Appendix E
Water Resources

E.1 Water Resources Scenarios

Chapter 4 of the Comprehensive Plan evaluates the impacts of the 2016 Comprehensive Plan Recommended Scenario against the 2013 Planning Commission Recommended Scenario. As described in Section 4.2, the calculations in this Appendix and Chapter 4 assume that the 2016 Comprehensive Plan Recommended Scenario would use approximately five percent more rural land than the Merged Scenario developed in late 2011.

E.2 Drinking Water Assessment

Groundwater Studies and Recommendations

The Water Balance methodology recommended by *Models and Guidelines #26* (the state's official guidance for preparation of the Water Resources Element) is not applicable for the Coastal Plain physiographic region, where Charles County is located.

The most recent MGS study, *Report of Investigations #76* (2007) discusses how, in 2002, the Magothy aquifer was near its "80 percent management level," the minimum acceptable level for which MDE will allow withdrawals. The County has been aware of the Magothy's limitations for many years, and has taken steps to sustain the aquifer. Beginning in the 1980s, the County shifted water production to the Lower Patapsco aquifer to preserve the Magothy. This action stopped the decline in the aquifer; and levels have generally been maintained since that time.

At the same time, the Lower Patapsco aquifer in the western portion of Charles County has a relatively limited production capability and a somewhat shallow depth. Given these limitations and the proximity of some of the County's production wells to this area, water levels in the Lower Patapsco tend to have greater fluctuation based on the activities occurring in the vicinity. MGS studies of area aquifers have also suggested that lowered water tables in shallow portions of the Patapsco aquifers could also reduce base flow to streams. In 2007, MDE approached the County with concerns that the water levels observed in the Potomac Heights area were nearing the 80% management level in the Lower Patapsco aquifer. The County immediately took action by shifting nearly all well pumping in the Bryans Road water system to the deeper Patuxent wells already in place. This shift immediately resulted in a rebound of the Lower Patapsco water levels and alleviated the concerns in the Potomac Heights area wells.

At the request of Charles County (Spring 2009), MGS developed another model of the Waldorf water system to evaluate the effect of significantly reducing or even stopping production from five of the County's Lower Patapsco aquifer wells in the Bensville area, and replacing this production with surface water purchased from WSSC. The results of this model projected a substantial rebound in the Patapsco aquifer, with the greatest improvements seen in the Bryans Road area.

These studies of the County's groundwater resources are important inputs into MDE's decision process for approving and altering renewed groundwater withdrawal permits for

water systems in Charles County (including systems operated by the County, municipalities, and private entities). In particular, MDE adjusts withdrawal permits in response to aquifer behavior. For example, increased or stabilized aquifer recharge rates could justify increased permit values. Conversely, a permit may be reduced at the time of renewal if there is concern over the aquifer. Generally, such changes are negotiated between MDE and the local government. For example, when MDE adjusted the County's groundwater permits for the Magothy wells in Waldorf in 2002, there was no observed decline in the Magothy aquifer. Because the County was not using all of its permitted capacity under the permit at the time, MDE reduced the permitted capacity in the Magothy in exchange for increased appropriation in the Lower Patapsco aquifer.

Recent computer models of the aquifers have indicated to MGS and MDE that the Lower Patapsco Aquifer will likely have less available capacity than previously thought. Based on the unique geographic location, geology and associated underground strata, it was estimated that Charles County would be affected by this change in available drawdown. To compensate for these forecasted issues, MDE reduced the allocation of (Lower Patapsco) groundwater to the Waldorf Water System during the 2014 Groundwater Appropriation Permit renewal. These permit changes and the resulting system capacity is reflected in Table 4-4 under the Waldorf System.

An additional concern is the impact that continual pumpage increases may have on overall water levels in aquifers. As demand continues to increase, the County is seeking alternatives to the increased withdrawal from the Lower Patapsco, in order to reduce or eliminate the impacts on private well users. Examples include shifting the majority of public water withdrawals for the Bryans Road system to the Patuxent aquifer (which has little to no private homeowner use due to its great depth and expense to reach) and the pending interconnection of the Strawberry Hills water system[1] to the Bryans Road water system.

Options to Address Drinking Water Issues

While near term projections have adequate supply to meet demand, Charles County is currently studying various alternative water supply options such as those listed below. The results of the County's studies will be available by 2016, and the findings of this study will be used to plan and fund the necessary improvements to provide future water services to meet the projected demand described in this Comprehensive Plan. Some options that the County may choose to consider are described below.

Alternate Well Locations

As described above, MGS modeling efforts have demonstrated the limitations of the production wells in the Lower Patapsco aquifer—particularly in the Indian Head and Bryans Road area. One option for addressing this concern is to relocate production wells to portions of the Patapsco Aquifer located farther southeast where the aquifer has greater capabilities

[1] The County has an approved Capital project to construct a 12-inch waterline along MD 227 to interconnect the Bryans Road water System to the County's stand-alone Strawberry Hills water system. The interconnection will allow the County to supply water from the deeper Patuxent aquifer to Strawberry Hills and eliminate the two wells that currently withdraw water from the Lower Patapsco. MGS projects that this interconnection will provide additional rebound of water levels in the Lower Patapsco aquifer.

and capacity. This could reduce the amount of drawdown near the Lower Patapsco's most constrained area, making it a more sustainable water supply source.

Wellfield Management

Another recommendation of the WRAC, based on studies conducted by MGS, is to implement a Wellfield Management system. Such a system can make the most sustainable use of the County's groundwater resources. Interconnection of the Waldorf and Bryans Road systems is one aspect of wellfield management. Other key components would include the construction of new wellfields and the automation of pumping from those wells to better balance production and to avoid imbalanced drawdowns of the County's aquifers. Locating wells further south and east—where aquifers have greater production capability—could enable the system to deliver a more sustainable supply with reduced overall impacts on the aquifer.

By rotating the withdrawals among the wells in the network, adequate water can be produced for the Waldorf system, while greatly minimizing impacts to the aquifer. This plan was derived based on MGS's 2003 Bryans Road Optimization Study and 2004 Waldorf Optimization Study, which defined a series of measures to maximize pumping efficiency while minimizing aquifer drawdown. The studies also suggested the locations of new wells in areas where they do not affect each other or other area users. Finally, in order to distribute water from the "down-dip" area (the southwest) to the more limited or "up-dip" aquifer areas, the County conducted the Waldorf Water Distribution Study in 2008-2009. That study determined the infrastructure needs to transmit water from Waldorf to Bryans Road, including water source needs; the system needs to move water between different hydraulic gradients, and water pressure needs and adjustments.

