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The Water Resources Element:

Planning for Water Supply and Wastewater and Stormwater Management

This document may not reflect current law and practice and may be inconsistent with current regulations.

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MODELS AND GUIDELINES

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Water Resources Element of the Comprehensive Plan
Guidance Document
Planning for Water Supply, Wastewater Management and Stormwater Management
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The Water Resources Element is one of several major new local planning requirements added to state law in 2006. These new mandates are summarized below.

House Bill 1141, *Land Use – Local Government Planning*, and House Bill 2, *The Agricultural Stewardship Act of 2006*, were signed into law on May 2, 2006. These laws establish new and modified local comprehensive plan elements under Article 66B of the Annotated Code of Maryland, the local planning and zoning enabling statute.

- The first new element mandated in HB 1141 is the Water Resources Element (WRE), the subject of this *Models and Guidelines* document. All counties and municipalities that exercise planning and zoning authority must adopt a water resources element in their comprehensive plans by October 1, 2009. The Maryland Department of Planning may grant up to two six-month extensions. The WRE will address the relationship of planned growth to planning area water resources.
- The second new element, mandated in HB 1141, is the Municipal Growth Element. It is required to be adopted by October 1, 2009 only in municipal comprehensive plans. It is related to the WRE in important ways. The Maryland Department of Planning has produced a publication, *Models & Guidelines #25: Writing the Municipal Growth Element*, that provides municipalities guidance on drafting and adopting this element.
- The third new element, the Priority Preservation Area Element (PPAE) is established in HB 2. It is required to be adopted as of July 1, 2008 for counties that wish to establish or continue certification of their farmland preservation programs by the Maryland Agricultural Land Preservation Program and the Maryland Department of Planning. This element is optional for counties without certified agricultural land preservation programs.
- The fourth change, from HB 1141, requires that two additional topics be addressed under the existing Sensitive Areas Element: agricultural lands and forestlands intended for resource protection and conservation. Improvements in this element can contribute to meeting the water resources proposals of the WRE.

The water resources element of the comprehensive plan should answer the following questions for a county or municipality:

- Is there adequate water supply to meet current and future needs?
- Is there adequate wastewater and septic supply to meet current and future needs?
- What, if any, impact will meeting these needs have on water resources?

This *Models & Guidelines* document, *The Water Resources Element: Planning for Water Supply and Wastewater and Stormwater Management*, has been produced to provide counties and municipalities guidance in writing their water resources element to comprehensive plans. In addition to guidelines, this document includes a model water resources element which contains all of the components of a completed WRE that could be adopted. Users of this publication should pay particular attention to the following features:

- Figure 2: The flowchart describing the water resources element analytical framework, page 11;
- Section IV,F: Review criteria for drinking water, page 27;
- Section V,F: Review criteria for wastewater, page 32; and
- Section VI,G: Review criteria for stormwater management, page 39.

The purpose of the Water Resources Element (WRE) is to ensure that future county and municipal comprehensive plans reflect the opportunities and limitations presented by local and regional water resources. WREs are intended to improve local jurisdictions' contribution to the protection of state land and water resources; to the protection of public health, safety and welfare; and to meeting local and state smart growth policies.

The purpose of this *Models and Guidelines* document is to help local governments prepare the WRE in a manner that will not only meet the requirements of the law but will strengthen their planning efforts by ensuring that water resources will be adequate to support smart growth while meeting local economic, environmental and land use goals.

To achieve these purposes, planning must reflect the broader geographical context of watersheds. Successful WREs will be based on this perspective. The common goals for Maryland's water resources are reflected in the Chesapeake Bay Tributary Strategies, federal and state regulatory programs and smart growth policies.

MDP encourages jursidictions that share watersheds to enter into cooperative agreements that facilitate meeting the goals, objectives and spirit of the water resources element law.

For many years, the Chesapeake Bay and all of the life it supports have been the focus of many organizations. Political administrations – from federal to state and local – have championed policies designed to improve the health of the bay. A multitude of reasons underlie this deserved attention. Chief among them is protection of the water resources the bay provides; the food it yields; and the recreational opportunities it creates. Each of these organizations and administrations has recognized the bay's fragile nature -- offering new ideas, strategies, programs, and laws in an effort to protect and restore this precious natural resource.

The Chesapeake Bay Watershed covers almost the entire land area of Maryland and portions of Virginia, Delaware, Pennsylvania, New York and West Virginia. It is Maryland's largest and greatest water resource; its health is directly tied to land management practices throughout the watershed. In recent years, sprawling land development patterns have visited nearly irreparable damage upon this great estuary and those who depend on it for their livelihood.

While the state of Maryland may not be the largest land area in the group of bay watershed states, Maryland does have the lion's share of shoreline and thus the most direct impact on water quality. Our actions on the land, the wastewaters we discharge to the streams, rivers and the bay permanently affect this fragile water resource.

An important new law passed in 2006, known as House Bill (HB) 1141, directly addresses land use, development and water resources, including water quality – one of the focal points of the legislation. HB 1141 requires that local comprehensive plans contain a water resources element. The water resources element (WRE) will address the relationship of planned growth to the area's water resources. The required water resources element is designed to address both the wastewater that is generated by our consumption habits and our invaluable, life-sustaining drinking water supply.

State Geology and Water Sources

While many Marylanders rely on surface water from reservoirs and rivers, others rely upon the underground streams, or aquifers, for their water source. These aquifers differ from location to location. But they all share a common feature: there are limits on how much water each can safely yield. The geological makeup of Maryland's landscape can be divided into two very different regions and each region provides different quantities of source water from each underground resource. These differecnes make it very difficult to know when too much demand has been put on it (possibly causing it to run dry). It is also difficult to determine when contaminations from outside sources may have affected water quality. These two factors of quantity and quality are key thresholds that development must calculate and account for as recent climatic events and over-development have left many residents with water shortages or non-potable water.

This is unacceptable as public health, and the overall welfare of citizens are primarily and inextricably linked to its water resources. This is the other focal point to the water resources element.

This water resources element Model and Guideline (WREMG) document serves to help local governments implement the provisions of HB 1141 by October 2009 and provide local officials with the information needed to fully comply with the terms of this new state planning law. The WREMG will assure that the comprehensive plan fully integrates water resources issues and potential solutions into its overall planning mission.

This document provides an outline as to how water supplies, wastewater effluents and stormwater runoff will be managed to support planned growth provided that existing and future water resources (and any limitations on those resources) are identified through this process. The limitations will include source water supply issues and the wastewater discharge assimilative capacity thresholds of the watersheds. Identifying these limitations (or opportunities) early in the planning process will ensure that comprehensive plans are realistic and environmentally sustainable. The water resources element will be instrumental in providing a sound foundation to implement Smart Growth throughout the state.

In Section I, the WREMG provides the reader with the statutory language of HB 1141 and explains the responsibilities of the state agencies.

Section II provides the methods and steps necessary to complete the comprehensive plan's land use analyses based on its population, housing and employment projections, and the water resource demands those projections might create.

Section III outlines the many ways that the water resources element is linked to the various planning documents that set land use policy and implement development plans. The information provides guidance to policies that will promote conservation, preservation, and encourage management practices that properly align projected growth with the planned area's water resources.

Sections IV and V focus on drinking water and wastewater assessment specifics. These sections provide more specific methods and data analysis and present possible solutions or alternatives to addressing the particular water resource limitations and/or development thresholds discovered in the planning process.

Section VI addresses the stormwater and relational land surface changes associated with development and land use impacts as they affect nutrient loading from various non-point sources. As in the previous sections, details are provided on measurement methods and alternatives to handle the future impacts through policy and practice.

A model water resources element follows the Guidelines presented as Part I. This example is of a fictitious county and its towns and how the WRE might look considering the many different boundaries that have to be reviewed, i.e., political, watershed, and public service area. While the initial effort in the implementation of HB 1141 is to inventory the water supply and calculate nutrient loading impacts from various land use patterns and discharge sources, there is a generality to be allowed until better and more complete information is collected in the years ahead.

It is the goal of the Departments of Planning, the Environment and Natural Resources to provide technical assistance as needed. This entire effort – to include a water resources element in each comprehensive plan -- will serve as another crucial plank in the platform to reach the restoration goals of the Chesapeake Bay and its tributaries. By balancing existing land use impacts and projected land use changes with the assurance of adequate water supplies and wastewater handling-capacity, Maryland can set the example for other states and jurisdictions in the Chesapeake Bay watershed.

In this effort to protect the Bay, by growing smarter and through better water resources planning, it is clear that certain solutions and challenges await us. Yet we know enough now to begin to better prepare for the challenges we are sure to encounter. New and bigger challenges demand better tools to meet and overcome them. Developing a water resources element offers a powerful new tool in Maryland's next step – taken together – to protect and restore our great Chesapeake Bay.

I. The Water Resources Element Law

A. Statutory Requirements

Section 1.03 (iii) of Article 66B of the Annotated Code of Maryland mandates that all Maryland counties and municipalities that exercise planning and zoning authority prepare and adopt a water resources element in their comprehensive plans.

What the Water Resources Element Means for Local Jurisdictions

Local jurisdictions must:

- Identify drinking water and other water resources that will be adequate for the needs of existing and future development proposed in the land use element of the plan, considering available data provided by the Maryland Department of the Environment (MDE).
- Identify suitable receiving waters and land areas to meet the storm water management and wastewater treatment and disposal needs of existing and future development proposed in the land use element of the plan, considering available data provided by MDE.
- Adopt a WRE in the comprehensive plan on or before October 1, 2009, unless extensions are granted by MDP pursuant to law.

Zoning classifications of a property may not be changed after October 1, 2009 (or as extended) if a jurisdiction has not adopted the WRE in its comprehensive plan.

What the Water Resources Element Means for State Agencies

The mandates of Maryland Departments of Planning (MDP) and the Environment under this law are:

- MDE must review the WRE to determine whether the proposed plan is consistent with the programs and goals of the department as reflected in the general water resources program required under § 5-203 of the Environment Article.
- MDE shall provide technical assistance upon written request to a local government on the development of the WRE of the comprehensive plan.
- MDP and other state agencies must review the WRE as part of their review of all comprehensive plan components under the 60-day review requirement of the Planning Act.
- MDP may grant up to two six-month extensions to a local government upon written request by a local planning agency if that local government shows good cause for extending the time limit in order to be able to comply with the WRE implementation date.

B. General Discussion

The WRE will ensure that the comprehensive plan fully integrates water resources issues and potential solutions. This element should outline how management of water and wastewater effluent and stormwater will support planned growth, given existing and future water resource limitations. These limitations include water supply and the assimilative capacity of water bodies (i.e., the ability to accept treated wastewater). Consideration of water resource limitations and opportunities early in the local planning process will ensure that comprehensive plans are realistic and environmentally sustainable, and will provide a sound foundation to support and expedite the County Water and Sewerage Plans and applications for financial assistance and regulatory permits.

All available information from state, local and other sources should be used to describe the existing status of drinking water supplies and of the streams that receive treated wastewater effluent, septic tank effluent and nonpoint source runoff. Some information may be unavailable to conduct ideal analyses. These limitations should be noted in the WRE, and specific outstanding data needs should be identified in conjunction with recommendations for filling the data gaps.

Once the current information is established, the status of water supplies and of receiving streams in a jurisdiction should be predicted in the context of the local land use plan element of the comprehensive plan as well as any other predictors of growth. Specifically, the WRE should outline the adequacy of water and wastewater resources with respect to future growth. The WRE should act as an early warning system to determine if water resources will be adequate to support growth in a jurisdiction.

It is important to emphasize that the content of the WRE should be at the general level that is appropriate to comprehensive plans. This guidance document describes technical work and studies that are necessary to prepare a sound WRE. This technical work, while used to preapre the WRE, should not be duplicated in the comprehensive plan. The goal is to summarize and/or reference the technical work in the WRE or elsewhere in the comprehensive plan and interpret that work into the policies, actions, maps, tables and recommendations that make up the core of the comprehensive plan. However, when the WRE is submitted to the state for review, local jurisdictions should be prepared to provide the technical work and background information that supports the WRE. Figure 1, below, illustrates this relationship of other technical work to the WRE.

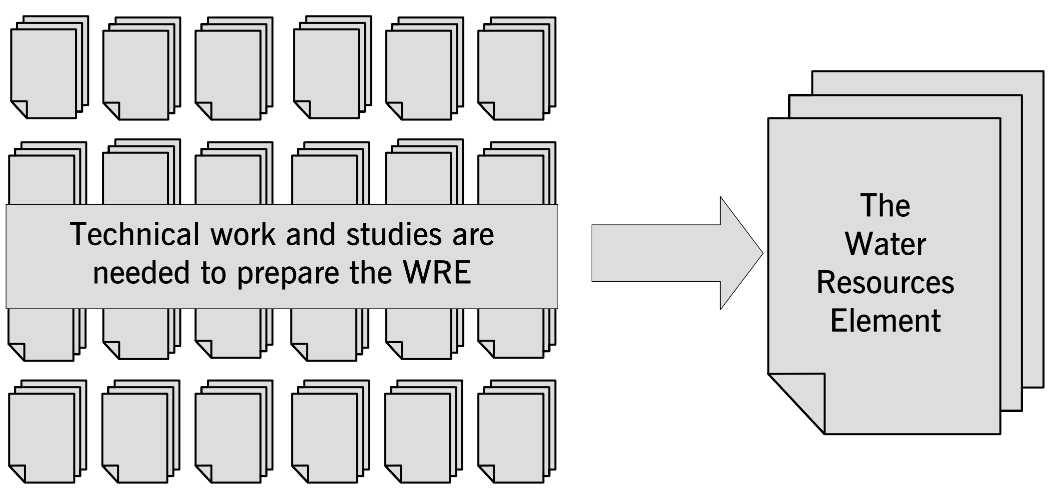


Figure 1. The water resources element is built upon the work contained in other technical studies. The water resources element should not duplicate these technical studies but rather summarize and reference them and interpret that work into the element's policies, actions, maps, tables and recommendations.

MDE, MDP and the Maryland Department of Natural Resources (DNR) can provide technical assistance and information to the extent possible to assist local governments to prepare and implement the WRE. Requests for technical assitance must be submitted in writing.

C. Interjurisdictional Coordination and Cooperation

Due to the inherent physical and geographic nature of water resources, it is imperative that the water resources element be developed through interjurisdictional coordination with a watershed focus. This is true for both counties and municipalities.

Counties and municipalities will need to work together to properly complete WREs. Because watersheds, water supply areas and water quality issues often overlap political boundaries, interjurisdictional coordination is key to a successful WRE. Tributary Teams, regional councils of government and watershed-based organizations can assist local governments with this coordination.

II. General Assessment Methodologies – Overall methods and definitions

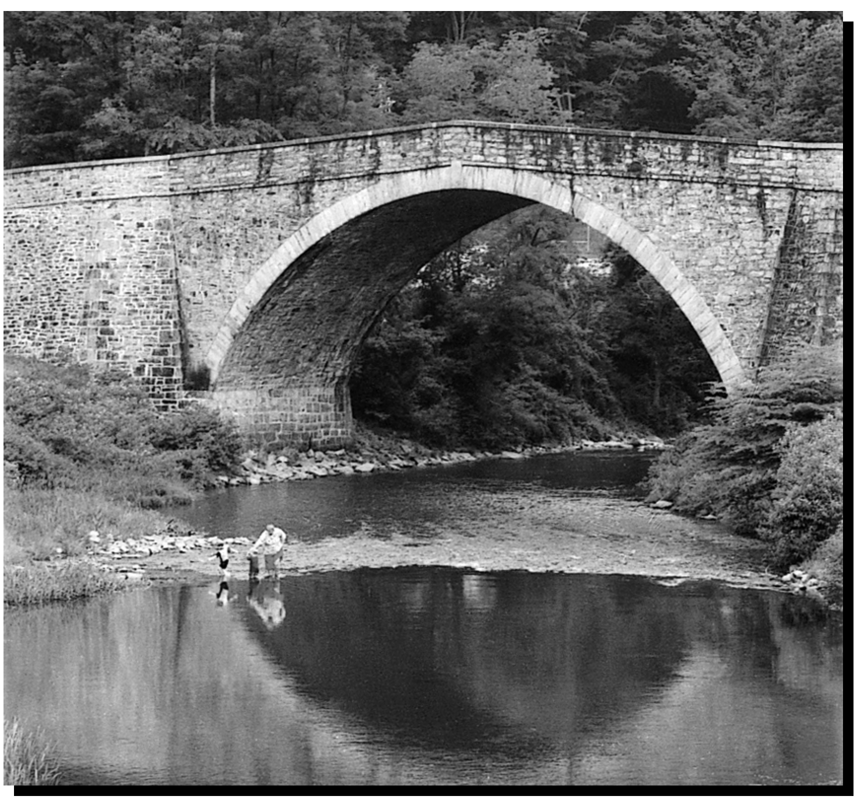
This section provides a broad overview of the steps and methods necessary to produce a WRE. The technical work that this section summarizes is elaborated in **section IV:** Drinking Water Assessment, **section V:** Wastewater Assessment and **section VI:** Stormwater Assessment. The appendix offers methodologies based on currently available data that can be used to make the necessary assessments.

A. General Scope of the WRE

The WRE should be at a level appropriate to the general scope and nature of a comprehensive plan. The details of technical assessments should be contained in other plans and documents as appropriate, such as the County Water and Sewerage Plan, appendices to the WRE or separate reports that can be included as part of the plan by reference.

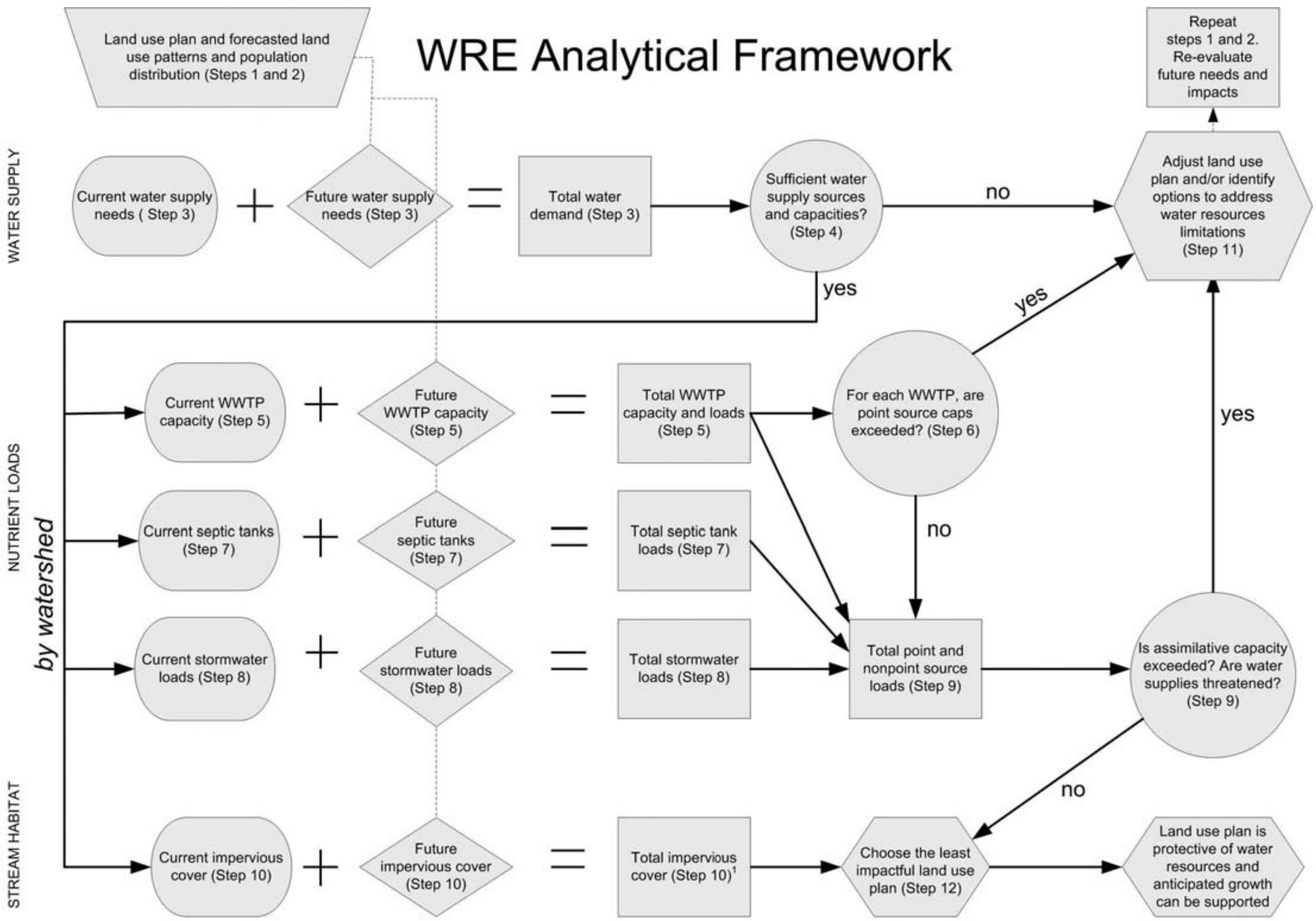
The WRE should include:

- Summaries of technical work for the entire plan;
- Interpretations of the meaning of the technical work for the entire plan;
- Maps and tables that support the WRE background and recommendations; and
- Policies and actions emanating from water resources issues as they relate to land use and infrastructure policies, programs and actions, as discussed in Section III of this guidance document.



