CAROLINE COUNTY
COMPREHENSIVE PLAN





Caroline County, Maryland
DRAFT
June 2009

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INTRODUCTION

Why Plan

Planning prepares the government to protect the public health, safety and welfare by projecting future population needs and making recommendations to ensure those needs are met.

Maryland's Planning & Zoning Enabling Act

As the State's pre-eminent growth management law, *Article 66B of the Annotated Code of Maryland, Land Use* (Planning & Zoning Enabling Act) requires that county and municipal plans be implemented by laws, ordinances, and regulations consistent with the Planning & Zoning Enabling Act and its "Visions."

The Planning & Zoning Enabling Act provides a blueprint for the implementation of local policies and regulations regarding land use and growth management. Each county and municipality within Maryland is required to review their comprehensive land use plans and implementation provisions every six years.

The eight "Visions" of the Planning & Zoning Enabling Act include the following:

1. Development is concentrated in suitable areas;
2. Sensitive areas are protected;
3. In rural areas, growth is directed to existing population centers and resources are protected;
4. Stewardship of the Chesapeake Bay and the land is a universal ethic;
5. Conservation of resources, including a reduction in resource consumption is practiced;
6. Economic growth is encouraged and regulatory mechanisms are streamlined;
7. Adequate public facilities and infrastructure under the control of the county or municipal corporation are available or planned in areas where growth is to occur; and
8. Funding mechanisms are addressed to achieve these "Visions."

Maryland has procedures to ensure that public infrastructure improvements are consistent with growth policies, as defined in the law. The Planning & Zoning Enabling Act stipulates that a local government may not approve a local construction project involving the use of State funds, grants, loans, loan guaranties, or insurance, unless the project is consistent with the State's "Visions."

The Planning & Zoning Enabling Act directs local government to coordinate planning and

development efforts between counties and municipalities (interjurisdictional coordination). The Act also requires that local planning efforts remain consistent with the State's planning laws and policies. Local comprehensive plans must include recommendations for improving planning and development processes to encourage economic progress and to direct future growth to appropriately designated areas where it can be served by adequate public infrastructure and services. Maryland put together a Task Force on the Future of Growth and Development in 2006. A subcommittee of this group reevaluated the eight visions and in their Final Report dated September 4, 2008 they proposed twelve new visions to replace the existing eight. These new visions, adopted in April 2009 in the Smart, Green, and Growing Act (House Bill 294), are listed below:

1. Quality of Life and Sustainability: A high quality of life is achieved through universal stewardship of the land, water and air resulting in sustainable communities and protection of the environment.
2. Public Participation: Citizens are active partners in the planning and implementation of community initiatives and are sensitive to their responsibilities in achieving community goals.
3. Growth Areas: Growth is concentrated in existing population and business centers, growth areas adjacent to these centers, or strategically selected new centers.
4. Community Design: Compact, mixed-use, walkable design consistent with existing community character and located near transit options is encouraged to ensure efficient use of land and transportation resources and preservation and enhancement of natural systems, open spaces, recreational areas, and historical, cultural, and archeological resources.
5. Infrastructure: Growth areas have the water resources and infrastructure to accommodate population and business expansion in an orderly, efficient, and environmentally sound manner.
6. Transportation: A well-maintained, multimodal transportation system facilitates the safe, convenient, affordable and efficient movement of people, goods and services within and between population and business centers.
7. Housing: A range of housing densities, types, and sizes provide residential options for citizens of all ages and incomes.
8. Economic Development: Economic development that promotes employment opportunities for all income levels within the capacity of the State's natural resources, public services, and public facilities is encouraged.
9. Environmental Protection: Land and water resources are carefully managed to restore and maintain healthy air and water, natural systems and living resources.
10. Resource Conservation: Waterways, open space, natural systems, scenic areas, forests and agricultural areas are conserved.

11. Stewardship: Government, business entities, and residents are responsible for the creation of sustainable communities by collaborating to balance efficient growth with resource protection.
12. Implementation: Strategies, policies, programs and funding for growth and development, resource conservation, infrastructure, and transportation are integrated across the local, regional, State and interstate levels to achieve these visions.

Neighborhood Conservation & Smart Growth Areas Act of 1997

In 1997, the Maryland General Assembly enacted the *Neighborhood Conservation and Smart Growth Areas Act* (Smart Growth Act). The intent of the legislation is to marshal the State's financial resources to support growth in Maryland's communities and limit development in agricultural and other resource conservation areas.

At the heart of the Smart Growth concept are the "Priority Funding Areas" (PFAs), which represent local growth areas targeted for state funding. PFAs include municipalities that existed on January 1, 1997, existing rural villages, and planned communities/growth areas and industrial areas to be served by public water and sewer. Areas annexed by municipalities after January 1, 1997 must meet additional density requirements and have water and sewer service in order to qualify as a PFA.

In terms of adequate public facilities and services, community planned objectives at the county and municipal levels are critical to direct growth to appropriately designated areas. Communities that have not enacted local plans and ordinances to manage growth and establish the infrastructure required to accommodate growth may not receive state funding.

Plans must show designated growth areas. Lands within local growth boundaries *may* be designated as a Priority Funding Area (PFA) provided sewer service is planned in the County's 10-Year Water and Sewerage Plan and provided such designation is a long-term and planned development policy that promotes efficient land use and public infrastructure, and provided that certain density requirements are met. Plans must include planned water and sewerage service areas, residential development areas, industrial development areas, economic development areas, and neighborhood parks.

Under the Smart Growth Act, all of Maryland's municipalities are automatically designated as PFAs. As of 1998, State funding can only be applied to "growth related projects" in PFAs. Growth related projects include highway and road construction and improvements, water and sewer construction, and economic development assistance.

Municipalities annexing territory must determine whether the area is eligible for PFA

status. Determination of PFA status is best achieved through joint review by municipal, county, and state planning agencies. Certificates for PFAs should be sent to the Maryland Department of Planning to ensure that the State has the necessary information to make funding decisions.

Adequate Public Facilities (APF) Laws

Adequate public facilities (APF) laws for counties and municipalities can include water and sewerage, schools, roads, emergency services and parks and are related to community growth objectives. In 1978, the Maryland General Assembly passed Article 66B, Section 10.01, enabling non-charter counties and municipalities to adopt adequate public facilities ordinances. Authority to enact adequate public facilities ordinances is based upon the general authority to sustain and promote the community.

APF laws were designed to curb development in areas where public facilities are inadequate and to delay development in planned growth areas until adequate public services can be obtained or assured. APF laws are growth management tools for growing counties and municipalities and are consistent with the Planning & Zoning Enabling Act. APF laws require clearly defined standards.

Comprehensive Plan Public Participation

The County advertised twice in the local newspaper that the review of the Comprehensive Plan was beginning and that we were looking for public opinion on six predetermined topics or interests. There was an interest meeting for: (1) educational facilities and infrastructure and recreation and parks, (2) transportation, public safety and emergency services, (3) residential development, (4) environmental concerns, (5) economic development, and (6) agriculture. The meetings were open to the public. Each meeting was attended by a small group of professionals, concerned citizens and staff. Minutes were kept from each meeting and posted on the Department web site and feedback on the process was encouraged through email and anonymous web and paper comment forms. Throughout the preparation of the comprehensive plan, updates and discussions were on the agenda at regularly scheduled Planning Commission meetings and the public was permitted to comment. The County regularly included municipalities in comprehensive plan discussions and requested comment on the draft as it progressed.

Background and History

Caroline County is located on the Delmarva Peninsula in the State of Maryland. It is part of the Upper Eastern Shore Region. The Upper Eastern Shore comprises five counties;

Caroline, Cecil, Kent, Queen Anne's, and Talbot. Caroline County is bordered by Queen Anne's, Talbot, and Dorchester Counties in Maryland and Kent and Sussex Counties in the State of Delaware. There are ten incorporated municipalities in Caroline County: Denton (the County Seat), Federalsburg, Goldsboro, Greensboro, Henderson, Hillsboro, Marydel, Preston, Ridgely, and Templeville. Caroline is a "Code Home Rule" county, as established by the State of Maryland, with three elected County Commissioners who serve four year terms.

Caroline County was formed in 1773 from portions of Dorchester and Queen Anne's Counties by Maryland's last colonial governor, Robert Eden. The County was named after Caroline Calvert, wife to Robert Eden and the sister of Frederick Calvert, the last Lord Baltimore. At the time of its creation, seven commissioners were appointed: Charles Dickinson, Benson Stainton, Thomas White, William Haskins, Richard Mason, Joshua Clark, and Nathaniel Potter. Much of the historic and cultural legacy of the County represents late colonial settlements, traditional agriculture, and the development of the railroad industry.

The County is intricately linked to the early life of Frederick Douglas, a famous black abolitionist of the Civil War era, and Harriet Tubman, famous for leading fellow runaway slaves to freedom along the Underground Railroad. Douglas was born into slavery near the Tuckahoe River in 1818, as part of the plantation of Holmes Hill Farm. The estate was owned by Aaron Anthony, who also managed the plantations of Edward Lloyd, one of the wealthiest Southern aristocrats in Maryland. The lands owned by Douglass' plantation master spanned both Talbot and Caroline Counties. Douglas' first wife was born in Denton and supported him in his efforts to end slavery. As an important area for national history, the County is a crucial heritage area link for the Eastern Shore region and an important component of the Underground Railroad.

Caroline County has historically been, and remains, a rural agricultural County. Agricultural preservation is a high priority. The County has developed multiple tools to achieve its agricultural preservation goals. A *Transfer of Development Rights* Program is used to direct growth to designated receiving areas, and no new major subdivisions are permitted in the rural zones of the County outside of receiving areas. The County intends to enhance this Program by coordinating sending and receiving development rights and areas with municipalities in the County. Caroline County also has abundant natural resources related to its waterways and forested lands. A Watershed Characterization has been developed for 2 of the 4 major watersheds in the County, and a similar document is planned for the remaining watersheds. These Characterizations will be used to develop watershed plans for the County. Protecting and preserving agriculture, natural resources and the rural and scenic countryside of the County are among the County's highest priorities.

Population & Demographics

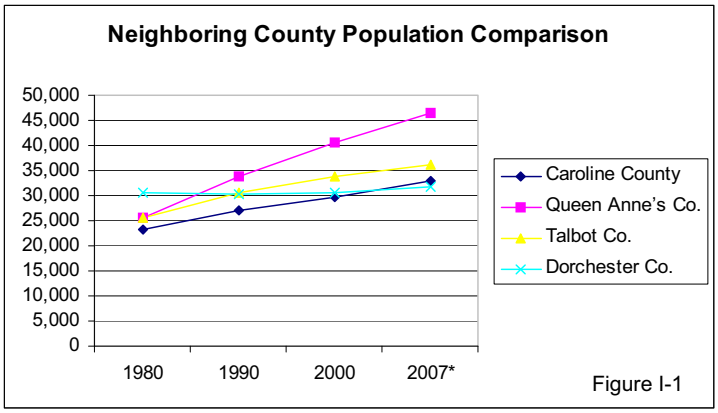


Figure I-1

Historically, Caroline County experienced population increases from 1880 to 1910 and 1970 to 2007. Based on Census 2000 data and the 2007 estimates, the population growth rate for entire Eastern Shore on average is 1.1% per year, only slightly below Caroline County at 1.4%. As illustrated in the chart titled *County Percent Growth Rate over Time*, the changes in Caroline County's growth have been more moderate since 1980, when compared to Queen Anne's and Talbot Counties. The same is true when comparing Caroline County with all other counties on the Eastern Shore. Growth factors in Caroline County define the need for the County to continue to balance growth with the protection of resources.

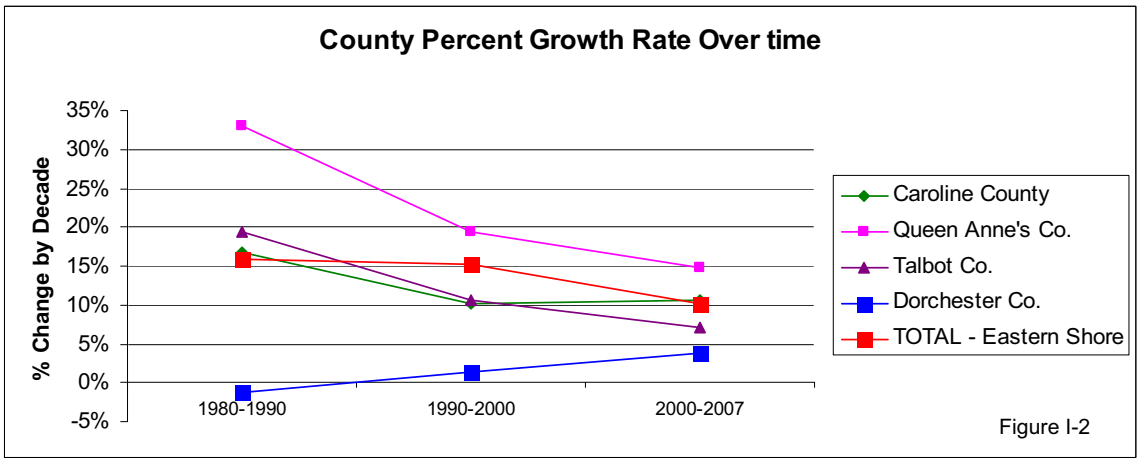


Figure I-2

Table I-1: Regional Population Statistics				
Eastern Shore Region	**1980**	**1990**	**2000**	**2007**
Caroline County	**23,143**	**27,035**	**29,772**	**32,910**
Cecil Co.	60,430	71,347	85,951	99,695
Kent Co.	16,695	17,842	19,197	19,987
Queen Anne's Co.	25,508	33,953	40,563	46,571
Talbot Co.	25,604	30,549	33,812	36,193
TOTAL - Upper Shore	**151,380**	**180,726**	**209,295**	**235,356**
Dorchester Co.	30,623	30,236	30,674	31,846
Somerset Co.	19,188	23,440	24,747	26,016
Wicomico Co.	64,540	74,339	84,644	93,600
Worcester Co.	30,889	35,028	46,543	49,374
TOTAL - Lower Shore	**145,240**	**163,043**	**186,608**	**200,836**
TOTAL - Eastern Shore	**296,620**	**343,769**	**395,903**	**436,192**

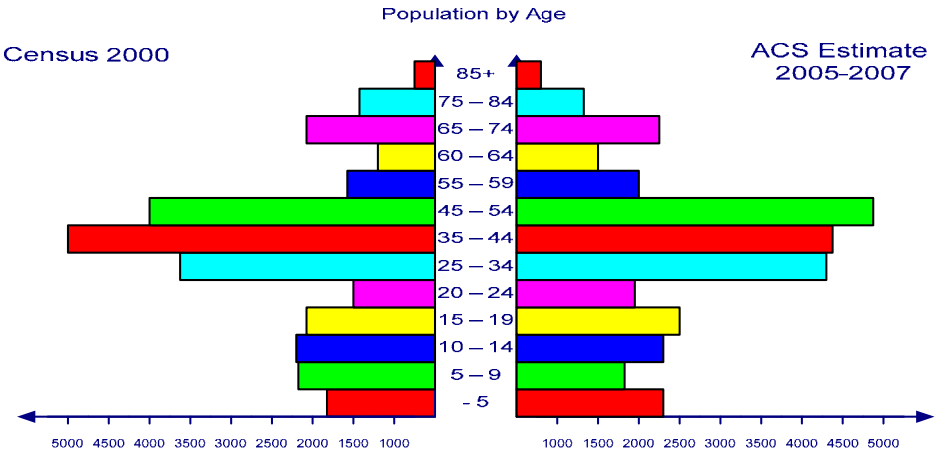
Source: US Census 2000; Data for 2007 are estimates

A comparison of municipal growth between 2000 and 2007 illustrates that while some municipalities have grown, several of the smaller municipalities are starting to lose population. This may be attributable to a lack of water and/or wastewater treatment facilities in some municipalities, driving developers to other towns with more well developed infrastructure. Additionally, the chart suggests that the dramatic growth in some municipalities appears to be correlative with their comparatively small populations, making any growth a significant change.

Table I-2: Caroline County Population Change			
	2000 Population	**2007 Population**	**Percent Change**
Denton	2,960	3,833	29%
Federalsburg	2,620	2,611	0%
Goldsboro	216	211	- 2%
Greensboro	1,632	1,967	21%
Henderson	118	121	3%
Hillsboro	163	157	- 4%
Marydel	147	142	- 3%
Preston	566	671	19%
Ridgely	1,352	1,514	12%
Templeville	80	82	3%
Total Incorporated	**9,854**	**11,309**	**15%**
Total Unincorporated	**19,918**	**21,601**	8%

Source: US Census 2000

According to the 2000 Census, the largest age group in Caroline County was the 35-44 group. In the estimate provided by American Community Survey you can see that part of that age group has shifted to the 45-54 age group. This shift should become more pronounced in future years and will put additional stress on medical facilities and public transportation over the next 25 to 30 years as that population ages.



Based on data from Census 2000 and American Community Survey Figure I-3

Based on U.S. Census 2000 statistics, 24,322 people in Caroline County were Caucasian, 82% of the County's total population. African Americans were approximately 15% of the population. The population of Caucasians and African Americans in the County has remained relatively unchanged, while other races, such as Asian and Pacific Islander have increased dramatically. Additionally, the number of inhabitants claiming Hispanic and Latino origins has increased by 73%.

Table I-3: Population by Race

Race	2000	2005-2007	% Change
White	24,322	26,241	8%
Black or African American	4,398	4,340	-1%
American Indian and Alaska Native	110	62	-44%
Asian	163	274	68%
Native Hawaiian and Other Pacific Islander	5	320	6300%
Some other race	376	530	41%
Hispanic or Latino (of any race)	789	1,363	73%

Source: Census 2000 and American Community Survey

New Home Construction

Between 1990 and 1999, approximately 1,751 new housing units were constructed in Caroline County, not including replacement homes. Of those new homes, 23% were located in municipalities. Between 2000 and 2007, approximately 1,793 new housing units were constructed. Of these 901 (50%) were located in the County and 892 (50%) were located within municipal boundaries.

Table I-4: New Home Construction								
	2000	2001	2002	2003	2004	2005	2006	2007
Unincorporated	125	127	121	122	138	109	87	72
Denton	10	14	9	77	64	138	147	86
Federalsburg	2	44	12	3	15	9	3	2
Goldsboro	-	-	-	-	-	-	1	-1
Greensboro	7	8	21	28	77	4	5	1
Henderson	-	-	-	-	-	-	1	0
Hillsboro	0	0	0	0	0	0	0	0
Marydel	-	-	-	-	-	-	0	-2
Preston	0	0	0	0	26	12	1	0
Ridgely	1	4	2	5	26	52	15	0
Templeville	-	-	-	-	-	-	-	0
Incorporated	17	66	44	109	202	209	159	86
% Incorporated	12%	34%	27%	47%	59%	66%	65%	54%
% Unincorporated	88%	66%	73%	53%	41%	34%	35%	46%

Prior to 2000, growth and development largely occurred in unincorporated areas. Growth and development began concentrating in municipalities in 2003 and by the end of 2004, for the first time since at least 1990, municipal growth surpassed growth in unincorporated areas. Development shifts are attributed to several factors, including new State and County laws, market trends, and access to public infrastructure and services. This shift in development correlates well with the County's desire to preserve its rural countryside, and the County will strive to continue the trend.

Population Projections

Shown below are the population projections for the unincorporated areas of Caroline County by the Maryland Department of Planning (MDP) and the Caroline County Department of Planning, Codes & Engineering (the Department). This plan is based on the projections made by the County, which were based on the state projections.

I-5: Population Projections						
Source	**Estimates**	**2010**	**2015**	**2020**	**2025**	**2030**
MDP	Population	22,727	24,695	26,517	28,170	29,686
	Annual % Increase	1.7	1.7	1.5	1.2	1.1
	New Annual DUs	161	177	160	157	145
County	Population	21,992	23,092	24,477	25,946	27,503
	Annual % Increase	1.0	1.0	1.2	1.2	1.2
	New Annual DUs	104	108	124	140	146
Note: Maryland Department of Planning, December 2008. Uses MDP Persons/Household projections. DU = Dwelling Unit						

As written earlier, the average annual growth rate for Caroline County over the past 20 years has been 1.4% and the current state of the National and local economies make it

difficult to justify the spike in the annual growth rate forecast in 2010 and 2015 by MDP. Therefore the County has adjusted the growth rate to show a slower steady growth over the next 20 years that averages out to an overall 1.3% growth rate.

The projected County growth affects water consumption, schools, recreation land, police and fire and rescue, as well as other public services and amenities such as libraries and transportation. Based on industry standards for forecasting demand, the Department estimates that between 2010 and 2030 the County will serve 5360 students total. It is also estimated that the County will need a total of 72 police personnel and 44 fire and rescue personnel with 22,002 square feet in fire and rescue facilities. A total of 825 acres of recreational land will be required and the recommended square footage of library space for the projected 2030 population is 2,750.

Transportation

Major highway access routes near or within Caroline County include US Route 301, US Route 50, US Route 13, and MD Route 404. MD Routes serving the County include 16, 404, 480, 311, 312, 317, and 328. Every major city within the Mid-Atlantic region is located less than 300 miles from the County. The closest regional cities include Dover and Wilmington, Delaware; Annapolis and Baltimore in Maryland; and Washington D.C., all located within 2 hours driving time of the County.

Geography, Resources, and Industry

Caroline County is approximately 321 square miles or 206,719 acres. According to the Maryland Geological Survey, the County elevation ranges from 0 to 79 feet above sea level and is located entirely with the Atlantic Coastal Plain, a geographical area extending along the East Coast seaboard below New York and Pennsylvania. The topography of the region is relatively flat, which has created an environment suitable for crop farming. Large mineral deposits of sand and gravel exist in the middle and southern portions of the County.

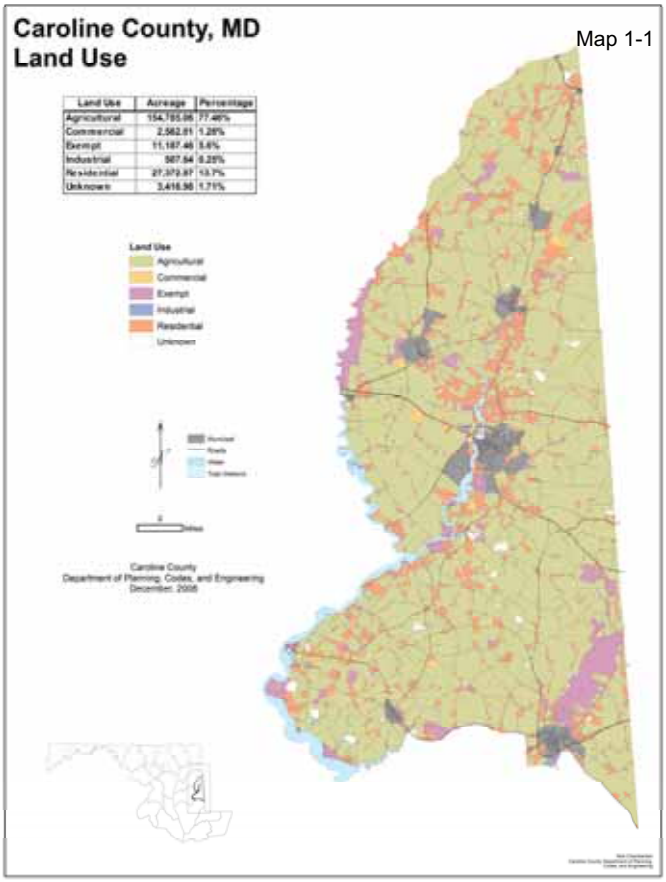
Caroline County contains numerous natural resource areas, including large forested areas, a number of rivers and streams, and large areas of wetlands. Major water resources include the Choptank and Tuckahoe Rivers and Marshyhope Creek. The County is served by several large fresh water aquifers.

CHAPTER 1: LAND USE AND GROWTH MANAGEMENT

The primary land use goal in Caroline County is to preserve agriculture, natural resources and the rural character of the County by continuing to direct future growth to existing population centers (e.g. incorporated municipalities, R-1, R-2, R-3, and Transfer of Development Rights (TDR) receiving areas). These areas generally include infrastructure and amenities such as roads, schools, businesses, and in some cases public water and sewer. Some modification of TDR receiving areas and regulations may be desired in order to improve and build upon the County's existing TDR program. The County's overall land use objectives to achieve this goal include the following:

- Providing adequate planning and regulatory mechanisms for rural land use and growth management;
- Maintaining the agricultural land-base to support the County's agriculture economy;
- Preserving valuable natural, historical, cultural, archeological and scenic resources;
- Improving County and Municipal coordination through the development of "Inter-Governmental Agreements" for land use, land preservation, growth management, and infrastructure and services.

The vision for Caroline County is to direct growth to existing population centers, while enhancing the conservation of resource lands as part of a region-wide rural conservation area that protects farmland and natural resources.



Existing Land Use

Unincorporated areas total 199,854 acres or 97% of the total land area for the region. Incorporated areas total 6,865 acres or 3% of the land area for the region. As shown on Map 1-1, there are 154,785 acres of agricultural, 2,562 acres of commercial, 507 acres of industrial and 27,372 acres of residential lands. Although this number is not illustrated on the map, there are approximately 66,915 acres of forested land according to the Department of Natural Resources (DNR) that is spread throughout

the various uses (particularly agricultural). There are many rural villages in the County, some of which are designated as Priority Funding Areas (PFAs). Those rural villages that are also PFAs are Choptank, Harmony, Hickman, Mt. Zion, Bridgetown, Hobbs, Burrsville, Williston, Tanyard, Bethlehem and American Corner. These areas consist of a mixture of denser residential development and commercial and industrial establishments.

Future Land Use

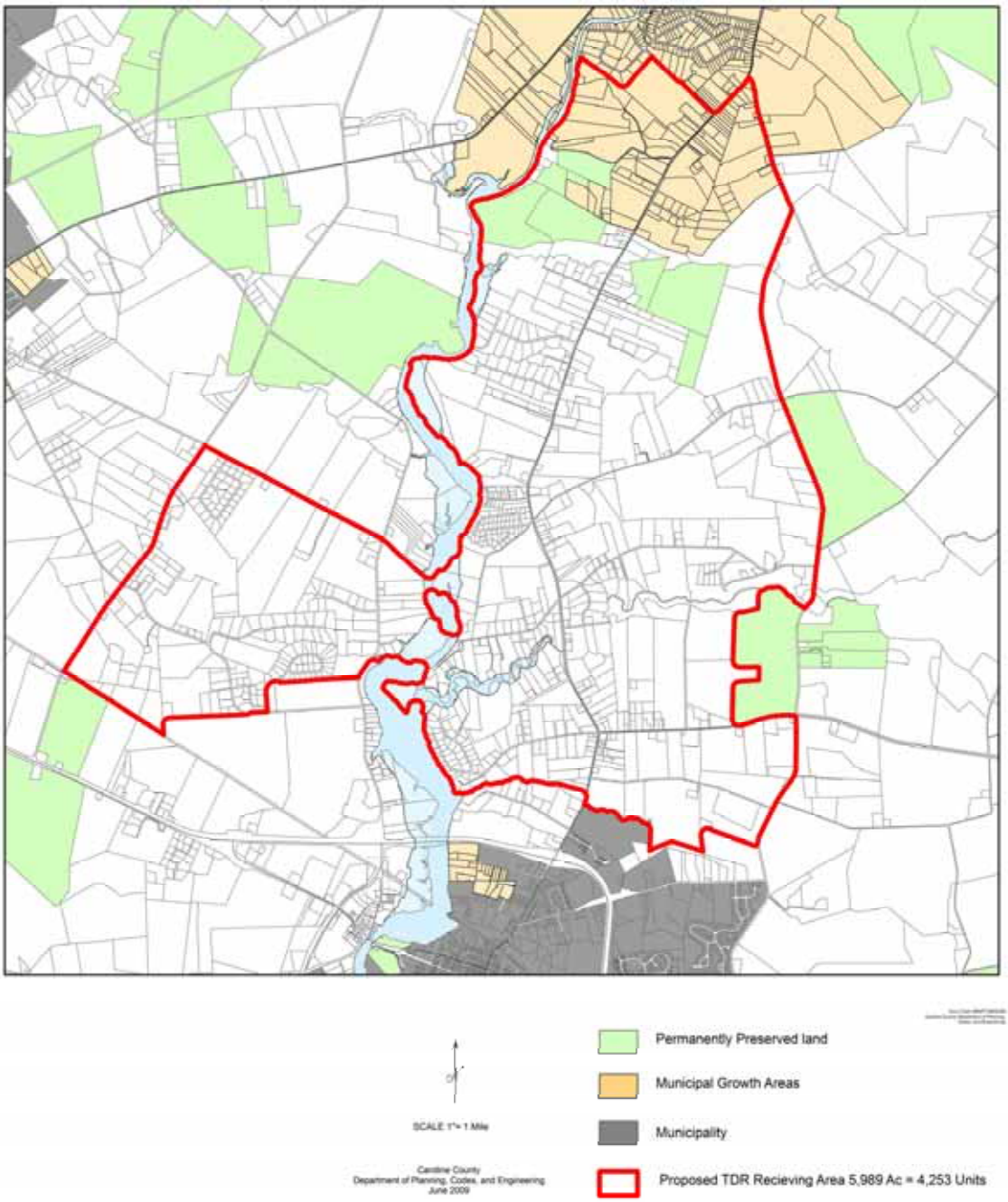
This land use element closely resembles the growth management policies of former plans by concentrating population in the existing towns and conserving agricultural and natural resources. In the past this has been accomplished by establishing a TDR program, zoning the rural portions of the County at a low density, and eliminating major subdivisions in the R-Rural Zone (with the exception of the TDR receiving area). A significant difference between this Plan and former Plans is a proposed change in the TDR Receiving Area. Currently the receiving area is located between the Towns of Denton and Greensboro (see Map 1-2). This Plan seeks to establish additional County growth areas around existing Town boundaries with the goal of developing a stronger inter-jurisdictional growth program with incorporated municipalities.

Pending the outcome of establishing additional TDR receiving areas (made in conjunction with a County/Town growth planning effort), changes in zoning and/or land use designations may be required to accommodate additional receiving areas around towns. The County will amend its existing and future land use map to reflect any changes at such time when inter-jurisdictional agreements are made to establish additional receiving areas (inter-jurisdictional growth areas). The County's comprehensive re-zoning project, currently underway, will likely precipitate additional changes in zoning and land use designations as well; the County will incorporate any revisions to land use designations made as a result of comprehensive re-zoning with revisions made as a result of inter-jurisdictional growth area agreements, and submit amended land use maps to MDP accordingly.

Areas are identified in portions of the County in the Resource Conservation Chapter that will be priority areas for coordinated Federal, State and local programs to preserve land and support a healthy agricultural economy. These areas include most of the R-Rural zone, flood prone areas, and other areas targeted for natural resource conservation. Ranking criteria may be modified for land preservation to more effectively demarcate town boundaries. Rather than specifically identifying properties to form greenbelts, the County anticipates working with towns to establish town boundaries and ranking properties adjacent to those boundaries higher in the land preservation process. Agriculture remains the preferred land use in Caroline County.

Map 1-2

Caroline County, MD
Current TDR Recieving Area



Existing rural settlement patterns are identified along with rural villages that are part of the County's unique character. In addition, the Land Use Plan makes provisions for the stability of the existing towns and rural villages. The Land Use Plan gives priority to the incorporated towns and rural villages as centers for future population growth and major capital investment. It also identifies potential areas for inter-jurisdictional growth where the County's growth can be directed and public services may be provided. The following describes land use districts and classifications:

Existing Municipalities

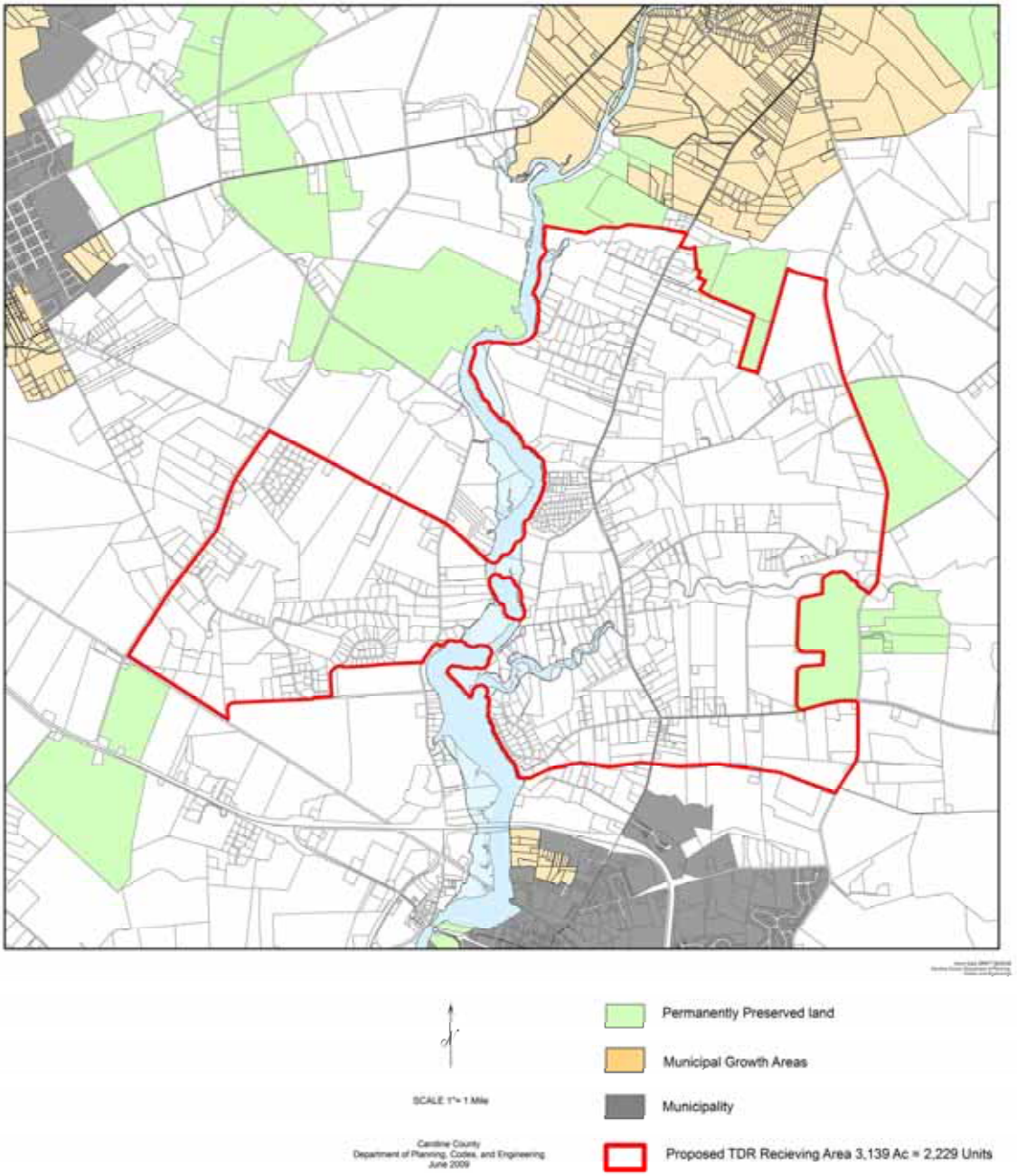
This land use element emphasizes a continuing role for the municipalities as major population and commercial, industrial, and institutional centers for the region. Concentrating population in and around the existing municipalities with adequate public infrastructure and services is the most efficient way to provide basic community facilities and services to residents, support historic investment in infrastructure (such as existing streets), and reduce pressure for development in rural areas. It also maintains the County's land use tradition, namely compact communities surrounded by rural countryside. Although a regional wastewater treatment facility for the northern portion of the County is currently being planned for public health reasons, the County does not plan to develop new wastewater treatment facilities in other areas. Instead, this Plan seeks to direct growth to the towns where treatment facilities already exist.

It is imperative that the towns and County work together to implement appropriate development and redevelopment strategies. In 2006 the County revised its TDR Program, including the elimination of rural major subdivisions in R-Rural zones of the County except in designated TDR receiving areas. This was a significant step towards redirecting growth to existing municipalities and other natural growth areas, and out of the rural countryside. The County would like to continue to improve upon its TDR Program by working with incorporated municipalities to develop a mutually beneficial Program in which the towns could serve as receiving areas for County TDR sending rights. All residents of the County benefit from having incorporated towns that are desirable places for residents to live, work, and shop. Most towns have significant infill, re-development opportunities, and growth areas. Several towns have indicated a desire for establishing greenbelts around their towns. The County proposes to use its existing R-Rural zoning combined with a higher ranking for preservation for properties adjacent to the Towns to establish a "green line" rather than a greenbelt. Furthermore, the County will review its current TDR Receiving Area and consider removing the portions immediately adjacent to the Towns of Greensboro and Denton (See Map 1-3).

The municipalities play an important role in the County's growth management strategies. As designated growth centers, the towns are the preferred location for future population growth and non-agricultural economic activity in the region, in accordance with State

Caroline County, MD
Proposed TDR Recieving Area

Map 1-3



laws. In 2006, the Towns and County embarked on a joint planning program together to begin addressing local growth management issues through Caroline Council of Governments. Continued cooperation between the County and Towns will build the community resources necessary to effectively implement growth management and revitalization strategies and achieve economies of scale, while also preserving jurisdictional integrity.

County Growth Areas

Growth area boundaries serve as a line between urban and suburban land uses and more rural land uses, such as agriculture, natural resource lands, or low-density rural-residential development. Growth Areas define a planned, long-range build-out limit for both the County and municipalities. Potential build-out scenarios include lands within current corporate boundaries and lands designated for future growth. Growth Areas include regions near the incorporated towns, which constitute the region's current "Priority Funding Areas" (PFAs) under the State's 1997 *Smart Growth Areas Act*.

Growth Areas also include existing developed regions adjacent to the towns, such as developed residential, commercial, industrial, and institutional areas as well as the rural villages, some of which will likely require public infrastructure and services in the future. Growth Areas include regions currently planned for major capital improvements and will constitute future PFAs for the region in compliance with State laws.

The emphasis for PFAs is to invest in key public infrastructure, increase economic activity, and revitalize existing neighborhoods. Overall emphasis is on ensuring the orderly expansion of towns and their infrastructure, coordinating County and town land use policies and growth management mechanisms, and promoting high quality development. County plans, policies, processes and regulations should seek the orderly and efficient transition of land in Growth Areas such as through municipal annexation and subsequent extension of public infrastructure and services. More discussion regarding the appropriate zoning classification for municipal growth areas will occur at the time of comprehensive rezoning.

Based on recent growth trends, the County projects its population will grow by 6412 people in the unincorporated areas by the year 2030. This equates to an estimated 2596 additional dwelling units in the County. An additional 2523 dwelling units is projected in the towns.

In 2006 with the revision of the County TDR Program, two receiving areas were officially designated which are essentially County Growth Areas. As shown on Map (1-2), these areas are located to the North and Northwest of Denton, extending as far North as Greensboro. Through an analysis of the TDR Program and development potential in

Caroline County, it has been determined that currently there is not enough area designated in the County's TDR Receiving area to accommodate all TDR sending rights available. The existing TDR receiving area can currently accommodate 2,904 new dwelling units while there are a total of 7,080 sending rights that could be available. In addition to TDR sending rights, the development capacity analysis results show there are approximately 4,211 minor subdivision rights and 7,431 R-1 development rights available.

As a result of this analysis, Caroline County has determined that it may eventually need to either find land to accommodate the additional 4,176 sending rights available, or modify its TDR Program. It can also be assumed that for many reasons, including participation in agricultural preservation programs, not all landowners will sell their development rights. This Plan outlines how the County proposes to handle these additional development rights in a way that is sensitive to natural resources and that utilizes Smart Growth principles.

Accommodating Growth from 2010-2030 and beyond

Currently the County has land available in its TDR receiving area, R-1, and R-Rural zones to accommodate growth projected for the planning period 2010-2030. No new growth areas are identified in this Plan, though portions of the TDR receiving area may be removed. In order to accommodate future growth and all TDR sending rights, the County will be looking to the towns to participate in an inter-jurisdictional growth program. The County will work with interested Towns to identify potential growth areas that could be shared, and has initiated this process internally by investigating potential available wastewater treatment capacity through the Water Resources Element of this Plan.

Based on Smart Growth Principles, it is estimated that roughly 1,080 acres would be needed to accommodate the additional 4,176 TDR sending rights[1]. The County plans to identify this acreage around towns that are interested in developing an inter-jurisdictional growth program. Directing the growth towards the towns is most appropriate because services and infrastructure are readily available. The nutrient loading for properties served by a wastewater treatment plant versus septic systems is significantly less, making this a better option for water quality the County's waterways. The following table shows a rough estimate of potential available wastewater treatment capacity by municipality as determined by Caroline County and using information from the Maryland

[1] This was calculated by first determining how much land area would be needed to accommodate one 8000 sq. ft. lot along with sidewalks, roads, stormwater management, etc. The County has assumed 71% as the multiplier. Therefore, 11,267 sq. ft. would be needed for each 8000 sq. ft. lot. With this figure, the following formula was used to determine the total acreage needed: (4176 development rights x 11,267 sq. ft.)/43,560 sq. ft. = Total acres needed.

Department of the Environment. The table is meant to be illustrative only in that the County is just beginning to initiate discussions with the towns regarding shared growth areas. While this information has been discussed with the Maryland Department of the Environment, the County has not necessarily discussed these numbers with the individual towns. Furthermore, the table assumes each treatment plant would be upgraded to meet either Enhanced Nutrient Removal (ENR) or Biological Nutrient Removal (BNR) treatment levels as indicated:

Table 1-1: Potential Wastewater Treatment Capacity by Municipality*		
Municipality	Potential new Dwelling Units (DU's)	Acres needed to accommodate new DU's
Denton (ENR)	2599	672
Federalsburg (ENR)	5274	1364
Greensboro (BNR)	0	0
Preston (BNR)	273	71
Ridgely (BNR)	293	76
Goldsboro (ENR)*	441	114
Henderson (ENR)*	191	49
Marydel (ENR)*	69	18
Templeville (ENR)*	7	2
Hillsboro	0	0
Total	**9147**	**2366**
*Wastewater Treatment System is in the Planning Phase		

Based on this preliminary analysis, this Plan establishes a goal to work with the towns to identify inter-jurisdictional growth areas that could be served by a wastewater treatment system. These new areas could accommodate the remaining TDR Sending rights depending on modifications to the County's existing TDR Program, or the development of a separate TDR/PDR Program. In addition to these new areas, the County will continue to work towards developing a mutually beneficial inter-jurisdictional growth program with the Towns that would provide growth guidelines for town growth areas, County growth areas and land preservation.

Currently the County does not operate any wastewater treatment systems, though there is one system planned for the northern portion of the County. For this reason, this Plan establishes a goal that all development in County growth areas be required to use denitrifying septic systems to reduce nutrient loading to the County's waterways. It is the County's goal that eventually the growth areas surrounding the Towns would be served by public water and sewer to reduce impacts to natural resources.

The R-Rural Zone as an Agricultural Conservation Area

The R-Rural zone has been referred to in past plans as an agricultural conservation area that includes active agricultural areas, existing agricultural land preservation districts, and land in private conservation easements. The area is characterized as rural and scenic countryside consisting of farm fields, large forested areas, extensive natural resources, and scattered historic and cultural sites and structures.

The growth management emphasis for agricultural conservation areas is to preserve the farmland base, the agricultural industry, and protect natural resources located in the region. It should be a priority area for programs designed to permanently preserve agricultural land, help maintain a viable agricultural industry, and protect natural resources. Low-density rural residential development and related land uses should be minimized to avoid conflicts with legitimate agricultural uses and reduce demand for capital investment in infrastructure, such as upgrades to county roads. The existing scenic, cultural, and historic resources that define the character of the area should be protected through appropriate programs and regulations.

Preserving agricultural conservation areas for agricultural industries is critical for Caroline County to remain a “rural” county. Designating Growth Areas in and near the towns is an important parallel growth management objective. If the towns are desirable places to live, it will help lessen development pressure in rural areas. Agricultural conservation areas should have maximum flexibility under policies and regulations to ensure the viability of farm industries and commercial and industrial uses related to agriculture. Maintenance of the agricultural land base is critical for a successful agricultural industry. Rural major subdivisions have been eliminated in agricultural conservation areas under the 2006 TDR Regulations. Minor subdivision rights have been preserved, however the minor subdivision regulations should be reviewed periodically due to their cumulative effects.

Using R-Rural Zone to Define a Growth Boundary

The R-Rural zone comprises the bulk of Caroline County and is intended to be a low-density agricultural area. This zone includes a mix of low density residential and agricultural land uses. Several towns have stated a desire or a plan for establishing a greenbelt surrounding their towns, and past County Comprehensive Plans have included discussions related to establishing greenbelts. The County recommends that the towns use the County’s R-Rural zoning to establish the edge of development and the beginning of the rural countryside. Furthermore, the County proposes to assign properties immediately adjacent to the towns be a higher priority for land preservation to help permanently establish the edge of development. The emphasis is to maintain a distinct rural edge from the designated growth areas characterized by agricultural use, open

space, natural resources, and low density residential uses.

In addition to R-Rural zoning, there are two tools the County and towns can use to protect this boundary between higher and lower density growth. First, as mentioned previously, properties immediately adjacent to town and County growth areas can be assigned a higher priority for land preservation. Preserving properties adjacent to towns will be done by encouraging property owners to participate in voluntary easement programs, such as the Maryland Agricultural Preservation Fund (MALPF), or through an expansion of the County's Transferable Development Right (TDR) program. It must be acknowledged, however, that even preserved lands can be annexed into towns in order for a town to grow beyond it existing boundary. The second tool is for the towns and the County to mutually agree not to rezone, annex, and/or develop those properties outside of the planned growth areas.

The County has started, and will continue, to review ordinances and policies for activities permitted adjacent to growth areas. For example, a recent ordinance change allowing certain trucking activities in the R-Rural zone specifically states that these activities may not be conducted immediately adjacent to municipalities, TDR receiving areas, and the R-1 residential zone. A comprehensive review of the County Code is planned following the adoption of this comprehensive plan. It is the County's intention that similar restrictions be placed on other activities that may be appropriate in the R-Rural zone, but no necessarily appropriate either in or immediately adjacent to developed areas.

Residential

The majority of the County's "Residential" areas consist of existing low-density residential uses located within the agricultural conservation areas and are the result of historic development patterns, including more recently, the creation of subdivision lots along State and County roads. The R-Rural zone allows an individual parcel to subdivide up to 4 lots (minimum size of one acre) providing the residual is twenty or more acres.

Some "Residential" areas have been included in growth areas and the TDR receiving area. These areas are transitioning away from traditional rural/agricultural land uses. Any additional large-scale rural residential development must be confined to TDR Receiving Areas. In early 2005, a Transferable Development Rights receiving area was established. The TDR Receiving Area is approximately 5,990 acres or 3% of the unincorporated County land area. TDR Receiving Areas are comprised of former "Residential" and agricultural conservation areas and are appropriately designed to accommodate new growth in areas that are transitioning away from traditional agriculture. As TDR Receiving Areas, development rights from Greenbelts and Agricultural Conservation Areas in Caroline County (Sending Areas) can be privately sold and transferred to this region for new residential development.

The concept is to provide a defined County region to direct residential development, while preserving established agricultural areas throughout the County in contiguous blocks. In unincorporated areas, TDR sales are a private transaction between landowners and developers. The Caroline County Planning Commission reviews the application of TDR's in County areas designated for residential growth. The County is currently engaging several towns in discussions about how to make their growth areas TDR receiving areas.

Developments in TDR Receiving Areas in unincorporated areas of the County should comply with regulations created by the County to ensure adequate development sensitive to public needs. The County should establish rural design standards for development in TDR receiving areas. Intensive agricultural industries should be discouraged in this area. The detailed analysis and planning of TDR Receiving Areas is recommended as an implementation strategy for this Comprehensive Plan to ensure an adequate receiving area that does not overlap with greenbelts or R-1 zoning districts.

Commercial

"Commercial" areas include isolated commercial business uses and commercial areas in or near rural villages. Commercial areas may include existing service facilities, such as automotive repair shops, trucking transport services, agricultural support uses, and more intense home-based businesses. Commercial uses are often associated with the historic character of the area and fulfill basic service needs for local residents. Uses include historic zoning patterns for commercial strip development. For example, the "Highway Commercial" zoning classification includes current properties along MD Route 404. Commercial uses along MD Route 404 are inappropriate and can create serious traffic and safety related issues. As one of the County's most traveled State Highways, particularly during the summer months, strict planning and design is required to avoid problems derived from strip commercial uses. Direct access for commercial properties on MD Route 404 should be strongly discouraged. The "Highway Commercial" zoning district should be reviewed and properties along MD Route 404 should be considered for rezoning during the comprehensive rezoning process.

New intense commercial uses in rural areas, with the possible exception of those that directly support local agriculture, should be restricted to areas planned for commercial business uses. Caroline County should seek to create new commercial space in growth areas.

Institutional

"Institutional" areas can be public spaces, but are areas where the primary uses include,

power substations, railroad rights-of-way, solid waste collection sites, water supply and wastewater treatment facilities, government buildings, community centers, museums, libraries, care facilities, places of worship and recreational areas. Some Institutional areas overlap with the preserved and conserved land use classification, such as Tuckahoe State Park, Adkins Arboretum, and other open space areas.

Institutional areas may also provide facilities and services to the public, such as regional information and shopping for tourists. Institutional areas require enhanced pedestrian and vehicular transportation routes to improve public access and tourism.

Industrial

"Industrial" areas include land in the agricultural conservation areas as well as land in rural villages. The County only provides for a Light Industrial Zoning District. The district is intended to provide a wide range of industrial uses which are compatible with adjacent uses to the extent that any adverse effects on health, safety, welfare or the environment are avoided. Light industries are considered those which manufacture, process, store, package or distribute goods and materials and are, in general, dependent on raw materials refined elsewhere. These industries should be in low buildings with off-street loading, off-street parking for employees and have access to major thoroughfares or railroads. Industrial uses include truck terminals, salvage yards, fuel storage, mineral extraction facilities, saw mills, agricultural products processing plants, power generating facilities, research and development facilities, concrete or asphaltic concrete batching and mixing plants, and manufacturing or assembly plants. Appropriate areas for industrial zoning in the County should be evaluated by the County.

Public Lands and Open Space

Open space areas are primarily State and County lands such as Tuckahoe State Park, Idyllwild Wildlife Management Area, and other areas with preservation and conservation easements.

As important natural and scenic amenities, Caroline County should facilitate connections via transportation initiatives (both pedestrian and vehicular) to improve public access and tourism. As an economic development initiative, these areas are a primary draw for regional tourism and provide necessary services.

In addition, open space areas provide public access to County waterways. These access points are used by local residents and visitors to enjoy the County's rivers, streams, and creeks. Hunting and fishing are provided for and sporting outlets are located in these areas.

Land Use Implementation

Through the implementation actions in this chapter the County hopes to achieve the following goals:

- Work with the towns to develop a mutually beneficial inter-jurisdictional growth program that will utilize the County's TDR sending rights, and provide wastewater treatment to new development to reduce nutrient pollution into the County's waterways.
- Update and revise the Caroline County zoning and subdivision regulations to incorporate appropriate zoning districts, zoning provisions/changes, and development standards as recommended in this chapter. Existing laws should also be enhanced and zoning classifications reviewed.
- Establish appropriate setbacks, buffers, and other regulatory standards that apply to the diverse uses located in the rural zoning district.
- Complete a comprehensive rezoning for the entire County.
- Establish rural design standards, such as buffers from main highways and design standards for developments in TDR receiving areas.
- Undergo a review of the TDR receiving area locations and regulations to ensure the continued effectiveness of the program.
- Review the Adequate Public Facilities regulations.

CHAPTER 2: WATER RESOURCES

The purpose of the Water Resources Element (WRE) is to identify drinking water and other water resources adequate for the needs of existing and future development estimated in the development capacity analysis of this comprehensive plan. The WRE must also identify suitable strategies for nutrient reduction to reduce point source and non-point source impacts to receiving waters now and in the future.

Part I: Water

Regional Water Resources

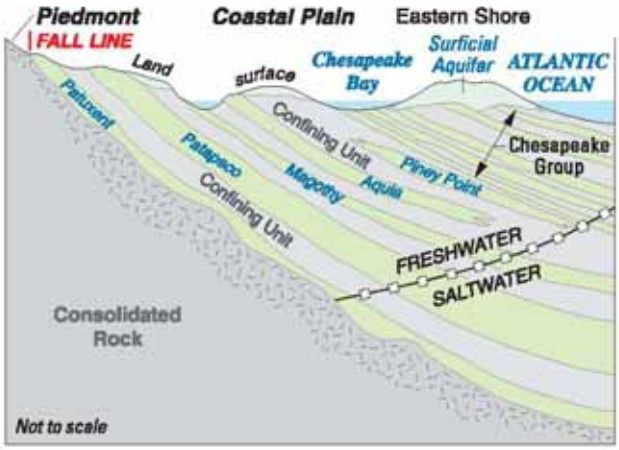


Figure 2-1: The Northern Atlantic Coastal Plain Aquifer System
Source: *A Science Plan for a Comprehensive Regional Assessment of the Atlantic Coastal Plain Aquifer System in Maryland*,
U.S. Dept. of Interior and U.S. Geological Survey.

Caroline County lies within the Northern Atlantic Coastal Plain (NACP) aquifer system. The NACP system extends from the North/South Carolina border to Long Island, New York. In Maryland the NACP is bounded in the west by the Fall Line and in the east by the Atlantic Ocean. The Coastal Plain system consists of sand and gravel aquifers interspersed with layers of silt and clay called confining beds. Beneath this system lies a layer of consolidated rock at depths ranging from zero at the Fall Line to about 8,000 feet at Ocean City.

Coastal Plain groundwater is drawn from unconfined, surficial aquifers and confined aquifers. Surficial aquifers are recharged by precipitation and depleted by drought, resulting in fluctuating water levels. Water in surficial aquifers travels along short flow paths of several hundred feet to less than a few miles where it is discharged in streams and rivers; it also percolates down through soil as recharge to confined aquifers. It generally takes less than 50 years for water from the surficial aquifer to reach discharge areas.[2] A confined aquifer has a layer of clay or fine silt above it (a 'confining' layer) that allows very little water to travel vertically into the aquifer. Confined aquifers receive recharge from leakage through confining beds from surficial aquifers and lateral movement of water from adjacent aquifers and thus are less vulnerable to drought conditions.

[2] Water Quality in the Delmarva Peninsula Delaware, Maryland, and Virginia, 1999–2001, USGS Circular 1228

The major aquifers in the Coastal Plain system in Maryland are the Patuxent, Patapsco, Columbia (a surficial aquifer), Magothy, Aquia, and Piney Point, and the Chesapeake Group. With the exception of the Columbia Aquifer, the Coastal Plain aquifers generally are confined.

Most Coastal Plain aquifers contain both fresh and salt water. Water directly below recharge areas is fresh; salt levels increase with aquifer depth and proximity to the ocean. Saltwater contamination, or intrusion, is one of the most common problems in Coastal Plain aquifers, particularly in low-lying, coastal areas. The degree of saltwater intrusion varies depending on the volume and rate of withdrawals from the aquifer, however saltwater intrusion is already affecting water quality in several waterfront communities in the State.[3]

The natural water quality of Coastal Plain ground water is generally good. Water condition ranges from very soft to very hard with the average in the moderately soft range. Iron concentrations in the water are generally low, but may be high in some areas.[4]

In 2000, total ground water use in Maryland exceeded 214 million gallons per day.[5] The urban areas of Baltimore and Washington, D.C. make up the largest percentage of water usage in the State. Much of the water supply for these urban areas is derived from surface water sources. Conversely, in Eastern Shore counties, ground water comprises 86 percent of the total water use.[6]

In 2004, the Maryland Advisory Committee on the Management and Protection of the State's Water Resources identified the need for a comprehensive study of the sustainability of the NACP system in Maryland. This study is currently being undertaken by the U.S. Department of the Interior and U.S. Geological Survey (USGS) in cooperation with the Maryland Geological Survey and Maryland Department of the Environment (MDE). The assessment will be conducted in three phases and is expected to take 7 to 8 years to complete. Currently, the project is in Phase I, begun in 2006. A key component of the assessment will be the development of an aquifer information system designed to serve the needs of both water managers and scientific investigators. When fully developed, the system will provide information that will assist local governments in developing short, medium and long-range water management strategies.[7]

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[3] *Sustainability of the Groundwater Resources in the Atlantic Coastal Plain of Maryland*, USGS Fact Sheet FS 2006-3009.
[4] Vokes, Harold E., and Jonathan Edwards, Jr.1974, *Geography and Geology of Maryland.* Maryland Geological Survey Bulletin 19.
[5] *An Overview of Wetlands and Water Resources of Maryland, b*y Denise Clearwater, Paryse Turgeon, Christi Noble and Julie Labranche. Prepared for Maryland Wetland Conservation Plan Work Group, January 2000
[6] Ibid.
[7] *A Science Plan for a Comprehensive Regional Assessment of the Atlantic Coastal Plain Aquifer System in Maryland* (Open-File Report 2007–1205), by Robert J. Shedlock, David W. Bolton, Emery T. Cleaves, James M. Gerhart, and Mark

Caroline County Water Resources

Groundwater - Aquifers

Groundwater sources in Caroline County include the Piney Point, Columbia, and Aquia Aquifers, and the Chesapeake Group, which includes aquifers within the Calvert and Choptank Formations. Aquifers within the Choptank and Calvert Formations yield small amounts of water, primarily to shallow, domestic wells.[8] The Columbia aquifer is the surficial aquifer on most of the Eastern Shore. The Piney Point aquifer is tapped by wells in an area about 40 miles wide between Caroline and St. Mary's Counties and is a major water source for Caroline County. The Aquia is a major water source for parts of the Eastern Shore (including northern Caroline County), southern Maryland, and Anne Arundel County.

In the western half of Caroline County, which contains gently rolling, well-drained land, the water table lies between 10 and 30 feet below the surface. The eastern half of the County is comparatively flat with poorly drained land, and the water table is generally within 10 feet of the surface.[9]

Water quality in the aquifers that serve Caroline County is generally good. A 2006 USGS study of pesticides in Coastal Plain groundwater reported that certain pesticides are detectable in surficial, unconfined ground water in many areas of the Maryland Coastal Plain, although no existing Federal drinking-water standards have been exceeded.[10] While many private, individual wells withdraw water from the surficial aquifer in Caroline County (the Columbia), no public or community water systems do. In 2003, Maryland Department of the Environment conducted Source Water Assessments for 19 community water systems and 9 non-community systems located in the County. MDE researched and identified potential sources of contamination for confined aquifers and analyzed each water system for susceptibility to pollutants originating at the land surface. MDE concluded that due to the protected nature of confined aquifers, the water supplies were not susceptible to surface contaminants. Some naturally occurring pollutants, such as arsenic and fluoride, do pose a risk to water systems supplied by the Aquia and Piney Point Aquifers but do not exceed EPA's maximum contaminant level (MCL). Tests conducted as part of MDE's Source Assessments indicated that that arsenic and fluoride levels measured less than 50 percent of the EPA's MCL in most of the County's community systems.

R. Nardi, U.S. Department of the Interior and U.S. Geological Survey, prepared in cooperation with the Maryland Geological Survey, the Maryland Department of Natural Resources and the Maryland Department of the Environment.

[8] *The Status of the Quantity and Quality of Groundwater in Maryland*, Volume II, Report to the General Assembly of Maryland, 1981.

[9] Ibid.

[10] Pesticides in Ground Water of the Maryland Coastal Plain, Judith M. Denver and Scott W. Ator, **USGS FS**-2006-3119, Prepared in **C**ooperation with the Maryland Department of Agriculture.

Potential sources of contamination to confined aquifers include leaking storage tanks, landfills, sewer treatment discharges, and large-scale animal feeding operations. Wells that draw from confined aquifers can only be contaminated via direct injection of a pollutant into the aquifer from poorly constructed or abandoned wells and underground injection wells. Certain land uses, such as industrial and agricultural, have the potential to contaminate groundwater over a large area. The locations of potential sources of contamination for water systems in the County are included in the source assessments conducted by MDE and are on file in the County's Environmental Health Department.