Patuxent Aquifer Wells

The Patuxent aquifer is the deepest aquifer in Charles County. This aquifer is relatively untapped and lies just above the coastal plain bedrock. While little is known about the production capabilities of the Patuxent aquifer in north-central and northeast Charles County, the Bryans Road water system uses two wells in this aquifer, the Indian Head NSWC also has several recently drilled Patuxent aquifer wells, and the Town of Indian Head is currently completing its first Patuxent aquifer well. The 1999 MGS Patuxent Aquifer Study in the Bryans Road-Indian Head area showed that there was approximately 500 feet of available drawdown in this area of the aquifer. These activities prove that the Patuxent aquifer is a viable source of water for the western portion of the County, making it a valuable resource in combination with the other actions described in this section. Therefore, the County is focusing on the Patuxent aquifer as a potential future source of drinking water.

In 2008, the County initiated a process to acquire the appropriations from two Patuxent aquifer production wells in Chapman State Park, for which the County had negotiated during the land transfer of the Chapman's property to DNR in 1998. During their initial pump tests in the mid-1990s, these wells were shown to have good water quality and a substantial water yield. However, in 2008, the Maryland General Assembly passed a law prohibiting the use of potable water from state lands for users outside of the state property. As a result, the General Assembly appropriated funding during the 2010 legislative session to compensate the Charles County for the loss of the previously-committed Chapman Park wells.

Based on Chapman State Park pump tests, the Patuxent aquifer water source should yield a sustainable water supply for the Bryans Road Water System. Costs associated with infrastructure to connect a new Patuxent well to the Bryans Road Water System has been evaluated and budgeted in the County's Capital Budget for construction. Therefore, installing this new well is viewed as a priority project to address the issues related to private water use in the area.

Surface Water

The County has an existing allocation from the WSSC for up to 1.4 million MGD. WSSC water is drawn from the Potomac River before being treated and distributed to customers. To address future water needs, particularly in the Waldorf system, the County is working with WSSC to evaluate the possibility of increasing that allocation to further reduce local dependence on groundwater, thus preserving water levels in the County's aquifers.

Direct withdrawals of surface water from the Potomac River in Charles County may also be an option to increase potable water supplies while preserving aquifer levels. The County should assess the technical and engineering considerations of a new surface water source. For example:

- A surface water source would require the construction of a water intake station, a water treatment facility, and associated transmission main and distribution lines.
- Because of the Potomac's tidal characteristics adjacent to Charles County, water treatment may require desalinization, a costly process.
- The location of a water treatment plant would have a great bearing on the costs associated with a surface water source. A plant located in close proximity to the existing distribution lines (likely in the northwestern portion of the County) would minimize the length of new distribution lines. However, co-location of the water treatment facility with the Morgantown Generating Station's existing intake facility could reduce other infrastructure costs.

In 2006, the County's Water Resources Advisory Committee issued a report on options to ensure sustainable water supplies for Charles County. The WRAC Report summarized previous studies that evaluated options for surface water reservoirs in Charles County. While some potential sites were identified, these studies concluded that reservoirs were not a feasible option in Charles County due to concerns about water quality, environmental impacts, and cost.[2]

Water Reuse

Water reuse refers to the process of redirecting treated effluent water from WWTPs to an industrial or other use, such as coolant at a power plant or irrigation for agriculture. This use of effluent not only diverts this water that would otherwise be discharged into a water body, but also takes the place of potable water that would have been used for the same purpose. Current state regulations strictly limit water reuse, although MDE has begun to relax some of these restrictions.

[2] 2006 Charles County Water Resource Advisory Committee Report.

Charles County currently distributes up to 2.4 MGD of treated effluent from the Mattawoman WWTP to the PANDA Brandywine Power Plant in Prince George's County for cooling purposes. The County also has an executed Agreement with the planned Competitive Power Ventures Power Plant (to be built in Charles County) to use additional treated effluent, further diverting Potomac River discharges and preserving potable water. The County continues to work with MDE to investigate these and other water reuse options and associated regulatory measures.

Water Conservation

Water conservation is an often-overlooked, but critically important element of water supply. Water-conserving fixtures have been the industry standard in new construction in Charles County for years—since 1986, all development in Charles County has used water-conserving fixtures and appliances. The Maryland Water Conservation Plumbing Fixtures Act also requires the use of water-conserving plumbing fixtures for new construction statewide. As a result, the County's per-household water use has dropped from approximately 260 gpd in the 1980s to 208 gpd today. The 2010 County Water Rate Study found that the 5-year average per EDU was 179.9 GPD.

One of the Charles County's goals with regard to water supply is to increase the public's awareness of water supply limitations, and to encourage citizens and businesses to help the County reach its conservation goals. The County promotes water conservation through media and educational seminars and publications, gives guidance to homeowners interested in water conservation, and has provided water-conserving fixtures to some homeowners. Nationwide and within the County, there is also a growing emphasis on incorporating energy savings and water conservation into new building design, most notably through LEED certification and the National Association of Home Builders'(NAHB) Green Building Program. If such education, retrofit, and design efforts could reduce average water use in the County to 180 gpd per household (including allowances for system water loss), the County's Year 2040 water demand in major public systems could be reduced by approximately 1.7 MGD (more than ten percent of the projected 2040 demand shown in Table 4-4).

In an effort to promote water conservation and make the public water system more fiscally sustainable, the County recently replaced its uniform unit rate structure with an inclining rate structure. Through this rate structure, the unit price for water increases as the volume consumed increases. This helps to incentivize water conservation: customers who use low or average volumes of water are charged a modest unit price and rewarded for conservation; those using significantly higher volumes pay higher unit prices.

Source water protection

The County protects public water sources primarily through wellhead protection efforts. These include fencing around all wellheads, enclosure of wellheads within buildings where possible and installation of wellhead covers for outdoor wells. For surface water obtained from WSSC, the County performs additional water treatment at the connection point at the Prince George's County line to ensure adequate water quality.

E.3 Wastewater Assessment

Alternative Wastewater Disposal Options

Wastewater Reuse

Following the full treatment process, effluent from a WWTP can be recollected and returned for a variety of types of reuse (see Section IV.C.1.e) of this document. The County has a strict allocation policy to manage the distribution of treated effluent, and continues to promote the use of the effluent water to reduce discharge into the rivers and streams and reduce unnecessary use of potable water. Three methods for wastewater reuse are briefly described below; however, more detailed investigation, in conjunction with MDE will be required on a case-by-case basis prior to implementation.

