Dorchester County, Maryland

Comprehensive Plan

Water Resources Element

Adopted

October 6, 2009

(Revised December 9, 2009)

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Water Resources Element

The Water Resources Element of the Dorchester County Comprehensive Plan creates a policy framework for sustaining public drinking water supplies and protecting the County's waterways and riparian ecosystems by effectively managing point and nonpoint source water pollution. It complies with the requirements of Article 66B of the Annotated Code of Maryland—as modified by Maryland House Bill 1141, passed in 2006. This element amends the 1996 Comprehensive Plan, the current plan of record. As of the adoption of this element, the County was in the process of preparing a revision of the 1996 Plan.

The Water Resources Element identifies opportunities to manage existing water supplies, wastewater effluent, and stormwater runoff, in a way that balances the needs of the natural environment with the County's projected growth, including the growth projected for the County's municipalities. In this way, this Water Resources Element helps to protect the local and regional ecosystem while ensuring clean drinking water for future generations of Dorchester County residents.

Interjurisdictional Coordination

There are nine incorporated municipalities in Dorchester County. Residents and businesses of six of these communities (Cambridge, Church Creek, East New Market, Hurlock, Secretary, and Vienna) receive public water and/or sewer service. These municipalities own and operate almost all of the County's public water systems, all wastewater treatment plants and most wastewater collection systems.

The municipalities are preparing their own Water Resources Elements. However, the County recognizes the importance of interjurisdictional water resources planning. This Countywide Water Resources Element compiles, to the greatest degree possible, up-to-date data from the municipalities—including completed Municipal Growth Elements (MGE), where available—in order to coordinate water resources, growth, and land use planning. As of August 2009, no municipality had completed and submitted a MGE to the County for review. Where possible, the County has also obtained data and information on water resources from adjoining Counties, in order to paint the fullest possible picture of future impacts to the Choptank, Nanticoke, and other rivers and streams that form Dorchester County's northern and southern boundaries.

1. Goals

In cooperation with the County's municipalities, maintain safe and adequate drinking water supplies and adequate wastewater treatment capacity in public systems.

Take steps to meet regulatory requirements by protecting and restoring water quality in the County's rivers and streams.

Use water resources planning as a tool to direct the location and type of development in Dorchester County.

This goal relates to the following other goals of the 1996 Comprehensive Plan and its forthcoming update:

- Direct growth to towns and Development Areas;
- Reduce sprawl;
- Protect groundwater, and reduce groundwater contamination from failing septic systems;
- Restrict strip development;
- Permit and encourage innovative residential development patterns; and
- Conserve the County's natural resources.

2. County Projections and Scenarios

This section describes the population and housing projections and future growth scenarios used in the Water Resources Element. All projections and scenarios in this section were developed to support the analyses in the Water Resources Element and are intended for use in this Element only. The County's official population projections will be updated as part of a full revision to the 1996 Comprehensive Plan.

Watersheds

This Element takes a watershed-based approach in analyzing the impact of future growth on Dorchester County's water resources—particularly in relation to nutrients discharged to the County's streams. Land in Dorchester County drains to one of eight major watersheds (or "8-digit watersheds," referring to the numeric classification system used by the Maryland Department of the Environment). These watersheds, shown on Map 1, are: the Lower Choptank River, Little Choptank River, Honga River, Fishing Bay, Transquaking River, Nanticoke River, Marshyhope Creek, and a small portion of the Lower Chesapeake Bay 8-digit watershed.

Population Projections

Table 1 shows the countywide population projections developed for the Water Resources Element. These projections indicate that County population will reach approximately 42,050 by the year 2030, an annual increase of approximately 1.2 percent per year, or 32 percent overall between 2007 and 2030. These projections differ from those prepared by the Maryland Department of Planning (MDP) in 2008. Based on past rates of housing permits and other measures of development interest, it is the County's position that it will experience higher population growth than is forecast by the state, even considering the recession that existed in 2008-9.[1]

Table 1. Population Projections for the Water Resources Element

Year	2007	2010	2015	2020	2025	2030	Change, 2007-2030		
							Number	Percent	Annual Increase
Population	31,846[1]	33,200[2]	35,400[2]	37,600[2]	39,900[2]	42,050[2]	10,204	32%	1.2%
1: Source: MDP, 2007 Estimates for Maryland's Jurisdictions									
2:Source: Dorchester County and ERM									

Scenarios

To gauge the impacts of alternative land use and water resources policies, this Water Resources Element uses three scenarios for the distribution of future growth. These scenarios are:

- **Trends:** Continues past trends whereby approximately half of all new residential and non-residential growth is directed to existing Priority Funding Areas (PFAs), or to areas identified for future public water and sewer service by the County's Water and Sewer Master Plan. Remaining development would occur in areas outside of public water and sewer service. This scenario represents the County's 1996 Comprehensive Plan, as implemented through zoning.

[1] The population projections developed prior to the recession for the Draft 2006 Comprehensive Plan (which has not been adopted) indicated a population of 42,050 by the year 2025. These WRE projections assume the same amount of development, extended over a longer period of time.


Lower Choptank River
Lower Choptank River
Marshyhope Creek
Secretary
Hurlock
East New Market
Eldorado
Brookview
Galestown
Cambridge
Little Choptank River
Church Creek
Vienna
Transquaking River
Nanticoke River
Fishing Bay
Honga River
Lower Chesapeake Bay
Dorchester County Water Resources Element
Watersheds
Watersheds
Municipalities
0 1 2 3 4 5
Miles
N

MAP 1

- **PFA Focus:** All new growth would be directed to existing PFAs, or to areas identified for future public water and sewer service by the County's Water and Sewer Master Plan. A negligible amount of new development would occur in areas outside of public water and sewer service.

- **Hybrid:** This scenario is a middle ground between the Trends and PFA Focus scenarios. Approximately three-quarters of new development would be directed to existing PFAs, or to areas identified for future public water and sewer service by the County's Water and Sewer Master Plan. Remaining development would occur in areas outside of public water and sewer service.

Because water and sewer service is often measured in terms of Equivalent Dwelling Units, or EDU,[2] the Water Resources Element uses housing units as the basis for its water, sewer, and nonpoint source pollution analyses. Table 2 shows the projected watershed-level distribution of housing units in each of the three scenarios described above. The projected increase of 6,153 housing units represents an annual increase of approximately 1.5 percent per year between 2007-2030, or 40 percent overall. The rate of housing growth outpaces population growth due to projected declines in household size through 2030.

A more detailed account of how these projections were developed is included in the Water Resources Element Appendix.

3. Drinking Water Assessment

This section describes existing conditions and projected future demand for drinking water in Dorchester County.

Public Water Systems

All public and private drinking water in Dorchester County is obtained from groundwater. Table 3 summarizes water sources, treatment technology, and other characteristics of the County's public drinking water systems. Map 2 shows the location of these water service areas as of 2008 (the most recent year for which mapping is available), as well as the areas that are expected to be served within five years. A more detailed description of the aquifers used by these public systems is included in the Appendix of this Water Resources Element. More detailed information on existing and proposed future water service areas can be found in the County's Water and Sewer Master Plan.

Approximately 7,900 dwelling units in Dorchester County (approximately half of all dwelling units in the County) and a considerable share of businesses receive drinking water from public water systems. This includes all dwelling units and businesses within the corporate limits of Cambridge, Church Creek, East New Market, Hurlock, Secretary, and Vienna. Dorchester County operates two small public water systems. Sanitary Commission District #2, serves the Bonnie Brook subdivision east of Cambridge, while District #6 serves the Lodgecliff neighborhood, west of Cambridge. Only District 2 relies on County-operated wells. All other public water systems are supplied by wells owned and operated by the five municipalities listed in Table 3.

Table 4 shows existing drinking water demand and system capacity, while Table 5 shows the projected water supplies, demands, surpluses and deficits for these water systems under each of the three scenarios described above.

[2] An EDU represents the average amount of water used by one household, and is also used to calculate residential and non-residential (e.g., businesses) water demand. In Dorchester County, one EDU equals to 250 gpd. Note that this differs from the 220 gpd used for the Draft WRE that the County submitted for state agency review. The lower figure was based on initial research, and has been updated based on input from County staff.

Table 2. Housing Unit Projections by Watershed

Watersheds	2007 Existing[4]	2030 Scenarios					
		Comp Plan/Trends (50% of growth to PFA)		PFA (100% of Growth to PFAs)		Hybrid (75% of Growth To PFAs)	
		Increment	Total	Increment	Total	Increment	Total
Lower Choptank River							
Secretary[1]	328	120	448	237	565	179	507
East New Market[1]	187	68	255	135	322	102	289
Cambridge (partial) [1,2]	5,488	2,000	7,488	3,967	9,455	2,999	8,487
Hurlock (partial) [1,2]	217	79	296	157	374	119	336
Remainder of Lower Choptank	2,186	960	3,146	-	2,186	472	2,658
Little Choptank River							
Church Creek [1]	86	31	117	62	148	47	133
Cambridge (partial) [1,2]	136	50	186	98	234	74	210
Remainder of Little Choptank	1,377	605	1,982	-	1,377	297	1,674
Honga River	668	293	961	-	668	144	812
Fishing Bay							
Cambridge (partial) [1,2]	955	348	1,303	690	1,645	522	1,477
Remainder of Fishing Bay	581	255	836	-	581	126	707
Transquaking River	754	331	1,085	-	754	163	917
Nanticoke River							
Vienna[1]	213	78	291	154	367	116	329
Galestown[3]	60	21	81	21	81	21	81
Remainder of Nanticoke	409	180	589	-	409	88	497
Marshyhope Creek							
Hurlock (partial) [1,2]	834	304	1,138	603	1,437	456	1,290
Eldorado[3]	27	15	42	15	42	15	42
Brookview[3]	27	14	41	14	41	14	41
Remainder of Marshyhope Creek	914	402	1,316	-	914	197	1,111
Total	**15,447**	**6,153**	**21,600**	**6,153**	**21,600**	**6,153**	**21,600**

Notes:

1: Includes the existing PFA, as well as areas designated for future public water and/or sewer service by the Dorchester County Water and Sewer Master Plan.

2: Indicates projections for the portions of these PFA/service areas that fall within the designated watershed. For a more detailed description of housing unit projections, please see the Water Resources Element Appendix.