Columbia Aquifer

The Columbia Aquifer (also called the Quaternary Aquifer) is a surficial aquifer which overlies the Chesapeake Group on the Eastern Shore. The Quaternary deposits of the aquifer cover most of the Eastern Shore and some parts of the western side of the Bay. These deposits are thinnest in the northern region of the Eastern Shore and thicken as the aquifer extends south and east towards the ocean. In its northern and central regions, which include Kent, Queen Anne's, Caroline, and Talbot Counties and the northeastern part of Dorchester County, the Columbia is unconfined. In Caroline County the thickness of Quaternary deposits ranges from 0 to 100 feet. The Columbia changes to a partly confined aquifer as it extends southeast into Wicomico and Worcester Counties.[11]

The quantity of water available from the Columbia is very high.[12] MDE's Water Rights Division instructs large agricultural users in Caroline County to use the Columbia Aquifer for irrigation and permits access to confined aquifers on a case-by-case basis. In the northern part of Caroline County the Columbia is thin and consequently poorly transmissive. In this area other aquifers are relied on for drinking water supply. In the County's middle region, the Columbia is 80 feet thick in local paleochannels (ancient stream beds) located in the vicinity of Ridgely and Harmony. In these areas the Columbia has a high yield and "a good potential to be a large-scale water supply source".[13] South and east of Preston the aquifer's thickness begins to increase as it approaches the Salisbury paleochannel in northern and central Wicomico County. In the paleochannel the Columbia averages 100 feet in thickness and in some areas is over 200 feet thick; it is estimated to hold 7 billions gallons of water.[14]

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[11] *The Columbia Aquifer of The Eastern Shore of Maryland*, L. Joseph Bachman, U.S. Department of the Interior, U.S. Geological Survey, and Maryland Energy Administration, 1984.
[12] Source *Water Assessment for Caroline County's Transient Water Systems*, MDE Water Management Administration Water Supply Program, February 2003.
[13] *The Columbia Aquifer of The Eastern Shore of Maryland*, L. Joseph Bachman, U.S. Department of the Interior, U.S. Geological Survey, and Maryland Energy Administration, 1984.
[14] 2004 Wicomico County Zoning Code Regulations, Chapter 225.

This area of the Columbia currently provides drinking water for the City of Salisbury and is an important future water supply for the City and Wicomico County. Because of the channel's enormous potential, Wicomico County established the Paleochannel Overlay District and enacted protective measures in the form of use limitations, performance standards and detailed review procedures to ensure that the channel is protected from contamination resulting from environmentally incompatible land uses.

The Columbia aquifer thins south of Princess Anne and Snow Hill and thus is not used extensively beyond those areas; it is not used at all in Ocean City because of saltwater contamination.[15]

The Columbia's principal source of recharge is precipitation, which is generally plentiful and enables the aquifer to function very productively with an ample water supply.[16] Most recharge occurs during winter and spring when precipitation is greatest; conversely, during summer, periods of drought can have a significant impact on the aquifer. Water quality in the Columbia varies with local soil types and land use. The Columbia's highly permeable soils (it is one of the most permeable aquifers in the Coastal Plain system) also make it vulnerable to contamination from surface pollution which seep down through the soil.[17] A 2006 USGS study of pesticides in Coastal Plain groundwater reported that certain pesticides are detectable in surficial, unconfined ground water in many areas of the Maryland Coastal Plain, although no existing Federal drinking-water standards were exceeded.[18] In the source water assessments performed for the County in 2003, MDE reported that in agricultural and high density residential areas with on-site septic systems, elevated nitrate levels and pesticide contamination may impact water quality in the surficial aquifer. While many private individual wells access the Columbia Aquifer for water, none of the public and community water systems in the County currently withdraw water from it. The last community systems to use the Columbia were Benedictine School outside of Ridgely and Liberty Mobile Home Park, near Federalsburg; both stopped withdrawing water from the Columbia after 2003.

The Chesapeake Group

The Chesapeake Group is comprised of four water-bearing formations: the Calvert, Choptank, St. Mary's, and Yorktown Formations. The Choptank and Calvert Formations provide water to parts of Caroline County. Within the Chesapeake Group, the Choptank Formation overlies the Calvert Formation. The major water-bearing unit in the Choptank Formation is the Frederica Aquifer.

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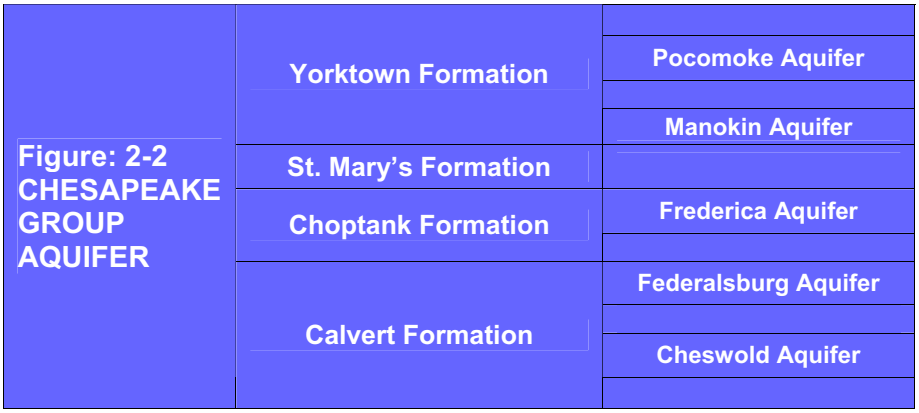
[15] *The Columbia Aquifer of The Eastern Shore of Maryland*, L. Joseph Bachman, U.S. Department of the Interior, U.S. Geological Survey, and Maryland Energy Administration, 1984.
[16] Ibid.
[17] Ibid.
[18] Pesticides in Ground Water of the Maryland Coastal Plain, Judith M. Denver and Scott W. Ator, USGS FS-2006-3119, Prepared in Cooperation with the Maryland Department of Agriculture.

In Caroline County, the aquifer's thickness ranges from 0 feet in the northern part of the County to 150 feet in southern Caroline County. The Frederica is used primarily in the areas where it is thickest: in the mid to southern region of Caroline County (the Town of Ridgely is one of its largest users), southwest Dorchester County and the eastern region of Talbot County. In areas where it is unconfined, the aquifer is recharged by the Columbia Aquifer and is susceptible to contamination from surface activities. In the downdip (deeper) area of the aquifer, where minerals have had time to dissolve, the water may need to be treated to use.[19]



The Frederica directly overlies the Federalsburg Aquifer, which overlies the Cheswold Aquifer (the Federalsburg and Cheswold are both within the Calvert Formation). In some areas the Frederica, Federalsburg and Cheswold Aquifers are separated by only a thin layer of silt and clay and operate as a single unit.[20]

Both the Federalsburg and Cheswold aquifers are important groundwater sources for the Eastern Shore.[21] The average thickness of the Federalsburg Aquifer is 50 feet. The Federalsburg Aquifer is used mostly in Caroline and Talbot counties, southwestern Queen Anne's County and northeast Dorchester County. The Town of Federalsburg is the aquifer's biggest user and the only user to average over 100,000 gallons per day. The water quality of the Federalsburg is generally very good but in the southern part of Caroline County water from the aquifer may require treatment for dissolved minerals.[22]

The Cheswold Aquifer lies at the base of the Choptank Formation and directly over the Piney Point Aquifer. As the two aquifers move deeper and eastward they are separated by a gradually thickening layer of silt and clay. Where they are connected or only slightly

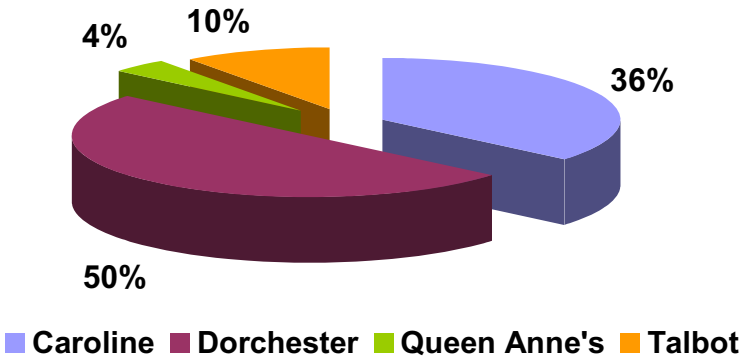
[19] Source *Water Assessment for Caroline County's Transient Water Systems*, MDE Water Management Administration Water Supply Program, February 2003.
[20] *The Status of the Quantity and Quality of Groundwater in Maryland*, Volume II, Report to the General Assembly of Maryland, 1981.
[21] Ibid.
[22] Source *Water Assessment for Caroline County's Transient Water Systems*, MDE Water Management Administration Water Supply Program, February 2003.

separated the Cheswold recharges the Piney Point.[23] The aquifer supplies water to areas in Delaware and Caroline, Talbot, Dorchester and Queen Anne's counties, and in some of these areas is as much as 150 feet thick. Water from the Cheswold usually requires treatment before it can be used.[24]

Piney Point Aquifer

The Piney Point aquifer extends from North Carolina to New Jersey. Together with the Cheswold aquifer, the Piney Point supplies about 80 percent of the total municipal and industrial water used in Kent County, Delaware.[25] In Maryland, the aquifer supplies water for much of Calvert and St. Mary's Counties on the western shore, and Queen Anne's, Talbot, Caroline, and Dorchester counties on the Delmarva Peninsula. It is a major supplier of drinking water in Caroline County.

Figure 2-3: Piney Point Aquifer 1995 Proportion of Use By Mid-Shore Counties



Source: *A Finite Difference of Analysis of the Piney Point Aquifer on the Eastern Shore of Maryland*, Maryland Department of the Environment Water Rights Division, 1995

The Piney Point lies below all of Caroline County and is confined in all regions of the County. The range of yield for wells in the aquifer is 10 to 1,200 gallons per minute (gpm).[26] On the Delmarva Peninsula, the aquifer's rate of transmissivity (a measure of how much water can be transmitted horizontally in an aquifer, for example, to a well) is highest in a zone that runs from Cambridge, Maryland to Dover, Delaware. Another zone of high transmissivity, due to the thickness of surficial sediments in the area, is in the vicinity of Ridgely. The aquifer becomes less transmissive away from this zone, as sediment thickness decreases and the aquifer becomes more shallow north of Greensboro.[27]

[23] Ibid.
[24] Source *Water Assessment for Caroline County's Transient Water Systems*, MDE Water Management Administration Water Supply Program, February 2003.
[25] *Ground-water Resources of the Piney Point and Cheswold Aquifers in Central Delaware as Determined by a Flow Model*, Delaware Geological Survey Bulletin No. 16., Leahy, P. P., 1982.
[26] *The Status of the Quantity and Quality of Groundwater in Maryland*, Volume II, Report to the General Assembly of Maryland, 1981
[27] *Agricultural Use of the Piney Point Aquifer*, Maryland Department of the Environment Water Rights Division, 1998

The Piney Point aquifer does not outcrop in Maryland.[28] The principal recharge to the aquifer on the Eastern Shore is from leakage from the overlying Cheswold aquifer in areas where the two aquifers are connected or separated by only a thin layer of silt and clay. In 1998, large water users on the Eastern Shore, particularly agricultural operations, withdrew about six times more water from the Columbia than the Piney Point aquifer.[29]

In the mid 1990s, Caroline County comprised approximately 36% of the Piney Point Aquifer's usage on the Eastern Shore. In 1998, an average of 31,280,800 gallons per day was pumped from the four Delmarva counties using the Columbia. By contrast, during the same period, permitted average pumpages from the Piney Point Aquifer totaled only 5,125,950 gpd, about one-sixth of what was being withdrawn from the Columbia.[30]

As noted earlier, MDE's Water Rights Division generally recommends that Caroline County farmers use the Columbia Aquifer and permits large agricultural operations to access the Piney Point and other aquifers on a case-by-case basis, thus reserving the more protected confined aquifers for drinking water supply. In the 1990s, an increasing number of farms sought water appropriation permits from confined aquifers (including the Piney Point) because of low yields in the Columbia that were most likely due to drought (the record of annual withdrawals between 1985 and 2000 showed that the highest amounts of withdrawals for irrigation occurred in 1993 and 1999, years during which rainfall was well below the State's normal annual average of 33 to 55 inches[31]).

In May 1998, MDE temporarily suspended processing applications from Caroline County farms for Water Appropriations Permits due to an increase in the number of large users requesting access to the Piney Point Aquifer for irrigation. MDE conducted a study of water use and availability in the region to evaluate the cumulative impacts of all existing water uses and proposed permitted water uses of the aquifer. This included known water uses in surrounding counties and Delaware. The study concluded that such uses, at that time, would not significantly impact the Piney Point Aquifer. In addition, the study found that the aquifer could support additional withdrawals above existing levels. MDE has resumed processing applications for ground water from the Piney Point Aquifer. The Department continues to direct large users to the Columbia Aquifer in areas where yield is sufficient and to permit large water users to access the Piney Point Aquifer on a case-by-case basis.

[28] *The Status of the Quantity and Quality of Groundwater in Maryland*, Volume II, Report to the General Assembly of Maryland, 1981
[29] *Agricultural Use of the Piney Point Aquifer*, Maryland Department of the Environment Water Rights Division, 1998
[30] Ibid.
[31] Freshwater Use Trends in Maryland,1985-2000, Judith Wheeler, U.S. Geological Survey.

Aquia Aquifer

The northern region of Caroline County draws some of its water from the Aquia Aquifer.[32] While it is not used extensively in Caroline County, the aquifer's overall good water-bearing properties and generally excellent water quality make it an important water source for Queen Anne and Talbot counties on the Eastern Shore and Anne Arundel County on the western shore.[33]

The Aquia is shallow in the vicinity of the Chesapeake Bay and recent studies have voiced concern about the increasing occurrence of salt water intrusion in the aquifer in the northern end of Kent Island and in some areas of eastern Anne Arundel County.[34] The State and Anne Arundel County have also voiced concern about recent data that indicates water levels in the Aquia are dropping at a significant rate and that in parts of Anne Arundel County the Aquia has reached its maximum allowable yield.[35] Anne Arundel County is exploring the feasibility of using alternative water resources and is working cooperatively with counties in Southern Maryland (where current and projected demand on the Aquia is also significant) on strategies to alleviate demand on the Aquia.

Groundwater Summary

State and federal reports issued subsequent to the commissioning of the NACP aquifer study continue to voice concerns about the region's water supply. MDE reports that steadily declining well water levels are a matter of concern to residents in areas of the State and recommends particular scrutiny of the Aquia, Piney Point, Magothy, and Patapsco aquifers, which are all heavily used in the Washington-Baltimore metropolitan area. In its.2007 Annual Report on Ground Water Protection, MDE identified several areas that require special management of ground water supplies: Kent Island and the Annapolis Neck area of Anne Arundel County (Aquia Aquifer), the Elkton area of Cecil County (Potomac Group aquifers), the Indian Head area in Charles County (Patapsco Aquifer), Princess Anne in Somerset County (Manokin Aquifer) and Ocean City (Pleistocene Aquifer). Special management includes limiting withdrawals from a certain aquifer, directing withdrawals to a different aquifer or requiring additional monitoring of water levels for permit applications.

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[32] *The Status of the Quantity and Quality of Groundwater in Maryland*, Volume II, Report to the General Assembly of Maryland, 1981.
[33] *Future of Water Supply from the Aquia and Magothy Aquifers in Southern Anne Arundel County, Maryland*, by David C. Andreasen 2002;
[34] *Water for Maryland's Future: What We Must Do Today*, Final Report of the Advisory Committee on the Management and Protection of the State's Water Resources, July 1, 2008.
[35] *Future of Water Supply from the Aquia and Magothy Aquifers in Southern Anne Arundel County, Maryland*, by David C. Andreasen 2002; *Effects of Withdrawals on Ground-Water Levels in Southern Maryland and the Adjacent Eastern Shore, 1980–2005*, by Daniel J. Soeder, Jeff P. Raffensperger, and Mark R. Nardi, Scientific Investigations Report 2007–5249, U.S. Department of the Interior, U.S. Geological Survey, 2007.

In 2007, the U.S. Department of the Interior (USDI) and U.S. Geological Survey (USGS) reported that "decades of increasing pumpage have caused ground-water levels in parts of the Maryland Coastal Plain to decline by as much as 2 feet per year in some areas of southern Maryland. Continued declines at this rate could affect the long-term sustainability of ground-water resources in Maryland's heavily populated Coastal Plain communities and the agricultural industry of the Eastern Shore."[36]

As the State and federal government assess the adequacy of the Coastal Plain Aquifer System, Caroline County will work with stakeholder agencies to receive all data relative to the County's current and future water needs and to develop appropriate groundwater management strategies.

Surface Water

Because of the abundance of good quality groundwater in the County, surface water has not been used as a drinking water resource and presently there are no impounded surface water reservoirs used for potable water supplies in the County.[37]

In 2000, an average of 6 million gallons per day of surface water was used in Caroline County for irrigation, less than half of the amount of groundwater used (16.4 million gallons per day) for irrigation.[38] While agricultural surface water usage has not resulted in systemic degradation of streams and rivers, the use of surface water sources during periods of extreme drought needs to be carefully monitored to ensure sustainability of aquatic life in the County's tributaries. Data from the USGS monitoring station in the Choptank River north of Greensboro indicates that during periods of drought, stream heights and flows are reduced in some areas as much as fifty percent, thereby aggravating seasonal tendencies towards dewatering of the channel bed and decreasing available aquatic habitat.

MDE evaluates drought conditions on a regional basis and assesses drought status monthly during normal conditions and more frequently during times of water shortage. During drought emergency periods (when stream and groundwater flow and precipitation levels are at or below a specified percentage of normal over a specified period) MDE coordinates with local governments using local drought coordinators to ensure that detrimental impacts of a drought emergency are minimized. Caroline County should develop an individual drought response plan to insure that the needs of the County's residents are met in times of drought emergencies.

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[36] *A Science Plan For A Comprehensive Regional Assessment Of The Atlantic Coastal Plain Aquifer System In Maryland*, Open File Report 2007 – 1205, U.S. Geological Survey, by Robert J. Shedlock, David W. Bolton, Emery T. Cleaves, James M. Gerhart, and Mark R. Nardi, 2007.
[37] Caroline County Comprehensive Water and Sewerage Plan, 1992.
[38] US Geological Survey Estimated Use of Water in the United States County-Level Data for 2000.

The National Weather Service, USGS and USDA each track indicators of drought conditions, including national and regional weather patterns, stream flows and groundwater levels. In Maryland, MDE has the primary responsibility for tracking drought conditions around the State and coordinating all drought responses. Like other Maryland county governments, the Commissioners of Caroline County appoint a County drought coordinator to work with MDE on local drought assessment and response, and to handle applications for exemptions or variances to State-issued Mandatory Drought Restrictions.

The Maryland Hazard Analysis ranked Caroline County's risk of drought at 3 (medium) on a scale of 1 – 5.[39] The County's Multi-Hazard Mitigation Plan, adopted in 2005, includes a drought hazard profile and a section that minimally addresses drought mitigation measures. The County has not adopted a Drought Management Plan and follows MDE's recommended drought response actions, which are based on each stage of the State Drought Index (Stage 1 Normal to Stage 4 Emergency).

While MDE's system is effective in regional assessments, it may not be adequate to predict water shortages at specific locations or for specific water systems. The drought section of the County's Multi-Hazard Mitigation Plan should be updated and expanded to include drought mitigation strategies that respond to regional drought warnings issued by the State as well as local conditions that are the result of prolonged dry periods. While not frequent, extended periods of little or no precipitation are not uncommon in Caroline County, resulting in decreased stream flows and groundwater levels. Strategies that address short and long-term local dry season conditions should be included in the County's Multi-Hazard Mitigation Plan, to insure that surface water resources are protected during extended periods of little or no precipitation.

Caroline County Water Use

The U.S. Geological Survey (USGS) tracks and reports water usage by state and jurisdiction at five-year intervals; the 2000 report is the most recently issued.

In 2000, Maryland's daily water use – fresh and saline – totaled 7.8 billion gallons per day. Fresh water usage totaled 1.45 billion gallons per day. The heaviest users of fresh water were public water systems (824 million gallons per day) and thermoelectric power generation (379 million gallons per day). Public water supply systems in Montgomery and Baltimore counties accounted for 80 percent of the total public systems usage in the State. By comparison, public water supply systems in Caroline County used 1.04 million gallons per day. Montgomery County alone accounted for 85 percent of the fresh water used for thermoelectric power in the State, while Calvert County alone accounted for 52 percent of the total saline water used for thermoelectric power (6,260 mgd).

[39] Caroline County Multi-Hazard Mitigation Plan, 2005.

In 2000, USGS recorded that surface and groundwater withdrawals in Caroline County totaled 21,220,000 gallons per day (Table 1 provides comparisons of water usage). Unlike counties on the western shore, the largest water use in Caroline County was irrigation, which averaged 15.48 million gallons per day (total agricultural fresh water use has averaged 3% to 5% of the State's fresh water use since 1980[40]). Caroline County had the third lowest usage (behind Allegany and Kent counties) of public water supply systems among jurisdictions in the State.

Table 1: Comparison of Groundwater Water Usage Categories Among Selected Counties - 2000

Jurisdiction	Total Water Withdrawals (gpd)	Total Irrigation Withdrawals (gpd)	Total Domestic Well Withdrawals (gpd)	Total Public System Withdrawals (gpd)
Caroline	21,220,000	15,480,000	1,570,000	1,040,000
Dorchester	14,240,000	8,710,000	940,000	2,470,000
Kent	4,390,000	1,630,000	880,000	1,110,000
Queen Anne's	8,410,000	3,700,000	2,400,000	1,690,000
Talbot	5,650,000	840,000	1,580,000	2,320,000

Source: U.S. Geological Survey Water-Use Data, 2000

Compared to other Mid-Shore counties, Caroline County withdraws the greatest amount of water overall (see Table 1), most of which is used for irrigation. Within usage categories, Caroline County has the largest amount of irrigation withdrawals by a significant margin. Caroline ranked third among domestic well withdrawals and lowest in the amount of water withdrawn for public water system use.

Table 2: Caroline County Wells

Classification	Number	Percentage of Total
Public Water Systems	38	0.5%
Private Water Systems		
Domestic & Commercial	6,617	83%
Agricultural	1,023	13%
Industrial	283	4%
Geothermal	18	0.2%
Total Wells	7,941*	100%

* Test wells (660) not included in total.
Source: Maryland Department of Environment, 2008

According to the Maryland Department of the Environment Well Database, since 1944 approximately 8,601 wells have been drilled in Caroline County (see Table 2). Groundwater from confined aquifers is the source for nearly three-quarters of the County's water usage. The remaining 27 percent of water withdrawals are from the surficial aquifer, the Columbia, and nearly all of that was for irrigation.

[40]Gary Felton, University of Maryland; *Addressing Competition for Ground Water Supply by Assessing Agricultural Irrigation Efficiency in the Coastal Plains of Maryland and Delaware Incorporating a GIS-based Decision Support System for Irrigation Scheduling on a Watershed Scale*.

Private Water Systems

Domestic

Residential and commercial wells make up the "domestic" category and account for the largest number of wells drilled in the County, over 75 percent. About 67 percent of all Caroline County households are located outside of towns; most of them access their water from private wells. In northern Caroline County the towns of Goldsboro, Marydel and Templeville do not have public water systems and residents in these communities access water through private wells. Wells drilled for domestic use in the County range from 14 to 400 feet deep and pump water at rates up to 600 gpm. The U.S. Geological Survey estimates that 18,850 domestic well users in Caroline County used 1,570,000 gpd of water in 2000.

Table 3: 2000 Private Water System Usage Statistics – Caroline County

DOMESTIC SELF-SUPPLY SYSTEMS		
Groundwater Withdrawals (gpd)	Surface Water Withdrawals (gpd)	Total Withdrawals (gpd)
1,570,000	0.00	1,570,000

Source: US Geological Survey Estimated Use of Water in the United States County-Level Data for 2000
Household size determined using 2000 U.S. Census per household figure for Caroline County (2.64)

Agriculture

While domestic users account for the largest number of wells in the County, irrigation accounts for the largest amount of water used in Caroline County. The amount of groundwater withdrawn for irrigation purposes in the County is nearly five times higher than the next heaviest use (mining) and more than six times higher than domestic use. Since 1947, a total of 1,023 wells have been drilled to support agricultural uses in the County. Irrigation well depths range from 10 feet to 600 feet; pumping rates range up to 1,400 gpm. Tracking and reporting of actual agricultural water use was not required by Maryland Department of the Environment until 1996[41]. The U.S. Geological Survey uses MDE permit information to provide estimates of agricultural water use. Irrigation, livestock, and aquaculture make up the three categories of agricultural water use. Details about agricultural water use in Caroline County are listed in Tables 4 and 5.

Table 4: 2000 Irrigation Water Statistics – Caroline County

Acres Sprinkler Irrigation	Acres Micro Irrigation	Acres Surface Irrigation	Acres Total Irrigation	Groundwater Withdrawals (gpd)	Surface Water Withdrawals (gpd)	Total Withdrawals (gpd)
11.80	0.60	0.00	12.40	9,770,000	5,710,000	15,480,000

Note: Acreage is in thousands
Source: Source: US Geological Survey Estimated Use of Water in the United States County-Level Data for 2000

[41] *Water for Maryland's Future: What We Must Do Today*, Final Report of the Advisory Committee on the Management and Protection of the State's Water Resources, July 1, 2008.

At 15.48 million gallons per day (mgd), the County's irrigation water usage is the highest of any county in the State. Only Dorchester comes close, at 8.71 mgd. While surface water resources have experienced limited development as major drinking water sources, they provide a potentially significant resource for agricultural users.[42]

Table 5: 2000 LIvestock Water Statistics – Caroline County		
Groundwater Withdrawals (gpd)	Surface Water Withdrawals (gpd)	Total Withdrawals (gpd)
600,000	400,000	640,000

Source: US Geological Survey Estimated Use of Water in the United States County-Level Data for 2000

Mining

At 2.16 mgd, Caroline County led all other counties in the State for mining water usage – only Garrett County came close, with 1.71 mgd. Large mineral deposits of sand and gravel located in the middle and southern portions of the County support about two dozen surface mining operations.

Table 6: 2000 Non-Domestic Water Usage Statistics – Caroline County		
MINING SYSTEMS		
Groundwater Withdrawals (gpd)	Surface Water Withdrawals (gpd)	Total Withdrawals (gpd)
2,160,000	0.00	2,160,000
INDUSTRIAL SYSTEMS		
Groundwater Withdrawals (gpd)	Surface Water Withdrawals (gpd)	Total Withdrawals (gpd)
330,000	0.00	330,000

Source: US Geological Survey Estimated Use of Water in the United States County-Level Data for 2000

Industrial

The 283 wells drilled for industrial use account for about 4 percent of the total wells in the County. The industrial usage category was the smallest amount of daily water usage (330,000 mgd) in the County. Industrial well depths range up to 1,000 feet.

Geothermal

Eighteen wells have been drilled in the County to support geothermal heating and cooling systems for private residences. All of them were drilled between 1998 and 2002 at depths of 180 feet or more.

[42] Caroline County Comprehensive Water and Sewerage Plan, 1992.

Nearly all of the wells dug for geothermal systems did not have pumps installed. Modern geothermal systems circulate an antifreeze solution through a closed loop of pipe that is buried underground, requiring no pumpage from a groundwater source. However, older "open loop" systems circulate ground water, which is then dispelled back to its source, such as a stream, well, or pond. Most of the eighteen geothermal wells drilled in Caroline County employ closed loop systems and the few that employ open loop systems do not number enough to represent a significant source of groundwater withdrawals.

Public Water Systems

Of the County's ten municipalities, six operate public water systems: Denton, Federalsburg, Greensboro, Henderson, Preston and Ridgely. These towns draw their water from a total of 36 wells in the Piney Point, Federalsburg, and Cheswold aquifers. Table 7 provides a brief summary of the characteristics of the municipal water systems located in Caroline County.

Caroline County does not presently own a public water system, however, to address ongoing water quality issues in individual wells located in the village of Jonestown (northeast of Preston), the County, in 2008, designated the Jonestown Priority Funding Area as a County Water Service Area and in 2008 initiated the planning and design phase of construction of a community water system to serve residents of the village of Jonestown and the neighboring Nelpine Heights subdivision (see Small Community/Multi-User Systems, later in this section).

Table 7: 2000 Public Water System Usage Statistics – Caroline County

PUBLIC SYSTEMS		
Groundwater Withdrawals (mgd)	Surface Water Withdrawals (mgd)	Total Withdrawals (mgd)
1,040,000	0.00	1,040,000

Source: US Geological Survey Estimated Use of Water in the United States County-Level Data for 2000

The Maryland Department of the Environment (MDE) issues ground water appropriation and use permits that allocate average and maximum daily flow capacities for public and community water systems. Annual average daily flow is the total volume of water flowing into a water facility during any consecutive 365 days, divided by 365 and expressed in units of mgd (million gallons per day) or gpd (gallons per day). Maximum daily flow capacity is the maximum quantity permitted to flow within a single 24-hour period.

Table 8: Municipal Water System Characteristics - 2007						
Water System	**Source**	**Permitted Avg Annual Use (gpd)**	**5-Year Avg Withdrawal 2007 (gpd)**	**% Capacity Used**	**Projected Additional Demand* (gpd)**	**Planned System Upgrades/ Expansions**
Denton	Piney Point	770,000	393,778	51%	254,000	Permit Increase Recently Appvd
Federalsburg	Cheswold Federalsburg	600,000	401,706	80%	77,000	Permit Increase Recently Appvd
Greensboro	Piney Point	325,000	183,000	58%	75,600	Permit Increase Recently Appvd
Preston	Piney Point	80,000		63%		
Ridgely	Piney Point	200,000	126,000	63%	172,750	Additional above-ground storage tank
Henderson	Piney Point	15,000				

* From approved but undeveloped projects and municipal estimates of growth
** 1992 Caroline County Comprehensive Water & Sewerage Plan
Source: MDE Water Appropriation and Use Permits; Caroline County Departments of Environmental Health and Planning, Codes and Engineering, 2008.

Town of Denton

The Town of Denton water system is comprised of three groundwater wells that draw from the Piney Point Aquifer. The system has a permit for 770,000 gpd average annual use, and a maximum permitted use of 1,000,000 gpd.

Between July 1999 and December 2006, the system's daily annual average use was 393,778 gpd. Annual average daily use in the Town in 2006 was 399,000 gpd, over 90 percent of the system's capacity at the time. With approved additional residential and commercial development projected to increase water usage by an additional 200,000 gpd[43], the Town applied to MDE to increase its appropriation permit from 420,000 gpd annual average use and 700,000 gpd maximum use to an annual average use of 770,000 gpd and 1,000,000 gpd maximum use. An impact study was performed to determine potential impacts to the Piney Point Aquifer and surrounding water users as a result of the proposed increase. The study determined that no adverse impacts to the aquifer or other users were expected as a result of Denton's existing and projected water usage and MDE subsequently approved the Town's application for a new appropriation and use permit in October 2007. No further expansions of the system are planned at this time.

Town of Federalsburg

The Town of Federalsburg water system draws water from five wells; two draw from the Federalsburg Aquifer and three draw from the Cheswold Aquifer. In 2007, MDE issued

[43] March 20, 2007 Letter to Town of Denton from Maryland Department of the Environment.

the Town two water appropriation permits totaling 600,000 gpd annual average use and 760,000 gpd maximum use.

In 2006, the five-year average daily use of water in the Town was 401,706 gpd, approximately 40 percent of the system's average daily capacity. The five-year daily average maximum use was 480,580 gpd, approximately 60 percent of maximum capacity.

Federalsburg's Water Resources Element, submitted in February 2008, projected only a minor increase in water withdrawals in the Town as a result of growth, with no significant impact expected on the region's groundwater supply; no system expansions are planned at this time.

Town of Greensboro

Greensboro withdraws its water from three wells in the Piney Point Aquifer. In 2008, the Town's MDE Appropriation and Use Permit was increased from 200,000 gpd average annual use to 325,000 gpd and from 300,000 gpd maximum use to 455,000 gpd.

In 2007, the average daily demand on Greensboro's water system was 183,551 gpd, about 57 percent of its permitted average daily capacity. The five-year average daily use was 183,000 gpd; approximately 55 percent of the system's permitted average daily capacity. The Town anticipates that growth in the form of infill development will not deplete the system's capacity, but growth beyond existing Town boundaries will require an increase in plant capacity and possible improvements in pumping and storage capabilities.[44]

Town of Henderson

The Town of Henderson utilizes three wells to withdraw water from the Piney Point Aquifer. Henderson is permitted to withdraw an average of 15,000 gpd annually, 20,000 gpd maximum.

Town of Hillsboro

Hillsboro maintains no public water facilities; water is supplied by private wells. According to the Town's 2007 Comprehensive Plan, the Town has no designated growth or annexation areas and does not anticipate an increase in population sufficient to warrant a need for public water and sewer facilities and services. However, as Maryland policies, guidelines, and regulations become more stringent for water quality initiatives,

[44] *Draft 2008 Greensboro Comprehensive Plan*

Hillsboro may be required by the State to fund and construct public water and sewer services at a future date.

North County Towns

The towns of Goldsboro, Marydel and Templeville do not maintain public water systems. The Town of Henderson is the only North County town that owns and operates a public water system. The majority of the residents of the other three North County towns access water from shallow (15 to 40 feet) wells drilled in the Columbia or Choptank Aquifer; however a few obtain water from deeper wells in the Aquia Aquifer.[45] Periods of extreme drought have resulted in a number of the shallow wells running dry; consequently, some of these have been replaced with deeper wells. Wells in the northern area of the County also are susceptible to contamination from failed septic systems, a circumstance that is reflected in nitrate levels in local drinking water. Septic systems in this area discharge inadequately treated wastewater onto the ground or into the groundwater where shallow wells are located. In many cases wells and septic systems are located less than 100 feet apart and high groundwater levels cause frequent flooding and cross-contamination of wells and septic systems.[46]

As a result, the North County towns have had health and environmental problems associated with failing on-site septic systems and contamination of groundwater supplies.[47] To address these problems, in 2008 Caroline County and the four North County Towns established the North County Water and Sewer Authority, and, working with Maryland Environmental Service (MES), created the North County Water and Sewer Service District, which includes all four towns, municipal growth areas, Cedars, Caroline Acres and Hilltop mobile home parks, the Harman subdivision, and a limited number of additional parcels served by failed or failing septic systems.

The construction of a regional wastewater system is intended to correct the existing water quality issues in the region by eliminating the use of septic systems. Based on a build-out analysis conducted for the region in 2007, the North County treatment facilities will be designed to serve the needs of the North County municipal population far into the future. Phase I of the project, the design and construction of a wastewater facility, is currently underway. The timeline for construction of a regional public water system has not been established.

Town of Preston

The Town of Preston's water system is comprised of two wells that draw water from the Piney Point Aquifer at depths of 600 and 533 feet. An elevated tank provides 150,000

[45] Caroline County Comprehensive Water & Sewerage Plan, 1992.
[46] Ibid.
[47] 2003 North Caroline County Comprehensive Plan

gallons of storage; chlorination is provided at the Town's water treatment plant. The system is permitted to withdraw an annual average of 80,000 gpd and a maximum of 120,000 gpd.

According to the Town's 2005 Comprehensive Plan, areas of corrosion along water distribution lines and inadequate pipe diameters limit the Town's ability to expand and serve customers outside of Town boundaries. In 2005 the Town was considering extending service to areas located southeast and southwest of the Town however to date no extension has been approved or finalized.[48] A tentative plan to extend water service north to the communities of Nelpine Heights and Jonestown was discussed between the communities, the Town and Caroline County, however no agreement was reached (see Community/Multi-User Systems, below).

Town of Ridgely

The Ridgely water system is comprised of two wells that draw from the Piney Point aquifer. A third well was installed in 2006 and is slated to come online when a new elevated storage tank and MDE permitting are completed. A Water Infrastructure Study was completed for the Town in 2007 and resulted in the recommendation of an additional elevated water storage tank with at least 500,000 gallons holding capacity. A Pre-Application for the project was submitted as an MDE Water Quality Infrastructure Program Capital Project and approved for funding; construction of the new tower is scheduled to be complete by June 2009.

The system is permitted to withdraw an annual daily average of 200,000 gpd and a maximum of 300,000 gpd. In 2007, the five-year annual average water usage in the Town was 126,000 gpd, approximately 60 percent of the system's permitted annual daily average allocation; in 2006 and 2007, however, usage averaged about 140,000 gpd, 70 percent of the system's permitted capacity.[49]

According to the Town's draft Comprehensive Plan, increased water demand as a result of residential and non-residential development is expected to exceed the water system's capacity before 2015. The Town plans an expansion of the system to accommodate the projected increase.[50]

Small Community/Multi-User Water Systems

Small community or multi-user water systems in Caroline County include systems that serve small areas or multiple users, such as major subdivisions, industrial facilities,

[48] Town of Preston, Maryland Comprehensive Plan, 2005
[49] Town of Ridgely Draft Comprehensive Plan, 2008.
[50] Ibid.

school campuses, and mobile home parks. Public schools in the County that operate small systems include Colonel Richardson High School (in the southern half of the County near American Corner) and North Caroline High School, located east of Denton. The Caroline County Board of Education owns these systems and contracts licensed operators to manage them.

Most of the County's small systems withdraw water from the Piney Point Aquifer at permitted rates of less than 10,000 gpd.[51] In 2003 Caroline Acres and Cedar mobile home parks were two of the largest users at 73,000 gpd and 35,000 gpd, respectively.

Mobile home park systems comprise the largest number of small systems in the County and include:

- Caroline Acres Mobile Home Park
- Cedar Mobile Home Park
- Holly Cove Mobile Home Park
- Prettyman Manor Mobile Home Park
- Nelpine Mobile Home Park
- Hilltop Mobile Home Park
- Tower Court Mobile Home Park
- Denny Taylor Mobile Home Park
- Marsh Creek Mobile Home Park
- Liberty Mobile Home Park

In 2004, amid public health concerns voiced by the residents of Jonestown, a Priority Funding Area located about 2 miles north of Preston, Caroline County commissioned a study of water quality issues present in the Jonestown area, including the private community system used by the residents of the Nelpine Heights subdivision. Concerns included the lack of a chlorination system and pressure tank on the subdivision's system and well contamination from failing septic systems in the greater Jonestown area. The study recommended the establishment of a County Water Service Area to serve the Jonestown PFA. The Nelpine Heights small community system will be upgraded to include a new treatment facility, disinfection equipment, pressure tank and distribution piping that allows for future fire flow requirements to be met. Distribution mains and service connections will also be extended to the residents of Jonestown and failed, private shallow wells will be abandoned. When complete, the system will be owned by Caroline County and will serve the residents of the Nelpine Heights subdivision and Jonestown.

[51] Source Water Assessment for Community Water Systems in Caroline County, Maryland , MDE Water Management Administration Water Supply Program, August 2003.

Nelpine Mobile Home Park, located nearby, is served by a shared system recently permitted by MDE and in good working condition. The MHP property is included in the Water Service Area; in the event its system fails, the mobile home park will be required to connect to the Jonestown community system. Construction of the Jonestown water system is anticipated to begin within the next 1 to 2 years.

Caroline County Future Water Use and Demand

Whether future increases in water use are a result of residential growth or increased agricultural demand, the County must be able to reasonably predict the needs of all water users and to ensure that there are sufficient water resources available to sustain future increases in use.

The USGS publishes estimates of future water use for major usage categories for states and jurisdictions. The most recent projection for future use in Caroline County reflected a 2 percent average annual increase in daily water usage of public, including domestic and agricultural uses, between 2000 and 2030.

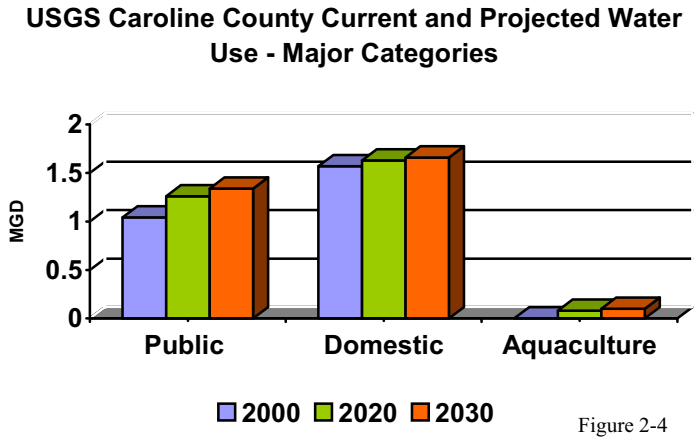


Figure 2-4

Domestic

Increases in Caroline County's domestic well water withdrawals can be approximately predicted based on approved development projects, population projections and (using the Maryland Department of Planning persons per household coefficient) housing unit projections.

To calculate residential water usage in the County's unincorporated areas, a coefficient of 250 gpd per household (MDE estimate of per dwelling unit daily water usage) was applied to the number of dwelling units projected to be built in the unincorporated areas of the County, based on a development capacity analysis performed for Caroline County by Maryland Department of Planning (see Land Use Element).

Based on MDP and Caroline County estimates of future population and housing unit increases (see Land Use element), projections for future residential water usage indicate an increase of approximately 30 percent between 2010 and 2030. This is significantly higher than USGS projections for domestic water usage for Caroline County, however,

because they are based on County growth trends and MDP estimates of population increase, these projections may be considered to be the more likely scenario for future water use in the County.

Table 9: Caroline County Projected Water Usage – Existing and Future Residential Development Unincorporated Areas 2010 - 2030

	2005	2010	2015	2020	2025	2030
Population	20,945	21,992	23,092	24,477	25,946	27,503
Housing Units	8,031	8,552	9,093	9,714	10,416	11,148
Est. Water Usage (GPD)	2,007,870	2,137,969	2,273,131	2,428,514	2,603,981	2,787,023

Source: Caroline County Dept. of Planning, Codes and Engineering, 2009; MDP

Agricultural

The limitations of available data make future agricultural water usage less predictable. While the 1990s saw a decrease in the total number of acres of Caroline County farmland, the number of irrigated acres increased during the same period, likely due to the lower than average rainfall amounts experienced at the time (according to a 2004 report on State water resources, since the mid-1980s, the amount of irrigated acres has increased from 40,000 to 70,000 acres statewide.[52] The 2004 report found that "the Eastern Shore accounts for over 80 percent of agricultural water withdrawals in the State and this trend is increasing."[53]).

The 2004 report on the State's water resources projects a 2 percent increase in overall water usage on the Eastern Shore, but also predicts that Eastern Shore agricultural water withdrawals will likely conflict with increased water demand as a result of future population growth.[54] Caroline County's efforts to preserve its farmland – some of the most prime farmland in the State – will hinge on whether or not farmers have an adequate supply of water available for crop irrigation. The Advisory Committee report noted:

> "Irrigation reduces the risk of crop loss for farmers, and as a result, the total area of irrigated acres is likely to decrease less than the total area for non-irrigated acres. Irrigated acres are more likely to stay in agricultural use when unimproved parcels are sold or converted. Therefore, future demand trends for agricultural water withdrawals are correlated with irrigated acres rather than with total farmland or cropland acres."[55]

[52] Final Report of the Advisory Committee on the Management and Protection of the Water Resources of the State of Maryland, 2004
[53] Ibid.
[54] Ibid.
[55] Final Report of the Advisory Committee on the Management and Protection of the Water Resources of the State of Maryland, 2004.

In other words, farmland that is irrigated is more likely to remain farmland than farmland that is not irrigated.

In addition to providing insurance against crop loss, irrigation systems assist farmers in reducing the amount of nutrients contained in runoff from agricultural land. Drought conditions result in slower uptake of nutrients by crops; irrigation ensures that nutrient uptake will not decrease during dry growing seasons.[56]

As a County committed to preserving agriculture as an economic, historic, cultural and scenic resource, Caroline County understands the critical need to preserve the natural resources that sustain agriculture. Regional planning and management of water resources must include future agricultural water needs along with future water demand as a result of growth. Caroline County supports State and federal efforts to assist farmers with developing cost-effective irrigation systems that combine technology and best management practices to conserve valuable water resources. The County supports the development of irrigation systems that aid in controlling non-point source pollution from agricultural lands by enabling crops to maximize nutrient uptake during dry or drought years.

An analysis of future water use contained in the 2004 Final Report of the State's Advisory Committee on Water Resources included projections for multiple categories – domestic self-supplied, public, commercial, industrial, mining and aquaculture – and segregated increases in usage by category. In the central and southern regions of the State, public supply is projected to be the dominant usage; in Western Maryland the largest future usages are thermoelectric and industrial, and on the Eastern Shore irrigation is projected to be the predominant use. The Report projects a 2 percent increase in total fresh water use – from 51 mgd to 52 mgd – for the Upper Eastern Shore (Caroline, Cecil, Kent, Queen Anne's and Talbot Counties). The projected increase for the Upper Eastern Shore is one of the smallest forecasts (see Table 10).

Table 10: Regional Water Use Projections
State of Maryland 2000-2030

	Fresh Water Use in MGD		
Region	**2000**	**2030**	**% change**
Baltimore Metropolitan	371	397	7.0%
Washington Suburban	805	901	11.9%
Southern Maryland	32	45	40.6%
Western Maryland	140	137	-2.1%

[56] Final Report of the Advisory Committee on the Management and Protection of the Water Resources of the State of Maryland, 2004.

Table 10: Regional Water Use Projections State of Maryland 2000-2030			
	Fresh Water Use in MGD		
Region	**2000**	**2030**	**% change**
Upper Eastern Shore	51	52	2.0%
Lower Eastern Shore	49	64	30.6%
Total	1,447	1,680	16.1%

Source: 2004 Final Report of the State's Advisory Committee on Water Resources

Until the NACP aquifer study is complete, the most recent technical information available about Caroline County's major aquifers indicates that the County's demand for groundwater is not currently significantly impacting the yields of its major aquifers. Further, the 1998 study performed on the Columbia and Piney Point aquifers in Caroline County indicates that increased usage as a result of projected growth and increased demand for irrigation in the County will not be detrimental to the aquifers' yields in the foreseeable future. The more likely threat to the sustainability of the County's major aquifers will come from significant increases in usages of the same aquifers in other areas of the State and in Delaware.

Projected long-term water demand in Caroline County will need to be measured against aquifer sustainability estimates developed as part of the NACP aquifer study. As the NACP study continues and a more comprehensive analysis of the region's water supply is developed, the County (along with the State) will have an improved ability to make informed decisions regarding allocation of water resources for specific uses. Water allocation policies should include ensuring adequate future supply for agricultural users along with other major users.

The County will use the information systems developed for the NACP aquifer system, as well as MDE groundwater and surface water appropriation permits for Caroline County, to monitor trends in County water usage supplies and to compare new data with projections of County water demand. Analysis of this data will enable the County to anticipate and address critical issues before they arise, particularly those related to drought conditions and surface water withdrawals, and to work with MDE to make future decisions about water resources, including permitted pumping rates (seasonal and annual), suitable well locations, and future allocations.

Caroline County will coordinate planning strategies with other local governments to ensure that regional needs are accounted for in water resources planning at the local level. Municipal water systems in the County should undergo critical review on a regular basis to determine if repairs or improvements can be made to conserve or increase current water supplies. Comprehensive water system assessments also should take place when potential annexations are under review, as well as when a system reaches

75 percent capacity. A comprehensive assessment of municipal water systems should include aquifer sustainability, distribution needs and treatment levels and capacities.

The County recommends that MDE's Water Rights Division improve its coordination of water permitting and planning with County and municipal governments to ensure that State policies and practices do not conflict or undo local efforts to conserve and enhance local and regional water supplies. For example, a number of Tier II streams segments were recently identified in the County, but Tier II waters have not specifically been addressed in the State's current water appropriation regulations.[57] MDE should establish methods and standards for data collection, analysis, monitoring and flow-preservation thresholds designed to protect Tier II waters and to guide water appropriation permit decisions.

Regular assessments of regional water supplies – and capacity issues – should be conducted by MDE to afford local governments and citizens a better understanding of the sustainability of the County's – and the region's – water resources.

In the event the results of the NACP study indicate that any of Caroline County's major aquifers are endangered, the County should take immediate action to protect existing water sources and identify alternative water sources. Depending on the availability of alternative water sources, the County may consider petitioning EPA to designate critical water source as a Sole Source Aquifer.

The Sole Source Aquifer (SSA) Program, which is authorized by Section 1424(e) of the Safe Drinking Water Act, allows communities to petition the EPA for protection when a community is dependent on a single source of drinking water and there is no possibility of a replacement water supply to be found. EPA defines a sole or principal source aquifer as one which supplies at least 50% of the drinking water consumed in the area overlying the aquifer. EPA guidelines also stipulate that these areas can have no alternative drinking water source(s) which would physically, legally, and economically supply all those who depend upon the aquifer for drinking water. Petitions for SSA designation are submitted to EPA along with usage data and other technical and administrative information. EPA regional offices review petitions and, if merited, the Regional Administrator will designate an area as a Sole Source Aquifer.

[57] Final Report of the Advisory Committee on the Management and Protection of the Water Resources of the State of Maryland, 2008

Part II: Water Quality

The Federal Clean Water Act (CWA) provides the framework for managing the nation's water resources. Water quality standards were developed "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters" (Clean Water Act §101). The standards include designated uses for waterways as well as specific criteria that indicate whether or not the uses are able to be achieved in each waterway. Uses are identified through a public process and are based on the use and value of the water body for 1) public water supply; 2) protection of fish, shellfish, and wildlife; and/or 3) recreational, agricultural, industrial, and navigational purposes. These designated uses provide the foundation for determining which of Maryland's waterways are managed under the CWA.

Once a waterway's designated use (or uses) has been established, stringent water quality criteria are developed to ensure the protection of the designated use. Water quality criteria identify quantifiable pollutant thresholds that are not to be exceeded. Once criteria are established they are inviolate, meaning that, "as a society, we have agreed not to violate standards regardless of implications *unless* we agree to change the underlying designated uses through an open public process, which then allows for the criteria to be changed in response."[58]

A waterway is identified as impaired when it no longer meets the water quality criteria established for it and it is unable to achieve the use for which it is designated.

Caroline County's major tributaries – Choptank River, Marshyhope Creek and Tuckahoe Creek – are all listed as impaired on the MDE's 2008 Integrated Report (formerly the 303(d) List and 305(b) Report).

A report on water quality in Maryland issued by the U.S. Geological Survey in 2004 indicates that the combination of soil and aquifer conditions and the regional predominance of agricultural land use are responsible for the concentrations of nitrogen, phosphorus, and pesticides in streams and rivers on the Eastern Shore.

While there are other, lesser contributors to nutrient levels in the region's tributaries including septic systems, wastewater treatment plants, and urban and suburban chemical applications, the study noted that primary sources of nutrients on the Delmarva Peninsula are inorganic fertilizer, and that the concentrations of nitrogen, phosphorus,

[58] Maryland's 2006 TMDL Implementation Guidance for Local Governments, Maryland Department of Environment, May 24, 2006.

and herbicide compounds in streams on the Delmarva Peninsula are similar to those in other predominantly agricultural areas of the United States.[59]

In addition to the Federal Clean Water Act, a number of Federal and State programs exist to provide support for achieving Bay water quality goals and assurance that goals can be reasonably met, including:

Water Quality Initiatives and Programs

Bay Restoration Fund Enhanced Nutrient Reduction (ENR)

The Bay Restoration Fund (BRF) was created by Senate Bill 246 in May, 2004. The BRF uses funding from public sewer taxes to provide up to 100 percent state grant funds to local governments to retrofit or upgrade sewage treatment plants to reduce the nutrient levels in plant discharge to Enhanced Nutrient Removal (ENR) levels: 3 mg/l total nitrogen (TN) and .3 mg/l total phosphorus (TP). Upon completion of an ENR upgrade, MDE requires the permittee to make a best effort to meet the load goals, providing reasonable assurance of implementation.

The BRF also funds the cost of installing denitrification upgrades for septic systems in the Bay watershed through funding supplied by septic user fees paid by property owners with septic systems. Denitrification systems remove 50 percent or more of the nitrogen discharged by septic systems. The Chesapeake Bay Nitrogen Reduction Act, passed at the end of the State's last legislative session, requires that septic systems being built or replaced for homes located within the Critical Area must utilize the "best available technology" to reduce the level of nitrogen output of the septic system. The Caroline County office of Maryland Department of Environmental Health oversees implementation of the BRF program and administration of the new law.

The Maryland Water Quality Improvement Act

The Maryland Water Quality Improvement Act "requires that comprehensive and enforceable nutrient management plans be developed, approved and implemented for all agricultural lands throughout Maryland." This act specifically requires that nutrient management plans for nitrogen be developed and implemented by 2002, and plans for phosphorus to be done by 2005. In 2008, 379 farming operations filed nutrient management plans with MDA; however only 80 percent, about 90,000 acres, reported that their nutrient management plans were actually implemented. EPA, through the Chesapeake Bay Program, continues to emphasize that achieving 100 percent implementation of agricultural nutrient management plans is critical to achieving nutrient

[59] *Water Quality in the Delmarva Peninsula, Delaware, Maryland, and Virginia, 1999–2001*, U.S. Geological Survey Circular 1228, Judith M. Denver, Scott W. Ator, Linda M. Debrewer, Matthew J. Ferrari, Jeffery R. Barbaro, Tracy C. Hancock, Michael J. Brayton, and Mark R. Nardi, 2004.

reduction. Caroline County supports the 100 percent implementation goal and will identify opportunities to assist MDA with increasing implementation of nutrient management plans for Caroline County farms.

Chesapeake Bay Agreement

In the 1987 Chesapeake Bay Agreement, Maryland made a commitment to reduce nutrient loads to the Chesapeake Bay. In 1992, the Bay Agreement was amended to include the development and implementation of plans to achieve these nutrient reduction goals. The Tributary Strategies developed in support of the 1992 Agreement provide a framework to support the implementation of non point source pollution controls in the Choptank River and LES basins.

Choptank River and Tuckahoe Creek Watershed Characterization

In 2006, Caroline County Planning staff convened a workgroup composed of representatives from the County, incorporated municipalities, non profits, the County Farm Bureau, and other interested citizens to update a watershed characterization document for the Upper Choptank River Watershed, and to develop a similar document for the Tuckahoe Creek Watershed. The resulting document, released in 2007, is intended to establish the baseline information needed to develop a watershed plan. A Memorandum of Understanding circulated among the affected jurisdictions in which each signatory jurisdiction agrees to take the findings of the watershed characterization into consideration in its planning activities. Similar characterizations will be completed for the other major watersheds in the County, followed by the development of watershed plans.

Tributary Strategies

Tributary Strategies are river-specific cleanup strategies that detail the "on-the-ground" actions needed to reduce the amount of nutrients and sediment flowing into the Chesapeake Bay. When all 36 strategies are added together, cleanup plans will be in place in every part of the Chesapeake Bay's 64,000 square-mile watershed. The strategies outline how the Bay states and the District will develop and implement a series of "best management practices" to minimize pollution. This includes planting new riparian forest buffers, upgrading sewage treatment plants, implementing nutrient management on farms, wisely managing storm water runoff, and other innovative programs to accelerate the restoration of the Bay and its rivers.

Each strategy is tailored to that specific part of the Bay watershed - there is no "one-size-fits-all" strategy for the entire Bay watershed. Pollution reduction actions needed in

rural watersheds, like the Choptank River Basin, vary greatly from those needed in more urban areas.

Tributary Strategies provide a framework that will evolve over time to chart the most efficient and effective course to a clean Bay. As they mature, the strategies will detail what funding initiatives are needed, what policies must be implemented and what technologies need to be developed to expedite Bay restoration. As technology improves, new innovations will be incorporated into the existing plans, allowing Bay Program partners to find new ways to reduce our collective impact on the Bay.

Caroline County Water Quality

Basins and Watersheds

Caroline County drains into two basins, or State-designated 6-digit watersheds: the Choptank River Basin and the Lower Eastern Shore (LES) Basin. Most of the County is located in the Choptank River Basin. The State-designated 8-digit watersheds in the Caroline County portion of the Choptank River Basin are the Tuckahoe River, Upper Choptank, and Lower Choptank watersheds. The Marshyhope Creek and Nanticoke River watersheds are the 8-digit watersheds located in the Caroline County portion of the Nanticoke River Basin.

Choptank River Basin

The Choptank River Basin covers approximately 795 square miles and extends from Maryland's Eastern Shore to Delaware. In Maryland, the Basin drains approximately 700 square miles (448,000 acres) of land, including portions of Caroline, Dorchester, Queen Anne's and Talbot Counties. The Basin's dominant characteristic is agriculture, which accounts for approximately 60 percent of the Basin's land use. Forestland comprises about 30 percent of total land use, and urban areas comprise the remaining 10 percent (Cambridge is the Basin's largest city). [60] Population density is 69 people per square mile (about 0.1 person per acre).

The Choptank River Basin Summary Report, issued by the Maryland Department of Natural Resources (DNR) in 2007, identified the area within the Basin as unique among other land areas on the Eastern Shore due to its large amount of forest land and poorly draining soils. The Basin Summary Report also lists agricultural land as the Basin's dominant characteristic, and identifies non-point source nutrient and sediment loads as the Basin's major water quality issues. Eighty percent of the streams in the Basin had

[60] Maryland Department of Planning Land Cover Data, 2002.

registered nitrate levels greater than 1 milligram per liter (mg/l), a level that may affect aquatic life. The main sources of nitrates in small streams are fertilizers and acid rain.[61]

As of 2005, the largest source of nitrogen in the Choptank River Basin was agriculture (70 percent). Agriculture was also the largest contributor of phosphorus (62 percent) and sediment loads (85 percent). In 2007, agricultural land contributed more than two-thirds of the total nutrient loads in the Basin.[62]

A significant portion of the land in the Basin is drained via public ditches that were dug decades ago, primarily to drain land for farming. Due to Caroline County's flat topography, drainage ditches are vital to the healthy functioning and productivity of the County's farms. Caroline County contains 68 such ditches maintained by Public Drainage Associations and Public Watershed Associations, which are cooperative programs formed by local landowners to manage agricultural drainage. These ditches cover 368 miles, and including their buffers, occupy 70,137 acres of County land.[63] They are generally kept clear of plants and other vegetative growth, which contributes to increased stream flows and speeds delivery of nutrients to water bodies before they have had a chance to be absorbed into the soil.

The Maryland Public Drainage Taskforce issued a report in 2000 which contained recommendations for public drainage systems as they pertain to development and watershed planning. The recommendations include developing site-specific plans to slow the rate of water flow and improve habitat, and the application of best management practices to reduce nutrient export and increase habitat quality.[64] Caroline County recommends that best management practices for drainage ditches, including drainage control structures and non-structural stormwater management (utilizing environmental site design techniques) should be utilized to the maximum extent practicable.

The major drainage channels in the Choptank Basin are Tuckahoe Creek, Choptank River, and Little Choptank and Honga Rivers (both located entirely in Dorchester County). The Choptank River is included on the State's 2008 Integrated Report as a Category 5[65] impaired water body, with increases in total nitrogen and phosphorus

[61] http://www.dnr.state.md.us/streams/pubs/choptank.pdf
[62] Maryland Tributary Strategy Choptank River Basin Summary Report for 1985-2005 Data, Maryland Department of Natural Resources Tidewater Ecosystem Assessment, August 2007.
[63] *Moving Water*, Report to the Chesapeake Bay Cabinet by the Public Drainage Task Force Dr. Wayne H. Bell, Chair, Center for the Environment and Society, Washington College, October 2000.
[64] *Moving Water,* A Report to the Chesapeake Bay Cabinet by the Public Drainage Task Force, Washington College and the Institute for Governmental Service at University of Maryland College Park, October 2000.
[65] In accordance with recent EPA guidance, Maryland's current List of Impaired Surface Waters [formerly the 303(d) List] is contained in an Integrated Report, which designates five categories of water quality: Category 1 indicates that a water body is meeting all standards, Category 2 means it is meeting some but not all, Category 3 indicates that there is insufficient data to determine whether standards are being met, Category 4 means that water quality standards are not being met but a TMDL is not needed, either because it has already been completed, other more immediate fixes are available, or the impairment is not load related, and finally, Category 5 indicates that a water body is impaired and a TMDL is needed (MDE, 2008).

recorded between 2006 and 2008. The Little Choptank is also listed in the Report as impaired; however it improved from a Category 5 in 2006 to a Category 3 in 2008. Tuckahoe Creek is included in the Report as impaired; however there is limited water quality data available.

Lower Eastern Shore (LES) Basin

The Lower Eastern Shore – LES Basin (also known as the Nanticoke River Basin) contains 370,000 acres of land in Maryland and Delaware. It drains approximately 206,692 acres in Maryland, including portions of Caroline, Dorchester, Wicomico, and Worcester counties.

Land use in the basin is 51 percent agriculture, 45 percent forest and 4 percent urban (developed). Major agricultural crops produced in the basin are barley, wheat, vegetables, soybeans and corn for grain.[66] Broilers are the most important livestock or poultry product produced in the basin, followed by beef and hogs.

Marshyhope Creek and the Nanticoke River are the major drainage channels in the LES basin. Both are listed on MDE's 2008 Integrated Report for nutrient and/or sediment impairments.

8-Digit Watersheds

Caroline County is located within six State-designated 8-digit watersheds: Upper Choptank River, Tuckahoe Creek, Marshyhope Creek, Lower Choptank River, Nanticoke River, and Upper Chester River. Most of the County is located with the Upper Choptank River, Tuckahoe Creek and Marshyhope Creek watersheds. Table 11 illustrates the percentages of Caroline County land within each watershed. The Upper Choptank River, Tuckahoe Creek and Marshyhope Creek watersheds together occupy nearly the entire County. Only about .1 percent of Caroline County lies within the Upper Chester River and Nanticoke River watersheds, consequently those watersheds will not be included in this section's discussion of water quality and nutrient loads.

Table 11: Caroline County Land in 8-Digit Watersheds

Watershed	Acres	Percentage of County
Upper Choptank River	117,900	58.5%
Tuckahoe Creek	35,287	17.5%
Marshyhope Creek	40,034	19.9%
Lower Choptank River	8,092	4.0%
Nanticoke River	196	0.1%
Upper Chester River	26	0.01%

Source: 2005 MD PropertyView

[66] U.S. Department of Agriculture National Resources Conservation Service, 2006.

