# Appendix 3:

## Water Resources Analysis and Best Management Practices Toolkit





**Tables and Figures**

## Section 1.0 Introduction

This report is an Appendix to the Queen Anne's County's 2010 Comprehensive Plan and provides an assessment of impacts of existing and projected growth on the County's water resource limitations, challenges and solutions summarized in Section 2.0 Sensitive Areas of the Comprehensive Plan. This report addresses the requirements for the Water Resource Element (WRE) as outlined in the Maryland Department of Planning's Managing Maryland's Growth, Models and Guidelines #26 – *Water Resources Element: Planning for Water Supply and Wastewater and Stormwater Management.* The WRE analysis considers:

- Land use planning in a geographical context of watersheds.
- Estimated nutrient discharges for total nitrogen and phosphorus.
- Total Maximum Daily Loadings (TMDLs) for total phosphorus and total nitrogen by eight digit watersheds.
- Drinking Water supply to support current and future populations.
- Drinking Water treatment plant capacity.
- Wastewater capacity to support current and future populations,
- Wastewater treatment plant capacity.
- Stormwater impacts on water resources with respect to total nitrogen and phosphorous.
- Best Management Practices Toolkit.
- Conclusions and recommendations.

This WRE assessment was conducted in cooperation with each of Towns within Queen Anne's County in order to provide a complete assessment of all projected growth and public facility availability. In addition, the Towns of Centreville, Queenstown and Church Hill, have prepared assessments with respect to water resources within their jurisdictions and planning areas as part of their Comprehensive Plans. This WRE analysis incorporates those assessments. This Appendix may be incorporated by reference into each Town Comprehensive Plan.

## Section 1.1 Purpose

The purpose of the WRE is to ensure that the future development considered in the County's Comprehensive Plan and the Town's Comprehensive Plans reflect the opportunities and limitations presented by "local" and "regional" water resources. Local and regional water supply sources are predominantly the Aquia, Matawan, Magothy and Upper and Lower Patapsco aquifers, and local and regional receiving waters for stormwater are within the Chester River watershed, Choptank River watershed and the Eastern Bay watershed. The WRE also identifies suitable strategies to reduce nutrients to these "local" and "regional" receiving waters. Planning and assessment for the WRE is done at the eight-digit watershed level.

This assessment provides the basis for future collaboration with others in the region on a watershed basis. HB 1141, passed in 2006, encourages counties and local municipalities to consider water availability and source water protection issues when determining land use and zoning, and to involve state agencies early in the development process, in order to avoid situations where development may be impacted due to water-related issues.

## Section 1.2 Regional & County/Town Water Resource Issues

Many of the County's waterbodies are impaired. Impairments can be the result of one or more pollutant levels that exceed established thresholds for the waterbody. Impairments can be result of local conditions and/or regional conditions that may share the water resource. Adequate steps must be taken at the Regional and County/Town level to ensure that pollutant loadings are minimized.

Total Maximum Daily Load (TMDLs) results for total nitrogen and total phosphorous have been completed for the Corsica River watershed, Southeast Creek watershed, Middle Chester River watershed and the Upper Chester watershed. The TMDL results for the other watersheds in the County are pending completion.

Surface and groundwater supplies in eastern Maryland are generally sufficient; however they are facing increasing demand from a growing population and land irrigation. By 2030, statewide demand for water supply is expected to increase from 1,447 million gallons per day (mgd) to 1,670 mgd, an increase of 223 mgd. Demand in Queen Anne's County for water supply, including Towns, is expected to increase by 2.3 mgd by 2030. With growth and development comes a variety of impacts on the region's water resources. Regional issues include:

- Increasing ground water recharge and stream base flows.
- Reducing nonpoint sources and point sources.
- Reducing stormwater runoff and erosion.
- Reduce the frequency and magnitude of flooding.
- Sustaining the quantity of ground and surface waters to support current and future water usage (water supply, irrigation, in stream aquatic resources, recreation and others).
- Protecting sources of public drinking water supplies from pollutants.
- Confining withdrawals from water supplies (aquifers) for public drinking water or irrigation to the limitations of the water source (aquifer).
- Improving the integrated planning of land use and infrastructure to guide growth into the most desirable areas and to protect rural and natural lands.

At the County level, our economy is heavily dependent on clean streams and bays to support vital aquatic ecosystems and recreational opportunities,

In 2000, Queen Anne's County's freshwater demand included 1.42 mgd from surface sources and 7.26 mgd from groundwater sources for a total of 8.68 mgd, including 4.4 mgd for residential use and 3.9 mgd for livestock watering and irrigation. Current demand for freshwater is projected at 5.2 mgd for the year 2010. This amount would increase by 1.23 mgd by 2020 and another 1.08 mgd by 2030. By the year 2030, the total demand for freshwater is projected at 7.5 mgd. Groundwater supplies are believed to be sufficient for

*County and Town Growth Plans must direct growth to areas where sufficient wastewater capacity exists to ensure that water quality goals can be achieved.*

*Source: Maryland Department of the Environment, Water Resources and Growth Implementation of HB 1141.*

existing and projected demand; however, limited groundwater withdraw from the Aquia aquifer in Kent Island is necessary to reduce further brackish-water intrusion into the Aquia aquifer. Shallow private wells in the Templeville area have experience elevated concentrations of nitrates. In addition to those regional issues previously identified, the following is a listing of key County/Town issues associated with water resources with emphasis on drinking water, wastewater and stormwater. These issues provide the framework for study analysis, as well as the premise for recommended strategies to remedy associated consequences.

Drinking Water

- Limited detailed hydro-geologic studies.
- Brackish water intrusion into the Aquia aquifer and future impacts of continued eastward migration.
- Additional water treatment for deeper aquifer sources.
- Increasing water storage capacity.
- Agricultural irrigation impacts.

Wastewater

- Limited sewage treatment plant capacity and limited assimilative capacity of streams can impact development opportunities, particularly in Planning Areas.
- Limited spray irrigation lands.
- Water resources and water quality infrastructure must have sufficient capacity or ability for expansion to accommodate planned growth and development.

Stormwater

- The amount of impervious surface across the County as well as in developed areas impact the quality, volume and rate of stormwater run-off and pollution of waterways.

The County and others across the state and Chesapeake Bay Watershed are challenged to develop best practices and best methods integrating water resources planning, policies and strategies with growth management planning, policies and strategies.
The key indicators for measuring impacts to Water Resources include:

- Preservation/conservation of designated environmentally sensitive lands;
- Current and future land use patterns:
    - Percentage of development in and outside of Planning Areas and Towns;
    - Percentage of development within Critical Areas; and
    - Nitrogen loads and Phosphorus loads (point source and nonpoint source);
- Conversion of Agricultural and Forest lands to development; and increases in impervious surfaces, especially outside of Planning Areas and Towns.

## Section 1.3 Coordination with Municipalities

Several of the municipalities within county borders provide public water and sewer service to households and businesses. Those municipalities providing public water and sewer service are addressed as part of this Appendix. Included is quantitative data from the municipalities on their drinking water and wastewater. Policy statements and implementation strategies for the Towns are

contained in their individual Comprehensive Plans and Municipal Growth Elements. This analysis was conducted and coordinated with input from participating Towns.

## Section 2.0 Vision for Water Resources

The following vision statement describes the desired outcome for the County's water resources serving as the foundation for more specific goals, objectives and policies developed in this report and the 2010 Comprehensive Plan.

> ***Water Resources Vision Statement:*** *Despite the increase in population, Queen Anne's County is a sustainable region because County government, with strong citizen support and education, coordinated the management of land and water resources; collected, tracked and analyzed essential data; secured adequate funding for water resources planning and management; prepared and continued to update a Water Management Plan; and embraced water conservation through practicing best management practices.*

The Resource Conservation and Environmental Protection Topic Committee for the 2010 Comprehensive Plan update focused on issues and concerns related to environmentally sensitive lands, natural resources and specifically water resources. The Committee reviewed a variety of issues impacting sustainability associated with the health, safety and welfare of the environment.

The following community perspective includes a vision statement related to resource conservation and environmental protection *(water resources being just one of those resources for conservation and protection)* as well as key objectives to be addressed throughout the planning and implementation process. The vision statement is part of a broader community vision with emphasis on valued resources developed as part of the public involvement process by the Resource Conservation & Environmental Protection Topic Committee. The vision for resource conservation and environmental protection envisions:

> *Queen Anne's County will remain a rural, agricultural, and maritime County because it restores, enhances, protects and conserves its valuable land, air and water resources through such measures as:*
>
> - *Conservation and protection of agricultural lands, open spaces, woodlands, wetlands, mineral resources, wildlife and their habitats;*
> - *Conservation and protection of all water resources: bays, rivers, creeks, lakes, groundwater, and shorelines, including adherence to environmental regulations and low-impact stormwater practices that seek to restore the Chesapeake Bay;*
> - *Preservation of good air quality and viewscapes, including but not limited to the night sky;*
> - *Support for agricultural, maritime, and tourism industries; and*
> - *Environmental education programs aimed to promoting energy efficiency, comprehensive recycling practices for residences, businesses and public buildings, clean air and water policies, resource conservation and good land use.*

## Section 2.1 Water Resource Goals & Objectives

The overarching goals to support achievement of this vision developed by the Resource Conservation and Environmental Protection Topic Committee as it relates to water resources are outlined below.

- *Adopt policies, regulations, legislation, enforcement procedures and appropriate funding for programs and projects necessary to restore, enhance, protect and conserve our land, air and water resources; and establish programs designed to generate an awareness of and support for these measures.*
- Maintain safe and adequate drinking water supply to accommodate the needs of current and future populations of the County.
- Identify areas where investment in water and sewer infrastructure is necessary to provide adequate capacity for projected demand and sufficient treatment and technology to reduce pollutant loading to the Chesapeake Bay and its tributaries.
- Identify a variety of land management practices, best management practices and other tools and techniques that protect surface water and groundwater quality and quantity.
- Promote intergovernmental cooperation and coordination with respect to land use planning and implementation with the intent to minimize impacts on water resources.
- Educate and engage the general public in watershed conservation and stewardship.

The following objectives are important to achieve the vision and overarching goals for water resources:

- Achieve nutrient, sediment and pollution reduction necessary to remove each waterway from the MDE Integrated Report of Surface Water Quality;
- Continue to adopt programs to promote and facilitate the permanent protection of Sensitive Areas;
- Protect Critical Areas;
- Prevent negative impacts from development on source water quantity;
- Protection of functioning soil resources;
- Provide adequate public facilities (water, wastewater and stormwater management); and
- Provide environmentally sensitive private water and sewage disposal systems (i.e. private wells, on-lot septic systems and community water and sewerage systems).

# Section 3.0 Results of Assessment of Water Resources

## Section 3.1 Conclusions

The following conclusions come from the information contained in this report highlighted from various reports and studies cited pertaining to water resources.

***Groundwater/Drinking Water***

- There are adequate drinking water supplies for future population growth; however, the drinking water source will be at a deeper depth and require additional treatment as compared to traditionally-used shallow aquifers.
- In County and Town Planning Areas, projected population increases will produce increased demand on groundwater resources resulting in more and additional pumping and treatment from public–supply wells to meet capacity needs will be necessary. Increased pumping of the

Aquia aquifer on Southern Kent Island, beyond established limits, will produce decreases in water levels which in turn may increase brackish-water intrusion and regional water level issues.

- Approximately 43% of water withdrawn in the County is used for irrigation.
- Pumping restrictions on Kent Island for using the Aquia aquifer to serve future demand within the County Planning Areas and water service areas may require shifts in pumpage distribution between various aquifers and require additional treatment.
- Significant withdrawals from near surface artesian aquifers rather than from deep aquifer sources may cause water levels in those artesian aquifers to decline, which in turn, may cause situations such as: brackish-water intrusion and well failure due to water levels falling below the pump intake.

***Wastewater***

- Increased sewer capacity and treatment, especially to accommodate future growth in the Planning Areas of Centreville, Queenstown and Sudlersville, will be necessary to meet current and future population needs and reduce nutrient loadings. Public health concerns suggest a need for elimination or reduction of on-site disposal systems on southern Kent Island:
  - 80% of existing septic systems in the Kent Island Estates/Romancoke areas discharge directly into groundwater and that constitutes a failure correctable only by public sewer or other innovative technology.
  - Other areas of concern on Southern Kent Island include: Queen Anne' Colony and Kentmorr Collection subarea; Chesapeake Estates, Sunny Isle of Kent, Normans/Batts Neck and Matapeake Estates Collection sub-area; and Dominion and Marling Farms Collection sub-area.

***Stormwater***

- A reduction in nutrient loading from designated uses and projected uses is necessary to protect water resources, reduce flooding and other impacts to the natural environment.
- A balanced land use pattern across sub-watersheds with new development and redevelopment targeted for areas with existing County or Town Planning Areas with impervious surface areas not exceeding more than 10% of the sub-watershed land area without increased nutrient management treatment.
- Newly updated stormwater regulations address increased State nutrient reduction requirements and retrofit of existing stormwater systems that do not currently meet the new regulations.

## Section 3.2 Recommendations

The use of Best practices and innovative technologies are key implementation strategies to strengthening the sustainability of the County. Strengthening sustainability through better protection and management of water resources will achieve the County's land use goals of:

- Remaining a ***quintessential rural agricultural community***;
- Protecting the Chesapeake Bay and its tributaries;
- Improving quality and quantity of stormwater;
- Directing residential growth to designated County and Town Planning Areas;

- Providing of adequate public infrastructure and supporting services; and

The following recommendations are provided based upon study results and assessment of current and future needs in the context of land use policies, strategies and regulation.

***Drinking Water***

An essential component to successful implementation of a growth management strategy to direct new development and infill development to existing County and Town Planning Areas is the ability to serve these areas with municipal water. The following recommendations are crucial to meeting growth management goals and objectives with respect to public water supplies and facilities.

- Require the development and use of 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.
- Establish watershed or wellhead protection strategies for water supply sources.
- Establish water service areas in the County's Comprehensive Water and Sewerage Plan consistent with the Land Use Element based upon ability of the water resource to support development based on population growth as well as development capacity analysis based upon zoning (i.e. make any necessary updates based upon changes to Planning Areas, Town annexations and Priority Funding Areas).
- Develop a Water Protection Plan working collaboratively through inter-jurisdictional agreements between the County and the Towns for planning and implementation.
  - Tracking water-level declines of groundwater resources.
  - Need for additional observation wells placed across the County to measure impacts of pumpage for domestic use and irrigation.
  - Continued monitoring and study to ensure an adequate supply of necessary water resources.
- Implement the immediate and short-term recommendations contained in the Queen Anne's County Water Service Area Study for Queen Anne's County Sanitary District (2009). The following is an abbreviated listing. Refer to the study for more details.
  - Obtain an improved water source for the Chesapeake Bay Business Park Water Treatment Plant (WTP) via a new well drawing from the Lower Patapsco aquifer.
  - Add a new well drawing from the Lower Patapsco aquifer to increase capacity to Thompson Creek WTP.
  - Construct a backup well for the Stevensville WTP.
  - Install new ion-exchange units for the Kent Island Village WTP.
  - Resolve operational connection issues between Bayside service area to the Bridge Pointe Service area.
  - Connect Stevensville service area to the Bayside service area.
  - Add a second well at the Bayside WTP for redundancy and to maximize the amount of treatment capacity.
- Make upgrades to existing water treatment facilities for the Towns as identified in their respective comprehensive plans, such as:
  - Arsenic removal at the Town of Centreville's Business Park water treatment plant to treat up to 1,440,000 gpd.

  - Increased water storage capacity near Queen Anne's County High School for up to 600,000 gallons.

  - Consider the reuse of water within planned annexation areas around Centreville.
- Implement water conservation policies, guidelines and regulations.
- Update the County's Comprehensive Water and Sewerage Plan consistent with any changes in land use within the 2010 Comprehensive Plan Update.

***Wastewater***

An essential component to successful implementation of a growth management strategy to direct new development and infill development to existing County and Town Planning Areas is the ability to serve these areas with municipal sewer. The following recommendations are crucial to meeting growth management goals and objectives with respect to public and private wastewater facilities.

- Implement the recommendations contained in the Queen Anne's County Comprehensive Water and Sewerage Plan (2006 and subsequent amendments). The following is an abbreviated listing. Refer to the study for more details.
  - Address on-lot septic system failures on Southern Kent Island and other areas of concern.
  - Upgrade existing facilities as needed to meet future capacity needs.
- Update the County's Comprehensive Water and Sewerage Plan consistent with any changes in land use within the 2010 Comprehensive Plan Update.
- Use of innovative methods including Best Available Technology (BAT) for on-site treatment and disposal of wastewater to address public health concerns by reducing nitrogen discharge levels.
- Continued compliance with state and federal requirements with respect to permitting and reaching nitrogen reduction standards (use of Enhanced Nutrient Reduction (ENR) technologies) for the purpose of contributing to maintaining acceptable levels of water quality.
- Upgrade/replace existing facilities within the Towns using innovative technology to meet current and future capacity needs.
- Enhanced coordination between the County and Municipalities to identify water and sewerage service areas to identify additional water infrastructure and supply development needed to serve expected growth, such as:
  - Rerating the Town of Centreville WWTP to treat up to 750,000 gpd or substantially improve treatment to treat up to 1,000,000 gpd.
  - Acquiring additional land for spray irrigation.
  - Extend stream outfall discharge pipe in Corsica River.
  - Increase stream discharge into Corsica River..
- Develop a financing, operation and maintenance plan for water connections.

***Stormwater***

Providing adequate treatment for the quality, volume and rate of stormwater run-off is an essential component directing new development and infill development to the County and Town Planning. The following recommendations are crucial to meeting growth management goals and objectives with respect to stormwater management.

- Develop a Watershed Management Plan working collaboratively through inter-jurisdictional agreements between the County and the Towns for planning and implementation.

- Balance the impacts of land use patterns across all landscapes (i.e. natural, agricultural, rural residential, suburban and town/village) by directing new development and infill development to existing County and Town Planning Areas or new County Planning Areas.
- Continue to implement and update as needed the County's stormwater management practices and procedures and Environmental Sensitive Design Manual practices and procedures.
- Evaluate the location of Transfer of Development Rights (TDR) receiving areas to ensure appropriate location within watersheds containing designated Planning Areas that can receive development without exceeding 10% of the watershed land area with impervious surfaces.
- Assess development plans with respect to effectiveness to implement load reduction alternatives on non-point source pollutant loads applying Environmental Sensitive Design (ESD) standards.
- Measure post construction tributary assimilative capacities for impacted sub-watersheds.
- Utilize open space and land preservation programs to provide water protection measures.
- Review and modify existing zoning and development regulations to direct growth to designated County and Town Planning Areas (i.e. ensure adequate receiving areas for TDRs, increase density in Planning Areas, and evaluate other growth management tools, such as, low impact development ordinance, household pollution reduction education programs, landscaping demonstration projects, and use of best management practices for road reconstructions).
- Identify water resource protection criterion in Forest Conservation Plans for individual developments.
- Establish appropriate buffers, setbacks and impervious surface regulations to protect water quality from impacts of development.
- Work collaboratively with the Municipalities and surrounding Counties to adopt water resource protection strategies and regulations.
- Direct growth within Priority Funding Areas (PFA) while managing or reducing the potential for development outside of the PFA to assure the ability to maintain assimilative capacity in the watershed.

## Section 3.3 Summary of Water Resource Assessment

This section provides summary level information with respect to wetlands, Chesapeake Bay Critical Areas, wastewater, drinking water and stormwater as well as a summary of point and nonpoint source impacts.

### Section 3.3.1 Resource Lands – Agricultural, Forested and Wetlands

An inventory of resource lands such as agricultural lands, forested lands and wetlands identify changes in acreages between 2002 and 2008 as shown in Table 3-1. Overall changes in these land use classifications reflect that 10,701 acres or approximately 5% of total lands within the County were reclassified to other uses between 2002 and 2008. Resource lands could be reduced if ***sustainable smart growth management strategy*** is not implemented. Those long-term (2050-2100) projected potential loss of resource lands to development could include an additional 23,601 acres or 10% of total lands if preservation goals and the preferred land use is not achieved. Refer to Appendix 5: Build-Out Analysis Report for additional details pertaining to projected reduction in resource lands under maximum capacity build-out.

**Table 3-1: Change in Inventory of Agricultural and Forested Lands and Wetlands**

| Select Resource Land Use Classifications | Acreage | | | | Change 2002 – 2008 | | 2050-2100 Projected Conditions |
|---|---|---|---|---|---|---|---|
| | 1973 | 1997 | 2002 | 2008 | Acreage Change | % Change | |
| Agricultural Land | 155,014.8 | 151,335.3 | 150,107.2 | 142,962.6 | -7,144.6 | -4.76% | 127,641.6 |
| Forested | 72,110.3 | 63,664.6 | 63,069.5 | 59,742.8 | -3,326.7 | -5.3% | 51,962.8 |
| Wetlands | 3,664.6 | 3,760.4 | 3,839.7 | 3,609.1 | -230.6 | -6.0% | |
| | | | | | | | |
| **Total County Acreage** | **238,337 Total Acres in Queen Anne's County** | | | | | | |
| Calculated Total Acreage from Datasets | 230,789.8 | 218,760.3 | 217,016.4 | 206,314.6 | -10,701.8 | -4.9% | |

*Source: Queen Anne's County, LGE & MDE/MDP Datasets*

## Section 3.3.2 Resource Lands – Critical Areas

Approximately 42,984 acres of land in the County fall within the Chesapeake Bay Critical Area designation. This includes all lands within 1,000 feet of the mean high water line of tidal waters. Development is not prohibited in the Critical Area, but development is restricted by one of three sub-categories. The most restrictive Critical Area sub-category is the Resource Conservation Areas (RCA), which limits densities no greater than 1 dwelling unit per 20 acres and limits impervious surface area generally limited to a maximum of 15% of the lot area. RCA areas are generally undeveloped areas or areas characterized by agricultural use, forests or other natural resources. Approximately 32,688 acres of land area designated as RCA with a total of 620 acres, or 1.9% of the RCA area estimated to be impervious.

The density and intensity of use in the Limited Development Areas (LDA) and Intensely Developed Areas (IDA) are established by the underlying local zoning classifications. Impervious surface areas are generally limited to a maximum of 15% of the lot area in the LDA and 80% of the lot area in IDA. Approximately 8,781 acres of land are designated as LDA with a total of 1,134 acres, or 12.9% of the LDA area estimated to be impervious. Approximately 1,514 acres of land are designated as IDA with a total of 414 acres, or 27.4% of the IDA area estimated to be impervious.

Table 3-2 depicts impervious surface acreages within Critical Areas for the Intensely Developed Areas (IDA), Limited Development Areas (LDA) and Resource Conservation Areas (RCA) designated areas of the County. Currently, five percent of total lands within the Critical Area are impervious surface. When development or redevelopment occurs, impervious surface area and stormwater runoff are minimized based upon application of County's new Environmental Design Standards.

**Table 3-2: Impervious Surface by Critical Area Designation - 2008**

| Critical Areas | Total Acres | Impervious Surface | | Undeveloped Land | |
|---|---|---|---|---|---|
| | | Acres | Percent | Acres | Percent |
| Intensely Developed Area – IDA | 1,514.7 | 414.8 | 27.4% | 1,099.9 | 72.6% |
| Limited Development Area – LDA | 8,781.3 | 1,134.0 | 12.9% | 7,647.3 | 87.1% |
| Resource Conservation Area – RCA | 32,688.5 | 620.4 | 1.9% | 32,068.1 | 98.1% |
| **Total Critical Areas** | **42,984.5** | **2,169.2** | **5.0%** | **40,815.3** | **95.0%** |

*Source: Queen Anne's County, LGE & MDE/MDP Datasets*

## Section 3.3.3 Water Resources – Wastewater

Table 3-3 identifies the demand and capacity of public wastewater treatment systems for various County and Town Planning Areas. The available capacity of existing public systems is sufficient for existing populations; however, additional capacity will be necessary to support projected growth within the various wastewater service areas. The wastewater treatment facilities are not interconnected and serve specific geographic County and Town Planning Areas where future growth is to be directed, or has been extended to correct septic tank failures. Expansion of existing facilities and the provision of new facilities are identified to meet the needs of planned growth as it occurs. The timing of planned expansions will be based upon individual facility needs as well as available funding from public and private partnerships.

**Table 3-3: Public Sewer Systems Demand and Capacity Summary**
**Million Gallons per Day (MGD)**

| Wastewater Treatment Plant (WWTP) Facility | Capacity Design (MGD) | Average Daily Flow (MGD) | Remaining Capacity (MGD) | Planned Growth – Future Demand Comments Relevant to Facility |
|---|---|---|---|---|
| Kent Narrows Stevensville Grasonville (KNSG) WWTP | 3.000 | 1.533 | 1.467 | The KNSG plant has reserved capacity for future development that includes non-residential space and 1,418 dwelling units plus 500,000 gallons per day (GPD) for failing septic systems. The plant is approaching capacity with these reserves. |
| Queenstown | .085 | 0.077 | 0.008 | Plant is essentially at capacity; however the Town anticipates adding capacity for planned development as per the Queenstown Community Plan. |
| Centreville | 0.542 | 0.381 | 0.161 | The Centreville Community Plan identifies planned development which could exceed existing plant capacity; however additional plant capacity is anticipated to accommodate planned development.* |
| Church Hill | 0.080 | 0.047 | 0.033 | The Town anticipates using remaining capacity for planned development as per the Church Hill Community Plan. Plant may need to expand capacity to accommodate anticipated Priority Funding Area (PFA) expansion as well as meet the requirement that all new development within PFA be connected to sewer. |
| Sudlersville WWTP & Barclay** | 0.090 | 0.044 | 0.046 | Remaining capacity of 50,000 gpd is reserved for a new school flow and connection to the Town of Barclay. Anticipated flow associated with growth will require expansion of plant capacity. |
| Chesapeake College | 0.015 | 0.005 | 0.010 | Chesapeake College plant will utilize remaining capacity as needed to support campus expansion. |

** The Town of Centreville requested and, in 2008, MDE re-rated the new Wastewater Treatment Plant (WWTP) to process an annual daily average of 542,000 gpd of flow. This new WWTP is also capable of expansion to handle up to 1.2 million gpd of flow.*
*** Barclay is dependent on Sudlersville for Capacity; flows include anticipated connections.*

## Section 3.3.4 Water Resources – Drinking Water

Table 3-4 identifies the public water system demand and capacity for facilities owned and operated by the County and for facilities owned and operated by the Towns. Existing water treatment facilities are generally sufficient to serve existing users; however, additional capacity will be necessary to support projected growth within the various water service areas. This table reflects existing demand and planned capacity needs with projected capacity surpluses or deficits. The various public water systems are not interconnected and generally serve specific geographic County and Town Planning Areas. Interconnectivity of County facilities, new facilities and/or system expansions may be necessary to meet future demands for planned growth in several communities.

**Table 3-4: Water System Demand and Capacity**

| Facility | Total Permitted Annual Average Daily Appropriations | Existing Demand | Population Served | Excess Annual Average Daily Capacity | Planned and Anticipated Capacity Needs | Net Excess Capacity | Potential Additional Users |
|---|---|---|---|---|---|---|---|
| ***County Facilities*** | | | | | | | |
| Bayside *Chester Growth Area* | 198,000 gpd | 114,585 gpd | 1,550 | 83,415 gpd | 35,000 gpd | 48,415 gpd | 194 |
| Bridge Pointe *Chester Growth Area* | 211,600 gpd | 90,229 gpd | 750 | 121,371 gpd | 32,500 gpd | 88,871 gpd | 355 |
| Grasonville *Grasonville Growth Area* | 100,000 gpd | 51,170 gpd | 766 | 48,830 gpd | 60,000 gpd | -11,170 gpd | -- |
| Oyster Cover *Kent Narrows Growth Area* | 95,800 gpd | 90,229 gpd | 588 | 5,571 gpd | 51,000 gpd | -45,429 gpd | -- |
| Prospect Bay *Stevensville Growth Area* | 125,000 gpd | 104,711 gpd | 754 | 20,289 gpd | 2,250 gpd | 18,039 gpd | 72 |
| Riverside *Chester Growth Area* | 5,100 gpd | 6,510 gpd | 58 | -1,410 gpd | 3,750 gpd | -5,160 gpd | -- |
| Stevensville *Stevensville Growth Area, Chesapeake Bay Business Park and Thompson Creek* | 925,000 gpd | 706,430 gpd | 5,530 | 218,570 gpd | 110,000 gpd | 108,570 gpd | 434 |
| **TOTAL** | 1,660,500 gpd | 1,163,865 gpd | 9,996 | 496,635 gpd | 294,500 gpd | 202,135 gpd | 809 |
| | | | | | | | |
| ***Town Facilities*** | | | | | | | |
| Centreville | 645,000 gpd | 459,800 gpd | 2,534 | 185,200 gpd | 20,000 gpd | 165,200 gpd | 660 |
| Queenstown | 77,000 gpd | 102,000 gpd | 635 | -25,000 gpd | 180,000 gpd | -205,000 gpd | - |
| Sudlersville | 17,500 gpd | 19,470 gpd | 432 | -1,970 gpd | 83,000 gpd | -84,970 gpd | - |
| **TOTAL** | 739,500 gpd | 581,270 gpd | 3,601 | 158,230 gpd | 283,000 gpd | -124,770 gpd | -660 |
| | | | | | | | |

Assessment of drinking water is accomplished by reporting on freshwater withdrawal by facility, treatment capacity and a summary of water system demand and capacity. Table 3-5 identifies the estimated freshwater withdrawal for the County with the identified groundwater allocation permit or well withdrawal limits should the most productive well used by that facility should become unavailable for any purpose. Under current demands, the Stevensville, Oyster Cove and Riverside facilities show a deficit in the event the best well is out of services.

**Table 3-5: GAP Well Withdrawal Limits Compared to Service Area Demand Projections**

| Service Area | GAP Well Withdrawal Limits | | 2006 Daily Well Withdrawal | | Deficit with Best Well Out-of-Service, GPD |
|---|---|---|---|---|---|
| | Total GPD | Best Well Out-of-Service GPD | Average | Max-Month Daily Average | |
| ***County Facilities*** | | | | | |
| Stevensville | 1,255,000 | 265,000 | 639,000 | 811,000 | 546,000 |
| Bridge Pointe | 170,000 | 170,000 | 68,000 | 93,000 | 0 |
| Bayside | 300,000 | 45,000 | 91,000 | 135,000 | 90,000 |
| Oyster Cove | 187,000 | 187,000 | 84,000 | 135,000 | 0 |
| Riverside | 8,500 | 0 | 4,800 | 6,000 | 6,000 |
| Grasonville | 210,000 | 210,000 | 60,000 | 88,500 | 0 |
| Prospect Bay | 195,000 | 195,000 | 85,500 | 146,000 | 0 |
| ***Town Facilities*** | | | | | |
| Centreville | 645,000 | NA | 400,000 | 627,000 | NA |
| Queenstown | | | | | |
| Sudlersville | | | | | |

Source: Queen Anne's County, Water Service Area Study for Queen Anne's County Sanitary District, 2009
GPD=Gallons Per Day
GAP = Groundwater Allocation Permit

Table 3-6 identifies the net treatment capacity and deficits for County water treatment facilities. There is a need to improve on treatment capacity at the Stevensville and Grasonville water treatment facilities to meet 2010 demands and a need for additional treatment capacity for the projected 2040 demand for all facilities with the exception of the Riverside and Bayside-Queen's Landing treatment plants. Treatment enhancments are required unless systems can be interconnected and utilize the combined treatment capabilities of several facilities or all facilities to meet projected demands.

**Table 3-6: Net Treatment Capacity Compared to Service Area Demand Projections**

| System | Net Treatment Capacity | Max-Daily Demand Assuming Moderate Growth (GPD) | | | Net Treatment Capacity Deficit Compared to 2010 Demands, GPD |
|---|---|---|---|---|---|
| | | 2008 | 2010 | 2040 | |
| ***County Facilities*** | | | | | |
| Stevensville | 478,400 | 609,000 | 869,000 | 1,480,000 | 390,600 |
| Bridge Pointe | 258,325 | 74,000 | 228,000 | 271,000 | 0 |
| Bayside-Queen's Landing | 355,010 | 107,000 | 168,000 | 264,000 | 0 |
| Oyster Cove | 237,900 | 125,000 | 197,000 | 254,000 | 0 |
| Riverside | 37,560 | 2,700 | 6,300 | 9,500 | 0 |
| Gransonville | 154,100 | 84,000 | 158,000 | 194,000 | 3,900 |
| Prospect Bay | 182,000 | 140,000 | 144,000 | 218,000 | 0 |
| ***Town Facilities*** | | | | | |
| Centreville Business Park | 720,000 | NA | NA | NA | |
| Centreville North Brook | 750,000 | 400,000 | 440,000 | NA | 350,000 |
| Queenstown | | | | | |
| Sudlersville | | | | | |

*Source: Queen Anne's County, Water Service Area Study for Queen Anne's County Sanitary District, 2009*

## Section 3.3.5 Water Resources – Stormwater

A change in land cover from vegetated or forested conditions to impervious surface increases stormwater run-off volumes, which when unmanaged can contribute to a reduction in water quality and can have the potential for flooding downstream properties. Construction associated with a wide array of community development activities results in a reduction of functioning soils resources which increases rates of stormwater run-off. Therefore, there are County stormwater regulations for stormwater management when development occurs to require development activities to treat stormwater to a level that matches the output of the site as if it were in the forested condition.

Studies have documented that the quality of aquatic habitat in streams, lakes and wetlands begins to decline when the area of impervious surface within a watershed reaches 10 percent of the total land area. However, if managed properly, impervious surfaces exceeding 10 percent in Planning Areas can be achieved. Based upon the 2008 conditions depicted in Table 3-7, watersheds at or near 10% include the Kent Island Bay and Eastern Bay Watersheds since the impervious cover has reached 10.23% and 9.04% respectively. Based upon 2030 projected development patterns, there's the potential for 7.1% of Corsica River Watershed and 7.5% of Kent Narrows Watershed to be impervious, with the Eastern Bay Watershed increasing to 12.2% and Kent Island Bay Watershed to 12.9%. The Sustainable Smart Growth Management Plan in Section 1.0 and Priority Preservation Areas identified in Section 3.0 address these sub-watershed conditions with the intent to reduce impacts on the environment.

**Table 3-7: Impervious Surface Coverage –
Comparison of Existing Conditions (2008) and Projected Conditions (2030)**

| Watershed | Total Watershed Acres | Acres of Impervious Surface | 2008 % Impervious Surface | 2030 Impervious Surface Potential Under Current Zoning in Acres | 2030 Preferred Future Land Use % Impervious Surface |
|---|---|---|---|---|---|
| Corsica River Watershed | 23,877.8 | 855.4 | 3.58% | 9,996.69 | 7.1% |
| Eastern Bay Watershed | 11,497.1 | 1,038.9 | 9.04% | 3,145.70 | 12.2 % |
| Kent Island Bay Watershed | 5,171.8 | 529.2 | 10.23% | 1,242.47 | 12.9% |
| Kent Narrows Watershed | 6,815.5 | 382.1 | 5.61% | 1,685.62 | 7.5% |
| Lower Chesapeake* | 8.1 | 0.2 | 2.55% | | |
| Lower Chester River Watershed | 17,647.5 | 810.8 | 4.59% | 6,380.03 | 5.2% |
| Middle Chester Watershed | 7,849.9 | 246.1 | 3.14% | 3,596.93 | 5.0% |
| Southeast Creek Watershed | 34,721.6 | 660.8 | 1.90% | 17,978.53 | 2.0% |
| Tuckahoe Creek Watershed | 46,085.5 | 747.6 | 1.62% | 20,071.06 | 1.0% |
| Upper Chester River Watershed | 52,066.8 | 1,073.4 | 2.06% | 27,169.79 | 2.0% |
| Upper Choptank Watershed | 1,924.8 | 26.4 | 1.37% | 28.87 | 1.5% |
| Wye River Watershed | 29,512.4 | 838.7 | 2.84% | 13,193.36 | 3.9% |
| **Total** | **237,178.8** | **7,209.6** | **3.04%** | **105,234.41** | |

*Source: Lands Available for Development – Build-Out Analysis, 2009 and WRE Tables Section 11.0*
**Lower Chesapeake Watershed –portion located within County boundaries is too small for assessment.*

## Section 3.3.6 Summary of Point and Nonpoint Sources Impacts

Table 3-8 identifies the total nitrogen and phosphorus loadings for point and nonpoint sources for existing land use conditions in 2008 and for two future development scenarios referred to as build-out scenarios: Scenario 1-Maximum Build-Out under current zoning regulations (a scenario considered "worst case") and Scenario 2-Sustainable Smart Growth Management Strategy with maximum preservation of rural agricultural areas and directing growth to County/Town Planning Areas.

As previously described, Scenario 1-Maximum Build-Out is described in detail in Appendix 5. Scenario 2 depicts the impacts for the preferred future land use scenario reflected on Maps LU-7A and LU-7B. Scenario 2 applies a variety of ***sustainable smart growth management*** principles resulting in lower levels of impacts to water resources with respect to quality.

## Section 3.3.7 Best Management Practices, Tools & Techniques

Water resources are best protected when a variety of best management practices, tools and techniques are available for use based upon both general characteristics of the assigned landscape typology as well as site specific conditions. Table 3-9 summaries the best management practices (BMP), tools, techniques and strategies typically associated with general characteristics of landscapes organized by State Tributary Strategy. The State Tributary Strategies as outlined in Maryland's Chesapeake Bay Tributary Strategy Statewide Implementation Plan (January 2008) includes a variety of strategies that

Counties should consider through implementation of land use and environmental regulation of development.

BMPs, tools, techniques and strategies specific to each eight digit watershed and agricultural, natural, rural, suburban and town/village landscapes identified below and defined in Appendix 3. As previously mentioned, landscapes are further defined in Section 1.0: Land Use.

**Table 3-8: Summary of Point and Nonpoint Source Impacts for Existing Conditions and Future Growth Scenarios**

| *(all data in lbs/year)* | | | Barclay Planning Area | Centreville Planning Area | Church Hill Planning Area | Island Growth Area | Queenstown Planning Area | Sudlersville Planning Area | County Total |
|---|---|---|---|---|---|---|---|---|---|
| 2008: Existing | Nonpoint | TN | 1,842 | 61,214 | 7,437 | 41,792 | 25,394 | 21,556 | 159,235 |
| | | TP | 104 | 5,330 | 582 | 4,013 | 2,197 | 1,785 | 14,011 |
| | Point | TN | - | 1,616 | 669 | 10,000 | - | - | 12,285 |
| | | TP | - | 58 | 50 | 700 | - | - | 808 |
| | **Total** | **TN** | **1,842** | **62,830** | **8,106** | **51,792** | **25,394** | **21,556** | **171,520** |
| | | **TP** | **104** | **5,388** | **632** | **4,713** | **2,197** | **1,785** | **14,819** |
| Scenario 1: Maximum Build-Out | Nonpoint | TN | 2,802 | 60,394 | 8,837 | 57,575 | 23,080 | 17,983 | 170,671 |
| | | TP | 113 | 5,791 | 568 | 4,375 | 2,161 | 1,728 | 14,736 |
| | Point | TN | - | 19,767 | 2,312 | 27,850 | 5,420 | 1,792 | 57,141 |
| | | TP | - | 1,483 | 173 | 2,039 | 406 | 135 | 4,236 |
| | **Total** | **TN** | **2,802** | **80,161** | **11,149** | **85,425** | **28,500** | **19,775** | **227,812** |
| | | **TP** | **113** | **7,274** | **741** | **6,414** | **2,567** | **1,863** | **18,972** |
| Scenario 2: Sustainable Smart Growth Management Strategy | Nonpoint | TN | 1,027 | 57,670 | 5,278 | 39,784 | 23,080 | 17,983 | 144,822 |
| | | TP | 113 | 5,791 | 568 | 4,375 | 2,161 | 1,728 | 14,736 |
| | Point | TN | 532 | 20,534 | 2,166 | 33,627 | 5,420 | 4,697 | 66,976 |
| | | TP | 40 | 1,540 | 162 | 2,472 | 390 | 353 | 4,957 |
| | **Total** | **TN** | **1,559** | **78,204** | **7,444** | **73,411** | **28,500** | **22,680** | **211,798** |
| | | **TP** | **153** | **7,331** | **730** | **6,847** | **2,551** | **2,081** | **19,693** |

*Source: Appendix 3 – Water Resource Analysis and Best Management Practices Toolkit 2010*
*Note: TN=Total Nitrogen, TP=Total Phosphorus.*

**Table 3-9: Summary of Best Management Practices, Tools, Techniques and Strategies**

| BMP, Tools, Techniques and Strategies (Tributary Strategy) | Agricultural Landscapes | Natural Landscapes | Rural Residential Landscapes | Suburban Landscapes | Town/Village Landscapes |
|---|---|---|---|---|---|
| **Point source/Urban Source Strategy** | | | | Expand water & wastewater system treatment | Expand water & wastewater system treatment |
| **Stormwater Strategy** | BMPs and Agricultural Best Practices | BMPs, Conservation and Agricultural Best Practices | BMPs and ESD | BMPs and ESD | BMPs and ESD |
| **Onsite Sewage Disposal Strategy (OSDS)** | BAT | BAT | BAT | Septic Elimination through connection to public sewer and BAT | Septic Elimination through connection to public sewer |
| **Growth Management Strategy** | PDR and Conservation/ Preservation | PDR, Conservation/ Preservation and Restrict Development in Critical Area Buffers | Cluster Development, ESD and Existing Infrastructure | Public Water and Wastewater Systems, TDR Receiving Areas | Infill/ Redevelopment, TDR Receiving Areas |
| **Agricultural Strategy** | Agricultural BMPs , Stormwater BMPs and Preservation/ Conservation | Stormwater BMPs and Preservation/ Conservation | Stormwater BMPs, Preservation/ Conservation and Cluster Development | TDR Receiving Areas | TDR Receiving Areas |
| **Waterway Strategies** | Buffers, Preservation/ Conservation and Tree Planting | Buffers, Preservation/ Conservation, Tree Planting and Living Shore Construction | Buffers, Preservation/ Conservation, Tree Planting and Living Shore Construction | Buffers, Tree Planting and Living Shore Construction | Buffers, Tree Planting and Living Shore Construction |
| **Air Deposition Strategy** | Forest Conservation and Preserve Green Infrastructure | Forest Conservation and Preserve Green Infrastructure | Forest Conservation Plans and Wooded Lot Standards | Forest Conservation, Woodlot Standards, Greenbelts and Trails/Paths | Walkable Communities (Pedestrian Facilities) and Expand Transit |

*Source: Appendix 3: Water Resource Analysis and Best Management Practices Toolkit 2010*
*BAT=Best Available Technology; BMPs=Best Management Practices, ESD=Environmental Sensitive Design, TDR=Transfer of Development Rights, PDR=Purchase of Development Rights*

## Section 3.4 Importance of Water Resource and Preservation in Determining Preferred Future Land Use

Land use and water resources are unequivocally linked. The type of land and the intensity of its use will have a strong influence on the receiving water resource. Depending upon the type of land use, the impacts on either the quantity or quality of water can be substantial.

This study assessed impacts on water resources with respect to nutrient loading and water/wastewater capacity needs for the following planning scenarios:

- Existing Conditions (base line);
- Maximum Capacity Build-Out under current zoning; and
- A Preferred Land Use Scenario projecting existing conditions with refinement applying a rural agricultural preservation strategy.

### Section 3.4.1 Sustainable Smart Growth Management Strategy

Existing development and development potential to the year 2030 and beyond were studied to determine the impacts on environmentally sensitive areas and water resources, as identified in Appendix 5: Build-Out Report. Through the analysis of development potential, preservation opportunities and impacts on water resources, a ***Sustainable Smart Growth Management Strategy*** (Scenario 2) emerged as the planning approach for further study and evaluation to map the preferred future land use for the County.

This ***Sustainable Smart Growth Management Strategy*** applies the Twelve Visions of Article 66B, water resource protection strategies and ***smart growth*** principles emphasizing new growth to be directed to County and Town Planning Areas. This analysis and study of future land use takes into the following key components of ***sustainable smart growth management*** as they relate to Queen Anne's County:

- ***Protection of sensitive areas and water resources*** applying a variety of tools and techniques such as restricting floodplains, stream buffers and environmentally sensitive areas from consideration for development;
- ***Protection of agricultural lands*** for the purpose of achieving the County's Priority Preservation Goal identified in Section 3.0 Priority Preservation Areas (PPA) Element in order to maximize preservation opportunities. The analysis applies the ***alternative rural land use preservation strategy*** (Option 2) outlined in Section 3.0 to limit on-site development within Agriculture (AG) and Countryside (CS) zoning districts and utilizing TDRs to direct growth to County and Town Planning Areas.
- ***Concentrating growth within Planning Areas*** at an average density of 3.5 dwelling units per acre while preserving land with the rural agricultural areas. ***Consideration of adequate public facilities*** with respect to water, sewer and transportation improvements.

# Section 4.0 Existing and Projected Conditions

## Section 4.1 Population Projections

The following tables represent population trends and projections supplied by the Maryland Department of Planning, Table 4-1.

**Table 4-1: Population Trends & Population Projections**

| | | | | | | | | | | Compound Annual Growth Rate | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1970 | 1980 | 1990 | 2000 | 2007 | 2008 | 2010 | 2020 | 2030 | 2000-2010 | 2010-2020 | 2020-2030 |
| Queen Anne's County | 18,422 | 25,508 | 33,953 | 40,563 | 46,571 | 47,091 | 48,650 | 55,650 | 61,900 | 2.0% | 1.4% | 1.1% |
| Upper Eastern Shore[1] | 131,322 | 151,380 | 180,726 | 209,295 | 235,356 | 236,521 | 243,850 | 288,550 | 328,400 | 1.7% | 1.8% | 1.4% |
| Maryland | 3,923,897 | 4,216,933 | 4,780,753 | 5,296,486 | 5,618,344 | 5,633,597 | 5,779,400 | 6,339,300 | 6,684,250 | 0.9% | 1.0% | 0.5% |

*Source: Maryland Department of Planning, 2008 US Census Bureau Estimates*

*[1] Caroline, Cecil, Kent, Queen Anne's & Talbot Counties*

## Section 4.2 Watersheds

Queen Anne's County is located within the Chesapeake Bay Watershed, a watershed that stretches over an area over 64,000 square miles in size and encompassing six states. The Chesapeake Bay Watershed contains many smaller sub-watersheds. These smaller sub-watershed areas to be used by local jurisdictions to elevate water resources are referred to by the Maryland Department of Environment (MDE) as "eight-digit" watersheds. Eight-digit refers to the Hydrologic Unit Code (HUC) as carried out to 8 places, meaning that these sheds are sub-sheds to the larger watershed. Queen Anne's County is divided between eleven eight-digit watersheds. A map depicting the eight-digit watersheds in Queen Anne's County is included in **Map ESA-4 – Watersheds**. Map ESA-4 also illustrates those watersheds considered by MDE to have impairments and/or a completed Total Maximum Daily Load (TMDL) studies and established TMDLs for nutrients. Map ESA-4 indicates that all watersheds in Queen Anne's County have impairments and that four of the eleven eight-digit watersheds within the County have a completed TMDL study for nutrients by MDE.

There is a small portion of the Lower Chesapeake Bay watershed in Queen Anne's County on the western edge of Kent Island - the portion, less than 2 acres, that was considered "deminimus" or "too small" by MDE, for reporting purposes and is therefore not included in reports or summaries.

## Section 4.3 Anti-degradation Policy

The State's anti-degradation policies regulate discharges to surface waters to maintain or improve the existing level of water quality. The policies provide differing degrees of protection according to one of three "tiers" of water quality protection assigned to all surface waters depending on their function. These anti-degradation policies are used to evaluate new discharges to waterways according to the water body's "tier" designation.

Since there are no Tier I and III designated surface waters identified in the following subsection emphasizes Tier II waters.

### Section 4.3.1 Tier I Waters

Tier I mandates that water uses and the level of water quality necessary to protect the uses (i.e. fishable and swimmable) Any pollutant discharged to a waterway that could endanger this level of protection is prohibited.

### Section 4.3.2 Tier II Waters

The Tier II designation is assigned to waters where existing water quality is better than the levels needed to meet the Federal Clean Water Act standards. Tier II waters may not receive new or increased discharges that would degrade water quality of the water body below the Tier II standards.

The Maryland Department of the Environment (MDE) describes Tier II water bodies as the following; "In addition to protecting existing uses and meeting the minimum water quality goals (sometimes referred to as "fishable and swimmable") which are subject to the MDE anti-degradation review policy. The goal of MDE anti-degradation review for projects in watersheds containing Tier II waters is to ensure that water quality is not degraded beyond the capacity to maintain a high quality status. Applicants proposing activities that will potentially impact Tier II waters must undergo anti-degradation review before permits are approved or activities can be added to a county's water and sewer plan."

The following are applicable policies, regulations and requirements established by the MDE with respect to county plans, reviews and exemptions.

- ***County Plans*** –If a proposed amendment to a County Water and Sewer Plan results in a new discharge or a major modification of an existing discharge to a Tier II water body, the applicant shall perform a Tier II anti-degradation review.

- ***Tier II Anti-degradation Review*** – The analysis must include reasonable alternatives that do not require direct discharge to a Tier II water body (no-discharge alternative). The analysis must include cost data and estimates to determine the cost effectiveness of the alternatives.

- ***Exemptions*** – The requirement to perform a Tier II anti-degradation review does not apply to individual discharges of treated sanitary wastewater of less than 5,000 gallons per day, if all of the existing and current uses continue to be met.

### Section 4.3.3 Tier III Waters

Tier III governs high-quality waters that are considered outstanding national resources, such as waters of national and State parks and wildlife refuges, or waters of exceptional recreational or ecological significance. Tier III guidelines prevent any action that would threaten the quality of these waters.

## Section 4.4 Tier II Waters in Queen Anne's County

The Tier II catchments areas encompass approximately 40.6% of the land area of the County. The Tier II Catchment areas include approximately 151 square miles or approximately 96,400 acres. Table 4-4: Tier II Catchment Areas by Watershed illustrates the percentage of each watershed that is in a Tier II Catchment Area. The Sanitary Sewer Service Areas within Tier II High Quality Waterways located in Queen Anne's County's thirteen Tier II catchment areas are illustrated in Map ESA-6.

**Table 4-2: Tier II Catchment Areas by Watershed**

| Watershed | Tier II Catchments | |
|---|---|---|
| | Acres | Percent of Watershed |
| Corsica River | 12,339 | 51.7% |
| Eastern Bay | 0 | 0.0% |
| Kent Island Bay | 0 | 0.0% |
| Kent Narrows | 0 | 0.0% |
| Lower Chester River | 51 | 0.3% |
| Middle Chester River | 0 | 0.0% |
| Southeast Creek | 16,857 | 48.5% |
| Tuckahoe Creek | 35,307 | 76.5% |
| Upper Chester River | 25,284 | 48.4% |
| Upper Choptank | 239 | 12.4% |
| Wye River | 6,286 | 21.3% |
| **TOTAL** | **96,363** | **40.6%** |

*Source: Calculated using Tier II Catchment Areas identified by MDE.*

Within the Tier II catchment areas, there are nineteen listed surface water streams that have been designated by the MDE as Tier II waters. Table 4-5: Queen Anne's County Tier II Waters, indicates the date the stream segment was listed, the 12-digit watershed and the Index of Biotic Integrity (IBI).

The Index of Biotic Integrity (IBI) is a tool or scale which is used to determine the health and integrity of the fish community in a given waterway. Maryland utilizes a scale of 1-5. The lower the score, the healthier the system is to support a variety of aquatic habitats.

**Table 4-3: Queen Anne's County Tier II Waters**

| Queen Anne's County Tier II Waters | | | | |
|---|---|---|---|---|
| **Date Listed** | **Stream Name** | **12 Digit Watershed** | **Fish IBI*** | **Benthic IBI*** |
| 2008 | Alder Branch 1 | 021305070395 | 4.67 | 4.71 |
| 2003 | Andover Branch 1 | 021305100425 | 4.17 | 4.57 |
| 2009 | Andover Branch 2 | 021305100425 | 4.33 | 5.00 |
| 2007 | Andover Branch UT 1 | 021305100425 | 4.67 | 4.71 |
| 2007 | Blockstone Branch UT 1 | 021304050529 | 4.00 | 4.14 |
| 2008 | Browns Branch 1 | 021305080401 | 4.33 | 4.71 |
| 2008 | Browns Branch 2 | 021305080401 | 4.44 | 4.71 |
| 2007 | Granny Finley Branch 1 | 021305080399 | 4.00 | 4.00 |
| 2008 | Mill Stream Branch 1 | 021305070396 | 4.67 | 4.43 |
| 2007 | Norwich Creek 1 | 021304050522 | 4.67 | 4.71 |
| 2003 | Red Lion Branch 1 | 021305100419 | 4.30 | 4.45 |
| 2007 | Red Lion Branch UT 1 | 021305100420 | 4.33 | 4.14 |
| 2007 | Southeast Creek 1 | 021305060401 | 4.67 | 4.43 |
| 2008 | Southeast Creek 2 | 021305080401 | 4.17 | 4.29 |
| 2003 | Southeast Creek UT 1 | 021305080403 | 4.33 | 5.00 |
| 2007 | Three Bridges Branch 1 | 021305070397 | 4.17 | 4.43 |
| 2008 | Tuckahoe River 1 | 021304050531 | 4.67 | 5.00 |
| 2007 | Wye East River UT 1 | 021305030436 | 4.67 | 4.71 |
| 2008 | Wye East River UT 2 | 021305030436 | 4.00 | 4.14 |

*Note: Specific latitude and longitude for each stream section can be obtained on MDE's website.*

*IBI = Index of Biotic Integrity

*Source: Maryland Department of the Environment, 2009.*

## Section 4.5 Impaired Water Bodies and TMDLs

Waters are classified as impaired when they exceed the water quality standards established for the water body. There are numerous standards or thresholds, including dissolved oxygen, nutrients (such as nitrogen and phosphorous), sediments, bacteria, metals, and other toxic contaminants, and biological criteria that can be measured to determined if the water body can meet the requirement to "support aquatic life."

Total Maximum Daily Loads (TMDLs) are assessments of the water bodies' threshold for accepting pollutant loads.. A TMDLs assessment includes estimates of the maximum amount of pollution loads, from all sources, at which the water quality standards of that water body is attained. **Map ESA-4-Watersheds**, illustrates the impaired watershed in the County that have a TMDL study completed. At this time, TMDL assessments have not been completed by the MDE for seven on the County's eleven sub-watersheds. MDE anticipates the studies to begin in 2010-2011. Once TMDL values are established, new development in those watersheds must comply with those standards. Table 4-6 lists the impairment status and available TMDL values for nitrogen and phosphorus.

**Table 4-4: Watershed Impairment & TMDL Status**

| MDE-8-Digit Number | Watershed Name | Impairment Status | TMDL for Nitrogen (lbs/year) | TMDL for Phosphorus (lbs/year) |
|---|---|---|---|---|
| 02130404 | Upper Choptank *(includes Templeville and surrounding area)* | Impaired | Pending | Pending |
| 02130405 | Tuckahoe Creek *(includes Queen Anne and surrounding area)* | Impaired | Pending | Pending |
| 02130501 | Eastern Bay | Impaired | Pending | Pending |
| 02130503 | Wye River *(includes Queenstown and surrounding area)* | Impaired | Pending | Pending |
| 02130504 | Kent Narrows | Impaired | Pending | Pending |
| 02130505 | Lower Chester River | Impaired | Pending | Pending |
| 02130507 | Corsica River *(includes Centreville and surrounding area)* | Impaired w/TMDL Completed | *Year 2000 Study* 287,670 | *Year 2000 Study* 22,244 |
| 02130508 | Southeast Creek *(includes Church Hill and surrounding area)* | Impaired w/TMDL Completed | *Not Studied* | *Year 2003 Study* 21,113 |
| 02130509 | Middle Chester River | Impaired w/TMDL Completed | *Year 2006 Study* 275,437 | *Year 2006 Study* 16,709 |
| 02130510 | Upper Chester River *(includes Sudlersville Barclay and surrounding area)* | Impaired w/TMDL Completed | *Year 2006 Study* 614,612 | *Year 2006 Study* 34,354 |
| 02130511 | Kent Island Bay | Impaired | Pending | Pending |

*Source: Maryland Department of the Environment, 2009.*

## Section 4.6 Land Use and Impervious Cover by Watershed

Table 4-7 shows acreage of different types of land cover and the amount of impervious surface area for each of the sub-watersheds within the County.

**Table 4-5: Existing Land Cover and Impervious Area by Watershed (Acres) – 2008**

| Watershed | Total Area | Commercial | Industrial | Residential | Agricultural | Natural Features* | Transportation & Utilities | Impervious Surface** |
|---|---|---|---|---|---|---|---|---|
| Corsica River | 23,886.0 | 578.60 | 0 | 2,487.9 | 14,412.00 | 6,272.5 | 135.0 | 855.0 |
| Eastern Bay | 11,540.5 | 566.2 | 0.4 | 4,419.3 | 3,844.6 | 2,668.0 | 42.0 | 1,039.0 |
| Kent Island Bay | 5,040.9 | 304.7 | 0 | 2,138.90 | 1,133.2 | 1,437.3 | 26.8 | 529.0 |
| Kent Narrows | 6,793.8 | 129.3 | 0 | 1,884.3 | 2,241.4 | 2,529.7 | 9.1 | 382.0 |
| Lower Chester River | 17,659.9 | 432.7 | 56.9 | 1,983.2 | 9,636.1 | 5,390.0 | 161.0 | 811.0 |
| Middle Chester River | 7,815.3 | 80.6 | 0 | 1,035.9 | 5,754 | 944.8 | 0 | 246.0 |
| Southeast Creek | 34,730.9 | 144.2 | 0 | 2,157.9 | 22,880.1 | 9,395.7 | 129.0 | 661.0 |
| Tuckahoe Creek | 46,047.1 | 69.70 | 0 | 1,935.3 | 32,125.9 | 11,916.2 | 0 | 748.0 |
| Upper Chester River | 52,157.9 | 314.0 | 55.8 | 4,272.4 | 30,946.3 | 16,460.2 | 109.2 | 1,073.0 |
| Upper Choptank | 1,926.0 | 0.3 | 0 | 83.2 | 937.8 | 904.7 | 0 | 26.0 |
| Wye River | 29,512.9 | 311.4 | 163.2 | 2,943.3 | 18,640 | 7,334.8 | 129.2 | 839.0 |

*Source: Calculated for each sub-watershed using data provided by Queen Anne's County Department of Land Use, Growth Management and the Environment. **Values from Impervious Cover Geodatabase.*

Existing development and development potential to the year 2030 and beyond were studied to determine the impacts on environmentally sensitive areas and water resources. The Build-Out Report contained in Appendix 5 analyzes existing conditions and build-out scenarios under maximum capacity conditions (referred to as Scenario 1). Through this water resources impact analysis of the potential impacts of development, a Growth Management Strategy (Scenario 2) emerged as the preferred future development scenario for further study and evaluation by directing development to County and Town Planning Areas.