B. Work Item Sequence for the WRE

To complete the WRE analyses, a number of overall steps are necessary. However, the process is circular and iterative. The flow chart in Figure 2, below, illustrates the steps and links discussed below. Note that each step number corresponds to the steps numbered in the flow chart.



1. The Center for Watershed Protection has developed a model that predicts water resource impacts due to watershed impervious cover. More information on the model can be found in the December 2005 Maryland Department of Natural Resources "A User's Guide to Watershed Planning in Maryland".

Figure 2. Water resources element analytical framework

Step1. Land Use Plan

Consider population projections for the planning period and choose a land use plan that will result in desired development densities and locations, given all of the goals and recommendations of the comprehensive plan. The population projections should bear a reasonable relationship to countywide projections that are derived from the MDP cooperative forecasting process. Because of the nature of WRE analyses, this land use plan might be a first draft – revisions might be necessary as a local government explores water resource demands and impacts of the plan. Deciding on a land use plan will require significant county and municipal cooperation.

Step 2. Land Use Pattern

After choosing the land use plan and defining the zoning that will be needed to implement the plan, forecast the likely land use patterns that will result (e.g., development densities and locations). MDP's Growth Model can be used to make this forecast.

Step 3. Water Demand

Assess current water needs from existing development. Then, considering future land use patterns and population distribution, assess future and total water needs. Use MDE's *Water Supply Capacity Management Plan Guidance*.

Step 4. Water Supply Capacity

Given the distribution and amount of water demand, determine whether water supply will be sufficient to support that demand. If water supply will be a limiting factor, go to step 11, **Adjust Land Use Plan or Identify Options to Address Limitations**. Options to address limitations should include realistic means of finding and developing new water supply sources, establishing stronger conservation measures, modifying planned development patterns or levels or making new development contingent on developing new water supplies.

Step 5. Wastewater Treatment Plant (WWTP) Demand

For each watershed, identify current WWTP discharge locations and loads. Then, considering future land use patterns and population distribution, identify future and total WWTP capacity needs. Use MDE's *Wastewater Capacity Management Plan Guidance* (WCCMP). Next, given future capacity needs and distribution, identify future and total discharge locations and loads.

Step 6. Wastewater Treatment Plant (WWTP) Limits

Every WWTP that discharges into the Chesapeake Bay and its tributaries has been assigned a nutrient loading cap. These point source caps are defined by Maryland's Tributary Strategy. In addition, nutrient waste load allocations have been established in Total Maximum Daily Loads (TMDLs) both within the Chesapeake Bay drainage area and elsewhere in the state. The limitation for a particular WWTP is the more stringent of the Tributary Strategy point source cap or a local TMDL. Also according to the Tributary Strategy, all future treatment plants with a surface discharge have zero nutrient allocation and must therefore offset 100% of their nutrient load.[1] Given the distribution and amount of WWTP demand, determine whether WWTP limits are an issue. If WWTP limits do apply, go to step 11, **Adjust Land Use Plan or Identify Options to Address Limitations**. For cases in which the cap or TMDL might be exceeded:

> a. Identify options for ensuring consistency with the cap/TMDL. These might include enhanced levels of wastewater treatment, point-to-point trades, offsetting with nonpoint source reductions, land application (e.g., spray irrigation) and repair of excessive inflow and infiltration. For plants that may exceed their nutrient cap, safeguards should be put in place in the local decision-making process to prevent decisions that would allow development to occur in conflict with the cap. These same considerations should be addressed for new treatment plants being considered to serve new development.
>
> b. Identify the necessary studies that would be needed to support these alternatives

[1] Note that the regulatory guidance for offsets and trades has not been completed at the time of this guidance document.

Step 7. Septic Systems

For each watershed, identify septic tank locations and loads. Then, considering future land use patterns and population distribution, identify future septic tank locations and loads.

Step 8. Stormwater Runoff

For each watershed, given current land use patterns and best management practices (BMP) locations and types, calculate current stormwater loads. Then, considering future land use patterns and BMP locations and types, calculate future and total stormwater loads. Technical assistance from MDE and MDP will be provided upon written request for this nonpoint source analysis.

Step 9. Overall Development Impacts

For each watershed, calculate the total nutrient load, which includes nutrient loads from current and future WWTP discharge, septic tanks and stormwater runoff. Compare the total nutrient load for each watershed with the assimilative capacity of the water body. The water body assimilative capacity is the total pollutant loading a water body can receive without violating water quality standards. For impaired water bodies, MDE calculates this through the TMDL process and establishes a total TMDL (point source and nonpoint source TMDL allocations combined) for the water body. In addition, assess whether the total nutrient load will threaten water supplies. If overall development impacts will be a limiting factor, go to step 11, **Adjust Land Use Plan or Identify Options to Address Limitations**. For cases where septic tank pollution is conributing to exceed the water body assimilative capacity:

Develop plans to account for offsetting the nitrogen loads from new septic systems. Consider the pros and cons of requiring denitrifying technology on new development. Either identify specific remediation options or the studies needed to identify nonpoint source offset options, such as reforestation, riparian buffers and emerging innovative technologies.

Step 10. Impervious Cover

For each watershed, given current land use patterns, calculate impervious cover. Then, considering future land use patterns, calculate future and total impervious cover.

Step 11. Adjust Land Use Plan or Identify Options to Address Limitations

If limits are reached at any of the above steps, especially steps 4, 6 and 9, the land use plan from Step 1 may need to be adjusted, or options should be identified that will help mitigate the limitations.

Step 12. Choose Land Use Plan with the Least Impact

C. Defining Water Resource Limitations

Each local government will need to identify and compare the potential water supply and wastewater treatment capacities relative to existing point source allocations over the planning period and capabilities relative to the projected growth in demand. The point at which the demand intersects supply and treatment capacity thresholds should be identified. The *Water Supply* and *Wastewater Capacity Management Plan* guidance documents published by MDE in October of 2006 provide a sound methodology for this analysis. Information on these documents can be found in the appendix.

Water resource limitations include existing water supply and wastewater infrastructure limitations, the susceptibility of potable water sources to pollution, Chesapeake Bay Tributary Strategy point source caps in Maryland's Point Source Strategy and the water body assimilative capacity or TMDLs.

Chesapeake Bay Tributary Strategy point source caps refers to the annual nutrient load caps for each of Maryland's significant wastewater treatment plants (i.e., those with a design capacity of 500,000 gallons per day or greater) that discharge to the Chesapeake Bay or its tributaries. The caps are based on an annual average concentration of 4.0 mg/l total nitrogen and 0.3 mg/l total phosphorus and the approved design capacity of the plant. In this context, the approved design capacity meets the following two conditions:

- A discharge permit was issued based on the plant capacity or MDE issued a letter to the jurisdiction with design effluent limits based on the new capacity as of April 30, 2003.
- Planned capacity was either consistent with an MDE-approved County Water and Sewer Plan as of April 30, 2003, or shown in a locally-adopted Water and Sewer Plan Update or amendment to the County Water and Sewer Plan, that were reviewed and approved by MDE. Maryland facilities discharging to the Chesapeake Bay or its tributaries with a design capacity of less than 500,000 gallons per day, also known as nonsignificant facilities, have annual nutrient load projections based on design capacity or projected 2020 flow (whichever is less) and concentration of 18 mg/l total nitrogen and 3 mg/l total phosphorus. With expansion, load projections for nonsignificant facilities become load caps not to exceed 6,100 lbs/yr total nitrogen and 457 lbs/yr total phosphorus.

Facilities that either grow beyond their established loads or are unable to achieve them because of technical limitations may be eligible to trade or use other nutrient load offsets, subject to the requirements of a National Pollutant Discharge Elimination System (NPDES) permit.

Achieving the point source TMDL allocation alone is not a guarantee that the TMDL will be achieved; reducing nonpoint source loads to meet the nonpoint source TMDL allocation must also be achieved. This can be assessed using a nonpoint source reduction feasibility analysis.

The WRE calls for a simple nonpoint source feasibility analysis to estimate changes in nutrient loads resulting from proposed land use changes. A nonpoint source feasibility analysis calculates whether it is possible to achieve nonpoint source allocation by implementing best management practices (BMP) within the watershed or planning area. Examples of BMPs include innovative environmental site design, agricultural riparian buffers and stormwater filtration systems. The nonpoint source reduction feasibility analysis can help a local government determine the potential for achieving the nonpoint source TMDL allocation and whether point source loads might need to be reduced beyond the point source TMDL allocation to achieve total TMDL.

Local governments should consider the percent of impervious cover (e.g., sidewalks, highways, rooftops) within a watershed as a water resource limitation even though there are currently no legal requirements to do so. As discussed in the Maryland Department of Natural Resources' (DNR) December 2005 publication, *A User's Guide to Watershed Planning in Maryland*, a wide array of research has documented the strong relationship between impervious cover and stream quality. According to the Center for Watershed Protection's Impervious Cover Model, most stream quality indicators decline when watershed impervious cover exceeds 10% with severe degradation expected beyond 25% impervious cover. More information on this can be found online at www.dnr.state.md.us/watersheds/pubs/userguide.html.

D. Assessing Projected Capacity Needs over the Planning Period

The land use element of the comprehensive plan identifies existing and proposed growth areas for the planning period, typically 20-25 years into the future, and defines desired development characteristics for each land use category (e.g., agriculture, residential, commercial). Using these development characteristics and the likely zoning and subdivision requirements that will codify them, a local government should calculate the potential demand for water and wastewater capacity throughout their jurisdiction. MDP can provide assistance in carrying out this development capacity analysis.

The development capacity calculations should be compared to MDP's countywide population projections for the next 25 years, which are done in a cooperative regional forecasting process for central Maryland counties and with local input for the remaining counties.

Projected demand from population forecasts and the development capacity numbers should be compared with both existing available water and wastewater infrastructure capacity, and the future ability of the existing water resources to provide water supply and assimilative capacity. From these two points, a local government can estimate potential additional infrastructure and water resource needs over the planning period based on both population projections, and the development capacity of proposed land use and zoning categories. For municipalities, this calculation should also consider the proposed growth areas identified in the municipal growth element (MGE). Counties should also consider municipal growth areas and work with municipalities to eliminate any double counting in these areas.

E. Assessing Development Impacts on Water Resources

Local governments will need to assess the development impacts of point and nonpoint source pollution to ground water and surface water bodies that would result from expected growth over the planning period. Point source pollution results from wastewater treatment plants, power plants, industry and commercial operations. Nonpoint source pollution results from a variety of sources including septic tanks, agricultural activities and stormwater runoff. A local government will need to determine whether the projected point source nutrient loads are within their treatment plant allocations and provide an estimate of projected nonpoint source loads. In addition, potential impacts to drinking water supplies should be evaluated including any discharges to surface water or ground water or the potential risks of spills to either ground water or surface water sources.

F. Deciding on Whether to Limit Growth or Address Water Resource Limitations

Where water resource limitations might be reached due to projected growth over the planning period, a range of options must be evaluated if a jurisdiction wants to continue to grow. Identifying and evaluating the feasibility of various options will typically require an interdisciplinary team of planners, engineers, economists, hydrologists and fiscal specialists. Technical studies may be required that can often be expensive and time consuming. Therefore, identifying future limitations as early as possible is vital. Decisions on growth and alternative measures will also require lengthy local and state public planning and regulatory processes, where economic, public and environmental health, community values and legal considerations can be debated before a consensus is reached by local elected officials. Decisions must be made that will prevent economic, public health and environmental problems in the future.

Methods for managing growth where there is limited resource availability include building permit limitations, down zoning, concentrating growth elsewhere, phasing growth and changing the amount and location of growth. Realizing that limiting growth in one area can lead to increased growth in other areas, local governments should work cooperatively with adjacent municipalities and counties to avoid conflicts, prevent sprawl and promote smart growth development inside PFAs.

III. Links to Other Comprehensive Plan Elements and Other Plans

A. Linking the Water Resources Element and the Land Use Element - Managing the amount, location and timing of growth and development

The land use element should be influenced by the adequacy assessments described in sections III and IV of this guidance document. The size, location and structure of present and future growth areas and water and wastewater service areas should be consistent with the water resources capacities. Maps to illustrate water resource issues in relation to land use, Priority Funding Areas (PFAs), jurisdictional boundaries and watersheds should also be presented in the comprehensive plan.

In cases where development will be limited by a shortage of water supply, assimilative capacity, water infrastructure capacity or sewer infrastructure capacity, the land use element should describe how growth will be adjusted (e.g., by timing, type, rate and/or pattern) to be consistent with the time required to identify and implement additional measures to support new growth and development.

The land use element should include policy and action recommendations (or refer to policy and actions recommendations in the Land Use Implementation Element) that support the proper coordination of water resource limitations and opportunities with current and future land uses.

The land use element should identify and map areas that require special measures to protect source water, water quality or other water resource values.

B. Linking the Water Resources Element and the Land Use Implementation Element – Making policies and recommending actions

After the assessments of water supply and wastewater in Sections IV and V of this document are complete and a WRE is being drafted, these findings should be incorporated into comprehensive plan land use action recommendations. Implementation mechanisms may include existing, modified or new local ordinances and/or regulatory programs pertaining to wastewater disposal, water supply verification, land use, development pattern changes or limitations, capacity allocation, use authorization and protection. Policy and action options for consideration in this element are included in Sections IV.D, V.D. and VI.F. of Part I of this guidance document.

C. Linking the Water Resources Element and the Community Facilities Element – Supporting the County Water and Sewerage Plan

The community facilities element of the comprehensive plan should describe the goals and recommendations for water and wastewater infrastructure. In addition to goals and recommendations for financing, operation and maintenance and sewer hookups, this element should summarize (or refer to) the water quality/stream habitat protection and water supply development goals and recommendations listed in the WRE.

The County Water and Sewerage Plan will delineate proposed water and sewer service areas and identify the infrastructure needed to serve expected growth within these areas. These service areas must be sized and phased in accordance with the findings and recommendations of the WRE, since the WRE should indicate whether the water resources can support the proposed growth/annexation areas. Subsection III.E., **Linking the Comprehensive Plan and the County Water and Sewerage Plan**, describes the relationship between the Water and Sewerage Plan and the comprehensive plan in more detail.

D. Linking the Water Resources Element and the Municipal Growth Element

For municipalities with planning and zoning authority, the municipal growth element (MGE) is required to be prepared in the same time frame as the WRE, that is, by October 1, 2009. The MGE section of Article 66B contains specific requirements about how much additional land will be needed and how various services will be impacted by the projected population of a municipality in proposed growth/annexation areas. Those various services include water and sewerage, which in turn depend on adequate water supply sources and the assimilative capacity of water bodies to accept treated wastewater discharges and stormwater runoff.

The MGE and the WRE must address some of the same issues regarding proposed new municipal growth areas. Therefore, the technical work necessary to produce both elements overlap and comprehensive plan policies and actions that are derived from this work should be compatible, if not identical, in both elements. A separate *Models and Guidelines* publication has been prepared for the municipal growth element. That document uses a fictional town to illustrate how to prepare the MGE. The fictional town of Piedmont is used in both documents to illustrate how to prepare each element.

E. Linking the Comprehensive Plan with the County Water and Sewerage Plan (CWSP)

HB 1141 does not explicitly address the relationship of the WRE to the County Water and Sewerage Plan (CWSP), nor does Article 66B. However, the County Water and Sewerage Plan statute does require the CWSP to be consistent with local comprehensive plans. Because of this consistency requirement, and because it is clear that these two local plans must be closely connected, it is critical that the WRE be drafted in a manner that supports the County Water and Sewerage Plans.

The technical requirements and information necessary to prepare the WRE substantially overlap with those required to prepare a County Water and Sewerage Plan. The commonality between these plans stems from the reality that both must operate within the context of water resources regulations and the physical capabilities and limitations of water resources. The differences are related to policy and content. The comprehensive plan sets out the broad land use and development policies for the jurisdiction, whereas, the County Water and Sewerage Plan must follow and help to implement, not make, local land use policy. The County Water and Sewerage Plan will contain more technical data and analysis than the comprehensive plan and it lays out the capital programs for water and sewerage facilities that are necessary to fulfill the comprehensive plan.

Figure 3 on page 20 compares the basic legal requirements of the County Water and Sewerage Plan and the local comprehensive plan. It depicts a grey area between the two plans since the details and exact nature of their interface may vary somewhat. However, the local comprehensive plan, including the WRE, and the County Water and Sewerage Plan should address and define this relationship in a manner that clearly fulfills the mandates and processes associated with each planning requirement. Ideally, the interface should be seamless.

The County Water and Sewerage Plan is a functional plan that supports the implementation of both county and municipal comprehensive plans. The fact that the County Water and Sewerage Plan must address all systems (e.g., county, municipal, private) underscores the need for very close interjurisdictional coordination for these combined planning processes to be effective.

Various sections later in this guidance document discuss more specifically how links between these plans can be addressed. At a minimum, the WRE should provide adequate guidance to the Water and Sewerage Plan by including:

- Countywide and small area population projections that carry over to, and are used in, the County Water and Sewerage Plan.
- Maps that show the limits of community service areas, showing stages for, at a minimum, the current, 10-year projected and ultimate build-out. These areas should bear a reasonable relationship to: projected population growth and land consumption; development capacity; and any municipal growth elements.
- Maps that show the relationships among jurisdictional, watershed, service area, Priority Funding Area(s), growth areas and any other relevant boundaries. Growth areas should reflect those shown in the municipal growth element.
- Policies that support the requirement in the County Water and Sewerage Plan law that the capacities of water and sewerage facilities may not be exceeded, and ensure that the locations, amounts and staging of growth, development and service areas must be within the capacities of both the support infrastructure and water resources.
- Actions recommended to: obtain needed water resource information; evaluate alternative measures to meet future needs; and adopt new or revised ordinances and regulations to ensure the protection of water resources.