MDE lists all 8-digit watersheds in the County as Priority (Restoration) watersheds, either because they contain impaired waterways, or require restoration in order to meet other (two or more) natural resource goals. All but the Lower Choptank Watershed are also listed as Category 3 Priority (Protection) watersheds, which indicates that these watersheds are biologically significant in such a way that requires the prioritization of high-quality water quality, natural resource, and/or landscape conditions. These findings suggest that despite varying degrees of impairment, Caroline County's waterways retain desirable natural characteristics and possess attributes that merit protection.[67]

Upper Choptank River Watershed

The Upper Choptank River Watershed covers approximately 118,000 acres of land in Caroline County. Land use within the Caroline portion of the watershed is predominantly agriculture (59 percent), followed by forest (29 percent), urban land (8 percent), and wetlands (3 percent). Less than one percent is classified as extractive or bare ground. About three-quarters of the County's portion of the watershed's nutrient and sediment impairments can be attributed to agricultural land (see Table 12 for nutrients and sediments by percentage and source). Population density in the water shed is (.16 person per acre).

Table 12: Upper Choptank River Watershed Sources of Impairments

Watershed	Nitrogen	Phosphorous	Sediment
Point Source	8.3%	11.7%	0.0%
Non-Point Source			
Agricultural Land	72.7%	66.6%	86.9%
Mixed Open Land	6.5%	12.2%	4.4%
Urban Land	5.6%	7.7%	3.4%
Forest Land	5.4%	0.8%	5.2%
Atm. Dep. To Water	1.6%	1.0%	0.0%

Source: Maryland Tributary Strategy Choptank Basin Summary Report for 1985-2003

The Upper Choptank River is listed on the State's 2008 Integrated Report as a Category 5 Priority Watershed. The watershed is cited for four impairments: biological, bacteria-fecal coliform, nutrients and sediments. A watershed plan prepared for the Upper Choptank in 2003 recommended a number of strategies to address water quality issues ; a plan update is scheduled and will include the establishment and funding of a long-term cover crop program, implementation of improved maintenance and buffer programs for public drainage ditches, better enforcement of local sensitive areas, flood protection and stormwater management ordinances and development of Geographic Information Systems (GIS) data, approval standards, and management policies for on-site sewage disposal systems.

[67] *Caroline County Land Preservation, Parks and Recreation Plan*, 2006

The Choptank River plays a significant role in the overall health of this watershed. The most densely developed land – urban land – within the Caroline County portion of the watershed is located around the Choptank River, and most of the County's wetlands are associated with the River and its tributaries. These wetlands are crucial to water quality improvement and stream recharge in the watershed. A substantial amount of the developed and agricultural lands in this part of the County are located on hydric soils. Most of these soils originated as wetlands and were drained (via public drainage ditches) to allow for more productive land uses.

The 2002 Upper Choptank River Watershed Characterization used a soil erodibility benchmark of .275/acre to compare the Upper Choptank to other Maryland watersheds. The benchmark was based on the soil erodibility (K) factor and degree of slope steepness of land within the Critical Area in the Watershed. Soil with a value of less than 0.275 was considered relatively beneficial for water quality; soil assigned a K-factor of 0.275 or more was considered to be a likely factor for water quality problems. The average soil erodibility within the Critical Area in the Upper Choptank River watershed is 0.28/acre, which indicates that effects from erosion, such as sedimentation and stream bank erosion, are impacting water quality in the watershed.[68] The USDA's Farm Service Agency and the Caroline County Natural Resources Conservation Service (NRCS) office work with farmers to take highly erodible land out of production for ten to fifteen years through the USDA's Conservation Reserve Program (CRP).

As discussed earlier, the soils in this region are poorly drained, the land is predominantly flat, and farmers have employed a network of drainage ditches to drain water off of fields. The practice of clearing these ditches to allow for unimpeded water flow has contributed to the high levels of nutrients leaving farms and entering waterways. The U.S. Department of Agriculture (USDA) Agricultural Research Service (ARS), as part of the Conservation Effects Assessment Project (CEAP) begun in 2003, is conducting a study of the Choptank River Watershed to assess nutrient reduction efforts and determine more accurate nutrient reduction efficiencies for agricultural best management practices (BMPs) including improved management of ditches, and the development of more efficient monitoring technologies for cover crops.

Tuckahoe Creek Watershed

The Tuckahoe Creek Watershed is comprised of 97,339 acres of land in three Maryland counties: Caroline, Queen Anne's and Talbot. Caroline County occupies about 40 percent of the watershed. All waterways in the watershed are designated Use 1 (Water Contact Recreation and Protection of Aquatic Life).

[68] Upper Choptank River Watershed Characterization, Maryland Department of Natural Resources, Talbot and Caroline Counties, September 2002

MDE's 2006 report, "Prioritizing Sites for Wetland Restoration, Mitigation, and Preservation in Maryland", cites multiple impairments in the Tuckahoe Creek Watershed, including nutrients, suspended sediments and methylmercury in fish that indicate the watershed's need of restoration.

The population density in the Tuckahoe Creek watershed is about 0.07 people per acre (or 44.24 persons per square mile) using 2000 Census data (summarized by Chesapeake Bay Program Office). This density is relatively low compared to the Upper Choptank watershed.

According to the Tuckahoe Creek Watershed Characterization completed in 2002, the average soil erodibility of lands within 1000 feet of streams in the watershed is 0.30 value/acre which suggests that control of soil erosion is particularly important here.

Watersheds with more highly erodible soils are naturally more susceptible to surface erosion, sedimentation, stream bank erosion and other problems related to soil movement. These negative effects of soil erodibility on water quality can be minimized through careful management. The soil erodibility indicator accounts for natural soil conditions but not for management of the land. (Existing crop land management was not considered.) The naturally erodible soils in the watershed are addressed by techniques called Best Management Practices (BMPs) to prevent soil loss that are typically in use on local farms. These BMPs can be seen in use in many places in the watershed.

Marshyhope Creek Watershed

The Marshyhope Creek Watershed contains 138,000 acres of land in Maryland and Delaware, about 40,000 acres are located in Caroline County. Land in the Caroline County portion of the watershed is predominantly undeveloped: 55 percent is agricultural land, 39 percent is forest, and 6 percent is comprised of urban areas. Population density in the watershed is approximately 77 people per square mile (about 0.12 person per acre).

The watershed runs a length of approximately 38 miles long from its headwaters in Delaware to its confluence with the Nanticoke River in Dorchester County, and contains large amounts of protected forest corridor within its Maryland borders, most notably the Idyllwild Wildlife Demonstration Area (WDA). The Idyllwild WDA extends from the Maryland State Line to an area around the Town of Federalsburg and covers approximately 3,300 acres. Federalsburg is one of only two urban areas within the Maryland portion of the watershed. The Federalsburg wastewater treatment plant is listed as one of the watershed's three major point sources of pollution.

Marshyhope Creek originates in the Kent and Sussex County region of Delaware, an area dominated by poultry farming. Additional nutrient impacts to the watershed in this area are the result of application of poultry wastes on row crops as fertilizer and the presence of numerous channelized streams dug to drain land for agricultural uses.[69] In Maryland, the Creek is designated as a Use 1 waterway (water contact recreation and protection of aquatic life). It is listed as impaired due to signs of eutrophication that are visible in the form of algae blooms and low dissolved oxygen (DO) concentrations.[70] Eutrophication literally means that there is an excess of nutrients present; the depressed levels of DO are a result of the eutrophic conditions. The 1998 Clean Water Action Plan classified the Marshyhope Watershed as Category 1, in need of restoration, and Category 3, in need of protection. Issues in the watershed that require addressing include high modeled nitrogen and phosphorus loads, significant wetland loss and impaired water quality.

DNR's watershed profile of the Marshyhope lists the watershed's soil erodibility factor at .275/acre, relatively beneficial to water quality.

Lower Choptank Watershed

Approximately 8,254 acres of the Lower Choptank Watershed are located in Caroline County.[71] Three-quarters of this acreage is in agricultural land use, with the remaining divided between forest (17 percent), developed land (6 percent) and wetlands (2 percent). MDE reports that the substantial areas of poorly drained (hydric) soils within this part of the watershed may be desirable locations for wetland restoration.

The1998 EPA Clean Water Action Plan classified the Lower Choptank Watershed as Category 1 Watershed due to failing indicators including high nutrient concentrations, low submerged aquatic vegetation (SAV) habitat index, high historic wetland loss, high percent of unforested stream buffer and being on the 2008 Integrated Report for water quality impairment.

Maryland's 2004 303(d) List cited the tidal portions of the Lower Choptank watershed for numerous impairments, including fecal coliform, nutrients, suspended sediments, and poor biological community.

In 2008, the Lower Choptank Watershed appeared on the State's 2008 Integrated Report as a Category 5 Priority Watershed for nutrient and sediment impairments.

[69] U.S. Department of Agriculture National Resources Conservation Service, 2006.
[70] Decision Rationale: Total Maximum Daily Load of Phosphorus for Marshyhope Creek, 2000.
[71] Priority Sites for Wetland Restoration, Mitigation, and Preservation in Maryland, Maryland Department of the Environment, May 2006.

Tier II Waters

The State's water quality standards include Designated Uses, the criteria to protect Uses, and an Antidegradation Policy. The Antidegradation policy protects waters where water quality exceeds the minimum requirements specified by the State. These waters are identified as Tier II waters. Implementation procedures were developed for Tier II waters to protect and maintain them as high quality waters so they are not allowed to degrade to meet only the minimum standards (Tier I). Apart from certain short-term changes, water quality cannot be lowered in such waters.

MDE recommends stream segments for Tier II consideration after measuring and monitoring data against biological criteria and water quality thresholds. If a segment exceeds minimum water quality standards, it is eligible for Tier II consideration. If a segment is designated Tier II, any new or proposed amendments to County water and sewer plans and NDPES discharge permits are required to assure consistency with anti-degradation requirements.

MDE is reviewing several Caroline County stream segments eligible for Tier II designation, including segments located along the north, east and west boundaries of Denton, one along the west boundary of Greensboro, and several segments located on unincorporated County land. Final review and comment on proposed Tier II designations will take place in June 2009. If Tier II designation is granted, the County will amend relevant planning documents to include standards of protection for the Tier II waters.

Total Maximum Daily Loads (TMDLs)

A primary indicator of the potential for future growth is the assimilative capacity of local receiving waters for the input of pollutants. Assimilative capacity is expressed in the Total Maximum Daily Limits (TMDLs) of contaminants for the receiving waters. TMDLs are used as regulatory mechanisms to identify and implement additional controls on both point and non-point source discharges in water bodies that are impaired from one or more pollutants and are not expected to be restored through normal point source controls. TMDLs establish limits or "caps" on the amount of pollutants permitted from point and non-point sources through an allocation system.

Point sources include urban stormwater systems and wastewater treatment plants with permits to direct discharge into waterways (National Pollutant Discharge Elimination System Permits-NPDES). Non-point sources are all discharges other than point source discharges, including stormwater runoff from land and erosion of stream and river banks.

TMDLs have been set for some of the Bay's impaired watersheds and tributaries. Eventually, all the Bay's impaired watersheds and major waterways will be assigned TMDLs.

The Choptank River and Tuckahoe Creek are major receiving waters for point and non-point source pollution from Caroline County. Both have been listed as impaired waterbodies by the EPA, which cited nitrogen, phosphorous and sediments as the primary sources of pollution in both tributaries. In its 2002 publication "Choptank River Overview", DNR reported that nutrients such as nitrogen and phosphorous are naturally occurring in soils, plants, animal waste and the atmosphere, but like a number of other Bay tributaries the Choptank River contains nutrients that urbanization and farming have raised to levels that are harmful to aquatic life.[72] Neither the Choptank River nor the Tuckahoe Creek will have the assimilative capacity to support growth in the region unless strategies are implemented to manage these sources of pollution.

None of the 8-digit watersheds in Caroline County are slated to receive TMDLs within the next two years.[73] Although no nutrient TMDLs have been set for either watershed, or for any of Caroline County's major tributaries or sub watersheds, MDE's Statewide Implementation Plan includes data on basin nutrient loads and recommended nutrient caps for the Choptank River Basin and the LES Basin.

These recommended basin nitrogen and phosphorus caps are used herein as the basis for the development of the County's recommended nutrient load limits.

When they are prepared, TMDLs for the County's watersheds will establish both the type and stringency of management practices that will be needed to address current and future point and non-point source loads. In the meantime, the County will work with other jurisdictions in the Choptank River Basin to identify and implement best management practices to reduce existing and future non-point loadings.

Point Source Nutrient Loads

Point source loads are measurable inputs of pollutants that are discharged into streams, rivers and lakes via pipes or drains, primarily from industrial facilities, stormwater drains and municipal treatment plants. Caroline County shares the Choptank River Basin with numerous municipalities that operate public wastewater facilities (Cambridge, Easton, St. Michaels, Trappe, East New Market, Secretary, and Hurlock). The LES Basin contains 10 major (over .5 mgd average daily flow) wastewater facilities and a number of towns in both basins operate stormwater drainage systems as well.

The nutrient loads of the WWTPs located in Caroline County are listed in Table 13.

[72] Choptank River Overview, Maryland Department of Natural Resource, November 2002.
[73] The 2008 Integrated Report of Surface Water Quality in Maryland, Part F5, Category 5 of the 2008 Integrated 303(d) List.

Table 13: Caroline County Point Source Loads						
			2007 CONCENTRATION		2007 AVG FLOW LOAD	
Wastewater System	2007 Avg Daily Flow (mgd)	Design Capacity (mgd)	Total Nitrogen (TN) mg/l	Total Phosphorus (TP) mg/l	Total Nitrogen (TN) lbs/yr	Total Phosphorus (TP) lbs/yr
Denton	0.349	0.800	8.10	1.18	8,605	1,254
Federalsburg	0.274	0.750	19.85	0.68	16,557	570
Greensboro*	0.112	0.280	21.02	3.48	7,167	1,186
Preston	0.058	0.116	11.34	1.00	2,016	177
Ridgely	0.134	0.180	18.00	3.00	7,342	1,224
					41,687	**4,411**

Source: EPA Chesapeake Bay Program Point Source Database, MDE, WWTP monthly discharge reports
*2007 TN & TP concentrations are avg. of 2002-2006 data

Wastewater

MDE's Water Management Administration administers the State's National Pollution Discharge Elimination System (NPDES) program. The program requires permits for discharges of more than 10,000 gallons of water a day within a one-month period, or any discharge of waste to surface or groundwater. MDE renews NPDES permits every five years.

Agricultural activities which may require an NPDES permit include animal waste facilities, aquaculture operations, crop irrigation, and large concentrated animal feeding operations. Wastewater treatment plants (WWTPs) require NPDES permits to discharge treated sewage into surface water or the ground. Permitted facilities must adhere to water quality standards as well as effluent limits. A water quality standard is an "in-stream" standard and applies to a water body whether or not there is a discharge. An effluent limit is a condition of a discharge permit which limits the amount of a particular pollutant that may be discharged into the water body.

The permit sets discharge limits and includes restrictions and monitoring requirements which are intended to insure that the discharge will not degrade water quality or harm aquatic life. Major plants are those facilities that discharge 500,000 gpd or more. There are 66 major plants in Maryland; two of them are in Caroline County.

At present, the public wastewater treatment facilities located in the County are owned and operated by the towns of Denton, Federalsburg, Greensboro, Preston, and Ridgely. Denton and Federalsburg own major plants.

Municipal Wastewater Systems

The towns in Caroline County that own and operation wastewater treatment plants (WWTPs) are listed in Table 14.

Table 14: Municipal Wastewater System Characteristics - 2007

Water System	Permitted Avg Daily Flow (gpd)	Design Capacity (gpd)	2007 Avg Daily Flow (gpd)	Planned System Upgrades/ Expansions
Denton	800,000	800,000	349,000	Upgrade to 1.6 MGD (ENR)
Federalsburg	740,000	750,000	250,000	Upgrade to ENR
Greensboro	220,000	280,000	112,000	
Preston	115,000	116,000	95,000	
Ridgely	200,000	200,000	129,000	Upgrade Spray Irrigation System

Sources: MDE Municipal Sewage Flow Capacity Reports, NPDES permits, Wastewater Capacity Management Plans, Caroline County Departments of Environmental Health and Planning, Codes and Engineering.

Town of Denton

The Denton wastewater treatment plant (WWTP) is located on Legion Road at the intersection of Legion Road and Foy Road; it discharges into the Choptank River. The WWTP was expanded in the late 1990s to a capacity of 0.80 million gallons per day. The WWTP receives flows from four pumping stations within the Town: 1) Second Street Pumping Station; 2) Industrial Park Pumping Station; 3) Denton Plaza Pumping Station; and 4) Lupine Lane Pumping Station.[74]

Several studies concerning expansion of the Town's sewer service have been conducted. The Town's 2007 Wastewater Treatment Facility Capacity Report indicated that, based on future reserved sewer allocations, the Town reported an over-allocation of -548,591 gpd. In 2007 the plant's three-year average flow (2004 – 2006) was 369,000 gpd. That year, with outstanding reserved sewer allocations totaling nearly 1 million gpd, the Town applied to MDE for an upgrade of the WWTP. In 2008, MDE approved a project to upgrade the plant's treatment level to ENR and to expand its capacity to 1.6 mgd, double its current design capacity. The project involves expanding the existing 800,000 gallons per day capacity to 1.2 million gallons per day, then to 1.6 million gallons per day (mgd) (see discussion of point source strategies in Reducing Nutrient Loads section of this chapter). The Town projects that plant capacity will be adequate to support projected growth during the planning period and does not anticipate a need for additional plant expansion.

[74] *2006 Denton Comprehensive Plan*

Town of Federalsburg

Federalsburg has a wastewater trickling filter and biotower treatment facility designed to treat an annual average daily flow of 750,000 gpd, which is treated and discharged into Marshyhope Creek. In 2008, average daily flow was 250,000 gpd; in wet weather conditions inflow and infiltration (I & I) increased flow to 375,000 gpd.[75] The Town is preparing to undertake a project to separate storm water and sanitary sewage lines (some of which date to the 1920s) which will reduce infiltration problems by 25-30 percent and reduce the wet weather flow significantly. In June 2008 MDE approved a construction project to upgrade the Federalsburg WWTP using funding from the Bay Restoration Program. The project is scheduled to be complete by 2010 and will include upgrading the plant first to Biological Nutrient Removal (BNR) and then to Enhanced Nutrient Removal (ENR) technology.

In its 2008 Comprehensive Plan Water Resources Element, the Town calculates that growth as a result of infill development will create an additional flow of 92,500 gpd, which when combined with the existing flow will place the system at about 45 percent of its permitted capacity. Development of growth areas is projected to create an additional flow 365,250 gpd, which combined with the existing flow will result in daily flow of 707,750 gpd, or 94 percent of the plant's current capacity.

Town of Greensboro

The Town of Greensboro's WWTP consists of two Rotating Biological Contactors (RBCs) and related treatment systems. The plant discharges to the Choptank River and has a design capacity and annual average daily permitted flow of 280,000 gpd. In 2008, the plant's three-year average daily flow was 112,000 gpd, with gross available capacity of 138,000 gpd.

The Town calculates that infill development will create demand for an additional 100,750 gpd, which would leave 37,250 gpd in remaining capacity and place the system at 85 percent of capacity. As a result, in 2006 the Town limited the sewer allocation to public uses, rehabilitative uses, and non-residential job-creating uses. According to the Town's draft 2008 Comprehensive Plan, any future growth beyond that from infill development would require expanding the plant and upgrading it to ENR treatment level.

Town of Preston

Preston's sewer plant is a lagoon wastewater treatment facility that discharges into Choptank River via Hunting Creek. The plant was originally constructed in the 1960s

[75] *Background Study: Water Quality of Receiving Waters (Water Resources Element),* Town of Federalsburg, Maryland February 26, 2008

with a capacity of 115,000 gpd. The stabilization lagoon was upgraded and expanded in 2003, however in recent years the plant has experienced a number of problems (including significant inflow and infiltration) caused by aging lines, equipment and machinery.

The Plant's average daily flow for 2007 was 95,000 gpd; the three-year average daily flow for the period 2004-2007 was 74,300 gpd. The Town has allocated 1,810 gpd of flow for projects that have been approved but not built and does not anticipate that future growth will warrant a plant expansion.

Town of Ridgely

Ridgely's wastewater plant is a lagoon treatment facility with two non-aerated storage lagoons and effluent spray fields. The plant discharges to Choptank River via Chicken Bridge Tax Ditch. The plant is currently permitted to operate with an average daily flow of 200,000 gpd. In 2007, the average daily flow was 129,000 gpd, or 65 percent of capacity. The three-year average annual flow in 2007 was 125,000 gpd.[76]

The Town is in the process of upgrading the plant's spray irrigation system, including the addition of more efficient sprayers and additional irrigation fields to be planted with loblolly pine. When complete the project is expected to increase the plant's overall nutrient removal efficiency. The project is estimated to be complete in mid-2009.[77] These upgrades will not increase the plant's design capacity of 200,000 gpd.

According to the Town's draft 2008 Comprehensive Plan, approved subdivision projects will result in 487 new dwelling units in the Town, or an additional demand of 121,750 gpd. The Town anticipates that by 2030, growth as a result of infill development will result in an average daily flow of 288,000 gpd, 44 percent above the system's permitted capacity. The Town will need to expand its capacity and upgrade its treatment capability to ENR level before 2030 to accommodate the additional projected demand.

North County Towns

In 2008, the Commissioners of Caroline County and government representatives of the North County towns – Goldsboro, Henderson, Marydel and Templeville – formed the North County Water and Sewer Authority (NCWSA) to address what had become a critical issue of failing septic systems in the area. The Authority will oversee the development and management of a regional wastewater treatment facility or facilities that will be constructed to serve the four towns and specific areas located near the towns where on-site septic systems are failing or will likely fail in the near future.

[76] *Draft 2008 Town of Ridgley Comprehensive Plan*, Water Resources Element
[77] *Ridgely Five Year Capital Improvement Projects Report*, April 2, 2007

The planning and design phase of the regional system is currently underway to determine parameters for capacity and treatment requirements. State and Federal economic forecasts indicate that the availability of public funding for large-scale infrastructure projects over the next few years will be limited to critical projects that serve large populations. As per an allocation agreement between the four towns and Caroline County, the maximum number of homes permitted to be connected to a North County treatment plant is 1,532; the allocation agreement restricts the plant's maximum flow to 383,000 gpd. Preliminary cost estimates for a plant of this size to serve the entire North County Water and Sewer District exceed $20 million. Consequently, NCWSA is working with Maryland Environmental Service (MES) and MDE to evaluate the feasibility of securing State and/or Federal funding for two or more sub-regional systems to be constructed in phases within the next few years. Because the Town of Goldsboro is currently under MDE Consent Order, MDE recommends that the Town be given priority status in any phased schedule NCWSA develops.

Small Sewer Systems

Small sewer systems in Caroline County include schools, large industrial and commercial sites, marinas, residential subdivisions and mobile home parks. The systems are included in the County Comprehensive Water and Sewerage Plan inventory of community and multi-user systems.

The Maryland Department of Environmental Health office in Caroline County oversees compliance requirements and enforcement of small system facilities operators. Common issues experienced at these facilities include aging equipment, excessive flows, and groundwater contamination. While these systems are generally adequate, there are instances of repeated compliance violations that require significant State and County involvement to correct, most commonly at mobile home parks.

In 2008, three of the largest of these facilities had active NPDES discharge permits:

Table 15: Smaller Sewer Systems with Active NPDES Discharge Permits

Facility	Basin	Design Flow	Permit Flow
North Caroline High School	Choptank River	0.024	0.018
Colonel Richardson Middle & High School	Lower Eastern Shore	0.05	0.011
Walkers (Cedars) Trailer Park	Choptank River	0.015	0.014

As of April 2009, the Cedars facility was in violation of its NPDES permit and was in the process of designing and installing a new system. The new system will have a design flow of .04 mgd.

Non-Point Source Nutrient Loads

Non-point source pollution occurs when rainfall, snowmelt, or irrigation runs off land or through the ground and gathers pollutants, which are carried with the runoff and deposited into surface water or leaked into ground water. The amount of stormwater runoff in developed areas is a function of the amount of impervious surface associated with the built environment, i.e., roads, parking areas, roofs, etc. The greater the percentage of impervious surface, the faster water flows over land. In wooded or heavily vegetated areas, the water is intercepted by undergrowth, plants and trees as it flows over land and it reaches streams more gradually, a process that underscores the importance of grass and forest riparian buffers, particularly on agricultural land. These natural impediments reduce flood-related stream discharges and enable lower, sustained flows which in turn reduce the potential for erosion caused by storm events. The slower pace of runoff from undeveloped land also allows time for vegetation to uptake the nutrients in the runoff, which results in lower nutrient loads being discharged into waterways.

Because undeveloped land comprises most of Caroline County, the nutrient loads delivered from County land are almost entirely from non point sources. This is true for much of Bay watershed. And because agricultural land comprises more than half (59 percent) of the County's total land area, the heaviest non-point source nutrient loads delivered from County land are from farms. Developed land, which includes residential, commercial, institutional and industrial properties, comprises about 7 percent of the County and forested land makes up the remaining 32 percent of the County.

Caroline County's non-point source loading rates were calculated using a formula that includes land use acreages, soil factors, average annual rainfall and impervious surface percentages. The result is a per-acre rate of loading for each land use.

Nitrogen loads from on-site septic systems are also included in the County's total non point source load. Nearly all properties located in the unincorporated areas of the County and some properties located within municipal boundaries are served by on-site sewage disposal systems – septic systems, approximately 11,105 as of the end of 2008. The nitrogen loading rate of a septic system is:

9.5 lbs nitrogen/person/year x average number persons per household
x 0.4 (transport factor)

The transport factor reflects the percentage of nitrogen lost as it is transported from the septic system to the nearest body of water. The 0.4 transport factor indicates that 60 percent of the nitrogen coming from septic systems is absorbed through uptake in plants and trees en route to where it is eventually discharged into a waterway.

The estimated loading rates for County land uses and septic systems are illustrated in Table 16.

Table 16: Caroline County Estimated Non-Point Source Loading Rates - 2008

	Nitrogen Loading Rate (lbs/ac)	Phosphorus Loading Rate (lbs/ac)
Agricultural Land	23.15	2.17
Forest	1.48	0.02
Developed	9.02	1.31
Other	8.83	1.18
Residential Septic Systems	**9.5 lbs/person/hshld**	**n/a**

Notes:
"Developed" includes residential, commercial, industrial and institutional land uses, "Other" includes extractive (mining) and open urban land uses, barren land, beaches, and bare exposed rock.
All loading rates based on MDE loading rate estimates. Agricultural loading rate based on MDE "No Action" (i.e., no BMPs implemented) rate, to illustrate impacts of BMPs implemented by farmers in 2008 (see Table XX).
Sources: Maryland Department of Engineering; Caroline County Dept. of Planning, Codes and Engineering, 2009.

Caroline County Point and Non-Point Source Nutrient Load Caps

To date no nutrient TMDLs have been set for the major tributaries or sub-watersheds in Caroline County, however, MDE's Statewide Implementation Plan includes data on basin nutrient loads and recommended nutrient caps for the two 6-digit watersheds in which Caroline County is located: the Choptank River Basin and the LES Basin. These basin nitrogen and phosphorus caps are used herein to evaluate the impact of the County's nutrient loads on receiving waters and assign appropriate nutrient caps for the County's point and non-point source nutrient loads.

Caroline County's percentage of MDE's recommended basin nutrient caps were determined using the percentage of Caroline County land in each basin, and calculating Caroline County's share of the nutrient cap using the same percentage of each basin's caps. Caroline County comprises 34 percent of the land in the Choptank River Basin, and about 13 percent of the land in the LES Basin. Consequently, 34 percent of the total cap for the Choptank Basin and 13 percent of the total cap for the LES Basin are used as the recommended caps for Caroline County nutrient loads. Maryland Tributary Strategy nutrient caps for the Choptank and LES basins, and the County's percentage of each cap, are illustrated in Tables 17 and 18. The County's point and non-point source loads for each basin are listed in Tables 19 and 20.

Table 17: Nutrient Loads and Caps for Choptank River Basin Basin-wide and Caroline County				
Source	**Basin Nitrogen Cap (lbs/yr)**	**County Nitrogen Cap (lbs/yr)**	**Basin Phosphorus Cap (lbs/yr)**	**County Phosphorus Cap (lbs/yr)**
Point Sources	206,105	70,076	19,147	6,510
Non Point Sources	2,073,895	705,124	190,853	64,890
Total Sources	2,280,000	775,210	210,000	71,400

Source: Maryland's Tributary Strategy Statewide Implementation Plan, 2007.

Table 18: Nutrient Loads and Caps for Lower Eastern Shore Basin Basin-wide and Caroline County				
Source	**Basin Nitrogen Cap (lbs/yr)**	**County Nitrogen Cap (lbs/yr)**	**Basin Phosphorus Cap (lbs/yr)**	**County Phosphorus Cap (lbs/yr)**
Point Sources	253,218	50,644	23,465	4,693
Non Point Sources	3,856,782	771,356	306,535	61,307
Total Sources	4,110,000	822,000	330,000	66,000

Source: Maryland's Tributary Strategy Statewide Implementation Plan, 2007

Table 19: Caroline County Point and Non-Point Nutrient Loads LES Basin			
2008 NON-POINT SOURCE LOADS	**ACRES**	**TN (lbs/yr)**	**TP (lbs/yr)**
LAND USE			
Agricultural Land	21,447	496,498	46,540
Forest Land	13,857	20,508	277
Developed Land	3,535	31,002	4,030
Other	1,172	10,349	1,383
Water	133	1,104	157
Septic Systems (#)	2005	18,286	0
TOTAL LES NPS LOAD		**577,747**	52,387
CAROLINE LES BASIN NPS CAPS		771,356	61,307
NPS NUTRIENT REDUCTIONS NEEDED		NONE	NONE
2008 POINT SOURCE LOADS	**AVG FLOW (mgd)**	**TN (lbs/yr)**	**TP (lbs/yr)**
Federalsburg WWTP	0.274	16,557	570
TOTAL LES PS LOAD		16,557	570
CAROLINE LES BASIN PS CAPS		50,644	4,693
PS NUTRIENT REDUCTIONS NEEDED		NONE	NONE

Notes:
"Developed" includes residential, commercial, industrial and institutional land uses, "Other" includes extractive (mining) and open urban land uses, barren land, beaches, and bare exposed rock.
All loads based on MDE loading rate estimates. Agricultural loading rate based on MDE "No Action" (i.e., no BMPs implemented) rate, to illustrate impacts of BMPs implemented by farmers in 2008 (see Table XX).
Sources: Maryland Department of Engineering; Caroline County Dept. of Planning, Codes and Engineering, 2009.

In the LES Basin, as shown in Table 18, total nutrient loads from Caroline County point and non-point source loads are below the recommended basin caps and do not appear to be a significant constraint for future growth in the County provided the County's nutrient reduction strategies can keep point and non-point source loads at or below their current levels (see strategies to reduce nutrient loads, next section).

Table 17 illustrates the County's point and non-point source loads in the Choptank Basin. Point source loads do not currently exceed the Tributary Strategy Basin cap, however, the estimate of non-point source nutrient loads exceed the County's share of the non-point source caps by significant margins (1,833,237 pounds TN and 162,919 pounds TP).

Table 20: Caroline County Point and Non-Point Nutrient Loads Choptank Basin

2008 NON-POINT SOURCE LOADS	ACRES	TN (lbs/yr)	TP (lbs/yr)
LAND USE			
Agricultural Land	93,736	2,169,988	203,407
Forest Land	41,552	61,497	831
Developed Land	21,856	191,677	24,916
Other	2,840	25,077	3,351
Water	859	7,130	490
Septic Systems (#)	9,100	82,992	0
TOTAL CHOPTANK NPS LOAD		2,538,361	232,995
CAROLINE CHOPTANK BASIN NPS CAPS		705,124	70,076
NPS NUTRIENT REDUCTIONS NEEDED		1,833,237	162,919
2008 POINT SOURCE LOADS	**AVG FLOW (mgd)**	**TN (lbs/yr)**	**TP (lbs/yr)**
Denton WWTP	0.349	8,605	1,254
Greensboro WWTP	0.149	9,534	1,578
Preston WWTP	0.058	2,016	177
Ridgely WWTP	0.134	7,342	1,224
TOTAL CHOPTANK PS LOAD		27,498	4,233
CAROLINE CHOPTANK BASIN PS CAPS		70,076	6,510
PS NUTRIENT REDUCTIONS NEEDED		NONE	NONE

Notes:
* Agriculture is made up of cropland, pasture, orchards, feeding operations, agricultural buildings, and row and garden crops.
"Developed" includes residential, commercial, industrial and institutional land uses, "Other" includes extractive (mining) and open urban land uses, barren land, beaches, and bare exposed rock.
All loads based on MDE loading rate estimates. Agricultural loading rate based on MDE "No Action" (i.e., no BMPs implemented) rate, to illustrate impacts of BMPs implemented by farmers in 2008 (see Table XX).
Sources: Maryland Department of Engineering; Caroline County Dept. of Planning, Codes and Engineering, 2009.

Part III: Strategies to Reduce Caroline County Nutrient Loads

Non-Point Source Load Reductions

Agricultural Land

Best management practices (BMPs) are strategies developed to reduce nutrient loads from specific types of land. Agricultural BMPs including installation of forest and grass buffers, implementation of soil conservation, water quality and nutrient management plans, planting of cover crops, and installation of drainage water control systems have been implemented on hundreds of Caroline County farms since the 1990s.

The EPA's Chesapeake Bay Program (CBP) calculated the efficiency of each BMP for reducing nutrient loads in runoff, i.e., how much nitrogen and/or phosphorus is removed from runoff as a result of the implementation of each BMP. These estimates, or efficiency values, were established in 1993 and were based on nutrient reductions achieved in modeling programs. Effectiveness estimates for several BMPs were recently revised to incorporate long-term data and field-tested implementation results.

The loading rates used to calculate the agricultural nutrient loads in Tables 18 and 19 are based on MDE's "no action" estimates of nutrients loaded from Caroline County farms, i.e., the estimates represent what the nutrient load would be if a farmer took no action (implemented no BMPs) to reduce the nutrient impact of his land on a receiving water. MDE estimates that between 1985 and 2002, the implementation of agricultural BMPs in Caroline County lowered the County's agricultural nitrogen loading rate from 23.15 pounds of nitrogen per acre to 15.64 pounds per acre.

Maryland Department of Agriculture and USDA's Natural Resources Conservation Service (NRCS) and Farm Service Agency (FSA) record data on Caroline County agricultural operations enrolled in State and Federal cost-share programs to implement agricultural best management practices. At the end of 2008, MDA reported that 364 farming operations (90,941 acres) in Caroline County filed Annual Implementation Reports (AIRs) for nutrient management plans. NRCS recorded approximately 17,000 acres of cover crops planted in the County in 2008 and estimates that at least 90 percent of the farms with current conservation plans utilize some form of conservation tillage (based on soil conservation plan statistics). Since 1998, FSA has recorded approximately 4,200 acres of grass buffers and 142 acres of forest buffers installed on farms in the County, and 149 acres of agricultural lands restored to wetlands. The cumulative result of the buffers, wetlands and cover crops was a total reduction of 423,680 lbs. of nitrogen and 44,039 lbs. of phosphorus in the Choptank River Basin (see Table 21).

To determine Caroline County agricultural land nutrient loads for 2008, the reduction values of agricultural BMPs implemented on Caroline County farms through 2008 were calculated and the total pounds reduced was subtracted from the "no action" total load for agricultural land. BMP cost-share programs tracked by NRCS and FSA indicate that participation was primarily on farms in the Choptank River Basin.

As illustrated in Tables 21 and 22, the BMPs implemented in 2008 resulted in a reduction in nutrient loads to the Choptank Basin from agricultural land and an overall decrease in the County's total non-point source loads.

Table 21: Nutrient Reduction from 2008 Agricultural BMPs Implemented Choptank River Basin

TN Reduction	TP Reduction	BMP	2008 Acres Implemented	BMP TN REDUCTION (lbs)	BMP TP REDUCTION (lbs)
3%*	5%*	Conservation Plans/ Conservation Till	55,439	31,187	6,062
8%*	15%*	Conservation Plans/ Conventional Till	5,544	10,267	2,245
24.3%**	7%**	Cover Crops Total	**7,125**	40,081	1,082
25%*	25%*	Forest Buffers	**142**	820	230
17%*	75%*	Grass Buffers	**4,382**	17,243	7,131
3.11 lbs/ac^	0.3 lbs/ac^	Nutrient Management	**90,941**	282,827	27,282
17%*	0*	Small Grain Enhancement Total	**10,267**	40,406	0
25%*	50%*	Wetland Restoration	**147**	848	159
		TOTAL		**423,680**	44,193

*Peer-Reviewed and CBP-Approved Nonpoint Source Best Management Practices for Phase 5.0 of the Chesapeake Bay Program Watershed Model, Revised 1/18/06.
** Chesapeake Bay Program Cover Crop TN Effectiveness for Phase 5 Watershed Model.
^ Chesapeake Bay Program Nutrient Sub-Committee, 2008 (Beth Horsey, MD Department of Agriculture).
Sources: MD Department of Agriculture; Natural Resource Conservation Service; USDA Farm Service Agency.
Note: For detailed information on acres enrolled in BMP cost-share programs and methodology for calculating nutrient reductions, see Technical Appendix.

Table 22 illustrates the impact of the BMPs on the County's overall non-point source loads and the progress achieved in meeting the Basin cap.

Table 22: Choptank River Basin Non-Point Source Loads after 2008 BMP Implementation - Caroline County

	TN (lbs)	TP (lbs)
NPS Nutrient Reductions Needed Before 2008 BMPs	1,811,824	162,919
BMP Reductions Achieved - 2008	**423,680**	44,193
NPS Nutrient Reductions Needed To Meet Basin Cap	**1,388,144**	**118,726**

Sources: MDE; Caroline County Department of Planning, Codes and Engineering, 2009.

The BMPs implemented as of the end of 2008 were effective in reducing significant amounts of nitrogen and phosphorus in runoff from agricultural land, however, they were not sufficient to bring the County's NPS load within reach of the recommended nutrient caps. It is important to note that reductions achieved as a result of buffer plantings and wetland restorations (or creation) are the only 'permanent' reductions in NPS loads. All other BMPs must be re-implemented annually.

EPA's published review[78] of the accomplishments to date of the Chesapeake 2000 Agreement and progress on the 2010 Goals addresses the major issues impeding significant progress on Bay cleanup, one of which is the limited implementation of agricultural conservation practices. In March 2009, EPA issued a "Bay Barometer" that the agricultural community had achieved 50 percent of the 2000 Agreement goal for reducing nutrient loads from agricultural land. The 2009 Barometer also reported that wastewater plants Bay-wide had achieved 67 percent of the WWTP nitrogen reduction goal and 91 percent of the phosphorus reduction goal. EPA acknowledges that since the 2000 Agreement, "less pollution is coming from the agricultural sector but the reduction is not enough to meet the water quality goal."[79]

Of the major issues impeding progress in reducing nutrient loads to the Bay, the issue of limited implementation of agricultural BMPs is the one most relevant to the County's role in the impairment of Bay water quality. The predominance of agricultural land use in the County makes the attainment of agricultural nutrient loading goals central to the success of the County's efforts to improve basin-wide water quality. The gap between the progress anticipated as a result of agricultural BMPs, as stated in the Tributary Strategy goals for the Choptank and LES basins, and the actual performance of those BMPs has not fully been explained. The fact that achievements have been lower than expected has been attributed to actual BMP efficiencies being lower than those projected by the Chesapeake Bay Watershed Model, as well as farmers not fully or incorrectly implementing BMPs. The lack of consistent and sustained funding sources to underwrite the cost of implementing BMPs is also cited as an impediment to progress.

The field-tested effectiveness of grass and forest buffers, cover crops and nutrient management plans continues to be significant enough to merit their inclusion in MDA and USDA cost-share programs and Caroline County supports effort to increase funding and implementation of these BMPs in the future. The County recommends the implementation of these BMPs and additional strategies to achieve reductions in agricultural land nutrient loads, including:

[78] *EPA Needs to Better Report Chesapeake Bay Challenges:* A Summary Report, Report No. 08-P-0199, July 14, 2008
[79] Saving the Chesapeake Bay Watershed Requires Better Coordination of Environmental and Agricultural Resources *(issued jointly with USDA OIG)* 2007-P-00004 November 20, 2006.

- **Nutrient Management Plans**

A Nutrient Management Plan (NMP) is a comprehensive plan that calculates the optimum use of fertilizer a crop needs to minimize nutrient loss while maintaining crop yield. Under the Annotated Code of Maryland, Title 15 Department of Agriculture, Subtitle 20 Soil and Water Conservation, an agricultural operation with a minimum gross annual income of $2,500 or a minimum of 8,000 pounds of live animal weight must have a current nutrient management plan at all times. Farmers are required to update their nutrient management plans and take new soil samples a minimum of once every three years. An Annual Implementation Report (AIR) describing how the farmer implemented the nutrient management plan during the previous calendar year must be filed with the Maryland Department of Agriculture (MDA) by March 1 of each year.

Maryland farmers were required to develop and implement plans by 2005. By 2008, most of Caroline County's farms had filed nutrient management plans.

Table 23: 2008 Nutrient Management Plan Implementation – Caroline County

Total Filed Plans		Total Annual Implementation Reports Filed	
Operations	**Acres**	**Operations**	**Acres**
379	93,095	364	90,941

Source: Maryland Department of Agriculture, 2008

Implementation reports were filed for about 90 percent of the agricultural land acreage in the County; 100 percent implementation (115,000 acres) would achieve an additional nutrient reduction of 31,100 lbs. of nitrogen and 18,700 lbs. of phosphorus. In its 2008 Nutrient Management Accomplishments Report, MDA noted that proper implementation of Maryland's nutrient management regulations continues to be an obstacle to achieving nutrient reduction goals. MDA reports that a majority of Maryland farmers are committed to the agriculture industry's efforts to improve water quality and are complying with the Nutrient Management Law. However, to fully achieve compliance with the law, MDA acknowledges that more personnel and resources are needed to support the effort.

The County supports MDA's goal of 100 percent implementation of nutrient management plans on Caroline County farms and will explore methods of reaching 100 percent implementation of nutrient management plans on County farms.

Table 24: Nutrient Management Plan Goal – 100 percent Implementation by 2010			
BMP	**Goal Acres**	**TN REDUCTION (lbs)**	**TP REDUCTION (lbs)**
Nutrient Management Plans	**115,000**	**311,000**	**27,282**

Source: Caroline County Dept. of Planning, Codes and Engineering, 2009.

- **Soil Conservation and Water Quality Plans (SCWQP)**

A Soil Conservation and Water Quality Plan (SCWQP) is a comprehensive plan that addresses natural resource management on agricultural lands and utilizes BMPs that control erosion and sediment loss and manage runoff. SCWQPs include agricultural practices such as crop rotations as well as erosion control practices such as terrace systems, water control structures and diversions and vegetative BMPs, including grassed waterways, critical area plantings and filter strips.

County farmers voluntarily work with the County's Soil Conservation District, Maryland Department of Agriculture (MDA) or USDA to determine what practices are needed to address specific erosion and runoff concerns on a farm. The practices are designed to control erosion within acceptable levels and to be compatible with management and cropping systems. A SCWQP can be used for up to ten years without revision if substantial changes in management of the farm do not occur. Nutrient reduction is only one of many benefits derived from SCWQPs. Also included in a SCWQP are recommendations concerning forestry management, wildlife habitat and plantings, pond construction and management, and other natural resource management recommendations.

MDA's Water Quality Cost Share Program (MACS) provides funding to farmers to assist in the implementation of MACS program BMPs, particularly structural practices such as grass waterways (in areas with concentrated flow), terraces, diversions, sediment basins, and drop structures. Farmers may also apply to USDA for cost share funding and in many instances USDA and MACS cost share funds can be combined.

Conservation tillage is a MACS best management practice that involves planting and growing crops with minimal disturbance of surface soil. Farmers can use a variety of conservation tilling methods with variable rates of effectiveness. For maximum nutrient reduction, conservation tillage requires non-inversion tillage methods (i.e., the soil is not turned over) and a minimum of 30 percent crop residue coverage at the time of planting. No-till farming is another form of conservation tillage in which the crop is seeded directly into either vegetative cover or crop residue with little disturbance of the surface soil. Minimum tillage farming involves some disturbance of the soil, but uses tillage equipment that leaves much of the vegetation cover or crop residue on the surface.

The Caroline County NRCS office estimates that at least 90 percent of the farms with current conservation plans utilize some form of conservation tillage. As of the end of 2008, approximately 50,000 acres of farmland were being managed under current conservation plans. This is not far off of the Caroline County Tributary Strategy goal for conservation plans of 55,000 acres.

Caroline County supports the goal of 55,000 acres of farmland managed under current conservation plans and will work with MDA staff to review regulatory and preservation programs to ensure that they are structured to provide maximum encouragement to farmers to file and implement Soil Conservation and Water Quality Plans.

Table 25: Conservation Plan Goal – 55,000 acres

BMP	Acres	TN REDUCTION (lbs)	TP REDUCTION (lbs)
2008 Conservation Plans	**49,895**	31,187	6,062
Conservation Plans Goals	**55,000**	38,198	5,968

Source: Caroline County Dept. of Planning, Codes and Engineering, 2009.

- **Traditional Cover Crops – 14,000 Acres**

After a crop is harvested, high levels of nutrients may remain in the soil (especially during drought years), regardless of nutrient uptake by the crop during the growing season. During the winter, these nutrients, particularly nitrogen, can seep into groundwater. To help absorb the excess nutrients, cereal cover crops such as rye, barley or wheat, are planted without fertilizer in the fall on land that would otherwise remain bare during the winter (planting the cover crop earlier than 7 days prior to first frost enables the greatest potential for crop uptake of nutrients). The cover crop uptakes some of the remaining nitrogen in the soil as it grows, preventing it from seeping into groundwater. The plants and roots of cover crops also help anchor the soil to decrease erosion and reduce phosphorus losses. Farmers can continue reducing nutrient levels in soil by timing when the cover crop is plowed under so that the nitrogen trapped in the cover crop can be used by the following crop.

Farmers are reimbursed for the cost of planting cover crops through the USDA's Conservation Reserve and Enhancement Program (CREP), which is administered locally by the USDA and NRCS office in Caroline County. To be eligible for the maximum cost-share amount (called a Level 1 Reduction), farmers must plant cereal cover crops earlier than one week prior to first frost.

Commodity cover crops (also called small grain enhancement – SGE) are planted as cover crops but differ in that they may be fertilized after March 1 following fall planting and harvested. The intent of this practice is to allow farmers to plant and harvest a commodity crop but to eliminate fall and winter fertilization and use nitrogen remaining in soil for part of the crop's growing cycle – thus allowing the SGE crop to function like a cover crop. Farmers who plant commodity cover crops are eligible to participate in USDA cover crop cost share programs but at a lower rate of reimbursement.

Caroline County farmers planted about 7,000 acres of cereal cover crops in 2008, resulting in a total nitrogen reduction of 40,000 lbs. of nitrogen and 1,100 lbs. of phosphorus. The 10,200 acres of SGE cover crops planted in Caroline County in 2008 reduced the County's nitrogen load by 40,406 lbs.

The County supports USDA and NRCS effort to enroll Caroline County farmers in cover crop programs. The County will work with USDA and NRCS staff to review County regulatory and preservation programs to ensure that they provide maximum encouragement to farmers to participate in cover crop cost share programs. Achieving a 50,000 acre goal would result in a reduction of 281,273 lbs. of nitrogen and 7,595 lbs. of phosphorus from the County's nutrient loads.

Table 26: Traditional Cover Crops

BMP	Goal Acres	TN REDUCTION (lbs)	TP REDUCTION (lbs)
Traditional Cover Crops	**50,000**	281,273	7,595

Source: Caroline County Dept. of Planning, Codes and Engineering, 2009.

- **Riparian Forest and Grass Buffers – 8,000 Acres**

Riparian (streamside) grass buffers are permanent strips of land planted in grass or other non-woody vegetation between the edge of fields and streams, rivers or tidal waters. Grassed buffers help intercept pollution in runoff, prevent erosion, and remove nutrients from groundwater. Riparian forest buffers are strips of wooded areas along rivers and streams that help filter nutrients, sediments and other pollutants from runoff as well as remove nutrients from groundwater. In addition to having the same water quality improvement benefits as grass buffers, their value at enhancing wildlife and aquatic habitat make forest buffers an important BMP for the overall preservation of natural resources.

As of the end of 2008, Caroline County farmers had established 142 acres of forest buffers and 4,382 acres of grass buffers as part of the Conservation Reserve Program (CRP), a USDA cost-sharing program managed by the Farm Service Agency (FSA). Grass buffers reduced nitrogen loads from those 4,382 acres approximately 17,000 lbs.

and phosphorus loads by approximately 7,000 lbs. The County's 142 acres of forest buffers reduced the nitrogen loads by 820 lbs. and the phosphorus load by 77 lbs. Increasing the coverage of forest buffers in Caroline County to 1,000 acres will result in load reductions of 27,549 lbs. of nitrogen and 11,393 lbs. of phosphorus.

Increasing coverage of grass buffers in Caroline County to 7,000 acres will result in load reductions of 5,788 lbs. of nitrogen and 1,628 lbs. of phosphorus. EPA has established that buffer width, along with a number of other factors, influences a buffer's ability to remove nitrogen. [80] Caroline County will review the feasibility of increasing the width of Conservation Reserve Program buffers in areas where increasing buffer width will improve nutrient reduction efficiency.

Table 27: Riparian Forest and Grass Buffers – 8,000 Acres

BMP	Goal Acres	TN REDUCTION (lbs)	TP REDUCTION (lbs)
Riparian Grass Buffers	**7,000**	27,549	11,393
Riparian Forest Buffers	**1,000**	5,788	1,628

Source: Caroline County Dept. of Planning, Codes and Engineering, 2009.

- **Drainage Ditch Overlay District**

There are 368 miles of drainage ways in Caroline County, and including their buffers, they occupy approximately 70,000 acres of County land.[81] These drainage ways, because they are routinely mowed and cleared in most of the County, act as conduits that funnel runoff from developed and agricultural land to receiving waters. USDA research has shown that an average of six percent of the nitrate applied to agricultural fields can be transported in drainage water to receiving surface waters.[82] Drainage ways include public tax ditches, agricultural ditches and roadside ditches that are part of the County and State road and highway systems.

Approximately 97 miles of the County's total drainage ways are owned by Public Drainage Associations (PDAs). In 1986 Maryland developed regulations requiring that water quality concerns be addressed in maintenance and operation plans for the ditches managed by PDAs. Regulations include conducting bi-annual walking inventories to determine maintenance needs and submitting operation and maintenance plans to MDA for approval every two to three years, with concurrent approval from DNR and MDE. MDA provides technical assistance to PDAs to assist with proper maintenance and until

[80] "Riparian Buffer Width, Vegetative Cover, and Nitrogen Removal Effectiveness: A Review of Current Science and Regulations", EPA/600/R-05/118, October 2005
[81] Moving Water, Report to the Chesapeake Bay Cabinet by the Public Drainage Task Force Dr. Wayne H. Bell, Chair, Center for the Environment and Society, Washington College, October 2000.
[82] Using Remote Sensing & Modeling for Evaluating Hydrologic Fluxes, States, & Constituent Transport Processes Within Agricultural Landscapes, Gregory McCarty, Wells Hively, Ali Sadeghi, Agricultural Resource Service, USDA, 2007.

1985, provided cost-share funds to reimburse PDAs for a portion of the cost of implementing BMPs.

Since then, the lack of cost-share funds has resulted in only routine maintenance needs – such as mowing – being met. In its 2000 report to the Chesapeake Bay Cabinet, the Public Drainage Task Force said that "Storm damage which may cause bank sloughing, accretion and other problems has not been adequately treated since FY1995. Additionally, innovative BMP installation had been restricted due to lack of funds."[83]

The Caroline County Department of Public Works (DPW) regularly maintains the ditches alongside County roads. In most cases the ditches only require periodic mowing and clearing of debris. Because most of the land in the County is agricultural or low density residential, most of the roadside ditches are bordered by perennial vegetation, i.e., a natural buffer. However many properties extend to within a few feet of roadside ditches and public drainage ways so that during storm events, fertilizer and other nutrients from yards and farms have little chance of uptake before they reach the drainage ditch. And while the County DPW no longer scrapes ditches clear of all vegetation, privately-maintained ditches have no real controls to prevent the practice.

The establishment of a Caroline County Ditch Overlay District that includes roadside ditches and public drainage ways, as well as designated buffers adjacent to ditches, would facilitate the development of uniform ditch maintenance standards for all drainage ways in the County. The Ditch Overlay District would allow the County to work with farmers, Public Drainage Associations, and homeowners to improve the standards of maintenance of ditches and enhance the ability of ditch systems to filter nutrients and reduce the level of contaminants discharging into surface waters.

Traditional ditch construction and maintenance practices focus mainly on drainage and flood control and only to a limited extent on sediment and erosion control. The Ditch Overlay District Ordinance will incorporate current practices with recommended best management standards including methods to slow the rate of water flow, reduce nutrient export and increase habitat quality. Best management practices may include drainage water control structures and non-structural stormwater management utilized to the maximum extent practicable. Maintenance standards will emphasize establishing vegetative cover on buffer areas and will not be permitted to impede upstream drainage.

Ditch Overlay District regulations would largely follow the current maintenance practices of the County DPW and the local PDAs that manage each ditch. Enhanced or alternative maintenance guidelines will be developed for demonstration projects for County road ditches, and for designated priority areas with sensitive environmental conditions. GIS

[83] Moving Water, Report to the Chesapeake Bay Cabinet by the Public Drainage Task Force Dr. Wayne H. Bell, Chair, Center for the Environment and Society, Washington College, October 2000.

will be used to identify potential priority areas; priority area designation may include ditches located in the Critical Area, proximity to non-tidal waters, highly erodible and potentially erodible land, and hydric soils. The County will coordinate the designation of these areas with PDAs and the County office of NRCS. Additional or alternative maintenance guidelines may include recommended types of vegetation for buffers, restrictions on scraping or clearing ditches of vegetation, filtration and infiltration systems, or the use of drainage control structures. Drainage ditches located adjacent to buffers enrolled in the USDA CREP program or other similar, voluntary buffer management programs will be considered to have met ditch maintenance standards.

The County will explore the feasibility of creating a County Ditch Overlay District that includes roadside ditches and public drainage ways, as well as designated buffers adjacent to ditches that would facilitate the development of uniform ditch maintenance standards for all drainage ways in the County.

- **Ditch Erosion and Drainage Control Systems**

The Conservation Effects Assessment Project (CEAP) is conducting research on the effectiveness of drainage control structures used on farms in the Choptank Basin. CEAP is evaluating this BMP under "real-world conditions and management" to determine optimum implementation methods.

USDA's Agricultural Research Service (ARS) conducted a study to evaluate the nitrogen removal effectiveness of drainage control structures in the Choptank Watershed. The following excerpt from the project's technical abstract describes the conditions and results of the study, which were published in 2008:

> "One of the best management practices (BMPs) being used in these open ditches is the installation of a water control structures at drainage outlets. These control structures can be used to control water levels in agricultural fields to reduce water flow from the field and promote nitrate nitrogen removal processes such as denitrification. A typical management schedule is to increase water elevation at the outlet such that the water table is just below the root zone during the growing season and lower water elevation to or near the bottom of the drainage ditch (free drainage) during planting and harvesting operations. Our research site, Choptank River basin located within the Eastern Shore region, also consisted of extensive open ditches. We have instrumented four control drainage structures with V notch weirs along with a number of shallow monitoring wells both upstream and downstream of the structures. Information from this research site will be used to validate newly modified SWAT control drainage component to assess the effectiveness of this BMP for water quality evaluation at the watershed level. Preliminary findings show reduction of nitrate in drainage water

from 15% to 30%. Findings from this study will provide quantitative efficiencies for both water and nitrate reductions and better management strategies for more efficient use of these control drainage BMPs."[84]

Caroline County supports the effort to mitigate the negative impacts that channelized drainage ways have on the water quality of the County's tributaries and will explore the feasibility of installing and maintaining drainage control structures in ditches. The County will assist PDA managers as much as possible with the implementation of erosion and drainage control BMPs to reduce sediment and nutrient flow in County waterways – particularly those that receive drainage from agricultural land. County assistance through the Planning and Public Works departments may include:

- Installing weirs, drainage control structures, and pocket wetland systems on County road ditches to demonstrate viability of filtration and erosion and drainage control BMPs. This strategy will be implemented initially on a small scale, on road sections to be selected by County Public Works Department. The long-term goal is installation of ditch erosion and drainage control BMPs on 50 miles of County roads.
- Identifying and securing funding assistance or cost-share funds for the repair and stabilization of emergency blowouts, channel obstructions and weir maintenance
- Identifying and securing funding assistance or cost-share funds to increase PDA buffer protection and maintenance areas up to 35 feet from the center line of drainage systems.

Drainage water control structures have an EPA CBP-approved benefit of 33 percent reduction in total nitrogen loaded by fields that drain into the ditch that holds the structure (there is no approved phosphorus benefit). Installing drainage control structures in ditches that drain 10,000 acres of agricultural land would result in a load reduction of approximately 76,000 lbs. of nitrogen. Demonstration projects conducted on County road ditches will include an evaluation component, i.e., "in-ditch" testing, to determine effectiveness of erosion and drainage control BMPs. Effectiveness results will be used to determine which BMPs will be installed on additional County roads.

[84] Sadeghi, A.M., McCarty, G.W., Moriasi, D., Hively, W.D. 2008. Watershed SWAT evaluation of control drainage structure in ditch management for improved water quality. In: Proceedings of the American Society of Agricultural and Biological Engineering International Conference, March 29-April 3, 2008, Concepcion, Chile. 2008 CDROM.

Table 28: Drainage Control Structures – 10,000 acres			
BMP	Goal	TN Reduction (lbs) per acre	TN Reduction (lbs) Total
BMP Demonstration Projects	**50 miles of County roads**	TBD	TBD
Drainage Control Structures	**10,000 ac. agricultural land**	7.6	76,396

Source: Caroline County Dept. of Planning, Codes and Engineering, 2009.

- **Incorporate BMPs in Prioritization Formulas and Standards for Agricultural Preservation Program Eligibility**

Caroline County participates in State funding programs for agricultural easements, including the Rural Legacy Program, which is locally managed by Eastern Shore Land Conservancy (ESLC), and the Maryland Agricultural Land Preservation Foundation (MALPF), which is locally managed by the County's Agricultural Preservation Advisory Board.

MALPF purchases agricultural preservation easements that permanently restrict development on prime farmland and woodland in Maryland. Caroline County land owners who wish to participate in the MALPF program must first submit an application to the County Agricultural Preservation Advisory Board for review. The Board has 60 days to review applications and approve up to the maximum number the Foundation will consider for that fiscal year. Purchase easements are only offered to applicants who have been approved by the County.

The County's Advisory Board ranks applications according to a prioritization formula that assigns weights to a number of criteria, including stewardship practices. Stewardship requirements are limited to conservation and nutrient management plans that are updated and at least partially implemented (these are MALPF's minimum standards also).

The County will recommend that the Agricultural Preservation Advisory Board amend the stewardship practices criteria used in the prioritization formula to give credit only for full implementation of nutrient management plans (currently, partial credit is given for partial implementation), and to add credit for participation in other State and Federal conservation programs, such CREP, CRP and CEAP. In so doing, the County will reward those farmers who are doing better than the minimum requirements and motivate those who could do better.

The Rural Legacy Program encourages local governments and private land trusts to identify suitable rural and agricultural lands and to competitively apply for funds to

purchase preservation easements for those properties. Under the Program farmers can sell or donate their development rights and still retain ownership to continue growing crops or raising livestock. ESLC, a private land trust, facilitates the program locally and ranks applicants based on minimal standards.

The County recommends that ESLC revise its standards to include required implementation of conservation and nutrient management plans, and award extra credit for farmers who implement additional agricultural BMPs. The County can assist with this effort by providing ESLC data on acres of locally implemented BMPs, and information on State-approved BMP efficiencies and cost-share programs.

- **Retire Highly Erodible and Potentially Highly Erodible Agricultural Land**

Agricultural land retirement takes environmentally sensitive crop land out of production by planting permanent vegetative cover such as shrubs, grasses, and/or trees. The Conservation Reserve Program pays farmers to take marginal and highly erodible farmland out of production for at 10-15 years. The nutrient load is reduced from agricultural land use levels to mixed open (a reduction of 17.35 lbs/ac TN and 1.27 lbs/ac TP) or forest (a reduction of 21.75 lbs/ac TN and 2.15 lbs/ac TP) land use levels.

FSA reports that as of the end of 2008, 142 acres of Caroline County agricultural land have been retired through the CRP program. There are 55 acres of highly erodible agricultural land and 732 acres of potentially highly erodible agricultural land in Caroline County. Retiring all of these acres would result in a nutrient load reduction of 14,268 lbs of nitrogen and 999 lbs of phosphorus. The County will explore ways to encourage the retirement of highly erodible and potentially highly erodible agricultural land through the Conservation Reserve Program.

