

CHAPTER 7

NATURAL ENVIRONMENT

INTRODUCTION

The natural environment plays an important role in shaping land use patterns. Few factors influence the actual selection of a site for development more than its physical characteristics. Consequently, an understanding of the natural elements of climate, topography, geology, soils, and water resources is necessary to develop a land use plan that will promote harmony between natural and man-made features.

The purpose of this chapter is to present information on the natural environment of Campbell County. Integrating this information with the other chapters of this plan makes it possible to better assess the suitability of development in particular locations. It is hoped that careful consideration of the natural factors identified in this chapter will lead to an environmentally sound plan that will assure wise land use and promote orderly growth in the future.

NATURAL ENVIRONMENT GOALS AND OBJECTIVES

GOAL 1: Perpetuate a healthy natural environment in Campbell County.

Objective 1: Manage water resources to ensure the quality remains good.

Objective 2: Maintain good air quality and enhance it where feasible.

Objective 3: Minimize risks to personal safety and property from natural hazards.

Objective 4: Ensure the continuation of native wildlife and vegetation through enforcement of existing regulations.

Objective 5: Consider implementing policies to identify, preserve, and protect scenic areas of exceptional quality.

GOAL 2: Promote an environmentally sound land use strategy for the County.

Objective 1: Ensure that development occurs in targeted areas and imposes minimal negative consequences on the scenic and environmental character of the County.

Objective 2: Ensure that proposals for development include adequate planning for transportation, parking, lighting, landscaping and recreation in reasonable harmony with the natural environment.

CURRENT ENVIRONMENTAL CONDITIONS

CLIMATE

Campbell County is located on the Southern Piedmont Plateau. The Appalachian Mountains are to the west, providing a buffer from some of the intense winter storms that occur in the eastern United States. Summers are warm, winters are not severe, and rainfall is normally adequate for most agricultural operations.

Annual mean temperatures for the area generally range between 54 degrees and 59 degrees. Maximum temperatures are 90 degrees or higher on an average of 23 days per year. Temperatures of 32 degrees or lower occur approximately 90 days of the year. The area has a frost-free growing season of approximately 200 days. The growing season is defined as the period between the last frost of one winter and the first frost of the next.

The average annual relative humidity is 65 percent. The average annual relative humidity varies from approximately 51% in April to 73% in August and September. The prevailing wind direction is from the southwest. Wind speeds average 8 miles per hour annually, ranging from 6.3 miles per hour in August to 9.1 miles per hour in March.

The annual average amount of sunshine in Campbell County is 60 percent. In January the monthly average is 48% and increases to 68% during the month of July.

Precipitation is distributed somewhat evenly throughout the year, but during the summer, rainfalls are often higher due to sporadic thundershowers. However, summertime rainfalls can be inadequate, since moisture demands are greater and the rate of evaporation is higher with increased temperature. Consequently, droughts most frequently occur during the summer.

GEOLOGY AND TOPOGRAPHY

Geological character of the land is important when determining appropriate types of development. By using the information available from geological surveys, it is possible to determine the strata of soils, elevation of groundwater and location of rock. This information is important to identify because certain geological conditions can make development costly.

Three of the most costly difficulties presented by subsurface conditions are unstable soils, high water tables, and solid rock close to the surface. Unstable soil creates a weak foundation upon which to build. As a result, large structures cannot be constructed on such soils unless substantial foundation work is undertaken. High water tables reduce soil bearing strength further, producing areas saturated with water. Rock areas close to the surface can make the drilling of wells difficult and expensive.

Campbell County is located in the Piedmont Plateau Province, which lies between the coastal

plain and the Appalachian Mountains. In general, the plateau has a gentle southeastward slope from an average altitude of 1,000 feet along the western margin to between 200 and 400 feet on the east. Topography on the Piedmont Plateau is generally rolling, the moderate elevations being punctuated by rather deep river valleys. Scattered hills and ridges, which are formed by hard rock that has not weathered, rise in some cases several hundred feet above the general level of the upland surface. Candler, Long and Red Oak Mountains are examples of these hills and ridges in Campbell County.