3: Projections from MDP's Detailed Population Projections spreadsheet, provided to Dorchester County in October 2008.

4: Source: Maryland Property View 2007

Table 3. Public Drinking Water System Characteristics

Water System	Source Aquifer (number of wells)	Planned/Potential System Upgrades or Expansions	Source Concerns / System Issues
SD #2	Pleistocene/Surficial		
SD #6	Purchased from Cambridge Municipal Utilities Commission		
Cambridge	Magothy (1); Patapsco: (2)		
East New Market	Piney Point (1) (closed); Choptank (1)	Replace Piney Point well, increase capacity to 224,000 gpd	High arsenic levels in the Piney Point aquifer
Secretary	Piney Point (3)	Two new wells in a new aquifer to address arsenic issues.	High arsenic levels.
Hurlock	Pleistocene/Surficial (3), Piney Point (1)		
Vienna	Calvert (2)	Drill 1-2 new wells, water system upgrades	High iron content (treated with greensand filters)

Source: 2004 Dorchester County Water and Sewer Master Plan; Municipalities

Table 4. Public Drinking Water System Demand and Capacity, 2007

		Sanitary District #2	Cambridge (Includes SD #6)	East New Market	Secretary	Hurlock	Vienna
Existing Water Production[1]	MGD[2]	0.08	4.02	0.10	0.34	0.42	0.12
	EDU[3]	320	16,080	400	1,324	1,680	480
Demand, 2007[4]	MGD	0.04	2.10	0.04	0.04	0.35	0.08
	EDU	156	8,400	180	176	1,400	308
Net Available Capacity, 2007	MGD	0.04	1.92	0.06	0.29	0.07	0.04
	EDU	164	7,680	220	1,168	280	172

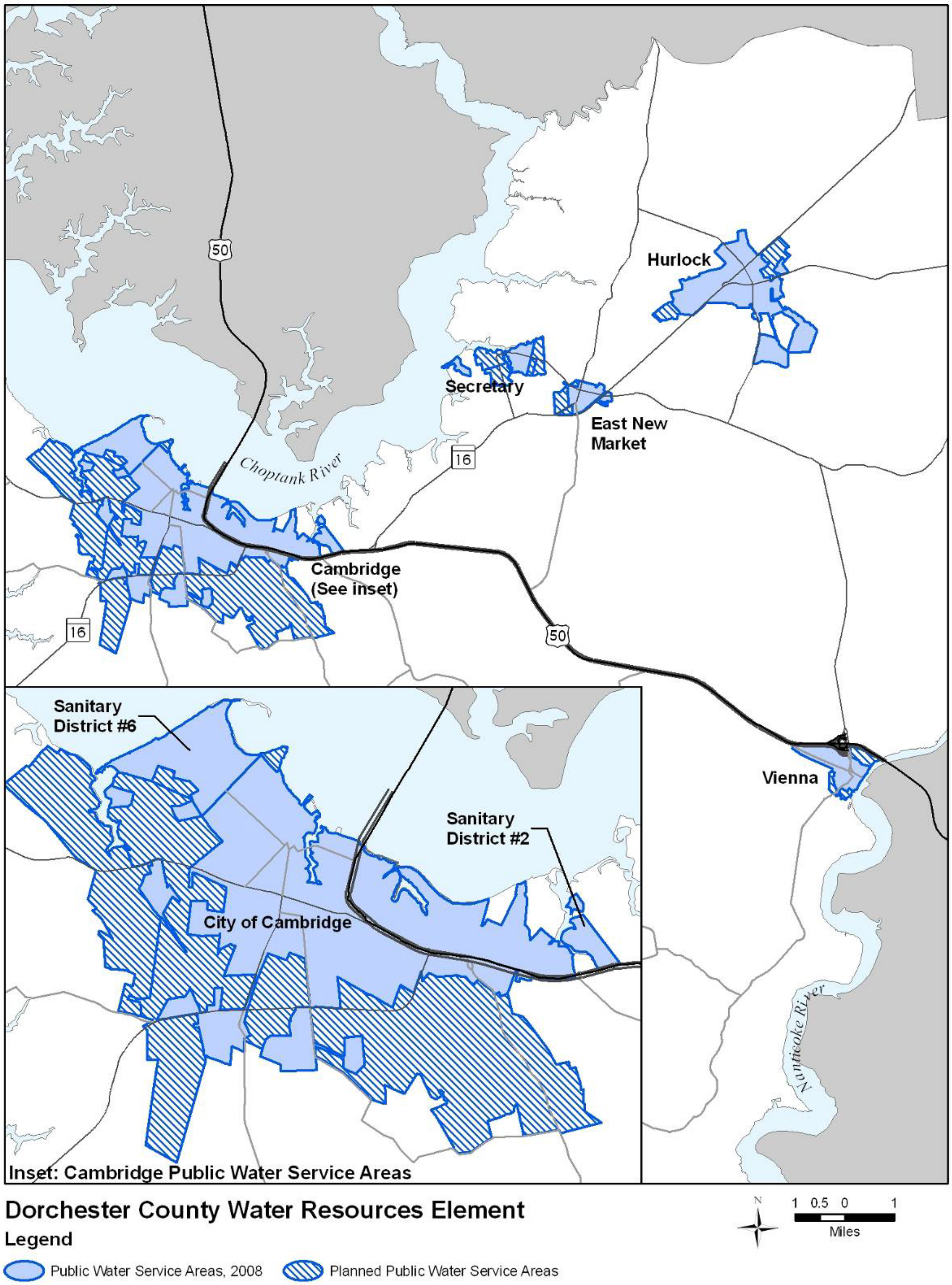
1: Indicates the more restrictive of either MDE's groundwater appropriations permit or the system's design capacity.

2: MGD = Million Gallons per Day

3: EDU = An Equivalent Dwelling Unit (EDU), equal to 250 gpd. This figure represents the average amount of water used by one household, and is also used to calculate residential and non-residential (e.g., businesses) water demand.

4: Includes residential and nonresidential demand.

Source: 2004 Dorchester County Water and Sewer Master Plan; municipalities


50
Hurlock
Secretary
East New
Market
Choptank River
16
Cambridge
(See inset)
16
50
Vienna
Nanticoke River
Sanitary
District #6
Sanitary
District #2
City of Cambridge
Inset: Cambridge Public Water Service Areas
Dorchester County Water Resources Element
Legend
Public Water Service Areas, 2008
Planned Public Water Service Areas
N
1 0.5 0 1
Miles

MAP 2

Table 5. Public Water System Demand and Capacity, 2030

Scenario		Sanitary District #2	Cambridge (Includes SD #6)			East New Market			Secretary			Hurlock			Vienna		
			Trend	PFA	Hybrid	Trend	PFA	Hybrid	Trend	PFA	Hybrid	Trend	PFA	Hybrid	Trend	PFA	Hybrid
System Capacity, 2030[1]	MGD	0.08			4.02			0.22			0.34			0.42			0.12
	EDU	320			16,080			896			1,344			1,680			480
Demand, 2007 (From Table 4)	MGD	0.04			2.10			0.04			0.04			0.35			0.08
	EDU	156			8,400			180			176			1,400			308
Projected New Residential Demand, 2008-2030	MGD	0.01	0.59	1.18	0.89	0.02	0.03	0.03	0.03	0.06	0.04	0.10	0.19	0.14	0.02	0.04	0.03
	EDU	26	2,371	4,729	3,570	68	135	102	120	237	179	383	760	574	78	154	116
Demand added from System Extensions[2]	MGD	0	0.12	0.12	0.12	0.00	0.00	0.00	0.02	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00
	EDU	0	463	463	463	4	4	4	60	60	60	1	1	1	0	0	0
Projected Non-Residential Demand, 2008-2030[3]	MGD	0	0.20	0.39	0.30	0.01	0.01	0.01	0.01	0.02	0.01	0.03	0.06	0.05	0.01	0.01	0.01
	EDU	0	790	1,576	1,190	23	45	34	40	79	60	128	253	191	26	51	39
Total Projected New Demand, 2008-2030	MGD	0.01	0.91	1.69	1.31	0.02	0.05	0.04	0.05	0.09	0.07	0.13	0.25	0.19	0.03	0.05	0.04
	EDU	26	3,624	6,768	5,222	95	184	140	219	376	299	512	1,014	767	103	205	155
Net Available Capacity, 2030	**MGD**	**0.03**	**1.01**	**0.23**	**0.61**	**0.16**	**0.13**	**0.14**	**0.24**	**0.20**	**0.22**	**(0.06)**	**(0.18)**	**(0.12)**	**0.02**	**(0.01)**	**0.00**
	EDU	**138**	**4,056**	**912**	**2,458**	**622**	**532**	**576**	**949**	**792**	**869**	**(232)**	**(734)**	**(487)**	**69**	**(33)**	**17**

Sources: Maryland Property View 2007, Dorchester County Water and Sewer Master Plan, 2009 Draft Cambridge Comprehensive Plan (WRE), 2007 Twin Cities (Secretary and East New Market) MGE and WRE document..

1: Incorporates all ongoing or planned capacity upgrades.

2: Estimated using Maryland Property View.

3: Estimated. Assumes that new non-residential demand is approximately 25% of total projected new demand, based on existing relationships between residential and non-residential demand in the County's water service areas..

All of the County's major public water systems have available capacity to support some additional growth and development, and all of these systems except for Hurlock can support projected growth through 2030. Vienna would exceed its capacity under the PFA scenario by 2030, while the Cambridge, East New Market (after completion of the system's planned upgrades, for which a specific date has not been identified), and Secretary Systems have considerable available capacity beyond 2030. The WRE section entitled "Potential Water Supplies" lists some options for securing the drinking water resources necessary to ensure an adequate future water supply.

Other Water Use

All residential units and businesses in Dorchester County outside of public water systems rely on individual or community wells. These wells are drilled in a variety of water-bearing formations, including the Aquia, Piney Point, Choptank, and Pleistocene, or surficial aquifer (sometimes referred to as the Columbia formation).

Table 6 shows the distribution of Countywide water use in 2000. Although not a precise representation of current water use, Table 6 does highlight the County's major water users: public systems, private residential users, and agricultural irrigation. The remainder of this section discusses those major categories of non-public water users in greater detail.

