Natural Resources

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CHAPTER 4 – NATURAL RESOURCES

INTRODUCTION

Balancing the protection of our natural resources with the demands for development can be a contentious issue. Until the 1960s, little thought was given to the effects of development activities. Erosion and sedimentation went unabated. Wetlands were filled to accommodate new development and pesticide and fertilizers were applied to croplands with little consideration for runoff. However, the adoption of the "Clean Air Act" in 1963 and "Clean Air Act" in 1972 provided greater attention on the adverse impacts of development on the environment, and began. As a result, citizens, farmers, developers, and public officials have become more informed and greater effort has been made to ensure the compatibility of land uses with the environment.

Caroline County has an abundance of natural resources in its agricultural and forestal lands, unspoiled watersheds, good water quality, scenic areas, wetlands, and other environmentally sensitive areas. An essential component of planning is to assess how natural resources can be responsibly utilized, managed and preserved within the community. Natural resources are vulnerable if improperly developed. Yet, these resources can also affect the manner in which land is developed, and even enhance the quality of development.

The term "development" generally has a bad reputation because, if done improperly, it may result in the destruction or degradation of our natural resources. To the contrary, it is the premise of this chapter that new development can be accommodated without threatening the County's resources. With proper methods and techniques, new development can be designed and built in a manner that is sensitive to and reflective of existing natural resources. In fact, development can assist in achieving some of the open space and other resource protections discussed in this chapter. The goal of this chapter is to preserve and protect our environmental resources, while encouraging beneficial and positive development.

This chapter provides an overview of the County's natural resources and addresses important issues related to these resources. Sensitive or significant resources are identified and recommendations made to manage and protect those resources. Finally, a series of goals, objectives and strategies for environmental protection are identified, with an emphasis on ensuring that development and resource preservation and protection complement each other.

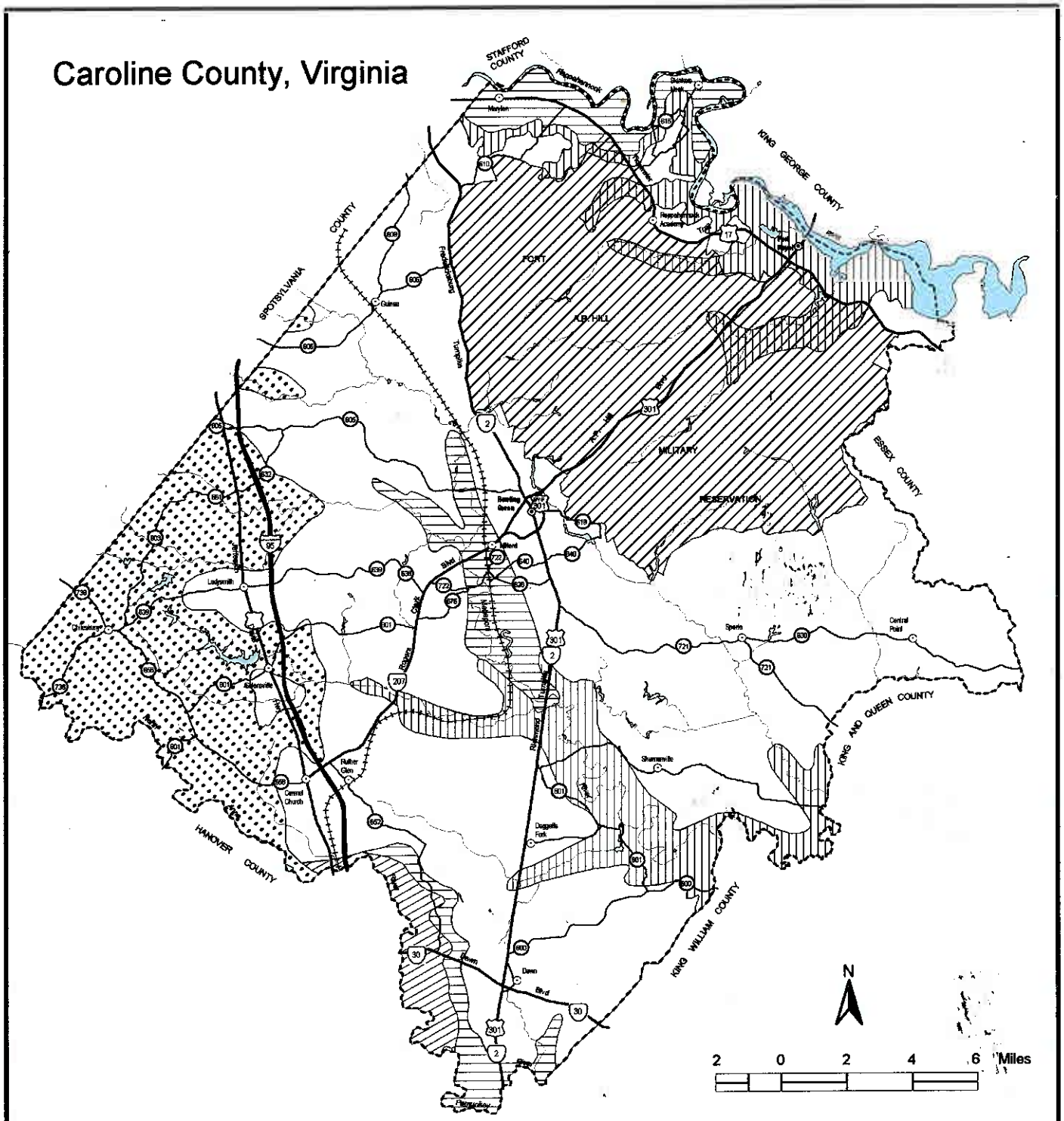
GEOLOGY

Caroline County is located within the Coastal Plain and Piedmont Physiographic Provinces. The majority of the County lies within the Coastal Plain Province, while the area generally west of Interstate 95 lies within the Piedmont Province. A map of the County's geological features, including mineral resources is shown in Map 4.1.

Corresponding to the boundaries of its physiographic provinces, most of the County is underlain by unconsolidated sediments of the Coastal Plain. The sediments are mainly sand and gravel of marine origin. Some clay and marl are present in a system of high terraces. Coastal Plain sediments extend west of Richmond Turnpike in isolated patches. These sediments are Tertiary in age, having been deposited within the last 60 million years.

Floodplain deposits and low alluvial terraces are found in three main belts: the North Anna River South of I-95, the Mattaponi, which branches up the Matta River, South River, Polecat Creek, and Maracossic Creek, and along the Rappahannock River. Sand and gravel with some silt and clay are the main constituents of these deposits. These sand and gravel deposits along the Mattaponi and Rappahannock Rivers are of sufficient depth and size to be attractive for extraction and processing for development use.

The Piedmont Province generally contains areas of metamorphic and sedimentary rocks. The metamorphic rocks occupy the far western portion of the County and include granite gneiss and hornblende gneiss. By far,



Map 4.1

Geological Features

Coastal Plain Province

- Calvert Formation Outcrop Area With Extensive Overlay of Upland Sand And Gravel
- Mattaponi (Aquia) Formation Outcrop Area
- Nanjamay Formation Outcrop Area
- Patuxent Formation

Peidmont Province

- Granite Gneiss

- Interstate
- US Highway
- VA Primary Highway
- VA Secondary Highway
- Rivers and Streams
- Rail

the most abundant rock is the granite gneiss, banded rock of quartz, feldspar, and mica (mostly biotite). This rock was originally granite that was altered through heat and pressure miles below the surface to form gneiss. Subsequent erosion through many eons removed the overlying rock to expose the gneiss. The gneiss lies predominantly west of Jefferson-Davis Highway (U.S. Route 1), although it extends east of I-95 in the valleys of Polecat Creek and the South River. The area west of Route 1 contains deposits that are suitable for quarrying construction grade stone.

A small area of hornblende gneiss extends into Caroline from Hanover County, two miles west of Richmond Turnpike. Hornblende gneiss is a banded white and dark green rock containing plagioclase feldspar and hornblende. Both rocks are Precambrian, which is more than 500 million years old.

Red sandstone and conglomerate of the Triassic age (about 180 million years old) occupy a relatively small area in the southern end of the County on both sides of Jefferson-Davis Highway extending into Hanover County. The sandstone and conglomerate disappear northward beneath the Coastal Plain. Along the North Anna River, these rocks plunge beneath trick alluvium.

TOPOGRAPHY

Topography within the County varies depending on location. The topography in the Coastal Plain Province tends to be mostly level to gently sloping with elevations of 30 to 250 feet above sea level. Some areas with steep slopes (>15%) exist along streams or rivers.

Topography of the Piedmont Province tends to be gently to moderately sloping with elevations of 50 to 350 feet above sea level. Again, some areas along streams or rivers may have steep slopes in excess of 15 percent.

In either case, steep slopes are a concern due to the sensitivity to disturbance. Steep slopes can be both very scenic and attractive for development. These same slopes, however, are quite susceptible to erosion, depending on the length of the slope, grade, ground cover, soil characteristics, and the amount of rain. Care should be taken in allowing development in areas identified as steep slopes.

RECOMMENDATION: *With the development of the County's geographic information system, environmentally sensitive features such as steep slopes should be inventoried and a database established to encourage better land use decisions. County regulations should also be reviewed and amended as necessary to ensure the protection of these features.*

SOILS

The Soil Conservation Service of the United States Department of Agriculture is responsible for preparing generalized soil surveys. These soil surveys, although primarily for agricultural purposes, have potential for identifying the general suitability of soils for development. The Soil Conservation Service recently completed the Caroline County Soil Survey. The completion of the survey was a high priority for both the Soil Conservation Service and the County.

Soils are divided into eight general soil classifications, the locations of which are shown in Map 4.2. A brief description of each classification and its characteristics is contained below:

COASTAL PLAIN SOILS

Coastal Plain Soils can be found in areas dominated by soils with sandy loam surfaces and sandy clay loam to clay loam subsoils of moderate to slow permeability.

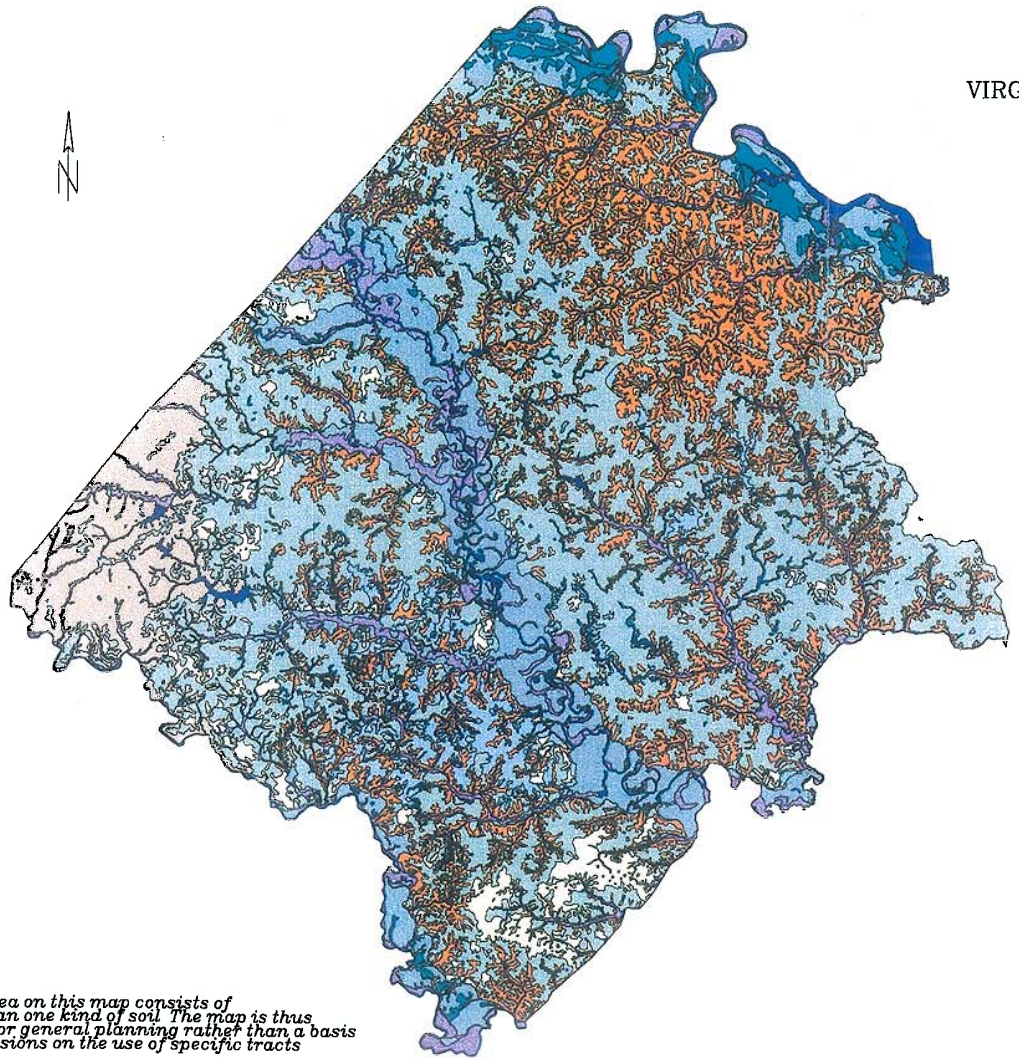
1. ***Emporia-Rumford-Slagle Association:*** Very deep, well-drained and moderately well-drained soils occurring on gently sloping to steep slopes of the Coastal Plain uplands.

Other Coastal Plain Soils are located in areas dominated by soils with loamy sand to sandy loam surface textures and loam to sandy clay loam subsoils of moderate permeability.

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

GENERAL SOIL MAP

CAROLINE COUNTY, VIRGINIA



1 0 1 2 3 4 5 6 7 8 9 10 STATUTE MILES

Scale 1:115,000

UTM Projection

Compiled 1996

- Appling—Cecil—Helena
- Kempsville—Emporia—Slagle
- Slagle
- Suffolk—Rumford
- Kempsville—Emporia—Remlik
- Altavista—Bojac—State
- Wickham
- Bibb—Chastain
- Water

Each area on this map consists of more than one kind of soil The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts

Map 4.2

Source: Natural Resources Conservation Service, Richmond, VA

2. ***Rumford-Suffolk-Emporia Association:*** Very deep, well drained soils occurring on gently sloping to steep slopes of the Coastal Plain uplands.

The final type of Coastal Plain Soil is found in areas dominated by soils with sandy loam surface textures and clay loam subsoils of moderate to slow permeability.

3. ***Slagle-Emporia-Yemassee Association:*** Very deep well-drained to somewhat poorly drained soils occurring on nearly level to moderately steep slopes of Coastal Plain uplands.

STREAM TERRACES AND FLOODPLAINS

Stream Terrace and floodplain solids are located in areas dominated by soils developed in alluvial stream deposits. These soils have loamy sand to sandy loam surfaces and sandy loam to clay subsoils.

4. ***Altavista-State-Bojac Association:*** Very deep, moderately well drained to well drained soils, occurring on nearly level to gentle sloping stream terraces and floodplains.

5. ***Roanoke-Altavista-Bibb Association:*** Very deep, poorly drained to moderately well drained soils occurring on nearly level to gently sloping stream terraces and floodplains.

PIEDMONT SOILS

Soils which have developed from the weathering of crystalline rock and have sandy loam surface textures with clay subsoils of moderate permeability.

6. ***Appling-Cecil-Emporia Association:*** Very deep, well-drained soils occurring on gently sloping to steep slopes in the Piedmont upland and the transition area between the Piedmont and Coastal Plain uplands.

7. ***Cecil-Appling-Wedowee Association:*** Very deep, well-drained soils occurring on gently sloping to steep slopes of the Piedmont uplands.

The Soil Conservation Service also identifies soils based on their ability to produce commonly cultivated crops and pasture plants over long periods of time without deteriorating. This designation is referred to as the land capability class and is beneficial in identifying the most suitable soils for agricultural production. Map 4.3 identifies the different soil mapping units and their classification codes. Soils with an asterisk next to them are considered prime agricultural soils. Efforts should be made to preserve prime agricultural soils, especially in the areas designated for rural and agricultural land uses.