Industrial Water Reuse

Charles County is especially familiar with industrial water reuse. The PANDA power plant in the Brandywine area of Prince George's County (within the Mattawoman watershed) uses effluent from the Mattawoman WWTP for cooling purposes. In addition, the County has an executed agreement with the operators of the proposed Competitive Power Ventures power plant project in eastern Charles County to reuse treated effluent from the Mattawoman WWTP for turbine cooling purposes, as well as for steam in the power generation process.[3] Together, the two power plants could divert as much as 8.4 MGD of treated effluent that would otherwise be discharged to the Potomac River.

Urban Irrigation Reuse

Urban irrigation includes providing reclaimed wastewater (or stormwater) to virtually any irrigated land within the developed portion of Charles County. In other states, reclaimed water is used to irrigate golf courses, parks, playing fields, cemeteries, commercial/industrial areas, multifamily residential lawns, single-family residential lawns, medians, and right-of-ways. Since urban irrigation involves applying reclaimed water to areas accessible to the public, secondary treatment with filtration and high-level disinfection is required. The County's ENR facilities achieve this level of treatment. Such uses are rarely seen in Maryland, due largely to extremely restrictive state requirements. A MDE-sponsored panel (which includes representatives from Charles County) is evaluating revised restrictions and regulations to encourage treated effluent reuse for urban irrigation.

Agricultural Reuse

Irrigation of agricultural crops with reclaimed effluent also requires high levels of treatment. A major restriction with agricultural reuse is that it cannot come in direct contact with foods that will not be cooked, peeled, skinned, or thermally processed prior to consumption. This restriction does not prohibit the irrigation of crops with reclaimed water, but restricts the irrigation method that can be utilized, as well as the types of crops involved.[4]

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[3] Nutrients that remain in the reused effluent following ENR treatment are typically dispersed through evaporation; a small portion of these nutrients are collected in the plant's wastewater stream (source: ERM).

[4] For more information, see http://www.mde.state.md.us/researchcenter/publications/general/emde/vol2no4/spray_irriqation.asp

Potable Reuse

Potable reuse (i.e., drinking water) is not currently permitted in Maryland, but is allowed in other states. Direct potable reuse of treated effluent—e.g., the transmittal of treated effluent directly to water treatment facilities—is not seen as a near-term alternative for Charles County due to current state restrictions.

Indirect potable reuse is practiced in other parts of the United States, and may be a long-term (beyond 2040) option. In the most common indirect reuse methodology, effluent is treated to potable (or better) standards before being injected into groundwater aquifers and later withdrawn (and treated) as potable water. One large-scale example of such a system is in place in Orange County, California.[5] In that system, treated effluent is used not only to recharge the aquifer (and to provide drinking water as a result), but also to halt and even reverse saltwater intrusion into the aquifer. Maryland has no regulations permitting this type of activity. However, given the potential benefits to aquifers, this approach may have merit for further investigation, and the County should coordinate with MDE in any future investigations.[6]

Nutrient Trading

Under the state's Policy for Nutrient Cap Management and Trading, [7] nutrient discharges can be traded between one point source and another within the same trading basin (for Charles County, this includes the entire Potomac River basin from St. Mary's County to Garrett County). In such a scenario, an existing WWTP outside of Charles County (likely in Maryland, but trades from Virginia could also be considered) would agree to forego a certain amount of development in exchange for payment, and then send or "trade" that excess treatment capacity to one of the County's WWTPs. The receiving WWTP would then be allowed to expand beyond its current permitted capacity (as long as its discharges would not exceed the limits set by a TMDL). Conversely, a WWTP in Charles County could act as the "seller" of nutrient credits.

Credits can also be accrued through other methods, such as:

- Upgrading an existing minor WWTP to Biological Nutrient Removal (BNR) or ENR technology (in Charles County, the Bel Alton, Clifton-on-the-Potomac and Cobb Island facilities are the only publicly-owned WWTPs that would be eligible);
- Retiring an existing minor WWTP after connecting its flow to a BNR or ENR facility, as is the case with the Mt. Carmel Woods and the College of Southern Maryland WWTPs, which will be retired and connected to the Mattawoman sewer system; or
- Retiring an existing On Site Disposal System (OSDS or septic system) by connecting its flow to an ENR facility. Under the state policy, a County WWTP could receive the following nutrient credits for each type of septic system retired:

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

[6] In addition to California, other states in the Western and Southeastern United States—notably, Florida—also use similar practices. The USEPA website contains information on Aquifer Recharge, including best practices and some of the key technological concerns that would need to be addressed before implementation: http://www.epa.gov/safewater/asr/index.html

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

- Septic systems in the Chesapeake Bay Critical Area: approximately 5.3 EDU per OSDS.
- Septic systems within 1,000 feet of any perennial surface water: approximately 3.3 EDU per OSDS.
- Any other OSDS: 2 EDU per OSDS

As an example, there are approximately 1,700 residential units on septic systems in the Critical Area in Charles County. By connecting half of those units to a WWTP (assuming that the other half are too scattered to extend service), the County's WWTPs could gain approximately 4,500 EDU (or 1.125 MGD) of capacity. Such an option could also be pursued with a new WWTP, as is the case in Benedict and Hughesville, as long as the new WWTP does not establish a new surface water discharge.

In addition to these point-to-point trading opportunities, MDE and the Maryland Department of Agriculture (MDA) recently adopted guidelines that allow trades between nonpoint sources (such as agriculture) and point sources. Under these guidelines, a WWTP could receive nutrient credits for reducing nutrient flows from agricultural areas or developed areas not governed by a municipal stormwater (MS4) permit.

Continue System Repairs

In some public wastewater collection systems in the County, considerable capacity is taken up by Inflow and Infiltration (I/I).[8]. While the County and its municipalities do not expect to be able to remove all I/I from public sewer systems—since it is impossible to police every property to ensure disconnection of roof drains and sump pumps—repairing the worst I/I problems is the most efficient means of securing additional capacity for public systems.

Alternative Disposal Options

Land Application of Treated Wastewater

Land treatment of wastewater may involve a wide variety (or combination) of techniques such as spray irrigation, drip irrigation, subsurface discharge, rapid infiltration basins, and overland flow. In a land application system, the soil and vegetative cover purify and dissipate the effluent (which has already been treated by a BNR or ENR process) as it percolates into the ground. In addition to the primary benefit of keeping harmful pollutants from water bodies, land application can also serve to recharge groundwater supplies, allow recovery and reuse of nutrients, and may provide an economic return if used for some agricultural purposes.