Campbell County is situated entirely in the Piedmont region. The Evington group, located on the western boundary of the County, consists of muscovite, chlorite, quartz, phyllite, and schist interbedded with volcanic greenstone and marble. The central and southern sections are made up of the metamorphosed sedimentary rocks that overlie the Blue Ridge schist. The southeast portions consist of narrow belts of Shelton organite gneiss mixed with other schists and gneiss. Campbell County has two additional formations; a formation consisting of phyllite, quartzite, greywacke and conglomerate is found in north central Campbell County, as is a narrow belt of Triassic rock. The geological rock formations and their makeup are listed in table format within this chapter.

The development of Campbell County has been affected by its geological formations. The steep terrain of Candler and Long Mountains has made development difficult, although it is on the gentler slopes of this area that most of the County's urban development has taken place.

Most agricultural development has occurred in the central, western and southern sections of Campbell County. Here, the rolling terrain poses no natural barrier to urban development, so conflicts are likely to occur between existing agricultural and expanding urban uses.

The Piedmont Plateau is characterized by hard, resistant, crystalline rocks (primarily of the Pre-Cambrian and Cambrian Ages, but also of the Paleozoic and, in some cases, the Triassic Age) that have resisted extreme eroding. Thus, groundwater supplies in the County are difficult and expensive to develop.

The general nature of the soils of Campbell County, shown on a map later in this chapter, is reproduced from a general soil map from the U. S. Department of Agriculture, January 1974. Soils are classified by soil series and soil associations. Soils that have profiles (sequences of natural layers) with similar characteristics compose a soil series. A soil association is usually made up of two or three soil series, comprising a geographical area that has a distinctive pattern of soils. These represent 80% of total land area in Campbell County. The remaining land consists of flood plain soils, which comprise 5% of the land area, and terse soils, which comprise 15 percent. The predominant soils of Campbell County are generally deep, well drained and gently sloping. Generally, there are no large areas with severe limitations for most land uses; however, there are a few such places that require additional building measures or completely preclude development. Either on-site evaluation or referral to detailed soil maps is necessary to determine individual site constraints.

GEOLOGY OF CAMPBELL COUNTY

ROCK FORMATION	DESCRIPTION
1. Evington Group	Muscovite, chlorite, paragonite, quartz phyllite and schist interbedded with graywacke, volcanic greenstone, and marble
2. Lynchburg Formation	Phyllite, quartzite, graywacke and conglomerate. Includes: Alum phyllite, quartz, muscovite phyllite with chlorite and biotite metacryst, and Willis phyllite, quartz, muscovite, chlorite, feldspar phyllite with garnet metacrysts.
3. Metamorphosed Sedimentary Rocks	Includes metamorphosed sedimentary and interlayered igneous rocks that overlie the Virginia Blue Ridge, previously mapped as Wissahickon schist and Wissahickongranite gneiss.
4. Shelton Granite Gneiss	Granite gneiss, augen gneiss, and mylonite
5. Hornblende Gabbro & Gneiss; Tale	Amphibole Chlorite schist, shloritic hornblende gneiss; and some amphibolite, chloritic diorite, and hornblende diorite; and kyanite schist and kyanite quartzite
6. Catoctin Formation	Basic lava flows, schist and gneiss composed of chlorite, plagioclase, amphibole, and epidote, amygdaloidal in part; and arkose, conglomerate, phyllite
7. Greenstone Volcanics	Basic lava flows, tuff and slate commonly altered to chlorite gearing rock; and amydaloidal in part.
8. Melrose Granite	Biotite, muscovite granite and augen gneiss.
9. Limestone and Marble	Includes equivalents of Cockeysville marble and Everona limestone
10. Calvert Formation	Clay, dark gray, olive or buss, sandy, distomaceous; and sand, fine-grained, buff.
11. Granite	Biotite and muscovite granite, granodiorite, and quartz monozonite. Includes Columbia granite, and some mica schist and gneiss.