Local Comprehensive Plans	Overlap	County Water and Sewerage Plans
Authority Article 66B	↔	Authority Environment Article §9-501-512
Required Plan Elements: Land Use Transportation Community Facilities Mineral Resources Land Development Regulations Sensitive Areas Transportation Priority Preservation Element (HB2) Municipal Growth Element (towns only – HB1141) Water Resources(HB1141)	↔ The W R E	Required Plan Chapters: Goals, organization and Comprehensive Planning Consistency General Physical and Planning Background Water Supply Wastewater Financial Information
Other Optional Content: housing, flood control, pollution control, conservation, natural resources, public utilities, development capacity, historic preservation	↔	Other Content: Service Area Development Capacity Project Financing Capital Program
Time Frame None specified – Typically 20-25 years	↔	Time Frame: Increments of up to at least 10 years
Review/Update Cycle 6 Year minimum Amendments at will	↔	Review/Update Cycle 3 year minimum Amendments at will
Local Adoption/Approval: County/Municipal Governing Body	↔	Local Adoption/Approval: County Governing Body
State Role Technical Assistance Advisory Comments WRE only – MDE Review Sensitive Areas Element only – DNR, MDE Review	↔	State Role: MDE Regulations MDE Approval with advice from MDP, DNR, MDA Technical Assistance Advisory Comments

↓ ↓

Land Use Regulations Subdivision Site Plan Design Other	↔	State and Local Permits Subdivision Plats Facilities Building Other

Figure 3. The table above presents a comparison of the basic legal requirements of the County Water and Sewerage Plans to local comprehensive plans

F. Linking the Water Resources Element with the County Land Preservation, Parks and Recreation Plan

The most recent county Land Preservation, Parks and Recreation Plan (LPPRP) should be a source of current land preservation and open space information, policies and programs. In some counties, the LPPRP may already include an assessment of the status and vulnerability of water resources as part of the natural resource element of the comprehensive plan. The WRE should evaluate LPPRP programs and make recommendations for how they can better serve water supply and water quality protection requirements. Some examples are:

- The amount of development allowed in rural and agricultural zones can be used to estimate the potential for additional population requiring potable water and the nature, intensity and impacts future development in those areas will have on both surface and gound water resources. The WRE should evaluate rural zoning and make recommendations for changes needed to better protect water resources.
- The WRE should identify opportunities to make water resource protection a stronger criterion in decisions concerning the acquisition and protection of park, agricultural and resource lands.
- The WRE should review policies and programs related to management practices on public lands or easement lands to ensure the best possible management practices for protection of water resources are required and implemented.

G. Sector and Subregional Comprehensive Plans

Jurisdictions that have small area, sector or subregional plans will need to determine the best way to approach the water resources element. It is recommended that a countywide WRE be prepared that serves as an umbrella for regional plans. The element will have to specifically state that the WRE takes precedence over any conflicting provisions in the subregional plans. Small area, sector or subregional plans should then be updated on a cycle that reflects the overall WRE. If a small area, sector or subregional plan also contains a WRE, it must be consistent with the WRE in the county comprehensive plan, while still more specific to the smaller area.

IV. Drinking Water Assessment

The July 2006 *Interim Report of the Advisory Committee on the Management and Protection of the State's Water Resources* (informally referred to as the Wolman Committee report) states on Page 2:

> "Clearly the era when the availability of water could be taken for granted is over."

This report highlights the need for extensive new regional and statewide plans and studies to better measure and understand the capabilities of the water supply resources in the state. (The Committee will complete its final report in July of 2008).

These detailed hydrogeologic studies, for which only limited funding has been provided to date, will take many years to complete even if adequately funded. In the meantime, state and local governments must carry out the WRE using the best information available on ground and surface water quantity and quality as they affect water supply needs. As additional and better data become available, these data should be assimilated into updates and revisions of this guidance document and in local planning documents.

A. Background

A safe and adequate drinking water supply is critical to the sustainability of existing communities and to the viability of future planned growth. Increasing demand from the 1.1 million additional people projected to live in Maryland over the next 25 years is expected to challenge local utilities' ability to provide safe drinking water and maintain good water quality. Some communities are already at or near current supply limitations. By 2030, the statewide demand for water for most uses, excluding self-supplied commercial and industrial uses, is expected to increase from 1,447 million gallons per day (MGD) in the year 2000 to 1,680 MGD, an increase of 233 MGD, or 16%. This total increase includes about 84 MGD of additional water for agricultural irrigation. Regional projections for 2030 demand are not available for irrigation uses.

The region with the largest projected demand for additional water, not including use for irrigation, is suburban Washington (Montgomery, Prince George's and Frederick counties) at 96 MGD. Southern Maryland is the region with the highest percentage projected increase from 2000 to 2030 at 40%, followed closely by the Lower Eastern Shore at 30%.

Maryland has faced a number of record drought periods in recent years that have necessitated the implementation of some difficult protective measures to enable the state to continue providing adequate water supplies. These stressors on water resources highlight the need to plan ahead to ensure adequate drinking water supplies at the local, comprehensive planning level.

Existing regional and county water resource studies should be used to inform local planning efforts. Local government experience in obtaining permits for water appropriation should also be taken into account when assessing the reasonableness of future expectations.

Decisions regarding growth and proposed land uses should consider planning-level assessments of the adequacy of drinking water resources for the planning time period under consideration. For the proposed number and location of homes, businesses and industrial facilities to be viable, the availability, costs and timeframes to provide an adequate water supply must be achievable. Local comprehensive plans must provide the vision and path needed to provide adequate water supplies for planned uses and needs within the planning time frame.

Limited water supplies can slow or stop planned development, resulting in the inability to fulfill the vision of local comprehensive plans and implement smart growth policies.

Options for addressing these circumstances need to be explored, including, but not limited to, modifying the land use element to change the amount or location of growth, thereby capping growth where it cannot be supported. Local planning and zoning entities must be flexible enough to react to these changes.

Protection of water supplies is a critical component of the vision for the comprehensive plan. Local land use and zoning decisions can have a profound impact on the risk of contamination to valuable drinking water supplies. Water supplies have varying degrees of vulnerability to contamination due to the nature of the aquifer being used, the size of the watershed, existing land uses and the potential sources of contamination within a recharge or watershed area.

MDE has provided reports assessing the risk to public water supply sources to all water systems, county environmental health agencies, county planning agencies and local libraries. These were completed for all public water systems in the state. These source water assessments map contributing areas for water supply sources, identify potential contaminant risks and make recommendations for protecting these sources. The WRE should take the findings of these reports into account to guide the development of comprehensive plans to ensure the integrity and protection of vulnerable water supply sources.

B. Assessment Approaches/Methodologies

To make the best possible plans for using water resources to serve a planning area, the comprehensive plan must identify the adequacy of existing water supplies, identify adequate sources and infrastructure for future needs and identify steps that need to be taken to protect existing and future water supply sources. These understandings must be made in the context of projected population growth and changing land use patterns. It is important to emphasize that this work can only be realistically and meaningfully accomplished within an interjurisdictional framework based on watershed rather than jurisdictional boundaries.

A number of approaches can be used to determine whether water resources and water supply infrastructure in the planning area have sufficient capacity to accommodate planned growth and development. These are described below.

1. Existing Supply Adequacy

Recent guidelines published by MDE, *Water Supply Capacity Management Plans* (WSCMP), provide a methodology for determining the net available capacity of existing water supplies (see pages 11-15 of the WSCMP). This available capacity, plus the estimated capacity from improving treatment of already existing sources or of obtaining water resources not yet permitted for withdrawal (to be determined using MDE-recommended methodologies), can then be used to develop an estimate of the approximate number or range of additional households and associated commercial, institutional and industrial water demand that can potentially be supported in a service area. If the capacity analysis shows a deficit, then the existing deficit must be addressed. This document is available at MDE's website: **www.mde.state.md.us/assets/document/water/WaterSupplyCapacityPlansGuidance.pdf**.

If capacity management plans have not been completed for all community water supplies, the WRE should recommend the completion of these plans as an action item.

2. Water Quality Issues

Assess existing or potential water quality problems that may impact water supplies by reviewing source water assessment protection reports produced by MDE. Source water assessment protection reports identify vulnerabilities (e.g., susceptibility to pollution or naturally-occurring contaminants) specific to each public water system, including community and non-community water systems. Source water assessment reports, water quality assessments conducted by the U.S. Geological Survey or the Maryland Geological Survey and other available county or region-specific assessments can also provide information for assessing areas served by residential wells. Tthose making use of unconfined aquifers, may need to be addressed. For example, water quality concerns related to naturally-occurring arsenic, radionuclides and radon have been identified in certain regions of the state and regions underlain by limestone aquifers are vulnerable to surface water contamination. Comprehensive plans should be used to direct growth away from known contaminated and vulnerable areas and to identify regions that would be best suited for future community water service.

3. Untapped Water Supply Sources

Identify any existing untapped sources to meet projected need. This can include estimating ground water availability associated with lands owned or controlled by the county or municipality using MDE's water balance methodology outlined in the appendix. MDE cautions that the water balance methodology may provide an estimate that exceeds the amount of water that is actually accessible, due to variable well yields in some regions. A jurisdiction may also have other untapped sources that should be identified and evaluated, such as unused or under-used surface water reservoirs and streams.

4. Alternatives and Costs Evaluation

Identify and evaluate various alternatives and costs for meeting projected needs, which can include purchasing water from other jurisdictions, acquiring additional property could supply ground water, investigating the possibility of building surface water reservoirs, identifying water reuse or conservation opportunities to reduce demand, purchasing water rights or prohibiting or postponing growth in specific geographic regions. In areas that have limited water resource information, the experience and knowledge acquired in similar situations must be used as the initial hypothesis for determining drinking water capacity. Under the best circumstances, water systems near the service area can provide significant data on potentially available water resources. For example, in the Piedmont region, a review of well yields for municipal water systems in similar geologic settings may provide the basis for estimating the amount of water that could potentially be obtained. Reviewing documentation related to the design and construction of existing or proposed surface water reservoirs may also provide a basis for estimating a potential contribution as well as any challenges related to building a new surface water reservoir.

5. Water Quality Protection Strategies Development

Develop strategies to protect existing and future water supplies and/or address any existing or anticipated public health issues. Source Water Assessment Reports provide recommendations for each public water system but countywide or regional solutions could also be considered. For example, interjurisdictional agreements for protecting regional reservoirs have been successful in reducing the risk to Baltimore area reservoirs. Where applicable, wellhead protection areas, reservoir watershed and other water supply areas should be protected from future development in the comprehensive plan.

C. Linking Water Supply with the Land Use Element – Managing the amount and location of growth and development

- The size, location and type of present and future growth should be planned to take into account water supply issues. In other words, growth should go where the water supply source can support it. This determination should be based on the adequacy assessments mentioned in subsection IV.B., **Assessment Approaches/Methodologies**, and should be depicted on land use and other maps.
- Phasing of growth is necessary if additional resources must be developed or made available to serve development that is presently precluded by a lack of water or water infrastructure.
- Environmental impacts of growth (e.g., wastewater, stormwater, air pollution) can affect comprehensive plan recommendations for regulatory and land use mechanisms to protect drinking water resources. These water quality protection policies are impacted directly by the size and location of future growth areas and indirectly by the availability of wastewater treatment capacity and nutrient caps

D. Linking Water Supply with the Land Use Implementation Element in the WRE– Policies and Actions

Once assessments of water supplies and infrastructure are complete, the WRE should outline how a jurisdiction will apply the findings. Implementation policies should clearly connect water adequacy findings to implementation policies, tools and actions. Implementation mechanisms may include existing, modified or new local ordinances or regulatory programs pertaining to water supply verification, land use, development pattern changes or limitations, capacity allocation, use authorization and protection. Possible policies and actions include the following:

1. Sustaining and Protecting Water Supplies:

- Require the development and use of a Water Supply Capacity Management Plans for each community water system to support new allocations or connections to the system and to prevent capacity over allocation.
- Deny allocations and/or connections to any system that would cause system capacity to exceed a set percentage of maximum capacity as determined by the CMP.
- Establish and require watershed or wellhead protection around existing water supply sources. Review the state model wellhead protection ordinance for applicability to local jurisdictions. More information can be found at: **www.mde.state.md.us/Programs/WaterPrograms/Water_Supply/wellheadprotection/index.asp**.
- Delineate and stage community water service areas in the land use element consistent with the ability of the water resource to support development based on population growth and development capacity analysis.
- Design and implement open space and land preservation programs in a manner that will best serve water protection requirements. Include water resource protection as a criterion in the Land Preservation, Parks and Recreation Plan (LPPRP) and for individual developments within Forest Conservation Plans.
- Examine source water protection opportunities and threats to drinking water supplies, including streams and their buffers, from development, runoff, pollution

and other causes. Identify private or government actions that can be effective in protecting drinking water supplies.

- In the land use implementation element, recommend programmatic or management practices such as buffering and setbacks needed to protect water resources from the impacts of development.
- Use interjurisdictional/regional approaches as necessary and adopt or amend ordinances as necessary to protect water resources.
- Create and implement drought management procedures and requirements.
- Design and implement a rigorous water conservation program including routine water audits, water accounting and loss control procedures, water reuse initiatives, conservation rate structures and outreach programs.

2. Developing new water supplies:

- Require new development to pay for the cost of providing water.
- Insist on rigorous enforcement of existing laws that require zoning, plat approval and development approval be contingent upon a demonstration that water supplies are adequate to meet requested demands.
- In the land use implementation element, reinforce the mandate in Environment Article Title 5, Subtitle 9 that:
    - Recommends that subdivision regulations or equivalent development ordinances include provisions requiring that site plan/subdivision plat submittals have documentation from an engineer or official notification from the appropriate municipal or county agency(ies) stating that adequate water either presently exists or will exist for all development depicted.
    - Requires that subdivision regulations or equivalent development ordinances contain language requiring the local approving authority, when reviewing development plans, to determine that sufficient water exists or will exist when needed for all development depicted on site plans/subdivision plats under consideration.
- Establish future reservoir or watershed areas and the appropriate restrictions and/or protections to ensure water supply development can proceed at the designated future time period.
- Evaluate regional solutions to future water supply capacity planning.
- Conduct water availability studies for the jurisdiction and/or collaborate on regional or statewide studies of water availability.

Each of the previous items provides basic guidance for the County Water and Sewerage Plan and will help ensure that the plan is fully consistent with the comprehensive plan as required by law.

E. Linking Water Supply, the Community Facilities Element and the County Water and Sewerage Plan with the WRE

The community facilities element of the comprehensive plan should describe goals and recommendations for water supply and water systems within the jurisdiction. In addition to goals and recommendations for financing, operation and maintenance and water connections, this element should summarize or refer to the water quality protection and supply development goals and recommendations listed in the WRE.

The County Water and Sewerage Plan will include proposed water service areas as well as a description of the additional water infrastructure and supply development needed to serve expected growth within these areas. These areas must be sized and phased in accordance with the findings and recommendations of the WRE, since the WRE will indicate how much growth can be supported within the planning time period and when adequate water supply will be available to serve that growth. The description of additional water infrastructure and supply development needed must also be consistent with the findings of the WRE.

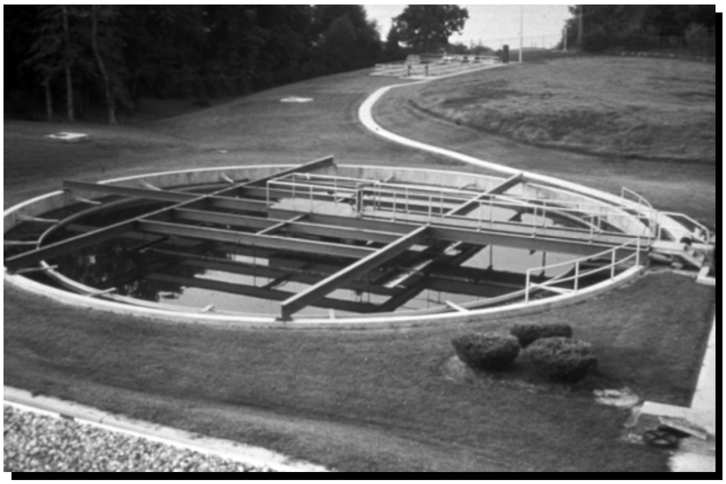
F. Review Criteria for Drinking Water

The comprehensive plan and its component elements are crafted by local jurisdictions in many different styles and levels of detail. At a minimum, the state will ask the following questions in its review and evaluation of a WRE. Does the WRE:

- show or refer to the boundaries of relevant areas used for planning, including jurisdictional boundaries, designated growth areas, current sewer and water service areas, watersheds, Priority Funding Areas and other relevant geographies?
- describe the types of assessments undertaken and the methods used?
- describe the available permitted capacity of existing community water systems and the general status of drinking water sources and uses according to WSCMP guidelines?
- estimate the future demand for water by reviewing population projections and associated commercial, industrial and agicultural water demand and development capacity of existing and planned community service areas and rural areas? Note that population projections for sub-county areas bear a reasonable relationship to the latest countywide cooperative forecasting projection published by MDP. If an alternative method of forecasting population is used, describe the information and methodology used for the analysis.
- estimate the potential water supply of surface and ground water resources not yet permitted for withdrawal, which can then be used to develop an estimate of the approximate number or range of additional households and associated commercial, industrial and agicultural water demand that can potentially be supported in the planning area?
- identify strategies to meet future water quantity needs, including alternative water sources, demand reductions or land use/zoning modifications?
- identify planning strategies to protect current and future water sources from pollution and overallocation?
- evaluate the capacity of rural areas to support uses in those areas including individual systems, agricultural irrigation and other possible users?
- provide policies that set forth the general goals of the jurisdiction with respect to the management and use of its water supply resources and how those goals guide the action sections of the WRE?
- describe the actions planned for implementation to ensure that water supplies are adequate and safe to meet future needs? If necessary, do the actions identify lead agencies, estimate budget needs and establish a project timeline?

V. Wastewater Assessment

Water quality regulation is currently evolving as new regulatory programs for both point and nonpoint source water quality and the management tools necessary to address those programs are developed. The Chesapeake Bay Tributary Strategy, preparation of total maximum daily loads (TMDLs), nonpoint source best management practices (BMPs) and related issues are all still evolving. Maryland's population growth over the next 25 years provides a challenging environment in which to integrate water quality planning with local comprehensive plans.



As with water supply, the quality of the data will continue to change and improve during the planning period mandated in HB 1141 and the regulatory context will continue to be clarified. Also as with water supply, this guidance document and the WREs that are prepared by local governments will have to be updated in the future to reflect changes in water quality programs and regulations.

A. Background

The WRE must address the availabilty of suitable receiving waters and land areas to meet wastewater treatment and disposal needs. Suitable means that surface waters can assimilate pollutants from wastewater sources, including wastewater treatment plants, community and individual septic tanks and industrial sources, without violating water quality standards. Suitable also refers to land areas that have the appropriate characteristics for gound water discharge of wastewater, which means that water quality standards will not be violated once gound water flows reach surface water bodies. Most surface waters are already considered impaired, or in violation of water quality standards, by the state as listed on the 303(d) list, which identifies each impaired water body and the standard or standards which it is violating. The state's 303(d) NPDES permit limits list is available at
www.mde.state.md.us/Programs/WaterPrograms/TMDL/Maryland%20303%20dlist/index.asp.

1. Nutrient Caps

Treated wastewater is discharged either to surface water or gound water via land application. When evaluating wastewater discharge permits, the state considers the nutrient caps of a water body or land area. The state has established two types of nutrient caps for wastewater discharge in Maryland:

- **Point Source Caps**: To help restore the Chesapeake Bay, the state has established the Chesapeake Bay Tributary Strategy point source caps for significant WWTPs (> 0.5 MGD) and point source projections for nonsignificant WWTPs (< 0.5MGD) that discharge to Chesapeake Bay tributaries.

- **Total Maximun Daily Loads**: To restore water quality in particular streams and other water bodies, the state has established TMDLs, which include a point source cap, also known as a point source waste load allocation. The TMDL also includes a nonpoint TMDL allocation that covers residential, agricultural and industrial pollutant sources via stormwater runoff, gound water pollution including septic system discharges and air pollution.

It is important to note that achieving wastewater discharge caps alone will not necessarily ensure that water body assimilative capacity is not exceeded. However, the caps are very important in helping the state and local jurisdictions make progress towards Chesapeake Bay and local tributary restoration.

For the state to authorize a wastewater discharge, the water body or land area proposed to receive the discharge must have the assimilative capacity to absorb the pollutant load in the discharge without violating water quality standards.

2. Impact of Water Quality Regulations on Land Use

Limited sewage treatment plant capacity and limited assimilative capacity of streams can inhibit or stop planned development. Therefore, the impact of regulations any other treatment capacity constraints on comprehensive plans and land use planning can be as constraining as the limits imposed by a lack of drinking water. The WRE must help to direct local comprehensive plans in ways that help to achieve wastewater disposal within water body assimilative capacities.

Options for addressing these limits include nutrient offsets, land application, growth limitation or redirection or, in the extreme, capping growth. As the regulations to govern the use of these or other techniques are completed, the basis for future updates of the WRE will be established.

