APPENDIX D

NATURAL RESOURCES

NATURAL RESOURCES APPENDIX

The following Natural Resources appendix resources have been studied and documented to satisfy Virginia State Code Sec. 15.2-2224, Surveys and studies to be made in preparation of plan; implementation of plan, Sec. 15-2.2223.2, Comprehensive plan to include coastal resource management guidance, and 4VAC50-90, Part V., Comprehensive Plan Criteria of the Chesapeake Bay Preservation Area Designation and Management regulations. Additionally, the information is an educational resource for the community, offering valuable insights into environmental resources and land use planning within Spotsylvania County.

PHYSIOGRAPHY

Spotsylvania County's total land area is approximately 407 square miles. The land surface is generally rolling and slopes gradually in a southeasterly direction to an irregular north/south line following the Interstate 95 corridor, where it drops slowly to a low flat plain. Elevations range from a high of about 450 feet above sea level in the western section of the county to sea level in the northeastern area along the Rappahannock River.

The most significant landform issue is the split of the county into two physiographic provinces; the Atlantic Coastal Plain and the Piedmont Plateau. The area of transition between the provinces, known as the fall line, marks the boundary between the free flowing rivers to the west and tidal to the east.

GEOLOGY

The geology of the county is generally comprised of precambrian, cambrian, and paleozoic formations. The principal geologic units found within the county are indicated below in order of the youngest to the oldest:

Table 1: Geology

System	Unit
Tertiary (Miocene, Eocene)	Calvert and Aquia Formations
Lowe Cretaceous	Patuxent Formation
Paleozoic and precambrian formations of uncertain age/relationship	Petersburg Granite
Formation of uncertain age	Granite, Granite Gneiss, Hornblende Gabbro, Metamorphosed Sedimentary Rocks, Quartz Diorite, and Metamorphosed Volcanic and Sedimentary Rocks

The Piedmont Plateau geology is dominated by granite gneiss, schist, and granite rocks, generally of the paleozoic and precambrian age. Small intrusive dikes of horneblende gabbro and similar rocks are also present.

Coastal Plain geology is dominated by patuxent, aquia, and calvert formations, and can be characterized by its veneer of sand, gravel and clay deposits.

Geology and Groundwater

The character and position of rocks and rocky formations control the collection, storage, transmission quality and yield of groundwater. Since groundwater is contained in and controlled by rocks, each rock formation or unit is profiled below with respect to groundwater potential.

Coastal Plain Province

In the Coastal Plain, the average well yields 11 gallons of water per minute at a 50-foot depth. Some yield as much as 50 to 60 gallons per minute. Many of the deeper wells produce water that
contains objectionable minerals. To the southeast of the City of Fredericksburg, patuxent formations are found. Patuxent formations are the most prolific aquifers, yielding 20 to 50 gallons per minute from deep wells. There are no true aquifer recharge areas within the county; however, silty clay sediments within the Coastal Plain provide the most permeability and promise of recharge to artesian aquifers by means of vertical seepage.

Calvert Formation

This formation occurs within the southeastern portion of the Coastal Plain area and generally consists of green clay, and very fine white sand. The calvert formation is not an important aquifer
although it does serve as a form of barrier confining water to the deep water-bearing sands.

Aquia Formation

This formation principally consists of fine-grained sands and moderate amounts of clay. No wells are known to produce from this formation within the county. The aquia formation is exposed above the patuxent formation.

Patuxent Formation

This formation occurs within the eastern most portion of the Coastal Plain area of the county and consists of white sand with lesser amounts of coarse gravel present. Clay lenses are common throughout the formation. The sands and gravel of the patuxent formation are the most prolific aquifers within Spotsylvania County. Wells, which have tapped water-bearing zones of the patuxent, which usually locate at a depth of 100 to 400 feet, have produced between 20 and 50 gallons per minute.

Piedmont Province

Within the Piedmont, small supplies of water are available near the surface where weathering has partially decomposed the rocks. Below the weathered zone, water occurs in fractures and along contacts between different rock types. Average wells extend to depths of 50 to 250 feet and yield from 5 to 15 gallons of water per minute, with some of the better wells yielding approximately 40 gallons per minute; this type of yield is suitable for domestic residential uses but little else. Most wells are shallow, as there is very little change of increasing well yields by drilling more than a few hundred feet due to the decrease in size and number of fractures in the rocks. In addition, objectionable minerals tend to increase with added depth.

Petersburg Granite

The Petersburg granite unit occurs within the northeastern portion of the Piedmont area of Spotsylvania County and is well exposed in the vicinity of the Rappahannock River. It is a coarse to fine grained pink granite intruded by fine-grained blue granite. Small supplies of water sufficient for domestic use are available from the weathered zone of these rocks where fractures are encountered, with yields greater than 20 gallons per minute possible.

Granite Gneiss Unit

The granite gneiss unit occurs within the southeastern portion of the Piedmont area of Spotsylvania County and consists of a gray medium to fine-grained granite gneiss with intrusions of light gray granite. Small to moderate supplies of water have been produced from these rocks. Yields ranging from 1.5 to 62 gallons per minute were produced from wells at Indian Acres. The depths of these wells range from 128 to 525 feet.

Granite

The granite unit occurs within the central and far western portion of the Piedmont area of Spotsylvania County and is primarily composed of gray biolite granite and quartz menozite. Small supplies of water have been produced from this unit with yields ranging from a few gallons per minute to 15 gallons per minute.

Horneblende Gabbro - Quartz Diorite

These units occur at several isolated locations as small elliptical bodies intruding the older rocks. Blue quartz is predominant in the quartz diorite, and the horneblende gabbro is composed chiefly of horneblende and other dark-colored minerals. These geologic units are poor sources of water with small accumulations of water occurring along the contact zones between these rocks and the surrounding formations.

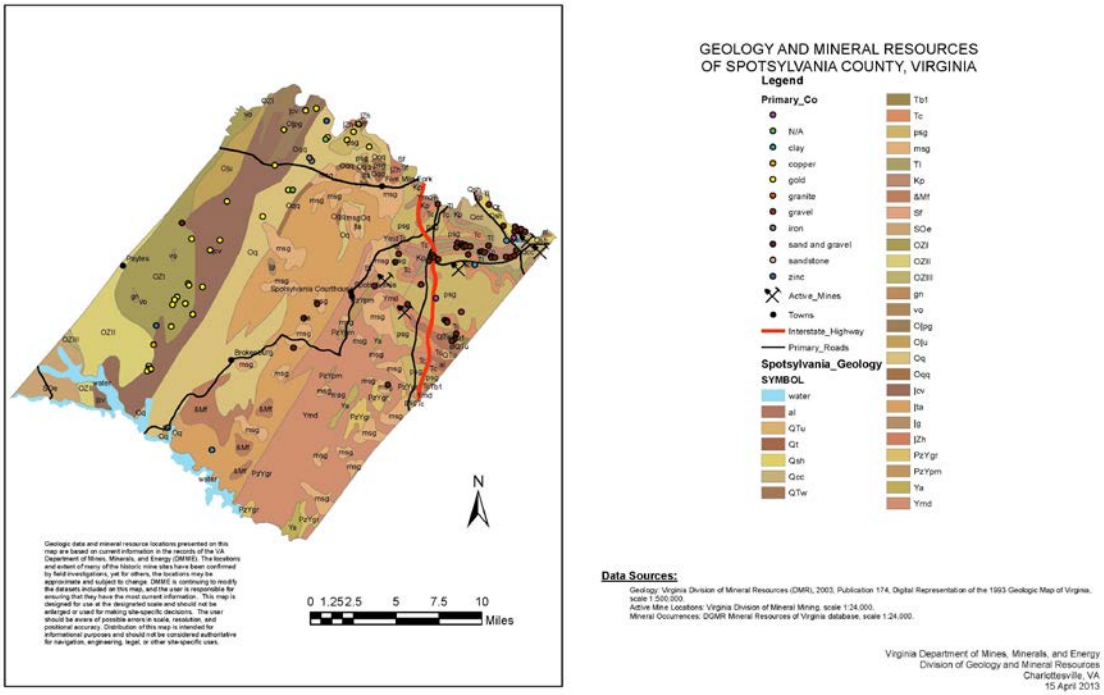
Metamorphosed Sedimentary Rocks

These rocks occur in the north/south belts within the western portion of the Piedmont area of Spotsylvania County and consist of a combination of schists, phyllites, gneisses and quartzites interlayed with igneous rocks. Rocks included in this unit have been fairly good sources of water in most areas. The chance of obtaining substantial groundwater yields depends much on encountering fractured zones within the crystalline rocks. Yields range from a few gallons per minute to over 100 gallons per minute in a few cases. A number of wells constructed for domestic uses in the county have averaged over 30 gallons per minute.

Metamorphosed Volcanic and Sedimentary Rocks

These rocks occur in north/south belts within the western portion of the Piedmont area of the county and consist of quartzites, phyllites, gneisses and schists. Most wells developed in these rocks produce less than 20 gallons per minute although a few wells have produced higher yields. Insufficient groundwater is a problem for the majority of the county for purposes other than low density residential uses. As the drain on groundwater supplies grows more severe and as intensity of use increases, less water will remain in the aquifers. In the future, reductions in residential densities may be necessary to guard against over-taxing of aquifers. The amount of impervious cover of aquifers and recharge areas associated with development further reduces the quantity of groundwater. The requirements for groundwater supply regulate the density of residential development and the extent of commercial/ industrial expansion into areas not served by a central water supply system.

GEOLOGY AND MINERAL RESOURCES MAP OF SPOTSYLVANIA COUNTY, VIRGINIA



Geology and Mineral Resources Map Unit Descriptions Source: Division of Mineral Resources, 2003, Digital Representation of the 1993 Geologic Map of Virginia, – Expanded Explanation: Publication 174)

Spotsylvania County straddles the Fall Line, a geologic zone where the sediments of the coastal plain lap up onto the metamorphic and igneous rocks of the piedmont.

Piedmont Rocks: Igneous Rocks of the Western Piedmont

OCpg *plagiogranite tonalite* (Pavlides, 1990).

Includes leucocratic to mesocratic plagioclase- and quartz-rich metamorphosed intrusive rocks containing little or no potassium feldspar. Plagioclase is variably altered to epidote, white mica, and chlorite. Quartz, generally blue, forms granoblastic aggregates that locally have cores of coarse-grained quartz with wavy extinction. Garnet is present locally. Hornblende, generally a minor constituent, is particularly abundant in the southwest portion of the pluton. Many of the plagiogranitic rocks have undergone cataclasis and are protomylonitic to mylonitic.

Piedmont Rocks: Stratified Rocks of the Western Piedmont

Mine Run complex (OZI, OZII, OZIII; Pavlides, 1989; 1990)

OZI *mélange zone I* (Pavlides, 1989).

Fine-grained schist and phyllite matrix encloses coarse-grained metasandstone beds locally; contains exotic blocks of mafic and felsic metavolcanic rocks (vo) similar to metavolcanic rocks of the Chopawamsic Formation (Ccv). Blocks of blastomylonitic tonalite and granodiorite gneiss (gn) are present locally.

OZII *mélange zone II* (Pavlides, 1989).

Schist and phyllite matrix is more complexly deformed than the matrix of mélange zone I; contains metavolcanic blocks (vo) similar to Chopawamsic Formation rocks (Ccv), in addition to granitoid blocks of altered tonalite and granodiorite (gr); intruded by the Ellisville biotite granodiorite (SOe).

OZIII *mélange zone III* (Pavlides, 1989).

Phyllite and schist matrix contains abundant euhedral magnetite; many matrix rocks are highly deformed on a mesoscopic and microscopic scale. Mafic exotic blocks (mf) include amphibolite, ultramafic rocks, serpentinite, and talc; many mafic and ultramafic blocks are composite. Biotite gneiss blocks (gn) are also present. Metavolcanic olistoliths (vo) are rare.

Geophysical signature: Strong positive magnetic anomaly. This unit is intruded by the Ellisville biotite granodiorite (SOe).

OCu *metasedimentary rocks, undivided* (Pavlides, 1990).

Gray to green phyllite, gray to white metasiltstone and fine-grained quartzite, fine-grained mica schist, green slate and phyllite, and sparse granule quartzite and graywacke; may be coeval in part with Old Mill Branch Metasiltstone Member of the Popes Head Formation (OCpo).

SOe *Ellisville biotite granodiorite* (Pavlides, 1990).

Mesocratic, coarse- to medium-grained, equigranular to porphyritic, massive to strongly foliated granodiorite. Mineralogy: quartz + plagioclase + potassium feldspar + biotite; accessories include epidote, allanite, titanite, and apatite. Porphyritic rocks contain potassium feldspar megacrysts up to 1.5 cm across; myrmekite commonly occurs adjacent to potassium feldspar. Brownish-green, strongly pleochroic biotite is associated with, and in places poikilitically encloses epidote, allanite, titanite, and apatite. Subhedral epidote locally encloses euhedral titanite. Pleochroic green amphibole and muscovite are minor constituents locally. The Ellisville has been dated at 440±8 Ma (Rb-Sr whole rock; Pavlides and others, 1982).

Rocks of the Central Virginia Volcanic-Plutonic Belt

PMf *Falmouth Intrusive Suite* (Pavlides, 1980).

Fine grained to pegmatitic granite, quartz monzonite, granodiorite, and tonalite; consists of dikes, sills and small plutons. Mineralogy: plagioclase + quartz + microcline + biotite + muscovite + hornblende ± garnet + epidote + apatite + titanite + opaque minerals; myrmekite common. The unit has been dated at 300-325 Ma (U-Pb zircon and Rb-Sr whole-rock; Pavlides and others, 1982). These rocks intrude the Ta River Metamorphic Suite (Cta), Falls Run Granite Gneiss (Sf), Holly Corners Gneiss (CZh), Quantico Formation (Oq) and porphyroblastic garnet-biotite gneiss (Ym; Po River Metamorphic Suite of Pavlides, 1980).

Sf *Falls Run Granite Gneiss* (Pavlides, 1980).

Pink to white, coarse-grained, strongly-foliated hornblende-biotite granite to monzonite gneiss. Mineralogy: microcline + plagioclase + quartz + biotite + muscovite ± hornblende; apatite, epidote, titanite, and magnetite-ilmenite are accessories; myrmekite is common. The Falls Run has been dated at 410 Ma (U-Pb zircon and Rb-Sr whole-rock; Pavlides and others, 1982); the gneiss intrudes Ta River Metamorphic Suite **(**Cta) and the Holly Corners Gneiss (CZh).

Quantico Formation (Oq, Oqq; Pavlides, 1980)

Oq *slate and porphyroblastic schist.*

Gray to black, graphitic, pyritic phyllite and slate (northern Piedmont); metamorphic grade increases to the southwest to produce porphyroblastic staurolite-, kyanite-, and garnet-biotite-muscovite schists. Locally the unit contains felsic metatuff, metagraywacke, and micaceous quartzite interbeds; thickness has been estimated at as much as 3000 feet (Pavlides, 1980). Mineralogy: quartz + muscovite + biotite ± garnet ± staurolite ± kyanite + opaque minerals; chlorite is a common secondary mineral. Geophysical signature: strike-elongated positive linear magnetic and radiometric anomalies. The unit was originally named Quantico Slate by Darton (1894), and modified to Quantico Formation by Pavlides(1980). An Ordovician age for the Quantico is indicated by fossils collected by Watson and Powell (1911) and more recently by Pavlides and others (1980). The Quantico unconformably overlies older units in the northeastern Piedmont, and is correlated with the Arvonia Formation to the southwest.

Oqq *micaceous quartzite.*

Light-gray, fine- to medium-grained quartzite and quartzose muscovite schist. Mineralogy: quartz + muscovite + plagioclase ± microcline. This lithology occurs as thin discontinuous lenses at the base of the Quantico; thin diopsidic calcsilicate layers are also found locally in the lower part of the Quantico (Pavlides, 1980).

Ccv *Chopawamsic Formation, undivided*, (Pavlides, 1981).

Includes laterally discontinuous lenses and tongues of metamorphosed felsic, intermediate, and mafic volcanic flows and volcanoclastic rocks, with interlayered quartzite, quartzose greywacke, schist, and phyllite. Volcanic flows are locally highly vesicular; fragmental breccia and tuff are common. Felsic flows are typically light-gray aphanitic rocks with phenocrysts of quartz and feldspar; intermediate flows are dark-green amphibole-bearing rocks with fine-grained quartz-feldspar matrix; greenstone metabasalts contain blue green amphibole, chlorite, albitic plagioclase, and quartz. Geophysical signature: linear strike-elongate pattern of elevated magnetic anomalies.

The Chopawamsic is correlated with the James Run Formation in Maryland; the James Run has been dated at 570 to 530 Ma (U-Pb zircon; Tilton and others 1970). The Chopawamsic is unconformably overlain by the Late Ordovician Arvonia and Quantico Formations. Pavlides (1981 and subsequent works) has made the interpretation on the basis of geologic and geochemical data that the Chopawamsic and related plutons represent an ancient island-arc sequence.

Cta *Ta River Metamorphic Suite, (undivided)*.

Layered sequence consists dominantly of greenish-gray to black, medium- to coarse-grained, poorly to well-lineated, massive to well-layered amphibolite and amphibole-bearing gneiss and schist; includes interlayered ferruginous quartzite, and minor biotite gneiss, felsic volcanic rocks, gabbro and granite. Amphibolitic rocks commonly contain quartz-epidote lenses and veins. Proportion of biotite gneiss and schist increases from northeast to southwest along strike, as does grade of regional metamorphism. Mineralogy: (hornblende, tremolite-actinolite, and cummingtonite) + quartz + calcic oligoclase ± epidote ± biotite ± garnet. Geophysical signature: linear positive and negative magnetic and radiometric anomalies.

Pavlides (1981) correlated the Ta River with the Chopawamsic and James Run Formations, and considered the Ta to be a more oceanward facies of a Chopawamsic island arc sequence, on the basis of geologic and geochemical factors. The Quantico Formation generally overlies the boundary between the Chopawamsic and the Ta, obscuring the contact relationships.

Cg *amphibole metagabbro*.

Dark-greenish-gray, coarse-grained, massive, hornblende metagabbro. Mineralogy: plagioclase + hornblende + biotite + clinopyroxene + quartz; relict olivine and myrmekitic intergrowths of quartz in other minerals are characteristic. Geophysical signature: small circular areas marked by positive magnetic anomalies. Metagabbro intrudes Ta River Metamorphic Suite.

CZh *Holly Corner Gneiss* (Pavlides, 1980; 1990).

Dark- gray to black, fine- to medium-grained, strongly-foliated hornblende-biotite-rich gneiss. Mineralogy: hornblende + plagioclase + biotite + quartz + titanite; accessory minerals include zircon, epidote, microcline, chlorite; trace amounts of apatite, calcite, muscovite, and opaque minerals are present. Myrmekitic intergrowths are common.

Rocks of the Eastern Piedmont

PzYgr *granite gneiss* (Pavlides, 1990).

Fine- to medium-grained, light-gray to white granite to tonalite gneiss; composed of biotite, oligoclase, quartz, and porphyroblastic microcline, with accessory muscovite, epidote, titanite, and magnetite; hornblende occurs locally within diffuse compositional layering. Inclusions of biotite gneiss and amphibolite are present locally. Unit occurs as irregular lenticular to tabular masses within porphyroblastic biotite gneiss (Ymd).

PzYpm *quartzofeldspathic gneiss* (Bobyarchick and others, 1981).

Light-gray, fine- to coarse-grained, foliated, layered muscovite-bearing quartzofeldspathic gneiss; contains intercalated quartz-muscovite schist. Mineralogy: quartz + plagioclase + microcline + garnet + muscovite + biotite.

Ya *amphibolite, amphibole gneiss, and schist*.

Melanocratic, fine- to coarse-grained, weakly to strongly foliated, irregularly layered amphibole-rich gneiss and schist. Mineralogy: hornblende + clinopyroxene + plagioclase + magnetite + biotite ± scapolite ± garnet ± quartz ± epidote. Geophysical signature: narrow, strike-elongate, positive magnetic anomaly. Lenses and layers of amphibolite and amphibole gneiss are interlayered with porphyroblastic garnet-biotite gneiss (Ymd). The mafic rocks constitute 50 percent or more of the section in a zone about 0.62 mile wide surrounding outcrop areas of State Farm gneiss (Ysf); farther away from the State Farm contact, lenses and layers of amphibolite and amphibole gneiss are more widely scattered, but are laterally persistent and outline map-scale structures (Marr, 1985). Amphibolite and interlayered biotite gneiss adjacent to the State Farm gneiss were named the Sabot amphibolite by Poland (1976), who characterized the formation as a tabular sheet 0.7 to 1.0 km thick. He and Goodwin (1970) interpreted these amphibolites as metamorphosed mafic volcanic or pyroclastic rocks. Glover and others (1989 and references therein) report a low-angle regional discordance between the base of the Sabot and the compositional layering in the underlying State Farm Gneiss.

Ymd *porphyroblastic garnet-biotite gneiss.*

Heterogeneous layered sequence is dominantly garnetiferous biotite gneiss and porphyroblastic gneiss, migmatitic in part, with subordinate interlayered amphibolite and amphibole gneiss (Ya), pelitic-composition gneiss, calcsilicate gneiss, biotite-hornblende-quartz-plagioclase gneiss, and garnetiferous leucogneiss. These lithologies contain amphibolite-facies metamorphic mineral assemblages consistent with rock chemistry. Farrar (1984) reports relict granulite-facies assemblages in some rocks. This unit underlies a wide area that surrounds the State Farm antiform (Poland, 1976; Reilly, 1980; Farrar, 1984) and two subsidiary antiforms to the northeast; the unit includes the Maidens gneiss and portions of the Sabot amphibolite of Poland (1976), the eastern gneiss complex and Boscobel granodiorite gneiss of Bobyarchick (1976), and the Po River Metamorphic Suite of Pavlides (1980). Poland (1976) and Reilly (1980) proposed that the Maidens gneiss and Sabot amphibolite were a Late Precambrian- to Early Paleozoic-age volcanic-sedimentary cover sequence unconformably overlying the State Farm gneiss. Farrar (1984) interpreted relict granulite-facies mineral assemblages to have equilibrated during Grenville-age regional metamorphism; this contributed to his conclusion that the Sabot and Maidens, in addition to the State Farm, are Grenville or pre-Grenville in age. Porphyroblastic garnet-biotite gneiss (Ymd) is intruded by rocks of the Carboniferous-age Falmouth Intrusive Suite (Pavlides, 1980).

Coastal Plain

al *alluvium (Holocene).*

Fine to coarse gravelly sand and sandy gravel, silt, and clay, light- to medium-gray and yellowish-gray. Deposited mainly in channel, point-bar, and flood plain environments; includes sandy deposits of narrow estuarine beaches, and mud, muddy sand, and peat in swamps and in fresh- and brackish-water marshes bordering tidewater rivers. Grades into colluvium along steeper valley walls at margins of unit. Mostly Holocene but, locally, includes low-lying Pleistocene (?) terrace deposits. As much as 80 feet thick along major streams.

QTu *Quaternary and Tertiary deposits*, undifferentiated.

Tabb through Windsor Formations and alluvial/tidal prism deposits.

Qt *Tabb Formation, undifferentiated* (upper Pleistocene, Johnson, 1976).

Sand, silt, and peat of coast-parallel plains seaward of the Suffolk and Harpersville scarps, includes coeval terrace deposits along major river valleys west to Fall Line. Subdivided into three members (Johnson, 1976).

Qsh *Shirley Formation* (middle Pleistocene, Johnson and Berquist, 1989).