Table 6. Freshwater Withdrawals in Dorchester County, 2000

Type of Withdrawal	Total Withdrawals (MGD)	Percent of County Withdrawals
Commercial	0.34	2.5%
Industrial	0.99	7.1%
Mining	0.02	0.1%
Livestock Watering	0.33	2.4%
Aquaculture	0.03	0.2%
Irrigation	8.71	62.9%
Thermoelectric Power	0.02	0.1%
Residential self-supplied	0.94	6.8%
Public Supply	2.47	17.8%
Total	**13.85**	**100%**

Source: USGS MD-DE-DE Water Science Center
http://md.water.usgs.gov/freshwater/withdrawals/

Private Residential Wells

Approximately 8,200 residential units in Dorchester County rely on individual wells (or, in a few cases such as mobile home parks, community wells) for drinking water supply, as do most businesses in rural portions of the County. These residential and small commercial uses accounted for approximately 1.2 MGD of groundwater withdrawal in 2004, as described in the County's Water and Sewer Master Plan. Approximately 40 percent of private residential and small commercial wells draw water from the Piney Point aquifer, another one/third of private wells draw from the Pleistocene aquifer, while the remaining private well users draw from the Aquia or other aquifers.

In addition to the arsenic concerns described above, some wells in the Pleistocene (the unconfined surficial aquifer) experience elevated nitrate levels. The sources of this contamination are not known, but could include cross-contamination from failing or inadequate septic systems, or agricultural fertilizer.

Major Commercial and Industrial Users

Most of the County's commercial business districts are concentrated in Cambridge or other towns, and are served by public water systems. Several large industrial water users are located outside of public systems. These include Allen Family Foods outside of Hurlock, seafood processing plants on Hooper's Island, other agribusiness related industries. The 2004 Water and Sewer Master Plan identified approximately 0.78 MGD of water use from such large facilities. Major seafood industry users, which accounted for less than 0.06 MGD in 2004, draw from the Piney Point aquifer, while other major commercial/industrial water users draw from the surficial aquifer.

Agricultural Water Users

As shown in Table 5, agricultural irrigation is the largest user of fresh water in Dorchester County, and is a critical component of agricultural activities in many parts of the state and the Eastern Shore. Agriculture is present in nearly every major watershed in Dorchester County, although it is concentrated in the northern and eastern portions of the County (particularly the Lower Choptank River, Transquaking River, and Marshyhope Creek watersheds). Surface water, specifically from the Chicamicomico River in eastern Dorchester County, provides small amount of this irrigation. However, the vast majority of water used for agricultural irrigation is drawn from surficial aquifers, which are recharged directly through absorbed rainwater. These aquifers do not supply the drinking water for public water systems in Dorchester County, and are only used as drinking water sources by a small proportion of the County's private wells. Thus, while agricultural water use is substantial in Dorchester County, it does not directly compete or threaten the quality of drinking water supplies.

Additional Issues – Drinking Water

Water Recharge

The limited drinking water capacity of the confined aquifers that serve Dorchester County is increasingly strained by new development throughout the Delmarva Peninsula. The US Geological Society (USGS) reports that "withdrawals from Maryland Coastal Plain aquifers have caused ground-water levels in confined aquifers to decline by tens to hundreds of feet from their original levels. Continued water-level declines could affect the long-term sustainability of ground-water resources in agricultural areas of the Eastern Shore."[3] Saltwater intrusion into freshwater aquifers is also a concern on the Eastern Shore, particularly in coastal areas such as Kent Island, in Queen Anne's County.

Groundwater and surface water resources are also linked. Water from surficial aquifers can comprise a significant amount of the base flow of streams and rivers. While groundwater withdrawn through wells is typically returned to the ground or surface via point source discharges, septic systems, and absorption of runoff from outdoor water uses (such as watering of lawns), large withdrawals can potentially impact the quality and quantity of flows in nearby surface water bodies.

There exists no comprehensive study of the water-bearing formations used by Dorchester County residents and businesses, and the Water Balance methodology recommended by Models and Guidelines #26 (the state's official guidance for preparation of the Water Resources Element) is not applicable for the Coastal Plain. MDE, the Maryland Geological Survey (MGS), and the US Geological Society (USGS) have begun work on a Coastal Plain Aquifer Study, but that study remains incomplete.

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[3] Source: USGS. 2006. Sustainability of the Ground Water Resources in the Atlantic Coastal Plain of Maryland. USGS Fact Sheet 2006-3009

In most cases, the recharge areas for the County's major aquifers (particularly the Piney Point and Aquia), are not necessarily found on the Eastern Shore. The County should use the data and recommendations of the Coastal Plain Aquifer Study (once completed) to shape its own water use policies and ordinances. However, the County also recognizes the need for and supports the development of broader regional water policies to protect already scarce resources.

For purposes of this Water Resources Element (and lacking specific evidence to the contrary), this Water Resources Element presumes that the MDE groundwater permit issued for each public drinking water system reflects the maximum safe yield of the aquifer(s) used by that system.

Arsenic

The primary drinking water quality concern in Dorchester County (for both public and private systems) is the presence of naturally-occurring elevated arsenic levels in some portions of the Aquia and Piney Point aquifers. The Dorchester County Health Department has identified two particular areas of concern: the Neck, Madison and Taylor's Island districts (Aquia and a portion of Piney Point), and the portion of the Piney Point that supplies the water systems in Secretary and East New Market. In particular, arsenic levels in the Secretary water system exceed federal standards. The Town is in the process of drilling two new wells into a different aquifer to address this problem. For other systems and individual wells, treatment technology for arsenic removal is not widely tested, and alternative aquifers should be explored. The County Health Department should also work with MDE to ensure that arsenic levels in private wells do not exceed health standards.

Groundwater Protection

The County's Ground-Water Protection Report (1988) is a management plan for the protection of the County's groundwater resources, particularly the surficial aquifer, and particularly in areas with seasonal high water tables. The Report's key findings are presented in the form of tables and supporting text that identify and describe the type of septic system (including specific construction techniques) that should be permitted in each of four zones (identified based on soil characteristics, water table, and other features) in the County. It also recommends minimum well depths, well construction techniques, and other factors to further reduce the possibility of contamination. The Ground-Water Protection Report is adopted by reference into the County's Water and Sewer Master Plan.

MDE has also prepared source water assessments for each of the public water systems in Dorchester County. The County should work with its municipalities to implement any action items identified in those assessments.

Potential New Water Supplies

While the County acknowledges the scarce nature of its primary confined aquifers (the Aquia and Piney Point), the County's land use and economic policies continue to encourage growth in appropriate locations. To accommodate this growth without straining existing water resources beyond their capacities, the County and particularly its municipalities should begin to investigate the feasibility of other sources of drinking water, including different aquifers and surface water bodies.

A number of other aquifers may be present under Dorchester County, and may be able to provide groundwater for Dorchester County, including the Matawan, Magothy, Patapsco, and Patuxent formations.[4] More detailed investigation is necessary to determine whether the water in these aquifers is of sufficient quality (particularly with relation to hardness, dissolved solids, and iron) and can be

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[4] Source: Dorchester County. 1988. Ground-Water Protection Report Table 6

produced in sufficient quantity for human consumption. The aquifers listed above also occur at significantly greater depths than the Aquia and Piney Point, adding to the cost of wells for new development (or new wells to serve existing systems).

Surface water impoundments are not currently used for drinking water in Dorchester County. Although surface water is plentiful in Dorchester County, preparing that water for public consumption can also be costly and difficult. Many of the County's major rivers, including the Choptank and Nanticoke, are impaired by a variety of pollutants, including biological material (typically fecal coliform), nutrients, and bacteria. Surface water cannot be ruled out as a potential new source of drinking water, and should be included in any comprehensive study of new drinking water sources. However, the County acknowledges that surface water will not likely be the preferred new source.

Linking Water Supply to Development

The provision of public services such as drinking water can be a major tool in guiding future development and redevelopment. However, this tool is not fully available to Dorchester County. The County maintains only two public drinking water systems (Sanitary Commission Districts #2 and #6), only one of which supplies its own water. Both are in the greater Cambridge area, and neither district contains significant undeveloped land. Cambridge and other municipalities in Dorchester County have historically extended public water service outside of existing municipal boundaries only for annexations, or to address public health emergencies.

As a result, the County has only limited ability to use water resources to guide land use and development. At the same time, new development is increasingly occurring on private well and septic systems in the northern portion of the County, where public water service is unavailable or constrained. The County's requirements for groundwater protection may exacerbate this problem, by requiring larger lots and lower residential densities than permitted under existing zoning regulations. This can consume more land than is desirable and generate higher levels of nonpoint source pollution.

Given the resulting low-density nature of unincorporated portions of Dorchester County, establishment of a new County-operated water system is a difficult proposition. However, to the degree that there are relatively concentrated areas—such as an emerging village center or road corridor—where development ought to be concentrated, the County may wish to investigate the establishment of a public water system. Such a system would be particularly well suited to areas where failing or marginal septic systems threaten or potentially threaten existing private wells. Updates to the Water and Sewer Master Plan should identify such areas and discuss the feasibility of a new County-operated public water system.

In addition, HB1141 requires all municipalities in Maryland with zoning authority to prepare a Municipal Growth Element (MGE). As part of that element, the municipality must consult with its county and come to an agreement regarding growth and development. As MGEs are prepared, Dorchester County should use the mandatory consultation period to address the appropriateness of proposed expansions of municipal water (and sewer) systems.

4. Wastewater Assessment

This section describes existing conditions and projected future demand for public wastewater treatment capacity in Dorchester County.

Public Sewer Systems

Approximately 7,900 dwelling units in Dorchester County (approximately half of all dwelling units in the County) and a considerable share of businesses discharge wastewater to one of the four municipally-owned and operated public wastewater treatment plants (WWTP) listed in Table 7. This includes all dwelling units and businesses within the corporate limits of Cambridge, Church Creek (wastewater pumped to Cambridge), East New Market, Hurlock, Secretary, and Vienna.

