ANNE ARUNDEL COUNTY GOVERNMENT

Chesapeake Bay TMDL

Phase II Watershed Implementation Plan

FINAL

Submitted by:
Anne Arundel County
Department of Public Works
Annapolis, MD

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

Anne Arundel County's Phase II Watershed Implementation Plan (WIP) identifies programs, policies and practices and establishes a commitment to implementation that ensures achievement of the nitrogen, phosphorus, and sediment load reductions assigned to the County by the Maryland Department of the Environment (MDE) in compliance with the Chesapeake Bay TMDL. The County's Phase II WIP sets forth a strategy for implementation that identifies statutory authority, capital projects, funding mechanisms and timelines for achieving its allocated loads using Total Nitrogen as the keystone nutrient. The countywide allocation by source sector is presented in Table 2.1.

This document serves as Anne Arundel County Government's Phase II WIP submittal to MDE, in response to MDE's July 2, 2012 deadline. The County recognizes the evolutionary process associated with implementation of the WIP strategies. As such the County will routinely assess Phase II WIP implementation, incorporate modifications as necessary to ensure plan success, and document modifications through the reporting methods described in Section 6.

Anne Arundel County's WIP was developed in consultation with and through coordination among the multiple stakeholders that comprised the Anne Arundel County WIP Team. While this document has not been "formally" adopted, elected officials in Anne Arundel County have been kept appraised throughout the development of the County's Phase II WIP and are aware of the short and long term implications associated with implementation.

SECTION 1. OVERVIEW OF ANNE ARUNDEL COUNTY'S TEAM PROCESS

1.1. Phase II WIP Pilot

Anne Arundel County was one of two local jurisdictions in Maryland invited to serve as a pilot for development of a Phase II WIP. The intent of the Pilot study was to identify the challenges that would be faced in the development of the Phase II WIPs for the remainder of Maryland. Through that process a County team consisting of multiple stakeholders was established to identify critical steps that laid the foundation for the development of the Phase II WIP.

Anne Arundel County Phase II WIP Team
Anne Arundel County DPW (lead County Department)
City of Annapolis
US Naval Academy
Dept. of the Army
Dept. of the Navy
Maryland Dept. of the Environment
Maryland State Highway Administration
Maryland Dept. of Agriculture
Maryland Aviation Administration (BWI)
Anne Arundel Soil Conservation District
South River Federation (public involvement)

The referenced stakeholders, members of the Anne Arundel County Pilot WIP Team, met monthly during the initial year of effort while MDE was determining the load allocation distribution at the local level, and periodically thereafter. The Anne Arundel County Department of Public Works (DPW) assumed the lead role in coordinating the multiple County departments in developing the strategies that will achieve the load reductions set forth in the County's Phase II WIP.

DPW worked in conjunction with the Office of Planning and Zoning, the Dept. of Inspections and Permits, Anne Arundel County Dept. of Health, and the Anne Arundel Soil Conservation District all of which will have a responsibility for implementation.

Additionally, Anne Arundel County initiated a partnership with Maryland's State Highway Administration (SHA) to coordinate implementation of WIP strategies that will maximize restoration collaboration and eliminate duplicate effort. The County has also engaged representatives of Fort Meade in an effort to identify responsibility for restoration projects in Anne Arundel County that mitigate impacts of runoff from the Fort.

It is important to note that while Anne Arundel County is a member of the Anne Arundel Phase II WIP Team, the implementation strategies presented herein; the discussion of current capacity; accounting for future growth; gap analysis; commitment to filling gaps; and the contingencies for slow or incomplete strategies are specific to Anne Arundel County Government and those programs and implementation mechanisms for which it has authority. Reliance is placed on the other accountable stakeholders (e.g., Federal and State agencies, the City of Annapolis, the agriculture sector, and private sector industrial and municipal permit holders) to achieve load

reductions allocated to them as described by MDE. Further, Anne Arundel County will look to MDE to ensure accountability is achieved by those stakeholders through such regulatory mechanisms as point source National Pollutant Discharge Elimination System (NPDES) Permits or NPDES Municipal Separate Storm Sewer System (MS4) Permits.

Refinements to Anne Arundel County's Phase II WIP will be made as progress toward achieving the 2 Year Milestones is assessed, data and model updates are received, and in response to the scheduled 2017 Re-Evaluation (Phase III WIP).

Anne Arundel County's Phase II WIP follows the guidance provided in the October 5, 2011 letter from EPA Region III which lays out a "Path Forward" as well as the guidance subsequently provided in MDE's "Maryland's Phase II WIP Report Structure" and "Guidance for Documenting Local Team Phase II WIP Strategies."

1.2. Public Outreach

Throughout the development the of County's Phase II WIP Anne Arundel County has given numerous public presentations. These presentations provided an understanding of the Chesapeake Bay TMDL and the WIP process; introduced the County's strategies for meeting its assigned load allocation; and sought input and comment. Since the submittal of its Draft Phase II WIP (November 2011) Anne Arundel County has presented to the organizations listed below.

- Severn River Association
- South River Federation
- Anne Arundel County Commercial Owners (NAIOP)
- Watershed Stewards Academy
- Anne Arundel County Chamber of Commerce, Environmental Committee
- Leadership Anne Arundel
- Chesapeake Environmental Protection Association (CEPA)

In spite of Anne Arundel County's citizens' focus on environmental issues, the Clean Water Act and the Chesapeake Bay TMDL, most citizens do not understand the degree that their individual actions affect waterway health and do not understand how they can be part of the solution. The County's watershed assessments reveal that 64% of the land in the County is privately owned, and that stormwater exiting those properties is a major contributing factor to the impairment of waterways. In order to implement an effective strategy to meet water quality standards and achieve pollutant load reduction, a very broad audience of landowners must be engaged. To that end, Anne Arundel County Department of Public Works and the County Board of Education's

Arlington Echo Outdoor Education Center created the ***Watershed Stewards Academy***. The Watershed Stewards Academy trains and supports Master Watershed Stewards, whose role it is to engage their communities in reducing pollution sources (pet waste, fertilizers, pesticides, motor oil, trash, bare soil, etc.) and employing stormwater/rainscaping retrofits (rain barrels, rain gardens, conservation landscapes, pervious hardscapes, tree/buffer plantings, etc.) to reduce their impacts thus reducing pollutant loads. Watershed Stewards complete over 64 hours of classroom and field training and a 7-month long capstone project. To date 72 Master Watershed Stewards have been certified. They are viewed as environmental resource persons who assist communities in taking relevant actions to reduce pollutant loads. Stormwater BMPs implemented by Certified Master Watershed Stewards are tracked and accounted for by the County in calculating the County's progress toward meeting its nutrient and sediment load reductions. By connecting Stewards and their communities to the specific goals of the Phase II WIP and presenting quantifiable ways that communities can contribute to reducing pollutants and installing rainscapes, a broad base of the population becomes part of the County's strategy for achieving load reductions.

1.3. Future Challenges

Anne Arundel County faces challenges as it works to achieve load reductions in the point source, septic and urban stormwater sectors.

1.3.1 Point Sources

The nutrient load caps assigned to the County's seven (7) Water Reclamation Facilities (WRF) introduce challenges to the County's ability to maintain continued economic growth and development. The Water Resource Element of the County's General Development Plan reveals more potential zoned capacity than the load caps allow. One avenue of relief to help mitigate these load cap constraints can be realized through the retirement of septic systems with their connection to public sewers that convey wastewater flow to the County's ENR WRFs. The State of Maryland authorizes a portion of the Total Nitrogen (TN) reduction resulting from the retirement of septic systems to be used for additional new point source load cap credits. The pounds of point source load cap credits are variable dependent upon defined TN delivery ratios (i.e. 80%, 50% and 30% respectively) based on the septic system's proximity to the Critical Area, 1,000 feet of non-tidal streams or areas beyond these limits. The point source facilities and their respective load caps are also vulnerable to the promulgation of more stringent Total Maximum Daily Loads (TMDLs) that would lower the assigned point source load cap.

1.3.2 Septic Systems

The retirement of septic systems through either connection to existing ENR sanitary sewer systems or construction of specific targeted cluster systems that treat to ENR efficiency is important to maximize the total nitrogen load reduction contributed to our waterways and ultimately the Chesapeake Bay. The cumulative pounds of total nitrogen removed from

treatment to ENR significantly exceed the alternative of converting conventional septic systems to nitrogen removal septic systems.

To allow local jurisdictions to maximize the pound load reduction of septic system total nitrogen contributions, restrictions within State Code as well as State Policies need to be carefully crafted to:

- Prevent the unintended consequences of growth inconsistent local General Development Plans,
- Ensure the principles of Smart Growth are achieved, and
- Facilitate opportunity to maximize the number of septic systems retired through connection to ENR treatment technologies.

This can largely be achieved through streamlining the MDE approval process that requires local jurisdictions to develop a Strategic Plan that clearly:

- Defines the proposed communities to be connected to ENR systems, and
- Demonstrates avoidance of unintended consequences of growth where it must otherwise be avoided by not proposing sewer infrastructure in those areas.

Once the details of the Strategic Plan ultimately demonstrate compliance with MDE/State Policies relative to avoidance of the unintended consequences, the Strategic Plan would be incorporated into the respective local jurisdiction's Wastewater Master Plan. As individual projects are implemented MDE would continue in its role as the approving authority through the review of Capital Project designs and construction projects.

Current language in Environment Article Section-9-1605.2, Subsection (h)(3)(ii)3. and Subsection (h)(3)(iii) 4 and 5 should be removed, revised or waived to facilitate opportunity for local governments to maximize the number of septic systems that are connected to ENR sanitary sewer systems while maintaining compliance with MDE/State Policies. Current restrictions related to Priority Funding Areas, Infill Development, Future Growth, and lots with septic systems installed prior to October 2008 need to be changed in favor of the creation of MDE/State Policies that achieve the ultimate goal of Smart Growth as it relates to the management of existing septic systems by retiring them to ENR compliant treatment systems.

It is also critical that the Bay Restoration Fund (BRF) be adequately funded to provide subsidies for retiring existing septic systems. This additional funding will help offset the costs incurred by either homeowners or local governments who cannot afford the additional expense associated with abandoning existing conventional septic systems and either connecting to the existing public system, connecting to new cluster systems or for installing new on-site nitrogen removing septic systems.

1.3.3 Urban Stormwater

A primary component of Anne Arundel County's stormwater WLA strategy involves the restoration of perennial and ephemeral stream channels through re-establishment of hydrology, connection to floodplains, and recovery of wetland functions as appropriate. Obtaining Federal and State regulatory acceptance of these chosen techniques has proven to be a difficult and lengthy process, often resulting in delay of permit issuance. For example, one permit recently issued includes requirements for both pre- and post-construction monitoring of water quality and aquatic biology, development of an invasive flora management plan, as well as the more often included requirements of post-construction physical stability assessments, wetland delineation, and vegetation survival assessments. Moreover, the pre-construction monitoring reports must be submitted to the permitting agencies before construction can be initiated. Such permit conditions result in significant additional project cost as well as expansion of project schedules due to the duration and timing of the required monitoring. These increases in project cost and extension of project schedule, when projected onto the multiple projects that must be designed/constructed to achieve the urban stormwater WLA by 2025, result in an extremely challenging if not impossible obstacle to overcome and may result in the County not achieving stormwater WLA requirements by 2025.

SECTION 2. INTERIM AND FINAL LOAD ALLOCATIONS

In August 2011, EPA provided revised nutrient and sediment target loads to Maryland and other Bay jurisdictions, based on the updated Chesapeake Bay Program (CBP) Phase 5.3.2 Watershed Model. The Final Target Loads were provided at the scale of the five major basins in Maryland, which are the Potomac River Basin, Eastern Shore, Western Shore, the Patuxent River Basin, and Maryland's portion of the Susquehanna River Basin. Maryland further sub-allocated the Final Target Loads by county-geographic area and by source sector using an equity-based allocation process consistent with the process used in Maryland's Phase I WIP. Anne Arundel County's Final Target Loads for Nitrogen by source sector are presented in Table 2.1. The State further sub-allocated the Urban Stormwater source sector Target Load to a finer level than is available in the EPA Bay Watershed Model. The Urban Stormwater sub-allocations for Anne Arundel County are presented in Table 2.2. It is the Urban – County Phase I/II MS4 load that is addressed by the County's Phase II WIP. It is important to note that the allocated loads were provided to the County as Edge of Stream (EOS) loads and delivered loads to the Bay. The 2025 Final EOS and Delivered Nitrogen Target Loads for Anne Arundel County Phase I/II MS4 are 480,687 lbs. and 449,641 lbs. respectively. In this document, Anne Arundel County references the EOS target loads when addressing the required reductions for all sectors. By meeting the EOS load, the County is inherently meeting the delivered load to the Bay. This is due to the fact that tidal delivery segments, which are often outside the County's jurisdiction, contain no additional load inputs from the County and are effectively load sinks in the Bay model with pre-determined and fixed load dilution capacity.

The allocations reported in Table 2.2 were obtained from the Maryland Assessment Scenario Tool (MAST). The baseline and progress load conditions in Table 2.2 were evaluated based on internal records housed in the Anne Arundel County Watershed Management Tool (WMT) and the MDE records in MAST. This evaluation revealed that local baseline records were within two to four percent of the MAST values. Further discussion on past and future reconciling efforts conducted by the County and MDE is discussed later in the report.

Table 2.1 Anne Arundel County Total Delivered Nitrogen Final Target Load by Source Sector

**Source: MAST June 2012*

Total Delivered Nitrogen Load– By Source Sector			
Source Sector	**2009 Progress [1]**	**Interim Target Load 2017 (60% of final target)**	**Final Target Load 2025**
Urban	884,663	717,203	605,563
Agriculture	176,336	135,187	107,755
Septic	518,458	376,382	281,664
Forest	214,444	213,080	212,170
Wastewater	1,278,983	1,073965	937,287
Total	**3,072,884**	**2,515,817**	**2,144,439**

[1] The 2011 progress load was not available for all sectors so the 2009 Progress was reported instead.

Table 2.2 Anne Arundel County Final EOS Nitrogen Urban Stormwater Target Load – County Phase I/II MS4

**Source MAST June 2012*

Scenario	Total Nitrogen Load (lbs/year)		
	EOS Load		Delivered Load (MAST)
	MAST [1]	WMT [2]	
2010 No Action	763,533	774,274	723,795
2011 Progress [3]	690,764	717,191	652,054
Interim Target Load 2017 (60% of final target)	593,825	N/A [4]	559,302
Final Target Load 2025	480,687	N/A [4]	449,641

[1] These EOS loads were obtained from MAST (June 2012) and reflect the AACO MS4 Urban sector.
[3] These EOS loads were obtained from the Anne Arundel County WMT model and reflect the AACO MS4 Urban sector.
[3] The 2011 progress load includes credit from BMPs and restoration activities constructed up to FY 2011.
[4] Target loads are determined by the Chesapeake Bay TMDL and are obtained directly from MAST and not WMT.

SECTION 3. CURRENT CAPACITY

This section summarizes Anne Arundel County's current programmatic capacity to meet the pollutant load reduction requirements of the Chesapeake Bay TMDL. The County's current capacity to meet the pollutant reductions requirements for major municipal water reclamation facilities, onsite sewage disposal systems, and urban stormwater is discussed. Further, this section provides a brief narrative describing the methods and assumptions used in quantifying this capacity. It is noted that Total Nitrogen (TN) is used throughout this section and the WIP document as a surrogate pollutant.

3.1. Major Municipal Water Reclamation Facilities

The following sources of information were used to compile the current Anne Arundel County municipal wastewater point source programmatic capacity:

- Current ENR schedules,
- Recently issued NPDES permits,
- Approved County budget and amendments, and
- County Water and Sewer Master Plan.

3.1.1 ENR Upgrade Program

Starting in 2006 with the signing of a Memorandum of Understanding between Anne Arundel County (County) and the Maryland Department of the Environment (MDE), the County initiated a series of procurements to provide design services for the upgrade of each of its wastewater facilities to achieve Enhanced Nutrient Removal (ENR). As defined by the State, ENR is defined as technology capable of achieving 3 mg/L total nitrogen (TN) and 0.3 mg/L total phosphorus (TP) on an annual average basis.

The County owns and operates seven (7) major water reclamation facilities (WRFs). The existing facilities were upgraded in the 1990s to primarily achieve the seasonal Biological Nutrient Removal (BNR) limits of 8 mg/L total nitrogen (TN) and 2.0 mg/L total phosphorus (TP). However, recently issued NPDES permits for the facilities will require ENR treatment levels to be achieved within the next few years. These new NPDES permits have two types of limits.

- The first is a concentration-based cap of 4 mg/L TN and 0.3 mg/L TP on an annual average basis. The concentration-based cap is based on the actual flow received at the facility and therefore could apply to flow less than the design flow, i.e., WRF's not at hydraulic capacity.

- The second type is a mass loading cap. Generally, the mass loading cap is equal to the design flow of the facility times the concentration caps. At the Annapolis WRF, the mass loading has been increased due to the recent decommissioning of a small private

wastewater treatment plant and transfer of the flow and associated load allocation to the County. For the Mayo WRF, the mass loading is to be based on an expanded facility flow of 0.82 MGD.

Under the ENR Upgrade program, each of the facilities is being designed to meet an annual average of 3 mg/L TN and 0.3 mg/L TP at the design flow for the facility. As of June 2012, six projects were under construction and the second phase of the County's largest project is nearing the bid phase. The Mayo WRF ENR project is in the initiation phase while other issues related to the facility are being resolved. The expected completion date for all projects, with the exception of the Mayo WRF, is the end of 2016.

3.1.2 Funding

The County's current funding capacity to implement the ENR upgrade program is found in the approved FY 12 Capital Improvement Program (CIP). MDE has provided varying levels of financial support for each project through the Bay Restoration Fund (BRF) based upon a determination of the ENR eligibility for the project. The County is providing local funding for the remainder through a combination of wastewater bonds and loans from the State Revolving Loan Fund. Because of the reliance on BRF funds for developing the project budgets, it should be noted that the execution of the ENR upgrade program is contingent upon the solvency of the BRF. Any reduction in State funding contribution could jeopardize the success of the program in meeting the schedules and associated nutrient load caps.

The County requires that all wastewater facilities operated by the County be completely self-supporting and places limits on the outstanding debt of the County for wastewater facilities. Costs for the Annapolis WRF are shared with the City of Annapolis. In accordance with this requirement the County establishes charges and assessments for connections that are used to pay all operating costs and debt service for the sewer utilities. The rates are periodically updated, with the most recent update taking effect in January 2012.