Light- to dark-gray, bluish-gray and brown sand, gravel, silt, clay, and peat. Constitutes surficial deposits of riverine terraces and relict bay mouth barriers and bay flood plains (altitude 35-45 feet) inset below depositional surfaces of the Chuckatuck Formation (Johnson and Peebles, 1984). Upper part of unit is truncated on the east by the Suffolk and Harpersville scarps; locally, lower part occurs east and west of scarps. Fluvial-estuarine facies comprises (1) a lower pebble to boulder sand overlain by (2) fine to coarse sand interbedded with peat and clayey silt rich in organic material, including *in-situ* tree stumps and leaves and seeds of cypress, oak, and hickory, which grades upward to (3) medium- to thick-bedded, clayey and sandy silt and silty clay. Marginal-matrix facies in lower James River and lowermost Rappahannock River areas is silty, fine-grained sand and sandy silt containing *Crassostrea virginica*, *Mulinia*, *Noetia*, *Mercenaria*, and other mollusks. *Astrangia* from lower Rappahannock River area has yielded a uranium-series age of 184,000 ± 20,000 yrs B.P. (Mixon and others, 1982). Thickness is 0 to 80 feet.

Qcc *Charles City Formation* (lower Pleistocene (?), Johnson and Berquist, 1989).

Light- to medium-gray and light-to dark-yellowish and reddish-brown sand, silt, and clay composing surficial deposits of riverine terraces and coast-parallel plains at altitudes of 70 to 80 feet. Unit is adjacent to, and inset below, the Windsor Formation and older deposits. Bay or shallow-shelf facies of the Charles City (Johnson and Peebles, 1984), present beneath flat to gently seaward-sloping plain in Suffolk area, includes a thin, basal, gravelly sand grading upward into fine- to medium-grained sand and an uppermost clayey and sandy silt; lower and middle parts of unit contain clay-lined, sand-filled burrows. Fluvial-estuarine facies in terrace remnants along major rivers consists of cross-bedded gravelly sand and clayey silt. Thickness is 0 to 55 feet, or more.

QTw *Windsor Formation* (lower Pleistocene or upper Pliocene, Coch, 1968).

Gray and yellowish- to reddish-brown sand, gravel, silt, and clay. Constitutes surficial deposits of extensive plain (altitude 85-95 feet.) seaward of Surry scarp and of coeval, fluvial-estuarine terraces west of scarp. Fining-upward sequence beneath plain consists of a basal pebbly sand grading upward into cross-bedded, quartzose sand and massive, clayey silt and silty clay; lower and upper parts of sequence were deposited, respectively, in shallow-marine or open-bay and restricted-bay or lagoonal environments. In terraces west of Surry scarp, fluvial-estuarine deposits comprise muddy, coarse, trough cross-bedded sand and gravel grading upward to sandy silt and clay. Thickness is 0 to 40 feet.

Tb1/Tb2 *Bacons Castle Formation* (upper Pliocene, Coch, 1965).

Gray, yellowish-orange, and reddish-brown sand, gravel, silt, and clay; constitutes surficial deposits of high plain extending from Richmond, eastward to the Surry scarp. Unit is subdivided into two members: Tb1, massive to thick-bedded pebble and cobble gravel grading upward into cross-bedded, pebbly sand and sandy and clayey silt, and Tb2, predominantly thin-bedded and laminated clayey silt and silty fine-grained sand. Tb2 is characterized by flaser, wavy, and lenticular bedding and rare to common clay-lined burrows including *Ophiomorpha nodosa*. Thickness is 0 to 70 feet.

Tc *Chesapeake Group* (upper Pliocene to lower Miocene, Darton, 1891).

Fine-to coarse-grained, quartzose sand, silt, and clay; variably shelly and diatomaceous, deposited mainly in shallow, inner- and middle-shelf waters. Ages of units based on studies of foraminiferal, nannofossil, diatom, and molluscan assemblages in Virginia and adjacent states (Andrews, 1988; Gibson, 1983; Gibson and others, 1980; Poag, 1989; Ward and Blackwelder, 1980; Ward and Krafft, 1984). Includes the following formations, from youngest to oldest:

Chowan River Formation (upper Pliocene, Blackwelder, 1981).

Gray to dusky blue-green sand, fine- to medium-grained, clayey and silty, commonly very shelly; grades laterally into laminated, silty clay and upward into cross-bedded, biofragmental sand, clayey silt, and silty clay. Discontinuous pebbly to bouldery sand at very irregular base of unit. Mollusks include *Glycymeris hummi*, *Noetia*

carolinensis, and *Carolinapecten eboreus bertiensis*. Thickness is 0 to 50 feet. Recognized only in southeasternmost Virginia and North Carolina.

Yorktown Formation (lower upper Pliocene to lower Pliocene, Clark and Miller, 1906).

Bluish-gray and brownish-yellow sand, fine- to coarse-grained, in part glauconitic and phosphatic, commonly very shelly, interbedded with sandy and silty blue-gray clay. In lower York and James River basins, unit includes cross-bedded shell hash. Mollusks include *Glycymeris subovata*, *Chesapecten jeffersonius*, *Chesapecten madisonius*, *Mercenaria tridacnoides*, *Panopea reflexa*. Coarse-grained sand and gravel facies of the Yorktown in up dip areas is mapped separately as unit psg. Thickness is 0 to 150 feet.

Eastover Formation (upper Miocene, Ward and Black-welder, 1980).

Dark-gray to bluish-gray, muddy sand, very fine to fine, micaceous, interbedded with sandy silt and clay. Lower part of unit is dominantly medium- to very-thin-bedded and laminated silt and clay interbedded with very-fine sand, lenticular and wavy bedding common; upper part is mainly very-fine- to fine-grained sand containing abundant clay laminae. Typical mollusks include *Chesapecten middlesexensis*, *Marvacrassatella surryensis*, *Glossus fraterna*. Thickness is 0 to 270 feet.

St. Marys Formation (upper and middle Miocene, Shattuck, 1902).

Bluish- to pinkish-gray, muddy, very-fine sand and sandy clay-silt, locally abundantly shelly. *Chesapecten santamaria*, *Buccinofusus parilis*, and *Ecphora gardnerae* are characteristic mollusks. Occurs northeast of Mattaponi River. Thickness is 0 to 40 feet.

Choptank Formation (middle Miocene, Shattuck, 1902).

Olive-gray sand, fine to very-fine, clayey and silty, shelly, and diatomaceous clay-silt; commonly forms fining-upward sequences. Mollusks include *Chesapecten nefrens*, *Mercenaria cuneata*, *Ecphora meganae*. Thickness is 0 to 50 feet.

Calvert Formation (middle and lower Miocene, Shattuck, 1902).

Commonly consists of 2 to 7 fining-upward sequences. Each sequence includes a light- to dark-olive-gray basal sand, very fine to fine, clayey and silty, very sparsely to abundantly shelly; grades upward to sandy, diatomaceous clay-silt and diatomite. Typical mollusks include *Chesapecten coccymelus*, *Crassatella melinus*, *Ecphora tricostata*. hickness is 0 to 600 feet.

psg *Pliocene sand and gravel*.

Interbedded yellowish-orange to reddish-brown gravelly sand, sandy gravel, and fine to coarse sand, poorly to well-sorted, cross-bedded in part, includes lesser amounts of clay and silt in thin to medium beds. Commonly caps drainage divides (altitude 250-170 feet) in western part of Coastal Plain. Lower part of unit, showing flaser and lenticular bedding and containing rare to abundant *Ophiomorpha nodosa*, represents deposition in marginal-marine environments and is, in part, a near-shore equivalent of the more down dip, marine facies of the Yorktown Formation. In the northern part of the Coastal Plain, the more poorly sorted and less cleanly washed upper part of unit, which lacks fossils, comprises fluvial-deltaic sediments that prograded eastward across the shelf during a regressive phase of the Yorktown. To the south, the upper part of unit is massively bedded clayey sand in places containing heavy mineral concentrations that average 8 percent or more; the sands are near shore, beach and dune origin; interstitial clay was derived, in part, from *in-situ* weathering of feldspar sand. Thickness is 0 to 50 feet.

msg *Miocene sand and gravel.*

Fine- to coarse-grained sand, sandy gravel, silt, and clay, gray to light-yellowish-gray, commonly oxidized to yellowish-orange and yellowish-brown; pebbles and cobbles are deeply etched. Commonly caps interfluves at northwestern edge of Coastal Plain and constitutes thin Coastal Plain outliers in easternmost Piedmont where deposits directly overlie weathered crystalline rocks. In part, may represent a fluvial to marginal-marine facies of the Choptank Formation. Thickness is 0 to 30 feet.

Tl *Lower Tertiary deposits* (Oligocene, Eocene, and Paleocene).

Mostly fine- to coarse-grained glauconitic quartz sand and clay-silt, shelly in part; includes lesser amounts of sandy limestone and limey sand. In outcrop, unit comprises the Pamunkey Group (Brightseat, Aquia, Marlboro, Nanjemoy, and Piney Point Formations) and the Old Church Formation. In subsurface, unit includes Eocene and Oligocene strata not included in the Pamunkey and Old Church. Ages of formational units based on foraminiferal,

nannofossil, dinocyst, pollen, and molluscan studies (Frederiksen, 1979; Gibson and others, 1980; Gibson and Bybell, 1984; Edwards, 1984, 1989; Edwards and others, 1984; Poag, 1989; Ward, 1985; Ward and Krafft, 1984). Stratigraphic sections vary widely, comprising one or more of the following formations:

Old Church Formation (Ward, 1985) and unnamed glauconitic sands (upper Oligocene).

In inner and middle Coastal Plain, unit is 0 to 5 feet of olive-gray, fine- to coarse-grained, shelly, very sparsely glauconitic quartz sand of the Old Church Formation; typical fossils include *Anomia ruffini*, *Lucina sp*., and *Mercenaria capax*. In subsurface of outer Coastal Plain, unit includes about 45 feet of dark-olive-gray to greenish-black glauconite sand with lesser amounts of quartz; sand has olive-brown clay-silt matrix.

Lower Oligocene beds.

Olive-gray to grayish-olive sand, very-fine-grained, clayey and silty, micaceous, glauconitic; coarsens upward to a very-fine- to fine-grained sand. Unit is 0 to 50 feet thick; identified only in subsurface of Eastern Shore area (Exmore, core hole, R. B. Mixon and D. S. Powars, personal communication).

Chickahominy Formation (upper Eocene, Cushman and Cederstrom, 1945).

Predominantly olive-gray clayey silt and silty clay, very compact, glauconitic, micaceous, contains abundant finely crystalline iron sulfide. Coarsens downward to a very-fine- to fine-grained sand, pebbles at base. Rare fragmental shell, microfossils very abundant. Thickness is 0 to 100 feet; present in subsurface of southeastern Virginia.

Piney Point Formation (middle Eocene, Otton, 1955).

Olive-gray and grayish-olive-green, glauconitic quartz sand, medium-to coarse-grained, poorly sorted, contains scattered quartz pebbles, interbedded with carbonate-cemented sand and moldic limestone. Unit is characterized by large, calcitic shells of the oyster *Cubitostrea sellaeformis*, a middle Eocene marker. Aragonitic mollusks are generally leached, leaving only molds and casts. Thickness is 0 to 60 feet.

Nanjemoy Formation (lower Eocene, Clark and Martin, 1901).

Dark-olive-gray, greenish-gray, and olive-black glauconitic quartz sand, fine- to coarse-grained, very clayey and silty, intensely burrowed, sparsely to abundantly shelly, interbedded with sandy clay-silt. Sand in upper part of unit is less clayey, very micaceous, and contains scattered quartz pebbles. Typical mollusks include *Venericardia potapacoensis*, *Venericardia ascia*, and *Macrocallista subimpressa*. Unit is 0 to 140 feet thick.

Marlboro Clay (lower Eocene (?) and upper Paleocene, Clark and Martin, 1901).

Light-gray, pinkish-gray, and reddish-brown kaolinitic clay, massively bedded to laminated, interbedded with lesser amounts of laminated and ripple cross-laminated silt and very-fine-grained sand. Contains rare molds of small mollusks and arenaceous foraminifera. Thickness is 0 to 30 feet.

Aquia Formation (upper Paleocene, Clark and Martin, 1901).

Light- to dark-olive gray, glauconitic quartz sand, fine- to coarse-grained, clayey and silty, thick- to massively bedded, sparsely to abundantly shelly. Lower part of unit is more poorly sorted and more calcareous than upper part and contains a few thin to medium beds of olive-gray, white, and pale greenish-yellow limestone. Upper part of unit is moderately well sorted and characterized by thin beds of the large, high-spired gastropod *Turritella mortoni*. Other common mollusks include *Cucullaea gigantea*, *Ostrea sinuosa*, and *Crassatellites alaeformis*. Thickness is 0 to 130 feet.

Brightseat Formation (lower Paleocene, Bennett and Collins, 1952).

Olive-gray to olive-black, micaceous quartz sand, fine- to very fine-grained, clayey and silty, variably glauconitic. Thickness is 0 to 20 feet.

Kp *Potomac Formation* (Lower and Upper(?) Cretaceous, McGee, 1886).

Light-gray to pinkish- and greenish-gray quartzo-feldspathic sand, fine- to coarse-grained, pebbly, poorly sorted, commonly thick-bedded and trough cross-bedded. Sand is interbedded with gray to green, massive to thick-bedded sandy clay and silt, commonly mottled red or reddish-brown. Includes lesser amounts of clay-clast conglomerate and thin-bedded to laminated, carbonaceous clay and silt. In the inner Coastal Plain, unit was deposited mainly in fluvial-deltaic environments, intertongues eastward with thin glauconitic sands of shallow-shelf origin. Spore and pollen assemblages and leaf impressions of ferns and cycads indicate an Early Cretaceous age (Doyle and Robbins, 1977). In some down dip areas, uppermost part of unit may be of earliest Late Cretaceous

age. Thickness ranges from a featheredge at western limit of outcrop to more than 3500 feet in subsurface of outermost Coastal Plain.

MINERAL RESOURCES AND INDUSTRIES

Most of Spotsylvania County is in the Piedmont province and is under-laid by igneous and metamorphic rocks. The easternmost portion of the county is in the Coastal Plain province and is predominantly underlain by sand, gravel and clay strata that are deposited on the rocks similar to those in the Piedmont portion.

Current Production

The mining industry in Spotsylvania County presently includes five locations conducted under mineral permits mine issued by the Virginia Department of Mines, Minerals, and Energy, Division of Mineral Mining. In 2012, only three were producing: The Luck Stone Corporation's Spotsylvania granite quarry, Bardon Incorporated's sand and gravel pit, and the Kent Brothers' gravel pit. Vulcan Construction Materials holds a permit for a sand and gravel pit at New Post, Luck Stone has a permit for a granite quarry at Massaponax, but neither of these produced in 2012. The total area included under the permits is about 1,409.5 acres. Granite is quarried and crushed for roadstone and other construction purposes; Sand and gravel was produced and processed for concrete aggregate, masonry sand, road material, and other purposes.

During 2012, the latest year for which production data is available, the three active mining operations produced 1,121,180 short tons of granite, gravel, and sand and gravel valued at $14.5 million. The mines employed a total of 27 workers in 2012, not including independent contractors. Wages accounted for $1.5 million.

Past Production

In the past granite was quarried for crushed stone or dimension stone at a number of sites along the Rappahannock River, west of Fredericksburg and also along the Hazel River, south of Fredericksburg, and near Chancellorsville. Sandstone has been quarried in the Fredericksburg area for use as dimension stone. Following are some of the major inactive stone quarries and sand & gravel pits in the County:

-Alum Springs Quarry, Hazel Run, Fredericksburg (1815)
-Aquia Sandstone Quarry, Hazel Run, Fredericksburg (early 1800s)
-Willis Hill Quarry, Hazel Run, Fredericksburg (early 1800s)
-Battlefield Granite Company, 2.5 miles NW of Fredericksburg (1893-1896)
-Cartright and Davis, NW of Fredericksburg (1899-1912)
-Battlefield Granite Corporation, NW of Fredericksburg (1914-1919)
-Fredericksburg Stone Company, NW of Fredericksburg (1958-1975)
-Haney and Adair Trucking-SE of Fredericksburg (1973-1975)
-Leavells Shop Corporation, SW of Fredericksburg (1970s)
-Alfred Ventura, south Fredericksburg (1975-1976)
-Franconia Gravel Corporation, S of Fredericksburg (1975-1982)
-Massaponax Sand and Gravel Corporation, SE of Fredericksburg (1919-1990)

Mica has been mined from the Edenton mine, located in the southwestern part of the County, about a mile northeast of the North Anna River. Kyanite is found in schists in the western part of the County, and glauconitic or greensand marl is found in the eastern part of the County. Monazite, a phosphate of the rare earths, occurs in saprolite over granitic rocks near Post Oak and Five Mile Fork.

Gold was discovered in Spotsylvania County in 1806, just northwest of Shady Grove Church, and gold mining and prospecting were carried on intermittently from about forty-one sites in the northern and western parts of the County. Reported gold production from Spotsylvania County is as much as 105,300 ounces with the bulk of the production from the Whitehall, Marshall (exact_location unknown), and the United States mines. At the Valzinco mine, located near Porters, lead and zinc ore, with some copper mineralization was mined by the Bertha Mineral Co. (1909-1912), the Virginia Lead and Zinc Corp., (1914-1918), and by the Panaminas Co. from 1942-1945; 500,000 pounds of lead and 1,250,000 pounds of zinc were produced during these periods. There is also reported by-product production of gold at this mine in the 1940s. Iron ore was mined from gossans in western Spotsylvania County for use in local iron furnaces. Pyrite occurrences have been prospected in the vicinity of Chancellorsville.

Clay materials were formerly extracted for use in the manufacture of brick at Fredericksburg. Three samples of clay materials were tested and found suitable as raw materials for the manufacture of brick. These samples include a sample of Tertiary clay, 5 miles south of Fredericksburg; a sample of Tertiary clay, 3.5 miles southeast of Fredericksburg, and a sample of clay residuum over granitic rocks, located near Lewistown in the southeastern part of the County.

REFERENCES

Building Stone

Harrison, N., 1986, Fredericksburg's Battlefield Granite: Virginia Minerals, v. 32, n. 3.

Sweet, P.C., 1990, Present and future dimension stone industry in Virginia, in: Zupan A.W., and Maybin, A.H. (eds), Proceedings of the 24th Forum on the Geology of Industrial Minerals, May 2-5, 1988, Greenville, South Carolina, p. 129-135.

Webb, H.W., and Sweet, P.C., 1992, Interesting uses of stone in Virginia – Part I: Virginia Minerals, v. 38, No 4.

Clay

Calver, J.L., Hamlin, H.P., and Wood, R.S., 1961, Analyses of clay, shale, and related materials – northern counties: Virginia Division of Mineral Resources Mineral Resources Report 2, p. 170-182.

Sweet, P.C., 1982, Virginia clay material resources: Virginia Division of Mineral Resources Publication 36, p. 112-113.

Sweet, P.C., 1986, Clay-material samples collected 1981-1984, Virginia Division of Mineral Resources Publication 68.

Copper

Luttrell, G.W., 1966, Base- and precious-metal and related ore deposits of Virginia: Virginia Division of Mineral Resources Mineral Resources Report 7, 167 p.

General – mineral production

Gilmer, A.K., Enomoto, C.B., Lovett, J.A., and Spears, D.B., 2005, Mineral and fossil fuel production in Virginia (1999-2003): Virginia Division of Mineral Resources Open-File Report 05-04.

Glauconitic marl

Clark, W.B., Miller, B.L., Berry, E.W., and Watson, T.L., 1912, Physiography and geology of the Coastal Plain Province of Virginia: Virginia Geological Survey Bulletin 4, p. 90-95, 248-249.

Gold

Lonsdale, J.T., 1927, Geology of the Gold-Pyrite Belt of the northeastern Piedmont Virginia: Virginia Geological Survey Bulletin 30, p. 84-85.

Luttrell, G.W., 1966, Base- and precious-metal and related ore deposits of Virginia: Virginia Division of Mineral Resources Mineral Resources Report 7, 167 p.

Sweet, P.C., 1971, Gold mines and prospects in Virginia: Virginia Minerals, v. 17, n. 3

Sweet, P. C., 1982, Gold occurrences in Virginia, an update: Virginia Division of Mineral Resources Virginia Minerals v. 28, n. 4, p. 33-41.

Sweet, P. C., and Trimble, D., 1983, Virginia gold resource data: Virginia Division of Mineral Resources Publication 45, p. 183-192.

Watson, T.L., 1907, Mineral resources of Virginia: The Virginia Jamestown Exposition Commission, J.P. Bell Company, Lynchburg, Virginia, p. 553-554.

Granite

Steidtmann, E., 1945, Commercial granites and other crystalline rocks of Virginia: Virginia Geological Survey Bulletin 64, p. 41.

Iron
Watson, T.L., 1907, Mineral resources of Virginia: The Virginia Jamestown Exposition Commission, J.P. Bell Company, Lynchburg, Virginia.

Lead
Luttrell, G.W., 1966, Base- and precious-metal and related ore deposits of Virginia: Virginia Division of Mineral Resources Mineral Resources Report 7, 167 p.

Mica
Brown, W.R., 1962, Mica and feldspar deposits of Virginia: Virginia Division of Mineral Resources Mineral Resources Report 3.

Pyrite
Lonsdale, J.T., 1927, Geology of the Gold-Pyrite Belt of the northeastern Piedmont Virginia: Virginia Geological Survey Bulletin 30, p. 9-10, 89-90.

Poole, J.L., 1973, Iron sulfide mines in Virginia: Virginia Division of Mineral Resources Virginia Minerals v. 19, n. 3, p. 29-33.

Sandstone
Watson, T.L., 1907, Mineral resources of Virginia: The Virginia Jamestown Exposition Commission, J.P. Bell Company, Lynchburg, Virginia.

Zinc
Luttrell, G.W., 1966, Base- and precious-metal and related ore deposits of Virginia: Virginia Division of Mineral Resources Mineral Resources Report 7, 167 p.

SOILS

Soils are a basic resource consisting of air, water, mineral and organic matter. Arranged in layers called horizons, these natural formations are termed soil profiles or classifications. The composition of a soil profile is determined by various factors such as parent material, relief, climate and vegetation. Classification of soils is important for determining the best uses and development constraints of an area.

Due to its varied physiography, Spotsylvania County is one of the most diverse soil communities in Virginia. Approximately 42 soil classifications have been mapped in the county by the United States Department of Agriculture, Soil Conservation Service (SCS). These maps, along with suitability charts, are published in the Soil Survey of Spotsylvania County Virginia, which was completed in 1985.

The soil survey is the county's best source of information concerning soil locations and development constraints. However, the field data only apply to a depth of five or six feet and do not eliminate the need for on-site investigations. In addition, it is common for great differences in soil properties to occur within short distances. Also, some of the survey fieldwork may be outdated, particularly data on septic limitations. In spite of the above precautions, the soil survey remains highly useful for general planning purposes. Pertinent characteristics for water quality planning, including presence of hydric soils, septic limitations, depth of water table, shrink/swell potential, degree of slope, and erodibility/ permeability are indicated for each classification and quantified by acreage. This data enables planners to make broad, countywide assessments of soil conditions and limitations.

Overview of Soil Conditions

By and large, most of Spotsylvania's soils are conducive to development. Because of the county's rolling topography, it possesses an abundance of broad upland terraces, convex ridgetops and well drained lands. Both the Piedmont and Coastal Plain areas are dissected by well-established drainageways, which keeps the water table low and reduces the problems with ponding, flooding and saturated soil. Some central portions of the county, however, are only moderately well drained by the smaller streams prevalent in that area. In addition, limitations to development can result from underlying rock formations and steep slopes found along some of larger streams and river terraces.

In certain sensitive areas, county soils exhibit a number of characteristics, which can limit development or add significantly to development costs. The major limitations are discussed in each subsection below.

Steep Slopes

The topography of Spotsylvania County is generally rolling hills of the piedmont and flat coastal plains. However, there are areas where fairly steep slopes that exist as the result of erosion of streams over time. The steepest slopes in Spotsylvania County are along the Rapidan and Rappahannock Rivers in the northern portion of the County and along Massaponax Creek in the northeastern portion. The Steep Slopes map shows the areas of the County where steep slopes are prevalent.

The soil survey provides additional data on soils associated with steep topography. Soils classifications are often divided into phases based on certain characteristics, including degree of slope. For example, Louisburg sandy loam, 25 to 50 percent slopes, is one of several phases in the Louisburg series.