B. Assessment Approaches/Methodologies

A number of approaches are suggested below that can be used to determine whether water resources and water quality infrastructure have sufficient capacity to accommodate planned growth and development:

1. Wastewater Treatment Capacity Adequacy

Potential demand and wastewater capacity needs for a planning area should be estimated using the guidance document prepared by MDE, *Wastewater Capacity Management Plans* (WWCMP), available at MDE's website, **www.mde.state.md.us**, under the **More Publications** heading. Page 12 of the WWCMP describes steps used to determine net available capacities for an individual WWTP.

A WWCMP is required to contain information on sewage system capacity and the demand created by existing and projected growth and development. A WWCMP is required by MDE for municipalities operating at 80% design capacity. However, it is recommended that this tool be used for all facilities to help comply with Subsection 9-512 of the Environment Article that prohibits state and municipal authorities from issuing building permits or approving subdivision plats without demonstrated adequate sewage conveyance and treatment capacity.

The net available capacity estimate can then be converted into estimates of the number or range of households and/or commercial/industrial capacity potentially available to support additional growth in the planning area. To determine the additional number of households that can be served by an existing WWTP, a flow of 250 gallons of wastewater per day per household could be used for planning purposes.

2. Limiting Factors

After determining flow capacity and potential demand, the next step is to consider whether nutrient caps will present a surface water discharge limitation. The more restrictive of the following two nutrient loading caps apply:

- Maryland's Point Source Strategy[2] cap to meet Chesapeake Bay water quality standards, and
- Total Maximum Daily Load (TMDL) waste load allocations set to meet local water quality standards.

Proposed treatment plant allocations are most often identified in the Technical Memoranda of the TMDL. However, the final allocation decision is made during the NPDES permitting process. Thus, NPDES permit limits are the more authoritative source of information on a plant's nutrient loading limit.

3. Antidegradation Policy

Maryland's antidegradation policy is another factor that needs to be considered as part of a WRE. This policy ensures that water quality continues to support designated uses. Where water quality is better than the minimum requirements specified by the water quality standards, that water quality must be maintained. An antidegradation review is triggered by new or proposed amendments to County Water and Sewerage Plans and discharge permits. The review is required to ensure that water quality remains consistent with antidegradation requirements. The policy states:

> "An applicant for proposed amendments to county plans or discharge permits for discharge to Tier II waters that will result in a new, or an increased, permitted annual discharge of pollutants and a potential impact to water quality, shall evaluate alternatives to eliminate or reduce discharges or impacts. If impacts are unavoidable, an applicant shall prepare and document a social and economic justification. The [Maryland] Department [of the Environment] shall determine, through a public process, whether these discharges can be justified."

Planned residential, commercial and industrial growth should not exceed water body assimilative capacity for the planning area. Implementation policies need to be considered to accommodate planned growth. These might include innovative design guidelines, zoning regulations, buffers for sensitive areas and overlay zones. It is recommended that major development be avoided in watersheds draining to highg quality water bodies, or Tier II waters.

The regulations identify Tier II waters for which additional protections are required. They are available at **www.dsd.state.md.us/comar/26/26.08.02.04-1.htm**.

4. Assessing Options

Existing dischargers of any size that want to grow beyond their loading caps will need to consider strategies. These strategies include, but are not limited to, implementation of higher levels of wastewater treatment, wastewater reuse (e.g., spray irrigation), nutrient offsets or trades from other existing dischargers, bubble permits or implementation of nonpoint source reductions. The guidance and regulations for these techniques are currently under preparation by MDE.

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[2] Maryland's Point Source Strategy for the Bay established nutrient loading caps for wastewater treatment plants. The Strategy is based on a two-part plan to (1) upgrade Maryland's wastewater treatment plants to state-of-the-art Enhanced Nutrient Removal (ENR) technology and (2) maintain established nutrient loading caps. For additional information regarding the Point Source Strategy please go to www.dnr.state.md.us/bay/tribstrat/implementation_plan/point_source.pdf or contact MDE's Water Quality Infrastructure Program. The nutrient load caps may restrict WWTP ability to expand to accommodate future growth. Other measures would have to be considered in order to accommodate planned development.

Bubble Permits

The bubble permit concept is based on the aggregate annual waste loading of total nitrogen and total phosphorus in pounds per year that is permitted as discharg from all wastewater treatment plants in a given planning area. This approach may provide flexibility in situations where the ability to achieve loading caps varies among WWTPs in the planning area.

Nutrient trading/offsets

MDE, with the assistance of stakeholder input, is in the process of developing a policy describing nutrient trading/offsets approaches.

Wastewater Reuse

Spray irrigation can be an important wastewater reuse strategy in planning existing wastewater treatment plant expansion or new discharges under nutrient caps. There are three options for determining spray irrigation site capacity:

> **Option A** provides a rough estimate of site capacity based on the general drainage characteristics of soils in a county without eliminating other limiting factors such as site slope, depths to gound water and bedrock, buffer zone requirements and reserve area. Soil drainage characteristics can be found in the General Soil Map provided in each County Soil Survey. The total site capacity for spray irrigation in a county can be added together after determining the site capacity of each drainage category as indicated by the last column of Table 1 shown in the appendix.
>
> **Option B** provides a more accurate site capacity estimate by also considering the site limiting factors including site slope, depths to gound water and bedrock, buffer zone and reserve area. Information pertaining to site slope, soil permeability and depth to gound water and bedrock can be found in the **County Soil Survey**. Please follow the procedures outlined in the appendix to determine the total site capacity for spray irrigating treated wastewater.
>
> **Option C** provides the most accurate method in determining countywide spray irrigation site capacity because it recommends retaining a soil consultant to conduct a comprehensive hydrogeological study in order to define the spray irrigation rate through soil infiltration tests and the suitable soil boundary through soil test pits or soil borings. Items to be included in the study and approved infiltration testing methods are shown in MDE *Guidelines for Land Treatment of Municipal Wastewater* available from the MDE web site.

Additional information on the above management approaches to limiting factors is available from MDE's Water Management Administration.

C. Linking Wastewater to the Land Use Element - Managing the amount and location of growth and development

As stated in Section III, **Links to Other Comprehensive Plan Elements and Other Plans**, the size, location and structure of present and future growth areas and water and wastewater service areas should be consistent with the water resources capacities. Guidance for this linkage to the land use element is the same as for water supply. See Section IV.C. on page 25.

D. Linking Wastewater to the Land Use Implementation Element – Policies and Actions

Once assessments of wastewater capacity needs and water body assimilative capacity are completed for a WRE, the jurisdiction should discuss how it will implement the findings is an appropriate component of the WRE and the comprehensive plan. These implementation policies should clearly connect the assessment findings and the land use element guidance to implementation recommendations and actions. Implementation mechanisms may include existing or new local ordinances or regulatory programs pertaining to wastewater disposal, capacity allocation, authorization and water quality protection. Suggested areas for policy considerations are as follows:

1. To sustain existing wastewater treatment capacity, consider policies and actions to:

- Require the development and use of capacity management plans for each wastewater treatment plant and system as part of the approval process for allocations and connections to the system.
- Limit allocations and connections to a system that would cause the system capacity to exceed a set level under maximum capacity.
- Establish and require water conservation measures to be implemented.
- Reduce inflow and infiltration into the wastewater collection system.
- Develop and implement wastewater reuse applications such as spray irrigation.
- Pursue nutrient offsets such as septic tank connections.

2. To develop new wastewater disposal capacity, consider policies and actions to:

- Require all new wastewater treatment systems to meet the proposed demand for future growth.
- Require that zoning, plat approval and development approval be contingent upon the demonstrated ability of wastewater treatment to meet discharge requirements and, if necessary, go beyond those requirements to achieve the total TMDL or assimilative capacity for other water bodies in the watershed.
- Require approval processes for new development to include meeting verified assimilative capacity requirements prior to final approval.
- Evaluate regional solutions to ensure future wastewater capacity and adequate management planning.

Each of the previous items provides basic guidance for the County Water and Sewerage Plan and will help ensure that the plan is fully consistent with the comprehensive plan as required by law.

E. Linking Wastewater to the Community Facilities Element and the County Water and Sewerage Plan

As stated in Section III, **Links to Other Comprehensive Plan Elements and Other Plans**, water and sewerage service areas must be sized and phased in accordance with the findings and recommendations of the WRE, since the WRE should indicate whether the water resources can support the proposed growth/annexation areas. Guidance for this linkage to the community facilities element is the same as for water supply. See Section IV.E. on page 26 for more information.

F. Review Criteria for Wastewater

The comprehensive plan and its component elements are crafted by local jurisdictions in many different styles and levels of detail. At a minimum, the state will ask the following questions in its review and evaluation of a WRE. Does the WRE:

- show or refer to the boundaries of all areas used for planning including jurisdictional boundaries, designated growth areas, sewer and water planning areas, watersheds, Priority Funding Areas and other relevant geographies?
- describe the assessment(s) undertaken and the methods used?
- show the available capacity of existing WWTPs?
- show the estimated additional capacity that could be achieved by higher levels of treatment, beneficial wastewater reuse such as spray irrigation or nutrient offsets?
- show the estimate of the approximate number or range of additional households and the associated commercial and industrial wastewater capacity potential available to support this additional growth in the planning area?
- estimate the additional capacity needed, if any, to serve designated growth areas, infill areas and other projected development outside of these areas?
- estimate current and future pollutant impacts from the projected development and compare this to nutrient caps and the water body assimilative capacity?
- summarize the results of all assessments and limiting wastewater resource findings?
- provide policies that set forth the general goals of the jurisdiction with respect to its protection of water quality and its ability to meet regulatory requirements that are reflected in planned implementation actions?
- describe the actions planned for implementation measures to ensure that wastewater capacity is adequate and pollutant loadings are safe to meet future needs? If necessary, do the planned actions that identify lead agencies estimate budget needs and establish a project timeline?

VI. Stormwater Assessment

A. Background

Changes in landscape, land cover, stormwater management practices and land uses result in varying changes to the quality and quantity of stormwater runoff. These changes may have positive or negative impacts on water quality, depending on the nature and combination of the changes. In general, changes that increase impervious surface coverage and diminish vegetative cover, particularly tree cover, are negative in that they alter hydrology in ways that result in increased surface runoff, decreased infiltration and alterations to stream profiles.

Urban and suburban development profoundly affects the quality of Maryland's waters and introduces a range of pollutants into runoff. Surface runoff accumulates trash, oil, fertilizers and pesticides from lawns, deposited air pollutants, sediment from poorly stabilized areas and other pollutants. During storm events, these pollutants quickly wash off and are rapidly delivered to downstream waters. Good and well-maintained management practices can, to varying degrees, help reduce pollutant discharges to water bodies.

Agriculture has its own profile of nonpoint pollution, which varies depending on the nature of the agriculture and management practices in a jurisdiction. Good agricultural management practices can help reduce soil erosion, animal waste and other pollutant discharges to water bodies.

B. State Stormwater Management Program

The state stormwater management law was enacted in 1982, requiring local governments to enact ordinances supporting stormwater management and approve stormwater management plans for new development projects by July 1, 1984. Since the law went into effect, experience and research have demonstrated the benefits to water quality of effective stormwater management planning, implementation and maintenance. Planned densities and open space must now include the accommodation of stormwater management needs. Maryland's stormwater management approach for new development projects is a unified sizing criteria for stormwater best management practices (BMPs) to meet pollutant removal goals, maintain gound water recharge, reduce channel erosion, prevent overbank flooding and mitigate extreme flooding.

Performance standards have been established for the design criteria of the five groups of structural and nonstructural BMPs. Innovative site planning is an integral part of this approach, relying on nonstructural site design techniques such as roof top disconnection, natural area conservation and impervious surface area reductions that reduce the generation of stormwater runoff and the reliance on structural BMPs.

Maryland encourages wise, environmentally sensitive site design techniques such as Low Impact Development (LID), that reduces the overall volume of runoff and the generation of runoff borne pollution. LID promotes infiltration using gound water recharge criteria from Natural Resources Conservation Service (NRCS) soil type data. To further upgrade the state's stormwater management program, the Maryland General Assembly enacted the Stormwater Management Act of 2007, which codified the requirements for implementation of Environmental Site Design (ESD) techniques. Maryland's approach also requires that appropriate volumes be controlled to protect stream stability (channel protection volume) and large rainfall events (over bank and extreme flood protection).

Limiting the amount of impervious surfaces by implementing the most effective stormwater management practices, such as ESD, must be incorporated in every new development and redevelopment project. Stormwater utilities are effective and should be incorporated in local ordinances to ensure that dedicated financial resources are available to support the maintenance of stormwater controls. They should also provide the resources needed to address existing developed lands that do not yet have stormwater management. This stormwater management approach provides flexibility to localities and developers/designers by ensuring that innovative site design techniques are blended into local grading, building and development codes, while mandating a specific pollution reduction performance standard.

Maryland has adopted smart growth policies that are geared toward concentrating development where it currently exists thereby reducing suburban sprawl and impervious surface. Therefore, redevelopment of existing areas is strongly encouraged. A stormwater management policy for redevelopment has been established that specifies a 20% reduction in impervious surface area below existing conditions. Because this may be impractical due to site constraints, water quality treatment of the volume of runoff from 20% of a site's impervious surfaces is allowed. Locally approved practical alternatives such as fees, off site implementation, watershed or stream restoration and retrofitting are allowed as well.

C. The WRE Role in Stormwater Management

A WRE must provide the vision and path to achieve the water quality levels necessary to support existing designated uses under Maryland's water quality standards through nonpoint source management and wastewater treatment. The WRE should also manage stormwater sufficiently to protect stream habitat. The implementation of the comprehensive plan's vision is realized through zoning and subdivision regulations.

Suitable stormwater treatment involves two key considerations:

- The programmatic aspects of effective stormwater management and
- The assessment of potential impacts of proposed land use changes on nonpoint source loads to state waters.

Limited assimilative capacity of receiving waters can inhibit or stop planned development within a watershed. This is the case whether assimilative capacity is exceeded as a result of increased point source loads, as a result of nonpoint source loads from new development or as a result of a combination of the two.

The National Pollutant Discharge Elimination System (NPDES) and State Stormwater Management programs do not directly regulate nonpoint source pollution loads from development or associated septic systems outside of areas served by water and sewer, which are typically also areas outside of Priority Funding Areas. For this reason, it is incumbent upon the WRE and land use management programs to properly manage and regulate development outside of PFAs. By doing so, local government can manage nonpoint source pollution loads, commensurate with the assimilative capacity of state waters. Failure to do so reduces assimilative capacity, and may hasten the time when constraints must be placed on planned development in a watershed through the NPDES program.

D. Assessment Approaches/Methodologies

The Stormwater Assessment component of a WRE is intended to inform the land use planning process by evaluating suitable receiving waters and land areas to include appropriate stormwater management treatment. It is also intended to ensure that the land use planning process is used as an effective nonpoint source pollution management instrument. This, in conjunction with the management of point source pollution, will help a jurisdiction achieve and maintain its water quality standards.

A local jurisdiction should provide a programmatic assessment that includes a review of all of its stormwater management requirements and the effectiveness of its program implementation. This should include a review of local ordinances, policies and plan approval requirements, enforcement as well as other key components of the program. As part of this guidance document, and to assist local jurisdictions in addressing the WRE, additional tools are listed in the appendix.

It is anticipated that a WRE, as a component of a comprehensive plan, will also include an analysis of nonpoint source nutrient loading and impervious surface changes at a broad planning level of detail. The preliminary assessments suggested in this guidance document are therefore crafted to provide general insights into this process, and serve as a starting point for future nonpoint source analyses.

1. Stormwater Programmatic Approach

Watershed protection and planning tools are available to improve local stormwater management programs. In addition to fully implementing the *2000 Maryland Stormwater Design Manual, Volume I* & *II*, improvements to local ordinances, guidelines and principles may be undertaken. A number of advanced model ordinances, development guidelines and principles are referenced in the appendix . An outline that includes suggested environmental enhancements, mapping, stream protection and stormwater sustainability as additional considerations when preparing programmatic assessments is also included.

2. Nonpoint Source Loading Analysis

The following is a conceptual outline of a planning-level analysis to assess the potential impact of proposed land use changes likely to occur under a comprehensive plan on nonpoint source loads:

- Using the most reliable population and employment projections available, estimate future development for the period of time covered by the comprehensive plan. Determine how the development required to accommodate the projections is most likely to be distributed geographically based on current trends in development activity, and other factors likely to affect development patterns. Map estimated future development identifying development types, population served by sewer versus septic systems, and for residential development, map lot or household density. Ideally, the results will take the form of a geographic information system (GIS) polygon coverage that identifies areas of new development and associated developed land uses and development densities. If it is reasonable to believe that the plan will produce future development patterns that will differ substantially from current trends, a WRE should explain or make reference to information that explains the basis for the differences.

- Using GIS techniques, intersect proposed future land use with existing land use to determine the net change in land uses. This will typically result in changes to the amounts of farmland, forestland and developed land in a jurisdiction.
- Determine the number of onsite disposal systems (septic systems) that are anticipated as a result of the estimated land use changes. Express this in terms of equivalent dwelling units (EDUs) to account for large shared systems and non-residential systems.
- Calculate the net change in stormwater nutrient loadings implied by the change in land use/cover.
- Calculate the increase in nutrient loads due to new septic systems and additional population on sewer services within the watershed, using information from the wastewater section of the WRE. This analysis may account for potential future use of septic denitrification technologies.
- Consider alternative land use plans to minimize nonpoint source loads (note that several iterations of analysis might be necessary).
- Summarize the results and discuss alternatives for future refinements.

The results of the nonpoint source loading assessment should be used to inform the land use, sensitive areas, environmental and other elements of the comprehensive plan that will direct and influence future development. Generally speaking, the analysis is intended to help quantify changes in open space (forest and agricultural lands), impervious cover and nutrient loads to open the way for alternative land use planning options. It will also help identify the most important factors that cause or may mitigate those changes. This will in turn help a jurisdiction identify strategies and implementation procedures that can mitigate or reduce those impacts.

E. Linking Stormwater Management to the Land Use Element

The nonpoint source and stormwater component of a WRE is intended to inform the land use planning process by evaluating receiving waters and land areas suitable for appropriate stormwater management treatment. It is also intended to ensure that the land use planning and management process is used as an effective nonpoint source pollution management instrument. By serving in this capacity, the WRE process will also ensure that nonpoint source pollution from development does not, in conjunction with point source pollution, exceed the assimilative capacity of receiving waters.

With respect to its broad role and purpose, a comprehensive plan should address the full range of options that might be employed to protect water resources. Options should be assessed to quantitatively evaluate competing goals and alternatives in an effort to shape the direction of the WRE and the comprehensive plan.

To illustrate, assume that an assessment reveals that a net increase in nonpoint source pollution resulting from estimated future development outside of a PFA under current trends or a reasonably foreseeable alternative development scenario will consume 50% of the assimilative capacity estimated to exist in a watershed at the time a comprehensive plan is being developed. That would leave 50% of the total capacity to support future development within a PFA in the watershed. However, 90% of the capacity will be needed to support 100% of the development intended for the PFA. At the simplest level, the Plan should either reduce the amount of development intended within the PFA, or reduce the potential for development outside of the PFA to a level likely to require only 10% of the assimilative capacity remaining in the watershed at the time of Plan development.

Since two goals of the comprehensive plan are to concentrate development in PFAs and conserve rural resource land outside of PFAs, only the second alternative – reduce the potential for development outside of a PFAs– is consistent with those goals. That alternative can be accomplished by: down zoning; initiating a transfer of development rights (TDR) program, which sends development rights from parcels outside of PFAs to parcels inside PFAs; by accelerating and intensifying an existing land preservation program; or through some combination of the preceding and a variety of other tools.

Additional implementation responses, such as those enumerated in subsection VI.F., **Linking Stormwater Management to the Land Use Implementation Elements**, can be employed to reduce the pollutant load or impervious cover required to accommodate a given amount of development outside of the PFA. Techniques under **Implementation Policies** in the **Wastewater Treatment** section on page 31 of this guidance document can be employed to support more development either within or outside of PFAs, or both. Advanced stormwater management and on-site sewage disposal techniques will reduce the pollution that must be assimilated by the receiving water body. Similarly, better protection of Sensitive Areas and aggressive use of environmentally sensitive and low impact development site design will also reduce impervious cover impacts. (Note that these impacts are beyond the scope of the analysis tools referenced in this Guidance.)