Major design parameters for land application systems include topography, permeability of the soils, depth to groundwater, and the location of nearby residences. Disposal of effluent via spray irrigation requires large amounts of land that are sprayed with effluent at very low application rates (1 to 2 inches per week). Seasonal limitations on spray irrigation are also a factor. State requirements mandate the provision of three months of effluent storage

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

capacity, to account for times when the ground may be frozen or have limited permeability. Suitable spray irrigation areas are characterized by permeable to highly permeable soils.

On dedicated lands, spray irrigation would be considered a non-public-access method of effluent disposal. The Cobb Island wastewater system disposes of treated effluent via spray irrigation on the Breeze Farm property. The planned Benedict and Hughesville WWTPs will also use land application techniques, although the specific technique and disposal location has not been determined.

Tertiary Treatment Wetlands

Wetland application is rapidly gaining recognition as a viable alternative for effluent disposal. It represents an extension of the land application and reuse concepts, and has been encouraged by USEPA. In this system, effluent is treated by a BNR or ENR facility and is then discharged into a series of constructed, vegetated (typically forested) wetlands. These wetlands purify the effluent to the point where the eventual discharge meets water quality standards with regard to nutrients and other pollutants. The best-known large-scale application of this technology occurs in Clayton County, Georgia.[9] This system treats 9.3 MGD of effluent on a 4,000 acre site, with a final discharge that meets drinking water standards. Other smaller applications of tertiary treatment wetlands—typically at schools or other institutional facilities—can be found in Maryland. Implementation of a large-scale tertiary treatment wetland facility in Charles County would depend heavily on soil characteristics and other site conditions. Considerable permitting and monitoring requirements are also associated with tertiary treatment wetlands.

E.4 Nonpoint Source and Stormwater Policies

Other Nonpoint Source Management Policies and Considerations

Failing Septic Systems

Numerous factors can lead to the failure or malfunction of individual septic systems: unsuitable soil characteristics, high water tables, improper installation and maintenance, and system age. The Comprehensive Water and Sewer Plan's objectives include (in part): the provision of opportunities for residents in identified failing septic areas or with failing wells to correct existing supply, health, and environmental problems; education regarding the proper maintenance of home septic systems; and where possible, provisions for financial assistance or grant opportunities to homeowners in areas of failing septic systems. Charles County is working with MDE and local citizen groups to seek grant funding through the state's Bay Restoration Fund to assist in the repair and enhancement of the existing systems.

The Comprehensive Water and Sewer Plan lists numerous areas of failing septic systems throughout the County, totaling approximately 1,200 homes with failing septic tanks. The vast majority (more than 1,000 homes) are in the Mattawoman Sewer Service Area, while the remaining homes are scattered throughout other parts of the County. To address failing or potentially failing septic systems, the County has:

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

- amended the Comprehensive Water and Sewer Plan[10] to define and allow the use of shared sewage disposal systems for major subdivisions outside of the Development District (and in "no planned service" areas);
- established a failing septic tank area petition process, whereby failing areas can appeal to the County for assistance in mitigating their failing systems;[11] approximately 150 homeowners have received grants to rehabilitate failing septic systems; and
- initiated plans to construct and manage sewer systems to address failing or potentially failing septic systems in the rural villages of Benedict and Hughesville. These new wastewater treatment plants will utilize land application techniques that avoid the establishment of a new point source discharge.

Septic Denitrification Systems

Maryland Senate Bill 554 (from the 2009 legislative session) now requires all new development on septic systems in the Chesapeake Bay Critical Area to include Best Available Technology (BAT) for nitrogen removal, as defined by MDE.[12] BAT for nitrogen removal (or "denitrification") can reduce the nitrogen loading from septic systems by approximately 50 percent. The County does not require denitrification for new septic systems, but Bay Restoration Funds have been used to install some denitrification systems in the Port Tobacco River watershed and other areas. Overall, approximately 40 homes in Charles County utilize denitrification units.

Septic denitrification (in any location—not just the Critical Area) can be one approach to meeting TMDL requirements. Denitrification systems are encouraged throughout the remainder of the County to reduce NPS nitrogen loads. The nonpoint source analysis (Section 7) assumes that one-quarter of all new residential and non-residential development outside of public sewer systems will utilize denitrification units, and that ten percent of existing septic systems will be retrofitted with BAT for nitrogen removal. Although not explicitly a goal of the County's existing Comprehensive Plan, this level of implementation is reasonably foreseeable by 2040.

Stormwater Retrofits and Maintenance

Since 1997, the stormwater discharge from Charles County's Development District has been regulated by a National Pollutant Discharge Elimination System (NPDES) permit, under the Municipal Separate Storm Sewer Discharge (or MS4) permit system. The need for such a permit is based on population thresholds established by the Clean Water Act. Its purpose is to eliminate non-stormwater discharges and reduce the discharge of pollutants in stormwater to the maximum extent possible. The MS4 NPDES permit requires significant monitoring, maintenance and improvements of the stormwater system.

Maintaining existing stormwater management (SWM) facilities to function properly helps reduce pollutants entering the County's streams and waterways. Additionally, providing new or improved stormwater management facilities where none exist, or retrofitting existing

[10] County Commissioners Resolution 09-16

[11] Charles County Health Department, 2006

[12] More information is available at: http://www.mde.state.md.us/Water/CBWRF/osds/brf_bat.asp. County regulations requiring denitrification in the Critical Area were being reviewed as of early 2010.

facilities that provide minimal benefit, can help to reduce nonpoint source pollution. The need for additional and improved urban SWM and for increased maintenance of existing SWM facilities is of particular concern to the County, especially in the Development District, where considerable development occurred prior to the codification of state and County SWM requirements.

Retrofits

There are approximately 2,863 acres of impervious surface (see VII.C below) in the Development District that lacks adequate (or, in some cases, any) SWM facilities.[13] Three Watershed Restoration Studies (2004, 2007, and 2010) have been completed for the Development District. Together, these Studies recommend improvements reduce stormwater-borne pollutants from entering streams and waterways. Recommended improvements include upgrading existing SWM facilities, construction of new facilities in areas developed prior to SWM regulations, installing rain gardens and pervious paving, stream channel restoration, and educational outreach activities such as rain barrel distribution events and trash removal from streams. As of 2016, the County has completed construction of new stormwater management facilities for 96 acres that previously lacked appropriate SWM. Several additional projects totaling nearly 240 acres of impervious surface are in the design and/or engineering phase.

Maintenance

To function properly and provide the most environmental benefits, stormwater facilities must be regularly maintained and inspected. State and local codes require Charles County to inspect the 1,075 SWM facilities located within its boundaries every three years. Charles County owns approximately 240 of these SWM facilities. Homeowners associations and private property owners own—and shoulder the maintenance burden of—the vast majority of the remaining SWM facilities.

