figure 29—A home with a basement dug in fixed limestone at a high cost. Will this basement drain properly? There are places where it cost as much as $1200 to move one rock outcrop from a home basement.

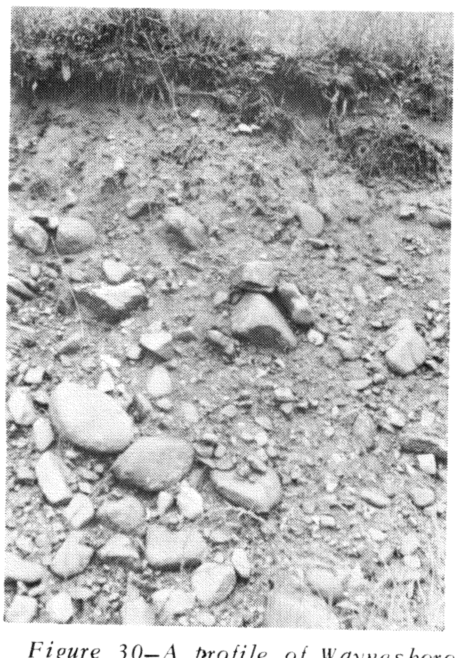

Figure 30—A profile of Waynesboro cobbly fine sandy loam. Loose cobbles and gravel make up over half of these soil layers. These stones can be moved but greatly affect the use of the soil for basement foundations, lawn and shrubs.

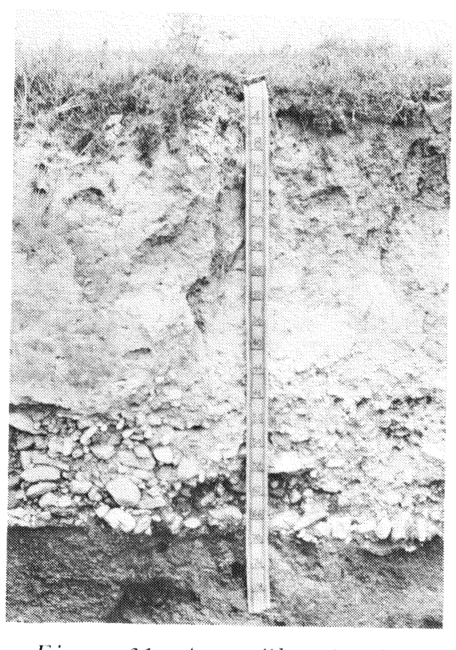

Figure 31—A profile of Altavista fine sandy loam showing a stone line below the subsoil. These stone lines are usually filled with fine compacted soil materials which greatly retard water movement.

Figure 32—House basement on Holston very cobbly loam. In many places these soils are so cobbly on the surface that good topsoil has to be hauled in to make good lawns.

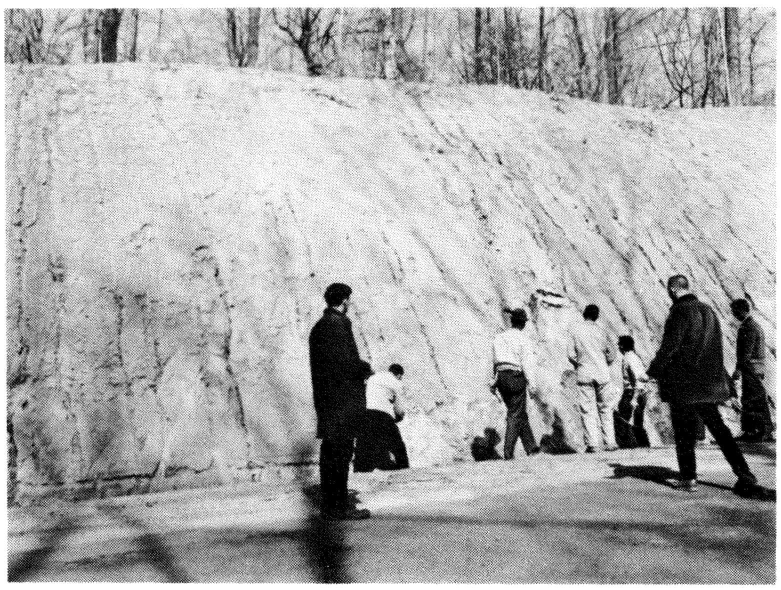

Figure 33—DEPTH TO BED ROCK: is more than 20" in the Appling, Glenelg, Manor and Cecil soils in many areas of the Piedmont region. Soils of this nature are easy to excavate or work. Water moves in and through them well and they are desirable for building roads, parking lots and underground storage and land fills.

Figure 34—The way the underlying rock is bedded is important to drainage and water supply. Massive rocks hold little water, soft rock that weathers deeply usually has good water supplying capacity. Horizontally bedded rocks drain slowly. This is interbedded sandstones and shales.