SOIL CHARACTERISTICS

Environmentally speaking, the soil survey can assist both County officials and landowners in land use decisions. The soil survey identifies soil types that, if developed improperly, can result in the degradation of the natural environment, and higher development costs. These soils are characterized as highly permeable, highly erodible, or hydric (wetlands). A brief description of these characteristics and their implications for development follows.

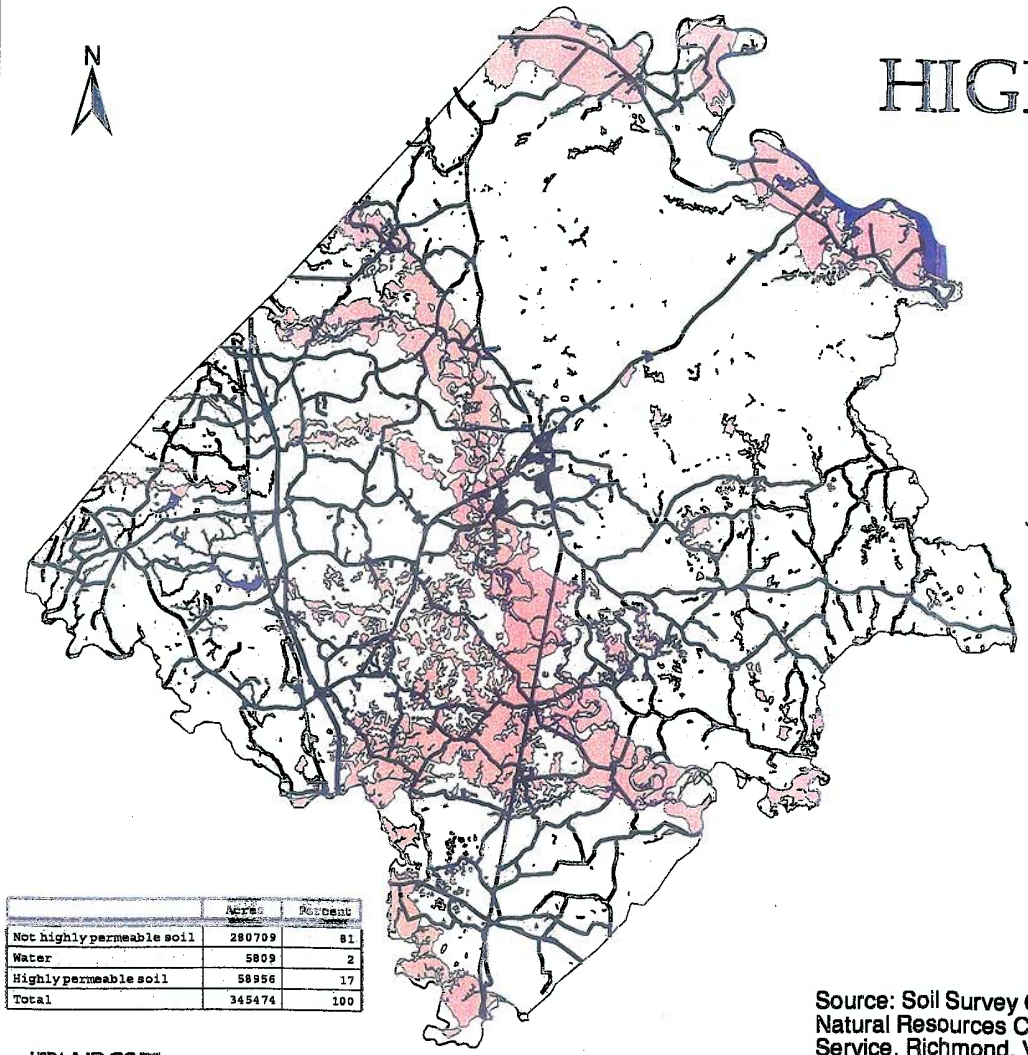
Highly Permeable Soils

Highly permeable soils are identified as any soil having permeability equal to or greater than six inches of water movement per hour in any part of the soil profile to a depth of 72 inches. In short, water percolates through these soils faster than other soils. The danger with development of these soils is that water carries pollutants with it through the soil profile, providing a conduit for the pollution of both surface and groundwater. Not surprisingly, these soils tend to be situated in river and stream valleys. These soils, which account for approximately 59,000 acres of land (17% of land area) and qualify for designation as a Resource Management Area under the Chesapeake Bay Preservation Act, are shown in Table 4.1.

Table 4.1: Numeric Map Unit Legend - Caroline Soil Survey Project

*	1A	5w	Bibb sl, 0-2% slopes, frequently flooded		87B	2s	Uchee ls, 0-6% slopes
	2A	5w	Iuka sl, 0-2% slopes frequently flooded		87C	3s	Uchee ls, 6-10% slopes
*	3A (5A,12A)	6w	Bibb-Chastain complex, 0-2% slopes, frequently flooded		87E		Remlik ls, 10-50% slopes
o	6A		Riverview sil, 0-2% slopes, occasionally flooded		92B(192B,92A)		Bojac sl, 0-6% slopes, rarely flooded
	7A	3w	Chewacla l, 0-2% slopes, occasionally flooded		101B	2e	Turbeville fsl, 2-6% slopes
*	11A	6w	Wedhadkee loam, 0-2 % percent slopes	o	102A	1	Faceville fsl, 0-2% slopes
*	15A	8w	Rappahannock muck, 0-1% slopes, frequently flooded	o	102B	2e	Faceville fsl, 2-6% slopes
*	26A	4w	Myatt fsl, 0-2%, rarely flooded		102C	3e	Faceville fsl, 6-10% slopes
*	29A	4w	Roanoke l, 0-2% slopes, rarely flooded	o	103A	2w	Mattaponi fsl, 0-2% slopes
	30A	2w	Wahee l, 0-2% slopes	o	103B	2e	Mattaponi fsl, 2-6% slopes
	31A	3w	Augusta fsl, 0-2% slopes, rarely flooded		103C	3e	Mattaponi fsl, 6-10% slopes
	35A	2w	Yemassee fsl, 0-2% slopes, rarely flooded		126C		Emporia-Slagle-Rumford complex, 2-15% slopes
*	41A	4w	Tomotley sl, 0-2% slopes, rarely flooded		126E		Emporia-Rumford-Remlik complex, 15-50% slopes
o	43B	2e	Cecil sl, 2-7% slopes	o	129B	2e	Helena fsl, 2-7% slopes
	43C	4e	Cecil sl, 7-15% slopes		140E	7e	Nevarc sl, 15-50% percent slopes
	44B(18B)	3s	Tarboro sand, 0-6% slopes, rarely flooded	o	147A	1	Emporia fsl, 0-2% slopes
	60A	2w	Nansemond sl, 0-2% slopes	o	147B	2e	Emporia fsl, 2-6% slopes
	60B	2e	Nansemond sl, 2-6% slopes		147C	3e	Emporia fsl, 6-10% slopes
	61B	2s	Rumford, 0-6% slopes	o	160B	2e	Appling sl, 2-7% slopes
	61C	3e	Rumford, 6-10% slopes		160C	4e	Appling sl, 7-15% slopes
	61D	4e	Rumford 10-15% slopes		161C	4e	Rion sl, 7-15% slopes
o	62A(64A)	1	State fsl, 0-2% slopes, rarely flooded		160D	6e	Rion sl, 15-25% slopes
o	62B	2e	State fsl, 2-6% slopes, rarely flooded		163E	7e	Ashlar-Rock Outcrop cpx, 25-70% slopes
o	63A	1	Suffolk fsl, 0-2% slopes		290A	2w	Munden sl, 0-2% slopes, rarely flooded
	63B	2e	Suffol fsl, 2-6% slopes		290B	2e	Munden sl, 0-6% slopes, rarely flooded
	63C	3e	Suffolk fsl, 6-10% slopes		300		Pits, quarries
o	71A	1	Wickham 1, 0-2% slopes, rarely flooded		305		udorthents, loamy, 0-15% slopes
o	71B	2e	Wickkham l, 2-6%, slopes, rarely flooded	o	318A	2w	Slagle fsl, 0-2% slopes
	71C (92C,62C)		Wickham l, 6-10% slopes, rarely flooded	o	318B	2e	Slagle fsl, 2-6% slopes
	74A	3w	Dragston sl, 0-2% slopes, rarely flooded		318C	3e	Slagle fsl, 6-10% slopes
	76A	2w	Altavista fsl, 0-2%, rarely flooded		340B		Abell, 2-7% slopes
	76B(85B)	3e	Altavista fsl, 2-6%, rarely flooded		W		Water (ponds, lakes)

o Prime Farmland ***** Hydric (poorly drained) **fsl:** fine silt loan **l:** loam **sl:** sandy loam **ls:** loamy sand



HIGHLY PERMEABLE SOILS

CAROLINE COUNTY, VIRGINIA

2 0 2 4 6 8 10 Miles

Scale 1:250,000
UTM Projection, NAD83

Roads
Highly permeable
Not highly permeable
Water

"Highly permeable soils are identified as any soil having a permeability equal to or greater than six inches of water movement per hour in any part of the soil profile to a depth of 72 inches.",
Chesapeake Bay Local Assistance Department, 1989

	Acres	Percent
Not highly permeable soil	280709	81
Water	5809	2
Highly permeable soil	58956	17
Total	345474	100

USDA NRCS

Source: Soil Survey Geographic (SSURGO) data base for Caroline County, Virginia, 1997, Natural Resources Conservation Service. Compiled by Natural Resources Conservation Service, Richmond, VA, August, 2000.
Roads from "County Map Series CD," VDOT, 9/98.

Highly Erodible Soils

Highly erodible soils are classified as any soil with an erodibility index of 8 or greater, as determined by a method established in the Food Security Act Manual of 1988. These soils, if cleared of vegetation and exposed to the elements of nature, may experience significant erosion and sedimentation problems. This often results in the loss of topsoil, which is good for the establishment of vegetation for "developed" sites, as well as nutrient enriched soils needed for agricultural production. These soils tend to be located on hillsides adjacent to the river valleys and their tributaries. Highly erodible soils constitute 21% of the County's land area or 73,241 acres, as shown in Map 4.4. The Chesapeake Bay Preservation Act also identifies these soils as a resource worthy of designation as a component of the Resource Management Area.

Hydric Soils (Wetlands)

Wetlands are identified as those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (33CFR323.2(c); 1984). Wetlands generally include swamps, marshes, bogs, perennial streams, and similar areas.

Until recently, wetlands were drained or filled for more beneficial uses such as agriculture, public improvements, or economic development efforts. However, as the benefits of wetlands have become increasingly more understood, efforts to drain or fill wetlands have been replaced by protection measures and requirements for the mitigation of impacts.

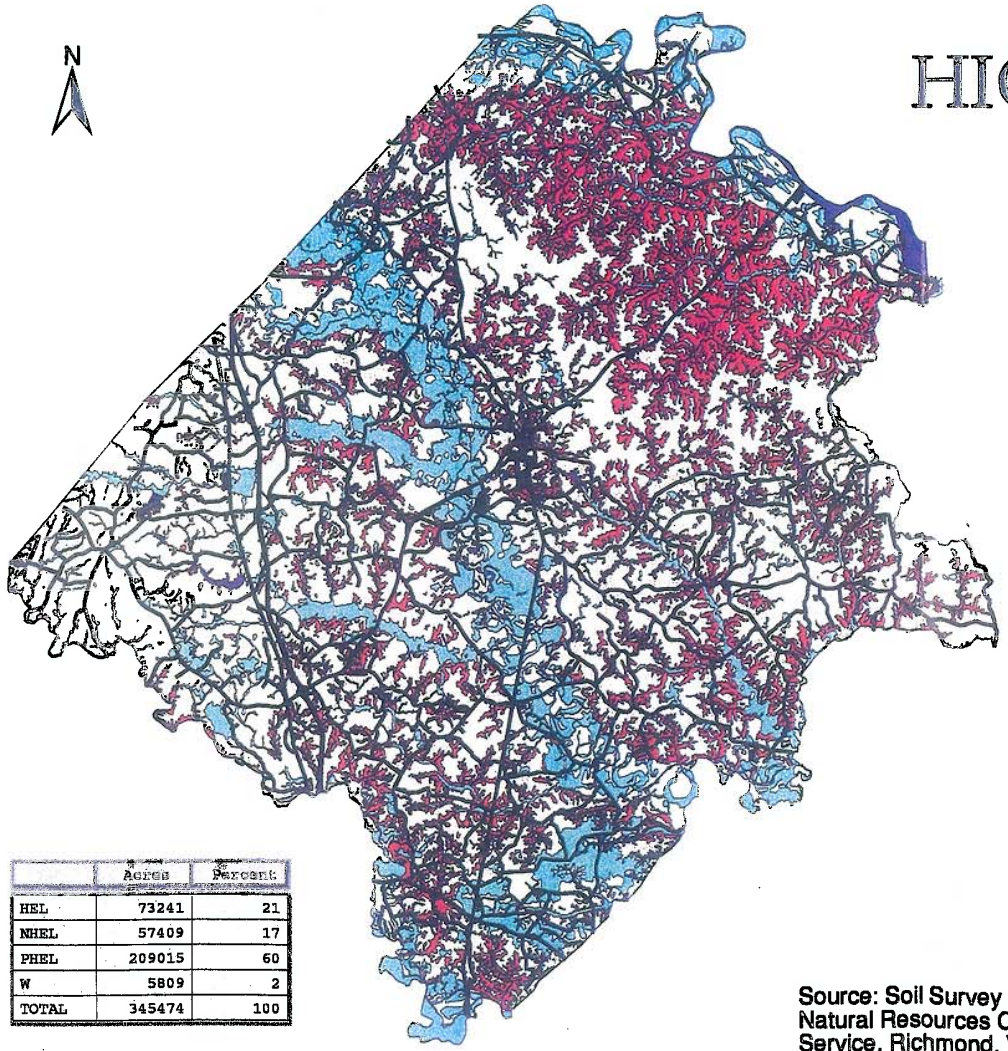
Wetlands have both direct and indirect benefits, and perform important roles that contribute to the quality of life of residents, as well as being economically beneficial. Wetlands perform the following functions:

- Protect surface water quality by trapping sediment and pollutants;
- Serve as a natural means of flood control by absorbing and storing water during high runoff periods;
- Provide recreational benefits to hunters, fisherman, and campers;
- Provide open space buffers for incompatible land uses; and
- Maintain the critical base-flow of surface water during times of drought through the gradual release of stored waters.

Approximately 34,500 acres of wetlands have been identified within Caroline County. These wetlands are classified as either tidal or non-tidal, and are further subdivided into wetland types such as emergent, shrub-scrub, forestal, marsh, etc. The National Wetlands Inventory Maps, produced by the U.S. Fish and Wildlife Service, together with the soil survey, were utilized for the general delineation of wetlands within the County. The location of Hydric Soils is shown in Map 4.5.

Wetlands disturbance activities are regulated by a number of federal, state, and local agencies.

Wetlands of Reedy Mill Creek off of Richmond Turnpike



HIGHLY ERODIBLE SOILS

CAROLINE COUNTY, VIRGINIA

2 0 2 4 6 8 Miles

Scale 1:250,000
UTM Projection, NAD83

Roads

HEL - Highly erodible land
PHEL - Potentially highly erodible land
NHEL - Not highly erodible land
Water

	Acres	Percent
HEL	73241	21
NHEL	57409	17
PHEL	209015	60
W	5809	2
TOTAL	345474	100

Areas rated as "potentially highly erodible" may or not be highly erodible depending on the site specific slope gradient and slope length.