Scenario 2 represents a balance of interests with respect to the preservation/conservation of agricultural and natural lands, community development and protection of water resources. The projected land cover/land use, impervious surface and protection of agricultural and natural lands for this scenario also referred to as the ***preferred future land use plan*** is detailed in Section 11.0 for each of the sub-watersheds. Impervious surface area has been calculated using two methods, one by Queen Anne's County and the other method calculated by Maryland Department of the Environment. A comparison of the two methods is provided in Table 4-8.

- The Queen Anne's County Department of Land Use, Growth Management & Environment impervious cover geodatabase was created in 2009. The impervious cover geo-database provides a general estimate amount of impervious cover within each watershed, based on features including paved and unpaved roads, bridges, paved and unpaved parking lots, driveways, public sidewalks, pools, buildings, paved athletic areas (i.e. – tennis courts), decks and patios, and stockpile, or mining areas. The percentage of impervious surface per watershed ranges from 1.4% in the Upper Choptank Watershed to 10.5% in the Kent Island Bay Watershed.

- Maryland Department of Environment provided an estimate of the amount of impervious cover and loading values per watershed (refer to Section 11.0 for tables for each sub-shed and Town). The estimates are based on acreage of land use as multiplied by a "standard" percentage that would be expected per land use. The percentage of impervious cover per watershed ranges deviate slightly from the County's results, due to the level of sophistication of the County's geo-database.

**Table 4-6: Comparison of Impervious Cover Estimates**

| Watershed | MDE - MDP Values from WRE Tables | | Queen Anne's County Department of Land Use, Growth Management & Environment Values from Impervious Cover Geodatabase | |
|---|---|---|---|---|
| | Estimate Impervious Cover (Acres) | Percent of Watershed | Impervious Cover (Acres) | Percent of Watershed |
| Corsica River | 774 | 3.2% | 855 | 3.6% |
| Eastern Bay | 1,054 | 9.1% | 1,039 | 9.0% |
| Kent Island Bay | 549 | 10.9% | 529 | 10.5% |
| Kent Narrows | 363 | 5.3% | 382 | 5.6% |
| Lower Chester River | 752 | 4.3% | 811 | 4.6% |
| Middle Chester River | 224 | 2.9% | 246 | 3.1% |
| Southeast Creek | 386 | 1.1% | 661 | 1.9% |
| Tuckahoe Creek | 216 | 0.5% | 748 | 1.6% |
| Upper Chester River | 687 | 1.3% | 1,073 | 2.1% |
| Upper Choptank | 9 | 0.5% | 26 | 1.4% |
| Wye River | 654 | 2.2% | 839 | 2.8% |
| **TOTAL** | **5,668** | **2.4%** | **7,209** | **3.0%** |

*Areas shaded in grey are areas approaching percentages of impervious surface of concern.*
*Source: Queen Anne's County Department of Land Use, Growth Management and the Environment and MDE/MDP Values from WRE Tables*

## Section 4.7 Water Resources

Water Restoration Action Strategy (WRAS) plans have been completed for the Corsica River Watershed (2003-2004), Middle Chester River Watershed (2001-2002), Upper Chester River Watershed (2004-2005), and the Upper Choptank River Watershed (2002-2003). Each of the plans provides a character description of ground water, surface water, and land use within the watershed. Each plan provides strategies which seek to improve or protect water resources within watersheds.

The Corsica River Watershed Restoration Action Strategy (WRAS) identified impairments and provides guidance to achieve water quality enhancement, expanded wildlife habitat, more sensitive land use conversions and conservation. Key actions recommended in the WRAS include:

- Planting cover crops: 4,000 acres of cover crops and 2,000 acres of small grain.
- Retrofitting urban stormwater facilities to be managed on 300 acres of urban lands.
- Implement 50 acres of Horse Pasture Management to limit nutrient runoff.
- Establishing approximately 100 acres of Conservation Reserve Enhancement Program buffers.
- Providing education and outreach to the public.
- Upgrading septic systems: retrofit 30 private septic systems.
- Establishing reforested buffers on non-agricultural land: approximately 200 acres of forested land.
- Assuring low impact development strategies
- Restoring oyster populations: restore 20 acres of oyster beds.
- Restoring submerged aquatic vegetation: restore 10 acres of submerged aquatic vegetation.
- Restoring wetlands: restore 50 acres of wetlands and two miles of stream channel.
- Monitor the effectiveness of BMPs.
- Upgrade and maintain Centreville Sewerage treatment plant with enhanced nutrient management.

The WRAS also recommends initiatives that will be undertaken by local government to develop and adopt policy and programmatic changes that seek to:

- Create innovative stormwater management practices for low impact development;
- Put in place tighter enforcement controls on erosion and sedimentation;
- Achieve the maximum feasible reduction of nitrogen and phosphorous in the
- municipal wastewater stream;
- Create mechanisms to design, fund, construct, and maintain acres of filtering non-tidal wetlands on public lands; and
- Teach our citizens of the environmental danger of poorly maintained septic systems, over fertilized lawns, eroding shorelines, and un-buffered streams.

## Section 4.7.1 Regional Groundwater Conditions

Groundwater is the primary source of water supply in Queen Anne's County and surrounding region. Groundwater is water that is found underground in the cracks and spaces in soil, sand and rock. Groundwater is stored in--and moves slowly through--layers of soil, sand and rocks called aquifers.

Aquifers typically consist of gravel, sand, sandstone, or fractured rock, like limestone. These materials are permeable because they have large connected spaces that allow water to flow through. The speed at which groundwater flows is dependent on several factors such as the size of spaces in the soil or rock and connectivity between these spaces.

Currently, there are no US Geological Survey (USGS) monitoring locations for ground water within Queen Anne's County. Readily available data consists of data for surrounding counties and the region referred to as the Maryland Coastal Plains.

A 2004 report by the Advisory Committee on the Management and Protection of the State's Water Resources identified the need for a comprehensive assessment of ground-water resources of the Maryland Coastal Plain. The Coastal Plains aquifers supply the majority of water needs in Queen Anne's County and surrounding region. Within the Coastal Plains, the Baltimore Metro Region is expected to grow by 300,000 people between 2000 and 2030, with the Upper Easter Shore is expected to grow by 63,000 people, and Queen Anne's County projected to grow by 21,337 people during the same timeframe.

Location of the Maryland Coastal Plain.

The Maryland Geological Survey (MGS) and the U.S. Geological Survey (USGS) have begun the first phase of a three-phase assessment of Maryland's Coastal Plain aquifer system. The assessment of the Coastal Plain region is important due to the following documented conditions:

- Water levels in the Coastal Plain aquifers are declining at a significant rate.
- Water quality in some areas is significantly compromised. Contamination such as saltwater intrusion, naturally high concentrations of trace element contaminants (including arsenic and radium) and elevated concentrations of nutrients and agricultural chemicals are of concern.
- Ground-water resource managers need better tools. There is a need for more comprehensive and interactive tools to support management and permitting decisions.

One or more of the above conditions could impact the following major aquifers supplying ground water to Queen Anne's County and Eastern Shore residents, businesses and institutions.

- The ***Columbia aquifer*** supplies some older homes and farms in the region, and is used for irrigation, but because it is shallow, it is vulnerable to contamination from surface sources and to going dry during droughts. 2008 reports indicate water levels in the Columbia (water-table) aquifer do not show any major long-term declining trend.
- The ***Miocene aquifers*** underlie the Columbia aquifer in the southeastern Queen Anne's and Talbot Counties, and are used for domestic, commercial and irrigation supplies in that area.
- The ***Piney Point Aquifer*** underlies the Miocene sediments in the southern part of the study area, but is absent in the northwest, and is a poor aquifer in some parts of the study area. It is used for domestic and commercial supplies where it is present, and for municipal supplies in neighboring Caroline and Dorchester Counties.
- The ***Aquia aquifer*** underlies the Piney Point and Columbia aquifers, and is used extensively throughout the study area, except for the southeastern portion of Talbot County. The Aquia aquifer supplies the majority of water for the County and is in many instances the most important groundwater source. Brackish water is present in the Aquia aquifer in a narrow strip along the Chesapeake Bay shore of Kent Island. Water levels in the Aquia aquifer have declines at a rate of about one-half foot per year since 1990, and may continue to decline as the region's population increases, and demand for irrigation water increases. 2008 reports indicate water levels in the Aquia aquifer do not show any major long-term declining trend.
- The ***Matawan aquifer*** underlies the Aquia aquifer in western Queen Anne's County and possibly elsewhere. It is used for small domestic supplies in parts of Kent Island where it provides an alternative water source to the Aquia aquifer and deeper Cretaceous aquifers that have severe iron problems. This problem is typically addressed through water treatment processes using various types of technology and filters resulting in the increased cost of providing potable water. Iron poses no health risks. High levels of iron content does result in poorer water quality with respect to taste and odor as well as staining of clothing and appliances, and deterioration and clogging of pipes and heating systems using water.
- The ***Magothy aquifer*** underlies the Matawan aquifer and may be hydraulically connected to it in some places. It supplies water for domestic and commercial uses on Kent Island but water from the Magothy aquifer is very high in iron, and must be treated before use. The Magothy aquifer is also used for much of the municipal water supply at Easton, where iron concentrations do not pose a problem.
- The ***Upper Patapsco aquifer*** underlies the Magothy aquifer and supplies water for domestic, commercial and municipal uses on Kent Island and eastward to Grasonville. Water from this aquifer also has a severe iron problem in the Kent Island area but becomes less severe to the east and south. 2008 reports indicate water levels in the Upper Patapsco aquifer water levels continue a general declining trend at Queen Anne, Chester, Matapeake and Kingstown.
- The ***Lower Patapsco aquifer*** underlies the Upper Patapsco aquifer on Kent Island. This aquifer has been used for part of the public supply system on Kent Island since late 1999. Although water from this aquifer requires treatment for iron, concentrations are much lower than in the Magothy and Upper Patapsco aquifers. In future water treatment plants the County will consider using ultra filtration or membrane filters to remove these contaminates from the drinking water. 2008 reports indicate that the water level in the Lower Patapsco aquifer near Chester appears to have leveled off or recovered slightly, while in wells near Kingstown, the water level continues to decrease as in previous years.

- The ***Middle Patapsco and Patuxent aquifers*** are potential ground-water sources, but are not currently used for water supply in Queen Anne's and Talbot Counties. Recent reporting as of 2008 indicates that the water level in the Patuxent aquifer appears to be leveling off near Chester.

## Section 4.7.2 Freshwater Withdrawals (Surface and Groundwater)

The following table, Table 4-9, shows the distribution of countywide water use in 2000. Although this information is dated, the distribution of usage indicated the County's major water users are irrigation (43%), Residential Self-Supplied (28%) and public supply distribution (17%). Over 91% of freshwater withdrawals are for domestic use (public and private 45%) and agricultural use (46%). Commercial and industrial users account for less than 10% of total usage.

**Table 4-7: Freshwater Withdrawals in Queen Anne's County, MD - 2000**

| Type of Withdrawal | Total Withdrawals (MGD) | | | Percent of Total County Withdrawals |
|---|---|---|---|---|
| | Surface Water | Groundwater | Total | |
| Public Supply Distribution | 0.00 | 1.47 | 1.47 | 17% |
| Residential Self-Supplied | 0.00 | 2.40 | 2.40 | 28% |
| Commercial | 0.00 | 0.49 | 0.49 | 5% |
| Industrial | 0.00 | 0.33 | 0.33 | 4% |
| Mining | 0.00 | 0.00 | 0.00 | 0% |
| Livestock Watering | 0.07 | 0.22 | 0.29 | 3% |
| Irrigation | 1.35 | 2.35 | 3.70 | 43% |
| **Total** | **1.42** | **7.26** | **8.68** | **100%** |

*Source: 2000 USGS MD-DE-DE Water Science Center, http://md.water.usgs.gov/freshwater/withdrawals/*

Groundwater is the sole source for municipal, industrial and private water supplies in the County. This is due to the availability of groundwater of good quality and the lack of suitable surface impoundment sites in the Aquia Formation, little treatment is required for potable water supplies, although water quality can vary within the aquifer. The Magothy Formation has high iron content that requires more extensive treatment. The following formation descriptions are from the Queen Anne's County Comprehensive Water and Sewerage Plan of 2006.

- ***Wicomico Formation –*** This formation exists as surface deposits over most of Queen Anne's County. Nearly all wells tapping the Wicomico Formation in the County are domestic dug or driven wells equipped with pumps yielding only a few gallons a minute. Because of its proximity to the surface, there is a high probability of groundwater contamination in this formation.
- ***Calvert Formation*** – The quality of the groundwater is generally good except for high silica content that may necessitate treatment if used for boiler purposes. Many wells have been drilled through the Calvert Formation to deeper aquifers as water was not found in the formation in sufficient quantity.
- ***Aquia Greensand Formation*** – The Aquia Greensand is currently the most important source of groundwater in Queen Anne's County. Several hundred wells withdraw water from this

formation. Most of the wells are located in a limited area on Kent Island and on the mainland at Grasonville and Queenstown. Analyses show that the groundwater from this formation contains

less iron and is softer than that from the Monmouth Formation. However, saltwater intrusion is being experienced on Kent Island. The cone of depression created by heavy pumping in the Talbot County towns of Easton and St. Michael's areas has, when combined with the Kent Island pumpage, created brackish water intrusion that is beginning to affect water quality on the northwestern half of Kent Island.

- ***Monmouth Formation*** – Water from this formation requires treatment due to excessive iron content. In the southern parts of Queen Anne's County this formation acts as a layer separating aquifers.
- ***Piney Point Formation*** – This aquifer is an important source of water in southeast Queen Anne's County.
- ***Magothy Formation*** – The Magothy Formation is an important potential source of groundwater; however iron removal will almost certainly be required. An increasing number of wells in Queen Anne's County are penetrating the Magothy Formation at this time as a result of new Aquia Greensand appropriations being restricted in the Grasonville and Kent Island area. For Kent Island, the Magothy and deeper formations will be the only sources available due to the over pumping and brackish water intrusion of the Aquia.
- ***Raritan Formation*** –Water from this formation has high iron concentrations. Although seldom tapped at this time due to its depth, the Raritan Formation is a potential water-bearing formation for the future.
- ***Patapsco Formation*** –During the winter of 1999, the Sanitary District constructed a test well into the Patapsco aquifer at the Stevensville water treatment plant. The results of the water quality analysis indicated an iron content of less than 5 parts per million, only one-sixth the iron produced by the on-site Magothy aquifer wells. As a result the Sanitary District has now drilled a production well into the Patapsco to replace the Magothy as the primary source of potable water.
- ***Patuxent Formation*** – The Patuxent Formation is a very deep aquifer in Queen Anne's County, and because large quantities of water are readily available in other aquifers, the Patuxent must be considered a reserve source rather than a source to be tapped in the immediate future. There is a potential problem with brackish water conditions.

## Section 4.8 Surface Water

The 2006 Maryland Department of the Environment's "Prioritizing Sites for Wetland Restoration, Mitigation – Queen Anne's County" report provided descriptions of surface waters within Queen Anne's County including streams and wetlands-ponds.

### Section 4.8.1 Streams

Most of the surface water drains in one of three directions from the highest natural point in the County, located one mile northwest of Starr--into the Chester River, the Choptank River (via Tuckahoe Creek) or Eastern Bay (via the Wye River, Prospect Bay, Crab Alley Bay, and Cox Creek). The western edge of Kent Island drains directly into the Chesapeake Bay.

Because the County is relatively flat and near sea level, the streams in the County are slow moving. The downstream portion of many rivers in the County are influenced by the tides and tend to have very slow "flushing" rates, reducing their ability to act as points of discharge for sewerage treatment systems.

All surface waters of Queen Anne's County have been classified as Class I or Class II. Class I waters are to be maintained as suitable for contact recreation and aquatic life. Class II waters are to be maintained as suitable for shellfish harvesting. The Code of Maryland Regulations Water Quality Regulations (COMAR 26.08.02) gives the specific water quality parameters for both classes. Limitations have been set for bacteria, nitrogen, phosphorus, sedimentation, oil, and several other pollutants.

### Section 4.8.2 Wetlands - Ponds

Wetlands are often credited with providing natural stormwater and flood control benefits. Inland wetlands adjacent to rivers, streams and creeks hold excess discharge and runoff during periods of increased precipitation such as storms and snow melts. Coastal wetlands also hold excess discharge from inland drainage networks as well as tidal waters during storms.

Ponds, marshes and oxbows serve an important function by receiving excess water during the rainy season and holding it throughout the dry season. These features receive water directly from a rising river or stream during the rainy season and then drain back into the river or stream as water levels drop. These water bodies serve as refuges for fish and other aquatic organisms.

## Section 4.9 State Priority Wetlands

**Map ESA-5 – DNR Sensitive Areas & Targeted Ecological Areas,** depicts the location of State Priority Wetlands and the Table 4-8 provides the acreage of State Priority Wetlands by Watershed. Note that not all wetlands within the County are designated as Statewide Priority Wetlands.

**Table 4-8: Statewide Priority Wetlands by Watershed**

| Watershed | Statewide Priority Wetlands | |
|---|---|---|
| | Acres | Percent of Watershed |
| Corsica River | 2,680 | 11.2% |
| Eastern Bay | 191 | 1.7% |
| Kent Island Bay | - | 0.0% |
| Kent Narrows | 520 | 7.7% |
| Lower Chester River | 807 | 4.6% |
| Middle Chester River | 61 | 0.8% |
| Southeast Creek | 5,386 | 15.5% |
| Tuckahoe Creek | 7,945 | 17.2% |
| Upper Chester River | 5,476 | 10.5% |
| Upper Choptank | 637 | 33.0% |
| Wye River | 1,710 | 5.8% |
| **TOTAL** | **25,413** | **10.7%** |

*Note: At this time, there are no Statewide identified Priority Wetlands in Kent Island Bay.*
*Source: DNR provided datasets with wetlands identified by Maryland Department of the Environment.*

## Section 4.10 Wellhead Protection Areas

Currently, due to lack of available funding, the County has not studied or identified wellhead protection areas. Wellhead protection is a strategy designed to protect public drinking water supplies by managing land surface around a well where activities might affect the quality of water. The Maryland Department of the Environment (MDE) has developed a model Wellhead Protection Ordinance for to local governments to consider in the protection of water supplies.

## Section 5.0 Study Methodology

The study is consistent with the methods outlined in MDP's Models and Guidelines publication number 26: Managing Maryland's Growth, The Water Resource Element: Planning for Water Supply and Wastewater and Stormwater Management and the maximum capacity build-out analysis methods Development Capacity. The maximum development capacity was based upon existing conditions (development supply) using current zoning and environmental constraints to determine development potential, for each eight-digit watershed in the County. The results of this watershed level analysis are contained within the tables and worksheets provided in Section 11.0.

### Section 5.1 Data Sources

The analysis contained in this report is based upon readily available and widely accepted data sources. The following key resource agencies provided existing condition data: Maryland Department of Planning, Maryland Department of the Environment, Queen Anne's County Department of Land Use, Growth Management & Environment, Queen Anne's County Public Works Department, Kent Narrows/Stevensville & Grasonville Wastewater Treatment Facility (KNSG), as well as the Incorporated Towns of Queen Anne's County, and others as identified within the document. The following plans provided information used to develop the Water Resources Element:

- Town of Centreville Maryland, Wastewater Capacity Management Plan 2008
- Corsica River Watershed Section 319 National Monitoring Program Project 2007
- Prioritizing Sites for Wetland Restoration, Mitigation, and Preservation in Maryland 2006 (MDE)
- Queen Anne's County Comprehensive Water and Sewerage Plan 2006
- Queen Anne's County Groundwater Protection Report, 1989
- Selected Groundwater Level Records from Observation Wells in Queen Anne's County, Maryland, Maryland Department of Natural Resources, June 2008
- Source Water Assessment from Community Water Systems in Queen Anne's County, Maryland 2003 (MDE)
- Water Restoration Action Strategy (WRAS) Plans (various 2001-2005)

Growth Element Plans - Community Plans- Comprehensive Plans

- Barclay Community Plan, 2006
- Barclay Draft Municipal Growth Element Plan, 2009
- Centreville Community Plan, 2009
- Chester/Stevensville Community Plan, 2007
- Church Hill Draft Comprehensive Plan, 2009
- Grasonville Community Plan, 2010 (draft)
- Kent Narrows Community Plan, 2006
- Queenstown Draft Community Plan, 2009
- Millington Comprehensive Plan, 2007
- Sudlersville Draft Municipal Growth Element Plan, 2009
- Templeville Draft Comprehensive Plan, 2009

## Section 5.2 Maryland Chesapeake Bay Tributary Strategies

The following summarizes the seven Statewide Tributary Strategies as outlined in Maryland's Chesapeake Bay Tributary Strategy Statewide Implementation Plan (January 2008).

### Section 5.2.1 Point Source Tributary Strategy

The Point Source Tributary Strategy addresses impacts attributed to specific identifiable end of pipe or point. Point sources are typically wastewater treatment plant (WWTP) outfalls. The strategy includes upgrade plans for WWTPs to use Enhanced Nutrient Removal (ENR) technology to meeting nutrient loading caps established for WWTPs. For local governments this may entail planning, design, and construction of ENR projects; developing implementation schedules to meet 2010 Urban Source Tributary Strategy goals, and seeking funding to make projects more affordable. The Urban Source Tributary Strategy recognizes that urban development, impervious surfaces, and sprawl development impact water qualities. Identified strategies include urban nutrient management, tree planting, urban forest buffers, erosion and sediment control, stormwater management, stream restoration, septic connections, septic denitrification, and WWTP upgrades.

### Section 5.2.2 Stormwater Tributary Strategy

The Stormwater Tributary Strategy seeks to support the implementation of stormwater practices including upgrades of older systems and/or retrofitting developments with stormwater facilities, promoting erosion and sediment control measures, as well as implementing the approaches identified in the Maryland Stormwater Design Manual and the Municipal Separate Storm Sewer System (MS4) Permit Program. For local governments this includes adoption of stormwater management ordinances, plan reviews, plan approvals, inspections, enforcement, monitoring, etc. of stormwater projects as well as erosion and sediment control measures, support for implementation of the Stormwater Strategy to minimize the water quality impacts on local waterways, and consideration of establishing stormwater utilities (secure stable funding and develop new and innovative financing strategies for stormwater management programs).

### Section 5.2.3 Onsite Sewage Disposal Systems (OSDS) Tributary Strategy

The Onsite Sewage Disposal Systems (OSDS) Tributary Strategy addresses the impact that septic systems have in contributing nitrogen to water systems. The strategy seeks to have 100 percent of all new OSDS include enhanced denitrification technology (nitrogen removal capabilities). The strategy acknowledges that closing the gap through implementation may be difficult but that it is necessary to reduce loadings on the Chesapeake Bay. The State has identified steps toward achieving the goal including exploration of updating the Code of Maryland Regulations, use of the Chesapeake Bay Restoration Funds, and legislative means to require or provide incentives for upgrading OSDS. Local governments are encouraged to implement local policies and code changes to encourage or require upgrades as well as seek supportive funding.

### Section 5.2.4 Growth Management Tributary Strategy

The Growth Management Tributary Strategy reaffirms the State's commitment to achieve a 30% reduction in the annual average rate of sprawl development. The strategy reiterates the significance of Priority Funding Areas (PFAs) and directing growth to County and Town designated areas, as well as the role of the Rural Legacy Program to protect large contiguous tracts of land from sprawl development. For local governments, achieving the strategy may be realized by updating Comprehensive Plans that

direct growth to PFAs and designated areas, plan for appropriate development within areas with impaired waters, and consider Total Maximum Daily Loads (TMDLs) and impaired waters in zoning decisions and land use planning.

### Section 5.2.5 Agricultural Tributary Strategy

The Agriculture Tributary Strategy includes working with the farm community to implement a range of Best Management Practices (BMP) across a watershed to reduce nutrient and sediment loads. The Maryland's Chesapeake Bay Tributary Strategy Statewide Implementation Plan identifies expanded BMP options and over 23 practices to protect soil and nature resources, such as manure/nutrient management, precision agriculture, and cover crops, among others.

### Section 5.2.6 Air Deposition Tributary Strategy

The Air Deposition Tributary Strategy is closely tied to requirements placed on Maryland through the EPA's Clean Air Act, particularly nitrogen oxide emission reductions and the nitrogen loads on the Chesapeake Bay. The Maryland Health Air Act (HAA) was developed with the purpose of bringing Maryland into attainment with the National Ambient Air Quality Standards (NAAQS) for ozone and fine particulate matter by the federal deadline of 2010. The act seeks reductions of nitrogen oxide, sulfur dioxide, and mercury emissions primarily from coal-burning power plants, but also addresses emission from vehicle emissions.

### Section 5.2.7 Other State Initiatives to Address Implementation Gaps Tributary Strategy

The Other State Initiatives to Address Implementation Gaps Tributary Strategy includes identification of programs and partnerships to assist and implement strategies such as Green Highways Partnerships, Transportation Enhancement Program, Green Infrastructure, wetland restoration, habitat restoration, TMDLs, NPDES permits, land use planning, comprehensive planning, educational outreach, research, improved communication, and agricultural conservation programs, among many others.

## Section 5.3 Water Resource Element – Water Supply Capacity

This report assesses the adequacy of existing water supplies, estimates future water demands, identifies adequate sources and infrastructure for future needs and identifies steps that need to be taken to protect existing and future water supply sources. MDE methods have been used to conduct this assessment and to support recommendations.

The assessment assumes that the best producing wells are not in operation which would result in water supply circumstances appearing more severe than actually exists. Therefore, the analysis "builds-in" a water system redundancy and measures the delivery systems ability to provide water in the event of mechanical failure or systems break-down.

## Section 5.4 Point & Non-Point Source Nutrients & Loadings

Tables contained in Section 11.0 for each of the County's eight-digit sub-watershed identify the baseline nutrient loads for Nitrogen and Phosphorus as calculated from the 2002 Maryland Land Use Land Cover datasets. In order to measure the impact of change in the baseline nutrient loads resulting from the land use changes experienced in the County since 2002, the first scenario includes the inventory of land uses in the County in 2008 and a calculation of the nutrient loads generated by the change in land uses during that period. The 2008 County land use dataset used for the County's Build-Out Scenarios. The

second scenario in tables contained in Section 11 includes land uses as a result of the Maximum Build-Out Scenario. The third scenario, whose acreages of land uses are similar to Scenario 2, directs growth to County and Town Planning Areas and accounts for consideration of green-belts and lower densities in the rural areas. The third scenario seeks to encourage any new development to be directed to existing and planned sewer service areas.

Estimates of Nitrogen loadings (point source, non-point source and septic), Phosphorus loadings (point source, non-point source, and septic) based upon the completed TMDL Studies in four of County's eight-digit watersheds is also incorporated into the table to measure the projected impacts of the various land use scenarios against established maximum nutrients loadings and the 2002 baseline conditions.

## Section 5.5 Corsica River Watershed National Monitoring Program Project

As part of EPA's Clean Water Act Section 319 grant, the Corsica River Watershed was selected as a National Monitoring Program project. The purpose of the grant is to record and monitor agricultural non-point source pollution, and development of non-point source pollution and the impacts of best management practices (BMPs) on water quality in an attempt to remove a Chesapeake Bay sub-watershed from the 303d list of impaired waters. Specific monitoring objectives include documenting tidal and non-tidal surface water nutrient concentrations and loads, effectiveness of cover crops, effectiveness of nitrogen removing on-site sewage disposal systems, and effectiveness of urban stormwater management retrofits. The project is currently on-going with an estimated 2005-2010 timeframe.

## Section 6.0 Municipal Growth Elements

The following Table 6-1summarizes planned municipal growth within incorporated Towns within Queen Anne's County as described in their Municipal Growth Elements.

**Table 6-1: Summary of Municipal Growth Elements**

| Incorporated Town | Change in Planning Area | Change in Planning Area | | Change in Incorporated Boundary (Annexation) |
|---|---|---|---|---|
| | | Existing | Establishing New Planning Areas | |
| Barclay | Barclay has identified long-term Future Planning Areas east and west of Goldsboro Rd. See Barclay Planning Area Map. | Barclay is not currently designated as a Planning Area | Barclay has proposed a 76-acre short-term Planning Area in the draft 2009 Plan | No immediate annexations are anticipated. Short-term Planning Areas may be annexed subject to water and sewer availability |
| Centreville | Centreville Planning Area has been expanded to include Greenbelt Areas and County Planned Business Park. | Centreville Growth Area includes all land within the Town and nine Planning Areas, including County Planned Business Park. | Centreville has identified nine Planning Areas totaling 1,720 acres in size. Not including Greenbelt Areas and County Planned Business Park. | No immediate annexations are anticipated. The Town anticipates a phased approach to annexation: phase one would include Planning Areas 1, 2, 4, 6, and 8; phase two Planning Areas, numbers 3, 5, 7, and 9, would be annexed subsequently. |
| Church Hill | Church Hill has identified a Study Area approximately 9,300 acres in size in their draft 2009 Plan. | Church Hill is not currently designated as a Planning Area. | Church Hill has identified eight potential Planning Areas in their draft 2009 Plan totaling 887 lots. | No immediate annexations are anticipated. The Town anticipates phased annexations of the eight Planning Areas. |
| Millington | No planned changes | No planned changes | No planned changes | No planned changes |
| Queen Anne | Queen Anne is requesting a six-month extension to their MGE. | | | |

**Table 6-1: Summary of Municipal Growth Elements (continued)**

| Incorporated Town / Population Center | Change in Planning Area | Change in Planning Area | | Change in Incorporated Boundary (Annexation) |
|---|---|---|---|---|
| Queenstown | Queenstown has identified a Study Area approximately 3,980 acres in size in their draft 2009 plan. | Queenstown's current Planning Area is approximately 2,845 acres in size. | Should Queenstown change their Planning Area it may change the size of the draft Planning Area. | Queenstown is approximately 921 acres in size. |
| Sudlersville | Sudlersville has identified a Study Area approximately 2,610 acres in size in their draft 2009 Plan. | Sudlersville is approximately 907 acres in size. | Sudlersville has identified an Inner-Loop and Outer-Loop Planning Area. The Inner-Loop is 354 acres in size. The Outer-Loop is 675 acres in size. | Sudlersville anticipates annexation of the Inner-Loop Properties as water and sewer become available and development is proposed. |
| Templeville | Templeville has identified a Study Area approximately 324 acres in size in their draft 2009 Plan. Portions of the Planning Area are within Caroline County. | Templeville is currently 48 acres in size, 30 of which are in Queen Anne's County. | Templeville has proposed a short-term and a long-term growth area. Short-term Planning Area is approximately 42 developable acres. Long-term Growth Area is approximately 55 developable acres. | Templeville anticipates annexation of parcels that are currently split between the County and Town jurisdiction. Growth will be subject to provision of water and sewer from Caroline County. |

Many of the changes, though draft, are the result of updates to Community Plans where communities are seeking to provide services and utilities to existing or anticipated development.

## Section 6.1 County Comprehensive Water and Sewerage Plan

Revise County's Water and Sewerage Plan consistent with any land use changes identified in the 2010 Comprehensive Plan, Land Use Element. Revisions should be based upon ability of the water resource (drinking water and wastewater) to support development based on population growth as well as development capacity analysis based upon zoning. Plans for water treatment and wastewater treatment facilities and collection and conveyance systems should be considered. The revisions should also take into account expansion of Growth Areas, Town Annexations and new Growth Areas to be established to accommodate growth in and around the Towns when identifying water and sewer service areas with appropriate phasing and timing consistent with land use plans.

- Conduct water availability studies and/or collaborate on regional and statewide studies.
- Evaluate regional solutions to future water supply capacity planning.
- Utilize eight-digit watersheds to identify appropriate restrictions and protections to ensure water supply to support the timing, phasing, density and intensity of land uses.
- New development must pay for the cost of providing water.

# Section 7.0 Drinking Water Assessment

A safe and adequate drinking water supply is critical to the sustainability of existing communities and to the viability of future planned growth.

## Section 7.1 General – Water Service Areas

Water services areas are identified in the County's 2006 Comprehensive Water and Sewerage Plan. The Comprehensive Water and Sewerage Plan also provides a description of **Water Service Areas and the Water Service Areas (and those areas of Public Health Concerns) Map ESA-6A** for water service area designations.

## Section 7.2 Water Treatment Facilities

The Queen Anne's County 2006 Comprehensive Water and Sewerage Plan provides an in-depth description of treatment facilities, water supplies, and water demand. An inventory of all County operated water treatment facilities in the County is included in Table 7-1. Those characteristics described include the year the facility was constructed, aquifer, number of wells, iron content, net water production capacity, GAP limit, pre-treatment type and primary treatment type. Tables 7-1 through 7-5 identify the capacity of the County operated water treatment facilities, existing production capacity, limitations and projected demands, and limits on existing Groundwater Appropriation Permits (GAPS). Table 7-6 was developed using the Maryland Department of the Environment Water Capacity and Supply worksheets and was completed to include all County and municipal water treatment facilities. For each facility, Table 7-6 illustrates the water source (aquifer), the watershed in which the facility is located, and the service area of the facility, as well as the water supply and capacity using permitted appropriations, average daily limiting factor, and planned or anticipated capacity needs based on planned developments or subdivisions.

## Section 7.3 Description of Water Treatment Facilities

This section contains a description of existing conditions for each of the Water Treatment Plants (WTPs) for Queen Anne's County Sanitary District as well as information for the individual Towns.

### Section 7.3.1 Bayside-Queens Landing Water System

The Bayside facility has two 10" wells into the Magothy aquifer (one of which had a casing failure in 2005 and is inoperable). It has a treatment capacity of 90 gallons per minute (gpm). An ion exchange unit was added in 2005 to enhance iron removal in an attempt to improve the water quality. Its daily production in fiscal year 2004 was 71,300 gpd. Its daily production in fiscal year 2008 was 72,509 gpd with a maximum output of 127,135 gpd. Storage consists of a 14,000-gallon clear well and the system is connected via a 10" main to the Queens Landing standpipe.

The Queens Landing facility has two 10" wells into the Aquia aquifer. It has a treatment capacity of 150 gpm with a maximum output of 180,000 gallons per day assuming a 20-hour run time as the maximum allowable. Its daily production in fiscal year 2004 was 32,000 gpd. Its daily production in fiscal year 2008 was 7,909 gpd with a maximum output of 49,616 gpd. Storage consists of a 425,000-gallon standpipe (of which only 120,000 gallons is considered usable from an adequate pressure point of view) shared with Bayside's water system.

### Section 7.3.2 Bridge Point Water System

This Bridge Point facility has two 6" wells into the Magothy aquifer. It has a treatment capacity of 90 gpm with a maximum output of 98,000 gallons per day assuming a 20-hour run time as the maximum allowable. An ion exchange unit was added in 2002 to enhance iron removal. Its daily production in fiscal year 2004 was 46,500 gpd. Its daily production in fiscal year 2008 was 65,538 gpd with a maximum output of 98,957 gpd. Storage consists of one 10,000-gallon and one 7,000-gallon hydro pneumatic tank, as well as a 300,000-gallon ground storage tank serviced by a booster pump station.

The Kent Island Village facility has one 6" well into the Aquia aquifer. It has a treatment capacity of 85 gpm with a maximum output of 102,000 gallons per day assuming a 20-hour run time as the maximum allowable. This system and Bridge Pointe's system were linked together in 1999 via an 8" main. Its daily production in fiscal year 2004 was only 2,400 gpd as the Sanitary District has shifted almost full reliance on the Bridge Pointe plant to provide water to the service area. Its daily production in fiscal year 2008 was 259 gpd with a maximum output of 1,450 gpd. Storage consists of a 10,000-gallon hydro pneumatic tank.

### Section 7.3.3 Grasonville Water System

This facility has two 10" wells into the Magothy, each with a yield of 700 gpm. The treatment capacity initially will be 120 gpm. The site also has a 290,000-gallon ground storage tank. Its daily production in fiscal year 2004 was 43,000 gpd. Its daily production in fiscal year 2008 was 60,838 gpd with a maximum output of 94,700 gpd. An ion exchange unit was added in 2005 to enhance iron removal.

### Section 7.3.4 Oyster Cove Water System

This facility has two 6" wells into the Aquia aquifer. It has a treatment capacity of 250 gpm with a maximum output of 300,000 gallons per day assuming a 20-hour run time as the maximum allowable. However, production from this site is restricted to 95,800 gpd due to the limit of its Groundwater Appropriation Permit (GAP). Its daily production in fiscal year 2004 was 77,000 gpd. Its daily production in fiscal year 2008 was 66,183 gpd with a maximum output of 112,410 gpd. Storage consists of a 20,000-gallon ground storage tank and an 180,000-gallon ground storage tank.

### Section 7.3.5 Prospect Bay Water System

This facility has two 10" wells into the Aquia aquifer. It has a treatment capacity of 220 gpm with a maximum output of 264,000 gallons per day assuming a 20-hour run time as the maximum allowable. Its daily production in fiscal year 2004 was 73,000 gpd. Its daily production in fiscal year 2008 was 70,378 gpd with a maximum output of 145,769 gpd. Storage consists of a 300,000-gallon elevated storage tower.

### Section 7.3.6 Riverside Water System

This facility has one 6" well into the Magothy aquifer. It has a treatment capacity of 30 gpm with a maximum output of 36,000 gallons per day assuming a 20-hour run time as the maximum allowable. Its daily production in fiscal year 2004 was 6,000 gpd. Its daily production in fiscal year 2008 was 4,190 gpd with a maximum output of 5,861 gpd. Storage consists of a 5,000-gallon hydro pneumatic tank.

## Section 7.3.7 Stevensville Water System

The Stevensville facility has a single 20" well into the lower Patapsco. It has a treatment capacity of 375 gpm with a maximum output of 450,000 gallons per day assuming a 20-hour run time as the maximum allowable. Its daily production for the fiscal year 2004 was 446,000 gpd. Its daily production in fiscal

year 2008 was 370,664 gpd with a maximum output of 490,500 gpd. Storage consists of a 36,000-gallon clear well and a 290,000-gallon ground storage tank.

The Thompson Creek facility has one 6" well into the Aquia. The water plant can only be run on an emergency basis due to the restrictions on the Groundwater Appropriation Permit. It has a treatment capacity of 210 gpm with a maximum output of 252,000 gallons per day assuming a 20-hour run time as the maximum allowable. Its daily production in fiscal year 2004 was 111,000 gpd. Its daily production in fiscal year 2008 was 112,726 gpd with a maximum output of 272,787 gpd. Storage consists of a 270,000-gallon ground storage tank.

This Chesapeake Bay Business Park facility has one 12" well into the Monmouth aquifer. It has a treatment capacity of 50 gpm with a maximum output of 60,000 gallons per day assuming a 20-hour run time as the maximum allowable. Its daily production in fiscal year 2004 was only 4,000 gpd. Its daily production in fiscal year 2008 was 33,772 gpd with a maximum output of 67,655 gpd. This plant's treatment efficiency is severely hampered by the extremely high iron concentration in the well water. Storage consists of a 250,000-gallon elevated tower shared with Thompson Creek and Stevensville and a 20,000-gallon clear well.

In addition to County managed facilities there are several Township managed facilities, including the following as illustrated in Table 7-2 and further described in this section.

**Table 7-1: Incorporated Town Water Treatment Facilities**

| Water Supply / Facility | Provides Service to: | Water Source - Aquifer (Aquia, Magothy, Patapsco) | Watershed |
|---|---|---|---|
| Centreville | Centreville Growth Area | Monmouth & Aquia | Corsica River |
| Church Hill | Church Hill | Aquia | Southeast Creek |
| Millington | Millington | Aquia | Upper Chester River |
| Queenstown | Queenstown Growth Area | Aquia | Wye River & |
| Sudlersville | Sudlersville | Aquia & Wicomico | Upper Chester River |

## Section 7.3.8 Barclay

The residents of Barclay obtain their water from private wells. Many are shallow wells which range from a depth of 25 to 35 feet and utilize the surface deposits of the Wicomico Formation for their source of water. Because the shallow aquifer has shown increasing nitrate/nitrogen levels, new wells and replacement wells are being drilled deeper into the Aquia aquifer.

Two 4-inch wells are used for fire protection. One is 54-feet deep with a yield of 45 gpm and the other is 60-feet deep with a yield of 270 gpm. The location of the two wells permits every building in the town to be protected from fire damage using normal fire-fighting equipment. The existing facilities for water supply are considered adequate and can be expected to serve well into the future.

## Section 7.3.9 Centreville Water System

The Town of Centreville operates a water supply system that serves the town and some adjacent county properties. As of 2006 there were approximately 925 building connections serving an estimated 2,500 people throughout an area of about 1,450 acres, and the Town issued 248 building permits for new construction in 2006 and 2007.

The source of water supply is from two deep wells utilizing the Monmouth and Aquia Formation aquifers. Gas chlorination is used for disinfection. However, the wells have Arsenic concentrations of 20 ppb and 28 ppb, respectively. Treatment for arsenic is required to meet the 10 ppb standard that became effective in January 2006.

The main distribution lines are of 6-inch, 8-inch, and 10-inch diameters. Storage is provided by three elevated tanks with capacities of 100,000-, 200,000- and 300,000- gallons. Any 4" service mains still existing will be eliminated as funds allow upgrading the distribution system.

Presently, the entire area within the corporate limits is serviced and the only areas outside the town limits receiving service are Queen Anne's County High School and Centreville Middle School. Ultimately, the Centreville water system may be expanded to reach other developments within the Town's planned Growth Areas.

The Centreville water service map also shows an area designated as W-3 at the intersection of U.S. Route 301 and MD 304. This is an area that has a mixture of commercial, industrial and municipal uses. In addition, there are some parcels that are currently agricultural. It is the intent that the vacant areas be developed into a County-developed business park.

Water service would either be by the Town of Centreville, or by a County owned and operated water plant. No planning or design for such a facility has been initiated as yet.

## Section 7.3.10 Church Hill Water System

In the past, residents of the Town of Church Hill obtained their water from surface deposits using private shallow wells. Most of these wells have been abandoned in favor of deep wells that are more reliable in dry periods.

The deep wells in the area are about 130 to 140 feet deep utilizing the Aquia Greensand Formation. Yields range from 20 to 60 gpm and the water quality is generally good. For fire protection there are two public deep wells located throughout the town. A sewerage system has been built which should protect the groundwater in the surface deposits from further contamination.

The Pond at Church Hill, a senior housing facility added in 2005, has a small water treatment system to service 43 age-restricted senior housing units.

### Section 7.3.11 Millington

Most of the Town of Millington lies in neighboring Kent County. However, a small portion of the Town is within Queen Anne's County. At the present time, all water needs are supplied by private wells, some of them being deep wells. Sufficient water yield is obtained from the Aquia Greensand Formation at depths of 85 to 105 feet. Except for moderate iron content, the water is of good quality.

### Section 7.3.12 Queen Anne

The Town of Queen Anne lies in both Queen Anne's County and Talbot County. Presently, private wells supply all the water needs of the area. Most of the wells are deep and a few are shallow. The shallow wells obtain a sufficient quantity of water from the Wicomico Formation at depths of 20 to 30 feet. However, water quality from these wells is high in iron content. The deep wells appear to get water of better quality utilizing the Cheswold Formation found at 80 to 100 feet or the Piney Point aquifer at 160 to 200 feet. To provide for fire protection, Queen Anne has a dry main and hydrant system. When required, water is pumped from Tuckahoe Creek into a distribution system of 4-inch diameter piping.

### Section 7.3.13 Queenstown Water System

The Charter of the Town of Queenstown requires all developed properties within the Town limits be served by a public water system owned and operated by the Town of Queenstown. In addition, the Town provides water service to Friel's Lumber Company and the Queen Anne's County Animal Control Facility which are located outside the corporate limits of the Town. The Town presently serves water to approximately 620 units plus commercial uses.

The Town of Queenstown has three wells drilled into the Aquia aquifer. As of 2006, the Town draws water from only two wells. They are referred to as the Del Rhodes Avenue Well and the Outlet Center Well. The Del Rhodes Avenue Well and the Outlet Center Well each have pumps rated at 150 gpm. The third well located at the Wall Street tower was abandoned.

The Town currently has a permitted water appropriation of 77,000 gallons per day drawn from two production wells in the Aquia aquifer and one recently permitted in the Matawan aquifer. Between 2002 and 2006, demand exceeded the permitted rate as much as 40 to 80 percent (30 to 60 thousand gallons per day). The Town currently is seeking a permit to withdraw 154,000 gallons per day; this supply will provide current residents and pending development projects, but the withdrawal rate will not provide for additional development described in the consolidated growth alternative of the Queenstown Community Plan. Further increasing municipal water supply requires expanding the Towns' waste water treatment capacity.

Due to limited water supply and arsenic contamination in existing wells, Queenstown began investigating additional water supplies in 2008. An exploratory well installed in the Matawan aquifer

indicated high production capacity (greater than 100,000 gallons per day) and overall excellent water quality (low iron and arsenic concentrations). In 2009, the exploration well was converted to a production well and currently is the Towns' main water source. During peak demand periods, water supply can be combined or blended with supply from the Aquia municipal wells while meeting the federal drinking standard for arsenic.

A new production well, permitted for up to 180,000 gallons per day, is being required contingent on accompanying improvements and increased capacity of the wastewater treatment plant. The Town has two elevated water storage tanks. The water tower at Wall Street is reported as a 50,000 gallon tank. The water tower at the Outlet well site is a 100,000 gallon tank. To ensure adequate fire flow, the Maryland Department of the Environment recommends a total storage of 432,000 gallons for municipalities with a population of less than 1,000.

A mix of residential and commercial land uses are proposed on lands adjacent to the Town and within the Queenstown growth area. If any of these lands were to be annexed, the Town will provide water and sewer service per the Town's charter. Additional water service of 300,000 to 527,000 gallons per day will be required to serve full build-out of the proposed Queenstown growth area.

### Section 7.3.14 Sudlersville Water System

Sudlersville residents presently use individual wells for their water supply needs. Some wells are shallow, utilizing the surface deposits of the Wicomico Formation. All new wells and replacement wells are utilizing the Aquia aquifer as their water source. Two new public wells were installed in the Fall of 2008 to provide service to the Town.

### Section 7.3.15 Templeville

Templeville has two-thirds of its population living in Queen Anne's County and the other third living in Caroline County. Residents use individual wells for their water supply. Many of the wells are shallow, utilizing the Wicomico Formation at depths from 15 to 30 feet. The most dependable source of good water in the area is the Aquia Greensand Formation used by deep wells of 150 to 200 feet. Present conditions are adequate at this time and will remain so providing that the surface deposits do not become contaminated.

## Section 7.3 Water Capacity Assessment

Future water demand, as illustrated in the Table 7-3 through 7-7 for all Water Treatment Facilities that provide over 20,000 gallons per day of treatment, indicates that there is a permitted capacity (appropriations) of 1.66 MGD and an average day drought demand of 1.64 MGD. According to reports all but the Riverside facility are able to meet average day drought demand. Within the water service areas there is an excess annual average daily capacity of approximately 0.5 MGD. Based on planned but undeveloped sub-divisions, there is an anticipated demand for approximately 0.3 MGD. The added demand indicates that the Grasonville, Oyster Cove, and Riverside sources would be unable to meet demand under current conditions; the most limiting factor of all three facilities is permitted average daily appropriations.

**Table 7-2: Net Treatment Capacity Compared to Service Area Demand Projections**

| System | Net Treatment Capacity | Max-Daily Demand Assuming Moderate Growth (GPD) | | | Net Treatment Capacity Deficit Compared to 2010 Demands, GPD |
|---|---|---|---|---|---|
| | | 2008 | 2010 | 2040 | |
| Stevensville | 478,400 | 609,000 | 869,000 | 1,480,000 | 390,600 |
| Bridge Pointe | 258,325 | 74,000 | 228,000 | 271,000 | 0 |
| Bayside-Queen's Landing | 355,010 | 107,000 | 168,000 | 264,000 | 0 |
| Oyster Cove | 237,900 | 125,000 | 197,000 | 254,000 | 0 |
| Riverside | 37,560 | 2,700 | 6,300 | 9,500 | 0 |
| Gransonville | 154,100 | 84,000 | 158,000 | 194,000 | 3,900 |
| Prospect Bay | 182,000 | 140,000 | 144,000 | 218,000 | 0 |

Source: Queen Anne's County, Water Service Area Study for Queen Anne's County Sanitary District, 2009

**Table 7-3: GAP Well Withdrawal Limits Compared to Service Area Demand Projections**

| Service Area | Gap Well Withdrawal Limits | | 2006 Daily Well Withdrawal | | Deficit with Best Well Out-fo-Service, GPD |
|---|---|---|---|---|---|
| | Total GPD | Best Well Out-of-Service GPD | Average | Max-Month Daily Average | |
| Stevensville | 1,255,000 | 265,000 | 639,000 | 811,000 | 546,000 |
| Bridge Pointe | 170,000 | 170,000 | 68,000 | 93,000 | 0 |
| Bayside | 300,000 | 45,000 | 91,000 | 135,000 | 90,000 |
| Oyster Cove | 187,000 | 187,000 | 84,000 | 135,000 | 0 |
| RIverside | 8,500 | 0 | 4,800 | 6,000 | 6,000 |
| Grasonville | 210,000 | 210,000 | 60,000 | 88,500 | 0 |
| Prospect Bay | 195,000 | 195,000 | 85,500 | 146,000 | 0 |

Source: Queen Anne's County, Water Service Area Study for Queen Anne's County Sanitary District, 2009

Line E on Tables 7-6 and 7-7 illustrate, based on the most limiting factor, the approximate net excess capacity (gpd) for new growth under maximum build-out conditions as identified by the Community Plans and Town Plans identified in Section 5.2. If an excess capacity value is negative, there is a capacity deficit for that demand category. For those Water Service Areas that have negative Daily Capacity or negative Net Excess Capacity (red numbers) may need to consider upgrades or changes in policy to meet anticipated growth.

The most limiting factor for water sources could include one of following; Total permitted Annual Average Daily Appropriations, Well-field capacity during drought, Safe yield of the reservoir system, Treatment Capacity, or Pump Capacity. Three of the seven County managed wells have as a limiting factor "Well-field capacity during drought," the remainder have "Total permitted Annual Average Daily Appropriations" as the limiting factor.

According to a Maryland Department of Natural Resources (DNR) report entitled *"Selected Ground-Water Level Records from Observation Wells in Queen Anne's County" (June 2008),* which presents information about 26 observation wells for a 21-month period; there are several groundwater source wells that are leveling off or show no indication of long-term declining trends such as the Patuxent Aquifer near Chester at Kent Island, the Lower Patapsco near Chester, and the water levels in wells in the Aquia and Columbia aquifers. There are however, reported decreases in water levels in wells near Kingstown (Lower Patapsco), and the Upper Patapsco Aquifer wells near Queen Anne, Chester, Matapeake, and Kingstown. The recorded decreases range from 3 feet to 8 feet since year 2000 observations.

According to correspondence between Maryland Department of the Environment and the Queen Anne's County Environmental Health Department (2009), regarding water levels in the region south of Centreville and the impact of large water appropriations users (typically farms for irrigation), there would be approximately a 50-foot drop in water levels but that drawdown would be within the 80% management level for wells; i.e. minimal impact to water supply for large appropriation users. There may however be impact to domestic users which would require a *"minimum 142 feet of 4- inch casing or a deep packer system to maintain functionality."* The average depth of domestic wells in the area is unknown, but domestic well depths within Queen Anne's County tend to be 200-300 feet, and a large percentage of the older domestic systems rely on suction, packer systems, or submersible pumps (but that may be less than 100 feet down) to access water. In the future however, "*since the top of the aquifer averages -285 feet (below sea level), a new well constructed with 345 feet of 4-inch casing would ensure performance now and into the future."* The correspondence infers that there is water supply (capacity), even for large appropriations users and domestic users, but that older domestic wells may be impacted and need to be upgraded to include " casings or submersible pumps that are at least 100-feet down.

## Section 7.5 Maximum Capacity Water Demand

An estimate maximum capacity water demand was determined based on the output from the Queen Anne's County Build-Out Analysis Report, using Baseline Scenario 2: Maximum Capacity Build-Out as illustrated on the **Baseline 2 Maximum Capacity Build-Out** map. Table 7-8: Water Demand under Maximum Capacity Build-Out shows the demand for water, assuming the development of additional housing units and additional non-residential space were to use water at a rate of 250 gpd for each housing unit and 0.375 gpd per each square foot of non-residential space. These water usage rates are generalized average rates used statewide for analytical purposes. The rates are typically higher than observed local rates of water usage for residential and non-residential uses.

**Table 7-4: Water Demand under Maximum Capacity Build-Out**

| Baseline Scenario 2: Maximum Capacity | 2008 Existing Conditions | Estimated Short-Term Projected Conditions 2015-2020 (includes Towns) | | Estimated Long-Term Projected Conditions 2050-2100 (includes Towns) | |
|---|---|---|---|---|---|
| | Existing Development | Total Development | Water Supply – Demand/ Needs* (MGD) | Total Development | Water Supply-Demand /Needs (MGD) |
| Population | 47,091 | 59,161 | | 115,479 | |
| Additional Housing Units (units) | 18,890 | 23,368 | 5.84 | 45,638 | 11.4 |
| Additional Square Footage of Non-residential Space (square feet) | 10,096,366 | 11,251,290 | 4.22 | 22,428,764 | 8.4 |
| **TOTAL** | | | 10.06 | | 19.8 |

** Based on 250 gpd per housing unit and 0.375 gpd per square foot of non-residential space.*

For purposes of this water demand analysis, Table 7-8 indicates that the County has 18,890 existing dwelling units. Applying the 250 gpd standard, these units could generate a demand for 4.72 MGD of water. Added with non-residential uses totaling 10,096,366 square feet, an additional 3.78 MGD of water demand could be generated, for a total existing County demand of 8.5 MGD. Under Maximum Capacity Build-Out short-term projected conditions there could be a demand for an additional 1.12 MDG for short-term residential demand and an additional 433,000 gpd for short-term non-residential demand would increase projected demands to a total 10.06 MGD. Under a Maximum Capacity Build-Out long-term, the amount of water demand could more than double over existing demand to 19.8 MGD,

In the 2009 Water Service Area Study prepared for the Queen Anne's County Sanitary District, it was projected that by 2040:

- None of the service areas, except Grasonville, would have the required groundwater appropriations permit withdrawal limits to meet the anticipated demands associated with a moderate growth scenario by 2040 considered in the study.
- The Stevensville, Bayside and Riverside service areas would experience severe shortages if the largest well in either service area failed under current maximum-day demands.
- Stevensville and Grasonville service area demands will exceed the net treatment capacity.
- Backup well capacity would be needed for Stevensville, Bayside and Riverside.
- Interconnection of separate service areas would provide increased redundancy and would minimize the potential for system failures.

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**Table 7-5: Queen Anne's County Water Treatment Facilities**

| Facility | Year Constructed | Aquifer | No. of Wells | Iron (MG/L) | Net Water Production Capacity, GPD | GAP (1) Limit, GPD | Treatment Type | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Pre-Treatment | Primary Treatment |
| Bayside | 1992 | Magothy | 1 | 26 | 193,100 | 144,00 | Ion Exchange | Microfloc Aquarius |
| Queen's Landing | 1984 | Aquia | 2 | 1.2 | 167,910 | 27,000 | -- | Permutit Pressure Filters |
| *Bayside/Queen's Landing Service Area Total* | | | *3* | | *361,010* | *171,000* | | |
| Bridge Pointe | 1990 | Magothy | 2 | 16 | 139,200 | 100,000 | Ion Exchange | Manganese Greensand |
| Kent Island Village(3) | 1986 | Aquia | 1 | 1 | 179,125 | 15,000 | -- | Ion Exchange |
| *Bridge Point/KIV Service Area Total* | | | 3 | | *318,325* | *115,000* | | |
| Business Park | 1986 | Monmouth | 1 | 32 | 82,400 | 170,000 | -- | Microfloc Trident |
| Stevensville | 1986 & 1991 | Lower Patapsco | 1 | 9 | 408,000 | 750,000 | -- | Microfloc Aquarius |
| Thompson Creek | 1988 | Aquia | 1 | 0.3 | 350,600 | 5,000 | | Microfloc Trident |
| *Stevesnville Service Area Total*(2) | | | 3 | | *490,400* | *920,000* | | |
| Oyster Cove | 1987 | Aquia | 2 | 0.2 | 237,900 | 95,800 | -- | Pressure Filtration |
| Riverside | 1991 | Magothy | 1 | 16 | 37,560 | 5,100 | -- | Manganese Greensand |
| Grasonville | 1996 | Magothy | 2 | 20 | 154,100 | 100,000 | Ion Exchange | Microfloc Trident |
| Prospect Bay West | 1975 | Aquia | 2 | 0.2 | 182,000 | 125,000 | -- | Iron-oxide Filtration |

Source: Queen Anne's County, Water Service Area Study for Queen Anne's County Sanitary District, 2009

Notes: (1) Groundwater Appropriation Permit daily average on a yearly basis.
(2) Stevensville service area total does not include values from Thompson Creek WTP because that facility is for emergencies only.
(3) Kent Island Village WTP is currently out-of-service pending resolution of ion exchange tank malfunction.