SOURCE: U.S. Department of Agriculture, Soil Conservation Service Soil Survey

SOIL ASSOCIATIONS

1. CECIL-APPLING ASSOCIATION	Deep, well drained, gently sloping to moderately steep soil, with firm dominantly clayey subsoils on uplands
2. APPLING-LOUISBURG ASSOCIATION	Deep or moderately deep, well drained to excessively drained, gently sloping to steep soils, with dominantly clayey or loamy subsoils on uplands.
3. MADISON-TALLAPOOSA ASSOCIATION	Deep to moderately deep, well drained to excessively drained, gently sloping to steep soils, with dominantly clayey or loamy subsoils on uplands.
4. MASADA-APPLING ASSOCIATION	Deep, well drained, gently sloping soils, with dominantly clayey subsoils on uplands
5. CULLEN-WILKES ASSOCIATION	Deep or moderately deep, well drained to excessively drained, gently sloping to steep soils, with dominantly clayey or loamy subsoils on uplands.
6. TATUM-MANTEO-NASON ASSOCIATION	Deep or shallow, well drained, gently sloping to steep soils, with dominantly clayey or loamy subsoils on uplands.
7. GEORGEVILLE-TATUM ASSOCIATION	Deep, well drained, gently sloping soils, with moderately steep soils, with dominantly clayey subsoils on uplands
8. MAYODAN-PENN WHITE STORE ASSOCIATION	Deep to moderately deep, well drained to somewhat poorly drained, nearly level to moderately steep soils, with dominantly clayey or loamy subsoils on uplands

SOURCE: U.S. Department of Agriculture, Soil Conservation Service Soil Survey

MINERAL RESOURCES

According to the Virginia Department of Mines, Minerals and Energy, there are active permits for the extraction of sand, greenstone, limestone, and marble. The crushed stone operation is the largest active commercial mineral resource. This is consistent with neighboring localities due to the geology of central Virginia. A map of mineral production areas in Virginia is included at the end of this chapter.

SLOPES AND FLOOD PLAIN AREAS

Slopes can direct and shape land development because they influence the direction and rate of water runoff, lend variety to the landscape, influence the species of vegetation and wildlife, affect the formation of soils, and affect the type and expense of urban development.

Very steep slopes in Campbell County are found in the northern (Candler and Long Mountain) and eastern (Red Oak Mountain) sections. Rolling land is concentrated mainly in the central and western section of the County. Level land is located in the northwest and southern sections. Very steep slopes (more than 20%) tend to cause rapid water runoff with very little water being retained by the soil. This runoff gradually erodes the soil layers until shallow soils eventually develop. Shallow soils are usually unstable for foundations and have high water tables.

As discussed in the previous section, geological constraints present development problems. Very steep slopes also preclude high-density urban development. Severe slopes can be offset only through costly reclamation and intensive maintenance, such as extensive grading and erosion control methods. The land in this category can best be used for outdoor recreation, wildlife management, watershed protection, and forest uses. Vegetation and wildlife in such areas consists of species that thrive on dry soil conditions.

Gently rolling to rolling slopes (5% to 20%) tend to have moderate water runoff and, therefore, are better able to retain water in the soil than are steep slopes. The soil does not erode as quickly, resulting in deeper soils. Deeper soils generally create a firmer foundation for urban-type development.

Rolling land is better suited for agricultural, residential, commercial, and most types of industrial uses not requiring extensive amounts of level ground. Slope limitations can be overcome through planning, design, or special maintenance.

Moderate slopes and their associated soils are conducive to both urban and agricultural land uses. As a result, conflicts frequently arise over which type of land use will prevail in moderately sloping areas. Priorities must be established for areas with such slopes in order to minimize these potential conflicts.