3.1.3 Staffing/Personnel

Engineering/Project Management

The County currently provides project management for the design and construction phases of water and sewer projects utilizing either County Project Managers in the Utility Design Division, or with Consultant Project Managers provided through a staff augmentation contract. Daily management of the ENR projects has likewise been divided between the County's staff and the augmented staff, including the largest project at the Cox Creek WRF. The County's current level of project management services, including augmented staff, is adequate to support the ENR Upgrade Program.

Operations/Maintenance

Presently it is anticipated that the Bureau of Utilities will retain their current management and operations structure. An Operations Team is assigned to each service area, including the

pumping stations and the treatment facility. Major maintenance functions are performed by the Bureau of Utilities' Central Maintenance group. Central Maintenance personnel include mechanical, electrical, and instrumentation support, as well as, pipeline maintenance support.

Generally, the upgraded facilities are expected to require more maintenance and operational attention due to the addition of significant new unit processes and also due to more stringent permit limitations. The new treatment and conveyance steps require additional mechanical equipment such as pumps, blowers, mixers, and filtration equipment. In addition, the upgrades have required numerous changes to the existing electrical power distribution equipment and field instrumentation. However, increased efficiency due to remote monitoring and enhanced process control may offset additional staffing requirements. Additionally, several of the facilities will be utilizing similar unit processes and equipment and therefore the Operations and Maintenance Personnel will be able to share institutional knowledge effectively.

Presently, the final impact of the ENR Upgrade Program on the staffing requirements for Operations and Maintenance personnel has not been determined. The greater levels of instrumentation and monitoring are expected to increase staffing requirements in this area, while the impacts on other specialties will be observed during the start-up and optimization phases of the project and after a review of the recommended maintenance schedules for the final approved equipment.

3.1.4 Current Baseline Loading

The current annual baseline loading (i.e. existing loading) is based on calendar year 2009 monthly discharge monitoring reports submitted to MDE in accordance with the requirements of the respective NPDES Permits for the County's seven water reclamation facilities. As noted earlier the existing facilities were designed to meet the seasonal BNR limits of 8 mg/L TN and 2 mg/L TP at the design flow. The Annapolis WRF, expanded in the earlier 2000s, was designed for an annual average TN of 6 mg/L and 1.5 mg/L TP. Currently facilities are operated for year-round nitrogen removal.

3.1.5 Loading After Completion of ENR Program

Following completion of the ENR Upgrade program, the facilities will be capable of meeting the ENR cap loads at their rated design flows. Facilities currently operating below their rated design flow will be required to meet the concentration-based limits.

As facilities are expanded from their design flow the cap load will be retained, requiring the annual average performance to be lower than 4 mg/L TN and 0.3 mg/L TP. It should be noted that the ENR cap loads are the same loads utilized for the edge-of-stream (EOS) loads in the Bay TMDL. A summary of the cap loads is provided in Table 3.1 below.

Table 3.1 Anne Arundel County ENR Cap Loads

ENR CAP LOADS (TMDL LOADS)		
Facility	**TN (lbs/yr)**	**TP (lbs/yr)**
Annapolis	158,835	11,956
Broadneck	73,093	5,482
Broadwater	24,364	1,827
Cox creek	182,734	13,705
Maryland City	30,456	2,284
Mayo	9,989	749
Patuxent	91,367	6,853

After the completion of the ENR Upgrade Program the County's wastewater treatment facilities will meet the assigned TMDL loads.

3.2. Onsite Sewage Disposal Systems (OSDS)

The following sources of information were used to compile the current programmatic capacity for reduction of nitrogen from OSDS in Anne Arundel County.

- *Onsite Sewage Disposal System: Evaluation Study and Strategic Plan, March 2008*
- DPW funding sources (Petition Projects, CIP projects, Developer Projects) and Anne Arundel County Budget ($2 million recently placed in the planning budget)
- Bay Restoration Fund
- State Legislation
- Anne Arundel County Staffing

3.2.1 OSDS Strategic Plan

The *Onsite Sewage Disposal System: Evaluation Study and the Strategic Plan* (OSDS Study) is a countywide evaluation of treatment options for existing Onsite Sewage Disposal Systems (OSDS). The overall goal was to develop the most-cost effective approach for reducing nitrogen loads from OSDS within the County. The study was a progressive effort to incorporate the database of existing OSDS (compiled in 2007 for implementation of the Bay Restoration Fund "Flush Fee") into the County's Comprehensive Sewer Strategic Plan.

According to the study, as of 2006 there were 40,684 OSDS within Anne Arundel County. The estimated base nitrogen load from these OSDS is approximately 1,000,276 lbs of TN[1]. The OSDS study included a strategic plan that identifies the most cost effective treatment option to reduce total Nitrogen loads to the Chesapeake Bay. Examined treatment options included connection to public sewer; connection to a cluster treatment system; upgrade of the OSDS with a Nitrogen Reduction Unit, and a no action option. The goal for the pollutant load reduction based on MDE's January 2011 draft TMDL allocations is 33%. This would equate to an allowable discharge of 670,185 lbs of TN or a reduction of 330,091 lbs of TN.

3.2.2 Current DPW Funding Model

Anne Arundel County DPW is responsible for the operation and maintenance of County owned water and sewer facilities (the Utility). The Utility is a self-supporting enterprise funded by the water and wastewater user fees. The utility enterprise fund is not supported by the County's general fund, i.e., does not receive financial support thru local real estate taxes.

Extension of public sewer within the County is typically accomplished through one of three ways. The first and most prominent is through the extension of service by developers as part of the development process. In this instance, the cost for capital improvements is borne by the development project. Per the County's Design Manual "*All adjacent improved lots which are not a part of the proposed development, but which may be served by the sanitary sewer line, shall be provided with a capped connection to the property line and shown on the contract drawings"*. Sewer extensions to existing properties as part of developer projects are not consistent and are provided on a case-by-case basis. In sewer extensions through the development process, existing homeowners are required to cover the cost of their on-site improvements.

The second method is through a planned capital project managed by DPW. This is relatively rare, as the majority of DPW projects involve construction of large diameter interceptors or other major improvements. For a sewer extension resulting from a project initiated by DPW, existing homeowners are required to cover the cost of their on-site improvements, similar to an extension occurring through a development project.

The last method of sewer extension is by petition for public service in which the property owners pay the cost of capital improvements via a thirty-year front foot assessment. The petition projects are initiated on a voluntary basis, and require a majority vote of effected property owners to proceed. In recent years, few petition projects have proceeded to construction. A review of the seven active petition projects in 2009 showed that the average cost per property was $43,600 and the average petition project included 47 properties.

[1] For ease of comparison to other counties, we have used the criteria in Appendix B of the Maryland Policy for Nutrient Cap Management and Trading in Maryland's Chesapeake Bay Watershed as a guide, and assumed non-residential OSDS deliver 1,300 gpd. The Appendix B used 3.2 people per household versus 2.6 people per household in the OSDS Study and therefore the TN loading above differs from the loading in the OSDS study.

There is no current funding source within the Utility enterprise fund to assist property owners with connection to the sewer system. To initiate the planned conversion of OSDS to public sewer in those areas identified in the OSDS Strategic Plan, the County has included a one-time budget appropriation of $2 Million[2] in the FY2012 CIP Budget. These dollars were envisioned as planning dollars to fund additional engineering studies to formulate future capital improvement project scopes and costs.

3.2.3 Existing Bay Restoration Fund Use

The Bay Restoration Fund (BRF) provides funding to upgrade existing OSDS with Nitrogen Reduction Units (NRU). This is administered in Anne Arundel County by the Dept. of Health. Based on information provided by the Anne Arundel County Dept. of Health during the period FY 2008-2010, the County averaged about 215 new OSDS per year, 410 existing OSDS required some type of replacement (e.g. new septic tank, new septic field) per year, and there were on average about 170 NRU installed per year of which about 60 per year were paid from BRF funds. The average cost of a NRU in FY2010 was $12,302. No information was given relative to the location of the OSDS relative to the Critical Area and surface water; therefore, it is assumed that the Delivery Ratio used to calculate the amount of TN delivered to the Bay will be similar to the overall percentages[3] found in the OSDS Study.

3.2.4 Legislation

There have been several pieces of legislation passed recently that will affect the installation of NRU and the retirement of OSDS. Maryland Legislature passed Senate Bill SB-554 in 2009 that requires the installation of an NRU for repair, replacement or new installation of septic systems within the Critical Area.

Also, the BRF legislative requirements in regards to OSDS have been expanded to allow the fund to be used for connection to public sewer and/or connection to cluster treatment systems, in addition to NRUs. There are however additional requirements for connection to public sewer that could limit its application, namely, requirements that OSDS be within Priority Funding Areas and limit future connections to wastewater facilities/collection lines that were constructed with BRF funds.

It is noted that use of the BRF will be limited, not only due to the size of the task at hand, but also financial solvency. House Bill 446 passed in the 2012 legislative session doubled the BRF fee to $60 per year per household. Based on the passage of HB 446, Statewide the BRF Onsite Disposal Systems Fund is estimated to generate approximately $27 Million per year. Approximately 60% of this fund or $16.2 Million is available for OSDS upgrades and retirement. Given the average cost for an NRU upgrade of $12,302 per unit, the fund could convert 1,317 OSDS per year statewide.

[2] From Anne Arundel County FY 2012 Capital Budget and Program -Wastewater Project Planning (X764200)
[3] Percentages for existing OSDS = 32.5% Critical Area, 54.1% Non-Tidal Surface Water, 13.3% Remaining Areas

The OSDS study targeted approximately 39,000 OSDS in Anne Arundel County alone for upgrade to an NRU, or connection to public sewer or a cluster treatment system. Assuming that the BRF could fund sewer extensions at the same level as NRU, i.e., $12,302 per OSDS, this would equate to only twenty eight percent of the estimated cost to connect to public sewer.

3.2.5 County Staffing

Project Management

The County currently provides project management for the design and construction efforts for petition projects utilizing either County Project Managers in the Utility Design Division, or with consultant Project Managers provided through a staff augmentation contract. The actual schematic design report and final design documents for petition projects are completed by outside engineering consultants. As of June 2012 the project management staff in the Utility Design Division consists of five full-time County staff with one supervisor. Eleven project managers are providing support through the staff augmentation contract. The staffing levels reflect the current backlog of projects being undertaken by DPW

To perform the required work associated with the conversion of OSDS to public sewer or cluster systems, a doubling of project management staff would be required to effectively execute the expanded wastewater CIP. It is assumed that NRU upgrades would be handled on a case by case basis though the Anne Arundel County Dept. of Health.

Operations/Maintenance

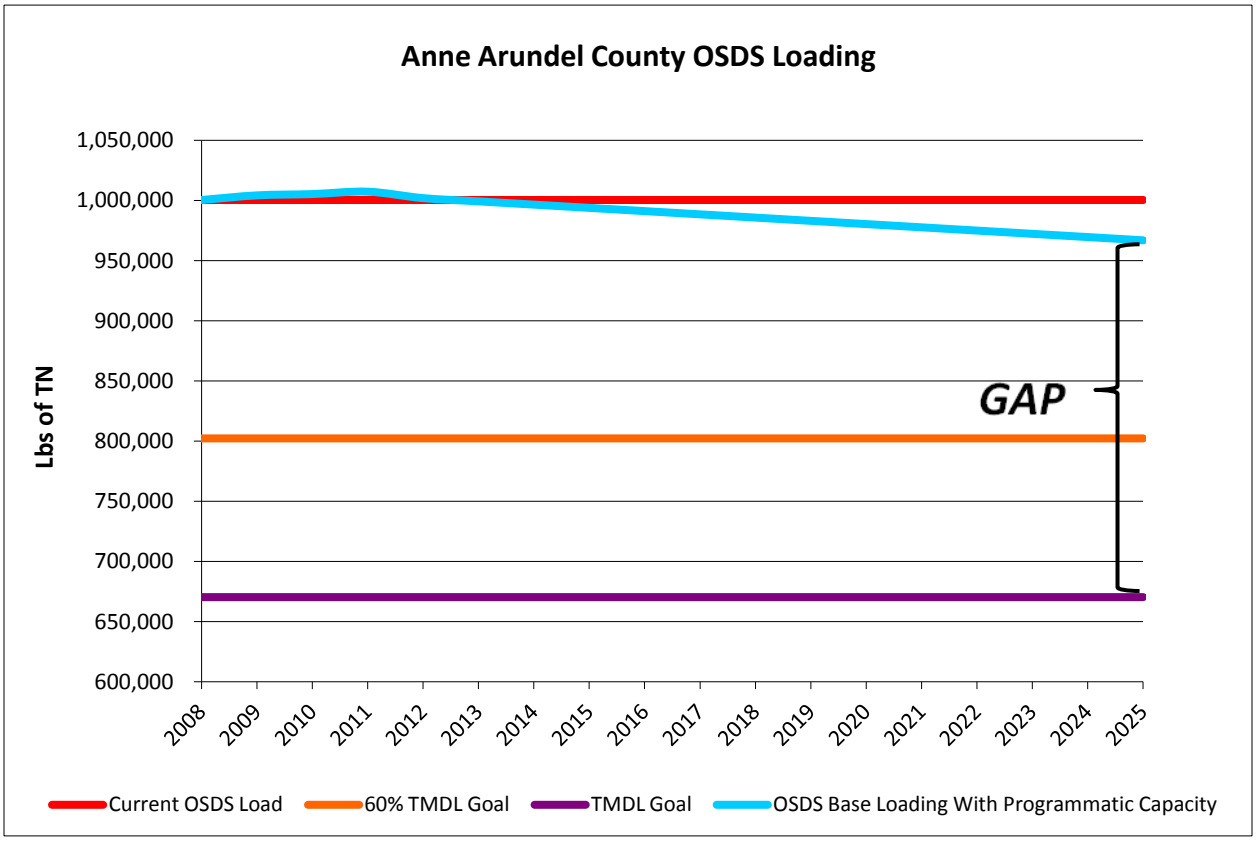
Presently it is anticipated that the wastewater service areas and facilities will retain their current management and operations structure. However, because the majority of OSDS targeted for connection to sewer or cluster treatment systems are in dense areas within the critical area, most of the "expanded" sewer drainage sheds will require pumping. It is estimated that 70 to 80 new pump stations will be required based on preliminary layouts of the targeted areas. This would be a 30% increase in the number of pump stations that the Operations staff currently maintains. Therefore additional staffing will be required, although a decision regarding the organization and administration of the areas has not been determined.

New cluster treatment facilities will also require additional staff. Although these will not need to be staffed to the same extent as a conventional treatment plant, the cluster systems will require oversight and maintenance. At this time an estimate of increased staffing is unknown. Staffing needs would be identified and expanded in conjunction with the design process for the extension of the wastewater collection systems and water reclamation treatment plant expansions.

Finally, a new entity to oversee the NRUs may be required. The BRF requires that all new NRU paid thru the BRF include a 5 year maintenance agreement. After this period, it is unclear how the NRUs will be inspected to make sure that they are operating properly. It is also uncertain whether this entity would be part of DPW Operations or part of the Dept. of Health.

Figure 3.1 shows the current OSDS base loading and the TMDL line based on MDE's January 2011 draft allocations, requiring a 33% reduction for OSDS. The estimated base nitrogen load for the existing OSDS is approximately 1,000,276 lbs of TN. The TMDL goal is 670,185 lbs of TN or a reduction of 330,091 lbs of TN. The difference between the TMDL goal and the OSDS base load with the programmatic capacity is the WIP gap. According to the Phase II WIP, 60% of the gap must be closed by 2017.

Figure 3.1 OSDS Base Load and Current Programmatic Capacity.



3.3. Urban Stormwater

Urban stormwater runoff is a primary means of conveying pollutants introduced to the land's surface to non-tidal streams and ultimately tidal waters. Source reduction of pollutants is critical to reducing their availability to be incorporated into stormwater run-off. Equally as critical, if not more critical, are the resultant dramatic changes that have occurred in the water balance whereby surface stormwater run-off has dramatically increased with much less infiltration and evaporation as the result of historical urbanization and land cover changes.

These changes in the dynamics of stormwater run-off have led to significant ephemeral and perennial channel erosion that is by far the leading contributor to the County's sediment

impairments. The erosion also releases sequestered phosphorus back into the water column. As the result of erosion, groundwater hydrology is dramatically reduced, forested wetlands are deprived of their saturation, and streams are disconnected from their historical floodplains. The capability of large areas of forested wetlands to process the removal of sediments, nitrogen, and phosphorus is greatly reduced.

For the reasons noted above, the County adopted an edge of stream (EOS) strategy to pursue Gap closure within the urban source sector. The majority of the nutrient and sediment load reduction throughout the County's watersheds will be achieved with the focus of this strategy. Further this strategy will be critical to restoring the functional capacity, efficiency, and overall health of the County's headwater stream systems.

The following sources of information were used to compile the current Anne Arundel County urban stormwater programmatic capacity.

1. The Anne Arundel County Watershed Management Tool (WMT) Edge-of-Stream (EOS) water quality model: used to estimate the base load and pollutant reduction credit from the existing capacity.

2. TMDL Allocations for gap analysis: obtained from MAST

3. Existing Best Management Practices (BMPs) installed as mitigation for historic development projects: pollutant removal capacity was calculated based on BMP type and associated pollutant removal efficiency, in accordance with the adopted values of the Chesapeake Bay Program (CBP) model.

4. Constructed environmental restoration projects, with quantifiable water quality benefit, implemented through the County's Capital Improvement Program (CIP) Budget from Fiscal Year 2002 through Fiscal Year 2010.

5. Constructed environmental restoration activities, with quantifiable water quality benefit, implemented from Fiscal Year 2002 through Fiscal Year 2010 by the Anne Arundel County Watershed Stewards Academy (WSA), and other Non Government Organizations (NGO) and entities implementing water quality improvement projects in the County.

6. Anne Arundel County projected CIP for future environmental restoration project implementation: based on the approved Fiscal Year 2011 CIP projects that span the 6-year period of 2011 through 2017. WSA and other NGO proposed projects are not included in this projection.

The County's WMT water quality model, utilizing the EPA simple method and high resolution land cover and impervious data, was used to quantify the total EOS current condition pollutant load from all public and private urban lands regulated under the NPDES-MS4 permit for the Anne Arundel County Government. This load, approximately 774K pounds of TN, did not

include any pollutant reduction credit from existing BMPs or restoration projects and is depicted on Figure 3.2 as a red horizontal line ("*Current Load without BMP Credit"*).