Table 29: Retirement of Agricultural Land Located in Sensitive Areas

BMP – Retirement of Agricultural Land	Goal (acres)	TN REDUCTION* (lbs)	TP REDUCTION* (lbs)
Highly Erodible/Potentially Highly Erodible Ag Land	**787**	14,268	999

*Using land use conversion values from agriculture to mixed open.
Source: Caroline County Dept. of Planning, Codes and Engineering, 2009.

- **Voluntary Efforts – Track and Quantify**

Finally, MDA and USDA estimate that many farmers are voluntarily – and without financial support from cost-share programs – implementing at least one best

management practice on their farms. In these cases where cost-share programs are not tracking acreages of implemented BMPs, there are no records to quantify progress and results. While resources are too limited to definitively track these efforts, if possible the County and the NRCS should work together to develop a system of gathering statistical data on the level of voluntary effort expended by Caroline County farmers to reduce nutrient loads from their land.

Table 30: Total Agricultural Land Nutrient Reduction Goal

BMP	Goal (acres)	TN REDUCTION* (lbs)	TP REDUCTION* (lbs)
Nutrient Management Plans	**100,000**	311,000	27,282
Conservation Plans Goals	**55,000**	38,198	5,968
Traditional Cover Crops	**50,000**	281,273	7,595
Riparian Grass Buffers	**7,000**	27,549	11,393
Riparian Forest Buffers	**1,000**	5,788	1,628
Drainage Control Structures	**10,000**	76,396	N/A
Retirement of Highly Erodible/Potentially Highly Erodible Land	**780**	14,268	999
TOTAL		**754,469**	**214,582**

Source: Caroline County Dept. of Planning, Codes and Engineering, 2009.

Developed Land

Reductions in nutrient loading from developed land (residential, commercial, institutional and industrial) are achieved through implementation of urban BMPs. Urban BMPs include erosion and sediment control practices, retro-active storm management systems, urban tree planting programs and urban stream restoration.

Urban BMPs have been implemented in the County only to a limited degree. More widespread implementation is possible and the County has developed recommendations for an urban BMP program that has the potential to reduce non-point source loads significantly, if it is fully implemented.

EPA's review[85] of the accomplishments to date of the Chesapeake 2000 Agreement and progress on the 2010 Goals addresses three major issues impeding significant progress on Bay cleanup. One of these is uncontrolled land development – the urbanization of the Bay watershed.

[85] *EPA Needs to Better Report Chesapeake Bay Challenges:* A Summary Report, Report No. 08-P-0199, July 14, 2008

Uncontrolled land development is an issue that historically has been confined to the western side of the Bay; however, development trends over the past two decades reflect increasing urbanization east of the Bay. While in Caroline County this has not (yet) been labeled "uncontrolled" development, it has raised public awareness to the extent that Caroline County landowners are becoming more aware of the fragmentation of farms and the alteration of natural shorelines, both of which are factors in the gradual disappearance of the historic form of the County's landscape.

As noted earlier in this chapter, both the Choptank River and Tuckahoe Creek are listed as impaired waterbodies by the EPA, which cited nitrogen, phosphorous and sediments as the primary sources of pollution in both tributaries. Neither the Choptank River nor Tuckahoe Creek will have the assimilative capacity to support development in the region unless strategies are implemented to manage these sources of pollution.

Nutrient impacts from developed land in Caroline County are primarily the result of nitrogen from on-site sewage disposal systems (septic systems), lawn fertilizers, and impervious surface runoff from residential. MDE estimates that parking lots are one of the most significant contributors to non point source loads from runoff of developed land in Caroline County.

Caroline County will develop programs to implement BMPs suitable for residential, commercial, institutional and industrial land to reduce the pollution load delivered to the County's tributaries from developed land.

- **Reduce On-Site Sewage Disposal Systems (OSDS – Septic Systems) Nitrogen Loads**

According to MDE data, there are 11,105 on-site sewage disposal systems (OSDS – septic systems) in Caroline County. Of this total, 9,100 are located in the Choptank River Basin and 2,005 are located in the LES Basin. About 13 percent of all septic systems in the County are located within the Critical Area, i.e., within 1,000 feet of tidal waters.

Septic systems are used to treat and discharge wastewater from toilets, sinks, bathtubs, dishwashers, washing machines, and other water-consumptive items. To work effectively, a septic system requires proper siting and installation and regular maintenance. A failing septic system is one that discharges effluent with pollutant concentrations that exceed established water quality standards. A report published in 2000 by the Center for Watershed Protection cites research that indicates that typical failure rates for septic systems range from one to five percent each year.[86] Improperly

[86] *The Practice of Watershed Protection: Techniques for Protecting our Nation's Streams, Lakes, Rivers, and Estuaries*, T. Schueler, H. Holland, Editors; Center for Watershed Protection, 2000.

functioning septic systems are recognized as significant contributors of nitrogen loads to ground and surface water, particularly in rural areas where most property owners do not have access to public sewer systems. MDE estimates that septic systems discharge 9.5 pounds of nitrogen per person, per household, per year. An estimated 60 percent of this is lost through uptake in plants and soil between a system and the nearest receiving water.

In 2008 the Maryland Board of Public Works voted to approve more than $6.6 million in Bay Restoration Funds (BRF) to upgrade septic systems with best available technology (BAT) for denitrification to prevent excess nitrogen from discharging to the State's waterways. Seven counties, including Caroline County, will receive $277,000 to $1.9 million each to upgrade septic systems with nutrient removing (denitrification) technology (Caroline County's share of the Fund is $600,000). The nitrogen load from a BAT system is 50 to 80 percent less than the load from a conventional system.

The Caroline County office of Maryland Environmental Health Services (EHS) oversees the BRF program to install denitrification septic systems in Caroline County. At present, one Registered Sanitarian (RS) and the EHS Director manage the program, including notifying property owners of available BRF funding, reviewing system specifications and requirements for candidate properties, and prioritizing eligible properties for funding. Failing systems located within the Critical Area are given top priority for BRF funds, followed by non-failing systems in the Critical Area. The RS overseeing the program estimates that 48 to 60 systems per year can receive BAT upgrades, based on his current and future estimated workload. Pending the implementation of the recently-passed denitrification law (SB 54), the number of upgrades per year may increase. Funding efforts will continue to be focused on upgrading the existing systems located in the Critical Area, with failing systems in the Critical Area being given top priority.

Upgrading all 1,499 septic systems in the Critical Area will result in a load reduction of 6,835 pounds of nitrogen per year. In addition to implementing the State law, which requires denitrification systems in the Critical Area, the County will explore the impacts and feasibility of requiring all new homes in TDR receiving areas to install BAT systems (unless connected to a sewer treatment facility). Requiring BAT systems in receiving areas would reduce septic system nitrogen loads by half of what they would be with conventional systems. At total build-out of receiving areas, this would mean approximately 46,800 *less* pounds of nitrogen entering County waterways each year.

The Bay Restoration Fund may be depleted before all septic systems in the seven counties using the Fund have been upgraded with denitrification technology. In lieu of a BAT upgrade, regular pump-outs can achieve some reduction in nitrogen loads from septic systems. Caroline County does not currently require regular septic maintenance on most systems (except BRF units and holding tanks), however Environmental Health Services staff use public education materials and on-site visits with property owners to

recommend regular septic pump outs every 2-5 years, depending on usage. In cases where prior issues have existed at a site, EHS staff may require that a tank be uncovered for inspection, and grant approval for an application for Water Supply/Sewer Verification (WSV) contingent upon a pump-out.

Table 31: BAT (Denitrification) Upgrades for OSDS

BMP – Denitrification OSDS	Goal (systems)	TN REDUCTION* (lbs)
Critical Area Septic Systems	**1,499**	**6,385**
TDR Receiving Area Septic Systems	**10,269**	**48,827**

*No credit given for phosphorus reduction
Source: Caroline County Dept. of Planning, Codes and Engineering, 2009.

- **Connect Septic Systems in Northern Caroline County to New Regional Wastewater Treatment Plant**

Upon completion of the North County sewer treatment facility, now in the design phase, approximately 642 existing homes will abandon on-site sewage disposal systems (many of which are failing) and connect to the regional system. Connecting these properties to the (future) North County wastewater treatment plant will reduce nitrogen loads from septic systems in this area by 1,934 pounds per year.

Table 32: Future North County WWTP Connections

BMP – Denitrification OSDS	Systems	TN REDUCTION* lbs/yr
North County existing properties	**642**	**1,934**
North County future DUs	**890**	**8,540**
North County WWTP total	**1,532**	**10,474**

*No credit given for phosphorus reduction
Source: Caroline County Dept. of Planning, Codes and Engineering, 2009.

- **Revise County Development Regulations to Include Environmental Site Design Techniques**

As part of the County's comprehensive re-zoning program, to begin in 2009, the County will revise its Zoning Ordinance, Subdivision Regulations, Erosion and Sediment Control Ordinance, and other development codes to incorporate environmental site design (ESD) and low-impact development (LID) techniques that optimize conservation of

natural features (e.g., drainage patterns, soil, vegetation), and minimize impervious surfaces (e.g., pavement, concrete channels, roofs). Existing regulations urge developers "to consider the impact upon the quality of the local water resources" but do not offer specific requirements or techniques to reduce negative impacts from development unless a property is located within the Critical Area. The County will propose revisions to development regulations to include environmental site design techniques, such as ESD or LID features on-site.

Developing regulations that clearly outline the goals and requirements of environmental site design – and offering incentives for implementation – will assist property owners in reducing the negative environmental impacts associated with development.

ESD techniques and implementation strategies may include:

- Providing incentives for conserving natural areas through density compensation, property tax reduction, and flexibility in the design process.
- Incorporating the use of nonstructural best management practices (BMPs) such as natural conservation areas, vegetated swales, and reducing impervious cover to the maximum extent practicable.
- Adopting flexible design criteria to allow developers to use low-impact, open space, and environmental site design.
- Limiting clearing, grading, and earth disturbance to only that required to develop a lot.
- Limiting impervious surface areas to 15 percent for all lots in identified sensitive areas (similar to Critical Area requirement).
- Permitting open section roadways in new developments for the installation of grassed swales and filter strips.
- Adopting street standards that include minimum required pavement widths needed to support travel lanes, on-street parking, and emergency, maintenance, and service vehicle access, based on traffic volume and desired speed.
- Utilizing landscaped islands in the center of cul-de-sacs and designing the islands to treat stormwater runoff.
- Permitting shared driveways and parking arrangements; using parking ratios as maximum number of spaces; minimizing parking space widths, incorporating pervious materials in parking lot surfaces.
- Requiring parking lots to be landscaped. Relax setbacks to allow for bio-retention islands or other stormwater practices in landscaped areas.
- Reducing minimum lot sizes, relaxing setbacks and allowing narrower frontages to reduce total road length and eliminate long driveways.
- Directing rooftop runoff to pervious surfaces and infiltration and catchment systems.

- Providing long-term protection of large tracts of contiguous forested areas; promote the use of native plantings.

- **Revise Stormwater Management Regulations to Include Revisions Made In State's New Stormwater Management Act and Stormwater Design Manual**

In 2007, the General Assembly passed the Maryland Stormwater Management Act **(**COMAR 26.17.02)**,** which mandates substantial revision of the State's Stormwater Design Manual. The most significant component of the Act is the requirement that new development use Environmentally Sensitive Design and Low Impact Development techniques, which are intended to "maintain pre-development runoff characteristics" on all development sites.

The County will propose revisions to its Stormwater Management Ordinance to include revisions made in the State's new Stormwater Management Act and Stormwater Design Manual. These revisions may include requiring environmental site design and low impact development practices to the maximum extent practicable. Additionally, the County may need to train relevant staff on new stormwater requirements and techniques, including:

- Regenerative stormwater outfall systems, which utilize weirs and other non-structural techniques as grade controls to disperse runoff and prevent incision of stream channels. Weirs facilitate the creation of pools that slow and detain stormwater, allowing nutrients and sediment to be filtered before they reach receiving waters. These systems can be installed at a lower cost than a conventional stormwater management system, have a significantly higher aesthetic value than drain pipes, and, unlike structural systems, improve with age.

- Bio-retention systems, which use filtration to treat stormwater runoff for all forms of development. The systems are modeled after the characteristics of forest and meadow ecosystems and use vegetation to filter and remove pollutants from stormwater runoff.

- Grassed swales, which are shallow channels lined with grass used to convey and store runoff.

- Porous concrete or asphalt paving materials, which allow water to seep through pavement into quick-draining layers of gravel filters before entering the soil.

- Rain barrels and cisterns, which store runoff directed from building downspouts. Rain barrels are generally better-suited to smaller structures (homes and outbuildings). Cisterns are larger, can be buried underground, and may be connected to a building's plumbing or irrigation system. Rain barrels and cisterns

also serve as sources of 'soft water' (i.e., chemically untreated) for irrigating gardens and lawns.

Additional revisions to the County's Stormwater Management Ordinance include the implementation of a stormwater management fee based on total area of disturbed land, development of incentives to encourage maximum use of low impact and environmental site design techniques, and required implementation of ESD BMPs on all stormwater management systems constructed on County-owned land.

- **Initiate Environmental Site Design and Low Impact Development Demonstration Projects on County Properties**

The County owns over 200 acres of institutional properties – schools, office buildings, libraries, and public works facilities – that feature large buildings, large paved parking areas, or both. The existing stormwater management systems on these properties consist of conventional stormwater drains, pipes and outfalls, many of which are outdated and often responsible for stream degradation and stream bank erosion. These properties present opportunities for ESD stormwater management retrofit (i.e., after development has occurred) projects and low impact development techniques that demonstrate how non-structural and ESD techniques can restore ecological functions to degraded stormwater conveyance channels and outfalls, reduce impacts to groundwater and nearby surface water, and aesthetically improve a property.

Potential sites for demonstration projects include:

- County public works facility in Denton: 3-acre impervious surface, abuts County public school and Maryland SHA facility. Projects: 600 feet of stream bank stabilization and stream restoration; regenerative stormwater management retrofit. Good interactive partnership potential for County, Denton, school and State.

- Public landings/wharves: the County maintains several public landings and boat launch facilities located adjacent to major and minor waterways. Issues: runoff from impervious surface areas. Projects: parking lot bio-retention areas, regenerative stormwater management retrofits, shoreline stabilization/restoration.

- Drainage ditches bordering County roads: There are approximately 600 miles of County owned and maintained roads in the County. Roadside ditches act as conduits, funneling runoff from roadways, collecting runoff from public ditches, eventually discharging to ground or surface water. Problems: nutrients in impervious surface runoff and agricultural ditch flows, sedimentation due to

ditch erosion. Projects: Demonstration projects on County road segments (to be selected by Department of Public Works), including installation of weirs, drainage control structures and pocket wetland systems, to demonstrate the viability of filtration and erosion and drainage control BMPs. Long term goal: installation of BMPs on 50 miles of County roads.

- County Health and Public Services (HAPS) building in Denton: 45,000 sq.ft. building on 6-acre campus. Issues: runoff from rooftop, parking lot, and other impervious surfaces. Projects: parking lot bio-retention area(s); regenerative stormwater management retrofit, demonstration/public education programs and exhibits.

- County public schools: 10 buildings on 9 campuses that total over 100 acres. Issues: runoff from rooftops, parking lots, and other impervious surfaces. Projects: rain barrels/cisterns, bio-retention areas, stream restoration where applicable, pervious surface installations, demonstration/public education programs and exhibits.

- County parks and recreational facilities: over 300 acres of land. Issues: runoff from parking lots and other impervious surfaces. Projects: bio-retention areas, regenerative stormwater management retrofits, stream restoration where applicable, demonstration/public education programs and exhibits.

- **Establish a Transfer of Development Rights (TDR) Program for the R-1 Residential Zone**

Caroline County's Transfer of Development Rights (TDR) Program was developed to protect the County's rural, agricultural land and direct growth towards towns and other areas where infrastructure exists to support it. The TDR Program permits property owners to transfer the development rights from a parcel of land located in the Rural (R) Zone to a parcel located in a County-designated "receiving area", where growth and/or infrastructure,, is planned. To date, the TDR program has been limited to property owners in the R Zone. The County's R-1 Residential Zone includes approximately 15,000 acres of properties that, if developed to their maximum potential, could yield an additional 12,000 houses in the County. Most of these new homes would be located in rural areas of the County, outside of municipal or Priority Funding Area boundaries and away from established infrastructure.

To prevent sprawl from occurring in these areas, the County will investigate the feasibility of establishing a Transfer of Development Rights (TDR) Program for properties in the R-1 Zone to allow the transfer of development rights from these areas to areas designated as receiving areas or municipal growth areas, where infrastructure

exists to support some level of development. An R-1 TDR program will further protect the County's rural land from development impacts and give property owners an equitable alternative to subdividing their properties.

- **Create a Program to Extinguish Development Rights in the Rural (R) Zone**

As discussed above, Caroline County's Transfer of Development Rights (TDR) program allows landowners to transfer the right to develop one parcel of land to another parcel of land, with the goal of shifting development from agricultural areas to designated growth areas where infrastructure is already in place or planned. Transactions within the TDR program take place between private landowners and developers; landowners may transfer development rights within the County's rural (R) zoning district at a 1:1 ratio (from sending to receiving area). In the past, the absence of a market for higher density development has limited the demand for this policy; consequently the program has been used infrequently. However, if fully utilized, the program has the potential to send as many as 10,000 development rights (dwelling units) from the Rural Zone to designated receiving areas.

The County will investigate the options to extinguish development rights in the Rural (R) Zone (e.g. Purchase of Development Rights (PDR) program and/or Installment Purchase Agreement (IPA) program). Either of the two (or both) programs could be funded from revenues received from the County's Agriculture Excise Tax, which is currently capped at $750/lot and directed to MALPF programs. Raising the tax to the maximum amount allowed ($5,000/lot), particularly if development demand were to increase also, would provide a reliable revenue stream with the potential to increase the County's buying power and reduce the number of potential building lots in the Rural (R) Zone.

- **Promote Voluntary Stewardship Programs**

Landowner Stewardship Referral Service: A free, voluntary program offered by the Maryland Department of Natural Resources that connects landowners who want to improve the natural resources on their property with organizations seeking sites for conservation activities. A natural resources expert will assist a property owner in identifying target areas on his/her property, deciding what activities will best meet a property owner's needs, and register a property as a potential site for tree planting, wetland restoration, stream bank stabilization or wildlife habitat improvement. Projects often qualify for cost-share, tax incentives or other funding opportunities. Property owners interested in enrolling can contact call DNR at 1-800-989-8852.

Stream ReLeaf: A Maryland Department of Natural Resources program managed by DNR regional foresters and part of Maryland's commitment to create and restore streamside forests by reforesting 600 miles of Maryland streamsides by the year 2010.

Interested property owners can contact the DNR Eastern Regional Forester at 410-543-6749.

Table 33 illustrates the potential reduction in nitrogen loading from developed land, with 100 percent implementation of the BMPs listed, with the exception of BAT systems in receiving areas. While build-out of the County's sending rights is not projected to occur within the planning period (2010-2030), it is likely that a portion of the sending rights directed to receiving areas will be used (i.e., property will be developed) between now and 2030. The County will track the development rate of properties in receiving areas and assess the progress on this goal – along with the other urban BMP goals proposed – in the update of the Comprehensive Plan in 2016.

Table 33: Total Developed Land Nutrient Reduction Goal

BMP	Goal	TN REDUCTION* (lbs)	TP REDUCTION* (lbs)
Critical Area BAT Denitrification OSDS (systems)	**1,499**	6,385	n/a
Receiving Area BAT Denitrification OSDS (systems)	**10,269**	48,827	n/a
North County WWTP total (dwelling units)	1,532	10,474	n/a
TOTAL		**65,686**	**n/a**

Source: Caroline County Dept. of Planning, Codes and Engineering, 2009.

Table 34 illustrates the potential impact from the implementation of agricultural and urban BMPs in Caroline County. One hundred percent implementation of the agricultural and urban BMPs described in this section (with the exception of BAT systems in receiving areas) would result in doubling the County's previously achieved nutrient load reductions; the County estimates that 100 percent implementation of its non-point source reduction goals (except for receiving area BAT systems in receiving areas) is achievable by 2020. As part of the update of the County Comprehensive Plan in 2015, the County will evaluate progress of implementation goals to date and set future BMP goals accordingly. It is possible that by that time, TMDLs will have been set for County watersheds or waterways and nutrient reduction goals will need to be revised accordingly.

Table 34: Total Non Point Source Nutrient Reduction Goal		
LAND USE	**TN REDUCTION* (lbs)**	**TP REDUCTION* (lbs)**
Agricultural	**754,469**	**214,582**
Developed	65,686	n/a
TOTAL	**820,682**	**214,696**

Source: Caroline County Dept. of Planning, Codes and Engineering, 2009.

Point Source: Wastewater Treatment Plants

The Chesapeake 2000 Agreement outlined a goal for Maryland towns and counties to work cooperatively to achieve a 40 percent reduction from 1985 Bay nutrient levels (also a component of the federal Clean Water Act – CWA). This goal was applied to point and non-point sources of pollution. State and Federal funding to reduce point source loads has been concentrated on upgrades to the state's 66 major treatment plants because they contribute 95 percent of wastewater flow into the Bay. The required reduction in major WWTP nutrient loads is made with plant upgrades to first BNR then ENR technology, which reduces total nitrogen (TN) load to 3 mg/l and total phosphorus (TP) to .3 mg/l (a 40 percent reduction from 1985 discharges). As of the end of 2007, point source loads were reduced 44 percent from 1985 nitrogen levels and 29 percent from 1985 phosphorus levels. While it will take several more years and millions more dollars ($750 million - $1 billion estimated for upgrades to all 66 plants), upgrading the major plants alone has the potential to meet the reduction goal for Bay-wide point source wastewater loads.

There are five wastewater treatment plants (WWTPs) in Caroline County. Two municipalities in Caroline County have major treatment plants, also known as "significant" point sources: Federalsburg and Denton. The Federalsburg WWTP ENR upgrade is currently underway; Denton is in the design phase of its upgrade. The towns of Preston, Greensboro, and Ridgely own minor treatment plants (flow less than .5 mgd). Table 33 provides information on the five municipal plants located in Caroline County.

Table 35: 2007 Municipal WWTP Flows and Nutrient Loads							
				2007 Data			
WWTP	2007 Avg Daily Flow (mgd)	Connections	Design Capacity (mgd)	TN mg/l	TP mg/l	TN lbs/yr	TP lbs/yr
Denton	0.349	1,396	0.8	8.10	1.18	8,605	1,254
Federalsburg	0.274	1,096	0.75	19.85	0.68	16,557	570
					TOTAL MAJOR	**25,162**	**1,823**
Greensboro**	0.149	444	0.28	21.02	3.48	9,534	1,578
Preston	0.058	232	0.116	11.34	1.00	2,016	177
Ridgely	0.134	536	0.18	18.00	3.00	7,342	1,224
					TOTAL MINOR	**18,892**	**2,979**
					TOTAL POINT SOURCES	**44,054**	**4,802**

**2007 TN & TP mg/l concentrations are avg. of 2002-2006 data
See Technical Appendix for detailed data on municipal plant flow calculations
Sources: EPA Chesapeake Bay Program Point Source Database; Caroline County Dept. of Planning, Codes and Engineering, 2008

The combined flows of the three smaller plants in 2007 loaded about 75 percent of the amount of nutrients loaded by the two major plants. While minor plants are considered "non-significant" point sources, the minor plants in Caroline County are very significant factors in the County's total nutrient load. Per MDE, funding for ENR upgrades to smaller plants will begin only after all major plant upgrades are done and if funding is still available. EPA and MDE are developing programs in conjunction with local governments to monitor projected growth and increases in flow allocations and resulting impacts to small plants. MDE also is exploring the feasibility of continuing funding for the BRF program to ensure ENR upgrade funding for all minor plants.

While upgrades to BNR and ENR treatment levels could result in a significant reduction in nutrient loading from WWTP point sources, the full potential of the advanced technology will go unrealized in plants whose flows increase to full capacity. Current NPDES permitting standards are based on plant flow capacity, i.e., the maximum number of gallons that can flow through a plant per day. A better permitting strategy would be to base permits on computed loads, i.e., nutrient concentrations times the volume of flow. Maximum limits of loads should be capped at values which sum to a 40 percent reduction from the 1985 load of a specific plant (see Table 34). Otherwise, if permit limits continue to be based on ENR treatment levels applied to the design capacity of a treatment plant, the long-term result will be that ENR technology will result in a nutrient reduction that is less than the goal of 40 percent reduction from 1985 loads.[87]

[87] Statewide Tributary Strategy Implementation Plan, Choptank Tributary Team/Public Comment Tracking Matrix, 6-23-06

Table 36: WWTP ENR/BNR						
		ENR or BNR* DESIGN CAPACITY FLOW		40% REDUCTION GOAL**		
WWTP	Design Capacity (mgd)	TN lbs/yr	TP lbs/yr	TN lbs/yr	TP lbs/yr	Potential new DUs to stay within goal†
Denton	0.800	7,306	731	8,811	3,426	2,599
Federalsburg	0.750	6,849	685	14,683	1,721	5,274
Greensboro	0.280	6,819	2,557	2,628	686	0
Preston	0.116	2,825	1,059	3,123	1,215	273
Ridgely	0.180	4,384	1,644	5,129	1,994	293
		28,182	6,676	34,373	9,042	

*ENR nutrient concentration: 3 mg/l TN, .3 TP mg/l; BNR nutrient concentration: 8 mg/l; 3 mg/l.
** 40 percent reduction from WWTP 1985 nutrient loads.
†Based on 250 gpd per dwelling unit.
Source: EPA/CBP Point Source Database; MDE, Caroline County Dept. of Planning, Codes & Engineering, 2009.

- **Coordinate with Municipalities to Achieve Clean Water Act Point Source Goals – 40 percent Reduction from 1985 Point Source Loads**

Caroline County will coordinate the designation of County growth and TDR receiving areas with municipalities based on available capacity of water and sewer systems, with the goal of achieving 40 percent reduction from 1985 point source loads. Consideration also needs to be given for the number of existing homes that now or may in the future have failing septic systems. Long term strategies to address failing septic systems in the region will be the result of coordinated planning between Caroline County and its municipalities.

Inter-jurisdictional planning for future growth in Caroline County will address:

- Capacity of municipal growth areas to receive transferred development rights from County;
- Capacity of municipal treatment plants to support additional growth, including that directed to County receiving areas near towns (without exceeding 40 percent goal);
- Determining thresholds and benchmarks for County point source nutrient loads based on population and housing units and the 40 percent reduction goals, and develop a system to monitor and address increases over time.
- Where future growth may exceed the 40 percent reduction goal for a municipal treatment plant, assist the town in finding technical and/or fiscal support for decreasing effluent concentrations of TN and TP, and increasing average daily flow by a factor sufficient to result in a zero sum gain in nutrient load. For example, the Denton WWTP will have a design capacity of 1.6 mgd upon

completion of its ENR upgrade. At capacity flow, the plant's nitrogen load would be 14,612 pounds, nearly double the goal of a 40 percent reduction from the plant's 1985 load (see Table 37). To maintain the reduction goal the plant would need to cap its flow at about .97 mgd, rather than its capacity flow of 1.6 mgd.

The County also will work with municipalities in determining what potential, if any; nutrient trading will have to reduce nutrient loads in County waterways. The State's Policy for Nutrient Cap Management and Trading was established by MDE as an effort to maintain water quality in the Bay watershed. All states in the Chesapeake Bay Watershed are now required to issue NPDES permits with limits for nutrients based on their state's Tributary Strategy nutrient load caps. This has not yet been implemented in Maryland, but when it is, all major WWTPs will have Tributary Strategy loading cap-based nutrient limits in their permits (no word yet on minor dischargers' permit requirements). Under the policy, to maintain the required caps, nutrient loadings from new or expanding major plants have to be offset by equivalent nutrient reductions.

The policy is being developed by MDE in two phases. Phase I establishes definitions, principles, and fundamentals of the trading program, as well as point-to-point trading policies. Phase II will address point source to non-point source trading and offsets. The State's trading policy is essentially a set of guidelines; it is not regulatory, and will be used by MDE primarily "to guide future administrative decisions."[88]

Caroline County is not prepared to support nutrient trading until the State's policy better addresses such things as baseline nutrient level requirements for traders (in other words, nutrient levels that must be achieved and maintained by a potential trader before he can participate), protocols for quantifying loads and reductions, and standards for compliance, for both point and non-point trading.

Future Growth and Nutrient Loads

Table 37 and Figure 2-5 illustrate the potential impact on County receiving waters of nitrogen loads from projected residential growth served by conventional septic systems, BAT (denitrification) septic systems, sewer systems with secondary treatment capabilities, BNR treatment capabilities, and ENR treatment capabilities.

The County is in the process of working with municipalities to determine the feasibility of sending County property development rights to municipal growth and/or infill areas. When formal agreements have been adopted, the County will be able to calculate nutrient impacts from development based on the number of rights sent to municipal areas, which would be calculated using WWTP loading rates, or to areas that would

[88] "*Maryland Policy For Nutrient Cap Management And Trading In Maryland's Chesapeake Bay Watershed*", Maryland Department of the Environment, Water Management Administration, April 17, 2008.

require OSDS, which would be calculated using septic denitrification loading rates. Table 38 illustrates the nutrient impacts of the total on-site and transferable development rights in the County served by OSDS and sewer service.

Figure 2-5: Potential TN Impacts from Residential Growth

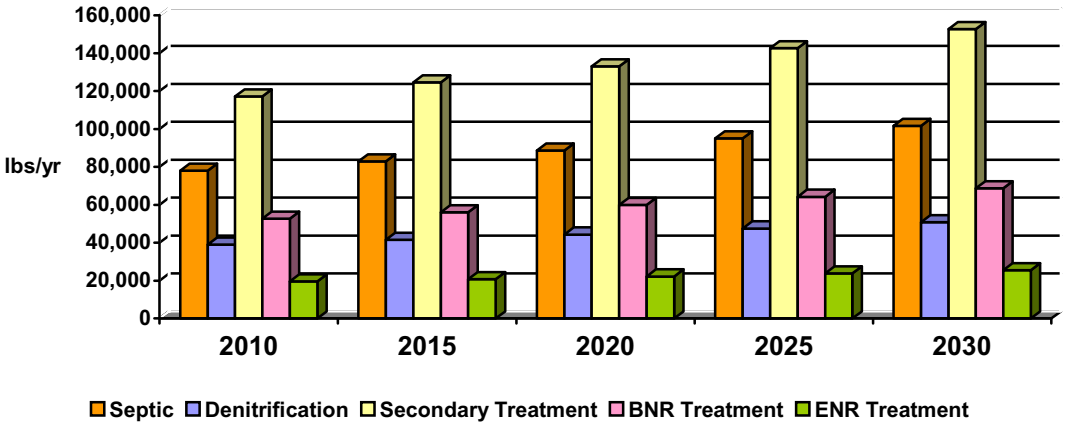


Table 37: Potential Total Nitrogen (TN) Impacts from Projected Residential Growth Caroline County (non-Municipal)						
	Units (#)	TN SEPTIC (lbs/yr)	TN DENITRIF (lbs/yr)	TN SECONDARY (lbs/yr)	TN BNR (lbs/yr)	TN ENR (lbs/yr)
2010 Housing Units	8,552	77,993	38,997	117,149	52,717	19,525
2015 Housing Units	9,093	82,924	41,462	124,560	56,052	20,760
2020 Housing Units	9,714	88,592	44,296	133,067	59,880	22,178
2025 Housing Units	10,416	94,993	47,497	142,683	64,207	23,781
2030 Housing Units	11,148	101,671	50,835	152,710	68,720	25,452
Source: Caroline County Department of Planning, Codes and Engineering, 2009.						

Table 38: Potential Total Nitrogen (TN) Impacts from All Potential Development* Caroline County (non-Municipal)						
	Units (#)	TN SEPTIC (lbs/yr)	TN DENITRIF (lbs/yr)	TN SECONDARY (lbs/yr)	TN BNR (lbs/yr)	TN ENR (lbs/yr)
TDR Sending Area transferable	7,080	64,570	32,285	96,985	43,643	16,164
TDR Receiving Area transferable	3,189	29,084	14,542	43,684	19,658	7,281
On-site developable	12,096	110,316	55,158	165,696	74,563	27,616
*Based on Development Capacity Analysis Source: Caroline County Department of Planning, Codes and Engineering, 2009.						

CHAPTER 3: RESOURCE CONSERVATION

Natural Resources

Caroline County has an abundance of natural resources including mineral resources, productive agricultural land, as well as forested and estuarine habitats that are rich with biodiversity. These resources have aesthetic and environmental qualities that define the essential character of the County.

A primary goal of the *Caroline County Comprehensive Plan* is to manage, protect and conserve the natural resources. Objectives for natural resources include:

- Enacting appropriate protection measures for environmentally sensitive areas;
- Responsibly managing forest resources;
- Improving surface water quality, specifically by reducing loads of nitrogen, phosphorus and sediments into County waterways;
- Conserving groundwater resources and the integrity of those sources of water;
- Enhancing County programs for natural resource protection/conservation; and

Guiding Legislation

In 2000, Maryland, Virginia, Pennsylvania and the city of Washington D.C. signed the *Chesapeake 2000 Agreement* (Chesapeake 2000) with the United States Environmental Protection Agency (EPA) and the Chesapeake Bay Commission. Chesapeake 2000 contains goals for protecting and restoring the Chesapeake Bay such as goals for water quality, sound land use, and stewardship of the Bay watershed. As North America's largest and most diverse estuary, implementing strategies to achieve the agreement's goals is critical for preserving the Chesapeake Bay.

Goals include the following:

- Living Resources**:** Restore, enhance, and protect the finfish, shellfish, and other living resources, their habitats and ecological relationships to sustain all fisheries and provide a balanced eco-system.
- Water Quality**:** Achieve and maintain the water quality necessary to support the living resources of the Bay and its tributaries and to protect human health.
- Habitat**:** Preserve, protect, and restore those habitats and natural areas that are vital to the survival and diversity of living resources of the Bay and its rivers, including submerged aquatic vegetation, watersheds, wetlands, and forests.
- Land Use**:** Develop, promote, and achieve sound land use practices which protect and restore watershed resources and water quality, maintain reduced pollutant

loadings for the Bay and its tributaries, and restore and preserve aquatic living resources.

- Stewardship**:** Promote individual stewardship and assist individuals, community based organizations, businesses, local governments and schools to undertake initiatives to achieve the goals and commitments of the Chesapeake 2000 Agreement.

Caroline County is also required to implement the Maryland Critical Areas Law, and the Caroline County Critical Areas Program. This legislation sets guidelines for land use and development for any land within 1000 feet of tidal waters. Additionally, Caroline County must act upon the Maryland State Forest Conservation Law, enacted to protect the forests of Maryland by making the identification and protection of forests and other sensitive areas an integral part of the site planning process. Land use in Caroline County is also regulated by the Clean Waters Act, which was designed to protect all navigable waters of the United States, and the Maryland State Water Quality Improvement Act, passed in 1998 requiring most of the areas farmers to manage nutrient application by formally creating a nutrient management plan.

General Soil Conditions

The dominant soil texture in Caroline County is sandy. The Department of Agriculture's Soil Survey of Caroline County classifies 3% of the soil as sand, 20% loamy sand, 53% sand loam, 18% loam, and 6% for all other soil textures. The sandy nature of the soil is responsible for rapid rates of infiltration, low moisture holding capacity, and considerable leaching. The leaching produces soils which are low in pH, generally 4.5 to 6.0.

Sensitive Environmental Areas

Article 66B of the Annotated Code of Maryland requires that every County adopt policies to address the protection of environmentally sensitive areas, including:

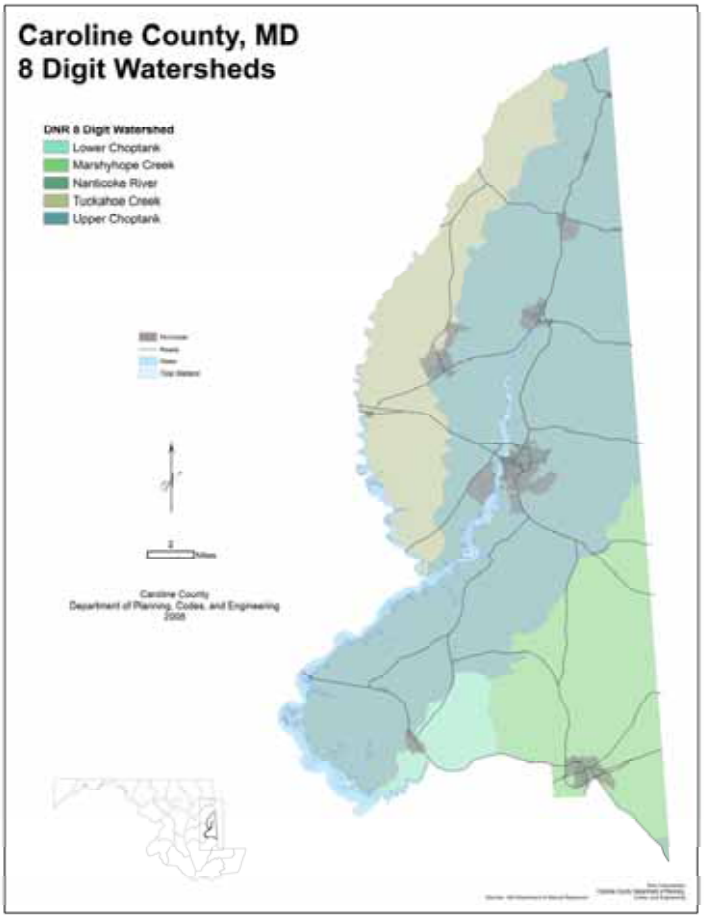
- Streams and Stream Buffers;
- Agricultural and Forested Lands intended for preservation;
- Steep Slopes;
- 100-Year Floodplains;
- Habitats of Threatened and Endangered Species; and
- Wetlands.

Table 3-1: Natural Resource Classification		
Total –Caroline County	**206,719**	**100%**
Sensitive Areas	**Acreage**	**Percent of Total**
Forested Areas*	66,915	32%
National Wetlands Inventory – NWI**	33,945	16%
Floodplain**	17,251	8%
Chesapeake Bay Critical Area	13,249	6%
Sensitive Species Habitat**	29,147	14%

* Provided by Maryland Department of the Environment
** Provided by Maryland Department of Natural Resources

Streams and Stream Buffers

The majority of Caroline County is part of four 8-digit watersheds: Tuckahoe River, Upper Choptank, Marshyhope Creek, and Lower Choptank. Major water resources in Caroline County include the Choptank River, Tuckahoe River, Marshyhope Creek and many miles of streams.
Streams and their buffers are important resources because they:



Map 3-1. 12 and 8-digit Watersheds

- Support recreational fishing and serve as spawning areas for commercial fish stock (such as Rock Fish);
- Encompass areas subject to flooding that can result in the loss of life and property;
- Provide habitat to countless species of animals and plants; and
- Include floodplains, wetlands, and wooded slopes that are important parts of the ecosystem.

Buffers serve as protection zones when located adjacent to streams and are vital for protecting natural eco-systems. Development increases impervious surface as it consumes larger amounts of land, forest cover and natural vegetation along streams is

diminished. Approximately 2-4% of the County is impervious[89]. The cumulative loss of open space and natural growth reduces the ability of remaining land along streams to buffer the effects of greater stormwater runoff, sedimentation, and higher levels of nutrient pollution. Buffers reduce sediment, nitrogen, phosphorous, and other runoff pollutants by acting as filters, thus minimizing stream damage and serving as a method to mitigate impervious surface. The effectiveness of buffers to protect stream water quality is influenced by their width, accounting for factors such as:

- Contiguous or nearby slopes;
- Soil erodibility;
- Adjacent wetlands or floodplains;
- Vegetation type within the buffer (some plants are more effective at nutrient uptake than others); and
- Maintenance of the buffer.

Buffers also provide habitat for wetland and upland plants, forming the basis of healthy biological communities. A variety of animals use the natural vegetation as a corridor for food and cover. A buffer system provides connections between remaining forest areas to support wildlife movement. Caroline County should review buffering standards to determine if they need to be enhanced.

Agricultural and Forest Lands Intended for Preservation

Agricultural lands make up the majority of Caroline County and all agricultural lands outside of growth areas and the TDR receiving area are intended for preservation. The Maryland Agricultural Land Preservation Foundation (MALPF) and the County's TDR program are methods for preserving these agricultural lands. Land preservation is discussed in depth later in this chapter.

The *Forest Conservation Act of 1991* (Annotated Code of Maryland; Natural Resources Article Sections 5-1601-5-1613) was enacted to protect the forested areas of Maryland by making forest conditions and character an integral part of the development site planning process.

The Forest Conservation Act is regulated by the Maryland Department of Natural Resources (DNR) but implemented and administered by local governments.
The Act maximizes the benefits of forests and slows the loss of forestland, while still allowing development to take place.

Caroline County contains large and contiguous tracts of forested areas. As indicated in

[89] Chesapeake Bay Program, DNR

Table 3-1, approximately, 66,915 acres or 32% of the County are forested areas. Forested areas and regions within Caroline County are subject to the *Caroline County Forest Conservation Ordinance*. Development must account for forested areas, insuring that these resources are protected and/or replaced.

Much of the County's forested lands are also habitat to an abundance of wildlife. There are regulations in place to protect the habitat of Forest Interior Dwelling Birds (FIDs), which need large tracts of forest. Other wildlife need to migrate throughout the County for survival, so it is important that forest be contiguous or connected with stream buffers throughout the County. This type of planned buffering is called green infrastructure. The County should explore the possibility of creating a forest management plan that includes strategies to protect existing forested corridors and large tracts of forest land. Forest management goals and strategies could be coordinated with municipalities in the form of urban tree planting programs and street tree requirements for new development.

Steep Slopes

Steep slopes provide an environment that facilitates the movement of soil and pollutants when land disturbances occur. Erosion control is achieved by the regulation of development on steep slopes because such areas represent the greatest opportunity for accelerated soil loss that carries sedimentation and pollution to streams.

Caroline County is approximately 321 square miles with an average elevation of only 40 to 70 feet above sea level. Steep slopes are rare in the County with only 1% of soils having been identified as having a slope greater than 15%. Most steep slopes occur along rivers and streams adjacent to or near tidal areas and are protected by the *Caroline County Chesapeake Bay Critical Area Program and Regulations*.

100-Year Floodplain

Some areas of Caroline County are subject to periodic flooding, which poses risks to the public health and safety, as well as potential loss of property. Flood-related losses may result from:

- Structures, which are inappropriately located, inadequately elevated, or otherwise unprotected and vulnerable
- Development, which increases flood damage to other lands.

While the protection of life and property provided the initial basis for the protection of floodplains, there has been a growing recognition in recent years that limiting disturbances within floodplains can serve a variety of additional public health benefits. Floodplains moderate and store floodwaters, absorb wave energies, and reduce erosion

and sedimentation. Wetlands found within floodplains help maintain water quality, recharge surface water supplies, protect fisheries, and provide habitat and natural corridors for wildlife.

In October 1980, Caroline County adopted regulations, which require any new development to have sufficient area outside the floodplain to accommodate all construction, including wells and septic systems. All development located in the 100-year floodplain is subject to strict flood protection measures.

Since 1995, Caroline County has participated in the Community Rating System (CRS) program. The CRS program is a voluntary program administered by the Federal Emergency Management Agency (FEMA) and provides discounts for flood insurance policy holders within participating communities.

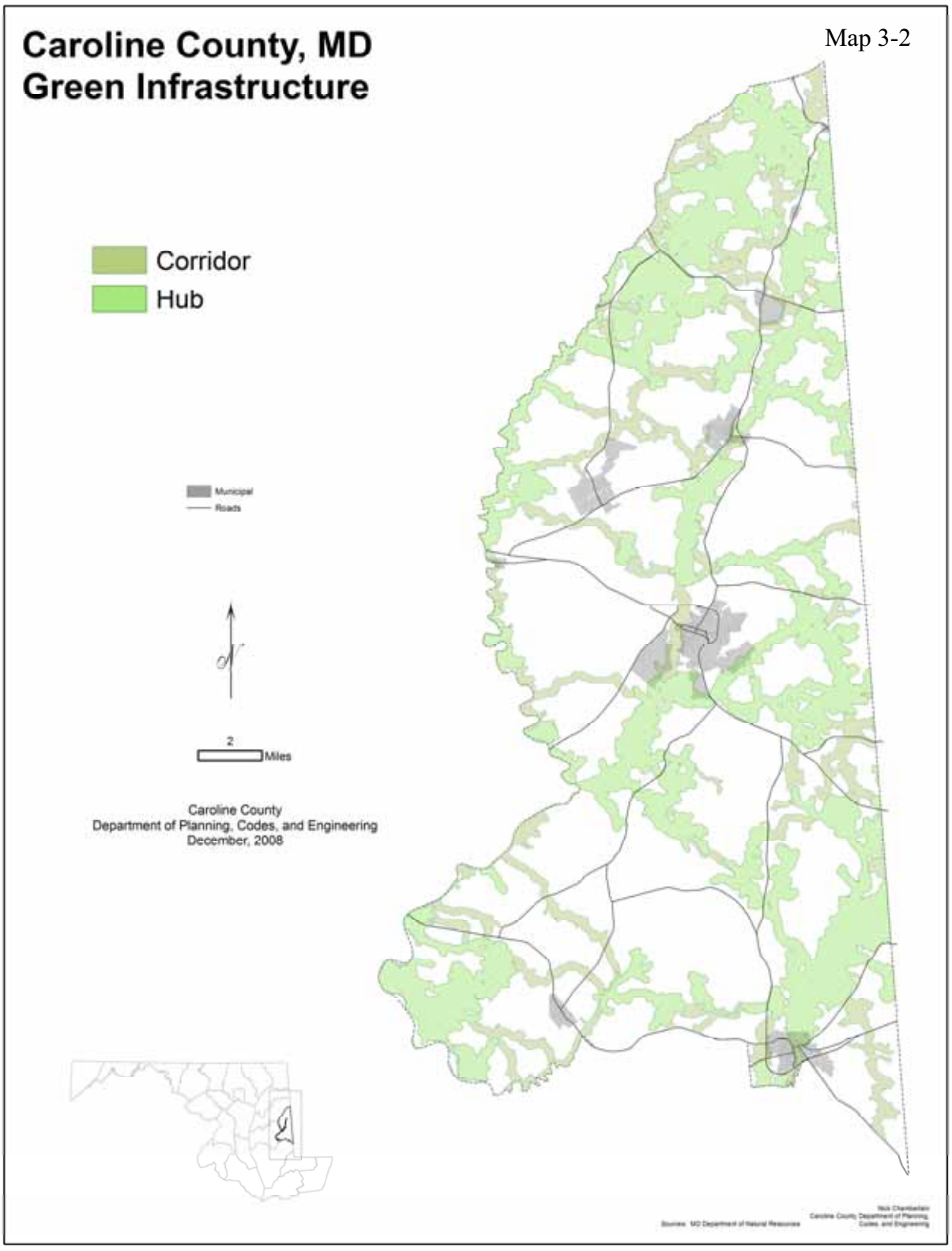
The County should develop a plan for improving the floodplain review process, as well as develop a plan for improving the County's community rating in the National Flood Insurance Program.

Habitat of Threatened & Endangered Species

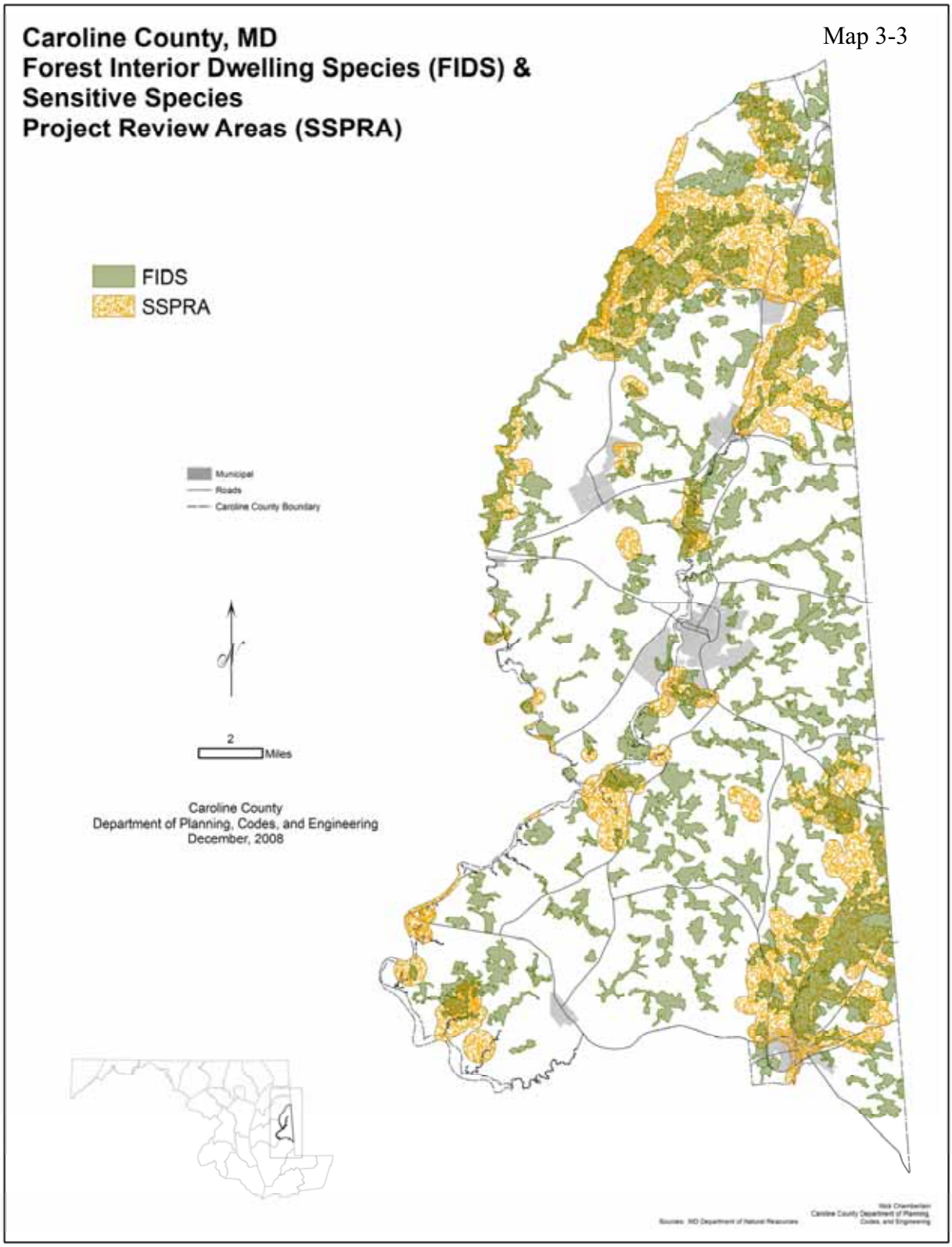
Habitat destruction and degradation is estimated to threaten some 400 native Maryland species with extinction. There are numerous laws that protect threatened and endangered species but the key to protection is preserving the environment in which plant and animal life exist. As stated in the "1991 Update" to the *Caroline County Comprehensive Plan*, the protection of threatened and endangered species should include providing information on the location of such species and habitats to property owners.

DNR maintains information on the habitats of threatened and endangered species. Caroline County contains 5 animal and 36 plant species listed as threatened or endangered by the State. Most habitat areas within the Chesapeake Bay Critical Area have been generally identified and development projects are reviewed with the requirement that they perform an environmental impact assessment with notification to the Maryland Wildlife and Heritage Division of DNR. Additionally, a report on ecologically significant areas in Caroline County that identifies areas with rare plant species was released in 2001 to help the County protect these areas. Twenty-three areas were identified. These areas included the Choptank Sandpit, Marshyhope Creek North, Mill Creek Woods, Skeleton Creek, South Pealiquor Landing Cove, Tuckahoe Creek North, Upper Choptank River, and Watts Creek. Portions of the County are habitat for

Map 3-2


Caroline County, MD
Green Infrastructure
Corridor
Hub
Municipal
Roads
2
Miles
Caroline County
Department of Planning, Codes, and Engineering
December, 2008

Map 3-3


Caroline County, MD
Forest Interior Dwelling Species (FIDS) &
Sensitive Species
Project Review Areas (SSPRA)
FIDS
SSPRA
Municipal
Roads
Caroline County Boundary
2
Miles
Caroline County
Department of Planning, Codes, and Engineering
December, 2008

threatened and endangered species. These include Bald Eagle nests, Delmarva Fox Squirrel areas, spawning areas for local fish species, including perch and rockfish, and plant species. Enhancing public awareness is important to raising appreciation for important wildlife habitat present in Caroline County. Caroline County should continue to improve its review of development projects in order to protect endangered species and habitat.

Wetlands

Wetlands are lands continuously or intermittently inundated with water. Tidal wetlands are found along tidal rivers and streams and are subject to the rise and fall of tides. Non-tidal wetlands are sometimes influenced solely by groundwater. Both types of wetlands host a myriad of plants that contribute to the natural food chain and also act as a filter for pollution from land sources. Presently wetlands are defined and protected by both State and Federal laws. These regulations are sufficient to protect wetlands in Caroline County. In addition, new digital mapping initiatives in the State can better determine wetland location during the development review process.

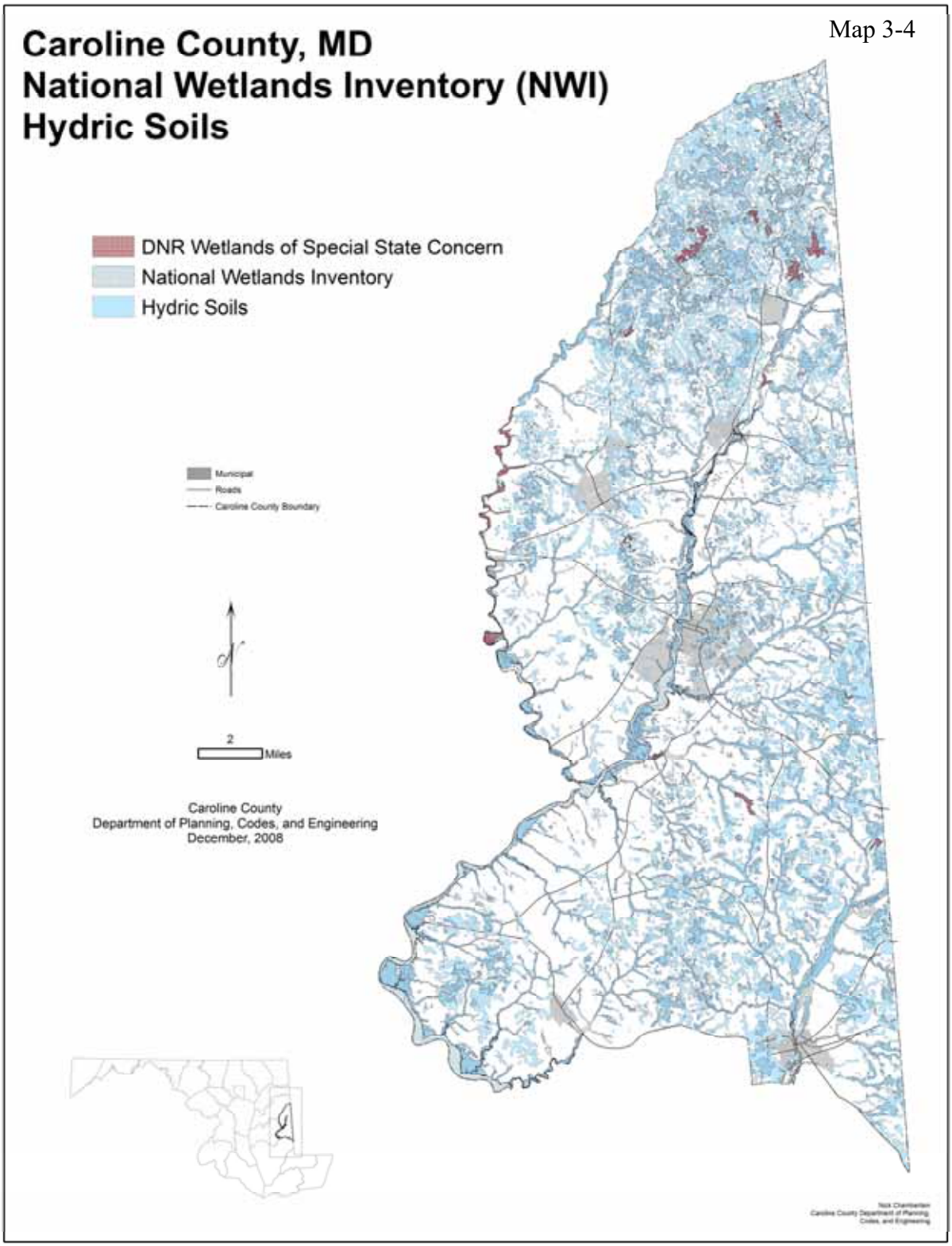
As indicated in Table 3-3, the County contains approximately 33,944 acres of tidal and non-tidal wetlands as indicated on the National Wetlands Inventory. Much of the farmland in the County was non-tidal wetlands and drained years ago by ditches, some of which are Public Drainage Associations (PDAs). PDAs are discussed further later in the chapter. There are also Delmarva Bays located in the County. Delmarva Bays are an unusual and unique type of shallow, irregularly inundated, freshwater depressional wetland occurring on the Delmarva Peninsula. These wetlands are considered to be significant because of they are uncommon and their features provide irreplaceable habitat for rare species. Primarily tidally influenced wetland areas are along the Choptank and Tuckahoe Rivers.

Chesapeake Bay Critical Areas Program

In 1984, the Maryland General Assembly passed the *Chesapeake Bay Critical Area Law* (Annotated Code of Maryland; Natural
Resources Article; Subtitle 18 and COMAR (Subtitle 27) in response to declining quality in the Bay and its tributaries.

The law created a special planning area known as the “Critical Area,” lands located within 1,000 feet landward from the mean high tide or the edge of tidal wetlands as designated on the State Tidal Wetlands Maps. The law requires local jurisdictions to develop and adopt a Critical Area Program and the “Critical Area Commission for the Chesapeake and Atlantic Coastal Bays” oversees the development of local programs

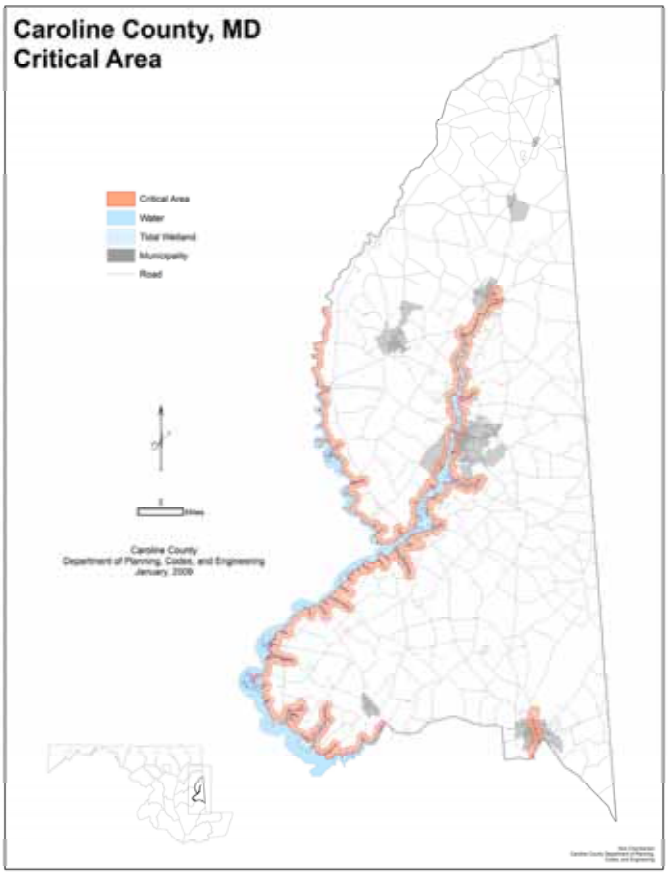
Map 3-4


Caroline County, MD
National Wetlands Inventory (NWI)
Hydric Soils
DNR Wetlands of Special State Concern
National Wetlands Inventory
Hydric Soils
Municipal
Roads
Caroline County Boundary
2
Miles
Caroline County
Department of Planning, Codes, and Engineering
December, 2008

and formulates proactive criteria.

Critical Area goals include the following:

- Minimizing adverse impacts on water quality that result from pollutants that are discharged;
- Conserving fish, wildlife, and plant habitat in the Critical Area; and
- Establishing land use policies for development in the Critical Area which accommodate growth and also address the fact that, even if pollution is controlled, the number, movement, and activities of persons in the Critical Area can create adverse environmental impacts.



Map 3-5. Critical Area

The *Caroline County Chesapeake Bay Critical Area Program* was prepared in 1989 and adopted in the *Caroline County Zoning Ordinance* in 1990 (Ordinance 89-010). Although the program was adopted, it was never codified. The County has developed and ordinance that is currently being reviewed by the Critical Area Commission. The proposed ordinance provides for Critical Area designations, the RCA-Resource Conservation Area and LDA-Limited Development Area, as well as amendments to the official Caroline County Zoning Maps. County amendments to the Critical Area Program include resolutions for impervious surfaces, Chesapeake Bay Critical Area Growth Allocation, and "fee in lieu" procedures for forest mitigation.