In Spotsylvania, eight (8) soil classifications are divided into steep phases (15% - 60%), as shown on the Soils Map. Roughly 9% (23,877 acres) of the county's soils are moderately sloped (15% - 25%), while an additional 3.7% (9,725 acres) of county soils exceed 25% in slope. Typically, the steeper lands are found adjacent to the county's larger streams and rivers. More precise locations of steep soils can be determined through the detailed map units in the soil survey.

Shrink-Swell Soils

Shrink/swell soils are those that shrink when dry and swell when wet. While uncommon in Spotsylvania, shrink/swell soils can result in severe and costly damage to roads, building foundations, and other structures. Most soil classifications within the county are characterized as having a low to moderate shrink/swell potential (98%). The only soils noted for high shrink/swell characteristics are Orange-Iredell loams. These particular soils are estimated to comprise only 1.3% (3,427 acres) of the county's total land area. Local shrink/swell soils are believed to be scattered in small, isolated locations within the county, usually on broad convex ridgetops or side slopes. These locations are depicted on the Shrink-Swell Soils Map, with more precise locations determined through the detailed map units in the soil survey or through soil testing.

Hydric Soils

Hydric soils are those that are sufficiently wet to support the growth and regeneration of hydrophytic vegetation. Since various state and federal laws safeguard wetlands, development activity on hydric soils is generally discouraged. Usually, the inherent wetness of hydric soils discourages development interest.

In certain instances, hydric soils may be exempt from wetland regulations, if they have been drained or converted to agricultural use (prior conversions). However, where hydric soils remain undisturbed and support wetland vegetation, development is usually prohibited or costly mitigation measures are required (e.g. construction of replacement/artificial wetlands).

Five (5) classifications within the county are considered hydric: Aqults, Cartecay, Fluvaquents/ Udifluvents, Partlow and Toddstav soils. In total, about 15% of Spotsylvania's soils (39,710 acres) are defined as hydric. If undrained, areas of hydric soils are saturated, flooded or ponded for a significant duration of the year. The water table for hydric soil generally lies just above (+12") or slightly below the surface (-36").

In Spotsylvania, hydric soils are coincident with the county's drainageways, floodplains and stream bottomlands and are depicted on the Hydric Soils Map. In a few cases, hydric soils may be found along stream terraces, toe slopes, and in upland depressions. More precise locations of hydric soils can be determined through the detailed map units in the soil survey. Many non-hydric soils in the county also contain "inclusions" of hydric soils, which can account for up to 20% of the dominant soil classification. Therefore, there may be small, isolated wetlands scattered in non-hydric areas of the county.

Erodibility/Permeability

Soil erosion is the process whereby rock and soil particles are detached from their original location by wind and water, and transported or deposited to a new site. Soil is considered highly erodible if it is easily detached or relocated. The water quality problems associated with erosion are considerable, particularly uncontrolled sediment originating from construction sites, stream embankments and agricultural fields. Mitigating sources of erosion through best management practices is a key focus of the Chesapeake Bay legislation.

Uncontrolled sedimentation can have a number of adverse consequences, particularly when transported to receiving waters. Sediments can screen sunlight to aquatic habitats and spur algae growth. Coarse soil particles can clog drainage ditches and accelerate channel scouring, while eroded fine silt can smother aquatic organisms and hinder their reproduction. A related area of concern is that many pollutants adhere themselves directly to soil particles. Urban and agricultural erosion can contain a variety of pollutants, such as petroleum products, phosphates, heavy metals, pesticides and bacteria. As a result, erosion is now considered to be the largest source of water pollution in the United States.

Soil that is highly permeable is that which allows liquid to be rapidly transmitted or percolated when the soil is saturated. This rapid rate of transmission can be downward or in slight lateral direction. Highly permeable soils can present a water quality hazard since pollutants may be transferred directly into the water supply before being adequately filtered. The use of on-site septic systems and underground storage tanks should be avoided in areas of highly permeable soils. The rapid movement of effluent through the soil diminishes its natural filtration ability, which can lead to the contamination of groundwater or nearby shallow wells. These soils are depicted on the Highly Erodible Soils Map.

Technical data on erosion can be found in Table 14 of the soil survey. The permeability and erodibility of Spotsylvania's soils have also been mapped in digital form as part of the VirGIS database. The VirGIS database defines highly erodible soils as those with an erodibility index (EI) equal to or greater than eight (8). Highly permeable soils are those having a permeability equal to or greater than six inches (6") of water movement per hour to a depth of 72". Based on the VirGIS criteria, significant portions of the county were found to be either highly erodible, highly permeable, or both.

The VirGIS analysis of county soils reveals numerous limitations to on-site septic system use. Altogether, on-site disposal methods are used by over half (59%) of all the occupied housing units in the county. In addition, 429 housing units in the county use some other means of sewerage disposal, including pit privies and direct discharges. Graywater discharges (kitchen/laundry wastewater) for the 325 housing units lacking complete plumbing also represent a water quality hazard.

Although no hard figures are available, health officials acknowledge that instances of substandard plumbing may be found in areas with permeable soils, thus exacerbating water quality problems. The following discussion provides a more in-depth look at septic suitability issues and protection policies in the county.

Septic Suitability Factors

Spotsylvania County has deferred to the Virginia Department of health's (VDH) regulations for the design and approval of onsite sewage systems. National technological advances in sewage treatment and disposal and supporting regulatory changes in Virginia have allowed alternative treatment and disposal designs to overcome many previously insurmountable site and soil limitations. VDH regulations governing design, construction, installation, and the operation and maintenance for conventional and alternative residential sewage systems and private water wells are available at: (http://www.vdh.virginia.gov/EnvironmentalHealth/Onsite/).

As stated earlier, Spotsylvania is one of the most diverse soil communities in Virginia. Great differences in soil properties occur within short distances. The ability of a site to accommodate onsite sewage septic systems is dependent on several performance-related factors. These include size of lot, slope, depth of the soil, percolation rate, filtering characteristics, susceptibility to ponding/wetness, depth of the water table, and depth to bedrock or restrictive horizons.

Site features and soil properties limit the use of septic systems in various ways. Generally, septic systems perform best when there is deep, unsaturated soil material beneath the absorption field. This allows for efficient filtering and disposal of effluent waste. The ability of a soil to absorb and treat effluent will be restricted if there is a high water table, poor permeability, or a minimal depth to bedrock. Likewise, site difficulties with bedrock or a cemented pan

can interfere with installation. Finally, groundwater can be polluted if there is hillside seepage, a high water table, fractured bedrock, or highly permeable soils (sand/gravel) below the absorption area.

Since each factor above can vary over short distances, each lot or parcel must be evaluated to determine whether it can support the proposed development, and if it can, what the size, design and location of the septic system should be. On-site evaluations, therefore, are the only definitive means of determining septic suitability for a particular parcel.

The purpose of a site evaluation is to understand the soil system and the hydrology of the site, to predict wastewater flow through the soil and into subsurface materials, and to preliminarily design a subsurface absorption system that complements the soil system and the hydrology of the site. The evaluation process is intended to allow the collection and documentation of sufficient information to determine the potential for a site to support a subsurface absorption system. A site evaluation follows a systematic approach that includes the description of surface characteristics, the interpretation of those characteristics for use in a subsurface absorption system, and the documentation of all results. The process of data collection, evaluation, and design is often repeated several times for each system. During each repetition, new information is obtained and a new design is tried until a design is developed that provides the best match with the site conditions. The comprehensive site evaluation requires considerable expertise by the evaluator. The evaluator must have substantial knowledge about soil science, geology, subsurface absorption system design, and environmental health. In Virginia, evaluators are licensed as Onsite Soil Evaluators (OSE) through the Department of Professional and Occupations Regulation (DPOR http://dpor.virginia.gov/). These certified professionals assist applicants in determining the suitability of sites for onsite sewage systems. In cases where alternative technology is required, the OSE may work in coordination with a licensed professional engineer to develop a suitable design for a system to fit lot conditions.

Generalized information on soil types and septic suitability criteria can be found in the Soil Survey. Although published in 1985, major fieldwork was gathered well prior to strengthened state laws governing on-site septic systems. Hence, the survey's performance criteria are oriented primarily towards accomplishing effluent disposal. Potential groundwater threats were not taken fully into account at that time. In spite of these recognized shortcomings, the survey remains a valuable source of information in assessing some aspects of septic suitability. The survey is available online at http://websoilsurvey.nrcs.usda.gov.

General Septic Limitations

Most major fieldwork for the county's soil survey was conducted in the late 1970's. Hence, it predates the latest environmental standards and regulatory codes pertaining to septic suitability. Nevertheless, the soil survey provides a helpful, generalized view of septic limitations within the county.

More than half of the county's soils (51%) have severe limitations for septic systems. Moderate limitations characterize 46% of the county's soils, while slight limitations represent 2.5%. Since septic suitability criteria have become more stringent in recent years, technological advances have kept pace, so these figures probably overstate the degree of septic limitations in the county.

Although Spotsylvania possesses an abundance of elevated, well-drained soils, other site factors limit the use of septic systems. Typical suitability problems in the local area include slow perk rates, shallow depth of bedrock, wetness, and steep slopes. Technology can overcome some of these limitations.

Depth of Water Table

Soils with a shallow depth to water table can pose additional constraints to development. Wet soils may readily compact under the weight of structures and settle at different rates. This can result in foundation cracks and loss of structural integrity. Costly engineering work, which is often required to successfully build on such soils, adds to the overall cost of development. In addition, the potential for wet basements, ponding and other drainage problems can reduce the desirability of such lands for development.

Approximately one third (33%) of the county's soils (88,600 acres) have a shallow depth to water table. This figure includes soils with a water table depth of less than 18" (11%); and those soils with a water table ranging between 18" - 36" of the surface (22%).

Areas with a high water table generally coincide with other sensitive features in the county, such as floodplains, stream corridors and drainageways. Upland areas of the county may also have high water tables, such as depressions or broad

terraces that are distant from sizeable drainageways. More precise locations of shallow water tables can be determined through the detailed map units in the soil survey.

Groundwater Recharge Areas

Groundwater is accumulated water under the earth's surface. Sometimes groundwater is close to the surface; sometimes it is very deep, held in underground aquifers. Groundwater can surface—or discharge—through natural means, such as in a spring, or with human help, such as in a pumped well.

Groundwater is replenished—or recharged—through surface water seeping from streams or lakes into the ground or through precipitation percolating into the ground. For the groundwater table to stay at the same level, the amount of recharge must equal the amount of discharge.

Aquifers represent a geological unit, which can store and supply significant quantities of groundwater. Aquifer recharge is a function of groundwater recharge rates. Groundwater recharge represents the net amount of water that infiltrates the soil matrix to a point below the root zone of vegetation. Groundwater recharge necessarily accounts for the loss of gross precipitation due to evapotranspiration (physical and biological uptake), consumption, and surface runoff. These losses are determined by impervious cover, slope, and soil properties affecting percolation. The quantity of groundwater making it into the aquifer is based on the geology and aquifer pumping rates, but is less well modeled than groundwater recharge. Factors such as karst geology in sedimentary formations and fractured trap rock affect the transport of groundwater into aquifers.

Urbanization, and drought poses a threat to our groundwater supply in several ways. Urban development increases the amount of impervious (nonporous) surface in a watershed. Impervious surface inhibits groundwater recharge because precipitation cannot penetrate the surface and runoff may be diverted elsewhere through storm sewer systems. In drought situations, consumption outweighs the rate of replenishment, further stressing the availability of groundwater.

Urbanization also increases the amount of pollution in our environment. If soil is contaminated or surface runoff is polluted, the quality of the groundwater will be affected. Polluted groundwater and/or a diminished supply of groundwater are of particular concern where groundwater is the major source for drinking and irrigation water. This is especially important for areas reliant on private well and septic systems. In Spotsylvania County, roughly 84% of the County's total land area is located outside of the County's Primary Development Boundary (where public water and sewer is provided), and therefore reliant on private well and septic systems.

Citizens can help protect groundwater supplies by:

- Don't pour toxic or hazardous waste down the drain, into a toilet, on the ground, or into storm drains.
- Properly dispose of litter and pet waste.
- Don't dump anything into a sinkhole.
- Don't use or store fertilizers, pesticides, gasoline or any toxic materials near a well.
- Pump out septic tanks regularly.
- Use porous material such as flagstone, gravel, stone, or interlocking pavers rather than asphalt or concrete.
- Conserve water in your home and landscape.

WATER RESERVOIRS

In Spotsylvania County, publicly accessible water reservoirs provide a source of potable water for residents or a cooling function for the generation of power. They also provide natural resource preservation, natural habitat preservation, recreational opportunities for fishing and electric motor boating. Reservoirs are protected locally with Reservoir Protection Overlay District, created for the purpose of protecting and promoting the public health, safety and welfare by preserving existing and potential public drinking water supply reservoir sites and protecting them from the danger if water pollution. Regulations within such districts are established to prevent water quality degradation due to pollutant runoff from septic fields, construction sites, lawns or material storage areas and to reduce sediment loadings that shorten reservoir life.

Ni Reservoir

The Ni Reservoir is a 411-acre Spotsylvania County water supply reservoir located near Chancellorsville. Angler success is very good at this impoundment for largemouth bass in the 15" size range and the potential exists for an occasional trophy

fish. There are also bluegill, redear sunfish, chain pickerel, white perch, and crappie available in good numbers for anglers to pursue.

Motts Run Reservoir

Motts Run is a city of Fredericksburg water supply reservoir located in Spotsylvania County. It is a steep-sided, 160-acre lake that is normally quiet and receives light fishing pressure. The shoreline is undeveloped, making it one of the more scenic lakes in Northern Virginia.

Hunting Run Reservoir

Hunting Run Reservoir is a 420-acre water supply reservoir owned and operated by Spotsylvania County. The lake was stocked by the Virginia Department of Game and Inland Fisheries and opened to fishing by Spotsylvania County in fall, 2007. There is one access point near the upper end of the lake off Ely's Ford Road. The lake has an excellent largemouth bass population that is currently "bass heavy" or "predator heavy", and size structure has recently shifted downward. The combination of the lake reaching full pool in 2009 (productivity surge) combined with additional planned forage stockings and highly encouraged angler harvest of bass below the slot should allow the population to realize its trophy potential.

Lake Anna

Lake Anna was created in 1972 by Virginia Power to provide condenser-cooling water for the North Anna Power Station. Since its impoundment, the lake has developed into a multi-use reservoir serving not only the needs of the power company, but also providing opportunities for boating, fishing, skiing, wind surfing, as well as extensive residential, business, and commercial development. These opportunities around the lake provide an economic benefit to the local economy, and are dependent on the water quality of the lake to support and maintain the recreational setting.

The Virginia Department of Environmental Quality (DEQ) coordinates with the Lake Anna Citizen Association (LACA) to perform water quality monitoring of Lake Anna on a yearly basis. Overall, the main body of the lake meets the water quality standards for the recreation (bacteria) and aquatic life (dissolved oxygen, pH, temperature, nutrients) uses. Lake Anna does not support the fish consumption use however. The entire lake is listed with a PCB impairment, due to a Virginia Department of Health, Division of Health Hazards Control, PCB fish consumption advisory. There is also a portion of the main lake that is also listed with a mercury impairment, based upon fish tissue data.

Dam Break Inundation Zones

The Spotsylvania utilities department has been engaged in the study of County dam break inundation zones for existing dams at the Hunting Run Reservoir, Ni Reservoir, and Motts Run Reservoir. These dams were put in place in the creation of local water supply reservoirs.

The Inundation Zone is the area that encompasses the affected downstream features should a dam break regardless of the current condition of the dam. The Dam Break Inundation Zone is determined using a computer model simulated dam break prepared by a professional engineer. The potentially impacted features such as homes, roads, commercial buildings, etc. dictate and result in the Hazard Classification designations. Dam Break Inundation Zone Computer Modeling and Mapping is required by the Virginia Department of Conservation and Recreation for all regulated dams for Hazard Classification (Exception for dams determined to be Special Criteria Low Hazard).

Private owners of regulated dams are required to provide the Inundation Zone Mapping to the local County of City authority for inclusion into municipal mapping. In Spotsylvania County, the dams at Lake Anna and Fawn Lake are examples. Their inundation zones have been studied and pictured in local mapping.

The computer model simulated dam break can be used for an Incremental Damage Analysis to determine if the minimum required spillway capacity could be lowered without increasing the hazard downstream to people or facilities. If the owner of a dam elects to have this work done, it must be done by a professional engineer.

WETLANDS

Wetlands are a valuable natural resource. They reduce floodwater damage by storing the floodwater for slow release, serve as groundwater discharge and recharge areas, improve water quality, and provide food and habitat for fish and wildlife. In addition, wetlands can be recreational and aesthetic resources. Two major legislative acts protect wetlands from alteration, destruction or potential misuse: The Clean Water Act of 1972 as amended, and the Chesapeake Bay Preservation Act of 1988.

Wetlands are defined as transitional lands between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is covered with shallow water. Wetlands must have the following three attributes: 1) at least periodically the land supports hydrophilic vegetation; 2) the substrate is predominantly undrained hydric soils; 3) the substrate is non-soil and is saturated with water or covered with water at some time during the growing season. This means that lands flooded at least a week at a time with supporting aquatic vegetation are generally considered to be wetlands.

Presence of Water

The physical nature of wetlands varies from place to place as well as season to season. As a result, the extent of wetness required to identify a wetland area may be a source of confusion to the untrained. Certain kinds of wetlands may have standing water on them throughout the year while others have water on the surface for a short period of time or not at all.

Wetland Vegetation

Wetland vegetation is characterized by hydrophytes. According to the National Audubon Society, hydrophytes are a special group of plants that can tolerate various degrees of flooding, or live in frequently saturated areas. It is a rather large group. There are whole scores of different kinds of wetland plants. These hydrophytes are distinctive in that they can only live in the conditions that wetlands provide. Thus they are good indicators of wetlands, and are used to delineate wetlands. An example of a hydrophyte would be a water lily.

Hydric Soils

Wetland soils are different from their upland counterparts. The presence of water affects the soil development. They are usually a gray color and have mottles (uneven spots or blotches) present. The technical definition says that hydric soils are soils that are saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper part.

Significance of Wetlands

Water Quality Control

- chemical and organic waste processing
- nutrient removal and transformation
- sediment retention

Due to their position between upland and deep water, wetlands can intercept surface water runoff from land and filter floodwaters. The way wetlands remove pollutants from the water supply has to do with the biotic life they support. Aquatic organisms such as algae and bacteria take up minerals and breakdown organic matter.

If sewerage is added upstream, the organic level will have been considerably reduced by the time the water has traveled several miles. Wetlands and wetland plants are nutrient traps and really help reduce air and water pollution problems. Runoff from development areas is a big source of wetland contamination. Runoff from agricultural areas tends to contain high levels of nitrogen and phosphorous, the two major chemicals of fertilizers. Runoff from urban sites is usually polluting the water with dangerous chemicals and/or domestic sewage. But wetlands are very efficient at removing this waste from the environment.

Flood Control

- hydrologic cycle
- water storage

Wetland soils act like a living sponge and soak up the rain, letting it enter the ground water system. The wetland also acts as a temporary storage basin or depression, wetlands are a perfect place for excess flood water to go. Wetlands lower flood crests and lessen the danger of flash floods downstream, therefore reducing the likelihood of flood damage. They "protect crops in agricultural areas as well as protecting roads, buildings, and human health and safety".

Groundwater Recharge

- critical groundwater recharge areas
- groundwater discharge

With growing urban development there are becoming significantly fewer areas available for groundwater recharge. It is increasingly important to conserve wetlands to keep some of these areas open. Wetlands are also important for groundwater discharge. Wetlands release the water they store slowly to provide long-term base-flow to streams and lakes. They also provide a steady source of moisture for the local climate.

Erosion Control

- sediment stabilization
- shoreline buffer
- wave attenuation
- current velocity
- storms
- ice

Wetlands on the shores and banks of rivers, ponds and beaches do many things to prevent erosion. Wetland plants growing on the banks stabilize the shore material. Their roots bind the soil and make it harder to erode. Wetlands along the shores and banks also prevent erosion by reducing the force of the moving water. The wetland's presence causes friction of the wave or current movement, lessening its power to erode.

Fish and Wildlife Diversity and Abundance

- habitats for rare and endangered species
- habitats for waterfowl and other birds
- fish spawning and nursery grounds
- home to many species of plants
- biodiversity

A large number of animals and plant types require wetland habitats for survival. Many of these organisms live primarily in wetlands, like the wood duck, muskrat, cattail, and swamp rose. Other types, like the peregrine falcon and white tail deer, don't directly reside in wetlands, but they rely on them for survival. The wetlands provide food, water, and cover for these animals - all essentials for living. Many of the organisms that need wetlands to survive are endangered species. "More than one-third of the nation's threatened and endangered species live only in wetlands and nearly one-half of these species use wetlands in some point in their lives". Acre for acre swamps often equal rain forests in biological diversity.

Food Chain Support

- detritus

Wetlands can be regarded as the farmlands of the aquatic environment since great volumes of food (plant material) are produced by them annually. The wetland food chain starts with detritus, which is "dead leaves and stems that break down in the water to form small particles of organic matter". Small aquatic invertebrates and forager fish eat the detritus. Then larger predatory fish hunt and eat these invertebrates and forager fish. Finally man catches and eats the larger predator fish.

Recreation

- nature observation
- education
- hunting and fishing

There is a substantial tourist trade in wetlands every year. "More than one-half of adults in the US hunt, fish, birdwatch, or photograph wildlife. Wetlands are usually very beautiful places in their own right. They are good places to enjoy nature through hiking, boating and other recreational activities. One can get a first-hand look at ecological processes, such as energy flow, recycling, and limited carrying capacity. Wetlands are essentially "living museums" or "outdoor laboratories" important for their educational qualities. Wetlands also support a large trade of recreational fishing and hunting.

Natural Products for Human Use

- seafood harvesting
- fish
- shellfish
- timber production
- peat moss mining
- fur trapping

Humans have harvested many things from natural wetlands. Seafood is a very important product strongly tied to wetlands. According to the National Oceanic and Atmospheric Administration (NOAA) Annual Commercial Landing Statistics, U.S. commercial fishermen landed 8.2 billion pounds of seafood in 2010, valued at $4.5 billion, an increase of 200 million pounds and more than $600 million in value over 2009. By 2011, U.S. commercial fishermen saw further increase, landing approximately 9.9 billion pounds of seafood, valued at $5.3 billion.

According to the Commercial Landing Statistics, Virginia's commercial fishermen landed approximately 494 million pounds of seafood in 2011, valued at about $191 million, up from $184 million in 2010.

The collection of U.S. commercial fisheries landings data is a joint state and federal responsibility. The cooperative State-Federal fishery data collection systems obtain landings data from state-mandated fishery or mollusk trip-tickets, landing weighout reports provided by seafood dealers, federal logbooks of fishery catch and effort, and shipboard and portside interview and biological sampling of catches. State fishery agencies are usually the primary collectors of landings data, but in some states NOAA Fisheries and state personnel cooperatively collect the data. Survey methodology differs by state, but NOAA Fisheries makes supplemental surveys to ensure that the data from different states and years are comparable.

Statistics for each state represent a census of the volume and value of finfish and shellfish landed and sold at the dock rather than an expanded estimate of landings based on sampling data. Principal landing statistics that are collected consists of the pounds and ex-vessel dollar value of landings identified by species, year, month, state, county, port, water and fishing gear. Most states get their landings data from seafood dealers who submit monthly reports of the weight and value of landings by vessel. Increasingly, however, states are switching to mandatory trip-tickets to gather landings data. At the conclusion of every fishing trip, seafood dealers and fishermen indicate their landings by species on trip-tickets and may be required to record other data such as fishing effort and area fished.

Managed Wetlands

In managed wetlands, the water level is actively managed for a specific purpose.