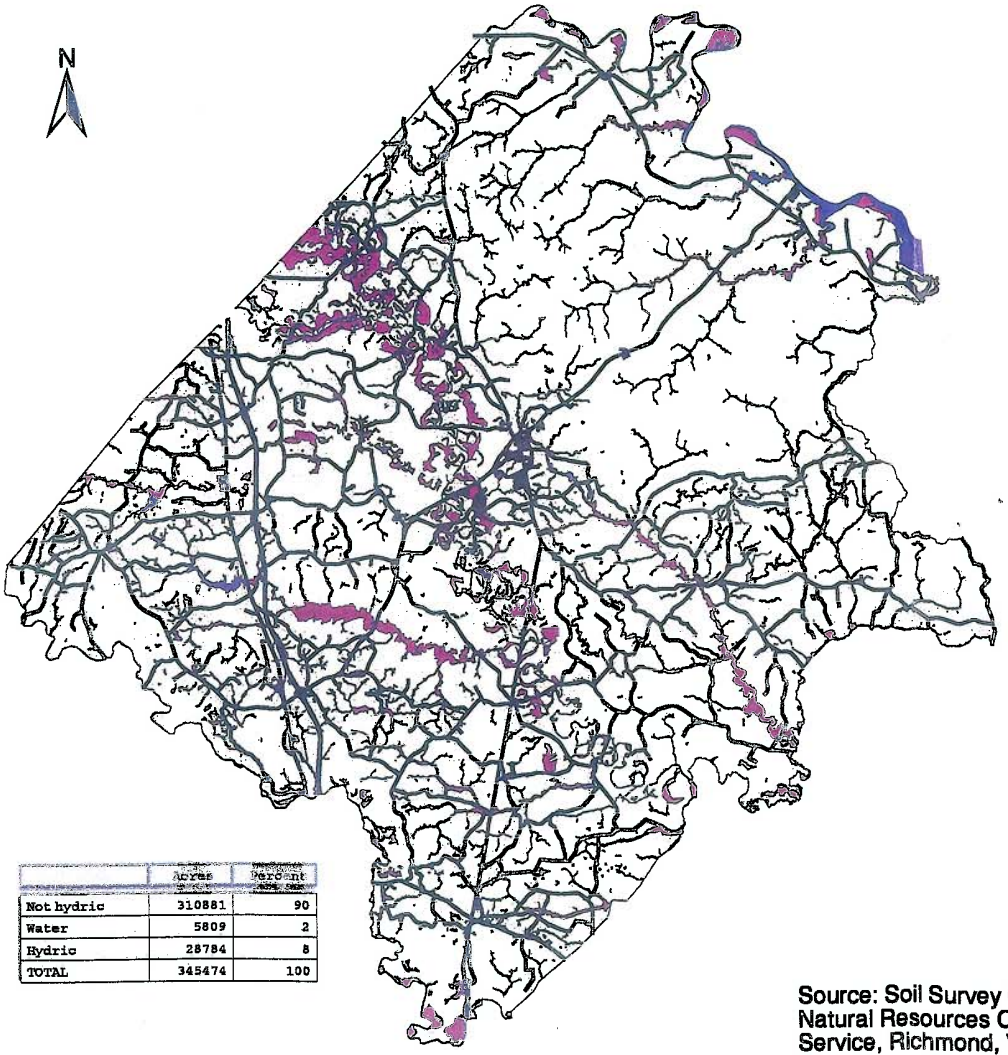
Source: Soil Survey Geographic (SSURGO) data base for Caroline County, Virginia, 1997, Natural Resources Conservation Service. Compiled by Natural Resources Conservation Service, Richmond, VA, August, 2000.
Roads from "County Map Series CD," VDOT, 9/98.

USDA NRCS Natural Resources Conservation Service

Map 4.4

HYDRIC SOILS

CAROLINE COUNTY, VIRGINIA



2 0 2 4 6 8 10 Miles

Scale 1:250,000
UTM Projection, NAD83

Roads
Hydric
Not hydric
Water

	Acres	Percent
Not hydric	310881	90
Water	5809	2
Hydric	28784	8
TOTAL	345474	100

Areas rated as "not hydric" may include small areas of hydric soils.

Source: Soil Survey Geographic (SSURGO) data base for Caroline County, Virginia, 1997, Natural Resources Conservation Service. Compiled by Natural Resources Conservation Service, Richmond, VA, August, 2000.
Roads from "County Map Series CD," VDOT, 9/98.

USDA NRCS Natural Resources Conservation Service

Map 4.6

The United States Army Corp of Engineers is responsible for regulating the disturbance of non-tidal wetlands. The Virginia Marine Resources Commission enforces and regulates activities within tidal wetlands. Caroline County protects wetlands and water quality through the Chesapeake Bay Protection Act, discussed later in this chapter.

In order to protect wetlands within the County, the following policies are implemented through the subdivision and zoning ordinances:

- Wetlands should be avoided to the extent possible. Where avoidance is not possible, disturbance should be minimized to the extent possible and any impacts mitigated.
- As part of the site plan submittal, wetland, floodplains, etc., must be identified on the site plan and supporting documentation. If existing wetlands are to be disturbed, the applicant is required to demonstrate whether or not a permit is required by the Commonwealth of Virginia and/or the Army Corps of Engineers.
- When a wetland permit is required, a copy of the wetland permit should be submitted to the County prior to approving development requests and the issuance of any land disturbing permits.
- If mitigation is required, then the applicant must submit the mitigation plans to the County. The plans should include where the mitigation will take place, the length of time before the project is completed, the length of time until the mitigation site is self-sustainable, and any long term responsibilities of the property owner for the mitigation site.

Soils and On-Site Sewage Disposal

Permits for on-site sewage disposal systems are required by State law to be obtained from the Virginia Department of Health (VDH). The VDH has established regulations that govern site specific criteria that must be met prior to the issuance of construction permits. Typically, a representative of the VDH visits a site and determines various soil characteristics, to include percolation rates, in order to design the system to meet site specific soil conditions. The most desirable areas should have a permeability rate of moderate or moderately rapid. Septic systems are least desirable in areas with either a rapid or slow permeability rate because of the public and environmental health risk involved in improper percolation of septic wastes. Development may be suitable in the areas when and if public wastewater treatment systems are available.

Percolation (measurement rate used by VDH) and permeability differ by definition but are used synonymously. The illustration of highly permeable soils in Map 4.3 also identifies areas where constraints for on-site sewage disposal should be evaluated during the planning process for new developments. In areas where poor soil conditions exist, a site specific soil analysis should be performed when not situated in a designated utility service area.

FLOODPLAINS

Floodplains are relatively flat or lowland areas such as rivers, streams, or other watercourses that are subject to partial or complete inundation. Floodplains provide a number of beneficial uses, as well as having certain natural values, such as:

- Providing for the natural moderation of floods, the maintenance of water quality, and the recharge of groundwater.
- Supporting large and diverse populations of plants and animals that represent important renewable resources.
- The wetland areas of floodplains have an increased biological production because they contain elements of both terrestrial and aquatic habitats and provide vital breeding grounds for fish and wildlife.
- Containing cultural resources including archeological and historical sites, unique habitats for ecological study, open space, and recreational opportunities.
- Providing excellent resources for agricultural, aqua cultural, and forestry production.
- Esthetic and other intangible attributes of floodplains have important social and economic values.

As flood losses increase, leading to higher financial costs, personal injury or loss of life, it has become increasingly evident that effective floodplain management programs are necessary. Federal, state and local governments have become aware of, and are increasingly concerned about, floodplain.

100 Year Floodplain near Bowling Green along the Mattaponi River

The designated frequency for floodplain identification used by the Federal Emergency Management Agency (FEMA) is the 100 year flood. The 100 year floodplain is an area that has a 100 percent chance of flooding at least once within 100 years or a one percent chance of flooding per year.

In August 1989, the Federal Emergency Management Agency (FEMA) completed a review of flood hazards in Caroline County by establishing Flood Hazard Maps. These maps were then adopted by the County.

The maps were subsequently updated by FEMA in 2008 and the Board re-adopted the maps and revised flood hazard overlay district in January 2009. The regulations are contained in Article XV Section 6 of the Caroline County Zoning Ordinance.

The general flood hazard map adopted by Caroline County is shown in Map 4.6. Maps with greater detail are available on the Department of Planning and Community Development webpage (www.visitcaroline.com/planning.html). As watersheds develop, the amount of impervious surface will increase. The location and amount of future impervious area should be monitored for the effects on the 100 year floodplain.

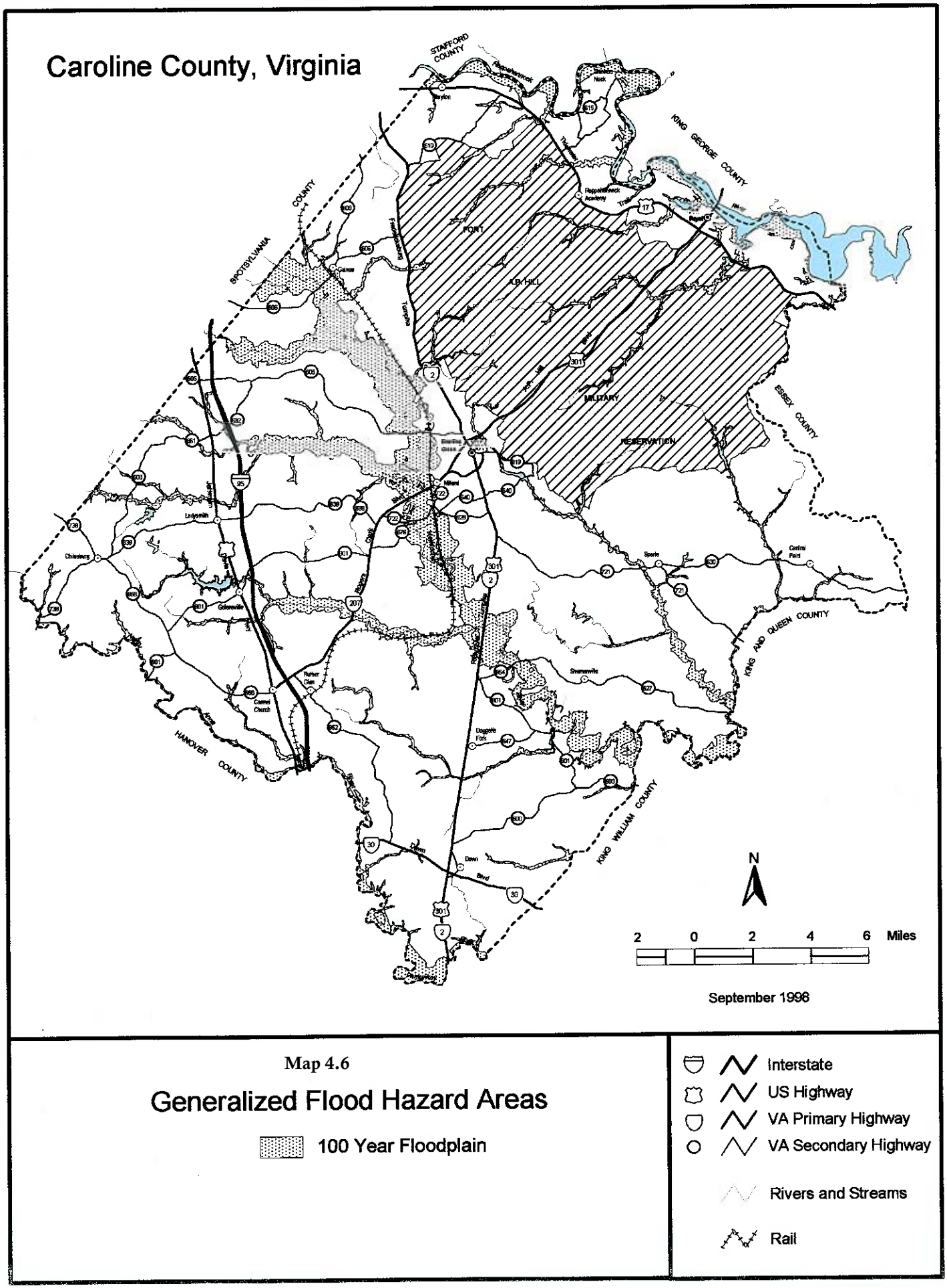
AGRICULTURE AND FORESTRY

As with most rural localities, Caroline County's economy is tied closely to the abundance of natural resources. As such, the wise use and protection of those resources is critical. These resources not only contribute to the economy but to the rural character and quality of life. Caroline County's agricultural and forestal resources have been and continue to be important to the County. The preservation of agricultural and timberlands and retention of the County's rural character, while accommodating development have always been goals espoused in the Comprehensive Plan.

The total amount of acreage available for agricultural or forestry uses is 313,306 acres or approximately 91% of the total area of the County. However, development policies that encourage rural development and discourage resource preservation can lead to significant a loss of these resources. County land use policies contained in this plan encourage balancing the demands for development with resource preservation.

AGRICULTURE

Agriculture is a small but important aspect of the economy and the quality of life in Caroline County. It is both an industry and a part of the County's rural character. However, land development and agriculture can



Map 4.6

Generalized Flood Hazard Areas

100 Year Floodplain

- Interstate
- US Highway
- VA Primary Highway
- VA Secondary Highway
- Rivers and Streams
- Rail

be and often are incompatible. By permitting the development of prime agricultural lands, useful land is taken out of production. Rural subdivisions not only take prime agricultural and forestal lands out of production and increase traffic loads on rural secondary roads, but they often create interface problems with agriculture such as dust, noise, and odor from the cultivation of fields or the raising of livestock. Planning efforts must be directed towards balancing the needs for future development while maintaining the County's rural character and agricultural activities.

AGRICULTURAL TRENDS

The overall trend in agricultural production has been declining as far back as the 1977 plan. During the fifteen year period between 1977 and 1992, the number of farms declined by about a third, while the acreage in production declined by about 30 percent. These reductions can be attributed to several factors, including agricultural programs that were instituted to take certain low yield or sensitive lands out of agricultural production.

Between 1997 and 2002, there was a net gain of 58 farms in the County, from 179 farms to 237 farms. The amount of acreage farmed also increased from 55,403 to 59,229 or approximately 7 percent. These recent trends reflect a reversal of previous agricultural activity (Table 4.2). Unfortunately, between 2002 and 2007 the number of farms and acreage decreased.

The total acreage devoted to cropland increased between 1997 and 2002 as did the total acreage harvested (Table 4.3).

Soybean harvest near Chilesburg in October of 2008

TABLE 4.2: FARM STATISTICS

Year	Number of Farms	Change	Acreage in Farms	Change	% of County in Ag Production
1977	272	—	73,916	—	21.3
1982	265	-7	73,802	-114	21.5
1987	200	-65	59,527	-14,275	17.4
1992	181	-19	51,604	-7,923	14.9
1997	179	-2	55,403	+3,799	—
2002	237	+58	59,229	+3,826	—
2007	225	-12	55,544	-3,685	—

Source 1978, 1987, 1992, and 2002 Census of Agriculture

TABLE 4.3: CROPLAND - 1997 - 2002

	1997	2002	Change	% Change
Total Cropland	35,707	39,091	+3,384	+9.48%
Harvested	29,631	34,705	+5,074	+17.12%
% Harvested	83%	89%	–	–

Source: 1997 & 2002 U.S. Census of Agriculture

FORESTRY

Virginia's forest resources are managed by the Virginia Department of Forestry (www.dof.virginia.gov). The mission of the Virginia Department of Forestry (VDOF) is to "develop healthy and sustainable forest resources for Virginians ". The forest industry has always been important to Caroline County. Approximately 76% of the County is covered by forest. In 1991, the Virginia Department of Forestry conducted a Forest Survey of Virginia, which detailed forest activity. Table 4.4 shows the acreage by timber type in Caroline County.

TABLE 4.4: ACREAGE BY TIMBER TYPE

Type	1991 Acres	2007 Acres	% Change Since 1991
Loblolly Pine	94,944	86,556	-9%
Upland Hardwood	113,672	118,447	+4%
Oak/Pine	33,976	22,259	-34%
Bottomland Hardwood	19,110	19,523	+2%
Total	261,702	246,788	-6%

Source: 1991 and 2007 Forest Survey of Virginia

Land devoted to forestry uses provides a number of benefits, both economic and environmental. Timber provides raw materials for forest industries, which in turn provides employment for County residents. It provides income for owners of forest properties. Forests also provide environmental benefits such as watershed protection, control of soil erosion and stream sedimentation, wildlife habitats, reduction of noise and air pollution, screening of incompatible land uses, and recreational opportunities.