**Table 7-6: Water Treatment Plant Capacity by Category**

| Water Treatment Facility | No. of Wells | Well Design Capacity GPD | GAP Well Withdrawal Limits Maximum Daily GPD | Design Treatment Capacity GPD | Gross Treatment Capacity GPD | Net Treatment Capacity GPD | Production Limitation |
|---|---|---|---|---|---|---|---|
| Stevensville WTP | 1 | 840,000 | 1,000,000 | 480,000 | 480,000 | 408,000 | Treatment Capacity |
| Business Park WTP | 1 | 420,000 | 255,000 | 420,000 | 96,000 | 70,400 | Treatment Capacity |
| Thompson Creek WTP | 1 | 420,000 | 10,000 | 420,000 | 360,000 | 350,600 | GAP Limit |
| Bridge Pointe WTP | 2 | 240,000 | 150,000 | 180,000 | 156,000 | 139,200 | Treatment Capacity |
| Kent Island Village | 1 | 180,000 | 20,000 | 180,000 | 180,000 | 119,125 | GAP Limit |
| Bayside WTP | 1 | 240,000 | 255,000 | 240,000 | 216,000 | 193,100 | GAP Limit |
| Queen's Landing WTP | 2 | 210,000 | 45,000 | 180,000 | 174,000 | 161,910 | GAP Limit |
| Oyster Cove WTP | 2 | 300,000 | 187,000 | 240,000 | 240,000 | 237,900 | GAP Limit |
| Riverside WTP | 1 | 120,000 | 8,5000 | 120,000 | 60,000 | 37,560 | Treatment Capacity |
| Grasonville WTP | 2 | 240,000 | 210,000 | 168,000 | 168,000 | 154,100 | Treatment Capacity |
| Prospect Bay WTP | 2 | 336,000 | 195,000 | 192,000 | 192,000 | 182,000 | Treatment Capacity |

Source: Queen Anne's County, Water Service Area Study for Queen Anne's County Sanitary District, 2009

## Table 7-7: County Facilities – Summary of Water Supply and Demands

| WATER SUPPLY FACILITY | Bay Side* | Bridge Pointe** | Grasonville | Oyster Cove | Prospect Bay | Riverside | Stevensville*** | WATER SUPPLY |
|---|---|---|---|---|---|---|---|---|
| Provides Service to: | Chester Growth Area | Chester Growth Area | Grasonville Growth Area | Kent Narrows Growth Area | Stevensville Growth Area | Chester Growth Area | Stevensville Growth Area, Chesapeake Bay Business Park, Thompson Creek | |
| Water Source - Aquifer (Aquia, Magothy, Patapsco) | Magothy & Aquia Aquifers | Magothy & Aquia Aquifers | Magothy Aquifer | Aquia Aquifer | Aquia Aquifer | Magothy Aquifer | Patapsco, Magothy, Aquia Aquifers | |
| WATERSHED | Lower Chester Watershed | Eastern Bay Watershed | Lower Chester Watershed | Kent Narrows Watershed | Eastern Bay Watershed | Eastern Bay Watershed | Stevensville: Eastern Bay Watershed Chesapeake Bay Business Park: Kent Island Bay Watershed Thompson Creek: Eastern Bay Watershed | |
| **EXISTING CONDITIONS / CAPACITY** | | | | | | | | |
| **A. Total Permitted Annual Average Daily Appropriations** | **198,000 gpd** | **211,600 gpd** | **100,000 gpd** | **95,800 gpd** | **125,000 gpd** | **5,100 gpd** | **925,000 gpd** | **1,660,500 gpd** |
| Average Day Capacity Limitation based on most limiting factor | 193,846 gpd | 85,846 gpd | 100,000 gpd | 95,800 gpd | 125,000 gpd | 5,100 gpd | 134,615 gpd | 740,208 gpd |
| *LIST the MOST LIMITING FACTOR (Total permitted Annual Average Daily Appropriations, Well-field capacity during drought, Safe yield of the reservoir system, Treatment Capacity, or Pump Capacity):* | Well-field capacity during drought / 1.3 Peak Factor | Well-field capacity during drought / 1.3 Peak Factor | Permitted Average Daily Appropriations | Permitted Average Daily Appropriations | Permitted Average Daily Appropriations | Permitted Average Daily Appropriations | Well-field capacity during drought / 1.3 Peak Factor | |
| **B. EXISTING DEMAND (Average Day Drought Demand)** | **114,585 gpd** | **90,229 gpd** | **51,170 gpd** | **90,229 gpd** | **104,711 gpd** | **6,510 gpd** | **706,430 gpd** | **1,163,865 gpd** |
| Population Served | 1,550 | 750 | 766 | 588 | 754 | 58 | 5,530 | 9,996 |
| Number of Connections (Residential and Non-Residential) | 649 | 235 | - | 275 | - | 54 | 2,332 | 3,545 |
| **C. EXCESS ANNUAL AVERAGE DAILY CAPACITY** | | | | | | | | |
| Excess Average Day Capacity (Appropriations - Demand) | 83,415 **gpd** | 121,371 **gpd** | 48,830 **gpd** | 5,571 **gpd** | 20,289 **gpd** | (1,410) **gpd** | 218,570 **gpd** | 496,635 **gpd** |
| **D. PLANNED or ANTICIPATED CAPACITY NEEDS** | | | | | | | | |
| Potential Annual Avg. Daily Demand (from approved but undeveloped subdivisions/permits) | 35,000 gpd | 32,500 gpd | 60,000 gpd | 51,000 gpd | 2,250 gpd | 3,750 gpd | 110,000 gpd | 294,500 gpd |
| **E. NET EXCESS CAPACITY:** | 48,415 **gpd** | 88,871 **gpd** | (11,170) **gpd** | (45,429) **gpd** | 18,039 **gpd** | (5,160) **gpd** | 108,570 **gpd** | 202,135 **gpd** |
| **F. POTENTIAL ADDITIONAL USERS BASED ON NET EXCESS CAPACITY** | | | | | | | | |
| Potential Additional Units (Net Excess Capacity / 250 gpd ) | 194 Units | 355 Units | (45) Units | (182) Units | 72 Units | (21) Units | 434 Units | 809 Units |

A = Permitted Appropriations
B = Existing Demand
C = Excess Daily Capacity (A-B)
D = Demand based on known developments, includes residential and non-residential flows
E = Net Excess Capacity after consideration for Planned or Anticipated Capacity Needs (C - D)
F = Potential additional development based on net excess capacity as divided by 250 gpd (E / 250 gpd)

**Bayside includes Bayside and Queen's Landing Facilities*
*** Bridge Point includes Bridge Pointe and Kent Island Facilities*
**** Stevensville includes Stevenville, Chesapeake Bay Business Park and Thompson Creek Facilities*
*Source: WRE Water Capacity and Supply Worksheets (2006) & Queen Anne's County Comprehensive Water and Sewer Plan 2006 as updated*

**Conclusions: Water Service Areas that have negative Daily Capacity or negative Net Excess Capacity (red numbers) may need to consider upgrades or changes in policy to meet anticipated growth.**

**Table 7-8: Town Facilities – Summary of Water Supply and Demand**

| WATER SUPPLY FACILITY | Sudlersville | Queenstown | Centreville | TOTAL WATER SUPPLY |
|---|---|---|---|---|
| Provides Service to: | Sudlersville | Queenstown Growth Area | Centreville Growth Area | |
| Water Source - Aquifer (Aquia, Magothy, Patapsco) | Aquia & Wicomico | Aquia | Monmouth & Aquia | |
| WATERSHED | Upper Chester River | Wye River & Lower Chester River | Corsica River | |
| EXISTING CONDITIONS / CAPACITY | | | | |
| **A. Total Permitted Annual Average Daily Appropriations** | **17,500 gpd** | **77,000 gpd** | **645,000 gpd** | **739,500 gpd** |
| Average Day Capacity Limitation based on most limiting factor | 17,700 gpd | 137,000 gpd | 775,400 gpd | 930,100 gpd |
| *LIST the MOST LIMITING FACTOR (Total permitted Annual Average Daily Appropriations, Well-field capacity during drought, Safe yield of the reservoir system, Treatment Capacity, or Pump Capacity):* | | | | |
| **B. EXISTING DEMAND (Average Day Drought Demand)** | **19,470 gpd** | **102,000 gpd** | **459,800 gpd** | **581,270 gpd** |
| Population Served | 432 | 635 | | 1,067 |
| Number of Connections (Residential and Non-Residential) | 293 | 640 | | 933 |
| **C. EXCESS ANNUAL AVERAGE DAILY CAPACITY** | | | | |
| Excess Average Day Capacity (Appropriations - Demand) | (1,970) **gpd** | (25,000) **gpd** | 185,200 **gpd** | 158,230 **gpd** |
| **D. PLANNED or ANTICIPATED CAPACITY NEEDS** | | | | |
| Potential Annual Avg. Daily Demand (from approved but undeveloped subdivisions/permits) | 83,000 gpd | 180,000 gpd | 20,000 gpd | 283,000 gpd |
| **E. NET EXCESS CAPACITY:** | (84,970) **gpd** | (205,000) **gpd** | 165,200 **gpd** | (124,770) **gpd** |
| **F. POTENTIAL ADDITIONAL USERS BASED ON NET EXCESS CAPACITY** | | | | |
| Potential Additional Units (Net Excess Capacity / 250 gpd ) | - Units | - Units | 660 Units | - Units |

A = Permitted Appropriations
B = Existing Demand
C = Excess Daily Capacity (A-B)
D = Demand based on known developments, includes residential and non-residential flows
E = Net Excess Capacity after consideration for Planned or Anticipated Capacity Needs (C - D)
F = Potential additional development based on net excess capacity as divided by 250 gpd (E / 250 gpd)

**Bayside includes Bayside and Queen's Landing Facilities*
*** Bridge Point includes Bridge Pointe and Kent Island Facilities*
**** Stevensville includes Stevenville, Chesapeake Bay Business Park and Thompson Creek Facilities*

*Source: WRE Water Capacity and Supply Worksheets (2006) & Queen Anne's County Comprehensive Water and Sewer Plan 2006 as updated*

**Conclusions: Water Service Areas that have negative Daily Capacity or negative Net Excess Capacity (red numbers) may need to consider upgrades or changes in policy to meet anticipated growth.**

## Table 8-1: County / Town Facilities – Summary of Wastewater Supply and Demand

| EXISTING FLOW AND CONDITIONS | | | | | | | PLANNED "IN THE WORKS" CONNECTIONS (1) | | |
|---|---|---|---|---|---|---|---|---|---|
| A | B | C | D | E | F | G | H | I | J |
| WWTP Facility | PERMIT NUMBER | Capacity Design (MGD) | 2007 Average Daily Flow of Wastewater (MGD)* | 2008 Average Daily Flow of Wastewater (MGD) | 2- Year Rolling Average (MGD) | Remaining Capacity (MGD) | Number of Building Permits Approved / Requested (EDUs) | Estimate Flow from Nonresidential Uses (GPD) | Capacity Needed (MGD) Assuming 250 GPD per EDU Plus Flow for Non-residential development |
| Queenstown | | 0.000 | 0.077 | 0.000 | 0.077 | -0.077 | - | - | 0.000 |
| Centreville | | 0.500 | 0.222 | 0.000 | 0.222 | 0.278 | - | - | 0.000 |
| Church Hill | | 0.000 | 0.054 | 0.000 | 0.054 | -0.054 | - | - | 0.000 |
| Barclay | | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | - | - | 0.000 |
| Sudlersville WWTP | MD0020559 | 0.090 | 0.062 | 0.000 | 0.062 | 0.028 | - | - | 0.000 |

*Maryland Department of the Environment provided data

| EXISTING | INFILL DEVELOPMENT (2) | | | EXISTING DEVELOPMENT THAT COULD BE ADDED TO SYSTEM: SEPTIC ELIMINATION AREAS (3) | | | INFLOW /INFILTRATION |
|---|---|---|---|---|---|---|---|
| A | K | L | M | N | O | p | Q |
| WWTP Facility | Potential EDU's Assuming 250 GPD per EDU | Estimate Flow from Nonresidential Uses (GPD) | Capacity Needed (MGD) for INFILL AREAS Assuming 250 GPD per EDU Plus Flow for Non-residential development | Number of EDU's in Septic Elimination Areas | Estimate Flow from Nonresidential Uses (GPD) | Capacity Needed (MGD) For SEPTIC ELIMINATION AREAS Assuming 250 GPD per EDU Plus Flow for Non-residential development | Estimated Inflow and Infiltration Flow impacting the Wastewater Treatment Facility (Subtract column D from E). Note State defined method. ** |
| Queenstown | - | - | - | - | - | - | (0.077) |
| Centreville | - | - | - | - | - | - | (0.222) |
| Church Hill | - | - | - | - | - | - | (0.054) |
| Barclay | - | - | - | - | - | - | (0.000) |
| Sudlersville WWTP | - | - | - | - | - | - | (0.062) |

*Maryland Department of the Environment provided data
** Maryland Department of the Environment method

| EXISTING FLOW & CONDITIONS | ESTIMATE REMAINING CAPACITY | | FUTURE DEVELOPMENT THAT COULD BE ADDED TO SYSTEM (4) | | | FUTURE ESTIMATE REMAINING CAPACITY | | FUTURE ESTIMATE GROWTH POTENTIAL | |
|---|---|---|---|---|---|---|---|---|---|
| | R | S | T | U | V | W | X | Y | Z |
| WWTP Facility | Estimate Remaining Capacity **without** I/I Estimation (MGD) | Estimate Remaining Capacity **with** I/I Estimation (MGD) | Number of EDU's in Future Sewer Areas (Assume EDU's or Nonresidential space for undeveloped lots) | Estimate Flow from Nonresidential Uses (GPD) | Capacity Needed (MGD) For FUTURE SEWER AREAS Assuming 250 GPD per EDU Plus Flow for Non-residential development | Estimate Remaining Capacity **without** I/I Estimation (MGD) | Estimate Remaining Capacity **with** I/I Estimation (MGD) | Estimate Potential EDU's **without** I/I Estimation | Estimate Potential EDU's **with** I/I Estimation |
| Queenstown | (0.08) | - | - | - | - | (0.08) | - | (308) | - |
| Centreville | 0.28 | 0.50 | - | - | - | 0.28 | 0.50 | 1,112 | 2,000 |
| Church Hill | (0.05) | - | - | - | - | (0.05) | - | (216) | - |
| Barclay | (0.00) | - | - | - | - | (0.00) | - | (0) | - |
| Sudlersville WWTP | 0.03 | 0.09 | - | - | - | 0.03 | 0.09 | 112 | 360 |

Source: MDE- WRE Documentation

(1) PLANNED Connections: Includes approved and requested development, development required to be on system based on density, or units desiring to connect
(2) INFILL Connections: Undeveloped lots within an area already serviced by sewer that could develop and connect to system
(3) SEPTIC ELIMINATION AREA Connections: EDU's or Non-residential uses that are currently within Sewer Service Areas that have a septic system; includes uses whose septic system is failing.
(4) FUTURE DEVELOPMENT Connections: Includes an estimate of potential EDU's, or flow from uses which could be incorporated into Sewer Service Areas.

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# Section 8.0 Wastewater Assessment

This section addresses the availability 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.

## Section 8.1 General –Sewer Service Areas

The Queen Anne's County 2006 Comprehensive Water and Sewerage Plan provided descriptions of Sewer Service Areas and the **Sewer Service Areas (and those areas of Public Health Concerns)** map provides the current status of Sewer Service Area Designations. Since the 2006 plan, there have been Community Plans completed for Queenstown, Wye Mills, Centreville, Sudlersville, and Church Hill areas, and the planned or anticipated growth for these may require further modification to designated sewer service areas. Note: the Wye Mills plan was not approved and analysis in this document was revised.

## Section 8.2 Wastewater Treatment Facilities

Wastewater treatment plant information was derived from the Queen Anne's County 2006 Comprehensive Water and Sewerage Plan, 2008 Town of Centreville Maryland, Wastewater Capacity Management Plan, recently completed Community Plans, and data as provided through Water Resource Element - Wastewater Capacity Management tables (MDE reporting tables). A summary table is provided.

### Section 8.2.1 Kent Narrows/Stevensville/Grasonville (KNSG)

The KNSG Wastewater Subdistrict is a consolidation of the Chester, Kent Narrows, Grasonville, Stevensville, and Prospect Bay subdistricts, and is the largest district and wastewater facility in Queen Anne's County. The plant's capacity is 3.0 MGD and the two-year rolling average (2007-2008) annual flow is approximately 1.53 MGD.

Major components of the existing wastewater treatment facilities are a septage handling station, primary clarification, and secondary treatment, which was constructed in 2007 and includes a 3.0 MGD activated sludge treatment plant capable of achieving Enhanced Nutrient Removal in accordance with the goals of the Chesapeake Bay nutrient reduction initiatives. Due to the outfall's discharge into shellfish waters, an emergency storage lagoon capable of holding 24 hours of flow is required.

The current wastewater collection system is a vacuum system. The wastewater transmission system is a force main consisting of five pump stations.

### Section 8.2.2 Queenstown

The Town operated on individual septic systems until 1971. The Town then constructed a wastewater treatment system. This treatment system was designed with a capacity of 65,000 gpd. The treated wastewater was, and is still currently, discharged into Little Queenstown Creek through a submerged 8-inch outfall. A vitrified clay pipe (VCP) wastewater collection system was also constructed at this time. The Town's Charter to require all properties in the Town to be served by this publicly owned utility.

The current wastewater discharge system is permitted and rated for an 85,000 gpd, and the two-year (2007-2008) rolling average daily flow is approximately 77,000 gpd. The draft (2009) Queenstown Community Plan anticipates under a Consolidated Option approximately 1,030 additional housing units

and 885,000 square feet of non-residential space. Queenstown anticipates expansion of the existing wastewater treatment plant to manage increased flows. The estimated demand to meet the upper limits of the proposed development as well as continue service to existing development is approximately 530,000 gpd.

**Table 8-2: Wastewater Treatment Facilities Summary**

| WWTP Facility | Capacity Design (MGD) | Average Flow (MGD) | Remaining Capacity (MGD) | Comments Relevant to Facility |
|---|---|---|---|---|
| Kent Narrows Stevensville Grasonville (KNSG) WWTP | 3.000 | 1.533 | 1.467 | The KNSG plant has reserved capacity for future development including non-residential space and 1,418 units plus 500,000 GPD for failing septic systems. The plant is approaching capacity with these reserves. |
| Queenstown | 0.077 | 0.073 | 0.004 | Plant is at or near capacity; however the plant anticipates adding capacity for planned development as per the Queenstown Community Plan. |
| Centreville | 0.542 | 0.381 | 0.161 | Plant has capacity which could be exceeded according to planned development identified in the Centreville Community Plan; however additional plant capacity is anticipated to accommodate planned development.* |
| Church Hill | 0.080 | 0.047 | 0.033 | The Town anticipates using remaining capacity for planned development as per the Church Hill Community Plan. Plant may need to expand capacity to accommodate anticipated Priority Funding Area (PFA) expansion and requirement that all new development within PFA be connected to sewer. |
| Sudlersville WWTP & Barclay** | 0.090 | 0.044 | 0.046 | Remaining capacity at plant is reserved for 50,000 GPD school flow and connection to Barclay residences. The anticipated additional flow will require expansion of plant capacity. |
| Chesapeake College | 0.015 | 0.005 | 0.010 | Chesapeake College plant will utilize remaining capacity as needed to support campus expansion. |
| **TOTAL*** ** | **3.804** | **2.083** | **1.721** | |

** The Town of Centreville requested and, in 2008, MDE re-rated the new WWTF to process an annual daily average of 542,000 gpd of flow. This new WWTF is also capable of expansion to handle up to 1.2 million gpd of flow.*

*** Barclay is dependent on Sudlersville for Capacity; flows include anticipated connections.*

****Wastewater treatment systems are not interconnected.*

### Section 8.2.3 Centreville

In 2008, MDE re-rated the Town's WWTF to process an annual daily average flow of 542,000 gpd. The WWTF is capable of expansion to handle up to 1.2 MGD. The two-year (2007-2008) rolling average daily flow is approximately 381,000 gpd.

The Centreville Community Plan (2009) anticipates through septic elimination areas and expansion of service area approximately 5,700 additional housing units to be added to the wastewater system. Centreville anticipates using the remainder of the plant capacity with eventual expansion to accommodate anticipated development.

### Section 8.2.4 Church Hill

Town of Church Hill treatment facility consists of a lagoon-type facility. The collection facility consists of 8-inch gravity sewer and 6-inch force main, and two pump stations. The system is designed for an average flow of 80,000 gpd and a peak flow of 140,000 gpd. The two-year rolling average annual flow is approximately 47,000 gpd.

The plant may need to expand capacity to accommodate anticipated Priority Funding Area expansion and the requirement that all new development in the Town be connected to sewer.

### Section 8.2.5 Sudlersville & Barclay

The Town of Sudlersville has constructed a community sewerage system with a capacity of 90,000 gpd designed to serve 900 people. Sewerage treatment consists of two stabilization lagoons followed by chlorination. The two-year (2007-2008) rolling average annual flow is approximately 44,000 gpd.

Remaining capacity at the plant is reserved, approximately 50,000 gpd, for a new middle school. Sudlersville and Barclay plan to create a denied access wastewater line between the communities to bring residents currently on septic onto a sewage system. Both communities anticipate, according to Community Plans, to increase in residential units and to eliminate current septic units. There are approximately 620 units anticipated for septic elimination and expansion.

According to the Draft Sudlersville Growth Management Plan (2009), there may be an additional 1,165 units which may be added to the planned WWTP in the near-term plan horizon.

### Section 8.2.6 Chesapeake College

Chesapeake College, the regional community college, operates an existing wastewater system serving approximately 3,500 students at Wye Mills. The method of treatment is an extended aeration unit followed by settling, chlorination, and dechlorination with discharge of the effluent to a tributary of the Wye East River. The collection system consists of 8-inch diameter gravity sewer lines and contains no pumping stations. The system is authorized an average flow of 15,000 gpd and a peak flow of 27,000 gpd. The two-year (2007-2008) rolling average flow is approximately 5,000 gpd.

## Section 8.3 Septic Systems

County-wide there are approximately 11,751 housing units on septic (9,119 units reported from the Chesapeake Bay Restoration Fund (CBRF) plus an estimated 2,157 housing units in pending developments to be on septic with 475 housing units on parcels spanning watersheds). Data provided in Table 8-1 are estimations only, as acreages for non-residential development include the entire parcel upon which a non-residential use is located, and there were approximately 475 units located on parcels which spanned watersheds. Housing unit counts for parcels that spanned watersheds were included in both watersheds so as not to under estimate the nitrogen impacts within watersheds. Often times it was not possible to determine where septic systems were located on a parcel and therefore in which watershed it should be included. The values in Table 8-1 were used to populate Water Resource Element Tables to estimate potential pounds of nitrogen and phosphorus that could be expected from septic systems.

**Table 8-3: Septic Systems per Watershed**

| Watershed | Approximate CBRF Units Per Watershed | CBRF Acres of Non-Residential Accounts |
|---|---|---|
| Corsica River | 905 | 331 |
| Eastern Bay | 1,978 | 141 |
| Kent Island Bay | 1,531 | 9 |
| Kent Narrows | 478 | 6 |
| Lower Chester River | 674 | 67 |
| Middle Chester River | 1,049 | 110 |
| Southeast Creek | 870 | 234 |
| Tuckahoe Creek | 895 | 328 |
| Upper Chester River | 1,900 | 767 |
| Upper Choptank | 60 | 2 |
| Wye River | 1,411 | 561 |
| **Total** | **11,751** | |

*Source: CBRF Dataset, MDE*

There are also public health and safety issues to consider, as failing septic systems, even within sewer service areas, can also contribute to groundwater contamination and ultimately Chesapeake Bay pollution. The County Department of Environmental Health indicates approximately 20 percent of the on-lot systems are failing due to age and type of technology.

In addition to the estimated nitrogen and phosphorus output from the Water Resources Element Point & Non-Point Sources tables, as provided for each watershed (refer to section Results by Watershed), the overall depth to groundwater within Queen Anne's County is less than 2 ½ feet; there are approximately 106,383 acres of land with less than 30 inches to groundwater (44.8% of the County's land area). The **Depth to Groundwater Map ESA-5** illustrates where the shallowest depths are located. Septic systems

within the shallowest depth to groundwater areas could be contributing to groundwater contamination and ultimately Chesapeake Bay pollution.

### Section 8.3.1 Prioritization of Septic Elimination Areas

Priority areas for septic elimination include southern Kent Island (an area with a predominant amount of malfunctioning on-site septic systems), Critical Areas and malfunctioning on-site septic systems within Wastewater Services Areas. Other areas for consideration for septic elimination are areas in and around the Towns and Growth Areas.

The Bay Restoration Fund (created by Senate Bill 320 in 2004) provides a dedicated source of funds, financed by wastewater treatment plant users, to upgrade Maryland's wastewater treatment plants with enhanced nutrient removal (ENR) technology. A separate fee is collected for onsite disposal users (Onsite Disposal Fund) with priority given to failing septic systems in Critical Areas to employ best available technology for nitrogen removal. The fees and process is known collectively in Queen Anne's County as the Chesapeake Bay Restoration Fund (CBRF).

## Section 9.0 Stormwater Management

Stormwater runoff from development is a major contributor of pollutants and sediment to the Bay. The use of proper best management practices (BMPs) can reduce harmful impacts to the local hydrology.

The construction of roads, buildings and other impervious surfaces disrupts the natural hydrology of the landscape. Runoff from impervious surfaces carries nonpoint source pollutants such as nutrients, sediments, oil and a variety of toxic chemicals. The following provides general impacts to waterways for each of these components:

- Nutrients, primarily nitrogen and phosphorus, cause algal blooms which cloud water and cause "dead zones" without oxygen.
- Small sediment particles decrease water clarity.
- Larger sediment settles to the bottom of waterways, smothering bottom life and fish spawning areas.
- Heavy sediment loads can fill stream channels.
- Oil and toxic chemicals can kill aquatic life and impact the ability to swim in the Bay and make fish unsafe for human consumption.

Studies have documented that the quality of aquatic habitat in streams, lakes and wetlands begins to decline when the area of impervious surface located in upstream watersheds reaches 10 percent of the total land areas. When impervious surface reaches more than 25% within a watershed, waterways can only support few fish species able to tolerate high levels of pollution.

Maryland's smart growth policies emphasize concentrating growth where development already exists within Growth Areas to reduce sprawl and the increase of impervious surface across rural landscapes. A stormwater management policy has been established by the state that specifies a 20% reduction in impervious surface area below existing conditions or water quality treatment of the volume of runoff from 20% of a site's impervious surface.

Stormwater management practices help control nonpoint source pollution through the use of nonstructural and/or structure techniques to intercept surface runoff from developed areas, filter and treat this runoff, and then discharge it at a controlled rate.

## Section 9.1 Environmental Site Design?

If planning, policies and site evaluation are done well, nutrients entering the Chesapeake Bay via stormwater can be greatly reduced. Controlling problems at their source is almost always more effective and much less expensive over the long-run. The state has identified the following Environmental Site Design (ESD) principles to be applied locally:

1. Develop a local ESD ordinance with specific benchmarks and ESD practices.
2. Require increased onsite recharge and runoff reduction volumes.
3. Require ESD mapping to ensure protection of environmentally sensitive features as part of initial site layout.
4. Require ESD as the first step in site design as a mechanism to address needs while reducing need for costly infrastructure.
5. Establish specific and numeric performance criteria to ensure a reduction of nutrient loadings to waterways.
6. Identify stringent performance criteria for design, installation and maintenance of all stormwater and ESD practices.
7. Establish specific triggers to promote non-structural controls for permanent stormwater management and for construction with the intent to maximize absorption of stormwater on-site.
8. Establish standards for runoff leaving construction sites and should prohibit off-site discharges of sediment.
9. Define more stringent stormwater criteria to protect special watersheds and maintain the biotic integrity of sensitive aquatic resources.
10. Establish mandatory training and certification for ESD for County design and plan review staff as well as third-party inspection staff.
11. Establish fees in accordance with Title 2 of the Financing Implementation portion of the Stormwater Management Act of 2007.

In 2008, the County adopted ESD standards to meet the requirements of this Act. The Maryland Department of the Environment (MDE) mandates the use of environmental site design (ESD) for all government and privately-funded projects through a regulatory program, effective April 1, 2010.

## Section 9.2 Maryland's Stormwater Management Regulations

Maryland's stormwater management law is written in the Annotated Code of Maryland, Environment Article, Title 4, Subtitle 2. Stormwater regulations are contained in the Code of Maryland Regulations (COMAR) 26.17.02. And, the procedure for calculating the size of stormwater BMPs is outlined in the Maryland Stormwater Design Manual. MDE's specific performance standards address four main categories to address water quality:

- standards requiring recharge to the water table
- flood protection
- stream channel erosion protection
- water quality improvement

## Section 9.3 County Regulation of Stormwater

In 2001 Queen Anne's County adopted a Stormwater Management Ordinance (Chapter 14, Section 4) whose purpose is to protect, maintain and enhance the public, health, safety, and general welfare by establishing minimum requirements and procedures to control the adverse impacts associated with increased stormwater runoff. The ordinance seeks to minimize damage to property, reduce the effects of development on land, control stream channel erosion, reduce local flooding, and maintain after development, as nearly as possible, the predevelopment runoff characteristics. The coordination and enforcement of the ordinance are under the Queen Anne's County Department of Public Works. Within the ordinance are articles requiring stormwater management plans, erosion and sediment controls, water recharge, flooding controls and application of Best Management Practices (BMPs).

Queen Anne's County in its Stormwater Management Ordinance has also identified the 2000 Maryland Stormwater Design Manual (Volumes I & II), to serve as the official guide for stormwater principles, methods and practices; which was supplemented, in December 2007, with a Queen Anne's County Environmental Site Design Manual. The County has routinely adopted the State Standards for Stormwater and adopted the latest standards in 2010.

## Section 9.5 Stormwater Facilities

Queen Anne's County has been proactive in addressing stormwater. The County adopted an Environmental Site Design (ESD) before it was required, and there are demonstration projects within the County including permeable concrete and rain gardens. The Queen Anne's County Department of Public Works recently completed a Geographic Information Systems (GIS) inventory of stormwater facilities and can utilize the recently completed impervious surface coverage to augment stormwater practices, programs, and activities. Within the County there are approximately 400 stormwater facilities with reports provided to the State. Although Queen Anne's County does not have a Stormwater Utility it has been considered in the past. Stormwater facilities as well as impervious cover are illustrated on the map.

## Section 10.0 Best Management Practices Matrix

A Best Management Practices matrix is provided in Table 10-2. The matrix includes information associated with a comprehensive planning and site design approaches that aims to minimize stormwater impacts associated with water quality volume and peak flows, and water supply. This approach relates to a number of growth management initiatives such as Smart Growth, Low Impact Design (LID), conservation-by-Design and Environmental Site Design (ESD). The matrix contains a variety of Best Management Practices (BMPs) and land management techniques and strategies that can be used as a toolkit to reduce impacts on water resources.

## Section 10.1 Landscapes Typologies

The following landscapes typologies are used to describe both natural and man-made environments across the County as well as used in the assessment of each watershed and associated Best Management Practices matrix tools and techniques.

- ***Agricultural Landscapes*** – Areas that are predominantly used and preserved (permanently or temporarily) for agricultural use with minimal intrusions by residential, commercial, industrial and institutional uses.
- ***Natural Landscapes*** – Areas that are predominantly undeveloped containing natural features such as waterways, riparian buffers, wetlands, floodplains, forests, wildlife habitats and other natural features.
- ***Rural Residential Landscapes*** – Areas within agricultural landscapes where historical or recent residential development and/or clusters have occurred.
- ***Suburban Landscapes*** – Areas in and around the Towns and Growth Areas where medium to low density residential, commercial and employment centers have developed or are permitted to expand in the future.
- ***Town/Village Landscapes*** – Incorporated Towns and Villages where historically development has occurred and has been supported by infrastructure improvements (e.g. water, sewer, roadways, etc.).

**Table 10-1: Evaluation of Land Use Management Tools and Techniques Matrix**

| Evaluation of Land Use Management Tools and Techniques Matrix | | | |
|---|---|---|---|
| **Key Tools/Techniques** | **Key Advantages** | **Implementation** | **Key Disadvantages** |
| **Preserve and Repair Riparian Buffers** | • Reduction of peak storm flow.<br>• Filtering pollutants.<br>• Reduction of nutrients in waterways.<br>• Streambank stabilization.<br>• Stream temperature control. | • Establish buffers, greenways, open space and recreational areas through comprehensive planning.<br>• Support local watershed groups.<br>• Riparian Corridor Conservation District – zoning overlay district.<br>• Consistency between zoning, subdivision/ development and stormwater management ordinances.<br>• Best Management Practices should be implemented by landowners in natural and rural landscapes. | • Establishments of buffers must be clearly tied to health, safety and welfare issues and environmental protection.<br>• A strong buffer awareness program may be required to educate development community and property owners. |
| **Stormwater Management Best Management Practices (BMPs)** | • Refer to Section 10.3 for examples of BMPs and other relevant information. | • Part of subdivision/development plans and required by stormwater management ordinances.<br>• Construct stormwater facilities on lands previously developed without such facilities.*<br>• Conversion of dry ponds for stormwater management to extended detention or retention facilities which are more effective at nutrient removal.*<br>• Requirements of various County and State permits. | • Lack of education/understanding of importance by the public.<br>• Initial cost of some practices may exceed traditional methods to address SWM. |
| **Agricultural Best Management Practices***<br>• Animal Waste Management Systems (Livestock & Poultry)<br>• Cover Crops<br>• Nutrient Management Plan Implementation<br>• Runoff Control<br>• Retirement of Highly Erodible Land<br>• Stream Protection with and without Fencing<br>• Conservation Tillage | • ***Animal waste management systems*** are designed to properly handle, store and use waste generated by confined animal facilities.<br>• ***Cover crops*** reduce nitrate leaching losses during the winter and also reduces erosion.<br>• ***Nutrient management plan implementation*** reduces impacts of nutrients due to management practices.<br>• ***Runoff control*** reduces nutrient impacts on waterways.<br>• ***Retirement of highly erodible land*** reduces potential for soil loss.<br>• ***Stream protection*** discourages animals from entering streams.<br>• ***Conservation tillage*** minimal soil disturbance. | • ***Animal waste management systems*** include ponds, lagoons and tanks for liquid waste, and sheds or pits for solid waste.<br>• ***Cover crops*** are small grains planted in September or early October on land otherwise fallow with no fertilizer applied.<br>• ***Nutrient management plan implementation*** comprehensive plan to manage the amount, placement, timing and application of animal waste, fertilizer, sludge or other plant nutrients.<br>• ***Runoff control systems*** include ponds, lagoons and tanks for liquid waste and sheds or pits for solid waste.<br>• ***Retirement of erodible lands***<br>• ***Stream protection*** provides troughs or other watering devices in remote locations away from streams to discourage animals from entering the stream and use of fencing adjacent to stream crossing to limit access points.<br>• ***Conservation tillage*** is a process that uses tillage equipment to seed the crop directly into the vegetative cover or crop residue on the surface. | • Cost associated with use of new equipment and procedures. |

*Source: Recommended Best Management Practices for Upper Eastern Shore as part of Tributary Strategies, MDE

| Evaluation of Preservation/Conservation Tools Matrix | | | |
|---|---|---|---|
| **Key Tools/Techniques** | **Key Advantages** | **Implementation** | **Key Disadvantages** |
| **Conservation Subdivision or Cluster Development Standards** | • Alternative to conventional development patterns that allow for preservation/conservation.<br>• Fewer environmental impacts.<br>• Potential reduction in infrastructure costs.<br>• Ability to create walkable neighborhoods and sense of community.<br>• On-lot systems can be used if designed and maintained properly. | • Amendment of zoning ordinance and subdivision/ development ordinance.<br>• Sketch plan process.<br>• Use of Map of Potential Conservation.<br>• Can be applied to all landscapes. | • May result in the need for community sewer systems.<br>• Continued use of agricultural uses in open spaces of cluster development creates conflict.<br>• Transportation and air quality impacts are the same as conventional development.<br>• Poor design can result in greater visual impacts than conventional design.<br>• May require more site inspections. |
| **Natural Features Conservation Standards or Conservation Zoning** | • Protection of floodplains, forests and vegetation.<br>• Preserve the Upper Delaware National Scenic and Recreational River Corridor.<br>• Protect groundwater and maintain groundwater recharge areas.<br>• Protect wellheads, riparian buffers, and steep slopes and manage stormwater.<br>• Protect and maintain water supply and reduce erosion and sedimentation.<br>• Protection of environmentally sensitive areas. | • Delineation of water resource features should be done by a professional hydro-geologist or engineer.<br>• Coordination with update of Natural Areas Inventory.<br>• Use of Map of Potential Conservation.<br>• Can be applied to all landscapes. | • Assessments can be costly. |
| **Floodplain Regulations** | • Protection of floodplain and water quality.<br>• Protection from flood damage.<br>• Creates riparian buffers to support wildlife habitats, greenways and access for recreation.<br>• Allowable and unallowable uses are defined in the ordinance. | • Map and ordinance regulations.<br>• Implemented as part of zoning ordinance.<br>• Land Development Plans subject to requirements and floodways, floodplain, flood areas and/or riparian buffers must be shown on plans. | • Cost associated with development of floodplain map and ordinance.<br>• Requires establishment of ordinance.<br>• Limitations on allowable uses may be too restrictive. |
| **Tree Planting*** | • Reduces runoff. | • Includes any tree planting on any site except those along rivers and streams.*<br>• Applicable to all landscapes. | • Cost to private property owners. |
| **Urban Nutrient Management*** | • Reduction of excess lawn fertilizer use. | • Education program targeted at suburban residents and businesses. | • Voluntary compliance through education. |

*Source: Recommended Best Management Practices for Upper Eastern Shore as part of Tributary Strategies, MDE

| Evaluation of Preservation/Conservation Tools Matrix | | | |
|---|---|---|---|
| **Key Tools/Techniques** | **Key Advantages** | **Implementation** | **Key Disadvantages** |
| **Resource Management Plan** | • Protection of natural environment.<br>• Preservation of open space.<br>• Ability to create greenways or connections.<br>• Provides proper context for environmental regulations, pre-emptive statutes and forest management techniques. | • MDE Funding available to prepare plan.<br>• Plan can build upon Comprehensive Plan and Land Preservation, Parks and Recreation Plan (LPPRP).<br>• Utilizes map of Potential Conservation.<br>• Applicable to all landscapes. | • Cost associated with development of the plan.<br>• Cost associated with implementation (management of resources) of the plan.<br>• May result in development of additional local land use regulations and environmental regulations.<br>• Forest succession may not be attractive to all residents. |
| **Resource Management Practices***<br>• Forest Harvesting Practices<br>• Marine Pump-outs<br>• Structural Shore Erosion Control<br>• Nonstructural Shore Erosion Control | • ***Forest harvesting*** with appropriate controls in management zones will reduce erosion and impacts of runoff.<br>• ***Marine pump-outs*** will improve water quality.<br>• ***Structural shore erosion controls*** will stabilize eroding shorelines.<br>• ***Nonstructural shore erosion controls*** will stabilize eroding shorelines. Contributes to creating wetland habitats.<br>. | • ***Forest harvesting*** is the application of regulatory and voluntary best management practices applied to timber harvesting including erosion and sediment control and streamside management zones.<br>• ***Marine pump-outs*** are facilities sited at marinas for pumping sewage from boat holding tanks to dockside storage facility. Regulatory requirements are contained in ordinances.<br>• ***Structural shore erosion controls*** is a practice of stabilizing eroding shorelines using stone riprap or timber bulkheads. Suitable for sites with high wave energy.<br>• ***Nonstructural shore erosion controls*** a practice for stabilizing eroding shorelines by establishing marsh grasses. Suitable for sites with lower wave energy. | • Costs to property owners. |
| **Use of Nitrate Levels to Restrict Development (Develop a Nitrates Map)** | • Guides development supported by on-lot systems to appropriate areas.<br>• Contributes to public health, safety and welfare.<br>• Identifies areas for expansion of public water and sewer systems or restriction of development. | • Development of a Nitrates Map.<br>• Identification of appropriate site analysis and testing.<br>• Part of plan review and permitting.<br>• Applicable to all landscapes. | • Cost associated with development of a nitrates map.<br>• Additional cost to developer/property owner. |
| **Purchase of Development Rights (PDR)** | • Municipal or state control of land through purchasing the rights of more intensive land use from current landowner.<br>• Landowner derives financial benefit from selling rights.<br>• Lower property value reduces taxes to owner.<br>• Property owner permitted to continue lower intensity use of property. | • Financial resources or tax incentive program to support ability to purchase development rights (state, county and local municipalities).<br>• Tracking mechanism.<br>• Supports conservation and preservation of rural resource areas (natural and rural landscapes). | • Tracking properties and regulation of land use.<br>• Loss of tax revenue. |

*Source: Recommended Best Management Practices for Upper Eastern Shore as part of Tributary Strategies, MDE

| Evaluation of Preservation/Conservation Tools Matrix | | | |
|---|---|---|---|
| **Key Tools/Techniques** | **Key Advantages** | **Implementation** | **Key Disadvantages** |
| **Priority Preservation Areas (PPAs) and other Land Preservation Programs** | • Targeted to natural or other environmentally sensitive resources such as wetlands, buffers along waterways, or forested areas that provide habitat for flora and fauna and wildlife habitats.<br>• Assist with maintaining functioning soil resources.<br>• If areas selected properly can contribute to wellhead protection and protection of other water resources.<br>• Funding may be associated with designations to assist with preservation and growth management. | • Designation of PPA as part of the comprehensive planning process.<br>• Designation of areas based upon specific programs. | • Potential for program to change or program to be augmented with a set of unknown regulations at the time of designation. |
| **Transfer of Development Rights (TDR)** | • Cost of preservation absorbed by property owner who purchases rights.<br>• Allows local government to direct density and growth away from sensitive landscapes and rural resource areas. | • Adequate planning to ensure adequate public facilities to support development in receiving areas.<br>• Appropriate to preserve rural resource areas while guiding development to designated growth areas (rural residential and village landscapes). | • Difficult to implement.<br>• Can be controversial.<br>• Often hard to identify areas where increased density is desirable.<br>• Must be established by ordinance. |
| **Planned Residential Development** | • Development standards are specified prior to development approval and applicable to all phases of development through agreement.<br>• Allows for provision of adequate public facilities as part of development. | • Adequate planning and implementation of public facilities is part of the development.<br>• Applicable to rural residential landscapes. | • All phases of development are defined by a legal instrument and must develop in that manner regardless of change in economic market and/or changes in desired land use patterns.<br>• Legal agreements and extensive Solicitor involvement. |

| Evaluation of Preservation/Conservation Tools Matrix | | | |
|---|---|---|---|
| **Key Tools/Techniques** | **Key Advantages** | **Implementation** | **Key Disadvantages** |
| **Traditional Neighborhood Development (TND)** | • Development pattern emulates smaller, older communities.<br>• Pedestrian oriented community.<br>• Streets are laid out in a grid pattern.<br>• More community open space is provided.<br>• Variety of housing types with small or no front yards are provided.<br>• Mixed use neighborhood.<br>• Environment where residents can walk from home to jobs and commercial establishments.<br>• Minimize environmental impacts due to less use of automobile and close proximity of uses.<br>• Can be used in existing villages, boroughs and mixed use neighborhoods to preserve historic resources and architectural integrity. | • Standards are typical of villages or small urbanized areas.<br>• Established through zoning ordinance and zoning map.<br>• Applicable for village landscapes (existing and proposed villages). | • Perception of public in rural areas results in hesitation to apply technique to residential communities that may require some level of mix use due to remote locations or lack of access to goods and services within existing community.<br>• Regulation of impacts and site design of non-residential uses must be addressed. |
| **Land Preservation Programs:**<br>• Program Open Space<br>• Maryland Agricultural Land Preservation Program (MALPF)<br>• Rural Legacy<br>• GreenPrint<br>• Maryland Environmental Trust<br>• Conservation Reserve Enhancement Program | • Preservation of natural resources, environmentally sensitive lands and agricultural lands.<br>• Some programs provide financial benefits or tax incentives.<br>• Promotes effective land management of natural environment. | • Coordination with the County and state for application/designation and eligibility requirements. | • Limitations on type, amount and intensity of development. |

## Section 10.3 Stormwater Management Tools

There are several innovative tools and technologies or Best Management Practices (BMPs) available to reduce stormwater problems. The following matrix provides a brief description of various stormwater management tools applicable to all landscapes that contribute to:

- Providing acceptable practices for compliance with regulation of stormwater management.
- Minimizing the increase of surface volumes, rates and frequencies resulting from development.
- Minimizing increases to downstream flooding.
- Increasing recharge to groundwater.
- Increasing treatment and pollutant removal for groundwater recharge and surface water discharge.
- Decreasing erosion and sedimentation.
- Offering aesthetic amenities for new development.
- Reducing infrastructure requirements, space requirements and maintenance costs for stormwater handling facilities.
- Enhancing stream and riparian corridor management.

**Table 10-2: Stormwater Best Management Practices Matrix**

| Stormwater Best Management Practices Matrix | | |
|---|---|---|
| **Tool** | **Description** | **Benefit** |
| Rain Gardens | Rain gardens are gardens containing flowering plants and grasses that can survive in soil soaked with water from rain storms. However, they are not gardens that have standing water. | Rain gardens collect and slow stormwater runoff and increase its infiltration into the soil. |
| Grassed Swales | Grassed swales are vegetated channels designed to treat and attenuate stormwater runoff for a specified water quality volume. | As stormwater flows through the channels, it is treated through filtering by the vegetation in the channel, filtering through a subsoil matrix, and/or infiltration into the underlying soils. |
| Pervious Pavement | Pervious pavement is designed to allow percolation or infiltration of stormwater through the surface into the soil. | The water is naturally filtered and pollutants are removed. |
| Parking Lot Filter Strips | Filter strips are gently sloping, vegetated areas adjacent to impervious surfaces. These strips are typically referred to as vegetated filter strips, grassed filter strips, grassed filters or buffer strips. | They are intended to reduce impacts of sheet flow and velocity of stormwater and help improve its water quality. They help remove sediments, other pollutants and increase infiltration. |

| Stormwater Best Management Practices Matrix | | |
|---|---|---|
| **Tool** | **Description** | **Benefit** |
| Bioretention Basins | Bioretention basins are landscaped depressions or shallow basins used to slow and treat on-site stormwater runoff. | Stormwater is directed to the basin and then percolates through the system. The slowed, cleaned water is allowed to infiltrate native soils or directed to nearby stormwater drains or receiving waters. |
| Underground Storage | On-site, underground stormwater retention/detention captures and stores stormwater collection from surrounding impervious areas. | The facility stores stormwater and then releases it directly through an outlet pipe back into natural waters at rates designed to reduce peak flows and mimic waters at rates designed to reduce peak flows and mimic pre-development conditions. In some cases, stored water can be allowed to infiltrate to recharge groundwater. |
| Green Roofs | Green roofs or vegetated roof covers (also referred to as living roofs, nature roofs and eco-roofs) are a thin layer of living plants growing on top of a roof. | A green roof is not a collection of potted plants to decorate a roof space, but rather an extension of a conventional roof which involves installation of a layered system of membranes, substrate and plants. |
| Stream and Shoreline Buffer Zones**(grass buffers and forested buffers:*<br>• ***Grassed Buffers*** – A linear strip of grass along rivers and streams that filters nutrients and sediments and enhances stream habitat.<br>• ***Forested Buffers*** – A linear strip of forest along rivers and streams that filters nutrients and sediment and enhances stream habitat. | Floodway areas consisting of natural vegetation such as grasses, shrubs and/or forests between 50 to 100 feet used as water quality buffer areas. | These zones can be effective in preventing runoff impacts and also in enhancing fish and wildlife by filtering pollutants and slowing runoff entering the waterway. These areas protect riparian and aquatic ecosystems and improve water quality. |
| Conservation of Natural Areas | Conservation of pervious natural areas and drainage pathways as well as avoiding disturbance of soils and native vegetation, especially on steep slopes. | Natural vegetation is used to minimize stormwater runoff and pollutant loads from the site. |

**Source: Recommended Best Management Practices for Upper Eastern Shore as part of Tributary Strategies, MDE*

## Section 11.0 Assessment of Land Use Impacts on Watersheds

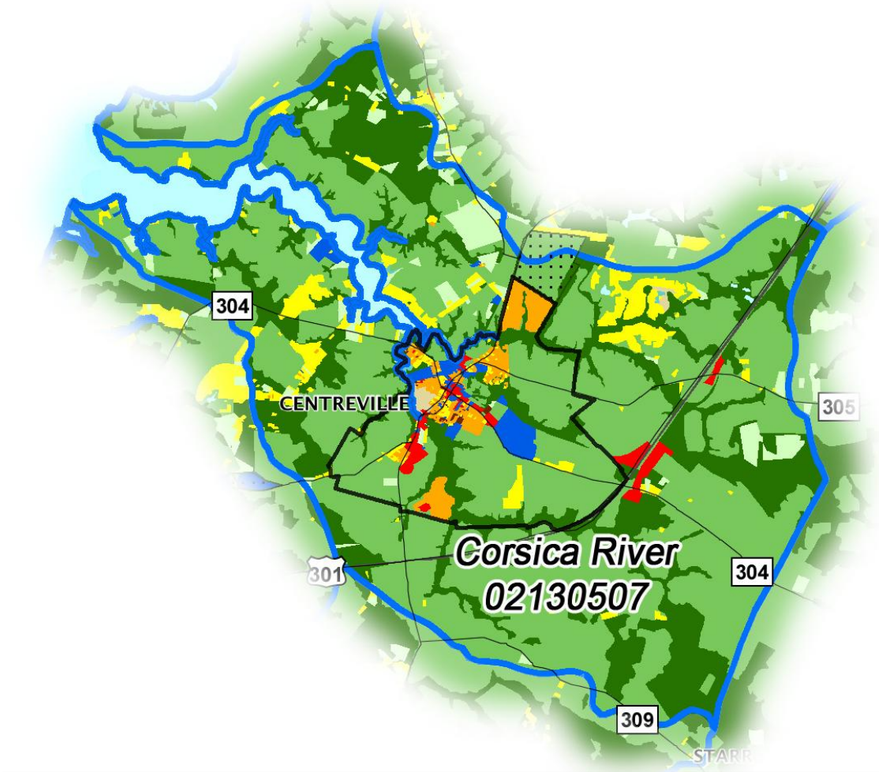
The following section provides information with respect to impacts of existing land use allocations and projected and preferred future land use allocations measured using the following inventories and indicators calculated for each of the County's eight-digit watersheds.

- Acreage of lands in Conservation
- Existing acreage of residential and non-residential land use s (2008)
- Projected acreage of residential and non-residential land uses (2030) Acreage of lands in Agricultural
- Acreage of lands in Forest
- Impervious surface Acreage of land available for development
- Existing and projected Nitrogen loads
- Existing and projected Phosphorus loads
- Number of residential and non-residential septic systems

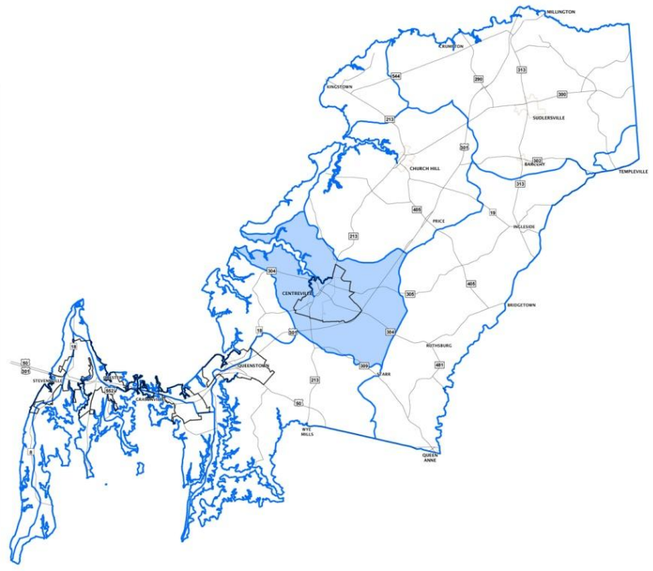
The assessment of each of the watersheds includes a suggested Best Management Practices Tool Kit for each of the landscapes located within the watershed.

## Section 11.1 Corsica River Watershed - 02130507

***Existing Land Use 2008***







| Table 11.1-1 Conservation Lands Programs | Acres |
|---|---|
| MALPF Easement | 1,775.93 |
| MALPF Greenprint | - |
| Rural Legacy Easement | 77.70 |
| MET | 850.31 |
| TDR Sending Areas | 10.22 |
| Private Conservation Easement | 69.87 |
| County Park | 436.12 |
| State Owned Land | - |
| Open Space (Deed Restricted) | 1,178.34 |
| Open Space (Non Contiguous) | 726.47 |
| MALPF Easement / Open Space | 98.30 |
| MET / Open Space | - |
| County Park / TDR | - |
| County Park / NCD | - |
| County Park / Open Space | - |
| County Park / MET | - |
| MET / TDR | - |
| **Total** | **5,223.26** |

| Land Available for Development | Acres |
|---|---|
| Available | 1,906.47 |
| Divisible | 8,090.22 |
| **Total** | **9,996.69** |

### Corsica Watershed Restoration Action Strategy (WRAS)

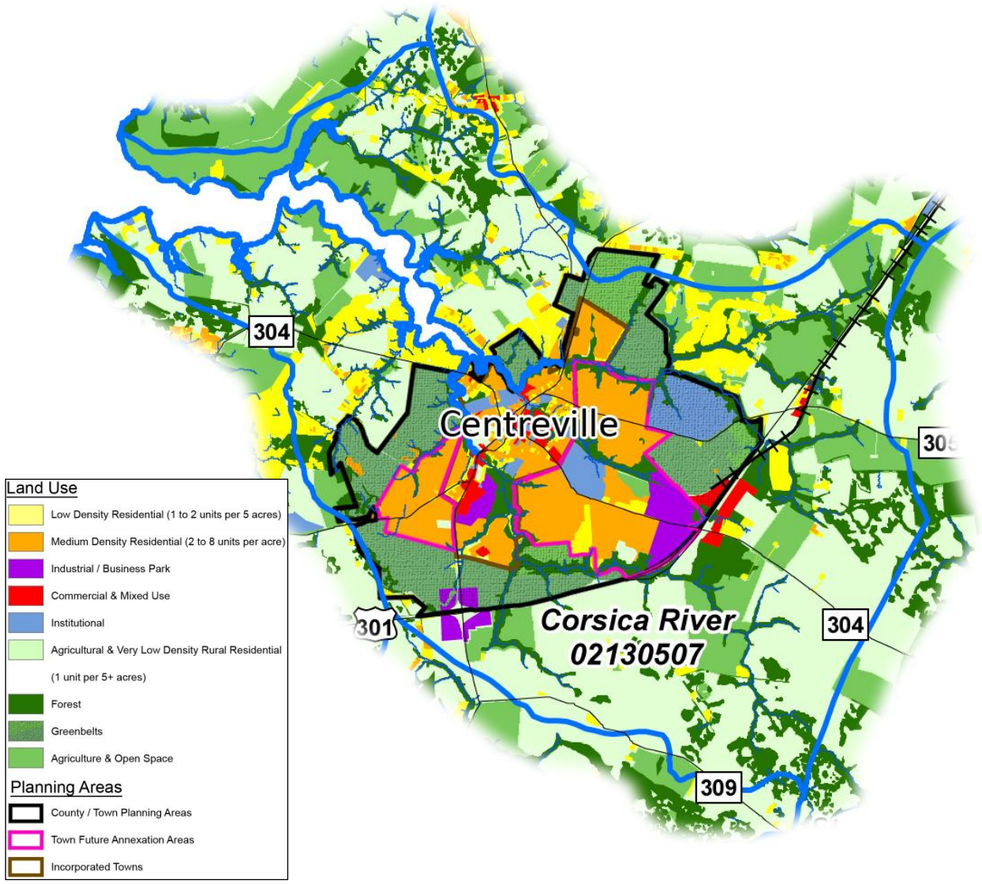
The Town of Centreville is located at the center of the Corsica River Watershed which forms the confluence of three major non-tidal sub-watersheds. The Corsica River Watershed Restoration Action Strategy (WRAS) was published by the Town. The WRAS identified impairments and provides guidance to achieve water quality enhancement, expanded wildlife habitat, more sensitive land use conversions and conservation. Key actions recommended in the WRAS include:

- Planting cover crops: 4,000 acres of cover crops and 2,000 acres of small grain.
- Retrofitting urban stormwater facilities to be managed on 300 acres of urban lands.
- Implement 50 acres of Horse Pasture Management to limit nutrient runoff.
- Establishing approximately 100 acres of Conservation Reserve Enhancement Program buffers.
- Providing education and outreach to the public.
- Upgrading septic systems: retrofit 30 private septic systems.
- Establishing reforested buffers on non-agricultural land: approximately 200 acres of forested land.
- Assuring low impact development strategies
- Restoring oyster populations: restore 20 acres of oyster beds.
- Restoring submerged aquatic vegetation: restore 10 acres of submerged aquatic vegetation.
- Restoring wetlands: restore 50 acres of wetlands and two miles of stream channel.
- Monitor the effectiveness of BMPs.
- Upgrade and maintain Centreville Sewerage treatment plant with enhanced nutrient management.

Source: http://www.corsicariver.org/

| Table 11.1-2 Updated General Land Use Classes (2008) | 2008 Land Uses | | 2030 Preferred Land Uses | |
|---|---|---|---|---|
| | Total Acres | Percent of Total Acres | Total Acres | Percent of Total Acres |
| Low Density Residential (1 to 2 units per 5 acres) | 1,164.1 | **4.9%** | 1,353.8 | **5.7%** |
| Medium Density Residential (2 to 8 units per acre) | 509.4 | **2.1%** | 2,250.2 | **9.4%** |
| High Density Residential (8+ units per acre) | 20.9 | **0.1%** | 20.9 | **0.1%** |
| Commercial | 255.2 | **1.1%** | 318.1 | **1.3%** |
| Mixed Commercial – Residential | - | **0.0%** | 35.4 | **0.1%** |
| Industrial | - | **0.0%** | 355.9 | **1.5%** |
| Institutional | 323.4 | **1.4%** | 610.0 | **2.6%** |
| Surface Mining | - | **0.0%** | - | **0.0%** |
| Very Low Density Rural (1 unit per 5+ acres) | 793.5 | **3.3%** | 2,214.2 | **9.3%** |
| Private Recreation | 57.2 | **0.2%** | 57.2 | **0.2%** |
| Agriculture | 14,412.0 | **60.3%** | 11,212.3 | **46.9%** |
| Forest | 6,052.9 | **25.4%** | 5,160.6 | **21.7%** |
| Water | 82.4 | **0.3%** | 82.4 | **0.3%** |
| Wetlands | 80.0 | **0.3%** | 80.0 | **0.3%** |
| Transportation | 135.0 | **0.6%** | 135.0 | **0.6%** |
| **Total** | **23,886.0** | **100.0%** | **23,886.0** | **100.0%** |

## *Preferred Land Use 2030*




**Preferred Land Use 2030**

The preferred land use within the watershed is based upon maximum capacity build-out under current zoning modified using the future land use plan for Centreville from the recently adopted Comprehensive Plan.