The pollutant reductions achieved through existing stormwater BMPs were estimated by taking all public and privately owned BMP facilities within the County's Urban BMP database and applying the proper pollutant removal efficiency for each BMP based on its structure type. Pollutant removal efficiencies utilized in this exercise were those adopted by the CBP Model Version 5.3.2. The resulting current condition pollutant load is approximately 717K pounds of TN and is depicted on Figure 3.2 as the green horizontal line ("*Current Load with BMP Credit*"). This scenario implies that if all existing BMPs are performing at their design capacity, approximately 7.3% reduction in the current condition pollutant load would result. It is understood that BMPs have limited life cycles and will experience reduced pollutant removal efficiencies over time; however, for this capacity analysis BMPs were modeled as performing to their assigned efficiencies.

The County's current funding capacity to implement urban stormwater restoration/retrofit projects is limited to two programs.

1. The County CIP Budget for environmental restoration and water quality improvement projects

2. Restoration activities implemented by the WSA and other NGO entities

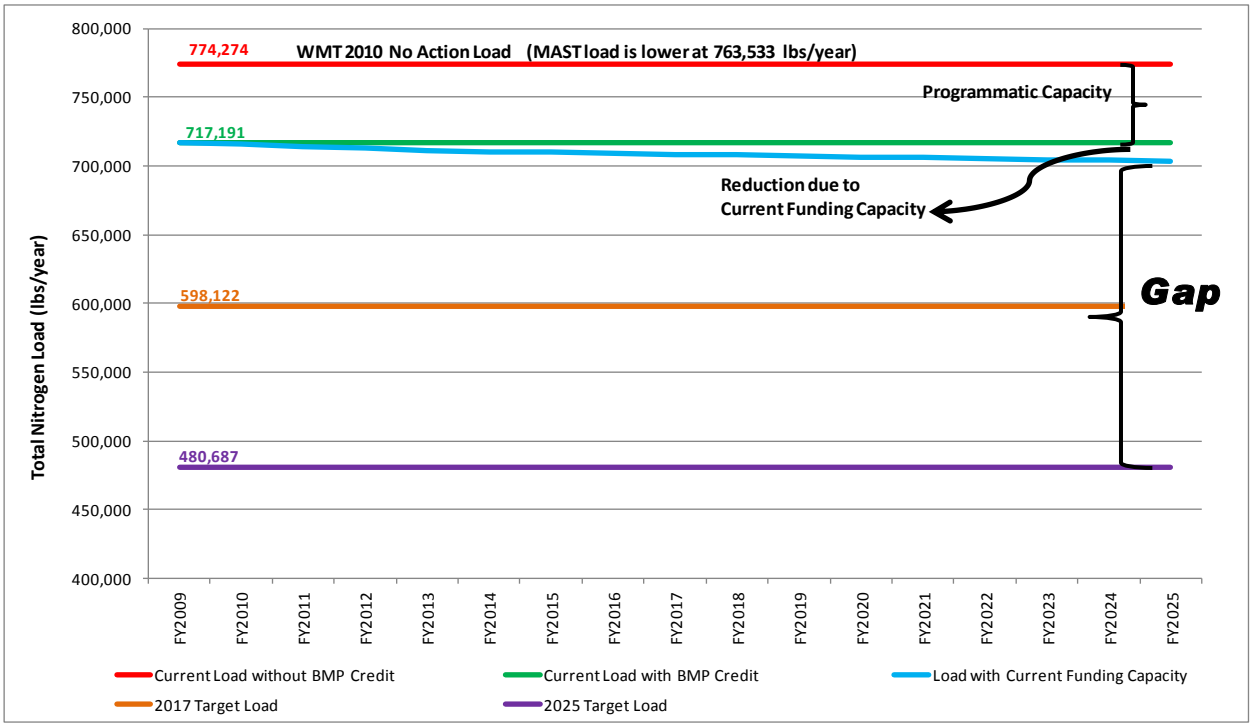
The "*Load with Current Funding Capacity"* trend (the blue line in Figure 3.2) was developed in two steps. From 2002 through 2013, funding capacity was based on actual data pertaining to pollutant reduction and cost from both the County CIP and non-County funded (WSA/NGO) projects. For the period of 2014 to 2025, funding capacity was constructed by dividing the yearly available budget for water quality project construction with the average cost per pound of pollutant removed. It is noted that the analysis from 2014 to 2025 does not include a forecast of the amount of pollutant reduction expected from water quality projects implemented by the WSA and other NGO entities.

Finally, the 2025 Target Load represented by the purple line on Figure 3.2 was based on the County Urban MAST allocations. The difference between the *2025 Target Load* and the pollutant "*Load with Current Funding Capacity*" is the WIP gap.

According to the Maryland Phase II WIP, 60% of the gap must be closed by 2017. This translates to annual reductions corresponding to approximately 20,000 lbs/year at a rate of $3000/lb of TN or approximately $60 million per year versus the currently budgeted $2 million/year. This does not take into account any offset/mitigation for future growth and assumes that future growth will be self mitigating, resulting in no net increase in pollutant load.

Anne Arundel County has prepared a stormwater strategy to close this gap. Establishing the supporting policies, inter-jurisdictional partnerships, and creating a funding mechanism to implement this strategy is a challenge that is underway.

Figure 3.2 Anne Arundel County MS4 Phase I Urban Stormwater Gap Analysis



SECTION 4. ANNE ARUNDEL COUNTY'S PHASE II WIP STRATEGIES

This section sets forth Anne Arundel County's strategy for achieving its interim target (2017) and final target (2025) load allocations. Anne Arundel County has set forth a strategy to achieve load reductions in the following source sectors: point sources, septic systems, and urban stormwater.

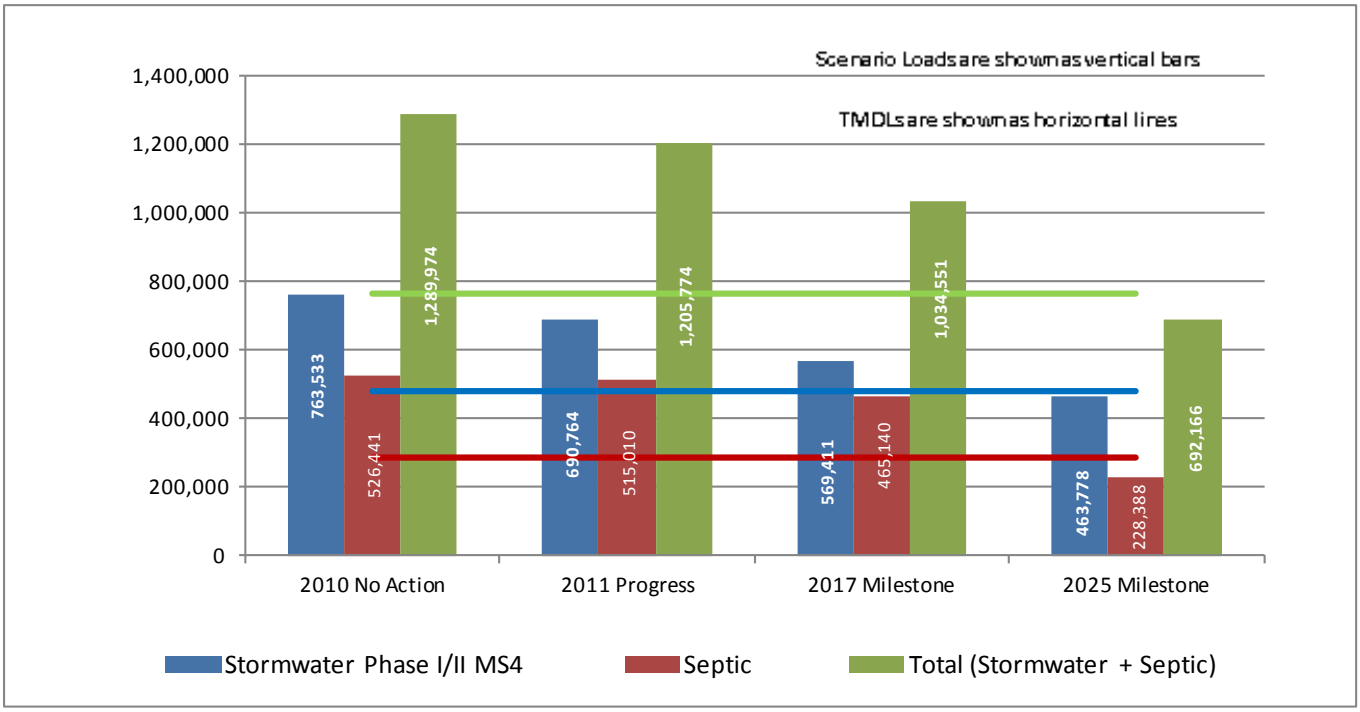
4.1. MAST Input

The individual strategies identified for implementation in both the septic systems and urban stormwater source sectors were entered into MAST. These included a "2010 No Action" scenario, a "2011 Progress" scenario, a "2017 Milestone" scenario, and a "2025 Milestone" scenario. The "2017 Milestone" scenario shows implementation of BMPs that achieve approximately 60% of the final 2025 target load. The reduction in nitrogen loads from these scenarios along with Anne Arundel County's assigned final 2025 nitrogen target load allocations are presented in Table 4.1 and Figure 4.1.

Table 4.1 MAST Input Scenarios for Stormwater and Septic Systems Source Sectors

ANNE ARUNDEL COUNTY GOVERNMENT TMDL WIP SCENARIOS			
Scenario	Edge of Stream Nitrogen Load (lbs/year)		
	Stormwater Phase I/II MS4	Septic	Total
2010 No Action	763,533	526,441	1,289,974
2011 Progress	690,764	515,010	1,205,774
2017 Milestone	569,411	465,140	1,034,551
2025 Milestone	463,778	228,388	692,166
TMDL Allocation	480,687	285,596	766,283

Figure 4.1 MAST Input Scenarios for Stormwater and Septic Systems Source Sectors



4.2. Point Source WIP II Strategy

A discussion of the County's strategy for achieving target and final load allocations associated with point sources (i.e., County WRFs) is presented below. Included in this discussion are the 2012-2013 programmatic and implementation milestones.

4.2.1 Major Municipal WWTPs (ENR Upgrades)

Strategy

Anne Arundel County will complete the upgrade of six (6) major WRFs to achieve Maryland's ENR Standards by 2020. At the current rate of implementation five (5) of the County's WRFs (Annapolis, Broadneck, Broadwater, Maryland City, and Patuxent) are scheduled to be operational by the end of 2015. Cox Creek, the County's largest upgrade, is anticipated to be operational in 2017. A study of alternative technologies has been conducted for the Mayo WRF, the County's seventh major facility, and is currently under review by MDE. The schedule for this facility upgrade is not yet set.

2012 - 2013 Programmatic Milestones

- Start-up and optimize new ENR facilities (i.e., Broadneck WRF) upon completion of construction.
- Bid and initiate construction at the Cox Creek WRF Phase 2 ENR upgrade.

- Obtain MDE approval of a strategy for expansion and upgrade of the Mayo WRF to realize its load cap capacity and achieve ENR limits of technology.

2012 – 2013 Implementation Milestones

Specific implementation milestones are set forth in the Table below.

Table 4.2 Major Municipal WRFs Implementation Milestone (2012-2013)

ENR Implementation Schedule					
Facility	Contract Phase	Design NTP	Construction Bid Phase	Construction NTP	Startup and Optimization
Annapolis WRF	Under Construction	12/2007	9/2010	5/2011	6/2015
Broadneck WRF	Under Construction	11/2007	2/2011	6/2011	12/2013
Broadwater WRF	Under Construction	11/2008	8/2011	5/2012	6/2015
Cox Creek WRF Phase 1	Under construction	10/2006	9/2009	4/2010	3/2017
Cox Creek WRF Phase 2	Bid Phase		7/2012	1/2013	
Maryland City WRF	Under Construction	11/2008	7/2011	4/2012	8/2015
Mayo WRF	Alternative study under review	On Hold	On Hold	On Hold	On Hold
Patuxent WRF	Under Construction	11/2008	06/2011	11/2011	9/2015

4.3. Septic Systems

Through implementation of the following strategies for septic load reduction, Anne Arundel County will achieve its 2025 final target load allocation of 285,596 lbs of Nitrogen. Full implementation of the strategies will not only achieve the 2025 target load allocation, but will succeed in reducing the load to 228,388 lbs of Nitrogen.

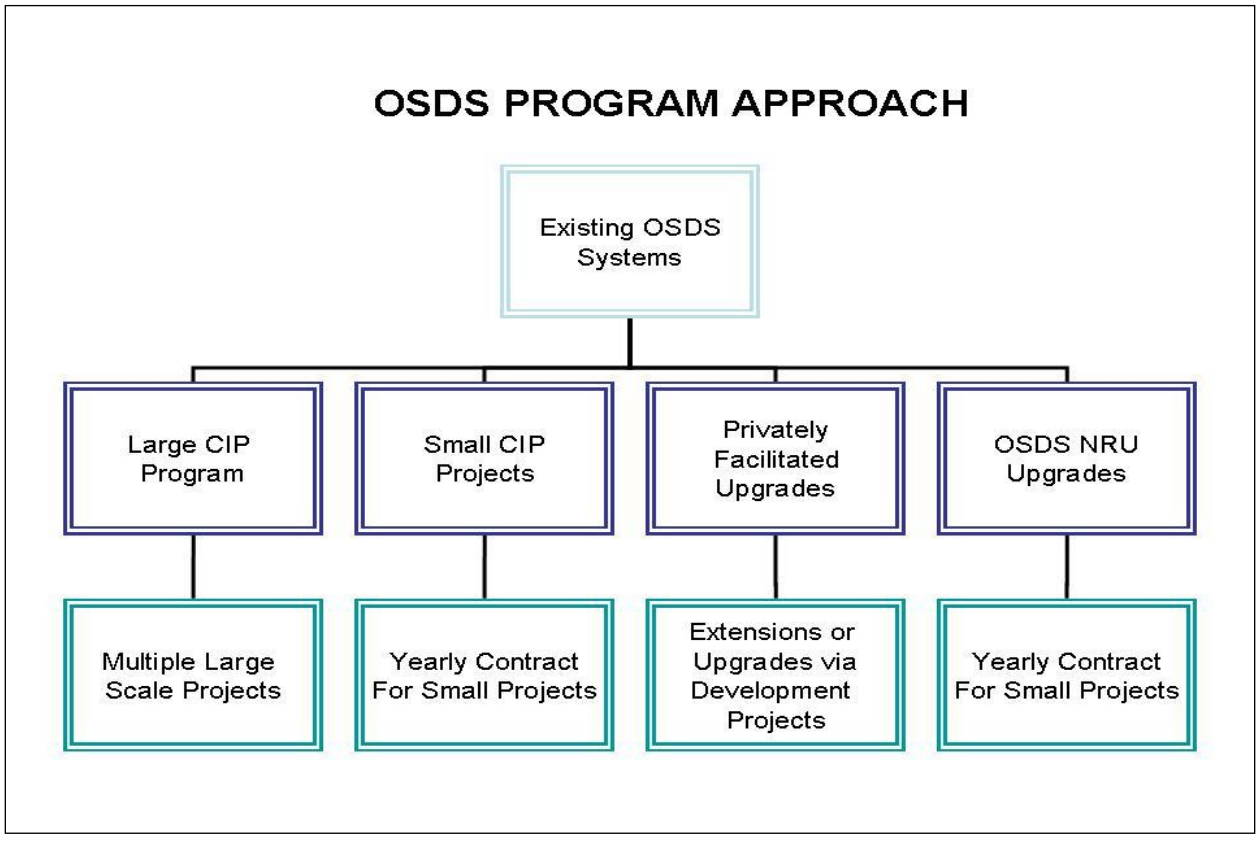
4.3.1 Implementation of Anne Arundel County's Onsite Sewage Disposal System (OSDS) Strategic Plan

Strategy

Anne Arundel County can achieve nitrogen reduction through the conversion of approximately 20,200 of the 40,700 septic systems identified in the County's *Onsite Sewage Disposal System Strategic Plan (2008)*. Nitrogen reduction can be achieved through one of the following:

- Connection to existing Enhanced Nutrient Removal (ENR) Water Reclamation Facilities (WRF),
- Conversion to ENR Cluster Systems, or
- Replacement with nitrogen reducing septic systems.

The strategy as illustrated below consists of large CIP projects, small CIP projects, individual system upgrades, and private sector facilitated upgrades. Implementation will require cooperation of multiple departments and agencies. However, the large CIP Program alone should achieve the majority of the septic load reduction needed to meet the TMDL loadings.



The following discussion provides an overview of each of the program components and the programmatic and implementation milestones.

4.3.1.1 Large CIP Program

The Large CIP program will consist of multiple, large-scale capital construction projects. The program will be managed by DPW through a combination of County staff and consultant project managers through a staff augmentation contract.

To implement this program, DPW will need to identify and fund overall projects, and oversee the design and construction of the individual construction contracts. The discussion below summarizes the steps in the overall process and identifies those that have already been taken by DPW.