- rice paddies
- cranberry bogs
- blueberry crops
- catfish farms
- storm-water management facilities
- wildlife refuges
- duck hunting clubs

Five Major Classifications and Characteristics of Wetlands

A classification system was established and adopted by the US Fish and Wildlife Service on December 12, 1977. This classification system was established due to the increased recognition of the value of wetlands and the need for more defined, reliable classification information that could be accepted universally amongst all other government agencies. This system allows for better inventory, evaluation, and management of wetland areas. This system defines five major classifications of wetlands: Marine (oceanic), Estuarine (tidal), Riverine (river), Lacustrine (lake), and Palustrine (marsh or swamp). Marine and estuarine habitats include coastal wetlands such as tidal marches and mangrove swamps. Lacustrine, riverine, and palustrine wetlands represent freshwater systems and account for 90% of the nation's wetland inventory.

Lacustrine wetlands are associated with lakes, riverine wetlands are found along rivers and streams, and palustrine wetlands include marshes, swamps and bogs.

Marine System

This system consists of the open ocean overlying the continental shelf. Marine habitats are exposed to the waves and currents of the open ocean and the characteristics of the water are determined by the ebb and flow of the oceanic tides. Salinities exceed 30%. An example of a marine system wetland is a mangrove swamp.

Estuarine System

This system consists of deep water tidal habitats and adjacent tidal wetlands that are usually semi-enclosed by land but have sporadic access to the ocean water that is usually diluted by freshwater runoff from the land. This system includes both estuaries and lagoons. Examples are the Chesapeake Bay and Chincoteague Bay, and the Lower Rappahannock below its fall line.

Riverine System

This system includes all wetlands and deeper habitats contained within a channel except for habitats with water containing ocean derived salts in excess of .5%. The riverine system is bound on the landward side by upland, by the channel bank (including natural and man-made levees), or by wetland dominated by trees, shrubs, mosses or lichens. The water is usually, but not always, flowing in this type of system. The Upper Rappahannock and the Ni and Po Rivers are categorized as this type of system.

Lacustrine System

This system includes wetlands and deep water habitats with the following characteristics: situated within a topographic depression or a dammed river channel, may lack trees, shrubs, mosses or lichens, and the total area may exceed 20 acres. The waters may be tidal or non-tidal. This system includes permanently flooded lakes and reservoirs (Lake Superior), intermittent lakes, and tidal lakes (Grand Lake, Louisiana). Within Spotsylvania County, this system includes Lake Anna, the Ni and Motts Run Reservoirs, and other ponds throughout the county.

Palustrine System

This system groups the tidal and non-tidal vegetated wetlands traditionally called by names such as marsh, swamp, bog and fen that are found throughout the United States. It also includes the small, shallow, permanent or intermittent water bodies often called ponds. Palustrine systems may also occur as islands in lakes or rivers, in isolated catchments, or on slopes. In Virginia, this system includes the Great Dismal Swamp.

WATERSHEDS

There are three main watersheds that drain Spotsylvania County, dividing the County into north, central, and south. Descriptions of the watersheds are as follows:

Rappahannock Watershed

The northern portion of the County is drained by the Rappahannock River watershed, a Major Chesapeake Bay watershed whose tributaries include Massaponax Creek, Deep Run, Hazel Run, Motts Run, Mine Run, Hunting Run, and Wilderness Run.

Potentially the most valuable natural resource in the area, the Rappahannock River has considerable scenic, recreational, and historical attributes. In the past, the River served as an important transportation corridor. Today, it is considered a promising source of water for domestic and industrial consumption. The Rappahannock River is the cleanest major tributary flowing into the Chesapeake Bay, and the maintenance of that distinction is essential to efforts to restore Virginia's estuary. The protection of this resource should be of paramount importance to localities along the River.

Spotsylvania County borders on two separate and distinct sections of the Rappahannock River. Above the fall line, the river is a free flowing fresh water stream winding its way through high-forested bluffs. Development that has occurred above the fall line has posed no immediate threat to the river, in part due to the fact that much of the shoreline is owned by the City of Fredericksburg, thereby establishing an effective, though narrow, buffer. The river below the fall line is tidal and its shores have seen greater development of many types: industrial, residential, recreational, and agricultural. Below the fall line are also located a number of wastewater treatment facilities, two of them in Spotsylvania County. Because the two

sections of the Rappahannock River are so different, actions to protect the river will be different for each. In addition to the Rappahannock, there are many valuable resources along the County's networks of streams. Stream corridors are relatively undeveloped because of the presence of floodplains and steep slopes. In addition, these areas are often wooded, making them excellent buffers for filtering out impurities in water moving toward a stream, and good wildlife corridors.

Mattaponi Watershed

A minor watershed whose tributaries include the Matta River, Po River, and Ni Rivers drain the center portion of Spotsylvania County. The Mattaponi drains into the York River watershed, a major Chesapeake Bay watershed, whose tributaries include York River, Pamunkey River, Mattaponi River.

Lake Anna Watershed

Lake Anna Watershed, whose tributaries include the North Anna River, Plentiful Creek, Northeast Creek and a portion of Terry's Run and Foremost Run drains the southern portion of the County. The Lake Anna watershed drains into the larger York River Major watershed. The Lake Anna watershed is that portion of the landscape that collects and provides the water flow to maintain water levels in the lake. Comprising three hundred and forty two (342) square miles, or 218,860 acres in portions of the three (3) counties that border the lake: Louisa (57.4%), Orange (22.3%) and Spotsylvania (20.3%).

The watershed is approximately twenty-eight (28) miles long extending from the main dam on the eastern edge of the watershed to the edges of Gordonsville and Orange on the western edge. At the widest point the water shed is approximately eighteen (18) miles wide extending from Louisa on the southern boundary to the intersection of Routes 522 and 20 on the north.

STREAM, RIVER CORRIDORS AND SHORELINES

Virginia Scenic River Program

The Rappahannock River, extending from its headwaters near Chester Gap to Ferry Farm is a designated Virginia Scenic River. Managed by the Virginia Department of Conservation and Recreation (DCR), the Virginia Scenic Rivers Program's intent is to identify, designate and help protect rivers and streams that possess outstanding scenic, recreational, historic and natural characteristics of statewide significance for future generations. This program is managed by the state and should not be confused with the federal Department of the Interior's Wild and Scenic Rivers Program. One of the program's strengths is the partnership forged between citizens, local governments and the state. This partnership begins in the evaluation phase and continues through and after the designation process.

Scenic river designations result from initiatives from partnerships of local groups, local governments, state agencies and the Virginia General Assembly. In addition to existing designated state scenic rivers, other river segments have been deemed worthy of further study. See *Virginia Outdoors Plan Chapter VII-F Scenic Rivers* (PDF), pages 152-160, for more detail.

The program's focus is on enhancing the conservation of scenic rivers and their corridors. State and federal agencies must take into consideration how projects and programs affect state scenic rivers. DCR is ready to help localities develop planning tools for their use in enhancing the conservation and protection of scenic river corridors. Ultimately, the locality decides what to institute.

The program's enabling legislation is the Virginia Scenic Rivers Act of 1970, §10.1-400.

Public and Private Access to Waterfront Areas

The six Chesapeake watershed states and the District of Columbia have all noted a high need for additional access in their State-wide Comprehensive Outdoor Recreation Plans (SCORPS), public access plans, and boating infrastructure plans. In Virginia's current SCORP, for example, the highest ranked outdoor recreation need is for better public access to the state's waters.

Throughout the six-state Bay region, water-based recreation—including fishing, all types of boating, swimming, and beach use—are among the top twelve activities based on the percent of the population participating in each activity. Wildlife observation and enjoying a water-related view from observation decks or the water's edge are also highly desirable.

The Strategy for Protecting and Restoring the Chesapeake Bay Watershed was released in May 2010, in response to Executive Order 13508 (Chesapeake Bay Protection and Restoration). This strategy includes a key goal to "Conserve Land

and Increase Public Access." Specifically, the strategy aims to increase public access to the Bay and its tributaries by adding 300 new public access sites by 2025. The basis for this goal lies in the long-standing public demand for greater access to the water in the Chesapeake Bay watershed, a 64,000 square-mile watershed with 17 million residents.

Consistent with the past public access planning efforts of the Chesapeake Bay Program, all tidal streams and bays with boating opportunities are included in the planning area. The plan covers "fifth-order streams" and higher. Stream order is a system for classifying streams and rivers based on a scale of 1 to 12, with first-order streams being the smallest and twelfth-order the largest. Typically, first- through third-order streams are small headwater tributaries. The Amazon, largest river in the world, is a twelfth-order stream. Within the Chesapeake watershed, the lower Susquehanna and lower Potomac are seventh-order streams; the Shenandoah River, a tributary of the Potomac, is a sixth-order stream; the York River is also a sixth-order stream, while one of its tributaries, the Pamunkey River, is a fifth-order stream. Fifth-order streams are large enough to offer canoe/kayak use during at least some part of the year.

About one third of existing public access sites throughout the Chesapeake watershed offer multiple types of recreational experiences. Specifically, 303 of the 1,150 existing public access sites offer two types of access, 95 sites offer three types of access, and five sites offer all four types of recreational access. The remaining 747 sites offer a single type of recreational access.

There are 699 existing public access sites that offer boating access (42 percent of total sites), 614 sites that offer fishing access, 267 sites that offer viewing access, and 78 sites that offer swimming access. It is worth noting that wildlife viewing and swimming occur at many sites not specifically designed for these uses.

The cost of developing the different types of access varies depending on the type of facility planned, the location, and characteristics of the proposed site. The most variable factor is the price of the land to be acquired for the access site. In some cases, the land is already in public ownership; in other cases, the land will have to be purchased. The cost of land in tidal areas of the state is dependent on its characteristics. Well-drained land above the floodplain, which is suitable for development of septic drain fields, has a higher value than low, poorly-drained land. Also, land fronting on deep water has a higher value than land adjacent to shallow waters to be suitable for boating. Lands that suffer from severe erosion generally cost less than stable or accreting lands.

Locally, existing access includes local and federal parks that front on the river in the city. Access is limited to a number of points along the Fredericksburg riverfront. East of the City of Fredericksburg there is no public access to the river in Spotsylvania County. The Chesapeake Bay Watershed Public Access Plan identifies a potential future boat launch access site near the confluence of the Rapidan and Rappahannock Rivers, a location within the City of Fredericksburg Rappahannock River easement. This is considered a Category 2 site, requiring additional planning and review, prior to development. The Plan acknowledges that the identification of potential access sites is not a closed or static process. New opportunities for access will continue to be identified over time by citizens, non-governmental organizations, and local, state, and federal government.

The Rappahannock River east of the city in Spotsylvania County has been recognized locally as a potential public access site, offering citizens additional public access opportunities along the Rappahannock River, to provide boating, bank fishing, picnicking, and other recreational uses. This section of the river could be easily accessible by vehicles off Route 17.

The Department of Health has a number of regulations that could impact existing or proposed public access sites.

- Local health department inspectors must approve any construction that requires development of a septic field to treat wastewater.
- The Bureau of Shellfish Sanitation is concerned about the public's health related to the consumption of oysters. Shore development, including marinas, are continually evaluated to determine effects of water quality and impacts on shellfish beds.
- The Division of Waste Water Engineering requires the development of adequate sanitary facilities in all new marinas, including pump out capability for boats.

EXISTING PROTECTION POLICIES: WATER RELATED RESOURCES

Legislation and Programs

Federal

The Clean Water Act calls for "maintaining and restoring the chemical, physical and biological integrity of our nation's waters." It covers every aspect of water-related topics in the United States. The part that pertains to wetlands is regulated by the U.S. Army Corps of Engineers (Corps) under Section 404, which regulates what you can build on or fill in a wetland with; it covers every kind of wetland, whether it's salt or freshwater, public land or private. The use of fill or dredged materials constitutes a pollutant, and is regulated by the Corps. The purpose of this legislation is that if there is a more efficient way to achieve the desired results, the permit will be denied. The Corps can only issue permits that are not contrary to the public interest. In addition, the Corps can only permit the least environmentally damaging practicable alternative.

The permits are approved by the Corps, who evaluate the applications based on the recommendations of the Environmental Protection Agency (EPA). The EPA sets the standards for review and the Corps complies. The EPA can veto a permit issued by the corps if it feels that the permit has been issued erroneously, but it rarely does. Both agencies share the authority to decide what constitutes a wetland, and other governmental agencies (like the Fish and Wildlife Service and the National Marine Fisheries Service) also provide input. As a result, definitions quite frequently either overlap or leave gaps, and there can be much dispute throughout the permit review process. However, the vast majority of Corps permits are general permits and have all environmental documentation provided by and approved by the agencies in advance.

To review a permit, the Corps performs an environmental assessment of the area and first determines whether jurisdictional streams and/or wetlands are present on a property. Subsequently, the impact of the proposed activity in jurisdictional areas is determined. If there is a way to achieve less impact to the aquatic environment, the Corps will make the appropriate recommendations and ask the applicant to amend the application.

To improve the efficiency of the federal review process, the Corps has developed several general permits to include nationwide permits, regional permits and programmatic permits for activities on similar scope and minimal adverse impacts to the aquatic environment. For common requests, most nationwide permits are easily verified by the Corps. However, Department of the Army permits (individual permits) are issued or denied based on a public interest review on a case-by-case basis. For instance, nationwide permits can be granted for small-scale activities like riprap, bulkheads, and dredge and/or fill projects involving less than 25 cubic yards of fill. Several nationwide permits require notification procedures and may not be easily verified if federally listed endangered or threatened species are involved or if historic properties that are listed or eligible for listing in the National Register of Historic Places.

Enforcement of these regulations can be difficult, as compliance is largely voluntary. If someone decides to forego the permit process, it is possible the infraction will go completely undetected. In most cases, the Corps depends on the public for surveillance of unauthorized activities. Perpetrators may face penalties that include suspension, revocation of permits, fines, civil or criminal prosecution, and enforced mitigation processes.

One form of wetland mitigation is the process of "wetland banking"; that is, the Corps will allow the altering of a wetland if other wetlands are created to compensate for the loss of the wetlands. Mitigation operates on a ratio basis. In the Norfolk District the mitigation ratios are as follows: 2:1 mitigation for the loss of forested wetlands, 1.5:1 for the loss of scrub/shrub wetlands and 1:1 for the loss of emergent wetlands. For example, if a builder proposes to fill five acres of forested wetlands then he would need to provide 10-acres of forested wetlands somewhere else. This is generally done in one of two ways: an artificial wetland is constructed, or the builder will purchase 10-acres of wetland credits from an approved wetland mitigation bank.

State

Chesapeake Bay Act

The Commonwealth of Virginia adopted the Chesapeake Bay Preservation Act in September 1989 to partially fulfill provisions of an interstate regional agreement made in 1984 between the states of Virginia, Maryland, Pennsylvania and Washington, D. C. The Bay Act mandates all Tidewater Virginia localities to establish programs, plans and ordinances to protect and improve Bay water quality. Spotsylvania is one of the 89 jurisdictions affected by the Bay Act. All of these communities border tidal waters, such as the Rappahannock River, Chesapeake Bay, or their tributaries; and have a considerable, cumulative impact on water quality.

The Bay Act legislation requires localities to establish programs to ensure compliance with the established goals set forth in the Bay Act. The initial program included a comprehensive inventory of the environmental characteristics of the locality, the identification of environmentally sensitive areas and their designation as such in officially adopted protection districts comprised of Resource Protection Area, Resource Management Areas and Intensely Developed Areas. The second component of the program includes adoption of performance criteria for guiding site development, and the provision of non-point source pollution standards to protect state water quality.

After preliminary environmental inventories were conducted, a designation was made of the Resource Protection Areas (RPAs) and the Resource Management Areas (RMAs). In 1992, the County adopted criteria for land use development in these areas.

Tidal Wetlands Act of 1972

The enactment of the Tidal Wetlands Act of 1972 gave the Virginia Marine Resources Commission (VMRC) the responsibility for issuing *tidal* wetlands permits under Chapters 12 and 13 of Title 28.2 of the Code of Virginia and authorizing localities to adopt their own wetlands zoning ordinances. This means that each locality has the option of imposing their own restrictions on top of those outlined at the federal and state level. At the state level, the Department of Environmental Quality (DEQ) and the VMRC further oversee the use of the Clean Water Act.

In the absence of a local wetland board, the VMRC is responsible for administering the permitting process. If there is a local board, the responsibility of issuing permits rests with them, and they do so based on guidelines set by the VMRC and the Virginia Institute of Marine Sciences (VIMS).

Virginia Water Protection Permit Program

The Department of Environmental Quality (DEQ) Virginia Water Protection permit (VWPP) program serves as Virginia's Section 401 certification program for federal Section 404 permits issued under the authority of the Clean Water Act and the Commonwealth's nontidal wetlands program under the State Water Control Law, independent of 401 certification.

DEQ VWPP program strives to protect state waters, which are defined by State Water Control Law (62.1-44.3) and VWP program regulations (9VAC 25-210) as *all water, on the surface and under the ground, wholly or partially within or bordering the Commonwealth or within its jurisdiction, including wetlands,* through the issuance of a VWP permit or the certification of Corps nationwide permits (NWP) or regional permits (RP). Permits issued by the VWP permit program protect state waters by ensuring no net loss of wetland acreage and function through mitigation requirement similar to the Corps outlined above and by avoidance and minimization of the wetland impacts to the maximum extent practicable. However, some activities are excluded, as detailed in Virginia Administrative Code 9 VAC 25-210-60, from requiring any type of VWP permit due to provisions in the law.

VWPP program conducts compliance inspections on mitigation and construction sites in order to ensure compliance with regulations and permit conditions and also investigates reports of alleged unpermitted activities in wetlands and initiates enforcement actions if alleged violations of law or regulation are found. Responses to alleged noncompliance and unpermitted impacts can result in various levels of resolution and can range from no action to referral to enforcement and potential penalties.

Water Quality Assessment Integrated Report

Many of the rivers and streams comprising the County's watersheds have been monitored and assessed by the Virginia Department of Environmental Quality (DEQ), and a few have been included in Total Maximum Daily Load (TMDL) studies, included in the DEQ's 305(b)/303(d) Water Quality Assessment Integrated Report. This Integrated Report (IR) pulls together the surface water data collected in Virginia and compares the information to the established water quality standards. The report provides details for those waterbodies that do not meet one or more of the water quality standards, including the TMDL development status. After a waterbody has been identified as impaired, a TMDL (Total Maximum Daily Load) is developed to identify the sources and determine the reductions of those sources needed for a waterbody to meet the water quality standards.

The report satisfies the requirements of the U.S. Clean Water Act sections 305(b) and 303(d) and the Virginia Water Quality Monitoring, Information and Restoration Act. The goals of Virginia's water quality assessment program are to determine whether waters meet water quality standards, and to establish a schedule to restore waters with impaired water quality.

Water quality standards designate uses for waters. There are six designated uses for surface waters in Virginia:

- aquatic life
- fish consumption
- public water supplies (where applicable)
- recreation (swimming)
- shellfishing
- wildlife

Additionally, several subcategories of aquatic life use have been adopted for the Chesapeake Bay and its tidal tributaries. The standards define the water quality needed to support each of these uses. If a water body contains more contamination than allowed by water quality standards, it will not support one or more of its designated uses. Such waters have "impaired" water quality. In most cases, a cleanup plan (called a "total maximum daily load") must be developed and implemented to restore impaired waters.

The table below provided by the Virginia Department of Environmental Quality contains information for the listed impaired streams in the Final 2010 Water Quality Integrated Report (IR). The information is organized by waterbody, with the waterbody type identified. The specific segments of the waterbody that are listed in the 2010 IR are given, as well as a description of where the segment begins and ends. The impaired designated use is listed, along with the cause and a link to the TMDL report if one has been completed.

There are a couple of things about this information that should be noted:

1. Some portions of an identified segment may fall outside of the Spotsylvania County boundary.
2. The impairment information is from the Final 2010 IR. There are some changes to this information in the Draft 2012 IR. They may be some segments that are identified here that are no longer listed as impaired, or there may be new impaired segments listed.
3. Those aquatic life impairments that are suspected to be caused by natural conditions will undergo investigation to determine if the causes of the impairment are from natural conditions or from anthropogenic sources. Depending on the result of this study, a TMDL may not be needed.