**Table 11.1-3 Best Management Practices Tool Kit**

| Tools, Techniques & Strategies | LANDSCAPES | | | | |
|---|---|---|---|---|---|
| | **Agricultural** | **Natural** | **Rural Residential** | **Suburban** | **Town** |
| **Point Source / Urban Source Strategy** | Spray irrigation fields within proximity to facilities and outside of Tier II Catchment Areas. | | | | Expand Centreville WWTP with enhanced nutrient removal systems and to accommodate planned growth within an expanded PFA. |
| **Stormwater Strategy** | BMPs, nutrient and manure management plans and fencing livestock out of streams. | BMPs and preserve buffers and forest conservation. No tree cutting in Critical Areas. | BMPs and ESD. | BMPs, ESD, retrofitting of SW facilities or inclusion in new development and reduction in use of lawn fertilizers. | BMPs, ESD, Retrofitting of facilities. |
| **Onsite Sewage Disposal Strategy (OSDS)** | Use denitrification technology for individual or shared on-lot septic systems. | Use denitrification technology for individual or shared on-lot septic systems. | Use denitrification technology for individual or shared on-lot septic systems. | Connect homes with failing septic systems to sewer or upgrade with denitrification technology. | Expand Sewer Service Area to include areas consistent with Municipal Growth Element. |
| **Growth Management Strategy** | Preserve environmentally sensitive lands and agricultural lands using State and Local programs. | Use greenbelts around Centreville and restrict growth in Critical Areas. Preservation of environmentally sensitive lands. | Cluster development, ESD and encourage development around areas with existing infrastructure. | Expand Growth Area to incorporate suburban landscapes. Cluster development and ESD. | Establish Infill/Redevelopment standards. Partner to complete planned expansion of utilities (water and sewer) to support growth. |
| **Agriculture Strategy** | Nutrient and manure management, BMPs, cover crops and other best practices. | Preserve floodplains, riparian buffers and wetland buffers. | Establish TDR sending areas and utilize PDRs outside of Growth Area. | Establish receiving areas for TDRs with density bonuses. | Establish Joint Planning Agreements to establish receiving areas for TDRs. |
| **Waterway Strategies** | Protect riparian buffers, tree planting along streams and living shoreline construction | Protect riparian buffers, tree planting along streams and living shoreline construction | Protect riparian buffers, tree planting along streams and living shoreline construction | Protect riparian buffers, tree planting along streams and living shoreline construction | Protect riparian buffers and tree planting along streams. |
| **Air Deposition Strategy** | Establish forest conservation strategies and incentives as well as utilize state and local preservation programs. | Establish greenways, greenbelts and forest conservation strategies and incentives. | Require Forest Conservation Plans and establish wooded lot standards outside of the Growth Area. | Require Forest Conservation Plans and trail/path connections within greenbelts to provide access to and from the Town. | Concentrate homes, commercial uses and business parks to create walkable communities. Connect uses with sidewalks, paths and trails. |

**Table 11.1-4 Summary of Projected Impacts to Agriculture and Forest**

| Land Use or Variable | 2008 Land Uses | | 2030 Preferred Land Uses | | Projected Change in Land Use (2008-2030) | |
|---|---|---|---|---|---|---|
| | Total Acres | Percent of Total Acres | Total Acres | Percent of Total Acres | Projected Total Acres Lost | Projected Percent of Total Acres Lost |
| Agriculture | 14,412.0 | **60.3%** | 11,212.3 | **46.9%** | -3,199.70 | **-13.4%** |
| Forest | 6,052.9 | **25.4%** | 5,160.6 | **21.7%** | -892.30 | **-3.7%** |
| ***Queen Anne's County Impervious Surfaces**** | 855.4 | **3.6%** | | | | |
| ***Statewide Priority Wetlands ***** | 2,680.0 | **11.2%** | | | | |
| ***Tier II Catchment Area within Watershed*** | 12,339 | **51.7%** | | | | |

**Impervious surfaces data was created using 2004 planimetric data as updated using 2008 Aerial imagery collected by the State. There is no guarantee that all features were collected nor as to the precision of the collected features. This data provides a general value of the impervious surface within a watershed.*
***Queen Anne's County may need to track on permits issued by MDE for development within theses wetlands to determine impacts.*

## Water Resources Element – Nitrogen, Phosphorus and Impervious Surface Data

The following Nitrogen, Phosphorus and Impervious Surface table has been provided by Maryland Department of the Environment. The table was loading using the 2008 land use and the projected maximum capacity build-out values based on the Build-Out Analysis Report, May 2009 as part of this Comprehensive Plan. The preferred land use is shown in the far right column. Note, the Corsica River 2006 Study TMDL: Nitrogen 287,670 lbs per year and Phosphorus 22,244 pounds per year. The Queen Anne's County portion of the Corsica River Watershed is 100%.

**Table 11.1-5 Assessing Impacts of Nitrogen, Phosphorus and Impervious Surface**

| Corsica River Watershed (02130508) | 2002 LU, 2002 BMPs | 2002 LU, Trib Strategy BMPs | 2008 Trib Strategy BMPs | Scenario 1 2030 Max Build-Out with Trib Strategy BMPs | Scenario 2 2030 Preferred Land Use with Trib Strategy BMPs |
|---|---|---|---|---|---|
| | (Acres) | (Acres) | (Acres) | (Acres) | (Acres) |
| Development | 1,442 | 1,442 | 2,878 | 6,684 | 6,684 |
| Agriculture | 15,332 | 15,332 | 14,412 | 11,212 | 11,212 |
| Forest | 6,601 | 6,601 | 6,133 | 5,241 | 5,241 |
| Water | 91 | 91 | 82 | 82 | 82 |
| Other | 419 | 419 | 381 | 667 | 667 |
| Total Area | 23,886 | 23,886 | 23,886 | 23,886 | 23,886 |
| | | | | | |
| Residential Septic (EDUs) | 0 | 0 | 905 | 1,674 | 154 |
| Non-Residential Septic (EDUs) | 0 | 0 | 827 | 1,118 | 0 |

**Total Nitrogen Loading**

| Corsica River Watershed (02130508) | 2002 LU, 2002 BMPs | 2002 LU, Trib Strategy BMPs | 2008 Trib Strategy BMPs | Scenario 1 2030 Max Build-Out with Trib Strategy BMPs | Scenario 2 2030 Preferred Land Use with Trib Strategy BMPs | |
|---|---|---|---|---|---|---|
| | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | |
| Development NPS | 12,622 | 8,735 | 17,433 | 40,494 | 40,494 | |
| Agriculture NPS | 239,224 | 133,197 | 125,159 | 97,497 | 97,497 | |
| Forest NPS | 9,793 | 9,127 | 8,480 | 7,246 | 7,246 | |
| Water NPS | 921 | 762 | 688 | 688 | 688 | |
| Other Terrestrial NPS | 3,634 | 2,531 | 2,297 | 4,025 | 4,025 | |
| **Total Terrestrial Load** | **266,193** | **154,352** | **154,058** | **149,950** | **149,950** | |
| Residential Septic (EDUs) | 0 | 0 | 8,412 | 15,559 | 1,431 | |
| Non-Residential Septic (EDUs) | 0 | 0 | 2,743 | 3,706 | 0 | |
| **Total Septic Load** | **0** | **0** | **11,154** | **19,265** | **1,431** | |
| **Total NPS Nitrogen Load** | **266,193** | **154,352** | **165,212** | **169,216** | **151,382** | |
| **Total PS Load** | **0** | **0** | **1,616** | **21,383** | **23,254** | **TMDL** |
| **Total Nitrogen Load (NPS+PS)** | **266,193** | **154,352** | **166,828** | **190,599** | **174,636** | **287,670** |

**Total Phosphorus Loading**

| Corsica River Watershed (02130508) | 2002 LU, 2002 BMPs | 2002 LU, Trib Strategy BMPs | 2008 Trib Strategy BMPs | Scenario 1 2030 Max Build-Out with Trib Strategy BMPs | Scenario 2 2030 Preferred Land Use with Trib Strategy BMPs | |
|---|---|---|---|---|---|---|
| | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | |
| Development NPS | 1,614 | 1,053 | 2,107 | 4,911 | 4,911 | |
| Agriculture NPS | 16,681 | 12,048 | 11,342 | 8,766 | 8,766 | |
| Forest NPS | 148 | 122 | 114 | 97 | 97 | |
| Water NPS | 52 | 52 | 47 | 47 | 47 | |
| Other Terrestrial NPS | 444 | 293 | 267 | 463 | 463 | |
| **Total Terrestrial Load** | **18,940** | **13,567** | **13,876** | **14,284** | **14,284** | |
| **Total PS Load** | **0** | **0** | **58** | **1,541** | **1,681** | |
| | | | | | | **TMDL** |
| **Total Phosphorus Load (NPS+PS)** | **18,940** | **13,567** | **13,934** | **15,825** | **15,965** | **22,244** |

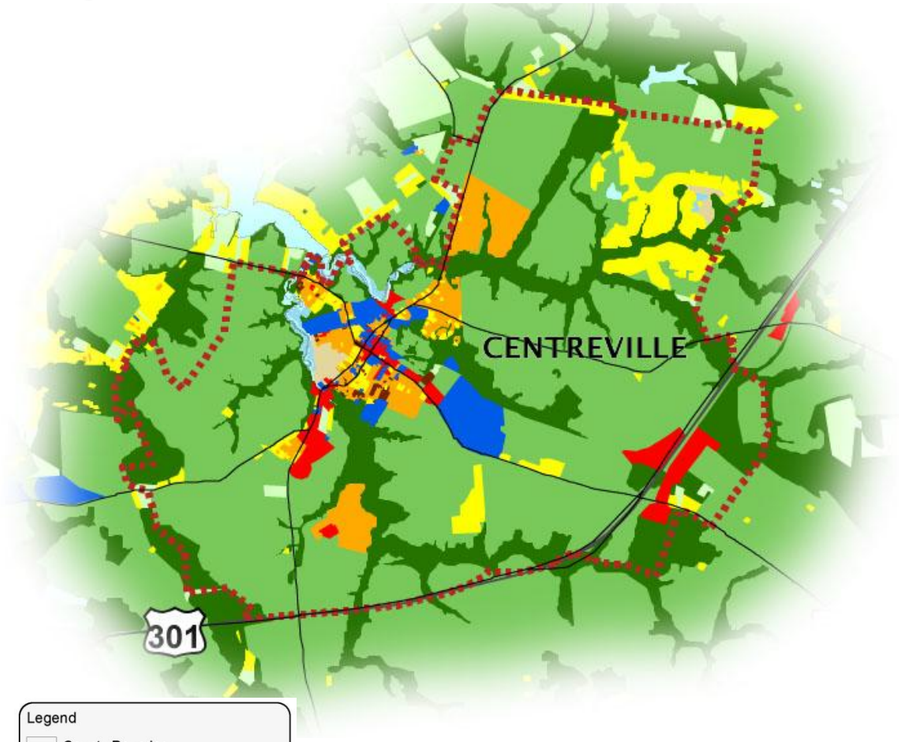
**Maximum Capacity Build-Out Carrying Capacity**

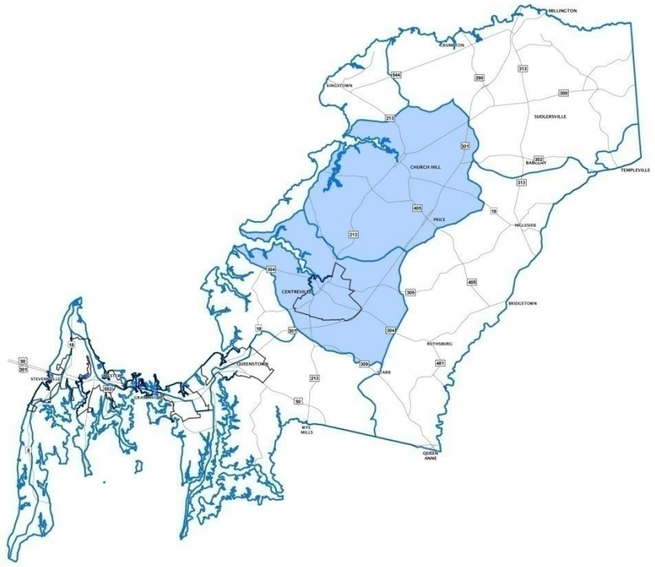
Maximum build-out of the watershed should not exceed 10% impervious surface with use of Tributary Strategies BMPs and other technologies. Studies have documented that the quality of aquatic habitat in streams, lakes and wetlands begins to decline when the area of impervious surface located in upstream watersheds reaches 10 percent of the total land areas. On the average, 20% of the total land area is impervious in a typical subdivision. When impervious surface reaches more than 25% within a watershed, waterways can only support few fish species able to tolerate high levels of pollution. Scientists suggest that once this point is reached even the best stormwater management practice cannot mitigate these impacts. *Source: A Citizen's Guide to Stormwater Management in Maryland.*

| Impervious Cover and Open Space | (Acres) | | | | |
|---|---|---|---|---|---|
| Corsica River Watershed (02130508) | 2002 LU, 2002 BMPs | 2002 LU, Trib Strategy BMPs | 2008 Trib Strategy BMPs | Scenario 1 2030 Max Build-Out with Trib Strategy BMPs | Scenario 2 2030 Preferred Land Use with Trib Strategy BMPs |
| Total Impervious Cover | 468 | 468 | 774 | 1,701 | 1,701 |
| Agriculture | 15,332 | 15,332 | 14,412 | 11,212 | 11,212 |
| Forest | 6,509 | 6,509 | 6,053 | 5,161 | 5,161 |
| Percent Impervious | 2.0% | 2.0% | 3.2% | 7.1% | 7.1% |

## Section 11.2 Centreville Growth Area

***Existing Land Use 2008***



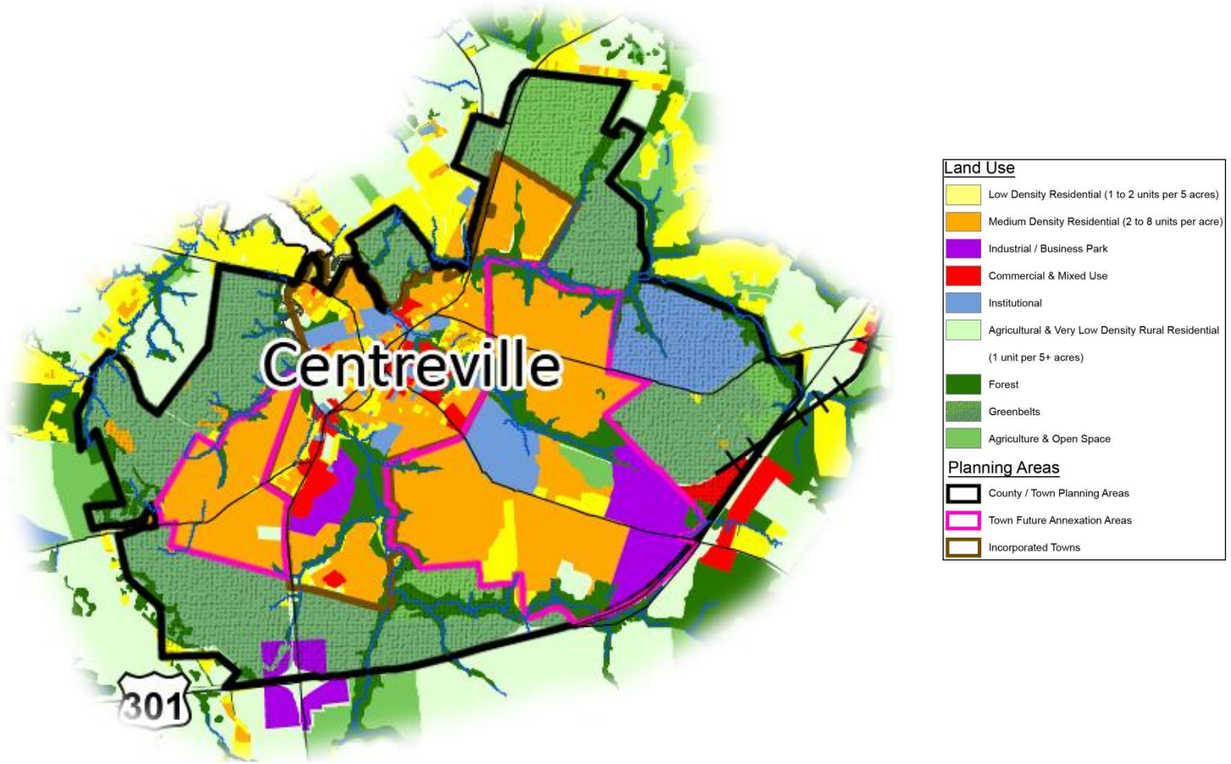



| Table 11.2-1 Conservation Lands Programs | Acres |
|---|---|
| MALPF Easement | 155.7 |
| MALPF Greenprint | - |
| Rural Legacy Easement | - |
| MET | - |
| TDR Sending Areas | - |
| Private Conservation Easement | - |
| County Park | 317.9 |
| State Owned Land | - |
| Open Space (Deed Restricted) | 434.7 |
| Open Space (Non Contiguous) | 562.4 |
| MALPF Easement / Open Space | - |
| MET / Open Space | - |
| County Park / TDR | - |
| County Park / NCD | - |
| County Park / Open Space | - |
| County Park / MET | - |
| MET / TDR | - |
| **Total** | **1,470.7** |

| Land Available for Development | Acres |
|---|---|
| Available | 261.5 |
| Divisible | 1,779.7 |
| **Total** | **2,041.2** |

| Table 11.2-2 Updated General Land Use Classes (2008) | 2008 Land Uses | | 2030 Preferred Land Uses | |
|---|---|---|---|---|
| | Total Acres | Percent of Total Acres | Total Acres | Percent of Total Acres |
| Low Density Residential (1 to 2 units per 5 acres) | 563.9 | **6.5%** | 635.1 | **7.%** |
| Medium Density Residential (2 to 8 units per acre) | 498.5 | **5.7%** | 2,181.1 | **25.1%** |
| High Density Residential (8+ units per acre) | 20.9 | **0.2%** | 20.9 | **0.2%** |
| Commercial | 237.9 | **2.7%** | 237.0 | **2.7%** |
| Mixed Commercial – Residential | - | **0.0%** | 35.3 | **0.4%** |
| Industrial | - | **0.0%** | 353.0 | **4.1%** |
| Institutional | 254.2 | **2.9%** | 542.1 | **6.2%** |
| Surface Mining | - | **0.0%** | - | **0.0%** |
| Very Low Density Rural (1 unit per 5+ acres) | 49.9 | **0.6%** | 328.9 | **3.8%** |
| Private Recreation | 57.2 | **0.7%** | 57.2 | **0.7%** |
| Agriculture | 5,126.3 | **58.9%** | 3,375.6 | **38.8%** |
| Forest | 1,738.1 | **20.0%** | 780.7 | **9.0%** |
| Water | 42.5 | **0.5%** | 42.5 | **0.5%** |
| Wetlands | 57.4 | **0.7%** | 57.4 | **0.7%** |
| Transportation | 50.3 | **0.6%** | 50.3 | **0.6%** |
| **Total** | **8,697.1** | **100.0%** | **8,697.1** | **100.0%** |

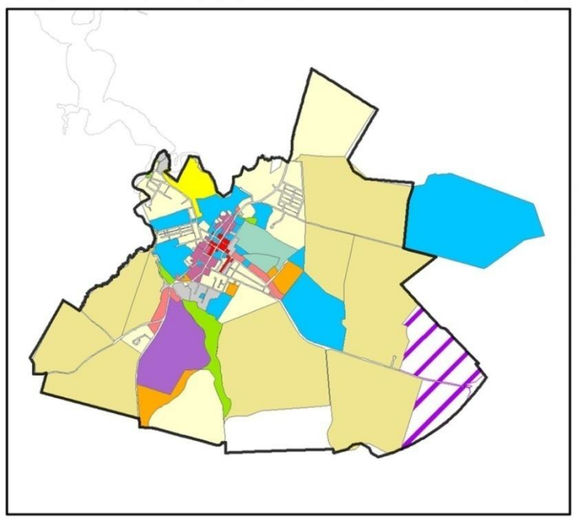
***Preferred Land Use 2030***




Land Use
- Low Density Residential (1 to 2 units per 5 acres)
- Medium Density Residential (2 to 8 units per acre)
- Industrial / Business Park
- Commercial & Mixed Use
- Institutional
- Agricultural & Very Low Density Rural Residential (1 unit per 5+ acres)
- Forest
- Greenbelts
- Agriculture & Open Space

Planning Areas
- County / Town Planning Areas
- Town Future Annexation Areas
- Incorporated Towns

CENTREVILLE COMMUNITY PLAN



**Centreville Legend**
- Single Family Residential
- Traditional Neighborhood Development
- Planned Unit Development
- Multi-Family Residential
- Central Business District
- Roadside Commercial
- Town Center
- Town Planned Business Park
- County Planned Business Park
- Public, Semi-Public, Institutional
- Park, Open Space, Resource Protection Area
- Redevelopment Area
- Mixed-Use Development

**Table 11.2-3 Summary Table of Projected Impacts to Agriculture and Forest**

| Land Use or Variable | 2008 Land Uses | | 2030 Preferred Land Uses | | Projected Change in Land Use 2008-2030 | |
|---|---|---|---|---|---|---|
| | Total Acres | Percent of Total Acres | Total Acres | Percent of Total Acres | Total Acres | Percent of Total Acres |
| Agriculture | 5,126.3 | **58.9%** | 3,375.6 | **38.8%** | -1,750.7 | **-20.1%** |
| Forest | 1,738.1 | **20.0%** | 780.7 | **9.0%** | -957.4 | **-11.0%** |
| ***Queen Anne's County Impervious Surfaces**** | 530.6 | **6.1%** | | | | |
| ***Statewide Priority Wetlands***** | 577.6 | **6.6%** | | | | |
| ***Tier II Catchment Area within Watershed*** | 3,948.7 | **45.4%** | | | | |

**Impervious surfaces data was created using 2004 planimetric data as updated using 2008 Aerial imagery collected by the State. There is no guarantee that all features were collected nor as to the precision of the collected features. This data provides a general value of the impervious surface within a watershed.*
***Queen Anne's County may need to track on permits issued by MDE for development within theses wetlands to determine impacts.*

## Water Resources Element – Nitrogen, Phosphorus and Impervious Surface Data

The following Nitrogen, Phosphorus and Impervious Surface table has been provided by Maryland Department of the Environment. The table was loading using the 2008 land use and the projected maximum capacity build-out values based on the Build-Out Analysis Report, May 2009 as part of this Comprehensive Plan. The preferred land use is shown in the far right column.

**Table 11.2-4 Assessing Impacts of Nitrogen, Phosphorus and Impervious Surface**

| Centreville - Corsica River | 2002 LU, 2002 BMPs | 2002 LU, Trib Strategy BMPs | 2008 Trib Strategy BMPs | Scenario 1 2030 Max Build-Out with Trib Strategy BMPs | Scenario 2 2030 Preferred Land Use with Trib Strategy BMPs |
|---|---|---|---|---|---|
| | (Acres) | (Acres) | (Acres) | (Acres) | (Acres) |
| Development | 823 | 823 | 1,421 | 3,841 | 3,841 |
| Agriculture | 5,643 | 5,643 | 5,126 | 3,376 | 3,376 |
| Forest | 1,860 | 1,860 | 1,796 | 838 | 838 |
| Water | 43 | 43 | 43 | 43 | 43 |
| Other | 328 | 328 | 311 | 599 | 599 |
| Total Area | 8,697 | 8,697 | 8,697 | 8,697 | 8,697 |
| | | | | | |
| Residential Septic (EDUs) | 0 | 0 | 375 | 252 | 0 |
| Non-Residential Septic (EDUs) | 0 | 0 | 0 | 115 | 0 |

**Total Nitrogen Loading**

| Centreville - Corsica River | 2002 LU, 2002 BMPs | 2002 LU, Trib Strategy BMPs | 2008 Trib Strategy BMPs | Scenario 1 2030 Max Build-Out with Trib Strategy BMPs | Scenario 2 2030 Preferred Land Use with Trib Strategy BMPs | |
|---|---|---|---|---|---|---|
| | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | |
| Development NPS | 7,146 | 4,970 | 8,576 | 23,193 | 23,193 | |
| Agriculture NPS | 87,531 | 48,944 | 44,435 | 29,348 | 29,348 | |
| Forest NPS | 2,760 | 2,572 | 2,483 | 1,159 | 1,159 | |
| Water NPS | 429 | 355 | 355 | 355 | 355 | |
| Other Terrestrial NPS | 2,847 | 1,981 | 1,881 | 3,616 | 3,616 | |
| **Total Terrestrial Load** | **100,712** | **58,822** | **57,729** | **57,670** | **57,670** | |
| Residential Septic (EDUs) | 0 | 0 | 3,485 | 2,342 | 0 | |
| Non-Residential Septic (EDUs) | 0 | 0 | 0 | 381 | 0 | |
| **Total Septic Load** | **0** | **0** | **3,485** | **2,724** | **0** | |
| **Total NPS Nitrogen Load** | **100,712** | **58,822** | **61,214** | **60,394** | **57,670** | |
| **Total PS Load** | **0** | **0** | **1,616** | **19,767** | **20,534** | **TMDL** |
| **Total Nitrogen Load (NPS+PS)** | **100,712** | **58,822** | **62,830** | **80,161** | **78,204** | **287,670** |

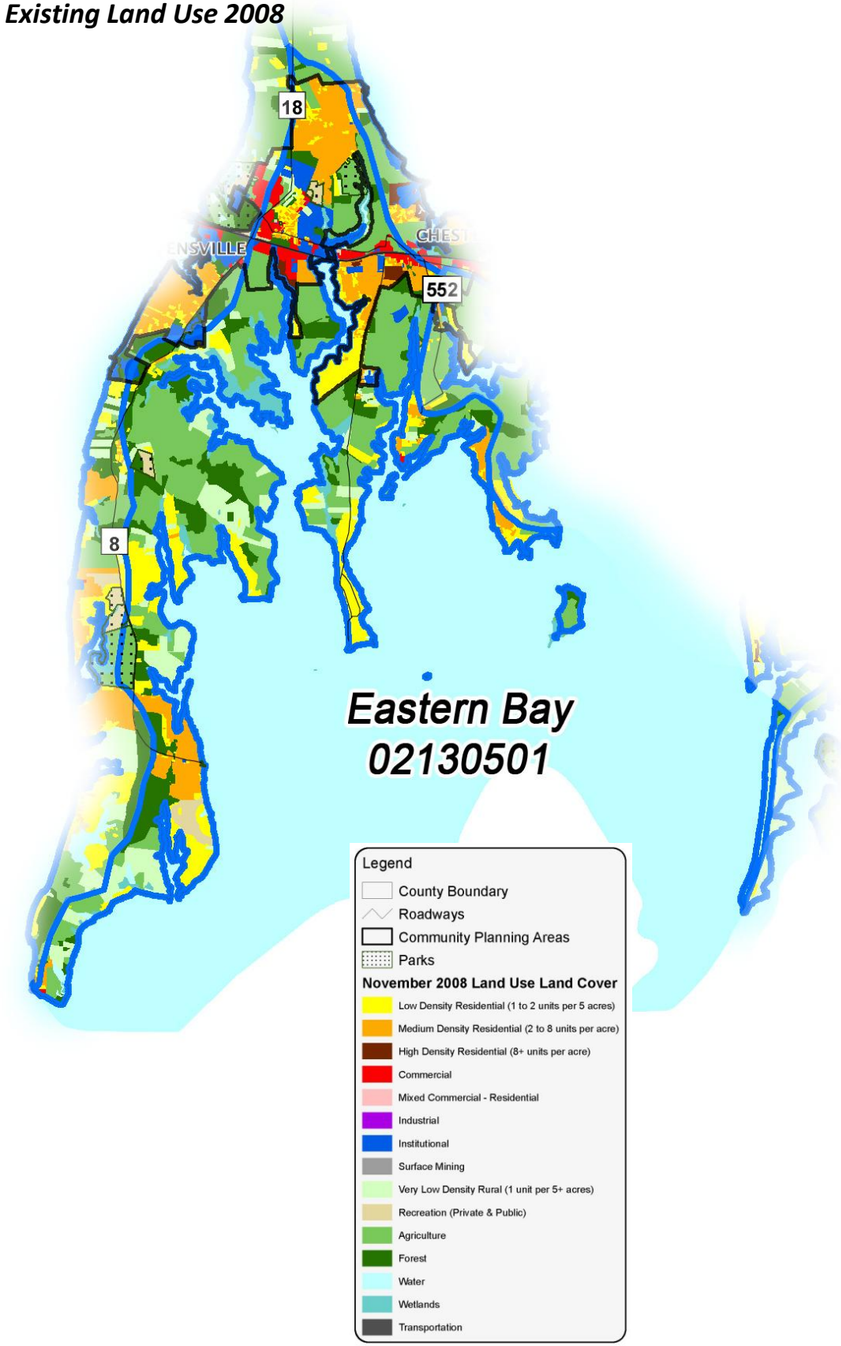
**Total Phosphorus Loading**

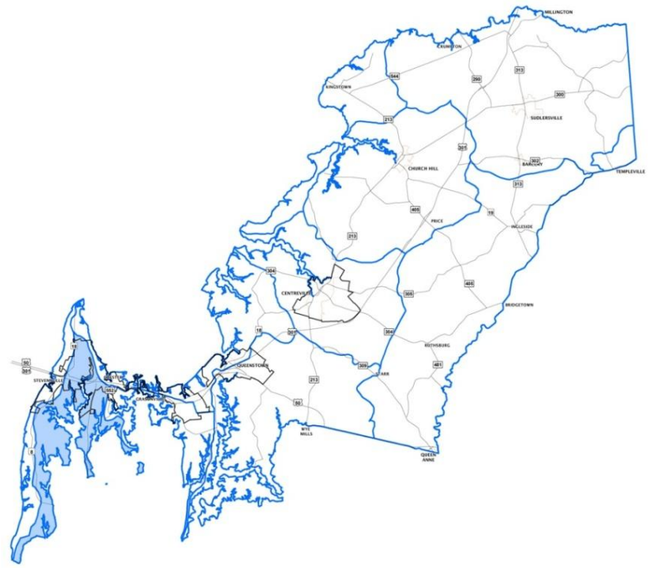
| Centreville - Corsica River | 2002 LU, 2002 BMPs | 2002 LU, Trib Strategy BMPs | 2008 Trib Strategy BMPs | Scenario 1 Max Build-Out with Trib Strategy BMPs | Scenario 2 2030 Preferred Land Use with Trib Strategy BMPs | |
|---|---|---|---|---|---|---|
| | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | |
| Development NPS | 883 | 581 | 988 | 2,696 | 2,696 | |
| Agriculture NPS | 6,165 | 4,463 | 4,065 | 2,639 | 2,639 | |
| Forest NPS | 42 | 34 | 33 | 16 | 16 | |
| Water NPS | 24 | 24 | 24 | 24 | 24 | |
| Other Terrestrial NPS | 350 | 231 | 219 | 416 | 416 | |
| **Total Terrestrial Load** | **7,464** | **5,333** | **5,330** | **5,791** | **5,791** | |
| **Total PS Load** | **0** | **0** | **58** | **1,483** | **1,540** | |
| | | | | | | **TMDL** |
| **Total Phosphorus Load (NPS+PS)** | **7,464** | **5,333** | **5,388** | **7,274** | **7,331** | **22,244** |

| Impervious Cover and Open Space | (Acres) | | | | |
|---|---|---|---|---|---|
| Centreville - Corsica River | 2002 LU, 2002 BMPs | 2002 LU, Trib Strategy BMPs | 2008 Trib Strategy BMPs | Scenario 1 2030 Max Build-Out with Trib Strategy BMPs | Scenario 2 2030 Preferred Land Use with Trib Strategy BMPs |
| Total Impervious Cover | 338 | 338 | 541 | 1,342 | 1,342 |
| Agriculture | 5,643 | 5,643 | 5,126 | 3,376 | 3,376 |
| Forest | 1,803 | 1,803 | 1,738 | 781 | 781 |
| Percent Impervious | 3.9% | 3.9% | 6.2% | 15.4% | 15.4% |

## Section 11.3 Eastern Bay Watershed - 02130501

***Existing Land Use 2008***



| Table 11.3-1 Conservation Lands Programs | Acres |
|---|---|
| MALPF Easement | 576.06 |
| MALPF Greenprint | - |
| Rural Legacy Easement | - |
| MET | 303.76 |
| TDR Sending Areas | 62.04 |
| Private Conservation Easement | - |
| County Park | 120.14 |
| State Owned Land | 195.97 |
| Open Space (Deed Restricted) | 235.91 |
| Open Space (Non Contiguous) | 24.81 |
| MALPF Easement / Open Space | - |
| MET / Open Space | - |
| County Park / TDR | 2.00 |
| County Park / NCD | 2.57 |
| County Park / Open Space | 19.80 |
| County Park / MET | 98.45 |
| MET / TDR | - |
| **Total** | **1,641.50** |

| Land Available for Development | Acres |
|---|---|
| Available | 939.23 |
| Divisible | 2,206.47 |
| **Total** | **3,145.70** |

| Table 11.3-2 Updated General Land Use Classes (2008) | 2008 Land Uses | | 2030 Preferred Land Uses | |
|---|---|---|---|---|
| | Total Acres | Percent of Total Acres | Total Acres | Percent of Total Acres |
| Low Density Residential (1 to 2 units per 5 acres) | 1,778.6 | **15.4%** | 1,559.9 | **13.5%** |
| Medium Density Residential (2 to 8 units per acre) | 1,353.3 | **11.7%** | 2,386.7 | **20.7%** |
| High Density Residential (8+ units per acre) | 64.9 | **0.6%** | 64.8 | **0.6%** |
| Commercial | 266.5 | **2.3%** | 276.3 | **2.4%** |
| Mixed Commercial – Residential | - | **0.0%** | 113.2 | **1.0%** |
| Industrial | 0.4 | **0.0%** | 11.7 | **0.1%** |
| Institutional | 299.7 | **2.6%** | 301.1 | **2.6%** |
| Surface Mining | - | **0.0%** | - | **0.0%** |
| Very Low Density Rural (1 unit per 5+ acres) | 1,222.5 | **10.6%** | 1,408.6 | **12.2%** |
| Private Recreation | 190.3 | **1.6%** | 273.6 | **2.4%** |
| Agriculture | 3,844.6 | **33.3%** | 3,050.8 | **26.4%** |
| Forest | 1,536.6 | **13.4%** | 1,110.7 | **9.6%** |
| Water | 190.4 | **1.6%** | 190.4 | **1.6%** |
| Wetlands | 750.7 | **6.5%** | 750.7 | **6.5%** |
| Transportation | 42.0 | **0.4%** | 42.0 | **0.4%** |
| **Total** | **11,540.5** | **100.0%** | **11,540.5** | **100.0%** |

***Preferred Land Use 2030***

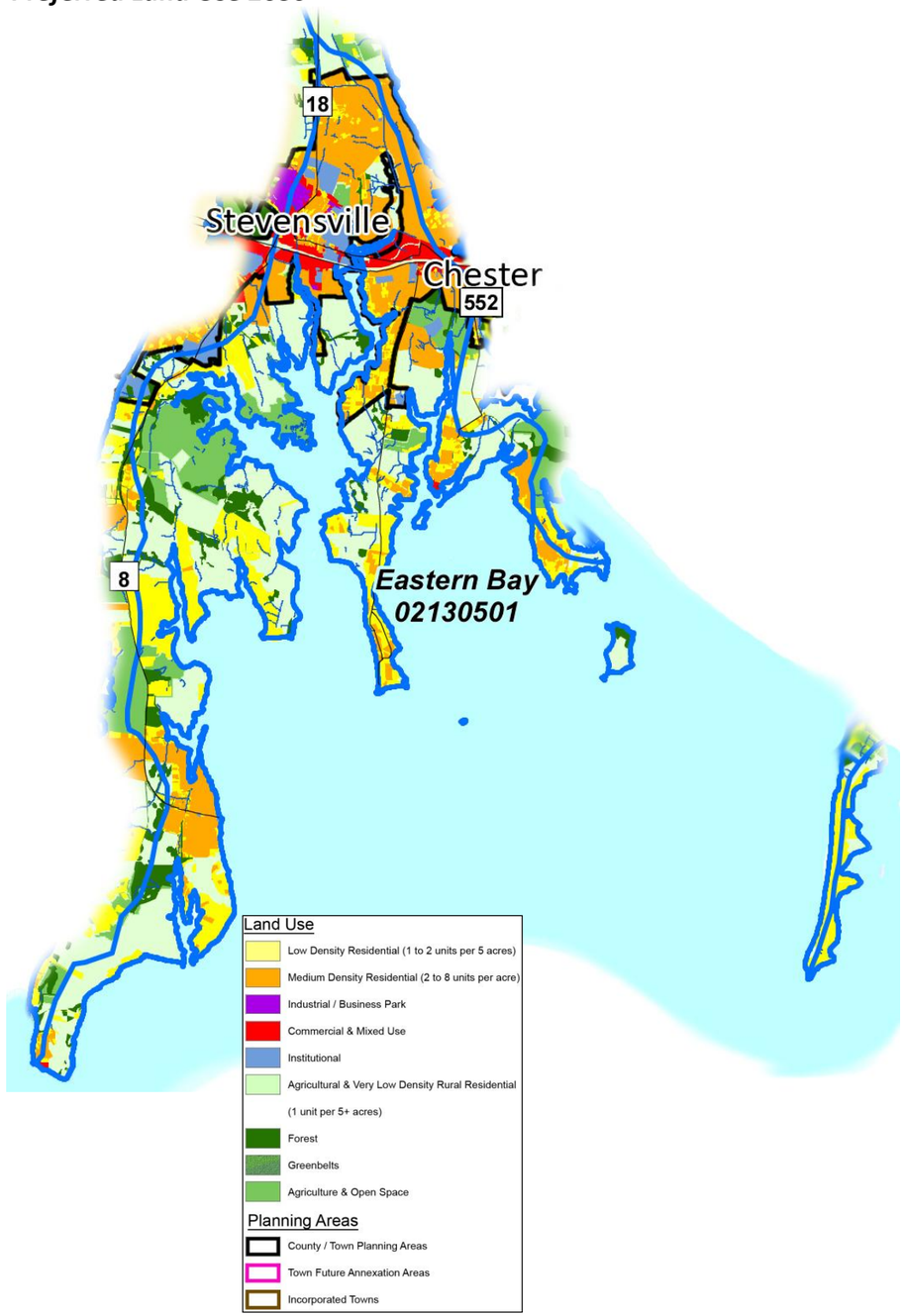



**Table 11.3-3 Best Management Practices Tool Kit**

| Tools, Techniques & Strategies | LANDSCAPES | | | | |
|---|---|---|---|---|---|
| | Agricultural | Natural | Rural Residential | Suburban | Town/Village |
| **Point Source / Urban Source Strategy** | | | | Expand and enhance KNSG WWTP and collection/ conveyance system with enhanced nutrient removal systems. Connect existing development located within Sewer Service Areas and adjacent areas with failing septic systems. | Provide opportunities for connections to Queenstown to support infill/ redevelopment activity in adjacent watershed. |
| **Stormwater Strategy** | BMPs, nutrient and manure management plans and fencing livestock out of streams. | BMPs, preserve buffers and forest conservation. No tree cutting in Critical Areas. | BMPs and ESD. | BMPs, ESD, retrofit SW facilities or include in new development and reduction in use of lawn fertilizers. | BMPs, ESD, retrofit facilities. |
| **Onsite Sewage Disposal Strategy (OSDS)** | Use denitrification technology for on-lot systems or connect to sewer system. | Use denitrification technology on-lot systems or connect to sewer system. | Use denitrification technology for on-lot systems or shared septic systems. | Connect homes with failing septic systems to sewer or upgrade with denitrification technology. | Connect existing development on septic systems within PFAs to public system. |
| **Growth Management Strategy** | Preserve environmentally sensitive lands and agricultural lands using State and Local programs. | Restrict development within Critical Areas. | Cluster development, ESD and encourage development toward areas with existing infrastructure. | Change zoning to minimize impacts on water resources. Suburban subdivisions must provide improvements and connection to public water and sewer systems. Reduce the number of shallow wells. | Establish Infill/Redevelopment standards and incentives. |
| **Agriculture Strategy** | Nutrient and manure management, BMPs, cover crops and best practices. | Preserve floodplains, riparian buffers and wetland buffers. | TDR receiving areas should be established outside of the watershed. | TDR receiving areas should be established outside of the watershed. | |
| **Waterway Strategies** | Protect riparian buffers and wildlife habitats, tree planting along streams and living shoreline construction. | Protect riparian buffers and wildlife habitats, tree planting along streams and living shoreline construction. | Protect riparian buffers, tree planting along streams and living shoreline construction. | Protect riparian buffers, tree planting along streams and living shoreline construction. | Protect riparian buffers, tree planting along streams. |
| **Air Deposition Strategy** | Establish forest conservation strategies and incentives as well as utilize state and local preservation programs. | Establish greenbelts and forest conservation strategies and incentives. | Require Forest Conservation Plans and establish wooded lot standards. | Require Forest Conservation Plans and trail/path connections within greenbelts to provide access to and from Town. | Concentrate homes, commercial uses and business parks to create walkable communities. Expand transit service. Connect uses with sidewalks, paths and trails. |

**Table 11.3-4 Summary of Projected Impacts to Agriculture and Forest**

| Land Use or Variable | 2008 Land Uses | | 2030 Preferred Land Uses | | Projected Change in Land Use 2008-2030 | |
|---|---|---|---|---|---|---|
| | Total Acres | Percent of Total Acres | Total Acres | Percent of Total Acres | Projected Total Acres Lost | Projected Percent of Total Acres Lost |
| Agriculture | 3,844.6 | **33.3%** | 3,050.8 | **26.4%** | -793.8 | **-6.9%** |
| Forest | 1,536.6 | **13.4%** | 1,110.7 | **9.6%** | -425.9 | **-3.8%** |
| ***Queen Anne's County Impervious Surfaces**** | 1,038.9 | **9.0%** | | | | |
| ***Statewide Priority Wetlands***** | 191.0 | **1.7%** | | | | |
| ***Tier II Catchments in the Watershed*** | 0.0 | **0.0%** | | | | |

**Impervious surfaces data was created using 2004 planimetric data as updated using 2008 Aerial imagery collected by the State. There is no guarantee that all features were collected nor to the precision of the collected features. This data provides a general value of the impervious surface within a watershed.*
***Queen Anne's County may need to track on permits issued by MDE for development within theses wetlands to determine impacts.*

## Water Resources Element – Nitrogen, Phosphorus and Impervious Surface Data

The following Nitrogen, Phosphorus and Impervious Surface table has been provided by Maryland Department of the Environment. The table was loading using the 2008 land use and the projected maximum capacity build-out values based on the Build-Out Analysis Report, May 2009 as part of this Comprehensive Plan. The preferred land use is shown in the far right column.

**Table 11.3-5 Assessing Impacts of Nitrogen, Phosphorus and Impervious Surface**

| Eastern Bay Watershed (02130501) | 2002 LU, 2002 BMPs | 2002 LU, Trib Strategy BMPs | 2008 Trib Strategy BMPs | Scenario 1 2030 Max Build-Out with Trib Strategy BMPs | Scenario 2 2030 Preferred Land Use with Trib Strategy BMPs |
|---|---|---|---|---|---|
| | (Acres) | (Acres) | (Acres) | (Acres) | (Acres) |
| Development | 3,843 | 3,843 | 4,728 | 5,863 | 5,863 |
| Agriculture | 4,385 | 4,385 | 3,845 | 3,051 | 3,051 |
| Forest | 2,693 | 2,693 | 2,287 | 1,861 | 1,861 |
| Water | 198 | 198 | 190 | 190 | 190 |
| Other | 421 | 421 | 490 | 575 | 575 |
| Total Area | 11,540 | 11,540 | 11,540 | 11,540 | 11,540 |
| | | | | | |
| Residential Septic (EDUs) | 0 | 0 | 1,978 | 175 | 35 |
| Non-Residential Septic (EDUs) | 0 | 0 | 353 | 3 | 0 |

**Total Nitrogen Loading**

| Eastern Bay Watershed (02130501) | 2002 LU, 2002 BMPs | 2002 LU, Trib Strategy BMPs | 2008 Trib Strategy BMPs | Scenario 1 2030 Max Build-Out Trib Strategy BMPs | Scenario 2 2030 Preferred Land Use with Trib Strategy BMPs |
|---|---|---|---|---|---|
| | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) |
| Development NPS | 33,620 | 23,269 | 28,679 | 35,530 | 35,530 |
| Agriculture NPS | 68,640 | 38,126 | 33,343 | 26,503 | 26,503 |
| Forest NPS | 3,995 | 3,724 | 3,163 | 2,574 | 2,574 |
| Water NPS | 1,999 | 1,654 | 1,589 | 1,589 | 1,589 |
| Other Terrestrial NPS | 3,695 | 2,554 | 2,966 | 3,482 | 3,482 |
| **Total Terrestrial Load** | **111,949** | **69,326** | **69,740** | **69,678** | **69,678** |
| Residential Septic (EDUs) | 0 | 0 | 18,385 | 1,627 | 325 |
| Non-Residential Septic (EDUs) | 0 | 0 | 1,172 | 8 | 0 |
| **Total Septic Load** | **0** | **0** | **19,557** | **1,635** | **325** |
| **Total NPS Nitrogen Load** | **111,949** | **69,326** | **89,297** | **71,313** | **70,003** |
| **Total PS Load** | **0** | **0** | **0** | **0** | **0** |
| **Total Nitrogen Load (NPS+PS)** | **111,949** | **69,326** | **89,297** | **71,313** | **70,003** |

**Total Phosphorus Loading**

| Eastern Bay Watershed (02130501) | 2002 LU, 2002 BMPs | 2002 LU, Trib Strategy BMPs | 2008 Trib Strategy BMPs | Scenario 2 2030 Max Build-Out with Trib Strategy BMPs | Scenario 2 2030 Preferred Land Use with Trib Strategy BMPs |
|---|---|---|---|---|---|
| | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) |
| Development NPS | 4,297 | 2,804 | 3,524 | 4,317 | 4,317 |
| Agriculture NPS | 4,757 | 3,432 | 3,043 | 2,396 | 2,396 |
| Forest NPS | 61 | 50 | 42 | 34 | 34 |
| Water NPS | 112 | 112 | 108 | 108 | 108 |
| Other Terrestrial NPS | 476 | 310 | 356 | 423 | 423 |
| **Total Terrestrial Load** | **9,703** | **6,708** | **7,074** | **7,278** | **7,278** |
| **Total PS Load** | **0** | **0** | **0** | **0** | **0** |
| **Total Phosphorus Load (NPS+PS)** | **9,703** | **6,708** | **7,074** | **7,278** | **7,278** |

| Impervious Cover and Open Space | (Acres) | | | | |
|---|---|---|---|---|---|
| Eastern Bay Watershed (02130501) | 2002 LU, 2002 BMPs | 2002 LU, Trib Strategy BMPs | 2008 Trib Strategy BMPs | Scenario 1 2030 Max Build-Out with Trib Strategy BMPs | Scenario 2 2030 Preferred Land Use with Trib Strategy BMPs |
| Total Impervious Cover | 994 | 994 | 1,054 | 1,411 | 1,411 |
| Agriculture | 4,385 | 4,385 | 3,845 | 3,051 | 3,051 |
| Forest | 1,879 | 1,879 | 1,537 | 1,111 | 1,111 |
| Percent Impervious | 8.6% | 8.6% | 9.1% | 12.2% | 12.2% |

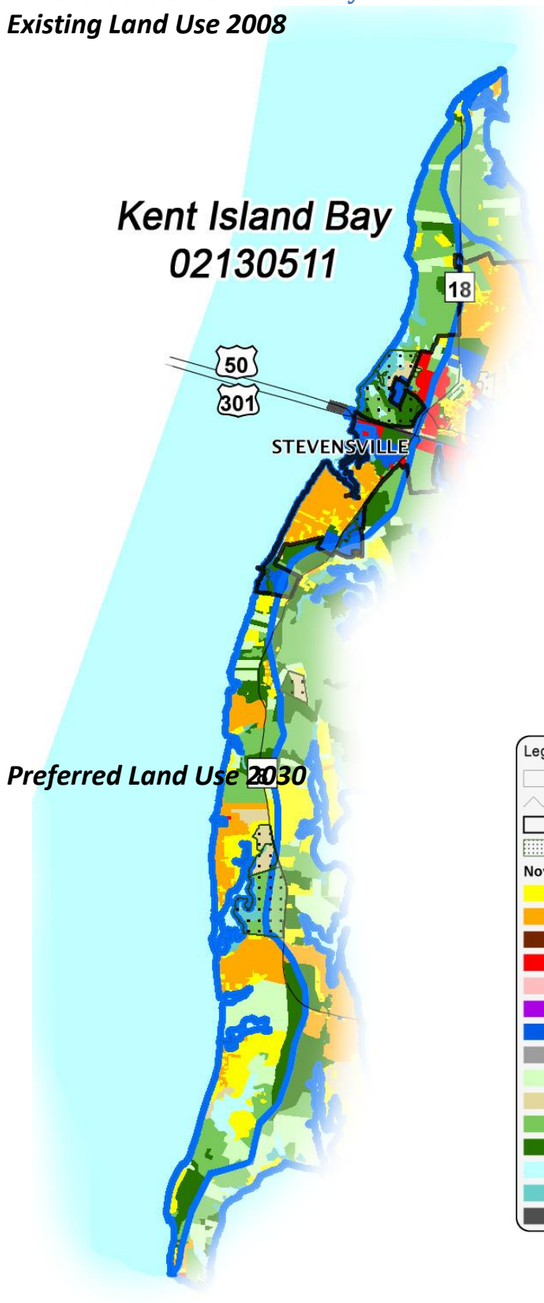
Note: Nitrogen and phosphorus output from sewage are counted as part of the Kent Island Bay Watershed, where the outfall of the KNSG facility is located.

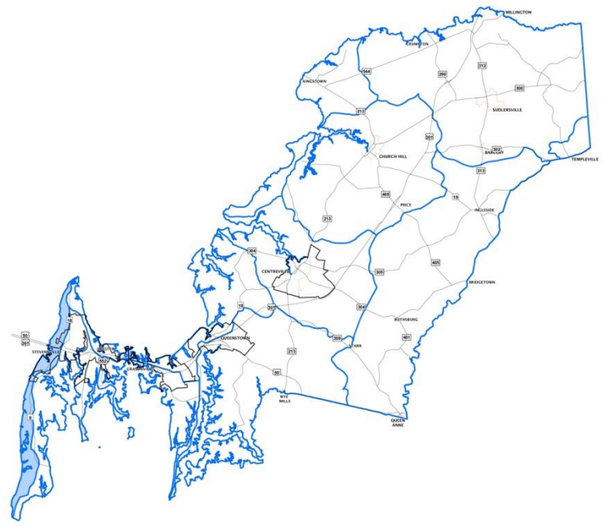
**Maximum Capacity Build-Out Carrying Capacity**

Maximum build-out of the watershed should not exceed 10% impervious surface with use of Tributary Strategies BMPs and other technologies. Studies have documented that the quality of aquatic habitat in streams, lakes and wetlands begins to decline when the area of impervious surface located in upstream watersheds reaches 10 percent of the total land areas. On the average, 20% of the total land area is impervious in a typical subdivision. When impervious surface reaches more than 25% within a watershed, waterways can only support few fish species able to tolerate high levels of pollution. Scientists suggest that once this point is reached even the best stormwater management practice cannot mitigate these impacts. *Source: A Citizen's Guide to Stormwater Management in Maryland.*

## Section 11.4 Kent Island Bay Watershed - 02130511

***Existing Land Use 2008***



| Table 11.4-1 Conservation Lands Programs | Acres |
|---|---|
| MALPF Easement | - |
| MALPF Greenprint | - |
| Rural Legacy Easement | - |
| MET | 121.27 |
| TDR Sending Areas | 61.49 |
| Private Conservation Easement | - |
| County Park | 361.61 |
| State Owned Land | 25.65 |
| Open Space (Deed Restricted) | 178.13 |
| Open Space (Non Contiguous) | - |
| MALPF Easement / Open Space | - |
| MET / Open Space | - |
| County Park / TDR | 42.24 |
| County Park / NCD | 0.34 |
| County Park / Open Space | 0.56 |
| County Park / MET | 125.83 |
| MET / TDR | - |
| **Total** | **917.12** |

| Land Available for Development | Acres |
|---|---|
| Available | 463.55 |
| Divisible | 778.92 |
| **Total** | **1,242.47** |

| Table 11.4-2 Updated General Land Use Classes (2008) | 2008 Land Uses | | 2030 Preferred Land Uses | |
|---|---|---|---|---|
| | Total Acres | Percent of Total Acres | Total Acres | Percent of Total Acres |
| Low Density Residential (1 to 2 units per 5 acres) | 732.9 | **14.5%** | 680.2 | **13.5%** |
| Medium Density Residential (2 to 8 units per acre) | 867.1 | **17.2%** | 1,049.7 | **19.8%** |
| High Density Residential (8+ units per acre) | - | **0.0%** | - | **0.0%** |
| Commercial | 100.4 | **2.0%** | 138.1 | **2.1%** |
| Mixed Commercial – Residential | - | **0.0%** | 19.8 | **0.2%** |
| Industrial | - | **0.0%** | 20.7 | **0.6%** |
| Institutional | 204.3 | **4.0%** | 200.3 | **4.0%** |
| Surface Mining | - | **0.0%** | - | **0.0%** |
| Very Low Density Rural (1 unit per 5+ acres) | 538.9 | **10.7%** | 791.4 | **15.5%** |
| Private Recreation | 169.9 | **3.4%** | 169.8 | **3.4%** |
| Agriculture | 1,133.2 | **22.5%** | 943.1 | **20.0%** |
| Forest | 836.1 | **16.6%** | 569.7 | **12.0%** |
| Water | 216.7 | **4.3%** | 216.7 | **4.3%** |
| Wetlands | 214.6 | **4.3%** | 214.6 | **4.3%** |
| Transportation | 26.8 | **0.5%** | 26.8 | **0.5%** |
| **Total** | **5,040.9** | **100.0%** | **5,040.9** | **100.0%** |

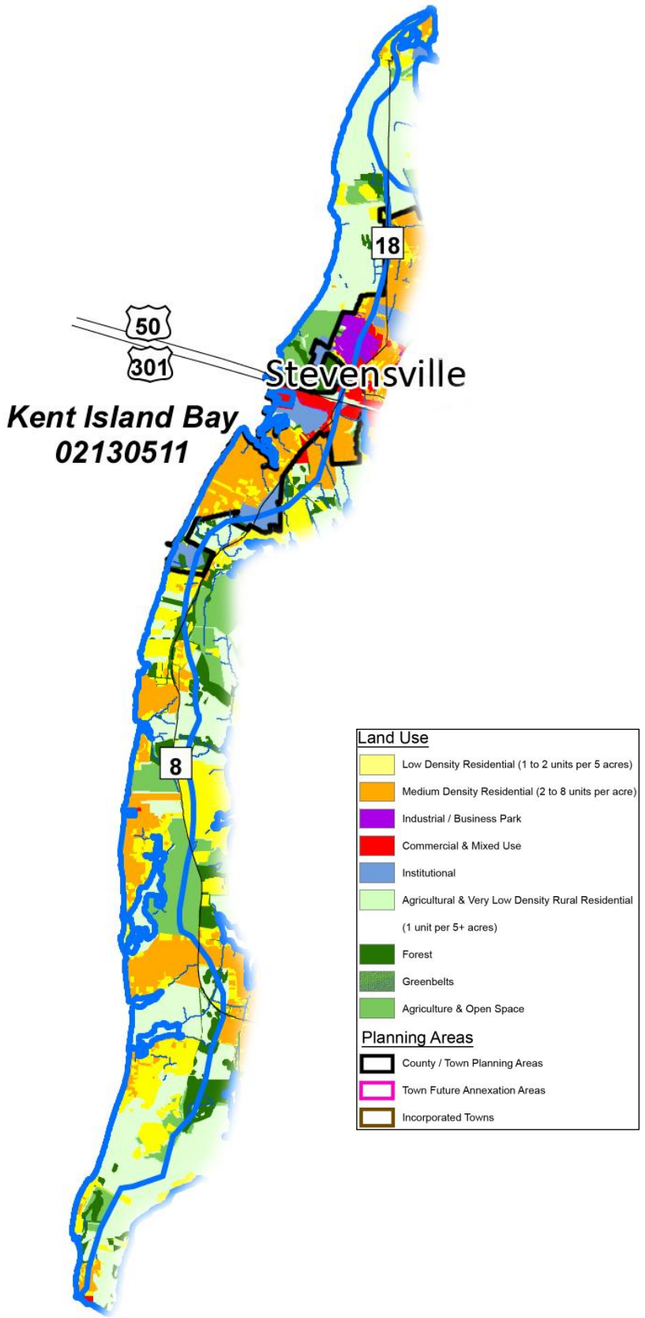



**Table 11.4-3 Best Management Practices Tool Kit**

| Tools, Techniques & Strategies | LANDSCAPES | | | | |
|---|---|---|---|---|---|
| | **Agricultural** | **Natural** | **Rural Residential** | **Suburban** | **Town/Village** |
| **Point Source / Urban Source Strategy** | | | | Expand and enhance KNSG WWTP and collection/ conveyance system with enhanced nutrient removal systems. Connect existing development located within Sewer Service Areas and adjacent areas with failing septic systems. | Within PFAs, connect existing septic systems to KNSG WWTP. Provide opportunities for connections to Queenstown to support infill/ redevelopment activity. |
| **Stormwater Strategy** | BMPs, nutrient and manure management plans and fencing livestock out of streams. | BMPs, preserve buffers and forest conservation. No tree cutting in Critical Areas. | BMPs and ESD. | BMPs, ESD, retrofit SW facilities or include in new development and reduce use of lawn fertilizers. | BMPs, ESD, retrofit facilities. |
| **Onsite Sewage Disposal Strategy (OSDS)** | Use denitrification technology for on-lot systems or connect to sewer system. | Use denitrification technology on-lot systems or connect to sewer system. | Use denitrification technology for on-lot systems or shared septic systems. | Connect homes with failing septic systems to sewer or upgrade with denitrification technology. | Connect existing development on septic systems within PFAs to public system. |
| **Growth Management Strategy** | Preserve environmentally sensitive lands and agricultural lands using State and Local programs. | Restrict development within Critical Areas. | Cluster development, ESD and encourage development toward areas with existing infrastructure. | Change zoning to minimize impacts on water resources. Suburban subdivisions must provide improvements and connection to public water and sewer systems. Reduce the number of shallow wells. | Establish Infill/Redevelopment standards and incentives. |
| **Agriculture Strategy** | Nutrient and manure management, BMPs, cover crops and best practices. | Appropriate floodplain, riparian buffer and wetland buffers. | TDR receiving areas should be established outside of the watershed. | TDR receiving areas should be established outside of the watershed. | |
| **Waterway Strategies** | Protect riparian buffers, tree planting along streams and living shoreline construction | Protect riparian buffers, tree planting along streams and living shoreline construction | Protect riparian buffers, tree planting along streams and living shoreline construction | Protect riparian buffers, tree planting along streams and living shoreline construction | Protect riparian buffers and tree planting along streams. |
| **Air Deposition Strategy** | Establish forest conservation strategies and incentives as well as utilize state and local preservation programs. | Establish greenbelts and forest conservation strategies and incentives. | Require Forest Conservation Plans and establish wooded lot standards. | Require Forest Conservation Plans and trail/path connections within greenbelts to provide access to and from Town. | Concentrate homes, commercial uses and business parks to create walkable communities. Expand transit service. Connect uses with sidewalks, paths and trails. |

**Table 11.4-4 Summary Table of Projected Impacts to Agriculture and Forest**

| Land Use or Variable | 2008 Land Uses | | 2030 Preferred Land Uses | | Projected Change in Land Use 2008-2030 | |
|---|---|---|---|---|---|---|
| | Total Acres | Percent of Total Acres | Total Acres | Percent of Total Acres | Projected Total Acres Lost | Projected Percent of Total Acres Lost |
| Agriculture | 1,133.2 | **22.5%** | 943.1 | **20.0%** | -190.10 | **-2.5%** |
| Forest | 836.1 | **16.6%** | 569.7 | **12.0%** | -266.40 | **-4.6%** |
| ***Queen Anne's County Impervious Surfaces**** | 529.2 | **10.2%** | | | | |
| ***Statewide Priority Wetlands***** | 0.0 | **0.0%** | | | | |
| ***Tier II Catchment Area within Watershed*** | 0.0 | **0.0%** | | | | |

**Impervious surfaces data was created using 2004 planimetric data as updated using 2008 Aerial imagery collected by the State. There is no guarantee that all features were collected nor to the precision of the collected features. This data provides a general value of the impervious surface within a watershed.*

***Queen Anne's County may need to track on permits issued by MDE for development within theses wetlands to determine impacts.*

## Water Resources Element – Nitrogen, Phosphorus and Impervious Surface Data

The following Nitrogen, Phosphorus and Impervious Surface table has been provided by Maryland Department of the Environment. The table was loading using the 2008 land use and the projected maximum capacity build-out values based on the Build-Out Analysis Report, May 2009 as part of this Comprehensive Plan. The preferred land use is shown in the far right column.