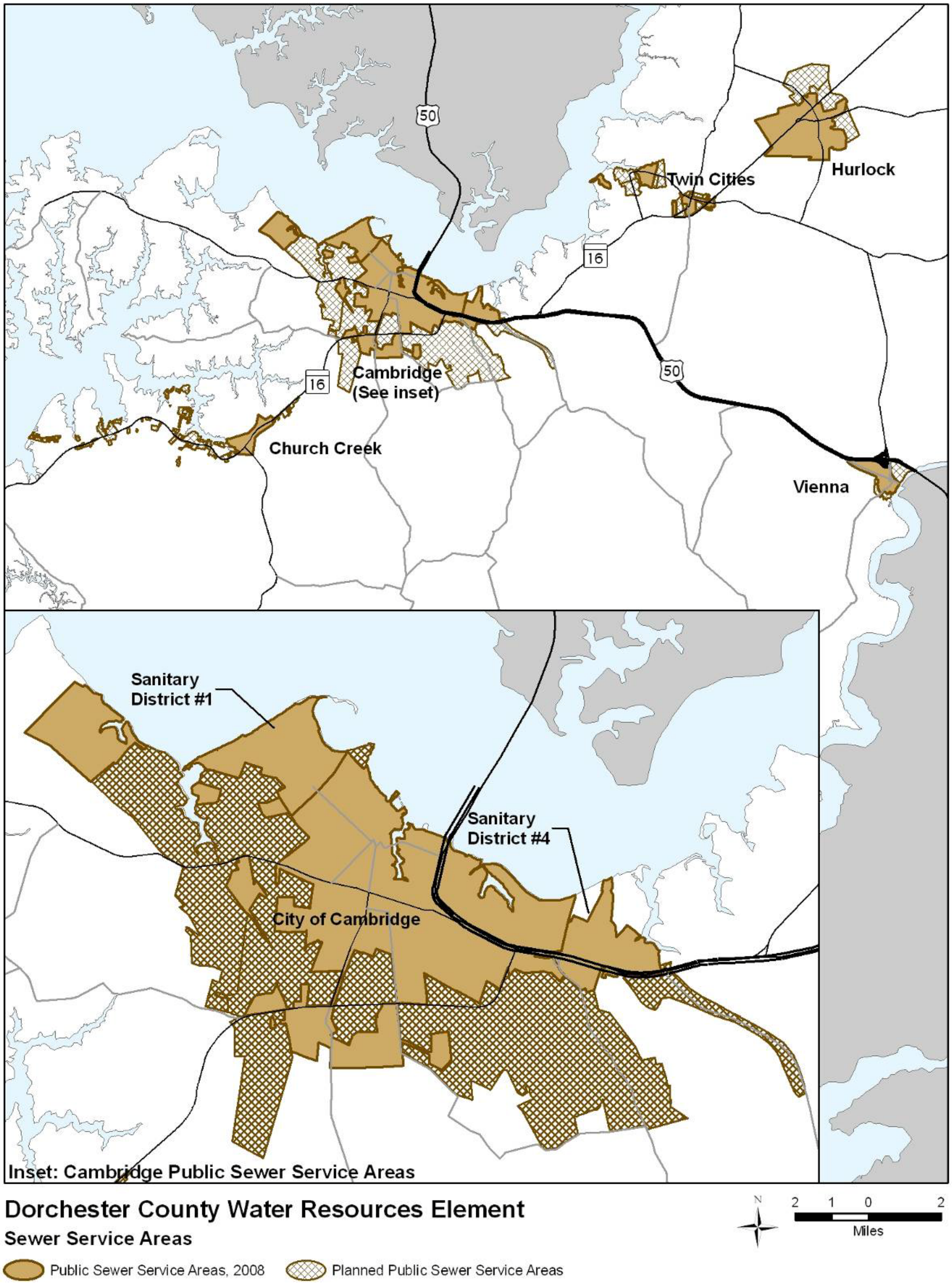
Table 7. Public Sewer System Characteristics

Wastewater Treatment Plant	Discharge Location	Existing Treatment Technology	Planned/Potential Upgrades or Expansions
Lower Choptank Watershed			
City of Cambridge *(includes SD#1, SD#4, and Church Creek)*	Choptank River	Biological Nutrient Removal (BNR)	Enhanced Nutrient Removal (ENR) Upgrade Planned
Twin Cities	Warwick River	Aerated lagoon	Upgrade/expansion to 0.4 MGD BNR; Inflow/Infiltration (I/I) reduction.[1] Nutrient reductions also needed to meet likely nutrient caps.
Marshyhope Creek Watershed			
Hurlock	Wrights Branch	ENR and spray irrigation	None
Nanticoke River Watershed			
Vienna	Nanticoke River	Extended aeration/ activated sludge	Upgrade/Expansion to 0.275 MGD, BNR or ENR

1: Inflow is water from storm events entering the system through roof drains sump pumps, and similar sources. Infiltration is groundwater entering the system through leaking pipes, manholes, and other elements. I/I takes up sewer capacity that should be reserved only for wastewater, effectively limiting the system's overall capacity.

Source: 2004 Dorchester County Water and Sewer Master Plan; Municipalities

Dorchester County does not own or operate a public WWTP. The Dorchester County Sanitary Commission has written agreements with the City of Cambridge to provide system maintenance, updating and billing to two Sanitary Districts (District 1 on Cambridge's western boundary, and District 4, or Jacktown, on Cambridge's eastern boundary), serving approximately 750 dwelling units. Wastewater from these Sanitary Districts flows to the Cambridge WWTP. Within the district boundaries, the Sanitary Commission controls the extension of municipal sewer services, provided that such extensions do not exceed the flow limit set by the agreement with the City.


50
Hurlock
Twin Cities
16
Cambridge
(See inset)
16
50
Church Creek
Vienna
Sanitary
District #1
Sanitary
District #4
City of Cambridge
Inset: Cambridge Public Sewer Service Areas
Dorchester County Water Resources Element
Sewer Service Areas
N
2 1 0 2
Miles
Public Sewer Service Areas, 2008
Planned Public Sewer Service Areas

MAP 3

In addition, approximately 250 residential units outside of a municipality or a Sanitary District discharge wastewater to municipal sewer systems. These units are generally located in West Vienna, Depot, Green Point, and outside of Hurlock. These are existing communities which, due to failing systems, were extended community sewer services by the nearest public system. Several of these areas also receive public water service. Map 3 shows the location of public sewer service areas as of 2008 (the most recent year for which mapping is available), as well as the areas that are expected to be served within five years.

Table 8 shows existing public sewer demand and system capacity, while Table 9 shows the projected supplies, demands, surpluses and deficits for these sewer systems under each of the three scenarios described in this Element.

All of the County's major public sewer systems have available capacity to support some additional growth and development, assuming implementation of the upgrades and expansions to the Twin Cities and Vienna WWTPs. The Cambridge and Hurlock systems could have considerable available capacity beyond 2030.

Table 8. Public Sewer System Demand and Capacity, 2007

		Cambridge (Includes SD #1, #4, and Church Creek)	**Twin Cities** (Includes East New Market and Secretary)	**Hurlock**	**Vienna**
Existing Treatment Capacity[1]	MGD	8.10	0.28	1.70	0.14
	EDU	32,400	1,124	6,800	550
Average Daily Flow, 2007[2]	MGD	3.50	0.19	1.10	0.07
	EDU	14,000	764	4,400	281
Net Available Capacity, 2007	MGD	4.60	0.09	0.60	0.07
	EDU	18,400	360	2,400	269

Notes:

1: Indicates the more restrictive of either MDE's discharge permit or the system's design capacity.

2: Includes all residential and non-residential flow.

Source: 2004 Dorchester County Water and Sewer Master Plan; municipalities

Nutrient Discharges and Assimilative Capacity

Nitrogen and phosphorus (more generally referred to as "nutrients") from WWTPs and from stormwater and other "non-point sources" are the primary contributors to degraded water quality in the Chesapeake Bay and its tributaries. As a result of Maryland's participation in the Chesapeake Bay 2000 Agreement, and resulting state policies designed to help restore the Bay, water and sewer planning must take into account the "assimilative capacity" of a receiving body of water—the mass of nutrients that the stream can receive while still maintaining acceptable water quality. This section describes the key limits on assimilative capacity as they apply to the County's WWTPs.

TMDL

Another measure of assimilative capacity is the Total Maximum Daily Load (TMDL), a series of calculations required by the Clean Water Act. A TMDL is the maximum amount of pollutant that a water body, such as a river or a lake, can receive without impairing water quality.

Table 9. Public Sewer System Demand and Capacity, 2030

		Cambridge (Includes SD #1, #4, and Church Creek)			Twin Cities (Includes East New Market and Secretary)			Hurlock			Vienna		
Scenario		**Trend**	**PFA**	**Hybrid**	**Trend**	**PFA**	**Hybrid**	**Trend**	**PFA**	**Hybrid**	**Trend**	**PFA**	**Hybrid**
System Capacity, 2030[1]	MGD			8.10			0.28			1.70			0.14
	EDU			32,400			1,124			6,800			550
Average Daily Flow, 2007	MGD			3.50			0.19			1.10			0.07
	EDU			14,000			764			4,400			281
Projected New Residential Demand, 2030	MGD	0.59	1.18	0.89	0.05	0.09	0.07	0.10	0.19	0.14	0.02	0.04	0.03
	EDU	2,371	4,729	3,570	188	372	281	383	760	574	78	154	116
Demand added from System Extensions[2]	MGD	0.23	0.23	0.23	0.02	0.02	0.02	0.02	0.02	0.02	0.00	0.00	0.00
	EDU	923	923	923	76	76	76	84	84	84	0	0	0
Projected New Non-Residential Demand, 2030[3]	MGD	0.20	0.39	0.30	0.02	0.03	0.02	0.03	0.06	0.05	0.01	0.01	0.01
	EDU	790	1,576	1,190	63	124	94	128	253	191	26	51	39
Total Projected New Demand, 2008-2030	MGD	0.79	1.58	1.19	0.06	0.12	0.09	0.13	0.25	0.19	0.03	0.05	0.04
	EDU	3,161	6,305	4,759	250	496	375	511	1,013	766	103	205	155
Grand Total Projected Demand, 2030	**MGD**	**4.29**	**5.08**	**4.69**	**0.25**	**0.32**	**0.28**	**1.23**	**1.35**	**1.29**	**0.10**	**0.12**	**0.11**
	EDU	**17,161**	**20,305**	**18,759**	**1,014**	**1,260**	**1,139**	**4,911**	**5,413**	**5,166**	**385**	**486**	**436**
Net Available Capacity, 2030	**MGD**	**3.81**	**3.02**	**3.41**	**0.15**	**0.08**	**0.12**	**0.47**	**0.35**	**0.41**	**0.18**	**0.15**	**0.17**
	EDU	**15,239**	**12,095**	**13,641**	**586**	**340**	**461**	**1,889**	**1,387**	**1,634**	**715**	**614**	**664**

Sources: Maryland Property View 2007, Dorchester County Water and Sewer Master Plan, 2009 Draft Cambridge Comprehensive Plan (WRE), 2007 Twin Cities (Secretary and East New Market) MGE and WRE document.