Table 2: Impaired Resources

Waterbody Name	Waterbody Type	Segment ID	Location	Impaired Designated Use	Cause	TMDL	Report Link
Rapidan River	River	VAN-E18R_RAP03A02 VAN-E18R_RAP02A02 VAN-E18R_RAP01A02	Segment begins at the confluence with Wilderness Run, rivermile 7.78, and continues downstream until the confluence with the Rappahannock River.	Fish Consumption	Mercury in Fish Tissue	No	
		VAN-E18R_RAP03A02	Segment begins at the confluence with Wilderness Run, rivermile 7.78, and continues downstream until the confluence with Middle Run.	Recreation	Escherichia coli	Yes	Bacteria TMDL for the Rapidan River Basin
Wilderness Run	River	VAN-E18R_WIL01A08	Segment begins at the confluence of North Wilderness Run and South Wilderness Run and continues downstream until the confluence with the Rapidan River.	Recreation	Escherichia coli	Yes	Bacteria TMDL for the Rapidan River Basin
Hazel Run	River	VAN-E20R_HAL01A00	Segment begins at the Route 95 crossing and continues downstream until the confluence with the Rappahannock River.	Fish Consumption	PCBs	No	
				Recreation	Escherichia coli	Yes	Bacteria TMDL for the Tidal Freshwater Rappahannock River Watershed
Massaponax Creek	River	VAN-E20R_MAP02A02	Segment begins at the confluence with an unnamed tributary to Massaponax Creek, just upstream of Route 1, and continues downstream until the confluence with another unnamed tributary, approximately 0.25 rivermile upstream of Ruffins Pond.	Aquatic Life	pH	No	
		VAN-E20R_MAP04A02 VAN-E20R_MAP03A02 VAN-E20R_MAP02A02	Segment begins at the confluence with an unnamed tributary, approximately 1.1 rivermiles downstream from Route 673, and continues downstream until the confluence with another unnamed tributary, approximately 0.25 rivermile upstream of Ruffins Pond.	Recreation	Escherichia coli	Yes	Bacteria TMDL for the Tidal Freshwater Rappahannock River Watershed
Motts Run Reservoir	Reservoir	VAN-E19L_MOT02A02 VAN-E19L_MOT01A02	Entire Motts Run Reservoir waterbody	Fish Consumption	Mercury in Fish Tissue	No	
Rappahannock River	Estuarine	VAN-E20E_RPP03A02 VAN-E20E_RPP02A02 VAN-E20E_RPP01A02	Segment begins at the fall line at Route 1 and continues downstream until the outlet of waterbody VAN-E20E.	Fish Consumption	PCBs	No	
				Recreation	Escherichia coli	Yes	Bacteria TMDL for the Tidal Freshwater Rappahannock River Watershed
Plentiful Creek	River	VAN-F07R_PLT01A00	Segment begins at the confluence with an unnamed tributary to Plentiful Creek, upstream from the Route 601 bridge, and continues downstream until the confluence with Lake Anna.	Recreation	Escherichia coli	Yes	Bacteria TMDL for York River Basin
Terrys Run	River	VAN-F07R_TRY03A08	Segment begins at the headwaters of Terrys Run and continues downstream until the confluence with Horsepen Branch.	Recreation	Escherichia coli	Yes	Bacteria TMDL for York River Basin
				Fish Consumption	PCBs	No	
Music Branch	River	VAN-F09R_MUS01A06	Segment begins at the headwaters of Music Branch and continues downstream until the confluence with Northeast Creek.	Recreation	Escherichia coli	Yes	Bacteria TMDL for the Pamunkey River Basin
Northeast Creek	River	VAN-F09R_NST03A08	Segment begins at the confluence with an unnamed tributary to Northeast Creek, at rivermile 9.39, and continues downstream until the confluence with another unnamed tributary to Northeast Creek, approximately 0.67 rivermiles upstream from Route 622.	Recreation	Escherichia coli	Yes	Bacteria TMDL for the Pamunkey River Basin
		VAN-F09R_NST01A08	Segment begins at the confluence with an unnamed tributary to Northeast Creek and continues downstream until the confluence with the North Anna River.	Recreation	Escherichia coli	No	*TMDL Currently Under Development*
		VAN-F09R_NST04A08 VAN-F09R_NST03A08	Segment begins at the confluence of Knights Branch with Music Branch, forming Northeast Creek, and continues downstream until the confluence with another unnamed tributary to Northeast Creek, approximately 0.67 rivermiles upstream from Route 622.	Aquatic Life	Dissolved Oxygen	No	*Suspected Natural Conditions*
		VAN-F09R_NST04A08 AND VAN-F09R_NST02A98	Segment begins at the confluence of Knights Branch with Music Branch, forming Northeast Creek, and continues downstream until the confluence with an unnamed tributary to Northeast Creek, approximately 2.28 rivermiles downstream from Route 208. AND Segment begins at the confluence with an unnamed tributary to Northeast Creek, approximately 0.67 rivermiles upstream from Route 622, and continues downstream until the confluence with another unnamed tributary to Northeast Creek.	Aquatic Life	pH	No	
Brock Run	River	VAN-F15R_BRK01A06	Segment begins at the confluence with Wash Branch and continues downstream until the confluence with the Ni River.	Recreation	Escherichia coli	No	
Ni River	River	VAN-F15R_NIR01A00	Segment begins at the confluence of an unnamed tributary to the Ni River, approximately 0.95 rivermiles downstream from the Route 608 bridge, and continues downstream until the confluence with the Po River, forming the Poni River.	Aquatic Life	Benthic-Macroinvertebrate Bioassessments	No	
Glady Run	River	VAN-F16R_GDY01A10	Segments begins at the headwaters of Glady Run and continues downstream until the confluence with the Po River.	Recreation	Escherichia coli	No	
Po River	River	VAN-F16R_POR01A10	Segment begins at an unnamed tributary to the Po River and continues downstream until the confluence with the Ni River, forming the Poni River.	Recreation	Escherichia coli	No	
Matta River	River	VAN-F18R_MTA01A00	Segment begins at the confluence with an unnamed tributary to the Matta River, approximately 0.5 rivermile upstream from the Route 646 bridge, and continues downstream until the confluence with the Poni River, forming the Mattaponi River.	Recreation	Escherichia coli	No	
		VAN-F18R_MTA02A04	Segment begins at the confluence of the Mat River and the Ta River and continues downstream until the confluence with an unnamed tributary to the Matta River, approximately 0.5 rivermile upstream from Route 646.	Aquatic Life	Benthic-Macroinvertebrate Bioassessments	No	
Ta River	River	VAN-F18R_TAR01A00	Segment begins at the confluence with Bluff Run, approximately 0.7 rivermile upstream from Route 738, and continues downstream until the confluence with the Mat River, forming the Matta River.	Aquatic Life	Dissolved Oxygen	No	*Suspected Natural Conditions*
					pH	No	
Ni River Reservoir	Reservoir	VAN-F15L_PNB01A02 VAN-F15L_NIR02A02 VAN-F15L_NIR01A02	Entire Ni River Reservoir waterbody	Fish Consumption	Mercury in Fish Tissue	No	
Lake Anna	Reservoir	VAN-F07L_TRY01A04 AND VAN-F07L_NAR01A02	Segment includes the Terrys Run arm of Lake Anna. AND Segment includes the lower portion of Lake Anna, beginning near the northern end of the Route 690 bridge, and continues downstream until the dam.	Fish Consumption	Mercury in Fish Tissue	No	
		VAN-F07L_TRY01A04 VAN-F07L_PMC02A02 VAN-F07L_PMC01A04 VAN-F07L_PLT01A04 VAN-F07L_NAR04A06 VAN-F07L_NAR03A02 VAN-F07L_NAR02A02 VAN-F07L_NAR01A02	Entire Lake Anna waterbody	Fish Consumption	PCBs	No	

Virginia Marine Resources Commission

A joint permit application process for authorization of work in the waters of the Commonwealth of Virginia is available from Local Wetlands Boards, the Virginia Marine Resources Commission, the Virginia State Water Control Board, the Tennessee Valley Authority, and the U.S. Army Corps of Engineers. The Virginia Marine Resources Commission functions as the clearinghouse for the joint permit application.

The Virginia Marine Resources Commission permit program is authorized by Title 62.1, Waters of the State, Ports and Harbors, Section 62.1, Authority Required for Use of Subaqueous Beds, and Chapter 2.1, Wetlands. These laws require permits for the use of state-owned bottomlands and tidal wetlands.

Comprehensive Coastal Resource Management for Tidewater Virginia Localities

The following coastal resource guidance, provided by the Virginia Institute of Marine Science (VIMS) applies to the tidal extent of the Rappahannock River. The County is working to create its own shoreline and eco environment document to address the non-tidal tributaries, streams, creeks and rivers. County environmental staff is currently working with Caroline County on researching non-tidal tributaries, creeks, streams and river shoreline restoration and preservation that will address our common watersheds and will be easily adaptable for the entire county.

Issue Statement

Coastal ecosystems reside at the interface between the land and the water, and are naturally very complex. They perform a vast array of functions that encompass biological, chemical and physical processes. Humans derive benefits from coastal ecosystems such as habitat, water quality, and shoreline stabilization.

For example, coastal wetlands absorb nutrients that drain off the upland. This is an important filtering process that improves water quality in the adjacent receiving waters. Humans benefit from having good water quality; therefore, the wetland is providing a service in that capacity.

Beaches and dunes are another component of the coastal ecosystem valued by humans. Although typically regarded for their recreational value, beaches and dunes also provide a number of other important direct and indirect services. Beaches and dunes provide habitat, foraging and nesting areas for shore birds, turtles, and crustaceans, among other organisms. They also act as the first line of defense to incoming high energy storm waves and therefore provide an important function protecting uplands from erosion and structural loss.

The science behind coastal ecosystem resource management has revealed that traditional resource management practices limit the ability of the coastal ecosystem to perform many of these essential functions. The loss of these services has already been noted throughout coastal communities in Virginia as a result of development in coastal zone areas, coupled with common erosion control practices. Beaches and dunes are diminishing due to a reduction in a natural sediment supply. Wetlands are drowning in place as sea level rises and barriers to inland migration have been created by construction of bulkheads and revetments. There is great concern by scientists at the Virginia Institute of Marine Science and on the part of the Commonwealth of Virginia that the continued armoring of shorelines and construction within the coastal areas will threaten the long-term sustainability of coastal ecosystems under current and projected sea level rise.

In the 1980s, interest arose in the use of planted wetlands to provide natural shoreline erosion control. Today, a full spectrum of living shoreline design options is available to address the various energy settings and erosion problems found. Depending on the site characteristics, they range from marsh plantings to the use of rock sills in combination with beach nourishment. Studies have found that these approaches minimize impacts to the natural coastal ecosystems while successfully combating shoreline erosion.

Research continues to reinforce the principle that an integrated approach for managing tidal shorelines enhances coastal resources. Therefore, adoption of new guidance and shoreline best management practices for coastal communities is now necessary to insure that functions performed by coastal ecosystems will be preserved and the benefits derived by humans from coastal ecosystems will be maintained into the future.

Policy Statement

In 2011, the Virginia Assembly passed legislation to amend §28.2-1100 and §28.2-104.1 of the Code of Virginia and added section §15.2-2223.2, to codify a new directive for shoreline management in Tidewater Virginia. In accordance with section §15.2-2223.2, all local governments shall include in the next revision of their comprehensive plan beginning in 2013, guidance prepared by the Virginia Institute of Marine Science (VIMS) regarding coastal resource management and, more specifically, guidance for the appropriate selection of living shoreline management practices. The legislation establishes the policy that living shorelines are the preferred alternative for stabilizing eroding shorelines. Adoption of the VIMS shoreline guidance will help communicate to stakeholders, including private and public property owners, contractors, and developers the Commonwealth's preference for a living shorelines approach wherever possible.

This guidance, known as Comprehensive Coastal Resource Management Plans, is being prepared by VIMS for localities within the Tidewater region of Virginia. It explicitly outlines where and what new shoreline best management practices should be considered where coastal modifications are necessary to reduce shoreline erosion and protect our fragile coastal ecosystems. This guidance will include a full spectrum of appropriate management options which can be used by local governments for site-specific application and consideration of cumulative shoreline impacts. The guidance applies a decision-tree method using a based resource mapping database that will be updated from time to time, and a digital geographic information system model created by VIMS.

Chesapeake Bay TMDL Phase I Watershed Implementation Plan

The Phase I Watershed Implementation Plan (WIP) was developed by the Commonwealth of Virginia as required by the U.S. Environmental Protection Agency (EPA) as an implementation plan for the Chesapeake Bay Total Maximum Daily Load (TMDL).

The Chesapeake Bay TMDL WIP can become a continuation of work begun with Virginia's Tributary Strategies in 2005. In Spotsylvania, those strategies included the York River Tributary Strategy and the Rappahannock River Tributary Strategy.

The Chesapeake Bay TMDL Phase I Watershed Implementation Plan charts out actions necessary to achieve the Chesapeake Bay TMDL allocations between now and 2025 with the greatest emphasis on actions planned between now and 2017. It incorporates the principles of adaptive management so that the success or failures of actions can be evaluated and adjustments to programs and strategies are made. The plan incorporates the experience of tributary strategy development along with new knowledge and new tools.

The WIP acknowledges shortcomings in available data or in our ability to analyze data where this is an issue. The actions proposed will be based on the best available science and data, but we expect the base of knowledge and information to expand and to make adjustments accordingly in consultation with affected stakeholders and the Environmental Protection Agency (EPA). Virginia is also bound by the provisions of state law that require cost evaluations along with a benefit analysis for implementation plans. Adjustments to this plan will be considered based on cost effectiveness and other key factors.

Although the Chesapeake Bay TMDL is often discussed and thought of conceptually as a single TMDL, it is comprised of 92 segments. Virginia contributes drainage to 39 segments within the watershed. All 39 segments are listed as impaired for excessive nutrients and sediments.

The WIP contains pollution loads allocated or assigned to different source sectors of nitrogen, phosphorus and suspended solids. These sectors include wastewater treatment plants, agriculture, forest, urban stormwater, onsite/septic and air sources that contribute to the nutrient and sediment (also referred to as total suspended solids or "TSS") problems of the Chesapeake Bay. The plan also provides broad strategies proposed to meet those allocations. In accordance with federal expectations, those strategies and contingencies included in the plan are intended to meet reasonable assurance requirements for the Chesapeake Bay TMDL. However, we acknowledge that this is a plan and does not confer any additional budgetary, regulatory or legal authority to governmental agencies. Any programs or strategies that are not currently authorized by state law or regulation may be pursued through the legislative process or through the Virginia Administrative Process Act.

Considering the WIP, Virginia Soil and Water conservation Districts, Regions, and localities have developed strategies aimed at improving TMDL's by sector through a number of measures including implementation, capacity building, or new Best Management Practice (BMP) approach.

Upper York River Basin Watershed Implementation Plan

The Virginia Total Maximum Daily Load (TMDL) program is a process to improve water quality and restore impaired waters in Virginia. Specifically, TMDL is the maximum amount of pollutant that a water body can assimilate without surpassing the state water quality standards for protection of the five beneficial uses: drinking water, recreational (i.e., primary contact/swimming), fishing, shellfishing, and aquatic life. If the water body surpasses the water quality criteria during an assessment period, Section 303(d) of the Clean Water Act (CWA) and the United States Environmental Protection Agency's (USEPA) Water Quality Management and Planning Regulation (40 CFR Part 130) both require states to develop a TMDL for each pollutant.

Beaver Creek, Mountain Run, Pamunkey Creek, Plentiful Creek, and Terrys Run were initially placed on the Commonwealth of Virginia's Section 303(d) List of Impaired Waters in 1998 for exceeding of the bacteria standard. Goldmine Creek was initially placed on the list in 2004 for exceeding of the bacteria standard. After these listings, a TMDL study was conducted in 2005 to identify bacteria sources in the watersheds and set limits on the amount of bacteria these rivers can tolerate and still maintain support of the Recreational Use.

A TMDL Implementation Plan (IP) was developed to reduce bacteria levels to attain water quality standards allowing delisting of the impaired waters from the Section 303(d) List. The TMDL IP describes control measures, which can include the use of better treatment technology and the installation of best management practices (BMPs), to be implemented in a staged process. Local support and successful completion of the implementation plan will enable restoration of the impaired water while enhancing the value of this important resource for the Commonwealth. Opportunities for Louisa, Orange, and Spotsylvania Counties, local agencies, and watershed residents to obtain funding will improve with an approved IP.

Health District

The Rappahannock Health District (VDH) provides environmental health services in Spotsylvania County. The Spotsylvania Office has three (3) Environmental Health Specialists assigned in the onsite program and two (2) in food protection. The Specialists also have responsibilities in rabies control, nuisance complaint and abatement, emergency preparedness and other duties as assigned.

Local environmental offices are tasked with managing the records for onsite systems in that locality. They review and issue approval for construction permits for well and septic systems, inspection reports, and provide quality assurance for private sector permits and approvals. In Spotsylvania County, most construction permits are prepared by OSE or PE's working in coordination with an OSE.

At present, the County enforces the Chesapeake Bay Act which specifies minimum pump out requirements and reserve area requirement for new onsite systems, and has adopted the minimum state sanitary regulations as promulgated by the Health Department. Those regulations establish minimum standards for septic system capacity, minimum separation distance between drainfields and the water table, minimum setbacks to wells and from impounded and natural waterways.

By law, local governments have the authority to adopt ordinances or regulations that are more stringent than State Health Department Regulations. The County has the option to further strengthen or tailor the State Code to meet its local site and soil performance conditions. Neighboring jurisdictions have customized their sanitary codes in various ways to protect sensitive resources.

Local Zoning and Ordinances

Local governments have a major role to play in maintaining the health of the Chesapeake Bay environment. Through the judicial administration of zoning laws and subdivision and land use ordinances, local governments influence how land will be used and how and where development will take place. The zoning of land uses ensures that land is protected from incompatible uses and that development activities follow the intent of the local comprehensive plan. Careful administration of these land use controls provides local governments with the tools they need to manage growth and to keep it within the carrying capacity of the local infrastructure. Local zoning, subdivision, and site plan review ordinances should be consulted in developing public access sites. These tools may also be used to protect good public access resources.

To better understand the problem one must remember that in the past the Rappahannock and York rivers both were noted for their aquaculture and recreational uses including commercial/recreational fishing and swimming. These activities have been drastically curtailed due to the increasing degradation of the water quality within these 2 rivers that ultimately flow to the Chesapeake Bay. Several factors related to land use and their associated land disturbances have impacted our watersheds through the years.

The identified contributing activities in the past were focused on urbanization, farming, timbering & gold mining however they have recently been redefined to focus on sediment transport and introduced fertilizer.

There is not one factor, entity or use that needs to be considered but all of them in their entirety must be focused on to stop the continuing deterioration of water quality. Storm events do not discern as to the development, farm, forest or mine nor a specific use or practice being performed. The stormwater runoff does use the land that is devoid of vegetation to move the water and its associated sediment quickly. The stormwater runoff will also pick up the unused portions of fertilizer (nitrogen & phosphorous) that is being introduced to the ground and relocate it in the creeks, streams, rivers and ultimately the bay.

To help better understand the activities that must be monitored, they break down into the following two (2) sections to be considered

1. Land disturbance; these are activities that are related to the actual removal of the vegetative ground cover which have traditionally been through development, farming, silviculture & mining within the commonwealth.
2. Fertilization (nitrogen & phosphorous); these are activities that have been closely related to pet waste, fertilizing lawns and agricultural crops/activities.

When considering the many factors that have impacted the water quality of the Commonwealth's waters one item must be considered as a major contributing player. The amount of water flow from impervious surfaces need to be reduced through practices that will allow the water to re-infiltrate into the soil as it was doing before any land disturbance activity occurred. The introduction of low impact development

(LID) techniques by means of infiltration facilities, landscaping and vegetative buffer will help to achieve this goal and promote a better water quality of stormwater runoff.

Other significant pollution includes industrial discharges and the discharges from municipal sewage treatment plants (STPs), of which there are six along the river. If improperly treated, the discharge from the wastewater plant can introduce chlorine, bacteria, and nutrients into the receiving waters, with the potential to cause harmful environmental effects.

Resource Protection Area (RPA)

Resource Protection Areas are buffer areas consistent with the Bay Act and include tidal shores, tidal wetlands, non-tidal wetlands and tributary streams, and a 100-foot wide buffer area located adjacent to and landward of the aforementioned features and along both sides of any tributary stream. This buffer area acts to filter run-off from developed areas, to provide natural stabilization of soils from forces of tidal and upland erosion, and to provide a setback which protect dwellings from erosion, wave action, and flooding. The total amount of land designated as RPAs in Spotsylvania County is estimated to be 12,800 acres, or roughly 5% of the county's total land area.

Development in the RPA is limited to water-dependent facilities and redevelopment. In the RPA, a 100 foot buffer of vegetation that is effective in limiting runoff, preventing erosion, and filtering non-point source pollution from runoff must be retained if already present, or established if it does not exist. Clearing in the RPA is limited to what is necessary to provide for reasonable views of the water, and for general woodland management purposes. Cleared vegetation must be replaced with other vegetation is equally effective in protecting water quality.

Resource Management Area (RMA)

In Spotsylvania County all land outside of the designated RPA is designated as a Resource Management Area. The RMA is protected by the County's Chesapeake Bay Preservation Ordinance (CBPO) and the County Design Standards Manual through the establishment of standards which apply to all development and redevelopment activities.

Resource Management Areas are intended as buffer areas outside of the RPAs wherein environmental factors are still significant to warrant water quality protection. These include areas where development impacts should be mitigated through the implementation or application of design guidelines and performance criteria. These areas include floodplains, highly erodible soils (including steep slopes), highly permeable soils, hydric soils, and isolated non-tidal wetlands not included in the RPA.

The CBPO and Design Standards require that no more land should be disturbed than is necessary to provide for the desired use or development. On-site impervious cover must be minimized, indigenous vegetation should be preserved, on-site sewage disposal systems not requiring a VPDES permit must be pumped at least once every five years, an on-site 100% reserve sewage disposal site must be provided, stormwater runoff must be controlled with the use of best management practices, and on lands where agricultural activity is taking place a Chesapeake Bay Conservation Plan is required.

<u>Reservoir Protection Overlay District</u>

Reservoir protection overlay districts are created for the purpose of protecting and promoting the health, safety and welfare by preserving the existing and potential public drinking water supply reservoir sites and protecting them from water pollution. Regulations within such districts are established to prevent water quality degradation due to pollutant runoff from septic fields, construction sites, lawns, agricultural lands or material storage areas and to reduce sediment loadings that shorten reservoir life. This district is in addition to and overlays all other zoning districts where it is applied, so that any parcel lying in such an overlay district shall also lie in one or more zoning district. The minimum lot size for any residential use

where such lot is contiguous to a reservoir site is five acres for lots to be served by private septic systems and two acres for lots to be served by public sewer.

River Protection Overlay District

River protection overlay districts are created for the purposes of promoting the public health, safety and welfare through the protection of valuable river resources that provide or may provide drinking water and recreational opportunities. Regulations within such districts are established to prevent water quality degradation due to pollutant runoff from septic fields, construction sites, or material storage areas. This district is in addition to and overlays all other zoning districts where it is applied. The effect is to create a new district that has the characteristics and limitations of the overlay district.

The minimum lot size for a single-family dwelling in river protection overlay districts is five acres for lots to be served by private septic systems. Lots to be served by public water and sewer, or public well and public sewer are subject to the lot size requirements of the underlying zoning district, which in most cases is two acres within subdivision and one acre outside of subdivision.

In addition to any use limitations in the underlying zoning districts, the following use limitations apply in the River Protection Overlay District:

- The placement of septic fields within the one-hundred-year floodplain is prohibited.
- Before the issuance of a land-disturbing permit for any activity that will disturb more than ten thousand (10,000) square feet of land, a site plan for the control or erosion and sediment runoff must be submitted to and approved by the department of utility construction and erosion control (single-family dwellings outside of subdivisions are exempt from this requirement).
- The aboveground storage of hazardous liquid materials, including fuel oil, pesticides, herbicides, etc., in bulk greater than one thousand (1,000) gallons without approved containment structures is prohibited.

Floodplains

The Floodplains map shows the level of the 100-year floodplain in Spotsylvania County. One hundred-year floodplains are defined as areas with a one percent chance of being flooded in any given year. In order to qualify for flood insurance, the Federal Emergency Management Agency (FEMA) requirements prohibit development within the floodway (water channel) and strongly discourage development in the adjacent 100-year floodway fringe.

Massaponax Creek Watershed Plan

The Friends of the Rappahannock (FOR), in partnership with Spotsylvania County received a Small Watersheds Program Grant from the Alliance for the Chesapeake Bay to develop and implement a water quality management plan for the Massaponax Creek watershed. The "Rapid Watershed Planning Handbook" will be used for this planning effort. The goal of this plan is to assist the County in preserving water quality and riparian corridors within the context of continued economic development. The Plan serves to guide the development of the County's regional stormwater plan, and well as future Comprehensive Plan revisions. Additionally, this project will use the planning process as a means to:

- Educate County staff, elected officials and citizens on the importance of watershed/ resource based planning:
- Reduce nutrient and toxics loads by specifying state-if-the-art stormwater management and site design practices;

- Demonstrate and model effective watershed planning to other localities; and Cultivate an informed and active grassroots constituency of FOR in the water shed, increasing their capacity to advocate locally for water quality protection.

FLORA AND FAUNA

Spotsylvania Natural Heritage Resources

Natural heritage resources as defined by the Virginia Department of Conservation and Recreation – Division of Natural Heritage (DCR) are the habitat of rare, threatened, or endangered plant and animal species, unique or exemplary natural communities, and significant geologic formations such as caves and karst features. Spotsylvania is currently home to 24 distinct types of natural heritage resources with 37 total occurrences throughout the county (Table I: Natural Heritage Resources). In addition, DCR has identified 22 terrestrial and aquatic conservation sites as areas necessary for their survival.

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 are polygons built around one or more rare plant, animal, or natural community designed to include the element and, where possible, its associated habitat, and buffer or other adjacent land thought necessary for the element's conservation. 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.

An example of a conservation site in Spotsylvania County is Hamilton's Thicket Conservation Site. In addition to multiple rare species and habitat types found here, the site/ecosystem are critically important because of the geographic location. 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, 1 being most significant. Hamilton's Thicket Conservation Site has been given a biodiversity significance ranking of B3, which represents a site of high significance.

The natural heritage resources associated with this conservation site are:

Coastal Plain / Outer Piedmont Acidic Seepage Swamp G3/S3/NL/NL
Coastal Plain Depression Wetland G3?/S2/NL/NL

Coastal Plain / Outer Piedmont Acidic Seepage Swamp
©2006, DCR-DNH, Gary P. Fleming

The Coastal Plain / Outer Piedmont Acidic Seepage Swamp (*Acer rubrum – Nyssa sylvatica – Magnolia virginiana – Viburnum nudum – Osmunda cinnamomea – Woodwardia areolata* Forest,), is an acidic groundwater saturated swamp forest that ranges from southeastern New York and New Jersey to southeastern Virginia, primarily on the Coastal Plain. In Virginia, it occurs mostly in the inner (western) portion of the Coastal Plain and the extreme eastern portion of the Piedmont. This community occurs in nutrient-poor soils in stream headwaters, where abundant groundwater is discharged in springs and seeps. The soil typically consists of muck or shallow peat over sandy mineral soil, with Sphagnum-covered hummocks and pools of standing water also present. The vegetation is a closed-canopy forest with red maple (*Acer rubrum*) and black gum (*Nyssa sylvatica*) typically dominant. Characteristic understory trees and shrubs include sweetbay magnolia (*Magnolia virginiana*), possum-haw (*Viburnum nudum*), and sweet pepperbush (*Clethra alnifolia*). The herbaceous flora is usually rich in sedges and ferns, especially cinnamon fern (*Osmunda cinnamomea*) and netted chain fern (*Woodwardia areolata*). Skunk-cabbage (*Symplocarpus foetidus*) forms large colonies early the growing season in many stands. This uncommon wetland habitat is vulnerable to alteration or destruction by beavers and various anthropogenic activities including hydrologic modifications (NatureServe, 2010).