On July 1, 2008 House Bill 1253 took effect. The bill fills gaps in operational structure and enhances State-local coordination, clarifies and strengthens enforcement procedures, streamlines the Critical Area Program in order to enhance consistency, predictability, and fairness, and further protects Maryland's tidal shoreline from negative impacts of growth and development. Among some of the most noted changes were the expansion of the buffer to 200' feet for developments meeting certain criteria being located in the Resource Conservation Area, holding contractors accountable for Critical Area violations, and the change of terminology from "impervious surface" to "lot coverage," to better control the amount of surface run-off into Chesapeake Bay

tributaries.

Other initiatives for the County's Critical Area Program include a Chesapeake Bay Critical Area ordinance in the County code and a digital mapping initiative to overlay Critical Areas with high resolution aerials, integrating the Critical Area Program with the County's GIS system. Additionally, the County should consider eliminating large-scale mineral extraction/surface mining operations (20 acres or more) as an accepted land use in the defined Chesapeake Bay Critical Area and preparing site development and performance standards for mineral extraction facilities that address site reclamation, infrastructure improvements, protection of adjacent properties, truck routes, hours of operation, and landscaping and maintenance standards.

Stormwater Management

Maryland Environment Article; Title 4; Subtitle 2 of the Annotated Code of Maryland states that the "…management of stormwater run-off is necessary to reduce stream channel erosion, pollution, siltation and sedimentation, and local flooding, all of which have adverse impacts on the water and land resources of Maryland."

Stormwater management was first adopted by Maryland in the early 1980's as part of the overall Chesapeake Bay initiative. Essentially, stormwater management has been used to control potential flooding and its effects generated by development and increased impervious surfaces.

In 2000, the Maryland Department of the Environment (MDE) developed the *Maryland Stormwater Design Manual* to assist local governments. This includes a new emphasis on controlling the quality of run-off and the quantity of run-off, which reduces erosion. New State goals promote environmentally sustainable techniques. Primary goals of State stormwater initiatives include the following:

- Protecting State waters from the adverse impacts of urban stormwater run-off;
- Providing design guidance on effective structural and non-structural "Best Management Practices" for development sites, including "Green Design;" and
- Improving the quality of "Best Management Practices" in the State with respect to their performance, longevity, safety, maintenance, community acceptance, and environmental benefits.

The *2000 Maryland Stormwater Design Manual* provides a step by step process that seeks to avoid adverse large-scale development practices such as clear-cutting, mass grading, structural fill, and suburban sprawl negatively impacting local hydrology. The process also seeks to minimize the impacts of stormwater run-off by requiring practices that replace or disconnect impervious surfaces, such as green technology. If all other

options are exhausted, remaining run-off must be treated using structural practices to mitigate water quality and erosion impacts.

As development occurs in Caroline County, a comprehensive stormwater management program that incorporates environmental site design (ESD) techniques to the maximum extent practical will help mitigate negative impacts to water quality as well as control flooding. New techniques, that incorporate regenerative and non-structural stormwater management design, should be integrated in County stormwater policies and regulations. The County should encourage Public Drainage Associations to adopt ESD stormwater management techniques as part of their long-term ditch maintenance programs to the maximum extent practicable.

On April 24, 2007, Governor Martin O'Malley signed the *Stormwater Management Act of 2007*, which became effective October 1, 2007. The Act requires that environmental site design, through the use of nonstructural best management practices and other better site design techniques, be implemented to the maximum extent practicable. Prior to this Act, environmental site design was encouraged, but not required. Revised stormwater management regulations incorporating ESD techniques have been drafted as a result of the new Act but have not yet adopted. Caroline County supports the adoption of the new State stormwater management regulations.

Land Preservation & Conservation

The County has historically been identified as a leader in agricultural land preservation. The county has enacted local development codes designed to discourage land use conflicts with agriculture as well as the application of land preservation and conservation programs, such as the County Transferable Development Right (TDR) program, Maryland Agricultural Land Preservation Foundation (MALPF); Rural Legacy; and Program Open Space (POS). However, as development pressures increase in the region, a more proactive County role is required to meet a goal of 100,000 acres preserved by 2020 (50% of the County).

A goal of the *Caroline County Comprehensive Plan* is to preserve agriculture and forestry in rural areas as the dominant land use in Caroline County. Objectives for land preservation and conservation include the following:

- Exploring policies that preserve agricultural land and the agricultural economy;
- Balance agricultural land use with environmental best management practices;
- Enhancing coordination for agricultural initiatives between Municipal, County, State, and Federal entities and private landowners;
- Supporting public and private preservation and conservation programs and initiatives;

- Enhancing County programs for preservation and conservation;
- Encouraging agricultural land owners to implement agricultural best management practices (BMPs) on their farms to the maximum extent practicable and assisting them in this effort to the maximum extent possible; and
- Investigate having our agricultural preservation program certified by the State

Agricultural Land Use

Caroline County has remained an agricultural community for over 300 years. In this regard, the County is a rural agricultural area where farming continues to be a vital component of the regional economy and a defining aspect of life. Caroline County has emphasized the preservation of agriculture since the adoption of the 1986 *Comprehensive Development Plan for Caroline County*.

Much of the County's existing land use is dedicated to agriculture, forestry, and/or open space. As shown in Table 3-6, approximately, 62,862 acres of the County have been protected under agricultural preservation and resource conservation programs. State conservation areas, including Tuckahoe State Park, account for approximately 6,826 acres of land in the County. A total of 45,160 acres has been preserved in Agricultural Preservation easements and districts and through the TDR program. Not all land currently preserved or conserved is under permanent easement.

Table 3-2: Land Preservation & Conservation Areas

Type	Acreage	% of Total County Acreage
Agricultural Preservation Easements	28,538.61	14%
Agricultural Preservation Districts	16,621.08	8%
State Conservation Land	6,826.03	3%
County Conservation Land	307.35	0%
Other Conservation Areas	3,673.51	2%
Rural Legacy Easements	2,888.46	1%
Maryland Environmental Trust	2,076.89	1%
TDR* Sending Parcels	2,151.64	1%
Rural Legacy Boundary Area	10,242.81	5%
*Transferable Development Rights		

The following are generally not permanent: Agricultural Preservation Districts and TDR Sending Parcels.

According to the Maryland State Data Center, from 2002 to 2007 the amount of farmland

increased from 114,843 to 131,277 acres. Irrigated land in farms decreased from 54,768 acres to 24,596. Overall, grain and vegetable production increased. In general, livestock production decreased with the exception of poultry broiler production, which increased by 24%.

To continue to ensure the perpetuation of Caroline County's agricultural economy, it is important for the farming community to partner with private and public entities in the future to create innovative economic opportunities. Potential opportunities include providing valuable sites for wastewater land application as State regulations become more stringent for the "point-source" discharge of wastewater effluent or providing land for regional stormwater management. Particularly important are partnerships with municipalities whereby symbiotic relationships are created between a town and outlying agricultural areas.

Public Agricultural Support Organizations

Existing agricultural agencies and support entities serving Caroline County are important partners in preserving agricultural industries. These include Federal, State, County and quasi-governmental organizations that support farming, such as the United States Department of Agriculture (USDA), Maryland Department of Agriculture (MDA), the Soil Conservation District (SCD) and the Maryland Agriculture Cooperative Extension.

The local SCD promotes and implements soil and water quality best management plans and practices to assist area farmers, landowners, and government agencies to minimize nutrient runoff, decrease soil erosion, improve public drainage, and enhance water quality. The SCD also assists Public Drainage Associations (PDAs), which are cooperative programs for agricultural drainage with local landowners, managing public drainage ditches. As a historical legacy, public drainage ditches for farmland were first channeled in the late 1700's. PDAs are located almost exclusively in rural Eastern Shore counties with 343.6 miles of manmade channels in Caroline County alone. Additionally, there are ditches that are not PDAs. Due to the County's flat topography, drainage ditches are vital to the healthy functioning and productivity of farms. They also benefit the County highway system, towns, and residential properties, by assisting in the drainage of excess water. The County supports the SCD efforts to assist PDAs with ditch management, and recommends that SCD work with PDAs to develop ditch maintenance plans that incorporate non-structural or ESD techniques to reduce erosion and mitigate impacts on water quality.

The Maryland Agriculture Cooperative Extension assists local agriculture by providing education on the management of nutrients, pesticides, cropping systems, irrigation, and farm business.

Private Agricultural Support Organizations

The Maryland Farm Bureau promotes and protects State agriculture and rural life. It is a private non-profit organization controlled by local members. The Farm Bureau's purpose is to enhance the economic vitality of agriculture and improve rural quality of life. As a legislative voice, it seeks to increase public understanding for the role of agriculture and to protect the agricultural industry.

Land Preservation

Caroline County's specific goal for land preservation and conservation is to protect 100,000 acres by 2020, approximately 50% of the County's land area. Recent changes to the County's Transferable Development Rights TDR regulations coupled with proposed changes to the County's overall land preservation and conservation focus indicate an aggressive program. As of December 2008 the County has preserved and conserved 62,862 acres of land[90]. Farmland is presently being preserved through state preservation and conservation programs and local regulatory initiatives. Agricultural Preservation/Conservation Programs within Caroline County are administered by the Caroline County Department of Planning, Codes, and Engineering. In order for the County to meet its preservation goals, new and innovative initiatives will be required.

Maryland Agricultural Land Preservation Foundation (MALPF)

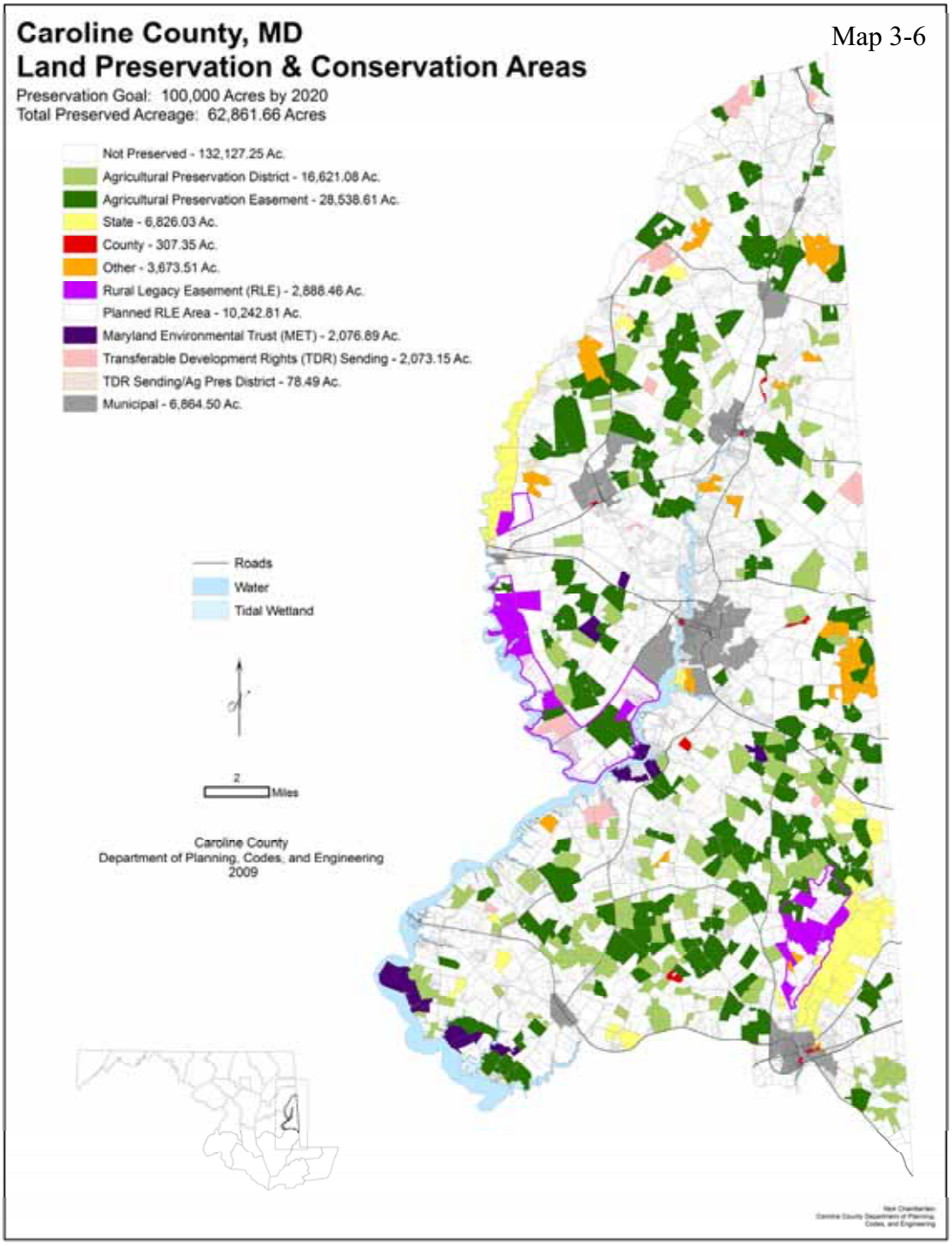
The *Maryland Agricultural Land Preservation Foundation* (MALPF) is the State's most effective program for preserving agricultural land. MALPF also has been the most successful agricultural preservation initiative to achieve County land preservation and conservation goals. In Caroline County, landowners are able to sell development rights to the State in return for placing a permanent preservation easement on the land. As of December 2008 Caroline County has preserved approximately 28,539 acres in Agricultural Preservation Easements through MALPF.

Rural Legacy Program (RLA)

Since the program's inception in 1998, Caroline County has had an active *Maryland Agricultural Security Corridor Rural Legacy Program* (ASCRLA). Rural Legacy Areas are targeted preservation regions. These include properties of prime farm land, important woodland habitat, environmental sensitive areas and scenic open space. The

[90] Of this total acreage, 42,775 acres is permanent easements.

Map 3-6


Caroline County, MD
Land Preservation & Conservation Areas
Preservation Goal: 100,000 Acres by 2020
Total Preserved Acreage: 62,861.66 Acres
Not Preserved - 132,127.25 Ac.
Agricultural Preservation District - 16,621.08 Ac.
Agricultural Preservation Easement - 28,538.61 Ac.
State - 6,826.03 Ac.
County - 307.35 Ac.
Other - 3,673.51 Ac.
Rural Legacy Easement (RLE) - 2,888.46 Ac.
Planned RLE Area - 10,242.81 Ac.
Maryland Environmental Trust (MET) - 2,076.89 Ac.
Transferable Development Rights (TDR) Sending - 2,073.15 Ac.
TDR Sending/Ag Pres District - 78.49 Ac.
Municipal - 6,664.50 Ac.
Roads
Water
Tidal Wetland
2
Miles
Caroline County
Department of Planning, Codes, and Engineering
2009

Marshyhope, Tuckahoe and Choptank Rural Legacy Areas seek to create contiguous blocks of preserved land in designated regions. The total “Rural Legacy Planning Area” is approximately 10,243 acres, of that 2,888 acres have been permanently preserved. Rural Legacy protection of resources is designed to support the long-term viability of the natural resources industry sector.

Federal Agricultural Programs

Conservation Reserve Program and Conservation Reserve Enhancement Program

The Conservation Reserve Program (CRP) provides technical and financial assistance to eligible farmers and ranchers to address soil, water, and related natural resource concerns on their lands in an environmentally beneficial and cost-effective manner. The program provides assistance to farmers and ranchers in complying with Federal, State, and tribal environmental laws, and encourages environmental enhancement. The program is funded through the Commodity Credit Corporation (CCC). CRP is administered by the Farm Service Agency, with NRCS providing technical land eligibility determinations, conservation planning and practice implementation.

The Conservation Reserve Program reduces soil erosion, protects the Nation's ability to produce food and fiber, reduces sedimentation in streams and lakes, improves water quality, establishes wildlife habitat, and enhances forest and wetland resources. It encourages farmers to convert highly erodible cropland or other environmentally sensitive acreage to vegetative cover, such as tame or native grasses, wildlife plantings, trees, filterstrips, or riparian buffers. Farmers receive an annual rental payment for the term of the multi-year contract. Cost sharing is provided to establish the vegetative cover practices.

Agricultural Management Assistance

Agricultural Management Assistance (AMA) provides cost share assistance to agricultural producers to voluntarily address issues such as water management, water quality, and erosion control by incorporating conservation into their farming operations. Producers may construct or improve water management structures or irrigation structures; plant trees for windbreaks or to improve water quality; and mitigate risk through production diversification or resource conservation practices, including soil erosion control, integrated pest management, or transition to organic farming.

Environmental Quality Incentives Program

The Environmental Quality Incentives Program (EQIP) was reauthorized in the Farm Security and Rural Investment Act of 2002 (Farm Bill) to provide a voluntary conservation program for farmers and ranchers that promotes agricultural production

and environmental quality as compatible national goals. EQIP offers financial and technical help to assist eligible participants install or implement structural and management practices on eligible agricultural land.

EQIP offers contracts with a minimum term that ends one year after the implementation of the last scheduled practices and a maximum term of ten years. These contracts provide incentive payments and cost-shares to implement conservation practices. Persons who are engaged in livestock or agricultural production on eligible land may participate in the EQIP program. EQIP activities are carried out according to an environmental quality incentives program plan of operations developed in conjunction with the producer that identifies the appropriate conservation practice or practices to address the resource concerns. The practices are subject to NRCS technical standards adapted for local conditions.

Conservation Security Program

CSP is a voluntary program that provides financial and technical assistance to promote the conservation and improvement of soil, water, air, energy, plant and animal life, and other conservation purposes on Tribal and private working lands. Working lands include cropland, grassland, prairie land, improved pasture, and range land, as well as forested land that is an incidental part of an agriculture operation. The program provides equitable access to benefits to all producers, regardless of size of operation, crops produced, or geographic location.

Farm and Ranch Lands Protection Program

The Farm and Ranch Land Protection Program (FRPP) provides matching funds to help purchase development rights to keep productive farm and ranchland in agricultural uses. USDA partners with State, tribal or local governments and non-governmental organizations to acquire conservation easements or other interests in land from landowners through existing programs. USDA provides up to 50 percent of the fair market easement value of the conservation easement.

To qualify, farmland must: be part of a pending offer from a State, tribe, or local farmland protection program; be privately owned; have a conservation plan for highly erodible land; be large enough to sustain agricultural production; be accessible to markets for what the land produces; have adequate infrastructure and agricultural support services; and have surrounding parcels of land that can support long-term agricultural production.

Private Conservation

Caroline County has numerous private conservation organizations including the following the Eastern Shore Land Conservancy (ESLC) and Chesapeake Forest.

Eastern Shore Land Conservancy: ESLC was formed in 1990 to preserve prime agricultural land, protect important natural areas, and monitor lands to ensure permanent easement. Sustaining the Eastern Shore's rich landscapes through strategic conservation and sound land use planning is ESLC's mission. To date, ESLC has preserved more than 45,000 acres on the Eastern Shore.

In 2003, ESLC developed *Eastern Shore 2010: a Regional Vision* under guidance from former Maryland Governor Harry Hughes, former U.S. Representative Wayne Gilchrest, and Eastern Shore leaders. The 2010 Agreement seeks to protect 50% of Eastern Shore from development (outside of locally designated growth areas) by 2010 through the use of voluntary preservation programs. The 2010 Agreement also highlights the importance of the Eastern Shore's rural heritage and resource based economy. ESLC is assisting with Federal programs under the *Farm Security and Reinvestment Act of 2002*, such as the Delmarva Conservation Corridors concept. The program was designed to assist agricultural preservation in areas such as Caroline County.

Chesapeake Forest Lands: Chesapeake Forest Lands are primarily former land holdings of the Chesapeake Forest Products Company located in five lower Eastern Shore counties. These areas comprise 12% of the productive forests in the region and comprise 58,173 total acres. Approximately 1,254 acres are located in Caroline County. To manage these areas, the State developed a sustainable forest management plan, which is intended to be a national model of public/private partnership, sustainable forestry and ecosystem management on public lands.

Chesapeake Forest Lands are administered by the Maryland Department of Natural Resources (DNR), which is currently conducting a resource inventory. The purpose of the purchase was to:

- Protect Maryland's Natural Resources;
- Maintain rural character, economy, and regional heritage;
- Maintain and enhance regional water quality and living resources; and
- Expand opportunities for public access.

Caroline County Transferable Development Rights Program (TDR)

The *Caroline County TDR Program* was enacted in 1989 to allow for the private sale of subdivision development rights. "Sending Areas" are located in rural areas and "Receiving Areas" are lands proposed for development.

The TDR Program is a major component of the County's overall growth management strategy and includes two (2) phases to address growth and preserve valuable

agricultural land. The first phase addresses TDR's for County areas. The second phase addresses development rights application for municipal annexation and development through a County administered Land Preservation Program and Fund to be developed with County municipalities.

Due to increased development pressure, in 2004, Caroline County initiated enhancements to the County TDR Program including the following:

- Designation of specifically mapped County TDR "Receiving Areas;"
- Minor subdivision rights maintained for landowners;
- Minor subdivision rights may be developed or transferred to "TDR Receiving Areas;"
- Elimination of rural major subdivisions in the farming communities in exchange for TDR's at 1 per 15 densities to be transferred to "TDR Receiving Areas" from rural areas;
- Elimination of the County's "Planned Development Overlay Zoning District;"
- Allowance for TDR banking without immediate assignment to designated "Receiving Parcels;" and
- Establishment of a TDR process and review mechanism within the Planning Department including the tracking of TDR transfer and a "Bulletin Board" to facilitate TDR sales.

Heritage Resources

A primary goal of the *Caroline County Comprehensive Plan* is to preserve the County's valuable historic sites and structures, archeological areas, and key scenic, natural and cultural landscapes. Objectives for heritage preservation include:

- Encouraging the appropriate preservation of Caroline County's historic, cultural, archeological, natural and scenic resources;
- Improving the County's inventory of historic sites, structures, and attractions;
- Encouraging and supporting heritage preservation through mapping, planning, and regulatory mechanisms;
- Coordinating strategies to achieve mutual County/Town heritage preservation goals and objectives;
- Encouraging the development of Historic Scenic Highways for County roads; and
- Encouraging industries that support heritage preservation.

Caroline County has many sites and structures that are of historic importance to the County, State of Maryland, and the Nation. Prominent historic resources include Oak Lawn (Whitehall), St. Paul's Church, the Daffin House, and the Neck Quaker Meeting House. The County has 17 properties listed on the National Register of Historic Places (NRHP).

Caroline County contains 366 inventoried historic sites (structures built before 1900) and 2 National Historic District, the Denton Historic District and Williston Mill Historic District. Other sites have not been included on the Maryland or national registers but are eligible for listing. The region contains archeological sites from the pre-colonial period, notably in the vicinity of the Choptank and Tuckahoe Rivers.

Historic Places on the National Register

Louis Antal (Athol) House (First Quarter, 19th century): Located South of Mt. Zion on Melville Road, its two-room-with–central-hall plan, gable-end chimneys, symmetrical window placement, restrained ornamentation, and precise Flemish bonding make it a representative example of a late Federal period brick farmhouse.

Castle Hall (1781; 1800; 1917): Castle Hall is one of Caroline County's most illustrious old colonial estates. The original estate existed on several hundred acres purchased from Captain John Fauntleroy in the mid 1700's by the Hardcastle family. Thomas Hardcastle, a prominent figure in Caroline County's early history, heralded from this "tidewater plantation" family. Upon his father's death, Thomas received the estate and purchased an additional 1,269 acres of land in the vicinity of present day Goldsboro. This would become the setting for Castle Hall, a Georgian mansion built between 1778 and 1783. Thomas Hardcastle was a prominent member of an active family in Caroline County and Maryland political affairs. He was also a master mason, a fact that was later reflected in the design of Castle Hall as the architectural aesthetics of the house reflect the Hardcastle family's social, economic, and political importance.

Daffin House (Circa 1760; 1785): The three-sectioned Daffin House is located on a farm south of Hillsboro overlooking Tuckahoe Creek. Built by Charles Daffin, the small brick house is notable for its high quality craftsmanship.

Denton Armory (Circa 1938): Originally built for the 104th Quartermaster's Company of the Maryland National Guard, it has since served many community purposes. Currently, it houses the Caroline County Department of Recreation and Parks.

Denton Historic District: Located in the town of Denton, the County seat, the town is located on the flat land along the south bank of the Choptank River. The west end of the Denton Historic District focuses on the courthouse square, which was laid out in the 1790's. The present courthouse is a late-19th-century structure which has undergone considerable alteration and contributes to the district by way of historical association. However, the square is faced on all sides by noteworthy residences and commercial structures dating from the mid-19th century through the early 20th century.

Exeter (Circa 1800): One of the earliest and largest surviving dwellings in Federalsburg, Exeter overlooks Marshy Hope Creek. The home gets its name from Exeter Mills which is no longer in existence.

Leonard House (Early 19th Century): Standing in the earliest section of Greensboro, it is a two-part, one-and-a-half-story gable-roofed frame house. The house plan is unique to the county, having a tiny vestibule with a large room to the south and a long narrow room to the east.

Marblehead (late 18th century): Marblehead, located in the Ridgely area, is a Federal dwelling composed of two large two-story brick sections connected at right angles by a one-story hyphen. It was built by the Boone family and it remained in the family until 1904.

Memory Lane (Circa 1860): Memory Lane stands on the north side of Williston Landing Road south of Denton. It is the best example of the Italianate style in the county with its extensive porches, its lantern and exterior woodwork. Neck Meeting House (1802): The Neck Meeting House is located west of the Town of Denton in the rural village of West Denton. The existing structure is located on property that belongs to Choptank Electric. Much of the upkeep for the structure has been accomplished through Choptank Electric and the Caroline County Historical Society. The land was deeded by William Wilson to the Quakers in the early 1800's and the first meeting was held in 1802. The rustic and plain interior of the Neck Meeting House is indicative of the Quaker lifestyle in the 18th and early 19th Centuries.

Oak Lawn (Circa 1783): Located north of Ridgely, it was constructed by Benjamin Sylvester, a large land holder of the Revolutionary period, who had his plantation resurveyed in 1790 as "White Hall." In the mid-19th century the property was owned by Greenbury Ridgely, founder of the Town of Ridgely.

Potter Hall (late 18th century, 1808, and 1930): Potter Hall, located in Williston, is historically significant because of the people who built and lived in. Zabdiel Potter was a Rhode Island sea captain that settled in the county. His son Nathaniel was a major during the Revolutionary War and Nathaniel's nephew, Nathaniel II, was one of the first American-trained physicians and became a faculty member at the University of Maryland Medical School. Nathaniel II's brother, William represented the county in the state legislature.

Denton Schoolhouse (1883): Now the home of Lily Pad Café, the school house is a one-story building with a Latin Cross form. In 1926, the Board of Education sold the building to the Denton Community Club, Inc, known as the Woman's Club.

St. Paul's Episcopal Church (Circa 1760, 1785): St. John's Parish was formed in 1748 by act of the Maryland Assembly. The first church was located in Queen Anne's County but in 1768 this new church was built in Hillsboro.

The West Denton Warehouse/Wharf (early 20th century): Situated opposite the Town of Denton, the timber framed warehouse structure sits on the banks of the upper Choptank River. The West Denton area was a commercial maritime center and transportation hub, which included wharves, granaries, a flour roller mill, a shirt factory, canneries, maritime warehousing and related agricultural/maritime industries.

Williston Mill Historic District (Potter's Mill) (Circa 1810): Replacing the original mill, General William Potter started, but never completed a ship channel from the mill to the Choptank River. The mill was renamed by S. Liden and W. Todd in the 1920s. Todd sold some of the equipment to Frank Langrell, his miller, who reinstalled it into the Linchester Mill in Preston.

Willow Grove (Circa 1770–1790): Located in Denton Area, Willow Grove was built by Col. Matthew Driver, who was one of the first Justices of the County Court in 1774 and later served as a member of the Committee of Observation in 1775.

Stories of the Chesapeake Heritage Area

Under the Maryland Heritage Areas Program administered by the Maryland Heritage Areas Authority (MHAA), the Counties of Caroline, Kent, Queen Anne's, and Talbot have partnered with the Eastern Shore Heritage Incorporated (ESHI – a public private partnership) to create the "Stories of the Chesapeake Heritage Area." Partners in the Heritage Area also include 21 municipalities within the region. The "Stories of the Chesapeake Heritage Area" is one of the largest in the State.

ESHI is a non-profit organization tasked to manage the Heritage Area and develop a Heritage Area Management Plan. As a guiding policy, the *Stories of the Chesapeake Heritage Area Management Plan* seeks to promote heritage preservation and tourism for economic development. The purpose of the organization and the plan is to achieve Certified Heritage Area Status from the MHAA and enhance heritage preservation and tourism on a regional scale.

In 2005, the Stories of the Chesapeake Heritage Area program was "Certified" by the Maryland Heritage Areas Authority and has been adopted into local policy through amendment to the *Caroline County Comprehensive Plan* and municipal plans. Certified Heritage Area Status confers many benefits, including grant funding for local projects such as the Wharves at Choptank Crossing in West Denton (skipjack museum), expansion of Adkins Arboretum in Tuckahoe State Park, as well as historic rehabilitation

tax credits for property owners.

Scenic & Cultural Resources

Caroline County has numerous scenic and cultural resources that should be considered for protection, restoration and enhancement where feasible. These resources include working landscapes employed for centuries as farms and forests; recreational areas including parks and water trails; a rich cultural history that is still evident in the architecture, steamboat landing sites, small town centers, and the stories of Native, African and European Americans.

Historic Scenic By-Ways

Under the National Scenic By-Ways Program, Caroline County is currently engaged in designating several State highways within the County as Historic Scenic By-Ways. The program is designed to recognize highways that are outstanding examples of scenic, historic, recreational, cultural, archeological, and/or natural qualities and provide special benefits, including the promotion of heritage tourism. Recently completed is the Harriet Tubman Underground Railroad Corridor Management Plan, which was done in partnership with Dorchester County. Currently underway is the Michener's Chesapeake Country Scenic Byway, which will involve partnerships with Talbot and Dorchester Counties that will follow the life of Frederick Douglas, as well as Native American trails. The byway was inspired by the book *Chesapeake* by James Michener, which tells the tales of Eastern Shore families through out stages of history.

Resource Conservation Implementation

- Implement the goals and objectives of the *Chesapeake 2000 Agreement*.
- Update and revise the *Caroline County Chesapeake Bay Critical Area Program & Regulations* and *Chesapeake Bay Critical Area Maps for Caroline County.*
- Work with appropriate State and Federal agencies develop more accurate natural resource maps.
- Research methods for improving the County's community rating in the National Flood Insurance Program.
- Work with stakeholders to develop a County-wide historic preservation plan.
- Develop target preservation areas in greenbelt and agricultural conservation areas to concentrate and maximize investments from local, State, and Federal preservation and conservation initiatives.
- Support and participate in public programs and private conservation initiatives that have similar objectives with the County's agricultural preservation program.
- Work with municipalities to design and implement interjurisdictional Transferable/Purchase of Development Rights programs to balance preservation

with new development.

- Encourage the Maryland legislature to raise the Agricultural Excise Tax limit for Caroline County to a maximum of $5,000 and to allow the collection of Excise Tax to be at the time of subdivision, rather than at the time of deed transfer. This includes revising the local existing Excise Tax Law.
- Eliminate large-scale mineral extraction/surface mining operations (20 acres or more) as an accepted land use in the defined Chesapeake Bay Critical Area and amend the *Caroline County Critical Area Program and Regulations* to reflect changes.
- Prepare site development and performance standards for mineral extraction facilities that address site reclamation, infrastructure improvements, protection of adjacent properties, truck routes, hours of operation, and landscaping and maintenance standards.
- Review code for historic preservation provisions.
- Explore the merits of developing protection standards for steep slopes located outside of the Critical Area.
- Review timber harvest guidelines to determine if they should more closely match the timber harvest guidelines for properties located within the Critical Area.
- Review the need to prepare a forestry management plan.

CHAPTER 4: COMMUNITY FACILITIES

For the purposes of this comprehensive plan, community facilities in Caroline County include the following: recreation and parks facilities, educational facilities, libraries, emergency and public health services facilities, courthouses and legal services facilities, correctional facilities, airports, and public works facilities.

A goal of the *Caroline County Comprehensive Plan* is to provide a system of community facilities that meet the changing needs of County residents and are consistent with Caroline County's land use and growth management goals and objectives. Objectives for community facilities include:

Table 4-1: Known Community Facilities Inventory	
Facility Type	**Number**
Public Elementary Schools	5
Public Middle Schools	2
Public High Schools	2
Parks and Recreation Facilities	45
Police Stations	8
Emergency Services Stations	6
Libraries	3
Airports	1
Courthouses/ Legal Services Facilities	13
Public Health Service Facilities	2

- Ensuring adequate park and open space land and facilities to meet current and projected demands;
- Coordinating planning and programming of community facilities with the appropriate Municipal, County, and State agencies and entities;
- Coordinating community facilities planning and programming to ensure consistency with Comprehensive Plan goals and objectives;
- Ensuring an adequate supply of potable water and adequate wastewater treatment for County residents;
- Encouraging municipalities to annex adjacent areas in need of public water and sewer;
- Directing growth toward designated priority funding areas (PFAs) served by existing or planned public infrastructure; and
- Requiring adequate public facilities to serve proposed new development;
- Work with public and private providers to ensure that the location of new public facilities and services are located and/or designed to support the growth management programs of the County and its municipalities.
- Management of communications towers and cable lines to enhance communications for emergency services and economic development.

Maryland Department of Planning (MDP) projects that the County and its municipalities will have a total of 46,000 residents by 2030, which represents an average annual growth rate of 1.3%.

MDP estimates that the 2005 County population (excluding towns) was 20,945, and

projects an increase of 9,788 people by 2030 – an average annual growth rate of 1.9% percent over the past 25 years. As the County population grows and its demographics change, demands for community facilities and services will change as well, including types and locations of facilities and services needed as well as the extent to which they will need to be provided.

The planned and orderly assessment, development, and expansion of adequate community facilities and services for County and Municipal governments are essential to serve a growing population base. This includes public water and sewer, parks and recreation facilities and services, and educational facilities and services. It also includes emergency management, fire, medical, and police. See Table 4-1 for an inventory of existing community facilities.

In addition, several areas have public health concerns associated with failing on-site septic systems and contamination of surface and groundwater supplies. This primarily includes Templeville, Marydel, Henderson, Goldsboro, the rural villages of Jonestown/Nelpine Heights subdivision, Bethlehem, Harmony, Trinity Boonsboro and West Denton as well as North Caroline High School and mobile home parks. Contamination in these areas is largely due to high density dwellings, businesses, and industries on individual well and septic systems.

The development of adequate public infrastructure for these areas, primarily water and sewer, will assist in the alleviation of environmental problems. In addition, County economic development strategies call for the revitalization/redevelopment of rural villages and are consistent with community facilities goals and objectives.

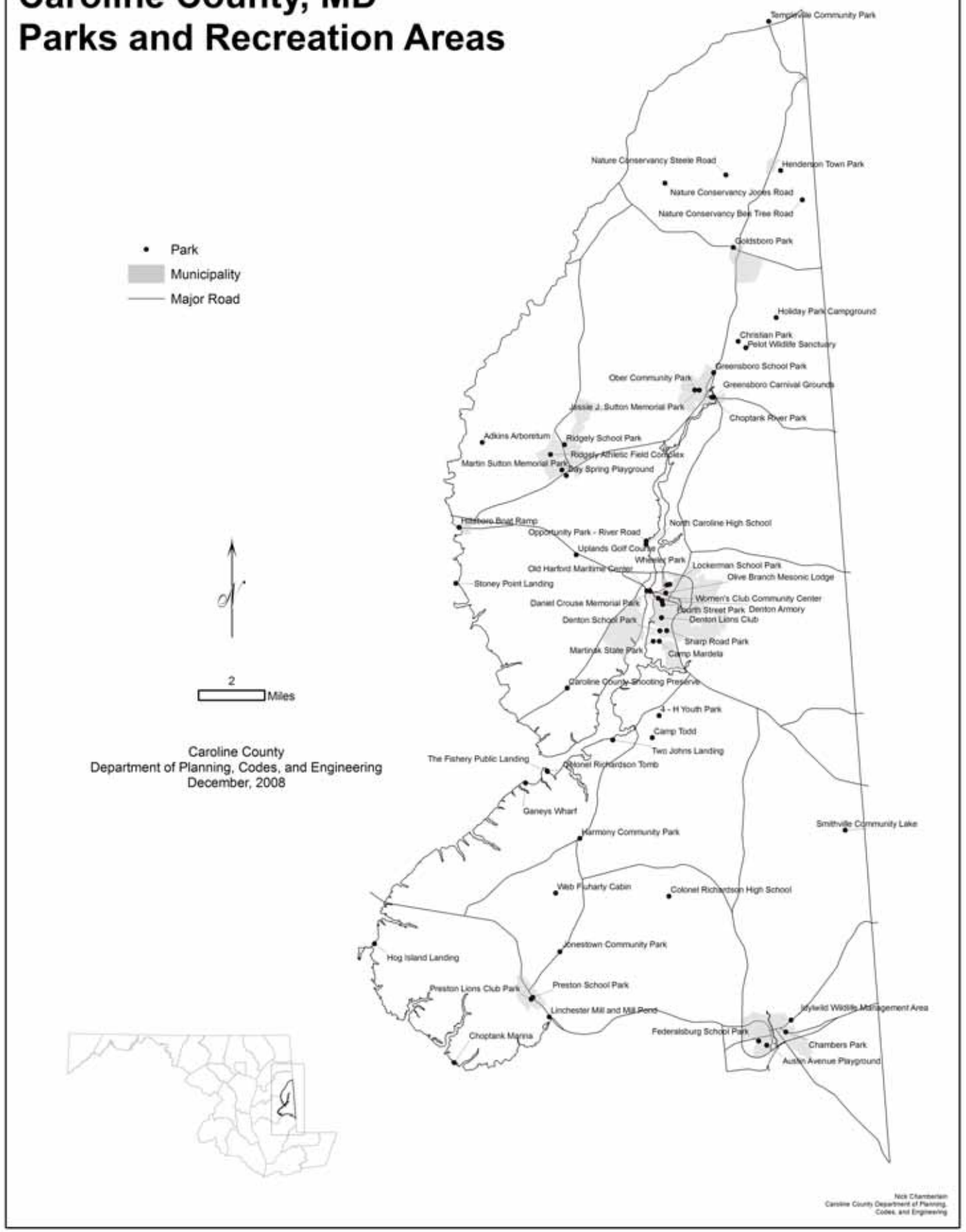
Table 4-2: Recreation and Resource Land by Owner

Owner	Recreation Land	Resource Land	Total Acres
Caroline Co.	185	85	270
BOE	127	-	127
Ridgely	60	-	60
Denton	37		
Federalsburg	29		
Preston	15		
Greensboro	6		
Hillsboro	5		
Templeville	1		
Goldsboro	1		
TOTAL	**466**	**96**	**562**
State/Federal	3,023	4,297	7,320
Private/Quasi-Public	1,207	1,073	2,279
TOTAL	**4,696**	**5,466**	**10,162**

Recreation and Parks Facilities

In 2006, the *Caroline County Land Preservation, Parks & Recreation Plan*-LPPRP was updated.

Caroline County, MD
Parks and Recreation Areas



Updates to the LPPRP are required under State law every six years.

The Caroline County LPPRP is designed to assist the State's evaluation of each County's land preservation and recreation program to ensure adequate public investment. Most importantly, the LPPRP qualifies local governments for Maryland Program Open Space (POS) funding/grants. The LPPRP serves as a guide for park acquisition and land preservation and conservation for the County and its towns. The LPPRP provides detailed strategies for recreation, land preservation, and natural resource conservation beyond this Comprehensive Plan.

The LPPRP supports the preservation and conservation aspects of this Comprehensive Plan. The "Mission Statement" of the LPPRP is to "improve citizen and community quality of life through youth development programming, recreation services, and public parks and facilities."

The LPPRP contains significant strategies related to recreation and parks; agricultural land preservation; and natural resource conservation. On of those strategies was to strengthen the mandatory dedication of open space regulations in the County subdivision regulations. As of May 1, 2007, the County began requires all major subdivisions to include accessible recreational or open space equal to at least five percent of the gross area of the subdivisions with the minimum area and parcel size being not less than three quarters of an acre. Additionally, at least seventy five percent of recreational or open space must be suitable for active open space. All required recreation and open space must be offered for public dedication. One of the major updates to the open space regulations was the exclusion of environmentally constrained areas in required open space calculations and adding that the land must be suitable for recreational activity. As indicated in Table 9-2, 4,696 acres of recreation land and 5,466 acres of resource land are located in the County. Much of the recreation and resource land is State owned and a smaller portion, approximately 562 acres, are local County, Town, and Board of Education (BOE). As of 2005, the County has a total of 10,162 acres of recreation and resource land.

Caroline County's municipalities are important to recreation in the County. Approximately 40% of the recreation land in the County lies within the incorporated towns. Municipalities serve as points of contact for the public. Many recommended acquisitions and projects for the future are located in or near municipalities.

LPPRP Recreational Attributes

County categories for recreation and resource land include regional parks, community parks, neighborhood parks, school recreation parks and fitness facilities, mini parks, special use areas, water access, and undeveloped parks (See Map 4-1).

State and Federal areas utilized for recreation and resource land include Tuckahoe State Park, Chesapeake Forest/State Forest Area, Martinak State Park, Idyllwild Natural Resource Area, and the Denton Armory. Most State recreation land is undeveloped and located within Tuckahoe State Park. There are no Federal lands within the County. Caroline County provides water access (public landings at four sites in the County. The County has ownership of the Hillsboro Boat Ramp (Tuckahoe River), Choptank Marina (Choptank River), and Ganey's Wharf (Choptank River). The County leases and operates the Greensboro Boat Ramp, which is owned by the Greensboro Fire Department. Additionally, there are public landings and/or marinas in Denton, Federalsburg, the state parks, and at Smithville Community Lake.

LPPRP Capital Improvement Program

Program priorities through 2020 would cost approximately $25.6 million with $3.2 million for new acquisition, $20 million for new facility development projects, and $2.4 million for rehabilitation projects. Cost estimates are in 2005 dollars.

Projects are in three categories: 1) short range (2006 – 2010); mid-range (2011 – 2015); and long range (2016 – 2020). Recreation land acquisition for the development program would total approximately 270 acres, primarily for regional, community, and neighborhood parks.

The Maryland goal for recreation acreage is 30 acres per 1,000 people. In 2005, Caroline County's population is 32,200 people. In 2005, the County required an additional 70 acres of recreation land to meet State goals. By 2020, population is projected to be approximately 51,400 people, requiring an additional 1,044 acres of recreation land.

Educational Facilities

As stated in the *Educational Facilities Master Plan for Caroline County Public Schools – 2008 Updat*e, prepared by Vitech Consulting Services, enrollment in Caroline County public schools is projected to increase significantly in the next 10 to 15 years. These dramatic increases mean that, now more than ever, the County and the Board of Education need to continue to work together to ensure that the capacity of educational facilities is considered during the development approval process.

Table 4-3: Historical School Enrollment (2002-2007)						
Classification	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Pre-K	214	217	241	250	302	298
Kindergarten	377	329	318	402	386	424
Special Ed.	8	2	0	0	0	0
Grade 1	365	396	337	331	409	408
Grade 2	380	359	407	350	341	423
Grade 3	390	367	353	423	352	352
Grade 4	378	393	374	351	437	362
Grade 5	433	380	398	401	354	436
Grade 6	449	416	388	399	407	366
Grade 7	466	455	419	400	404	420
Grade 8	453	475	459	444	415	407
Grade 9	507	501	535	565	528	492
Grade 10	400	412	443	445	463	444
Grade 11	331	365	381	423	391	416
Grade 12	384	333	359	386	422	410
TOTAL	**5,535**	**5,400**	**5,412**	**5,570**	**5,611**	**5,658**
***** Enrollment by Grade as indicated in the *Educational Facilities Master Plan*.						

According to the Educational Facilities Master Plan, as of June 2008, public school enrollment in Caroline County will increase by 21% by 2017. These projections indicate that new educational facilities and services will be needed.

Educational Facilities Needs Assessment

As shown in Table 4-3, Caroline County historical school enrollment from 2002 to 2007 indicates that since 2003 the total number of enrolled students has been on the rise. There were 258 more students in 2007 than in 2003. Critical projects included the following:

- Planning and development of a potential new middle school for the County;
- Renovations and improvements to Greensboro and Ridgely Elementary Schools;
- Renovations and improvements to Lockerman Middle School;
- Renovations and improvements to the “Career and Tech Center” at North Caroline High School; and
- Development of portable classrooms to accommodate additional students and classes.

The improvements and expansions to secondary schools is important because the large Kindergarten enrollment in 2002, began middle school this year and another surge in enrollment from 2005 to 2007 in Kindergarten will need to be accommodated at the

secondary level beginning 2011. In 2013, all three of those large enrollments will be in the middle schools simultaneously. There are other factors that affect enrollment on a yearly basis, but it is important to use this data to prepare as these larger classes move their way through the school system.

Impacts of New Development on Educational Facilities & Services

Prior to current development trends, the current school age population and enrollment projections indicated that the construction of new schools was not necessary in Caroline County, thus, renovations and additions to current facilities were recommended.

Table 4-4: Current and 10-Year Projected Enrollment (2007 – 2017)						
Grade	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Elem. PK-5	2,703	2,744	2,837	2,995	3,118	3,265
Elem. K-5	2,405	2,432	2,521	2,667	2,765	2,895
Middle 6-8	1,193	1,242	1,201	1,197	1,192	1,250
High 9-12	1,762	1,721	1,706	1,642	1,690	1,663
TOTAL K-12	**5,360**	**5,395**	**5,428**	**5,506**	**5,647**	**5,808**
TOTAL PK-12	**5,658**	**5,707**	**5,744**	**5,834**	**6,000**	**6,178**
*Note: Kindergarten is full-day, pre-kindergarten is half-day						

Grade	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Elem. PK-5	3,265	3,380	3,487	3,614	3,707	3,782
Elem. K-5	2,895	3,000	3,103	3,223	3,308	3,376
Middle 6-8	1,250	1,350	1,381	1,418	1,472	1,542
High 9-12	1,663	1,605	1,691	1,686	1,776	1,883
TOTAL K-12	**5,808**	**5,954**	**6,176**	**6,327**	**6,556**	**6,802**
TOTAL PK-12	**6,178**	**6,334**	**6,560**	**6,718**	**6,955**	**7,208**
*Note: Kindergarten is full-day, pre-kindergarten is half-day						

As shown in Table 4-4, elementary schools are projected to receive the largest portion of school enrollment increases in the next five years.

As shown in Table 4-5, existing and projected school facility utilization based on official State Rated Capacity (SRC). By 2017, substantial deficits are projected for all grade levels.

The *2008 Educational Facilities Master Plan* update includes the following options for Caroline County public schools:

Elementary Schools

- Maximize potential capacity by converting some rooms to uses with a higher State Rated Capacity (SRC) – benefits are limited, short term, and may impact the quality of programs;

Table 4-5: Existing & Projected Education Facility Utilization/Excess Capacity Based on Official State Rated Capacity (SRC)								
			Current Year 2007			Year 10 2017		
School	**Grades**	**Official SRC**	**FTE Enroll.**	**Percent Utilization**	**Capacity Excess or (Deficit)**	**FTE Enroll.**	**Percent Utilization**	**Capacity Excess or (Deficit)**
Denton ES	PK-5	664	602	91%	62	872	131%	(208)
Federalsburg ES	PK-5	510	431	85%	79	540	106%	(30)
Greensboro ES	PK-5	647	636	98%	11	945	146%	(298)
Preston ES	PK-5	431	402	93%	29	545	126%	(114)
Ridgely ES	PK-5	476	484	102%	(8)	677	142%	(201)
TOTAL - All Elementary Schools		**2,728**	**2,555**	**94%**	**173**	**3,579**	**131%**	**(851)**
Col. Richardson MS	6-8	542	418	80%	124	486	90%	56
Lockerman MS	6-8	977	775	83%	202	1,057	108%	(80)
TOTAL - All Middle Schools		**1,519**	**1,193**	**82%**	**326**	**1,543**	**102%**	**(24)**
Col. Richardson HS	9-12	717	577	91%	140	609	85%	108
North Caroline HS	9-12	1,213	1,185	96%	28	1,274	105%	(61)
TOTAL - All High Schools		**1,930**	**1,762**	**94%**	**168**	**1,883**	**98%**	**47**
TOTAL - All Schools	**Pk-12**	**6,177**	**5,510**	**88%**	**667**	**7,005**	**113%**	**(828)**
*Note: Table based on Official State Rated Capacity (SRC)								

			Current Year 10 2015			Year 15 – Extended Growth 2020		
School	**Grades**	**Official SRC**	**FTE Enroll.**	**Percent Utilization**	**Capacity Excess or (Deficit)**	**FTE Enroll.**	**Percent Utilization**	**Capacity Excess or (Deficit)**
Denton ES	PK-5	664	894	135%	(230)	1,028	155%	(364)
Federalsburg ES	PK-5	510	568	111%	(58)	600	118%	(90)
Greensboro ES	PK-5	647	984	152%	(337)	1,108	171%	(461)
Preston ES	PK-5	431	470	109%	(39)	506	117%	(75)
Ridgely ES	PK-5	476	594	125%	(118)	637	134%	(161)
TOTAL - All Elementary Schools		**2,728**	**3,510**	**129%**	**(782)**	**3,879**	**142%**	**(1,151)**
Col. Richardson MS	6-8	542	527	97%	15	561	103%	(19)
Lockerman MS	6-8	977	1,188	122%	(211)	1,335	137%	(358)
TOTAL - All Middle Schools		**1,519**	**1,715**	**113%**	**(196)**	**1,895**	**125%**	**(376)**
Col. Richardson HS	9-12	717	586	82%	131	623	87%	94
North Caroline HS	9-12	1,213	1,274	105%	(61)	1,434	118%	(221)
TOTAL - All High Schools		**1,930**	**1,861**	**96%**	**69**	**2,056**	**107%**	**(126)**
TOTAL - All Schools	**Pk-12**	**6,177**	**7,085**	**115%**	**(908)**	**7,831**	**127%**	**(1,654)**

- Add additional portable classrooms as a temporary solution;
- Adding classroom capacity must be consistent with Board of Education policies on recommended school size and site size and may be feasible based on core facility capacity – existing elementary school capacity ranges from 431 at Preston to 665 at Denton;
- Build two (2) new elementary schools, one in Denton and one in Greensboro – these could be in new locations or on the sites of the existing elementary schools;
- The Board of Education may want to consider a primary/intermediate grade organization for the new and existing elementary schools to ensure that the student populations are diverse.
- Renovations and additions will be needed at all other elementary schools;
- Reserve sites for future elementary schools in locations acceptable to the Board of Education by donation, exaction, and/or purchase.

Middle Schools

- Colonel Richardson Middle School (CRMS) is currently being modernized and will make better use of existing space. State Rated Capacity (SRC) has been increased from 488 to 542 within the existing building envelope. Enrollment is not projected to exceed capacity at CRMS during the next ten years;
- A feasibility study was done in 2006 to determine the future use of Lockerman Middle School and it was found that the only option is to modernize the building, despite the fact that it will decrease its capacity, and build a new middle school in the northern half of the county to absorb the excess capacity.

High Schools

- Colonel Richardson High School (CRHS) enrollment is not projected to exceed capacity during the next ten years.
- Renovation of CRHS is currently underway. This project is expected to maximize capacity by converting uses of rooms and recapturing underutilized space.
- North Caroline High School (NCHS) has recently been modernized and expanded by a science classroom project completed in 1998 and by a major project completed in 2002 that added new classrooms and improved the use of space in the existing building. These projects significantly increased SRC by 293 students from 920 to 1,213.
- Because of demographic cycles, enrollment is expected to be below capacity until near 2015. Enrollment will increase significantly after 2015.
- Adding future classrooms at NCHS must be consistent with Board of Education policies on recommended school size and be feasible based on core facility capacity.

Career and Technology Center

- There are plans to renovate the existing school or build a new school to meet capacity, modernize and meet new program requirements. Planning for this is expected in fiscal year 2017 and funding is expected to be requested in fiscal year 2018.
- During the agricultural interest group meeting held in June 2008, a need for localized education was identified to encourage our students to enter in to business fields, such as agribusiness, which would benefit our County's economy and support our plan to maintain our rural culture and environment.

Higher Education

Currently there are no facilities for post-secondary education in Caroline County. However the County is in the service area of Chesapeake College, located in Wye Mills, and has representation on the Board of Directors. The educational interest group meeting indicated a need to bring courses from the college directly to our students in the high school. Currently there are opportunities for high school students to take college courses at Chesapeake College, however it was felt that leaving the school made it more difficult to fit the courses into the schedule and that the need for the student to provide their own transportation excludes students of lower income families.

Libraries and Museums

There are currently libraries located in the corporate limits of Federalsburg, Denton, and Greensboro. A bookmobile services unincorporated areas surrounding Preston, as well as Hillsboro, Ridgley, Goldsboro, Henderson and Marydel.

The Choptank River Heritage Center & Joppa Wharf Museum, located in West Denton, is dedicated to preserving and interpreting the evolution and development of the land, its inhabitants and their relationship with the Choptank River.

The Museum of Rural Life, located on Second Street in Denton, tells the stories of residents living in Caroline's agriculture-based economy and houses the headquarters for the County Historical Society.

Caroline County School Excise Tax

By law, Caroline County's School Excise Tax is capped at $5,000 per housing unit and is currently at that level. The County's excise tax is set at these limits however, current limits fail to account for inflation, escalation in the costs of school construction by square footage, and anticipated school enrollment stemming from new development, which will

continue to increase pressure for new schools.

Currently, the excise tax assists Caroline County to address capital improvements to school facilities. It also assists in assessing service levels. School construction and other costs could total $50 million or more in the next ten years. Unless, Caroline County initiates impact fees, which will require a full “Impact Fee Study,” the County should seek to raise the current excise tax rate to $8,000 to $10,000 per unit in the next five years.

Emergency and Public Health Facilities

With population growth anticipated in the County, expanded resources and services will be required for emergency and public health services. This is particularly true of emergency management, fire, police, and medical services.

There are two types of emergency services in Caroline County that provide inter-related services, including Emergency Management Services (EM) and Emergency Medical Services (EMS). Both are divisions of Emergency Services.

EM is a Caroline County department that provides emergency planning and coordination, natural disaster relief, and 911 system management. EM also provides police communications for the Sheriff’s Department and 5 town police departments as well as fire and rescue units for 8 Fire/EMS-Medical Departments. EM manages the National Crimes Information Computer System for police agencies. EM oversees a comprehensive and progressive risk management program, including employee safety, workman’s compensation, and general and property liability insurance.

EMS is a Caroline County department that provides emergency medical services through a combination of volunteer and career providers. EMS operates out of the towns of Denton, Federalsburg, Greensboro, Goldsboro, Preston, and Ridgely. A staffed career paramedic unit is dispatched on every EMS incident. The closest volunteer ambulance also is dispatched. On some calls requiring additional resources volunteer fire and rescue equipment are dispatched. Caroline County has mutual aid agreements with all surrounding counties.

The Director of Emergency Services is appointed by the Commissioners of Caroline County. The department is an active participant with the County Association of Fire Chief's, EMS Association, and the County Volunteer Firemen's Association. The Basic Life Support Enhancement Committee is a County Commissioner appointed committee to oversee the billing for services program and daytime enhancement of career personnel.

Funding for EMS-Medical is supplied through the County general fund appropriations

and a fee for services program. The fee for services program bills patients and their insurance companies according to national standards. Income from the fee for services does not offset the appropriation to totally fund EMS-Medical.

The public demand for EMS has developed over the past two decades. National and state regulations/standards define the characteristics of a quality EMS system. The future demand for EMS will require substantially increased funding efforts by Caroline County to ensure adequate services for residents, a growing population, and visitors.

Volunteer fire departments are housed in County municipalities and respond to regional needs. However, with large-scale population growth, the efficiency of volunteer fire departments will be strained. Sub-stations and expanded facilities and services are required. A study for fire services could greatly assist in assessing additional needs, including potential funding sources for expansions and upgrades. At present, volunteer fire departments purchase equipment through a combination of County allotment and funds derived from fund-raising efforts.

Police services are important for protecting the community health and safety. At present, the Caroline County Sheriff's Department and Maryland State Police serve unincorporated areas. Caroline County's five largest towns, Denton, Federalsburg, Greensboro, Preston, and Ridgely all maintain local municipal police forces. Large-scale population growth will require an expansion of law enforcement facilities and services. Caroline County municipalities should work closely with the Caroline County Sheriff's Department to provide for efficient and cost effective services. New technologies will assist law enforcement to provide adequate services and defray escalating costs.

Medical services are critical, particularly for a region with an older and/or aging population base. In Caroline County, the segment of the population aged between 40 and 60 has the potential to put additional strain on our medical services over the next 25 to 30 years. Aging populations typically require additional medical services because, as a group, they tend to have more medical needs. Currently there are no hospitals or emergency medical care centers in Caroline County. There are also no 24-hour medical clinics or commercial urgent care facilities available. The lack of such facilities puts even more strain on the County's Emergency Medical Services and the Maryland Department of Mental Health and Hygiene offices located in the Town of Denton, both of which serve the entire County.

This could include regional hospital facilities and emergency "out-patient" businesses for the Mid-Shore area. The Shore Health System merged with the University of Maryland Medical System in 2006 which has increased access to funding for additional facilities and facility improvements. There is currently planning underway for a regional hospital that will better serve Caroline and Queen Anne's Counties which are projected to be the fastest growing counties in the Mid-Shore region.

Regarding government facilities and services, emergency and public health services are the most impacted by large-scale population growth. Generally taxation increases are the product of necessary expansions to emergency and public health services, which accompany population increases. Caroline County should engage in pro-active planning to meet projected needs including the development of a detailed study for emergency and public health services in relation to projected development. Any study should explore traditional and innovative ways to provide funding for expanded Emergency Services.

Correctional Facilities

The Caroline County Detention Center is located in Denton. The facility underwent extensive renovations in 1980. In addition to the Detention Center, the facility currently houses the Department of Corrections and Caroline County Sherriff's office.

The Detention Center has a maximum capacity is 142 beds; however more can be accommodated if necessary. Its size is currently adequate to serve the County's inmate population. The concept of establishing a regional corrections facility to serve the mid-Shore area has been discussed by representatives of Kent, Queen Anne's and Caroline counties but to date no formal plan has been developed.

Public Works Facilities

Solid Waste

Caroline County has a Solid Waste Management Plan. The goal of the plan is to promote the provision of solid waste collection and disposal services in an economical and efficient manner, while protection the overall public health, natural resources and environmental quality of Caroline County. The plan is currently undergoing an update that will be complete prior to the adoption of this plan.

Mid-Shore Regional Landfill

The Mid-Shore Landfill Cooperative was formed in the late 1980s and includes the counties of Caroline, Kent, Queen Anne's, and Talbot. Caroline County's Holly Road solid waste transfer station, purchased in 1975, was designated as the second site for the Mid-Shore Regional Landfill to serve the area's waste needs from 2011 to 2030. After 2030 the next landfill host will be Queen Anne's County.

Residential development within the defined landfill impact zone should be discouraged. As the landfill and surrounding areas are currently located within the Ridgely Greenbelt, they are classified as targeted for preservation and/or conservation. County preservation

strategies should target properties within the defined “Landfill Impact Zone” as a primary preservation and conservation area. The County will supply information on the landfill and the landfill impact zone, including the location of the zone and estimated impacts as a result of the construction and operation of the landfill, to realtors and others who oversee the purchase and sale of properties to provide for prospective buyers.

Midshore Regional Recycling Program

The Midshore Regional Recycling Program (MRRP) is a cooperative partnership that was formed in 1993 by Caroline, Kent, Queen Anne’s, and Talbot Counties. The program provides free recycling opportunities to residents. MRRP is primarily funded through a surcharge on solid waste disposed at the Mid-Shore Regional Landfill in Easton. Other revenue sources include the sale of recyclables and grants. The County should explore methods to enhance the recycling program in Caroline County.