**Table 11.4-5 Assessing Impacts of Nitrogen, Phosphorus and Impervious Surface**

| Kent Island Bay Watershed (02130511) | 2002 LU, 2002 BMPs | 2002 LU, Trib Strategy BMPs | 2008 Trib Strategy BMPs | Scenario 1 2030 Max Build-Out with Trib Strategy BMPs | Scenario 2 2030 Preferred Land Use with Trib Strategy BMPs |
|---|---|---|---|---|---|
| | (Acres) | (Acres) | (Acres) | (Acres) | (Acres) |
| Development | 1,752 | 1,752 | 2,266 | 2,727 | 2,727 |
| Agriculture | 1,411 | 1,411 | 1,133 | 943 | 943 |
| Forest | 1,132 | 1,132 | 1,051 | 784 | 784 |
| Water | 233 | 233 | 217 | 217 | 217 |
| Other | 513 | 513 | 374 | 370 | 370 |
| Total Area | 5,041 | 5,041 | 5,041 | 5,041 | 5,041 |
| | | | | | |
| Residential Septic (EDUs) | 0 | 0 | 1,531 | 182 | 36 |
| Non-Residential Septic (EDUs) | 0 | 0 | 23 | 30 | 0 |

**Total Nitrogen Loading**

| Kent Island Bay Watershed (02130511) | 2002 LU, 2002 BMPs | 2002 LU, Trib Strategy BMPs | 2008 Trib Strategy BMPs | Scenario 1 2030 Max Build-Out with Trib Strategy BMPs | Scenario 2 2030 Preferred Land Use with Trib Strategy BMPs |
|---|---|---|---|---|---|
| | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) |
| Development NPS | 15,302 | 10,602 | 13,741 | 16,531 | 16,531 |
| Agriculture NPS | 21,705 | 12,215 | 9,835 | 8,184 | 8,184 |
| Forest NPS | 1,680 | 1,566 | 1,453 | 1,084 | 1,084 |
| Water NPS | 2,347 | 1,942 | 1,809 | 1,809 | 1,809 |
| Other Terrestrial NPS | 4,521 | 3,113 | 2,266 | 2,243 | 2,243 |
| **Total Terrestrial Load** | **45,555** | **29,438** | **29,104** | **29,851** | **29,851** |
| Residential Septic (EDUs) | 0 | 0 | 14,230 | 1,692 | 335 |
| Non-Residential Septic (EDUs) | 0 | 0 | 77 | 99 | 0 |
| **Total Septic Load** | **0** | **0** | **14,307** | **1,791** | **335** |
| **Total NPS Nitrogen Load** | **45,555** | **29,438** | **43,411** | **31,642** | **30,185** |
| **Total PS Load** | **0** | **0** | **10,000** | **27,850** | **32,471** |
| **Total Nitrogen Load (NPS+PS)** | **45,555** | **29,438** | **53,411** | **59,492** | **62,656** |

**Total Phosphorus Loading**

| Kent Island Bay Watershed (02130511) | 2002 LU, 2002 BMPs | 2002 LU, Trib Strategy BMPs | 2008 Trib Strategy BMPs | Scenario 1 2030 Max Build-Out with Trib Strategy BMPs | Scenario 2 Preferred Land Use with Trib Strategy BMPs |
|---|---|---|---|---|---|
| | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) |
| Development NPS | 1,942 | 1,269 | 1,682 | 2,020 | 2,020 |
| Agriculture NPS | 1,553 | 1,128 | 894 | 744 | 744 |
| Forest NPS | 25 | 21 | 19 | 15 | 15 |
| Water NPS | 132 | 132 | 123 | 123 | 123 |
| Other Terrestrial NPS | 598 | 387 | 274 | 272 | 272 |
| **Total Terrestrial Load** | **4,250** | **2,937** | **2,993** | **3,173** | **3,173** |
| **Total PS Load** | **0** | **0** | **700** | **2,039** | **2,385** |
| **Total Phosphorus Load (NPS+PS)** | **4,250** | **2,937** | **3,693** | **5,212** | **5,558** |

| Impervious Cover and Open Space (Acres) | | | | | |
|---|---|---|---|---|---|
| Kent Island Bay Watershed (02130511) | 2002 LU, 2002 BMPs | 2002 LU, Trib Strategy BMPs | 2008 Trib Strategy BMPs | Scenario 1 2030 Max Build-Out with Trib Strategy BMPs | Scenario 2 2030 Preferred land Use with Trib Strategy BMPs |
| Total Impervious Cover | 522 | 522 | 549 | 653 | 653 |
| Agriculture | 1,411 | 1,411 | 1,133 | 943 | 943 |
| Forest | 891 | 891 | 836 | 570 | 570 |
| Percent Impervious | 10.4% | 10.4% | 10.9% | 12.9% | 12.9% |

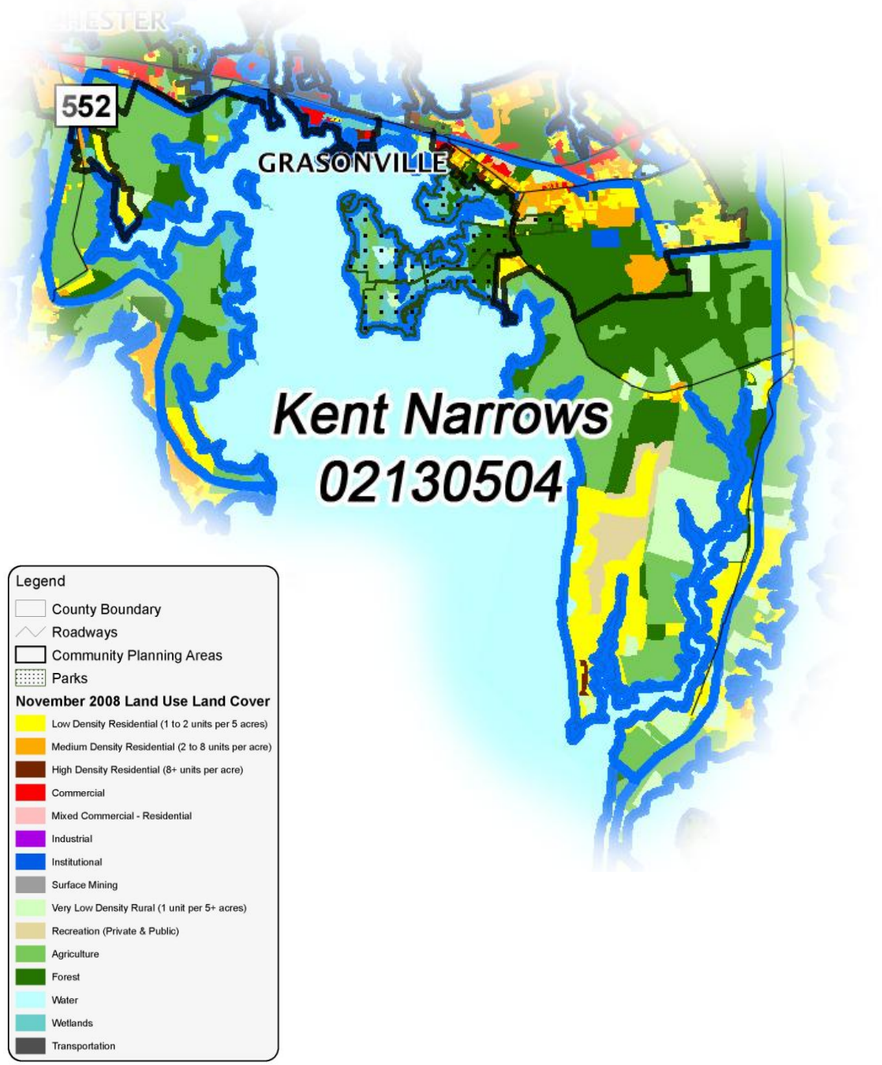
Note: Nitrogen and phosphorus output from sewage are counted as part of the Kent Island Bay Watershed, where the outfall of the KNSG facility is located.

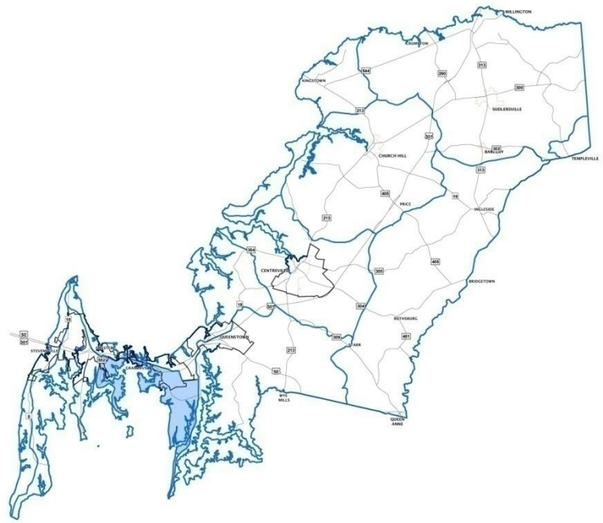
**Maximum Capacity Build-Out Carrying Capacity**

Maximum build-out of the watershed should not exceed 10% impervious surface with use of Tributary Strategies BMPs and other technologies. Studies have documented that the quality of aquatic habitat in streams, lakes and wetlands begins to decline when the area of impervious surface located in upstream watersheds reaches 10 percent of the total land areas. On the average, 20% of the total land area is impervious in a typical subdivision. When impervious surface reaches more than 25% within a watershed, waterways can only support few fish species able to tolerate high levels of pollution. Scientists suggest that once this point is reached even the best stormwater management practice cannot mitigate these impacts. *Source: A Citizen's Guide to Stormwater Management in Maryland.*

## Section 11.5 Kent Narrows Watershed - 02130504

***Existing Land Use 2008***



| Table 11.5-1 Conservation Lands Programs | Acres |
|---|---|
| MALPF Easement | 239.68 |
| MALPF Greenprint | - |
| Rural Legacy Easement | - |
| MET | 1,526.73 |
| TDR Sending Areas | - |
| Private Conservation Easement | - |
| County Park | 123.85 |
| State Owned Land | 0.06 |
| Open Space (Deed Restricted) | 130.19 |
| Open Space (Non Contiguous) | - |
| MALPF Easement / Open Space | - |
| MET / Open Space | 30.88 |
| County Park / TDR | - |
| County Park / NCD | - |
| County Park / Open Space | 4.26 |
| County Park / MET | - |
| MET / TDR | 40.08 |
| **Total** | **2,095.73** |

| Land Available for Development | Acres |
|---|---|
| Available | 569.80 |
| Divisible | 1,115.83 |
| **Total** | **1,685.62** |

| Table 11.5-2 Updated General Land Use Classes (2008) | 2008 Land Uses | | 2030 Preferred Land Uses | |
|---|---|---|---|---|
| | Total Acres | Percent of Total Acres | Total Acres | Percent of Total Acres |
| Low Density Residential (1 to 2 units per 5 acres) | 990.5 | **14.6%** | 973.5 | **14.3%** |
| Medium Density Residential (2 to 8 units per acre) | 269.4 | **4.0%** | 644.9 | **9.5%** |
| High Density Residential (8+ units per acre) | 44.9 | **0.7%** | 44.9 | **0.7%** |
| Commercial | 66.2 | **1.0%** | 64.4 | **0.9%** |
| Mixed Commercial – Residential | - | **0.0%** | 79.1 | **1.2%** |
| Industrial | - | **0.0%** | 0.8 | **0.0%** |
| Institutional | 63.1 | **0.9%** | 61.5 | **0.9%** |
| Surface Mining | - | **0.0%** | - | **0.0%** |
| Very Low Density Rural (1 unit per 5+ acres) | 579.5 | **8.5%** | 801.4 | **11.8%** |
| Private Recreation | 188.5 | **2.8%** | 188.5 | **2.8%** |
| Agriculture | 2,241.4 | **33.0%** | 2,184.4 | **32.2%** |
| Forest | 1,568.6 | **23.0%** | 968.7 | **14.2%** |
| Water | 92.5 | **1.4%** | 92.5 | **1.4%** |
| Wetlands | 680.1 | **10.0%** | 680.1 | **10.0%** |
| Transportation | 9.1 | **0.1%** | 9.1 | **0.1%** |
| **Total** | **6,793.8** | **100.0%** | **6,793.8** | **100.0%** |

***Preferred Land Use 2030***

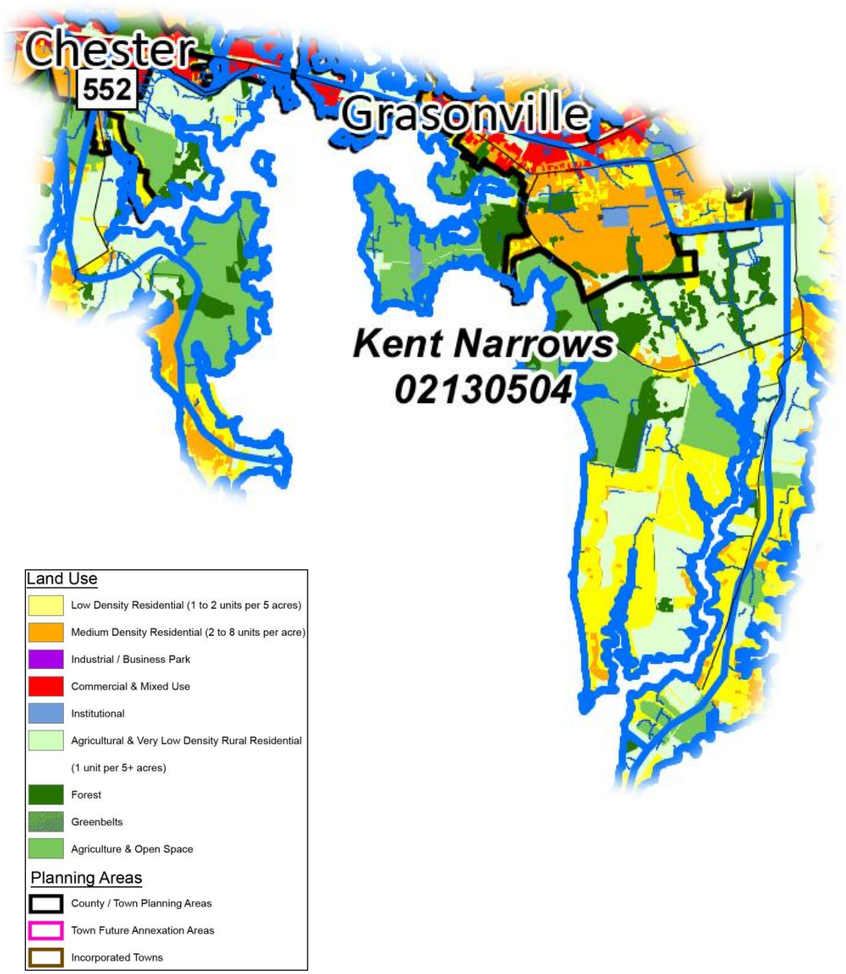



**Table 11.5-3 Best Management Practices Tool Kit**

| Tools, Techniques & Strategies | LANDSCAPE | | | | |
|---|---|---|---|---|---|
| | **Agricultural** | **Natural** | **Rural Residential** | **Suburban** | **Town/Village** |
| **Point Source / Urban Source Strategy** | | | | Expand and enhance KNSG WWTP and collection/ conveyance system with enhanced nutrient removal systems. Connect existing development located within Sewer Service Areas and adjacent areas with failing septic systems. | Within PFAs, connect existing septic systems to KNSG WWTP. Provide opportunities for connections to Queenstown to support infill/ redevelopment activity. |
| **Stormwater Strategy** | BMPs, nutrient and manure management plans and fencing livestock out of streams. | BMPs, preserve buffers and forest conservation. No tree cutting in Critical Areas. | BMPs and ESD. | BMPs, ESD, Retrofit SW facilities or include in new development and reduce use of lawn fertilizers. | BMPs, ESD, retrofit facilities. |
| **Onsite Sewage Disposal Strategy (OSDS)** | Use denitrification technology for on-lot systems or connect to sewer system. | Use denitrification technology on-lot systems or connect to sewer system. | Use denitrification technology for on-lot systems or shared septic systems. | Connect homes with failing septic systems to sewer or upgrade with denitrification technology. | Connect existing development on septic systems within PFAs to public system. |
| **Growth Management Strategy** | Preserve environmentally sensitive lands and agricultural lands using State and Local programs. | Restrict development within Critical Areas. | Cluster development, ESD and encourage development toward areas with existing infrastructure. | Change zoning to minimize impacts on water resources. Suburban subdivisions must provide improvements and connection to public water and sewer systems. Reduce the number of shallow wells. | Establish Infill/Redevelopment standards and incentives. |
| **Agriculture Strategy** | Nutrient and manure management, BMPs, cover crops and best practices. | Preserve floodplains, riparian buffers and wetland buffers. | TDR receiving areas should be established outside of the watershed. | TDR receiving areas should be established outside of the watershed. | |
| **Waterway Strategies** | Protect riparian buffers, tree planting along streams and living shoreline construction | Protect riparian buffers, tree planting along streams and living shoreline construction | Protect riparian buffers, tree planting along streams and living shoreline construction | Protect riparian buffers, tree planting along streams and living shoreline construction | Protect riparian buffers and tree planting along streams. |
| **Air Deposition Strategy** | Establish forest conservation strategies and incentives as well as utilize state and local preservation programs. | Establish greenways, greenbelts and forest conservation strategies and incentives. | Require Forest Conservation Plans and establish wooded lot standards. | Require Forest Conservation Plans and trail/path connections within greenbelts to provide access to and from Town/village. | Concentrate homes, commercial uses and business parks to create walkable communities. Expand transit and shuttle service. Connect uses with sidewalks, paths and trails. |

**Table 11.5-4 Summary of Projected Impacts to Agriculture and Forest**

| Land Use or Variable | 2008 Land Uses | | 2030 Preferred Land Uses | | Projected Change in Land Use 2008-2030 | |
|---|---|---|---|---|---|---|
| | Total Acres | Percent of Total Acres | Total Acres | Percent of Total Acres | Total Acres Lost | Percent of Total Acres Lost |
| Agriculture | 2,241.4 | **33.0%** | 2,184.4 | **32.2%** | -57.0 | **-0.8%** |
| Forest | 1,568.6 | **23.0%** | 968.7 | **14.2%** | -599.9 | **-8.8%** |
| ***Queen Anne's County Impervious Surfaces**** | 382.1 | **5.6%** | | | | |
| ***Statewide Priority Wetlands ***** | 520.0 | **7.7%** | | | | |
| ***Tier II Catchment Area within Watershed*** | 0.0 | **0.0%** | | | | |

**Impervious surfaces data was created using 2004 planimetric data as updated using 2008 Aerial imagery collected by the State. There is no guarantee that all features were collected nor to the precision of the collected features. This data provides a general value of the impervious surface within a watershed.*
***Queen Anne's County may need to track on permits issued by MDE for development within theses wetlands to determine impacts.*

## Water Resources Element – Nitrogen, Phosphorus and Impervious Surface Data

The following Nitrogen, Phosphorus and Impervious Surface table has been provided by Maryland Department of the Environment. The table was loading using the 2008 land use and the projected maximum capacity build-out values based on the Build-Out Analysis Report, May 2009 as part of this Comprehensive Plan. The preferred land use is shown in the far right column.

**Table 11.5-5 Assessing Impacts of Nitrogen, Phosphorus and Impervious Surface**

| Kent Narrows Watershed (02130504) | 2002 LU, 2002 BMPs | 2002 LU, Trib Strategy BMPs | 2008 Trib Strategy BMPs | Scenario 1 2030 Max Build-Out with Trib Strategy BMPs | Scenario 2 2030 Preferred Land Use with Trib Strategy BMPs |
|---|---|---|---|---|---|
| | (Acres) | (Acres) | (Acres) | (Acres) | (Acres) |
| Development | 1,555 | 1,555 | 2,023 | 2,627 | 2,627 |
| Agriculture | 2,352 | 2,352 | 2,241 | 2,232 | 2,232 |
| Forest | 2,513 | 2,513 | 2,249 | 1,593 | 1,593 |
| Water | 96 | 96 | 92 | 92 | 92 |
| Other | 278 | 278 | 189 | 250 | 250 |
| Total Area | 6,794 | 6,794 | 6,794 | 6,794 | 6,794 |
| | | | | | |
| Residential Septic (EDUs) | 0 | 0 | 478 | 589 | 118 |
| Non-Residential Septic (EDUs) | 0 | 0 | 15 | 3 | 0 |

| Total Nitrogen Loading<br>Kent Narrows Watershed (02130504) | 2002 LU, 2002 BMPs | 2002 LU, Trib Strategy BMPs | 2008 Trib Strategy BMPs | Scenario 1 2030 Max Build-Out with Trib Strategy BMPs | Scenario 2 2030 Preferred Land Use with Trib Strategy BMPs |
|---|---|---|---|---|---|
| | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) |
| Development NPS | 13,653 | 9,427 | 12,284 | 15,945 | 15,945 |
| Agriculture NPS | 36,403 | 20,396 | 19,402 | 19,331 | 19,331 |
| Forest NPS | 3,729 | 3,475 | 3,109 | 2,203 | 2,203 |
| Water NPS | 969 | 801 | 772 | 772 | 772 |
| Other Terrestrial NPS | 2,453 | 1,687 | 1,149 | 1,520 | 1,520 |
| **Total Terrestrial Load** | **57,205** | **35,786** | **36,716** | **39,770** | **39,770** |
| Residential Septic (EDUs) | 0 | 0 | 4,443 | 5,475 | 1,097 |
| Non-Residential Septic (EDUs) | 0 | 0 | 50 | 8 | 0 |
| **Total Septic Load** | **0** | **0** | **4,493** | **5,483** | **1,097** |
| **Total NPS Nitrogen Load** | **57,205** | **35,786** | **41,210** | **45,253** | **40,867** |
| **Total PS Load** | **0** | **0** | **0** | **0** | **0** |
| **Total Nitrogen Load (NPS+PS)** | **57,205** | **35,786** | **41,210** | **45,253** | **40,867** |

| Total Phosphorus Loading<br>Kent Narrows Watershed (02130504) | 2002 LU, 2002 BMPs | 2002 LU, Trib Strategy BMPs | 2008 Trib Strategy BMPs | Scenario 1 2030 Max Build-Out with Trib Strategy BMPs | Scenario 2 2030 Preferred Land Use with Trib Strategy BMPs |
|---|---|---|---|---|---|
| | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) |
| Development NPS | 1,773 | 1,152 | 1,531 | 1,978 | 1,978 |
| Agriculture NPS | 2,579 | 1,868 | 1,796 | 1,778 | 1,778 |
| Forest NPS | 56 | 47 | 42 | 29 | 29 |
| Water NPS | 54 | 54 | 52 | 52 | 52 |
| Other Terrestrial NPS | 327 | 211 | 149 | 191 | 191 |
| **Total Terrestrial Load** | **4,789** | **3,332** | **3,570** | **4,029** | **4,029** |
| **Total PS Load** | **0** | **0** | **0** | **0** | **0** |
| **Total Phosphorus Load (NPS+PS)** | **4,789** | **3,332** | **3,570** | **4,029** | **4,029** |

| Impervious Cover and Open Space | (Acres) | | | | |
|---|---|---|---|---|---|
| Kent Narrows Watershed (02130504) | 2002 LU, 2002 BMPs | 2002 LU, Trib Strategy BMPs | 2008 Trib Strategy BMPs | Scenario 1 2030 Max Build-Out with Trib Strategy BMPs | Scenario 2 2030 Preferred Land Use with Trib Strategy BMPs |
| Total Impervious Cover | 368 | 368 | 363 | 510 | 510 |
| Agriculture | 2,352 | 2,352 | 2,241 | 2,232 | 2,232 |
| Forest | 1,781 | 1,781 | 1,569 | 913 | 913 |
| Percent Impervious | 5.4% | 5.4% | 5.3% | 7.5% | 7.5% |

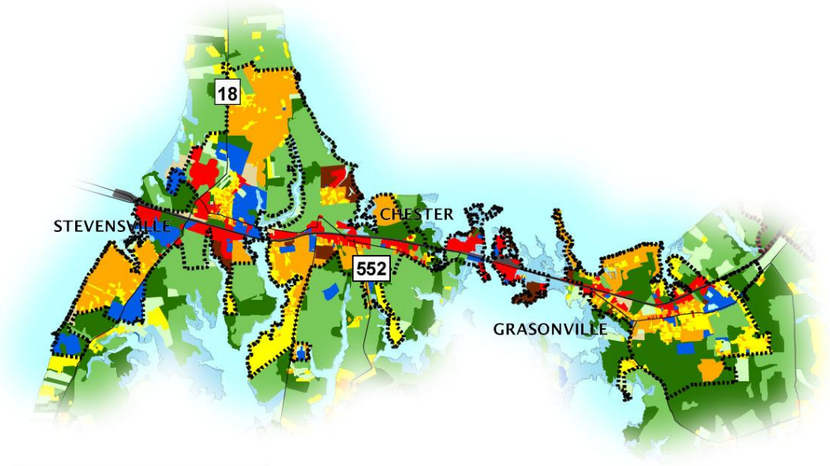
Note: Nitrogen and phosphorus output from sewage are counted as part of the Kent Island Bay Watershed, where the outfall of the KNSG facility is located.

**Maximum Capacity Build-Out Carrying Capacity**

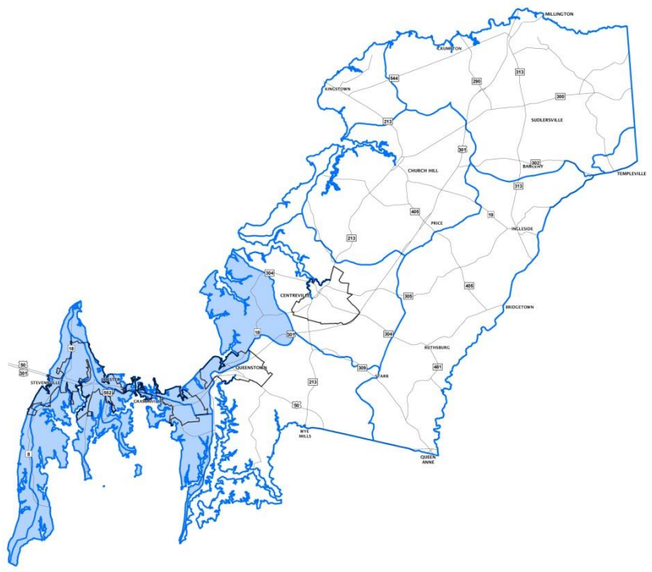
Maximum build-out of the watershed should not exceed 10% impervious surface with use of Tributary Strategies BMPs and other technologies. Studies have documented that the quality of aquatic habitat in streams, lakes and wetlands begins to decline when the area of impervious surface located in upstream watersheds reaches 10 percent of the total land areas. On the average, 20% of the total land area is impervious in a typical subdivision. When impervious surface reaches more than 25% within a watershed, waterways can only support few fish species able to tolerate high levels of pollution. Scientists suggest that once this point is reached even the best stormwater management practice cannot mitigate these impacts. *Source: A Citizen's Guide to Stormwater Management in Maryland.*

## Section 11.6 Islands Growth Area

***Existing Land Use 2008***







| Table 11.6-1 Conservation Lands Programs | Acres |
|---|---|
| MALPF Easement | 0.4 |
| MALPF Greenprint | - |
| Rural Legacy Easement | - |
| MET | 3.7 |
| TDR Sending Areas | - |
| Private Conservation Easement | 12.6 |
| County Park | 244.9 |
| State Owned Land | 23.0 |
| Open Space (Deed Restricted) | 268.6 |
| Open Space (Non Contiguous) | - |
| MALPF Easement / Open Space | - |
| MET / Open Space | - |
| County Park / TDR | - |
| County Park / NCD | - |
| County Park / Open Space | 4.3 |
| County Park / MET | - |
| MET / TDR | - |
| **Total** | **557.5** |

| Land Available for Development | Acres |
|---|---|
| Available | 417.4 |
| Divisible | 687.9 |
| **Total** | **1,105.3** |

| Table 11.6-2 Updated General Land Use Classes (2008) | 2008 Land Uses | | 2030 Preferred Land Uses | |
|---|---|---|---|---|
| | Total Acres | Percent of Total Acres | Total Acres | Percent of Total Acres |
| Low Density Residential (1 to 2 units per 5 acres) | 948.4 | **13.7%** | 773.9 | **11.2%** |
| Medium Density Residential (2 to 8 units per acre) | 1,753.1 | **25.4%** | 3,209.1 | **46.4%** |
| High Density Residential (8+ units per acre) | 195.0 | **2.8%** | 195.0 | **2.8%** |
| Commercial | 658.7 | **9.5%** | 644.1 | **9.3%** |
| Mixed Commercial – Residential | - | **0.0%** | 345.9 | **5.0%** |
| Industrial | 0.4 | **0.0%** | 117.8 | **1.7%** |
| Institutional | 588.2 | **8.5%** | 574.9 | **8.3%** |
| Surface Mining | - | **0.0%** | - | **0.0%** |
| Very Low Density Rural (1 unit per 5+ acres) | 133.7 | **1.9%** | 76.2 | **1.1%** |
| Private Recreation | 83.0 | **1.2%** | 150.8 | **2.2%** |
| Agriculture | 1,050.6 | **15.2%** | 68.2 | **1.0%** |
| Forest | 1,038.1 | **15.0%** | 293.3 | **4.2%** |
| Water | 93.1 | **1.3%** | 93.1 | **1.3%** |
| Wetlands | 208.5 | **3.0%** | 208.5 | **3.0%** |
| Transportation | 163.1 | **2.4%** | 163.1 | **2.4%** |
| **Total** | **6,913.9** | **100.0%** | **6,913.9** | **100.0%** |

***Preferred Land Use 2030***

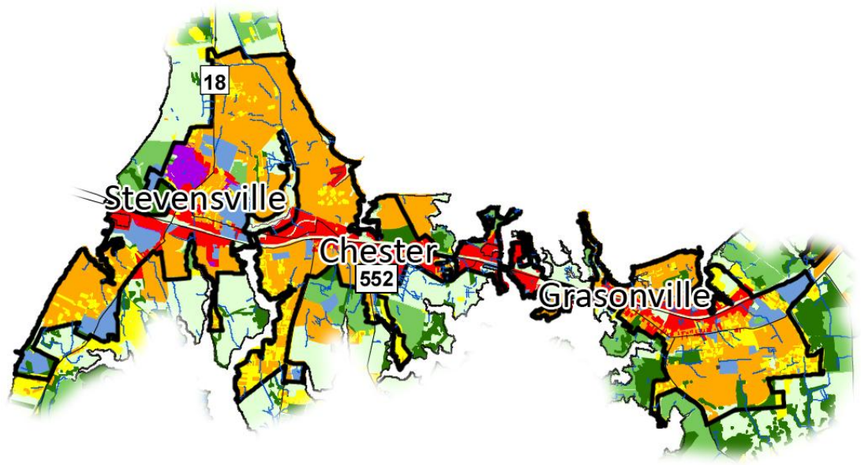



**Table 11.6-3 Best Management Practices Tool Kit**

| Tools, Techniques & Strategies | LANDSCAPE | | | | |
|---|---|---|---|---|---|
| | **Agricultural** | **Natural** | **Rural Residential** | **Suburban** | **Town/Village** |
| **Point Source / Urban Source Strategy** | | | | Expand and enhance KNSG WWTP and collection/ conveyance system with enhanced nutrient removal systems. Connect existing development located within Sewer Service Areas and adjacent areas with failing septic systems. | Within PFAs, connect existing septic systems to KNSG WWTP. Provide opportunities for connections to Queenstown to support infill/ redevelopment activity. |
| **Stormwater Strategy** | BMPs, nutrient and manure management plans and fencing livestock out of streams. | BMPs, preserve buffers and forest conservation. No tree cutting in Critical Areas. | BMPs and ESD. | BMPs, ESD, Retrofit SW facilities or include in new development and reduce use of lawn fertilizers. | BMPs, ESD, retrofit facilities. |
| **Onsite Sewage Disposal Strategy (OSDS)** | Use denitrification technology for on-lot systems or connect to sewer system. | Use denitrification technology on-lot systems or connect to sewer system. | Use denitrification technology for on-lot systems or shared septic systems. | Connect homes with failing septic systems to sewer or upgrade with denitrification technology. | Connect existing development on septic systems within PFAs to public system. |
| **Growth Management Strategy** | Preserve environmentally sensitive lands and agricultural lands using State and Local programs. | Restrict development within Critical Areas. | Cluster development, ESD and encourage development toward areas with existing infrastructure. | Change zoning to minimize impacts on water resources. Suburban subdivisions must provide improvements and connection to public water and sewer systems. Reduce the number of shallow wells. | Establish Infill/Redevelopment standards and incentives. |
| **Agriculture Strategy** | Nutrient and manure management, BMPs, cover crops and best practices. | Preserve floodplains, riparian buffers and wetland buffers. | TDR receiving areas should be established outside of the watershed. | TDR receiving areas should be established outside of the watershed. | |
| **Waterway Strategies** | Protect riparian buffers, tree planting along streams and living shoreline construction | Protect riparian buffers, tree planting along streams and living shoreline construction | Protect riparian buffers, tree planting along streams and living shoreline construction | Protect riparian buffers, tree planting along streams and living shoreline construction | Protect riparian buffers and tree planting along streams. |
| **Air Deposition Strategy** | Establish forest conservation strategies and incentives as well as utilize state and local preservation programs. | Establish greenways, greenbelts and forest conservation strategies and incentives. | Require Forest Conservation Plans and establish wooded lot standards. | Require Forest Conservation Plans and trail/path connections within greenbelts to provide access to and from Town/village. | Concentrate homes, commercial uses and business parks to create walkable communities. Expand transit and shuttle service. Connect uses with sidewalks, paths and trails. |

**Table 11.6-4 Summary of Projected Impacts to Agriculture and Forest**

| Land Use or Variable | 2008 Land Uses | | 2030 Preferred Land Uses | | Projected Change in Land Use 2008-2030 | |
|---|---|---|---|---|---|---|
| | Total Acres | Percent of Total Acres | Total Acres | Percent of Total Acres | Total Acres | Percent of Total Acres |
| Agriculture | 1,050.6 | **15.2%** | 68.2 | **1.0%** | -982.4 | **-14.2%** |
| Forest | 1,038.1 | **15.0%** | 293.3 | **4.2%** | -744.8 | **-10.8%** |
| ***Queen Anne's County Impervious Surfaces**** | 1,400.7 | **20.3%** | | | | |
| ***Statewide Priority Wetlands***** | 65.9 | **1.0%** | | | | |
| ***Tier II Catchment Area within Watershed*** | 0.0 | **0.0%** | | | | |

**Impervious surfaces data was created using 2004 planimetric data as updated using 2008 Aerial imagery collected by the State. There is no guarantee that all features were collected nor as to the precision of the collected features. This data provides a general value of the impervious surface within a watershed.*
***Queen Anne's County may need to track on permits issued by MDE for development within theses wetlands to determine impacts.*

## Water Resources Element – Nitrogen, Phosphorus and Impervious Surface Data

The following Nitrogen, Phosphorus and Impervious Surface table has been provided by Maryland Department of the Environment. The table was loading using the 2008 land use and the projected maximum capacity build-out values based on the Build-Out Analysis Report, May 2009 as part of this Comprehensive Plan. The preferred land use is shown in the far right column.

**Table 11.6-5 Assessing Impacts of Nitrogen, Phosphorus and Impervious Surface**

| Island Growth Area | 2002 LU, 2002 BMPs | 2002 LU, Trib Strat BMPs | 2008 Trib Strat BMPs | Scenario 1 2030 Max Build-Out with Trib Strat BMPs | Scenario 2 2030 Preferred Land Use with Trib Strat BMPs |
|---|---|---|---|---|---|
| | (Acres) | (Acres) | (Acres) | (Acres) | (Acres) |
| Development | 3,309 | 3,309 | 3,852 | 5,525 | 5,525 |
| Agriculture | 1,187 | 1,187 | 1,051 | 78 | 78 |
| Forest | 1,672 | 1,672 | 1,247 | 492 | 492 |
| Water | 143 | 143 | 93 | 93 | 93 |
| Other | 603 | 603 | 671 | 726 | 726 |
| Total Area | 6,914 | 6,914 | 6,914 | 6,914 | 6,914 |
| | | | | | |
| Residential Septic (EDUs) | 0 | 0 | 211 | 1,899 | 0 |
| Non-Residential Septic (EDUs) | 0 | 0 | 297 | 43 | 0 |

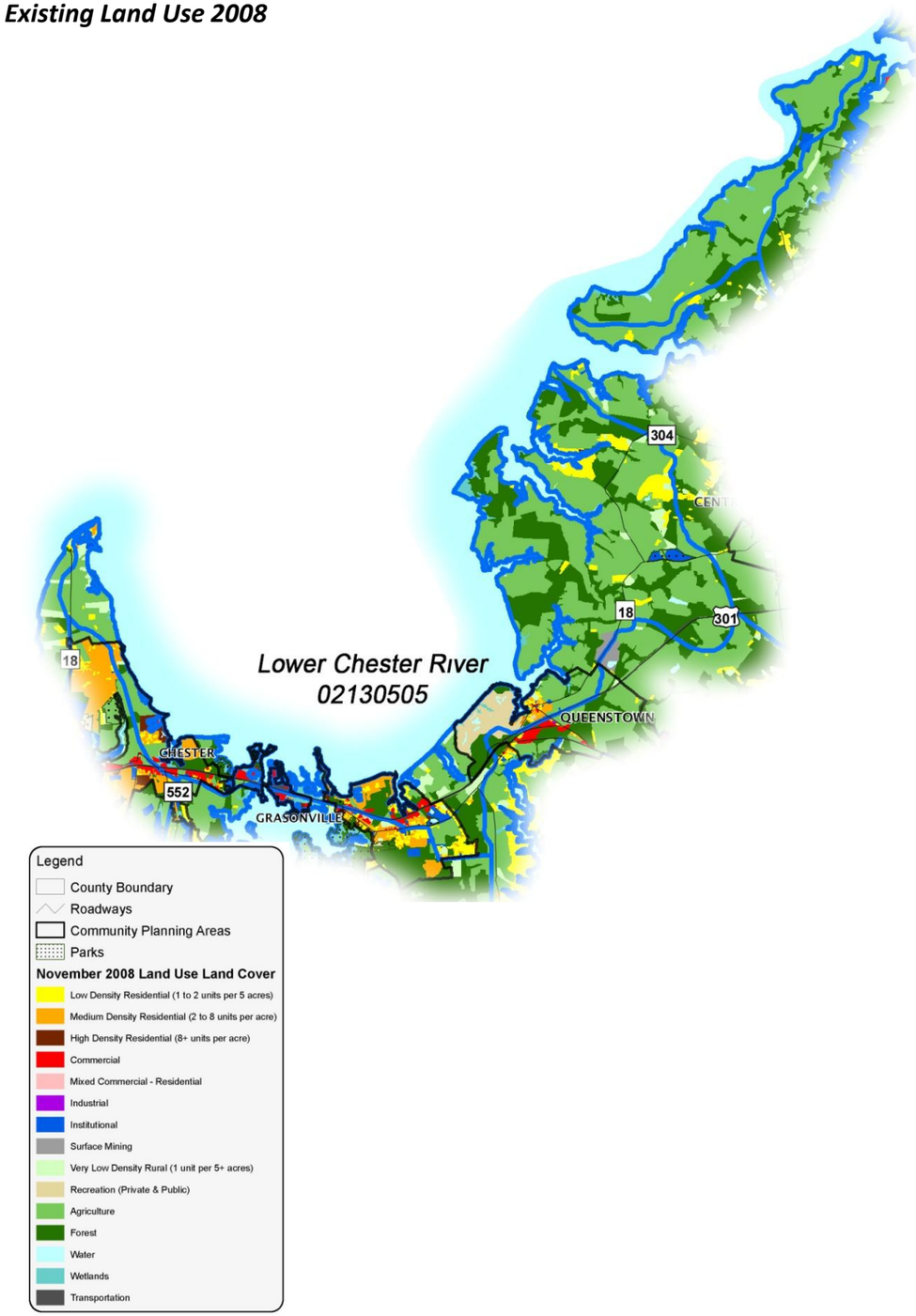
| Total Nitrogen Loading<br>Island Growth Area | 2002 LU, 2002 BMPs | 2002 LU, Trib Strat BMPs | 2008 Trib Strat BMPs | Scenario 1 2030 Max Build-Out with Trib Strat BMPs | Scenario 2 2030 Preferred Land Use with Trib Strat BMPs |
|---|---|---|---|---|---|
| | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) |
| Development NPS | 28,560 | 19,943 | 23,209 | 33,269 | 33,269 |
| Agriculture NPS | 17,606 | 10,181 | 9,085 | 673 | 673 |
| Forest NPS | 2,481 | 2,312 | 1,724 | 681 | 681 |
| Water NPS | 1,442 | 1,193 | 777 | 777 | 777 |
| Other Terrestrial NPS | 5,241 | 3,644 | 4,051 | 4,384 | 4,384 |
| **Total Terrestrial Load** | **55,330** | **37,274** | **38,846** | **39,784** | **39,784** |
| Residential Septic (EDUs) | 0 | 0 | 1,961 | 17,650 | 0 |
| Non-Residential Septic (EDUs) | 0 | 0 | 985 | 141 | 0 |
| **Total Septic Load** | **0** | **0** | **2,946** | **17,791** | **0** |
| **Total NPS Nitrogen Load** | **55,330** | **37,274** | **41,792** | **57,575** | **39,784** |
| **Total PS Load** | **0** | **0** | **10,000** | **27,850** | **33,627** |
| **Total Nitrogen Load (NPS+PS)** | **55,330** | **37,274** | **51,792** | **85,425** | **73,411** |

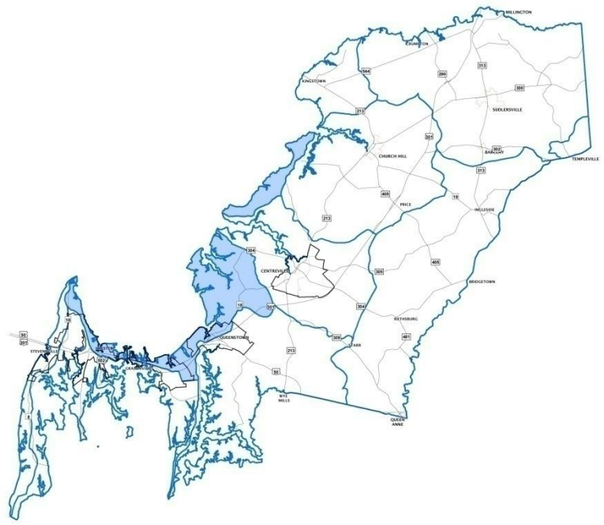
| Total Phosphorus Loading<br>Island Growth Area | 2002 LU, 2002 BMPs | 2002 LU, Trib Strat BMPs | 2008 Trib Strat BMPs | Scenario 1 2030 Max Build-Out with Trib Strat BMPs | Scenario 2 2030 Preferred Land Use with Trib Strat BMPs |
|---|---|---|---|---|---|
| | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) |
| Development NPS | 3,429 | 2,271 | 2,626 | 3,738 | 3,738 |
| Agriculture NPS | 1,343 | 987 | 843 | 62 | 62 |
| Forest NPS | 38 | 31 | 23 | 9 | 9 |
| Water NPS | 81 | 81 | 53 | 53 | 53 |
| Other Terrestrial NPS | 649 | 426 | 468 | 513 | 513 |
| **Total Terrestrial Load** | **5,539** | **3,797** | **4,013** | **4,375** | **4,375** |
| **Total PS Load** | **0** | **0** | **700** | **2,039** | **2,472** |
| **Total Phosphorus Load (NPS+PS)** | **5,539** | **3,797** | **4,713** | **6,414** | **6,847** |

| Impervious Cover and Open Space | (Acres) | | | | |
|---|---|---|---|---|---|
| Island Growth Area | 2002 LU, 2002 BMPs | 2002 LU, Trib Strat BMPs | 2008 Trib Strat BMPs | Scenario 1 2030 Max Build-Out with Trib Strat BMPs | Scenario 2 2030 Preferred Land Use with Trib Strat BMPs |
| Total Impervious Cover | 1,286 | 1,286 | 1,546 | 2,195 | 2,195 |
| Agriculture | 1,187 | 1,187 | 1,051 | 78 | 78 |
| Forest | 1,416 | 1,416 | 1,038 | 293 | 293 |
| Percent Impervious | 18.6% | 18.6% | 22.4% | 31.7% | 31.7% |

## Section 11.7 Lower Chester River Watershed - 02130505

***Existing Land Use 2008***



| Table 11.7-1 Conservation Lands Programs | Acres |
|---|---|
| MALPF Easement | 1,217.38 |
| MALPF Greenprint | - |
| Rural Legacy Easement | 139.60 |
| MET | 2,964.84 |
| TDR Sending Areas | 277.51 |
| Private Conservation Easement | 15.48 |
| County Park | 597.68 |
| State Owned Land | - |
| Open Space (Deed Restricted) | 519.77 |
| Open Space (Non Contiguous) | 117.49 |
| MALPF Easement / Open Space | - |
| MET / Open Space | - |
| County Park / TDR | 19.87 |
| County Park / NCD | - |
| County Park / Open Space | - |
| County Park / MET | - |
| MET / TDR | - |
| **Total** | **5,869.63** |

| Land Available for Development | Acres |
|---|---|
| Available | 1,689.95 |
| Divisible | 4,690.09 |
| **Total** | **6,380.03** |

| Table 11.7-2 Updated General Land Use Classes (2008) | 2008 Land Uses | | 2030 Preferred Land Uses | |
|---|---|---|---|---|
| | Total Acres | Percent of Total Acres | Total Acres | Percent of Total Acres |
| Low Density Residential (1 to 2 units per 5 acres) | 901.6 | **5.1%** | 821.6 | **4.7%** |
| Medium Density Residential (2 to 8 units per acre) | 508.7 | **2.9%** | 1,308.1 | **7.4%** |
| High Density Residential (8+ units per acre) | 93.1 | **0.5%** | 93.1 | **0.5%** |
| Commercial | 224.0 | **1.3%** | 258.2 | **1.5%** |
| Mixed Commercial – Residential | - | **0.0%** | 305.0 | **1.7%** |
| Industrial | - | **0.0%** | 3.5 | **0.0%** |
| Institutional | 208.7 | **1.2%** | 199.6 | **1.1%** |
| Surface Mining | 56.9 | **0.3%** | 56.9 | **0.3%** |
| Very Low Density Rural (1 unit per 5+ acres) | 479.8 | **2.7%** | 1,280.4 | **7.3%** |
| Private Recreation | 426.8 | **2.4%** | 426.8 | **2.4%** |
| Agriculture | 9,636.1 | **54.6%** | 8,445.4 | **47.8%** |
| Forest | 4,050.4 | **22.9%** | 3,387.5 | **19.2%** |
| Water | 243.9 | **1.4%** | 243.9 | **1.4%** |
| Wetlands | 668.9 | **3.8%** | 668.9 | **3.8%** |
| Transportation | 161.0 | **0.9%** | 161.0 | **0.9%** |
| **Total** | **17,659.9** | **100.0%** | **17,659.9** | **100.0%** |

***Preferred Land Use 2030***

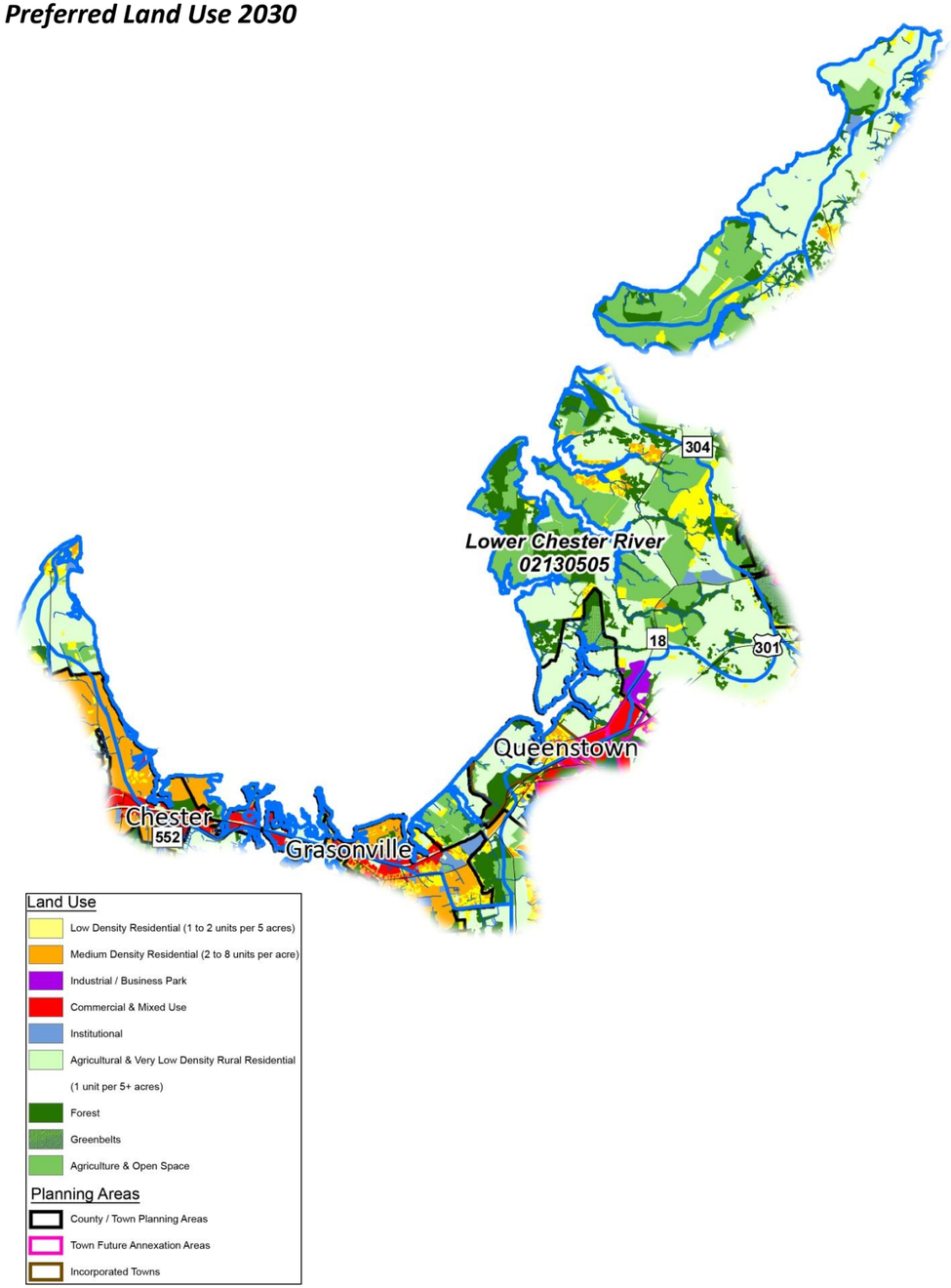



**Table 11.7-3 Best Management Practices Tool Kit**

| Tools, Techniques & Strategies | LANDSCAPE | | | | |
|---|---|---|---|---|---|
| | **Agricultural** | **Natural** | **Rural Residential** | **Suburban** | **Town/Village** |
| **Point Source / Urban Source Strategy** | | | | Expand and enhance KNSG WWTP and Queenstown WWTP and collection/ conveyance system with enhanced nutrient removal systems. Connect existing development located within Sewer Service Areas and adjacent areas with failing septic systems. | Within PFAs, connect existing septic systems to KNSG WWTP and Queenstown WWTP. |
| **Stormwater Strategy** | BMPs, nutrient and manure management Plans and fencing livestock out of streams. | BMPs, preserve buffers and forest conservation. No tree cutting in Critical Areas. | BMPs and ESD. | BMPs, ESD, Retrofit SW facilities or include in new development and reduce use of lawn fertilizers. | BMPs, ESD, retrofit facilities. |
| **Onsite Sewage Disposal Strategy (OSDS)** | Use denitrification technology for on-lot systems or connect to sewer system. | Use denitrification technology on-lot systems or connect to sewer system. | Use denitrification technology for on-lot systems or shared septic systems. | Connect homes with failing septic systems to sewer or upgrade with denitrification technology. | Connect existing development on septic systems within PFAs to public system. |
| **Growth Management Strategy** | Preserve environmentally sensitive lands and agricultural lands using State and Local programs. Continue participation in Rural Legacy Preservation Program. | Restrict development within Critical Areas. | Cluster development, ESD and encourage development toward areas with existing infrastructure. | Suburban subdivisions must provide improvements and connection to public water and sewer systems. | Establish Infill/Redevelopment standards and incentives. |
| **Agriculture Strategy** | Nutrient and manure management, BMPs, cover crops and best practices. | Protect floodplains, riparian buffers and wetland buffers. | TDR receiving areas should be established outside of the watershed. | TDR receiving areas should be established outside of the watershed. | |
| **Waterway Strategies** | Protect riparian buffers, tree planting along streams and living shoreline construction | Protect riparian buffers, tree planting along streams and living shoreline construction | Protect riparian buffers, tree planting along streams and living shoreline construction | Protect riparian buffers, tree planting along streams and living shoreline construction | Protect riparian buffers and tree planting along streams. |
| **Air Deposition Strategy** | Establish forest conservation strategies and incentives as well as utilize state and local preservation programs. | Establish greenways, greenbelts and forest conservation strategies and incentives. | Require Forest Conservation Plans and establish wooded lot standards. | Require Forest Conservation Plans and trail/path connections within greenbelts to provide access to and from Town. | Concentrate homes, commercial uses and business parks to create walkable communities. Expand transit service. Connect uses with sidewalks, paths and trails. |

**Table 11.7-4 Summary of Projected Impacts to Agriculture and Forest**

| Land Use or Variable | 2008 Land Uses | | 2030 Preferred Land Uses | | Projected Change in Land Use 2008-2030 | |
|---|---|---|---|---|---|---|
| | Total Acres | Percent of Total Acres | Total Acres | Percent of Total Acres | Total Acres Lost | Percent of Total Acres Lost |
| Agriculture | 9,636.1 | **54.6%** | 8,445.4 | **47.8%** | -1,190.7 | **-6.8%** |
| Forest | 4,050.4 | **22.9%** | 3,387.5 | **19.2%** | -662.9 | **-3.7%** |
| ***Queen Anne's County Impervious Surfaces**** | 810.8 | **4.6%** | | | | |
| ***Statewide Priority Wetlands***** | 807.0 | **4.6%** | | | | |
| ***Tier II Catchment Area within Watershed*** | 51.0 | **0.3%** | | | | |

**Impervious surfaces data was created using 2004 planimetric data as updated using 2008 Aerial imagery collected by the State. There is no guarantee that all features were collected nor to the precision of the collected features. This data provides a general value of the impervious surface within a watershed.*

***Queen Anne's County may need to track on permits issued by MDE for development within theses wetlands to determine impacts.*

## Water Resources Element – Nitrogen, Phosphorus and Impervious Surface Data

The following Nitrogen, Phosphorus and Impervious Surface table has been provided by Maryland Department of the Environment. The table was loading using the 2008 land use and the projected maximum capacity build-out values based on the Build-Out Analysis Report, May 2009 as part of this Comprehensive Plan. The preferred land use is shown in the far right column.