The Charles County Homeowners' Association Task Force reported in 2001 that in many cases, the owners of properties containing SWM facilities are responsible for maintenance that benefits other private or public users. Yet, these owners have no practical recourse to collect a proportional share of the maintenance expense from these other parties. Dealing with these issues involves a gray area between public and private ownership interests and rights of access. The County is working with affected parties to attempt to resolve these issues to meet public health, safety, and natural resource objectives.

Monitoring

The County monitors its stormwater system as required by the NPDES permit. This includes monitoring nutrients, other contaminants, and the physical condition of receiving waters. Monitoring is the basis for status and progress assessments. In addition to stream monitoring, the County inspects large storm drain outfall pipes for stormwater flow during dry weather. If water is observed flowing from a pipe when there hasn't been a storm event, the water is tested to see whether it contains pollutants. This test helps determine if there

[13] Source: NPDES Annual Report (2009-10), Charles County, Maryland. Municipal Separate Storm Sewer Discharge Permit.

has been an illicit discharge into the system. Discharges into the County's stormwater system are not allowed unless individually permitted by MDE.

Watershed Management Planning

Watershed management planning is important for maintaining water quality. Several County watersheds have management plans and commissions to support their implementation. These include the Wicomico River and Zekiah Swamp, the Patuxent River,[14] and the Potomac River. The most recently completed watershed plans include the Mattawoman Creek Watershed Management Plan and the Port Tobacco River Watershed Restoration Action Strategy.

Mattawoman Creek Watershed Management Plan

In 2003, the U.S. Army Corps of Engineers completed a watershed management plan for Mattawoman Creek in Charles County. The plan was written in response to concerns that development within the Development District had the potential to significantly affect Mattawoman Creek, with water quality and biota (plants and animals) the primary concerns. The purpose of the plan was to balance the protection of the Mattawoman Creek's natural resources and water quality with the development plans of the County. A computer model assessed future pollutant loads within the watershed in a variety of land use scenarios and time scales. Based on the model results, and considering natural resources protection needs and the County's development plans, the Corps made three recommendations to minimize pollutant loads in Mattawoman Creek and its tributaries:

- For future development, implement low impact design techniques [these techniques are largely required by the ESD provisions of the County's 2010 stormwater regulations], minimize impervious surfaces, retaining forest to the maximum extent possible, and promoting stormwater disconnects.
- Delineate and protect the stream valley—defined as the top of the slope to the stream.
- Examine existing developments for stormwater retrofit opportunities.

Port Tobacco Watershed Restoration Action Strategy

The Port Tobacco River watershed is fully contained within the County, but overlaps a portion of the Town of La Plata. In 2007, the County prepared a Watershed Restoration Action Strategy (WRAS) for the Port Tobacco watershed. The WRAS was adopted for implementation by the Charles County Commissioners in 2007[15] and by the Town of La Plata in 2008. The WRAS includes a plan to achieve the residents' visions for restoration of the Port Tobacco River watershed. These include:

- Reduce bacteria levels below the State limits for contact recreation.
- Mitigate future changes to watershed hydrology.
- Reduce sedimentation rates.

[14] The County formally adopted the 1984 Patuxent River Policy Plan (County Commissioners Resolution 84-18) and its 1997 update (CR 00-77).

[15] County Commissioners Resolution 07-57.

- Prevent summer algal blooms by reducing summer nutrient levels from non-point sources to the low-flow load allocation as specified by the TMDL.

Based on extensive fieldwork, data review, discussion, and computer pollutant modeling, nine recommendations were made to achieve these goals:

- Eliminate septic system failures.
- Eliminate sanitary sewer overflows [i.e., from the La Plata WWTP].
- Protect a greater percentage of the watershed.
- Reduce the volume of runoff generated at new developments through better site design [e.g., ESD] and well-designed and constructed stormwater management.
- Reduce stream bank erosion caused by existing development without stormwater management practices by constructing stormwater retrofits.
- Enforce sediment and erosion control regulations.
- Eliminate illicit discharges to reduce nutrient and bacteria loads and protect the biological functions of streams.
- Educate the watershed residents about water quality impacts of individual actions.
- Exclude livestock from streams.

Many specific implementation projects were identified to achieve the above recommendations, some of which have been completed—primarily through the efforts of the Port Tobacco River Conservancy. These include installation of rain gardens, wetland restoration, and education on water quality impacts of individual actions. Additional implementation progress is being pursued by the County and Town of La Plata.

Sludge

Most sewage treatment plants in Charles County process sludge via aerobic digestion processes followed by dewatering on sand beds. These plants produce approximately 7 wet tons per year. Of that total, approximately 93 percent (6.5 tons) is processed at the Mattawoman WWTP. The Mattawoman WWTP uses gravity thickening, aerobic digestion, and Belt Filter Processing with the County's Land Application Contracts. The County's sludge is applied to farmland.

Sludge from the La Plata WWTP is processed in aerobic digesters and taken to a landfill in Virginia. This facility also has anaerobic digesters, which are not currently in use. La Plata's intent is to eventually dispose of this sludge via land application. The Town of Indian Head processes sludge in an aerobic digester and dewaters it on drying beds. Currently, the town trucks its sludge to the Mattawoman WWTP. Smaller plants located in the County do not have the facilities to process excess sludge. These plants contract haulers to dispose of excess sludge, either at the Mattawoman WWTP or via land spreading.

State regulations require that all septage gathered by sewage pumping trucks be treated at a sewage treatment plant. According to these regulations, raw septage may not be applied directly to any land surface in the State.

Land Preservation, Parks, and Recreation Plan

Charles County's 2005 Land Preservation, Parks, and Recreation Plan (LPPRP) was adopted as an amendment to the Comprehensive Plan. While the LPPRP contains few goals,

objectives, policies, and implementation actions that directly relate to the analyses in this WRE, its overall emphases on the preservation of rural and agricultural land, and the use of waterways for recreation are consistent with the WRE.

Agriculture

Maintaining rural character and agriculture as an industry is a major goal of the County. However, runoff from cropland, feedlots, and pastures can carry nutrients and pollutants from manure, fertilizers, ammonia, pesticides, livestock waste, soil, and sediment into waterways. Across the Chesapeake Bay basin, agriculture is one of the largest contributors of nitrogen and phosphorus to the Bay and its tributaries. However, this impact can be reduced through the application of agricultural Best Management Practices (BMPs) such as planting cover crops, judicious use of fertilizer (especially animal manure), and maintaining appropriate buffers along rivers and streams. The County continues to work with the agricultural community to ensure that agricultural BMPs are implemented to the greatest degree feasible.