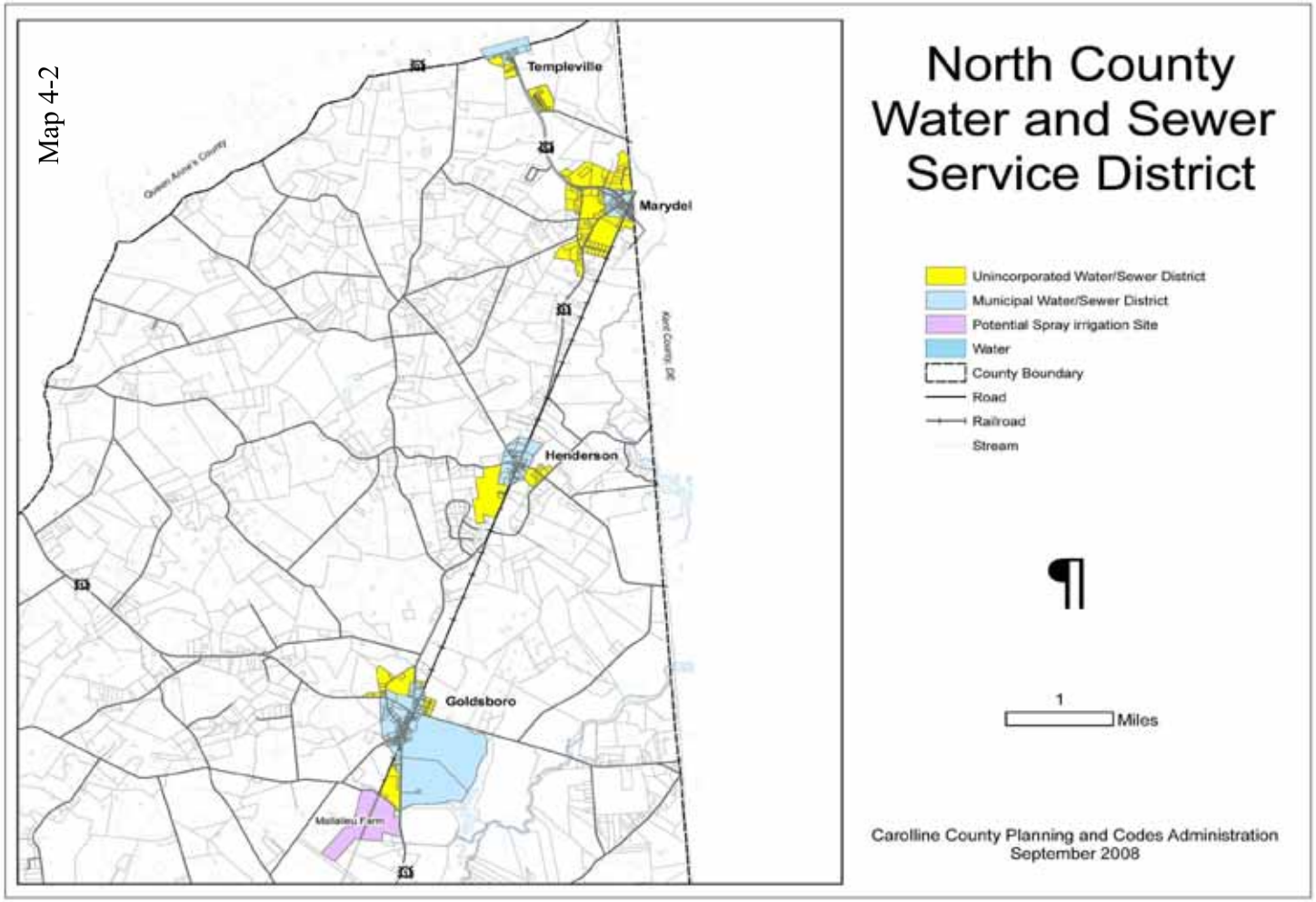
Collection Sites

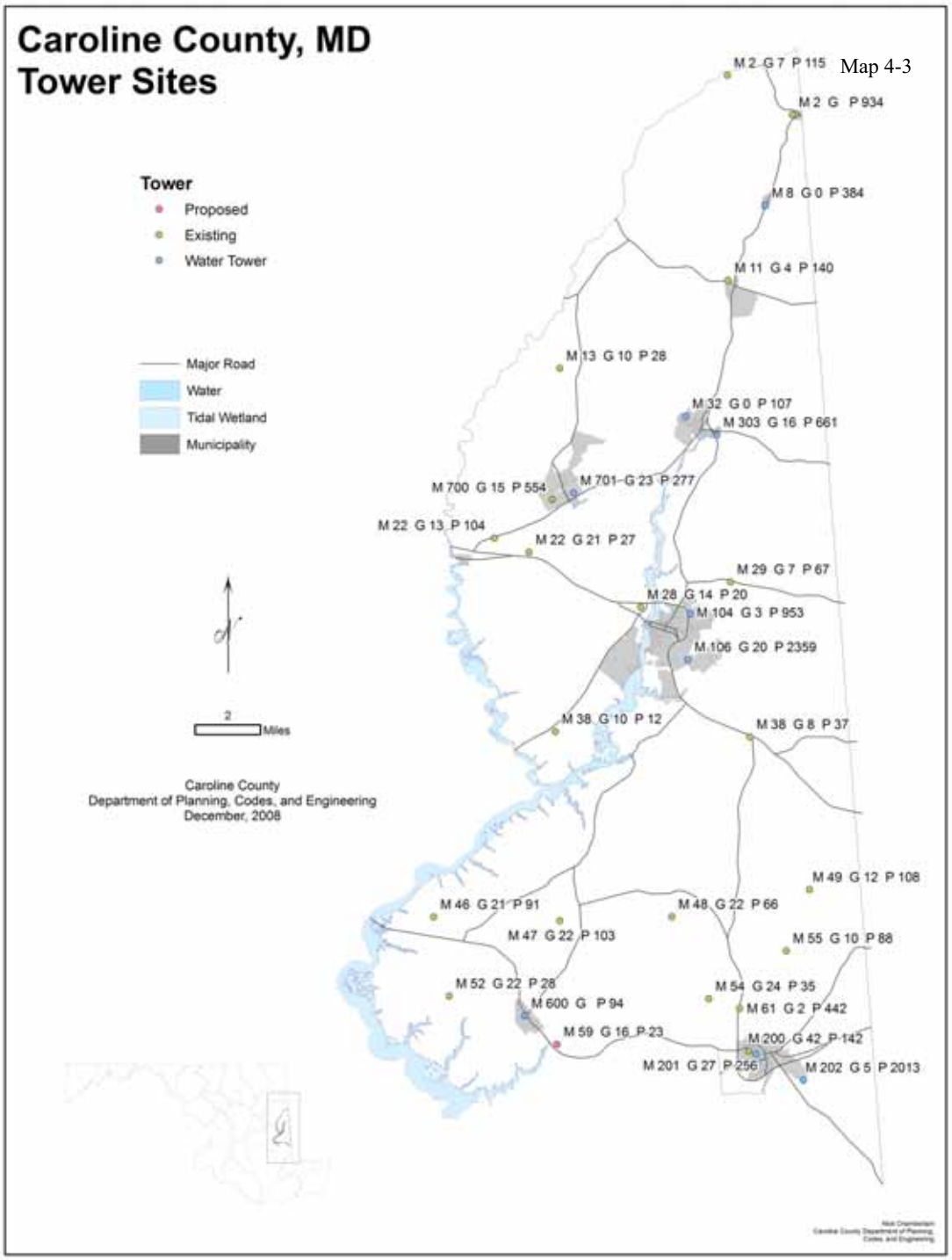
There are four solid waste collection sites in the County – Hobbs in Denton, Holly Road in Ridgely, Melville Road in Henderson, Old Denton Road in Federalsburg, and Preston. The hours for each site vary throughout the week. Currently, they are all open from 11 a.m. to 6 p.m. Friday and 8 a.m. to 4 p.m. Saturday.

Water & Sewer

Adequate water and sewer infrastructure is important to the safe and healthy functioning of towns and growth areas. A major goal of this Comprehensive Plan is to improve coordination between the County and its municipalities for the overall provision of public infrastructure including water and sewer. All public water and sewer systems currently operating in Caroline County are owned and operated by municipal governments (see Water Resources Element for detailed descriptions of these systems).

Multi-jurisdictional water and sewer projects currently underway include the construction of a County-owned and managed public water system to serve the village of Jonestown, and a new sewage treatment facility to serve residents in the North County towns of Goldsboro, Henderson, Marydel and Templeville and areas outlying the towns. The North County Wastewater Treatment Plant will be owned and managed by the North


Map 4-2
Templeville
Marydel
Henderson
Goldsboro
Mallalieu Farm
North County
Water and Sewer
Service District
Unincorporated Water/Sewer District
Municipal Water/Sewer District
Potential Spray irrigation Site
Water
County Boundary
Road
Railroad
Stream
1
Miles
Caroline County Planning and Codes Administration
September 2008


Caroline County, MD
Tower Sites
Tower
Proposed
Existing
Water Tower
Major Road
Water
Tidal Wetland
Municipality
2
Miles
Caroline County
Department of Planning, Codes, and Engineering
December, 2008
M 2 G 7 P 115
M 2 G P 934
M 8 G 0 P 384
M 11 G 4 P 140
M 13 G 10 P 28
M 32 G 0 P 107
M 303 G 16 P 661
M 700 G 15 P 554
M 701 G 23 P 277
M 22 G 13 P 104
M 22 G 21 P 27
M 29 G 7 P 67
M 28 G 14 P 20
M 104 G 3 P 953
M 106 G 20 P 2359
M 38 G 10 P 12
M 38 G 8 P 37
M 49 G 12 P 108
M 46 G 21 P 91
M 48 G 22 P 66
M 47 G 22 P 103
M 55 G 10 P 88
M 52 G 22 P 28
M 54 G 24 P 35
M 600 G P 94
M 61 G 2 P 442
M 59 G 16 P 23
M 200 G 42 P 142
M 201 G 27 P 256
M 202 G 5 P 2013

Map 4-3

County Water and Sewer Authority, which includes a representative from the County and each of the four towns. The Authority will oversee the planning, construction and operation of the facility, which will be designed to accommodate projected increases in the region's population based on a build-out study of the region conducted in 2007. Sewer districts to be served have been designated by the Authority. Both of these projects are being undertaken to address existing and potential septic system failures and to prevent negative impacts to public health and the environment. The Jonestown and North County projects are in the early stages of design and engineering; timelines for construction have not yet been developed.

Communication Infrastructure

There are 32 existing communications towers located in the County. Four towers are used for emergency services. Nine towers water towers within municipalities (See Map 4-3).

The County has a franchise agreement with Comcast for the supply of cable to unincorporated areas of the County. Municipalities are responsible for obtaining and maintaining their own agreements.

The Maryland Broadband Cooperative is funded by the Maryland Rural Broadband Coordination Board, which was formed under Senate Bill 753. The Mid-Shore Regional Council has been one of the driving forces behind bringing the broadband through the County. Based on the Maryland Broadband Cooperative's projected coverage map, the fiber optical cable is proposed to be installed in Caroline County linking Queenstown and Centreville in Queen Anne's County to Ridgely, Ridgely to Denton and Denton to Easton. The cable will be instrumental to the success of the Mid-Shore Regional Business and Technology Park located in Ridgely.

Community Facilities Implementation

- Coordinate with surrounding jurisdictions for the enhanced planning of private health and medical facilities for the Upper and Mid-Shore areas.
- Review the Adequate Public Facilities Ordinance and explore the appropriateness of impact fees to address demand on public facilities and services created by new development.
- Coordinate planning between the County, municipalities, and Board of Education to provide adequate public infrastructure to areas in need.
- Examine the coverage areas of communication service providers and gaps in coverage from communications towers for consideration when reviewing communication tower applications and completing emergency services planning.
- Explore methods of improving Caroline County's recycling program.

CHAPTER 5: TRANSPORTATION

The transportation element of the Caroline County Comprehensive Plan will address the existing and proposed needs of Caroline County citizens with regard to transportation infrastructure. The goal of the transportation element of the *Caroline County Comprehensive Plan* is to provide for the safe and efficient movement of people and goods and encourage regional and local coordination of transportation and communications decisions. Objectives include:

- Improving the transport of people and goods along MD Route 404 (Shore Highway);
- Maintenance of county roads and bridges;
- Improving safety for motorists by controlling access along State and County roads;
- Minimizing the need for extensive capital investment in upgrading County roads outside of designated growth areas and greenbelts;
- Encouraging the location of jobs close to population centers in order to reduce vehicle miles of travel;
- Supporting and coordinating planning with transportation providers for improved public transportation;
- Provide safe, excellent airport facilities and services to its based aircraft owners and the flying public; and
- Providing for alternative modes of travel within designated growth areas such as pedestrian and bicycle routes.

State Highways

Major highway access routes in Caroline County include MD Routes 16, 404, 480, 311, 312, 313, 328 and 331. There are 19 State Highways that total approximately 165 miles. The existing State highway system provides for easy connections to higher order roads that access metropolitan areas in Maryland and Delaware, such as US Routes 50, 301, and 13. County Towns are within easy driving distance of major metropolitan centers in Maryland and Delaware, such as Easton, Dover, Salisbury and Annapolis.

Access to metropolitan areas will be enhanced when MD Route 404 is dualized (see next section). The closest regional cities include Dover and Wilmington, Delaware; Philadelphia, Pennsylvania; Annapolis and Baltimore, Maryland; and Washington D.C., all located within 2 to 3 hours driving time.

The arterial system is MD Route 404, which bi-sects the County from East to West connecting with Federal highways in Maryland (US 50) and Delaware (US 13). A major collector system of State maintained “feeder” highways connects to MD Route 404 and includes MD Routes 480, 313, 312, and 16. County maintained roads and Town streets form the minor collection system, branching from State arterial and collector routes to

serve County residents.

MD Route 404 Improvements

With the increase in traffic volume, proposed new development in the County and growing concerns regarding safety, MD Route 404 (Shore Highway) requires major improvements. MD Route 404 begins at MD 662 in Wye Mills, Maryland and runs to the Delaware line (approximately 25 miles). MD Route 404 traverses Caroline, Queen Anne's, and Talbot Counties. Maryland Department of Transportation (MDOT) and State Highway Administration (SHA) have planned the dualization of the remainder of MD Route 404 to provide a major arterial connection to US Route 50 in Maryland and US Route 13 in Delaware.

In response to growing public safety concerns along MD Route 404, the "Citizens for Transportation Emergency Action in Maryland" (C-Team) was formed in 2000, comprised of residents in Caroline, Queen Anne's, and Talbot Counties. The group includes over 40 local community leaders. The primary role of the C-Team is to stimulate widespread public support for the immediate planning, design, and construction of a dualized MD Route 404. The C-Team has assisted Caroline County regarding MD Route 404 dualization and other improvements.

Traffic congestion problems have escalated as beach resort areas grow. In 2002, traffic volumes indicate 16,700 vehicles per day during non-vacation months and 21,700 vehicles per day during the vacation season. The primary reason for traffic volume escalation is through traffic for shore points in Maryland and Delaware. By 2025, SHA has projected an increase in volume to 22,400 vehicles per day for non-seasonal months and 27,700 vehicles per day for seasonal months.

Current SHA plans call for the dualization of MD Route 404 to a 4-lane divided highway from US 50 to the MD Route 16 near Denton (approximately 12 miles). Coordination includes Caroline, Queen Anne's and Talbot Counties. The project was divided into seven phases. The first phase, which dualized MD Route 404 from The Denton By-Pass to the intersection of MD Route 16, has been completed. The next phase will be from MD Business 404 to the Queen Anne's County line.

County Roads

There are 481 miles of County roads and 404 of those miles are paved. For a predominately rural area, the system operates at acceptable levels of service. Travel demand and safety considerations are low enough on County roads and Town streets that no major capital improvements are planned at this time outside of designated growth areas; however the County should develop road design technical standards.

Unpaved Roads

The *Caroline County Road Priority Improvement Program* places the lowest priority on paving and widening low volume dirt roads in rural areas. The Caroline County collection system contains 78 miles of unpaved roads. Increased development pressure has created problems along unpaved roads. As subdivision and development increases, the County is experiencing a demand for these roads to be paved. Current local traffic along unpaved roads has not reached a vehicular volume substantial enough to require paving.

Future development along unpaved roads should be limited in local land use policies and regulations. These areas are inappropriate for large-scale rural residential development due to the current state of the road system. Gravel roads create problems for County services particularly Emergency Management, the Fire Department, and Police.

Gravel Roads also create maintenance problems during adverse weather conditions, such as hurricanes and snow storms. Due to the tremendous local cost associated with paving and maintaining these gravel roads, Caroline County should enact more stringent policies and regulations to limit future development in these areas.

Bridge Construction and Repairs

The two main bridges in the unincorporated area of the County are maintained by the SHA Administration and have been slated for repairs. The Dover Bridge at Maryland Route 331 has been functionally deficient, specifically that the lanes are too narrow at only ten feet. However, the bridge is structurally sound, causing the project to be postponed as other projects posing greater safety hazards require state resources. The Tuckahoe River Bridge or Frederick Douglas Memorial Bridge at Maryland Route 328 has been identified as a bridge that will soon be structurally deficient by State Highway Engineers. The planning and engineering for both bridges is already underway. Construction of the new Tuckahoe River Bridge is scheduled to begin in Spring 2010 and be completed before Spring 2012.

Municipal Concerns

Two municipalities within Caroline County have discussed a need for a bypass route to relieve congestion and/or divert truck traffic from landfill or mining operations away from local and main streets. To date, none of these projects has been approved by the State Highway.

The Town of Preston is in the process of working with the State Highway Administration to determine if there is adequate need for a bypass route to divert traffic around the Town's Main Street. Significant average daily traffic counts have been recorded for the Town's principle access route, Route 331, a two-lane highway that extends through Town as Main Street and connects County residents to Delaware and Talbot County, Maryland. Maryland Route 16, the main connector between Preston and Denton, intersects with Route 331 in the middle Town and brings additional thru-traffic to downtown streets. The 2007 average daily traffic count for Main Street topped 10,000 per day, the highest traffic count in the County not located on Maryland Route 404. The Town of Preston should continue to work with the State to monitor traffic conditions to determine the necessity, effectiveness, feasibility and impacts of a bypass. Particular attention should be paid to the impacts of a bypass on the character of the Town and town businesses.

Traffic concerns for the Town of Ridgely include existing truck traffic generated from nearby surface mining operations and projected increases in truck traffic as a result of the opening of the Midshore Regional Landfill II. The Town is working with SHA to determine the need for a bypass route that would connect Maryland Route 312 (which extends through Ridgely as Central Avenue, the Town's main street) to Maryland Route 480 to divert thru-traffic around the Town. A 2008 traffic impact study commissioned for the landfill project indicates that current and mid-term projected traffic flows do not warrant a bypass route in the near future. In 2007, average daily traffic counts in town on Maryland Route 480 were less than 6,000 and less than 4,000 on Maryland Route 312 in town. However, the traffic study projected that by 2030, the intersection of Maryland Routes 312 and 480 in Town will not operate at acceptable levels of service and recommended that the intersection be closely monitored over the long-term. In the meantime, SHA is developing road upgrades as alternatives to help offset additional truck traffic through Ridgely, including the addition of deceleration lanes at critical intersections to minimize the impact of trucks traveling to and from the landfill on local traffic flow. Coordinated planning with Maryland Environmental Service (which will manage the landfill) and surface mining operators also may help reduce or prevent excessive truck traffic in the Town.

Crash Data

According to crash data for Caroline County provided by the Maryland Highway Safety Office, between 2003 and 2007 there was a general decline in crashes and in injuries and fatalities resulting from crashes. More than half of all crashes and injuries and fatalities resulting from crashes occur on State Highways. Although records indicate that traffic congestion increases during the summer months on MD Route 404, the month of the year does not appear to have significant influence on crashes or injuries or fatalities

resulting from crashes. The most crashes and crashes resulting in injuries occur around 7 a.m. and between 3 and 6 p.m., while fatalities from crashes appear more sporadic.

Drivers between the age of 21 and 24 make up the highest percentage of driver fatalities, 24%. Ten percent of Caroline County drivers are in this age bracket. Drivers aged 20 and under make up 20% of Caroline County's drivers and have the highest percentage of driver injuries at 21%.

Farm Equipment

Farming is an important part of Caroline County's rural heritage. The safe and efficient movement of farm equipment along County highways and roads is critical for the farm-based economy. The development of transportation related plans, policies, and regulations should include Farm Bureau representatives and remain cognizant of the needs of the farming industry as a whole in relation to the planning for transportation routes. This includes appropriate right-of-ways for farm equipment as well as signage that vehicular traffic is entering an agricultural area.

Public Transportation

Delmarva Community Transit (DCT), the current transportation provider for Caroline County, provides limited public transit in for Kent, Caroline, Talbot and Dorchester Counties. Queen Anne's County Ride provides limited transit in Queen Anne's and Talbot Counties. DCT participates in Maryland Upper Shore Transit (MUST), which is a collaborative effort between Upper Shore Transportation providers to operate regional fixed routes. DCT as a part of Delmarva Community Services, Inc., also provides transportation to the elderly and disabled to help them live a more independent lifestyle, through American Disabilities Act (ADA) and Medical Assistance (MA) programs. Additionally, they provide demand-response coverage to areas where there are no fixed routes. DCT received an award from the Community Transit Association of America as the Best Rural Transit Provider in the Country for 2007.

In Caroline County, there are no fixed routes being offered by DCT north of Greensboro. This may be due to their determination that there is a lack of high density in the area in their Transportation Development Plan Transit Needs Analysis dated August 2008. However in their list of high density housing in the County mobile home parks were not included and there are several mobile home parks in the Goldsboro and Marydel areas that may benefit from public transportation.

Identified transit needs for Caroline County in the Transit Development Plan Transit Needs Analysis included:

- Frequency of Service – regional routes have only one morning run and one return run in the afternoon
- Hours of Operation – not late enough for the workforce
- Weekend Service – limited weekend service available
- Northern Caroline County – limited access to public transportation services
- Information – difficult to identify existing public transportation services (bus stops/shelters)
- Coordination – perception that there are multiple transportation programs and services providers serving same people

Ridgely Airpark

Ridgely Airpark, a privately-owned public-use airport, is located approximately two miles northeast of Ridgely and provides an existing runway length of 3,214 feet. The County is attempting to acquire this airpark, because a publicly owned public-use airport is needed to help sustain and promote economic growth in the County. The goal is to develop the runway to 3,400 feet and then move to a 5,000 foot runway, when feasible. Access to the airpark is already established using existing roads, Maryland Route 312 and River and Race Track Roads. Only Race Track Road may require upgrading and not traffic patterns will need to be altered.

The first two phases of development (2002-2012) focus on airfield development. Airfield development includes environmental studies and permits; land acquisition; tree cutting; clearing and grubbing; terrain grading; and construction of the runway, taxiways, aprons, taxilanes, terminal building, automobile parking, perimeter fence, electrical vault, rotating beacon, obstruction removal, and access road.

Additional services offered by the airpark within the 20-year planning period are minimal, including aerial tours/sightseeing and flight instruction. The Airport Master Plan suggests that future aviation services offered beyond the planning period should include a Fixed Base Operator (FBO) that provides major engine and airframe maintenance. An FBO is an aviation business located on an airport and often responsibilities associated with airport management are negotiated with the FBO.

Tourism and Economic Development

Economic development trends indicate that the Eastern Shore region is becoming a service and tourism based economy. This includes heritage tourism as well as eco-tourism, the enjoyment of natural amenities such as Caroline County's rivers and creeks. Therefore the strengthening of the County's historic, cultural, natural, and scenic qualities is essential for promoting tourism.

Caroline County is currently investing capital for heritage preservation and tourism. Initiatives, such as the reconstruction of Linchester Mill and Underground Railroad sites provide valuable links for potential tourists to experience important elements of our national history. Each of these initiatives provides a link to build a critical mass of tourism destination sites. Many areas in the region, such as Chestertown and Easton, are experiencing reinvigorated economies due to tourism. Transportation related initiatives for heritage preservation and tourism in the County include the following:

- Providing visitor services in key locations, including the Linchester Mill, Maritime Museum Visitor Center in West Denton and Adkins Arboretum in Tuckahoe State Park;
- Enhancing highway, rail and road connections to visitor center locations for enhanced tourism services;
- Providing a pedestrian, bicycle, and trail connection from Ridgely to Adkins Arboretum (via Sawmill to Bell Roads); and

The creation of linkages via highways, roads, and trails provides tourists an opportunity to experience Caroline County's rich rural heritage. It also provides valuable economic development components for building a tourism-based economy. For example, a Ridgely connection to Adkins Arboretum and Tuckahoe State Park can supply a valuable amenity for the new Ridgely Business & Technology Park, assisting in the enticement of new businesses. Connections to tourism facilities and services also provide Caroline County residents with useful amenities.

There is also a passenger railroad project, the North Dorchester Scenic Railroad, in the development stages. The project would involve utilizing an existing 6.1 mile track which runs from Hurlock to Preston. The train would begin in Hurlock and travel at a leisurely pace, approximately 45 minutes, before letting passengers off in Preston to shop, dine or visit historical sites, such as the Linchester Grist Mill and millpond. The Town of Hurlock offered its two rail cars to the project. The tourism trade benefit from the railroad and specialty cars like holiday or dinner trains can be added to retain interest. A grant application was made by the Dorchester County Tourism Office for the feasibility study in late 2008. The major hurdle to the project is obtaining support from Maryland Department of Transportation and Maryland Freight Rail Services.

Transportation Implementation

- Provide input as needed to the Department of Public Works to identify and prioritize County roads and bridges for future construction, upgrades, and/or improvements.
- Request signage in appropriate locations on State Highways that indicate that vehicular traffic is entering an agricultural area.

- Work cooperatively with the County's transportation provider to improve access to public transportation.
- Support tourism transportation initiatives that will be beneficial to the County.
- Continue to be an advocate of the dualization of Maryland Route 404.
- Continue working to acquire the Ridgely Airpark.

CHAPTER 6: ECONOMIC DEVELOPMENT

Sustaining a healthy economy is basic to the quality of life objectives embodied in the growth management strategies of this Comprehensive Plan. Healthy economic growth supports a higher quality of life for residents by providing a diverse mix of employment opportunities. It also helps provide the means to improve and expand public facilities and community services. A goal of the *Caroline County Comprehensive Plan* is to improve economic development and employment opportunities for Caroline County, while preserving the agricultural economy in the unincorporated areas of the County. Objectives for economic development include:

- Maintain and enhance support of existing and new County businesses;
- Encourage development of new businesses, particularly those that offer better wage opportunities for the local labor force;
- Support development of local and regional workforce training programs that target growing industry sectors, such as healthcare and technology;
- Encouraging economic development that will strengthen and support the agricultural community;
- Support development of local and regional industries, particularly those that produce locally grown products; and
- Ensuring land zoned for industrial, commercial, and institutional land uses are in appropriate locations.

According to the Demographic and Socio-Economic Outlook prepared by MDP in November 2007, the total number of jobs in Caroline County has been consistently lower than the total labor force. MDP projects the gap to increase to 20 percent before 2015 and to reach 33% by 2030. The County should continue to work cooperatively with municipalities to progress on a number of fronts, such as growth management, community facilities development, and community revitalization in order to improve the economic prospects for the region.

The most prevalent economic development constraints facing the County include:

- A lack of adequate infrastructure necessary for serving new businesses;
- Limited commercial and industrial areas;
- Limited labor resources;
- Limited tax base; and
- Lack of basic and affordable housing.

Industry Characteristics

In 2002, the United States Census Bureau produced the *2002 U.S. Economic Census*

according to the North American Industry Classification System (NAICS). The NAICS was first adopted in 1997 under the North American Free Trade Agreement (NAFTA). Prior to 1997, economic data was produced according to the Standard Industrial Classification (SIC) system. Economic data will be referenced under the NAICS system including the following industry categories:

- Forestry & Agricultural Support Industries
- Mining;
- Construction;
- Manufacturing;
- Wholesale Trade;
- Retail Trade;
- Transportation and Warehousing;
- Information;
- Finance & Insurance;
- Real Estate & Rental/Leasing;
- Professional, Scientific, & Technical Services;
- Management of Companies & Enterprises;
- Administrative/Support & Waste Management and Remediation Services;
- Educational Services;
- Health Care & Social Assistance;
- Arts, Entertainment & Recreation;
- Accommodation & Food Services; and
- Other Services.

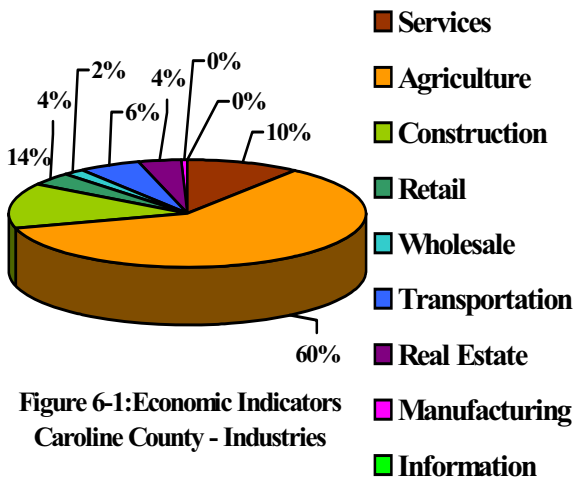


Figure 6-1:Economic Indicators
Caroline County - Industries

Agricultural Industries

Agriculture is Caroline County's largest industry sector, approximately 60%. In 1997, Caroline County passed *Right to Farm* legislation that encourages the protection of the County's agricultural lands. The ordinance is intended to prevent nuisance lawsuits, which may arise from residential growth in agricultural areas and protect the economic viability of farming in Caroline County.

In 1997, Caroline County had 556 farms with an average farm size of 202 acres. In 2007, according to statistics prepared by the National Agricultural Statistics Service (NASS) and Agricultural Census, Caroline County had 574 farms with an average farm size of 229 acres.

Table 6-1: Agriculture Economic Statistics – Caroline County			
Agricultural Classifications	**1997**	**2002**	**2007**
Number of Farms	556	506	574
Average Farm Size (Acres)	202	227	229
Land in Farms (Acres)	**112,545**	**114,843**	**131,277**
Market Value of Production – Avg. Per Farm	$189,728	$206,242	$324,109
Total Farm Production Expenses	$95,335,000	$86,582,000	$142,006,000
Total Farm Production Expenses - Avg. Per Farm	$170,545	$170,437	$247,398
Government Payments	$706,000	$1,870,000	$3,028,000
Average per Farm Receiving Payment	$4,059	$9,398	$8,318
TOTAL - Market Value of Production	**$105,489,000**	**$104,358,000**	**$186,039,000**
United States Department of Agriculture: National Agricultural Statistics Service			

As shown in Table 6-1, in 2007 the County generated $186 million from agricultural industries. This is an increase in total production value from 1997 ($105 million) It is important to note that government payments increased from $706,000 in 1997 to $1,870,000 in 2002 to $3,028,000 in 2007, which assisted in preserving the agricultural industry sector.

Mineral Extraction

Caroline County's sand and gravel is a non-renewable resource that must be protected to ensure future use because these minerals are important to the State economy. Section 15-802; Title 15; Subtitle 8: Surface Mining of the Annotated Code of Maryland states that "local jurisdictions must protect mineral resources from the encroachment of other land uses that could potentially make these resources unavailable for future use." In addition, surface mining laws require that land uses be balanced to ensure areas for mineral extraction. In 1975, Surface Mining Laws were enacted in Maryland, mainly for implementing environmental controls through State approved mining and reclamation plans and processes. A two-tiered process of State and local regulations assists in preserving mineral resources, while also allowing flexibility for the mining industry.

Current development associated with growth may be creating land use conflicts with surface mining, rendering some areas unsuitable for surface mining. Surface mining near County municipalities is an inappropriate land use creating issues for population centers through increased industrial operations and traffic near highly concentrated population centers. The proximity of residential housing and development to surface mining operations potentially creates public health and safety concerns. In addition, past surface mining operations in Caroline County have failed to adequately mitigate and

reclaim sites.

As of September 2008, the County had 23 active surface mining operations. Of the active operations, 6 are for the purpose of creating an irrigation pond for farming operations.

Inappropriate Surface Mining Areas

Surface mining should continue to be an accepted use in the County approved by "Special Use Exception" through the Caroline County Board of Zoning Appeals. Surface mining is inappropriate in growth areas, Transferable Development Rights receiving areas, and within the defined Chesapeake Bay Critical Areas boundary (1,000 ft from existing tidal tributaries).

County municipalities are concerned with surface mining operations located close to town boundaries. The elimination of surface mining as an accepted land use in growth areas will ensure that mineral extraction industries are located an appropriate distance from population centers.

Surface Mining Performance and Site Mitigation Standards

The development of detailed "Surface Mining Performance and Site Mitigation Standards" (Performance Standards) is needed for Caroline County. Performance Standards should apply to both small and large-scale surface mining operations to mitigate potential conflicts. Performance Standards should include detailed plans for each phase of the surface mine with particular emphasis on pre-planning (buffering, landscaping etc.) and end use (site mitigation/reclamation). Due to the County's flat topography, surface mining operations in rural areas are highly visible. Therefore, Performance Standards should preserve scenic rural quality and visual aesthetics, in addition to quality of life. Buffers are essential to alleviate public concerns and landscaping should include indigenous vegetation suitable to existing climate and soil conditions. Tall story and under-story vegetation is required and buffering should be initiated before mineral extraction commences to provide suitable time for vegetation to grow.

Mineral Extraction Tax

Surface mining industries place burdens on local infrastructure, particularly large-scale operations located on County roads, creating an undue burden for local taxpayers. Truck traffic generated by the industry negatively impact County and town roads requiring additional repair and maintenance. In addition, inappropriately located mineral extraction enterprises can detract from County visual aesthetics and scenic resources, adversely

impacting tourism initiatives and the local economy.

The development of a Mineral Extraction Tax will compensate the public for the loss of resources that leave the County for other areas of the State and nation and will compensate the County for additional road repairs and upgrades. Caroline County should coordinate with regional counties to assist in the enactment of a Mineral Extraction Tax. Past and current efforts to enact a Mineral Extraction Tax have met with State resistance therefore a regional multi-jurisdictional effort is required to facilitate efforts. Organizations like the Maryland Association of Counties (MACO) and local State legislators can greatly assist efforts for the development of a Mineral Extraction Tax.

Other Industries

According to the *2002 Economic Census* for Caroline County, from 1997 to 2002 growth was indicated in eleven (11) out of seventeen (17) industry sectors under the NAICS classification system. As shown in Table 6-2, from 1997 to 2002 Caroline County experienced major growth in several industry sectors including Services, Construction, and Wholesale Trade. Caroline County experienced a significant increase in the Services Sector. Services include the following: Finance & Insurance; Professional Services; Administrative Services; Educational Services, Health Care Services; Arts & Entertainment; Accommodation and Food Services; and Other Services. Increases include Professional Services, Health Care Services, Arts & Entertainment, and Other Services.

In 2002, the Services Sector accounted for 10% of the County's total gross domestic product of $178 million. In 1997, receipts for the Services Sector totaled approximately $13 million. In 2002, receipts for the Services Sector totaled approximately $18 million, a 38% increase in five years. The largest industry sector increase within Services occurred in Administrative, Support, Waste Management, and Remediation Services with a 131% increase from 1997 to 2002. This industry sector primarily consists of government and related services (pre-1997 SIC categories) realigned to the NAICS classification system. The Construction Sector is the second largest single industry sector in Caroline County next to agriculture.
Construction Sector growth from 1997 is partly attributed to the demand for new housing, location, and historic low interest rates for home-buyers.

The Wholesale Trade Sector experienced the third most significant increase in Caroline County. Wholesale Trade grew 104% between 1997 and 2002 with 2002 receipts totaling $3 million. Other substantial industry sectors include Real Estate; Forestry and Agricultural Support Services; Retail Trade Industries; and Transportation and Warehousing. Real Estate was the fourth largest industry sector for growth from 1997 to 2002, an approximate 48% increase. Forestry and Agricultural Support Services

experienced a 25% increase from 1997 to 2002. Retail Trade increased by 13% and Transportation and Warehousing increased by 19%.

As shown in Table 6-2, Manufacturing experienced a 54% decrease in receipts from 1997 to 2002. This was the largest decline in any single industry sector. As shown in Table 6-3, although Manufacturing represents the County's largest employer, figures indicate an overall decline in gross domestic product. Construction, Manufacturing, Wholesale/Retail Trade, and Transportation and Warehousing are large employers. Construction experienced a 37% increase in employment from 1997 and 2002 and Transportation and Warehousing experienced a significant 66% increase. Wholesale Trade experienced a modest decline of 24% from 1997 to 2002 and Retail Trade experienced a decrease of 1%.

Table 6-2: Total Gross Domestic Product GDP – Caroline County

Industry Type	**1997**	**2002**	**Percent Change +/-**
Forestry & AG Support Services	$2,109,000	$2,635,000	+25%
Mining	N/A	N/A	N/A
Construction	14,000,000	24,285,000	+74%
Manufacturing	1,494,000	687,000	-54%
Wholesale Trade	$1,556,000	$3,181,000	+104%
Retail Trade	$6,242,000	$7,032,000	+13%
Transportation/Warehousing	$8,313,000	$9,898,000	+19%
Information	$254,000	$245,000*	-4%
Finance & Insurance	$598,000	$587,000	-2%
Real Estate & Rental/Lease	$4,804,000	$7,098,000	+48%
Professional, Scientific/Technical Services	$2,791,000	$4,296,000	+54%
Administrative/Support Services	$1,397,000	$3,228,000	+131%
Educational Services	$89,000	$84,000	-6%
Health Care Services	$1,916,000	$2,792,000	+46%
Arts, Entertainment & Recreation	$518,000	$872,000	+68%
Accommodation & Food Services	$912,000*	$577,000	-37%
Other Services	$4,565,000	$5,751,000	+26%
TOTAL	**$51,558,000**	**$73,248,000**	**+42%**

*Note: 1998 figures for Accommodation and 2001 figures for Information – No information available for Mining – US Economic Census

Table 6-3: Number of Employees – Caroline County			
Industry Type	**1997**	**2002**	**Percent Change +/-**
Forestry & AG Support Services	20 - 99	20 - 99	N/A
Mining	N/A	20 - 99	N/A
Construction	456	626	+37%
Manufacturing	1,567	1,701	+9%
Wholesale Trade	331	250	-24%
Retail Trade	962	967	-1%
Transportation/Warehousing	340	563	+66%
Information	0 - 19	100 - 249	+1200%
Finance & Insurance	176	229	+30%
Real Estate & Rental/Lease	20 - 99	20 - 99	N/A
Professional, Scientific, & Technical Services	20 - 99	117	+18%
Administrative/Support Services	100 - 249	206	-17%
Educational Services	20 - 99	250 - 499	+400%
Health Care Services	348	889	+155%
Arts, Entertainment & Recreation	20 - 99	20 - 99	N/A
Accommodation & Food Services	219	264	+21%
Other Services	526	324	-38%
US Economic Census			

As shown in Table 6-3, in 2002, the Service Sector was the largest employer in the County. Increases from 1997 to 2002 are indicated in several service industries including Finance and Insurance; Professional Services; Educational Services, Health Care Services; Accommodation and Food Services; and Other Services. Substantial employment growth was cited for Educational and Health Care Services. Educational Services employment increased 400% plus from approximately 99 employees in 1997 to approximately 499 in 2002. Health Care Services rose from 348 employees in 1997 to 889 employees in 2002, a 155% increase.

Promising signs of employment growth are indicated in the Information Sector. The Information Sector includes businesses related to new information technologies. Although currently a small industry sector in Caroline County and low percentage of the overall County GDP, employment for the Information Sector has increased 1200%+ from 1997 to 2002. In addition, as shown in Table 6-4, Information establishments in Caroline County have increased 100% from 1997 to 2002, indicating substantial growth.

Services indicated the highest number of establishments, approximately 264 businesses. Most industry establishments in the County indicate modest growth from 1997 to 2002. However, Information, Real Estate, Educational and Health Care Services, and Arts and Entertainment indicated substantial growth. Construction and Retail Trade maintained the second and third highest number of establishments in

Caroline County. Construction experienced a 21% increase in establishments from 1997 to 2002 and Retail Trade experienced a slight decline of 6%.

Table 6-4: Number of Establishments – Caroline County			
Industry Type	**1997**	**2002**	**Percent Change (+ or -)**
Forestry & AG Support Services	6	4	-33%
Mining	N/A	1	N/A
Construction	118	143	+21%
Manufacturing	34	34	0%
Wholesale Trade	26	32	+23%
Retail Trade	108	101	-6%
Transportation/Warehousing	41	46	+12%
Information	3	6	+100%
Finance & Insurance	28	32	+14%
Real Estate & Rental/Lease	18	27	+50%
Professional, Scientific, & Technical Services	28	35	+25%
Administrative/Support Services	26	34	+31%
Educational Services	3	5	+67%
Health Care Services	31	45	+45%
Arts, Entertainment & Recreation	5	11	+120%
Accommodation & Food Services	27	29	+7%
Other Services	68	73	+7%
TOTAL	**515**	**658**	**+28%**
US Economic Census			

Commuting & Workforce Characteristics

As shown in Table 6-5, the County has exceptional access to regional markets. Transportation improvements, such as the dualization of MD Route 404, will greatly increase access for commuters. Close proximity to major U.S. cities and highways can create tremendous economic potential for the County in years to come. The closest cities are Annapolis and Baltimore, Maryland, and Dover, Delaware.

As shown in Table 6-6, a majority of workers (55%) commuted less than 30 minutes to work. Most workers commuted to a job site (71%) with 7% indicating a home occupation (worked in place of residence). Forty-four percent (44%) worked in Caroline County and fifty-six percent (56%) worked outside Caroline in another County or State.

Table 6-5: Commuting Characteristics (Access to Major Cities) – Town of Denton, Caroline County		
Metropolitan Area	**Distance**	**Approximate Travel Time**
Annapolis, MD	**45 Miles**	**50 Minutes**
Baltimore, MD	**61 Miles**	**1 Hour**
Washington, D.C.	75 Miles	1.5 Hours
Wilmington, DE	85 Miles	2 Hours
Dover, DE	**30 Miles**	**35 Minutes**
New York, NY	202 Miles	4 Hours
Philadelphia, PA	102 Miles	2.5 Hours
Richmond, VA	181 Miles	3.5 Hours
Statistics prepared by the Caroline County Department of Planning & Codes Administration		

Table 6-6: Work Force & Commuting Characteristics – Caroline County		
Travel Time to Work	**Total**	**Percent**
Total "Out of Home" Workers	13,386	100%
Less than 30 minutes	7,345	55%
30 – 44 minutes	3,184	24%
45 – 59 minutes	1,245	9%
60 minutes or more	1,612	12%
Place of Work – State/County Level	**Total**	**Percent**
Total Workers	14,093	100%
Worked in State of Residence	12,515	88%
Worked Outside State of Residence	1,578	11%
Worked in County of Residence	6,219	44%
Worked Outside County of Residence	6,292	45%
Mean Travel Time to Work	**30 Minutes (Commute)**	**59 Minutes (Public Transportation)**
U.S. Census Bureau – Census 2000 Commuting & Workforce Characteristics – Caroline County, Maryland		

Income Characteristics

According to data prepared by MDP in November 2007, the per capita income in Caroline County has been significantly lower than any other County in Maryland since 1980. It should be noted that during the 2000 U.S. Census, 9% of Caroline County's population were below the poverty line and the unemployment rate ranked 5th among nine counties of the Eastern Shore. Caroline County had an unemployment rate of 3.2%, the same as the State average and the same as the Eastern Shore regional average.

Table 6-7: National & Regional Income Characteristics – Caroline County			
Caroline County	**1989**	**1999**	**Percent Change**
Median Household Income	$27,758	$38,832	+40%
Median Family Income	$32,093	$44,825	+40%
Avg. Per Capita Income	$11,926	$17,275	+45%
Caroline County	**Caroline County**	**Maryland**	**United States**
Median Household Income	$38,832	$52,868	$40,816
Per Capita Income	$17,275	$25,614	$21,587
Source: U.S. Dept. of Commerce, Bureau of the Census, Tabulated by the Maryland Department of Planning			

As shown in Table 6-7, in 2000 Caroline County Median Household Income was $38,832 and Per Capita Income was $17,275. Caroline County income levels were significantly lower than both Maryland and national averages. County Median Household income was 26% less than the State average and 5% less than the national average. County Per Capita Income was 33% less than the State average and 20% less than the national average.

These income projections are economic indicators of the amount of available capital for individuals and families to purchase goods and services, when compared with cost of living data. On the Eastern Shore, Caroline County's cost of living index for 2005 compares most closely with the Lower Eastern Shore counties of Dorchester and Wicomico, both of which also have a large agricultural community. However Dorchester and Wicomico both have a lower cost of living index than Caroline and have a greater per capita income (see Table 6-8). This can be attributed to both counties having an urban center located on Maryland Route 50. The metro core (Salisbury and the surrounding area) and Cambridge are very developed and defined growth areas and serve as major employment centers.

Table 6-8: Cost of Living Index & Per Capita Income Per Eastern Shore County (2005)		
County	**Cost of Living Index**	**Per Capita Personal Income**
Caroline	99.6	23,667
Cecil	103.6	29,765
Kent	101.2	35,298
Queen Anne's	112.7	36,081
Talbot	112.9	45,589
Dorchester	95.8	26,187
Somerset	85.3	20,723
Wicomico	96.3	26,967
Worcester	108.6	31,380
Source: Cost of Living Index, Maryland Department of Business and Economic Development, December 2006; Per Capital Income, Maryland Department of Planning, Planning Data Services, November 2007		

Economic Development Initiatives

Major economic development initiatives in Caroline County are the improvement of regional infrastructure and services, achieving economies of scale, expanding tourism opportunities and creating new industry opportunities. These initiatives should improve the economic outlook for Caroline County.

Infrastructure includes roads, bridges, water and sewer, as well as technological infrastructure such as fiber optics and broadband. Adequate infrastructure assists in attracting new businesses to Caroline County. Public and private services also are critical for attracting business. This includes government services as well as a host of private services such as health care and medical.

Regional "economies of scale" can foster interjurisdictional connections. Coordination occurs between counties at the regional level; towns and counties; and local government and State and Federal government. "Economies of scale" provide financial incentives to maximize investments and decrease long-term costs. New economic development councils assist to facilitate regionalism. In Caroline, Dorchester, and Talbot Counties the regional economic development entity is the Mid-Shore Regional Council. The County helped the Council develop the *Midshore Comprehensive Economic Development Strategy.* Among the projects in the action plan were the North County Water and Sewer project and the Mid-Shore Regional Business and Technology Park located in Ridgley. The Maryland Broadband Cooperative is proposing to install fiber optical cable from Centreville, Queen Anne's County to Ridgely, from Ridgely to Denton, and from Denton to Easton, Talbot County. Caroline County should plan for the potential industrial growth that may occur in areas where broadband will be available.

Tourism is an industry that helps sustain small local businesses and there have been recent efforts to improve tourism in Caroline County by marketing County history through the reopening of the Linchester Mill as a historical destination and developing scenic byways. Additionally, the Chesapeake Culinary Center, initiated by the Friends of the Grape, Inc., is partnering with the Denton Development Corporation, Town of Denton, Caroline County, and Caroline County Board of Education to provide training opportunities for high school students and adults in the food service/tourism industry.

The County can help encourage economic development by encouraging unincorporated growth near municipalities and improving infrastructure and public services. Municipal growth will bring in new larger employers, encourage the growth of local shops in Downtown areas, and create a greater demand for the service industry. It may also improve the agricultural economy through an increased demand in locally grown produce and locally made goods. Additionally improving the economy, should bring in a younger population that will help provide a tax base for the public services our growing

elderly population will require.

Economic Development Implementation

- Set aside adequate land in appropriate locations for new commercial, industrial, and institutional uses.
- Support the revitalization of rural villages.
- Revise Caroline County regulations for Home Based Businesses to encourage economic development, especially that development related to agribusiness, while minimizing the impacts of home businesses on neighboring property owners.
- Support municipal Smart Growth efforts.
- Support historical tourism efforts.
- Support development of local and regional workforce training programs that target growing industry sectors.
- Support development of local and regional industries, particularly those that produce locally grown products.
- Eliminate mineral extraction/surface mining as an accepted land use in "Inter-Jurisdictional Growth Areas" and TDR Receiving Areas and amend the *Caroline County Zoning Ordinance and Subdivision Regulations* to reflect changes.

CHAPTER 7: HOUSING

A goal of the *Caroline County Comprehensive Plan* is to provide for affordable, safe, and sanitary housing for the residents of the Caroline County. Objectives for housing include:

- Providing sufficient land and infrastructure for residential development in designated Growth Areas;
- Supporting local and regional policy and regulatory initiatives that facilitate affordable housing; and
- Encouraging the preservation, revitalization, and redevelopment of the existing housing stock.

Like most areas in Maryland and the nation, Caroline County has an affordable housing issue. In regions where a strong demand and market exists for land and housing, costs have escalated dramatically. According to the Secretary of the Maryland Department of Housing and Community Development (DHCD), the median sales price of a single-family home in Maryland increased 68% between 2000 and 2004. In 2000, DHCD used a ratio of house prices to income levels and discovered that houses were affordable in every Maryland jurisdiction except Garrett and Talbot counties. By 2004, homes in all but five jurisdictions were not affordable; Allegany County, Baltimore City, Baltimore County, Harford, and St. Mary's counties. Housing affordability, based on the First-Time Buyer Housing Affordability Index created by the Maryland Association of Realtors, began improving in the second quarter of 2007. For the first time since 2005, first-time home buyers had more than half, 52 percent, the income they needed to buy their first home. Since the index has been measured, first-time homebuyers have never had 100 percent of the income they need to buy their first home. However in 2002, the index indicated that they at least had 78 percent of the income needed.

Rent increases are outpacing per capita income growth statewide. In 2004, the Governor's Commission on Housing Policy identified a statewide shortage of 157,000 affordable housing units during the subsequent 10 years. According to the Maryland Alliance for the Poor, workers including teachers, salespersons, cashiers, wait staff, service workers, janitors and food preparation staff, are not paid enough for workers to afford a two-bedroom apartment at fair market rent. This underscores the need for Maryland to look not only at housing affordability, but also the availability of workforce housing.

On the Eastern Shore, a strong housing market and limited supply of available land is caused a severe escalation in land and housing prices. Since the national sub-prime mortgage crisis home values have declined, development has slowed and there have been record numbers of foreclosures.

New development on the Eastern Shore includes a retirement market from surrounding metropolitan areas, where existing land and home prices far exceed Eastern Shore prices. As new residents move from urban areas to more rural areas such as Caroline County, new-comers spend more money on land and housing as a result of net gains in urban areas. This causes a cost upsurge created by supply and demand. The consequence is that lower-wage earners on the Eastern Shore cannot afford existing land and housing prices, which creates economic and social hardship conditions.

Current demographic trends on the Eastern Shore, primarily an aging population base, lead to the conclusion that service workers are critical to serve County residents. This includes a range of services from daily living needs to health care, construction/repair, and government services. In this regard, the County should coordinate housing plans, policies, and regulations closely with municipalities to provide adequate affordable housing served by public infrastructure.

Housing Characteristics

According to U.S Census 2000 data, Caroline County contains 12,028 total housing units. Approximately 8,223 or 68% of housing stock are owner-occupied with 2,874 or 24% identified as renter occupied. Approximately 931 housing units or 8% are vacant. Median gross rents in 2000 for the County ranged from $600 to $680. Maryland as a whole was categorized as a high rent state, along with other northeastern areas. Following the same trend as homeownership, renting has also become less affordable.

Most homes in Caroline County are single-family residential dwellings. The average household size in the County is 2.64 persons per unit and the average family size is 3.02 persons per unit. According to reports by Metropolitan Regional Information Systems, Inc. (MRIS), in 2000 the median price of single-family dwellings in Caroline County was $100,000. Median home prices increased steadily through 2007 reaching $185,000, nearly double (85 percent higher) than what it was in 2000. During the same period (200-2007), median family income rose only 32 percent, from $44,825 to $59,443. In 2008, the price of homes in Caroline County began falling. The median price of a single-family dwelling in the second quarter of 2008 was $167,750, down about 10 percent from 2007.

Table 7-1: % of Caroline County Housing by Age (1980-2000)

Housing Age	Rural Areas		Towns	
	1980	2000	1980	2000
10 Years & Less	31%	24%	15%	16%
11 - 59 Years	38%	61%	29%	50%
60 Years & Above	32%	15%	36%	34%

Substandard Housing

In September 2004, Salisbury University's Center for Family and Community Life developed the *Caroline County Substandard Housing Study – Survey and Analysis of Substandard Housing in Caroline County*

(comparison with similar study conducted in 1989). The Substandard Housing Study was designed to identify, locate, and describe substandard housing in Caroline County.

Substandard housing was assessed in comparison to a previous study developed 15 years ago. The University then mapped substandard housing locations with Geographic Information Systems – GIS to provide a geo-location and data file identifier.

The age of housing is a critical identifier for determining the level of substandard housing. As shown in Table 7-1, according to statistics prepared in the Substandard Housing Report, a majority of housing in 2000 was between 11 and 59 years old. In 1980, U.S. Census data for Caroline County indicated that 6.8% of housing units did not have plumbing. In 2000, data indicated that only 1.9% of housing units did not have plumbing, an overall decrease for all rural areas and towns. While more housing units have more plumbing, which marks an improvement, the majority of the County's housing stock is in the 11-59 year age range, which is generally the age that housing repairs become necessary more frequently. Aging homeowners are less able, physically, to perform routine housing maintenance and repairs, and those on fixed incomes are less likely to be able to afford to pay to have maintenance and repairs performed by others. This raises the potential for a number of older houses to fall into increasing states of disrepair and neglect. This is just one issue that will need to be addressed as a result of an aging population.

The Substandard Housing Study identified areas of substandard housing in the County. These primarily include mobile home parks in the northern part of the County and rural village areas. However, the Study also cited substandard housing units on unpaved County roads and within municipalities. The County and municipalities should begin discussing innovative ways to ensure that the housing stock is well maintained, such as registration of rental homes that are inspected on a regular basis and more programs to help low-income households and the elderly with home repairs. The cost of home repair can make an otherwise affordable home, unaffordable for low-income households.

Areas with failing septic systems are beginning to experience severe social and economic problems due to increasing regulatory constraints. In many cases, these problems are exacerbated when combined with sub-standard housing stock and absentee landlords. With proper infrastructure, including public water and sewer, areas in need are provided tools for revitalization and increased public/private investment in property improvement and maintenance. In the future, Caroline County should seek to develop a long-term and comprehensive strategy for serving areas in need that not only includes infrastructure and services but also revitalization and improvement to the existing housing stock. The County should seek partnerships with public and private entities, where appropriate.

The Caroline Housing Rehabilitation Program, which began in 2002, has been helping low income homeowners repair their homes. To date more than 80 homes have been rehabilitated. The program coordinates the inspections and reports and helps homeowners with the grant and assistance applications. Much of the funding for this program comes from a rehabilitation grant from the Department of Housing and Community Development, which pays for construction. Funding also has been received from the United States Department of Agriculture and Maryland Energy Assistance has helped with repairing and replacing windows and doors. The program has coordinated efforts with Interfaith Housing. Rebuilding Together, and Accessible Homes for Seniors to be able to provide more outreach. The program has also been helping with community clean up by providing dumpsters and focusing rehabilitation efforts in problem areas.

Affordable Housing

Workforce housing is providing homes that are affordable for police, teachers, nurses, firefighters and others on whom our local economies and communities depend. On a national level, five million working families pay more than 50% of their incomes for housing when the standard stipulates that less than 30% is affordable.

In Caroline County, the average monthly cost of rent in 2000 was $676, which is only 13 percent of the average income in 2000. However 37 percent of renters in Caroline County were paying 30 percent or more of their income on rent. More recent data will be available after the 2010 census. Additionally, affordable home ownership is out of reach for many low-paid employees in Maryland including retail workers and firefighters. Housing prices are outpacing income growth nationally. As evident in Table 7-2, the average housing cost burden for all homeowners has decreased, due to the rising median income and the decrease in home prices. A more accurate depiction of affordable housing in Caroline County would break down the income data by age group, so that implementation plans can address more specific needs.

Table 7-2: Estimated Home Owner Cost Burden by Year

Calculated using median income and home prices

Year	Income	Home Price	Monthly Cost	Cost Burden (%)
2000	$38,850	$100,000	$948	29
2006	$47,200	$231,000	$1617	41
2008	$47,200	$190,000	$1422	36

2008 calculated using the 2006 median income; 2006 monthly cost estimated using 2008 monthly cost to home price ratio; 2000 median income using 1999 median income

Sources: www.census.gov and MRIS and the Coastal Association of Realtors

Maryland affordable housing initiatives are important in assisting working families to live and work in the State. The Maryland Governor's Commission on Housing Policy has

provided recommendations to increase the supply of safe, accessible and affordable housing. Most importantly, these include mortgage options and closing cost assistance available under the Maryland Department of Housing and Community Development (DHCD) as well as low-interest mortgage loans to eligible low and moderate-income homebuyers through private lending institutions.

The lack of affordable housing in Maryland is critical because it causes a loss of revenue to businesses. When workers must spend higher levels of income for housing consumer spending is impacted. It also adversely impacts community safety because police and firefighters cannot afford to live in areas that they serve. Economic development is impacted creating problems for the recruitment, retention and relocation of employees.

Tools that can be used to improve workforce housing include land use planning and regulatory applications, particularly density bonuses and infill development for Caroline County and its towns. A reduction in regulatory barriers greatly assists the affordable housing market including fee waving, permit streamlining, rehabilitation code reform, and vacant property title clearance. An increase in the use of "subsidy resources," such as Community Development Block Grants from DHCD, Section 8 subsidies, housing trust funds, and tax incentives assist in housing affordability. Caroline County currently works with local affordable housing organizations to provide a reduction in property taxes for affordable housing projects.

From the homebuilding industry's perspective, the problem is partially the strong demand for housing, the market for higher income homes, and the imposition of local government fees and taxes. Coupled with a restricted supply of developable residential land caused by local growth management controls, the results are severe shortages of appropriately zoned land, approved subdivisions, and finished lots. These problems are particularly true on the Eastern Shore, where agricultural, historical, and natural resource preservation is vital to maintaining the character of the communities.

Many of these trends are evident on the Eastern Shore and in Caroline County. Local residents are seeking affordable housing and new comers are seeking less expensive housing. As supply in Queen Anne's and Talbot Counties is restricted, demand and cost will rise in Caroline County. The implications of a severe affordable housing shortage for the region are an inadequate workforce, higher consumer prices, supply induced sprawl, and a further decline in economic growth. Increasing the capacity for high density and mixed use development in towns holds the most promise for increasing the supply of affordable housing. Although, the burst of the housing market bubble has caused severe problems for both the public and private sectors, home prices are beginning to fall to an affordable level.

Caroline County does have a Caroline County Housing Advisory Board that meets quarterly and is made up of direct service agency representatives, such as government

agencies, local non-profits and development corporations. However, greater participation from County representatives should be encouraged to provide information, improve planning and implementation efforts and facilitate housing studies.

Housing Implementation

- Encourage greater participation by County and municipal representatives in the Caroline County Housing Advisory Board to review, assess and report on the state of housing and housing needs in the County, including affordability, availability, condition of housing stock, special needs housing (i.e., senior citizens), adequacy of housing assistance resources (local, state, and federal) and regulatory issues/strategies.
- Investigate the feasibility of requiring rental housing property owners to obtain a County-issued license to rent property to the public. Include annual or biennial inspection and reporting requirements as a condition of licensing. Use licensing fees to fund County housing initiatives.
- Review existing livability codes (including mobile home regulations) for adequacy and relevance. Update where necessary and appropriate.
- Create regulatory incentives to encourage timely repairs and/or rehabilitation of older housing stock.
- Facilitate the renovation of older housing stock by providing greater access to resources, such as a packet with regulations, contacts and other helpful information.
- Consider creating regulatory incentives for adaptive reuse of older housing stock, for example, allowing a Bed and Breakfast as a use in residential zoning districts provided it be subject to 30-Day objection procedures, rather than requiring a special use exception.
- Explore opportunities to expand hands-on and/or financial assistance to older or special needs homeowners for maintenance and/or repairs to older structures through the Caroline County Housing Rehabilitation Program.

IMPLEMENTATION

The purpose of the implementation chapter is to compile the implementation goals in the chapters of the comprehensive plan and to discuss priorities and feasibility of implementing these goals.

Land Use

- Work with the towns to develop a mutually beneficial inter-jurisdictional growth program that will utilize the County's TDR sending rights and provide wastewater treatment to new development to reduce nutrient pollution into the County's waterways.
- Update and revise the Caroline County zoning and subdivision regulations to incorporate appropriate zoning districts, zoning provisions/changes, and development. Existing laws should also be enhanced and zoning classifications reviewed.
- Establish appropriate setbacks, buffers, and other regulatory standards that apply to the diverse uses located in the rural zoning district.
- Complete a comprehensive rezoning for the entire County.
- Establish rural design standards, such as buffers from main highways and design standards for developments in TDR receiving areas.
- Undergo a review of the TDR receiving area locations and regulations to ensure the continued effectiveness of the program.
- Review the Adequate Public Facilities regulations.

Objectives

The goals of the land use chapters fall under two larger tasks - the update and revision of the Caroline County zoning and subdivision regulations and the comprehensive rezoning of the entire County. During these tasks, appropriate setbacks, buffers, and other regulatory standards should be evaluated and included in revisions. The rural design standards would are an example of regulations that need to be developed for inclusion in the revision of the zoning and subdivision regulations. All of the implementation goals for the land use chapter will likely be in the process of implementation before the plan has been adopted. This is due to their significance to the County's ability to manage growth and the desire to undergo these changes while growth has been stalled by the economic downturn being faced by the United States. The code revisions should be completed before the end of 2010 and the comprehensive rezoning should be completed before the end of 2011. The deadline allows for ample time to study the county's natural resources, economic needs, and municipal and public goals. Those resources, needs and goals should be balanced with the need to manage growth.