Identification of Priority Management Areas

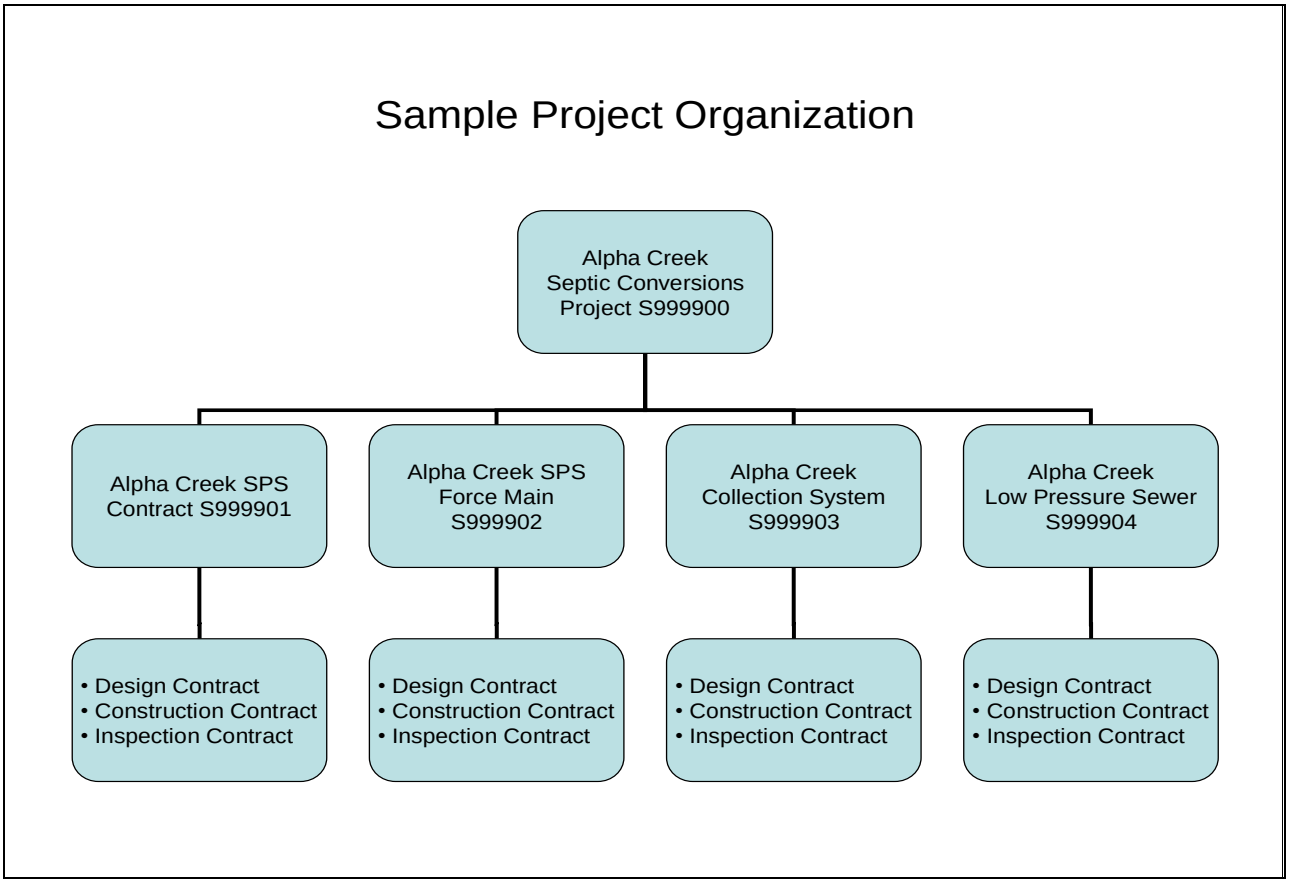
In 2008, the OSDS study identified all the existing septic systems within the County. OSDS systems were grouped by "management areas"; with each area comprised of a group of OSDS with like characteristics that would allow the same treatment technology to be assigned. Using this approach an OSDS Strategic Plan was developed to provide the most cost effective approach for treatment. Cost effectiveness was based on the estimated equivalent uniform annual cost (EUAC) per pound of nitrogen reduced based on treatment type.

Defining Projects

Building on the work done as part of the Comprehensive Sewer Strategic Plan (CSSP) and the OSDS Strategic Plan, DPW began in 2011 to develop preliminary layouts and cost estimates for extending public sewer service (via the existing sewer system and proposed cluster treatment system) to OSDS systems within areas identified as Priority Management Areas. The Priority Management Areas are a subset of the OSDS Management Areas that provided the greatest number of OSDS with high pound Total Nitrogen (TN) removal per acre, thus lending themselves to larger capital improvement projects (CIP). Eleven of these Priority Management Areas were developed which included approximately 20,000 existing septic systems. As of June 2012, this process is ongoing, with portions of the preliminary layouts being developed by DPW staff while other layouts are being developed by engineering consultants. It is expected that layouts and estimates for extending service within all of the Priority Management Areas will be completed by early 2013.

These preliminary layouts are to be used to coordinate efforts within a Priority Management Area. For incorporation into the County's budget program, work within each Priority Management Area will be divided into "Projects" and "Contracts." In terms of the County budgeting process, a *project* is defined by a broad description and funding allocations, and may consist of multiple contracts. Projects are specifically identified and approved in the budget. A *contract* provides a narrower funding allocation within a defined project. Within a contract there may be several subsidiary agreements or contracts. Contracts are not specifically itemized in the yearly budget but are to be accounted for in the development of the overall project budget.

The preliminary layouts within each of the 11 Priority Management Areas will be divided into Project Areas. Project areas will be defined based on the geographic proximity to the Service Area and Sub-Service Area. Each project will be further subdivided into contracts as best determined by DPW. Possible divisions between contracts could be based upon the nature of the work or the size of the contract. A hypothetical example is provided below.



In general, firms engaged to perform design services will be capable of providing design services for all four components listed above: pumping stations, force mains, gravity servers, and low pressure sewers. Therefore, in many instances there may be only one overall design contract with several construction bid packages produced.

2012 – 2013 Programmatic Milestones (Large CIP Program)

- Determine long term funding methods to pay for connection of existing OSDS to public sewer and cluster treatment systems.
- Develop mechanisms and policies to achieve funding;
- Modify the County Code and administrative procedures as needed to provide authorization for the program.

- Develop a tracking and reporting system to follow the progress of OSDS conversion and upgrades.
- Determine staffing requirements and pursue position authorizations within DPW, Inspections and Permits, and the Office of Planning and Zoning to support the expected workload.
- Develop scope descriptions and tasks for workload to be delegated using staff augmentation contracts.
- Review and clarify legal and administrative policies to connect existing OSDS to public sewer and cluster treatment systems.
- Review and clarify permitting requirements to connect existing OSDS to public sewer and cluster treatment systems.
- Develop Countywide Public Relations Strategy.
- Develop new requirements and boundaries for the proposed Cluster Treatment Areas for incorporation into the Water and Sewer Master Plan.
- Pursue new legislation that authorizes mandatory participation by residents and businesses on septic systems for connection to the public sewer system where recommended to achieve TN pollutant load reduction.
- DPW and the Dept. of Health will work collaboratively to develop technical standards for new cluster systems capable of nitrogen removal.

<u>2012 – 2013 Implementation Milestones (Large CIP Program)</u>

- Evaluate the potential for increased staffing in project management, public relation, and other areas either through direct hiring or staff augmentation contracts.
- Initiate designs for capital projects within the Priority Management Areas.
- Initiate a design for a cluster treatment system and collection system by 2013.
- Refine sewer extension and cluster treatment system implementation plans and cost estimates based upon site specific engineering studies.
- Revise the Water and Sewer Master Plan to incorporate areas outside of the Sewer Service Areas that are intended to be connected to public sewer as part of the Phase II WIP implementation.
- Submit to MDE a strategic plan defining the areas and projects to be included in the Large CIP Program.

- Submit budget requests to support design and construction contracts within the Priority Management Areas.
- Determine existing downstream infrastructure capacity for conveyance of wastewater resulting from the sewer system expansion designed to retire septic systems.
- Prepare an overall schedule for the design and construction of the sewer system expansion to facilitate a systematic and logical progression for retirement of septic systems.

4.3.1.2 Small CIP Program

While the Large CIP Project Program will convert a large number of the existing OSDS, nearly half will remain untouched as they will be outside of the 11 Priority Management Areas. Within this group there will be numerous areas with a smaller number of septic systems that could be connected to the public system though the use of grinder pumps or ejector pumps, or through relatively small collection system extensions.

DPW will set up an ongoing project to fund smaller projects through the use of a contract that will utilize a "menu" of unit prices for the needed facilities. DPW uses similar contracts on road work and for water line maintenance. The contract would be re-funded annually to keep work progressing.

Although simpler in organization, the Small CIP Program will have several key tasks.

Identification of Project Areas

DPW will work with the Dept. of Health to develop a list of potential projects from those areas that are excluded from the large CIP Program but within existing service areas. Approximately 3,900 OSDS systems have been identified that appear to be cost-effective, but lie outside of the 11 Priority Management Areas of the large CIP Program.

Development of Selection Criteria

A system for prioritizing the projects will be created to generate a list of assignments. The major criteria are expected to be the following:

- Proximity to the shoreline or waterway,
- Estimated cost per pound nitrogen removed,
- Other DPW projects in the areas such as stormwater and/or road work,
- Public acceptance and support, and
- Expected schedule for completion

Development of Technical Standards

DPW will need to develop standard details and specifications unique to the septic system decommissioning and new connections to supplement its existing details.

Development of Incentives for Participation

The County will pursue the feasibility of incentives to encourage homeowners to participate in the program.

2012 – 2013 Programmatic Milestones (Small CIP Program)

- Determine whether the program will be voluntary-only or a combination of mandatory and voluntary, and develop the necessary administrative procedures or legislation.
- Determine how costs will be shared by existing homeowners.
- Consider the issue of equity between homeowners connected through the large CIP Program and those connected through the Small CIP Program. In general, connections through the Small CIP Program are expected to be lower cost projects.
- Explore incentive systems for individual homeowners to increase interest in voluntary participation.
- Develop a system in coordination with the Dept. of Health for identifying and prioritizing areas to determine upcoming projects to be performed each year.
- Develop a public outreach program to notify neighborhoods of upcoming projects.
- Determine an annual funding level for the program implementation.
- Determine staffing requirements within DPW and the Dept. of Health to support the program.

2012 – 2013 Implementation Milestones (Small CIP Program)

- Pursue the legislation and administrative procedures needed to authorize the program.
- Create a prioritization list for identifying projects.
- Create and fund projects for inclusion in the FY14 annual budget.

4.3.1.3 Private Sector Facilitated Upgrades

Opportunities may exist to accelerate the rate of connections by utilizing privately facilitated projects. This is primarily envisioned as occurring through the development process, where the Office of Planning and Zoning (OPZ) is the primary point of contact for developers; although it

is conceivable that other funding sources could be established through collaboration with advocacy groups or other entities.

Extension and Conversions

Privately funded projects such as large subdivisions or commercially based projects often require the extension of existing public services and the upgrade of existing infrastructure. DPW and OPZ should work proactively with the development community to generate a combination of incentives and mandatory approaches that will result in the conversion of existing OSDS systems when adjacent or nearby areas are developed. The oversight of these approaches would require jointly shared responsibility between OPZ and DPW.

Mandatory requirements could include identifying the 11 Priority Management Areas of the large CIP Program in the Master Plan for Water and Sewer and requiring new developments in these areas to either convert some existing systems or pay into a fund that the County can use for future improvements.

Additionally, approaches could be discussed with the development community to determine what type of incentives could encourage the voluntary conversion of OSDS systems. For example, the County does not currently have a transfer of development rights (TDR) program, but there may be a place for such a program within a broader growth management program.

2012 – 2013 Programmatic Milestones (Private Sector Facilitated Upgrades)

- Develop new policies and procedures to minimize construction of new septic systems in management areas designated as high priority for conversion to point source treatment. These new policies will be developed in accordance with Senate Bill 236 (Sustainable Growth and Agricultural Preservation Act of 2012). Areas identified for connection to public sewer or cluster treatment will likely be designated under Tier 2, which does not allow major subdivisions to be developed on septic systems. New septic systems are only allowed for minor subdivisions and are viewed as a temporary solution.

- Develop new policies to further reduce nutrient loading from future OSDS.

2012 – 2013 Implementation Milestones (Private Sector Facilitated Upgrades)

- Amend the Master Plan for Water and Sewer to identify the Priority Management Areas.

- Perform outreach to the development community explaining potential program changes

4.3.1.4 OSDS Nitrogen Reducing Unit Upgrades

Even after the completion of the Large CIP Program and Small CIP Program, the County will still have approximately 12,900 OSDS that are either in the Critical Area (2,600 units) or outside of the Critical Area but within 1,000 feet of non-tidal waters (10,300 units).

A more aggressive program will need to be developed to facilitate the conversion of these systems to nitrogen reducing units (NRU Upgrades). It is expected that this program would be developed jointly by DPW and the County's Dept. of Health to establish priorities and procedures. This will help ensure that departments will not duplicate their efforts and target different areas of the County for NRU Upgrades and sewer service.

To begin facilitation of this component of the OSDS Strategic Plan Implementation, the County Dept. of Health has developed a strategy for NRU Upgrades. This strategy is summarized in the following text. Overarching programmatic milestones for 2012 – 2013 are summarized at the end of this section.

Implement the Chesapeake Bay Nitrogen Reduction Act of 2009

Strategy

The requirements of the Chesapeake Bay Nitrogen Reduction Act of 2009 (the Act) for new on-site sewage disposal systems will continue to be implemented within the Critical Area. Best Available Technology (BAT) for removing nitrogen will continue to be required for compliance with the Act. The County will certify the use of pre-qualified licensed disposal system contractors to install a BAT unit.

The Chesapeake Bay Nitrogen Reduction Act of 2009, or Senate Bill 554, became effective October 1, 2009. A nitrogen-reducing unit (NRU) is required in place of a septic tank where a repair, replacement, or new on-site sewage disposal system installation is made within the Chesapeake and Atlantic Bay Critical Areas. The requirements apply to permit applications for septic tanks, drainfields, drywells, sand mound systems, pressure dosed beds and any other type of on-site sewage disposal system on a property in the Critical Area. Any portion of a property that falls within the Critical Area must comply with the Act. Properties located outside the Critical Area and the repair or replacement of piping in the Critical Area due to clogged or broken sewer lines are not required to comply with the Act.

2012 - 2013 Implementation Milestones (Nitrogen Reduction Act of 2009)

- Install 419 BAT systems.

Implement the Bay Restoration (Septic) Fund Program

Strategy

Anne Arundel County will continue to administer a Bay Restoration (Septic) Fund program. The program is supported by a State grant from the Maryland Water Quality Financing Administration of the Maryland Department of the Environment (MDE) and is subject to the

Maryland Board of Public Works approval. Anne Arundel County is required to implement the Bay Restoration (Septic) Fund program consistent with the program implementation guidance issued by MDE.

The Bay Restoration (Septic) Fund provides up to 100% funding to property owners to cover part or all of the cost for the nitrogen-reducing unit. Applications are prioritized based on the guidance given from MDE, with repair of failing systems in the Critical Area given the highest priority for funding. A geographic information system (GIS) is used to determine the location of the property in proximity to the Chesapeake Bay Critical Area. The County utilizes only third party verified BAT approved units for grant eligibility. BAT units are approved based on their capability of reducing total nitrogen from an on-site sewage disposal system by 50%. MDE evaluates and establishes a list of nitrogen-reducing units approved as Best Available Technology (BAT) for nitrogen removal. Grant awards include the purchase and installation cost of a BAT unit and a 5 year service contract.

2012 – 2013 Implementation Milestones (BRF (Septic) Program)

- Install 278 nitrogen reducing units.

Continue to Implement Anne Arundel County Code Requirements

Strategy

The requirements of the Anne Arundel County Subdivision and Development Code for new on-site sewage disposal systems in the Critical Area and Bog Protection Areas will continue to be implemented. Best Available Technology (BAT) for removing nitrogen will continue to be required to comply with the Anne Arundel County Code. The County will certify the use of pre-qualified licensed disposal system contractors and inspect installations of each BAT unit installed in the County.

The Anne Arundel County Subdivision and Development Code, 17-8-203 and 17-9-205, became effective December 12, 2004. A nitrogen-reducing unit (NRU) is required in place of a septic tank where a new on-site sewage disposal systems installation is made within the Chesapeake Bay Critical Area and the Bog Protection Areas. The requirements apply to permit applications for septic tanks, drainfields, drywells, sand mound systems, pressure dosed beds and any other type of on-site sewage disposal system on a property in the Critical Area or Bog Protection Area. Any portion of a property that falls within the Critical Area must comply with the County Code.

2012 – 2013 Implementation Milestones (County Code Requirements)

- 76 BAT units will be installed.

Continue to Implement the Requirements of the Groundwater Protection Plan

Strategy

The County Dept. of Health will continue to implement the requirements of the Groundwater Protection Plan as found in Appendix D of the County's Master Water and Sewer Plan. This

Plan documents and summarizes policies and programs regarding on-site sewage disposal systems and the protection of groundwater where public sewer is not available. Nitrogen-reducing technology is utilized on properties for the repair of failing on-site sewage disposal systems, limited home additions, and new construction outside the Critical Area where variances to lot size, number of replacement systems, or change in the size of the on-site disposal system is necessary.

2012- 2013 Implementation Milestones (Groundwater Protection Plan)

- 88 nitrogen reducing units will be installed.

2012-2013 Overarching Programmatic Milestones (OSDS Nitrogen Reducing Units)

- Continue to educate Anne Arundel County residents and businesses on proper maintenance of an on-site sewage disposal system. Continue to recommend septic tank inspections and pump-outs be conducted by a licensed liquid waste hauler once every three (3) years. Annually distribute 450 copies of educational materials in the form of DVDs, records, file folders, and brochures to Anne Arundel County residents and businesses to meet the Septic System Maintenance requirement goals.

- Continue to enforce the requirements of the Anne Arundel County Property Maintenance Code. The Anne Arundel County Property Maintenance Code requires that property owners maintain their septic system in a safe, sanitary, and functional condition. Where a violation is identified, Anne Arundel County enforces the requirements of the Maintenance Code including the issuance of notices, citations, and civil fines.

- As needed, develop and implement updates to the inventory of developed accounts served by an on-site sewage disposal system. This inventory is critical to the assessment of the State's Flush Fee, and to ensure accurate accounting of NRU and BAT units installed for tracking purposes.

- Develop a mandatory septic tank pump out program.

4.4. Urban Stormwater

In pursuit of its 2025 EOS Nitrogen target load allocation of 480,687 pounds per year, Anne Arundel County has identified a "Core" Urban Stormwater Strategy that has as its ultimate goals:

- Restored stream stability,
- Restored hydrology with floodplains and streams,
- Restored biological health of streams, and
- Compliance with water quality standards.