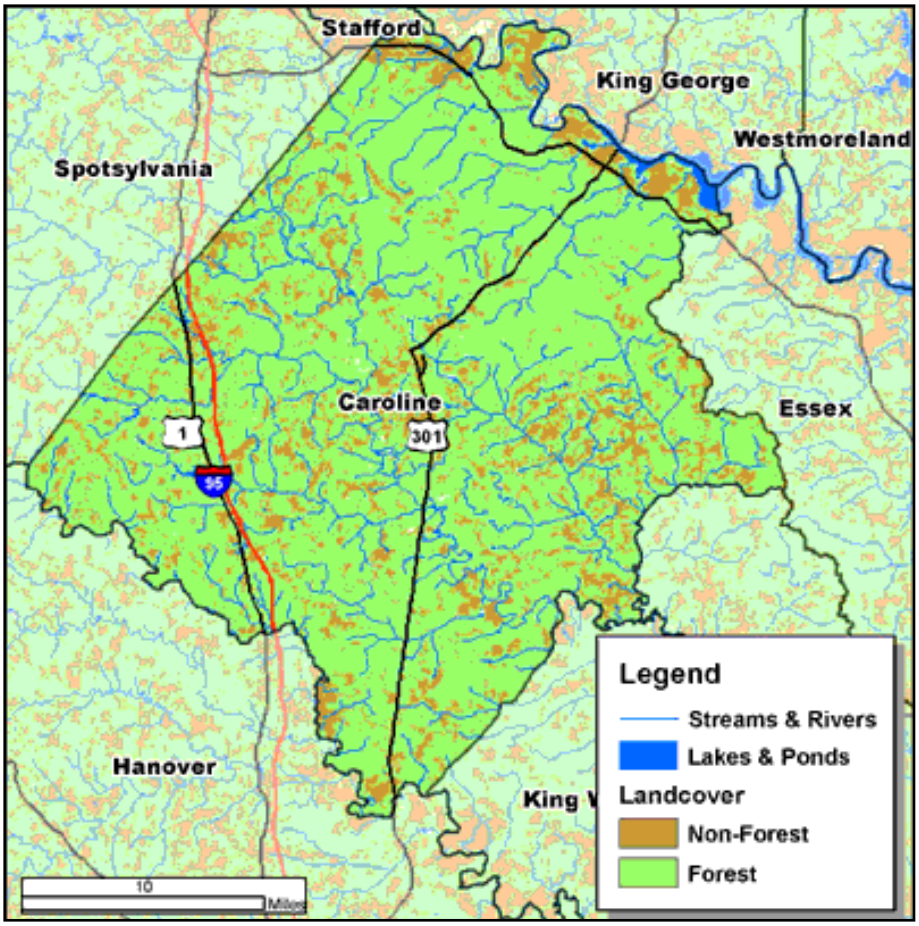
While forestlands provide a number of benefits, the amount of forestland is gradually being reduced, not by timbering, but through residential development. The abundance of rural land makes Caroline County attractive for people desiring rural lots. A significant percent of residential development over the last two decades has been the development of 2 - 10 acre lots, encouraged by County regulations. While this type of development may be attractive to new residents, it represents a waste of a valuable resource that, once developed in this manner, is non-renewable.

Table 4.5 indicates that of the 246,788 acres of forestland, 75% (185,192 acres) is privately owned and therefore, potentially susceptible to development. A recent trend is the sale of land owned by the forest industry to private individuals. In some of these cases, the properties were purchased by developers and subsequently subdivided, eliminating the property as a resource.

TABLE 4.5: COMMERCIAL FOREST -1991 TO 2007

Location	1991 (in acres)	2007 (in acres)	Change in Acreage	Percent Change
Ft. A.P. Hill	55,565	50,288	-5,277	-9.5%
Forest Industry Owned	20,144	11,308	-8,836	-43.9%
Privately Owned	185,993	185,192	-801	-.004%
Total	261,702	246,788	-14,914	-5.7%

Source: 1991 and 2007 U.S.Forest Survey



Map produced by the Virginia Department of Forestry, 2003

ISSUES

As previously stated, land development and resource protection and preservation are often incompatible. Land use policies, decisions and regulations regularly encourage the development of resources that warrant protection. This, in turn, creates interface problems between the development and the agricultural/forestal industry.

Once land is developed, its resource potential is severely limited or eliminated altogether. For example, it is much easier to timber a single parcel of 100 acres than ten parcels of ten acres, even though the total acreage

is the same. In order to encourage positive development while preserving and protecting the County's agricultural/forestal resources, the following should be encouraged:

- Analyze the recently completed soil survey by the Soil Conservation Service, which was imperative to the identification of the prime agricultural/forestal soils, as well as environmentally sensitive features.

  The County should use the soil survey to develop policies for specific areas to supplement the general policies and planning guidelines.

- Develop clustering regulations that preserve natural resources where development is permitted.

  Cluster development regulations allow the owners of large tracts of agricultural or forestlands to develop part of the property as residential lots, while preserving the majority of the land with the best resources for agricultural or forestal uses. In utilizing this concept, low density zoning of the parcel of land limits the number of residential lots that may be developed. The lots are then allowed to be arranged to occupy a small portion of the property with smaller lot sizes than those of a conventional lot in that zoning district. The remainder of the property is then preserved, through easements, for agricultural, forestal or open space uses.

  If properly utilized, clustering also has the added benefit of preserving the rural character of the County.

- Promote conservation easements and other non-regulatory tools to protect natural resources.

  A number of non-regulatory preservation tools exist that the County should encourage, including conservation easements and the purchase of development rights. Conservation easements are voluntary restrictions on the use and development land entered into by a landowner with an agency permitted by law to hold such an easement. In return for granting such an easement, the owner receives tax benefits and/or financial compensation to offset the potential development value lost with the easement.

  The voluntary purchase of development rights could be utilized in conjunction with conservation easements. Under this scenario, a developer seeking to obtain higher density zoning in the primary growth area, could work with property owners in rural areas and purchase their development rights. A conservation easement would then be placed on the agricultural land. Care must be taken to differentiate between a voluntary purchase of development rights and a formal Transfer of Development Rights (TDR) Program, recently authorized by Virginia Code.

FISHERIES

There are no commercial fishing operations currently located in Caroline County, though recreational fishing is popular throughout the County's streams and rivers. The North Anna is an attractive river for bass fisherman and the Mattaponi River for bass and pickerel fishing. The Rappahannock River is notorious for supporting large catfish and various bass species, including striped bass as they make their way upriver annually to spawn. The absence of commercial fisheries is, in part, due to low salinity levels in this part of the Rappahannock River, which generally supports the desired harvestable species.

Also, due to the low salinity levels, submerged aquatic vegetation (SAV), or seagrass, is virtually non-existent within our borders. SAV is a valuable marine resource found adjacent to shorelines. SAV provides ideal habitat for blue crab and juvenile fish and also acts to provide protection for molting crabs and is a source of food for some waterfowl. The 1999 Distribution of Submerged Aquatic Vegetation on the Chesapeake Bay, published by the Virginia Institute of Marine Science, indicated there was no SAV present. However, the 2003 survey indicated the presence of Hydrilla, a freshwater SAV near Goldens Creek on the Rappahannock River.

WATER RESOURCES

Water Resources can be classified as either surface or groundwater, depending on location and characteristics. Each is beneficial in its own unique way, depending on its use. Each resource is also susceptible to pollution from various manmade and other sources. Today's water quality protection regulations date back to the adoption of the Federal Water Pollution Control Act of 1972, or as it is commonly known, the "Clean Water Act". Federal involvement in water quality was mandated by Congress, due to the pollution of major water bodies and the destruction of wetlands, the impacts of which were just beginning to be recognized.

SURFACE WATER

Surface waters are waters found on the ground, in streams, wetlands, lakes, rivers and oceans that are naturally replenished by rain water and naturally depleted by evaporation. The origins of surface water makes them susceptible to the adverse effects of land use. The sources of pollutants are many, but the primary sources are: runoff from agriculture, cultivation, runoff from impervious surfaces, failing drainfields, soil loss from timbering or agricultural operations and discharges from wastewater treatment plants. Changes in land use result in increased point and non-point source pollution such as those identified above, which in turn leads to water quality degradation.

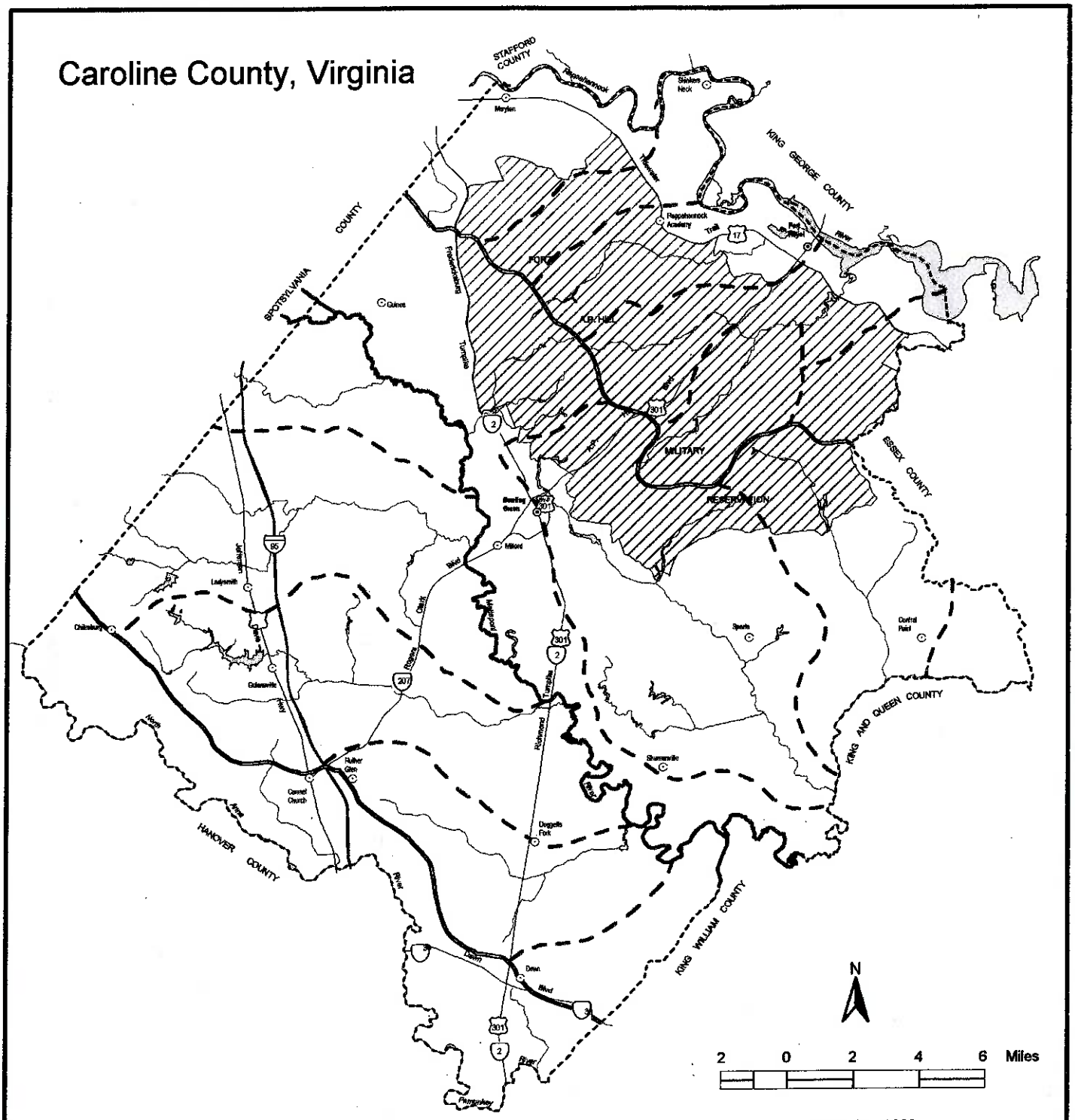
Soil erosion from construction site carrying pollutants into a stream

Caroline County is located within two major river watersheds; the Rappahannock River and the York River (Map 4.7), both of which are major tributaries of the Chesapeake Bay. The York River Watershed has three major sub-watersheds; the North Anna/Pamunkey River, the Mattaponi River, and Maracossic Creek. The Mattaponi subwatershed has several major tributaries, including: Polecat Creek, Reedy Creek, and the South River. The York River Watershed covers the southern two-thirds of the County.

Several state agencies, as well as the County, are responsible for monitoring water quality and establishing regulations to ensure that acceptable standards for water quality are met. The Department of Environmental Quality (DEQ) monitors water quality for compliance with federal and state regulations through a series of monitoring stations throughout the County. This agency is also responsible for permitting point source discharges, such as wastewater treatment plants, to ensure that these dischargers meet certain minimum standards. Surface waters are susceptible to the adverse effects of land use.

Beaverdams, such as this one, can impact the water quality

The DEQ Water Quality Assessment Report (www.deq.virginia.gov/water), published in 2008, indicates good water quality for most water bodies in the county. In fact, many water bodies wholly within the County were determined to have good-to-excellent water quality. Where impairments were



Map 4.7

Watersheds and Subwatershed Boundaries

- Subwatershed Boundaries
- Watershed Boundaries
- Major River

- Interstate
- US Highway
- VA Primary Highway
- Rivers and Streams

Rappahannock River near Skinker's Neck

identified, they included e.coli, fecal coliform, pH, or dissolved oxygen. The report does not indicate specific sources of the these impairments. Such impairments are typical of urban and agricultural runoff, or in some cases, the presence of wildlife.

A significant exception is the Rappahannock River, in which numerous impairments were determined. Of special concern was the identification of PCBs in the sediment of the river, which caused DEQ to post a warning about the consumption of fish from the river. Point source discharges from combined sewer overflows and untreated runoff from intensely developed urban areas are the likely sources. These impairments appear to originate from upstream sources rather than within Caroline County. Impaired waters are shown on Map 4.8.

SHORELINE CONDITIONS

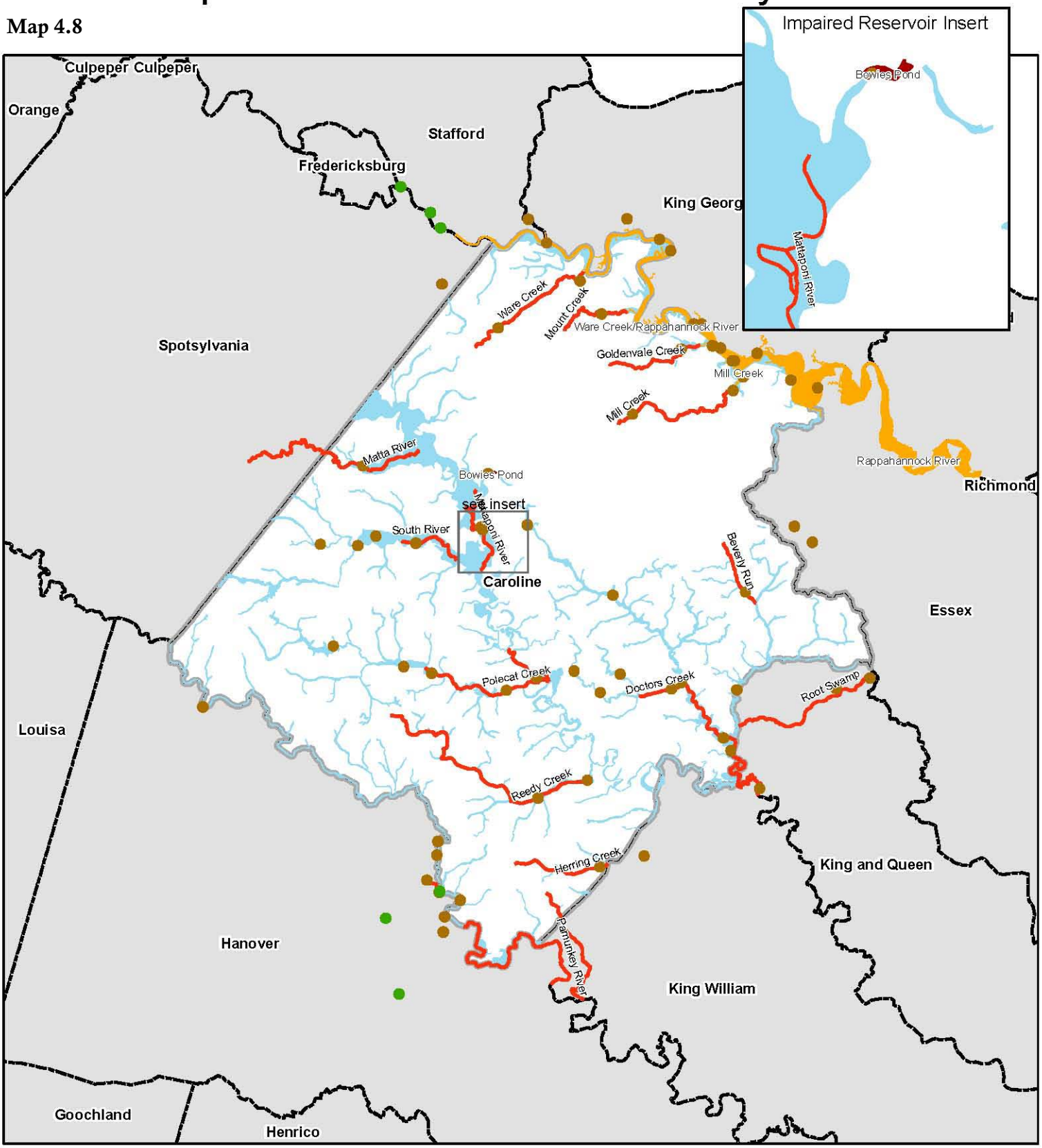
Rappahannock River Basin

The Rappahannock River shoreline comprises approximately 42.6 miles of the County's total shoreline. The shore lands are divided almost equally between low shore, moderate shore and moderately high-to-high shore lands, including bluff areas. Approximately 96% of the shoreline is comprised of fringe, embayed and extensive marshes, while the remaining 4% is comprised of beach areas. A detailed analysis of the river was undertaken in the late 70's by the Virginia Institute of Marine Science and their findings reported in the Shoreline Situation Report for King George and Caroline Counties, VIMS, 1979.