Water Resources

- Explore methods of reaching 100 percent implementation of nutrient management plans on County farms.
- Work with MDA staff to review regulatory and preservation programs to ensure that they are structured to provide maximum encouragement to farmers to file and implement Soil Conservation and Water Quality Plans.
- Work with USDA and NRCS staff to review County regulatory and preservation programs to ensure that they provide maximum encouragement to farmers to participate in cover crop cost share programs.
- Review the feasibility of increasing the width of Conservation Reserve Program buffers in areas where increasing the buffer width will improve nutrient reduction efficiency.
- Explore the feasibility of creating a County Ditch Overlay District that includes roadside ditches and public drainage ways, as well as designated buffers adjacent to ditches that would facilitate the development of uniform ditch maintenance standards for all drainage ways in the County.
- Explore the feasibility of installing and maintaining drainage control structures in ditches.
- Recommend that the County's Agricultural Preservation Advisory Board amend the stewardship practices criteria used in the prioritization formula to give credit for only full implementation of nutrient management plans and to add credit for participation in other State and Federal conservation programs.
- Recommend that ESLC revise its standards to include required implementation of conservation and nutrient management plans, and award extra credit for farmers who implement additional agricultural BMPs.
- Explore ways to encourage the retirement of highly erodible and potentially highly erodible agricultural land through the Conservation Reserve Program.
- Work with NRCS to explore the feasibility of developing a system to track and quantify voluntary best management practices to reduce nutrient loads by County farmers.
- Explore the feasibility of developing programs to implement BMPs suitable for residential, commercial, institutional and industrial land to reduce the pollution load delivered to the County's tributaries from developed land.
- Explore the impacts and feasibility of requiring all new homes in TDR receiving areas to install systems utilizing best available technology, unless connected to a sewer treatment facility.
- Continue working on the completion of the North County sewer treatment facility.
- Propose revisions to County development regulations to include environmental site design techniques.
- Propose revisions to Stormwater Management Regulations to include revisions

made in the State's new Stormwater Management Act and Stormwater Design Manual.

- Where possible include or retrofit Environmental Site Design and Low Impact Development Demonstration Projects on County Properties.
- Investigate the feasibility of a Transfer of Development Rights (TDR) program for land zoned R-1.
- Investigate options to extinguish development rights in the rural zone (e.g. IPA or PDR programs).
- Develop outreach materials for property owners regarding voluntary stewardship programs through DNR.
- Work with municipalities to coordinate planning efforts that will hook up septic systems where feasible to waste water treatment plants, as well as reduce point source loads.

Objectives

Goals and strategies discussed in the Water Resources chapter are aimed to reduce non-point and point source nutrient loads County-wide for agricultural and developed land. The majority of strategies focus on ways to reduce loads from agricultural land because it represents the largest source of nutrient loading and land use in the County. Other strategies include best management practices for developed lands, as well as methods to improve and/or reduce individual septic systems used in the County. Many strategies include better utilizing or expanding existing programs through property owner education and cooperation with State agencies.

Resource Conservation

- Implement the goals and objectives of the *Chesapeake 2000 Agreement*.
- Update and revise the *Caroline County Chesapeake Bay Critical Area Program & Regulations* and *Chesapeake Bay Critical Area Maps for Caroline County.*
- Work with appropriate State and Federal agencies develop more accurate natural resource maps.
- Research methods for improving the County's community rating in the National Flood Insurance Program.
- Work with stakeholders to develop a County-wide historic preservation plan.
- Develop target preservation areas in greenbelt and agricultural conservation areas to concentrate and maximize investments from local, State, and Federal preservation and conservation initiatives.
- Support and participate in public programs and private conservation initiatives that have similar objectives with the County's agricultural preservation program.
- Work with municipalities to design and implement interjurisdictional Transferable/Purchase of Development Rights programs to balance preservation

with new development.

- Encourage the Maryland legislature to raise the Agricultural Excise Tax limit for Caroline County to a maximum of $5,000 and to allow the collection of Excise Tax to be at the time of subdivision, rather than at the time of deed transfer. This includes revising the local existing Excise Tax Law.
- Eliminate large-scale mineral extraction/surface mining operations (20 acres or more) as an accepted land use in the defined Chesapeake Bay Critical Area and amend the *Caroline County Critical Area Program and Regulations* to reflect changes.
- Prepare site development and performance standards for mineral extraction facilities that address site reclamation, infrastructure improvements, protection of adjacent properties, truck routes, hours of operation, and landscaping and maintenance standards.
- Review code for historic preservation provisions.
- Explore the merits of developing protection standards for steep slopes located outside of the Critical Area.
- Review timber harvest guidelines to determine if they should more closely match the timber harvest guidelines for properties located within the Critical Area.
- Review the need to prepare a forestry management plan.

Objectives

Resource conservation goals work together to further implement conservation measures, create better tools for determining how environmental resources affect development, gain an understanding of our historic resources and how to preserve them, and strengthen the agricultural economy in the County.

The implementation of conservation measures includes updating and revising the Caroline County Chesapeake Bay Critical Area Program, Regulations and maps, improving the County's community rating in the National Flood Insurance program, and developing target preservation areas in greenbelt and agricultural conservation areas to concentrate and maximize investments from local, State, and Federal preservation and conservation initiatives.

The County should work with stakeholders to develop a County-wide historic preservation plan. There are currently no regulations that protect the historic resources of the County, which are essential to the character of the County and potentially beneficial to the local economy. Stakeholders should include municipalities, county residents, business owners, the historical society and the Caroline Economic Development Corporation to ensure that preservation efforts of the County are coordinated effectively with municipalities.

Strengthening the agricultural economy of Caroline County is important to the history, the character, and the way of life resident enjoy. Finding ways to ensure the strength of our agricultural economy is imperative, as we try to balance agriculture with environmental concerns. Supporting and participating in public programs and private conservation initiatives will assist the County in meeting land preservation goals. Additionally, working with the municipalities to design and implement interjurisdictional transferable or purchase of development rights programs will encourage growth around existing infrastructure, help preserve farm land, and potentially add another layer of validity to municipal growth areas, if the growth in the County is encouraged in municipal growth areas.

Community Facilities

- Coordinate with surrounding jurisdictions for the enhanced planning of private health and medical facilities for the Upper and Mid-Shore areas.
- Review the Adequate Public Facilities Ordinance" and explore the appropriateness of impact fees to address demand on public facilities and services created by new development.
- Coordinate planning between the County, municipalities and Board of Education to provide adequate public infrastructure to areas in need.
- Examine the coverage areas of communication service providers and gaps in coverage from communications towers for consideration when reviewing communication tower applications and completing emergency services planning.
- Explore methods of improving Caroline County's recycling program.

Objectives

Although community facilities are generally located near population centers, such as municipalities, it is important that the County work with municipalities to ensure that adequate public facilities are provided for both municipal and county residents. The entire County Department of Emergency Management is relied on heavily by all County jurisdictions. Public recreational facilities located in municipalities may be utilized by residents outside the municipality as well. All the proposed implementation goals in the Community Facilities chapter are aimed at improving access to public facilities and making sure that there are adequate public facilities for County residents.

Transportation

- Provide input as needed to the Department of Public Works to identify and prioritize County roads and bridges for future construction, upgrades, and/or improvements.

- Request signage in appropriate locations on State Highways that indicate that vehicular traffic is entering an agricultural area.
- Work cooperatively with the County's transportation provider to improve access to public transportation.
- Support tourism transportation initiatives that are beneficial to the County.
- Continue to be an advocate of the dualization of Maryland Route 404.
- Continue to work to acquire the Ridgely Airpark.

Objectives

In Caroline County transportation services will become increasingly important as the population ages. Transportation and communications infrastructure are both important to tourism and economic development efforts. The overarching goal of this chapter is to cooperate with transportation-oriented agencies to provide a safer transportation system.

Economic Development

- Set aside adequate land in appropriate locations for new commercial, industrial, and institutional uses.
- Support the revitalization of rural villages.
- Revise Caroline County regulations for Home Based Businesses to encourage economic development, especially that development related to agribusiness, while minimizing the impacts of home businesses on neighboring property owners.
- Support municipal Smart Growth efforts.
- Support historical tourism efforts.
- Support development of local and regional workforce training programs that target growing industry sectors.
- Support development of local and regional industries, particularly those that produce locally grown products.
- Eliminate mineral extraction/surface mining as an accepted land use in "Interjurisdictional Growth Areas" and TDR Receiving Areas and amend the *Caroline County Zoning Ordinance and Subdivision Regulations* to reflect the changes.

Objectives

The main objective of the economic development chapter is to create strategies to foster appropriate economic development. All the implementation goals for economic development require reassessing locations of County zoning districts and the uses that are permitted within them. All of these concerns should be addressed during the comprehensive rezoning process.

Housing

Encourage greater participation by County and municipal representatives in the Caroline County Housing Advisory Board to review, assess and report on the state of housing and housing needs in the County, including affordability, availability, condition of housing stock, special needs housing (i.e., senior citizens), adequacy of housing assistance resources (local, state, and federal) and regulatory issues/strategies.

- Encourage greater participation by County and municipal representatives in the Caroline County Housing Advisory Board to review, assess and report on the state of housing and housing needs in the County, including affordability, availability, condition of housing stock, special needs housing, adequacy of housing assistance resources and regulatory issues and strategies.
- Investigate the feasibility of requiring rental housing property owners to obtain a County-issued license to rent property to the public. Include annual or biennial inspection and reporting requirements as a condition of licensing. Use licensing fees to fund County housing initiatives.
- Review existing livability codes (including mobile home regulations) for adequacy and relevance. Update where necessary and appropriate.
- Create regulatory incentives to encourage timely repairs and/or rehabilitation of older housing stock.
- Facilitate the renovation of older housing stock by providing greater access to resources, such as a packet with regulations, contacts and other helpful information.
- Consider creating regulatory incentives for adaptive reuse of older housing stock, for example, allowing a Bed and Breakfast as a use in residential zoning districts provided it be subject to 30-Day objection procedures, rather than requiring a special use exception.
- Explore opportunities to expand hands-on and/or financial assistance to older or special needs homeowners for maintenance and/or repairs to older structures through the Caroline County Housing Rehabilitation Program.

Objectives

The goals of the housing chapter are to improve the existing housing stock and create more affordable housing. These goals can be accomplished through code review and greater participation in the Caroline County Housing Advisory Board. Even with the economic downturn housing has not reached affordable levels for the majority of the population, indicating a need that most likely stems from a combination of factors, including: low density housing patterns, insufficient multi-family housing available near municipalities, an increasing aging population, and insufficient employment opportunity.

CAROLINE COUNTY
COMPREHENSIVE PLAN
GENERAL APPENDIX

DRAFT 2009

Table of Contents (General Appendix)

Caroline County Comprehensive Plan

Meeting Minutes of the External Comprehensive Plan Team

Wednesday, April 9, 2008

Health and Public Services Building, Denton

Attending: Terry Fearins, Town of Denton; Cheryl Lewis, Town of Templeville; Bruce Galloway, Town of Greensboro; Jeannette DeLude, Town of Greensboro; David Kibler, Town of Greensboro; Bill Cooper, Town of Hillsboro; Debbie Rowe, Town of Marydel; Betsy Walk, CC P&C; Allison Dungan, CC P&C; Nick Chamberlain, CC P&C; and Katheleen Freeman, CC P&C.

The majority of the discussion centered on the best way to get the public involved early, however we also discussed our goals for the Comprehensive Plan, the best way to organize the comprehensive plan and our existing resources.

It was brought up to look for resources in places that aren't obvious, such as the market analysis done by Wal-Mart for their new Denton location. Cheryl Lewis also stated that we should be sure to read the comp plans and comments on other jurisdictions available on the MDP web site.

We determined that since this is the first truly comprehensive plan for the entire county in a 20+ years that we should stick to the format outlined in 66B. An afterthought to make the Comp Plan more accessible to the public would be to do another document that would be highlights of the comp plan or something along those lines. It was also brought up that more attention should be paid to the regional landfill, airport and the broadband that will be making a loop through Ridgely and what effects these projects may have. It was also suggested that Interjurisdictional TDRs be given additional thought.

Regarding public involvement several ideas were tossed around and we settled upon having public meetings centered on specific topics that catered to our interest groups preliminarily so that we can include their concerns in our plan. Following those preliminary meetings we would have public meetings in each region of the County in an attempt to reach the most citizens and present the findings of these groups, comp plan goals, and get additional feedback.

Prior to the next meeting, internally, we need to determine our topics/interest groups to target for the preliminary meetings and set up an outline of meeting dates for the public meetings and meetings of the external team, so that it can be distributed to our external team.

Caroline County Comprehensive Plan
Meeting Minutes of the External Comprehensive Plan Team
Tuesday, June 10, 2008
Health and Public Services Building, Denton

Attending: Bill Kastning, Town of Denton; Cheryl Lewis, Town of Templeville; Debbie Rowe, Town of Marydel; Nancy Gearhardt, Citizen of Ridgely; Betsy Walk, CC P&C; Allison Dungan, CC P&C; and Katheleen Freeman, CC P&C.

The first order of business was to reschedule the September external team meeting which was previously set for Labor Day to September 2, 2008. Ms. Lewis affirmed that she would now be the circuit rider for all four northern Towns and provided her contact information.

Ms. Walk and Ms. Dungan updated the team on comments made during the public meetings that had been held. Among the issues that the public seemed most concerned about were growth, tying TDRs to Towns and Greenbelts, preserving open space, improving the County economy, preserving agricultural heritage and supporting the farming community, while expanding the County's focus on agriculture to include additional types of economic development and preservation of additional resources in the County.

The conversation then moved to how the County was going to write the comprehensive plan to include the municipalities and to what capacity the Department would be able to provide assistance to Towns with their comprehensive plans. It was determined that most Towns already have comprehensive plans to work with and the County would provide assistance as necessary, particularly with the WRE (previously agreed upon) and the municipal growth element. It was determined that Ms. Walk would begin working with Ms. Lewis on the Town of Templeville and work south with each Town, so that when it came time to work with the larger Towns a system will already be in place.

Ms. Freeman discussed briefly that she would be talking with Ray Anderson of MDE about the Water and Sewer Plan to determine if we can do an update for know to accommodate the needs of the North County Water and Sewer Project or if the whole plan will need to redone at this time.

Mr. Kastning requested that the external team keep minutes of their meetings, so that we would have documentation of the work being completed to report to Town Councils and superiors. Ms. Walk indicated that she had been keeping notes of the meetings and it would be no problem to put these in the format of minutes.

Ms. Dungan informed the team that Ms. Walk would now be the primary comprehensive plan contact, but if that specific questions about the WRE or if Ms. Walk was unavailable they could certainly contact her.

The meeting was adjourned at 12 p.m. The next meeting will be held July 1, 2008.

Caroline County Comprehensive Plan
Meeting Minutes of the External Comprehensive Plan Team
Tuesday, July 1, 2008
Health and Public Services Building, Denton

Attending: Bill Kastning, Town of Denton; Cheryl Lewis, MRDC; Bruce Galloway, Town of Greensboro; Sue Simmons, Recreation and Parks; Milton Nagel, Board of Education; Bryan Ebling, Emergency Management & Office of Technologies; Cindy Towers, Emergency Management; Nick Chamberlain, CC P&C; Betsy Walk, CC P&C; Allison Dungan, CC P&C; and Katheleen Freeman, CC P&C.

The meeting began with Ms. Walk introducing the draft of the land use chapter. She explained that the previous plans did not follow 66b precisely, so some of the chapters from the previous plans have been included in the land use chapter, rather than being eliminated or set aside as their own distinct chapter. The Land Use Chapter will include information on current and future land use, land preservation and conservation, heritage preservation, economic development, housing and implementation measures. Ms. Walk stated that she started drafting the chapter with the West County plan language, as it was the most recent planning document; while adjusting the specific language to make it general to the entire County. Next she highlighted any statistics that need to be verified or updated and identified maps that needed to be modified or created. As Ms. Walk works with the municipalities she will continue to update the mapping, statistics and language as needed.

Ms. Walk stated that she still needs a current County land use map that shows municipal growth areas and greenbelts, comprehensive plans from a couple Towns, and a decision on the growth percentage the County would like to set as a goal. That percentage goal is currently at 2 percent and there have been concerns from the public that 2 percent may be too high. Individuals present at the meeting questioned the necessity of setting such a number since the County cannot effectually control all growth to meet a set number. The discussion then moved on the interjurisdictional growth areas and greenbelts. Ms. Walk asked how municipalities felt about these growth management tools and how they are currently operating. Mr. Ebling requested the definition of greenbelts.

Ms. Walk explained that it is an area surrounding a municipality that is marked for preservation to prevent growth of a municipality beyond its predetermined growth area. Mr. Galloway agreed and added that the greenbelt around Greensboro is mostly forested with very light development and agricultural lands. Ms. Freeman mentioned that the County's TDR Receiving Area may conflict with one or more of the proposed greenbelts. That appeared to be true when comparing maps, so the problem was noted as something that needed to be resolved in the plans. It was mentioned that the TDR receiving area might be better located around the municipalities and that the County is having very preliminary discussions about the possibility of an interjurisdictional TDR program. Ms. Simmons expressed concern, however, that the TDR program and potentially upcoming discussions are centered more on agriculture than on recreation and parks or heritage preservation which has been included in the land use chapter. She said that the elephant in the room is where is the funding going to come from for these preservation initiatives.

Ms. Dungan initiated discussion on the community facilities chapter. A PowerPoint presentation outlining the purpose of the chapter, what information needs to be included and posing some questions was delivered. Ms. Dungan explained that the definition of community facilities provided by 66B needed to be more accurately defined to clarify what facilities are included in the plan, as semi-public. She added that she felt it was in our best interest to be as comprehensive as possible, but wanted to know from the group what facilities should be included and how they would determine semi-public. Among the buildings, lands, and facilities that she listed to include in the plan were: recreation and parks facilities, educational facilities, emergency services stations, public health services buildings, police stations, court houses, legal services, child care services and senior care services. In general it was agreed that child care services and organizational buildings should be included in the chapter and that when in doubt, if an organization receives any public funds, it should be included in the chapter. This included but is not limited by the following suggestions made by the group: libraries, public works buildings, houses of worship, nursing homes and assisted living facilities, half-way houses, cemeteries, museums and structures, correctional facilities, shelters, Raritan, Rotary, FFA, Lions, and organizations that may not have a specific building like boy scouts, girl scouts and 4H.

Ms. Dungan then asked the group where they thought communication facilities belonged in the comprehensive plan. She expressed that during an internal meeting, staff was unsure where these facilities should go because they are not public or semi-public, but do provide public services and are influenced by local governments. County planners were taking into consideration that their nature is similar to transportation because they are infrastructure and they impact economic development and land use. The external team consensus was that it should be included in community facilities because that is where infrastructure would generally be located within their municipal plans. Ms. Dungan suggested making the transportation chapter transportation and infrastructure, but the final decision will be made by the internal team.

Before the meeting was adjourned, Ms. Dungan reminded the group that the department would appreciate feedback on the process and on these external meetings, especially this one, since it was the first discussion of chapters. Mr. Kastning stated that he thought that good discussion had come out of the meeting today. Mr. Galloway said that he had a quick comment on the land use chapter, which was to be more specific in the implementation section regarding what is priority, why, and goals for completion. He stated that it is the first section municipalities will read because they want to know what the County is going to do. Ms. Walk thanked him for his comments, adding that suggestions such as his were going to make the comprehensive plan much stronger.

Ms. Dungan, Ms. Freeman and Ms. Walk thanked those who came to participate and the meeting was adjourned at approximately 11: 30 p.m. The next meeting will be held August 1, 2008 and will discuss Areas of Critical State Concern. The meeting will also provide an opportunity for anyone to make comments regarding the land use and community facilities chapters and address the new municipal chapters to be included in the comprehensive plan.

Caroline County Comprehensive Plan

Meeting Minutes of the External Comprehensive Plan Team

Wednesday, November 5, 2008

Health and Public Services Building, Denton

Attending: Cheryl Lewis, MRDC Circuit Rider for North County Towns; Bruce Galloway, Town of Greensboro; Bill Kastning, Town of Denton; and Betsy Walk, Allison Dungan and Nick Chamberlain, CC P&C.

The meeting began at 1:30 p.m. Nick Chamberlain began the meeting by discussing his methodology for the development capacity. Mr. Chamberlain had prepared a draft outline to distribute to all those present at the meeting and explained his process. He stated that he was concentrating on lands outside of the municipal priority funding areas because the Eastern Shore Regional GIS Cooperative is completing a municipal build out analysis for all the Towns but those covered in the North County Comprehensive Plan because Peter Johnston did a build out analysis for them at the time the plan was written. Those present agreed that Mr. Chamberlain's proposed method for handling the development capacity seemed reasonable and accurate.

There was a brief discussion of the accuracy of the incorporated limits, growth areas and greenbelts currently depicted on the land use map. There being no further discussion the meeting was adjourned.

Caroline County Comprehensive Plan

Meeting Minutes of the External Comprehensive Plan Team

Monday, Dec. 1, 2008

Health and Public Services Building, Denton

Attending: Amy Owsley, Eastern Shore Land Conservancy (ESLC); Jacob Day, ESLC; Bruce Galloway, Town of Greensboro; and Kevin Clark, Leslie Grunden, Betsy Walk, Allison Dungan and Nick Chamberlain, CC P&C.

The meeting began at 10:10 a.m. Ms. Walk stated that the purpose of the meeting was to take comments on the draft chapters of the County comprehensive plan and for Ms. Grunden to talk about her work on the water resources element (WRE).

Ms. Walk asked if Mr. Galloway had any comments on the draft chapters. Mr. Galloway apologized, stating that he had not yet had a chance to review them. Ms. Walk stated that the chapters were a work in process and because the maps and growth scenarios were not complete more changes to the draft would be made. Mr. Galloway suggested giving the municipalities a deadline to comment on the existing draft chapters.

Ms. Walk turned the meeting over to Ms. Grunden to discuss the WRE. She asked Mr. Galloway if he would be preparing the WRE for the Town of Greensboro. He stated that the town received a grant and is hiring a consultant to prepare the element. He did state that he as already prepared information for the consultant. Ms. Owsley stated that she believed the grant to be a HUD grant. Ms. Dungan added that the four northern Towns have received HUD grants to complete their WREs and municipal growth elements (MGEs).

Ms. Grunden asked Mr. Chamberlain to explain the build out analyses performed by the Eastern Shore Regional GIS Cooperative (ESRGC) and the development capacity done by Maryland Department of Planning (MDP). Mr. Chamberlain stated that the build out analyses were requested by the County for Greensboro, Ridgely, Denton, Preston and Federalsburg, however ESRGC was unable to get information from Federalsburg to complete the analysis. Mr. Chamberlain then explained that MDP has their own GIS layers and well as some that were provided by our department that they use to run their own growth analysis based on density allowed in our zoning districts. He stated that Melissa Appler with MDP can run the numbers for him. Mr. Clark added that they will ultimately be doing a hybrid of MDP's analysis because of the additional restrictions to the R-Rural Zoning District that MDP does not take into account.

Ms. Grunden then discussed her work on the water section of the WRE, with particular attention to her study of aquifer information. She stated that Agricultural uses are the main source for nutrient loading and that would have to be addressed in the plan. She also added that Piney Point had the most recent aquifer information and it was dated 1998.

She stated that according to that study the Piney Point was not in any trouble. In her research, she said that the Aquia is the only aquifer that experiencing severely low water levels (mainly in urban areas). She said that Anne Arundel County has already indicated that they need to stop using the Aquia and start tapping into the Magothy aquifer, which is deeper. Ms. Grunden indicated that she expected to have a working draft of the WRE by the end of January.

Ms. Owsley asked Ms. Walk what the status of the comprehensive plan was as a whole. Ms Walk indicated that today is the date of completion for draft chapters, which was the reason for the meeting. Ms. Dungan added that the chapters are on the Planning Commission agenda for discussion December 10th. She stated that there were no further plans for public participation at this time because all efforts have been put into the completion of a draft, but that after the New Year she imagined a new timeline would be put together and additional public involvement would be considered. Ms. Walk added that since Ms. Owsley was probably last involved in a discussion of the comprehensive plan, the format has changed a bit. Originally the plan was to have two-part comprehensive plan. The first part would be the County plan and the second part would be municipal chapters. The municipal chapters came out of the idea that we would all be able to do one WRE. Since talks with the State and our own staffing issues, it was determined that we could not all have the same WRE and that the County would be unable to provide as much assistance as it had hoped. Therefore the municipal chapters would only be a reiteration of the hard work the Towns have already put into their own plans, so the chapter idea was put aside. We've since decided that the Town's information would be included throughout the plan where it is pertinent.

Ms. Owsley then introduced Jacob Day, the new planner for ESLC that will primarily be working with municipalities on the Eastern Shore. She stated that ESLC's main focus is conservation and sound land use planning. She stated that they have learned that their primary focus regarding land use planning needs to be on the municipalities. Ms. Owsley said that municipalities are facing the brunt of the pressure from developers giving them various scenarios for growth. She stated that the assistance they will provide to the Towns includes assistance with HB1141 in the form of networking and resources.

Mr. Day then stated that his first two weeks were dedicated to going from town to town to learn where everyone is located. He added that his priority is gaining an understanding of where the needs are and categorizing them. His focus has been on Denton for the past week but will be moving on soon. Mr. Day indicated that he will be working with towns from all over the Eastern Shore and is looking forward to it.

Mr. Galloway asked Mr. Day if he would be limiting himself to assistance with HB1141. Mr. Day stated that at this time HB1141 would be his primary focus. Mr. Galloway asked him to consider assisting with the new Chesapeake Bay Critical Area law as well. He stated that most of the Towns will hire a consultant to meet the requirements of HB1141; but that the Critical Area law is already in force and we do not know what the law is yet. He added that the Critical Area Commission has finished all the guidance documents or worked out all of the new problems created by this law which is making enforcement and

the adoption of compliant local code difficult. Ms. Dungan agreed and specified some of the various issues with the new law that pose a problem. The main example provided was that decks are not considered lot coverage by the law but gravel is and many local codes required gravel be placed beneath decks. Once the gravel is placed beneath the deck, the deck must be counted as lot coverage.

Ms. Walk asked if anyone had anything further to discuss. Mr. Galloway asked Ms. Walk to provide the municipalities with a deadline for submitting comments on the draft chapters that they received in preparation for this meeting. Ms. Walk agreed and the meeting was adjourned.

Caroline County Comprehensive Plan Public Meeting
Educational and Recreational Facilities Summary
May 5, 2008, 6:30-9:00 PM, HAPS Building

Attendees: Margaret Iovino, Citizen; Bill Kastning, Town of Denton; Sandy Berry, Caroline County Board of Education member; Milton Nagel, Caroline County Public Schools; Sue Simmons, Caroline County Recreation and Parks; and Allison Dungan, Betsy Walk, Katheleen Freeman, Nick Chamberlain, and Stacey Weisner with Caroline Planning & Codes Administration.

The first public meeting to address citizen interests in planning for the County Comprehensive Plan was held May 5, 2008 and was dedicated to the discussion of Education and Recreational Facilities. The Department of Planning and Codes (Planning) advertised all of the Comp Plan Public Meetings in the Times Record, posting flyers and through email. Ms. Weisner added the Department was appreciative of Mr. Nagel arranging to have the e-mail forwarded to PTA groups and schools. It was noted that the meeting date was advertised with a school newsletter.

Sue Simmons, Director of Recreation and Parks led a discussion on the County's programs followed by a discussion on the County's Education facilities and plans by Milton Nagel, Chief Operating Officer of Caroline County Public Schools. Ms. Simmons explained to the group that the Recreation and Parks Department completed a Land Conservation and Recreation Plan in 2005 in order to justify its use of Program Open Space funding. The report integrated protected recreational and park space as with the land preservation program. The report set a goal for attaining 370 acres within the next ten years. It identified a need for 4 community and neighborhood parks, an indoor community recreation facility, 2 swimming pools, and new or rehabilitated water access points. The Parks Program works mostly to acquire and support active forms of recreational use, such as ball fields and playgrounds, as opposed to preserved open space for passive use, such as resource conservation.

Some of these needs may be met through more collaboration between the school system and the Recreation and Parks department. North Caroline High School is currently being made available to the public for fitness activities and doing so allowed for the school to get monetary support for the construction of the facility. They plan on doing a similar collaboration with the renovation of Colonel Richardson High School.
Milton Nagel also shared information about planning that the school system is doing for the future of the education facilities. He explained that while the County had not had a school built in many years, a new school would need to be built in the foreseeable future to handle student capacity especially in the elementary age group. The County currently utilizes 15 relocatable classrooms and the school systems anticipates that the location of a new facility will cause much debate because there is not one single area which is growing fast enough to

warrant a new facility, thus students may have to be redistricted and bussed to the new location. Currently the county is renovating its existing facilities when they reach an age of 40 years old in order to receive the maximum amount of funding from the State.

Mr. Nagel provided a Facility Needs Analysis. The meeting was adjourned at 9:00 pm.

Caroline County Comprehensive Plan Public Meeting
Transportation and Emergency Services Summary
May 22, 2008, 6:30-8:30 PM, HAPS Building

Attendees: Betsy Walk CC P&C; Katheleen Freeman CC P&C; Margaret Iovino, Citizen; Joanne Shipley, Citizen; Robert Clendaniel, Citizen; Sarah Pearce, Times Record; Albert Lee Cheezum, Citizen; and Thomas E. Cheezum, Citizen.

The second public meeting to address citizen interests in planning for the County Comprehensive Plan was held May 22, 2008 and was dedicated to the discussion of transportation and emergency services. There were no planned presentations for this meeting. The floor was open for comment and citizen led discussion.

The overall discussion centered around transportations in and around the Towns, particularly Preston and Denton. Citizens representing Preston were concerned about the proposed Preston Bypass. They felt that if there were a bypass it should go behind the school, but did not think Preston needed a bypass because it would be detriment to the businesses in Town. The citizens felt that growth in the Town needed to be stopped. A citizen from the Town of Denton expressed concern about the impending Wal-Mart and the affect that the super store would have on traffic, particularly at the intersection of Maryland Route 404 and Legion Road.

According to Smart Growth Principles governing planning in the State of Maryland, growth should be directed to existing towns and population centers. So the conversation naturally progressed into the topic of growth and how to slow it down or prevent it. Ms. Walk stated that the population was projected to grow, so it is a matter of managing the growth more than preventing it. One citizen mentioned further down-zoning County land, so that agricultural land could not be further subdivided. Ms. Walk agreed that down-zoning may work, but that much of the agricultural community relies on the ability to subdivide their land to secure income for retirement and that down-zoning may not be well received.

Emergency services were discussed briefly. Citizens expressed concern that the current services would be insufficient as the population grows. Citizens mentioned that there is a way to make developers provide things like fire trucks, ambulances, emergency care clinics and the like, however the pain of growth is felt more in the long term expenses such as those related to personnel and that developers would not agree to pay for the salaries of additional emergency services personnel. A citizen suggested the possibility of having developers pay into a fund for emergency services based on the number of units that would be able to provide funding for the expansion of services as the population grows. The overwhelming sentiment of the citizens that evening being that they should not have to pay to prepare for a growth in population that they do not want. The citizens would like to see the developers paying more for these services that will

be affected by the incoming population.

The meeting was adjourned at 8:30 pm.

Caroline County Comprehensive Plan Public Meeting
Residential Development Summary
May 28, 2008, 6:30-8:30 PM, HAPS Building

Attendees: Betsy Walk CC P&C; Katheleen Freeman CC P&C; Nick Chamberlain, CC P&C; Tammy Buckle CC P&C; Margaret Iovino, Citizen; Joanne Shipley, Citizen; Robert Clendaniel, Citizen; Dan Devilio, Times Record; Albert Lee Cheezum, Citizen; Nancy Gearhart, Citizen; Jimmy Todd, Citizen and Trish Todd, Citizen.

The third public meeting to address citizen interests in planning for the County Comprehensive Plan was held May 28, 2008 and was dedicated to the discussion of residential development. Ms. Walk opened the meeting by introducing Ms. Buckle, who made a brief presentation on the County's transferable development right (TDR) program. The TDR program was introduced as a more recent attempt by the County to control and direct growth to existing population centers. Following the presentation the floor was opened to the public for questions, comments, and concerns.

The majority of the evening was spent fielding questions about the TDR program and agricultural preservation programs. Other questions raised by the citizens included: What else can be done to manage growth? Can we cap growth? Is there a way to discriminate between professional developers and regular citizens when it comes to developing a fee schedule that would discourage growth in the County?

What else can be done to manage growth?

One of the ways that was discussed to manage growth is through zoning, which Ms. Walk stated that the County would be going through the Comprehensive Rezoning process in the coming year. Ms. Buckle added that the rezoning process would be highly publicized. A citizen asked how long it had been since the County had been rezoned and who did the original zoning of the County? Ms. Buckle stated that the County had not been comprehensively rezoned since the original zoning and that she was not sure who had done the original zoning of the County in the 60s.

Additionally, the potential for including Towns in the TDR receiving area and how to go about doing that was added as an option to further manage growth. Ms. Buckle responded that there were some preliminary discussions about how to do that so that Towns would also be benefiting from the cooperative effort. Ms. Buckle added that she would be at the next Denton Planning Commission Meeting to start discussion on this topic between the County and the Town of Denton.

Can we cap growth?

No, we can not legally state that the County's population has reached its desired number or percentage of growth for the year and then stop permitting subdivisions until the following year.

Is there a way to discriminate between professional developers and regular citizens when it comes to developing a fee schedule that would discourage growth in the County?

At the meeting it was stated that it is unknown if this is a legal way to manage growth, however the majority of subdivision currently happening in the County is the result of minor subdivisions (four lots or less) by regular County citizens. This change has been the result of the recent changes to the TDR program which do no allow major subdivisions in Rural zoning districts, which encompasses the majority of the County.

The meeting was adjourned at 8:30 pm.

Caroline County Comprehensive Plan Public Meeting
Environmental Interests Summary
June 4th 2008, 6:30-9:00 PM, HAPS Building

Attendees: Allison Dungan, CC P&C; Katheleen Freeman CC P&C; Nick Chamberlain CC P&C; Stacey Weisner CC P&C; Eric Frase, Citizen; Nick and Margaret Carter, Citizens; Thomas Cheezum, Citizen; Albert Cheezum, Citizen; Jason Willey, Citizen; Angel Bollinger, Citizen; Francis Scott, Citizen.

Environmental Interest Group Meeting, emailed comments:

Jason Willey: **1)**Laying the policy groundwork in the master plan for eventually codifying stopgaps to address deficiencies in State and Federal environmental legislation is appropriate and prudent. I see more stringent performance standards for wetland and forest mitigation sites (and strict enforcement of those standards) as particularly appropriate issue for the County to address in the Comp Plan process. **2)** Implementing a "no net loss" policy for forested land and wetlands in the critical area, including IDA and LDA, would be appropriate. **3)** Following the State's process for regulating chicken manure storage, to see if opportunities exist for practicable enhancement of the State's proposed controls at the County level. **4)** Providing more opportunities for recycling of waste products that are currently difficult to recycle locally, including non-corrugated cardboard, compact fluorescent light bulbs, and electronic equipment.

Nick and Margaret Carter: **1)** Preserve as much natural habitat as possible for wildlife and human recreation. Encourage greenbelts around municipalities, green spaces in developed areas, and preserve natural corridors for wildlife. **2)** Since trees clean and cool our air, improve our water, and provide wildlife habitat, protection of our forests should be a priority and tree planting should be strongly encouraged in developed areas. **3)** Protect and IMPROVE the water quality in the tributaries and main branches of the Choptank, Tuckahoe, and Marshyhope Rivers - protect and expand forested buffers, upgrade sewage treatment plants to remove more nitrogen and phosphorus, replace failing septic systems. There should be no development of any kind, including agriculture and logging, in tidal or non-tidal wetlands. **4)** Agriculture is obviously necessary to provide food, and it is very important economically in Caroline County. But farmers should be encouraged and required, if necessary, to use all possible BMPs to prevent run-off and pollution of both ground and surface water. Buffers and CREP plantings should be encouraged and funded. Agricultural and conservation easements should be encouraged and funded. **5)** While it is difficult to slow it down, housing development/population increase should not be allowed to grow unchecked in Caroline County. And the development which does occur should be as sensitive to environmental concerns as possible.

In addition to these comments which were emailed in, Albert and Tom Cheezum, of the farming community, conveyed how strongly they felt against residential

development in association with environmental degradation. They also brought up concerns with adequate water and sewer services being provided for residential and agricultural uses. These citizens were from the Preston area and used the current debate over providing potable water to Jonestown to frame their comments.

Meeting was adjourned at about 9 pm.

Caroline County Comprehensive Plan Public Meeting
Economic Development Summary
June 9th 2008, 6:30-8:30 PM, HAPS Building

Attendees: Joann Redden, Citizen; Ann Jacobs, Citizen; Thomas Cheezum, Citizen; Albert "Lee" Cheezum, Citizen; Jason Willey, Citizen; Margaret Iovino, Citizen; JOK Walsh, Caroline Economic Development Corporation; John Seward, Eastern Shore Land Conservancy; Betsy Walk, CC P&C; and Stacey Weisner CC P&C.

Ms. Walk opened the meeting and gave the floor to Mr. Walsh, who provided a County history of Economic Development, an overview of various programs available in the County, and efforts by both the Caroline Economic Development Corporation (CEDC) and the County to diversify the economy of the County within and outside of the agricultural industry. The county has three industrial parks – two in Federalsburg and one in Denton. The Bell Grower network, which produces millions of potted flowers and plants via a series of automated and hydroponic greenhouses, was cited as an example of diversifying agriculture because it was a program modeled after the poultry business with some differences.

Mr. Walsh stated that the CEDC focuses on small businesses, particularly those located in downtown areas. Some examples of businesses that they have provided assistance to are Friendship Farms, Greensboro Trading Company, and Market Street Public House. He added that he would like to expand their services to do more small business counseling, in addition to the small business loans. Mr. Walsh added that tourism development and the infrastructure, which is basically helping small businesses, has been done by non-profits in the County. Currently, CEDC is working on a small pilot program grant from the County for an Indian Interpretive Center in Greensboro because Greensboro is unique in that four major Indian trails converged in Greensboro where the water was shallow enough to cross on foot.

Ms. Iovino, referring to a handout on Economic Development as addressed in the West County Comprehensive Plan, remarked that it was interesting that farmers, approximately 10% of the population, account for 60% of the County's economic development.

Mr. Tom Cheezum stated that he heard that the stores, such as Lowes and Home Depot, are no longer buying plants from participants in the Bell Grower program.

Ms. Iovino expressed interest in protecting farmers and/or nurseries from corporate agriculture.

Mr. Seward clarified her concern by stating that by keeping farmers independent of large corporations that take most of the profit, she basically meant cutting out the middle man. He added that Caroline County was one of the first to sign on to the Eastern Shore 2010 document that is based on agricultural economic development and would like to see more of this addressed in the comprehensive plan.

Mr. Walsh stated that there are multiple ways for the average farm to make money.

Mr. Lee Cheezum stated that the County needs a biodiesel plant, which sparked a brief discussion of various crops that could be used in a plant such as switchgrass, corn and soybeans.

Mr. Willey said that he is hearing various problems being identified but wants to know how we go about bringing in desirable businesses, such as those related more to technology.

The general consensus in the room was that education in technical fields is lacking in the County and that perhaps this problem extends beyond the County to the State of Maryland because the State of Delaware has a lot of success with its vocational programs.

Ms. Weisner stated that it might be a good idea to approach the school system and Chesapeake College about offering the college courses in the schools rather than requiring students interested in taking advantage of secondary education be limited by their ability to make travel arrangements.

After this point, attendees broke out into discussions amongst themselves, so the meeting was adjourned at 8:30 p.m.

Caroline County Comprehensive Plan Public Meeting
Agricultural Interest Group Meeting Summary
June 24th 2008, 6:30-8:30 PM, HAPS Building

Attendees: Nancy Gearhart, Citizen; Ann Collier, Citizen; Bill Collier, Citizen; James O. Baker, Citizen; Dr. Eric A. Cheezum, Citizen; Margaret Iovino, Citizen; John Seward, Eastern Shore Land Conservancy; Betsy Walk, CC P&C; and Tammy Buckle, CC P&C.

Ms. Walk opened the meeting and gave the floor to the attendees to ask any questions.

Dr. Cheezum asked what the legal rights of the Towns were to annex land. Mrs. Walk replied that she wasn't prepared to answer that question but she would provide him with some documents that will help.

Mr. Baker brought up a concern that setbacks required by zoning for certain farming operations were prohibitive in some cases and should not be permitted to be so restrictive because of the Right to Farm Bill adopted by the County. Mr. Collier stated that he thought that if those setbacks were kept in the zoning ordinance that they should be reciprocal. For example, if he cannot build poultry house less than 200 feet from his property line, then the adjoining property owner should not be able to build within 200 feet of the property line, either.

Mrs. Walk noted this as a concern and potential change for the zoning ordinance and asked if there were any further questions. There were none, so she opened the meeting by asking the attendees why they farm. She stated that she often only hears how difficult it is and felt it was important to include in the plan why we farm.

Dr. Cheezum opened by stating that he could only speak for his father, but that it can be profitable, the family is invested in agriculture, they are stewards of the land and it is a way of life that is rooted in the history of the County. Mr. Collier stated that you have to enjoy it and you have to make a living at it. It's a lot of work, but you have a chance to be busy or not busy and to do a lot of different things. He stated that most farmers supplement their farming income with other agricultural practices, such as livestock, or have another family member that works outside of the farm.

Mrs. Walk then asked if there were hurdles to farming in Caroline County that may or may not be able to be solved through comprehensive planning. Mr. Collier explained that the hurdles were different depending upon the type of farming because the needs vary. However, some are acreage, labor, state regulations, bureaucracy and paper work. Another hurdle brought up was public education and redeveloping an interest in agriculture in the youth of the County. Mr. Seward stated that the County was losing its agricultural diversity and that

keeping youth interested in agriculture might help that. Dr. Cheezum added that right now the school system works against farming because environmentalism is favored of agriculture in school curriculum. Mrs. Collier stated that anything that could be done to make it easier for farming would help, such as loosening restrictions on home occupations and road side stands and exploring the possibilities of promoting locally grown produce. Mr. Collier stated that the poultry industry needs to be protected because it keeps grain farming profitable.

Mr. Seward asked if there was anything in the realm of transportation that needed improvement for the farm community. Mr. Collier stated that often the roads have only a paved width of 30' which makes it difficult for larger farm equipment to get down the road.

There was a brief discussion of irrigation systems and water used by the agricultural community. Mr. Seward asked if the Water Resources Element required by House Bill 1141 takes into account agricultural water usage. Mrs. Walk responded that the Bill does require that all water usage be accounted for and that for this first round of Water Resources Elements, Maryland Department of the Environment is putting together an Excel spreadsheet that can be used as a template for calculating the required information. Then in future years, the Counties and Municipalities would be required to expand the element and include more accurate information.

After Mrs. Walk and Mrs. Buckle inquired that all questions had been answered and concerns discussed, the meeting was adjourned (8:45 p.m.).

CAROLINE COUNTY PLANNING AND CODES

We want your two cents...

Caroline County Department of the Planning and Codes Administration is moving away from creating regional plans and will be creating a comprehensive plan for the County as a whole. The process of revisiting the County Comprehensive Plan has started and we want your opinion. We encourage you to attend the meetings that interest you the most.

Meeting to be held at the
Health and Public Service Building
403 S. Seventh St.,
Room 110
Denton, Maryland 21629
At
6:30 p.m.

Phone: 410-479-8100
Fax: 410-479-4187
Email: info@carolineplancode.org

May 5	Education facilities and infrastructure & Recreation and Parks
May 12	Agriculture
May 22	Transportation & Public Safety and Emergency Services
May 28	Residential Development
June 2	Environmental Concerns
June 9	Economic Development

Times-Record

First comprehensive plan input session is not well attended

By DANIEL DIVILIO
Times-Record

DENTON — The Caroline County Planning Commission got an update at their last meeting on the status of the county's comprehensive plan revision.

County Planner Betsy Walk gave commission members an update on her office's progress in gathering public input for an upcoming revision of the Caroline County Comprehensive Plan at a May 14 meeting.

The county's Planning and Codes Administration office held the first input meeting on May 5 for discussions about education facilities and infrastructure and recreation and parks.

"Attendance wasn't very high, but the discussion was very good," Walk said. She said chairs were placed in a circle to make the meeting feel more open.

Walk said Recreation and Parks Director Sue Simmons led talks on the department's land preservation plan and Board of Education Chief Operations Officer Milton Nagel talked about school facilities and gave an overview of the board's master plan.

Walk said the May 12 meeting about the plan's agriculture section was postponed due to weather and has been rescheduled for June 24.

Some planning board members expressed concerns over having a meeting about agriculture in late June, due to it being time for crop harvesting.

"You won't get any farmers," said Planning Commission President John Schmidt.

Walk said those who cannot attend the meetings may also submit written comments to the planning office. She said the idea is to get the meetings done by mid-June so they can have a draft completed by year- end.

Walk said the planning office has put up a Web page to keep the public updated as the meeting series progresses. The site may be accessed through www.carolineplancode.org.

The next comprehensive plan public input meeting is scheduled for May 22. The topics will be transportation and public safety and emergency services. It will be held at 6:30 p.m. in Room 110 of the Health and Public Safety Building in Denton.

Caroline County to start informational meetings on comprehensive plan

By DANIEL DIVILIO
Staff Writer

DENTON — Government planners are set to begin creating a new road map for growth and development in Caroline County, kicking off their efforts with a series of public interest meetings.

The Caroline County Department of Planning and Codes Administration is taking its focus away from creating regional comprehensive plans, such as the recently completed draft of the West County Comprehensive Plan, and starting to work on one for the entire county.

Comprehensive development plans, said county planner Betsy Walk, are required by the state.

"They have to be done and they have to be reviewed every six years," she said.

County planners are going to be starting from scratch in some aspects of the comprehensive plan, Walk said, while primarily revising others.

"We have to add some new elements," she said, such as pieces from the north and west county regional plans and a new water resources element.

As part of the process, county planners are holding a series of public meetings, each on a particular element of the plan, in an effort to get input from area residents.

"These interest group meetings are to raise concerns from the get-go," Walk said.

The currently scheduled meeting dates with the topics to be discussed are as follows:

- May 12: Agriculture
- May 22: Transportation, Public Safety and Emergency Services
- May 28: Residential Development
- June 2: Environmental Concerns
- June 9: Economic Development

All the meetings will begin at 6:30 p.m. and be held in room 110 of the Health and Public Service Building, located at 403 S. Seventh Street in Denton.

"We do hope to have a good turnout," Walk said.

While some of those dates and times coincide with regular monthly town commission meetings, she said that was not intentional. Her office, she said, had to book the HAPS building meeting room and those were the available nights.

They plan on having another series of public meetings, Walk said, held in the towns to inform people on what was discussed during the initial meetings.

"We're still fleshing out all the details on, I guess, the rest of the process," she said.

The Planning and Codes Administration, Walk said, also wants to put the comprehensive plan drafts online, so the public can view the plan's progress and make comments.

For additional information on the Caroline County Comprehensive Plan, contact 410-479-8100 or e-mail info@carolineplancode.org.

QUEEN ANNE'S

Jones Boys to perform July 3 at 'God Bless America Luncheon'

STEVENSVILLE — The Kent Island Senior Center in

February 2009

Caroline County Comprehensive Plan Update

Caroline County Planning, Codes, & Engineering

Special points of interest:

- Where are we now?
- Stay Involved
- What Are Greenbelts?

Where are we now?

Planners and GIS specialists have been working diligently in the Department of Planning, Codes, and Engineering to prepare a draft of the Comprehensive Plan.

The main challenges to this new plan are the state mandated Water Resources Element (WRE), the development capacity and growth projections, and what recommendations to make for land use in the future to manage the growth in ways that are acceptable to the County and communities, preserve our agricultural heritage, and conserve our natural resources.

A complete draft will be available for public review before the plan goes to the State of Maryland for its 60-Day Clearing House Review. The ideal time for the County to submit to State for review is June because it gives us time after the review period to make changes and adopt the plan before the October 2009 deadline set by the State to have a WRE included in our Comprehensive Plan. We plan to host regional informational meetings in May after the release of the draft plan.

Shown above is the existing land use map. The green indicates agricultural use, the dominant County land use.

Planning Commission Meeting Information

Planning Commission meetings are held on the second Wednesday of every month at 7:30 p.m. in the Health and Public Service Building, 403 S. Seventh Street. Room 110, Denton.

STAY INVOLVED

It has been about a year since we had our first interest group meetings for the comprehensive plan. Your effort to be a part of the process is greatly appreciated. The Comprehensive Plan continues to be discussed at Planning Commission meetings along with other important County land use issues. To keep up-to-date and express concerns, please attend these meetings. Additionally, phone calls and emails with concerns and ideas are also welcome.

Caroline County Planning, Codes, & Engineering

Health & Public Services Building
403 South Seventh Street, Suite 210
Denton, Maryland 21629-1035

Phone: 410-479-8100
Fax: 410-479-4107
E-mail: info@carolineplancode.org
www.carolineplancode.org/comp_plan.html

Planning for a Better Tomorrow while Building a Better Today!

Green Garden County Gets Belted...

County Planners are working with municipalities that do not have an identified greenbelt to create them for inclusion in the Comprehensive Plan and will be shown on the future land use map.

What Are Greenbelts?

The "Greenbelt" is generally considered a planning area that provides a ring of protected lands around Towns to define a rural edge. Greenbelt areas are "green" transitional land uses located at the edge of Growth Areas. The primary objective of the greenbelt is to provide definition to municipal boundaries. These areas include a mix of low density residential and agricultural land uses surrounding towns.

The emphasis in this area is on maintaining a distinct rural edge from the designated Growth Areas characterized by agricultural use, open space, natural resources, and low density residential uses. Effective greenbelts require the protection of land within its boundaries. Primary protection is acquired through the preservation and/or purchase of land within the greenbelt. Purchase and preservation are ways to ensure that land is permanently protected within the greenbelt. The zoning and permitted uses within greenbelts should be reviewed to develop effective policies and regulations to maintain a rural area.

Unless and until the land use permitted in zoning districts changes, the properties are rezoned, or the properties are voluntarily preserved through purchase or easements, the property maintains the same property rights as all other parcels in its zoning district.

Following the Comprehensive Plan, the County will begin the comprehensive rezoning process and all property owners with land proposed to be rezoned will be notified and work groups and public meetings will be held.

Additional Resources

www.dnr.md.gov/land/rurallegacy/index.asp

www.plannersweb.com/sprawl/focus.html

Did you know?

- Greenbelts help prevent urban sprawl and serve as an amenity (air cleansing, flood control, food and wood production, recreation, and scenery) to urban residents.
- There are jurisdictions in the United States (municipal and County) that actually purchase the development rights or the land outright because they believe the greenbelt to be beneficial to their communities.
- Greenbelts discourage speculation on greenbelt land and encourage farmers with land in greenbelts to maintain agricultural investments.

Example of a greenbelt (green) surrounding the municipal growth area (orange) and municipality (gray).

CAROLINE COUNTY
COMPREHENSIVE PLAN
TECHNICAL APPENDIX

DRAFT 2009

Table of Contents (Technical Appendix)

Caroline County Development Capacity Report
June 2009

OVERVIEW:

The importance of development capacity analysis has been emphasized greatly in the past several years as some jurisdictions approach maximum build-out through low-density development coupled with high growth rates. Governor Robert Ehrlich's Priority Places Executive Order 01.01.2003.33 (October 2003) called for the creation of the Development Capacity Task Force in order to define a need for development capacity analysis, define key data and methodology issues, and how to include the residential capacity analysis in comprehensive plan updates.

In July 2004, the "Final Report of the Development Capacity Task Force" was delivered to the Governor. It provides recommendations for how the analysis should be done and has a draft MOU and Executive Order in order to commit local governments to conducting development capacity analysis (DCA). The MOU was signed by the Maryland Municipal League and the Maryland Association of Counties and it gave jurisdictions the opportunity to conduct their own DCA or to work with MDP in conducting a DCA. The Executive Order directs MDP to look for the inclusion of a DCA in comprehensive plan updates and to comment negatively in it's review if one is not included (MDP).

For Caroline County's 2009 comprehensive plan update, this DCA provides planners with a useful tool for addressing the future of residential development in the county. Development capacity is the ability of the land to accommodate greater development; "In it's simplest meaning, developable land is vacant or underused land, without severe physical constraints, which is planned or zoned for more intense use and has access to the urban services necessary to support development" (Kaiser). The focus is on these zoned lands in the county and how the County's regulations will steer residential development towards its future maximum capacity. The Caroline County Development Capacity Analysis asks our zoning ordinance how much and where it will allow population to grow so that planners can make informed decisions about our regulations in accordance with the comprehensive plan.

METHODOLOGY:

The level of complexity may vary from jurisdiction to jurisdiction depending on each one's available resources. The general progression of steps, however, remains consistent. The Maryland Department of Planning (MDP) provides a model to DCA participants through its internal "Growth Simulation Model" (GSM). It uses a set of assumptions and data collection methods to produce a highly generalized set of DCA results. These results may be used if a jurisdiction wishes not to provide their own assumptions and inputs.

The most common approach to the analysis involves working in conjunction with MDP to perform a "customized" DCA by considering a jurisdiction's unique development

trends and regulations. The Caroline County DPCE Engineering Division used this approach in an attempt to decrease the level of generalization in MDP's analysis.

The following is an general outline of the steps followed to calculate Caroline County's development capacity:

I. Collect the necessary data (including GIS data).
II. Identify all vacant or partially-vacant residentially zoned parcels. Remove all environmentally constrained, protected, and tax-exempt lands from consideration. Remove town parcels.
III. Determine, from the Zoning Ordinance, the minimum lot size allowed (MLA) per acre for each zoning classification. Express this in a Dwelling Unit/Acre formula called the zoning yield.
IV. Assign each parcel its respective zoning.
V. Apply the zoning yield to each parcel's acreage based on its zoning.
VI. Adjust for unknown development constraints (what average percentage of the capacity is actually developed). Based on local planning expertise.

I. **Collect the necessary data (including GIS data)** - Collaboration between MDP and Caroline County in data sharing efforts allowed for a more precise, geographically based analysis. A major input is GIS parcel data. The most commonly used parcel data is MD Property View 2007. It is a set of points that represent the center point of each parcel in the county and it's tax information. It allows us to see where properties are scattered throughout the county without using hard copy tax maps and tax assessment information. MD Property View gives us the ability to see where these properties lie within boundaries like zoning and wetlands. Other data includes but is not limited to:

- Zoning Layers (GIS)
- Protected Lands (GIS)
- Critical Areas (GIS)
- Wetlands (GIS)
- Municipal Boundaries (GIS)
- Water and Sewer Service Areas (GIS)
- Zoning and Subdivision of Land, County of Caroline

II. **Find vacant/partially-vacant residentially zoned parcels** - A vacant parcel is any undeveloped parcel that could accommodate residential development. A partially-vacant parcel is any developed parcel that can accommodate further development. In a GIS application, MDP uses the protected lands, wetlands, and other layers that represent areas that cannot accommodate development to assign those parcels a development capacity of zero or "no capacity."

Parcels that are partially vacant are also found using GIS. MD Property View 2007 contains the tax assessed new free market improvement value or the "NFMIMPVL" of any parcel in the county. An improvement value of above $10,000 gives an indication that a parcel owner has built a "dwelling unit" on their property.

Dwelling units (DU) are the units used to express capacity in most DCA. A dwelling unit may be defined as "a room or group of rooms within a dwelling, forming a

single habitable unit" (City of Mankato, Minnesota); "a single unit providing complete, independent living facilities for one or more persons, including permanent provisions for living, sleeping, eating, cooking and sanitation." (City of Davis, California); "'a dwelling unit' is any building or portion thereof which contains living facilities, including provisions for sleeping, eating, cooking and sanitation as required by the Code, for not more than one family.." (San Francisco Planning Department).

In Caroline County's DCA, "dwelling unit" and "lot" may be used interchangeably, especially when referencing residentially zoned development in the county. Since there is a very low number of Multi-Family Residential zoned parcels in the county, the assumption can be made that one lot = one DU = one home = one Maryland Department of the Environment Equivalent Dwelling Unit (EDU). EDU "is a measure where one unit is equivalent to wastewater effluent from one home, which is 250 gallons per day per home (1 EDU = 250 gallons per day)" (MDE).

IV. **Determine, from the Zoning Ordinance, the minimum lot number allowed per acre for each zoning classification. Express this in a Dwelling Unit/Acre formula called the "Zoning Yield" -** Zoning yield (sometimes referred to as "density yield") is the means for calculating the development capacity of vacant/partially-vacant lands. It is a ratio of Dwelling Unit/Acre which is then multiplied by the acreage of the parcel and then rounded down to give a whole number of DU that the acreage of the parcel can accommodate through subdivision:

(Parcel Acreage) x (Zoning Yield) = DU Capacity of Parcel

Each county residential zoning district has its own zoning yield based on minimum lot area and the gross density shown in the "Table of General Design Regulations," (Chapter 175 Attachment 4:1) and the 2006 "Transfer of Development Rights Ordinance" (#2006-001).

The TDR Program in Caroline County creates a separation between allowable capacity of parcels in terms of on-site development and TDR. This required the County to consider two separate density yields: On-Site and TDR. **On-Site Density Yield -** Number of dwelling units per acre that can be built ON-SITE in Zoning District of interest. **TDR Zoning Yield -** The number of transferrable development rights available to LIFT in the TDR Sending Area and to RECEIVE in the TDR Receiving Area.

III. **Assign each parcel its respective zoning -** In the master resulting database created by MDP, each parcel is joined in GIS to the area of zoning that it is contained within. This process assigns each parcel its zoning. Once zoning is determined for a parcel, the respective zoning yield expression can be applied to the acreage of the vacant parcel.

IV. **Apply the zoning yield to each parcel's acreage based on its zoning -** The zoning yields for each residential zoning districts were translated into mathematical expressions for MDP to use in the GSM. Based on the zoning a parcel is assigned, the acreage of that parcel is inserted into its respective zoning yield expression and a whole number dwelling unit capacity is generated. The following table illustrates the zoning yield expressions.

ZONING DISTRICT	ON-SITE ZONING YIELD	EXPRESSION*
TDR Sending Area R	Number of dwelling units per acre that can be built ON-SITE (Minor Subdivision) in the TDR Sending Area (All R - Rural Zoning not in the TDR Receiving Area)	If PA < 4, Then DU = (1 DU/Ac)*PA If 4 ≤ PA < 24, Then DU = 4 If PA ≥ 24, Then DU = 5
TDR Receiving Area R	Number of dwelling units per acre that can be built ON-SITE (Minor Subdivision and Density Rights) in the TDR Receiving Area (All R - Rural Zoning in the TDR Receiving Area)	If PA < 4, Then DU = (1 DU/Ac)*PA If 4 ≤ PA < 24, Then DU = 4 If PA ≥ 24, Then DU = 5 + [(PA - 24)/15]
R1	Number of dwelling units per acre that can be built ON-SITE in the R1 - Single Family Residential Zoning District	DU = (2 DU/Ac)*PA
R2	Number of dwelling units per acre that can be built ON-SITE in the R2 - Single/Two Family Residential Zoning District	DU = (2 DU/Ac)*PA
R3	Number of dwelling units per acre that can be built ON-SITE in the R3 - Multi-Family Residential Zoning District	DU = (2 DU/Ac)*PA
MH	Number of dwelling units per acre that can be built ON-SITE in the MH - Mobile Home Zoning District	DU = (4 DU/Ac)*PA
TOTAL RESIDENTIAL ON-SITE DEVELOPMENT CAPACITY	Total number of dwelling units that can be built on vacant residential county land	SUM
ZONING DISTRICT	**TDR ZONING YIELD**	**EXPRESSION***
TDR Sending Area R	Number of TRANSFERRABLE Density Rights available in the TDR Sending Area (All R - Rural Zoning not in the TDR Receiving Area)	TDRC = (PA - 4)/15 - 1
TDR Receiving Area R	Capacity if all available TDR's were utilized to build-out to maximum density in the TDR Receiving Area	TDRC = (1 DU/Ac)*PA TDRC ≠ 50+
TOTAL AVAILABLE SENDING RIGHTS	Total Potential Sending Rights in TDR Sending Area (Minor Subdivision and Density Rights)	(Minors + Density Rights)
NEEDED SENDING RIGHTS TO REACH TDR RECEIVING AREA BUILD-OUT	Number of TDR Sending Rights needed to reach 3189 DU capacity of TDR Receiving Area	(Capacity - On-Site Capacity)

* PA - Parcel Acreage, DU - Dwelling Unit, TDRC - Transferrable Development Right Capacity, all results are rounded down

V. **Adjust for unknown development constraints (what average percentage of the capacity is actually developed based on local planning expertise) -** Since it would be unrealistic to assume subdivision of residential land results in the maximum built-out of a parcel, considerations must be made to account for un-measurable constraints on capacity. This is expressed as a percentage reduction from the calculated full capacity of a parcel.

It was necessary to examine historical subdivision trends to make an inference of what the average reduction of capacity results on a parcel from un-measureable constraints. A study was done to identify these un-measureable constraints and to find an acceptable average amount of constraint they inflict on subdivision capacity. It was determined that on average, the majority of subdivisions only achieve approximately 50%

of the maximum capacity of a parcel. This can be said for on-site development in all zoning districts. For TDR capacity, no reduction was applied in calculating transferrable density rights in the TDR sending area. In the TDR receiving area, however, a reduction of 29% was applied to major subdivision capacity when utilizing bought density rights (Appendix A: MEMO, Development Capacity Analysis: Environmental Constraints and Design Limitations)

In addition to un-measureable constraints, a reduction of one DU is applied to the capacity of parcels that have a tax-assessed improvement value of greater than $10,000. This is to consider the influence of pre-existing development on parcels (sometimes referred to as "semi-vacant parcels"). This, like the aforementioned reduction factors, is an assumption made to try to account for this influence on capacity. Future considerations, when resources become available, should be made through field verification of aerial photography and on-the-ground observation.