Anne Arundel County possesses a suite of technical models housed within its Watershed Management Tool (WMT) which are used to characterize current and future runoff impacts and water quality conditions to the Edge of Stream (EOS) as well as to perform what-if scenarios for restoration and preservation. The water quality model within the WMT employs the EPA simple method to estimate pollutant loads and utilizes a spreadsheet and GIS-interfaced series of intersections and calculations aimed at integrating treatment decisions in a topologically correct network to ensure accurate estimates of the load to each individual treatment strategy (BMP) with no overlaps or duplication in claiming treatment credits. The WMT GIS-interfaced water quality model utilizes 2007 high resolution (12 inch) land cover and impervious surface coverage for estimating the baseline current condition load, aka 2010 No Action load. It is noted that the County will be using its recently acquired 2011 high resolution (6 inch) land cover and impervious coverage in 2012 and 2013 to update the model and reassess the baseline conditions. Over the past two years, Anne Arundel County has worked with MDE through the WIP pilot development process to reconcile baseline pollutant load estimates. One of the main Bay Program parameters that required reconciling was the land cover and impervious surface GIS coverages. Another was developing better definition for the various landowner jurisdictional and WIP pollutant sector boundaries within Anne Arundel County and their associated allocation responsibilities. In addition, Anne Arundel County adjusted its pollutant load event mean concentrations (EMCs) to better match the Bay model estimates. Due to these efforts, the margin of difference between pollutant load estimates from the Bay Model and the Anne Arundel County WMT model has been reduced from more than 30% to effectively less than 3%. Anne Arundel County has elected to utilize its WMT model for the Chesapeake Bay TMDL WIP urban stormwater pollutant load accounting and the associated NPDES-MS4 Phase I permit-required impervious treatment tracking to consolidate and stream line its implementation, reporting, and associated multi-faceted audited funding programs. In addition to using the WMT as the primary WIP development and tracking tool, the County will continue to update its strategy in MAST so any future reconciling efforts with the Bay Program can be identified and addressed. All load estimates and allocations referenced in this document are to the edge of stream.

Following establishment of the baseline "2010 No Action" load, the existing programmatic capacity and on the ground Best Management Practices (BMP) credits were integrated into the County's WMT model and the 2011 Progress load was estimated. The model integrated all urban stormwater BMPs with known delineated drainage area polygons in a manner that ensures no treatment overlaps. For the remaining BMPs with no available delineated drainage area polygons, the drainage area value was arithmetically incorporated in the model similar to methods employed by MAST using the percent area treated formula. This simplification can result in extensive treatment overlaps especially when integrated with the WIP strategy. Anne Arundel County plans to complete the delineation of the drainage boundaries to all remaining BMPs in FY13 and using this updated information to reassess the 2013 Progress load. The Maryland Department of Environment (MDE) *Accounting for Stormwater Wasteload Allocation*

and Impervious Acres Treated (Draft June 2011) document was consistently used in the WMT model for assigning the BMP pollutant removal efficiency values for calculating pollutant reductions. Anne Arundel County will incorporate any future updates to this State guidance document into the WMT model and pollutant reductions will be reassessed.

The next step was to develop the WIP pollutant reduction strategy to meet the stormwater WLA provided to the Anne Arundel County MS4 Phase I Urban jurisdictional area. The Anne Arundel County Urban Stormwater WIP Strategy is divided into three major categories: Core Strategy Tier I, Core Strategy Tier II, and Potential Load Reductions Outside the Tier I and Tier II Core Strategy.

4.4.1 Core Urban Stormwater Strategy – Tier I

This category includes the restoration of ephemeral and perennial streams with a MBSS Maryland Physical Habitat Index (MPHI) score of severely degraded or degraded, implementing stormwater management treatment at currently untreated major pipe outfalls, and retrofitting stormwater management ponds built prior to 2002 to optimize the pollutant reduction and ecosystem functions for the facilities. In addition, the core strategy includes other already programmed water quality improvement projects with approved budget for FY12 and FY13. Additional information about the individual strategies is shown below.

Anne Arundel County has performed comprehensive assessments for all perennial and ephemeral streams within the Patapsco Tidal and Bodkin Creek Watersheds. Comprehensive assessments for just the perennial channels were performed for the Patapsco Non-Tidal, Magothy, Severn, South, and Upper Patuxent Watersheds. Anne Arundel County is currently conducting comprehensive perennial and ephemeral stream assessments for the Little Patuxent Watershed and is planning to complete the remaining stream assessments by 2015. A Strahler stream order was assigned to all assessed streams. It is noted that the stream ordering was performed using the County's comprehensive stream coverage which is much denser than the USGS NHD data set. Those channels with Strahler stream order less than 2 (i.e., incised ephemeral and low order perennial channels) and a Maryland Physical Habitat Index (MPHI) rating of Degraded and Severely Degraded are proposed to be retrofitted with a regenerative Step Pool Storm Conveyance (SPSC) system. An attempt to size these systems to accommodate the Environmental Site Design (ESD) volume will be made and treatment credits will be claimed in a prorated manner for projects that provide partial ESD volume. These systems are designed to filter the ESD volume through an underlying sand and wood chip medium. Shallow pools provide the head that drives the seepage. This system mimics the sand filter BMP and thus the pollutant removal efficiency used is similar to a sand filter.

Perennial channels with a Strahler Order of 2 or higher and an MPHI score of Degraded or Severely Degraded will be retrofitted using an appropriate stream restoration technique. The use of constructed instream riffles has been a successful Anne Arundel County stream restoration tool for restoring headcuts and connecting streams to their floodplain with minimal disturbance.

For these perennial channels, stream restoration credit was assigned based on the restored length and the CBP Technical Bulletin 9 adopted efficiencies. When constructed instream riffles are in use, the restored length will be calculated as the total length of stream stabilized and the upstream portion inundated by the constructed riffle and effectively connected to the floodplain.

Anne Arundel County has identified and mapped its piped storm drain system and associated outfalls. Inspection is only available for a small subset of these pipe outfalls. For the purpose of this WIP, Anne Arundel County selected all pipe outfalls that are larger than 24 inch in diameter and that are located within a watershed with high priority for restoration. Additionally, outfalls that received an inspection rating of D or below and/or outfalls identified in the NPDES MS4 Program Illicit Discharge Detection and Elimination assessments were also targeted for retrofit. The distance between these outfalls and the nearest perennial channel was estimated so that outfall retrofits and downstream restoration projects could be bundled based on their proximity. The identified outfalls primarily discharge to ephemeral channels and are proposed to be retrofitted with SPSC systems. An attempt to size these systems to treat 100% of the ESD volume would be made to claim the sand filter pollutant removal efficiencies. Designs that achieve treatment volumes less than the ESD volume would have their pollutant reduction credit prorated accordingly.

Anne Arundel County reviewed records for existing stormwater best management practices and those built prior to 2002 are recommended for retrofit. The retrofits will be designed to treat the water quality volume or portion thereof and the credit will be pro-rated based on the provided treatment and the MDE credit for pre-2002 BMP retrofit activities.

In addition, the Core Strategy which is summarized in Table 4.3 includes implementing the programmed and budgeted FY11-FY13 restoration projects. These projects include a range of pond and outfall retrofits, stream restoration, and implementation of projects by the Watershed Stewards Academy, watershed organizations, and other non-governmental groups.

Table 4.3 Core Urban Stormwater Strategy – Tier I

Anne Arundel County WIP Phase II 2025 Strategy for MS4 Urban Stormwater Sector									
Retrofit Type	**Strategy**	**Quantity**	**Units**	**Description**	**Nested Treated Drainage Acres**	**Nested Treated Imperv. Acres**	**Pollutant Reduction [1]**		
							TN (lbs/yr)	**TP (lbs/yr)**	**TSS (Tons/yr)**
Core Strategy (Tier I) Restoration of Incised Zero and First Order Streams (Ephemeral and Intermittent) using SPSC/regenerative wetland seepage systems									
Severely Degraded Streams (2)	Core Tier I	15.15	Miles	Retrofit lower order incised channels with regenerative SPSCs or wetland seepage systems	4,518	1,168	11,051	2,202	214.0
Degraded Streams (2)	Core Tier I	48.95	Miles		15,159	2,332	25,386	4,981	482.1
Restoration Second and Higher Order Streams (Perennial) using In stream Constructed Riffles									
Severely Degraded Streams (2)	Core Tier I	16.97	Miles	Retrofit higher order incised channels with constructed in stream riffles	3,012	1,032	17,919	6,093	13,887
Degraded Streams (2)	Core Tier I	41.63	Miles		10,610	2,466	43,966	14,948	34,073
Retrofit of ponds designed prior to 2002 to provide enhanced water quality functions									
Public Pond Retrofits	Core Tier I	258	# of Ponds	Retrofit pre-2002 SWM facilities to meet ESD criteria	3,175	845	4,803	822	124.0
Private Pond Retrofits	Core Tier I	197	# of Ponds		2,641	1,071	5,440	952	172.6
Retrofit of impaired pipe outfalls using regenerative SPSC filtering systems									
Severely Degraded Outfalls (3)	Core Tier I	1187	# of Outfalls	Retrofit Outfalls with SPSC system (Ephemeral systems)	11,931	4,309	37,253	6,917	770.1
Degraded Outfalls (3)	Core Tier I	749	# of Outfalls		8,354	2,505	22,250	4,069	463.0
CIP Programmed Projects (Various types of retrofits)									
2011 -2013 Future Budgeted CIP	Core Tier I	52	Projects	This scenario quantifies the benefits of implementing future CIP restorations with approved budget for implementation in FY 2012 and FY 2013	2,343	760	5,943	1,136	132.7
Core Strategy Subtotals					**61,744**	**16,486**	**174,012**	**42,121**	**50,319**

[1] Pollutant reductions based on 2007 land cover, EPA simple method, and removal efficiencies outlined in MDE guidelines. TB-9 efficiencies were used for the perennial stream restoration strategy.

[2] Coverage is subject to expansion pending further countywide assessments. Currently, watershed studies have been performed for the Bodkin, Magothy, Patapsco Tidal, Patapsco Non-Tidal, Severn, South, and Upper Patuxent watersheds.

[3] This coverage is subject to further refinement pending further feasibility investigation.

Strategy (Stream Restoration)

This strategy involves restoration of incised ephemeral and first order stream channels using regenerative step pool storm conveyance techniques. Additionally, degraded and severely degraded perennial channels will be restored using appropriate techniques.

2012 - 2013 Programmatic Milestones

(Overarching Tier I programmatic milestones are presented at the end of the Urban Stormwater Strategy Tier I section)

2012 – 2013 Implementation Milestones

- Connect 2 miles of incised perennial streams to their floodplains using appropriate restoration techniques. Projects programmed into the County's CIP for 2012-2013 are conventional stream restoration projects. Those projects on ephemeral and first order reaches do not rely on the use of constructed instream riffles.

- Construct seepage wetland systems to restore degraded and severely degraded perennial streams and effectively manage runoff from 456 acres.

Strategy (Stormwater Pipe Outfall Retrofits)

This strategy involves retrofitting major outfalls from stormwater pipe conveyance systems and zero order ephemeral channels with Step Pool Storm Conveyance filtering systems (SPSC) to effectively treat 1,015 acres. Priority will be given to those outfalls within severely degraded and degraded subwatersheds as classified through County watershed assessments.

2012 – 2013 Programmatic Milestones

- In conjunction with the Office of Planning and Zoning investigate the feasibility of developing a fee in lieu to enable restoration of unstable outfalls.

2012 – 2013 Implementation Milestones

- Initiate retrofit design and construction for 17 major outfalls.

Strategy (Pre 2002 Stormwater Management Pond Retrofits)

This strategy involves retrofitting stormwater management ponds that were constructed before 2002 and that drain more than ten (10) acres. Anne Arundel County proposes to reconstruct these ponds as shallow wetlands/marsh filtering systems.

2012 – 2013 Programmatic Milestones

(Overarching Tier I programmatic milestones are presented at the end of the Urban Stormwater Strategy Tier I section)

2012 – 2013 Implementation Milestones

- Initiate design and construction of retrofits on approximately 11 stormwater management ponds.

Overarching Tier I Urban Stormwater Strategy Programmatic Milestones

- Establish a work group to develop legislation creating a financing method for financing the WIP Phase II Implementation Plan to meet the requirements of promulgated TMDLs and the County's NPDES MS4 Permit, as well as maintenance of the County's stormwater management infrastructure.

- Adopt and implement a Stormwater Remediation Fee as required by House Bill 987 by July 1, 2013.

- Develop and execute a Memorandum of Understanding (MOU) with the State Highway Administration (SHA) for coordinated implementation of urban stormwater projects.

- Identify, prioritize, and establish a timeline for joint SHA/AACo implementation projects.

- Coordinate with Federal/State regulators to reduce permitting time.

4.4.2 Core Urban Stormwater Strategy – Tier II

The Tier II Core Urban Stormwater Strategy includes additional pollutant reduction activities that must be implemented to meet the 2025 allocations. These activities include monthly vacuum assisted street sweeping and associated inlet cleaning for all closed section roads, a reforestation plan for available public open space land, and stormwater management to the maximum extent practical for County-owned properties including recreation areas. Additional information about the individual strategies is shown in Table 4.4 and discussed below.

Strategy (Street Sweeping)

This strategy involves enhancing the County's street sweeping program from a twice yearly operation to a monthly operation and expanding the coverage to include all curbed roads to keep debris out of streams, creeks, and rivers. The ability to fully implement this strategy is dependent upon securing additional staff and financial resources.

<u>2012 – 2013 Programmatic Milestones</u>

- Examine the County's current street sweeping program to determine opportunities for expanding the current program to allow monthly sweeping of all curbed roads.

- Assess staffing resources and assignments. Develop a plan to augment staff as needed.

<u>2012 – 2013 Implementation Milestones</u>

- Implement monthly street sweeping of up to 266 miles of curbed County roads as determined feasible by the examination of the County's current street sweeping program.

Table 4.4 Core Urban Stormwater Strategy – Tier II

Anne Arundel County WIP Phase II 2025 Strategy for Urban Stormwater									
Retrofit Type	**Strategy**	**Amount**	**Units**	**Description**	**Nested Treated Drainage Acres**	**Nested Treated Imperv. Acres**	**Pollutant Reduction**		
							TN (lbs/year)	**TP (lbs/year)**	**TSS (Tons/year)**
Core Tier II Strategy									
Street Sweeping [(1)]	Core Tier II	770	Miles	Monthly Street Sweeping of Curbed County Roads	1,847	1,469	2,789	360	76.7
Inlet Cleaning [(1)]	Core Tier II	12,625	Inlets	Cleaning of curb opening inlets	15,935	5,281	5,724	845	291.2
Reforestation [(1)]	Core Tier II	1,306	Acres	Reforestation of Public Open Space	1176	19	1577	354	33.3
ESD for County Rec and Parks [(1)]	Core Tier II	244	Acres	Retrofit with ESD devices Micro practices implemented to MEP to treat contributory ESD volume	154	154	1,212	188	27.0
Stormwater to the MEP for County Schools [(1)]	Core Tier II	638	Acres		317	317	2,741	444	50.2
Stormwater to the MEP for County Facilities [(1)]	Core Tier II	421	Acres		236	236	2,068	305	42.2
Core Tier II Strategy Subtotals					**19,665**	**7,475**	**16,111**	**2,496**	**521**

[(1)] This coverage is subject to refinement pending further feasibility investigation.

Strategy (Inlet Cleaning)

This strategy proposes annual cleaning of curb opening inlets. The ability to fully implement this strategy is dependent upon securing additional staff and financial resources.

2012 – 2013 Programmatic Milestones

- Assess staffing resources and assignments. Develop plan to augment staff as needed.

2012 – 2013 Implementation Milestones

- Propose the cleaning of up to 17,200 inlets yearly.

Strategy (Tree Planting)

This strategy involves the development of a comprehensive tree planting program for the County that has, as its goal, the planting of approximately1,284 acres of urban tree canopy by 2025.

2012 – 2013 Programmatic Milestones

- Develop a short term and long term reforestation plan that identifies areas appropriate for planting.
- Work with the Dept. of Inspections and Permits to determine the feasibility of creating a Rural Residential Reforestation Program.
- Implement a stream buffer planting program on county land adjacent to creeks, stream, and rivers.
- Work with the Dept. of Inspections and Permits to develop a standard operating procedure for capturing and tracking load reductions associated with reforestation and afforestation projects.

2012 – 2013 Implementation Milestones

- Implement reforestation on 60 acres.

Strategy (Stormwater to the Maximum Extent Practicable)

This strategy applies to public facilities as well as private and commercial/industrial areas within high priority for restoration watersheds. Example retrofit areas would include County parks, County building complexes, and densely developed residential areas with no or minimal stormwater management. This strategy will apply a suite of stormwater BMPs to each retrofit area with the intent of maximizing stormwater management and pollutant load reduction. Approximately 702 acres of impervious surface is proposed to be managed through this strategy by 2025.

2012 – 2013 Programmatic Milestones

- In conjunction with other County agencies develop a methodology for identifying and prioritizing those areas where maximizing stormwater management of currently undermanaged sites is feasible and cost effective.

2012 – 2013 Implementation Milestones

- Provide stormwater treatment to the maximum extent practical on 76 acres of publically owned land and facilities.

4.4.3 Potential Load Reductions Outside the Tier I and Tier II Core Urban Stormwater Strategy

This strategy focuses on the work of private citizens and Watershed Master Stewards in implementing stormwater controls to the Maximum Extent Practical for residential rooftops, in high density areas, and for private commercial and industrial properties. These areas have been selected geographically outside the area treated by the WIP core strategy. This selection is conservative because private citizens may also elect to implement stormwater controls and landscape restoration practices within the area treated by a proposed WIP core strategy. The

strategy for load reductions outside the Tier I and Tier II strategies would supplement the treatment provided by the core strategy and potentially increase the treatment efficiency of an area to up to one hundred percent pollutant removal. Additional information about the individual strategies is shown in Table 4.5 and described below.

Table 4.5 Urban Stormwater Strategy outside the Tier I and Tier II Core Urban Strategy

Anne Arundel County WIP Phase II 2025 Strategy for Urban Stormwater									
Retrofit Type	**Strategy**	**Quantity**	**Units**	**Description**	**Nested Treated Drainage Acres**	**Nested Treated Imperv. Acres**	**Pollutant Reduction**		
							TN (lbs/yr)	**TP (lbs/yr)**	**TSS (Tons/yr)**
Potential Load Reductions Outside the Core Strategy WIP Areas [(1)]									
Stormwater to the MEP for Private Commercial and Industrial Properties	Outside of Tier I and II Areas	793	Acres	Retrofit with ESD devices	776	776	6,807	950	156.8
Rain Barrels and Rain Gardens for Residential Rooftops in High Density Areas	Outside of Tier I and II Areas	972	Acres	Retrofit downspouts, driveways for high density residential areas	966	886	9,411	1,312	135.6
Core Tier II Strategy Subtotals					**1,741**	**1,662**	**16,219**	**2,263**	**292**

[(1)] This applies to residential and commercial/industrial private restoration opportunities outside areas treated by the core Tier I and core tier II strategy. Areas that drain to a Tier I or II strategy project may qualify for credits after all downstream inadequacies are retrofitted.
Additional detail about the individual treatment strategy, their pollutant removal efficiency, assumptions in calculating the pollutant reduction, and how the unit cost was developed for each strategy is documented in the Patapsco Tidal and Bodkin Comprehensive Watershed Study, June 2012 (http://www.aacounty.org/DPW/Watershed/PatapscoBodkinStudy.cfm)

Strategy (Watershed Stewards Academy and Watershed Organization Implementation)

2012 – 2013 Programmatic Milestones

- Work in conjunction with the Watershed Stewards Academy to establish a Neighborhood Norm Certification Program. This initiative will expand and extend the WSA by deploying an army of trained, certified, and motivated master Watershed Stewards to create a paradigm shift in behavior and land use within neighborhoods to reduce pollution at its source.