An updated report was published in May 2006. This report features GPS and GIS technology to collect and analyze shoreline information. Generally, the report indicates shoreline conditions along the Rappahannock River have remained largely undeveloped over the study period interval. The updated report can be found at http://ccrm.vims.edu/gis_data_maps/shoreline_inventories/virginia/carolineva/Caroline.pdf

GWRC Impaired Waters Caroline County

Map 4.8



Map Features

- Sewage or Water Treatment Plant
- Water Quality Monitoring Station
- Impaired Riverine Segment
- Impaired Reservoir/Lake
- Impaired Estuarine Segment
- Resource Protection Area
- Caroline County
- Virginia Counties
- Limited Access
- Highway
- Major Road

0 1 2 4 Miles

Impairement Totals	Caroline	Total
PCB	4	**57**
Bacteria	12	**63**
DO, pH	20	**63**
Aquatic Plants	0	**13**
Other	4	**10**
Total	**40**	**206**

The findings are characterized for three sections of the Rappahannock as follows:

Caroline/Spotsylvania Boundary to White Marsh

The shoreline erosion rate along this stretch is characterized as typically slight/no change to moderate/non critical. Most of the erosion takes place on the outside bend of the meanders. The Skinkers Neck and Moss Neck areas are experiencing erosion rates of up to 2.0 feet per year.

White Marsh to the James Madison Bridge

The erosion rate has been classified as slight or no change. Again, some slight erosion is occurring on the outside bend of the meanders, especially at the base of the cliffs. The marsh area opposite Cleave Marsh has an average historical accretion of 2.9 feet per year. Some artificial stabilization is located at the base of the James Madison Bridge, as well as the boat ramp on the southwest side of the bridge.

James Madison Bridge to Portabago Creek

The last segment of the Rappahannock River within Caroline County has an erosion rate of slight/no change to moderate/non critical. The stretch of shoreline from the marsh north of Portabago Bay to Mill Creek has an average historical erosion rate of 1.5 feet per year. A review of 1995 and 2004 aerial photography indicates no evidence of critical shoreline erosion.

York River Basin

Shoreline Erosion Conditions

Numerous perennial and intermittent streams flow directly or indirectly to the Mattaponi and Pamumkey rivers and, eventually into the York River. These streams are typically slow and meandering with considerable wetlands. An extensive survey of shoreline erosion conditions has not been performed on the Mattaponi or Pamunkey Rivers. However, staff has analyzed both 1995 and 2004 aerial photography and did not find any evidence of critical erosion. Due to the meandering nature of the streams, some erosion on the outside bends and accretion on the inside of bends is expected.

The Pamunkey River - part of the York River Watershed

Shoreline Protection Policies

Significant shoreline erosion can be hazardous to shellfish, submerged aquatic vegetation, and water quality due to sedimentation. Nutrients and other contaminants may be attached to sediments, further degrading

water quality and the flora and fauna inhabiting the water bodies. Land disturbing activities and shoreline development can aggravate shoreline erosion and sediment loss.

Retaining walls and rip rap to control erosion at Port Royal Boat Landing

The few access points that currently exist in the County, and mentioned in the River Access portion of this chapter, have been established for several years. Mature vegetation exists at these sites which provides effective erosion stabilization without the incorporation of structural controls. The newest access point to the Rappahannock River, located on the west side of Main Street in Port Royal, has incorporated structural controls in the form of retaining walls parallel to the access ramp and rip-rap and synthetic bulkhead along the shoreline. These erosion controls have proven effective at this site.

As with any development proposal, the recommended first choice for erosion stabilization is the use of vegetative controls, with particular emphasis on vegetation for shoreline stabilization. Vegetated erosion controls are well suited for the majority of the County including our largest water body, the Rappahannock River. Shoreline areas with vast expanses of open water that allow wind and wave action to impact the shoreline, generally do not exist. Therefore, structural controls should only be used to supplement vegetative controls.

The County's Chesapeake Bay Preservation Area Overlay District also helps preserve the existing vegetative cover along the shorelines. To minimize the adverse effects of shoreline development, the major rivers, associated wetlands and tributaries are designated as Resource Protection Areas (RPAs). A 100-foot buffer area in the RPAs limits land disturbance within the buffer, provides a filter for water runoff from adjacent properties and protects properties from further erosion. These regulations are discussed in greater detail under Caroline County Environmental Programs near the end of this chapter.

Recommendations

While water dependant facilities are permitted within RPAs, the potential for shoreline erosion should be minimized by implementing the following strategies:

- Shoreline structures, including stabilization structures, piers, dock, water treatment facilities, must have appropriate permits.

- Shoreline stabilization projects should be reviewed by appropriate agencies to determine the extent of erosion problems and the adequacy of proposed stabilization plans. Vegetative controls should be used to the greatest extent possible.

- Physical development is removed from shoreline areas to the extent practical and legally permissible.

- Where appropriate, a shoreline assessment should required with development applications. Where significant or critical shoreline erosion is identified, the preparation and implementation of a shoreline plan should be required as part of the project.

- The County should consider amending its ordinances to require the development and implementation of shoreline stabilization strategies where significant or critical shoreline erosion is occurring.

Such action should be considered carefully to include input from the various agencies that deal with shorelines and estuarine processes, as well as, the development industry.

- The County should prepare educational material on shoreline erosion and erosion control guidelines, which will be made available on the County website and distributed to property owners.

WATER ACCESS

Water access, including shoreline fishing, in-stream fishing, motorized and non-motorized boating, hunting, and other recreational opportunities, is an important resource to County residents. With the exception of the Rappahannock River, the geology and topography of the County makes the waterways narrow and shallow, suitable for only car top launching areas or shoreline access for scenic or passive recreation.

Hick's Landing near Rappahannock Academy

The only developed access sites within the County are located in the Rappahannock Basin. Two private access sites are located at Portobago Bay and Hicks Landing (fee). Public access is available in the Town of Port Royal, but it has limited capacity due to parking and access. A semi-public facility is also available on the west side of Main Street in Port Royal. A new facility is also proposed at Haymount, in the Skinker's Neck area. Finally, a new non-motorized public access is planned on the North Anna River at Route 30, on property abutting the Meadow Events Center.

Water access points that are poorly designed or improperly located may promote shoreline erosion through the random development of access points by the water users. Locations for water access should be evaluated using local development criteria. In the development of potential waterfront access sites, the County will utilize the Virginia Marine Resource Commission guidelines as contained in Chapter VI, Public and Private Access to Waterfront Areas and the Local Assistance Manual, Chesapeake Bay Local Assistance Department. The manual recommends consideration of the following in selecting waterfront access sites:

- desirability of the site for public access;
- physical characteristics of the site;
- availability of access nearby; and
- adjacent land uses.

The manual further recommends the following site characteristics when selecting a public water access site:

- a water depth of greater than 3 feet at mean low water;
- a maximum wave height of less than 1 foot;
- a current of less than 1 knot;
- does not require dredging;
- less than 50 feet to navigable water;
- an absence of threatened or endangered species;
- no wetlands impacts;
- not presently used for recreational purposes;
- an absence of aquatic vegetation and shellfish; and
- unimportant for spawning or nursery of any commercially or recreationally valuable species.

Most of the waterfront property in the County is privately owned. The only river front subdivision contains community access to the waterfront with a small boat launch area. Continued utilization of community ac-

cess should be encouraged through the use of zoning and subdivision regulations. For example, RPA features should be maintained as common areas, both to protect sensitive resources and to enhance community access, as is planned with the Haymount community.

This plan identifies several potential non-motorized boat access points in the Mattaponi and Pamunkey River watersheds (Map 4.9). These sites should be further analyzed for their river access potential and funding sources identified.

River Access Development

When locating potential river access points, a number of issues should be considered to minimize possible impacts. The following policies should be utilized by the County in the development of river access sites:

- All non-water dependent structures should be located outside of any Resource Protection Areas.
- RPA development should be limited to water dependent facilities and passive recreation such as boardwalks, trails and picnic areas.
- Environmentally sensitive areas such as wetlands, natural heritage areas, cultural resources, or areas of critical shoreline erosion should be avoided when developing structures. Such features may be incorporated as passive recreation features of the river access site.
- When developing river access sites all potential uses should be considered and as many as possible included as part of the river access site. These uses may include:
    - Bank and pier fishing
    - Nature study and education;
    - Hiking;
    - Picnicking;
    - Camping; and
    - Hunting.

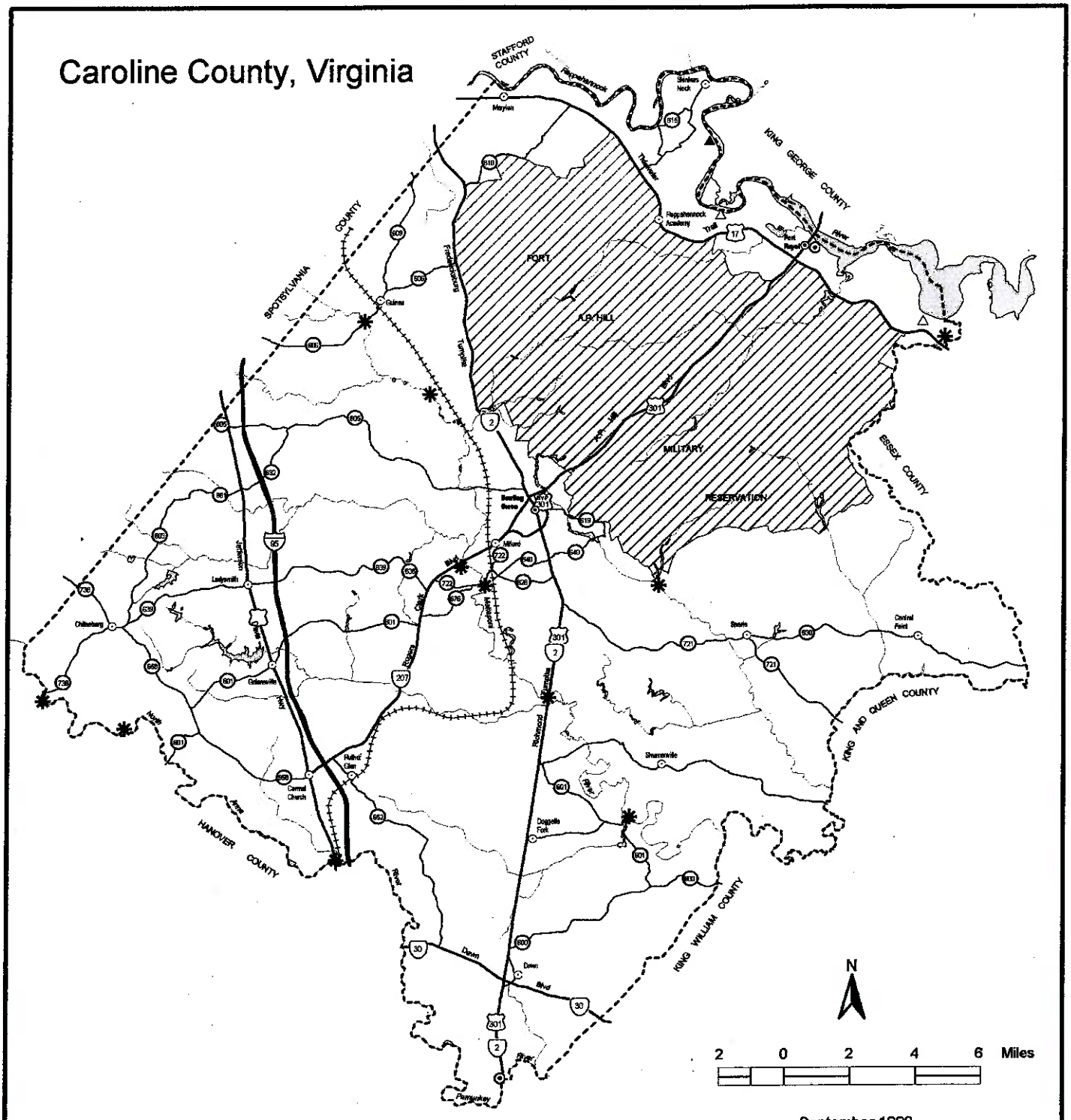
GROUNDWATER

Groundwater is the primary source of potable water in Caroline County, as it is the water located underground in between rock formations and is generally extracted by wells. Only the Lake Caroline Community utilizes surface water withdrawal to supply its water requirements.

Groundwater in Caroline County is found in two different types of aquifers: consolidated rock of the Piedmont and unconsolidated sediments of the Coastal Plain. Figure 4.1 is a profile view of these aquifers. The aquifer in the western portion of the County consists of fractures and joints in the granite bedrock and decomposed granite above the bedrock. This aquifer is particularly vulnerable to contamination from any pollutants introduced at the land's surface.

Aquifers in eastern Caroline County are comprised of unconsolidated sand, gravel, silt, and clay. One of these aquifers known as the "water table aquifer" is located near the surface of the earth. Many private wells withdraw water from this aquifer, especially if the dwelling was constructed prior to the 1990. There are no public water supply wells withdrawing water in this area. This is fortunate since these wells are particularly susceptible to contamination from surface pollutants. The more water that is withdrawn from these wells, the greater the area around them that requires protection. Beneath these surface aquifers are thick layers of clay through which the water moves very slowly. Beneath the layers of clay are other aquifers known as "confined" or "artesian" aquifers. Most of the public water supply wells in the eastern portion of Caroline County withdraw water from these aquifers.

Water recharges confined aquifers by two different routes. A portion of the groundwater leaks very slowly through the overlying clay layers. However, most of the water enters the aquifer near the Mattaponi River where the aquifer is exposed at the surface. These groundwater recharge areas require protection from land uses that may leave contaminants on the land surface. It is also important to eliminate any conduits from the surface to the aquifers, such as improperly abandoned wells. Figure 4.2 depicts the interaction between land uses and groundwater.