**Table 11.7-5 Assessing Impacts of Nitrogen, Phosphorus and Impervious Surface**

| Lower Chester River Watershed (02130505) | 2002 LU, 2002 BMPs | 2002 LU, Trib Strategy BMPs | 2008 Trib Strategy BMPs | Scenario 1 2030 Max Build-Out with Trib Strategy BMPs | Scenario 2 2030 Preferred Land Use with Trib Strategy BMPs |
|---|---|---|---|---|---|
| | (Acres) | (Acres) | (Acres) | (Acres) | (Acres) |
| Development | 1,720 | 1,720 | 2,368 | 3,441 | 3,441 |
| Agriculture | 9,995 | 9,995 | 9,636 | 8,990 | 8,990 |
| Forest | 4,930 | 4,930 | 4,719 | 4,296 | 4,296 |
| Water | 257 | 257 | 244 | 244 | 244 |
| Other | 757 | 757 | 692 | 690 | 690 |
| Total Area | 17,660 | 17,660 | 17,660 | 17,660 | 17,660 |
| | | | | | |
| Residential Septic (EDUs) | 0 | 0 | 674 | 1,643 | 191 |
| Non-Residential Septic (EDUs) | 0 | 0 | 167 | 35 | 0 |

| Total Nitrogen Loading<br>Lower Chester River Watershed (02130505) | 2002 LU, 2002 BMPs | 2002 LU, Trib Strategy BMPs | 2008 Trib Strategy BMPs | Scenario 1 2030 Max Build-Out with Trib Strategy BMPs | Scenario 2 2030 Preferred Land Use with Trib Strategy BMPs |
|---|---|---|---|---|---|
| | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) |
| Development NPS | 14,986 | 10,402 | 14,317 | 20,833 | 20,833 |
| Agriculture NPS | 155,380 | 86,786 | 83,653 | 78,092 | 78,092 |
| Forest NPS | 7,314 | 6,817 | 6,526 | 5,940 | 5,940 |
| Water NPS | 2,596 | 2,148 | 2,035 | 2,035 | 2,035 |
| Other Terrestrial NPS | 6,719 | 4,608 | 4,208 | 4,191 | 4,191 |
| **Total Terrestrial Load** | **186,994** | **110,762** | **110,738** | **111,092** | **111,092** |
| Residential Septic (EDUs) | 0 | 0 | 6,265 | 15,271 | 1,775 |
| Non-Residential Septic (EDUs) | 0 | 0 | 552 | 116 | 0 |
| **Total Septic Load** | **0** | **0** | **6,817** | **15,387** | **1,775** |
| **Total NPS Nitrogen Load** | **186,994** | **110,762** | **117,555** | **126,479** | **112,867** |
| **Total PS Load** | **0** | **0** | **0** | **7,171** | **9,490** |
| **Total Nitrogen Load (NPS+PS)** | **186,994** | **110,762** | **117,555** | **133,650** | **122,357** |

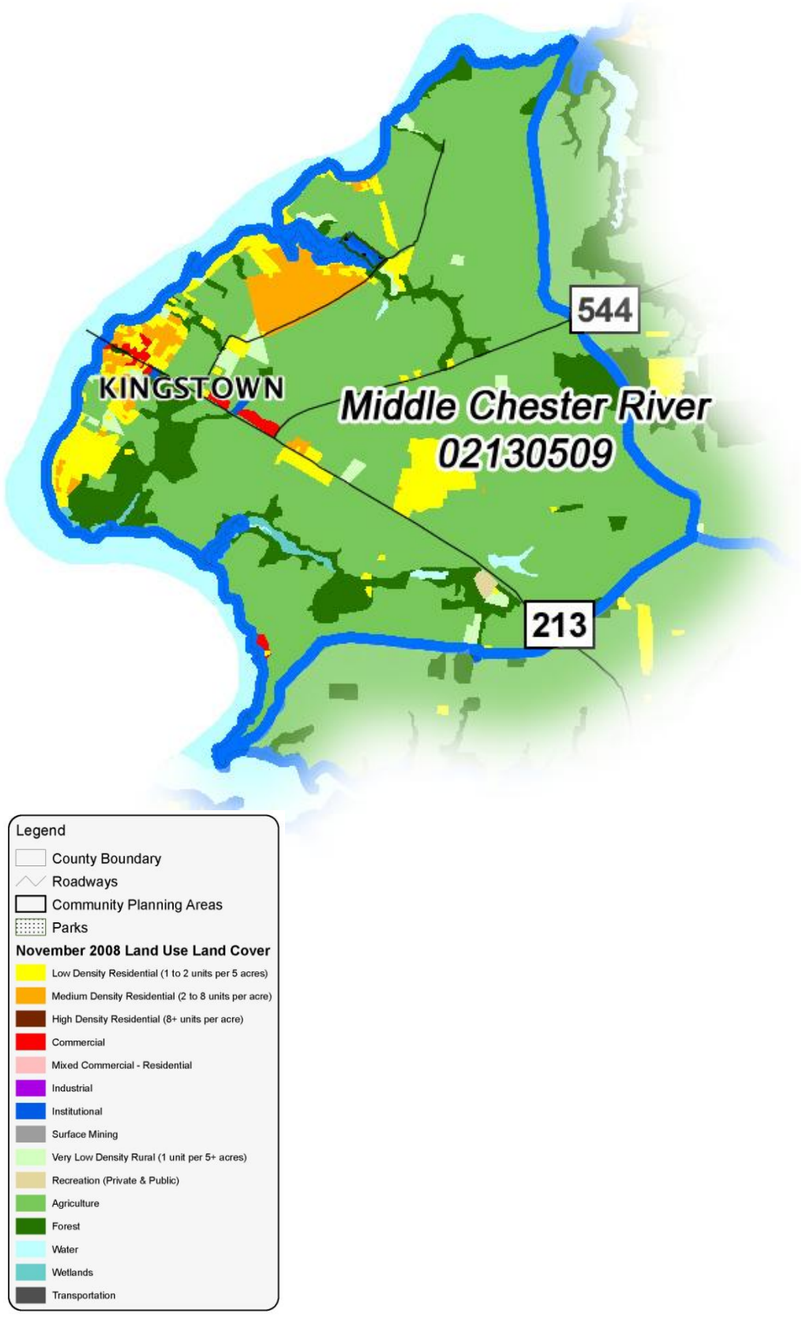
| Total Phosphorus Loading<br>Lower Chester River Watershed (02130505) | 2002 LU, 2002 BMPs | 2002 LU, Trib Strategy BMPs | 2008 Trib Strategy BMPs | Scenario 1 2030 Max Build-Out with Trib Strategy BMPs | Scenario 2 2030 Preferred Land Use with Trib Strategy BMPs |
|---|---|---|---|---|---|
| | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) |
| Development NPS | 1,877 | 1,231 | 1,692 | 2,509 | 2,509 |
| Agriculture NPS | 10,928 | 7,902 | 7,628 | 7,087 | 7,087 |
| Forest NPS | 111 | 91 | 87 | 80 | 80 |
| Water NPS | 146 | 146 | 138 | 138 | 138 |
| Other Terrestrial NPS | 911 | 586 | 527 | 525 | 525 |
| **Total Terrestrial Load** | **13,973** | **9,956** | **10,073** | **10,339** | **10,339** |
| **Total PS Load** | **0** | **0** | **0** | **538** | **712** |
| **Total Phosphorus Load (NPS+PS)** | **13,973** | **9,956** | **10,073** | **10,877** | **11,051** |

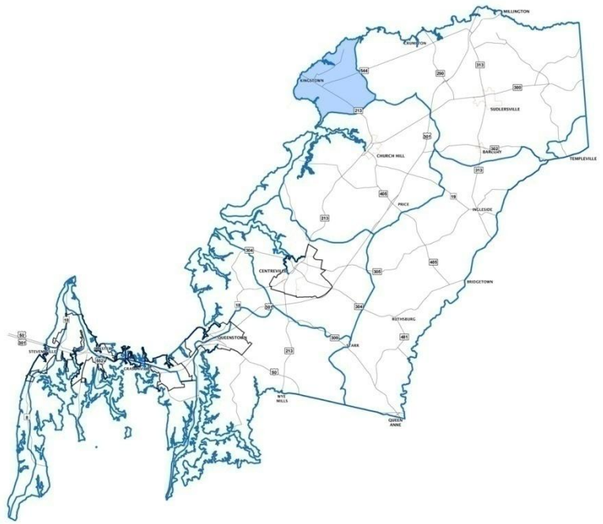
| Impervious Cover and Open Space | (Acres) | | | | |
|---|---|---|---|---|---|
| Lower Chester River Watershed (02130505) | 2002 LU, 2002 BMPs | 2002 LU, Trib Strategy BMPs | 2008 Trib Strategy BMPs | Scenario 1 2030 Max Build-Out with Trib Strategy BMPs | Scenario 2 2030 Preferred Land Use with Trib Strategy BMPs |
| Total Impervious Cover | 561 | 561 | 752 | 920 | 920 |
| Agriculture | 9,995 | 9,995 | 9,636 | 8,990 | 8,990 |
| Forest | 4,228 | 4,228 | 4,050 | 3,627 | 3,627 |
| Percent Impervious | 3.2% | 3.2% | 4.3% | 5.2% | 5.2% |

Note: Nitrogen and phosphorus output from sewage are counted as part of the Kent Island Bay Watershed, where the outfall of the KNSG facility is located.

## Section 11.8 Middle Chester River Watershed - 02130509

***Existing Land Use 2008***



| Table 11.8-1 Conservation Lands Programs | Acres |
|---|---|
| MALPF Easement | 95.49 |
| MALPF Greenprint | - |
| Rural Legacy Easement | 1,565.25 |
| MET | - |
| TDR Sending Areas | 26.54 |
| Private Conservation Easement | 91.54 |
| County Park | 76.68 |
| State Owned Land | - |
| Open Space (Deed Restricted) | 244.06 |
| Open Space (Non Contiguous) | 443.45 |
| MALPF Easement / Open Space | - |
| MET / Open Space | - |
| County Park / TDR | - |
| County Park / NCD | - |
| County Park / Open Space | - |
| County Park / MET | - |
| MET / TDR | - |
| **Total** | **2,543.00** |

| Land Available for Development | Acres |
|---|---|
| Available | 872.00 |
| Divisible | 2,724.93 |
| **Total** | **3,596.93** |

| Table 11.8-2 Updated General Land Use Classes (2008) | 2008 Land Uses | | 2030 Preferred Land Uses | |
|---|---|---|---|---|
| | Total Acres | Percent of Total Acres | Total Acres | Percent of Total Acres |
| Low Density Residential (1 to 2 units per 5 acres) | 595.5 | **7.7%** | 538.9 | **6.9%** |
| Medium Density Residential (2 to 8 units per acre) | 304.3 | **3.9%** | 617.8 | **7.9%** |
| High Density Residential (8+ units per acre) | - | **0.0%** | - | **0.0%** |
| Commercial | 55.9 | **0.7%** | 129.9 | **1.6%** |
| Mixed Commercial – Residential | - | **0.0%** | - | **0.0%** |
| Industrial | - | **0.0%** | 0.5 | **0.0%** |
| Institutional | 24.7 | **0.3%** | 24.3 | **0.3%** |
| Surface Mining | - | **0.0%** | - | **0.0%** |
| Very Low Density Rural (1 unit per 5+ acres) | 136.1 | **1.7%** | 553.6 | **7.1%** |
| Private Recreation | 13.6 | **0.2%** | 13.6 | **0.2%** |
| Agriculture | 5,754.0 | **73.6%** | 5,156.8 | **66.0%** |
| Forest | 816.0 | **10.4%** | 664.7 | **8.5%** |
| Water | 46.0 | **0.6%** | 46.0 | **0.6%** |
| Wetlands | 69.2 | **0.9%** | 69.2 | **0.9%** |
| Transportation | - | **0.0%** | - | **0.0%** |
| **Total** | **7,815.3** | **100.0%** | **7,815.3** | **100.0%** |

***Preferred Land Use 2030***

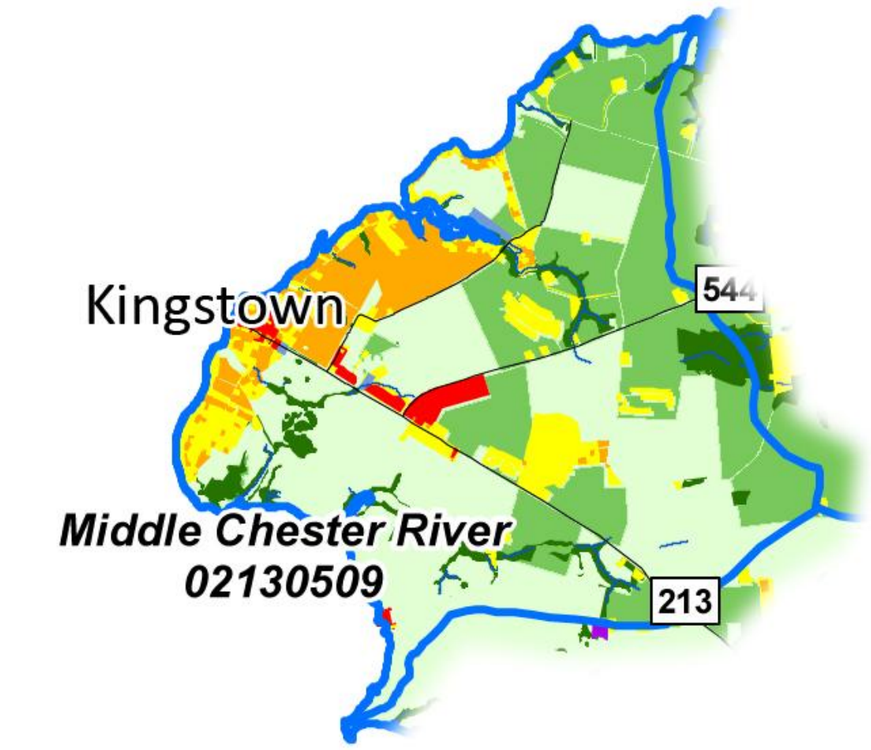




**Table 11.8-3 Best Management Practices Tool Kit**

| Tools, Techniques & Strategies | LANDSCAPE | | | | |
|---|---|---|---|---|---|
| | **Agricultural** | **Natural** | **Rural Residential** | **Suburban** | **Town/Village** |
| **Point Source / Urban Source Strategy** | | | | | Make appropriate connections |
| **Stormwater Strategy** | BMPs, nutrient and manure management plans and fencing livestock out of streams. | BMPs, preserve buffers and forest conservation. No tree cutting in Critical Areas. | BMPs and ESD. | BMPs, ESD, Retrofit SW facilities or include in new development and reduce use of lawn fertilizers. | BMPs, ESD, and retrofit facilities. |
| **Onsite Sewage Disposal Strategy (OSDS)** | Use denitrification technology for on-lot systems or connect to sewer system. | Use denitrification technology on-lot systems or connect to sewer system. | Use denitrification technology for on-lot systems or shared septic systems. | Failing septic systems should be connected to the public sewer system. | Connect existing development on septic systems within PFAs to public system. |
| **Growth Management Strategy** | Preserve environmentally sensitive lands and agricultural lands using State and Local programs. | Restrict development within Critical Areas. | Cluster development, ESD and encourage development toward areas with existing infrastructure. | Suburban subdivisions must provide improvements and connection to public water and sewer systems. | Establish Infill/Redevelopment standards and incentives. Establish a Growth Area for Kingstown consistent with Sewer Service Areas. |
| **Agriculture Strategy** | Nutrient and Manure Management, BMPs, Cover Crops | Appropriate floodplain, riparian buffer and wetland buffers. | TDR receiving areas should be established outside of the watershed. | TDR receiving areas should be established outside of the watershed. | |
| **Waterway Strategies** | Protection of riparian buffers, tree planting along streams and living shoreline construction | Protection of riparian buffers, tree planting along streams and living shoreline construction | Protection of riparian buffers, tree planting along streams and living shoreline construction | Protection of riparian buffers, tree planting along streams and living shoreline construction | Protection of riparian buffers, tree planting along streams. |
| **Air Deposition Strategy** | Establish forest conservation strategies and incentives as well as utilize state and local preservation programs. | Establish greenbelts and forest conservation strategies and incentives. | Forest Conservation Plans and establish wooded lot standards. | Forest Conservation Plans and trail/path connections within greenbelts to provide access to and from Town. | Concentration of homes, commercial and institutional uses for walkable community. |

**Table 11.8-4 Summary of Projected Impacts to Agriculture and Forest**

| Land Use or Variable | 2008 Land Uses | | 2030 Preferred Land Uses | | Projected Change in Land Use 2008-2030 | |
|---|---|---|---|---|---|---|
| | Total Acres | Percent of Total Acres | Total Acres | Percent of Total Acres | Total Acres | Percent of Total Acres |
| Agriculture | 5,754.0 | **73.6%** | 5,156.8 | **66.0%** | -597.2 | **-7.6%** |
| Forest | 816.0 | **10.4%** | 664.7 | **8.5%** | -151.3 | **-1.9%** |
| ***Queen Anne's County Impervious Surfaces**** | 246.1 | **3.1%** | | | | |
| ***Statewide Priority Wetlands***** | 61.0 | **0.8%** | | | | |
| ***Tier II Catchment Area within Watershed*** | 0.0 | **0.0%** | | | | |

**Impervious surfaces data was created using 2004 planimetric data as updated using 2008 Aerial imagery collected by the State. There is no guarantee that all features were collected nor to the precision of the collected features. This data provides a general value of the impervious surface within a watershed.*
***Queen Anne's County may need to track on permits issued by MDE for development within theses wetlands to determine impacts.*

## Water Resources Element – Nitrogen, Phosphorus and Impervious Surface Data

The following Nitrogen, Phosphorus and Impervious Surface table has been provided by Maryland Department of the Environment.
The table was loading using the 2008 land use and the projected maximum capacity build-out values based on the Build-Out Analysis Report, May 2009 as part of this Comprehensive Plan. The preferred land use is shown in the far right column.
**Middle Chester River 2006 Study TMDL: Nitrogen 275,437 lbs per year and Phosphorus 16,709 pounds per year.**
**Queen Anne's County portion of Middle Chester River Watershed is 19.6%.**

**Table 11.8-5 Assessing Impacts of Nitrogen, Phosphorus and Impervious Surface**

| Middle Chester River Watershed (02130509) | 2002 LU, 2002 BMPs | 2002 LU, Trib Strategy BMPs | 2008 Trib Strategy BMPs | Scenario 1 2030 Max Build-Out with Trib Strategy BMPs | Scenario 2 2030 Preferred Land Use with Trib Strategy BMPs |
|---|---|---|---|---|---|
| | (Acres) | (Acres) | (Acres) | (Acres) | (Acres) |
| Development | 834 | 834 | 1,092 | 1,948 | 1,948 |
| Agriculture | 6,028 | 6,028 | 5,754 | 5,050 | 5,050 |
| Forest | 877 | 877 | 885 | 734 | 734 |
| Water | 51 | 51 | 46 | 46 | 46 |
| Other | 25 | 25 | 38 | 38 | 38 |
| Total Area | 7,815 | 7,815 | 7,815 | 7,815 | 7,815 |
| | | | | | |
| Residential Septic (EDUs) | 0 | 0 | 1,049 | 1,865 | 1,865 |
| Non-Residential Septic (EDUs) | 0 | 0 | 276 | 474 | 474 |

**Total Nitrogen Loading**

| Middle Chester River Watershed (02130509) | 2002 LU, 2002 BMPs | 2002 LU, Trib Strategy BMPs | 2008 Trib Strategy BMPs | Scenario 1 2030 Max Build-Out with Trib Strategy BMPs | Scenario 2 2030 Preferred land Use with Trib Strategy BMPs | |
|---|---|---|---|---|---|---|
| | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | |
| Development NPS | 7,272 | 5,046 | 6,623 | 11,818 | 11,818 | |
| Agriculture NPS | 94,716 | 52,481 | 50,095 | 43,945 | 43,945 | |
| Forest NPS | 1,301 | 1,212 | 1,224 | 1,014 | 1,014 | |
| Water NPS | 514 | 425 | 384 | 384 | 384 | |
| Other Terrestrial NPS | 221 | 153 | 232 | 229 | 229 | |
| **Total Terrestrial Load** | **104,024** | **59,317** | **58,558** | **57,391** | **57,391** | |
| Residential Septic (EDUs) | 0 | 0 | 9,750 | 17,334 | 17,334 | |
| Non-Residential Septic (EDUs) | 0 | 0 | 916 | 1,571 | 1,571 | |
| **Total Septic Load** | **0** | **0** | **10,666** | **18,905** | **18,905** | |
| **Total NPS Nitrogen Load** | **104,024** | **59,317** | **69,224** | **76,296** | **76,296** | |
| **Total PS Load** | **0** | **0** | **0** | **0** | **0** | **TMDL** |
| **Total Nitrogen Load (NPS+PS)** | **104,024** | **59,317** | **69,224** | **76,296** | **76,296** | **275,437** |

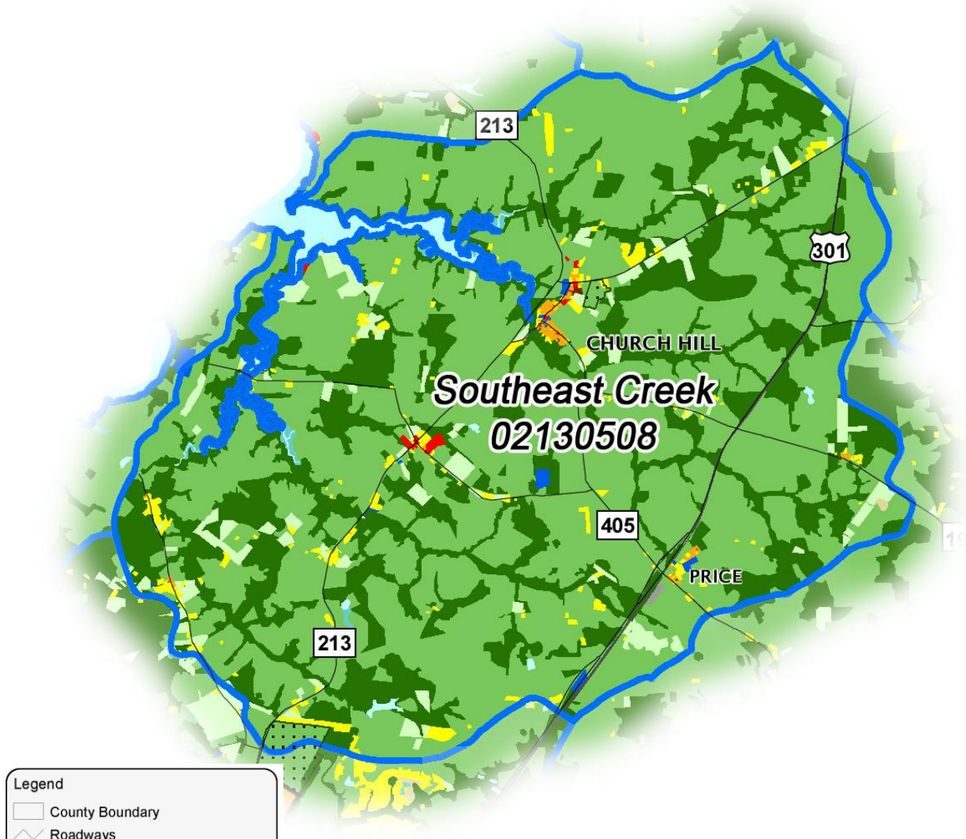
**Total Phosphorus Loading**

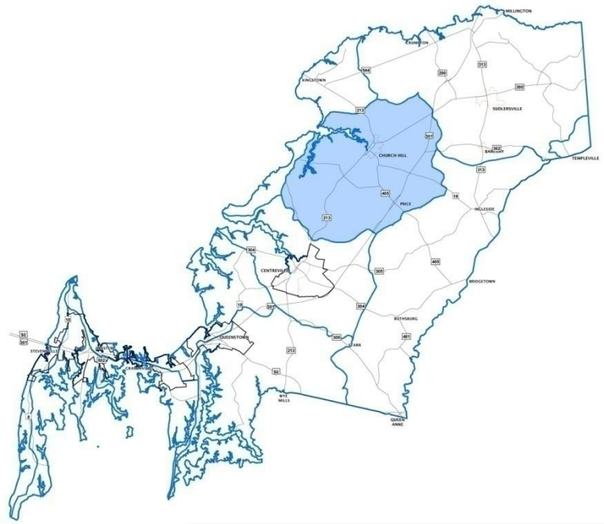
| Middle Chester River Watershed (02130509) | 2002 LU, 2002 BMPs | 2002 LU, Trib Strategy BMPs | 2008 Trib Strategy BMPs | Scenario 1 2030 Max Build-Out with Trib Strategy BMPs | Scenario 2 2030 Preferred Land Use with Trib Strategy BMPs | |
|---|---|---|---|---|---|---|
| | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | |
| Development NPS | 914 | 599 | 815 | 1,455 | 1,455 | |
| Agriculture NPS | 6,531 | 4,704 | 4,490 | 3,934 | 3,934 | |
| Forest NPS | 20 | 16 | 16 | 14 | 14 | |
| Water NPS | 29 | 29 | 26 | 26 | 26 | |
| Other Terrestrial NPS | 29 | 19 | 28 | 27 | 27 | |
| **Total Terrestrial Load** | **7,523** | **5,366** | **5,375** | **5,455** | **5,455** | |
| **Total PS Load** | **0** | **0** | **0** | **0** | **0** | |
| | | | | | | **TMDL** |
| **Total Phosphorus Load (NPS+PS)** | **7,523** | **5,366** | **5,375** | **5,455** | **5,455** | **16,709** |

| Impervious Cover and Open Space | (Acres) | | | | |
|---|---|---|---|---|---|
| Middle Chester River Watershed (02130509) | 2002 LU, 2002 BMPs | 2002 LU, Trib Strategy BMPs | 2008 Trib Strategy BMPs | Scenario 1 2030 Max Build-Out with Trib Strategy BMPs | Scenario 2 2030 Preferred Land Use with Trib Strategy BMPs |
| Total Impervious Cover | 225 | 225 | 224 | 388 | 388 |
| Agriculture | 6,028 | 6,028 | 5,754 | 5,050 | 5,050 |
| Forest | 807 | 807 | 816 | 664 | 664 |
| Percent Impervious | 2.9% | 2.9% | 2.9% | 5.0% | 5.0% |

## Section 11.9 Southeast Creek Watershed - 02130508

***Existing Land Use 2008***



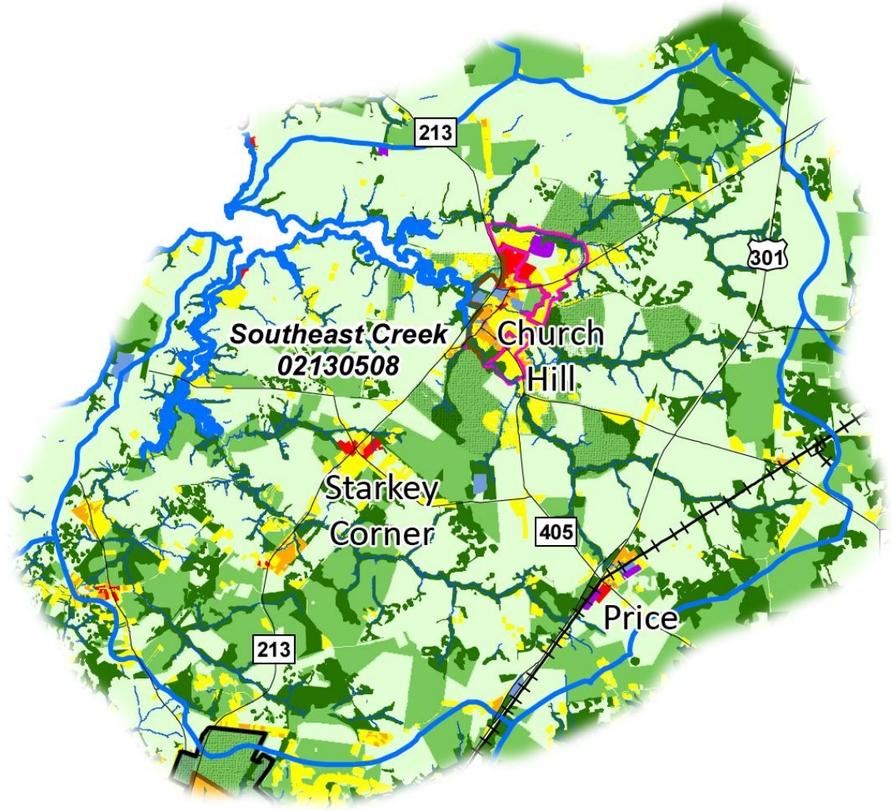



| Table 11.9-1 Conservation Lands Programs | Acres |
|---|---|
| MALPF Easement | 3,541.44 |
| MALPF Greenprint | - |
| Rural Legacy Easement | 309.19 |
| MET | 328.32 |
| TDR Sending Areas | 701.62 |
| Private Conservation Easement | - |
| County Park | 167.30 |
| State Owned Land | - |
| Open Space (Deed Restricted) | 1,701.60 |
| Open Space (Non Contiguous) | 2,386.07 |
| MALPF Easement / Open Space | 474.68 |
| MET / Open Space | 111.63 |
| County Park / TDR | - |
| County Park / NCD | - |
| County Park / Open Space | - |
| County Park / MET | - |
| MET / TDR | - |
| **Total** | **9,721.85** |

| Land Available for Development | Acres |
|---|---|
| Available | 5,402.97 |
| Divisible | 12,575.56 |
| **Total** | **17,978.53** |

| Table 11.9-2 Updated General Land Use Classes (2008) | 2008 Land Uses | | 2030 Preferred Land Uses | |
|---|---|---|---|---|
| | Total Acres | Percent of Total Acres | Total Acres | Percent of Total Acres |
| Low Density Residential (1 to 2 units per 5 acres) | 720.1 | **2.2%** | 1,290.1 | **3.7%** |
| Medium Density Residential (2 to 8 units per acre) | 96.3 | **0.3%** | 259.3 | **0.7%** |
| High Density Residential (8+ units per acre) | 7.5 | **0.0%** | 7.4 | **0.0%** |
| Commercial | 58.0 | **0.2%** | 63.0 | **0.2%** |
| Mixed Commercial – Residential | - | **0.0%** | 102.5 | **0.3%** |
| Industrial | - | **0.0%** | 53.3 | **0.2%** |
| Institutional | 86.2 | **0.2%** | 107.7 | **0.3%** |
| Surface Mining | 14.2 | **0.0%** | 14.2 | **0.0%** |
| Very Low Density Rural (1 unit per 5+ acres) | 1,334.0 | **3.8%** | 3,682.7 | **10.6%** |
| Private Recreation | 9.8 | **0.0%** | 9.8 | **0.0%** |
| Agriculture | 22,880.1 | **65.9%** | 20,652.8 | **59.5%** |
| Forest | 9,042.0 | **26.0%** | 8,005.3 | **23.1%** |
| Water | 107.2 | **0.3%** | 107.2 | **0.3%** |
| Wetlands | 246.5 | **0.7%** | 246.5 | **0.7%** |
| Transportation | 129.0 | **0.4%** | 129.1 | **0.4%** |
| **Total** | **34,730.9** | **100.0%** | **34,730.9** | **100.0%** |

## *Preferred Land Use 2030*




**Preferred Land Use 2030**

The preferred land use within the watershed is based upon maximum capacity build-out under current zoning modified using the future land use plan for Church Hill from the recently adopted Comprehensive Plan and Municipal Growth Element.


**Table 11.9-3 Best Management Practices Tool Kit**

| Tools, Techniques & Strategies | LANDSCAPES | | | | |
|---|---|---|---|---|---|
| | Agricultural | Natural | Rural Residential | Suburban | Town/Village |
| **Point Source / Urban Source Strategy** | | | | Expand and enhance Church Hill WWTP and collection/ conveyance system with enhanced nutrient removal systems. Connect existing development located within Sewer Service Areas and Growth Area. | Within PFAs, connect existing septic systems to Church Hill WWTP. |
| **Stormwater Strategy** | BMPs and Nutrient and Manure Management Plans, fencing livestock out of streams. | BMPs and preservation of buffer and forest conservation. No tree cutting in Critical Areas. | BMPs and ESD. | BMPs, ESD, Retrofitting of SW facilities or inclusion in new development and reduction in use of lawn fertilizers. | BMPs, ESD, Retrofitting of facilities. |
| **Onsite Sewage Disposal Strategy (OSDS)** | Use denitrification technology for on-lot systems or connect to sewer system. | Use denitrification technology on-lot systems or connect to sewer system. | Use denitrification technology for on-lot systems or shared septic systems. | Connect homes with failing septic systems to sewer or upgrade with denitrification technology. | Connect existing development on septic systems within PFAs to public system. |
| **Growth Management Strategy** | Preservation of environmentally sensitive lands and agricultural lands using State and Local programs. Establish PPA for agricultural land outside of Growth Area. | Restrict development within Critical Areas. | Cluster development, ESD and encourage development toward areas with existing infrastructure. | Suburban subdivisions must provide improvements and connection to public water and sewer systems. Establish the Growth Area as a TDR receiving area. | Establish Infill/Redevelopment standards and incentives. Establish a Growth Area around the Town and update Sewer Service Areas. |
| **Agriculture Strategy** | Nutrient and Manure Management, BMPs, Cover Crops | Appropriate floodplain, riparian buffer and wetland buffers. | Establish lands outside of Growth Area as TDR sending areas. | | |
| **Waterway Strategies** | Protection of riparian buffers, tree planting along streams and living shoreline construction | Protection of riparian buffers, tree planting along streams and living shoreline construction | Protection of riparian buffers, tree planting along streams and living shoreline construction | Protection of riparian buffers, tree planting along streams and living shoreline construction | Protection of riparian buffers, tree planting along streams. |
| **Air Deposition Strategy** | Establish forest conservation strategies and incentives as well as utilize state and local preservation programs. | Establish greenbelts and forest conservation strategies and incentives. | Forest Conservation Plans and establish wooded lot standards. | Forest Conservation Plans and trail/path connections within greenbelts to provide access to and from Town/village. | Concentration of homes, commercial and institutional uses for walkable community. |

**Table 11.9-4 Summary of Projected Impacts to Agriculture and Forest**

| Land Use or Variable | 2008 Land Uses | | 2030 Preferred Land Uses | | Projected Change in Land Use 2008-2030 | |
|---|---|---|---|---|---|---|
| | Total Acres | Percent of Total Acres | Total Acres | Percent of Total Acres | Total Acres | Percent of Total Acres |
| Agriculture | 22,880.1 | **65.9%** | 20,652.8 | **59.5%** | -2,227.3 | **-6.4%** |
| Forest | 9,042.0 | **26.0%** | 8,005.3 | **23.1%** | -1,036.7 | **-2.9%** |
| ***Queen Anne's County Impervious Surfaces**** | 660.8 | **1.9%** | | | | |
| ***Statewide Priority Wetlands***** | 5,386.0 | **15.5%** | | | | |
| ***Tier II Catchment Area within Watershed*** | 16,857.0 | **48.5%** | | | | |

**Impervious surfaces data was created using 2004 planimetric data as updated using 2008 Aerial imagery collected by the State. There is no guarantee that all features were collected nor to the precision of the collected features. This data provides a general value of the impervious surface within a watershed.*

***Queen Anne's County may need to track on permits issued by MDE for development within theses wetlands to determine impacts.*

## Water Resources Element – Nitrogen, Phosphorus and Impervious Surface Data

The following Nitrogen, Phosphorus and Impervious Surface table has been provided by Maryland Department of the Environment. The table was loading using the 2008 land use and the projected maximum capacity build-out values based on the Build-Out Analysis Report, May 2009 as part of this Comprehensive Plan. The preferred land use is shown in the far right column.

**Table 11.9-5 Assessing Impacts of Nitrogen, Phosphorus and Impervious Surface**

| Southeast Creek Watershed (02130508) | 2002 LU, 2002 BMPs | 2002 LU, Trib Strategy BMPs | 2008 Trib Strategy BMPs | Scenario 1 2030 Max Build-Out with Trib Strategy BMPs | Scenario 2 2030 Preferred Land Use with Trib Strategy BMPs |
|---|---|---|---|---|---|
| | (Acres) | (Acres) | (Acres) | (Acres) | (Acres) |
| Development | 813 | 813 | 2,345 | 5,587 | 5,587 |
| Agriculture | 23,965 | 23,965 | 22,880 | 20,653 | 20,653 |
| Forest | 9,718 | 9,718 | 9,289 | 8,252 | 8,252 |
| Water | 109 | 109 | 107 | 107 | 107 |
| Other | 126 | 126 | 110 | 132 | 132 |
| Total Area | 34,731 | 34,731 | 34,731 | 34,731 | 34,731 |
| | | | | | |
| Residential Septic (EDUs) | 0 | 0 | 870 | 3,075 | 1,311 |
| Non-Residential Septic (EDUs) | 0 | 0 | 586 | 708 | 586 |

**Total Nitrogen Loading**

| Southeast Creek Watershed (02130508) | 2002 LU, 2002 BMPs | 2002 LU, Trib Strategy BMPs | 2008 Trib Strategy BMPs | Scenario 1 2030 Max Build-Out with Trib Strategy BMPs | Scenario 2 2030 Preferred Land Use with Trib Strategy BMPs | |
|---|---|---|---|---|---|---|
| | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | |
| Development NPS | 7,134 | 4,926 | 14,255 | 34,013 | 34,013 | |
| Agriculture NPS | 372,731 | 208,088 | 198,593 | 179,551 | 179,551 | |
| Forest NPS | 14,416 | 13,437 | 12,844 | 11,410 | 11,410 | |
| Water NPS | 1,102 | 912 | 895 | 895 | 895 | |
| Other Terrestrial NPS | 1,118 | 768 | 666 | 796 | 796 | |
| **Total Terrestrial Load** | **396,501** | **228,131** | **227,252** | **226,664** | **226,664** | |
| Residential Septic (EDUs) | 0 | 0 | 8,086 | 28,581 | 12,185 | |
| Non-Residential Septic (EDUs) | 0 | 0 | 1,942 | 2,349 | 1,942 | |
| **Total Septic Load** | **0** | **0** | **10,029** | **30,930** | **14,128** | |
| **Total NPS Nitrogen Load** | **396,501** | **228,131** | **237,280** | **257,594** | **240,792** | |
| **Total PS Load** | **0** | **0** | **916** | **4,095** | **9,461** | **TMDL** |
| **Total Nitrogen Load (NPS+PS)** | **396,501** | **228,131** | **238,196** | **261,689** | **250,253** | **0** |

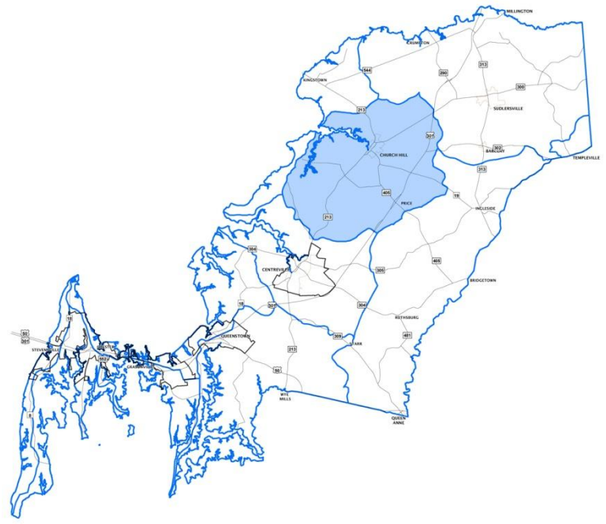
**Total Phosphorus Loading**

| Southeast Creek Watershed (02130508) | 2002 LU, 2002 BMPs | 2002 LU, Trib Strategy BMPs | 2008 Trib Strategy BMPs | Scenario 1 2030 Max Build-Out with Trib Strategy BMPs | Scenario 2 2030 Preferred Land Use with Trib Strategy BMPs | |
|---|---|---|---|---|---|---|
| | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | |
| Development NPS | 926 | 602 | 1,797 | 4,353 | 4,353 | |
| Agriculture NPS | 26,187 | 18,930 | 18,093 | 16,204 | 16,204 | |
| Forest NPS | 218 | 180 | 172 | 153 | 153 | |
| Water NPS | 62 | 62 | 61 | 61 | 61 | |
| Other Terrestrial NPS | 151 | 97 | 78 | 93 | 93 | |
| **Total Terrestrial Load** | **27,544** | **19,871** | **20,201** | **20,865** | **20,865** | |
| **Total PS Load** | **0** | **0** | **259** | **497** | **900** | |
| | | | | | | **TMDL** |
| **Total Phosphorus Load (NPS+PS)** | **27,544** | **19,871** | **20,460** | **21,362** | **21,765** | **21,113** |

| Impervious Cover and Open Space | (Acres) | | | | |
|---|---|---|---|---|---|
| Southeast Creek Watershed (02130508) | 2002 LU, 2002 BMPs | 2002 LU, Trib Strategy BMPs | 2008 Trib Strategy BMPs | Scenario 1 2030 Max Build-Out with Trib Strategy BMPs | Scenario 2 2030 Preferred Land Use with Trib Strategy BMPs |
| Total Impervious Cover | 195 | 195 | 386 | 702 | 702 |
| Agriculture | 23,965 | 23,965 | 22,880 | 20,653 | 20,653 |
| Forest | 9,467 | 9,467 | 9,042 | 8,005 | 8,005 |
| Percent Impervious | 0.6% | 0.6% | 1.1% | 2.0% | 2.0% |

## Section 11.10 Church Hill Growth Area

***Existing Land Use 2008***

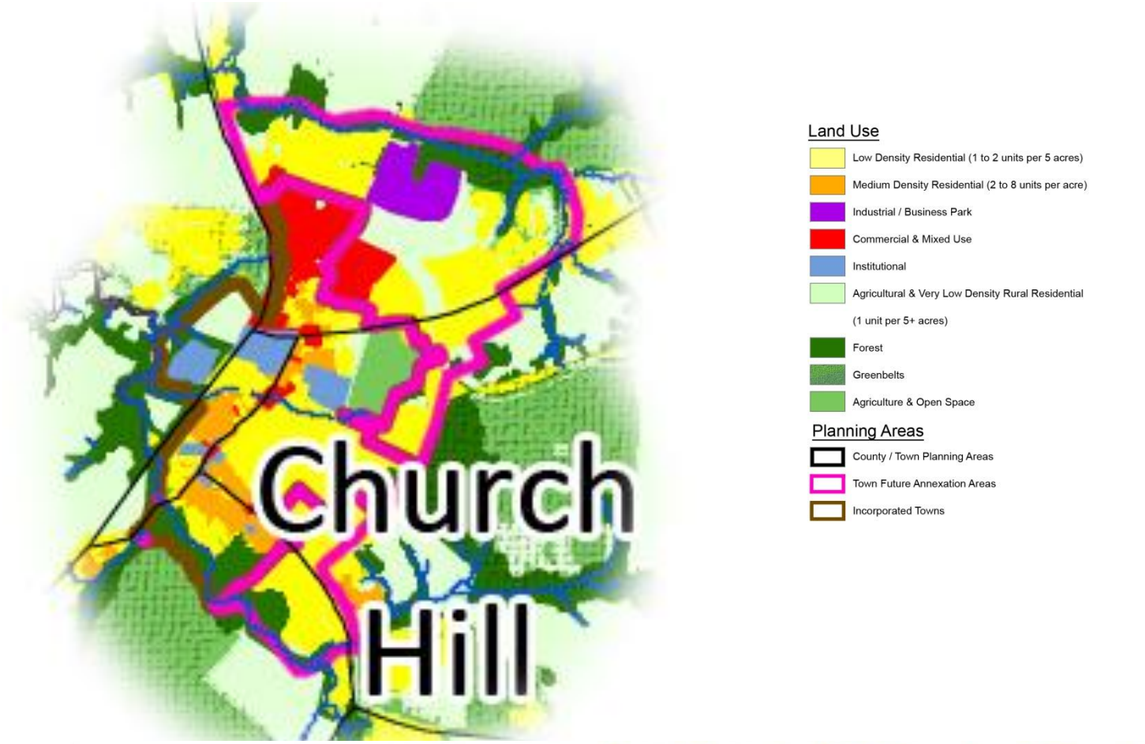



| Table 11.10-1 Conservation Lands Programs | Acres |
|---|---|
| MALPF Easement | 14.0 |
| MALPF Greenprint | - |
| Rural Legacy Easement | - |
| MET | - |
| TDR Sending Areas | - |
| Private Conservation Easement | - |
| County Park | 40.1 |
| State Owned Land | - |
| Open Space (Deed Restricted) | - |
| Open Space (Non Contiguous) | 31.6 |
| MALPF Easement / Open Space | - |
| MET / Open Space | - |
| County Park / TDR | - |
| County Park / NCD | - |
| County Park / Open Space | - |
| County Park / MET | - |
| MET / TDR | - |
| **Total** | **85.7** |

| Land Available for Development | Acres |
|---|---|
| Available | 183.5 |
| Divisible | 227.1 |
| **Total** | **410.6** |

| Table 11.10-2 Updated General Land Use Classes (2008) | 2008 Land Uses | | 2030 Preferred Land Uses | |
|---|---|---|---|---|
| | Total Acres | Percent of Total Acres | Total Acres | Percent of Total Acres |
| Low Density Residential (1 to 2 units per 5 acres) | 93.3 | **9.8%** | 334.7 | **35.2%** |
| Medium Density Residential (2 to 8 units per acre) | 63.0 | **6.6%** | 70.0 | **7.4%** |
| High Density Residential (8+ units per acre) | 7.3 | **0.8%** | - | **0.0%** |
| Commercial | 14.2 | **1.5%** | 22.6 | **2.4%** |
| Mixed Commercial – Residential | - | **0.0%** | 61.3 | **6.4%** |
| Industrial | - | **0.0%** | 35.1 | **3.7%** |
| Institutional | 16.0 | **1.7%** | 43.5 | **4.6%** |
| Surface Mining | - | **0.0%** | - | **0.0%** |
| Very Low Density Rural (1 unit per 5+ acres) | 65.0 | **6.8%** | 59.3 | **6.2%** |
| Private Recreation | - | **0.0%** | - | **0.0%** |
| Agriculture | 482.4 | **50.7%** | 141.7 | **14.9%** |
| Forest | 206.5 | **21.7%** | 179.5 | **18.9%** |
| Water | 0.2 | **0.0%** | 0.2 | **0.0%** |
| Wetlands | 4.3 | **0.5%** | 4.3 | **0.5%** |
| Transportation | - | **0.0%** | - | **0.0%** |
| **Total** | **952.2** | **100.0%** | **952.2** | **100.0%** |

## *Preferred Land Use 2030*



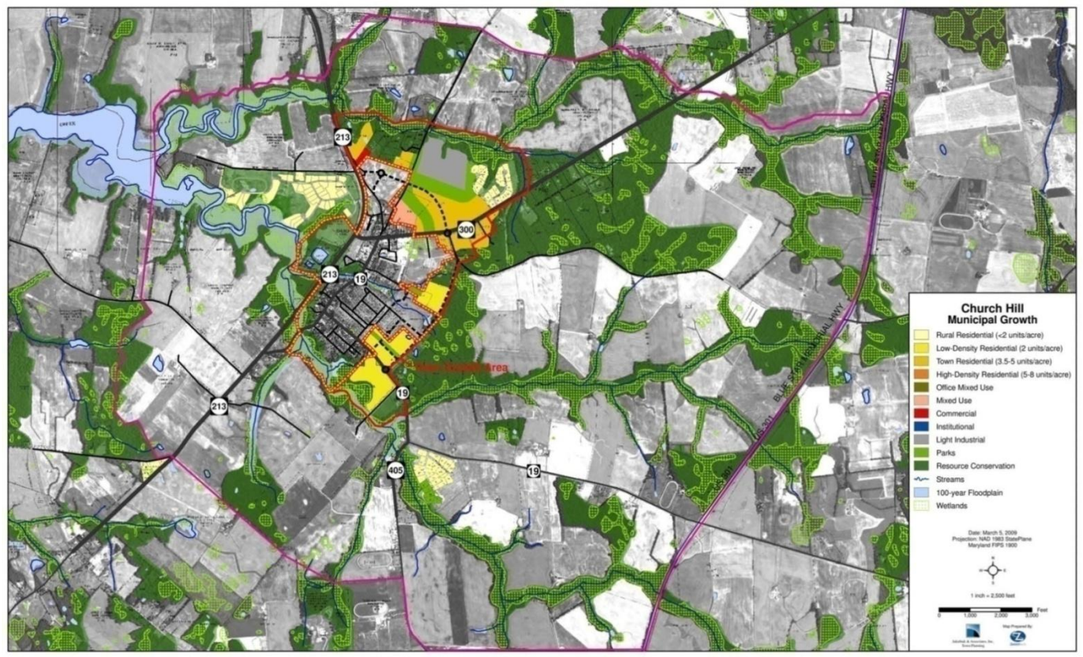



**Table 11.10-3 Summary of Projected Impacts to Agriculture and Forest**

| Land Use or Variable | 2008 Land Uses | | 2030 Preferred Land Uses | | Projected Change in Land Use 2008-2030 | |
|---|---|---|---|---|---|---|
| | Total Acres | Percent of Total Acres | Total Acres | Percent of Total Acres | Total Acres | Percent of Total Acres |
| Agriculture | 482.4 | **50.7%** | 141.7 | **14.9%** | -340.7 | **-35.8%** |
| Forest | 206.5 | **21.7%** | 179.5 | **18.9%** | -27.0 | **-2.8%** |
| ***Queen Anne's County Impervious Surfaces**** | 60.7 | **6.4%** | | | | |
| ***Statewide Priority Wetlands***** | 120.0 | **12.6%** | | | | |
| ***Tier II Catchment Area within Watershed*** | 240.3 | **25.2%** | | | | |

**Impervious surfaces data was created using 2004 planimetric data as updated using 2008 Aerial imagery collected by the State. There is no guarantee that all features were collected nor as to the precision of the collected features. This data provides a general value of the impervious surface within a watershed.*

***Queen Anne's County may need to track on permits issued by MDE for development within theses wetlands to determine impacts.*

## Water Resources Element – Nitrogen, Phosphorus and Impervious Surface Data

The following Nitrogen, Phosphorus and Impervious Surface table has been provided by Maryland Department of the Environment. The table was loading using the 2008 land use and the projected maximum capacity build-out values based on the Build-Out Analysis Report, May 2009 as part of this Comprehensive Plan. The preferred land use is shown in the far right column.

**Table 11.10-4 Assessing Impacts of Nitrogen, Phosphorus and Impervious Surface Land Use and Septic Systems**

| Church Hill - Southeast Creek | 2002 LU, 2002 BMPs | 2002 LU, Trib Strategy BMPs | 2008 Trib Strategy BMPs | Scenario 1 2030 Max Build-Out with Trib Strategy BMPs | Scenario 2 2030 Preferred Land Use with Trib Strategy BMPs |
|---|---|---|---|---|---|
| | (Acres) | (Acres) | (Acres) | (Acres) | (Acres) |
| Development | 130 | 130 | 243 | 583 | 583 |
| Agriculture | 615 | 615 | 482 | 142 | 142 |
| Forest | 195 | 195 | 211 | 184 | 184 |
| Water | 0 | 0 | 0 | 0 | 0 |
| Other | 12 | 12 | 16 | 43 | 43 |
| Total Area | 952 | 952 | 952 | 952 | 952 |
| | | | | | |
| Residential Septic (EDUs) | 0 | 0 | 151 | 383 | 0 |
| Non-Residential Septic (EDUs) | 0 | 0 | 0 | 0 | 0 |
| | | | | | |

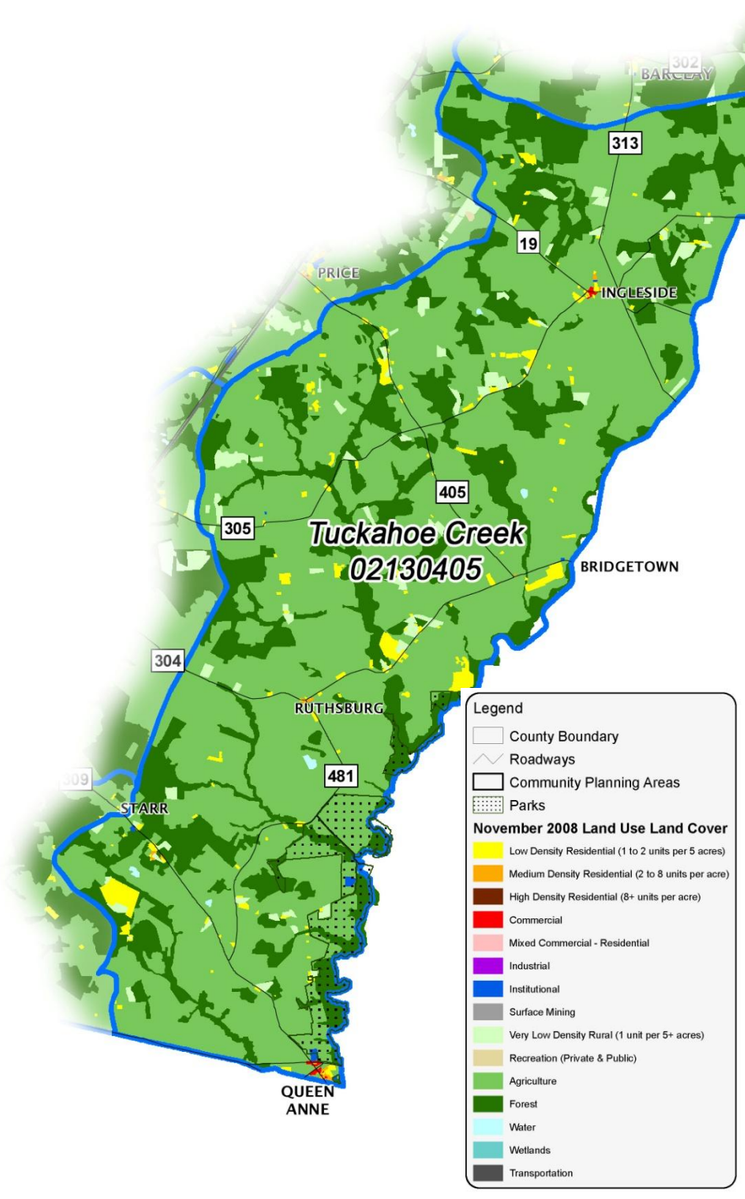
| Total Nitrogen Loading<br>Church Hill - Southeast Creek | 2002 LU, 2002 BMPs | 2002 LU, Trib Strategy BMPs | 2008 Trib Strategy BMPs | Scenario 1 2030 Max Build-Out with Trib Strategy BMPs | Scenario 2 2030 Preferred Land Use with Trib Strategy BMPs | |
|---|---|---|---|---|---|---|
| | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | |
| Development NPS | 1,134 | 788 | 1,473 | 3,529 | 3,529 | |
| Agriculture NPS | 9,466 | 5,320 | 4,171 | 1,230 | 1,230 | |
| Forest NPS | 289 | 269 | 291 | 254 | 254 | |
| Water NPS | 2 | 2 | 2 | 2 | 2 | |
| Other Terrestrial NPS | 104 | 72 | 96 | 262 | 262 | |
| **Total Terrestrial Load** | **10,995** | **6,452** | **6,034** | **5,278** | **5,278** | |
| Residential Septic (EDUs) | 0 | 0 | 1,403 | 3,560 | 0 | |
| Non-Residential Septic (EDUs) | 0 | 0 | 0 | 0 | 0 | |
| **Total Septic Load** | **0** | **0** | **1,403** | **3,560** | **0** | |
| **Total NPS Nitrogen Load** | **10,995** | **6,452** | **7,437** | **8,837** | **5,278** | |
| **Total PS Load** | **0** | **0** | **669** | **2,312** | **2,166** | **TMDL** |
| **Total Nitrogen Load (NPS+PS)** | **10,995** | **6,452** | **8,106** | **11,149** | **7,444** | **0** |

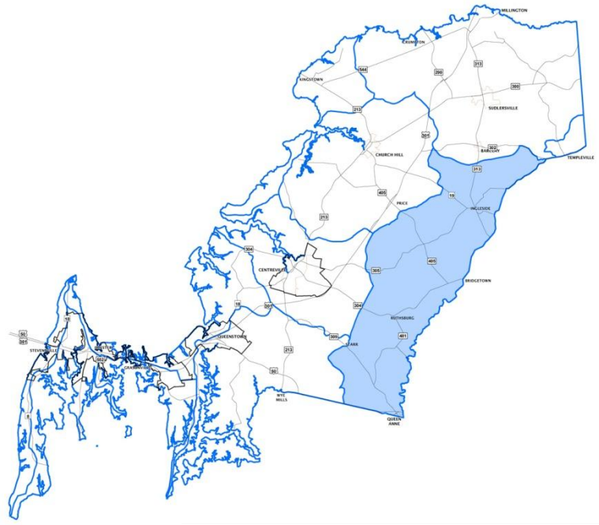
| Total Phosphorus Loading<br>Church Hill - Southeast Creek | 2002 LU, 2002 BMPs | 2002 LU, Trib Strategy BMPs | 2008 Trib Strategy BMPs | Scenario 1 2030 Max Build-Out with Trib Strategy BMPs | Scenario 2 2030 Preferred Land Use with Trib Strategy BMPs | |
|---|---|---|---|---|---|---|
| | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | |
| Development NPS | 141 | 93 | 182 | 424 | 424 | |
| Agriculture NPS | 675 | 490 | 385 | 112 | 112 | |
| Forest NPS | 4 | 4 | 4 | 3 | 3 | |
| Water NPS | 0 | 0 | 0 | 0 | 0 | |
| Other Terrestrial NPS | 12 | 8 | 11 | 30 | 30 | |
| **Total Terrestrial Load** | **833** | **595** | **582** | **568** | **568** | |
| **Total PS Load** | **0** | **0** | **50** | **173** | **162** | |
| | | | | | | **TMDL** |
| **Total Phosphorus Load (NPS+PS)** | **833** | **595** | **632** | **741** | **730** | **21,113** |

| Impervious Cover and Open Space | (Acres) | | | | |
|---|---|---|---|---|---|
| **Church Hill - Southeast Creek** | **2002 LU, 2002 BMPs** | **2002 LU, Trib Strategy BMPs** | **2008 Trib Strategy BMPs** | **Scenario 1 2030 Max Build-Out with Trib Strategy BMPs** | **Scenario 2 2030 Preferred Land Use with Trib Strategy BMPs** |
| Total Impervious Cover | 41 | 41 | 52 | 156 | 156 |
| Agriculture | 615 | 615 | 482 | 142 | 142 |
| Forest | 190 | 190 | 207 | 179 | 179 |
| Percent Impervious | 4.3% | 4.3% | 5.5% | 16.4% | 16.4% |

## Section 11.11 Tuckahoe Creek Watershed - 02130405

***Existing Land Use 2008***



| Table 11.11-1 Conservation Lands Programs | Acres |
|---|---|
| MALPF Easement | 9,303.68 |
| MALPF Greenprint | - |
| Rural Legacy Easement | - |
| MET | 362.49 |
| TDR Sending Areas | 417.31 |
| Private Conservation Easement | - |
| County Park | 5.73 |
| State Owned Land | 1,849.37 |
| Open Space (Deed Restricted) | 2,274.30 |
| Open Space (Non Contiguous) | 3,269.98 |
| MALPF Easement / Open Space | 243.49 |
| MET / Open Space | - |
| County Park / TDR | - |
| County Park / NCD | - |
| County Park / Open Space | - |
| County Park / MET | - |
| MET / TDR | 74.80 |
| **Total** | **17,801.15** |

| Land Available for Development | Acres |
|---|---|
| Available | 7,108.45 |
| Divisible | 12,962.61 |
| **Total** | **20,071.06** |

| Table 11.11-2 Updated General Land Use Classes (2008) | 2008 Land Uses | | 2030 Preferred Land Uses | |
|---|---|---|---|---|
| | Total Acres | Percent of Total Acres | Total Acres | Percent of Total Acres |
| Low Density Residential (1 to 2 units per 5 acres) | 890.6 | **1.9%** | 1,280.6 | **2.8%** |
| Medium Density Residential (2 to 8 units per acre) | 39.6 | **0.1%** | 145.3 | **0.3%** |
| High Density Residential (8+ units per acre) | 0.1 | **0.0%** | 0.1 | **0.0%** |
| Commercial | 27.4 | **0.1%** | 42.9 | **0.1%** |
| Mixed Commercial – Residential | - | **0.0%** | 31.7 | **0.1%** |
| Industrial | - | **0.0%** | 3.5 | **0.0%** |
| Institutional | 42.3 | **0.1%** | 40.7 | **0.1%** |
| Surface Mining | - | **0.0%** | - | **0.0%** |
| Very Low Density Rural (1 unit per 5+ acres) | 1,005.0 | **2.2%** | 4,097.7 | **8.9%** |
| Private Recreation | - | **0.0%** | - | **0.0%** |
| Agriculture | 32,125.9 | **69.7%** | 29,384.1 | **63.8%** |
| Forest | 11,858.7 | **25.8%** | 10,963.0 | **23.8%** |
| Water | 52.0 | **0.1%** | 52.0 | **0.1%** |
| Wetlands | 5.5 | **0.0%** | 5.5 | **0.0%** |
| Transportation | - | **0.0%** | - | **0.0%** |
| **Total** | **46,047.1** | **100.0%** | **46,047.1** | **100.0%** |

## *Preferred Land Use 2030*

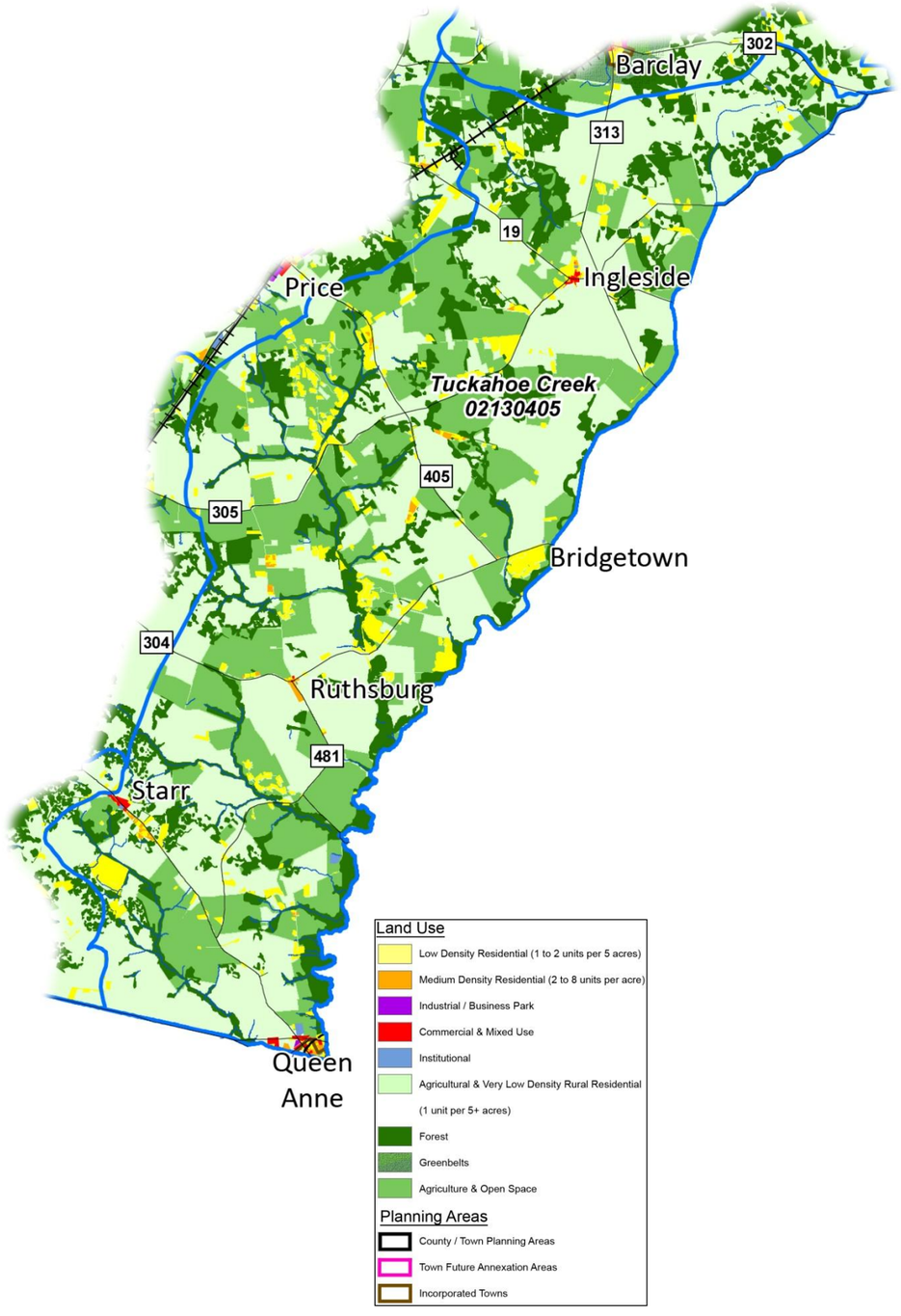



**Table 11.11-3 Best Management Practices Tool Kit**

| Tools, Techniques & Strategies | LANDSCAPES | | | | |
|---|---|---|---|---|---|
| | **Agricultural** | **Natural** | **Rural Residential** | **Suburban** | **Town/Village** |
| **Point Source / Urban Source Strategy** | | | | | Within PFAs, connect existing septic systems to Church Hill WWTP. |
| **Stormwater Strategy** | BMPs and Nutrient and Manure Management Plans, fencing livestock out of streams. | BMPs and preservation of buffer and forest conservation. No tree cutting in Critical Areas. | BMPs and ESD. | BMPs, ESD, Retrofitting of SW facilities or inclusion in new development and reduction in use of lawn fertilizers. | BMPs, ESD, Retrofitting of facilities. |
| **Onsite Sewage Disposal Strategy (OSDS)** | Use denitrification technology for on-lot systems or connect to sewer system. | Use denitrification technology on-lot systems or connect to sewer system. | Use denitrification technology for on-lot systems or shared septic systems. | Connect homes with failing septic systems to sewer or upgrade with denitrification technology. | Connect existing development on septic systems within PFAs to public system. |
| **Growth Management Strategy** | Preservation of environmentally sensitive lands and agricultural lands using State and Local programs. Establish PPA for agricultural land outside of villages. | Restrict development within Critical Areas. | Cluster development, ESD and encourage development toward areas with existing development. | Suburban development is not a compatible land use pattern. | Infill and redevelopment of villages. |
| **Agriculture Strategy** | Nutrient and Manure Management, BMPs, Cover Crops | Appropriate floodplain, riparian buffer and wetland buffers. | Establish lands outside of Growth Area as TDR sending areas. | | |
| **Waterway Strategies** | Protection of riparian buffers, tree planting along streams and living shoreline construction | Protection of riparian buffers, tree planting along streams construction | Protection of riparian buffers, tree planting along streams and construction | Protection of riparian buffers, tree planting along streams and living shoreline construction | Protection of riparian buffers, tree planting along streams. |
| **Air Deposition Strategy** | Establish forest conservation strategies and incentives as well as utilize state and local preservation programs. | Establish greenway and forest conservation strategies and incentives. | Forest Conservation Plans and establish wooded lot standards. | Forest Conservation Plans and trail/path connections within greenbelts to provide access to and from villages. | Provide improvements such as sidewalk where appropriate for villages to be walkable. |

**Table 11.11-4 Summary of Projected Impacts to Agriculture and Forest**

| Land Use or Variable | 2008 Land Uses | | 2030 Preferred Land Uses | | Projected Change in Land Use 2008-2030 | |
|---|---|---|---|---|---|---|
| | Total Acres | Percent of Total Acres | Total Acres | Percent of Total Acres | Total Acres | Percent of Total Acres |
| Agriculture | 32,125.9 | **69.7%** | 29,384.1 | **63.8%** | -2,741.8 | **-5.9%** |
| Forest | 11,858.7 | **25.8%** | 10,963.0 | **23.8%** | -895.7 | **-2.0%** |
| ***Queen Anne's County Impervious Surfaces**** | 747.6 | **1.6%** | | | | |
| ***Statewide Priority Wetlands***** | 7,945.0 | **17.2%** | | | | |
| ***Tier II Catchment Area within Watershed*** | 35,307.0 | **76.5%** | | | | |

**Impervious surfaces data was created using 2004 planimetric data as updated using 2008 Aerial imagery collected by the State. There is no guarantee that all features were collected nor to the precision of the collected features. This data provides a general value of the impervious surface within a watershed.*

***Queen Anne's County may need to track on permits issued by MDE for development within theses wetlands to determine impacts.*

## Water Resources Element – Nitrogen, Phosphorus and Impervious Surface Data

The following Nitrogen, Phosphorus and Impervious Surface table has been provided by Maryland Department of the Environment. The table was loading using the 2008 land use and the projected maximum capacity build-out values based on the Build-Out Analysis Report, May 2009 as part of this Comprehensive Plan. The preferred land use is shown in the far right column.