1: Incorporates all ongoing or planned capacity upgrades, as well as Inflow and Infiltration (I/I), although specific I/I volumes are not known.

2: Estimated using Maryland Property View.

3: Estimated. Assumes that new non-residential demand is approximately 25% of total projected new demand (see Note in Table 5).

Water bodies are classified as “impaired” when they are too polluted or otherwise degraded to support their designated and existing uses. The TMDL is typically expressed as separate discharge limits from point sources such as WWTPs, as well as non-point sources such as stormwater or agricultural runoff.

The impaired waters list is called the 303(d) list, named after the section in the Act that establishes TMDLs (Center for Watershed Protection, 2005). In Dorchester County, all 8-digit watersheds except the Fishing Bay and Nanticoke River watersheds are impaired by nutrients. TMDLs have been prepared for the Transquaking River watershed (nitrogen and phosphorus), the Chicamacomico River (a tributary of the Transquaking), and the Marshyhope Creek watershed (phosphorus only, May 1 through October 31). Marshyhope Creek is the receiving body for discharges from the Hurlock WWTP. The phosphorus TMDL for the Hurlock WWTP is incorporated into the plant’s National Pollution Discharge Elimination System (NPDES) permit, and is expressed in its point source cap (see below).

Nutrient TMDLs have not been completed for the Lower Choptank, Little Choptank, and Honga River watersheds. The completion of these studies, particularly for the Lower Choptank, will have tremendous impact on how the County and its municipalities manage wastewater, stormwater, and other sources of nitrogen, phosphorus, and other pollutants.

Point Source Caps

To address nutrient loads from point sources such as WWTPs, the state has established Chesapeake Bay Tributary Strategy point source caps. These caps are numerical limits on the amount of nitrogen and phosphorus that WWTPs can discharge to the Bay and its tributaries (expressed as pounds per year of nitrogen and phosphorus). Point source caps have been established for the Cambridge and Hurlock WWTPs. Table 10 lists these nutrient caps, as well as existing and projected future nutrient discharges under each future land use scenario.

This Water Resources Element assumes that by 2030 ENR upgrades will be complete at the Cambridge WWTP, and that the Twin Cities and Vienna WWTPs will use BNR treatment technology (which is being investigated for both plants). Given these assumptions, as well as assumptions about the nitrogen and phosphorus concentrations in future discharges (see Note 4 on table 10), the Cambridge and Hurlock WWTPs will not exceed their nutrient caps under any Year 2030 growth scenario.

The Hurlock facility combines an ENR point-source discharge with the Town’s previously existing lagoon and spray irrigation system. According to the Town, approximately 95 percent of treated wastewater effluent from the Hurlock sewer service area is discharged through the WWTP’s point source outfall, with the remaining five percent discharged through the lagoon/spray system. The spray system also currently handles the waste-activated sludge from the ENR facility. It is not known whether the Hurlock spray irrigation system could discharge higher volumes of treated wastewater. Accordingly, the Estimated Nutrient Discharges (2030) in Table 10 reflect nutrient loading from 95 percent of Hurlock’s projected 2030 ADF.

The Vienna WWTP would exceed its phosphorus cap by 2030 under all scenarios, and the Twin Cities WWTP would exceed its nitrogen and phosphorus caps by a wide margin under all scenarios. Accordingly, these two systems should consider ENR upgrades or other methods of accommodating projected growth without violating water quality standards.

Table 10. Projected Point Source Nutrient Discharges, 2030

		Cambridge (Lower Choptank River)			Twin Cities (Lower Choptank River)			Hurlock[5] (Marshyhope Creek)			Vienna (Nanticoke River)		
		Trends	PFA	Hybrid	Trends	PFA	Hybrid	Trends	PFA	Hybrid	Trends	PFA	Hybrid
Projected Capacity, 2030	MGD	8.10			0.40			1.70			0.28		
Estimated Existing Nutrient Loads, 2007[2]	TN[1]	40,000			15,386			5,000			4,000		
	TP[1]	5,000			3,846			1,000			1,300		
Likely Nutrient Caps, 2030[3]	TN	98,676			6,100			20,101			3,223		
	TP	7,401			457			1,508			457		
Projected ADF, 2030	MGD	4.29	5.08	4.69	0.25	0.32	0.28	1.23	1.35	1.29	0.10	0.12	0.11
Assumed Treatment Technology, 2030		ENR			BNR			ENR			BNR		
Estimated Nutrient Discharges, 2030[4]	TN	39,152	46,325	42,798	6,169	7,667	6,930	10,643	11,732	11,196	2,340	2,959	2,654
	TP	3,915	4,633	4,280	1,542	1,917	1,733	1,064	1,173	1,120	585	740	664
Remaining Discharge Capacity	TN	59,524	52,351	55,878	(69)	(1,567)	(830)	9,458	8,369	8,905	883	264	569
	TP	3,486	2,768	3,121	(1,085)	(1,460)	(1,276)	444	335	388	(128)	(283)	(207)

1: TN = Total Nitrogen (lbs/year); TP = Total Phosphorus (lbs/year)

2: Sources:

Cambridge, Hurlock: estimates from MDE's ENR Fact Sheets for Cambridge and Hurlock WWTPs (http://www.mde.state.md.us/Water/CBWRF/pop_up/enr_status_map.asp; Twin Cities Water Resources Element (August 28, 2007); Vienna existing discharges estimated based on 2007 ADF at 18 mg/L TN, and 6 mg/L TP.

3: Sources:

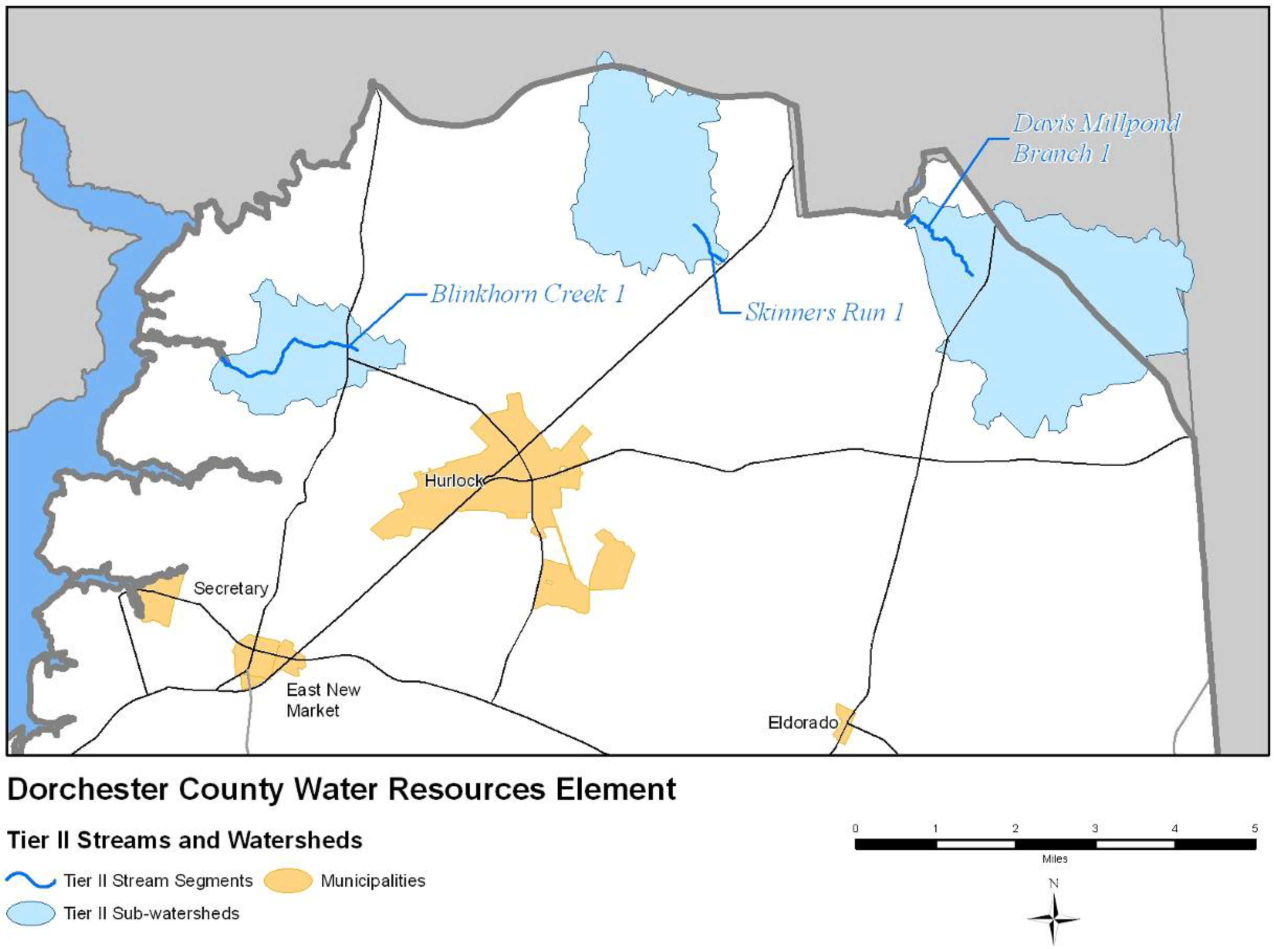
Cambridge, Hurlock: MDE's ENR Fact Sheets for Cambridge and Hurlock (http://www.mde.state.md.us/Water/CBWRF/pop_up/enr_status_map.asp), reflecting the caps applicable to these facilities upon completion of ENR upgrade; Vienna: Town of Vienna Physical Infrastructure Impact Study; Twin Cities: Cap estimated based on MDE's baseline for minor WWTPs, as calculated in MDE's "Point Source Nutrient Loading Cap and WWTP Capacity Planning," presentation, prepared by Dr. Y. Chang.