Map 4.9

River Access Points

- ▲ Future Public
- ✱ Potential Public
- △ Private
- ⊙ Public

- Interstate
- US Highway
- VA Primary Highway
- VA Secondary Highway
- Rivers and Streams
- Rail

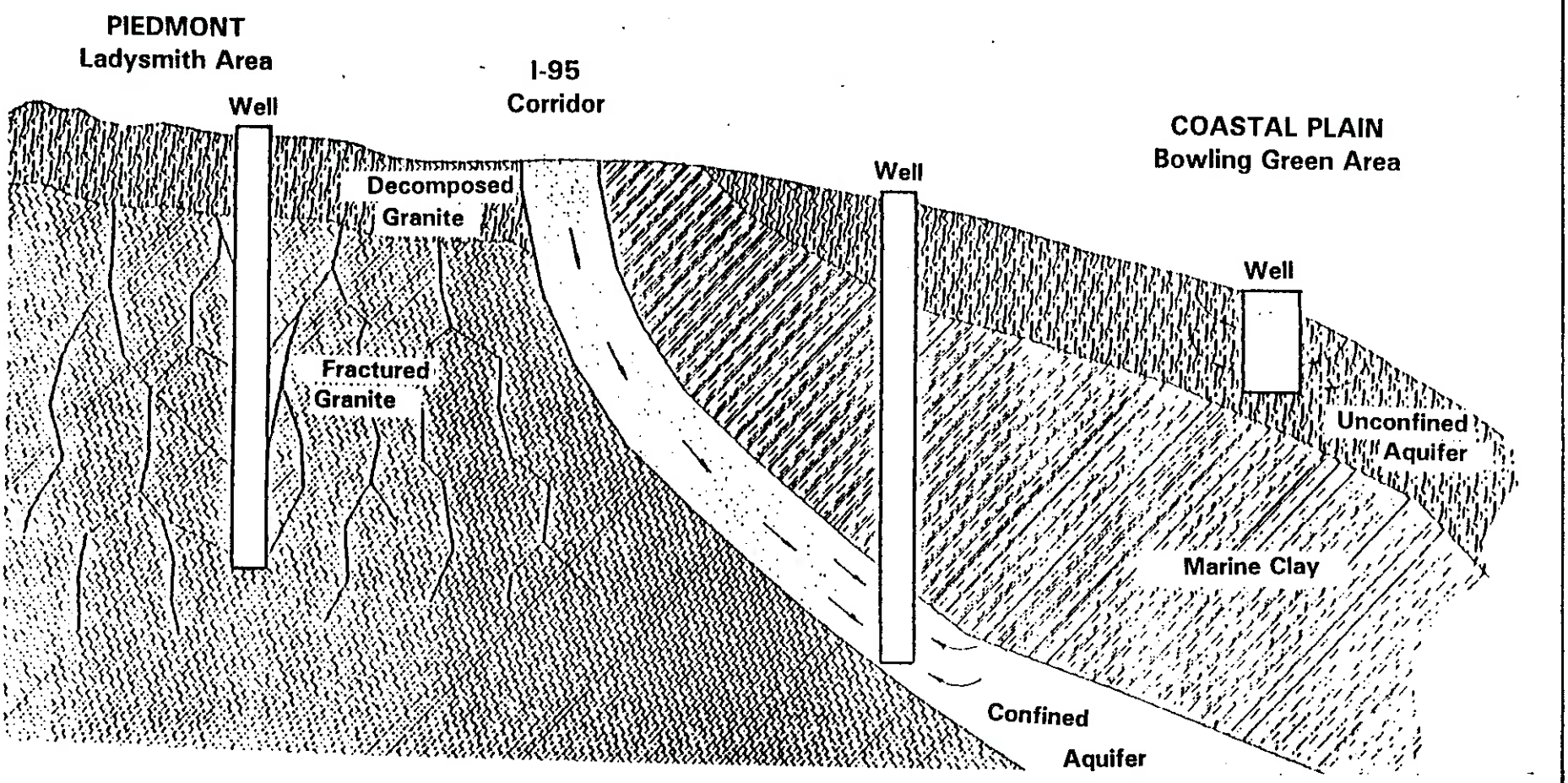


Figure 4.1

Groundwater Aquifer Profile

Source: Department of Public Works

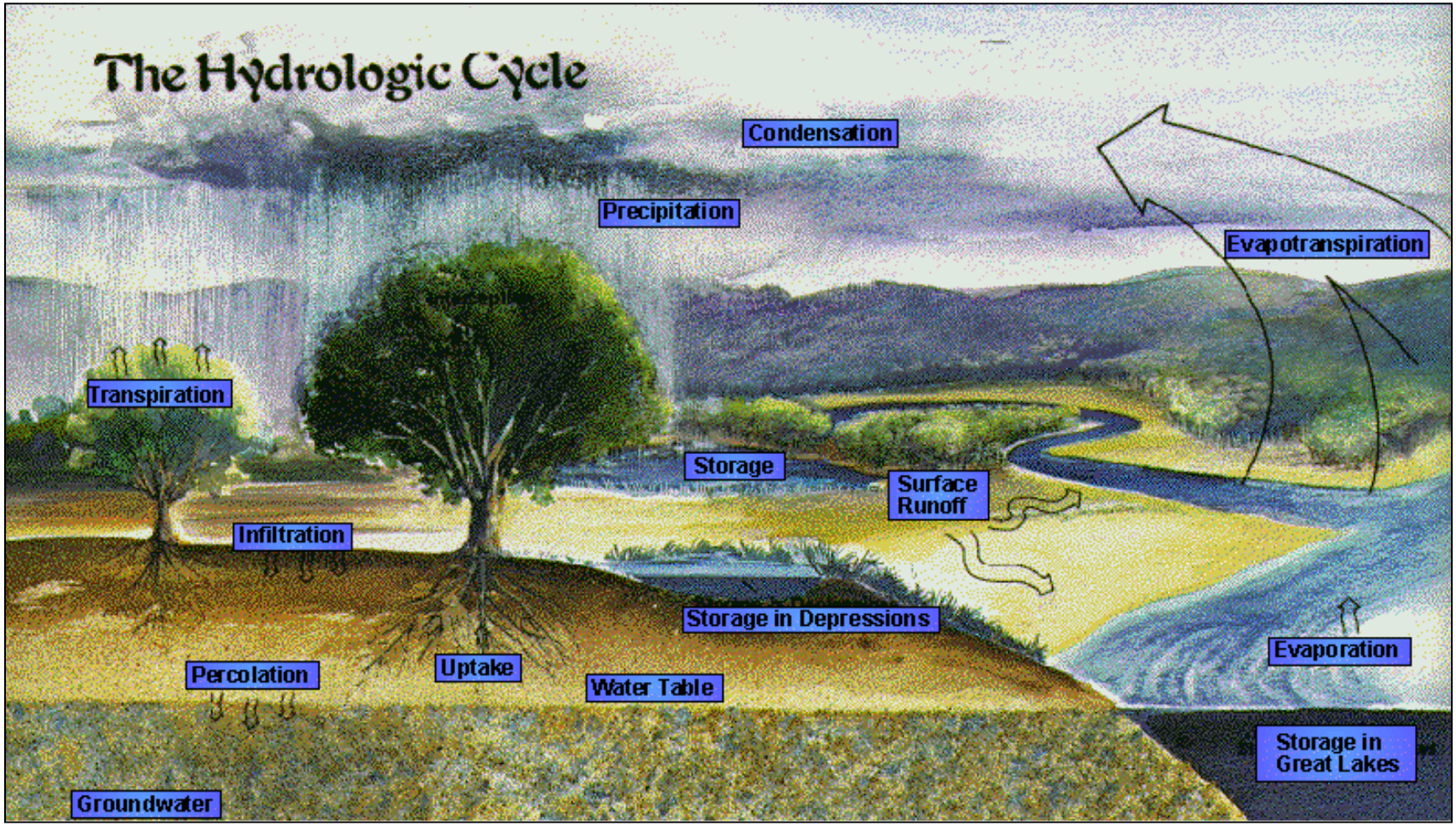


Figure 4.2: The Hydrologic Cycle
http://www.iwr.msu.edu/edmodule/water/cycle.htm

An important groundwater recharge area exists along U.S. Route 1 between two of the County's growth areas, Carmel Church and Ladysmith. Therefore, it is important that the County continue to encourage the extension of public utilities along this corridor to negate the need for on-site septic systems. County officials will not typically not give favorable consideration to development proposals without the inclusion of public utilities, where such utilities are available or can be cost effectively extended.

Groundwater withdrawals are regulated ensuring that the long term supply for future demand remains adequate. The quantity of water in the underground rock and sand formations are estimated so that withdrawals do not deplete the supply. The Department of Environmental Quality Water Division (www.deq.virginia.gov/water) and the Virginia Department of Health (www.vdh.state.va.us) manage the Commonwealth of Virginia's water resources. They maintain an inventory of available water sources and monitor withdrawals through permitting programs.

To avoid overuse of groundwater in areas of high withdrawal rates, the State Water Control Board (www.deq.state.va.us/cboards/wateroverview.html) regulates withdrawals through "Groundwater Management Areas". In these areas, new or expanded groundwater withdrawals must receive a permit from the State Water Control Board (SWCB), unless the withdrawal rate will be less than 300,000 gallons per month. The SWCB can deny, limit, or restrict a request for water if it determines that the withdrawal will interfere with existing users or if there will be a wasteful use of groundwater. One such area that affects Caroline County is in West Point, located in King William County. The Smurfit-Stone Container Corporation has a large paper products plant that utilizes significant amounts of groundwater in its production processes. The County should carefully monitor any requests for additional withdrawals to evaluate potential impacts.

Groundwater Contamination Sources

Wells

Uncapped and/or abandoned wells are a potential source for groundwater contamination. These wells, particularly shallow bored wells, can become conduits to the groundwater supply if contaminants are introduced. Abandoned deep wells can provide contaminant access to the lower confined aquifers that are generally protected from vertical movement. The Virginia Department of Health (VDH) has conducted a census as part of their wellhead protection program to determine the number and location of uncapped wells, and local codes address these wells for obvious safety and health concerns.

Underground Storage Tanks

According to the Virginia Water Quality Assessment for 1992, underground storage tanks (USTs) are the primary source of groundwater contamination in Virginia. USTs are particularly dangerous because they are installed below the surface and consequently are "out of sight and out of mind." Often, leaks are not detected until contamination of the adjacent soils or groundwater has occurred. Additionally, tanks abandoned before more restrictive regulations were instituted may pose an unwanted and potentially expensive liability on the property owner or locality.

Underground Storage Tank after extraction

Underground storage tanks are regulated by the Environmental Protection Agency under the authority of the Federal Solid Waste Disposal Act of 1970 and the Resource Conservation and Recovery Act (RCRA) of 1976. Underground storage tanks are regulated if its system, including piping, has at least 10 percent of its volume underground, and contains a regulated substance. Several types of underground tanks are excluded from the regulations, including: farm or residential tanks of 1,100 gallons or less storing motor oil for noncommercial uses, tanks for storing heating oil for on site consumption, and septic tanks.

The Virginia State Water Control Board (SWCB) is responsible for enforcing underground tank regulations throughout the Commonwealth. The SWCB keeps an inventory all underground storage facilities within the State and deals with all aspects of underground storage tanks including design, construction and installation, compatibility standards, leak detection, record keeping, reporting, closure, corrective action, and financial responsibility.

Current state regulations for underground storage tanks require that tanks be protected from corrosion if they are to be placed underground. Owners of new and existing tanks must provide a method, or combination of methods, for release detection. Tanks are also required to be monitored periodically by the owners for leaks. In addition, owners are required to report, investigate, and clean up any spills and overfills in accordance with state regulations. The SWCB ensures that tanks installed prior to 1989 have been upgraded to new tank standards as of December 1998.

Regulated tanks are found at most gas stations, convenience stores, commercial petroleum storage facilities, and sometimes abandoned businesses. As sites are redeveloped, older tanks should be identified and removed or replaced with a tank constructed of materials resistant to corrosion and with catholic protection.

ABOVE GROUND STORAGE TANKS

Individual above ground storage tanks are regulated by the federal government under 40 CFR Part 112 of the Clean Water Act of 1972. This section of the Act requires owners of single tanks with a capacity of 660 gallons (or multiple tanks with a combined capacity greater than 1,320 gallons) to register their tanks and devise a "Spill Prevention Control and Countermeasure Plan." The SWCB regulates and controls above ground storage tanks and requires landowners to file an "Oil Discharge Contingency Plan" before a tank can be registered. This plan identifies a course of action in the event of a catastrophic discharge of a substance from the largest tank. The plan must also identify the potential impact of such a release on the environment, and mitigation measures in the event a spill occurs. As most home fuel tanks are usually 200 to 660 gallons, residential and small business above ground storage tanks are not regulated. It is therefore incumbent upon the individual tank owners to ensure that leaks and spills do not occur with the implementation of spill containment measures.

The SWCB has estimated that approximately 90 percent of releases from individual tanks are a result of overfilling or tipping. Overfilling can occur if the individual filing the tank is inattentive while performing the task. Overfilling may also occur if the tank capacity has been misidentified or is simply not known. In order to reduce the risk of an accidental spill, the owner of the tank or the fuel company should inspect the tank prior to filling to ensure that the tank is sound and does not display any signs of corrosion. Additionally, the owner of the tank should clearly demonstrate the capacity of the tank and the location of the filling cap.

ON-SITE SEWAGE DISPOSAL FACILITIES

The majority of residences in Caroline County rely upon individual septic systems for wastewater treatment and disposal. With less than one percent of the total number of systems requesting repair, the County does not appear to be experiencing a significant number of system failures. Malfunctioning systems can result in fecal coliform contamination of localized groundwater. As previously mentioned, failing systems have the potential to create a significant threat to the groundwater quality.

The Caroline County Health Department has identified a number of malfunctioning septic systems, most of which are over 30 years of age. Newer drainfields experiencing problems are usually the result of hydraulic overloading by the residents of the structure, poor construction techniques, or are improperly sited.

In 1997, the county evaluated the feasibility of constructing a public water and/or sewer system. Construction of a public system could alleviate any identified problems as well as spur economic development efforts in the area.

Replacement of a septic system in association with Dawn Project

In 1998, the County started the grant application process to provide public sewer to the community. Initial applications were unsuccessful, and the County revised its plans several times before successfully receiving its first grant in 2003.

To help in addressing the sewage disposal issues in the Dawn community, the County partnered with DEQ, VDH, and the Virginia Department of Housing and Community Development (DHCD), the Dawn Progressive Association and numerous other groups to develop the decentralized wastewater treatment system. To date, 180 failed or problematic systems identified in the Phase I Service Area have been connected to the system, which became operational in 2009. Overall, the County does not appear to be experiencing significant system failures in other areas.

To provide a further level of protection against existing systems, prior to the issuance of building permits for redevelopment, the Health Department conducts a re-evaluation inspection. This inspection assures that the systems are in proper operating condition and that any system failures are corrected prior to the issuance of the building permit.

In addition to these measures, The Chesapeake Bay Preservation Act requires that all septic systems in the CBPA Overlay District be inspected and/or pumped out at least once every five (5) years. In 2007, The County issued septic pumpout notices to all applicable households. However, numerous issues arose from that approach. Subsequently, the County worked with DCR/CBLAD to develop a plan that would accomplish the septic pumpout on a recurring five year cycle. Accordingly, in January 2008, the County issued pumpout notices to households located in the RPA buffer. The next group of notification letters is scheduled to be issued in 2009.

The County has protection measures in place for groundwater and through the requirements of its Chesapeake Bay Preservation Area Overly District, it encourages impervious surface to be minimized and encourages other developmental criteria that address water quality issues. In addition, farms in the County are required, through the CBPA Overlay District regulations, to have farm plans that address the amount of nutrients, fertilizers, pesticides, and herbicides applied to the land surface. The Hanover/Caroline Soil and Water Conservation District prepares and/or reviews the Farm Plans with the landowner. The County performs environmental assessments of redeveloping properties to search for existing wells and storage tanks to ensure protection of water resources. Assistance in the protection of individual wells is provided by the Virginia Department of Health and the proper administration and enforcement of existing County Codes.