**Table 11.11-5 Assessing Impacts of Nitrogen, Phosphorus and Impervious Surface Land Use and Septic Systems**

| Tuckahoe Creek Watershed (02130405) | 2002 LU, 2002 BMPs | 2002 LU, Trib Strategy BMPs | 2008 Trib Strategy BMPs | Scenario 1 2030 Max Build-Out with Trib Strategy BMPs | Scenario 2 2030 Preferred Land Use with Trib Strategy BMPs |
|---|---|---|---|---|---|
| | (Acres) | (Acres) | (Acres) | (Acres) | (Acres) |
| Development | 695 | 695 | 1,963 | 5,602 | 5,602 |
| Agriculture | 33,002 | 33,002 | 32,126 | 29,384 | 29,384 |
| Forest | 12,262 | 12,262 | 11,864 | 10,968 | 10,968 |
| Water | 52 | 52 | 52 | 52 | 52 |
| Other | 36 | 36 | 42 | 41 | 41 |
| Total Area | 46,047 | 46,047 | 46,047 | 46,047 | 46,047 |
| | | | | | |
| Residential Septic (EDUs) | 0 | 0 | 895 | 3,432 | 3,432 |
| Non-Residential Septic (EDUs) | 0 | 0 | 819 | 942 | 819 |

**Total Nitrogen Loading**

| Tuckahoe Creek Watershed (02130405) | 2002 LU, 2002 BMPs | 2002 LU, Trib Strategy BMPs | 2008 Trib Strategy BMPs | Scenario 1 Max Build-Out with Trib Strategy BMPs | Scenario 2 Preferred Land Use with Trib Strategy BMPs |
|---|---|---|---|---|---|
| | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) |
| Development NPS | 6,106 | 4,213 | 11,958 | 34,163 | 34,163 |
| Agriculture NPS | 516,249 | 286,982 | 279,204 | 255,446 | 255,446 |
| Forest NPS | 18,191 | 16,955 | 16,405 | 15,166 | 15,166 |
| Water NPS | 524 | 434 | 434 | 434 | 434 |
| Other Terrestrial NPS | 315 | 220 | 255 | 245 | 245 |
| **Total Terrestrial Load** | **541,385** | **308,804** | **308,256** | **305,455** | **305,455** |
| Residential Septic (EDUs) | 0 | 0 | 8,319 | 31,899 | 31,899 |
| Non-Residential Septic (EDUs) | 0 | 0 | 2,718 | 3,124 | 2,718 |
| **Total Septic Load** | **0** | **0** | **11,036** | **35,023** | **34,617** |
| **Total NPS Nitrogen Load** | **541,385** | **308,804** | **319,292** | **340,478** | **340,072** |
| **Total PS Load** | **0** | **0** | **0** | **0** | **0** |
| **Total Nitrogen Load (NPS+PS)** | **541,385** | **308,804** | **319,292** | **340,478** | **340,072** |

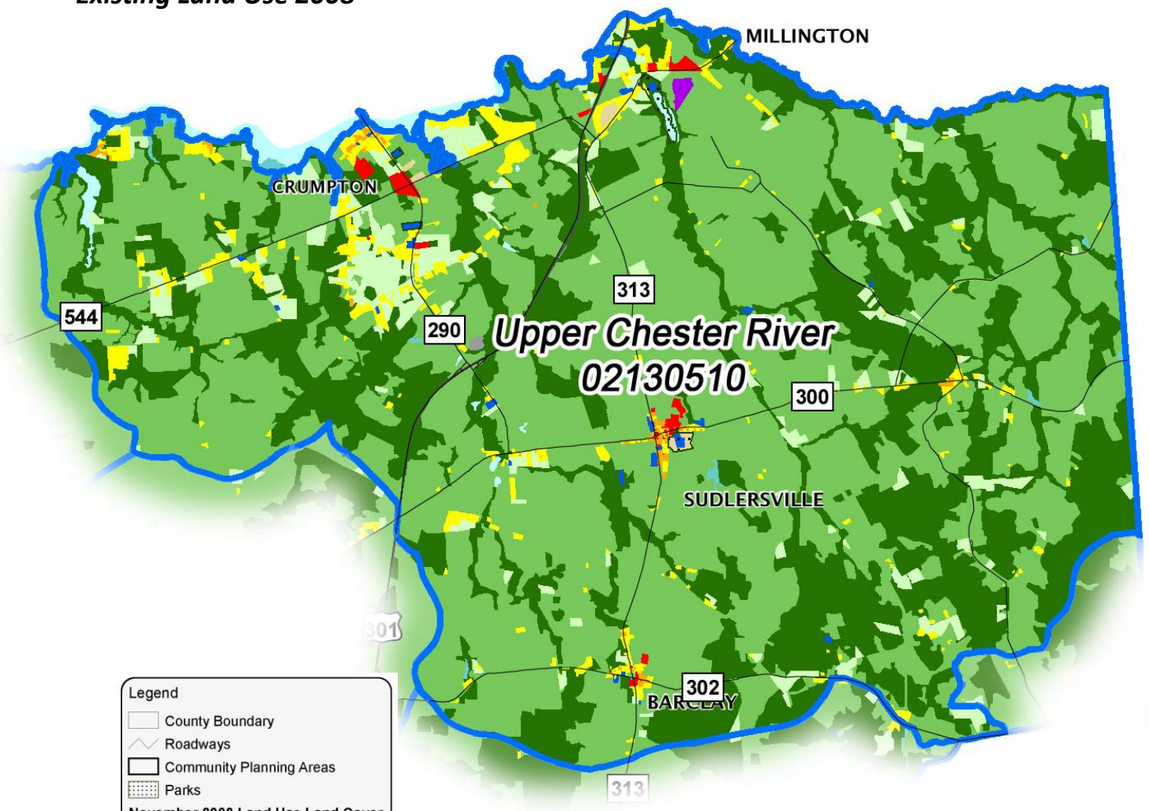
**Total Phosphorus Loading**

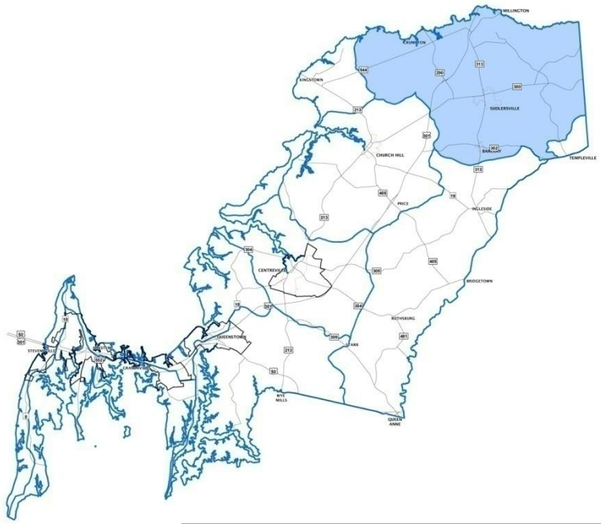
| Tuckahoe Creek Watershed (02130405) | 2002 LU, 2002 BMPs | 2002 LU, Trib Strategy BMPs | 2008 Trib Strategy BMPs | Scenario 1 2030 Max Build-Out with Trib Strategy BMPs | Scenario 2 2030 Preferred Land Use with Trib Strategy BMPs |
|---|---|---|---|---|---|
| | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) |
| Development NPS | 797 | 517 | 1,545 | 4,462 | 4,462 |
| Agriculture NPS | 35,890 | 25,889 | 25,253 | 23,052 | 23,052 |
| Forest NPS | 276 | 227 | 220 | 203 | 203 |
| Water NPS | 29 | 29 | 29 | 29 | 29 |
| Other Terrestrial NPS | 38 | 25 | 29 | 28 | 28 |
| **Total Terrestrial Load** | **37,030** | **26,688** | **27,076** | **27,774** | **27,774** |
| **Total PS Load** | **0** | **0** | **0** | **0** | **0** |
| **Total Phosphorus Load (NPS+PS)** | **37,030** | **26,688** | **27,076** | **27,774** | **27,774** |

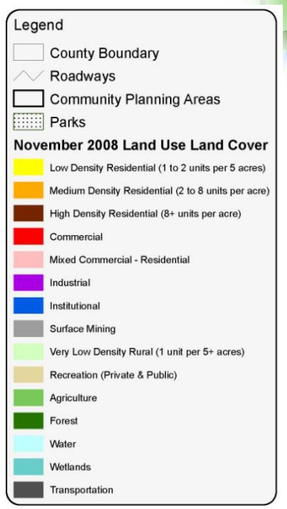
| Impervious Cover and Open Space | (Acres) | | | | |
|---|---|---|---|---|---|
| Tuckahoe Creek Watershed (02130405) | 2002 LU, 2002 BMPs | 2002 LU, Trib Strategy BMPs | 2008 Trib Strategy BMPs | Scenario 1 Max Build-Out with Trib Strategy BMPs | Scenario 2 2030 Preferred Land Use with Trib Strategy BMPs |
| Total Impervious Cover | 157 | 157 | 216 | 453 | 453 |
| Agriculture | 33,002 | 33,002 | 32,126 | 29,384 | 29,384 |
| Forest | 12,257 | 12,257 | 11,859 | 10,963 | 10,963 |
| Percent Impervious | 0.3% | 0.3% | 0.5% | 1.0% | 1.0% |

## Section 11.12 Upper Chester River - 02130510

***Existing Land Use 2008***



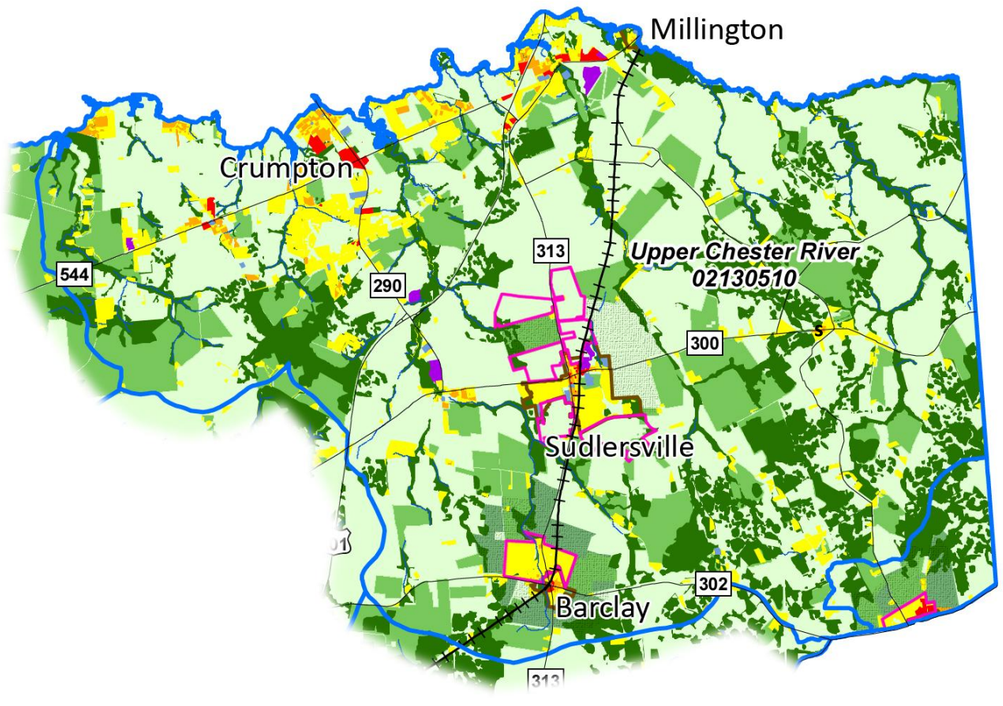



| Table 11.12-1 Conservation Lands Programs | Acres |
|---|---|
| MALPF Easement | 3,060.86 |
| MALPF Greenprint | 444.97 |
| Rural Legacy Easement | 2,953.41 |
| MET | 93.06 |
| TDR Sending Areas | 600.27 |
| Private Conservation Easement | 39.23 |
| County Park | 79.96 |
| State Owned Land | 201.73 |
| Open Space (Deed Restricted) | 2,953.10 |
| Open Space (Non Contiguous) | 1,032.37 |
| MALPF Easement / Open Space | 157.39 |
| MET / Open Space | - |
| County Park / TDR | - |
| County Park / NCD | - |
| County Park / Open Space | - |
| County Park / MET | - |
| MET / TDR | - |
| **Total** | **11,616.35** |

| Land Available for Development | Acres |
|---|---|
| Available | 9,276.31 |
| Divisible | 17,893.48 |
| **Total** | **27,169.79** |

| Table 11.12-2 Updated General Land Use Classes (2008) | 2008 Land Uses | | Preferred Land Uses | |
|---|---|---|---|---|
| | Total Acres | Percent of Total Acres | Total Acres | Percent of Total Acres |
| Low Density Residential (1 to 2 units per 5 acres) | 1,690.4 | **3.2%** | 2,208.7 | **4.2%** |
| Medium Density Residential (2 to 8 units per acre) | 144.7 | **0.3%** | 445.6 | **0.9%** |
| High Density Residential (8+ units per acre) | 1.2 | **0.0%** | 1.2 | **0.0%** |
| Commercial | 186.2 | **0.4%** | 167.7 | **0.3%** |
| Mixed Commercial – Residential | - | **0.0%** | 32.2 | **0.1%** |
| Industrial | 40.3 | **0.1%** | 108.6 | **0.2%** |
| Institutional | 127.8 | **0.2%** | 132.7 | **0.3%** |
| Surface Mining | 15.5 | **0.0%** | 15.5 | **0.0%** |
| Very Low Density Rural (1 unit per 5+ acres) | 2,436.1 | **4.7%** | 6,049.2 | **11.6%** |
| Private Recreation | 67.3 | **0.1%** | 67.3 | **0.1%** |
| Agriculture | 30,946.3 | **59.4%** | 28,618.2 | **54.9%** |
| Forest | 16,027.6 | **30.7%** | 13,836.5 | **26.5%** |
| Water | 222.6 | **0.4%** | 222.6 | **0.4%** |
| Wetlands | 142.7 | **0.3%** | 142.7 | **0.3%** |
| Transportation | 109.2 | **0.2%** | 109.2 | **0.2%** |
| **Total** | **52,157.9** | **100.0%** | **52,157.9** | **100.0%** |

## *Preferred Land Use 2030*




**Preferred Land Use 2030**

The preferred land use within the watershed is based upon maximum capacity build-out under current zoning modified using the future land use plan for Sudlersville and Barclay from the recently adopted Comprehensive Plans and Municipal Growth Elements.


**Table 11.12-3 Best Management Practices Tool Kit**

| Tools, Techniques & Strategies | LANDSCAPES | | | | |
|---|---|---|---|---|---|
| | Agricultural | Natural | Rural Residential | Suburban | Town/Village |
| **Point Source / Urban Source Strategy** | | | | Expand and enhance Sudlersville WWTP and collection/ conveyance system with enhanced nutrient removal systems. Connect existing development located within Sewer Service Areas and Growth Areas to existing or expanded facilities. | Within PFAs, connect existing septic systems to Sudlersville WWTP. |
| **Stormwater Strategy** | BMPs, nutrient and manure management plans and fencing livestock out of streams. | BMPs, preserve buffered and forest conservation. No tree cutting in Critical Areas. | BMPs and ESD. | BMPs, ESD, Retrofit SW facilities or include in new development and reduce use of lawn fertilizers. | BMPs, ESD and retrofit facilities. |
| **Onsite Sewage Disposal Strategy (OSDS)** | Use denitrification technology for on-lot systems or connect to sewer system. | Use denitrification technology on-lot systems or connect to sewer system. | Use denitrification technology for on-lot systems or shared septic systems. | Connect homes with failing septic systems to sewer or upgrade with denitrification technology. | Connect existing development on septic systems within PFAs to public system. |
| **Growth Management Strategy** | Preserve environmentally sensitive lands and agricultural lands using State and Local programs. Establish PPA for agricultural land outside of towns, villages, Growth Areas and PFAs. | Restrict development within Critical Areas. | Cluster development, ESD and encourage development toward areas with existing development. | Suburban subdivisions must provide improvements and connection to public water and sewer systems. Establish the Growth Area as a TDR receiving area. | Infill and redevelop towns and villages. Establish a Growth Area around Sudlersville and Barclay. Establish a Growth Area boundary for Crumpton and Millington. Establish Growth Areas as TDR receiving areas. |
| **Agriculture Strategy** | Nutrient and manure management, BMPs, cover crops and best practices. | Preserve floodplains, riparian buffers and wetland buffers. | Establish lands outside of Growth Areas as TDR sending areas. | | |
| **Waterway Strategies** | Protect riparian buffers, tree planting along streams and living shoreline construction | Protect riparian buffers, tree planting along streams and living shoreline construction | Protection of riparian buffers, tree planting along streams and living shoreline construction | Protect riparian buffers, tree planting along streams and living shoreline construction | Protect riparian buffers and tree planting along streams. |
| **Air Deposition Strategy** | Establish forest conservation strategies and incentives as well as utilize state and local preservation programs. | Establish greenways, greenbelts and forest conservation strategies and incentives. | Require Forest Conservation Plans and establish wooded lot standards. | Require Forest Conservation Plans and trail/path connections within greenbelts to provide access to and from villages. | Provide improvements such as sidewalk where appropriate in towns and villages to enhance walkability. |

**Table 11.12-4 Summary of Projected Impacts to Agriculture and Forest**

| Land Use or Variable | 2008 Land Uses | | 2030 Preferred Land Uses | | Projected Change in Land Use 2008-2030 | |
|---|---|---|---|---|---|---|
| | Total Acres | Percent of Total Acres | Total Acres | Percent of Total Acres | Total Acres | Percent of Total Acres |
| Agriculture | 30,946.3 | **59.4%** | 28,618.2 | **54.9%** | -2,328.1 | **-4.5%** |
| Forest | 16,027.6 | **30.7%** | 13,836.5 | **26.5%** | -2,191.1 | **-4.2%** |
| ***Queen Anne's County Impervious Surfaces**** | 1,073.4 | **2.1%** | | | | |
| ***Statewide Priority Wetlands ***** | 5,476.0 | **10.5%** | | | | |
| ***Tier II Catchment Area within Watershed*** | 25,284.0 | **48.4%** | | | | |

** Impervious surfaces data was created using 2004 planimetric data as updated using 2008 Aerial imagery collected by the State. There is no guarantee that all features were collected nor to the precision of the collected features. This data provides a general value of the impervious surface within a watershed.*

*** Queen Anne's County may need to track on permits issued by MDE for development within theses wetlands to determine impacts.*

## Water Resources Element – Nitrogen, Phosphorus and Impervious Surface Data

The following Nitrogen, Phosphorus and Impervious Surface table has been provided by Maryland Department of the Environment. The table was loading using the 2008 land use and the projected maximum capacity build-out values based on the Build-Out Analysis Report, May 2009 as part of this Comprehensive Plan. The preferred land use is shown in the far right column.

**Note, the Upper Chester River Watershed 2006 Study TMDL: Nitrogen 614,612 lbs per year and Phosphorus 34,354 pounds per year.**
**The Queen Anne's County portion of the Upper Chester River Watershed is 59.3%.**

**Table 11.12-5 Assessing Impacts of Nitrogen, Phosphorus and Impervious Surface**

| Upper Chester River Watershed (02130510) | 2002 LU, 2002 BMPs | 2002 LU, Trib Strategy BMPs | 2008 Trib Strategy BMPs | Scenario 1 2030 Max Build-Out with Trib Strategy BMPs | Scenario 2 2030 Preferred Land Use with Trib Strategy BMPs |
|---|---|---|---|---|---|
| | (Acres) | (Acres) | (Acres) | (Acres) | (Acres) |
| Development | 2,048 | 2,048 | 4,608 | 9,122 | 9,122 |
| Agriculture | 32,508 | 32,508 | 30,946 | 28,618 | 28,618 |
| Forest | 17,161 | 17,161 | 16,170 | 13,979 | 13,979 |
| Water | 236 | 236 | 223 | 223 | 223 |
| Other | 205 | 205 | 211 | 216 | 216 |
| Total Area | 52,158 | 52,158 | 52,158 | 52,158 | 52,158 |
| | | | | | |
| Residential Septic (EDUs) | 0 | 0 | 1,900 | 3,967 | 2,313 |
| Non-Residential Septic (EDUs) | 0 | 0 | 1,918 | 2,136 | 1,918 |

| Total Nitrogen Loading | | | | | | |
|---|---|---|---|---|---|---|
| **Upper Chester River Watershed (02130510)** | **2002 LU, 2002 BMPs** | **2002 LU, Trib Strategy BMPs** | **2008 Trib Strategy BMPs** | **Scenario 1 2030 Max Build-Out with Trib Strategy BMPs** | **Scenario 2 2030 Preferred Land Use with Trib Strategy BMPs** | |
| | **(Lbs/Yr)** | **(Lbs/Yr)** | **(Lbs/Yr)** | **(Lbs/Yr)** | **(Lbs/Yr)** | |
| Development NPS | 17,987 | 12,419 | 28,027 | 55,560 | 55,560 | |
| Agriculture NPS | 508,681 | 282,694 | 268,985 | 248,877 | 248,877 | |
| Forest NPS | 25,458 | 23,728 | 22,359 | 19,329 | 19,329 | |
| Water NPS | 2,379 | 1,969 | 1,857 | 1,857 | 1,857 | |
| Other Terrestrial NPS | 1,805 | 1,244 | 1,275 | 1,305 | 1,305 | |
| **Total Terrestrial Load** | **556,311** | **322,053** | **322,504** | **326,929** | **326,929** | |
| Residential Septic (EDUs) | 0 | 0 | 17,660 | 36,872 | 21,498 | |
| Non-Residential Septic (EDUs) | 0 | 0 | 6,362 | 7,083 | 6,362 | |
| **Total Septic Load** | **0** | **0** | **24,022** | **43,955** | **27,860** | |
| **Total NPS Nitrogen Load** | **556,311** | **322,053** | **346,525** | **370,883** | **354,789** | |
| **Total PS Load** | **0** | **0** | **0** | **6,038** | **11,068** | **TMDL** |
| **Total Nitrogen Load (NPS+PS)** | **556,311** | **322,053** | **346,525** | **376,921** | **365,857** | **614,612** |

| Total Phosphorus Loading | | | | | | |
|---|---|---|---|---|---|---|
| **Upper Chester River Watershed (02130510)** | **2002 LU, 2002 BMPs** | **2002 LU, Trib Strategy BMPs** | **2008 Trib Strategy BMPs** | **Scenario 1 2030 Max Build-Out with Trib Strategy BMPs** | **Scenario 2 2030 Preferred Land Use with Trib Strategy BMPs** | |
| | **(Lbs/Yr)** | **(Lbs/Yr)** | **(Lbs/Yr)** | **(Lbs/Yr)** | **(Lbs/Yr)** | |
| Development NPS | 2,337 | 1,519 | 3,553 | 7,152 | 7,152 | |
| Agriculture NPS | 35,331 | 25,484 | 24,284 | 22,369 | 22,369 | |
| Forest NPS | 386 | 318 | 299 | 259 | 259 | |
| Water NPS | 134 | 134 | 126 | 126 | 126 | |
| Other Terrestrial NPS | 237 | 154 | 153 | 157 | 157 | |
| **Total Terrestrial Load** | **38,425** | **27,609** | **28,416** | **30,062** | **30,062** | |
| **Total PS Load** | **0** | **0** | **0** | **453** | **830** | |
| | | | | | | **TMDL** |
| **Total Phosphorus Load (NPS+PS)** | **38,425** | **27,609** | **28,416** | **30,515** | **30,892** | **34,354** |

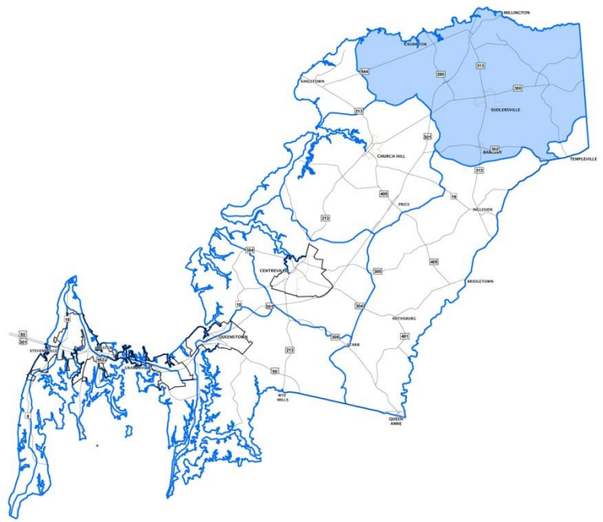
| Impervious Cover and Open Space | (Acres) | | | | |
|---|---|---|---|---|---|
| Upper Chester River Watershed (02130510) | 2002 LU, 2002 BMPs | 2002 LU, Trib Strategy BMPs | 2008 Trib Strategy BMPs | Scenario 1 2030 Max Build-Out with Trib Strategy BMPs | Scenario 2 2030 Preferred Land Use with Trib Strategy BMPs |
| Total Impervious Cover | 466 | 466 | 687 | 1,030 | 1,030 |
| Agriculture | 32,508 | 32,508 | 30,946 | 28,618 | 28,618 |
| Forest | 17,010 | 17,010 | 16,028 | 13,837 | 13,837 |
| Percent Impervious | 0.9% | 0.9% | 1.3% | 2.0% | 2.0% |

## Section 11.13 Town of Barclay Growth Area

***Existing Land Use 2008***


Land Use
- Low Density Residential (1 to 2 units per 5 acres)
- Medium Density Residential (2 to 8 units per acre)
- Industrial / Business Park
- Commercial & Mixed Use
- Institutional
- Agricultural & Very Low Density Rural Residential (1 unit per 5+ acres)
- Forest
- Greenbelts
- Agriculture & Open Space

Planning Areas
- County / Town Planning Areas
- Town Future Annexation Areas
- Incorporated Towns



| Table 11.13-1 Conservation Lands Programs | Acres |
|---|---|
| MALPF Easement | - |
| MALPF Greenprint | - |
| Rural Legacy Easement | - |
| MET | - |
| TDR Sending Areas | - |
| Private Conservation Easement | - |
| County Park | - |
| State Owned Land | - |
| Open Space (Deed Restricted) | - |
| Open Space (Non Contiguous) | - |
| MALPF Easement / Open Space | - |
| MET / Open Space | - |
| County Park / TDR | - |
| County Park / NCD | - |
| County Park / Open Space | - |
| County Park / MET | - |
| MET / TDR | - |
| **Total** | **0.0** |

| Land Available for Development | Acres |
|---|---|
| Available | 33.1 |
| Divisible | 15.7 |
| **Total** | **48.8** |

| Table 11.13-2 Updated General Land Use Classes (2008) | 2008 Land Uses | | 2030 Preferred Land Uses | |
|---|---|---|---|---|
| | Total Acres | Percent of Total Acres | Total Acres | Percent of Total Acres |
| Low Density Residential (1 to 2 units per 5 acres) | 52.9 | **29.0%** | 81.3 | **44.5%** |
| Medium Density Residential (2 to 8 units per acre) | 14.7 | **8.1%** | 14.7 | **8.1%** |
| High Density Residential (8+ units per acre) | - | **0.0%** | - | **0.0%** |
| Commercial | 12.7 | **7.0%** | 10.5 | **5.7%** |
| Mixed Commercial – Residential | - | **0.0%** | - | **0.0%** |
| Industrial | - | **0.0%** | - | **0.0%** |
| Institutional | 6.8 | **3.7%** | 6.8 | **3.7%** |
| Surface Mining | - | **0.0%** | - | **0.0%** |
| Very Low Density Rural (1 unit per 5+ acres) | 14.9 | **8.1%** | 5.4 | **3.0%** |
| Private Recreation | - | **0.0%** | - | **0.0%** |
| Agriculture | 34.4 | **18.8%** | 30.3 | **16.6%** |
| Forest | 46.2 | **25.3%** | 33.6 | **18.4%** |
| Water | - | **0.0%** | - | **0.0%** |
| Wetlands | - | **0.0%** | - | **0.0%** |
| Transportation | - | **0.0%** | - | **0.0%** |
| **Total** | **182.6** | **100.0%** | **182.6** | **100.0%** |

### *Preferred Land Use 2030*

From the Barclay Municipal Growth Plan Draft 2009

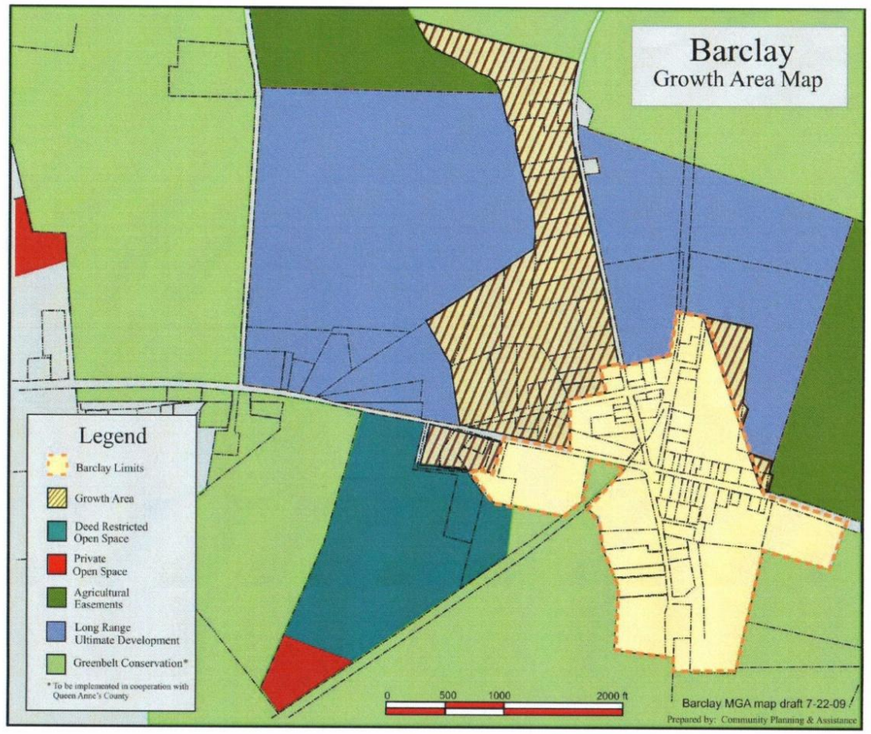



**Table 11.13-3 Summary of Projected Impacts to Agriculture and Forest**

| Land Use or Variable | 2008 Land Uses | | Preferred Land Uses | | Change in Land Use*** | |
|---|---|---|---|---|---|---|
| | Total Acres | Percent of Total Acres | Total Acres | Percent of Total Acres | Total Acres | Percent of Total Acres |
| Agriculture | 34.4 | **18.8%** | 30.3 | **16.6%** | -4.1 | **-2.2%** |
| Forest | 46.2 | **25.3%** | 33.6 | **18.4%** | -12.6 | **-6.9%** |
| ***Queen Anne's County Impervious Surfaces**** | 27.8 | **15.2%** | | | | |
| ***Statewide Priority Wetlands***** | 2.0 | **1.1%** | | | | |
| ***Tier II Catchment Area within Watershed*** | 182.6 | **100.0%** | | | | |

**Impervious surfaces data was created using 2004 planimetric data as updated using 2008 Aerial imagery collected by the State. There is no guarantee that all features were collected nor as to the precision of the collected features. This data provides a general value of the impervious surface within a watershed.*

***Queen Anne's County may need to track on permits issued by MDE for development within theses wetlands to determine impacts.*

## Water Resources Element – Nitrogen, Phosphorus and Impervious Surface Data

The following Nitrogen, Phosphorus and Impervious Surface table has been provided by Maryland Department of the Environment. The table was loading using the 2008 land use and the projected maximum capacity build-out values based on the Build-Out Analysis Report, May 2009 as part of this Comprehensive Plan. The preferred land use is shown in the far right column.

**Table 11.13-4 Assessing Impacts of Nitrogen, Phosphorus and Impervious Surface**

| Barclay - Upper Chester River | 2002 LU, 2002 BMPs | 2002 LU, Trib Strategy BMPs | 2008 Trib Strategy BMPs | Scenario 1 2030 Max Build-Out with Trib Strategy BMPs | Scenario 2 2030 Preferred Land Use with Trib Strategy BMPs |
|---|---|---|---|---|---|
| | (Acres) | (Acres) | (Acres) | (Acres) | (Acres) |
| Development | 81 | 81 | 95 | 112 | 112 |
| Agriculture | 54 | 54 | 34 | 30 | 30 |
| Forest | 42 | 42 | 46 | 34 | 34 |
| Water | 0 | 0 | 0 | 0 | 0 |
| Other | 5 | 5 | 7 | 7 | 7 |
| Total Area | 183 | 183 | 183 | 183 | 183 |
| | | | | | |
| Residential Septic (EDUs) | 0 | 0 | 77 | 175 | 0 |
| Non-Residential Septic (EDUs) | 0 | 0 | 45 | 45 | 0 |

**Total Nitrogen Loading**

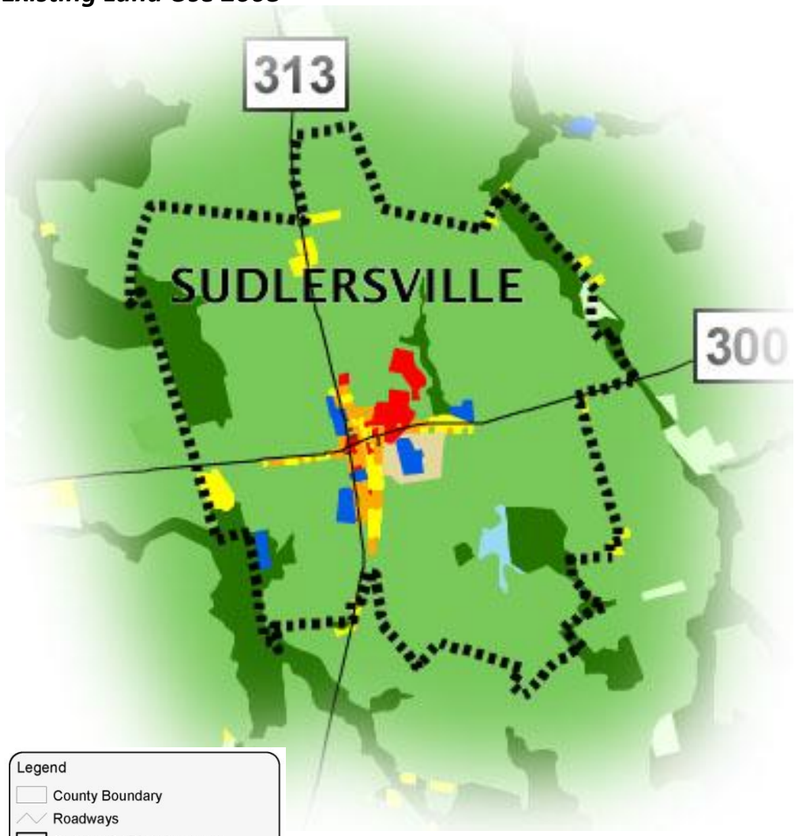
| Barclay - Upper Chester River | 2002 LU, 2002 BMPs | 2002 LU, Trib Strategy BMPs | 2008 Trib Strategy BMPs | Scenario 1 2030 Max Build-Out with Trib Strategy BMPs | Scenario 2 2030 Preferred Land Use with Trib Strategy BMPs |
|---|---|---|---|---|---|
| | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) |
| Development NPS | 710 | 493 | 577 | 679 | 679 |
| Agriculture NPS | 854 | 473 | 296 | 261 | 261 |
| Forest NPS | 62 | 58 | 64 | 46 | 46 |
| Water NPS | 0 | 0 | 0 | 0 | 0 |
| Other Terrestrial NPS | 40 | 28 | 41 | 41 | 41 |
| **Total Terrestrial Load** | **1,666** | **1,052** | **977** | **1,027** | **1,027** |
| | | | | | |
| Residential Septic (EDUs) | 0 | 0 | 716 | 1,627 | 0 |
| Non-Residential Septic (EDUs) | 0 | 0 | 148 | 148 | 0 |
| **Total Septic Load** | **0** | **0** | **864** | **1,775** | **0** |
| | | | | | |
| **Total NPS Nitrogen Load** | **1,666** | **1,052** | **1,842** | **2,802** | **1,027** |
| **Total PS Load** | **0** | **0** | **0** | **0** | **532** |
| **Total Nitrogen Load (NPS+PS)** | **1,666** | **1,052** | **1,842** | **2,802** | **1,559** |

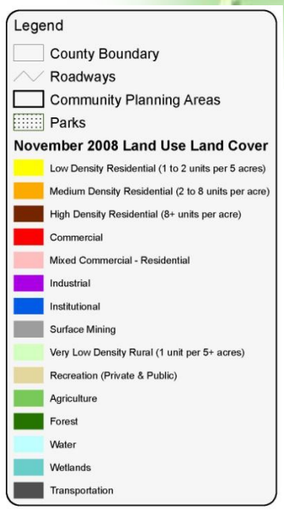
| Total Phosphorus Loading<br>Barclay - Upper Chester River | 2002 LU, 2002 BMPs | 2002 LU, Trib Strategy BMPs | 2008 Trib Strategy BMPs | Scenario 1 2030 Max Build-Out with Trib Strategy BMPs | Scenario 2 2030 Preferred Land Use with Trib Strategy BMPs |
|---|---|---|---|---|---|
| | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) |
| Development NPS | 89 | 58 | 70 | 83 | 83 |
| Agriculture NPS | 59 | 42 | 28 | 25 | 25 |
| Forest NPS | 1 | 1 | 1 | 1 | 1 |
| Water NPS | 0 | 0 | 0 | 0 | 0 |
| Other Terrestrial NPS | 5 | 3 | 5 | 5 | 5 |
| **Total Terrestrial Load** | **153** | **105** | **104** | **113** | **113** |
| **Total PS Load** | **0** | **0** | **0** | **0** | **40** |
| **Total Phosphorus Load (NPS+PS)** | **153** | **105** | **104** | **113** | **153** |

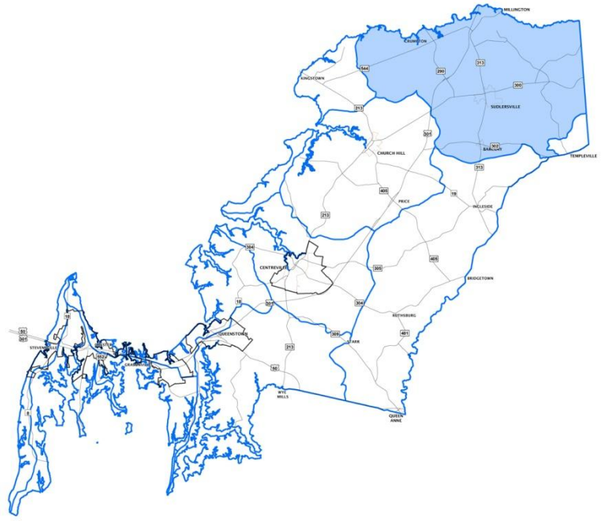
| Impervious Cover and Open Space (Acres)<br>Barclay - Upper Chester River | 2002 LU, 2002 BMPs | 2002 LU, Trib Strategy BMPs | 2008 Trib Strategy BMPs | Scenario 1 2030 Max Build-Out with Trib Strategy BMPs | Scenario 2 2030 Preferred Land Use with Trib Strategy BMPs |
|---|---|---|---|---|---|
| Total Impervious Cover | 23 | 23 | 24 | 26 | 26 |
| Agriculture | 54 | 54 | 34 | 30 | 30 |
| Forest | 42 | 42 | 46 | 34 | 34 |
| Percent Impervious | 12.9% | 12.9% | 12.9% | 14.0% | 14.0% |

## Section 11.14 Sudlersville Growth Area

***Existing Land Use 2008***



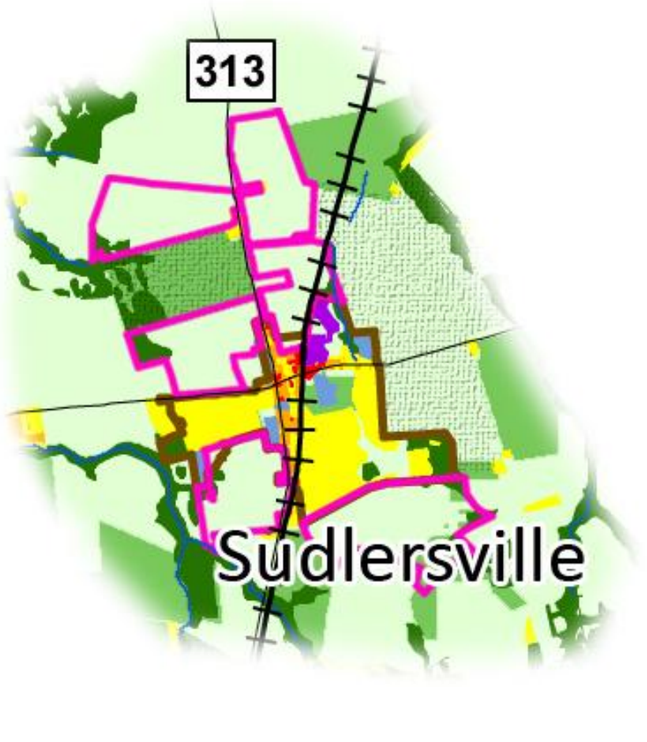



| Table 11.14-1 Conservation Lands Programs | Acres |
|---|---|
| MALPF Easement | - |
| MALPF Greenprint | - |
| Rural Legacy Easement | - |
| MET | - |
| TDR Sending Areas | - |
| Private Conservation Easement | - |
| County Park | 36.7 |
| State Owned Land | - |
| Open Space (Deed Restricted) | 331.0 |
| Open Space (Non Contiguous) | 66.9 |
| MALPF Easement / Open Space | - |
| MET / Open Space | - |
| County Park / TDR | - |
| County Park / NCD | - |
| County Park / Open Space | - |
| County Park / MET | - |
| MET / TDR | - |
| **Total** | **434.6** |

| Land Available for Development | Acres |
|---|---|
| Available | 650.4 |
| Divisible | 1,137.6 |
| **Total** | **1,788.0** |

| Table 11.14-2 Updated General Land Use Classes (2008) | 2008 Land Uses | | 2030 Preferred Land Uses | |
|---|---|---|---|---|
| | Total Acres | Percent of Total Acres | Total Acres | Percent of Total Acres |
| Low Density Residential (1 to 2 units per 5 acres) | 61.8 | **2.4%** | 322.4 | **12.4%** |
| Medium Density Residential (2 to 8 units per acre) | 50.5 | **1.9%** | 50.3 | **1.9%** |
| High Density Residential (8+ units per acre) | 1.2 | **0.0%** | 1.2 | **0.0%** |
| Commercial | 41.4 | **1.6%** | 17.0 | **0.7%** |
| Mixed Commercial – Residential | - | **0.0%** | - | **0.0%** |
| Industrial | - | **0.0%** | 26.9 | **1.0%** |
| Institutional | 40.2 | **1.5%** | 46.4 | **1.8%** |
| Surface Mining | - | **0.0%** | - | **0.0%** |
| Very Low Density Rural (1 unit per 5+ acres) | 5.8 | **0.2%** | 235.9 | **9.0%** |
| Private Recreation | 26.2 | **1.0%** | 26.2 | **1.0%** |
| Agriculture | 2,080.0 | **79.7%** | 1,498.3 | **57.4%** |
| Forest | 284.2 | **10.9%** | 366.8 | **14.1%** |
| Water | - | **0.0%** | - | **0.0%** |
| Wetlands | 19.1 | **0.7%** | 19.1 | **0.7%** |
| Transportation | - | **0.0%** | - | **0.0%** |
| **Total** | **2,610.4** | **100.0%** | **2,610.4** | **100.0%** |

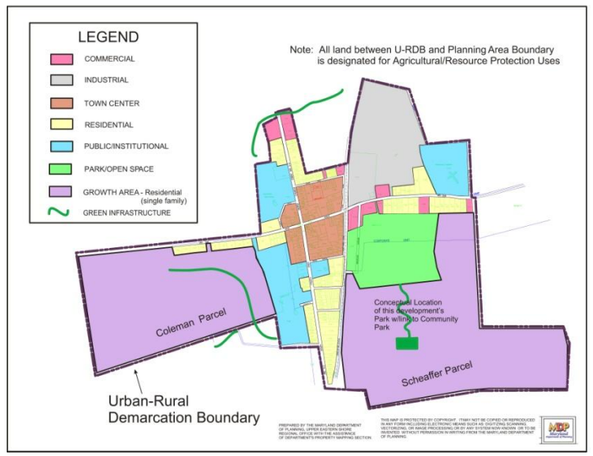
## *Preferred Land Use 2030*




Sudlersville Comprehensive Plan

Map 3

Future Land Use




DRAFT Sudlersville Growth Potential DRAFT

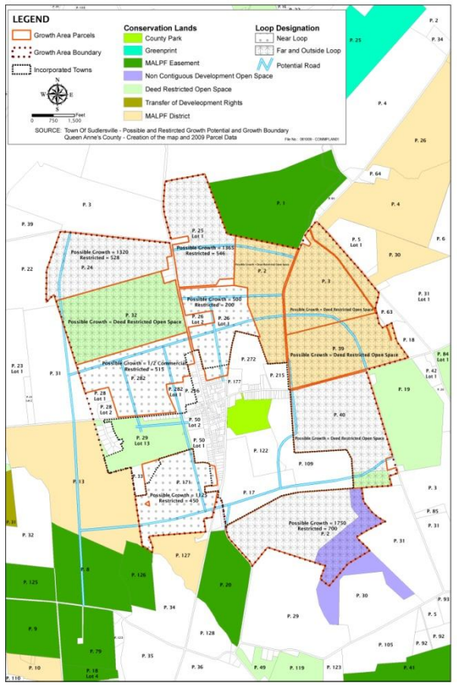


**Table 11.14-3 Summary of Projected Impacts to Agriculture and Forest**

| Land Use or Variable | 2008 Land Uses | | 2030 Preferred Land Uses | | Projected Change in Land Use 2008-2030 | |
|---|---|---|---|---|---|---|
| | Total Acres | Percent of Total Acres | Total Acres | Percent of Total Acres | Total Acres | Percent of Total Acres |
| Agriculture | 2,080.0 | **79.7%** | 1,498.3 | **57.4%** | -581.70 | **-22.3%** |
| Forest | 284.2 | **10.9%** | 366.8 | **14.1%** | 82.6 | **3.2%** |
| ***Queen Anne's County Impervious Surfaces**** | 67.9 | **2.6%** | | | | |
| ***Statewide Priority Wetlands***** | 88.9 | **3.4%** | | | | |
| ***Tier II Catchment Area within Watershed*** | 1,067.4 | **40.9%** | | | | |

**Impervious surfaces data was created using 2004 planimetric data as updated using 2008 Aerial imagery collected by the State. There is no guarantee that all features were collected nor as to the precision of the collected features. This data provides a general value of the impervious surface within a watershed.*

***Queen Anne's County may need to track on permits issued by MDE for development within theses wetlands to determine impacts.*

## Water Resources Element – Nitrogen, Phosphorus and Impervious Surface Data

The following Nitrogen, Phosphorus and Impervious Surface table has been provided by Maryland Department of the Environment. The table was loading using the 2008 land use and the projected maximum capacity build-out values based on the Build-Out Analysis Report, May 2009 as part of this Comprehensive Plan. The preferred land use is shown in the far right column.