RESULTS:

The discussed methodology results in a GIS database in which each parcel is assigned a capacity number in DUs. Parcels that were not considered vacant and unable to accommodate development were assigned a capacity of zero DU. The benefits of using GIS in this and similar analyses is that specialists are able to summarize the resulting information in a very wide variety of formats including tables, maps, and descriptive statistics.

The following table displays the total capacities for all areas of interest including on-site capacity of the residential zoning districts and TDR capacity of the TDR sending and receiving areas. Some totals were calculated to give an idea of the capacity of these areas of interest in reference to the jurisdictional boundary of Caroline County, yet GIS provides us with tools to generate total capacities of virtually any geographic scale or boundary within the County.

ZONING DISTRICT	ON-SITE ZONING YIELD	EXPRESSION*	REDUCTION	ON-SITE ZONING YIELD (RESULTS)
TDR Sending Area R	Number of dwelling units per acre that can be built ON-SITE (Minor Subdivision) in the TDR Sending Area (All R - Rural Zoning not in the TDR Receiving Area)	If PA < 4, Then DU = (1 DU/Ac)*PA If 4 ≤ PA < 24, Then DU = 4 If PA ≥ 24, Then DU = 5	50%	4,211 DU
TDR Receiving Area R	Number of dwelling units per acre that can be built ON-SITE (Minor Subdivision and Density Rights) in the TDR Receiving Area (All R - Rural Zoning in the TDR Receiving Area)	If PA < 4, Then DU = (1 DU/Ac)*PA If 4 ≤ PA < 24, Then DU = 4 If PA ≥ 24, Then DU = 5 + [(PA - 24)/15]	50%	285 DU
R1	Number of dwelling units per acre that can be built ON-SITE in the R1 - Single Family Residential Zoning District	DU = (2 DU/Ac)*PA	50%	7,431 DU
R2	Number of dwelling units per acre that can be built ON-SITE in the R2 - Single/Two Family Residential Zoning District	DU = (2 DU/Ac)*PA	50%	35 DU
R3	Number of dwelling units per acre that can be built ON-SITE in the R3 - Multi-Family Residential Zoning District	DU = (2 DU/Ac)*PA	50%	116 DU
MH	Number of dwelling units per acre that can be built ON-SITE in the MH - Mobile Home Zoning District	DU = (4 DU/Ac)*PA	50%	18 DU
TOTAL RESIDENTIAL ON-SITE DEVELOPMENT CAPACITY	Total number of dwelling units that can be built on vacant residential county land	SUM	N/A	12,096 DU
ZONING DISTRICT	**TDR ZONING YIELD**	**EXPRESSION***	**REDUCTION**	**TDR ZONING YIELD (RESULTS)**
TDR Sending Area R	Number of TRANSFERRABLE Density Rights available in the TDR Sending Area (All R - Rural Zoning not in the TDR Receiving Area)	TDRC = (PA - 4)/15 - 1	0%	7,080 DU
TDR Receiving Area R	Capacity if all available TDR's were utilized to build-out to maximum density in the TDR Receiving Area	TDRC = (1 DU/Ac)*PA TDRC ≠ 50+	29%	3,189 DU
TOTAL AVAILABLE SENDING RIGHTS	Total Potential Sending Rights in TDR Sending Area (Minor Subdivision and Density Rights)	7080 + 4,211 (Minors + Density Rights)	N/A	11,291 DU
NEEDED SENDING RIGHTS TO REACH TDR RECEIVING AREA BUILD-OUT	Number of TDR Sending Rights needed to reach 3189 DU capacity of TDR Receiving Area	3189 - 285 (Capacity - On-Site Capacity)	N/A	2,904 DU

* PA - Parcel Acreage, DU - Dwelling Unit, TDRC - Transferrable Development Right Capacity, all results are rounded down

CONCLUSIONS:

The significance of this analysis not only comes in the definition of a numerical representation of the County's capacity, but also in the definition of a reference for how

to conduct development capacity analyses in the future. The analysis itself implies that the County could further subdivide 15,000 more dwelling units under current zoning regulations. This would be in addition to approximately 7,866 existing "developed" dwelling units in the County (towns not included) (MD Property View 2007).

The analysis on TDR Sending and Receiving rights indicates that there are 11,291 available transferrable development rights in the designated TDR Sending Area. It also indicates that the TDR Receiving Area can accommodate 3,189 of these rights, and would need 2,904 to achieve maximum build-out.

Since assumptions were made throughout the process of devising this methodology, the County must work towards increasing the accuracy of this analysis. This would include considering a larger sample of historical subdivision to gain a better idea of what the average zoning yield reduction percentage is. Also, the County should develop the necessary GIS data to use vectorized parcel polygon data rather than parcel centroid points from MD Property View 2007.

For future analyses, it would be advantageous to consider a wide variety of scenarios of development capacity for planning purposes. The effects of changes can be found through what-if scenarios such as changes in zoning boundaries, minimum lot size allowance, TDR Receiving Area size and location, etc.

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San Francisco Planning Code, Section 315, "Housing Requirements for Residential and Live/Work Development Projects." http://www.sfgov.org/site/planning_index.asp?id=24911.

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Kaiser, Edward J. Godschalk, David R. Chapin, Francis S. "Urban Land Use Planning." University of Illinois Press 1995. P. 198

APPENDIX A:

Kevin Clark, Planner III Caroline County Planning, Codes, and Engineering, "MEMO: Development Capacity: Environmental Constraints & Design Limitations," March 11, 2009:

March 11, 2009

TO: Planning Commission Members
FROM: Kevin Clark, Planner III
CC: Katheleen Freeman, David Porter
SUBJ: **Development Capacity: Environmental Constraints & Design Limitations**

Environmental Constraints & Design Limitations:

- Non-Tidal Wetland Buffers
- Stream Buffers
- PDA Buffers
- Storm Water Management Facilities
- Drainage Easements
- Undesirable Soils

Reduction Methodology: Sending Area

A pool of recorded Major and Minor Subdivisions were analyzed in order to develop an accurate percentage of reduction for environmental constraints and design limitations.

Major Subdivisions –

Seven Major Subdivisions were reviewed for the number of recorded lots in comparison to the number of allowable lots by zoning. (On average, 49.4 % of the land was not utilized in the creation of new lots)

Minor Subdivisions –

Five (3 lots or less) Minor Subdivisions were review for the acreages utilized in recorded lots, and the acreage in remaining lands (after the subdivision). (25% of the land was not utilized in the new lots).

An additional 25% reduction was incorporated to account for the possibility of previously recorded minor lots (after December 31, 1972) for the target parcels. The combined percentage resulted in a 50% reduction for Minor Subdivisions.

Reduction Methodology: Receiving Area

Caroline County Planning, Codes, and Engineering 1

Based on environmental constraints and design limitations, it is estimated that a 70 acre parcel is required to facilitate a 50 lot subdivision within the receiving area.

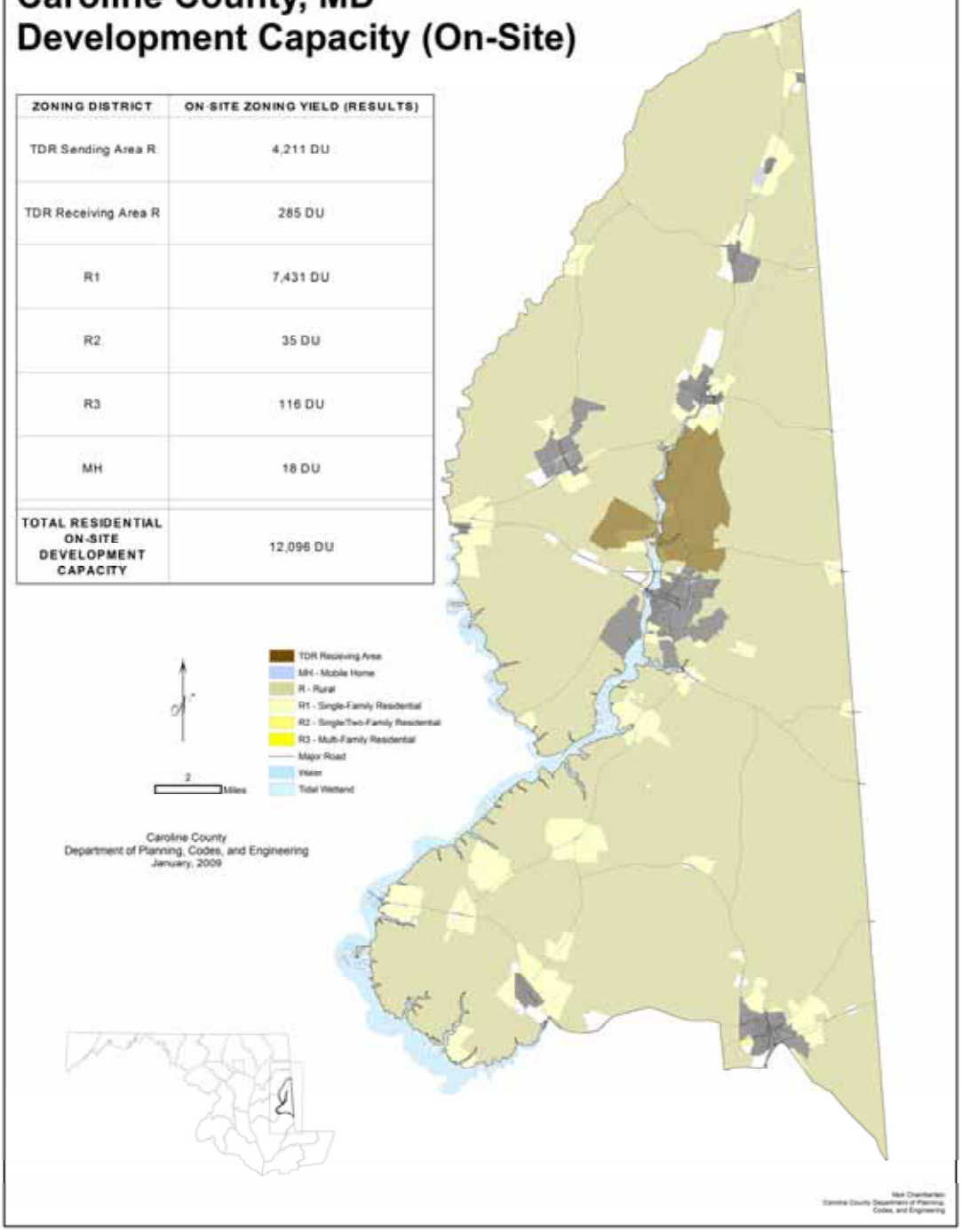
Receiving Area Expression: 50/70 = .71 available density per parcel (equating to a 29% reduction in development potential per parcel)

Summary:

Once the MDP Growth Simulation Model is run using Caroline County zoning density and subdivision regulations, a 50% reductions of the total on-site build out is applies to the sending area, based on environmental constraints, design limitations and possible lots recorded after December 31, 1972. The 29% density reduction is applied to all parcels within the receiving areas.

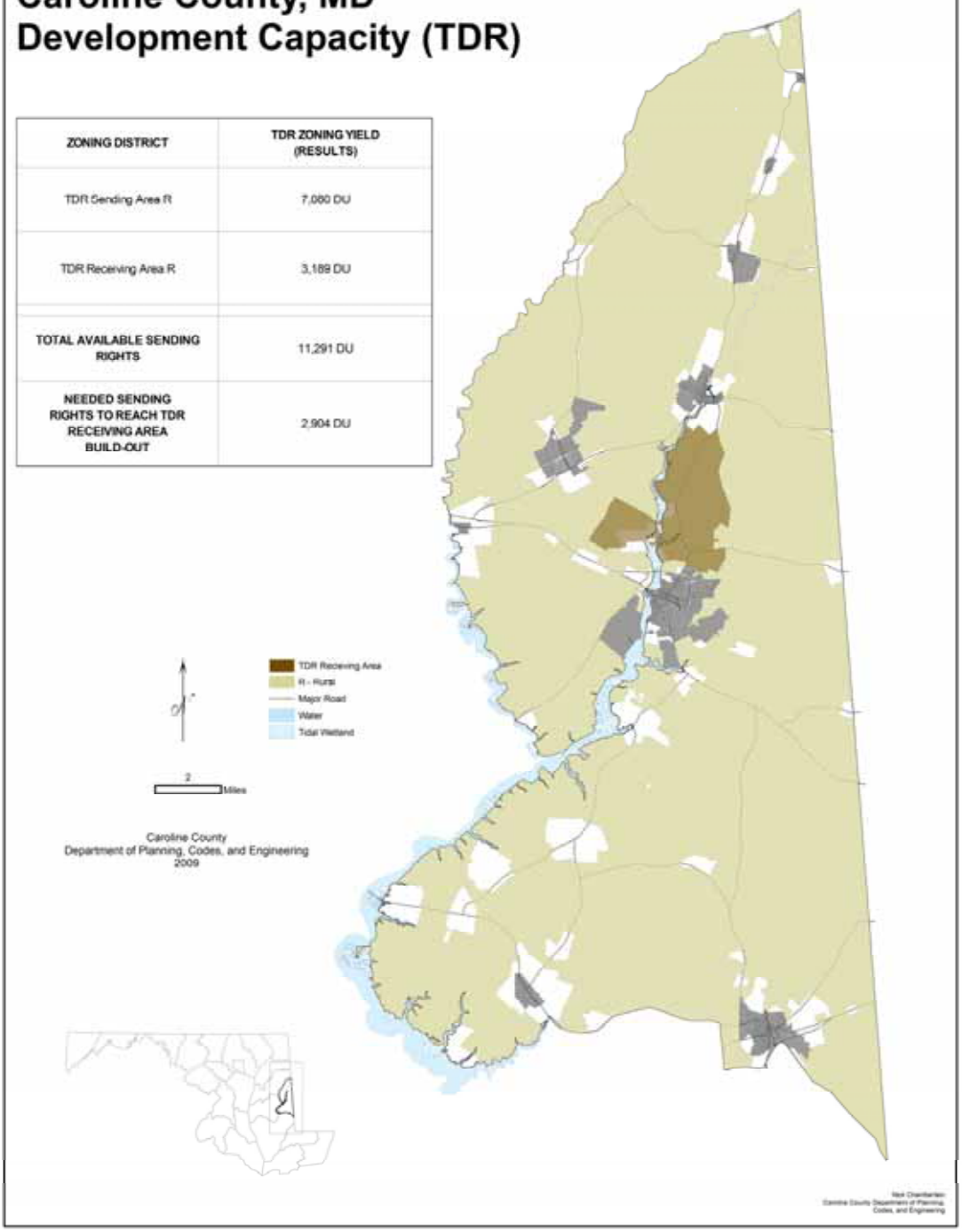
Caroline County, MD
Development Capacity (On-Site)

ZONING DISTRICT	ON-SITE ZONING YIELD (RESULTS)
TDR Sending Area R	4,211 DU
TDR Receiving Area R	285 DU
R1	7,431 DU
R2	35 DU
R3	116 DU
MH	18 DU
TOTAL RESIDENTIAL ON-SITE DEVELOPMENT CAPACITY	12,096 DU



Caroline County, MD
Development Capacity (TDR)

ZONING DISTRICT	TDR ZONING YIELD (RESULTS)
TDR Sending Area R	7,080 DU
TDR Receiving Area R	3,189 DU
TOTAL AVAILABLE SENDING RIGHTS	11,291 DU
NEEDED SENDING RIGHTS TO REACH TDR RECEIVING AREA BUILD-OUT	2,904 DU



Implementation Of BMPs To Achieve Nutrient Reduction

The best management practices recommended in the Caroline County Comprehensive Plan to reduce nutrient loads are among the BMPs included in the State's Tributary Strategies for Chesapeake Bay basins and watersheds. The following information is the documentation of data sources used to track implementation of the Tributary Strategies. The methodology used to calculate the County's point and non-point source nutrient loads is illustrated in the County Point Source and Non Point Source spreadsheet files (.xls), also included in the appendices to this Plan.

Wastewater Treatment Plants:

1) Biological and Chemical Nutrient Removal-- Wastewater treatment plant (WWTP) BNR implementation data are tracked by the Maryland Department of the Environment's (MDE's) BNR Program. Data listed in the implementation tracking table are defined as the number of WWTPs that have completed a BNR upgrade during a state fiscal year. The data are obtained from MDE's Wastewater Projects Database maintained by the Water Management Administration (WMA) Capital Projects Program. Related data used to calculate the estimated nutrient reduction from a WWTP upgrade consist of the design capacity of the WWTP at the time of the upgrade and the average yearly flow for the same state fiscal year. Average monthly flow data are reported to MDE by each WWTP in monthly discharge monitoring reports (DMR) and are tracked through the Point Source Database maintained by the MDE Technical and Regulatory Service Administration (TARSA).

Developed Land:

1) Erosion and Sediment Control-- Data for the "Erosion and Sediment Control" (E&SC) option are tracked through MDE's WMA Notice of Intent (NOI) Database. An owner of a construction site with a planned total disturbance of five or more acres is required to submit a NOI, which is entered into the NOI Database. (These construction sites are covered under Maryland's General Permit for Construction Activity as part of the National Pollution Discharge Elimination System stormwater discharge requirements.) Data listed in the implementation tracking table are defined as the total number of acres covered by E&SC for construction projects in a tributary basin started during a state fiscal year. "Total Disturbed Area" submitted on an NOI is assumed to equal the amount of acreage covered by E&SC, because all disturbed area is required to be placed under E&SC. Timing of construction projects (i.e., SFY when E&SC acreage is accounted for) is based on the date on which MDE sends a letter of authorization allowing a project to proceed. Construction projects less than five acres in size are not included in E&SC tracking.

2) Enhanced Stormwater Management-- Data for the "Enhanced Stormwater Management" option are developed from the statewide Urban Best Management Practice (BMP) Database maintained by MDE's TARSA. The Urban BMP Database is the repository for information collected from local jurisdictions having their own stormwater management programs. (State stormwater management regulations require local jurisdictions to submit this information to MDE within 45 days of construction completion of a new stormwater BMP. Jurisdictions currently have a choice of submitting either a one-page form for every new BMP or a standardized database on an annual basis.) Data listed in the implementation tracking table are defined as the total amount of drainage acreage for stormwater management projects in a tributary basin completed during a state fiscal year. Data shortcomings reflect inadequate reporting rather than a lack of construction activity.

3) Stormwater Management Retrofits-- Data for the "Stormwater Management Retrofits" option are tracked through MDE's Non-Point Source Database maintained by the WMA Capital Projects Program. The data for this option are obtained from MDE's Stormwater Pollution Control Cost-Share Program. Stormwater management retrofits provide stormwater management and nutrient removal for areas previously developed without stormwater management facilities. The database tracks the state fiscal year of implementation and the project's total drainage acreage. Data listed in the implementation tracking table are defined as the total amount of drainage acreage covered by stormwater management retrofit projects in a tributary basin completed during a state fiscal year. Acreage data for this option are based on information in applications submitted by local jurisdictions to MDE in order to receive cost-share funds. Local projects that do not receive state funding are not included in the implementation tracking table at this time.

4) Stormwater Management Conversion-- Data for the "Stormwater Management Conversion" option are tracked through MDE's Non-Point Source Database maintained by the WMA Capital Projects Program. The data for this option are obtained from MDE's Stormwater Pollution Control Cost-Share Program. Stormwater management conversion is defined as an upgrade of an existing stormwater management facility to provide nutrient removal and stormwater management. The database tracks the state fiscal year of implementation and the project's total drainage acreage. Data listed in the implementation tracking table are defined as the total amount of drainage acreage covered by stormwater management conversion projects in a tributary basin completed during a state fiscal year. Acreage data for this option are based on information in applications submitted by local jurisdictions to MDE in order to receive cost-share funds. Local projects that do not receive state funding are not included in the implementation tracking table at this time.

5) Septic Pumping-- Data are not currently available for this option.

6) Septic Denitrification-- Data for the "Septic Denitrification" option are tracked through MDE's Non-Point Source Database maintained by the WMA Capital Projects Program. The data for this option are obtained from local health departments and are defined in the implementation tracking table as the number of septic denitrification systems installed in a tributary basin during a state fiscal year. Septic denitrification systems tracked through the Non-Point Source Database include free-access recirculating sand filters which treat septic tank effluent before it is discharged. It has been reported that these systems achieve 40-60% nitrogen removal. A number of other septic denitrification systems are in use in Maryland; however, nitrogen removal monitoring data are not available for these systems.

7) Septic Connections-- Data for the "Septic Connections" option are tracked through MDE's Non-Point Source Database maintained by the WMA Capital Projects Program. Data listed in the implementation tracking table are defined as the number of homes in which connection to public sewer systems was completed during a state fiscal year. Most connections occur in areas with failing septic systems. The data for this option are obtained from MDE's Needs Survey and Wastewater Projects Database maintained by the WMA Wastewater Engineering Program. Although not listed in the implementation tracking table, the number of homes with failing septic systems is also available through this tracking mechanism.

8) Urban Nutrient Management-- Data are not currently available for this option.

Agricultural Land:

1) **Soil Conservation & Water Quality Plan Implementation & Treatment of Highly Erodible Land** - Data for the "Soil Conservation & Water Quality Plan Implementation" (SCWQPI) option and the "Treatment of Highly Erodible Land" option are combined under one heading. Tracking data are obtained from the 23 Soil Conservation Districts through workload analysis information to the Maryland Department of Agriculture by the Soil Conservation Districts. It is estimated that 85% of the Best Management Practices called for in these Plans have been installed according to the plan schedule. Data listed in the implementation tracking table represent 85% of the total acres planned and are defined as the total number of acres in a tributary basin upon which implementation of SCWQPs occurred during a state fiscal year. Data for SCWQPI acreage that appears as a negative value indicates a reduction in staff and/or database correction.

2) **Conservation Tillage** - Data for the "Conservation Tillage" option are derived from annual reports developed by the Conservation Technology Information Center. Survey data are coordinated by the USDA Natural Resources Conservation Service through consultation with the Cooperative Extension Service, Farm Services Agency, Soil Conservation Districts, and local business owners and farmers. Data tracked through this mechanism are organized by county, tributary basin figures are obtained by

multiplying a county's conservation tillage total by the percentage of the county's land area located in a tributary basin. These estimates for counties comprising a tributary basin are then summed. The county land area percentages were provided by the Maryland Office of Planning, based on 1990 GIS analysis. Data listed in the implementation tracking table are defined as the total number of new acres of conservation tillage implemented in a tributary basin during a state fiscal year. (This is a change in format from last year's annual report, which reported total acres.) Data for conservation tillage acreage that appears as a negative value indicates a reduction in this practice due to field rotation, weather conditions, and market forces.

3) Retirement of Highly Erodible Land-- The Maryland Agricultural Water Quality Cost-Share Program Database is the data source for the "Retirement of Highly Erodible Land" option. Data listed in the implementation tracking table are defined as the total number of acres of highly erodible land in a tributary basin retired during a state fiscal year. In cases where this practice is reported in linear feet, total acreage is calculated assuming a 30 feet width. Implementation of this practice by farmers outside of federal, state, and local programs is not included in the implementation tracking table.

4) Animal Waste Management Systems-- Implementation data for livestock and poultry waste management systems are combined under the "Animal Waste Management Systems" option. The Maryland Agricultural Water Quality Cost-Share Program Database is the data source for this option. Data listed in the implementation tracking table are defined as the total number of animal waste management systems completed in a tributary basin during a state fiscal year. Implementation of this practice by farmers outside of federal, state, and local programs is not included in the implementation tracking table.

5) Runoff Control-- The Maryland Agricultural Water Quality Cost-Share Program Database is the data source for the "Runoff Control" option. Data listed in the implementation tracking table are defined as the total number of runoff control systems completed in a tributary basin during a state fiscal year. Implementation of this practice by farmers outside of federal, state, and local programs is not included in the implementation tracking table.

6) Stream Protection with Fencing-- The Maryland Agricultural Water Quality Cost-Share Program Database is the data source for the "Stream Protection with Fencing" option. Data listed in the implementation tracking table are defined as the total number of acres covered by stream protection with fencing in a tributary basin completed during a state fiscal year. Implementation of this practice by farmers outside of federal, state, and local programs is not included in the implementation tracking table.

7) Stream Protection without Fencing-- The Maryland Agricultural Water Quality Cost-Share Program Database is the data source for the "Stream Protection without Fencing"

option. Data listed in the implementation tracking table are defined as the total number of acres covered by stream protection without fencing in a tributary basin completed during a state fiscal year. Implementation of this practice by farmers outside of federal, state, and local programs is not included in the implementation tracking table.

8) Nutrient Management Plan Implementation-- Implementation data for nutrient management planning using chemical fertilizers and animal wastes/sludge are combined under the "Nutrient Management Planning" option. Data are tracked by the Nutrient Management Program of the Maryland Department of Agriculture Office of Resource Conservation, through the combined efforts of the University of Maryland Cooperative Extension Service and certified industry consultants. Data listed in the implementation tracking table are defined as the total number of new acres in a tributary basin for which nutrient management planning occurred during a state fiscal year. Data provided by the University of Maryland Cooperative Extension Service and certified industry consultants are reported by county; tributary basin figures are obtained by multiplying a county's nutrient management planning acreage total by the percentage of the county's land area located in a tributary basin. These estimates for counties comprising a tributary basin are then summed. The county land area percentages were provided by the Maryland Office of Planning, based on a 1990 GIS analysis. SFY95 data provided by the University of Maryland Cooperative Extension Service are reported by watershed. Implementation of this practice by farmers outside of federal, state, and local programs is not included in the implementation tracking table.

9) Cover Crops-- Implementation data for planting of cover crops with and without nutrient management planning are combined under the "Cover Crops" option. The Maryland Agricultural Water Quality Cost-Share Program Database is the data source for this option. Data listed in the implementation tracking table are defined as the total number of acres of cover crops planted in a tributary basin during a state fiscal year. Implementation of this practice by farmers outside of federal, state, and local programs is not included in the implementation tracking table.

Resource Protection & Watershed Planning:

1) Forested Buffers-- The Maryland Department of Natural Resources (DNR) Forest Service Target and Accomplishment Reporting System is the data source for the "Forest Buffers" option. Implementation data for this practice outside of DNR's Greenshores Program are currently not available and not included in the implementation tracking table. These state programmatic data are reported on a quarterly basis, but the data provided in the quarterly reports represent cumulative totals for a given year. SFY95 was the first year in which data were reported on a state fiscal year basis; previous reports were organized on a calendar year (CY) basis. SFY94 data were derived as follows: [CY94 Quarter 2 + (CY93 Quarter 4 - CY93 Quarter 2)]. The forest buffer total from the Target and Accomplishment Reporting System is calculated by adding the acres

accomplished under the Green Shores-Public listing and the acres accomplished under the Green Shores-Private listing. Data in this reporting system are organized by county; tributary basin figures are obtained by multiplying a county's forest buffer total by the percentage of the county's land area located in a tributary basin. These estimates for counties comprising a tributary basin are then summed. The county land area percentages were provided by the Maryland Office of Planning, based on a 1990 GIS analysis. In a few cases data are grouped as a unit representing more than one county (i.e., Howard and Montgomery, Kent and Queen Anne's, and Caroline and Talbot). To obtain county-specific figures in these cases, the forest buffer figures for the unit are multiplied by 0.5.

2) Grassed Buffers (agricultural land)-- The Maryland Agricultural Water Quality Cost-Share Program Database is the data source for the "Grassed Buffers" option. Data listed in the implementation tracking table are defined as the total number of grassed buffers acreage implemented in a tributary basin during a state fiscal year. In cases where this practice is reported in linear feet, total acreage is calculated assuming a 30 feet buffer width. Implementation of this practice by farmers outside of federal, state, and local programs is not included in the implementation tracking table.

3) Structural Shore Erosion Control-- Data for the "Structural Shore Erosion Control" option are maintained by DNR's Shore Erosion Control staff and include state-assisted projects for local governments and projects on DNR-managed lands. Data listed in the implementation tracking table are defined as the total number of linear feet attributed to structural shore erosion control projects completed during a state fiscal year. Local government project assistance terminated in July 1996.

4) Nonstructural Shore Erosion Control-- Data for the "Nonstructural Shore Erosion Control" option are maintained by DNR's Shore Erosion Control staff and include state-assisted projects on private and local government lands, as well as projects on state-owned lands. Data listed in the implementation tracking table are defined as the total number of linear feet attributed to nonstructural shore erosion control projects completed during a state fiscal year.

5) Forest Conservation-- Data for the "Forest Conservation" option are maintained by the DNR Forest Service and recorded in State Forest Conservation Program Annual Reports. Data listed in the implementation tracking table for SFY94, SFY95, and SFY97 are limited currently to state or state-funded projects, in addition to local-level projects (e.g., residential subdivisions) reviewed by DNR Forest Service where local governments do not have FCA review authority (41 projects in SFY95). Local governments have not yet reported data on FCA projects they reviewed, but this information will be added as soon as it is available. SFY96 data also include projects approved by local governments for jurisdictions with FCA review authority. Data listed in the implementation tracking table are defined as total forest acreage protected through

the Maryland Forest Conservation Act and associated with development projects with plans approved during a state fiscal year. (SFY94 and SFY95 data represent acreage covered by plans submitted for review, while SFY96 data represent acreage covered by plans approved.) Total acreage protected is calculated by summing the retained acreage and the planted acreage for a development project, and tributary-specific data are derived by summing the total acreage protected for all projects in a tributary basin. Acreage totals will increase significantly when all local government data are included.

6) Tree Planting-- DNR's Forest Service Target and Accomplishment Reporting System, containing state programmatic data, is the source for the "Tree Planting" option. (A description of this reporting system and related assumptions are provided under the "Forest Buffers" option.) Implementation data for this practice outside of DNR are currently not available and not included in the implementation tracking table. The tree planting total from the Target and Accomplishment Reporting System is calculated by adding the acres accomplished under the Afforestation listing and the acres accomplished under the Urban Forestry Plantings listing. In cases where completed units under the Urban Forestry Planting listing are reported in feet only, total acreage is calculated assuming one acre equals 100 feet.

7) Forest Harvesting Practices-- Data are not currently available for this option.

8) Marine Pumpouts (installation)-- Data for the "Marine Pumpouts" option are maintained by DNR's Waterway Resources Division through a marina database. Data listed in the implementation tracking table are defined as the total number of marine pumpout installations completed during a state fiscal year. These data are limited to facilities with marine pumpout installations that are open for use by the general public, and a majority of these facilities have participated in a grant program operated by DNR.

Nonpoint Source Best Management Practice Supplement
Revised 1/12/06

How are Nonpoint Source BMPs Reported for use in the Chesapeake Bay Program Watershed Model?

All nonpoint source BMPs that the states report to the Chesapeake Bay Program Office are reported as cumulative (the total acres, linear feet, or systems installed or implemented during an entire period) with the exception of the following BMPs which are reported as annual (the amount of a BMP installed or implemented for that year only):

- Cover crops - Cereal and Commodity Cereal - early and late planting.
- Alternative uses of manure/manure transport
- Poultry phytase
- Urban erosion and sediment control*
- Urban and mixed open nutrient management
- Forest harvesting practices*
- Septic pumping

How and When are Nonpoint Source BMPs Used in the Chesapeake Bay Program Watershed Model?

To answer the question of how and when a nonpoint source BMP is used in the Chesapeake Bay Program Watershed Model, it is helpful to divide the BMPs into three categories:

(1) BMPs that have been peer-reviewed and approved by the CBP and will be used in Phase 5.0 calibration of the watershed model,
(2) BMPs in various stages of peer review and are given credit in the Tributary Strategies, but will not be used the Phase 5.0 calibration, and
(3) BMPs that are under consideration for the model and are not currently proposed for use in the Tributary Strategy or in the Phase 5.0 calibration.

(1) BMPs used in Phase 5.0 Watershed Model Calibration

These BMPs are peer-reviewed and approved by the CBP and have been reported on-the-ground during the Phase 5.0 calibration window (1985-2003). These BMPs will be used in the Phase 5.0 calibration. These BMPs are used in annual Phase 4.3 model estimates of nutrient and sediment reductions resulting from reported implementation progress each year.

Agricultural BMPs

- Riparian forest buffers*
- Riparian grass buffers
- Wetland restoration*
- Agricultural land retirement
- Tree planting
- Conservation tillage*
- Continuous No-Till

* BMPs chosen by the Nutrient Subcommittee and its Tributary Strategy Workgroup for the 2-Year EPA CBPO FY2006 BMP Project to develop or refine efficiencies.

- Traditional nutrient management
- Poultry phytase
- Poultry litter transport
- Conservation plans*
- Cover crops - late planting*
- Small grain enhancement/commodity cover crops - late planting*
- Off-stream watering with fencing*
- Off-stream watering without fencing
- Off-stream watering with fencing & rotation grazing*
- Animal waste management systems: livestock
  - barnyard runoff control
  - loafing lot management
- Animal waste management systems: poultry

Urban and Mixed Open BMPs

- Impervious surface reduction
- Forest conservation
- Abandoned mine reclamation
- General stormwater management
- Urban wet ponds & wetlands*
- Dry detention ponds & hydrodynamic structures*
- Dry extended detention ponds*
- Urban infiltration practices
- Urban filtering practices
- Urban stream restoration*
- Urban erosion & sediment control*
- Urban nutrient management
- Mixed open nutrient management
- Septic connections
- Septic pumping

Other BMPs

- Forest harvesting practices*
- Structural tidal shoreline erosion control
- Non-structural tidal shoreline erosion control

(2) BMPs Credited in Tributary Strategies but not used in Phase 5.0 Calibration of Watershed Model

These BMPs are credited in the Tributary Strategies using Phase 4.3 of the Chesapeake Bay Watershed Model, but will not be used in the Phase 5.0 Calibration because they were not reported as implemented on-the-ground during the calibration window (1985-2003).

All of these BMPs have a means for credit in the model and are in various stages of peer review. Those BMPs that are still in need of peer review are not used in annual Phase 4.3 estimates of

* BMPs chosen by the Nutrient Subcommittee and its Tributary Strategy Workgroup for the 2-Year EPA CBPO FY2006 BMP Project to develop or refine efficiencies.

nutrient and sediment reductions since they are still under peer-review. However, they are used in preliminary assessments of Tributary Strategy implementation progress on a Chesapeake Bay watershed jurisdictional basis to help jurisdictions predict the potential reductions they may achieve if these BMPs are implemented, based on the latest science.

Agricultural BMPs:

- Carbon sequestration/alternative crops (peer reviewed)
- Enhanced nutrient management (peer reviewed)*
- Cover crops - early planting (peer reviewed)*
- Small grain enhancement/commodity cover crops - early planting (peer reviewed)*
- Water control structures (peer reviewed)
- Precision agriculture (needs peer review)*
- Dairy precision feeding and/or forage management (needs peer review)*
- Swine phytase (needs peer review)
- Ammonia emissions reductions (needs peer review)*
- Precision or intensive rotation grazing (needs peer review)*
- Horse pasture management (needs peer review)*

Urban BMPs:

- Urban street sweeping & catch basin inserts (needs peer review)
- Non-urban stream restoration (needs peer review)*
- Dirt & gravel road erosion & sediment control (needs peer review)*

(3) BMPs not Currently in Tributary Strategies or Phase 5.0 Calibration

These BMPs are not currently in the Tributary Strategies and will not be used in the Phase 5.0 calibration, but are under assessment for inclusion in the Watershed Model in the future. These BMPs are under consideration by one or more Chesapeake Bay watershed jurisdictions for inclusion in the Tributary Strategies. These BMPs merit further assessment to determine if and how they can be described in future modeling efforts.

Agricultural BMPs:

- Mortality composters*

Urban BMPs:

- Roadway systems

Other BMPs:

- Coastal floodplain flooding
- SAV planting & preservation
- Oyster reef restoration & shellfish aquaculture
- Voluntary air emission controls within jurisdictions (utility, industrial & mobile)

* BMPs chosen by the Nutrient Subcommittee and its Tributary Strategy Workgroup for the 2-Year EPA CBPO FY2006 BMP Project to develop or refine efficiencies.

Table 1: Nonpoint Source Best Management Practices that have been Peer-Reviewed and CBP-Approved for Phase 5.0 of the Chesapeake Bay Program Watershed Model Revised 1/18/06

Agricultural BMPs	How Credited	TN Reduction Efficiency	TP Reduction Efficiency	SED Reduction Efficiency
Riparian Forest Buffers and Wetland Restoration - Agriculture[1]:	Landuse conversion + efficiency	Efficiency applied to 4 upland acres	Efficiency applied to 2 upland acres	Efficiency applied to 2 upland acres
Coastal Plain Lowlands	Efficiency	25%	75%	75%
Coastal Plain Dissected Uplands	Efficiency	40%	75%	75%
Coastal Plain Uplands	Efficiency	83%	69%	69%
Piedmont Crystalline	Efficiency	60%	60%	60%
Blue Ridge	Efficiency	45%	50%	50%
Mesozoic Lowlands	Efficiency	70%	70%	70%
Piedmont Carbonate	Efficiency	45%	50%	50%
Valley and Ridge Carbonate	Efficiency	45%	50%	50%
Valley and Ridge Siliciclastic	Efficiency	55%	65%	65%
Appalachian Plateau Siliciclastic	Efficiency	60%	60%	60%
Riparian Grass Buffers - Agriculture:	Landuse conversion + efficiency	Efficiency applied to 4 upland acres	Efficiency applied to 2 upland acres	Efficiency applied to 2 upland acres
Coastal Plain Lowlands	Efficiency	17%	75%	75%
Coastal Plain Dissected Uplands	Efficiency	27%	75%	75%
Coastal Plain Uplands	Efficiency	57%	69%	69%
Piedmont Crystalline	Efficiency	41%	60%	60%
Blue Ridge	Efficiency	31%	50%	50%
Mesozoic Lowlands	Efficiency	48%	70%	70%
Piedmont Carbonate	Efficiency	31%	50%	50%
Valley and Ridge Carbonate	Efficiency	31%	50%	50%
Valley and Ridge Siliciclastic	Efficiency	37%	65%	65%
Appalachian Plateau Siliciclastic	Efficiency	41%	60%	60%

[1] These peer-reviewed BMP efficiencies and/or landuse conversions will be refined with more recent data for use in Phase 5.0 of the Chesapeake Bay Program Watershed Model based on results of the EPA CBPO FY2006 BMP Literature Synthesis project. Estimated Completion Date: TBD.

Agricultural BMPs (continued)	How Credited	TN Reduction Efficiency	TP Reduction Efficiency	SED Reduction Efficiency
Conservation Plans - Agriculture[1] (Solely structural practices such as installation of grass waterways in areas with concentrated flow, terraces, diversions, drop structures, etc.):	Efficiency			
Conservation Plans on Conventional-Till	Efficiency	8%	15%	25%
Conservation Plans on Conservation-Till and Hay	Efficiency	3%	5%	8%
Conservation Plans on Pasture	Efficiency	5%	10%	14%
Cover Crops[1]:	Efficiency			
Cereal Cover Crops on Conventional-Till:	Efficiency			
Early-Planting - Up to 7 days prior to published first frost date	Efficiency	45%	15%	20%
Late-Planting - Up to 7 after published first frost date	Efficiency	30%	7%	10%
Cereal Cover Crops on Conservation-Till:	Efficiency			
Early-Planting - Up to 7 days prior to published first frost date	Efficiency	45%	0%	0%
Late-Planting - Up to 7 after published first frost date	Efficiency	30%	0%	0%
Commodity Cereal Cover Crops / Small Grain Enhancement on Conventional-Till:	Efficiency			
Early-Planting - Up to 7 days prior to published first frost date	Efficiency	25%	0%	0%
Late-Planting - Up to 7 after published first frost date	Efficiency	17%	0%	0%
Commodity Cereal Cover Crops / Small Grain Enhancement on Conservation-Till:	Efficiency			
Early-Planting - Up to 7 days prior to published first frost date	Efficiency	25%	0%	0%
Late-Planting - Up to 7 after prior to published first frost date	Efficiency	17%	0%	0%
Off-stream Watering with Stream Fencing (Pasture)[2]	Efficiency	60%	60%	75%
Off-stream Watering with Stream Fencing and Rotational Grazing (Pasture)[3]	Efficiency	20%	20%	40%

[1] These peer-reviewed BMP efficiencies and/or landuse conversions will be refined with more recent data for use in Phase 5.0 of the Chesapeake Bay Program Watershed Model based on results of the EPA CBPO FY2006 BMP Literature Synthesis project. Estimated Completion Date: TBD.
[2] Will be credited as a landuse conversion in the final Phase 5.0 of the Watershed Model.
[3] Will be credited as a landuse conversion and efficiency in the final Phase 5.0 of the Watershed Model.

Agricultural BMPs (continued)	How Credited	TN Reduction Efficiency	TP Reduction Efficiency	SED Reduction Efficiency
Off-stream Watering without Fencing (Pasture)	Efficiency	30%	30%	38%
Animal Waste Management Systems - Applied to model manure acre where 1 manure acre = runoff from 145 animal units:[2]	Reduction in manure acres			
Livestock Systems[2]	Reduction in manure acres	100%	100%	N/A
Poultry Systems[2]	Reduction in manure acres	100%	100%	N/A
Barnyard Runoff Control / Loafing Lot Management[2]	Reduction in manure acres	100%	100%	N/A
Conservation-Tillage[1]	Landuse conversion	N/A	N/A	N/A
Land Retirement - Agriculture	Landuse conversion	N/A	N/A	N/A
Tree Planting - Agriculture	Landuse conversion	N/A	N/A	N/A
Carbon Sequestration / Alternative Crops	Landuse conversion	N/A	N/A	N/A
Nutrient Management Plan Implementation - Agriculture	Landuse conversion	135% of modeled crop uptake	135% of modeled crop uptake	N/A
Enhanced Nutrient Management Plan Implementation – Agriculture[1]	Landuse conversion + Built into simulation	115% of modeled crop uptake	115% of modeled crop uptake	N/A
Alternative Uses of Manure / Manure Transport	Built into preprocessing	Reduction in nutrient mass applied to cropland	Reduction in nutrient mass applied to cropland	N/A
Poultry Phytase	Built into preprocessing	N/A	Reduction in nutrient mass applied to cropland	N/A

[1] These peer-reviewed BMP efficiencies and/or landuse conversions will be refined with more recent data for use in Phase 5.0 of the Chesapeake Bay Program Watershed Model based on results of the EPA CBPO FY2006 BMP Literature Synthesis project. Estimated Completion Date: TBD.

Agricultural BMPs (continued)	How Credited	TN Reduction Efficiency	TP Reduction Efficiency	SED Reduction Efficiency
Dairy Precision Feeding / and Forage Management[1]	Built into preprocessing	Reduction in nutrient mass applied to cropland	Reduction in nutrient mass applied to cropland	N/A
Swine Phytase	Built into preprocessing	N/A	Reduction in nutrient mass applied to cropland	N/A
Continuous No-Till:				
Below Fall Line	Efficiency	10%	20%	70%
Above Fall Line	Efficiency	15%	40%	70%
Water Control Structures	Efficiency	33%	N/A	N/A
Urban and Mixed Open BMPs				
Stormwater Management::	Efficiency			
Wet Ponds and Wetlands[1]	Efficiency	30%	50%	80%
Dry Detention Ponds and Hydrodynamic Structures[1]	Efficiency	5%	10%	10%
Dry Extended Detention Ponds[1]	Efficiency	30%	20%	60%
Infiltration Practices	Efficiency	50%	70%	90%
Filtering Practices	Efficiency	40%	60%	85%
Erosion and Sediment Control[1]	Efficiency	33%	50%	50%

[1] These peer-reviewed BMP efficiencies and/or landuse conversions will be refined with more recent data for use in Phase 5.0 of the Chesapeake Bay Program Watershed Model based on results of the EPA CBPO FY2006 BMP Literature Synthesis project. Estimated Completion Date: TBD.

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Urban and Mixed Open BMPs (continued)	How Credited	TN Reduction Efficiency	TP Reduction Efficiency	SED Reduction Efficiency
Nutrient Management (Urban)	Efficiency	17%	22%	N/A
Nutrient Management (Mixed Open)	Efficiency	17%	22%	N/A
Abandoned Mine Reclamation[2]	Landuse change converted to efficiency	Varies by model segment	Varies by model segment	Varies by model segment
Riparian Forest Buffers – Urban and Mixed Open	Landuse conversion + efficiency	25%	50%	50%
Wetland Restoration – Urban and Mixed Open	Landuse conversion	N/A	N/A	N/A
Stream Restoration – Urban and Mixed Open[1]	Load reduction converted to efficiency	0.02 lbs/ft	0.0035 lbs/ft	2.55 lbs/ft
Impervious Surface and Urban Growth Reduction / Forest Conservation	Landuse conversion	N/A	N/A	N/A
Tree Planting – Urban and Mixed Open	Landuse conversion	N/A	N/A	N/A
Resource and Septic BMPs				
Forest Harvesting Practices[1]	Efficiency	50%	50%	50%
Septic Denitrification	Efficiency	50%	N/A	N/A
Septic Pumping	Efficiency	5%	N/A	N/A
Septic Connections / Hook-ups	Built into pre-Processing	N/A	N/A	N/A

[1] These peer-reviewed BMP efficiencies and/or landuse conversions will be refined with more recent data for use in Phase 5.0 of the Chesapeake Bay Program Watershed Model based on results of the EPA CBPO FY2006 BMP Literature Synthesis project. Estimated Completion Date: TBD.
[2] Will be credited as a landuse conversion in the final Phase 5.0 of the Watershed Model.

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Table 2: Nonpoint Source Best Management Practices Requiring Additional Peer-Review for Phase 5.0 of the Chesapeake Bay Watershed Model
Revised 1/12/06

(Note: Credit and Efficiencies are listed in parenthesis since they have not received formal peer review)

Agricultural BMPs Requiring Peer Review	How Credited	TN Reduction Efficiency	TP Reduction Efficiency	SED Reduction Efficiency	CBP Lead Status Estimated Completion Date
Precision Agriculture	(Built into simulation)	N/A	N/A	N/A	Tributary Strategy Workgroup EPA CBPO FY2006 BMP Literature Synthesis project will determine efficiency for Phase 5.0 Completion Date: TBD Delaware Maryland Agribusiness Association plans to work with CBPO to provide tracking data for this BMP.
Manure Additives	TBD	TBD	TBD	TBD	Agriculture Nutrient Reduction Workgroup TBD TBD
Ammonia Emission Reductions	(Built into preprocessing)	(Reduction in ammonia deposition)	N/A	N/A	Tributary Strategy Workgroup EPA CBPO FY2006 BMP Literature Synthesis project will determine efficiency Completion Date: TBD
Precision Grazing	Efficiency	(25%)	(25%)	(25%)	Agriculture Nutrient Reduction Workgroup Tributary Strategy Workgroup EPA CBPO FY2006 BMP Literature Synthesis project will determine efficiency Completion Date: TBD
Mortality Composters	Efficiency	(14%)	(14%)	N/A	Tributary Strategy Workgroup EPA CBPO 2006/2007 project will determine efficiency June 2008
Horse Pasture Management	Efficiency	(20%)	(20%)	(40%)	Tributary Strategy Workgroup EPA CBPO FY2006 BMP Literature Synthesis project will determine efficiency Completion Date: TBD

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Agricultural BMPs Requiring Peer Review (continued)	How Credited	TN Reduction Efficiency	TP Reduction Efficiency	SED Reduction Efficiency	CBP Lead Status Estimated Completion Date
Non-Urban Stream Restoration	Load reduction converted to efficiency				
Non-Urban Stream Restoration on Conventional-Till and Pasture	Load reduction converted to efficiency	(0.026 lbs/ft)	(0.0046 lbs/ft)	(3.32 lbs/ft)	Tributary Strategy Workgroup EPA CBPO FY2006 BMP Literature Synthesis project will determine efficiency Completion Date: TBD
Non-Urban Stream Restoration on Conservation-Till, Hay	Load reduction converted to efficiency	(0.02 lbs/ft)	(0.0035 lbs/ft)	(2.55 lbs/ft)	Tributary Strategy Workgroup EPA CBPO FY2006 BMP Literature Synthesis project will determine efficiency Completion Date: TBD
Urban and Mixed Open BMPs Requiring Peer Review					
Non-Urban Stream Restoration on Mixed Open	Load reduction converted to efficiency	(0.02 lbs/ft)	(0.0035 lbs/ft)	(2.55 lbs/ft)	Tributary Strategy Workgroup EPA CBPO FY2006 BMP Literature Synthesis project will determine efficiency Completion Date: TBD
Dirt & Gravel Road Erosion & Sediment Control on Mixed Open	Load reduction converted to efficiency	(0.02 lbs/ft)	(0.0035 lbs/ft)	(2.55 lbs/ft)	Tributary Strategy Workgroup EPA CBPO FY2006 BMP Literature Synthesis project will determine efficiency Completion Date: TBD
Roadway Systems	TBD	TBD	TBD	TBD	Urban Stormwater Workgroup (USWG) USWG will meet with Departments of Transportation to identify roadway BMPs and efficiencies TBD
Urban Street Sweeping and Catch Basin Inserts	Efficiency	(10%)	(10%)	(10%)	Urban Stormwater Workgroup EPA CBPO street sweeping project will provide efficiency recommendations for the Urban Stormwater Workgroup review in Fall 2007

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Urban and Mixed Open BMPs Requiring Peer Review (continued)	How Credited	TN Reduction Efficiency	TP Reduction Efficiency	SED Reduction Efficiency	CBP Lead Status Estimated Completion Date
Riparian Grass Buffers – Urban and Mixed Open	TBD	TBD	TBD	TBD	TBD
Resource BMPs Requiring Peer Review					
Non-Urban Stream Restoration on Forest	Load reduction converted to efficiency	(0.02 lbs/ft)	(0.0035 lbs/ft)	(2.55 lbs/ft)	Tributary Strategy Workgroup EPA CBPO FY2006 BMP Literature Synthesis project will determine efficiency Completion Date: TBD
Dirt & Gravel Road Erosion & Sediment Control on Forest	Load reduction converted to efficiency	(0.02 lbs/ft)	(0.0035 lbs/ft)	(2.55 lbs/ft)	Tributary Strategy Workgroup EPA CBPO FY2006 BMP Literature Synthesis project will determine efficiency Completion Date: TBD
Voluntary Air Emission Controls within Jurisdictions (Utility, Industrial, and Mobile)	Built into preprocessing	(Reduction in nitrogen species deposition)	N/A	N/A	Nutrient Subcommittee TBD TBD

Table 3: Nonpoint Source Best Management Practices that have been Peer Reviewed and CBP Approved for the Chesapeake Bay Water Quality Model
Revised 1/12/06

Shoreline BMPs	How Credited	TN Reduction Efficiency	TP Reduction Efficiency	SED Reduction Efficiency
Structural Tidal Shoreline Erosion Control	Water Quality Model	N/A	N/A	N/A
Non-Structural Tidal Shoreline Erosion Control	Water Quality Model	N/A	N/A	N/A

Table 4: Nonpoint Source Best Management Practices Requiring Additional Peer Review for the Chesapeake Bay Water Quality Model
Revised 1/12/06

Resource BMPs	How Credited	TN Reduction Efficiency	TP Reduction Efficiency	SED Reduction Efficiency	CBP Lead Status Estimated Completion Date
Coastal Floodplain Flooding	TBD	TBD	TBD	TBD	Sediment Workgroup TBD TBD
SAV Planting and Preservation	Water Quality Model	TBD	TBD	TBD	Living Resources Subcommittee TBD TBD
Oyster Reef Restoration and Shellfish Aquaculture	Water Quality Model	TBD	TBD	TBD	TBD TBD TBD
Structural Shoreline Erosion Controls:					Sediment Workgroup TBD TBD
Shoreline hardening	Water Quality Model	TBD	TBD	TBD	Sediment Workgroup TBD TBD

Resource BMPs (continued)	How Credited	TN Reduction Efficiency	TP Reduction Efficiency	SED Reduction Efficiency	CBP Lead Status Estimated Completion Date
Off-shore breakwater	Water Quality Model	TBD	TBD	TBD	Sediment Workgroup TBD TBD
Headland control	Water Quality Model	TBD	TBD	TBD	Sediment Workgroup TBD TBD
Breakwater systems	Water Quality Model	TBD	TBD	TBD	Sediment Workgroup TBD TBD

Bay Program Cover Crop TN Effectiveness for Phase 5 Watershed Model

Coastal Plain/Piedmont Crystalline/Karst Settings

Watershed scale = plot scale * .85 (subsurface edge of field) *.75 (landscape scale)

Species:	Rye				Wheat				Barley			
Seeding method:	Drilled	Other	Aerial/ soy	Aerial/ corn	Drilled	Other	Aerial/ soy	Aerial/ corn	Drilled	Other	Aerial/ soy	Aerial/ corn
Early planting	44.6	37.9			31.2	26.6			37.9	32.2		
Standard planting	40.8	34.7	na	na	28.6	24.3	na	na	28.6	24.3	na	na
Late planting	19.1	16.3	na	na	13.4	11.4	na	na	na	na	na	na

Mesozoic Lowlands/Valley and Ridge Siliciclastic

Watershed scale = plot scale * .65 (subsurface edge of field) *.75 (landscape scale)

Species:	Rye				Wheat				Barley			
Seeding method:	Drilled	Other	Aerial/ soy	Aerial/ corn	Drilled	Other	Aerial/ soy	Aerial/ corn	Drilled	Other	Aerial/ soy	Aerial/ corn
Early planting	34.1	29.0			23.9	20.3			29.0	24.7		
Standard planting	31.2	26.5	na	na	21.8	18.6	na	na	21.8	18.6	na	na
Late planting	14.6	12.4	na	na	10.2	8.7	na	na	na	na	na	na

Water Resources Technical Data (Spreadsheets)

The technical data used for the water resources element are spreadsheets created in Microsoft Excel and include numerous formulas which cannot be viewed when the tables are in print format. The formulas are essential to fully understanding the tables; therefore the technical data is available as a supplement to the plan in electronic form. Water Resources technical data can be obtained by contacting the Caroline County Department of Planning, Codes, & Engineering and requesting an electronic copy of this plan and the water resources technical data or by visiting the Department Web site at www.carolineplancode.org.

Time Frame for Implementation Goals

0 to 10 Years	10 to 20 Years	On Going
Update and revise the zoning and subdivision regulations to incorporate appropriate zoning districts, zoning provisions/changes, and development standards as recommended in this chapter. Existing laws should also be enhanced and zoning classifications reviewed.	Work with appropriate State and Federal agencies develop more accurate natural resource maps.	Implement the goals and objectives of the Chesapeake 2000 Agreement
Establish appropriate setbacks, buffers, and other regulatory standards that apply to the diverse uses located in the rural zoning district.	Work with stakeholders to develop a County-wide historic preservation plan.	Support and participate in public programs and private conservation initiatives that have similar objectives with the County's agricultural preservation program.
Complete a comprehensive rezoning for the entire County.	Review the code for historic preservation provisions.	Encourage the Maryland legislature to raise the Agricultural Excise Tax limit for Caroline County to a maximum of $5,000 and to allow the collection of Excise Tax to be at the time of subdivision, rather than at the time of deed transfer. This includes revising the local existing Excise Tax Law.
Establish rural design standards, such as buffers from main highways and design standards for developments in TDR receiving areas.	Examine the coverage areas of communication service providers and gaps in coverage from communications towers for consideration when reviewing communication tower applications and completing emergency services planning.	Coordinate with surrounding jurisdictions for the enhanced planning of private health and medical facilities for the Upper and Mid-Shore areas.
Undergo a review of the TDR receiving area locations and regulations to ensure the continued effectiveness of the program.	Explore methods of improving Caroline County's recycling program.	Coordinate planning between the County, municipalities and Board of Education to provide adequate public infrastructure to areas in need.
Review the Adequate Public Facilities regulations	Request signage in appropriate locations on State Highways that indicate that vehicular traffic is entering an agricultural area.	Provide input as needed to the DPW to identify and prioritize County roads and bridges for future construction, upgrades, and/or improvements.
Update and revise the Chesapeake Bay Critical Area Program, Regulations and Maps.	Explore opportunities to expand assistance to older or special needs homeowners for maintenance and repairs to older structures through the County Housing Rehabilitation Program.	Work cooperatively with the County transportation provider to improve access to public transportation.

Work with the towns to develop a mutually beneficial inter-jurisdictional growth program that will utilize the County's TDR sending rights and provide wastewater treatment to new development to reduce nutrient pollution into the County's waterways.	Review the feasibility of increasing the width of Conservation Reserve Program buffers in areas where increasing the buffer width will improve nutrient reduction efficiency.	Continue to work to acquire the Ridgely Airpark.
Research methods for improving the County's Community Rating in the NFIP	Explore the feasibility of creating a County Ditch Overlay District that includes roadside ditches and public drainage ways, as well as designated buffers adjacent to ditches that would facilitate the development of uniform ditch maintenance standards for all drainage ways in the County.	Support tourism transportation initiatives that are beneficial to the County.
Develop target preservation areas in greenbelt and agricultural conservation areas to concentrate and maximize investments from local, State, and Federal preservation and conservation initiatives.	Explore the feasibility of installing and maintaining drainage control structures in the ditches.	Continue to be an advocate of the dualization of Maryland Route 404.
Work with municipalities to design and implement interjurisdictional Transferable/Purchase of Development Rights programs to balance preservation with new development.	Explore ways to encourage the retirement of highly erodible and potentially highly erodible agricultural land through the Conservation Reserve Program.	Support municipal Smart Growth efforts
Eliminate large-scale mineral extraction/surface mining operations (20 acres or more) as an accepted land use in the defined CBCA and amend the program and regulations to reflect the changes.	Work with NRCS to explore the feasibility of developing a system to track and quantify voluntary best management practices to reduce nutrient loads by County farmers.	Support historical tourism efforts.
Prepare site development and performance standards for mineral extraction facilities that address site reclamation, infrastructure improvements, protection of adjacent properties, truck routes, hours of operation, and landscaping and maintenance standards.	Explore the impacts and feasibility of requiring all new homes in TDR receiving areas to install systems utilizing best available technology, unless connected to a sewer treatment facility.	Support development of local and regional workforce training programs that target growing industry sectors.
Explore the merits of developing protection standards for steep slopes located outside of the Critical Area.	Investigate the feasibility of a Transfer of Development Rights program for land zoned R-1.	Support development of local and regional industries, particularly those that produce locally grown products.

Review timber harvest guidelines to determine if they should more closely match the timber harvest guidelines for properties located within the Critical Area.	Investigate options to extinguish development rights in the Rural zone (e.g. IPA or PDR programs).	Encourage greater participation by County and municipal representatives in the Caroline County Housing Advisory Board to review, assess and report on the State of housing and housing needs in the County.
Review the need to prepare a forestry management plan.		Explore and develop where feasible programs to implement BMPs suitable for residential, commercial, institutional, and industrial land to reduce the pollution load delivered to the County's tributaries from developed land.
Review the Adequate Public Facilities regulations and explore the appropriateness of impact fees to address demand on public facilities and services created by new development.		Continue working on the completion of the North County Sewer Treatment Facility.
Set aside adequate land in appropriate locations for new commercial, industrial and institutional uses.		Where possible include or retrofit Environmental Site Design and Low Impact Development demonstration projects on County properties.
Support the revitalization of rural villages.		
Revise Home Based Business regulations to encourage economic development especially that development related to agribusiness, while minimizing the impacts of home businesses on neighboring property owners.		
Eliminate mineral extraction/surface mining as an accepted land use in interjurisdictional growth areas and TDR receiving areas and amend the zoning and subdivision regulations to reflect these changes.		

Investigate the feasibility of requiring rental housing property owners to obtain a County-issued license to rent property t the public. Include annual or biennial inspection and reporting requirements as a condition of licensing. Use licensing fees to fund County housing initiatives.	Work with MDA staff to review regulatory and preservation programs to ensure that they are structured to provide maximum encouragement to farmers to participate in cover crop cost share programs.	Propose revisions to Stormwater Management Regulations to include revisions made in the State's new Stormwater Management Act and Stormwater Design Manual.
Review existing livability codes (including mobile home regulations) for adequacy and relevance. Update where necessary and appropriate.	Work with USDA and NRCS staff to review County regulatory and preservation programs to ensure that they provide maximum encouragement to farmers to participate in cover crop cost share programs.	Develop outreach materials for property owners regarding voluntary stewardship programs.
Facilitate the renovation of older housing stock by providing greater access to resources, such as a packet with regulations, contacts and other helpful information.	Recommend that the County's Agricultural Preservation Advisory Board amend the stewardship practices criteria used in the prioritization formula to give credit for only full implementation of nutrient management plans and to add credit for participation in other State and Federal conservation programs.	Work with municipalities to coordinate planning efforts that will hook up septic systems where feasible to waste water treatment plants, as well as reduce point source loads.
Consider creating regulatory incentives for adaptive reuse of older housing stock, for example, allowing a Bed and Breakfast as a use in residential zoning districts provided it be subject to 30-day objection procedures, rather than requiring a special use exception.	Recommend that ESLC revise its standards to include required implementation of conservation and nutrient management plans, and award extra credit for farmers who implement additional agricultural BMPs.	
Explore methods of reaching 100 percent implementation of nutrient management plans on County Farms.	Propose revisions to County development regulations to include environmental site design techniques.	