Whatever implementation is prescribed by a comprehensive plan, it is important to bear in mind that the WRE and the associated land use management programs used to direct development to appropriate areas will play a major role in determining a jurisdiction's ability to realize its plans for future development within a PFA. If the amount and location of development is not considered in this context, it will inefficiently consume the assimilative capacity needed to support future development.

F. Linking Stormwater Management to the Land Use Implementation Element

Once the assessments of stormwater program enhancements and nonpoint loads are complete for a WRE, how a jurisdiction will implement the findings is an appropriate component of the WRE and comprehensive plan. These implementation policies should clearly connect the enhancement and nonpoint source loading analysis findings to implementation methods. Implementation mechanisms may include revision of existing or development of new local ordinances or regulatory programs pertaining to stormwater management, wastewater disposal and the land uses impacting overall water body assimilative capacity. Suggested areas for policy considerations are as follows:

1. To enhance stormwater management programs

- Limit impervious surface areas to 10% in Critical or Sensitive Areas.
- Require open section roadways in all new developments.
- Incorporate the use of nonstructural best management practices (BMPs) such as natural conservation areas, roof and nonroof top disconnection, vegetated swales, sheet flow to buffer, reduced impervious cover to the maximum extent practicable and promote environmentally sensitive design (ESD) or low impact development (LID) techniques.

- Maintain existing forest cover and promote the enhancement of contiguous forest areas.

2. To address nonpoint source loading impacts

Nonpoint source loading analyses, conducted in support of a WRE, provide a preliminary assessment of potential changes in nonpoint source loads due to land use planning decisions. Implementation policies should include a commitment to refining these analyses over time and at more refined geographic scales. In addition, the following implementation tools may help achieve water quality goals:

- Transfer and purchase of development rights ordinances (TDR and PDR)
- Land preservation programs such as the Maryland Agricultural Land Preservation Foundation (MALPF) and Rural Legacy
- More effective agricultural and rural preservation zoning
- Septic tank ordinances: require nutrient offset projects for subdivisions built using individual septic tanks; and require denitrification units for all new septic tanks
- Enhanced forest conservation ordinances
- Modernized subdivision ordinances, which allow for innovative site design techniques
- Stormwater utilities that provide a dedicated fund for enhanced inspection, maintenance and restoration activities
- Update policies on variances allowed under existing programs (See Appendix G of *Maryland's 2006 TMDL Implementation Guidance for Local Governments*)

G. Review Criteria for Stormwater Management

The comprehensive plan and component elements are crafted by local jurisdictions in many different styles and at many different levels of detail. At a minimum, the state will ask the following questions in its review and evaluation of WREs.

For Stormwater Management, Does the WRE:

- show or refer to the boundaries of the relevant areas used for planning including jurisdictional boundaries, designated growth areas, sewer and water service areas, watersheds, Priority Funding Areas and other relevant geographies?
- recommend the adoption of the latest model ordinance for stormwater management that emphasizes the use of nonstructural best management practices (BMPs) and/or better site design techniques to the maximum extent practicable?
- recommend the modification of local building codes and/or planning/zoning requirements as deemed necessary to minimize impediments to the use of nonstructural BMPs?

For Nonpoint Source Loading, Does the WRE:

- include the nonpoint source loading analyses conducted in support of the WRE? Do they provide a preliminary assessment of potential changes in nonpoint source loads due to land use planning decisions?
- make general findings for alternative land use options?
- inform the land use element and other elements of the comprehensive plan?

- describe the alternative future development options for which nonpoint source and point source loading estimates were performed?
- note any alternatives that affect the number of development units and different usage of sewer versus septic systems?
- make findings that address estimated changes in both point and nonpoint nutrient loads? The WRE should discuss trade-offs in competing objectives that are revealed by the analyses, e.g., preservation of cropland that may result in higher nutrient loads than alternative land use options that consume more cropland, which at the same time would limit the amount of impervious surface and habitat fragmentation.
- provide reasonable justification with supporting documentation for any alternative analytical tools, parameters or assumptions that were used?
- provide all existing procedures and/or recommendations for new procedures to ensure that future nonpoint source and point source loading analyses are instituted within local government planning and decision-making processes?

Part II of this guidance document presents a model WRE that has been prepared to illustrate one approach to applying these guidelines.

Model Water Resources Element of the Coastmont County General Development Comprehensive Plan

Preface

The following is a model, or prototype, of a water resources element. This model provides an overview of applicable comprehensive plan vision statements. It describes the method used by fictional Coastmont County and its two municipalities, Piedmont and Forestville, to evaluate and decide upon the county's land use plan. The model lists the goals and recommendations of the water resources element and the supporting data that was used by the county to develop its recommendations.

Coastmont County Comprehensive Plan Overview

The comprehensive plan vision statements applicable to the water resources element include the following:

a. Promote the minimization of impervious surfaces

b. Focus growth within Priority Funding Areas and water and sewer planning areas

c. Preserve open spaces of the rural areas through zoning that protects the rural resources and economics and minimize further rural development

d. Promote agricultural preservation participation

e. Reduce nonpoint source nutrient loading through stormwater and septic tank management

f. Encourage concentrated growth in towns that provide focused central business areas that are mixed with residential living and maintian and enhance vibrant communities

Coastmont County's Comprehensive Land Use Plan projects a modest growth in population and housing based on the Maryland Department of Planning's (MDP) population projections. The land use plan focuses development in and adjacent to the incorporated towns and the designated Growth Area surrounding the unincorporated community of Waverly. The county's land use plan and municipal land use plans for the towns of Piedmont and Forestville are consistent with each other. Each town prepared a municipal growth element (MGE) that reviewed population and housing projections against the ability to provide adequate and safe source(s) of water supply and wastewater treatment. To decide upon appropriate land use plans, the county and towns used a growth model to conduct a series of analyses based on the tenets mentioned above, historical growth trends and natural resource limitations, and focused on the eight Visions of the State Planning Act of 1992.

The county recognizes that protection of source water recharge areas is of paramount importance when preparing a land use plan. The county identified these areas and worked closely with the two towns to help prepare the best growth plan possible. The town growth plans balance projected growth with open space preservation around major aquifer recharge areas and raise land use concerns for those areas inside and adjacent to wellhead protection areas.

Collaboratively, the county and towns have prepared water resources elements that will:

> "focus growth to areas best suited to use the existing and planned water and wastewater infrastructure that will protect and preserve the natural environs, promote economic growth and support diversity of living environments in Coastmont County."

Coastmont County Water Resources Element

I. Water Resources Goals and Recommendations

Land Use Plan Analysis

The county and towns, with assistance from the Maryland Department of the Environment (MDE), reviewed and calculated the potential water supply from current and immediately available sources. It was determined that the Coastal Plain aquifers were more than adequate to meet the population projections in that region of the county. A comparable water availability assessment was conducted for the Piedmont region comparing the current water availability limitiations for the town of Piedmont service area to current demands and development projections which illustrated the many challenges in meeting the water demands of any growth projection. Ultimately, it was decided that a modest growth projection be developed to help deal with previous growth issues and investigate solutions that would be economically feasible and supportable by existing and projected customers. It was noted that, for the Piedmont region, future growth is uncertain at this time based on source water availability alone. The land use analyses would progress with a very focused growth projection for this region, with all growth restrictions imposed until adequate public facilities were available.

The same population projections used to review and calculate potential water supply were used to calculate the generation of wastewater and test the initial assimilative capacities of receiving waters. These were found to be within reasonable limits with modifications to the treatment processes, implementation of best management practices (BMPs) and the use of offsets and trading measures. From this group of population, housing and employment projections, the county and towns were able to prepare comparative growth plans.

Next, each municipality prepared a series of future growth plans in cooperation with county planning personnel and evaluated patterns of low density sprawl development to high density smart growth development. Each plan scenario resulted in different nitrogen and phosphorus loading amounts and very different impervious surface footprints. Each land use scenario was evaluated against the environmental conditions and issues of each area and the need to repair damage caused by previous growth patterns and practices. To restore and protect its streams and rivers, the county introduced a watershed planning initiative to implement the Chesapeake Bay Tributary Strategy and to best manage expected development impacts within each of the county's smaller sub-watersheds. Different scales were used for the land use plan analysis: political jurisdictions, infrastructure service areas and the watersheds of Coastmont County. After completing the evaluation, the county and municipalities chose the higher density smart growth model as the best land use plan goal.

Implementing the land use plan will require the county and towns to amend local subdivision regulations and zoning ordinances, enhance local stormwater management programs and tools and establish watershed development thresholds. These thresholds will focus on impervious surfaces, water supply, wastewater discharges and stream quality and how those factors relate to the amount of development impact that can be sustained without further degradation. The history of development in the county and towns has led to water supply and wastewater nutrient loading limits imposed by MDE that have affected the ability to continue such patterns. Each municipality will address its development and conservation issues to ensure implementation of the water resources element goals listed below.

Water Resources Element Goals

- Maintain and protect an adequate water supply to serve the residents of Coastmont County and collaborate with the town of Piedmont and the town of Forestville to serve current and future populations through 2030.
- Protect water supply from pollution and encroachment.
- Take steps to restore and protect water quality and contribute toward meeting water quality regulatory requirements in Coastmont County's rivers and streams, including the Coastmont River and its tributaries, Jones Creek and Tides Creek and the Yorkie River and its tributaries, including Thistle Creek. This will require addressing current water quality impacts as well as future impacts from land development and population growth.
- Protect the habitat value of Coastmont County's rivers and streams.

The water resources element goals provide direction to both county and town planning initiatives. Meeting the water resources element regulatory goals will entail requiring that new development be on smaller lot sizes, implementing water conservation, staging growth to the availability of needed water resources, clustering development while creating new forested areas, enhancing existing developed areas through infill and mixed-use zoning and implementing best management practices.

Water Resources Element Recommendations:

- Develop watershed planning and management guidelines and relate all development to its impact on the county's water resources.
- Require that agricultural areas are supported and preserved by very low density zoning to prevent sprawl and slow the growth rate of impervious surfaces. To reduce nutrient impacts from agricultural areas, implement best management practices immediately.
- Connect septic systems in or near existing sewer service areas. In addition, establish a retrofit program funded by the Bay Restoration Fund to upgrade 40 failing septic systems in order to advance bionutrient reduction systems in the Chesapeake Bay Critical Areas.
- Retrofit developed town areas without stormwater management systems. All new permits issued must require full stormwater management implementation.
- Convert all wastewater treatment plants (WWTPs) to enhanced nutrient reduction (ENR) systems and repair collection systems to minimize infiltration and inflow.
- Initiate development of spray irrigation systems for current WWTP surface discharges.
- Require mandatory clustering for all new development in rural areas with the provision of dedicated preservation land for groundwater banking. Require shared wastewater treatment systems for all subdivisions of four or more lots that are not able to connect to a public sewer system.
- Develop water conservation methods and policies and encourage innovative technologies for stormwater management such as bio-roofs.

Specific recommendations to address the town of Piedmont's adequate water supply needs:

- Evaluate impacts from appropriating 2 MGD of water from the Coastmont River.
- Consider a town connection to Waverly area water supplies.
- Implement strong water conservation strategies.
- Investigate and correct water distribution leaks.

II. Coastmont County Watersheds *

Coastmont County is divided by two basin watersheds, Coastmont River and the Yorkie River, and three local watersheds, Jones Creek, Thistle Creek and Tides Creek.

The **Coastmont River Watershed** covers Coastmont, Rock Plains, and Western Mountain counties in Maryland and part of Hanover County in Pennsylvania. The Jones Creek sub-watershed is part of the Coastmont River Watershed that drains a large section of the Piedmont area of Coastmont County. While the Jones Creek watershed is within most of Coastmont County it also extends into Western Mountain County, Maryland and Hanover County, Pennsylvania. Jones Creek is an impaired stream and Total Maximum Daily Loads (TMDLs) have been established by MDE for fecal coliform, nitrogen and phosphorus. The TMDLs are currently being exceeded and a plant ENR upgrade for the town of Piedmont's WWTP to minimize these loading impacts is currently funded.

The Tides Creek sub-watershed meanders through the coastal area of Waverly and empties into the Chesapeake Bay. Tides Creek does not have any point source discharge, but it does drain a large area of the county and the influences of stormwater runoff have impaired the stream's water quality due to urban runoff. The county comprehensive plan recommends the immediate implementation of restoration efforts.

The **Yorkie River Watershed** extends into Coastmont County in the northeast area of the county. The town of Forestville is located in this watershed as is the pristine Thistle Creek watershed – Thistle Creek is a sub-watershed that drains into the Yorkie River. Due to the relatively healthy and stable conditions in Thistle Creek, Coastmont County and the town of Forestville have designated the drainage area of Thistle Creek for low impact development and as a forest conservation zoning district.

* See Coastmont County Watershed Map on Page 52

III. Public Utility Services of Coastmont County

Coastmont County stretches across the fall line of Maryland, and includes areas of public water and sewer service that are in both the Piedmont and Coastal Plain regions. Water supply in the Piedmont area is derived from limited groundwater sources, while in the Coastal Plain area, the groundwater sources are relatively abundant. The wastewater discharge methods currently used are spray irrigation and tertiary treatment facilities with biological nutrient reduction (BNR). The WWTPs discharge into Coastmont River, which flows into the Chesapeake Bay and Jones Creek, an upland stream of the Coastmont River in the Piedmont area. The town of Forestville uses a spray irrigation system in the Yorkie River watershed. Please refer to the Coastmont County Water and Sewerage Master Plan for details on each water and wastewater facility and the utility demand and allocation methodologies.

Sewer Service

Coastmont River Watershed*

Coastmont County owns and operates the Big Pond WWTP, which serves the unincorporated community of Waverly and surrounding suburban areas. The Big Pond WWTP is a 15 MGD activated sludge BNR tertiary treatment facility. It is currently being upgraded to ENR to meet the nutrient cap permit discharge limits and to provide needed discharge capacity. Current flows are exceeding the permitted discharge and a building moratorium is currently in place. A sewer equivalent dwelling units (EDU) allocation policy has also been developed to prevent future over-allocations and the resulting permit violations. The discharge is a deep water outfall at the mouth of the Coastmont River estuary to the Chesapeake Bay.

In the Piedmont region, the Jones Creek WWTP serves the town of Piedmont and is a 0.8 MGD activated sludge BNR plant that discharges into Jones Creek, a tributary of the Coastmont River. Given the projected growth in and around the town of Piedmont and plans to connect a number of failing septic systems from surrounding areas, a plant expansion is necessary to meet future service demands. An ENR upgrade to the Jones Creek WWTP will help the town take steps toward meeting the fecal coliform, nitrogen and phosphorus TMDLs for this waterbody.

Yorkie River Watershed*

Within the Yorkie River Watershed, the Woody Thistle WWTP serves the town of Forestville and is also a four MGD activated sludge BNR plant that uses outlying drain fields for its spray irrigation discharge. This system is operating very efficiently and will not require any enhancements within the planning horizon.

* See Coastmont County Watershed Map on Page 52

Water Supply

The county-owned water supply system serves the Waverly area. Coastmont County obtains its raw water from groundwater within the Coastmont and Shasta confined aquifers. The town of Piedmont owns and operates its own water supply system and uses groundwater from the Piedmont crystalline strata (fractured, unconfined aquifer). The town of Forestville's water supply system, also owned and operated by the town, obtains its water from deep wells in the coastal plain Coastmont aquifer.

Individual private wells in the Coastal region tap the upper unconfined aquifers. In the Piedmont region, individual wells tap groundwater from the same Piedmont crystalline strata as the town of Piedmont.

IV. Current Statistics and Future Projections

A. Coastmont County

Coastmont County is home to 188,182 residents and has two incorporated towns. The towns range in population from 5,637 in Piedmont to 21,034 in Forestville with 161,511 residents living in unincorporated areas of the county. The county's comprehensive land use plan incorporates MDP's projections of modest growth in population and housing. It focuses development in and about the incorporated towns of Forestville and Piedmont, and the designated growth area surrounding the unincorporated Waverly area. Based on past trends, the average household size is projected to decrease. The county projects that population growth outside of the incorporated towns will increase slightly slower than historical trends. The Coastmont County Comprehensive Plan vision statements discourage sprawl by promoting the minimization of impervious surfaces, focused growth within Priority Funding Areas, preservation of the open spaces of the rural areas through minimal zoning and support the Rural Village concept by requiring cluster type development with forestation requirements and participation in agricultural preservation.

The population and housing growth projections stated in this plan predict an area increase from 188,182 residents/75,491 households in 2010 to 212,132 residents/87,851 households in 2030. The non-municipal portion of this overall growth is 17,389 new residents and 9,458 new households. Of this total growth, 8,418 households will connect to public water and sewer or community systems and 1,040 households will use individual well and septic systems. Currently, 16,110 households are not served by public water or sewer systems. Given these new growth projections, by 2030, 17,150 households are expected to use individual well and septic systems, all located outside of public utility service areas. The county expects that some existing systems will be eliminated when they are connected to public water and sewer systems as annexation occurs, and plans to implement a new policy to require community wastewater treatment systems for subdivisions of four or more lots outside of PFAs or public utility planned service areas.

B. Greater Waverly Area

The Greater Waverly area is home to 119,856 residents/50,295 households, of which 117,349 residents/49,316 households are currently served by the public water and sewer system. Population projections for this area reflect the growth goals stated in this plan, and the projections are in agreement with the projection estimates prepared by the state. The water and sewer service areas are delineated on the land use plan map as growth area. While there are many opportunities for infill development in the existing service area, the county is planning for public utility services to extend beyond the current service area. It anticipates that these services will support 136,155 residents/57,734 households by 2030.

The PFA comment area shown in the land use plan is a group of agricultural parcels located in future water and sewer service areas. These parcels are zoned for low-density development at this time, and landowners are expected to maintain agricultural activities beyond the 2030 time frame. However, there is a need to address stream bank buffers along Coastmont River in this area and to continue support for BMPs by the landowners.

C. Town of Forestville

Forestville is currently home to 21,034 residents/7,938 households and is projected to grow to 25,200 residents/9,882 households by 2030. Forestville's comprehensive plan update, developed in conjunction with Coastmont County Administration and Planning personnel, identifies three county areas adjacent to the town that it expects to annex. 75% of the new growth or 1,458 households will be located in these areas. 15% of the new growth or 291 households is existing county households requesting annexation for public water and sewer services. The remaining 10% of growth or 195 households is attributed to infill development within current town boundaries. The current public sewer area and water service areas coincide with the town limits, and will be expanded to serve new annexations as they occur.

D. Town of Piedmont

The town of Piedmont recently submitted its new comprehensive plan to the state for review and comment prior to adoption by the town commissioners. The current population is 5,637 residents/2,127 households and the plan projects population to increase to 8,032 residents/3,085 households by 2030. The town's comprehensive plan recommends that a new growth area be added to the west and south of the town. Development studies determined that 25 % of new residents will be within the present town boundaries and 75% will be on annexed lands. A portion of the town's growth will come from two older county communities developed on septic systems that are experiencing problems and are being considered for annexation to help address nonpoint source loading impacts to Jones Creek. The new connections will require capital improvements to meet water supply demands and wastewater treatment needs.

Please refer to the land use maps for Coastmont County and the town for delineated growth areas and comprehensive land use information. Table 1 below and Table 2 on page 48 provide the 2030 projected population and household figures and associated water and wastewater demands.

	Population		**Households**		**Population**	**Household**
	2010	**2030**	**2010**	**2030**	**Change**	**Change**
County						
Waverly Area	117,349	136,155	49,316	57,734	18,806	8418
Unserved	44,162	42,745	16,110	17,150	-1417	1040
Total	**161,511**	**178,900**	**65,426**	**74,884**	**17,389**	**9458**
Forestville	21,034	25,200	7938	9882	4166	1944
Piedmont	5637	8032	2127	3085	2395	958
TOTAL	**188,182**	**212,132**	**75,491**	**87,851**	**23,950**	**12,360**

Table 1. Population and Housing Projections for 2030

V. Drinking Water Supply Assessment

A. Greater Waverly Area

The county public water supply system that serves the Greater Waverly area obtains its source water from the Coastmont and Shasta confined aquifers. This water is treated at two county-owned and operated treatment plants. These plants can produce up to 15 MGD and all supply systems are interconnected to provide redundancy. The current wells are all in operation. The county water and sewer plan outlines a plan to take a few smaller wells offline in the next three years and replace them with three larger production wells that, with existing wells, will produce 18 MGD under full operation. Current water production meets current water demands, and the new wells will ensure the adequate supply of water beyond planning horizon demands. The two aquifers from which the county draws water are estimated to be able to produce up to 25 MGD on short-term high demand. The portions of the county outside of the Waverly area are served by individual wells which tap the upper unconfined aquifers. Based on MDE's best estimates, the county believes that the water supply provided by these aquifers will be sufficient to meet the demands of the unserved population outside of the Waverly area.