- Work in conjunction with the WSA and other watershed organizations to develop protocols for inspecting and maintaining projects implemented by NGOs for which load reduction credit is being taken to ensure that they are functioning as designed for pollutant reduction.

- Engage the South River Federation in the development of a Phase II WIP for the South River Watershed to serve as a pilot for other watershed specific WIPs in Anne Arundel County.

- Work in collaboration with watershed organizations to leverage and secure grant funding for implementation projects.

2012 – 2013 Implementation Milestones

- The Anne Arundel County Watershed Stewards Academy will implement/install 100 water quality projects.

- The watershed organizations operating within Anne Arundel County will implement/install 4 water quality projects.

4.4.4 Urban Stormwater Strategies Summary

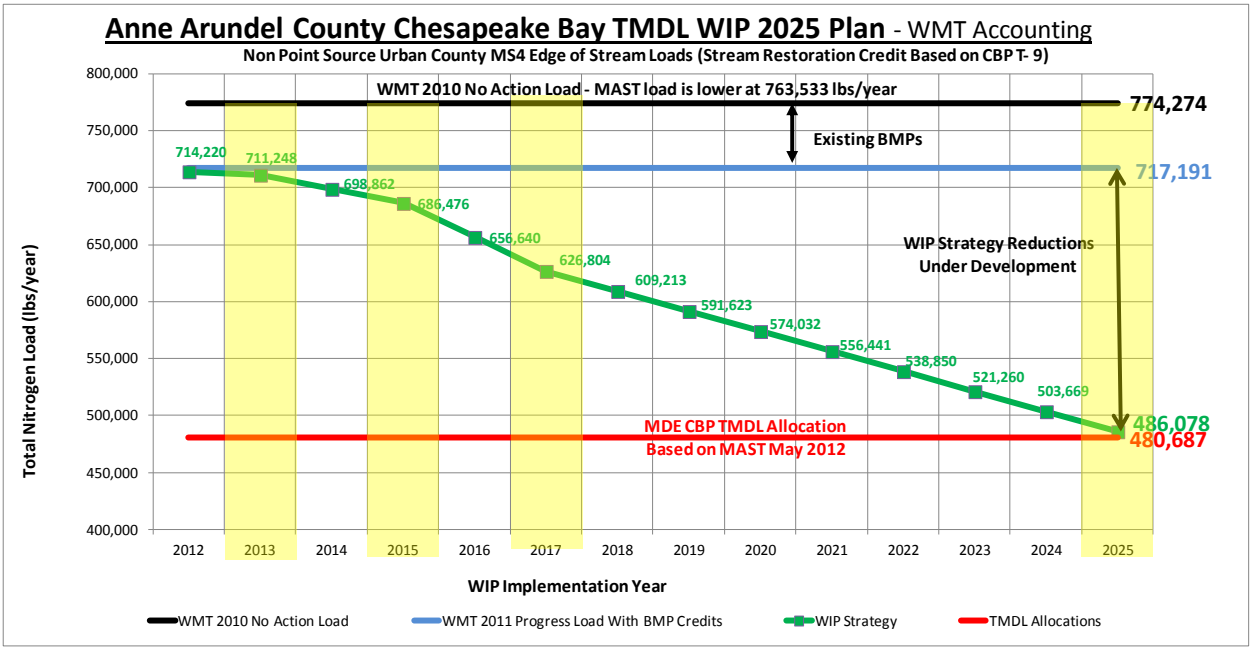
As previously discussed, Anne Arundel County has evaluated several means of assessing the WIP II strategy for meeting the Bay TMDL Stormwater WLA (SW WLA). Scenarios evaluated included using the County's own models to ascertain the current 2010 No Action pollutant load as well as the MAST scenarios for both Edge of Stream and Delivered Loads (Table 4.6 and Figure 4.2).

Table 4.6 WIP II Strategy Scenarios for the Urban Stormwater Load: Total Nitrogen (lbs)

	MAST Delivered Load Scenario	MAST Edge of Stream Scenario	County (WMT) Edge of Stream Modeled Scenario
2010 No Action Load	723,795	763,533	774,274
2011 Progress (Load with Existing Credits*)	652,054	690,764	717,191
WIP II 2017 Strategy	533,642	569,411	N/A
WIP II 2025 Strategy	431,308	463,778	486,078
Bay TMDL SW WLA (from MAST)	**449,641**	**480,687**	**480,687**
Above or Below SW WLA (lbs)	Below (18,333)	Below (16,909)	Above (5,391)

MAST Scenario data:
MAST loads derived from the following MAST scenarios: AnneArundel_2010Noaction_MS4phase1_July2012
AnneArundel_2017_MS4phase1_July2012
AnneArundel_2025_MS4phase1_July2012
Geographic Scale: County with Federal Split
Geographic Area: Anne Arundel MD – Non-Federal
Load Type: Land use

Figure 4.2 WIP II Strategy Timeline for Urban Sector Stormwater Load: Total Nitrogen (lbs)



* Existing credits include existing stormwater BMPs and water quality restoration projects implemented between 2002 and 2011 that are not included in the 2010 No Action Load. Disconnect credits were not included in the 2011 progress and will be included in the 2015 milestone after they have been fully investigated.

Applying the County WIP II urban stormwater strategy to the 2010 No Action Scenario, as originally entered into MAST, the County demonstrates that implementing the WIP II strategy described in this section will ultimately meet the Bay TMDL 2025 SW WLA for MAST Edge of Stream scenario as well as the MAST modeled Delivered Load scenario. Pursuant to the use of the County's own models (WMT accounting), the WIP II strategy is still slightly above the Edge of Stream allocation. As discussed in Section 9.1 of this document, this urban stormwater strategy includes implementation recommendations from 7 of the County's 12 watersheds. Project identification and implementation from the remaining five watersheds will likely result in additional pollutant load reduction.

As shown in Table 4.6, the County has developed a 2017 and 2025 plan that meets both the MAST EOS and delivered WLAs. Currently, the WMT accounting estimated a higher 2010 No Action Load than MAST which translated to higher estimates for the 2011 Progress and the 2025 Strategy results. As discussed earlier and demonstrated in the modeling methods and procedures found in the County's Tidal Patapsco and Bodkin Creek Watersheds Comprehensive Study (http://www.aacounty.org/DPW/Watershed/PatapscoBodkinStudy.cfm), the WMT model offers the County the most comprehensive, accurate, and defensible GIS interfaced input and results and will be used by the County as the primary tool for refining the strategy, implementation accounting, and progress reporting. The County will continue to work with MDE to enhance the accounting tools at the local scale.

SECTION 5. 2 YEAR MILESTONES (2012 – 2013)

The 2-year milestones discussed in Section 4 of this document and presented below and in Table 5.1, represent Anne Arundel County's initial commitment to implementing the County's WIP. The milestones are organized by source sector (urban stormwater, wastewater treatment facilities, and septic systems) and are presented in 2 categories: **Implementation Milestones** that cover the time period of July1, 2011 through June 30, 2013; and **Programmatic Milestones** that cover the time period of January 1, 2011 through December 31, 2013.

In addition to the source sector milestones Anne Arundel County has identified the following programmatic milestones associated with growth in loads.

2012 – 2013 Programmatic Milestones (Growth in Loads)

- The Department of Public Works will work in collaboration with the Office of Planning and Zoning and other County agencies to identify and map the Four Tiers of land use categories defined by the Sustainable Growth and Development Act of 2012 by December 31, 2012.
- Provide local government perspective and assistance to the Maryland Department of Planning in the development of the State's Offset Policy.
- Develop tracking and reporting mechanisms in conjunction with the Office of Planning and Zoning to account for growth or reduction in loads from new development, redevelopment, and revitalization areas.
- Continue investigating options for nutrient trading as a tool to offset future loads from new development.

The achievement of a particular strategy or milestone will be dependent upon County staffing levels and the ability to secure funding. These milestones will be revised as necessary to reflect changes in the status of staffing and funding or in response to new State legislative and programmatic initiatives.

Table 5.1 Anne Arundel County WIP II 2012-2013 Milestones

Anne Arundel County Government WIP -- Two Year Milestones (2012 - 2013)															
IMPLEMENTATION ACTION MILESTONES (2012-2013)	BMP Type	# of Projects	Quantity	Units	TN Efficiency [2]	TP Efficiency [2]	TSS Efficiency [2]	Treatment Units for Credit Computation	Units Available	TN Load Reduction	TP Load Reduction	TSS Load Reduction	Impervious Acres Treated	Unit Cost ($/lbs of TN)	Line Item Cost
Urban and Suburban Stormwater [1]															
Connect incised perennial streams to floodplain using Constructed Instream Riffles	Stream Conventional	**5**	**2**	**Miles**	0.2	0.068	310	Feet	**10666**	**213**	**59**	**16**	**302**	$ 34,594	$ 7,379,501
Restore perennial degraded and severely degraded channels as seepage wetland systems	Stream Wetland	**4**	**TBD**	**Miles**	40	60	85	Acres	**456**	**554**	**106**	**11**	**169**	$ 14,749	$ 8,165,115
Restoring zero order ephemeral streams and pipe outfalls with Step Pool Storm Conveyance (filtering systems)	Ephemeral Filtration	**17**	**TBD**	**Miles**	50	60	90	Acres	**1015**	**516**	**93**	**11**	**399**	$ 24,266	$ 12,524,327
Retrofit pre-2002 ponds as Shallow Wetland	Pond wetland/filtration	**11**	**11**	**# of Ponds**	40	60	85	Acres	**280**	**210**	**38**	**3**	**84**	$ 14,123	$ 2,968,946
Street Sweeping (closed section road)	Street Sweep	**TBD**	**266**	**Center Miles**	4	4	22	Acres	967	**349**	**349**	**1918**	**967**	$ 1,663	$ 580,043
Inlet cleaning	Inlet Clean	**TBD**	**17,200**	**Inlets**	10	2	56	Acres	2371	**2137**	**427**	**11966**	**1660**	$ 534	$ 1,141,326
Stormwater to the MEP for County Schools	SW to MEP	**3**	**35**	**Acres**	50	60	90	Acres	**35**	**156**	**187**	**281**	**14**	$ 4,604	$ 719,075
Watershed Organization Projects [3]	Various Filtration BMPs	**4**	**100**	**Acres**	40	60	85	Acres	**100**	**51**	**9**	**1.1**	**15**	Cost not incurred by County	
Watershed Steward Academy [4]	LID NGO	**100**	**1045**	**Acres**	50	60	90	Acres	**1045**	**75**	**15**	**1.0**	**418**	Cost not incurred by County	
Stormwater to the MEP for County Facilities	LID Facilities	**16**	**41**	**Acres**	50	60	90	Acres	**41**	**185**	**222**	**333**	**16**	$ 4,604	$ 850,608
Upland Tree Plantings	Plantings	**N/A**	**60**	**Acres**	66	77	57	Acres	**60**	**357**	**416**	**308**	**N/A**	$ 9,430	$ 1,500,000
TOTAL										4,802	1,922	14,849			$ 28,449,441
Waste Water Treatment Facilities															
ENR Upgrade to Annapolis WRF	ENR	1	N/A		N/A	N/A	N/A	N/A	N/A	158,388	47,524	0	N/A	$126	$20,000,000
TOTAL										158,388	47,524	0	N/A		$20,000,000
Septic Systems															
OSDS NRU Strategy															
Implementation of the Chesapeake Bay Nitrogen Reduction Act of 2009 [5]	Residential Septic	419			50	0	0	each	419	4,378	0	0	0	$12,500	$5,237,500
Implementation of the Bay Restoration (septic) Fund Program [5a]	Residential Septic	278			50%	0	0	each	278	3,162	0	0	0	$12,500	$3,475,000
Implement AACounty Code (Subdivision and Development Code in Critical Areas & Bog Protection Areas [6]	Residential Septic	76			50%	0	0	each	76	547	0	0	0	$12,500	$950,000
Groundwater Protection Plan (Outside Critical Areas) [7]	Residential Septic	88			50%	0	0	each	88	456	0	0	0	$12,500	$1,100,000
OSDS Public Sewer Connection Strategy															
Connection to Public Sewer via Petition Project (Deale Road Wastewater Extension Petition Project) [8]	Residential	35			0				35	851	0	0	0		
	Commercial	14							14	1,770	0	0	0		
TOTAL										11,164	0	0	0		
PROGRAM DEVELOPMENT ACTION MILESTONES (2012-2013)															
Urban Stormwater															
Establish MOU with SHA for implementation of urban stormwater projects															
Draft & adopt legislation to create a stormwater utility enterprise fund															
Coordinate with Fed/State regulators to reduce permitting time															
Continue investigating options for nutrient trading as a tool to offset future loads from new development.															
Waste Water Treatment Facilities															
Refine costs for design/construction of pump station upgrades															
In 2012, revise Water and Sewer Master plan to incorporate areas outside of the Sewer Service Areas that are intended to be connected as part the WIP. Develop new requirements and boundaries for the proposed Cluster Treatment Areas to incorporate them into the Water and Sewer Master Plan. Develop Policies and Procedures to promote public sewer in management areas designated as high priority and for capital improvement projects.															
Septic Systems															
Request FY12 County budget appropriation for Septic Implementation Plan															
Execute contract for Septic Implementation Plan															
Continue to refine sewer extension and cluster treatment system implementation plans and cost estimates.															
Determine long term funding methods to pay for connection of existing OSDS to public sewer and cluster treatment systems. Develop mechanisms and policies to achieve funding, may require legislation actions. Begin planning for long term implementation of these funding policies.															
Continue researching more cost effectives alternatives to serve the proposed cluster treatment areas. Initiate a pilot project to serve a cluster treatment area in 2013.															
Develop a tracking and reporting system to follow the progress of OSDS conversion and upgrades.															
Develop Policies and Procedures for handling Operation and Maintenance for upgraded OSDS															
Develop approach for prioritization of OSDS upgrades.															
Determine Staffing requirements and receive position authorizations.															
Develop polices to reduce nutrient loading due to future growth of OSDS.															
Review and Clarify legal and administrative policies to connect existing OSDS to public sewer and cluster treatment systems.															
Review and Clarify permitting requirements to connect existing OSDS to public sewer and cluster treatment systems.															
Develop Countywide Public Relations Strategy															
Footnotes															
[1] Urban Stormwater pollutant reduction strategy reported for FY-12 and FY-13 is based on currently programmed County CIP projects and does not imply that all projects will be fully constructed by the end of FY13. These project are currently in various levels of implementation from concept design and project initiation to under construction. Construction completion is contingent upon permitting, right of way, availability of capital and grant funds, and other factors.															
[2] All Urban and Suburban stormwater strategy efficiencies with the exception of wetland creation systems are based on MDE's June 2011 document "Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated." In this document MDE utilizes a similar efficiency for wetland creation and wet ponds, which deviates from efficiencies reported in earlier publications. The pollutant reduction computations reported in this spreadsheet are based on TN = 40%, TP=60%, and TSS= 85%, which is consistent with "Center for Watershed Protection. 2007a. National Pollutant Removal Performance Database. Version 3. Ellicott City, MD. September 2007. Available at: http://www.cwp.org/Downloads/bmpwriteup_092007_v3.pdf ".															
[3] It is assumed that 4 Watershed Organization Projects will be implemented annually. The filtration efficiency was assigned to these projects.															
[4] It is assumed that the Watershed Steward Academy will implement 100 projects per year ranging from rainbarrels and rain gardens.															
[5] This includes both new, repaired, and replaced OSDS															
[5a] Some of these systems maybe covered under the Chesapeake Bay Nitrogen Reduction Act of 2009.															
[6] Assumes that this only includes those OSDS within the Bog Protection Areas and outside of the Critical Area, those in the Critical Area would be under the Chesapeake Bay Nitrogen Reducing Act of 2009															
[7] Assumes that these areas are within the 50% Delivery Ratio															
[8] Assumed that average flow rate for commercial properties = 1300 gpd. This equals approximately 1300/250 = 5.2 EDUs per Commercial Property. TN Load Reductions will be included in the Broadwater WRF capacity															

SECTION 6. IMPLEMENTATION TRACKING, VERIFICATION AND REPORTING METHODS

This section provides an overview of Anne Arundel County's tracking, verification and reporting protocols for the implementation of its load reducing strategies for the following source sectors – Major Municipal Wastewater, Septic, and Urban Stormwater.

6.2. Major Municipal Water Reclamation Facilities (WRF)

The MDE Water Management Administration is the delegated authority to carry out and administer the NPDES Permitting Program for WRFs in Maryland. Anne Arundel County is required to file self-monitoring results at the frequency specified in the NPDES permits for each of its municipal WRFs. These results are reported in the form of Discharge Monitoring Reports (DMRs) and Monthly Operating Reports (MORs). MDE's Compliance Program reviews and tracks DMRs during physical site inspections and as part of established QAQC procedures to verify data and reporting integrity.

As noted further below, the County will develop a system for tracking OSDS systems that are converted to the public system. Data to be included with these reports will include the nitrogen trading credits that have been generated within a treatment plant service area. Ongoing yearly documentation should allow the total credits within a treatment plant service area to be consolidated and allocated to an individual wastewater treatment plant in conjunction with the five-year renewal cycle of the plant's NPDES permit.

6.2. Septic Systems

6.2.1 Sewer System Extensions

A tracking and reporting system will be developed for OSDS that are retired through the sewer system extension projects. The standard reporting format would contain the following information and be completed upon the conditional acceptance of the project.