4: Assumes discharge concentrations of 3mg/L TN and 0.3 mg/L TP for ENR; 8 mg/L TN and 2 mg/L TP for BNR

5: According to the Hurlock Department of Public Works, approximately five percent of the Town's treated wastewater is discharged via its spray irrigation system. The data in this table therefore reflect nutrient loading from 95 percent of the Town's projected ADF.

Antidegradation

Maryland's antidegradation policy significantly limits new discharge permits (and expansions of existing permits) that would degrade water quality in Tier II (high quality) waters, as defined by the US Environmental Protection Agency (EPA) (MDE 2008). In these areas, new nutrient discharges can be permitted, as long as they do not degrade existing water quality. Maryland does not have any waters designated for Tier III, but Dorchester County has three stream segments designated as Tier II waters and shown on Map 4: Blinkhorn Creek, Skinners Run, and Davis Millpond Brach. None of the County's public WWTPs discharge to Tier II waters.



MAP 4

Source: MDE, http://www.mde.state.md.us/assets/document/hb1141/dorchester/Dorchester_County.pdf

Alternative Wastewater Disposal Options

A number of other opportunities exist to protect and improve water quality while still accommodating projected growth and development. This section summarizes key concepts that the County and its municipalities may wish to consider.

Continue System Repairs

Considerable capacity is taken up by I/I in the Twin Cities collection system, a problem that East New Market and Secretary are both addressing. Repairing these problems (which is not reflected in the data in tables 9-10) will give the system additional capacity, and may avert the need for ENR upgrade. Other municipalities should continue to test their sewer systems for I/I and address problems as they arise.

Land Application of Treated Wastewater

The application of treated wastewater effluent directly to the soil can allow pollutants to be absorbed before the effluent reaches receiving streams. Spray irrigation is the most common form of land application, although other options (such as drip irrigation or subsurface discharge) can also be considered. Although Dorchester County's land area is larger than that of all but three Maryland counties, much of that land area is covered by wetlands or is subject to seasonal high water tables. This limits the role that land application can play in meeting the County's wastewater needs.

The Preliminary Spray Irrigation Site Capacity Estimate tool provided in *Models and Guidelines #26*, the state's guidance document for the preparation of the Water Resources Element, was used to analyze opportunities for spray irrigation in Dorchester County. Based on this analysis, more than 53,000 acres of land in Dorchester County may be suitable for land application, subject to more detailed investigation. Factors such as slope, soil depth and granularity, water table behavior, and buffers from streams and developed areas are important in determining true suitability.[5]

Other important considerations for land application include storage and seasonal restrictions. Land application systems typically require large storage lagoons capable of holding several months' worth of effluent. Land application may not be permitted during winter months, when frozen soil cannot accept effluent, or during other months when water tables rise. Any future land application system would likely be paired with the nearby surface discharge to maximize system capacity without exceeding nutrient caps or TMDLs.

Those caveats notwithstanding, there does appear to be an opportunity for public wastewater systems to utilize land application as an alternative or enhancement to surface water discharge. Much of the potentially suitable land is within a reasonable distance of the Vienna and Twin Cities WWTPs, the facilities that could reach or exceed their nutrient caps by 2030.

Tertiary Treatment Wetlands

In this system, effluent is treated at a WWTP (either BNR or ENR) and then discharged into a series of constructed, vegetated (typically, forested) wetlands. These wetlands purify the effluent to the point where the eventual discharge is essentially free of nutrients and other pollutants. The best-known application of this technology occurs in Clayton County, Georgia. In this system (which treats 9.3 million gallons of wastewater per day on a 4,000 acre site), the wetland-treated effluent is pure enough to be used for drinking water.[6]

Other smaller applications of tertiary treatment wetlands can be found throughout Maryland. These facilities are typically used at schools and other institutional uses. Implementation of such a facility would depend heavily on soil characteristics and other conditions.

Wastewater Reuse

In some cases, treated wastewater effluent can be used to recharge groundwater aquifers. As with tertiary treatment wetlands, effluent is treated to potable (or better) standards before being injected into the aquifer. One such large-scale system is in place in Orange County, California.[7] In that system, treated

[5] Please see the Water Resources Element Appendix for further detail on this calculation.

[6] For more information, see http://www.ccwa1.com/operations/water.reclamation.aspx

[7] For more information, see http://www.gwrsystem.com/

effluent is used not only to recharge the aquifer (and to provide some drinking water as a result), but also to halt and even reverse saltwater intrusion from the Pacific Ocean into the aquifer. Given the documented drops in aquifer levels on the Eastern Shore, and the presence of saltwater intrusion in some areas (notably the Aquia aquifer on Kent Island), this approach may have merit in Dorchester County. The County should work with MDE to investigate the feasibility of such a system.

Nutrient Trading

Under the state's Policy for Nutrient Cap Management and Trading,[8] one of the County's WWTPs could agree to forego a certain amount of development in exchange for payment, and then send or "trade" that excess treatment capacity to another WWTP on the Eastern Shore in need of capacity. The receiving WWTP would then be allowed to expand beyond its current permitted capacity, provided that such expansion does not exacerbate existing water quality impairments or violate TMDL requirements.

With a large existing and projected capacity surplus, the Cambridge WWTP is most likely to take advantage of this system (upon completion of its ENR upgrade), although the Hurlock WWTP may also choose to trade some of its available capacity. The County should work with the municipalities to ensure that any such nutrient trading approaches fall within the County's overall land use and growth management approach.

WWTPs with ENR technology may also be able to expand their facilities by connecting septic systems to public sewer systems. The County Health Department has identified a number of rural communities whose failing septic systems threaten water quality in older, shallow wells. Many of these areas along MD 16 west of Cambridge are expected to be connected to the Cambridge WWTP in the next five to ten years. In addition, MDE and the Maryland Department of Agriculture (MDA) are developing guidelines that would allow trades between nonpoint sources (such as agriculture) and point sources. The County should work with the municipalities to identify and prioritize areas of failing septic systems and other nonpoint source pollution "hot spots" for potential inclusion in any trading system.

Additional Issues – Wastewater

Linking Sewer Supply to Development

The County does not operate a wastewater treatment plant (WWTP) and does not directly supply public sewer services. The County provides public water service to limited areas in the Cambridge vicinity. Thus, the County cannot use the provision of public sewer as a tool in guiding future development and redevelopment.

As with public water systems, the low-density nature of unincorporated portions of Dorchester County makes the construction and establishment of a new County-operated wastewater system a difficult proposition. Indeed, state regulations mandate that any new WWTP cannot discharge any nitrogen or phosphorus to surface waters. Thus, any County-operated WWTP would have to rely on land application or some other wastewater reuse technique. If the County were to implement such a system, it could potentially generate wastewater credits, which could be sold to other systems on the Eastern Shore.

To the degree that there are relatively concentrated areas of failing septic systems, the County may wish to study the feasibility of a new small-scale WWTP and collection system, tied to land application or a similar alternative form of discharge. Such an approach may be especially viable in locations where connection to an existing WWTP would be excessively expensive or technically challenging. Updates to

[8] Information available at: http://www.mde.state.md.us/Water/nutrientcap.asp

the Water and Sewer Master Plan should identify such areas and discuss the feasibility of a new County-operated public wastewater treatment plant and collection system.

As Municipal Growth Elements are prepared, Dorchester County should use the mandatory consultation period to address the appropriateness of proposed expansions of municipal water (and sewer) systems.

5. Programmatic Assessment of Nonpoint Source Policies

Nonpoint sources of nutrient pollution include agricultural run off, erosion and sediment from development, stormwater runoff from roads, atmospheric deposition, and any other source other than an outfall pipe. These sources are called nonpoint because they involve widely dispersed activities, and hence are difficult to measure. All non-point sources of pollution eventually reach the waters of the Chesapeake Bay unless filtered or retained by some structural or nonstructural technique.

Various technologies reduce nutrients from agricultural and developed lands. Nutrient reduction technologies for nonpoint source pollution are generally referred to as "Best Management Practices" (BMPs). Examples of these technologies include animal waste storage, agricultural nutrient management planning, stormwater settling ponds, and erosion controls. Natural controls or "low-impact development techniques are extremely effective in reducing the amount of pollutants that reach waterways. Woodlands and wetlands release fewer nutrients into the Bay than any other land use. For these reasons, forests, grasslands, and wetlands are critical to restoring and maintaining the health of the aquatic environment.

This section characterizes the policies and procedures in place to manage nonpoint source pollution in Dorchester County.

Maryland Stormwater Design Manual

The 2000 Maryland Stormwater Design Manual, Volumes I & II is incorporated by reference into the Dorchester County Code, and serves as the official guide for stormwater principles, methods, and practices. In addition, the County requires that all redevelopment projects reduce on-site impervious surface by 20 percent. The County encourages non-structural stormwater management techniques such as natural area conservation, sheet flow to buffers, and disconnection of rooftop runoff.

The 2007 Maryland Stormwater Management Act, passed by the General Assembly, mandates substantial revision of the Stormwater Design Manual. The most notable provision of the 2007 Act is the requirement that new development use Environmentally Sensitive Design (ESD) techniques, which are intended to "maintain pre-development runoff characteristics" on the site.[9] ESD techniques are based on the premise that stormwater management should not be seen as stormwater disposal. Instead of conveying and treating stormwater in large, costly end-of-pipe facilities located at the bottom of drainage areas, ESD addresses stormwater through the use of small, cost-effective landscape features that are frequently located onsite. It is an effective means of managing both stormwater quality and quantity.

As of early 2009, the revised Maryland Stormwater Design Manual and accompanying model regulations are available in draft form. The County should revise its Stormwater Management Ordinance to incorporate the forthcoming revision of the Maryland Stormwater Design Manual and other enhanced stormwater management policies recommended by MDE, pursuant to the Stormwater Management Act of 2007.