Coastal Plain Depression Wetland
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The Coastal Plain Depression Wetland is a seasonally flooded forest of shallow seasonal ponds and other, more irregular basin depressions of the Chesapeake Bay region. The habitat is flooded up to 50 cm deep during the winter and spring, but typically draws down early in the summer. The substrate is characterized by mineral soils, generally acidic, gleyed to mottled, sandy or clay loams. Characteristic tree species include red maple (*Acer rubrum*), sweet gum (*Liquidambar styraciflua*), and black gum (*Nyssa sylvatica*), which are nearly constant in the canopy. Mature stands, however, usually contain willow oak (Quercus phellos) as an overstory dominant or co-dominant. Associates include American holly (*Ilex opaca*), southern magnolia (*Magnolia virginiana*), swamp tupelo (*Nyssa biflora*), sassafras (*Sassafras albidum*),pin oak (*Quercus palustris*), and loblolly pine (*Pinus taeda*. The shrub layer is characterized by fetterbush (*Leucothoe racemosa*), highbush blueberries *(Vaccinium formosum* and *V. fuscatum*), sweet pepperbush (*Clethra alnifolia*), winterberry (*Ilex verticillata*), and swamp azalea (*Rhododendron viscosum)*. Roundleaf greenbriar (*Smilax rotundifolia*) is a particularly characteristic vine. Herbs characteristic of these communities are well adapted to periods of submersion and are generally sparse.

This community type has been greatly reduced since European settlement by draining and clearing for agricultural conversion. Ongoing threats include ditching, damage from timber harvests, ATV incursions, and adjacent agriculture with insufficient buffers to protect from pesticide and fertilizer use. Since this community depends on groundwater hydrology, depletion of the water table is a serious threat in developed areas. (NatureServe, June 5, 2012)

Potential Threats to Natural Heritage Resources:

The single greatest threat to natural heritage resources is the ongoing conversion of habitat to residential and commercial development. Forest removal, and increased impervious surfaces can influence water quality, and aquatic natural communities. Alteration of the local hydrology by land disturbance can change or eliminate terrestrial habitat. Fragmentation of forests and the introduction of invasives, both flora and fauna, can have a direct effect on the survival of many native plants and the resources that rely upon them for survival. Threats to the Natural Communities include incompatible development, and recreational activities, invasive species; and incompatible agricultural and forestry practices.

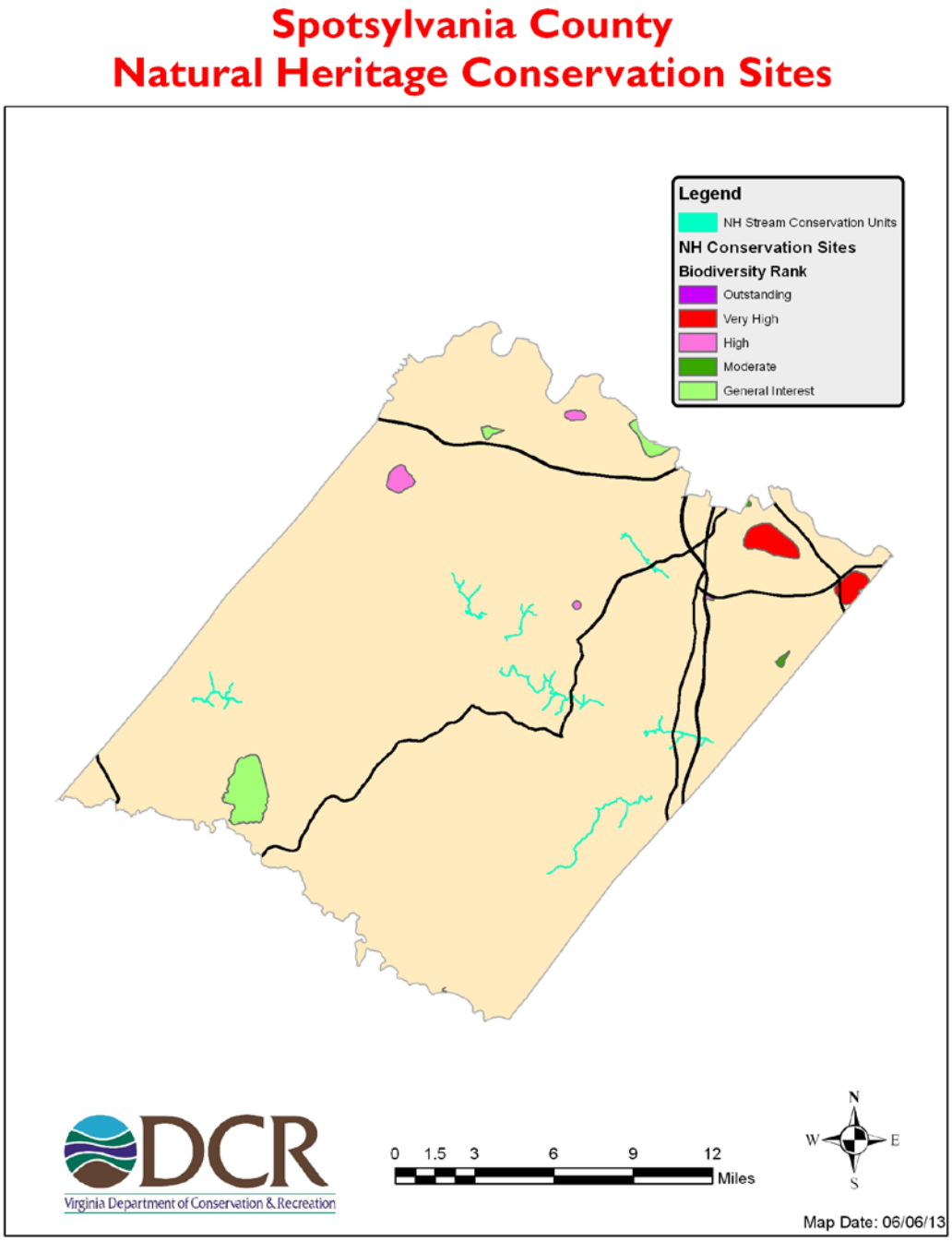

Table 3:

Natural Heritage Resources and Conservation sites

Group Name	Scientific Name	Common Name	Ecological Group	Last Observed	First Observed	Global Rank	FWS_ Species of concern	State Rank	Federal Status	State Status	Conservation Site Name
Nonvascular Plant	Sphagnum carolinianum	Carolina Peatmoss		1993-04-21	1993-04-21	G3		S2			SUMMIT RAILROAD TRACKS
Terrestrial Natural Community	Acer rubrum - Nyssa sylvatica - Magnolia virginiana / Viburnum nudum / Osmundastrum cinnamomeum - Woodwardia areolata Forest	Coastal Plain / Outer Piedmont Acidic Seepage Swamp	Coastal Plain / Piedmont Acidic Seepage Swamp	2004-07-19	2004-07-06	G3?		S3			HAMILTONS THICKET
Terrestrial Natural Community	Acer rubrum - Nyssa sylvatica - Magnolia virginiana / Viburnum nudum / Osmundastrum cinnamomeum - Woodwardia areolata Forest	Coastal Plain / Outer Piedmont Acidic Seepage Swamp	Coastal Plain / Piedmont Acidic Seepage Swamp	2004-06-15	2004-06-03	G3?		S3			PICKETTS CIRCLE
Terrestrial Natural Community	Acer rubrum - Nyssa sylvatica - Magnolia virginiana / Viburnum nudum / Osmundastrum cinnamomeum - Woodwardia areolata Forest	Coastal Plain / Outer Piedmont Acidic Seepage Swamp	Coastal Plain / Piedmont Acidic Seepage Swamp	2005-05-17	2005-05-02	G3?		S3			SOUTH FREDERICKSBURG
Terrestrial Natural Community	Quercus phellos - Acer rubrum - Liquidambar styraciflua / Vaccinium (formosum, fuscatum) Forest	Coastal Plain Depression Swamp (Willow Oak - Red Maple - Sweetgum Type)	Coastal Plain Depression Wetland	2004-05-07	2002-08-08	G3		S2			HAMILTONS THICKET
Vascular Plant	Saccharum coarctatum	Compressed plumegrass		1972-10-08	1972-10-08	G5?		S1?			
Vascular Plant	Quercus prinoides	Dwarf Chinquapin Oak		1977-07-24	1977-	G5		S1			
Vascular Plant	Quercus prinoides	Dwarf Chinquapin Oak		2001-05-31	1977-07-24	G5		S1			
Invertebrate Animal	Alasmidonta heterodon	Dwarf Wedgemussel		1925-08-18	1925-	G1G2		S1	LE	LE	
Invertebrate Animal	Alasmidonta heterodon	Dwarf Wedgemussel		1994-09-12	1994-08-27	G1G2		S1	LE	LE	RAPPAHANNOCK RIVER - ROCKY PEN RUN SCU
Invertebrate Animal	Alasmidonta heterodon	Dwarf Wedgemussel		2008-06-12	1993-12-09	G1G2		S1	LE	LE	PO RIVER - ANDREWS BRIDGE SCU
Invertebrate Animal	Alasmidonta heterodon	Dwarf Wedgemussel		2000-06-09	1998-05-15	G1G2		S1	LE	LE	PO RIVER - WRIGHTS POND - PILTZER CREEK SCU
Invertebrate Animal	Lampsilis radiata	Eastern Lampmussel		1989-09-04	1989-	G5		S2S3			PO RIVER - STANARDS MILL SCU
Invertebrate Animal	Callophrys irus	Frosted Elfin		1993-04-21	1993-04-21	G3		S2?			
Invertebrate Animal	Lasmigona subviridis	Green Floater		1927-10-07	1927-	G3		S2		LT	
Invertebrate Animal	Stylurus laurae	Laura's Clubtail		1967	1967	G4		S2			
Terrestrial Natural Community	Quercus (phellos, pagoda, michauxii) / Ilex opaca - Clethra alnifolia / Woodwardia areolata Forest	Non-Riverine Wet Hardwood Forest (Northern Coastal Plain Type)	Non-Riverine Flatwood / Swamp	2005-05-31	2004-05-19	G2?		S2			SOUTH FREDERICKSBURG
Terrestrial Natural Community	Quercus (phellos, pagoda, michauxii) / Ilex opaca - Clethra alnifolia / Woodwardia areolata Forest	Non-Riverine Wet Hardwood Forest (Northern Coastal Plain Type)	Non-Riverine Flatwood / Swamp	2009-06-12	2008-09-23	G2?		S2			NEW POST FLATWOODS
Vascular Plant	Sarracenia purpurea	Northern pitcher plant		1986-08-20	1986-	G5		S1			

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Natural Heritage Resources and Conservation sites

Aquatic Natural Community	NP-Lower Rappahannock Second Order Stream	NP-Lower Rappahannock Second Order Stream		2011-01	2011-01	G2?		S2?			MASSAPONAX CREEK SCU
Aquatic Natural Community	NP-Mattaponi First Order Stream	NP-Mattaponi First Order Stream		2011-01	2011-01	G3?		S3?			PO RIVER AT RT 613 SCU
Aquatic Natural Community	NP-Mattaponi First Order Stream	NP-Mattaponi First Order Stream		2011-01	2011-01	G3?		S3?			MATTA RIVER SCU
Aquatic Natural Community	NP-Pamunkey Fifth Order Stream	NP-Pamunkey Fifth Order Stream		2011-01	2011-01	G1G2		S1S2			NORTH ANNA RIVER BELOW RT 601 SCU
Aquatic Natural Community	NP-Pamunkey Second Order Stream	NP-Pamunkey Second Order Stream		2011-01		G3		S3			PLENTIFUL CREEK SCU
Aquatic Natural Community	NP-Rapidan-Upper Rappahannock Second Order Stream	NP-Rapidan-Upper Rappahannock Second Order Stream		2011-01	2011-01	G3		S3			
Terrestrial Natural Community	Quercus alba - Quercus (coccinea, velutina, montana) / Gaylussacia baccata Forest	Piedmont / Central Appalachian Mixed Oak / Heath Forest	Oak / Heath Forest	2011-05-18	2007-07-17	G5		S5			LAKE ANNA UPLANDS
Vascular Plant	Asclepias rubra	Red Milkweed		1990-07-21	1990-07-21	G4G5		S2			
Vascular Plant	Asclepias rubra	Red Milkweed		1992-10-02	1990-	G4G5		S2			LITTLE HUNTING RUN
Invertebrate Animal	Elliptio roanokensis	Roanoke Slabshell		2000-06-09	1999-08-17	G3		S1			PO RIVER - WRIGHTS POND - PILTZER CREEK SCU
Vascular Plant	Isotria medeoloides	Small Whorled Pogonia		1999-06-23	1998-06-24	G2		S2	LT	LE	UPPER MINE RUN TRIBUTARY
Vascular Plant	Isotria medeoloides	Small Whorled Pogonia		2006-06-15	2006-06-15	G2		S2	LT	LE	NI RIVER TRIBUTARY SLOPES
Vascular Plant	Isotria medeoloides	Small Whorled Pogonia		2006-06	2006-06	G2		S2	LT	LE	COSNER CORNER EAST
Invertebrate Animal	Sigara depressa	Virginia Piedmont Water Boatman		1969-07-03	1969-07-03	G1G2	SOC	S1S2		LE	
Vascular Plant	Ranunculus ambigens	Water-plantain crowfoot		1977-07-31	1977-07-31	G4		S1			
Terrestrial Natural Community	Justicia americana Herbaceous Vegetation	Water-Willow Rocky Bar and Shore	Rocky Bar / Shore	2008-08-26	2008-08-26	G4G5		S4			EMBREY HILL
Invertebrate Animal	Elliptio lanceolata	Yellow Lance		1995-07-26	1995-	G2G3	SOC	S2S3			PO RIVER - ANDREWS BRIDGE SCU
Invertebrate Animal	Elliptio lanceolata	Yellow Lance		1994-10-22	1993-11-24	G2G3	SOC	S2S3			MATTA RIVER SCU

Conservation Site Name	Biodiversity Rank
Little Hunting Run	B5
Summit Railroad Tracks	B4
Upper Mine Run Tributary	B3
Rappahannock River- Rocky Pen Run SCU	B2
Po River - Andrews Bridge SCU	B2
Hamilton's Thicket	B3
Picketts Circle	B4
South Fredericksburg	B2
Ni River Tributary Slopes	B3
Cosner Corner East	B3
Mata River SCU	B4
Lake Anna Uplands	B5
New Post Flatwoods	B2
Snow Creek Ravine	B4
Embrey Hill	B5
Plentiful Creek SCU	B4
Massaponax Creek SCU	B3
Hazel Run Rt 1 To Rt 2 SCU	B3
Po River - Stanards Mill SCU	B5
Po River - Wrights Pond - Piltzer Creek SCU	B2
Po River At Rt 613 SCU	B4
North Anna River Below Rt 601 SCU	B2

Prepared by DCR-DNH 6/18/2013

Literature Cited

NatureServe. 2010. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: March 19, 2012).

NatureServe. 2012. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: June 5, 2012)

Natural Heritage Resources Definitions

Definitions of Abbreviations Used on Natural Heritage Resource Lists of the Virginia Department of Conservation and Recreation

Natural Heritage State Ranks

The following ranks are used by the Virginia Department of Conservation and Recreation to set protection priorities for natural heritage resources. Natural Heritage Resources, or "NHR's," are rare plant and animal species, rare and exemplary natural communities, and significant geologic features. The criterion for ranking NHR's is the number of populations or occurrences, i.e. the number of known distinct localities; the number of individuals in existence at each locality or, if a highly mobile organism (e.g., sea turtles, many birds, and butterflies), the total number of individuals; the quality of the occurrences, the number of protected occurrences; and threats.

S1 - Critically imperiled in the state because of extreme rarity or because of some factor(s) making it especially vulnerable to extirpation from the state. Typically 5 or fewer populations or occurrences, or very few remaining individuals (<1000).

S2 - Imperiled in the state because of rarity or because of some factor(s) making it very vulnerable to extirpation from the state. Typically 6 to 20 populations or occurrences or few remaining individuals (1,000 to 3,000).

S3 - Vulnerable in the state either because rare and uncommon, or found only in a restricted range (even if abundant at some locations), or because of other factors making it vulnerable to extirpation. Typically having 21 to 100 populations or occurrences (1,000 to 3,000 individuals).

S4 - Apparently secure; Uncommon but not rare, and usually widespread in the state. Possible cause of long-term concern. Usually having >100 populations or occurrences and more than 10,000 individuals.

S5 - Secure; Common, widespread and abundant in the state. Essentially ineradicable under present conditions, typically having considerably more than 100 populations or occurrences and more than 10,000 individuals.

S#B - Breeding status of an animal within the state

S#N - Non-breeding status of animal within the state. Usually applied to winter resident species.

S#? - Inexact or uncertain numeric rank.

SH - Possibly extirpated (Historical). Historically known from the state, but not verified for an extended period, usually > 15 years; this rank is used primarily when inventory has been attempted recently.

S#S# - Range rank; A numeric range rank, (e.g. S2S3) is used to indicate the range of uncertainty about the exact status of the element. Ranges cannot skip more than one rank.

SU - Unrankable; Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.

SNR - Unranked; state rank not yet assessed.

SX - Presumed extirpated from the state. Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered.

SNA - A conservation status rank is not applicable because the element is not a suitable target for conservation activities.

Natural Heritage Global Ranks are similar, but refer to a species' rarity throughout its total range. Global ranks are denoted with a "G" followed by a character. Note GX means the element is presumed extinct throughout its range. A "Q" in a rank indicates that a taxonomic question concerning that species exists. Ranks for subspecies are denoted with a "T". The global and state ranks combined (e.g. G2/S1) give an instant grasp of a species' known rarity. These ranks should not be interpreted as legal designations.

FEDERAL LEGAL STATUS
The Division of Natural Heritage uses the standard abbreviations for Federal endangerment developed by the U.S. Fish and Wildlife Service, Division of Endangered Species and Habitat Conservation.

LE - Listed Endangered
LT - Listed Threatened
PE - Proposed Endangered
PT - Proposed Threatened
C - Candidate (formerly C1 - Candidate category 1)
E(S/A) - treat as endangered because of similarity of appearance
T(S/A) - treat as threatened because of similarity of appearance
SOC - Species of Concern species that merit special concern (not a regulatory category)
NL – no federal legal status

STATE LEGAL STATUS
The Division of Natural Heritage uses similar abbreviations for State endangerment.

LE - Listed Endangered
PE - Proposed Endangered
SC - Special Concern - animals that merit special concern according to VDGIF (not a regulatory category)
LT - Listed Threatened
PT - Proposed Threatened
C - Candidate
NL - no state legal status

For information on the laws pertaining to threatened or endangered species, please contact:

U.S. Fish and Wildlife Service for all FEDERALLY listed species;
Department of Agriculture and Consumer Services, Plant Protection Bureau for STATE listed plants and insects
Department of Game and Inland Fisheries for all other STATE listed animals

Conservation Sites Ranking
Brank is a rating of the significance of the conservation site based on presence and number of natural heritage resources; on a scale of 1-5, 1 being most significant. Sites are also coded to reflect the presence/absence of federally/state listed species:

Conservation Site Ranks	Legal Status of Site
B1 – Outstanding significance	FL – Federally listed species present
B2 – Very High significance	SL – State listed species present
B3 – High significance	NL – No listed species present
B4 – Moderate significance	
B5 – Of general Biodiversity significance	

FORESTRY

Forestry in Spotsylvania County, as it is most anywhere, is dictated largely by its soils, its historical uses and management techniques, local demands and the natural forest cover present. Historically, Spotsylvania County was rich in minerals as well as in agricultural and forestal resources. The county seal, with an image of three trees, reflects the importance of forestry to the local economy.

During colonial times, a great deal of effort was spent in mining iron ore, gold, silver and other minerals from the soils of this county. The county was named after colonial Lt. Gov. Alexander Spotswood (1676-1740), who, among other things, was responsible for establishing iron furnaces and foundries in the area. As these resources were being mined, productive timberland was harvested to provide firewood to operate the furnaces used to melt these minerals into a usable form.

During the Civil War, four major battles and countless minor battles and skirmishes were fought in the area, earning Spotsylvania the title “Crossroads of the Civil War.” Civil War-era photos show the vast amount of open land during this time period; the timber had been cleared to provide firewood for the numerous furnaces in the county, as well as to make way for crop fields. The northwest area of the county is called "Wilderness," where large areas of dense shrub land made the area nearly impossible to travel through. The "Wilderness" shrubs grew in the poor soils that resulted from forest clearing and the removal of raw materials.

Both the mining operations and the land clearing, combined with poor agricultural practices have left Spotsylvania with depleted topsoils. Additionally, certain areas of the county have poorly drained soils that may be the result of a ‘plow pan’ or ‘hard pan’ layer, developed during agricultural tillage. Once bountiful regions had now been reduced to marginal productivity, at best. Although marginal for agriculture, the soils were good for pine plantations, predominately Loblolly pine (Pinus taeda).

Once the Civil War ended, with the majority of the pre-war workforce no longer available, much of the cleared land throughout the county reverted back to forest land. A considerable amount of the hardwoods (oak, hickory, poplar, etc.) existing in the county today is a result of the forest succession that began after the Civil War ended.

After the turn of the 20th century, and most of the 1900s, forestry and forest products were an important part of the economy of Spotsylvania County. Numerous portable sawmills, permanent sawmills and timber harvesters operated in the area, providing a livelihood for many families. The operations were responsible for harvesting the hardwoods, milling the product on site in the forest, and shipping only the final product (in the form of rough lumber) out of the forest. This process usually focused on trees of merchantable size, species and quality, and left unmerchantable trees uncut. Primary products for this era included grade lumber and railroad ties, among others. This method of harvesting timber was common for several reasons: harvesting timber was very labor intensive, so crews only focused on what was profitable, and there was generally little to no market value for smaller or poorly formed trees. However, in some cases, this left the forest devoid of any market value, often for decades after the harvest.

Prior to the 1950's, it was commonplace for a landowner to sell the standing timber and land together as a unit, or once the timber had been harvested, sell the land for a very low cost. The value of the land was in the forest, and with the forest having been harvested, the landowner would then be required to pay taxes on the property until the forest matured again, possibly taking many decades. In some cases, the landowner was unwilling to carry that long. Clearing the land for agriculture was generally not an option because it was often not suited for farming. However, due to the differences of agriculture and farming, land that was substandard for agriculture often grows pines very well.

Beginning in the 1960's and 1970's, paper companies, such as WestVaCo, Continental Can, Bear Island, Chesapeake and other smaller, locally owned sawmills would purchase these lands for the expressed purpose of growing pines for fiber production.

Eventually, clear cutting as a method of timber harvesting was used more frequently, primarily due to the marketability of previously un-merchantable wood, such as hardwood pulpwood, as well as the onset of mechanized harvesting (which reduced the amount of manual labor required in the harvesting process). Clear cutting made it possible for the forest landowner to reforest using planted pine; the pine plantation was thereby developed.

As a result of Interstate 95 being built during the early 1960s, and the fact that Spotsylvania lies mid-way between Washington, D.C., and Richmond, the population of Spotsylvania began to grow. Prior to that, much of the timberland in the county was owned in large tract sizes by paper and pulp companies, sawmills and other timber producers as a relatively inexpensive commodity. As the population of Spotsylvania increased, however, so did the value of the land. Developers and builders were able to buy land to subdivide, further increasing the price of real estate. This once rural county has now become suburbanized, with large tracts of land being broken into smaller and smaller pieces, contributing to forest fragmentation.