- Project name
- Number of ODSD systems converted in each project
- Hydrological watershed for each project
- Treatment plant service area for each project
- Nitrogen reduction credits for each project
- Nitrogen trading credits for each project

6.2.2 Anne Arundel County Property Maintenance Code

The Anne Arundel County Property Maintenance Code (Article 15, Title 4) establishes that an on-site sewage disposal system must be properly operated and maintained in a safe, sanitary, and functional condition. The Property Maintenance Code requires the maintenance of an on-site sewage disposal system that is free from obstructions, leaks, and defects so as to avoid creating a public health nuisance. The Anne Arundel County Dept. of Health enforces the requirements of the Property Maintenance Code. Where a violation is identified, the Dept. of Health enforces the requirements of the Code including the issuance of notices, citations, and civil fines. When unsafe or hazardous conditions are present, the Dept. of Health requires a property owner to immediately pump the septic tank, contain the sewage overflow, apply hydrated lime to the affected area, repair or replace the septic system, and restrict access where a septic tank or drywell presents a safety hazard. If a property owner fails to comply with the stated requirements, notices, citations, and civil fines are issued. A referral to the Anne Arundel County Office of Law is made when compliance is not achieved within the prescribed timeline.

6.2.3 Performance Monitoring

The Dept. of Health will continue to evaluate the performance of engineered nitrogen reducing units in reducing nitrogen from on-site sewage disposal systems in Anne Arundel County. The Dept of Health will conduct periodic inspection and testing of wastewater to evaluate the overall performance and continued use of engineered units in the County. On-site inspections will be performed on existing engineered units at a frequency of once every five (5) years. Wastewater samples will be analyzed to assure engineered units meet the prescribed 50% nitrogen reduction standard. Modifications to the minimum design criteria will be made based on inspection, sampling, and performance data.

6.2.4 Assessment of On-site Wastewater Management Problem Areas

The Dept. of Health has identified thirty-seven wastewater management problem areas, and these areas are denoted in the County's Water and Sewer Master Plan. The areas are identified based on documentation of failing on-site sewage disposal systems in combination with certain site conditions including high water table, small lot size, impermeable soils, and/or slopes in excess of 25%. Such site conditions make it difficult to facilitate repair of failing OSDS while also meeting minimum design requirements of State and County code.

The Dept. of Health will continue to assess On-site Wastewater Management Problem Areas and other areas of the County that pose problems with the repair of failing on-site sewage disposal systems within a defined geographic area. The Dept. of Health will assess the developed accounts within the On-site Wastewater Management problem areas, in consultation with the Dept. of Public Works, to ascertain whether the community can be served by a clustered community on-site system or whether public sewer service may be feasible. The Dept. of Health will participate in community meetings to convey important information about maintenance and upgrade of on-site sewage disposal systems.

6.3. Urban Stormwater

6.3.1 NPDES MS4

Urban stormwater is defined in the Clean Water Act as a point source discharge and assigned a Waste Load Allocation (WLA) in the Chesapeake Bay TMDL. Point sources, including stormwater, are regulated through NPDES Permits. Therefore, the Anne Arundel County NPDES MS4 permit becomes the regulatory mechanism to track, verify, and report progress and compliance with the assigned stormwater WLA.

Annually, Anne Arundel County provides progress reports to MDE. These annual reports document watershed restoration activities that include those described in the Urban Stormwater Strategy (see Section 4 of this document). Projects such as stream restoration, outfall retrofits, pond retrofits, and implementation of stormwater management in those areas currently undermanaged or not managed are captured in a watershed restoration database.

Anne Arundel County maintains a GIS-interfaced Watershed Management Tool (WMT) that accounts for pollutant load reduction and impervious area captured/controlled by qualified restoration activities within the County. The model is used as a basis for quantifying credit and satisfying NPDES-MS4 annual reporting requirements related to stormwater WLA and accounting for impervious acres managed (controlled). Anne Arundel County relies on MDE's guidance document *Accounting for Stormwater Waste-load Allocation and Impervious Acres Treated; Guidance for National Pollutant Discharge Elimination System Stormwater Permits, June (Draft) 2011*, and future document updates, to quantify restoration activities and to claim pollutant reduction and credit for impervious acres controlled.

Anne Arundel County's NPDES MS4 Permit includes the requirement to document and report on two items included in the urban stormwater supplemental strategy described in Section 4. Those items are street sweeping and inlet cleaning. Thus, the County has records and maintains documentation of the miles of roadway swept and number of inlets assessed and cleaned. New guidance issued in June 2011 by MDE in its draft document *Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated* provides the County with the needed information to assign pollutant load reductions to these activities. Such pollutant load reductions will be incorporated into annual NPDES MS4 progress reports.

6.3.2 Non-Governmental Organizations (NGOs)

Anne Arundel County maintains a web-based application form to accept data on water quality restoration activities performed by Non-Governmental Organizations (NGOs), (e.g. Master Watershed Stewards, watershed groups) and private citizens and businesses. Access to this web-based application is through http://www.aacounty.org/DPW/Watershed/Restoration/index.cfm . Information submitted on this form is evaluated by technical staff within the County's Watershed Assessment and Planning Program to establish whether the project qualifies for water quality credit, and to determine the extent of water quality credit to be incorporated into the WMT.

Further, the projects are evaluated in the field to ensure that the submitted information matches what was constructed. All qualified projects must have a maintenance agreement on file.

6.3.3 Water Quality Restoration Project Qualification

The restoration activities described below are considered qualified water quality projects for receiving pollutant load reduction credit for the urban stormwater sector.

1. All new stormwater management facilities designed and constructed in accordance with the MDE Stormwater Management Manual and sized to provide water quality and recharge for the entire, or a portion of the entire contributory drainage area. This includes detention, extended detention, wetlands, infiltration, filtration (bio-retention, sand filters), and other environmental site design activities. These projects may not be done as direct mitigation for a development activity. Stormwater management activities conducted as mitigation for development are housed and reported separately.

2. Retrofit of existing SWM facilities to improve the treatment efficiency or to upgrade an older facility designed during an era with lower treatment standards.

3. Step Pool Storm Conveyance, Coastal Plain Outfalls and /or Regenerative Storm Conveyance projects. The pollutant removal efficiencies for these facilities are listed in the MDE June 2011 draft document. The facility must be designed per the Anne Arundel County guidance document (http://www.aacounty.org/DPW/Watershed/StepPoolStormConveyance.cfm) to receive full credit as a filtering structure.

4. Redevelopment projects. Anne Arundel County claims pollutant removal as shown in MDE's guidance document *Accounting for Stormwater Waste-load Allocation and Impervious Acres Treated; Guidance for National Pollutant Discharge Elimination System Stormwater Permits, June (Draft) 2011* for restoration activities that qualify as redevelopment projects.

5. Street Sweeping and Catch Basin/Inlet Cleaning. Anne Arundel County claims pollutant removal as shown in MDE's guidance document *Accounting for Stormwater Waste-load Allocation and Impervious Acres Treated; Guidance for National Pollutant Discharge Elimination System Stormwater Permits, June (Draft) 2011*.

6. Tree Planting and Reforestation. Anne Arundel County claims pollutant removal as shown in MDE's guidance document *Accounting for Stormwater Waste-load Allocation and Impervious Acres Treated; Guidance for National Pollutant Discharge Elimination System Stormwater Permits, June (Draft) 2011*.

7. Stream Restoration. Anne Arundel County claims credit for stream stabilization and stream restoration activities that provide floodplain connection and load reduction. . Anne Arundel County claims pollutant removal as shown in MDE's guidance document *Accounting for*

Stormwater Waste-load Allocation and Impervious Acres Treated; Guidance for National Pollutant Discharge Elimination System Stormwater Permits, June (Draft) 2011.

8. Other activities approved by MDE for the purpose of TMDL implementation and impervious retrofit.

6.3.3 Reforestation and Afforestation

Reforestation and afforestation activities Countywide are captured by the County's Forestry Program. Annually, the Forestry Program reports acres reforested and afforested to both the Maryland DNR Forest Service and the Maryland Critical Area Commission.

6.4. Credit for Implementation

In addition to the strategies set forth in Section 4, the County has identified and is prepared to take credit for existing urban stormwater runoff nutrient load reductions. These credits are captured in the previously referenced scenarios as described below.

All capital improvement stormwater environmental enhancement projects constructed from 2002 to 2011 were included in the 2011 progress scenario run. Credit was taken proportional to the nested drainage area treated coupled with the water quality volume captured. In addition, the County's Urban Stormwater BMP database was divided into two groups. The first group included Urban BMPs within the Patapsco Tidal, Bodkin Creek, and the Patapsco Non-tidal watershed. These BMPs have delineated GIS drainage area boundaries that were inserted into the WIP treatment terrain GIS layer. Credit was taken proportionally to the nested drainage area treated and water quality volume captured. The remaining BMPs within the Urban BMP database do not yet have GIS-delineated drainage areas. For these BMPs, pollutant load reduction credit was taken based on the reported tabular drainage area. Anne Arundel County anticipates completing drainage areas delineation for all urban BMPs by 2014, at which time the credit will be reassessed.

In addition to known stormwater BMPs, Anne Arundel County has evaluated other urban landscape credits that meet the State's stormwater criteria for Environmental Site Design. A planning level estimate of the credit achieved from rooftop and non rooftop disconnects is shown on Table 6.1. This credit, however, was not included in the 2011 progress run and is anticipated to be more fully investigated and applied by the 2015 milestone. Other credit not shown in Table 6.1 such as existing shoreline restoration/stabilization projects, old residential areas with high percentage tree canopy cover, urban pollution prevention plans, etc. will be evaluated and applied in the future.

Table 6.1 Nutrient Load Reduction Credits

Anne Arundel County WIP Phase II 2025 Strategy for Urban Stormwater									
Retrofit Type	**Strategy**	**Quantity**	**Units**	**Description**	**Nested Treated Drainage Acres**	**Nested Treated Imperv Acres**	**Annual Pollutant Reduction**		
							TN (lbs)	**TP (lbs)**	**TSS (Tons)**
Credits calculated for the WIP 2025 scenario assuming that all WIP strategies are implemented and working in tandem with existing BMPs [1]									
Existing CIP	Credits	235	Projects	This scenario quantifies the benefit for CIP project restorations performed since 2002 and up to 2011	4,864	1,091	4,323	919	101
Existing County Public BMPs	Credits	374	BMPs	Based on BMP with nested DA delineations (PNT, PT, and Bodkin)	2,410	603	3,309	648	77
Existing County Public BMPs [2]	Credits	1124	BMPs	Based on BMP without DA delineations (Remaining Urban BMP database)	2,411	723	16,230	1,971	137
Existing County Private BMPs	Credits	1632	BMPs	Based on BMP with nested DA delineations (PNT, PT, and Bodkin)	2,524	1,059	6,721	1,066	159
Existing County Private BMPs [2]	Credits	6642	BMPs	Based on BMP without DA delineations (Remaining Urban BMP database)	4,053	1,216	24,499	3,222	245
Roof-top disconnects	Credits	N/A		Existing rooftops that are disconnected	2055	1894	19,243	2,752	300
Non roof top disconnects	Credits	N/A		Existing open section roads with swales	736	535	5,529	912	129
Credit Subtotals					**18,077**	**6,935**	**78,299**	**11,011**	**1.148**

[1] Credits claimed under this section are subject to findings of inspection reports.

[2] Accurate location information does not exist for these BMPs to allow accurate calculations of the treatment areas. Values shown do not reflect nesting and may carry large over estimations. Impervious treatment shown reflects that 20% of the BMP drainage area is treated

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SECTION 7. RELATIONSHIP OF LOCAL WATERSHED PLANNING TO PHASE II WIP

Anne Arundel County has a long history of watershed based planning dating back to the late 1980's when the County began development of a Comprehensive Watershed Management Program through which the County defined current and proposed water resource conservation programs and initiated a detailed watershed by watershed inventory used to identify specific problems and direct funding to effective remedial measures.

The Watershed, Ecosystem, and Restoration Services (WERS) Division in the County's Department of Public Works, Bureau of Engineering continues to focus on watershed based planning. WERS is responsible for planning, management and implementation associated with the County's NPDES-MS4 Permit, Water Resource Element of the General Development Plan, local TMDLs, and the Chesapeake Bay TMDL and, as such, is the lead entity in Anne Arundel County for development, oversight, and implementation of the County's Phase II WIP. Further, WERS is responsible for integrating all surface water resource related programs into a unified watershed management program working in conjunction with the County's Office of Planning and Zoning, Dept. of Inspections and Permits, the Dept. of Health, and Soil Conservation District. In addition to working in conjunction with the previously mentioned agencies, WERS works collaboratively with the Anne Arundel Watershed Stewards Academy, the RiverKeepers operating within the County, watershed and community associations, other non-government organizations (NGOs) and the citizen and business community to plan and develop projects, track progress, educate, and provide technical assistance in furtherance of pollutant load reduction.

SECTION 8. TECHNICAL DISCREPANCIES AND RECOMMENDED STEPS TO ADDRESS THEM

8.1. MAST

The Anne Arundel County government utilizes a spatially-interfaced pollutant load model with high resolution land cover, impervious cover, soils, and topographic data. Existing and proposed stormwater BMPs and other components of the County's Urban Stormwater Strategy Scenarios (e.g. stream restoration) are spatially identified within the model as pour points (the lowest elevation in a watershed) and their drainage areas delineated and reconciled topologically to the extent possible to minimize overlaps that may lead to double credit accounting. It should be understood that MAST has inherent simplifications that may cause over or under estimation in the pollutant reduction credits. These simplifications relate to assumptions made in MAST as follows:

- Uniform land use, imperviousness, soils, topography, and runoff conditions to all BMPs,
- All BMPs are designed to a uniform water quality treatment standard,
- BMP drainage areas do not overlap, and
- There are no inter-jurisdictional boundary treatments in the BMPs. As an example, an Anne Arundel County stream restoration project constructed by the County may drain and treat some SHA property and vice versa.

Anne Arundel County has worked with the MDE through the WIP II pilot process to identify technical discrepancies and to offer recommended actions to address them. Actions taken thus far to reconcile discrepancies are described below.

- Chesapeake Bay Model 2010 updated land cover and impervious coverage
- Incorporation of the State and Federal lands and the NPDES MS4 jurisdictional boundaries
- Reconciling BMP efficiencies and pollutant load export coefficients/event mean concentrations
- Anne Arundel County developed a comprehensive WIP strategy treatment terrain model that integrates the entire strategy (current, future, credits, and retrofits) in a single topologically correct layer. The BMP acres treatment from this model are now used as input into MAST to address the simplifications related to MAST as stated above and to minimize overlaps.

The above actions have resulted in reduced discrepancy between the 2010 No Action State (MAST) and County (WMT) load accounting from approximately 30% to less than 2%. In addition, the 2025 stormwater urban load estimate by the County WMT model is now within 4% of the MAST estimate with the WMT providing more conservative pollutant reduction estimates.

Currently MAST does not provide a full listing of all BMP types that are approved by MDE in the June 2011 guidance document previously referenced. For purposes of MAST input, Anne Arundel County Government utilized BMPs with similar pollutant removal efficiencies to reflect those BMPs not currently included in MAST. Rooftop and non rooftop disconnect credits are one example. Bioswales were used by Anne Arundel County to describe these disconnect credits in MAST. In addition, catch basin or inlet cleaning was not included in MAST as a BMP scenario option. The County utilized the Mechanical Street Sweeping BMP to describe inlet cleaning in MAST. Recommendations for addressing such discrepancies would include reconciling the MDE June 2011 draft guidance document and the suite of available stormwater BMPs identified in MAST.

8.2. OSDS Strategy

A large discrepancy exists between the MAST results (520,665 lbs of TN) and Anne Arundel County's estimate of the TN Loading from OSDS (1,000,276 lbs of TN) even though the total number of septic systems is similar. This difference occurs because of three issues.

First, Anne Arundel County's estimate uses a more robust surface water GIS layer which results in higher average nitrogen delivery rates. This is due to a greater number of OSDS located in the Critical Areas and especially within 1,000 feet of non-tidal surface water per the County's GIS layer. A July 2010 comparison of the Anne Arundel County estimate and the Chesapeake Bay Program numbers yielded the following results:

	Anne Arundel County	Chesapeake Bay Program
Critical Area:	13,233	12,669
Within 1,000 feet non-tidal waters:	22,019	8,580
Over 1,000 feet from surface water:	5,430	18,017
Total Number OSDS (July 2010):	40,682	39,266

Second, the MAST estimate assumes that all septic systems are generally residential and does not take into consideration non-residential users that may have significantly higher use rates. The Anne Arundel County estimate bases its non-residential use rate on a flow of 1,300 gpd. The County's OSDS Evaluation Study and Strategic Plan estimated the average water consumption for 51 non-residential properties with OSDS and public water to be 2,157 gpd. However the sample size was not considered large enough to apply to all non-residential OSDS properties. Instead, the County's flow factor for commercial property, assuming one acre per non-residential system, was used (1,300 gpd).

Finally, Anne Arundel County's methodology for computing residential OSDS follows MDE's Maryland Policy for Nutrient Cap Management and Trading in Maryland's Chesapeake Bay Watershed (April 17, 2008) to calculate OSDS Hookup Credits. This methodology assumes a load of 30.4 lbs of TN from each residential OSDS before the delivery ratio is applied. Based on the MAST results, it does not appear that the program uses the same method.

Recommended steps to address these issues:

- Update the MAST data to use the County's more refined stream layer,
- Improve the MAST methodology to include estimating non-residential OSDS loads, and
- Create a consistent policy on estimating OSDS load that works with both the WIP and current trading policies.

SECTION 9. CONTIGENCIES FOR SLOW OR INCOMPLETE IMPLEMENTATION

Anne Arundel County concurs with EPA and the State of Maryland and recognizes the need for adaptive management in WIP development and implementation. As discussed in *Maryland's Phase II Watershed Implementation Plan For The Chesapeake Bay, March 30, 2012*, as implementation moves forward goal achievement will need to be evaluated and WIPs modified in response to the rate of progress, additional modeling results, and resource availability. Anne Arundel County will monitor its progress through its various accounting and tracking systems to annually assess whether the rate of implementation is consistent with its WIP strategy and will adapt its efforts accordingly. The establishment of programmatic and implementation 2-Year Milestones will greatly assist in ensuring that the County remains on track for meeting its interim (2017) and final (2025) target loads. If it is determined that a contingency is needed to meet overall nutrient reductions, Anne Arundel County will work with MDE and adjacent counties to refine the concept of "Trading-In-Time."