**Table 11.14-4 Assessing Impacts of Nitrogen, Phosphorus and Impervious Surface**

| **Sudlersville - Upper Chester River** | 2002 LU, 2002 BMPs | 2002 LU, Trib Strat BMPs | 2008 Trib Strat BMPs | Scenario 1 2030 Max Build-Out with Trib Strat BMPs | Scenario 2 2030 Preferred Land Use with Trib Strat BMPs |
|---|---|---|---|---|---|
| | (Acres) | (Acres) | (Acres) | (Acres) | (Acres) |
| Development | 134 | 134 | 161 | 653 | 653 |
| Agriculture | 2,104 | 2,104 | 2,080 | 1,498 | 1,498 |
| Forest | 308 | 308 | 303 | 386 | 386 |
| Water | 6 | 6 | 0 | 0 | 0 |
| Other | 58 | 58 | 66 | 73 | 73 |
| Total Area | 2,610 | 2,610 | 2,610 | 2,610 | 2,610 |
| | | | | | |
| Residential Septic (EDUs) | 0 | 0 | 179 | 0 | 0 |
| Non-Residential Septic (EDUs) | 0 | 0 | 1 | 0 | 0 |

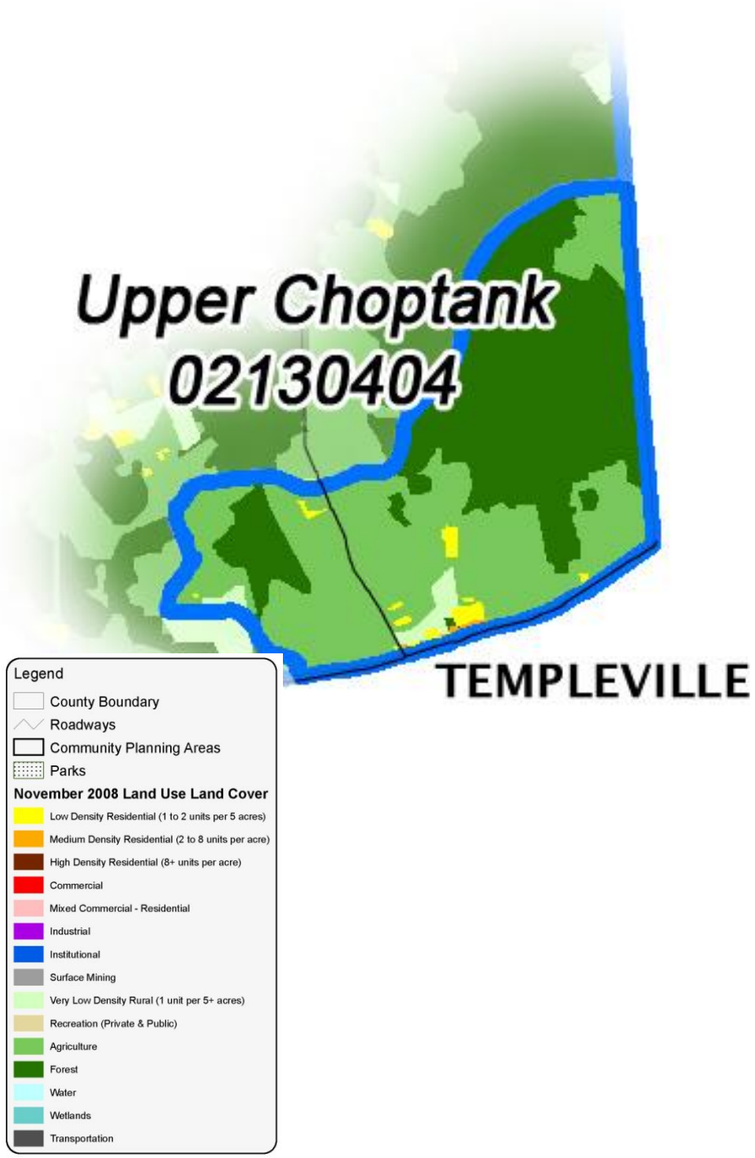
| Total Nitrogen Loading | | | | | | |
|---|---|---|---|---|---|---|
| **Sudlersville - Upper Chester River** | 2002 LU, 2002 BMPs | 2002 LU, Trib Strat BMPs | 2008 Trib Strat BMPs | Scenario 1 2030 Max Build-Out with Trib Strat BMPs | Scenario 2 2030 Preferred Land Use Trib Strat BMPs | |
| | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | |
| Development NPS | 1,164 | 810 | 969 | 3,972 | 3,972 | |
| Agriculture NPS | 33,060 | 18,310 | 18,100 | 13,038 | 13,038 | |
| Forest NPS | 456 | 425 | 419 | 534 | 534 | |
| Water NPS | 63 | 52 | 0 | 0 | 0 | |
| Other Terrestrial NPS | 515 | 355 | 402 | 439 | 439 | |
| **Total Terrestrial Load** | **35,258** | **19,952** | **19,891** | **17,983** | **17,983** | |
| | | | | | | |
| Residential Septic (EDUs) | 0 | 0 | 1,664 | 0 | 0 | |
| Non-Residential Septic (EDUs) | 0 | 0 | 2 | 0 | 0 | |
| **Total Septic Load** | **0** | **0** | **1,666** | **0** | **0** | |
| | | | | | | |
| **Total NPS Nitrogen Load** | **35,258** | **19,952** | **21,556** | **17,983** | **17,983** | |
| **Total PS Load** | **0** | **0** | **0** | **1,792** | **4,697** | **TMDL** |
| **Total Nitrogen Load (NPS+PS)** | **35,258** | **19,952** | **21,556** | **19,775** | **22,680** | **614,612** |

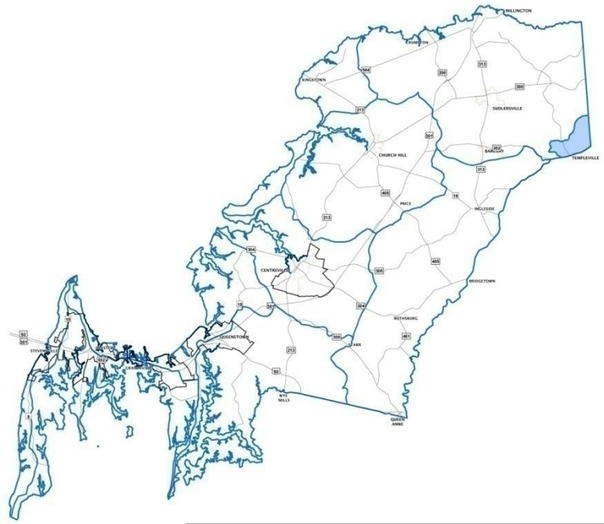
| Total Phosphorus Loading | | | | | | |
|---|---|---|---|---|---|---|
| **Sudlersville - Upper Chester River** | 2002 LU, 2002 BMPs | 2002 LU, Trib Strat BMPs | 2008 Trib Strat BMPs | Scenario 1 2030 Max Build-Out with Trib Strat BMPs | Scenario 2 2030 Preferred Land Use with Trib Strat BMPs | |
| | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | |
| Development NPS | 143 | 94 | 111 | 501 | 501 | |
| Agriculture NPS | 2,275 | 1,639 | 1,621 | 1,167 | 1,167 | |
| Forest NPS | 7 | 6 | 6 | 7 | 7 | |
| Water NPS | 4 | 4 | 0 | 0 | 0 | |
| Other Terrestrial NPS | 68 | 44 | 48 | 52 | 52 | |
| **Total Terrestrial Load** | **2,497** | **1,786** | **1,785** | **1,728** | **1,728** | |
| | | | | | | |
| **Total PS Load** | **0** | **0** | **0** | **135** | **353** | |
| | | | | | | **TMDL** |
| **Total Phosphorus Load (NPS+PS)** | **2,497** | **1,786** | **1,785** | **1,863** | **2,081** | **34,354** |

| Impervious Cover and Open Space | (Acres) | | | | |
|---|---|---|---|---|---|
| **Sudlersville - Upper Chester River** | 2002 LU, 2002 BMPs | 2002 LU, Trib Strat BMPs | 2008 Trib Strat BMPs | Scenario 1 2030 Max Build-Out with Trib Strat BMPs | Scenario 2 2030 Preferred Land Use with Trib Strat BMPs |
| Total Impervious Cover | 50 | 50 | 69 | 114 | 114 |
| Agriculture | 2,104 | 2,104 | 2,080 | 1,498 | 1,498 |
| Forest | 289 | 289 | 284 | 367 | 367 |
| Percent Impervious | 1.9% | 1.9% | 2.7% | 4.4% | 4.4% |

## Section 11.15 Upper Choptank - 02130404

***Existing Land Use 2008***



| Table 11.15-1 Conservation Lands Programs | Acres |
|---|---|
| MALPF Easement | 262.24 |
| MALPF Greenprint | 87.05 |
| Rural Legacy Easement | - |
| MET | - |
| TDR Sending Areas | - |
| Private Conservation Easement | - |
| County Park | - |
| State Owned Land | - |
| Open Space (Deed Restricted) | - |
| Open Space (Non Contiguous) | 59.82 |
| MALPF Easement / Open Space | - |
| MET / Open Space | - |
| County Park / TDR | - |
| County Park / NCD | - |
| County Park / Open Space | - |
| County Park / MET | - |
| MET / TDR | - |
| **Total** | **409.11** |

| Land Available for Development | Acres |
|---|---|
| Available | 441.10 |
| Divisible | 333.13 |
| **Total** | **774.23** |

| Table 11.15-2 Updated General Land Use Classes (2008) | 2008 Land Uses | | 2030 Preferred Land Uses | |
|---|---|---|---|---|
| | Total Acres | Percent of Total Acres | Total Acres | Percent of Total Acres |
| Low Density Residential (1 to 2 units per 5 acres) | 32.0 | **1.7%** | 22.9 | **1.2%** |
| Medium Density Residential (2 to 8 units per acre) | 9.6 | **0.5%** | 19.9 | **1.0%** |
| High Density Residential (8+ units per acre) | 0.2 | **0.0%** | 0.2 | **0.0%** |
| Commercial | - | **0.0%** | - | **0.0%** |
| Mixed Commercial – Residential | - | **0.0%** | 22.3 | **1.2%** |
| Industrial | - | **0.0%** | - | **0.0%** |
| Institutional | 0.3 | **0.0%** | 0.3 | **0.0%** |
| Surface Mining | - | **0.0%** | - | **0.0%** |
| Very Low Density Rural (1 unit per 5+ acres) | 41.4 | **2.1%** | 117.9 | **6.1%** |
| Private Recreation | - | **0.0%** | - | **0.0%** |
| Agriculture | 937.8 | **48.7%** | 907.7 | **47.1%** |
| Forest | 904.7 | **47.0%** | 834.8 | **43.4%** |
| Water | - | **0.0%** | - | **0.0%** |
| Wetlands | - | **0.0%** | - | **0.0%** |
| Transportation | - | **0.0%** | - | **0.0%** |
| **Total** | **1,926.0** | **100.0%** | **1,926.0** | **100.0%** |

***Preferred Land Use 2030***

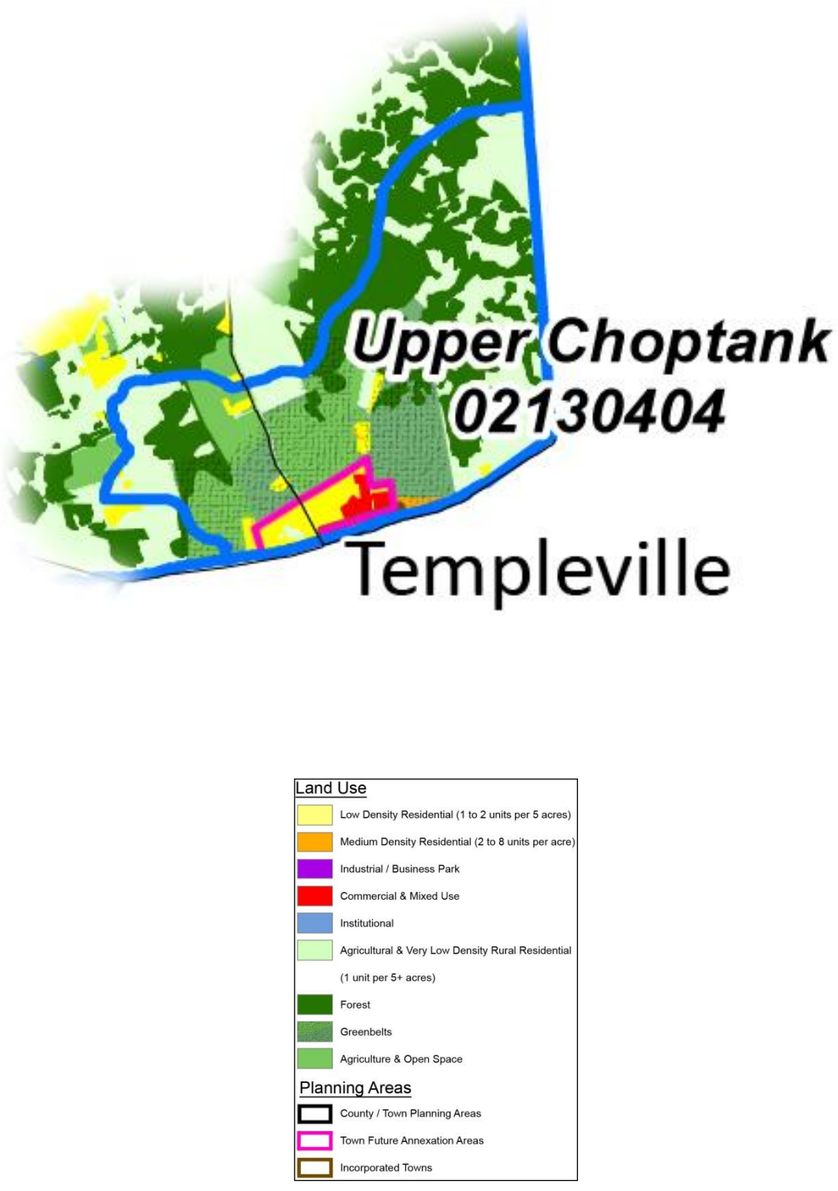



**Table 11.15-3 Best Management Practices Tool Kit**

| Tools, Techniques & Strategies | LANDSCAPES | | | | |
|---|---|---|---|---|---|
| | **Agricultural** | **Natural** | **Rural Residential** | **Suburban** | **Towns** |
| **Point Source / Urban Source Strategy** | | | | | Provide adequate facilities to Templeville and planned expansion. |
| **Stormwater Strategy** | BMPs and Nutrient and Manure Management Plans, fencing livestock out of streams. | BMPs and preservation of buffer and forest conservation. No tree cutting in Critical Areas. | BMPs and ESD. | BMPs, ESD, Retrofitting of SW facilities or inclusion in new development and reduction in use of lawn fertilizers. | BMPs, ESD, Retrofitting of facilities. |
| **Onsite Sewage Disposal Strategy (OSDS)** | Use denitrification technology for on-lot systems or connect to sewer system. | Use denitrification technology on-lot systems or connect to sewer system. | Use denitrification technology for on-lot systems or shared septic systems. | Connect homes with failing septic systems to sewer or upgrade with denitrification technology. | Connect existing development on septic systems within PFAs to public system. |
| **Growth Management Strategy** | Preservation of environmentally sensitive lands and agricultural lands using State and Local programs. | Restrict development within Critical Areas. | Cluster development, ESD and encourage development toward areas with existing infrastructure. | Suburban subdivisions must provide improvements and connection to public water and sewer systems. | Establish Infill/Redevelopment standards and incentives. |
| **Agriculture Strategy** | Nutrient and Manure Management, BMPs, Cover Crops | Appropriate floodplain, riparian buffer and wetland buffers. | Establish lands outside of Growth Area as TDR sending areas. | | |
| **Waterway Strategies** | Protection of riparian buffers, tree planting along streams and living shoreline construction | Protection of riparian buffers, tree planting along streams construction | Protection of riparian buffers, tree planting along streams and construction | Protection of riparian buffers, tree planting along streams and living shoreline construction | Protection of riparian buffers, tree planting along streams. |
| **Air Deposition Strategy** | Establish forest conservation strategies and incentives as well as utilize state and local preservation programs. | Establish greenway and forest conservation strategies and incentives. | Forest Conservation Plans and establish wooded lot standards. | Forest Conservation Plans and trail/path connections within greenbelts to provide access to and from villages. | Provide improvements such as sidewalk where appropriate for villages to be walkable. |

**Table 11.15-4 Summary of Projected Impacts to Agriculture and Forest**

| Land Use or Variable | 2008 Land Uses | | 2030 Preferred Land Uses | | Projected Change in Land Use 2008-2030 | |
|---|---|---|---|---|---|---|
| | Total Acres | Percent of Total Acres | Total Acres | Percent of Total Acres | Total Acres | Percent of Total Acres |
| Agriculture | 937.8 | **48.7%** | 907.7 | **47.1%** | -30.1 | **-1.6%** |
| Forest | 904.7 | **47.0%** | 834.8 | **43.4%** | -69.9 | **-3.6%** |
| ***Queen Anne's County Impervious Surfaces**** | 26.4 | **1.4%** | | | | |
| ***Statewide Priority Wetlands***** | 637.0 | **33.0%** | | | | |
| ***Tier II Catchment Area within Watershed*** | 239.0 | **12.4%** | | | | |

**Impervious surfaces data was created using 2004 planimetric data as updated using 2008 Aerial imagery collected by the State. There is no guarantee that all features were collected nor to the precision of the collected features. This data provides a general value of the impervious surface within a watershed.*

***Queen Anne's County may need to track on permits issued by MDE for development within theses wetlands to determine impacts.*

## Water Resources Element – Nitrogen, Phosphorus and Impervious Surface Data

The following Nitrogen, Phosphorus and Impervious Surface table has been provided by Maryland Department of the Environment. The table was loading using the 2008 land use and the projected maximum capacity build-out values based on the Build-Out Analysis Report, May 2009 as part of this Comprehensive Plan. The preferred land use is shown in the far right column.

**Table 11.15-5 Assessing Impacts of Nitrogen, Phosphorus and Impervious Surface Land Use and Septic Systems**

| Upper Choptank Watershed (02130404) | 2002 LU, 2002 BMPs | 2002 LU, Trib Strategy BMPs | 2008 Trib Strategy BMPs | Scenario 1 2030 Max Build-Out with Trib Strategy BMPs | Scenario 2 2030 Preferred Land Use with Trib Strategy BMPs |
|---|---|---|---|---|---|
| | (Acres) | (Acres) | (Acres) | (Acres) | (Acres) |
| Development | 32 | 32 | 83 | 200 | 200 |
| Agriculture | 1,027 | 1,027 | 938 | 963 | 963 |
| Forest | 868 | 868 | 905 | 763 | 763 |
| Water | 0 | 0 | 0 | 0 | 0 |
| Other | 0 | 0 | 0 | 0 | 0 |
| Total Area | 1,926 | 1,926 | 1,926 | 1,926 | 1,926 |

| | | | | | |
|---|---|---|---|---|---|
| Residential Septic (EDUs) | 0 | 0 | 60 | 199 | 199 |
| Non-Residential Septic (EDUs) | 0 | 0 | 5 | 47 | 5 |

**Total Nitrogen Loading**

| Upper Choptank Watershed (02130404) | 2002 LU, 2002 BMPs | 2002 LU, Trib Strategy BMPs | 2008 Trib Strategy BMPs | Scenario 1 2030 Max Build-Out with Trib Strategy BMPs | Scenario 2 2030 Preferred Land Use with Trib Strategy BMPs |
|---|---|---|---|---|---|
| | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) |
| Development NPS | 278 | 191 | 507 | 1,218 | 1,218 |
| Agriculture NPS | 15,993 | 8,914 | 8,160 | 8,376 | 8,376 |
| Forest NPS | 1,288 | 1,200 | 1,251 | 1,055 | 1,055 |
| Water NPS | 0 | 0 | 0 | 0 | 0 |
| Other Terrestrial NPS | 0 | 0 | 2 | 2 | 2 |
| **Total Terrestrial Load** | **17,558** | **10,305** | **9,919** | **10,650** | **10,650** |
| Residential Septic (EDUs) | 0 | 0 | 558 | 1,850 | 1,850 |
| Non-Residential Septic (EDUs) | 0 | 0 | 15 | 156 | 15 |
| **Total Septic Load** | **0** | **0** | **573** | **2,005** | **1,865** |
| **Total NPS Nitrogen Load** | **17,558** | **10,305** | **10,492** | **12,656** | **12,515** |
| **Total PS Load** | **0** | **0** | **0** | **0** | **0** |
| **Total Nitrogen Load (NPS+PS)** | **17,558** | **10,305** | **10,492** | **12,656** | **12,515** |

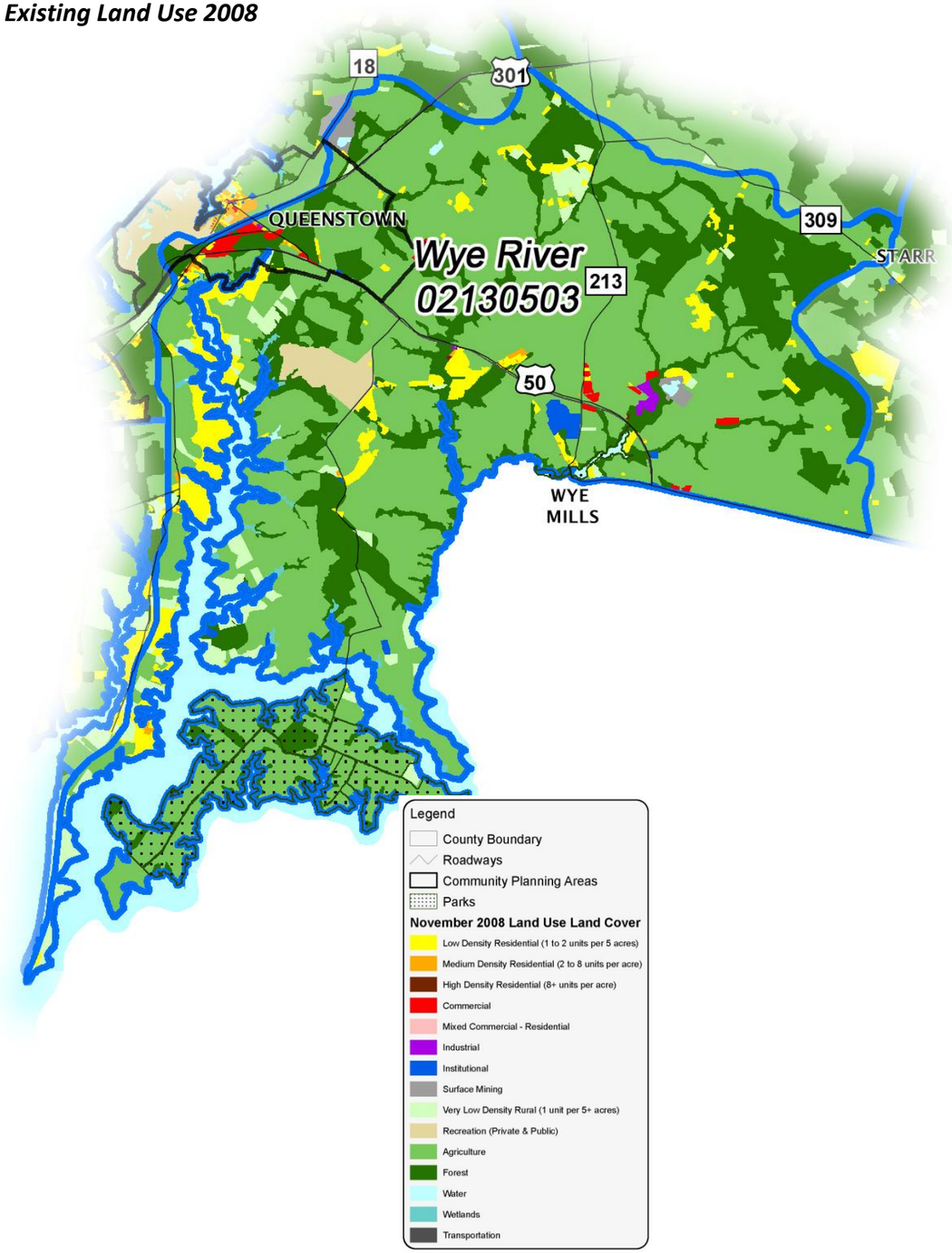
**Total Phosphorus Loading**

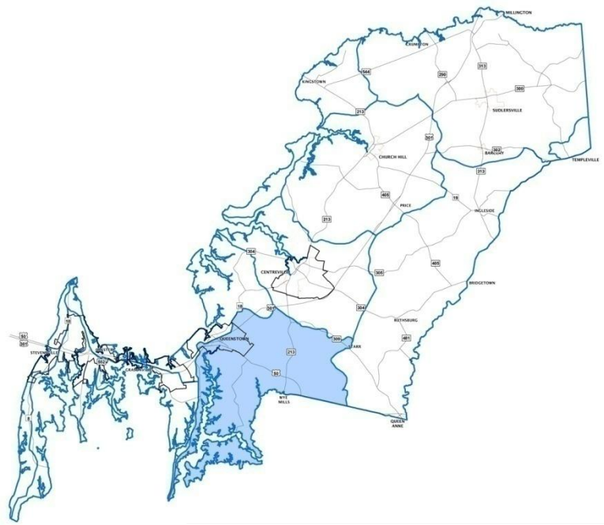
| Upper Choptank Watershed (02130404) | 2002 LU, 2002 BMPs | 2002 LU, Trib Strategy BMPs | 2008 Trib Strategy BMPs | Scenario 1 2030 Max Build-Out with Trib Strategy BMPs | Scenario 2 2030 Preferred Land Use with Trib Strategy BMPs |
|---|---|---|---|---|---|
| | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) |
| Development NPS | 37 | 24 | 65 | 154 | 154 |
| Agriculture NPS | 1,118 | 808 | 731 | 751 | 751 |
| Forest NPS | 20 | 16 | 17 | 14 | 14 |
| Water NPS | 0 | 0 | 0 | 0 | 0 |
| Other Terrestrial NPS | 0 | 0 | 0 | 0 | 0 |
| **Total Terrestrial Load** | **1,174** | **848** | **813** | **919** | **919** |
| **Total PS Load** | **0** | **0** | **0** | **0** | **0** |
| **Total Phosphorus Load (NPS+PS)** | **1,174** | **848** | **813** | **919** | **919** |

| Impervious Cover and Open Space | (Acres) | | | | |
|---|---|---|---|---|---|
| **Upper Choptank Watershed (02130404)** | 2002 LU, 2002 BMPs | 2002 LU, Trib Strategy BMPs | 2008 Trib Strategy BMPs | Scenario 1 2030 Max Build-Out with Trib Strategy BMPs | Scenario 2 2030 Preferred Land Use with Trib Strategy BMPs |
| Total Impervious Cover | 6 | 6 | 9 | 28 | 28 |
| Agriculture | 1,027 | 1,027 | 938 | 963 | 963 |
| Forest | 868 | 868 | 905 | 763 | 763 |
| Percent Impervious | 0.3% | 0.3% | 0.5% | 1.5% | 1.5% |

## Section 11.16 Wye River - 02130503

***Existing Land Use 2008***



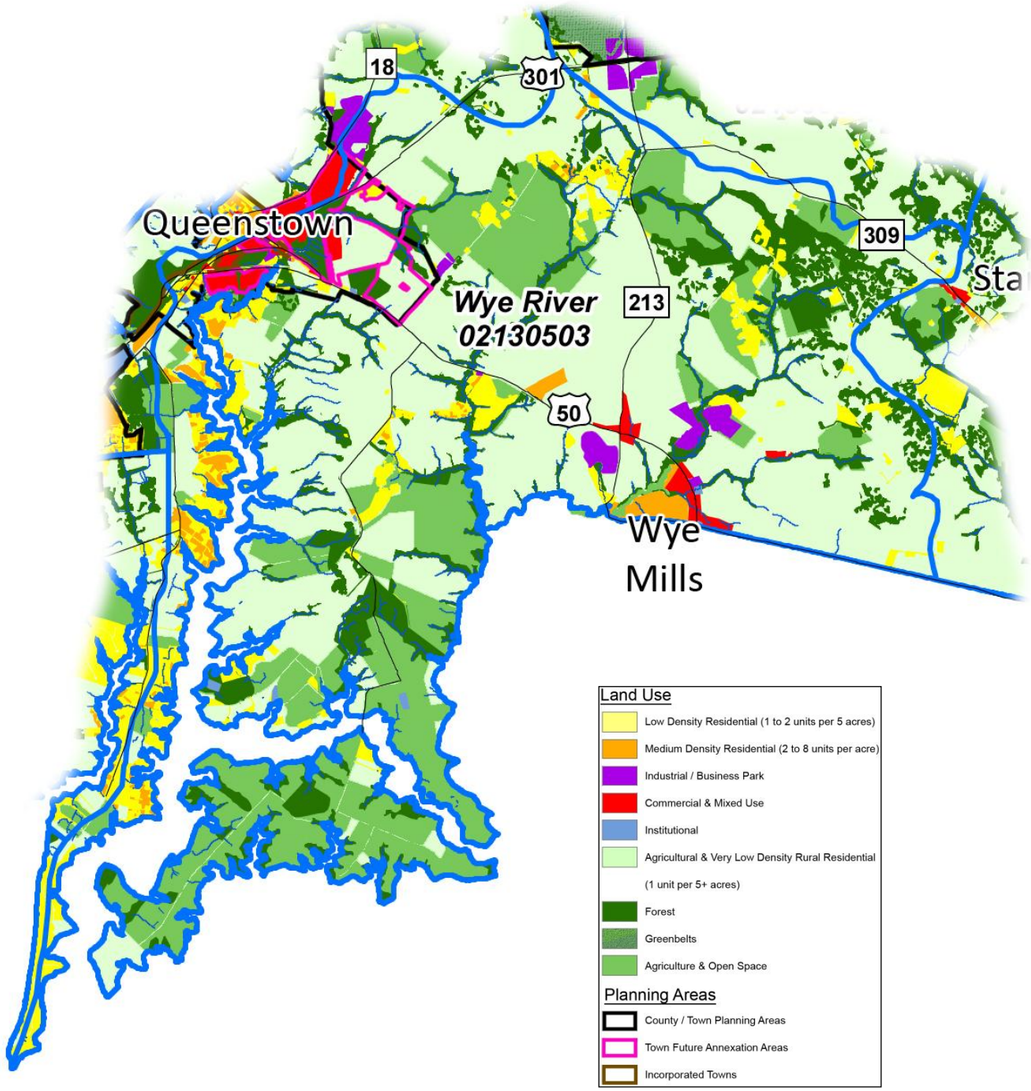



| Table 11.16-1 Conservation Lands Programs | Acres |
|---|---|
| MALPF Easement | 2,317.41 |
| MALPF Greenprint | - |
| Rural Legacy Easement | - |
| MET | 954.61 |
| TDR Sending Areas | 350.75 |
| Private Conservation Easement | 848.19 |
| County Park | - |
| State Owned Land | 2,810.12 |
| Open Space (Deed Restricted) | 728.18 |
| Open Space (Non Contiguous) | 508.93 |
| MALPF Easement / Open Space | - |
| MET / Open Space | 2.31 |
| County Park / TDR | - |
| County Park / NCD | - |
| County Park / Open Space | - |
| County Park / MET | - |
| MET / TDR | - |
| **Total** | **8,520.51** |

| Land Available for Development | Acres |
|---|---|
| Available | 3,306.93 |
| Divisible | 9,886.43 |
| **Total** | **13,193.36** |

| Table 11.16-2 Updated General Land Use Classes (2008) | 2008 Land Uses | | 2030 Preferred Land Uses | |
|---|---|---|---|---|
| | Total Acres | Percent of Total Acres | Total Acres | Percent of Total Acres |
| Low Density Residential (1 to 2 units per 5 acres) | 1,590.4 | **5.4%** | 1,482.7 | **5.0%** |
| Medium Density Residential (2 to 8 units per acre) | 62.0 | **0.2%** | 481.2 | **1.6%** |
| High Density Residential (8+ units per acre) | 5.2 | **0.0%** | 5.2 | **0.0%** |
| Commercial | 178.6 | **0.6%** | 184.6 | **0.6%** |
| Mixed Commercial – Residential | - | **0.0%** | 255.1 | **0.9%** |
| Industrial | 45.0 | **0.2%** | 311.9 | **1.1%** |
| Institutional | 132.8 | **0.4%** | 198.5 | **0.7%** |
| Surface Mining | 118.2 | **0.4%** | 118.2 | **0.4%** |
| Very Low Density Rural (1 unit per 5+ acres) | 1,285.7 | **4.4%** | 2,818.3 | **9.5%** |
| Private Recreation | 377.0 | **1.3%** | 376.9 | **1.3%** |
| Agriculture | 18,640.0 | **63.1%** | 16,860.6 | **57.1%** |
| Forest | 6,586.4 | **22.3%** | 5,928.2 | **20.1%** |
| Water | 148.0 | **0.5%** | 147.9 | **0.5%** |
| Wetlands | 223.4 | **0.8%** | 223.4 | **0.8%** |
| Transportation | 129.2 | **0.4%** | 129.2 | **0.4%** |
| **Total** | **29,521.9** | **100.0%** | **29,521.9** | **100.0%** |

***Preferred Land Use 2030***




**Preferred Land Use 2030**

The preferred land use within the watershed is based upon maximum capacity build-out under current zoning modified using the future land use plan for Queenstown from the recently adopted Comprehensive Plan and Municipal Growth Element.

**Table 11.16-3 Best Management Practices Tool Kit**

| Tools, Techniques & Strategies | LANDSCAPE | | | | |
|---|---|---|---|---|---|
| | Agricultural | Natural | Rural Residential | Suburban | Town/Village |
| **Point Source / Urban Source Strategy** | | | | Expand and enhance Queenstown WWTP and collection/ conveyance system with enhanced nutrient removal systems. Connect existing development located within Sewer Service Areas and adjacent areas with failing septic systems. | Within PFAs, connect existing septic systems to Queenstown WWTP. |
| **Stormwater Strategy** | BMPs, nutrient and manure management plans and fencing livestock out of streams. | BMPs, preserve buffers and forest conservation. No tree cutting in Critical Areas. | BMPs and ESD. | BMPs, ESD, Retrofit SW facilities or include new development and reduce use of lawn fertilizers. | BMPs, ESD, and retrofit facilities. |
| **Onsite Sewage Disposal Strategy (OSDS)** | Use denitrification technology for on-lot systems or connect to sewer system. | Use denitrification technology on-lot systems or connect to sewer system. | Use denitrification technology for on-lot systems or shared septic systems. | Failing septic systems should be connected to the public sewer system. | Connect existing development on septic systems within PFAs to public system. |
| **Growth Management Strategy** | Preserve environmentally sensitive lands and agricultural lands using State and Local programs. | Restrict development within Critical Areas. | Cluster development, ESD and encourage development toward areas with existing infrastructure. | Suburban subdivisions must provide improvements and connection to public water and sewer systems. | Establish Infill/Redevelopment standards and incentives. |
| **Agriculture Strategy** | Nutrient and manure management, BMPs, cover crops and best practices. | Preserve floodplains, riparian buffers and wetland buffers. | TDR receiving areas should be established within the watershed. | TDR receiving areas should be established within the watershed. | |
| **Waterway Strategies** | Protect riparian buffers, tree planting along streams and living shoreline construction | Protect riparian buffers, tree planting along streams and living shoreline construction | Protect riparian buffers, tree planting along streams and living shoreline construction | Protect riparian buffers, tree planting along streams and living shoreline construction | Protect riparian buffers, tree planting along streams. |
| **Air Deposition Strategy** | Establish forest conservation strategies and incentives as well as utilize state and local preservation programs. | Establish greenbelts and forest conservation strategies and incentives. | Require Forest Conservation Plans and establish wooded lot standards. | Require Forest Conservation Plans and trail/path connections within greenbelts to provide access to and from Town. | Concentrate homes, commercial uses and business parks for walkable community. |

**Table 11.16-4 Summary Table of Projected Impacts to Agriculture and Forest**

| Land Use or Variable | 2008 Land Uses | | 2030 Preferred Land Uses | | Projected Change in Land Use 2008-2030 | |
|---|---|---|---|---|---|---|
| | Total Acres | Percent of Total Acres | Total Acres | Percent of Total Acres | Total Acres | Percent of Total Acres |
| Agriculture | 18,640.0 | **63.1%** | 16,860.6 | **57.1%** | -1,779.4 | **-6.0%** |
| Forest | 6,586.4 | **22.3%** | 5,928.2 | **20.1%** | -658.2 | **-2.2%** |
| ***Queen Anne's County Impervious Surfaces**** | 838.7 | **2.8%** | | | | |
| ***Statewide Priority Wetlands**** | 1,710.0 | **5.8%** | | | | |
| ***Tier II Catchment Area within Watershed*** | 6,286 | **21.3%** | | | | |

**Impervious surfaces data was created using 2004 planimetric data as updated using 2008 Aerial imagery collected by the State. There is no guarantee that all features were collected nor to the precision of the collected features. This data provides a general value of the impervious surface within a watershed.*

***Queen Anne's County may need to track on permits issued by MDE for development within theses wetlands to determine impacts.*

## Water Resources Element – Nitrogen, Phosphorus and Impervious Surface Data

The following Nitrogen, Phosphorus and Impervious Surface table has been provided by Maryland Department of the Environment. The table was loading using the 2008 land use and the projected maximum capacity build-out values based on the Build-Out Analysis Report, May 2009 as part of this Comprehensive Plan. The preferred land use is shown in the far right column.

**Table 11.16-5: Assessing Impacts of Nitrogen, Phosphorus and Impervious Surface Land Use and Septic Systems**

| Wye River Watershed (02130503) | 2002 LU, 2002 BMPs | 2002 LU, Trib Strategy BMPs | 2008 Trib Strategy BMPs | Max Build-Out Trib Strategy BMPs | Preferred Land Use with Trib Strategy BMPs |
|---|---|---|---|---|---|
| | (Acres) | (Acres) | (Acres) | (Acres) | (Acres) |
| Development | 2,196 | 2,196 | 3,296 | 5,667 | 5,667 |
| Agriculture | 19,647 | 19,647 | 18,640 | 16,861 | 16,861 |
| Forest | 7,119 | 7,119 | 6,810 | 6,151 | 6,151 |
| Water | 140 | 140 | 148 | 148 | 148 |
| Other | 419 | 419 | 628 | 694 | 694 |
| Total Area | 29,522 | 29,522 | 29,522 | 29,522 | 29,522 |

| | | | | | |
|---|---|---|---|---|---|
| Residential Septic (EDUs) | 0 | 0 | 1,411 | 3,644 | 1,850 |
| Non-Residential Septic (EDUs) | 0 | 0 | 1,399 | 1,674 | 1,399 |

| Total Nitrogen Loading | | | | | |
|---|---|---|---|---|---|
| **Wye River Watershed (02130503)** | 2002 LU, 2002 BMPs | 2002 LU, Trib Strategy BMPs | 2008 Trib Strategy BMPs | Max Build-Out Trib Strategy BMPs | Preferred Land Use with Trib Strategy BMPs |
| | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) |
| Development NPS | 19,278 | 13,315 | 20,016 | 34,400 | 34,400 |
| Agriculture NPS | 306,451 | 170,646 | 161,846 | 146,633 | 146,633 |
| Forest NPS | 10,562 | 9,844 | 9,416 | 8,506 | 8,506 |
| Water NPS | 1,412 | 1,169 | 1,235 | 1,235 | 1,235 |
| Other Terrestrial NPS | 3,715 | 2,548 | 3,821 | 4,217 | 4,217 |
| **Total Terrestrial Load** | **341,418** | **197,523** | **196,334** | **194,990** | **194,990** |
| Residential Septic (EDUs) | 0 | 0 | 13,115 | 33,869 | 17,195 |
| Non-Residential Septic (EDUs) | 0 | 0 | 4,641 | 5,553 | 4,641 |
| **Total Septic Load** | **0** | **0** | **17,755** | **39,422** | **21,836** |
| **Total NPS Nitrogen Load** | **341,418** | **197,523** | **214,089** | **234,412** | **216,826** |
| **Total PS Load** | **0** | **0** | **450** | **5,469** | **10,926** |
| **Total Nitrogen Load (NPS+PS)** | **341,418** | **197,523** | **214,539** | **239,881** | **227,752** |

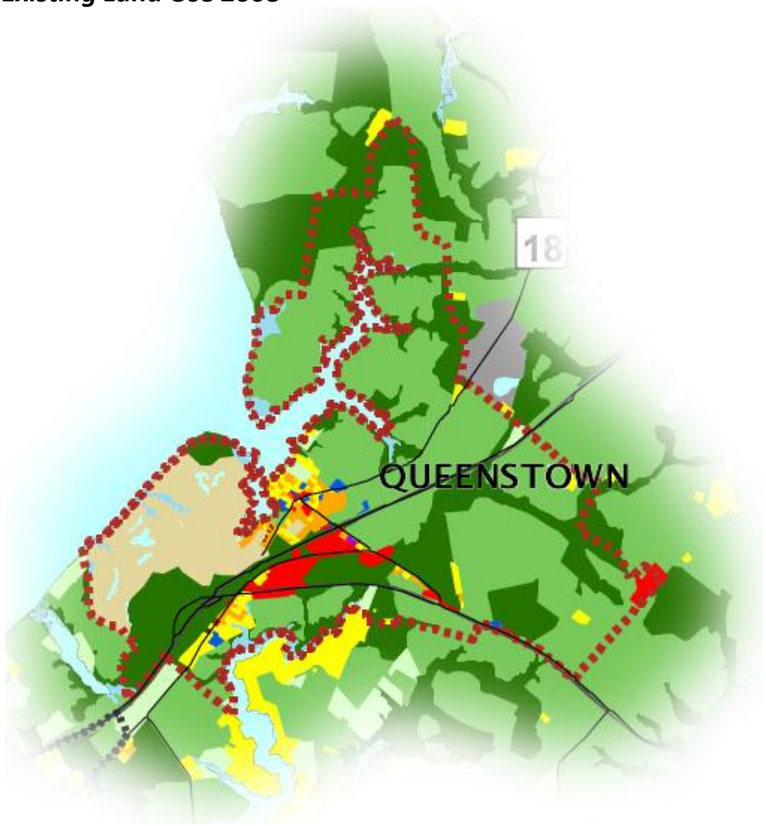
| Total Phosphorus Loading | | | | | |
|---|---|---|---|---|---|
| **Wye River Watershed (02130503)** | 2002 LU, 2002 BMPs | 2002 LU, Trib Strategy BMPs | 2008 Trib Strategy BMPs | 2030 Max Build-Out Trib Strategy BMPs | 2030 Preferred Land Use with Trib Strategy BMPs |
| | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) |
| Development NPS | 2,499 | 1,625 | 2,492 | 4,261 | 4,261 |
| Agriculture NPS | 21,372 | 15,437 | 14,668 | 13,175 | 13,175 |
| Forest NPS | 160 | 132 | 126 | 114 | 114 |
| Water NPS | 79 | 79 | 84 | 84 | 84 |
| Other Terrestrial NPS | 504 | 324 | 486 | 531 | 531 |
| **Total Terrestrial Load** | **24,614** | **17,597** | **17,857** | **18,165** | **18,165** |
| **Total PS Load** | **0** | **0** | **150** | **527** | **936** |
| **Total Phosphorus Load (NPS+PS)** | **24,614** | **17,597** | **18,007** | **18,692** | **19,101** |

| Impervious Cover and Open Space | (Acres) | | | | |
|---|---|---|---|---|---|
| **Wye River Watershed (02130503)** | 2002 LU, 2002 BMPs | 2002 LU, Trib Strategy BMPs | 2008 Trib Strategy BMPs | 2030 Max Build-Out Trib Strategy BMPs | 2030 Preferred Land Use with Trib Strategy BMPs |
| Total Impervious Cover | 522 | 522 | 654 | 1,139 | 1,139 |
| Agriculture | 19,647 | 19,647 | 18,640 | 16,861 | 16,861 |
| Forest | 6,884 | 6,884 | 6,586 | 5,928 | 5,928 |
| Percent Impervious | 1.8% | 1.8% | 2.2% | 3.9% | 3.9% |

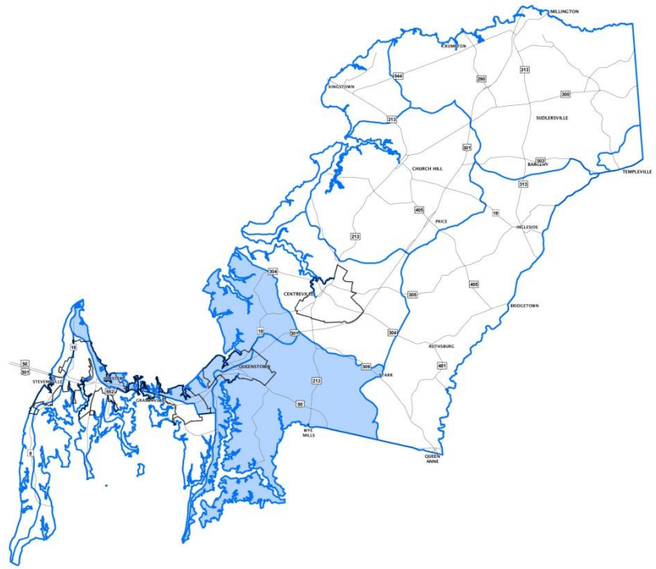
Note: The Queenstown nitrogen and phosphorus output from sewage are counted as part of the Lower Chester River Watershed.

## Section 11.17 Queenstown Growth Area

***Existing Land Use 2008***





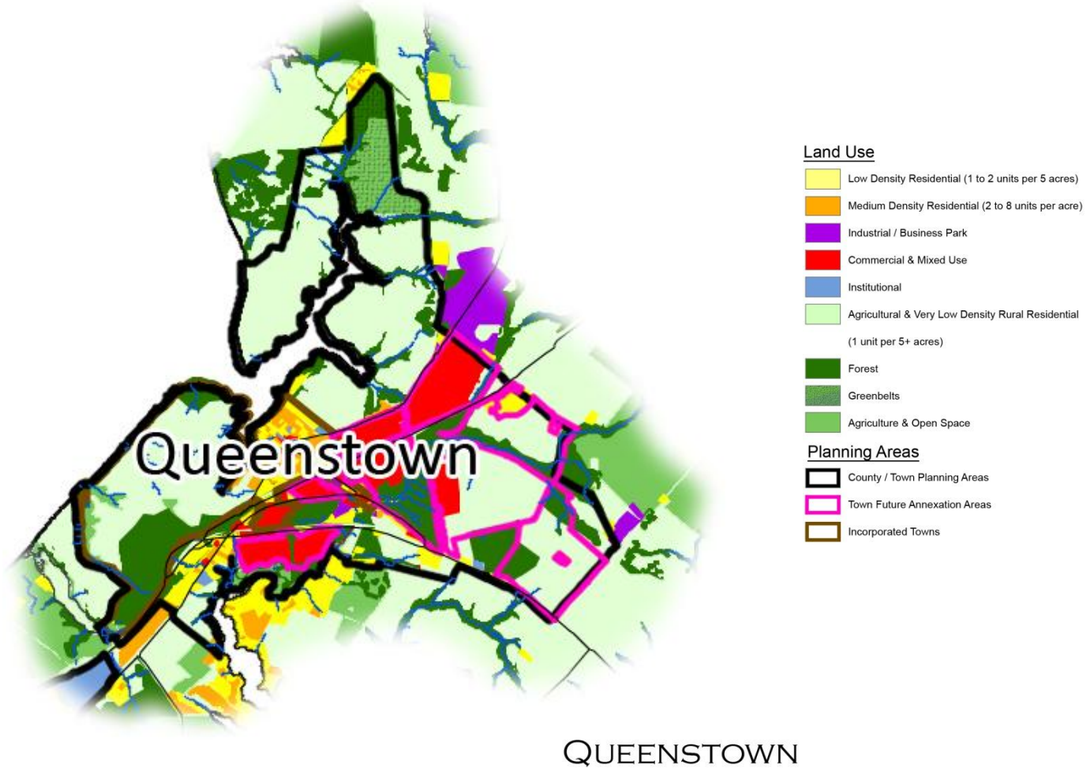


| Table 11.17-1 Conservation Lands Programs | Acres |
|---|---|
| MALPF Easement | 199.1 |
| MALPF Greenprint | - |
| Rural Legacy Easement | - |
| MET | 192.8 |
| TDR Sending Areas | 61.3 |
| Private Conservation Easement | - |
| County Park | - |
| State Owned Land | - |
| Open Space (Deed Restricted) | 24.6 |
| Open Space (Non Contiguous) | - |
| MALPF Easement / Open Space | - |
| MET / Open Space | - |
| County Park / TDR | - |
| County Park / NCD | - |
| County Park / Open Space | - |
| County Park / MET | - |
| MET / TDR | - |
| **Total** | **477.8** |

| Land Available for Development | Acres |
|---|---|
| Available | 562.7 |
| Divisible | 613.2 |
| **Total** | **1,175.9** |

| Table 11.17-2 Updated General Land Use Classes (2008) | 2008 Land Uses | | 2030 Preferred Land Uses | |
|---|---|---|---|---|
| | Total Acres | Percent of Total Acres | Total Acres | Percent of Total Acres |
| Low Density Residential (1 to 2 units per 5 acres) | 107.2 | **2.7%** | 151.2 | **3.8%** |
| Medium Density Residential (2 to 8 units per acre) | 89.8 | **2.3%** | 109.6 | **2.8%** |
| High Density Residential (8+ units per acre) | 1.9 | **0.0%** | 1.9 | **0.0%** |
| Commercial | 109.5 | **2.8%** | 94.8 | **2.4%** |
| Mixed Commercial – Residential | - | **0.0%** | 365.8 | **9.2%** |
| Industrial | 1.7 | **0.0%** | 22.4 | **0.6%** |
| Institutional | 17.7 | **0.4%** | 17.6 | **0.4%** |
| Surface Mining | - | **0.0%** | 2.1 | **0.1%** |
| Very Low Density Rural (1 unit per 5+ acres) | 17.4 | **0.4%** | 100.6 | **2.5%** |
| Private Recreation | 449.3 | **11.3%** | 449.3 | **11.3%** |
| Agriculture | 1,931.0 | **48.5%** | 1,487.6 | **37.4%** |
| Forest | 1,059.9 | **26.6%** | 982.5 | **24.7%** |
| Water | 42.7 | **1.1%** | 42.7 | **1.1%** |
| Wetlands | 86.2 | **2.2%** | 86.2 | **2.2%** |
| Transportation | 64.6 | **1.6%** | 64.6 | **1.6%** |
| **Total** | **3,978.9** | **100.0%** | **3,978.9** | **100.0%** |

***Preferred Land Use 2030***




QUEENSTOWN

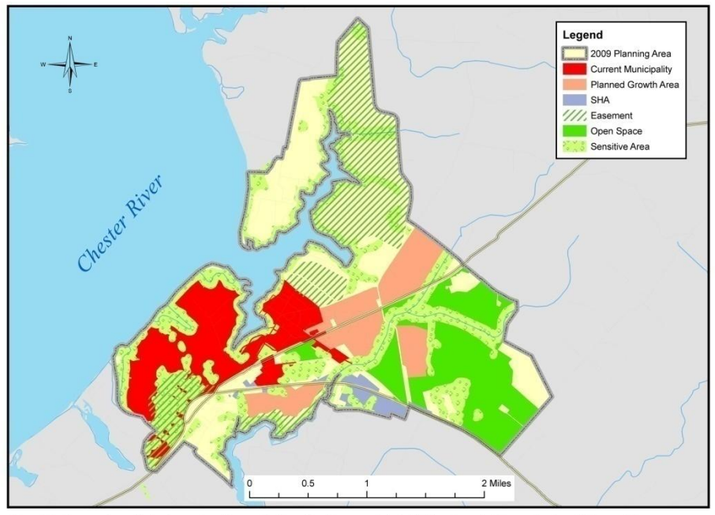



Figure 1-9. Preserved areas in the Queenstown Community Plan. Sensitive areas include 300 foot stream buffers, wetlands, and Category III Hurricane flood zones.

**Table 11.17-3 Summary of Projected Impacts to Agriculture and Forest**

| Land Use or Variable | 2008 Land Uses | | Preferred Land Uses | | Change in Land Use*** | |
|---|---|---|---|---|---|---|
| | Total Acres | Percent of Total Acres | Total Acres | Percent of Total Acres | Total Acres | Percent of Total Acres |
| Agriculture | 1,931.0 | **48.5%** | 1,487.6 | **37.4%** | -443.4 | **-11.1%** |
| Forest | 1,059.9 | **26.6%** | 982.5 | **24.7%** | -77.4 | **-1.9%** |
| ***Queen Anne's County Impervious Surfaces**** | 212.3 | **5.3%** | | | | |
| ***Statewide Priority Wetlands***** | 206.0 | **5.2%** | | | | |
| ***Tier II Catchment Area within Watershed*** | 2.6 | **0.0%** | | | | |

**Impervious surfaces data was created using 2004 planimetric data as updated using 2008 Aerial imagery collected by the State. There is no guarantee that all features were collected nor as to the precision of the collected features. This data provides a general value of the impervious surface within a watershed.*

***Queen Anne's County may need to track on permits issued by MDE for development within theses wetlands to determine impacts.*

## Water Resources Element – Nitrogen, Phosphorus and Impervious Surface Data

The following Nitrogen, Phosphorus and Impervious Surface table has been provided by Maryland Department of the Environment. The table was loading using the 2008 land use and the projected maximum capacity build-out values based on the Build-Out Analysis Report, May 2009 as part of this Comprehensive Plan. The preferred land use is shown in the far right column.

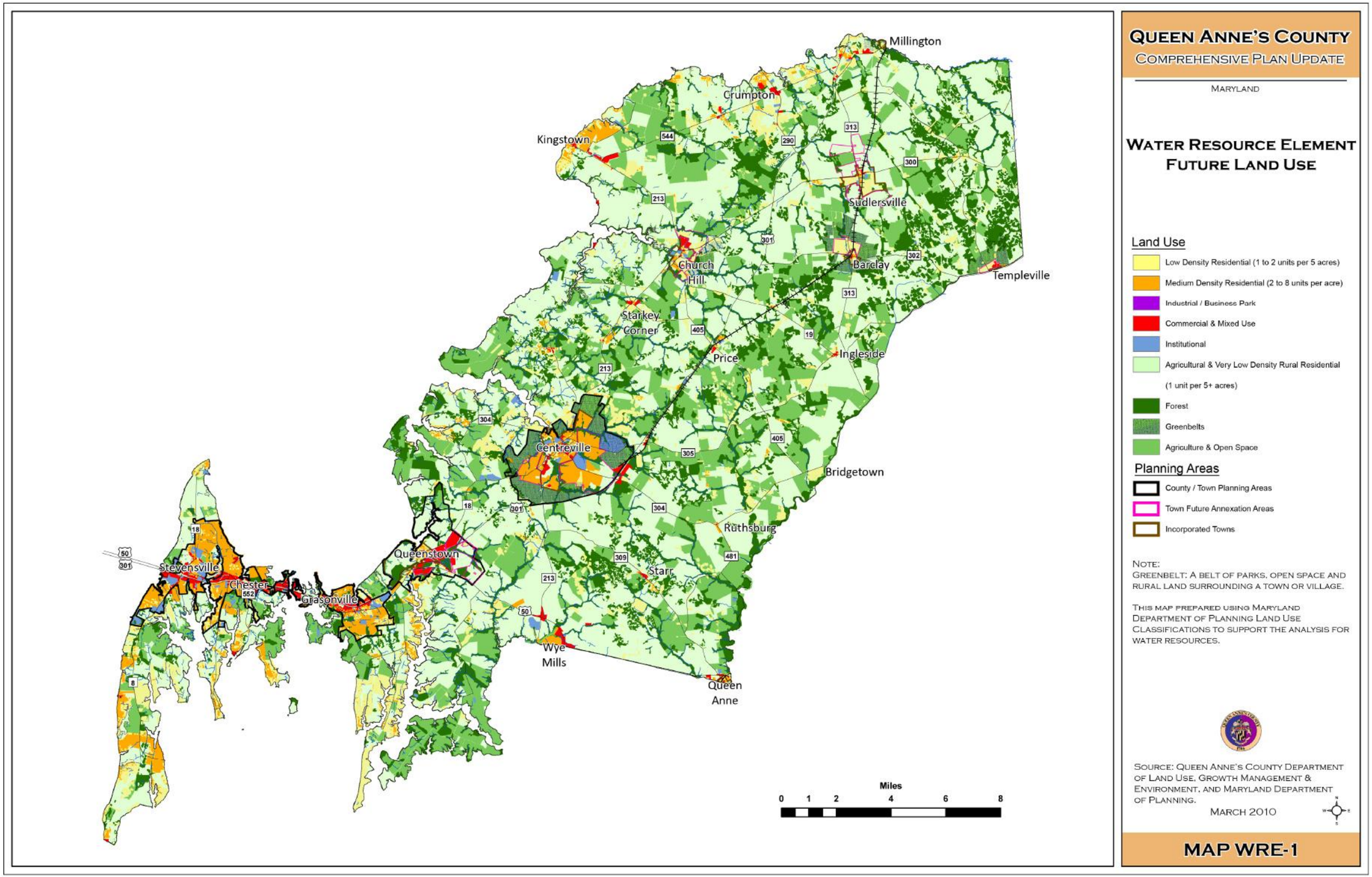
**Table 11.17-4 Assessing Impacts of Nitrogen, Phosphorus and Impervious Surface Land Use and Septic Systems**

| Queenstown | 2002 LU, 2002 BMPs | 2002 LU, Trib Strat BMPs | 2008 Trib Strat BMPs | 2030 Max Build-Out Trib Strat BMPs | 2030 Preferred Trib Strat BMPs |
|---|---|---|---|---|---|
| | (Acres) | (Acres) | (Acres) | (Acres) | (Acres) |
| Development | 346 | 346 | 392 | 913 | 913 |
| Agriculture | 1,904 | 1,904 | 1,931 | 1,488 | 1,488 |
| Forest | 1,045 | 1,045 | 1,146 | 1,069 | 1,069 |
| Water | 43 | 43 | 43 | 43 | 43 |
| Other | 643 | 643 | 469 | 469 | 469 |
| Total Area | 3,981 | 3,981 | 3,981 | 3,981 | 3,981 |
| | | | | | |
| Residential Septic (EDUs) | 0 | 0 | 129 | 0 | 0 |
| Non-Residential Septic (EDUs) | 0 | 0 | 77 | 0 | 0 |

| Total Nitrogen Loading | | | | | |
|---|---|---|---|---|---|
| **Queenstown** | 2002 LU, 2002 BMPs | 2002 LU, Trib Strat BMPs | 2008 Trib Strat BMPs | 2030 Max Build-Out Trib Strat BMPs | 2030 Preferred Trib Strat BMPs |
| | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) |
| Development NPS | 2,970 | 2,082 | 2,349 | 5,472 | 5,472 |
| Agriculture NPS | 29,674 | 16,532 | 16,790 | 12,917 | 12,917 |
| Forest NPS | 1,551 | 1,446 | 1,585 | 1,478 | 1,478 |
| Water NPS | 431 | 356 | 356 | 356 | 356 |
| Other Terrestrial NPS | 5,731 | 3,919 | 2,858 | 2,857 | 2,857 |
| **Total Terrestrial Load** | **40,356** | **24,335** | **23,939** | **23,080** | **23,080** |
| Residential Septic (EDUs) | 0 | 0 | 1,199 | 0 | 0 |
| Non-Residential Septic (EDUs) | 0 | 0 | 256 | 0 | 0 |
| **Total Septic Load** | **0** | **0** | **1,455** | **0** | **0** |
| **Total NPS Nitrogen Load** | **40,356** | **24,335** | **25,394** | **23,080** | **23,080** |
| **Total PS Load** | **0** | **0** | **0** | **5,420** | **5,420** |
| **Total Nitrogen Load (NPS+PS)** | **40,356** | **24,335** | **25,394** | **28,500** | **28,500** |

| Total Phosphorus Loading | | | | | |
|---|---|---|---|---|---|
| **Queenstown** | 2002 LU, 2002 BMPs | 2002 LU, Trib Strat BMPs | 2008 Trib Strat BMPs | 2030 Max Build-Out Trib Strat BMPs | 2030 Preferred Trib Strat BMPs |
| | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) | (Lbs/Yr) |
| Development NPS | 346 | 231 | 247 | 578 | 578 |
| Agriculture NPS | 2,072 | 1,497 | 1,534 | 1,170 | 1,170 |
| Forest NPS | 23 | 19 | 21 | 20 | 20 |
| Water NPS | 24 | 24 | 24 | 24 | 24 |
| Other Terrestrial NPS | 792 | 508 | 369 | 369 | 369 |
| **Total Terrestrial Load** | **3,258** | **2,279** | **2,197** | **2,161** | **2,161** |
| **Total PS Load** | **0** | **0** | **0** | **406** | **390** |
| **Total Phosphorus Load (NPS+PS)** | **3,258** | **2,279** | **2,197** | **2,567** | **2,551** |

| Impervious Cover and Open Space | (Acres) | | | | |
|---|---|---|---|---|---|
| **Queenstown** | 2002 LU, 2002 BMPs | 2002 LU, Trib Strat BMPs | 2008 Trib Strat BMPs | 2030 Max Build-Out Trib Strat BMPs | 2030 Preferred Trib Strat BMPs |
| Total Impervious Cover | 192 | 192 | 230 | 468 | 468 |
| Agriculture | 1,904 | 1,904 | 1,931 | 1,488 | 1,488 |
| Forest | 957 | 957 | 1,060 | 983 | 983 |
| Percent Impervious | 4.8% | 4.8% | 5.8% | 11.8% | 11.8% |




# QUEEN ANNE'S COUNTY
## COMPREHENSIVE PLAN UPDATE

MARYLAND

## WATER RESOURCE ELEMENT
## FUTURE LAND USE

**Land Use**

- Low Density Residential (1 to 2 units per 5 acres)
- Medium Density Residential (2 to 8 units per acre)
- Industrial / Business Park
- Commercial & Mixed Use
- Institutional
- Agricultural & Very Low Density Rural Residential (1 unit per 5+ acres)
- Forest
- Greenbelts
- Agriculture & Open Space

**Planning Areas**

- County / Town Planning Areas
- Town Future Annexation Areas
- Incorporated Towns

NOTE:
GREENBELT: A BELT OF PARKS, OPEN SPACE AND RURAL LAND SURROUNDING A TOWN OR VILLAGE.

THIS MAP PREPARED USING MARYLAND DEPARTMENT OF PLANNING LAND USE CLASSIFICATIONS TO SUPPORT THE ANALYSIS FOR WATER RESOURCES.

SOURCE: QUEEN ANNE'S COUNTY DEPARTMENT OF LAND USE, GROWTH MANAGEMENT & ENVIRONMENT, AND MARYLAND DEPARTMENT OF PLANNING.

MARCH 2010

**MAP WRE-1**

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- Water Restoration Action Strategy (WRAS) Plans (various 2001-2005)

Growth Element Plans - Community Plans- Comprehensive Plans

- Barclay Community Plan, 2006
- Barclay Draft Municipal Growth Element Plan, 2009
- Centreville Community Plan, 2009
- Chester/Stevensville Community Plan, 2007
- Church Hill Draft Comprehensive Plan, 2009
- Queenstown Draft Community Plan, 2009
- Millington Comprehensive Plan, 2007
- Sudlersville Draft Municipal Growth Element Plan, 2009
- Templeville Draft Comprehensive Plan, 2009

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# Appendix 3:

## *Water Resources Analysis and Best Management Practices Toolkit*