Level land (slopes less than 5%) has development potentials similar to those described for rolling slopes. Extremely flat land may, however, have drainage problems that result in flooding. This

flooding may cause the soil to become unstable. Level land presents no slope limitations on development except for those areas subject to frequent flooding. To overcome such problems, grading may be required to ensure proper drainage. Vegetation and wildlife in these areas would be limited to moisture-loving species.

FLOOD PLAINS

Flood plains are areas adjoining a river, stream, watercourse, lake or a standing body of water that have been or may be flooded with water. Introducing any type of development in flood-prone areas is hazardous, and use should be severely restricted.

Certain areas of Campbell County along major streams, creeks, and rivers have been designated flood hazard areas by the Federal Emergency Management Agency (FEMA). The flood plain areas in the County have been delineated on maps drawn by FEMA to assist in land use planning and flood plain utilization. The County has incorporated those maps into our geographic information system to make them more easily accessible. The major portions of the flood hazard areas are located along the James and Roanoke (Staunton) Rivers, as well as larger creeks.

WATER

Our most valuable natural resource is water, an essential element to sustain life. One of the objectives of an environmental analysis of water resources is to determine if there is an existing water supply that will adequately serve the needs of the community. The two major sources of water are surface and ground water.

Surface Water - Surface water sources include all tributary streams and drainage basins, natural lakes and artificial reservoirs. Investigative studies must be made to determine: (1) if there is an adequate supply of water, (2) if this supply will be able to provide for anticipated growth, and (3) if the source will meet the required standards for a safe yield.

Campbell County has within its boundaries a generally good supply of surface water; however the supply is influenced by extreme weather conditions. The James River, which forms the northern boundary of the County, had an average flow of 1,541 million gallons per day (MGD) in 2012. Its headwaters are in the Allegheny Plateau, from which it flows eastward to the Chesapeake Bay. Surface water flowing from the northern third of the County enters the James River through Blackwater, Opossum and Beaver Creeks. These three creeks, together with many smaller tributaries, comprise the major portion of the James River watershed in Campbell County. Surface water in the watersheds and tributaries from Campbell County is generally low in mineral content making it invariably soft. The water in the James River is relatively hard due to chemicals picked up by the river as it flows through other geological areas.

The southern two-thirds of Campbell County drain into the Roanoke (Staunton) River. The Roanoke (Staunton) River had an average flow at Altavista of 641 million gallons per day

(MGD) in 2012. Surface water flows to the river through the Otter, Seneca, and Falling Rivers. The water flowing through the three major rivers and their tributaries to the Roanoke (Staunton) River is generally very soft. Prior to reaching Campbell County, the Roanoke River, like the James, flows through other geological areas where it becomes relatively hard.

Groundwater - Groundwater is that water which is naturally found below the surface of the earth, either in the soil – in the zone of saturation – or flowing in underground streams and reservoirs. While 95% of the nation's available fresh water is groundwater and 80% of public water systems use groundwater as their source, surface water sources actually supply a far greater number of people. This is because systems such as Hampton Roads and New York have developed large reservoirs, supplying more concentrated populations.

Groundwater is available in most areas but at varying depths. The farther down the source, the more costly it is to drill wells. Although reaching the depth of a suitable groundwater source can involve extensive drilling, the potential of groundwater as a primary source of supply will become increasingly important for future development. As population increases, the surface water quality will continue to deteriorate through reuse and abuse, depleting the surface water supply. Increased protection measures for groundwater and surface water should be considered.

Igneous and metamorphic rocks underlie all of Campbell County except for a narrow belt of sedimentary rocks between Spring Hill and Long Island. The bedrock is covered by a zone of soil and partially weathered rock that is 20 to 90 feet thick in most places. Large diameter wells dug or bored into this zone for farm and domestic water supplies usually terminate a few feet below the water table. Although these shallow wells often store several hundred gallons of water, the rate of recharge is usually less than 5 gallons per minute. The water from this near-surface zone is generally of good chemical quality. Fine-grained sediment from the overburden, contamination from nearby unsanitary sources, and water-table fluctuations that periodically cause decreased yields are the principal problems with these wells.