B. Town of Piedmont

The residents of the town of Piedmont receive their drinking water from the Harkins Water Treatment Plant, which is owned and operated by the town. Current well production is permitted for 0.65 MGD. The water source is groundwater from the fractured Piedmont crystalline rock and has been calculated to be at its maximum safe yield at the current draw down. An assessment of water availability indicates that sufficient groundwater supplies are not available to meet projected needs. Due to the inability to expand water production from the groundwater source within the town limits, there is a moratorium on new building permits at this time, and the town is investigating numerous options to expand its water supply. One option is a water appropriation to withdraw two MGD from the Coastmont River. The town and county are investigating a pipeline connection to Waverly area water supplies. The town is also implementing water conservation measures, seeking to detect and correct water distribution losses and investigating mandatory clustering for all new development, requiring dedicated preservation land for groundwater banking.

C. Town of Forestville

The town of Forestville owns, operates and maintains its own water supply and distribution system. The water supply comes from deep wells in the Coastmont aquifer. Current water production produces three MGD, and the town's MGE indicates that the future water demands from expected growth will be met by the ample supply of water within the Coastmont Aquifer. However, the town will apply for an additional one MGD water appropriation from the Coastmont Aquifer in approximately 2020.

Coastmont County recognizes that the protection of source water recharge areas is of paramount importance when preparing a land use plan. The county identified recharge areas and worked closely with the two towns to help them prepare the best growth plan possible. The town growth plans balance projected growth with open space preservation around major aquifer recharge areas and raise the resulting land use concerns for those areas inside and adjacent to wellhead protection areas.

	Population		Households		Population	Household	Water Demand (MGD)	
	2010	2030	2010	2030	Change	Change	Currrent	Future
County								
Waverly Area	117,349	136,155	49,316	57,734	18,806	8418	13.9	16.7
Unserved	44,162	42,745	16,110	17,150	-1417	1040		
Total	**161,511**	**178,900**	**65,426**	**74,884**	**17,389**	**9458**		
Forestville	21,034	25,200	7938	9882	4166	1944	2.6	3.8
Piedmont	5637	8032	2127	3085	2395	958	0.65	1.2
TOTAL	**188,182**	**212,132**	**75,491**	**87,851**	**23,950**	**12,360**	**17.15**	**21.7**

Table 2. Projected Water Service Demand, 2010 - 2030

1. Waverly demands included in the county water demands.
2. All water demands include residential, commercial and industrial uses.

VI. Wastewater Treatment and Stormwater Management Assessment

A. Greater Waverly Area

The Greater Waverly area is served by the 15 MGD Big Pond WWTP. Residential development contributes 11.2 MGD, and 1.8 MGD is attributed to the commercial and industrial developed lands. Wastewater flow has exceeded its permitted nutrient discharge limit and the county has applied for a permit increase to full capacity at 15 MGD in conjunction with an ENR upgrade. There is a new construction permit moratorium in place at this time due to plant capacity issues. By reducing nutrient loading, an ENR upgrade will allow for the moratorium to be removed and allow immediate growth plans to continue.

Buildout of the entire Waverly growth area will require the WWTP to expand to 18 MGD. With the growth area fully developed, it is expected that the nutrient capacity for Coastmont River will be exceeded, and a study will be initiated to determine the feasibility of a spray irrigation system to divert effluent from the surface water outfall. The county's water resources element recommendation is to introduce a policy to require community wastewater systems instead of septic tanks where possible for new growth in unserved areas in order to reduce new nonpoint source pollution.

B. Town of Forestville

The town of Forestville WWTP is a four MGD activated sludge BNR plant that uses a spray irrigation discharge method on county-owned land located east of Forestville. This plant is currently permitted for three MGD and its current total flows are 2.23 MGD. The town does not surface discharge any wastewater to Thistle Creek, but it does impact the creek from the urban nonpoint sources, as do agricultural activities within its drainage basin.

C. Town of Piedmont

The town of Piedmont sends its wastewater to the Jones Creek WWTP. This treatment plant is a 0.8 MGD facility that is currently permitted to discharge 0.6 MGD, and current flows to the plant of 0.6 MGD do not permit any new connections. To help avoid future capacity issues, the town has developed a capacity management plan for its WWTP. The discharge is to Jones Creek, a tributary of the Coastmont River, and TMDL limits for fecal coliform, nitrogen and phosphorus are being exceeded. A capital project to add ENR technology to the existing plant will help toward reaching the TMDL, but the permit moratorium will not be lifted until an ample water supply is secured and WWTP expansion is complete.

Permitting discussion is ongoing with MDE to determine expansion of the treatment plant from 0.8 MGD to 1.2 MGD to meet the town's projected growth. Alternative measures including offsets will be required. These measures will include the connection of existing septic systems that will be annexed into the town, cluster development and the creation of forested lands, stream buffering and stormwater management BMPs. However, offsets for nutrient loading cannot be calculated until the state finalizes its nutrient offset policy. The town is also working with the county to identify spray irrigation sites that could divert a portion of the wastewater discharge. *Note: This diversion was not used in any of the land use plan analyses when comparing nutrient loading changes.*

Jones Creek is also threatened by inadequate stormwater management that has caused significant bank erosion and siltation resulting in impaired stream habitat. The Maryland Biological Stream Survey (MBSS) confirms that Jones Creek is impaired biologically and is classified as poor for benthic and fish habitat. The town is currently adopting new stormwater legislation to minimize future stream bank degradation, and the county is working with the town to retrofit existing storm drains with retention ponds and provide primary treatment prior to discharge. Community organizations are assisting landowners whose properties front Jones Creek with riparian buffer enhancements.

Tides Creek does not have any point source loading influences, but it has been impaired by urban runoff from the county's most populated area and agricultural areas to the west and north of Waverly. The upper reaches of this creek drain a large farming area. The Coastmont County Comprehensive Plan recommends that Jones Creek and Tides Creek be restored and protected to ensure sustainability for the natural habitats that they support. In addition to implementing many new stormwater best management practices, or BMPs, the county is also implementing low impact development (LID) design criteria to promote a resource conservation approach for all new development, promoting the idea that minimal disturbance requires minimal maintenance.

	Population		Households		Population	Household	Waste Water (MGD)	
	2010	2030	2010	2030	Change	Change	Current	Future
County								
Waverly Area	117349	136155	49316	57734	18806	8418	13.1	17.3
Unserved	44162	42745	16110	17150	-1417	1040		
Total	**161511**	**178900**	**65426**	**74884**	**17389**	**9458**		
Forestville	21034	25200	7938	9882	4166	1944	2.23	2.91
Piedmont	5637	8032	2127	3085	2395	958	0.6	1.2
TOTAL	**188182**	**212132**	**75491**	**87851**	**23950**	**12360**	**15.93**	**21.41**

Table 3. Projected Wastewater Service Demand, 2010 - 2030

1. Waverly flows include the county flows
2. All flows include residential, commercial and induistrial connections
3. All improved lots in the towns of Forestville and Piedmont are served with both public water and sewer.

VII. Point and Nonpoint Source Loading Status and Remediation

Coastmont County planning staff worked with planning committees and officials from each municipality and the county to assess nonpoint source loading impacts tied to the different land uses and their associated land covers. MDP and MDE have also been valuable resources, aiding in the computation of these loading impacts. The calculations are based on the 2030 land use map from Coastmont County. 2030 county land uses were matched to MDP land use categories to accommodate the State Growth Development Loading Model. With the expectation that water supply will be sufficient to serve 2030 projected population, wastewater impacts from both septic tanks and WWTPs were incorporated into the analyses.

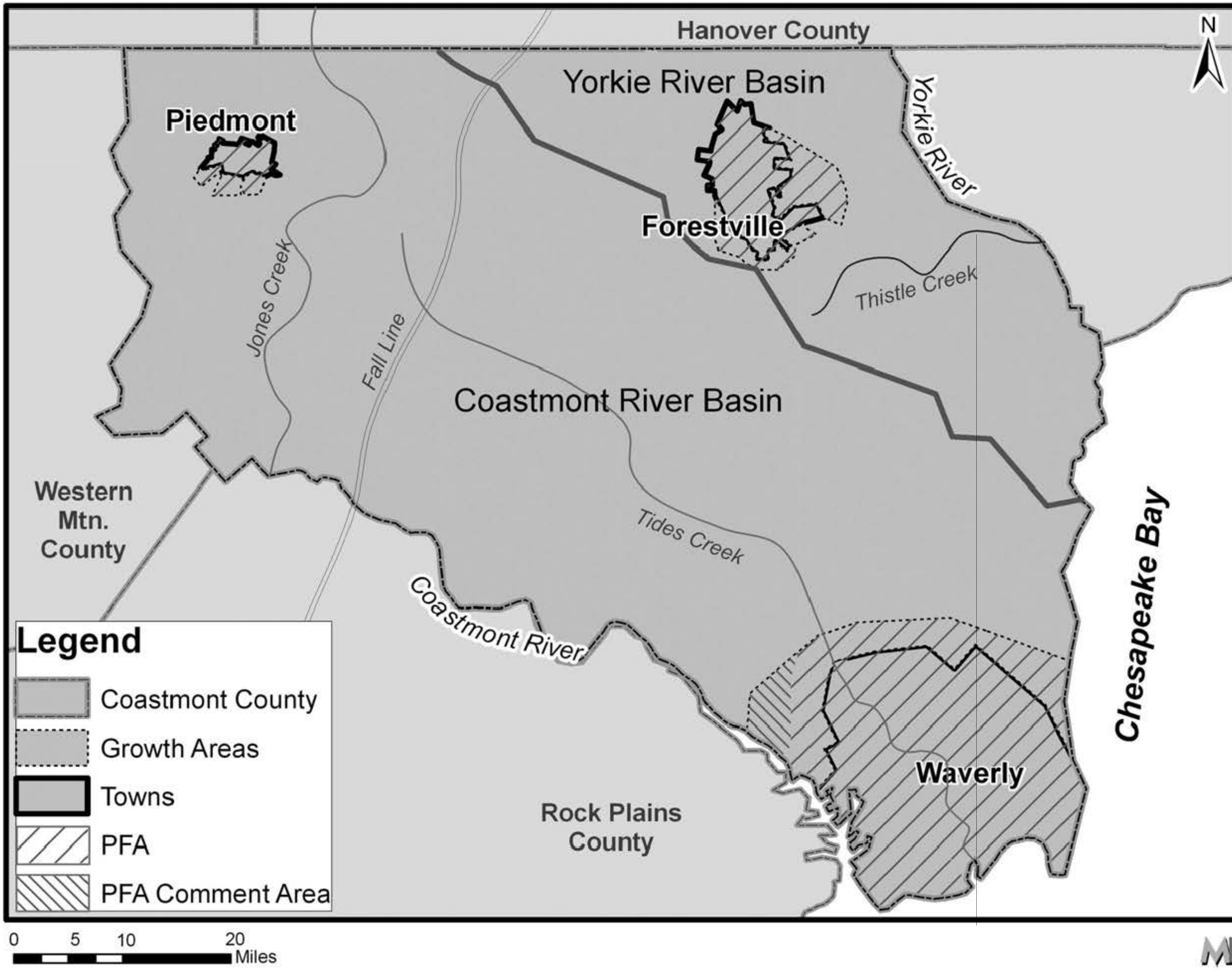
Next, the county determined which land use development plan would best minimize future impervious surfaces and stormwater nutrient loading. Numerous land use plans were tested, and it was determined that the smart growth land use plan produced the best reduction in overall loading calculations. The use of cluster development and the continued implementation of BMPs on all land uses, coupled with mandatory open space and forestation requirements, will help minimize the impacts of stormwater runoff. The smart growth land use plan also minimized the increase in impervious surfaces, which contributed to an overall reduction in nonpoint source loading impacts. The highest nutrient reductions were attributed to the conversion of BNR treatment plants to ENR technology and the connection of numerous existing septic systems. *Note: A reduction in farmland was also projected due to the historic trend of market driven influences. Added to that, a partial conversion of farmland into pasture for grazing created a minimal increase to the nonpoint source loading changes in this region.*

VIII. Capital Improvement Projects

Major capital improvement projects that address long range planning needs for public sewer and water are:

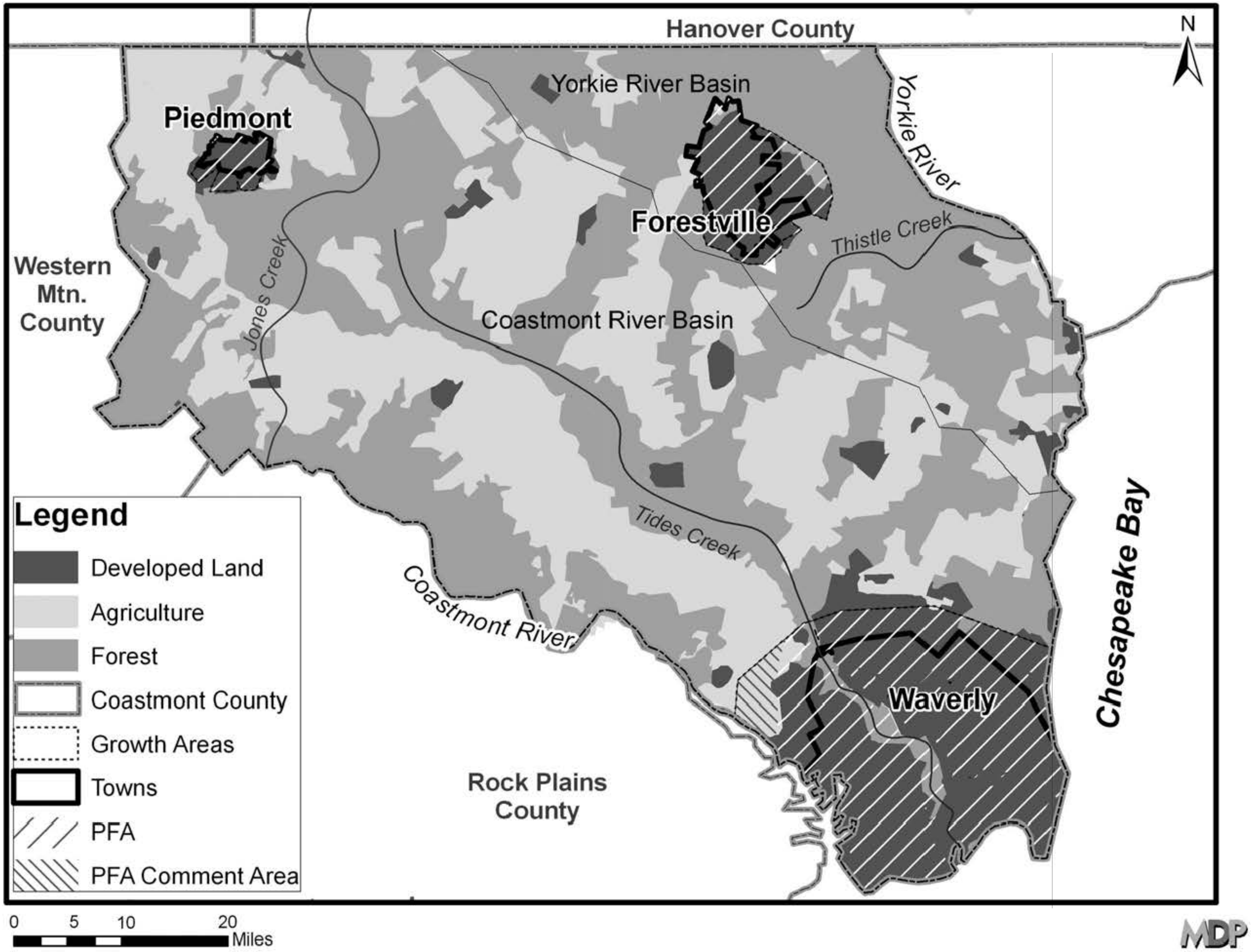
- The ENR projects at the Big Pond WWTP (15 MGD) and Jones Creek WWTP (0.8 MGD)
- A 0.4 MGD expansion of the Jones Creek WWTP
- The addition of three pumping stations to handle the additional flow from existing septic systems in the area surrounding Piedmont over the next five years
- Establishment of a septic system retrofit program funded by the Bay Restoration Fund to upgrade 40 failing septic systems to the advanced bionutrient reduction systems that are in the Chesapeake Bay's Critical Area
- A new reverse osmosis water treatment facility to serve the expected drinking water demands in the Waverly area, with three new wells in the Millers Glen area that will yield 18 MGD
- Appropriation of funds to study the feasibilty of building a 6 mile 20" pipeline from the Coastmont River or a supply line from the Coastmont Water Treatment Plant in the Waverly area to meet the expected water demands from the large annexation project in Piedmont expected by 2015