Roads and Stormwater Management

The design of roads can impact nonpoint source nutrient loading. Open section roads (roads without curbs and gutters) can help to reduce impacts on water quality by dispersing runoff from pavement. Such roads are most appropriate outside of towns, urban areas, and populated areas where pedestrian facilities are a priority.

"Green streets" provide similar water quality benefits, but are used in towns and urban areas where pedestrian facilities are priority. Green streets make use of many ESD practices and can be applied to new development or to retrofit existing development. The green street design approach blends natural hydrological features and processes within the designed urban landscape. Components of green streets often include:

- Landscaped curb extensions,
- Swales that store and promote infiltration of stormwater runoff,
- Lowered or raised planter strips,
- Permeable surfaces, such as porous paver blocks and pervious asphalt or concrete, and
- Street trees.

Where reasonably feasible and fiscally practicable, new roads in such areas of the County are designed with open sections.

E.5 Additional Information

Water and Sewer Demand Projection Methodology

New water and sewer demand through 2040 was calculated based on housing unit projections for individual Traffic Analysis Zones (TAZs) or Planning Areas that corresponded with water and sewer service areas. The difference in demand between the 2014 Comprehensive Plan Recommended Scenario and the 2013 Planning Commission Recommended Scenario reflect the different land use patterns and water/sewer service boundaries assumed under these scenarios.

As described in Section 4.2, projected water and sewer demand under the 2014 Comprehensive Plan Recommended Scenario is assumed to be unchanged from the Merged Scenario evaluated in previous versions of the Comprehensive Plan. The calculations for the 2013 Planning Commission Recommended Scenario are unchanged from calculations provided in the 2013 Draft Comprehensive Plan.

In all scenarios, nonresidential (e.g., commercial, industrial, employment, and institutional) demand was projected to grow proportionately with new residential demand. The 2012 Comprehensive Plan replicates the assumption in the 2011 Water Resources Element that nonresidential demand for water and sewer would be approximately 20 percent of residential demand.

Land Application of Treated Wastewater

Option A, Preliminary Spray Irrigation Site Capacity Estimate (from *Models and Guidelines 26*, page 67) was used to estimate the acreage in Charles County that could be appropriate for future land application (spray irrigation) of treated wastewater effluent. Charles County's GIS soils database was used to identify soil types and permeability classes that most closely matched the drainage categories listed in the state guidelines. Table D-1 shows the results of this analysis. Map D-1 shows areas that, based on this analysis, might be suitable for land application.

Table D-1. Potential Land Application Acreage in Charles County

Drainage Category	Estimated Site Capacity for Each 100 Acres	Total Potential Land Area[1]
Excessively drained	640,000 gpd	1,846 acres
Well drained	480,000 gpd	12,061 acres
Moderately well drained	320,000 gpd	22,504 acres
Total		36,411 acres

Notes:

1: Limited to Agricultural land (Land Use/Land Cover categories 21, 22, 23, and 24) outside of municipal boundaries. Does not include buffers from streams or developed areas.

Developed areas, bare ground, wetlands, and forests were not considered appropriate for land application. Forests, in particular, should be preserved due to their ability to filter and reduce nonpoint source pollution. Because spray irrigation (with groundwater) is already a common agricultural practice in Maryland, agricultural areas are considered to be the most appropriate locations for future land application of treated wastewater.

It is understood that Option A is a coarse level of analysis, and is preliminary in nature. More detailed evaluations of soil characteristics, water table, and other factors are necessary before identifying specific locations for land application. However, these results indicate that, in some areas, land application may be an appropriate way to expand existing public wastewater system capacity (or to establish new public wastewater systems) without increasing nutrient loads to receiving bodies of water. For example, a 50-acre plot of "well drained" land (with appropriate depth to bedrock, buffers, and other favorable physical conditions) could translate to as much as 900 EDU of capacity.

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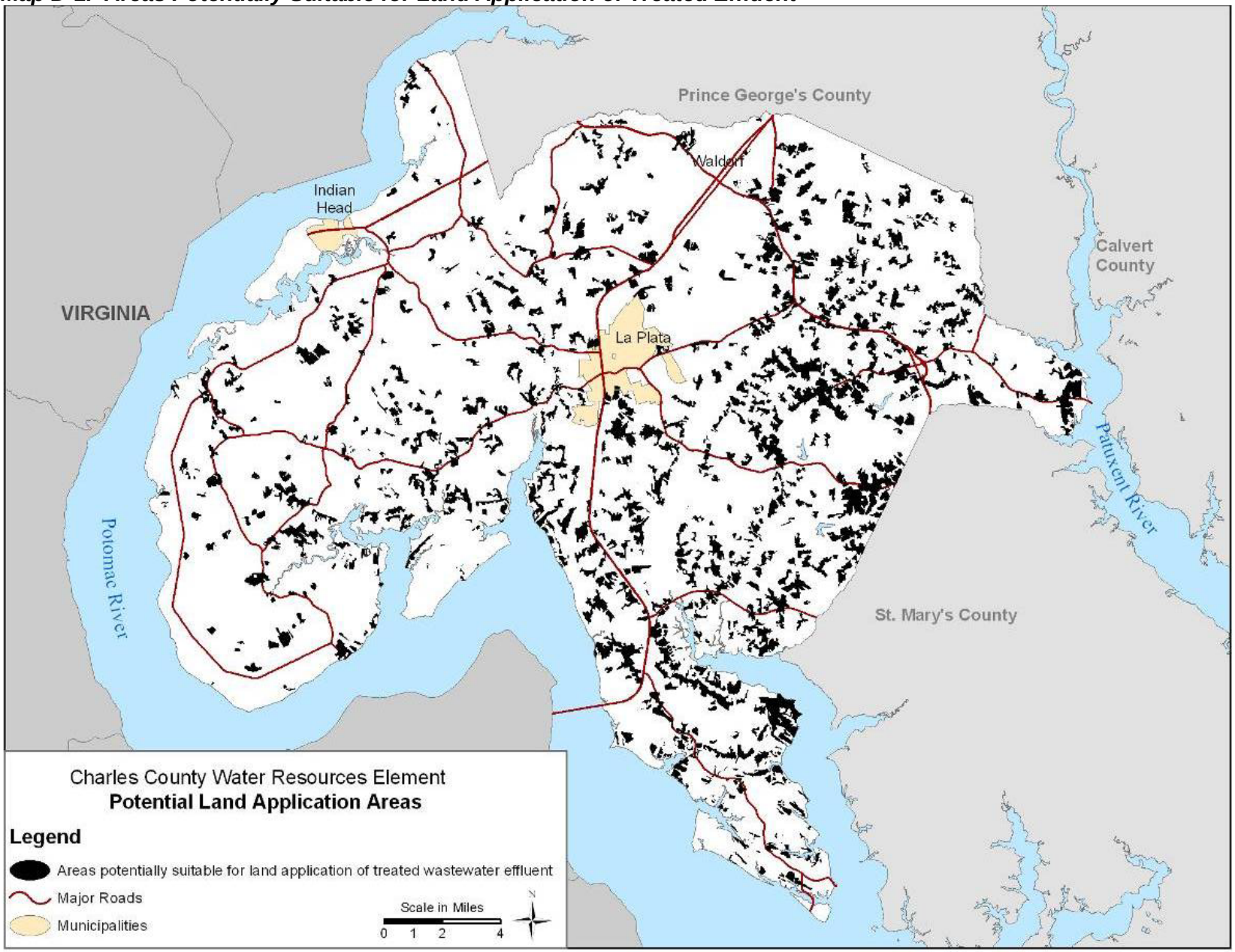
Map D-1. Areas Potentially Suitable for Land Application of Treated Effluent