Currently, there are still a large number of loblolly pine plantations of considerable size being managed here in the county. However, many of the paper and pulp companies have sold their holdings here in the county; some of which has gone to landowners with forest management goals, while other tracts have been converted into housing developments. Converting a pine plantation into a housing development presents two important issues:

1. It creates a fire hazard for the homes of that community (due to the highly flammable nature of loblolly pine) and;

2. The larger forest, now subdivided, is now much more difficult to manage. Due to the difficulty in managing this stand, often the forest becomes overcrowded, stressed, and susceptible to insects and diseases. Trees killed by insects and diseases (often this occurs in areas of several acres or more) become a fire hazard, and have no market value whatsoever.

Bearing this history in mind, and its influences on the forests of today, the soils of Spotsylvania County are by and large well suited for Loblolly and Shortleaf pine. Pines can be grown in a higher quality and in a shorter amount of time than hardwoods. In Spotsylvania, on upland sites, a typical hardwood forest is dominated by white oak, red oak, hickory and yellow poplar. On bottomland sites, a typical hardwood forest is dominated by river birch, sycamore, sweet gum and red maple. The quality of the hardwood present today on upland sites is generally fair to poor, as quality hardwoods require very productive soils.

Forest products in Spotsylvania County today include pulpwood, grade lumber (both pine and hardwood), railroad ties, and some veneer. Of course, firewood, fence posts and associated products are produced on a small scale. Some timber harvesters, however, have begun chipping low quality and unmerchantable

products created during the timber harvest (such as tree tops) into a mulch-like material, where it is used as fuel at large mills and plants.

The trend of forestry in Spotsylvania is similar to that elsewhere in eastern Virginia. Timber harvesting in general is tied closely to both the economy and to the housing market. Acres harvested statewide were down in 2009, however, they have recovered to more typical numbers today. Total acres reforested, after a timber harvest have maintained a steady trend over the past few years. Spotsylvania County ranks 44th statewide in timber harvesting for total average annual harvest value, from 2000 to 2011.

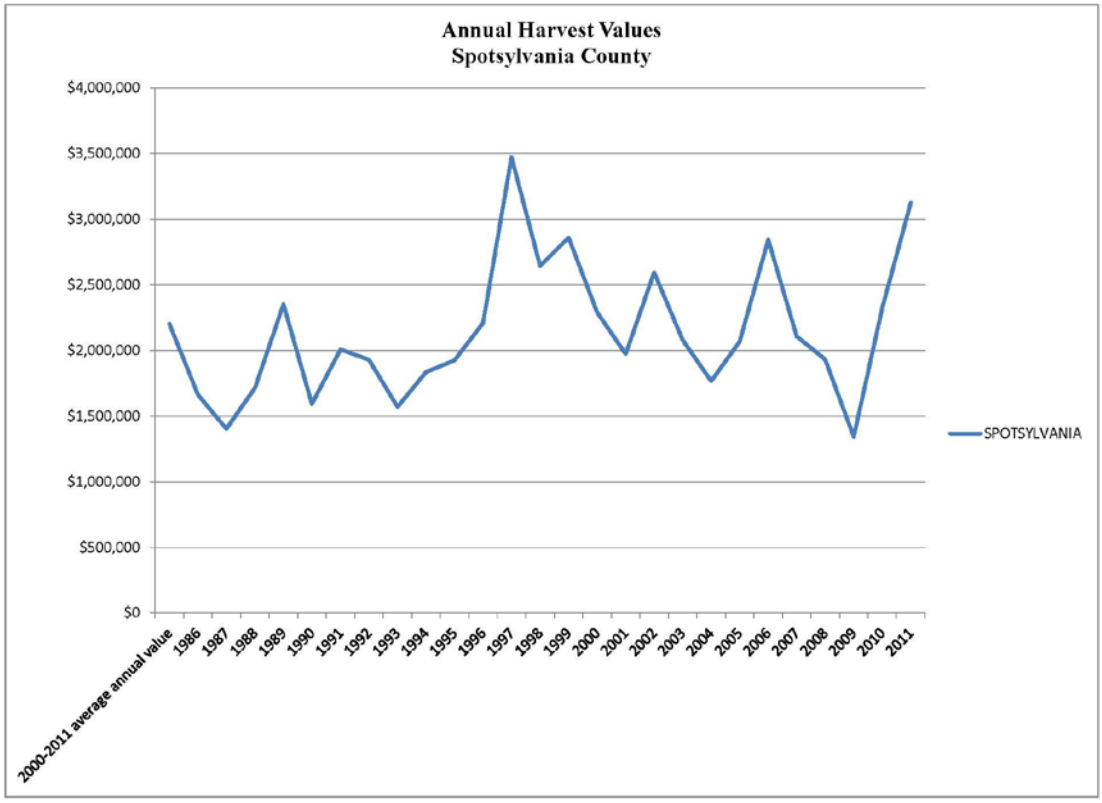
One notable trend over the past thirty years is the absence of fire. While no one would argue that wildfires are good, a prescribed fire does have benefits when handled properly. Due to the high population in Spotsylvania County, the use of prescribed fire as a management tool has been increasingly difficult to use, due to the problems associated with smoke. Additionally, in rural Virginia periodic wildfires, although dangerous, did have an affect the forest over time. Certain tree species such as sweetgum, red maple and others, typically were killed off by fire, whereas most species of oak were able to survive and even thrive. Periodic wildfires often gave way to a higher composition of oaks in Virginia forests, which in turn were more marketable. Fire now largely precluded from the forestland, many hardwood forests now are comprised more heavily of sweetgum, red maple, and less of the oaks.

While portions of the western and southern sections of the county are still somewhat rural, Spotsylvania County today is largely made up of suburban areas. Many county residents commute to Northern Virginia or Washington, D.C., for high-paying jobs. Other people are moving to Spotsylvania from those areas because of the relatively lower cost of living. As a result of this shift from rural to suburban, the urban and community forests have become increasingly important to homeowners, and new housing developments are being built with “green spaces” for their residents to enjoy. These people also see the value in protecting forested areas so that all will be able to enjoy the many benefits forests provide.

Forest Industry

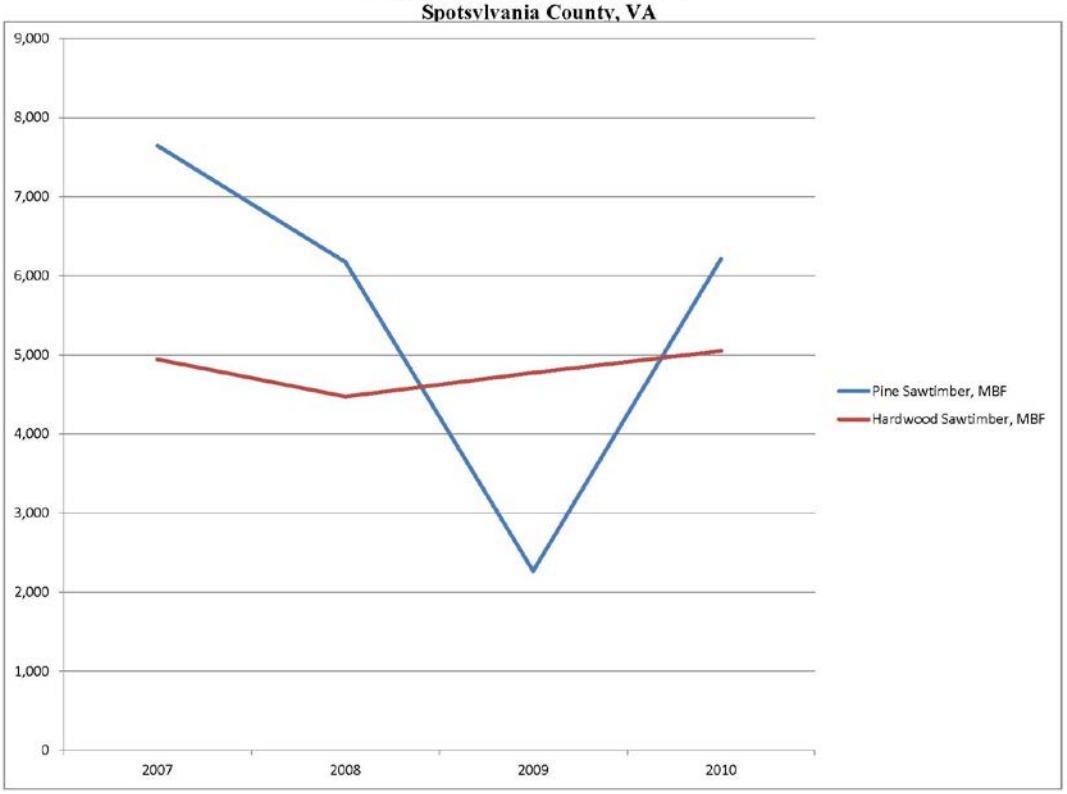
Currently, there are two operating, commercial sawmills within Spotsylvania County, however, there are at least two smaller portable mills in existence, and likely others. Additionally, there is a wood preservative plant and a planing mill, neither of which uses raw logs in their processes. The wood preservative plant treats finished lumber with an approved chemical for use in exterior construction, such as decks, playground equipment, etc. The planing mill receives large cants, and re-saws them into pallet parts.

Much of the timber harvested in Spotsylvania County is hauled to primary processing facilities outside of the county, and in some cases, outside of Virginia.



The "annual harvest value" is in fact the value of the timber harvested in the county, for a given year. The term generally used to describe timber removed from a given site is 'stumpage'. In order to determine this number, harvest volume (the amount of timber harvested) is needed, as well as value (price paid for what was harvested). Therefore, this data is derived from a combination of two sources. The county harvest volumes come from the forest products tax information and the values are based on average stumpage values that are collected each year from local consultants and sources like Timber-Mart South.

Annual Harvest Volumes, Sawtimber
Spotsylvania County, VA



Annual Harvest Volumes, Pulpwood
Spotsylvania County, VA

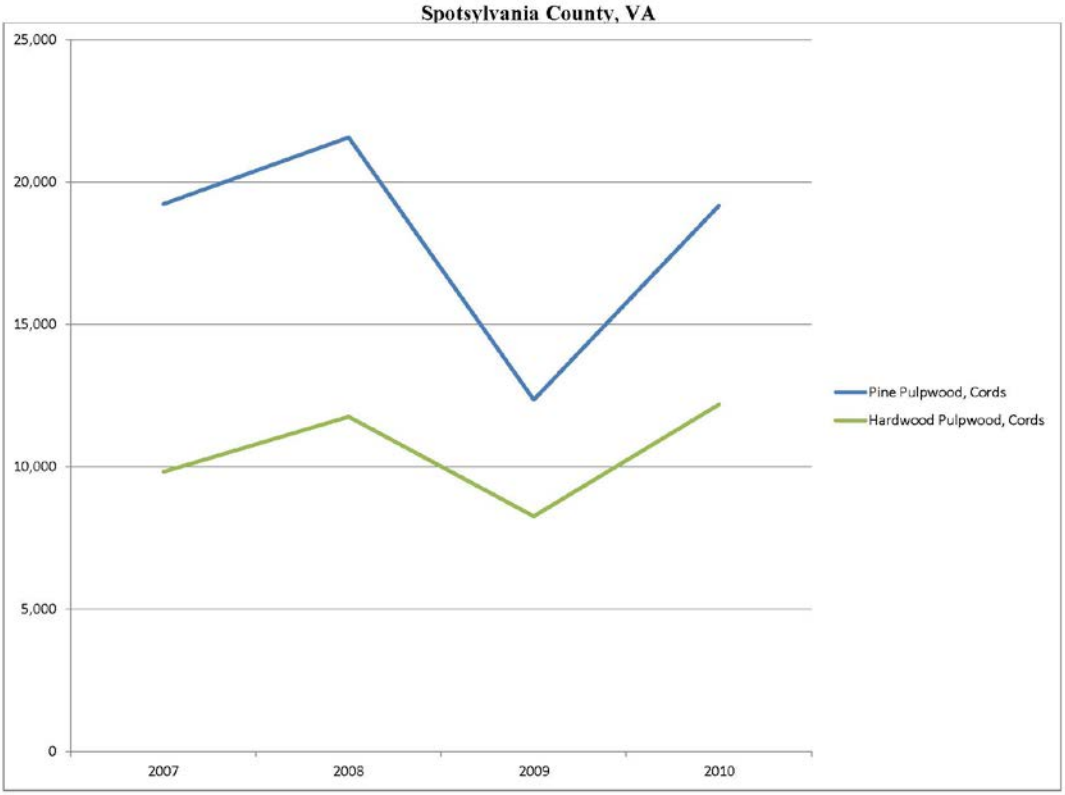


Table 4: Virginia Department of Forestry: Spotsylvania County Timber Value and Supply				
	2010	2009	2008	2007
Pine (MBF)	6,217	2,265	6,173	7,646
Pine (cords)	19,177	12,353	21,568	19,227
Value: Pine	$1,342,075	$602,479	$1,307,209	$1,493,002.34
Hardwood (MBF)	5,050	4,774.14	4,474	4,944
Hardwood (cords)	12,189	8,263.29	11,756	9,824
Value: Hardwood	$981,331	$740,899	$624,608	$614,755
Total Value	$2,323,406	$1,343,378	$1,931,817	$2,107,757

Table 5: USDA Census of Agriculture: Spotsylvania County Woodland Crops				
		2007	2002	% change
Cut Christmas Trees	Farms	11	9	22
	Acres in Production	80	96	-17
	Trees Cut	2,282	4,170	-45

Forest Conservation Value Map

The Virginia Department of Forestry has established a relative Forest Conservation Value (FCV) for all of the forestland in the state. This FCV ranking is based on the level of benefits provided by a particular area of forest in combination with the level of threat the area faces from conversion to another land use, primarily to development. The FCV map divides the state's forestlands into five categories, the Virginia Department of Forestry (VDOF) has identified categories 4 and 5 as having high forest conservation value. While all forests provide a range of benefits and the threat of forest conversion is widespread, the VDOF recommends that these high conservation value forests be given priority in land conservation efforts such as donated conservation easements, PDR programs, or Ag-Forestal Districts.

In the GIS analysis used to develop the FCV rankings, the forest benefits that were measured included water quality protection, natural habitat, the extent of contiguous forest cover, and the potential forest economic productivity. Threat to conversion was based on the likelihood that the area would change from rural land to a more developed use. This was determined based on road density, county population projections, and 30-year projections of housing density.

In developing the FCV map, the following datasets were used to calculate forest benefits utilizing a weighted overlay model. The model also included forest conversion threat as described above.

1. Streams, shorelines, and floodplain forests and forested wetlands
2. Forests in headwaters and on steep slopes
3. Forests protecting drinking water supplies
4. Large contiguous blocks of forest; and
5. Sustainable, managed working forests - based on woodland soil productivity, forest types, and economic value of timber
6. Areas of high terrestrial integrity – takes into account stream buffers, road fragmentation, and impervious surfaces
7. Areas of high aquatic integrity – incorporates number of species and species richness

PRODUCTION OF FOOD AND FIBER

The Census of Agriculture, conducted only once every five years, is the only source of consistent and comprehensive agricultural data for every state and county in the nation. The Census is conducted by the United States Department of Agriculture (USDA) National Agricultural Statistics Service. It looks at farms, value of land, market value of agricultural production, farm practices, expenditures, and other factors that affect the way farmers and ranchers do business. The information is used by town planners, policy makers, agribusinesses and others to help make important growth-generating decisions.

Report forms for the 2012 Census of Agriculture were mailed to farm and ranch operators in late December 2012 to collect data for the 2012 calendar year. Completed forms were due by February 4, 2013. Additional mailings were sent around February 14 and March 20 to farmers and ranchers who have not responded.

The USDA National Agricultural Statistics Service will release Census data, in both electronic and print formats, beginning in February 2014. Detailed reports will be published for all counties, states and the nation. Updates to food and fiber production data will be reflected in future updates of the Comprehensive Plan as the information comes available.

Until results of the 2012 Census are released, the 2007 Census results are the most recent available. The following tables, looking at 2007 and 2002 data, summarize and reflect Spotsylvania County's production of food and fiber.

Table 6: USDA Census of Agriculture: Spotsylvania County Farms

		2007	2002	% change
Number of Farms		359	369	-3
Land in Farms		52,230 acres	56,346 acres	-7
Average Size of Farm		145 acres	153 acres	-5
Total Cropland	Farms	278	315	-12
	Acres	23,773	27,442	-13
Harvested Cropland	Farms	235	248	-5
	Acres	18,355	17,936	2

Table 7: USDA Census of Agriculture: Spotsylvania County Livestock and Poultry				
		2007	2002	% change
Cattle and Calves Inventory	Farms	149	158	-6
	Number	12,062	9,140	31
Beef Cows	Farms	134	147	-9
	Number	5,501	4,149	32
Milk Cows	Farms	8	10	-20
	Number	599	884	-32
Cattle and Calves Sold	Farms	125	121	3
	Number	4,662	3,566	31
Hogs and Pigs Inventory	Farms	15	10	50
	Number	313	506	-38
Hogs and Pigs Sold	Farms	12	9	33
	Number	781	1,353	-42
Sheep and Lambs Inventory	Farms	10	12	-17
	Number	129	366	-65
Broilers and other meat-type chickens sold	Farms	-	5	-100
	Number	-	228	-100
Layers Inventory	Farms	51	41	24
	Number	2,014	1,624	24
Horses and Ponies	Farms	125	129	-3
	Number	1,043	948	10
Goats, all	Farms	25	8	213
	Number	321	(D)	-

Table 8: USDA Census of Agriculture: Spotsylvania County Selected Crops Harvested				
		2007	2002	% change
Corn for Grain	Farms	28	20	40
	Acres	3,314	3,132	6
	Bushels	193,088	128,690	50
Corn for Silage or Greenchop	Farms	17	11	55
	Acres	1,262	1,162	9
	Tons	14,446	10,955	32
Wheat for Grain, All	Farms	18	15	20
	Acres	796	487	63
	Bushels	46,236	27,273	70
Winter Wheat for Grain	Farms	18	15	20
	Acres	796	487	63
	Bushels	46,236	27,273	70
Oats for Grain	Farms	3	3	0
	Acres	48	50	-4
	Bushels	2,400	3,240	-26
Barley for Grain	Farms	13	14	-7
	Acres	698	882	-21
	Bushels	54,762	59,031	-7
Sorghum for Grain	Farms	-	1	-100
	Acres	-	(D)	-
	Bushels	-	(D)	-
Sorghum for Silage or Greenchop	Farms	4	-	-
	Acres	221	-	-
	Tons	1,402	-	-
Soybeans for Beans	Farms	20	18	11
	Acres	2,914	1,954	49
	Bushels	65,885	34,649	90
Forage	Farms	203	216	-6
	Acres	9,910	11,082	-11
	Tons, dry	16,720	18,284	-9
Vegetables harvested for sale	Farms	9	8	13
	Acres	41	60	-32
Land in Orchards	Farms	9	10	-10
	Acres	34	62	-45

Based on the 2007 Census, top crop items reported in Spotsylvania County, based on acreage farmed, were forage (land used for all hay and haylage, grass silage, and greenchop), corn, soybeans, and wheat. All of the top crops saw an increase in production from the 2002 census to the 2007 census with the exception of forage crops that saw an approximately eleven (11) percent decline from 11,082 acres to 9,910 acres.

The County's chief livestock inventory items include cattle, layers (category includes table-egg type layers, hatching layers for meat-types, and hatching layers for table egg types), horses and ponies, and goats.

Nursery Crops

Looking at the 2002 and 2007 Census of Agriculture, Spotsylvania County does not have many farming operations devoted to the production of Nursery, Greenhouse, Floriculture, Aquaculture, Sod,

Mushrooms, Vegetable Seeds, and Propagative Materials Grown for Sale. The County's 2007 Census value of sales by commodity group of Nursery, greenhouse, floriculture, and sod ranked 69th, of 98 Counties in Virginia, 94 comparables with production. There were no aquaculture producers counted.

LAND CONSERVATION

In 1970, Virginia's population was about 4.6 million. It had grown by more than 50 percent to 7.1 million by the year 2000, and to 8 slightly over million by the 2010 US Census. Consistent with population growth in Virginia, Spotsylvania County has seen a great deal of growth over the last twenty years. The County population in 1990 was 57,403. By 2000, the population had grown to 90,395 and within the next 10 years grew another 35% to a population of 122,397 by the 2010 US Census. While such growth is certainly impressive – even enviable – more people require more land and, as the saying goes, "They're not making any more of it."

This growth necessitates careful and intelligent planning. There are lands in Virginia that have witnessed some of America's greatest human triumphs and tragedies. Our open spaces, farms, award-winning parks, battlefields and other historic places attract visitors from around the world. Similarly, Virginia's beautiful natural habitats – some types of which are found nowhere else – provide sanctuary for many exceptional plants and animals. Such astonishing natural and cultural resources come as well with an extraordinary responsibility. Land conservation is a big part of that responsibility.

The public benefits from such protection because it assures the availability of land for agriculture, forests, recreation and open space. It protects our natural resources and maintains and enhances air and water quality. Land conservation also preserves historical, architectural and archaeological heritage.

And conserving land doesn't mean it can't be touched. For example, land in conservation or open space easements can typically still be used normally, such as for timber harvesting, farming, residency, etc. The easement simply protects the property's unique characteristics – prime soils, wetlands, endangered species habitat, and so forth. There are a variety of tools and levels of land conservation that can be employed. Some, like conservation easements can result in the conservation of parcels of land in perpetuity, while others, like the Comprehensive Plan and Water and Sewer Master Plan can have the effect of conserving land from the effects of urban and suburban sprawl.

Virginia Conservation Lands Needs Assessment (VCLNA)

The Virginia Conservation Lands Needs Assessment (VCLNA) is helping guide effective conservation by providing tools that help both government and private organizations identify resource protection areas and that, at the local level, help planners manage growth in a balanced way. The VCLNA is helping the Virginia Land Conservation Foundation to prioritize conservation targets.

The VCLNA is a flexible, widely applicable tool for integrating and coordinating the needs and strategies of different conservation interests, using GIS (Geographic Information System) to model and map land conservation priorities and actions in Virginia. The VCLNA allows the manipulation of issue-specific data sets that can be weighted and overlaid to reflect the needs and concerns of a variety of conservation partners - issues like:

- unfragmented natural habitats
- natural heritage resources
- outdoor recreation
- prime agricultural lands
- cultural and historic resources
- sustainable forestry

- water quality improvement
- drinking water protection

The VCLNA can be utilized as a decision support tool for local and regional agencies and organizations in their efforts to employ green infrastructure principles during their planning processes.

There are no legal or regulatory requirements associated with Virginia Conservation Lands Needs Assessment, nor should the VCLNA serve as sole justification for any activities. The VCLNA is a rather coarse-scale analysis that, though informative, needs to be considered in conjunction with any number of other factors in guiding conservation actions or any other activities. The Department of Conservation and Recreation is continuing to work on the VCLNA to identify some of these additional decision-guiding factors, but economic, local, and even personal considerations will always be important in decision-making.

Zoning Ordinance

The regulations set forth in the Spotsylvania Zoning Ordinance are adopted for the purposes that include but are not limited to: provide for the preservation of agricultural and forested lands and other lands of significance for the protection of the natural environment; protect surface water and groundwater, especially within areas designated as Chesapeake Bay Preservation Area Overlay Districts, in accordance with requirements of the Virginia Chesapeake Bay Preservation Act; and protect against destruction of, or encroachment upon historic areas.

A number of zoning districts within Spotsylvania County have been established to protect and maintain the rural character of the county and to protect and enhance the agricultural economy of the county, while providing for low density residential development in a rural setting. The Rural and Agricultural Districts have been established to achieve that purpose to varying intensities. In To complement the intention of the Rural and Agricultural districts especially, the zoning ordinance contains a number of regulations to help achieve the purpose of the ordinance, the conservation portion of which has been outlined above. The zoning ordinance employs open space requirements, minimum lot size requirements, maximum densities and lot yield. Within Agricultural, Rural, and some Residential districts, the zoning ordinance includes the ability for cluster subdivision, a means to achieve smaller lots in exchange for greater open space.