Most of the recorded wells in the County today are six inches in diameter and range from 25 to 614 feet in depth. Although in almost 80% of these wells sufficient water is reported to have been encountered between 70 and 230 feet below ground surface, more than two-thirds of the recorded wells have yielded less than 15 gallons per minute. These wells, however, together with the few pump tests performed to determine maximum yields, probably do not indicate the true groundwater potential in most areas.

It is likely that yields larger than the current average can be obtained from wells of proper depth drilled at selected sites or from specially constructed wells in thick flood plain deposits at places along the James and Roanoke Rivers. Flood plain areas generally have a higher water table. Thus wells in this area are able to tap into a larger source.

FORESTRY

Campbell County has a relatively active role in forestry in terms of the volume of lumber harvested and the value of the trees involved. The Virginia Department of Forestry reports that in fiscal year 2010, Campbell County produced 5,585,000 board feet of pine lumber and 11,011,000 board feet of hardwood lumber. The combined stumpage value of the trees was \$4,013,442. This places the County in the top half of all lumber producing localities in the state. A forest land assessment map from the Department of Forestry is included at the end of this chapter. It shows major land use types including agriculture and rural forests in each of the area localities. The desire to preserve land for forestry is discussed in Chapter 4.

AGRICULTURE - FOOD AND FIBER PRODUCTION

The Virginia Agricultural Statistical Service and the U. S. Department of Agriculture report that Campbell County ranked in the top twenty Virginia producers in three of four of the livestock-related agricultural statistical categories in calendar year 2009. The County ranked thirteenth in all cattle and calves, fifteenth in beef cows, and fourteenth in all sheep and lambs.

The 2012 Census of Agriculture reported 761 farms in the County encompassing 150,689 acres, of which 23.98 percent was harvested cropland. Harvested crops accounted for \$6,499,000 in cash receipts, while livestock, poultry, and their products accounted for \$17,736,000 for a combined total \$24,235,000. Overall, Campbell County ranked thirtieth among localities in market value of agricultural products sold in 2007.

The production of animal feed continues to account for the majority of cropland acreage in Campbell County. Hay was grown on 27,383 acres of land, while corn for silage was raised on 2,082 acres. More than 81% of all harvested cropland in the County is devoted to hay or silage at least some portion of the year. The desire to preserve land for agricultural uses is discussed in Chapter 4.

NATURAL ENVIRONMENT PLAN

Campbell County lies in the foothills of the Blue Ridge Mountains. Bordered on the north by the James River and on the south by the Staunton (Roanoke) River, the County is comprised of rolling hills and mountain streams that create a very scenic landscape. Water and air quality within the County are both at exceptionally good levels. All efforts should be taken to retain and enhance this level of quality.

Challenges do exist in the local natural environment. The rolling topography and many streams make some areas prone to flooding. Building in these areas should be avoided. The Smith Mountain and Leesville dams built upstream by Appalachian Power Company in the 1960's now control flooding along the Staunton River.

There are also concerns regarding the lack of groundwater in certain parts of Campbell County. Many wells have gone dry in the area between Sunburst Road and Evington. Recent drought conditions have made this problem worse and have exposed similar problems in other areas. The availability of groundwater or public water should be a factor in future development decisions throughout Campbell County.

The makeup of the soil and rock formations allows for fairly easy and cost efficient construction projects in the vast majority of Campbell County. However, building activities in flood plains, on steep slopes and in excessively rocky areas will be more expensive.

The County should closely monitor commercial development, ensuring that forestlands are protected while also attempting to avoid unsightly development that detracts from the natural, physical beauty of the landscape.