Impervious Surface Calculations

Existing (baseline) and future impervious surface acreages in Table 4-8 were calculated based on Geographic Information System (GIS) mapping of existing land use patterns and the two future land use scenarios described above. Each land use type was assigned an assumed impervious surface percentage, as shown in Table D-2. Acres of each land use type were multiplied by the assumed impervious percentage. Table 4-9 further assumes that future impervious surface would not be less than existing impervious surface, even if the mathematical calculation described above resulted in less impervious surface. Finally, please note that land in the County's incorporated municipalities was not included in the analysis, nor were areas of open water.

Table D-2. Impervious Surface Assumptions

Future Land Use Category	Percent Impervious[1]
Commercial	72%
Business and Employment[4]	53%
Federal Lands[5]	34%
Mixed Use[6]	72%
Protected	0%
Rural Conservation[2]	4%
Rural Residential[7]	14%
Development District Residential[3]	28%
Agricultural Conservation[2]	4%
Watershed Conservation District[2]	4%

Notes:

1: Source: MDE Nutrient Loading Analysis Spreadsheet—spreadsheet model for 2011 WRE.
2: Corresponds to the Rural Residential land use designation in the MDE spreadsheet.
3: Corresponds to the Medium Density Residential land use designation in the MDE spreadsheet.
4 Corresponds to the Industrial land use designation in the MDE spreadsheet.
5 Corresponds to the Institutional land use designation in the MDE spreadsheet.
6 Corresponds to the Commercial land use designation in the MDE spreadsheet.
7 Corresponds to the Low Density Residential land use designation in the MDE spreadsheet.
8 Corresponds to the Rural Residential land use designation in the MDE spreadsheet, reduced by 10 percent to reflect the Merged Scenario's emphasis on concentrating development within water and sewer service areas.

Forested Area Calculations

Existing (baseline) forested acreages in Table 4-9 were carried over from the baseline information in the 2011 Water Resources Element. Future forested acreage was calculated based on the impervious surface calculations described above. Within each watershed, the amount of new impervious surface was assumed to consume either forest or agricultural land. The ratio of consumed forest land to consumed non-forest land within each watershed was assumed to be the same as the ratio of existing forest and non-forest acreage within that watershed.

For example, forest comprises approximately 81 percent of the undeveloped portion of the Nanjemoy Creek watershed. Thus, the WRE assumes that 81 percent of new impervious surface would consume existing forested land. This consumed forest land was subtracted from existing forest land to calculate the projected 2040 forest coverage in each scenario.

Memorandum

Environmental Resources Management

200 Harry S. Truman Pkwy.
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Annapolis, MD 21401
(410) 266-0006
(410) 266-8912 (fax)

To: Jay Sakai, Director, Water Management Administration, Maryland Department of the Environment

Through: Steven Ball, Planning Director Charles County Department of Planning and Growth Management

From: Clive Graham and Ben Sussman

cc: Rich Josephson, Jason DuBow, Maryland Department of Planning

Date: May 3, 2012

Subject: Charles County Comprehensive Plan, Water Resources Element

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Charles County is in the process of revising its 2006 Comprehensive Plan. As required by State law, the new Comprehensive Plan will include a new Water Resources Element (WRE) that evaluates the impacts of the Comprehensive Plan on drinking water resources and water quality.

Environmental Resources Management (ERM) is assisting Charles County in developing the new Comprehensive Plan. The Charles County Planning Commission has requested that County staff develop a new draft Plan by July 2012.

The County adopted its first WRE in 2011. That WRE evaluated the 2006 Comprehensive Plan using the methodology set forth in *Models and Guidelines (M&G) 26*, including a spreadsheet-based water quality model provided by the Maryland Department of the Environment (MDE). The Maryland Department of Planning (MDP) determined that the 2011 Charles County WRE met the requirements for WREs under state law (letter to Steven Ball, September 24, 2010).

The MDE Science Services Administration's comments on the 2011 WRE (December 9, 2010) indicated that the next WRE would have to address consistency with the then-pending (and now adopted) Chesapeake Bay Total Maximum Daily Load (TMDL). ERM understands that MDE and MDP plan to update *M&G 26* to reflect the Chesapeake Bay TMDL, but that this update will not be ready in time to meet Charles County's Comprehensive Plan schedule.

As part of the Chesapeake Bay TMDL process, the Chesapeake Bay model has also been updated, with nutrient loading rates that reflect the best available science; however, the Bay model's findings—especially loading rates—are not available in a format that can be applied to MDE's spreadsheet-based water quality model (the model that MDE provided for use in the first round of WREs). In addition, that first-round model did not include sediment loads, which is a requirement of the Chesapeake Bay TMDL.

In light of these concerns ERM requests guidance from MDE on the following questions so that the new WRE will meet state requirements:

1. Absent new guidance for WREs, should ERM use M&G 26 as the basis for preparing the new WRE?

2. What nutrient and sediment loading rates should ERM use to calculate nitrogen, phosphorus, and sediment; and what land use designations should these loading rates be applied to?

3. ERM proposes to incorporate Charles County's Watershed Implementation Plan (WIP) into the WRE as the primary means for addressing consistency with the Chesapeake Bay TMDL in the WRE. Is this approach acceptable to MDE?

4. Does MDE have any other guidance for Charles County at this time to ensure that its new WRE will meet state requirements?

Thank you for your time and attention. Given the County's fast schedule, ERM would greatly appreciate your response as soon as you are able.