[9] Source: MDE. http://www.mde.state.md.us/assets/document/act%20-%20a%20state%20perspective.pdf

Land Preservation, Parks, and Recreation Plan

Dorchester County's 2005 Land Preservation, Parks, and Recreation Plan (LPPRP) was adopted as an amendment to the 1996 Comprehensive Plan, and contains numerous goals, policies, and implementation actions, many of which address issues similar to those analyzed as part of this WRE. Key implementation strategies that support the policies in this WRE are listed below.

- Develop a Transfer of Development Rights and Purchas of Development Rights program, if feasible.
- Look at measures to decrease development in agricultural areas, such as payment to the County to preserve land [equivalent to the amount being developed].
- The County must consider stronger agricultural zoning or consider other methods to ensure that development does not exceed land protection.
- Encourage all farms to have Soil Conservation and Water Quality Plans.
- Continue to establish and build upon greenways along the waterfront

In addition, the LPPRP contains a map of Priority Focus Areas—portions of the County where the purchase of agricultural easements by the Maryland Agricultural Land Preservation Foundation (MALPF), Maryland Environmental Trust (MET), and other entities should be concentrated. The Priority Preservation Areas include large portions of the Lower Choptank, Little Choptank, Marshyhope Creek, and Transquaking River watersheds. As will be discussed in Section 6, these watersheds are heavily impacted by nutrients. Easement purchases in these watersheds can help to reduce nutrient loading.

Other Nonpoint Source Management Policies and Considerations

Failing Septic Systems. A number of areas have been identified as either type 1 or type 2 septic system problem areas in the Water and Sewer Master Plan. Type 1 areas are areas with concentrated development where a sanitary survey has found and documented a high incidence of failing septic systems and the soil conditions and lot sizes make continued septic system correction impractical. Type 2 areas are areas with concentrated development where safe and reliable septic system operation is presumed to be difficult due to poor soil conditions and/or small lot size, however no sanitary survey has been conducted to document and define the problem.

The County should work with the municipalities to evaluate ways to address these areas of failing septic systems, either by connection to public sewer systems, or through the alternative wastewater disposal options discussed above. As described in Section 4, the County could also consider new wastewater collection and treatment systems, tied to land application (or another alternative disposal method) to address failing septic systems.

Septic Denitrification. The County does not currently require denitrification units for new or existing septic systems. The County should consider requiring the use of septic denitrification units in new construction outside of public wastewater systems, and encouraging denitrification retrofits for existing septic systems. The nonpoint source analysis in this WRE assumes that, under all three scenarios, half of all new rural (i.e., not connected to a public sewer system) residential and commercial development will utilize denitrification units, and that one-quarter of all existing units will be retrofitted with denitrifying units. Although not explicitly a goal of the 1996 Comprehensive Plan, this level of implementation is reasonably foreseeable in the next two decades.

Agriculture. Agriculture is important to the aesthetic and economic value of the County, but runoff from cropland, feedlots and other livestock operations carries nutrients and pollutants from manure, fertilizers, ammonia, pesticides, soil and sediment into waterways. Agriculture is a large contributor of nitrogen and phosphorus to the Bay and its tributaries in Dorchester County. However, this impact can be reduced through the application of agricultural Best Management Practices (BMPs) such as planting cover crops, judicious use of fertilizer (especially animal manure), and maintaining appropriate buffers along rivers and streams. All farms in Dorchester County must already prepare and follow Nutrient Management Plans, and many farms also prepare Soil Conservation Plans.[10] The County should continue to work with the agricultural community to implement agricultural BMPs to the greatest degree feasible.

Sedimentation and Erosion. Sedimentation and other impacts resulting from construction activity, and increased stormwater flows to streams and rivers from development are also a potential threat to water quality. Most new non-agricultural development in Dorchester County requires a sedimentation and erosion control plan that is approved by the Dorchester County Soil Conservation District.

Open Section Roads. Outside of towns and populated areas where pedestrian facilities are a priority, new roads in the County should continue to be developed with open sections, to better disperse stormwater.

Stormwater Retrofits. Stormwater retrofits can help to reduce nonpoint source pollution, particularly in more densely developed areas. The County should identify locations where such retrofits could address concentrations of nonpoint source pollution ("hot spots"), or where retrofits can help to protect environmentally sensitive areas. Future retrofit funds and implementation activities should be targeted to these priority areas.

6. Total Nutrient Loads and Assimilative Capacity

Nutrient loads from point sources (WWTPs), stormwater, and other nonpoint sources are major contributors to degraded water quality in the Chesapeake Bay and its tributaries. This section evaluates existing and projected point and nonpoint source pollution loads.

Nonpoint Source Loading

Table 11 shows the estimated existing and future nonpoint source loading (nitrogen and phosphorus) in each 8-digit watershed under each of the three scenarios. Nonpoint source nutrient loads (including septic systems) were estimated using methodology developed by the Maryland Department of the Environment, as modified by the County to reflect revised nutrient loading rates. More detail on the nonpoint source evaluation methodology is presented in the Water Resources Element Appendix. Table 12 shows the total nutrient discharges, including nonpoint and point sources, as well as nutrient caps set by the Transquaking River TMDL (the only completed full-year nutrient TMDL). Both Tables 11 and 12 include nutrient discharges from the County's municipalities. The loadings described in Tables 11 and 12 represent estimates only, and intended only to facilitate comparison between scenarios.

All three scenarios would result in decreased nutrient loadings in all watersheds, compared to 2007 levels. This is due largely to the nonpoint source analysis assumption that nutrient-reducing Best Management Practices (BMPs) for urban stormwater and agricultural runoff would be more widely implemented by 2030. All three scenarios would produce comparable levels of nonpoint source nitrogen and phosphorus discharges (the highest and lowest scenarios are separated by less than 14,000 lbs/day of TN, about one half of one percent of the 2007 loading), although the PFA Focus scenario would have the lowest nonpoint source nutrient discharge.

[10] Source: Dorchester County Soil Conservation District. 2009. Testimony at Planning Commission Public Hearing, July 1.

Table 11. Nonpoint Source Nutrient Loading, By Land Use Scenario[1]

(all data in lbs/year)	Existing		Trends Scenario		PFA Focus Scenario		Hybrid Scenario	
Watershed	**TN**	**TP**	**TN**	**TP**	**TN**	**TP**	**TN**	**TP**
Lower Choptank River	498,298	37,211	333,515	25,141	329,735	25,227	331,589	25,184
Little Choptank River	364,675	24,822	254,453	16,932	251,154	16,769	252,727	16,850
Lower Chesapeake Bay	216,887	3,082	209,711	2,691	209,711	2,691	209,711	2,691
Honga River	135,525	5,683	115,337	4,077	113,387	4,012	114,346	4,044
Fishing Bay	444,510	23,685	336,298	16,421	334,230	16,298	335,246	16,358
Transquaking River	583,122	43,242	365,446	29,062	364,034	29,046	364,728	29,054
Nanticoke River	288,370	19,986	188,792	13,480	188,368	13,474	188,580	13,478
Marshyhope Creek	374,816	29,051	231,831	19,359	231,382	19,441	231,603	19,401
Total Nonpoint Source	**2,906,203**	**186,762**	**2,035,383**	**127,163**	**2,022,001**	**126,958**	**2,028,530**	**127,060**

Notes:

1: Includes septic systems. Septic assumptions for all future scenarios: 50% of new residential and nonresidential development uses nitrogen removal technology, 25% of existing (2007) residential and nonresidential development is retrofitted with nitrogen removal technology.

Total Nutrient Loading

Table 12 shows the total combined point and nonpoint source discharge in each 8-digit watershed under each of the three scenarios. This table combines the information in Tables 10 and 11. As with the nonpoint source loadings alone, all three scenarios would considerably reduce nutrient loading compared to existing levels, and all three scenarios would result in comparable levels of nonpoint source nitrogen and phosphorus discharges. The PFA Focus scenario would again have the lowest nutrient discharge, but only by a narrow margin compared to the other three scenarios. All three scenarios would achieve the nitrogen and phosphorus reductions required by the nutrient TMDLs for the Transquaking River watershed.

Impervious Surface

Impervious surfaces are primarily human-made surfaces that do not allow rainwater to enter the ground. Impervious cover creates runoff that causes stream bank erosion, sediment deposition into stream channels, increases in stream temperatures, and degradation of water quality and aquatic life. The amount of impervious surface in a watershed is a key indicator of water quality. Water quality in streams tends to decline as watersheds approach ten percent impervious coverage, and drops sharply when the watershed approaches 25 percent impervious coverage. Table 13 summarizes existing and potential impervious coverage in Dorchester County by watershed. Table A-9 in the WRE Appendix repeats these impervious surface calculations while excluding wetlands.

Countywide, 2.5 percent of all land (excluding open water within the County's boundaries) is impervious. Impervious surface coverage is moderately high in the Lower Choptank River watershed, where much of the County's developed land is found. However, impervious coverage in most other watersheds is relatively low—typically under three percent.