ENVIRONMENTAL CONTROL STRATEGIES

The following policies are intended to preserve or enhance the natural environment of Campbell County:

1. Acquire and/or protect future multi-purpose water resource sites.
2. Protect groundwater resources by discouraging concentrated development in areas of likely septic system failure or where groundwater may be depleted.
3. Increase public awareness of policies and practices that will enhance erosion and sedimentation control, storm water management and reduce runoff from chemical agents into local water sources, wetlands or watersheds.
4. Encourage use of water conservation devices and practices in homes, businesses and industry.

5. Encourage non-polluting industries to locate in Campbell County.
6. Discourage development in areas of excessive slopes.
7. Encourage the return of flood plains, where appropriate, to their natural state or to uses that will not increase flood levels or pose other dangers to life or property.
8. Discourage development in areas of good habitat for game animals.
9. Discourage destruction of desirable indigenous trees, ground cover or other vegetation.
10. Encourage the proliferation of desirable trees.
11. Utilize forestlands both as open space and as a renewable natural resource.
12. Increase public education programs that combat littering and increase recycling efforts.
13. Implement the environmental policy adopted for Campbell County government (see below).

Campbell County Environmental Policy
(Adopted August 19, 2002)

Understanding the need to be good stewards, Campbell County is committed to preserve and protect the environment while providing first class local government services to our citizens, employees and visitors. To demonstrate its commitment, the local government of Campbell County will:

1. Comply with all applicable environmental legislation, State and Federal regulation, internal requirements, and local standards.
2. Educate and train our County employees for improved environmental performance and increased awareness of environmental issues.
3. Continue to review and modify our methods of operation to the latest accepted industry standards to prevent pollution.
4. Continue to improve our environmental management system and make it an integral part of our standard business practices.
5. Set and periodically review environmental objectives and targets.
6. Identify and implement methods to reduce the generation of solid and hazardous waste; and

7. Encourage and increase citizen awareness and involvement in efforts to protect the environment.

This commitment to protect the environment is required of all County employees.

On June 16, 2008 the Board adopted official energy savings strategies and supported staff efforts to continue developing additional energy saving measures. The following strategies are included:

1. Work with the Virginia and National Association of Counties (VACo and NACo) to explore the *Cool Communities* and *Go Green* initiatives that can be implemented locally;
2. Implement Low Energy Environmental Design (LEED) strategies in new building engineering;
3. Require teleconferencing and/or video conferencing instead of travel when possible;
4. Don't travel if not necessary. When it is, plan and combine trips;
5. Carpool as possible when travel is required;
6. Turn off lights when rooms are not in use;
7. Maintain heat levels in winter at or below 70 degrees – encourage appropriate dress;
8. Maintain cooling levels in summer at or above 74 degrees – encourage appropriate dress;
9. Continue with upgrades to more efficient HVAC systems that utilize computer controlled thermostats and setback temperatures during non-working hours;
10. Eliminate the use of space heaters – encourage appropriate dress;
11. Maintain ongoing light replacement program to replace older lighting with more energy efficient lighting while still providing appropriate lighting levels;
12. Encourage maximum use of facility energy by encouraging office sharing, flex time, and telecommuting when it does not affect customer service;
13. Continuous evaluation of County and School take home vehicle policy;
14. Ongoing review of fleet operations best practices to reduce fuel utilization. For example, maximize bus routing to reduce miles driven, have law enforcement park vehicles for 30 minutes per day in a visible location with motor off, combining inspections; etc.

15. When traveling and gas purchase is required to get back only purchase gas necessary to return and then fill up at the County tanks.

SUMMARY

Campbell County's natural environment is a valuable asset that contributes to the quality of life enjoyed by local residents. With a good supply of surface water, pleasant climate, and a topography that is very suitable for development, Campbell County has appeal to people and businesses alike. Maintenance of the physical beauty and natural resources of the area is critical to retaining its appeal. The County must continue to pursue strategies that will protect, preserve, and enhance these positive qualities.