Coastmont County Watersheds

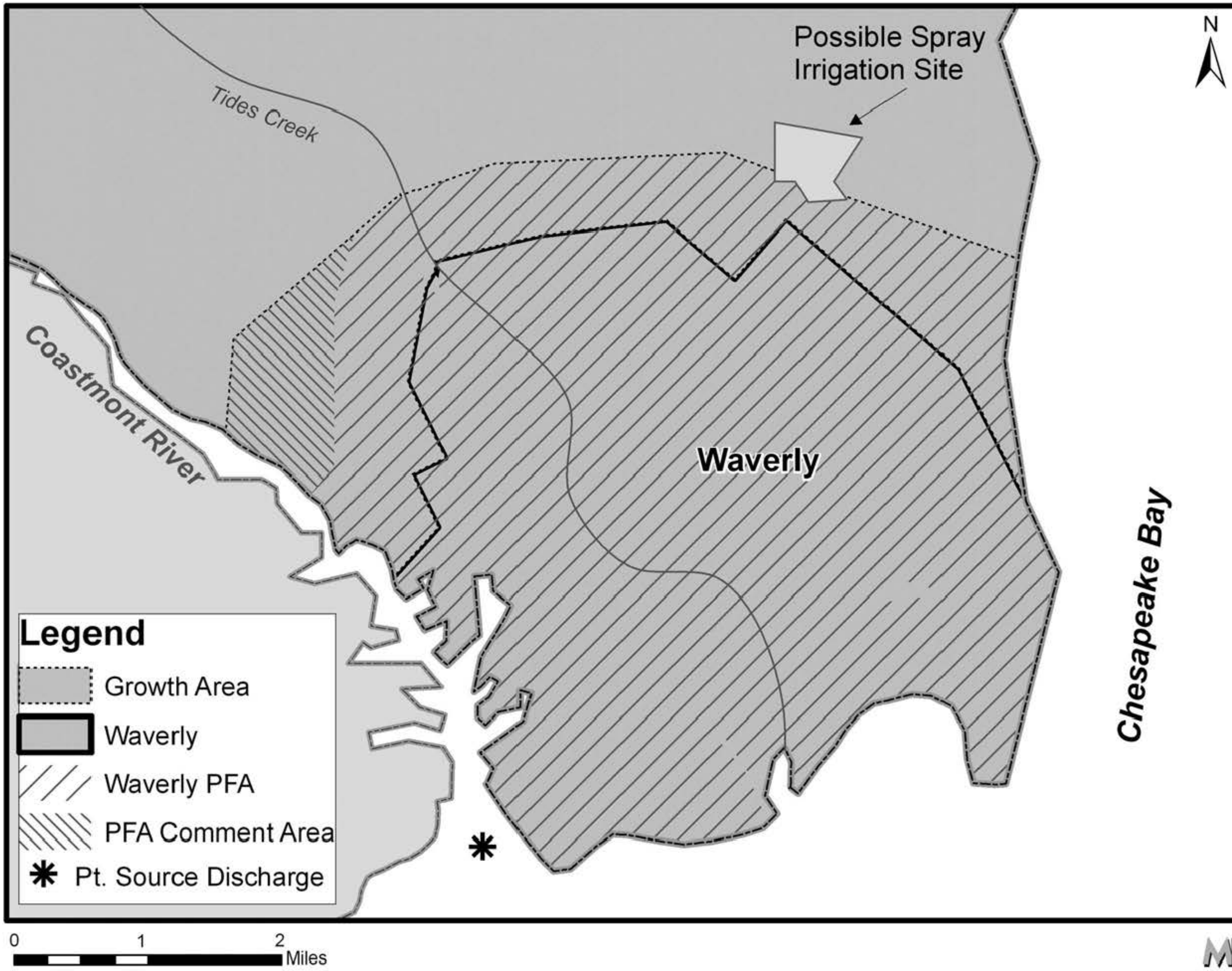


MDP

Coastmont County Land Use Plan

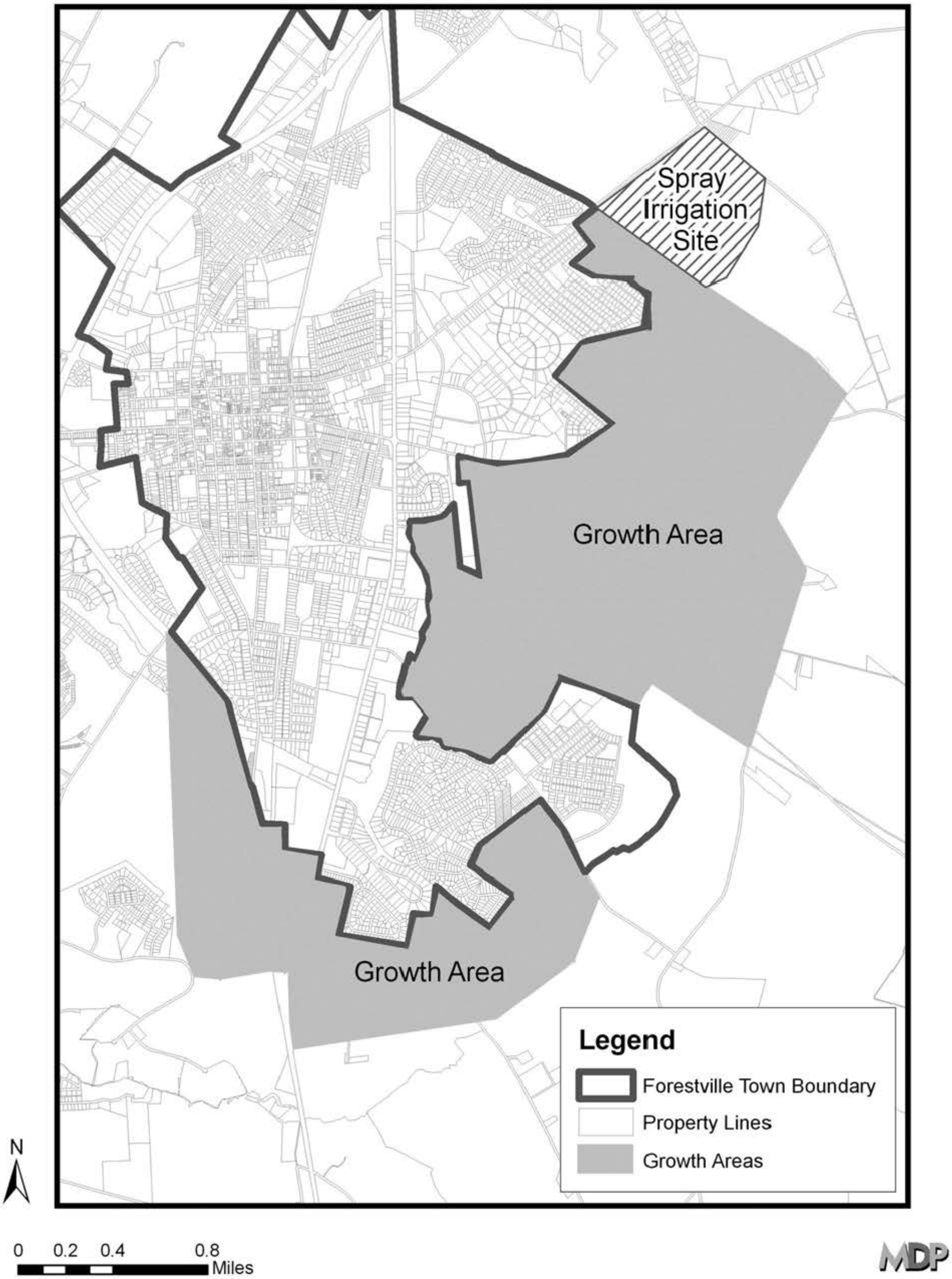


Waverly Metro Area

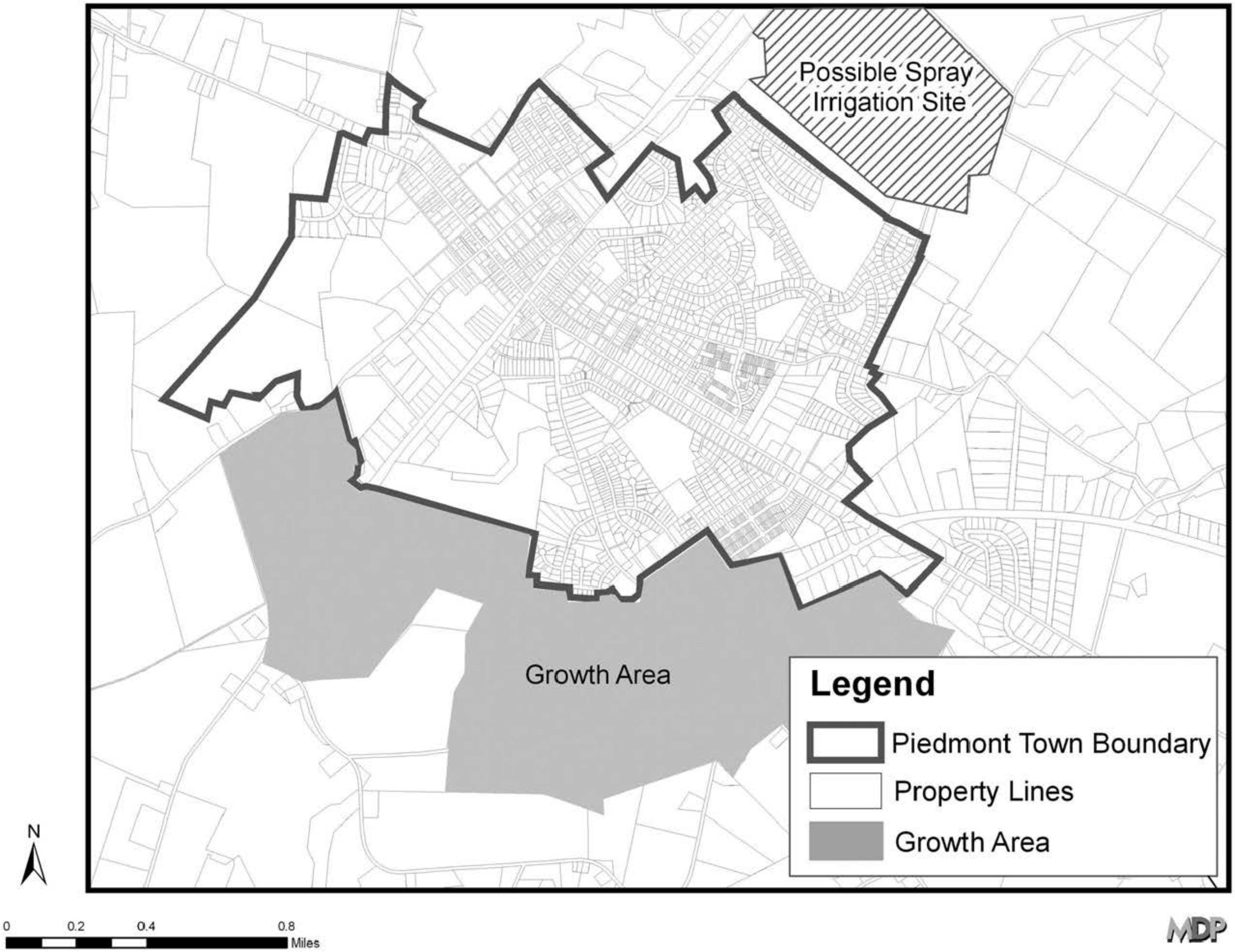


MDP

Town of Forestville



Town of Piedmont



Cross Reference Index to Model and Guidelines #26

This reference aid links the information in Part I: Guidelines with Part II:Model. The bold page numbers refer you to the information and discussion of a topic in the guidelines to the specific pages in the model. In many instances, a single sentence or paragraph will address the required information. When the actual WRE is written, the supporting information or data may be requested by the state agencies to assist in the review process.

Bold page numbers refer to the WRE Guideline pages.

I. Maryland Department of the Environment Capacity Management Guidance Documents

Local governments will need to identify and compare potential water supply and wastewater treatment capacities relative to existing point source allocations over the planning period, and capabilities relative to the projected growth in demand – the point at which the supply meets demand, and treatment capacity thresholds should be identified. For guidance in performing these analyses, consult the followng MDE publications:

Water Supply Capacity Management Guidance

www.mde.state.md.us/assets/document/water/WaterSupplyCapacityPlansGuidance.pdf

Wastewater Capacity Management Guidance

www.mde.state.md.us/assets/document/water/WastewaterCapacityMgmtGuidance.pdf

II. Detailed Assessment Approaches and Methodologies

A. Drinking Water - Water Balance

Applicability

The water balance approach is not applicable for those watersheds where water will be supplied solely by surface water sources and, therefore, should not be developed for watersheds that fall into this category. The water balance calculations presented herein are intended for evaluating ground water supplies in fractured rock, carbonate rock and consolidated sedimentary rock, not coastal plain aquifers.

Disclaimer

This approach calculates the upper limit on what is available. The quantity indicated by the water balance may not be extractable. Further, the water balance does not consider seasonal effects of ground water withdrawals on base flow. Also, the procedures described herein are intended for planning purposes. A watershed-based calculation does not replace site-specific analysis for a water appropriation permit and, in some areas of the state, is an oversimplification of the procedures that would be necessary for permit analysis. For example, a permit analysis restricts the amount available to the land owned or served by a permitee within the watershed in which the withdrawal occurs. The boundaries of the relevant watershed are determined in the permit process. A permit analysis also deducts the acreage that is under impervious cover.

Recharge

Effective recharge[1] or base flow has been computed by the Water Supply Program (WSP) at a number of stream gages using a base flow separation analysis. The general procedure for computing the recharge that can be allocated for water appropriation in a watershed is to: select an appropriate stream gage from Table 1 on page 64; determine the 1-in-10 year drought effective recharge in inches and the 7-day-10-year low flow (7Q10) in inches from the table; and then subtract the 7Q10 from the drought year effective recharge yielding the recharge that is available for water appropriation.

Selection of Stream Gage

The first step is to determine the hydrogeomorphic rock type(s) in the watershed using the *USGS OFR 00-424*, *Hydrogeomorphic Regions of the Chesapeake Bay Watershed*[2] GIS coverage. If there is more then one rock type in a watershed, the area for each rock type within the watershed must be determined and the recharge for each rock type must be computed separately. For the small portion of Cecil County not covered by USGS OFR 00-424, the rock type is PCR (Piedmont Crystalline). For that portion of Garrett County not covered, the rock type should be assumed to be APS (Appalachian Plateau Siliciclastic).

The procedure for determining the appropriate stream gage to represent each rock type from Table 1 varies by county.

For Cecil, Harford, Baltimore, Howard, and Montgomery counties and the city of Baltimore

If the rock type is PCR (Piedmont Crystalline) you will choose from stream gages with a HGMR (column 3 of Table 1) of PCR. Choose a gage within the same watershed, if possible. Otherwise choose the closest gage with an HGMR of PCR.

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[1] Effective recharge differs from actual recharge in that the latter includes ground water evapotranspiration.
[2] USGS OFR 00-424, Brakebill, J.W. and Kelley, S.K, U.S. Geological Survey, 2000, water.usgs.gov/lookup/getspatial?HGMR

If the rock type is PCA (Piedmont Carbonate), use gage 5715 (Yellow Breeches, PA).

For Carroll County or Frederick County

For the Catoctin Basin, use stream gage 6375 (Catoctin Cr)

If rock type is PCR (Piedmont Crystalline):

a. If east of Parrs Ridge, choose from 5820, 5830, 5835, or 5875. If West of Parrs Ridge, choose from 6395, 6425, or 6435.

b. Choose stream gage in the same basin, if possible.

c. If step (b.) did not resolve the choice of gage, choose the closest gage.

If Rock Type is Carbonate (PCA or VRC):

a. In Carroll County, use 5715.

b. In Frederick County, use 6195.

If Rock Type is ML (Mesozoic Lowlands), use stream gage 6390 (Monocacy R Bridgeport)

If Rock Type is BR (Blue Ridge), use closer of 6375, 6405 or 64103

For Washington County

Caution: In addition to the other cautions in this document, accurate estimation of recharge for the area west of Sideling Hill requires the use of procedures beyond the scope of this document. Values computed for this area are for rough planning purposes only. When computing recharge for areas west of Sideling Hill, consult the Water Supply Program for technical assistance.

If Rock Type is BR (Blue Ridge), use closer of 6375, 6405 or 6410

If Rock Type is VCR (Valley and Ridge Carbonate), use 6195 (Antietam Cr)

If Rock Type is VRS (Valley and Ridge Siliciclastic)

a. East of Sideling Hill, use 6145 (Conococheaque Cr)

b. West of Sideling Hill, use 6115 (Cacapon R WV) but see the caution (above).

For Allegany County:

Caution: In addition to the other cautions in this document, accurate estimation of recharge for the area east of Collier Mountain/Bush Ridge/Martin Mountain requires the use of procedures beyond the scope of this document. Values computed for this area are for rough planning purposes only. When computing recharge for this area, consult the Water Supply Program for technical assistance.

If rock type is VRS (Valley and Ridge Siliciclastic), use 6115 (Cacapon R WV)

If rock type is VCR (Valley and Ridge Carbonate), use 6195 (Antietam Cr)

If rock type is APS (Appalachian Plateau Siliciclastic), Choose from 5965 (Savage River) and 6015 (Wills Creek)

a. Choose stream gage in same (eight digit) basin, if possible

b. If step (a) did not resolve the choice of gage, choose the closest gage.

For Garrett County

Within the Potomac drainage (DNR eight digit basins 02141004, 02141005 or 02141006), Choose from 5965 (Savage River), 5970 (Crabtree Creek), or 5950 (Potomac R. @Steyer)

a. Choose stream gage in same basin, if possible.

b. If step (a) did not resolve the choice of gage, choose the closest gage.

Within the Casselman River Watershed, use 0780 (Casselman R)

For DNR twelve digit watersheds 050202010015, 050202010016, 050202010018, 050202010020 050202010021, and 050202010022—

a. Use 0766 (Bear Creek).

b. Otherwise, use 0660 (Blackwater R WV).

Table 1. Base Flow Hydrograph Separation Analyses

Number	Gage Name	HGMR	Basin Area (sq.mi.)	Ratio Bflow/ Tflow	Average (in)	Drought 1-in-10 yr Mean (in)	Yr	Ratio Drought to Avg	Drought of Record Mean (in)	Yr	1965 (in)	1966 (in)	1931 (in)	2002 (in)	7Q10 (in)	Period of Record	Prec. (in)	Elev. ft msl	Slope ft/mi
4810	Brandywine Crk (PA)	PCR	287	0.70	13.2	8.4	65	0.64	7.0	31	8.4	7.9	7.0	7.2	2.8	12-02	45	470	14.5
4950	Big Elk Creek	PCR	52.6	0.66	11.7	7.5	41	0.64	6.0	02	6.6	6.1	-	6.0	2.6	33-02	44	398	17.9
5715	Yellow Breeches (PA)	MIX	216	0.82	14.9	10.2	69	0.68	8.4	02	10.1	9.0	-	8.4	5.3	55-02	42		
5800	Deer Creek	PCR	94.4	0.75	13.6	8.0	65	0.59	5.7	02	8.0	6.5	5.9	5.7	3.7	27-02	44.5	657	17.7
5820	Little Falls@Blue Mt	PCR	52.9	0.80	13.9	7.7	65	0.55	6.3	02	7.7	6.5	-	6.3	3.3	45-02	45	658	33.8
5830	Slade Run	PCR	2.1	0.81	12.6	6.7	63	0.53	5.0	66	7.1	5.0	-	-	1.3	48-80	46.1	591	2.6
5835	Western Run	PCR	59.8	0.78	12.2	6.8	65	0.56	4.9	02	6.9	5.4	-	4.9	2.5	45-02	45	544	24.5
5845	Little Gunpowder Falls	PCR	36.1	0.73	12.2	6.8	63	0.56	5.2	31	8.0	6.0	5.2	-	2.8	27-69	45	542	21.1
5875	S. Br. Patapsco R.	PCR	64.4	0.73	11.5	6.1	63	0.53	5.4	66	6.9	5.4	-	-	1.1	49-79	43	642	26.2
5893	Gwynns Falls V N	PCR	32.5	0.55	8.9	5.8	86	0.65	5.2	66	6.2	5.2	-	-	1.5	58-87	44.5	554	21
5910	Patuxent R.@Unity	PCR	34.8	0.72	11.0	6.1	66	0.55	4.9	02	7.5	6.1	-	4.9	1.0	45-02	42.5	589	28.2
5935	Little Pax R@Guilford	PCR	38.0	0.58	9.0	6.3	54	0.70	4.8	02	7.2	6.3	-	4.8	1.4	33-02	43	409	22.1
5950	Potomac R.@Steyer	APS	73.0	0.64	20.7	16.6	59	0.80	14.5	65	14.5	18.5	-	21.8	0.3	57-02	52.5	2850	30.5
5965	Savage River	APS	49.1	0.60	12.5	9.7	54	0.78	8.6	91	11.5	9.9	-	11.2	0.2	49-02	46	2510	65.1
5970	Crabtree Creek	APS	16.7	0.67	15.8	11.7	64	0.74	8.9	69	13.7	12.0	-	-	0.8	49-80	48	2501	137
6015	* Wills Creek	APS	247	0.62	11.3	7.7	36	0.68	5.5	30	8.8	7.0	7.6	8.5	0.7	30-02	42	1880	55
6115	Cacapon R (WVA)	VRS	677	0.57	6.7	3.7	38	0.55	2.8	69	5.9	3.7	3.4	5.6	0.8	23-03	36	1700	10.4
6145	Conococheque Creek	VRS	494	0.67	11.1	6.9	63	0.62	5.3	31	7.8	6.1	5.3	6.5	1.4	29-02	39.5	1050	11.2
6195	Antietam Creek S	VRC	281	0.85	11.4	7.0	34	0.61	4.3	31	6.3	5.6	4.3	5.0	2.8	29-02	40	781	10.8
6375	Catoctin Creek	BR	66.9	0.69	10.9	5.7	66	0.52	4.2	02	6.0	5.8	-	4.2	0.2	48-02	42.5	1110	47.5
6390	Monocacy R Bridgeport	ML	173	0.38	6.1	4.0	66	0.66	3.0	54	3.4	4.0	-	4.2	0.1	43-02	43.5	597	18.9
6395	Big Pipe Creek	PCR	102	0.64	9.6	5.2	63	0.54	4.1	02	4.6	4.7	-	4.1	1.1	48-02	43.5	625	12.8
6405	Owens Creek	BR	5.9	0.75	16.2	8.9	63	0.55	6.8	69	10.7	8.8	-	-	0.5	32-83	47.5	1460	202
6410	Hunting Creek	BR	18.4	0.72	14.1	8.1	63	0.57	6.6	54	8.7	8.2	-	-	1.0	50-91	46	1100	135
6425	Linganore Creek	PCR	82.3	0.69	9.0	5.2	54	0.58	4.6	59	6.0	5.6	-	-	1.1	35-71	42.5	576	19.2
6430	Monocacy R Jug Brdg	MIX	817	0.54	8.4	4.9	65	0.58	2.9	31	4.9	4.8	2.9	4.3	0.8	30-02	44	621	5.6
6435	Bennett Creek	PCR	62.8	0.68	10.1	5.9		0.58	4.3	02	-	-	-	4.3	1.5	49-02	41	468	23.8
6440	Goose Creek (VA)	MIX	332	0.60	7.8	4.3	66	0.55	1.2	31	6.6	4.4	1.2	3.9	0.1	30-02	40	660	8.3
6450	Seneca Creek	PCR	101	0.66	9.6	5.7	55	0.59	2.6	31	6.4	5.7	2.6	6.7*	0.9	31-02	41	468	15.1
6480	Rock Creek	PCR	62.2	0.58	8.0	5.0	63	0.63	2.3	31	5.1	5.4	2.3	3.9	0.5	30-02	43.5	387	12.6
0660	Blackwater R (WVA)	APS	86.2	0.55	17.4	14.1	88	0.81	8.8	30	14.7	14.6	14.3	18.8	0.8	22-02	52	3250	6.1
0766	Bear Creek	APS	48.9	0.66	16.8	12.7	65	0.76	10.2	69	12.9	11.0	-	16.2	0.6	65-02	48	2460	65.6
0780	Casselman R.	APS	62.5	0.64	16.6	13.5	95	0.81	10.8	69	13.3	13.0	-	16.1	0.3	48-02	51	1620	28.1

(*- reg) HGMR = hydrogeomorphic region (USGS W-RIR 98-4059, Bachman, et. al., 1998): APS (Appalachian Plateau Siliciclastic), VR (Valley and Ridge), S (Siliciclastic), C (Carbonate), ML (Mesozoic Lowland), MIX (Mixed). Prepared by P.A. Hammond 10/31/2000(rev. 01/2006). Computer program adapted from Rutledge (1993, USGS W-RIR 93-4121) by J. Smith

Computation of recharge available for use

For each rock type in the twelve-digit basin you are interested in: compute the area in acres; select the 1-in-10 year drought recharge and 7-day 10-year low flow (7Q10) from Table 1; and compute the recharge available as:

[Available Recharge] = [Drought Recharge] - [7Q10])*[Area]*(74.346)

Where:

[Available Recharge] is the recharge available for all existing and proposed appropriations in a watershed in **gallons per day**;

[Drought Recharge] is the effective recharge during a 1 in 10 year drought in **inches per year** from column seven of Table 1;

[7Q10] is the 7-day 10-year low flow in **inches per year**;

[Area] is the area in **acres** and

74.346 is a conversion factor changing acre-inches per year to gpd.