MARYLAND DEPARTMENT OF THE ENVIRONMENT
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Martin O'Malley
Governor

Anthony G. Brown
Lieutenant Governor

Robert M. Summers, Ph.D.
Secretary

June 13, 2012

Steven Ball, Planning Director
Charles County Department of Planning and Growth Management
200 Baltimore St., La Plata, MD 20646

Subject: Charles County Comprehensive Plan, Water Resources Element

Dear Mr. Ball:

In order to prepare the new Water Resources Element for the revised Charles County Comprehensive Plan, you asked four questions, as set forth below. Per your request, we reviewed the four questions and offer the following responses to guide you in the preparation of the new Water Resources Element for Charles County.

Question 1. Absent new guidance for WREs, should ERM use Models and Guidelines 26 as the basis for preparing the new WRE?

MDE RESPONSE:
Since there are no plans at this time to update the 2007 Models & Guidelines 26, we highly recommend that ERM use the existing Guidelines to prepare the drinking water and wastewater assessments. However, since local governments are fully engaged in the development and implementation of detailed Watershed Implementation Plans to address the Chesapeake Bay TMDL and the State is in the process of developing a growth and offset policy as described in Maryland's Phase I WIP, the Department recognizes that there may be better alternatives to evaluating the non-point source loading impacts from land use changes than the Nonpoint Source Loading Tool, which uses outdated loading estimates that were based on older models. The State's soon-to-be released Draft Growth and Offset Policy will address how nonpoint source loads from new development are to be characterized, and therefore, preparation of the NPS Analysis included in M&G 26 is optional. Instead, MDE and MDP recommend that ERM characterize the acres of impervious surfaces and the acres of forest cover for alternative land use scenarios.

Question 2. What nutrient and sediment loading rates should ERM use to calculate nitrogen, phosphorus, and sediment; and what land use designations should these loading rates be applied to?

MDE RESPONSE:

If ERM chooses to prepare the NPS Analysis, you may use the loading rates included in the NPS Tool. However, if you would like to use alternative loading rates based on more current information, you may do so. Ideally, ERM should use the loading rates that are attributed to the latest version of the Chesapeake Bay Model. The current iteration that was used in Maryland's Phase II WIP scenario is based on version 5.3.2 of the model. Please include documentation if you pursue this alternate approach. Please note that the key aspect of the NPS Analysis is the relative change in loads in response to alternative land use scenarios. How much are the loads going up or down in response to the land use alternatives?

Question 3. ERM proposes to incorporate Charles County's Watershed Implementation Plan (WIP) into the WRE as the primary means for addressing consistency with the Chesapeake Bay TMDL in the WRE. Is this approach acceptable to MDE?

MDE RESPONSE:

We would encourage Charles County to incorporate its Phase II Watershed Implementation Plan in the Water Resource Element as the primary means for addressing consistency with the Chesapeake Bay TMDL, under the assumption that the County's Phase II WIP accurately reflects the expected loading increases from land use changes that are contemplated in the County's Comprehensive Plan.

Question 4. Does MDE have any other guidance for Charles County at this time to ensure that its new WRE will meet state requirements?

MDE RESPONSE:

a) The Maryland General Assembly, in its 2012 Session, adopted into law the Sustainable Growth and Agricultural Preservation Act of 2012 (SB236). The enrolled version of the bill is available online at http://mlis.state.md.us/2012rs/billfile/sb0236.htm. SB236 was the result of a two-year effort on the part of elected and appointed officials, homebuilders, environmentalists, farmers, planners, and others to reach agreement on ways to minimize the water quality impacts of new development on Maryland's rivers, streams and estuaries, including the Chesapeake and Coastal Bays, as well as maintain and preserve valuable farm and forest lands throughout the State. The law deals with how and where land can be subdivided for residential development and what type of sewerage is permitted to serve the development. The law outlines the development of four categories of Growth Tiers, including who is responsible for mapping the Tiers, how the Tiers will be used, and what role the State will have in reviewing and commenting on the Tiers. The Departments of Planning and Environment are currently developing guidance for local governments to assist in the implementation of this legislation. This legislation will have a significant effect on Charles County's water resources planning efforts and the

County is encouraged to work closely with both agencies to ensure that WRE development is consistent with this new law.

b) The Maryland Department of the Environment is in the process of establishing guidelines/regulations to promote use of reclaimed water. The guidelines/regulations promulgation process is divided into two phases. Phase I was completed in April, 2010 to amend the existing "Guidelines for Land Treatment of Municipal Wastewater" to include the use of Class III effluent. Class III effluent can be irrigated onto non-restricted public access areas including parks, play grounds, school yards, cemeteries, highway landscaping and other green open spaces. Phase II is currently in the final stage. The Phase II water reuse guidelines include the requirements for residential and commercial water reuses such as lawn irrigation, flushing toilets and urinals in commercial buildings; fire fighting for commercial buildings; decorative fountains; commercial laundries; artificial snow-making for commercial outdoor usage; and commercial car washing and landscaping. Similar to the Phase I guidelines, the Phase II guidelines will be incorporated by reference in COMAR and are expected to be finalized in May 2013. Charles County may want to consider expanded reuse of reclaimed water in its planning process for both water supply and wastewater treatment.

c) Please be advised that if a water supply system or wastewater system is operating at 80 percent or more of its design capacity, the system will be required to submit either a Water Supply Capacity Management Plan or a Wastewater Capacity Management Plan to the Department, as appropriate.

d) Please be further advised that all possible considerations should be implemented to protect Tier II streams (COMAR 26.08.02.04). Tier II streams are high quality waters that must be given extra considerations to protect their quality. Any new or expanded discharge to these Tier II watersheds would require an Anti-degradation Review. Furthermore, all possible considerations should be implemented to protect high quality waters from any necessary development. This primarily consists of rigorous watershed planning, with consideration of the extra provisions necessary to protect high quality waters.

The Department recommends that the County consider the following measures in efforts to maintain Tier II- high quality waters when approving new growth in the watersheds of these stream segments:
1) Implement restrictive zoning or ordinances to protect environmental features;
2) Re-direct planned growth out of the watersheds of these stream segments;
3) Retrofit existing stormwater infrastructure;
4) Incorporate environmental site design (ESD) and other low impact development (LID) practices into new development;
5) Maintain and expand existing forest cover; and
6) Provide riparian buffers of 100-230 feet (depending upon soil types and slopes).
The County should be aware that future plans facilitated by the County's Comprehensive Plan might incur an additional Anti-degradation Review at later stages, on a project-by-project basis.

If you would like to discuss MDE's responses to your questions, please contact Janice Outen at 410-271-8893.

Sincerely,

Jay Sakai
Director, Water Management Administration
Maryland Department of the Environment