Table 12. Total Loading, By Land Use Scenario											
(all data in lbs/year)			**Lower Choptank River**	**Little Choptank River**	**Lower Chesapeake Bay**	**Honga River**	**Fishing Bay**	**Transquaking River**	**Nanticoke River**	**Marshyhope Creek**	**Total**
Existing (2007)	Nonpoint	TN	498,298	364,675	216,887	135,525	444,510	583,122	288,370	374,816	**2,906,203**
		TP	37,211	24,822	3,082	5,683	23,685	43,242	19,986	29,051	**186,762**
	Point	TN	55,386	0	0	0	0	0	4,000	5,000	**64,386**
		TP	8,846	0	0	0	0	0	1,283	1,000	**11,129**
	Total	**TN**	**553,684**	**364,675**	**216,887**	**135,525**	**444,510**	**583,122**	**292,370**	**379,816**	**2,970,589**
		TP	**46,057**	**24,822**	**3,082**	**5,683**	**23,685**	**43,242**	**21,269**	**30,051**	**197,891**
	Nutrient TMDL	TN						410,729			
		TP						29,298		*See Note*	
	Overage vs. TMDL	**TN**						172,393			
		TP						13,944			
Trends Scenario	Nonpoint	TN	333,515	254,453	209,711	115,337	336,298	365,446	188,792	231,831	**2,035,383**
		TP	25,141	16,932	2,691	4,077	16,421	29,062	13,480	19,359	**127,163**
	Point	TN	45,322	0	0	0	0	0	2,340	10,643	**58,305**
		TP	5,458	0	0	0	0	0	585	1,064	**7,107**
	Total	**TN**	**378,837**	**254,453**	**209,711**	**115,337**	**336,298**	**365,446**	**191,132**	**242,474**	**2,093,688**
		TP	**30,599**	**16,932**	**2,691**	**4,077**	**16,421**	**29,062**	**14,065**	**20,423**	**134,270**
	Overage vs. TMDL	**TN**						(45,283)			
		TP						(236)			
PFA Focus Scenario	Nonpoint	TN	329,735	251,154	209,711	113,387	334,230	364,034	188,368	231,382	**2,022,001**
		TP	25,227	16,769	2,691	4,012	16,298	29,046	13,474	19,441	**126,958**
	Point	TN	53,992	0	0	0	0	0	2,959	11,732	**68,683**
		TP	6,549	0	0	0	0	0	740	1,173	**8,462**
	Total	**TN**	**383,727**	**251,154**	**209,711**	**113,387**	**334,230**	**364,034**	**191,327**	**243,114**	**2,090,684**
		TP	**31,776**	**16,769**	**2,691**	**4,012**	**16,298**	**29,046**	**14,214**	**20,614**	**135,420**
	Overage vs. TMDL	**TN**						(46,695)			
		TP						(252)			
Hybrid Scenario	Nonpoint	TN	331,589	252,727	209,711	114,346	335,246	364,728	188,580	231,603	**2,028,530**
		TP	25,184	16,850	2,691	4,044	16,358	29,054	13,478	19,401	**127,060**
	Point	TN	49,728	0	0	0	0	0	2,654	11,196	**63,578**
		TP	6,012	0	0	0	0	0	664	1,120	**7,796**
	Total	**TN**	**381,317**	**252,727**	**209,711**	**114,346**	**335,246**	**364,728**	**191,234**	**242,799**	**2,092,108**
		TP	**31,196**	**16,850**	**2,691**	**4,044**	**16,358**	**29,054**	**14,142**	**20,521**	**134,856**
	Overage vs. TMDL	**TN**						(46,001)			
		TP						(244)			

Note for Table 12

The phosphorus TMDL for the entire Marshyhope Creek (including areas in Dorchester and Caroline Counties) is defined as 767 lbs/month. This includes 415 lbs/month for point sources and 249 lbs/month for nonpoint sources, only from May 1 through October 31. No phosphorus TMDL was established for the remainder of the year, and no subdivision of the TMDL exists specifically for Dorchester County.

The TMDL shown for the Transquaking River is for the nonpoint source nutrients. There is also a point source TMDL of 14,954 lbs per year TN and 1,496 lbs per year TP. The only point source in the watershed is the Darling International, Inc. rendering facility.

Table 13. Impervious Coverage

Watershed	Total Acreage[1]	Impervious Surface							
		Existing		Trends		PFA Focus		Hybrid	
		Acres	*Percent*	*Acres*	*Percent*	*Acres*	*Percent*	*Acres*	*Percent*
Lower Choptank River	37,954	2,892	7.6%	4,330	11.4%	3,277	8.6%	3,794	10.0%
Little Choptank River	47,382	1,696	3.6%	2,719	5.7%	1,705	3.6%	2,204	4.7%
Lower Chesapeake	5,143	1	0%	1	0%	1	0%	1	0%
Honga River	23,246	676	2.9%	949	4.1%	676	2.9%	811	3.5%
Fishing Bay	98,049	1,094	1.1%	1,627	1.7%	1,220	1.2%	1,419	1.4%
Transquaking River	69,209	733	1.1%	1,289	1.9%	733	1.1%	1,006	1.5%
Nanticoke River	36,435	481	1.3%	886	2.6%	493	1.5%	686	2.0%
Marshyhope Creek	37,829	1,140	3.0%	2,071	5.7%	1,167	3.2%	1,612	4.5%
Dorchester County	**355,247**	**8,713**	**2.5%**	**13,872**	**3.9%**	**9,273**	**2.6%**	**11,534**	**3.2%**

Notes:
1: Excludes open water within County boundaries.

Countywide impervious coverage would increase under all scenarios for all watersheds. The PFA Focus scenario would result in the smallest increase in impervious surface coverage, while the Trends scenario would push Countywide impervious surface close to four percent, and would increase the impervious surface share above 11 percent in the Lower Choptank Watershed. They Hybrid scenario would result in a moderate increase in Countywide impervious surface, and would bring the Lower Choptank watershed to approximately 10 percent impervious coverage.

Choice of Land Use Plan

A major goal of the Water Resources Element is to more closely link land use and development to water quality. Ideally, the Water Resources Element should use measures of assimilative capacity, such as completed TMDLs for nutrients, to guide direction of growth and land use patterns within the County. Because TMDLs have not been completed for the County's impaired 8-digit waterways, particularly the Choptank River, it is difficult for the County to clearly identify "appropriate" receiving waters for its point and nonpoint source nutrient loads, or to direct future growth toward those appropriate receiving waters.

Lacking this specific data, the Water Resources Element's broader goal of improving water quality should guide the County's choice of future land use plan. The preferred land use plan should minimize future nutrient loads and impervious surface in all watersheds. While all three scenarios would produce similar nutrient loads, the PFA Focus scenario has consistently lower nutrient loads, and substantially lower impervious surface than other scenarios—it is the only scenario in which the Lower Choptank watershed does not approach the ten percent "tipping point."

However, the PFA Focus scenario—in which essentially *no* new development occurs outside of PFAs—could not be easily implemented in Dorchester County, even with strong growth controls outside of PFAs. While also ambitious, the Hybrid Scenario represents a more feasible approach. It would acknowledge the likelihood of some development in rural areas, while focusing the majority of growth (significantly more than past trends) into PFAs, where sewer and stormwater management infrastructure can help to minimize impacts on the County's waters.

Relationship to Local Land Use Goals

In 2009, the Senate Bill 276 was signed into law. The new law amends Article 66B, requiring the establishment of a statewide goal for increasing the amount of development within PFAs and decreasing development outside of PFAs. As part of this law, jurisdictions must also establish (beginning in 2011) local land use goals that increase development inside of PFAs. Each of the three scenarios evaluated in this Element would impact Dorchester County's ability to address these state and local goals.

The Trends scenario would essentially continue existing trends, in which approximately half of all new development occurs outside of PFAs. The Hybrid and PFA scenarios significantly increase the amount of development directed toward PFAs. Adoption of the PFA scenario as the County's preferred land use plan would result in the quickest progress toward the statewide (and eventually the local) land use goals. However, the Hybrid scenario, which directs 75 percent of new development to PFAs, is a distinct departure from current trends, and therefore strongly supports the state land use goal.

This Water Resources Element will be adopted as a stand-alone amendment to the County's 1996 Comprehensive Plan. In revising the full Comprehensive Plan, the County should take into account the findings of this section, and should choose a future land use plan that resembles the Hybrid Scenario. Upon completion of nutrient TMDLs for the County's impaired waterways, the County should adjust its future land use plan in subsequent Comprehensive Plan updates to direct future growth to the most appropriate locations.

7. Policies and Strategies

This section describes policies and implementation strategies that the County should pursue in order to achieve the goals of this Water Resources Element.

1. Work with MDE, MGS, and USGS to complete the Coastal Plain Aquifer Study, and use the results of this study to guide future decisions regarding groundwater withdrawals.
2. Work with MDE to identify new sources of drinking water, specifically by evaluating the quality and quantity of water in the County's deeper and less frequently used aquifers.
3. Update the County's building and land development codes to require water-conserving fixtures and appliances for all new development and retrofits.
4. Work with MDE, the Dorchester County Health Department to establish procedures for ensuring that new wells are drilled in locations (or into aquifers) where arsenic does not pose a health concern. In addition, develop a program to notify property owners in areas where arsenic contamination may be a problem and assist affected property owners with the installation of treatment equipment, or the drilling of a new well.

5. In cooperation with the County's municipalities, consider developing a joint Water Conservation Plan.
6. Update the County's Water and Sewer Master Plan to reflect revised population and public water/sewer system data, and to address the following WRE recommendations:
    - Identify unincorporated areas in the County where a new County-operated public water system, to replace existing individual wells, might be appropriate.
    - Identify unincorporated areas in the County where a new County-operated public sewer system, to replace existing individual septic systems, might be appropriate and feasible—taking into consideration the inability to create a new surface water discharge point from such a system.
7. Use the Municipal Growth Element coordination process to help guide expansion of municipal water and sewer service.
8. Work with municipalities to extend public sewer service to existing communities identified as failing septic areas in the County's Comprehensive Water and Sewer Plan.
9. Work with municipalities to identify and implement alternative wastewater disposal methods, such as land application of treated wastewater, tertiary treatment wetlands, wastewater reuse, and nutrient trading.
10. Consider requiring all new development outside of public sewer service areas to use septic denitrification systems.
11. Work with MDE and the Department of Natural Resources (DNR) to encourage retrofit of existing septic systems with denitrification units.
12. Amend the County's Stormwater Management ordinance to incorporate by reference the Maryland Stormwater Design manual, as revised by MDE to reflect provisions of the Stormwater Management Act of 2007—including the required use of ESD for new development.
13. Work with MDE, DNR, and the Maryland Department of Agriculture (MDA) to assist farmers in adopting best management practices, to reduce nonpoint source loads of nutrients and other pollutants.
14. Continue to support land preservation activities such as MALPF, Rural Legacy, the Maryland Environmental Trust, and other public and private entities, specifically encouraging such activities on land that drains to Tier II waterways, and in sub-watersheds where impervious coverage approaches or exceeds 10 percent.
15. As part of the ongoing Comprehensive Plan update, adopt a future land use plan and growth management strategies (such as Transfer of Development Rights, zoning requirements, and other approaches) that resembles the Hybrid model described in this WRE.
16. As part of future Comprehensive Plan updates, re-run the nonpoint source loading analysis, incorporating up-to-date land use and any changes to the state's default model.
17. In conjunction with MDE and Talbot, Caroline, Wicomico, and Sussex (DE) Counties, consider establishing a regional water resources committee whose purpose would be to coordinate decisions involving groundwater, surface water discharges, and growth and development.