Then sum the recharge available for appropriation from all of the rock types within the twelve-digit watershed to obtain the total water appropriation that could be supported in that watershed. Note that this recharge must support all ground water appropriations; existing and proposed, regardless of whether a permit is required for that water use.

B. Wastewater – Capacity Template and Reuse – Spray Irrigation

Wastewater Capacity Template

1. Identify future growth to be served by WWTPs: # of EDUs

2. Identify Service Areas:

   Planned Service:

   Existing or 3-to 5 year planned service - # EDUs

   10-year service - #EDUs

   No-Planned Service Area- #EDUs – Need W/S Plan amendment

3. Identify WWTPs

WWTP	Design Capacity	3-year rolling av (mgd)	Remaining capacity (mgd)	Building Permits approved/ requested EDU	Capacity Needed (mgd)	Capacity for growth (mgd)	Potential EDU's
#1	1 MGD	0.500	0.500	400	0.100	0.4	1,600
#2	1 MGD	0.500	0.500	4000	1.0 MGD	*(1)	

Example table- Refer to the tables provided in the Capacity Management Plans for greater detail

4. Compute Nutrient Loads:

   Major Plants (0.5 mgd or greater):

   Total Nitrogen: FLOW (mgd) x 4.0 (mg/l) x 8.334 x 365 days/yr

   Total Phosphorus: FLOW (mgd) x 0.3 (mg/l) x 8.334 x 365 days/yr

   Minor Plants (less than 0.5 mgd):

   Total Nitrogen: FLOW (mgd) x 18.0 (mg/l) x 8.334 x 365 days/yr

   Total Phosphorus: FLOW (mgd) x 3.0 – 6.0 (mg/l) x 8.334 x 365 days/yr

5. For new plants, or plants that expand beyond their nutrient cap or other limitation, develop plans for expansion or offsets considering current requirements, laws, and information from state agencies:

Identify potential limitations

   a. TMDL

   b. Load Cap

   c. Compliance issues, including Combined Sewer Overflows (CSOs)/Sanitary Sewer Overflows (SSOs)

   d. NPDES requirements

   e. Water Supply and Wastewater Capacity Management Plans

   f. Inflow/Infiltration

Develop a plan of action

a. Upgrade WWTPs

b. Plan expansion (amend Water and Sewer Plan)

c. Identify offsets

d. Limit # of EDUs to be developed

e. Water Supply and Wastewater Capacity Management Plans

Update Comp Plan to reflect planned actions

Wastewater Reuse – Spray Irrigation

Option A - Preliminary Spray Irrigation Site Capacity Estimate

Table 2. Estimates of application rates and site capacities based on soil drainage

Drainage Category*	**Soil Type or permeability class****	**Application rate*****	**Estimated site capacity for each 100 acres**
Excessively drained	Soil properties similar to Sassafras, Rumford, Evesboro, Fort Mott, Lakeland, Manor and Galestown soils	Less or equal 2.0"/wk	640,000 gallons
	Or permeability of the limiting layer in the soil profile is greater than 2.0" /hour		
Well drained	Soil properties similar to Matapeake, Woodstown, and Glenelg soils	Less or equal 1.5"/wk	480,000 gallons
	Or permeability of the limiting layer in the soil profile is 0.6"-2.0" /hour		
Moderately Well drained	Soil properties similar to Mattapex, and Chester soils	Less or equal 1.0"/wk	320,000 gallons
	Or permeability of the limiting layer in the soil profile is 0.2"-0.6" /hour		
Poorly drained	Permeability of the limiting layer in the soil profile is less than 0.2"/hour	Not suitable for spray irrigation	

* Soil drainage characteristics can be found in the "General Soil Map" provided in each County Soil Survey

** Soil type and soil permeability can be found in the soil map and soil property table provided in each County Soil Survey

*** Application rates shown in this table are for County planning purpose only and are not to be used for permit applications and system designs.

Option B - Refined Spray Irrigation Site Capacity Estimate

1. Determine soil type, soil permeability, land slope, depth to bedrock and gound water table depth from County Soil Survey

2. Eliminate area with slope in excess of 15% in open field and 25% in wooded area

3. Eliminate area with gound water table less than 4 ft or less than 2 ft in eastern shore

4. Eliminate area with depth to bedrock less than 4 ft.

5. Eliminate area with the most limiting layer soil permeability of less than 0.2"/hr shown in the County Soil Survey

6. Delineate the suitable area (keep 100 ft. away from streams and 25 ft to home structures) and measure the acreage.

7. Use Table 2 in Option A to determine the application rate (H) based on the soil type and Equation 1 below to determine the initial site capacity (Q)

8. Reduce site capacity by 25% for reserve purpose and determine the final site capacity, Q_f (Q_f =75% Q).

9. Add up final site capacities (Q_f) determined from Step 8 for all suitable lands with various soil types in the county.

Equation and Example

Q = [A x 27,154 x (365 –G) x H] / [365 x (E+F)]............. (1)

Where:

A is area in acres (from Step 6 above)

Q is the flow in gallons per day

E+F is the loading cycle (loading plus rest periods) in days per week

E is the loading period in days per week

F is the rest period in days per week

G is the storage requirement in days per year (90 days for Washington, Allegany and Garrett Counties, 60 days for other counties)

H is the application rate (loading rate) in inches per week

Conversion factors

365 = days per year

27,154 = gallons per acre-inch

The following example of these calculations assumes 100 acres suitable spray irrigation area at 1"/weekk application rate and a 60-day storage time:

Q = [100 x 27,154 x (365 –60) x 1"/wk] / [365 x (7 days)] = 324,147 gal/day

C. Stormwater Management – Programmatic Assessment Outline

1. Watershed Protection and Planning Tools to Improve Local Stormwater Management Programs

- Model Stormwater Ordinance and Supplement, www.mde.state.md.us/assets/document/sedimentstormwater/model_ordinance.pdf Manage stormwater runoff through the use of nonstructural best management practices (BMPs) to the maximum extent practicable (MEP);

- Water Resource Manual and Regulatory Code (Carroll County example, see ccgovernment.carr.org/ccg/resmgmt/wrmmanual.pdf);
- Using Critical Area Commission Intensive Development Guidelines Jurisdiction-wide 10% impervious surface area limitation;
- Montgomery County's Sustainability Approach, see www.montgomerycountymd.gov/content/dep/Publications/mcdep-tenyear.pdf;
- Frederick County Model Development Principles, see www.cwp.org/Frederick.pdf

2. Protection Measures

a. Streams and water resource protection

- Stream Buffer Plan
- Reforestation and Protection of Contiguous Forests
- Sensitive Areas Protection (see Sensitive Areas Element)

b. Sustainability

- Capturing and Reusing Stormwater Runoff
    - Criteria for Stormwater Harvesting, i.e., rain barrels and cisterns
    - Design Consideration
    - Calculating Stormwater Volume Reduction
- Meet Leadership in Energy & Environmental Design (LEED) Stormwater Management, Erosion & Sediment Control, and Landscaping Requirements (see www.usgbc.org/ShowFile.aspx?DocumentID=1095)

c. Mapping

- Storm Drain Systems
- Stormwater BMPs
- Forest Coverage
- Streams, rivers, etc.
- Water Quality Indicators
- Sensitive Areas
- Wetlands
- Endangered Species

3. Development Strategy

- Avoidance
- Minimization
- Mitigation

D. Nonpoint Source Loading Analysis

Expectations for the Loading Analysis

Expectations for the analysis are three fold:

Simple before-and-after nonpoint source loading analysis for nutrients

The state will provide a default methodology spreadsheet upon request. Local governments may use this method, refine this method, or use their own method provided that assumptions are justified and sources of information are documented. There is no specific loading "target" or "right answer" for this preliminary level of analysis. The minimum expectation is that a good faith loading analysis be conducted to assess the change in nutrient loads in relation to projected land use changes and potential BMPs, such as septic denitrification. Changes in open space (forest and cropland) and impervious cover may also be assessed.

Reasonable assurance that alternative land use options have been considered

The expectation is to explore a variety of innovative planning techniques designed to protect water quality, e.g., directed growth and down-zoning, Smart Growth, transfer of development rights (TDR) ordinances, cluster development (e.g., shared driveways), increased densities, maximum limits on parking spaces or related impervious footprint, etc. This can be documented in supplemental information provided with the WRE for review by MDE.

Discussion of Future Steps

This analysis is expected to be preliminary. The documentation should include recommendations for ensuring that future loading analyses are institutionalized within local government planning and decision making procedures.

The spirit of this analysis is to assess how planned growth within a local jurisdiction might affect nonpoint source loads to receiving waters. This is not an easy or straightforward task: questions of scale, land use definitions, pollutant loading rate assumptions, planned versus projected growth trends, among others, present a host of challenges.

Policies and tools for assessing nonpoint source loads are in transition and changing rapidly. This guidance *initiates a proce*ss that is sufficiently flexible to begin addressing the need for meeting implementation goals of local TMDLs as well as Chesapeake Bay loading caps. Although the current analysis method in this guidance is not intended to solve the TMDL implementation puzzle, or achieve the Chesapeake Bay Tributary Strategies, it represents a bridge to achieving those goals.

The Chesapeake Bay community is actively investing state and federal resources into the development of the Phase 5.0 Chesapeake Bay Watershed Model, managed by the Chesapeake Bay Program. This tool and its components, such as assumptions about land use loading rates and BMP efficiencies, will help to resolve many of the present challenges related to scale and land use. This Phase 5.0 model will be used to develop future nutrient TMDLs for many of the larger tidal rivers in Maryland as well as the Baywide TMDL that will be completed in about 2011.

Lessons learned and data generated through the WRE nonpoint source loading analyses may generate valuable information to be used as inputs to the Phase 5.0 Chesapeake Bay Watershed Model. In addition, current efforts to build Tributary Basin Implementation Plans provide an opportunity for local governments to ensure that the construction of the Chesapeake Bay TMDL technical framework is based on the best available local data. Recognizing this in the context of the WRE analyses provides the incentive for state and local governments to shape future polices and technical tools. This will help ensure Maryland's ability to grow in concert with its demand for healthy, vibrant rivers and Bays.

Technical Guidance

There are two options for conducting this analysis:

1. Work with the Maryland Department of Planning to perform future growth and land use pattern projections using their Growth Model; or

2. Use a local growth projection model. (If a local growth projection model is chosen, information and methodology used should be provided for review.)

In either case, the general goal is to determine an initial estimate of land use/cover and future land use/cover[1]. Then, determine the change in nonpoint source nutrient loads due to the change in land use/cover. For those who choose option 1, working with the Maryland Department of Planning Growth Model, the load estimation can be conducted using a spreadsheet developed for use within that context (Available upon request from MDE). For those who choose option 2, technical assistance is available from MDE upon request. Alternative loading analysis methods may be used provided that assumptions are justified and documented.

The steps outlined below should be conducted for a variety of land use planning alternatives.

1. Estimate Initial Land Cover and Septic Systems

As a default, MDP 2002 land use information can be used for initial land cover.

2. Estimate the Future Land Cover and Septic Systems

Use the MDP Growth Model (or other accepted method) to estimate future land use patterns and the number of equivalent dwelling units (EDUs) over a specific time horizon. This step may be repeated for alternative land use configurations that consider different zoning options, rural protection programs, physical constraints (e.g., hydric soils or steep slopes), and alternative assumptions about the availability of water and sewer service. The MDP Growth Model will compute the future land use areas for those that employ the state's technical assistance.

The MDP Growth Model will provide an estimate of the number of future residential septic systems by determining which future dwelling units will not be on county or municipal sewer. This necessitates that sewer planning areas be identified. Those who do not use the MDP Growth Model will likely need to use GIS techniques to estimate the numbers of EDUs on sewer versus septic systems.

[1] The "future" land use/cover will depend on the local land use plan, zoning, rural protection programs (e.g., purchase or transfer of development rights), availability of water and sewer service, and time horizon of the analysis.

3. Estimate the Nonpoint Source Nitrogen and Phosphorus Loads for Initial Land Cover

A. Using average annual loading rates, by land use type, multiply the acres of each land use by the corresponding loading rate. Sum these loads by land use type to derive a total average annual load.

B. Using the best available information for the number of existing septic systems, the following formulas are used to estimate the current septic system nitrogen loads (zero phosphorus loads are assumed from septic systems).

Individual Systems:

Number of individual systems x # persons/household[2] x 9.5 lbs/person/yr x 0.4

Where 0.4 is the transport loss factor used by the Chesapeake Bay Program.

Shared Residential Systems: This is addressed implicitly by using the calculation above and multiplying by the number of EDUs.

Non-Residential Septic Loads: (Commercial, industrial, institutional systems (e.g., public schools, public hospitals, etc.)) To calculate non-residential septic loads, a series of three simple equations are presented below that provide rough estimates of non-residential nutrient loads from septic systems.

1) Acres of Non-Residential Land on Septic x Avg. Flow/Acre = gallons per day (GPD)

2) GPD/1,000,000 = Millions of gallons per day (MGD)

Then, using the total MGD just found, plug into:

3) MGD x 40 mg/L of N x 8.34 x 0.4 x 365

Table 3 below provides the estimated average flow per acre based on the type of non-residential land use that is needed in the equation above. Table 3 below provides estimated average flows per acre based on the type of non-residential land use that is needed in the equation above. Local governments may have a better idea of local industry flows and those numbers may be substituted for those in the following table.

Land Use	**Average Flow/Acre (gal)**
Commercial	1,300
Light Industrial	500
Heavy Industrial	1,000

Table 3. Average Flow in Gallons by Land Use

Source: www.aacounty.org/PlanZone/MasterPlans/WaterSewer/Index.cfm. Reference the last page of Appendix A.

[2] The 2000 census value of average number of people per household, provided by the Maryland Department of Planning (HHsize_Proj05.xls) can be found on the MDP website.

4. **Estimate the Nonpoint Source Nitrogen and Phosphorus Loads for the Future Land Cover**

A. Using average annual loading rates, multiply the acres of each land use by the corresponding loading rate. Sum these loads by land use type to derive a total average annual load.

B. Using the best available information for the number of future septic systems (from Step 2), estimate the future septic system nitrogen loads. An alternative option for using denitrifying septic systems could be explored as part of the analysis.

C. The amount of forested land may be adjusted to account for various conservation options. Any changes in forest cover, however, should be documented and justified.

5. **Compare the Initial Loads to the Future Loads**

Compare the initial and future loads (by state basin or county-wide) in conjunction with an analysis of future increases in WWTP nutrient loadings as a result of future land use changes. WWTP, septic tank, and nonpoint source loadings from future development all should be considered together to assess the comprehensive impacts of land use changes. The MDP Growth Model projects the amount of future development that will use WWTPs versus septic tanks. Nutrient loadings from WWTPs will depend on the nutrient removal technology of the existing or proposed WWTP providing service. (The NPS spreadsheet mentioned above will also include point source load estimation worksheets. This is available upon request from MDE).

Ideally, the future loads should be less than the initial loads. If the future loads are greater, consider land use alternatives (e.g., greater densities, and different patterns or locations of development), spray irrigation of wastewater, and nutrient offset projects (e.g., forest preservation and restoration). Assess potential sources of uncertainty in the analysis that could be refined as part of the WRE analysis or in the future.

Supporting Information and Tools

- MDP 2002 land use/cover in GIS (available www.mdp.state.md.us/zip_downloads_accept.htm)
- Table of standard percentages of impervious cover by MDP 2002 land use category (see Table 4 on the following page)
- GIS coverages of state basins

  This GIS coverage is also available from MDE upon request.
- Default estimates of the number of existing and future septic systems by County and state basins

  The future numbers can be provided as an output of the MDP Growth Model.
- Average number of people per household, provided as a worksheet on the Maryland Department of Planning website

MDP Land Use (and code)	Impervious Rate*
Low Density Residential (11)	0.14
Medium Density Residential (12)	0.28
High Density Residential (13)	0.41
Rural Residential (191,192)	0.04
Commercial (14)	0.72
Industrial (15)	0.53
Institutional (16)	0.34
Extractive (17)	0.02
Open Urban Land (18)	0.09
Cropland (21)	0
Pasture (22)	0
Orchards (23)	0
Feeding Operations (24,241)	0
Agricultural Buildings (242)	0
Row and Garden Crops (25)	0
Deciduous Forest (41)	0
Evergreen Forest (42)	0
Mixed Forest (43)	0
Brush (44)	0
Water (50)	0
Wetlands (60)	0
Beaches (71)	0
Bare Rock (72)	0.09
Bare Ground (73)	0.09
Transportation (80)	0.95

Table 4. MDP Land Use and Center for Watershed Protection's Impervious Rates

Source: Cappiella and Brown, *Urban Cover and Land Use in the Chesapeake Bay Watershed,* Center for Watershed Protection, 2001, as referenced in Table 4.1 of a *User's Guide to Watershed Planning in Maryland*, dnr.maryland.gov/watersheds/pubs/userguide.html

III. Additional Data Sources for Use in Developing the WRE

Developing and Implementing a Water Conservation Plan: Guidance for Maryland Public Water Systems on Best Management Practices for Improving Water Conservation and Water Use Efficiency available at:

www.mde.state.md.us/assets/document/water_cons/WCP_Guidance2003.pdf

Source Water Assessment reports for each public drinking water system

Source Water Assessment reports may be obtained as digital data by contacting MDE's Water Supply Program at 410-537-3714. These reports have been distributed to water systems, county environmental health agencies, county planning agencies and local libraries.

Martin O'Malley, Governor
Anthony G. Brown, Lt. Governor

MDP

Maryland Department of Planning

Richard Eberhart Hall, AICP, Secretary
Matthew J. Power, Deputy Secretary