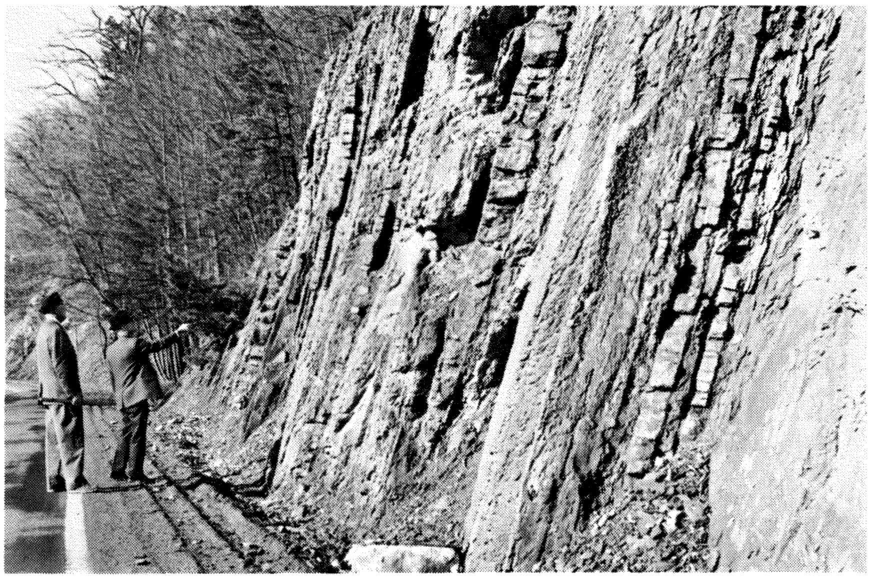

Figure 35—Soils over vertically bedded rock drain more rapidly. This is interbedded limestone and shales.

Figure 36—Soils of shattered syenite rock drains better than over massive rock. This is Montalto silt loam, a shallow soil.

Figure 37 shows main positions on the land surface where different soils occur within a limestone valley area. Soils of the uplands and higher terrace lands are usually best suited for homesites; many soils on colluvial lands are fair to poor; and soils on the first bottom lands or flood plains are unsuited because of flooding.

Flat upland soils are usually gray and wet. Concave slopes collect lots of seepage water, even on gentle slopes. Steep and very steep slopes usually have shallow soils and rapid runoff of water. Gently sloping, sloping, and moderately steep soils usually have best drainage and are desirable for homesites. This is generally true for all regions of Virginia.

Figure 37—a landscape of soils in Limestone Valley.

1B1 Lodi loam, porous substrata—2-7% slope—good soil on ridge uplands.
1C1 Lodi loam, porous substrata—7-15% slope—fair soil on sloping uplands.
1D2 Lodi loam, porous substrata—15-25% slope—fair to poor soil on moderately steep uplands.
2B1 Greendale silt loam—2-7% slope—poor soils subject to seepage water on colluvial land.
3A1 Melvin silt loam—0.2% slope—very poor, wet soil on flood plain.

✓ *Rock outcrops*	——————•• ——————>	*Intermittent drains*
S Eroded spot	. . . .	*Soil boundary*

Summary

What should you know about soils before selecting a homesite?

First, you should look at the soils' position in topography and relief on the land's surface. You should know whether it is on residual uplands, has been moved in by gravity and deposited on colluvial lands, or washed in by water and lies on terrace lands or flood plains.

Find out about: soil drainage--both runoff and internal; depth to bedrock or some slowly permeable layer or hardpan; swelling and shrinking clays; stoniness or rockiness; slope gradient; extremely sandy, droughty, or porous areas; conditions that might cause soil slippage or landslide; and look at vegetation cover and study past history of use and management for indications of good or poor soil conditions. Subsoil colors indicate drainage. Red and brown colors are best; gray indicates poor drainage.

YOU CAN GET FOOLED BADLY BY JUST LOOKING AT THE SURFACE SOIL OR LISTENING TO YOUR NEIGHBOR. THE SOIL CAN BE DIFFERENT JUST UNDER THE SURFACE AND JUST OVER THE FENCE.

Look across the soil to see how it lies and what is growing on it. Look down through the soil to see the texture, structure, color, and thickness of various layers. Look beneath the soil to see what kind of rock layers are there, below 5' or 10' if possible.

Where detailed soil maps are available, they can give you good information about the things you need to know. On-site investigations are sometimes necessary for small tracts of land, and for extremely variable and complex soil areas. Soil maps are available in Extension offices in counties where soils have been mapped. Remember detailed soil maps are available in more than half of our Virginia counties, and extension agents, research, and Soil Conservation Service soil scientists are available in all areas. There is little excuse for improper placements of homesites to the various soil conditions in the state.

Glossary

Landslide--The slipping down of a mass of rock or soil.

Flood Plain--Land on which water overflows; usually level.

First Bottom--Low-lying, nearly level land near a permanent stream, subject to flooding usually on first level above stream bed.

Internal soil drainage--The quality of a soil that permits the downward movement of excess water through it. Movement of water in soils range from very rapid in sands to very slow in swelling clays.

Percolation--The movement of water through a column of soil, usually measured in inches per hour.

Permeability--The characteristics that determine how fast air and water move through soil layers. The rate of water movement through a soil is determined by the least permeable layer or horizon.

Impermeable--Impervious or non-permeable.

Sewage Lagoon--A shallow pond or lake where sewage wastes are deposited and treated. Water level is usually 3' to 4', and bottom of lagoon is nearly level. A one acre lagoon will take care of sewage wastes from 250-300 people.

Watertable--The height or upper level which ground water reaches within the soil during different seasons. In wet seasons it is much higher than in dry seasons.

Septic tank drainfield--A number of small ditches designed to drain sewage effluent from a septic tank system into the soil.

Fragipan--Compact brittle horizons or layers rich in silt, or sand or both, that retard water and root movement.

Claypan--Compact horizons or layers rich in clay that retard water and root penetration.