Comprehensive Plan

The Comprehensive Plan is a guide designed to encourage the most appropriate use of land, water and resources within the County consistent with the interests of the citizens. The Comprehensive Plan sets forth goals, objectives, policies and implementation techniques that will guide the development activity within the County and promote, preserve and protect the health, safety, and general welfare of its citizens. The Comprehensive Plan acknowledges the importance of historic and natural resource protection and has established development districts and future land use categories intended to promote the continuance of the rural farm and forestal character in many areas of the County, whereby reducing the effects of urban and suburban sprawl.

As of 2012, Spotsylvania County's identified growth areas within the Primary Development Boundary include the Primary Settlement District and Jackson Gateway. This area is approximately 66.8 square miles in size, or roughly 16% of the County's total land area (approximately 407 square miles), leaving 84% of the County's total land outside of the areas intended for growth and more intense development.

Water and Sewer Master Plan

The Water and Sewer Master Plan is intended to complement and facilitate implementation of the Comprehensive Plan. After considering the County's settlement districts and their intent, along with the future land use, the Master Plan defines specific capital water and sewer projects that must be

implemented to facilitate the intended growth areas consistent with the Comprehensive Plan. Development intensity and development demands tend to be higher in areas where public water and sewer facilities are available. In other areas, outside of intended growth areas or outside of the primary settlement district for instance, where the rural and agricultural character and economy are intended to be sustained, public water and sewer are not planned. As a result, the tendency for urban and/ or suburban sprawl is inhibited, the larger lot agricultural and forestal tracts of land tend to be maintained, and the "urban heat island" effects and impervious surface areas are kept low.

Parks

There are Federal, State, and County Parks within Spotsylvania County. The Fredericksburg and Spotsylvania National Military Park, including the Wilderness, Chancellorsville, and Spotsylvania Courthouse Battlefields, and portions of the Fredericksburg Battlefield cover roughly 7200 acres in total. Since the Battlefield Parks are considered passive parks, they act as both historic and natural conservation sites. Lake Anna State Park is roughly 2800 acres in size, offering both active and passive recreational opportunities with many acres left in their natural state. At present, there are approximately 600 acres of existing County Park land, of which approximately 32% are considered active recreation. The remainder of the acreage is either passive recreation or not yet developed and activated, either way maintaining a more natural state.

Conservation Easements

Conservation easements preserve farmland, forestland, and natural and recreational areas by restricting intensive uses, such as development and mining, which would alter the conservation values of the land. Each easement is tailored to reflect the conservation values of the property and is recorded in the local courthouse as a permanent part of the property records. Easements do not grant public access to a landowner's property.

Spotsylvania County has a number of conservation easement holders for historic and natural resources including the Central Virginia Battlefields Trust, whose easements include but are not limited to Pelhams Corner and the Stonewall Jackson amputation site, an 81 acre parcel along Rt. 3 affiliated with the Chancellorsville Battlefield. The Virginia Department of Conservation and Recreation, Virginia Department of Forestry, Virginia Department of Historic Resources, The Nature Conservancy and the Virginia Outdoors Foundation have conservation easement within the County.

Agricultural/ Forestal District

The purpose of Agricultural/Forestal Districts is to encourage the preservation, development and improvement of the appropriate lands in the county for the production of agricultural and forestal products by providing a mechanism for the creation and administration of agricultural and forestal districts of statewide significance. The Board of Supervisors finds that agricultural and forestal lands are valued natural and ecological resources which provide essential open spaces for clean air sheds, watershed protection, wildlife habitat, as well as aesthetic value in our community. It is the purpose of these Districts to provide a means to protect and enhance agricultural and forestal land as a viable segment of the county's economy and as an economic and environmental resource of major importance.

Purchase of Development Rights

The purposes of the Purchase of Development Rights program include, but are not limited to: establishing a program to facilitate county acquisition of conservation easements voluntarily offered by owners to serve as one means of preserving the county's character and resources; preserving farm and forest land and to protect and enhance family farms and the economic viability of the agricultural and forestal sectors of the local economy; conserving and protecting water resources and environmentally sensitive lands, waters and other natural resources; conserving and protecting biodiversity and wildlife and aquatic habitat; assisting in shaping the character and direction of the development of the community; Improving the quality of life for the inhabitants of the county; and promoting recreation and tourism through the preservation of scenic and historical resources.

Land Use Program

The purpose of the Land Use Program is to further the public interest by encouraging the preservation of land, to conserve and protect the County's natural resources, to protect safe water supplies, and to promote orderly land use planning and development. The Land Use Program is a **tax deferral**, not a discount. The assessment of the land is based on the use value and not the fair market value. The tax deferral amount will be repaid with interest if the use of the land changes.

Four categories that qualify for the Land Use Program:

Agricultural Use:

When devoted to the bona fide production for commercial sale of plants and animals or plant and animal products useful to man under uniform standards prescribed by the Virginia Commissioner of Agriculture and Consumer Services, or when devoted to and meeting the requirements and qualifications for payments or other compensation pursuant to a soil conservation program under an agreement with an agency of the federal government. Requiring 5 acres minimum in agricultural use.

Virginia State Code requires a minimum of five (5) contiguous (unimproved or more) acres. One acre is excluded for a house-site (if dwelling exists) or a proposed house-site. The remaining five acres or more may qualify for Land Use taxation.

AND

The property must have a five (5) year previous history of continuous farming or horticultural activity before qualifying on the sixth year. If land is left vacant for one year or more, the farm history must begin again for five (5) continuous years.

AND

The farm must produce either 1/2 of the county average in crops or meet the minimum animal requirements. The entire farm must be qualified with adequate livestock: One mature cow, five goats, five sheep, or five swine, one hundred chickens, and/or sixty-six turkeys per every five acres for twelve (12) months. Horses can qualify the land only if they are being used for breeding or a boarding business.

Horticultural Use:

When devoted to the bona fide production for sale of fruits of all kinds, including grapes, nuts and berries, vegetables, nursery and floral products under uniform standards prescribed by the Virginia Commissioner of Agriculture and Consumer Services, or when devoted to and meeting the requirements and qualifications for payments or other compensation pursuant to a soil conservation program under an agreement with an agency of the federal government. Requiring 5 acres minimum.

Forest Use:

When devoted to tree growth in such quantity and so spaced and maintained as to constitute a forest area under standards prescribed by the Virginia State Forester. Requiring 20 acres minimum in forest use.

Open Space:

When so used as to be provided or preserved for park or recreational purposes, conservation of land or other natural resources, floodways, historic or scenic purposes, or assisting in the shaping of the character, direction, and timing of community development or for the public interest sand consistent with the local land use plan under uniform standards prescribed by the Director of the Virginia Department of Conservation and Recreation. Requires 5 acres minimum in Open Space use unless the local ordinance specifies otherwise.

IMPLEMENTATION AND FUNDING PROGRAMS

Natural and Historic Resource Conservation

The **Virginia Land Conservation Fund (VLCF)** is administered by the Virginia Land Conservation Foundation to conserve certain categories of land. Those categories are: open spaces and parks; natural areas; historic areas; and farmland and forest preservation. The foundation establishes, administers and makes expenditures from the Virginia Land Conservation Fund, which is special, non-reverting money in the state treasury. DCR provides staff and administrative support. An interagency taskforce reviews and recommends grant applications to the VLCF. Grant awards are based on applications for 50 percent or less of total project costs pursuant to specific criteria defined in each category.

The **Virginia Open-Space Lands Preservation Trust Fund (VOSLPTF),** administered by the Virginia Outdoors Foundation helps landowners cover costs of conveying conservation easements and the purchase of all or part of the value of the easements. Conservation easements preserve farmland, forestland, and natural and recreational areas by restricting intensive uses, such as development and mining, which would alter the conservation values of the land. Costs that the fund may reimburse include:

- legal costs
- appraisal and other costs and
- all or part of the easement's value.
- Priority may be given to applicants who seek cost re-reimbursement only, demonstrate financial need, or cover a family-owned or -operated farm.

The **Land and Water Conservation Fund** by the Department of Conservation and Recreation administers a grant-in-aid program for acquisition and development of public outdoor recreation areas and facilities. These grants are for public bodies only. Towns, cities, counties, regional park authorities and state agencies may apply for 50 percent matching fund assistance from the Virginia Outdoors Fund (VOF). When available, these funds are provided through state general fund appropriations and from federal apportionment from the Land and Water Conservation Fund (L&WCF) meant for the acquisition and/or development of outdoor recreation areas. This is a reimbursement program meaning that the sponsoring agency should be capable of financing the project while requesting periodic reimbursement.

The **Federal Farm and Ranch Land Protection Program (FRPP)** provides matching funds to help purchase development rights to keep productive farms in agricultural use. Working through existing programs, the United States Department of Agriculture (USDA) partners with state, tribal or local governments and non-governmental organizations to acquire conservation easements or other interests in land from willing landowners. The USDA provides up to 50 percent of the fair-market value of the conservation easement.

To qualify, farmland must: be privately owned; have a pending offer from a state, tribe or local farmland protection program; and contain significant amounts of prime farmland, historic or archaeological resources, or land that furthers a systematic state or local farmland protection program consistent with FRPP.

The **American Battlefield Protection Program (ABPP)** is a federal program that fosters opportunities for stewardship of historic battlefields through grants and technical assistance that support public and private partners in identifying, evaluating and planning for preservation. The ABPP promotes the preservation of significant historic battlefields associated with wars on American soil. The goals of the program are to: protect battlefields and sites associated with armed conflicts that influenced the course of American history; encourage and assist all Americans in planning for the preservation, management and interpretation of these sites, and; raise awareness of the importance of preserving battlefields and related sites for future generations. The ABPP focuses primarily on land use, cultural resource and site

management planning, and public education. DCR is the state governmental sponsor for this National Park Service program.

Civil War Battlefield Acquisition Grants. A portion of Federal Land and Water Conservation Fund (LWCF) monies are made available to help states and communities acquire and preserve threatened Civil War battlefield land. The grants are awarded on to state and local governments. Private, nonprofit organizations can apply for these funds in partnership with a state or local government agency. In Virginia, the designated agency partner is DCR.

LWCF grants are awarded through a competitive process. Each grant requires a dollar-for-dollar non-federal match. Grants are available for the fee simple acquisition of land, or for the acquisition of permanent, protective interests in land as listed by the Civil War Sites Advisory Commission's 1993 *Report on the Nation's Civil War Battlefields*. Greater consideration is given to proposals for acquisition of endangered Priority I or II battlefield lands.

Historic Resources (DHR) Incentives and Grants The Department of Historic Resources runs various programs that offer funding for historic preservation. DHR historic resources incentives and grants, include easements, archaeological threatened sites, local government grants, survey and planning cost-share, rehabilitation tax credits, state grants, and non-state grants.

The **Grassland Reserve Program (GRP)** is a voluntary conservation program by the United States Department of Agriculture (USDA) that emphasizes support for working grazing operations, enhancement of plant and animal biodiversity and protection of grassland under threat of conversion to other uses.

Participants voluntarily limit future development and cropping uses of the land while retaining the right to conduct common grazing practices and operations related to the production of forage and seeding, subject to certain restrictions during nesting seasons of bird species that are in significant decline or are protected under Federal or State law. A grazing management plan is required for participants.

The GRP has multiple enrollment options including a rental contract for 10, 15, or 20 years or enrollment of the land in a conservation easement for an indefinite period of time. GRP applications are accepted anytime and enrollment offers are processed through the Virginia Farm Service Agency (FSA) office. Offers in this program are ranked against other offers, but only statewide.

In addition to improving the environment in multiple ways, those enrolled in GRP receive an annual rental payment for their enrolled acres. FSA also provides cost-sharing and other incentives to help offset the costs associated with putting these practices in place.

USDA Farm Service Agency's (FSA) **Emergency Conservation Program (ECP)** provides emergency funding and technical assistance for farmers and ranchers to rehabilitate farmland damaged by natural disasters and for carrying out emergency water conservation measures in periods of severe drought. Funding for ECP is appropriated by Congress.

Public and Private Access to Waterfront Areas

The **Chesapeake Bay National Estuarine Research Reserve System** in Virginia was established to provide representative natural areas for long-term research, monitoring, and education. The primary aim of the research reserve program is to improve scientific understanding of estuarine systems and to provide information to government and the public on the condition of estuarine resources. Although a number of sites have been considered as candidates for inclusion in the system, the early efforts of the program have been focused on the York River drainage. Four sites have been subsequently nominated for inclusion in

the system and accepted by the National Oceanic and Atmospheric Administration. The program is administered by the Virginia Institute of Marine Science of the College of William and Mary.

The mission of the Chesapeake Bay Estuarine Research Reserve System is to establish a network of natural research areas which are representative of the diversity of coastal ecosystems found within the Bay and its tributaries. These reserves will be used for research and long-term monitoring of the condition of the selected sites over time. Estuarine reserves will serve as benchmarks for analyzing long term impacts from changes in climate, air and water quality, sea level and other external factors. These sites may offer the opportunity for natural area access and can serve to protect sensitive natural resources.

The **Land and Water Conservation Fund (LWCF)** Act of 1965 established a federal reimbursement program for the acquisition and/or development of public outdoor recreation areas. Since the LWCF began 45 years ago, Virginia has received more than $76 million in assistance. It has made more than 400 projects possible. The LWCF is a 50-50 percent matching reimbursement program. The grant recipient must be able to fund 100 percent of the project while seeking periodic reimbursements.

The **Recreational Trails Program (RTP)** is a reimbursement grant program for the creation and maintenance of trails and trail facilities. DCR administers the program, which is funded through the Federal Highway Administration (FHWA). Grants may go to registered nonprofit organizations, city governments, county governments or other government entities but must be considered in accord with guidance from the Virginia Recreational Trails Program Advisory Committee. The RTP requires that 30 percent of trail program funds be used for motorized recreational trail uses, 30 percent for non-motorized recreational trails uses, and 40 percent for proposals with the greatest number of compatible recreational purposes and/or those that provide for innovative recreational trail corridor sharing (multiple-use trails).

Grants to Localities Program. The Virginia Department of Game and Inland Fisheries announces the availability of grants for fiscal year (FY) 2013 and requests applications. Eligible to receive grants are Virginia localities (Counties, Cities, and Towns). The purposes of the grants are to assist localities in providing public opportunities for boating access facilities for new development or the renovation or improvements to existing public boating access facilities.

Recreational boating is a popular activity and there are approximately 250,000 registered boats in Virginia. Many more boats (canoes/kayaks) that are not registered use existing facilities or are in need of additional sites. This grant program provides up to 75% of the approved project costs to construct or renovate boating access facilities for trailer or non-trailer hand launch facilities.

The **Federal Aid in Sport Fish Restoration Program** arose out of concerns by anglers, boaters, industry and government resource conservation agencies, that permanent, predictable funds were necessary to power state programs for fisheries conservation, boating access and recreational boating safety. Congress adopted such an approach in 1950 with the passage of the Sport Fish Restoration Act (known popularly as the Dingell-Johnson Act). Later amendments to this Act, which greatly expanded its funding base, came in 1984 from Senator Malcolm Wallop and (then Congressman) Senator John Breaux.

The Program is an outstanding example of a "user pays - user benefits," or "user fee" program. In this case, anglers and boaters are the users. Anglers and boaters are responsible for payment of fishing tackle excise taxes, motorboat fuel taxes, and import duties on tackle and boats. These monies, along with other special fuel taxes on small engines, are deposited in the Department of Treasury, and are allocated the year following collection to state fishery agencies for sport fishery restoration, wetlands conservation, boat safety, and boating access and facilities projects. Each project must be evaluated and approved by the U.S. Fish and Wildlife Service (USFWS). The benefits provided by these projects to users complete the cycle between "user pays - user benefits." When the regional Federal Aid office approves a project, an amount up to 75% of the estimated cost of the project is set aside for the state to be reimbursed from the

Sport Fish Restoration Account. The state must first expend the money on the project and is then reimbursed for up to 75% of the cost. The state share must be at least 25% of the cost and must be derived from a non-federal source.

Virginia's apportionment is approximately 6.5 million dollars each year. The first 15.0% of Virginia's allocation must be spent on motor boat access and the remaining funds are split between the Department of Game and Inland Fisheries (63%) and Marine Resources Commission (37%) for freshwater sport fisheries and saltwater sport fisheries projects, respectively. Sport fisheries research and management activities, boating access development and maintenance, aquatic resource education projects, lake construction and maintenance, land acquisition, technical assistance, habitat enhancement, administration/planning, and hatchery construction are all allowable types of projects.

Water Quality

The **Water Quality Improvement Fund (WQIF)** provides water quality improvement grants to local governments, soil and water conservation districts, and individuals for point and nonpoint source pollution prevention, reduction and control programs. This includes riparian open-space and conservation easements. A primary objective of WQIF is to fund grant projects that will reduce the flow of excess nitrogen and phosphorus into Chesapeake Bay and Virginia's southern rivers. Projects can include riparian buffers open-space and conservation easements. The Virginia Department of Conservation and Recreation (DCR) distributes a request for proposal package to solicit grant applications and project proposals for the WQIF. A team of DCR and other agency or local government staff provides technical expertise in the review, scoring, prioritization and selection of grant applications and proposals. Final decisions for project selection are at the discretion of DCR's director.

The **Conservation and Recreation Enhancement Program (CREP)** aims to improve the Virginia's water quality and wildlife habitat by offering rental payments to farmers who voluntarily restore riparian buffers, filter strips and wetlands through the installation of approved conservation practices. State cost-share payments are administered through local Soil and Water Conservation District (SWCD) offices. The state will reimburse up to 25 percent, not to exceed $200 per acre of restored buffer or wetland, of conservation practice costs deemed eligible by the local SWCD. There is also a 25 percent state income tax credit for out-of-pocket expenses, thus further reducing the landowner's cost. Federal reimbursement is made through the Farm Service Agency (FSA) for up to 50 percent of a participant's eligible expenses for implementing best management practices (BMP), such as fencing or alternative watering systems.

Conservation Reserve Program (CRP). USDA Farm Service Agency's (FSA) Conservation Reserve Program (CRP) is a voluntary program available to agricultural producers to help them use environmentally sensitive land for conservation benefits. Producers enrolled in CRP plant long-term, resource-conserving covers to improve the quality of water, control soil erosion, and develop wildlife habitat. In return, FSA provides participants with rental payments and cost-share assistance. Contract duration is between 10 and 15 years.

The **Transition Incentives Program (TIP)** provides up to two additional Conservation Reserve Program (CRP) annual rental payments to a retired or retiring owner or operator of land under an expiring CRP contract if the land is sold or leased to a non-family member beginning or socially disadvantaged farmer or rancher for the purpose of returning some or all of the land to production using sustainable grazing or crop production methods.

The **Farmable Wetlands Program (FWP)** is a voluntary program to restore up to one million acres of farmable wetlands and associated buffers by improving the land's hydrology and vegetation. Eligible producers in all states can enroll eligible land in the FWP through the Conservation Reserve Program (CRP).

Producers plant long-term, resource-conserving covers to improve the quality of water, control soil erosion and enhance wildlife habitat on land enrolled in CRP. In return, FSA provides participants with rental payments and cost-share assistance. Contract duration is between 10 and 15 years. FWP is designed to prevent degradation of wetland areas, increase sediment trapping efficiencies, improve water quality, prevent soil erosion and provide habitat for waterfowl and other wildlife.

The **Source Water Protection Program**, a joint project by the U.S. Department of Agriculture's (USDA) Farm Service Agency (FSA) and the nonprofit National Rural Water Association (NRWA), is designed to help prevent source water pollution in 33 states through voluntary practices implemented by producers at the local level.

The program has been implemented in the following states: Alabama, Arizona, Arkansas, California, Colorado, Florida, Georgia, Idaho, Illinois, Indiana, Iowa, Kansas, Louisiana, Minnesota, Mississippi, Missouri, Montana, Nevada, New Mexico, Ohio, Oklahoma, Oregon, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Utah, Virginia, Washington, West Virginia, Wisconsin and Wyoming. The 33 states participating in the Source Water Protection Program were chosen based on objective technical criteria relating to water quality and population.

The program is authorized by Sec. 12400 of the 1985 Farm Bill, as amended. Source water is surface and ground water that is consumed by rural residents. According to the NRWA, ground water is the primary source of drinking water for some 44,000 communities in the United States.

Producers in the aforementioned states are encouraged to participate in the Source Water Protection Program. They can take part in the program by administering voluntary practices on their land and/or by becoming team members responsible for the development of Rural Source Water Protection plans. Citizens from federal, state, local and private entities also can serve on local teams.

The Virginia Agricultural Best Management Practice (BMP) Cost Share (VACS) Program

The Virginia Department of Conservation and Recreation (DCR) administers programs through local Soil and Water Conservation Districts (SWCDs) to improve or maintain water quality in the state's streams, lakes and bays through the installation or implementation of agricultural BMPs. The cost-share program supports using various practices in conservation planning to treat animal waste, cropland, pastureland and forested land. Some are paid for at a flat rate or straight per-acre rate. Others are cost-shared on a percentage basis up to 75 percent. In some cases, USDA also pays a percentage. In fact, the cost-share program's practices can often be funded by a combination of state and federal funds, reducing the landowner s expense to less than 30 percent of the total cost.

Because demand for cost-share assistance is great, districts support the implementation of only those plans which meet local water quality guidelines. Since all requests can't be satisfied, priority ranking of practices must be used to make sure money is distributed and spent wisely.

An individual may receive a maximum of $50,000 for cost-share, except for those utilizing livestock exclusion (SL-6) and animal waste (WP-4 and WP-4b) practices, who may receive up to $70,000. In any case, the VACS payment, combined with federal payments, cannot exceed 75 percent of the total eligible costs.

All practices in the program have been included because of their ability to improve or protect water quality. Many will also increase farm productivity by conserving soil and making wise use of other farm resources.

The BMP Tax Credit Program

The Virginia Agricultural BMP Tax Credit Program, which began with the 1998 tax year. The program supports voluntary installation of BMPs that will address Virginia's nonpoint source pollution water quality objectives.

Agricultural producers with an approved conservation plan can take a credit against state income tax of 25 percent of the first $70,000 spent on agricultural BMPs. The amount of the tax credit can't exceed $17,500 or the total state income tax obligation. Starting with tax year 2011, any unusable tax credit - i.e., exceeding the state tax obligation - will be refunded to the taxpayer by the Virginia Department of Taxation.

Agricultural operators' BMPs, if approved, will be inspected by the district after they're installed. Soon after this certification, the operators will receive cost-share payments or a tax credit approval letter from their local Soil and Water Conservation District (SWCD).

Forest Products

As part of the creation of Governor McDonnell's **Agriculture and Forestry Industries Development Fund (AFID)** during the 2012 General Assembly session, the Governor set aside funding to encourage localities to think strategically about how they can better support and integrate agriculture and forestry-based industries into their community's overall economic development efforts.

These AFID Planning Grants give local governments the flexibility to undertake the kind of planning, study, or local initiative they think best to grow and support agriculture and forestry-based businesses in their community and region. The planning grant program also provides a greater voice in local economic development to agriculture and forestry stakeholders by requiring that any grant funded program be implemented by a board, committee or working group representing agriculture and/or forestry interests in the affected locality.

The competitive grant program allows political subdivisions to apply for up to $20,000 in matching funds, or up to $35,000 for multi-jurisdictional applications, to undertake efforts that support local agriculture and forestry-based businesses. These efforts might include developing a strategic plan for agriculture and forestry economic development, creating new local policies and zoning ordinances that better support these industries, or funding feasibility studies and predevelopment work for new facilities that bring significant and lasting benefits to the local agriculture and forestry sectors.

The amount of an AFID Planning Grant and the terms under which it is given are determined by the Secretary of Agriculture and Forestry and approved by the Governor. Factors used in determining grant awards and conditions include the project's expected impact on the affected locality's agriculture and forestry related industries, and the extent to which the effort will improve local capacity to support these industries' development beyond the life of the grant.