As mentioned previously, the Route 1 corridor has potential to experience growth and possible redevelopment. Although this corridor is mostly undeveloped and contains large parcels that interest developers, there exist opportunities for redevelopment. Redevelopment along this corridor provides the opportunity to remove problematic septic systems, storage tanks, implement effective Best Management Practices (BMP's), establish riparian buffers and remove all other potential groundwater pollutants to generally enhance water quality.

Redevelopment occurring throughout the County's CBPA's are subject to the ordinance requirements which specify there should be a no net increase in nonpoint source pollution from new development, and a 10 per-

cent reduction in nonpoint source pollution from redevelopment. In order to achieve these objectives, the performance standards contained in the ordinance minimize erosion and sedimentation potential, and, among other things, maximize rainwater infiltration.

AIR QUALITY

Caroline County residents consider themselves removed from many of the urban issues of our neighboring localities, including the quality of the air we breath. Most residents would not believe that our air quality does not meet the current standards for Ozone, as determined by the Environmental Protection Agency (EPA).

Ozone is beneficial in upper levels of the atmosphere where it forms a protective layer from the sun's ultraviolet rays. However, near the earth's surface, it is classified as a pollutant, which occurs mainly in the summer due to chemical reaction between emissions from vehicles, industries or other sources and sunlight. Many of these emissions are carried from their source of origin to areas such as Caroline County by the wind patterns, a concept called *transport*.

In March of 2008, EPA (www.epa.gov/ozonedesignations/) revised the standards for ozone to 0.075 parts per million over an eight hour average. Based upon the data from a monitor at the USGS Geomagnetic Observatory in Corbin, Caroline County is a candidate for designation as an Ozone Non-Attainment Area. If so designated by the EPA, Caroline County would be classified in an area together with the City of Fredericksburg, Spotsylvania and Stafford Counties. These localities would be required to develop a plan to bring the region into compliance with the ozone standards. The status of this designation is unknown at this time and should be monitored closely to determine the impacts to the County.

SCENIC RESOURCES

Because the County still retains its rural character, it also still retains many scenic areas contributing to that character. For example, a portion of the North Anna River from Landora Bridge Road (Route 601) to Jefferson Davis Highway (Route 1) has been identified by the Department of Conservation and Recreation as qualifying for scenic river status. Sections of the Rappahannock River are also noted as being worthy of consideration.

The County also has attractive viewsheds that along its roads. Tidewater Trail has long been noted for the scenery through which it traverses, and has been designated as a Scenic Byway.

Tidewater Trail looking westbound near Camden

RECOMMENDATION: The County should undertake an analysis of its scenic resources and recognize those resources that merit protection through the Commonwealth's Scenic Rivers or scenic roads programs.

NATURAL HERIITAGE RESOURCES

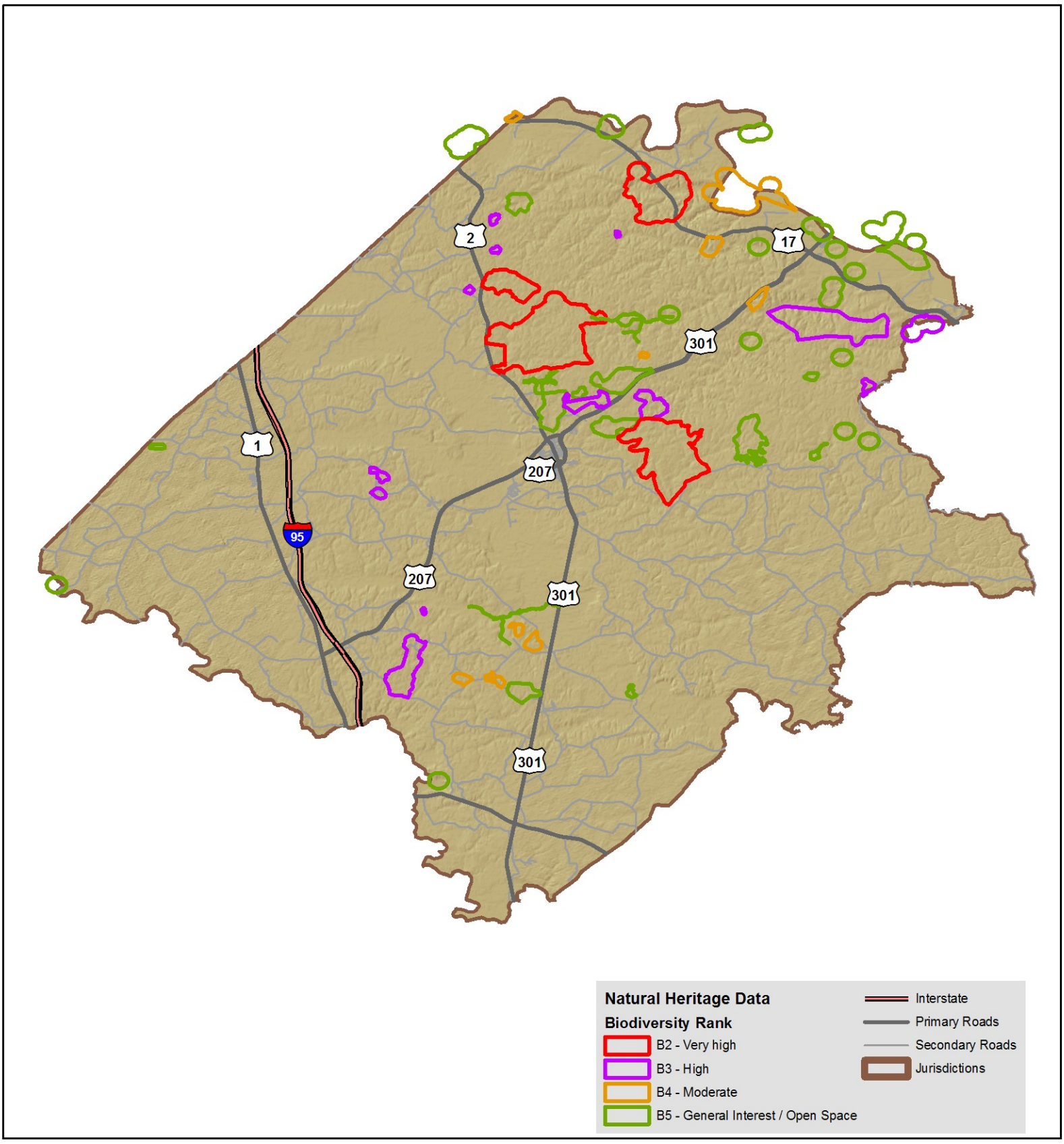
The Natural Heritage Program was established to protect the diversity of wildlife, flora and fauna in Virginia. As a program of the Department of Conservation and Recreation (DCR), it emphasizes the identification, protection and stewardship of natural heritage resources, such as the habitats of rare or endangered species, rare or Virginia significant natural communities and other similar features.

DCR identifies and protects natural heritage resources statewide and maintains a comprehensive database of all documented occurrences of natural heritage resources in Virginia. DCR has developed conservation sites that contain known populations of natural heritage resources and include adjacent or surrounding habitat vital for their protection. Conservation sites do not represent protected lands. They are recommended for protection and stewardship because of the natural heritage resources and habitat they support, but are not currently under any official protection designation. Conservation sites can be used to screen development projects for potential impacts to natural heritage resources, aid local and regional planning, identify targets for acquisitions and easements and guide priorities for restoration activities.

Map 4.10 shows the location of Natural Heritage Conservation Sites within Caroline County based on their biodiversity rank. Conservation sites are given a biodiversity significance ranking based on the rarity, quality, and number of element occurrences they contain; on a scale of 1-5, with 1 being most significant. During the development review process, the protection and preservation of these resources should be of high importance, consistent with the emphasis placed on other environmental programs administered by the County.

Additional information can be found on the Natural Heritage website at: http://www.dcr.virginia.gov/natural_heritage/index.shtml

Natural Heritage Conservation Sites



N
W
E
S

0 3 6 12 Miles

DCR
Virginia Department of Conservation & Recreation

Map 4.10

CAROLINE COUNTY ENVIRONMENTAL PROGRAMS

EROSION AND SEDIMENT CONTROL AND STORMWATER MANAGEMENT PROGRAMS

Introduction

The Department of Conservation and Recreation (DCR), Division of Soil and Water Conservation, oversees the Erosion and Sediment Control (E&S) program and the Stormwater Management (SWM) program. Caroline County administers the E&S program locally. The SWM program is undergoing a major reorganization, and is scheduled to become a locally administered program. DCR is drafting new SWM regulations that, if adopted, will result in significant changes. Both of these programs seek to reduce non-point source pollution through the use of E&S controls (during construction) and Best Management Practices (BMPs) for post construction/development runoff.

The Caroline County E&S program has four major components: administration, plan review, inspection, and enforcement. Administration consists mainly of the ordinance and the various procedures to ensure timely and appropriate processing of applications, permits, etc. To facilitate this processes, a Standard Operating Procedures Manual has been created.

Plan Review not only ensures that E&S plans meet the mandated minimum standards, it also ensures that the proposal is consistent with numerous other County and State requirements. This is accomplished in part by utilizing a multi-agency/department Technical Review Committee.

Inspection of land disturbing activities was greatly enhanced in 2006 by the addition of full time staff members to handle environmental issues. Site inspections are consistent with state-mandated requirements and additional inspections are conducted either by request (i.e., technical assistance), during critical operations, or severe weather.

Enforcement measures include issuance of notice to comply letters and stop work orders. In addition, the county holds an E&S bond to ensure that runoff from the disturbed areas is properly controlled and final stabilization is achieved.

The Caroline County E&S program has been successfully reviewed by DCR in 2001 and again in 2008.

CHESAPEAKE BAY PRESERVATION REGULATIONS

Caroline County is also responsible for water quality protection through the adopted Chesapeake Bay Preservation Overlay District, contained in Article XV of the Caroline County Zoning Ordinance. Land use changes result in increases in both point and nonpoint sources of pollution, which significantly contribute to water quality degradation and the Chesapeake Bay. Hence, the Commonwealth of Virginia adopted the Chesapeake Bay Preservation Act (ACT) in 1988. This legislation created the Chesapeake Bay Local Assistance Department (CBLAD), which was charged with the task of developing regulations to protect water quality within the Chesapeake Bay Watershed for those localities situated within the Coastal plain. The Department has since been merged as is now the Chesapeake Bay Local Assistance Division of the Department of Conservation and Recreation.

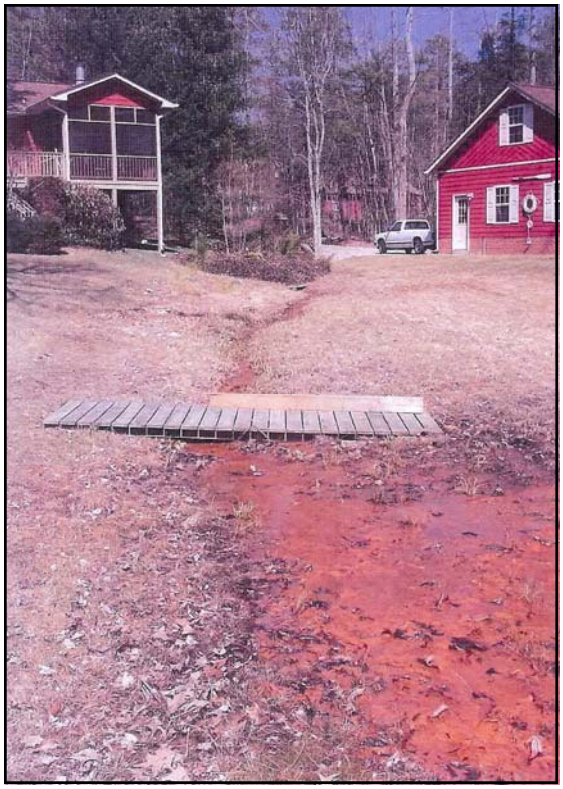
Protection is accomplished through the implementation of protective criteria on lands designated as Chesapeake Bay Preservation Areas (CBPAs). The regulations are based on the premise that the improper use or development of CBPAs may result in substantial damage to the water quality of the Chesapeake Bay and its tributaries. The regulations also establish the criteria that local governments must use in determining CBPAs and managing land uses. Local programs are required to encourage and promote the following:

- Protect existing high quality state waters and restore other state waters to a condition or quality that will permit reasonable public uses and will support the propagation and growth of all aquatic life, including game fish, which might reasonably be expected to inhabit them;

- Safeguard the clean waters of the Commonwealth from pollution;
- Prevent any increase in pollution;
- Reduce existing pollution;
- Promote water resource conservation to provide for the health, safety and welfare of the present and future citizens of the Commonwealth.

Chesapeake Bay Preservation Areas

The ACT is designed to protect water quality of the Chesapeake Bay and it tributaries through land use management techniques. This is to be accomplished by identifying Chesapeake Bay Preservation Areas and implementing the criteria set forth in the regulations. CBPAs include both Resource Protection Areas (RPAs) and Resource Management Areas (RMAs). A third designation of Intensely Developed Areas (IDAs) can also be designated in areas meeting those qualifications. There are no IDAs in Caroline County.



Before & After pictures of an RPA restoration project in Lake Caroline designed to replace vegetation and correct a drainage problem

Resource Protection Areas

Resource Protection Areas are defined as lands at or near the shoreline that have an intrinsic water quality value due to the ecological and biological processes they perform or are sensitive to impacts that may result in significant degradation to the quality of state waters. RPAs in a natural condition provide for the removal and/or reduction of sediments, nutrients and potentially harmful toxic substances in runoff.

RPAs include the following environmentally sensitive land areas:

- Tidal wetlands;
- Nontidal wetlands connected by surface flow and contiguous to tidal wetlands or tributary streams;
- Tidal shores;
- Other lands deemed by the governing body as necessary to protect the quality of state waters; and
- A buffer area not less than 100 feet in width located adjacent to and landward of the components listed above, and along both sides of any tributary stream.

Permitted land uses within RPAs are limited to the following:

- New or expanded water-dependent facilities that:
  - do not conflict with the comprehensive plan;
  - comply with the performance criteria of state regulations and local ordinances; and
  - locate any non-water-dependent component outside of the Resource Protection Areas.

- Land development that constitutes redevelopment, provided it conforms to applicable stormwater management and erosion and sediment control criteria;

- The construction of roads and driveways across RPA's are subject to the following conditions:
  - The County makes a finding that there are no reasonable alternatives to aligning the road or driveway in or across the RPA;
  - The alignment and design of the road or driveway optimized consistent with other applicable requirements to minimize encroachment in the RPA and adverse effects on water quality; and
  - The design and construction of the road or driveway satisfies all applicable criteria of the regulations and county ordinances;

- Vested uses including permitted uses in the underlying zoning district consistent with the performance criteria of the Chesapeake Bay Protection Ordinance.

RESOURCE MANAGEMENT AREAS

RMAs are defined as lands that, if improperly used or developed, have a potential for causing significant water quality degradation or diminishing the functional value of the RPA. The regulations require RMAs to be contiguous to the entire inland boundary of the Resource Protection Area.

The regulations require the following to be considered for inclusion in the Resource Management Area:

- Floodplains;
- Highly erodible soils, including steep slopes;
- Highly permeable soils;
- Nontidal wetlands not included in the Resource Protection Area; and
- Other lands necessary to protect the quality of state waters.

All uses permitted in the underlying zoning district are permitted. However, stormwater management and erosion and sediment control measures as specified in the Chesapeake Bay Preservation Overlay District must be met. Additionally, any parcel of land subdivided and platted after October 1, 1989, is required to have a drainfield and 100% reserve area, if septic systems are to be utilized.

IDENTIFICATION AND DESIGNATION OF CHESAPEAKE BAY PRESERVATION AREAS

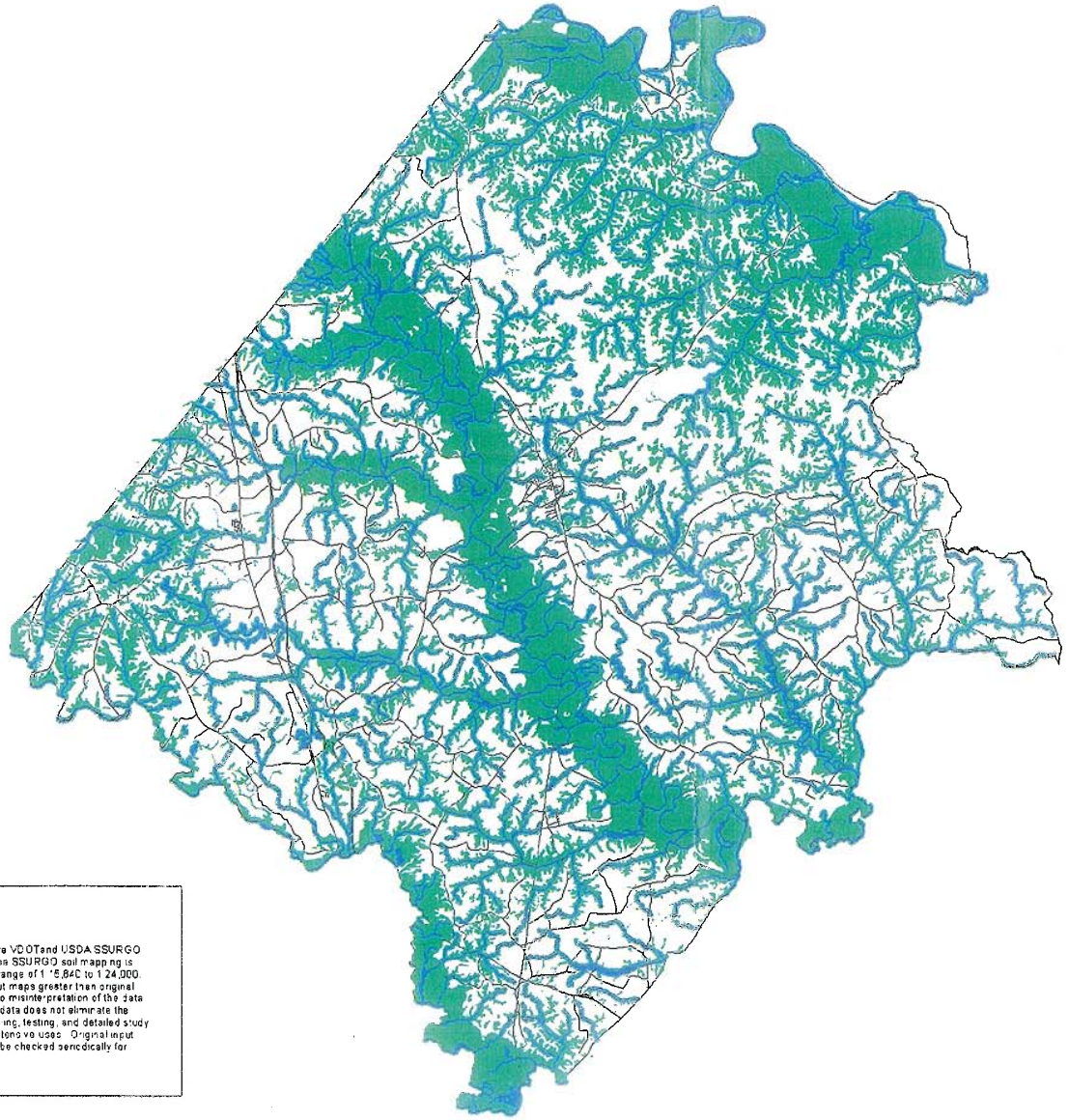
In designating the Chesapeake Bay Preservation Areas, the County used the National Wetlands Inventory Maps, United States Geological Survey (U.S.G.S.) 7.5' Topographic Maps and the Caroline County Soil Survey to identify the RPAs. The RPAs designated are those sensitive environmental lands or bodies identified in the regulations plus a 100 foot buffer landward and contiguous to those lands identified as RPA lands. Additionally, RPA lands are associated only with "Tributary Streams". Intermittent streams may be designated as RPAs if they are determined to be environmentally sensitive based on a site analysis.

Resource Management Areas were identified using the National Flood Insurance Program Flood Insurance Rate Maps (August 15, 1989), U.S.G.S. 7.5' Topographic Maps and the soil survey. RMAs are identified as slopes greater than 15%, the 100 year floodplain or a minimum distance of 300 feet landward and contiguous to the RPA 100 foot buffer.

The County, after much review, adopted its Chesapeake Bay Preservation Area Overlay District and the Chesapeake Bay Local Assistance Board approved the County's maps and regulations on in 1993. The Caroline Chesapeake Bay Program was reviewed in 2008 and found to be fully consistent.

Since the completion of the soil survey, the County has reevaluated its Chesapeake Bay Preservation Maps. The County secured the assistance of the United States Department of Agriculture's Natural Resource Conservation Service to analyze the soil survey and perform the mapping of the soil characteristics utilized for the analysis of the Chesapeake Bay Preservation maps. Map 4.11 generally identifies Chesapeake Bay Preservation areas. Map 4.12 identifies the areas with development constraints in the County.

The County has also undertaken the development of a GIS program that will enable further evaluation of the designated CBPA Overlay District. The County receive grant funding from DCR/CBLAD Water Quality Improvement Fund to assist in this project.



Caroline County

CBPA Features

Roads

Streams

RPA / RMA Boundaries

2 0 2 4 Miles

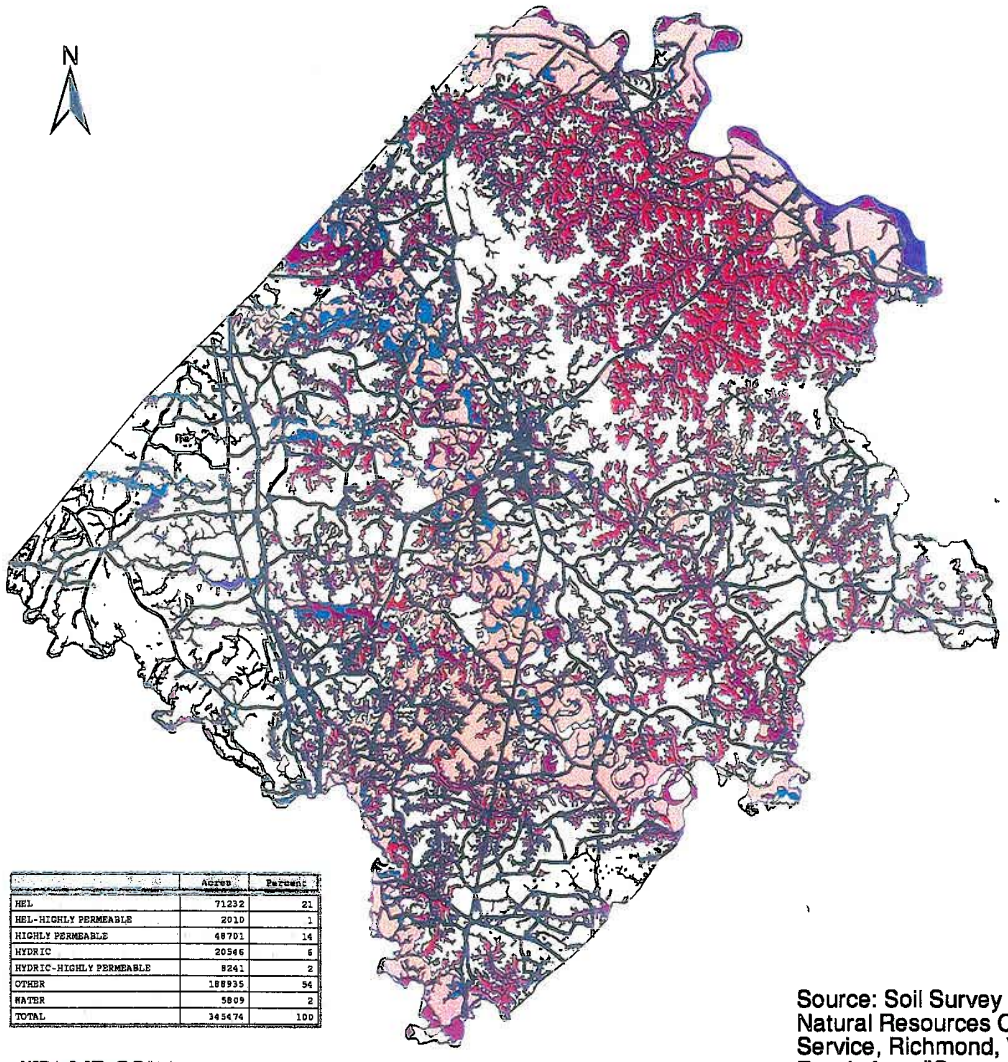
November 17, 2001

Map 4.11

Input data sources are VDOT and USDA SSURGO data sets (1997). The SSURGO soil mapping is produced at a scale range of 1:15,840 to 1:24,000. Enlargement of output maps greater than original production can lead to misinterpretation of the data. The depiction of this data does not eliminate the need for onsite sampling, testing, and detailed study of specific sites for intended uses. Original input data sources should be checked periodically for latest updates.

CONSTRAINTS FOR DEVELOPMENT

CAROLINE COUNTY, VIRGINIA



2 0 2 4 6 8 10 Miles

Scale 1:250,000
UTM Projection, NAD83

Roads
HEL
HEL-HIGHLY PERMEABLE
HIGHLY PERMEABLE
HYDRIC
HYDRIC-HIGHLY PERMEABLE
OTHER
WATER

	Acres	Percent
HEL	71232	21
HEL-HIGHLY PERMEABLE	2010	1
HIGHLY PERMEABLE	48701	14
HYDRIC	20546	6
HYDRIC-HIGHLY PERMEABLE	8241	2
OTHER	188935	54
WATER	5809	2
TOTAL	345474	100

USDA NRCS Natural Resources Conservation Service

Source: Soil Survey Geographic (SSURGO) data base for Caroline County, Virginia, 1997, Natural Resources Conservation Service. Compiled by Natural Resources Conservation Service, Richmond, VA, August, 2000.
Roads from "County Map Series CD," VDOT, 9/98.

Map 4.12

GOALS, OBJECTIVES & STRATEGIES

GOAL: Identify, conserve, and protect our important Natural Resources through land use planning, zoning, environmental programs, and educational awareness.

Objective 4.1 - Locate development in a manner that preserves important environmental resources, agricultural lands, forestlands, open space, scenic beauty, and high quality ground and surface water resources.

Action Strategy 4.1.1: Assure that development proposals are consistent with the protection of environmentally sensitive areas and the maintenance of the County's overall environmental quality.

Action Strategy 4.1.2: Encourage landscaping and physical improvement of existing development to improve the overall visual quality of the County.

Action Strategy 4.1.3: Require underground utilities in all new developments. Encourage screening and buffering of existing above ground utilities and their placement below ground.

Action Strategy 4.1.4: Encourage building, site and road designs that enhance the natural landscape and preserve scenic view sheds.

Objective 4.2 - Identify existing or potential sources of surface and groundwater pollution and actions to address any identified pollution problems.

Action Strategy 4.2.1: Undertake a countywide analysis of existing land uses to identify potential sources of surface and groundwater pollution; including but not limited to above ground storage tanks, underground storage tanks and animal feed lots.

Action Strategy 4.2.2: Develop a well head protection program for public water supply wells.

Action Strategy 4.2.3: Develop voluntary and regulatory measures to reduce pollution potential.

Objective 4.3 - Encourage the preservation of agricultural lands, forestal lands, scenic areas, open space and environmentally sensitive areas through a combination of techniques, including: land use value assessment, cluster development provisions, conservation easements, land trusts, or the purchase/transfer of development rights.

Action Strategy 4.3.1: Preserve open space, agricultural lands, forest lands and the rural character of the County.

Action Strategy 4.3.2: Educate the public about voluntary techniques to preserve and protect sensitive environmental lands; wildlife habitats; and agricultural, forestal and other open space land.

Objective 4.4 - Continue the development and implementation of environmental programs (i.e., erosion and sediment control, Chesapeake Bay Program, stormwater management and best management practices) that protect downstream properties, wetlands, floodplains, and other environmentally sensitive areas from the adverse effects of development.

Action Strategy 4.4.1: Identify environmentally sensitive areas and develop recommendations for voluntary and regulatory means to protect resources identified in studies of environmentally sensitive areas.

Action Strategy 4.4.2: Encourage the use of best management practices to mitigate water quality and runoff impacts.

Action Strategy 4.4.3: Continue development and enforcement of zoning regulations and other county ordinances that ensure the preservation and protection of wetlands, floodplains, natural areas, and other environmentally sensitive areas and resources.

Action Strategy 4.4.4: Identify the existing and potential uses of county steams and rivers and develop standards to support these uses. Protect the quality and quantity of these surface waters so they will continue to support these uses. Consideration should be given to existing and potential water resource uses when reviewing land development applications.

OBJECTIVE 4.5 - PROTECT THE WATER QUALITY AND THE FLORA AND FAUNA WHICH INHABIT THE WATERS OF THE COUNTY THROUGH THE ESTABLISHMENT AND IMPLEMENTATION OF A CHESAPEAKE BAY PRESERVATION PLAN FOR CAROLINE COUNTY.

Action Strategy 4.5.1: Encourage, to the extent possible, increases in the amount of pervious surfaces.

Action Strategy 4.5.2: Maintain a policy of no net increase in nonpoint source pollution.

Action Strategy 4.5.3: Encourage minimal land disturbance to achieve the proposed use.

Action Strategy 4.5.4: Encourage development to identify any environmental constraints and to avoid environmentally sensitive features during land disturbing activities.

Action Strategy 4.5.5: Preserve indigenous vegetation to the maximum extent possible.

Action Strategy 4.5.6: Minimize any unavoidable environmental impacts.

OBJECTIVE 4.6 – ASSUME A LEADERSHIP ROLE REGARDING THE CONSERVATION, PROTECTION, AND PRESERVATION OF ITS IMPORTANT NATURAL RESOURCES.

Action Strategy 4.6.1: Monitor the possible non-attainment designation of Caroline County.

Action Strategy 4.6.2: Work with Virginia DEQ to develop a designation that addresses the requirements, while attempting not to burden County residents and businesses.

OBJECTIVE 4.7 – SEEK ALLIANCES AND PARTNERSHIPS, BOTH WITHIN AND OUTSIDE OF THE COUNTY, IN ORDER TO IMPROVE COUNTY PROGRAMS AND INITIATIVES AND TO IMPROVE OVERALL SUCCESS.

OBJECTIVE 4.8 – IMPLEMENT A WATERSHED APPROACH TO IDENTIFY AND ADDRESS POLLUTION PROBLEMS, IMPAIRMENTS, AND UNIQUE AREAS WORTHY OF PROTECTION.

Action Strategy 4.8.1: Utililize DEQ's Water Quality Assessment Report to identify impaired waters.

Action Strategy 4.8.2: Identify and pursue independent study projects for area college students.

OBJECTIVE 4.8 – DEVELOP POTENTIAL LAND USE/POLLUTANT LOAD MODELS IN SUPPORT OF THE TMDL MANDATES.

Action Strategy 4.9.1: Utilize GIS technology for land use data, soils, and other data layers.

Action Strategy 4.9.2: Identify environmentally sensitive areas such as RPA features, wetlands, etc.

OBJECTIVE 4.10 – CREATE A COUNTYWIDE NETWORK OF WEATHER STATIONS AND WATERSHED MONITORING STATIONS TO PROVIDE PUBLIC SERVICE (AWARENESS), IMPROVE EFFICIENCY AND EFFECTIVENESS OF ENVIRONMENTAL PROGRAMS, ASSESSMENT OF CHANGES AND IMPACTS TO AQUATIC RESOURCES RESULTING FROM VARIOUS LAND USES AND DEVELOPMENT ACTIVITIES.

OBJECTIVE 4.11 - IMPROVE ENVIRONMENTAL AWARENESS OF NATURAL PROCESSES, ECOSYSTEMS, DIVERSITY, ETC.

OBJECTIVE 4.12 - PROVIDE OUTSTANDING CUSTOMER SERVICE THAT ENCOURAGES COOPERATION, INTERACTION, AND THE PUBLIC'S USE OF COUNTY STAFF KNOWLEDGE AND RESOURCES.