9.1. Urban Stormwater Strategy

Anne Arundel County took a conservative approach in developing its Urban Stormwater Strategy by structuring it to achieve the Edge of Stream (EOS) Final Target Load derived from the WMT baseline estimate which is higher than the MAST baseline estimates. In addition, the WIP strategy presented thus far only includes restoration and preservation recommendations from the seven completed watershed studies and doesn't capture WIP recommendations for the Little Patuxent, West and Rhode Rivers, Herring Bay, and Middle Patuxent River Watersheds. As the County completes the remaining comprehensive watershed studies by 2015, additional WIP load reduction recommendations will become available. These additional load reduction opportunities will bring the achieved stormwater load below the target allocations and could serve as a contingency if implementation is slow or incomplete.

If it is determined that implementation is significantly lagging behind milestone schedules, the County will revisit the concept of residual designation as a stop- gap measure to ensure the 2025 Final Delivered Target Load is met.

9.2. Overall OSDS Strategy

As noted earlier, the overall OSDS strategy consists of the Large CIP Program, the Small CIP Program, Privately Facilitated Upgrades, and OSDS NRU Upgrades. The Large CIP program is intended to convert approximately half of the existing OSDS to the public sewer system where flow will be treated to ENR levels at one of the County's wastewater treatment plants. This approach should enable compliance with the majority of the septic load reductions required by the TMDL.

However, the magnitude and complexity of the Large CIP program carries many substantial risks and challenges that could impact the implementation schedule. As a contingency against these risks, the other program components will be developed and initiated in parallel with the Large CIP Program. Because of the smaller scope and complexity, the other program components may be able to be initiated more rapidly and will be able to have their program funding adjusted as the overall OSDS strategy develops and is implemented.

Large CIP Program Risks

As the Large CIP Program has been developed, potential risks have been identified. Generally, these risks can be categorized into one of four areas: Internal, External, Organizational, and Project Management. Many risks originate from the influence of outside stakeholders on the project. A brief description on each risk category is provided below.

- Internal Risks are those directly associated with DPW-Engineering's work in developing the technical aspects of project and contract requirements. These include defining the contract areas, the project schedules, defining quality standards, and developing project budgets.

- External Risks are those from organizations or entities outside DPW-Engineering. This includes stakeholders with regulatory or administrative oversight or those with strong personal or business interests.

- Organizational Risks are those associated with DPW and the County government as a whole. These types of risks include funding, staffing, legal authority, interdepartmental coordination, and administrative procedures that may be needed to implement the program.

- Program Management Risks are risks associated with managing the program and interacting with stakeholders. Program management risks include identifying stakeholder requirements, providing communications with stakeholders, monitoring cost and providing project reporting.

At this point in the program it is difficult to develop detailed contingencies since the exact problems have yet to occur. However, a broad listing of the types of challenges is provided below.

Large CIP Program Challenges

The Large CIP program is expected to face numerous challenges due to the magnitude of the program, the large geographical areas to be covered, the high costs, and the sensitive environmental areas where work will be done. In addition, the need for direct involvement with property owners may be an ongoing challenge depending on the methods chosen for funding the program.

Inadequate Funding – Early estimates are approximately $51,000 per septic system converted to public sewer. This cost is based on an average projected cost over time to 2025. The actual costs will vary for each project area due to differences in topography.

The following are key considerations.

- Overall, the large CIP Program is estimated at $760,000,000 for all 11 Priority Management Areas. For perspective, the cost of the septic system conversion program is expected to be nearly three times the cost of the ENR Upgrade Program.
- The County wastewater budget for Fiscal Year 2013 had a total of $916 million for all wastewater projects listed. Therefore, the proposed Large CIP Program strategy would be comparable to the cost of *all* current projects, and would present significant challenges in balancing these projects against other wastewater infrastructure needs in the County.
- Providing funding under the current self-supporting model would be expected to result in significant rate increases across the County.
- Outlays to designers and contractors will be due in the near term to implement the program, while future rate increases or assessments will not cover the interim expenditures. Additionally, increasing future connection fees may not produce a predictable revenue source.
- Long term operational costs will increase due to the significant expansion of the pumping station and collection system.
- If additional financial resources are required from the overall County budget, expenditures in this area will need to be weighed against other demands on the County's fiscal resources.
- The number of OSDS systems that will remain within the Critical Area even after the completion of the large and small system extensions far exceeds the funding support available from the BRF.

Different options will be explored to provide funding support for the Large CIP Program. Among them are the following:

- Legislation to generate revenue to subsidize the Utility Enterprise Fund to help finance expansion of utility infrastructure. This could take the form of a County-level fee similar to the State fee used for the Bay Restoration Fund.
- Because the Bay Restoration Fund (BRF) Grants may be a valid revenue source, realignment of Priority Funding Areas (as designated by the Office of Planning and Zoning) to facilitate the availability of BRF grant funds is recommended.

- The current mix of funding sources needs to be reviewed to cover the initial costs of the program as well as the long-term operational and maintenance costs.

- The County could consider whether private capital can be utilized to fully fund or provide supportive funding for different projects through public-private partnerships.

Inadequate Staffing – Implementing the program requirements will result in project workloads that significantly exceed the current organizational set up in several departments. Within DPW, it is estimated that to support the proposed construction contract workload approximately 15 new project management staff members or supplemental project management staff would be needed.

Several other components of the program will have significant manpower impacts that will need to be monitored and assessed:

- Additional staff time will be required for interacting with stakeholders such as the public and may require an increase in Customer Relations staffing or in administrative support.

- The large increase in the number of pumping stations and the expected use of cluster systems and grinder pumps will require increases in the County Operations and Maintenance Staffing.

- Additional DPW staff or supplemental contract staff will be required for program support and for developing and maintaining stakeholder relationships, providing program guidance and coordination, and providing progress updates.

- Additional staff will be required in Utility Planning for analysis and update of modeling and maintenance of the GIS system.

- Additional staff will be required within DPW Operations – Technical Support Services, to assist with review of contract documents and product submittals during construction

- Additional construction inspection staff within DPW Technical Engineering will be required to support construction management of projects such as those within the Small CIP Program.

- Additional or supplemental staff will be required in the Dept. of Health to provide inspection services for the additional OSDS upgrade systems.

- Additional staff will be required in the Dept. of Inspections and Permits to review and process the large number of capital projects that will result from the program.

- Additional staff will be required within the Office of Planning and Zoning to provide review and coordination for projects in environmentally sensitive areas.

Legal Authority and Administrative Procedures – Legal authority or administrative procedures may need to be enacted by the County Council and/or County Executive to facilitate the work being done and establish how challenges or objections to the program will be fairly addressed. The following types of legislation and procedures appear to be necessary, although in some cases similar code provisions and procedures may already be in place:

- Modification of the current funding model to subsidize the Enterprise Fund.
- Authority for transitioning private systems within planned service areas to the public system and appropriate administrative procedures. This would include consideration of procedure/process for individual homeowners to request relief from hook-up requirements.
- Development of agreement for access of County staff or the County's Contractors onto private property for construction work.
- Development of agreement for access of County Personnel or Contractors onto private property for maintenance purposes.
- Procedure for reviewing challenges to established contract boundaries and lots included in contract.
- Procedure for reviewing challenges to the program schedule and timing of contracts.
- Procedures for working with homeowners that may have a recently installed system or site-specific data that contravenes the underlying program assumptions regarding system performance and/or pollutant migration.

Permitting – The County's topography is challenging and many existing OSDS systems in the Critical Area were initially installed because of the difficulty in reaching available public service. Because of the environmentally sensitive areas, a number of often interrelated permits will be required that can affect the timing of a project. At this time, we anticipate the most difficult permitting issues to be the following:

- Environmentally Sensitive Areas – Most new pumping stations will be constructed at local low spots within the Critical Area and involve disturbance of existing roadways. As noted earlier, the preliminary layouts are still under development, but it is expected that the total number of individual contracts may exceed 100. Therefore, frequent Critical Area Commission involvement is expected, as is a protracted permitting process due to the interdependencies of some permits.
- Stormwater Management Requirements – If these utility projects are classified as new development, compliance with the new stormwater management regulations may be challenging with respect to meeting the requirements for the treatment of existing

impervious area. Much work will be done in older neighborhoods with existing roadways, which may be interpreted as requiring these areas to be provided with new stormwater management controls for existing impervious areas. While these controls are beneficial in the broad application, finding land within individual project areas or even within drainage areas may be difficult. Withholding permit approvals until all areas are acquired may delay projects.

- Shellfish Protection Requirements – State regulations require that certain provisions be installed in new pumping stations to mitigate against the possibility of sewage overflows that could impact shellfish areas. In general, these requirements reflect best engineering practice and are instrumental in preventing sewage overflows. However, some requirements, such as storage tanks, can be land-intensive and locating and/or acquiring the rights to the areas may be difficult in existing neighborhoods.

- Offsite Mitigation – It is expected that acquisition of the necessary land will be a significant schedule challenge. In many instances, compliance with Critical Area and/or stormwater management requirements will need to be resolved through off-site improvements since acquiring the available land area within the project areas may be limited. If permits are not issued until all offsite mitigation properties are identified and acquired, there could be significant delays in implementing projects.

The following recommendations are made with respect to the permitting process

- Establish explicit guidance on the interpretation of the stormwater management regulations with respect to the definitions of disturbance and the Limit of Disturbance for utility projects including water, sewer, and storm drain.

- Examine whether exemptions or waivers can be provided for temporary disturbances such as those associated with linear pipeline utility projects.

- Examine whether the current County procedures could be modified to permit a variation of the single lot application within the Critical Area based upon permanently disturbed area only.

- Enlarge County mitigation banks in watershed areas where septic conversion work is to be concentrated and utilize fee-in-lieu to facilitate project schedules.

- Review approach for providing shellfish protection requirements with MDE to identify alternate approaches such as upstream storage or oversized piping to avoid the land acquisition requirements that may be needed for larger stations.

Public Relations – Educating the public on the benefits of the program and maintaining transparency are expected to be integral to the overall success of the program.

In the County's normal petition process, which is voluntarily initiated by interested homeowners, costs of the project are presented at several phases with costs in the form of a front-foot assessment that would be applied to property taxes. If more than a simple majority of the property owners vote against the project, it does not proceed and is dropped. Recently only a few petition projects have been carried through as most are voted down when the costs are presented. Therefore, even within these interested communities, the costs are frequently more than owners are willing to bear if all costs are passed on to the homeowner through assessments. Because of this, the County will need to consider carefully the funding mechanisms for the program.

While the need for additional staffing has already been mentioned, other key aspects of a successful public relations program are identified below:

- In reviewing similar efforts in other communities, significant public outreach efforts have been made including, public presentations, distribution of information to individual communities, and the development of program websites that provide information, receive questions, and provide program updates through the internet.

- A program website should be set up to present information to the public and provide a "one-stop" location for any information needed by the public such as forms or applications, and relevant enabling legislation.

- Similar programs in areas such as Sarasota, Florida and Lake Havasu, Arizona have received broad public support due to the recognized importance of nearby waterbodies to the local economy. The County should engage with advocacy groups to receive their backing and active support of the program through public education and outreach.

Competing State Objectives – While the overarching State objective is the completion of Maryland's Bay restoration activities within the next 13 years, it is possible that other State objectives (e.g., Priority Funding Areas, Smart Growth policies, financial and procurement requirements) may impact projects. It is not clear at this early stage how the interaction between these objectives and priorities may impact the projects. In general, each additional constraint or requirement placed on the program will impact one of the core project elements of scope, cost, quality, and time. This is not to advocate that there be no consideration of different objectives, but to note that if all requirements or constraints from differing perspectives were given equal weight, it would be difficult to reconcile them in a timely fashion.

One area of concern is related to the impact of funding negotiations or planning reviews on project schedules. While it is understood that the State does not wish to have projects provide incentive for additional growth, the County may decide that accommodating future growth is the appropriate engineering decision and in the County's interests. An example of this is in regards to use of Bay Restoration Funding for connection to public sewer. Based on current legislation,

it would appear that infill lots located within an existing service timing category would not be allowed to connect to a public sewer that has received BRF grants. In this case, these lots would need to install new septic systems in order to accommodate future development. This does not seem consistent with the objectives of WIP nor Smart Growth.

In such situations where there may be some discussion regarding the State's financial participation, the technical and engineering reviews should be able to proceed and permits be issued. The following recommendations are offered for consideration:

- Development of an internal task force or working group within the State to review the procedures that will be applied for administering their respective programs with respect to projects associated with the Bay TMDL. A streamlined and coordinated review process will be needed to administer possibly hundreds of new projects in a relatively short time frame.

- Issues related to planning and funding should be separated from the issuance of construction permits.

Maintaining Program Schedule – It is expected that many related projects will need to start with downstream improvements and work back upstream, adding new connections as the downstream infrastructure is upgraded. Therefore, delays on implementation of some projects can delay entire areas from being converted and significantly disrupt the program schedule.

It is recommended that several formal working groups be established to maintain regular contact with different stakeholder groups. The working groups will focus on reviewing outstanding projects and ensuring that timely decisions are reached on project specific questions.

Working groups will need to be within the County government and external to the County government.

- Formal working groups should be established with the following stakeholders:
    - MDE for discussing of planning, funding, and permitting
    - Critical Area Commission and Office of Planning and Zoning for discussion of permitting issues
    - Inspection and Permits for discussion of permitting issues
    - Homeowners Associations and advocacy groups for discussing project areas and public impacts, and for providing progress updates

Pursuant to this, issue resolution on individual projects would be facilitated if appropriate guidance is provided to project-level staff. Therefore it is recommended that consideration be given to developing appropriate Memorandum of Understandings (MOUs) among County

departments and between the County and other governmental agencies to provide effective direction to project-level staff and enable efficient issue resolution.

SECTION 10. ACCOUNTING FOR GROWTH IN LOADS

Anne Arundel County has utilized its comprehensive zoning coupled with its long range planning holding capacity study to forecast the future growth in loads. For the Urban Stormwater Sector, the County has developed a future load model that takes into account development with protection of regulated natural resources and implementation of Environmental Site Design (ESD) to the Maximum Extent Practical (MEP). In accordance with the State of Maryland Stormwater regulations, parcels identified for development with an existing impervious cover that is less than 40 percent are classified as "new development projects" and mitigation equivalent to ESD volume storage for the entire site will be provided. Parcels with an impervious cover that is more than 40 percent are classified as "redevelopment projects" and mitigation equivalent to 50% of the ESD volume is required for the old impervious and 100% for the new impervious. Following the existing development mitigation policies and regulations, coupled with the current approved Bay BMP efficiencies, will result in modeled ultimate development conditions with approximately 1% increase in the Total Nitrogen load, 7% decrease in Total Phosphorous load, and a 25% decrease in the total suspended sediment load from 2011 Progress Loads. In addition to MDE's ESD to MEP requirements, Anne Arundel County's stormwater management regulations require stable and adequate public facilities and outfalls as a pre-requisite to development projects that increase the 10-year runoff conditions from existing levels. A rapid stream assessment protocol is implemented for all development projects to assess the stability of the downstream conditions. For those projects with unstable downstream areas, the developer is asked as first preference to stabilize the downstream conditions through restoration. Alternatively, but less preferred, the developer is asked to provide additional quantity mitigation upstream to return the 10 year runoff conditions equivalent to "woods in good condition". The development of a fee-in-lieu system to enable restoration of unstable outfalls is a programmatic policy recommendation for this WIP.

The 2025 target load for the Municipal Wastewater Sector dictates Enhanced Nutrient Removal (ENR) treatment levels and allows for an increase to the design capacity that is consistent with the County's strategic Water and Sewer Master Plan. Future increases in design capacity at WRFs may be possible with better treatment technologies that allow for treatment plants to consistently achieve TN concentrations below 4mg/L.

Anne Arundel County is in the process of developing a strategy to mitigate, track and account for future growth in loads. Currently under Maryland's ENR Cap Strategy, flows at Anne Arundel County's major WRFs are allowed to increase to the design capacity of the WRF while establishing a nutrient loading cap and waste load allocations via each facility's NPDES permit. To offset additional future growth beyond the current permitted capacity, Anne Arundel County is investigating the use of MDE's OSDS Hookup Credit. Based on Appendix B of the *Maryland Policy for Nutrient Cap Management And Trading in Maryland's Chesapeake Bay Policy (MDE*

April 2008), nutrient trading credits may be obtained for retiring existing residential OSDS by converting to an ENR facility.

The Sustainable Growth and Agricultural Preservation Act of 2012 (Senate Bill 236) provides an approach for controlling increased nutrient loads from new development with OSDS by creating four tiers of land use categories which are to be used to identify where major and minor residential subdivisions may be located and what type of sewage system will serve them. The intent of the Act is to limit the disproportionate impacts of large subdivisions served by OSDS on farm and forest land, streams, rivers, and the Chesapeake Bay; thus, providing a mechanism to assist in managing the increase in loads from new development. Anne Arundel County's Office of Planning and Zoning will be working in collaboration with other County departments to identify and map the four tiers defined in the Act.

Recognizing the need to offset potential increases in nutrient loads and/or to further reduce loads to achieve and maintain its target load allocation, Anne Arundel County has entered into preliminary discussions with interested stakeholders regarding the concept of nutrient trading. Dialogue on this topic is expected to continue as Maryland moves forward with establishing an Offset Policy. As part of this dialogue Anne Arundel County will work with MDE, Baltimore City, and Howard County to define each jurisdiction's share of the remaining capacity of the Patapsco and Patuxent WRFs.

APPENDIX A

MAST SCENARIOS PRINT OUT

URBAN STORMWATER SCENARIO FOR ANNE ARUNDEL COUNTY MS4 SECTOR (SHEET 1 OF 2)

Scenario 1 and 2 and 3 are the same and represent– 2010 No Action

Compare Scenarios

Geographic Scale:	County with Federal Split
Geographic Area:	Anne Arundel, MD - Non-Federal
Scenario 1:	AnneArundel_2010Noaction_MS4phase1_20111117
Scenario 2:	AnneArundel_2010Noaction_MS4phase1_20111117
Scenario 3:	AnneArundel_2010Noaction_MS4phase1_20111117
Compare to Allocations:	☑
Load Type:	Landuse

Compare

Landuse Acres

	Landuse	Scenario 1 Acres	Scenario 2 Acres	Scenario 3 Acres
	Sector: Agriculture			
		18,947.6	18,947.6	18,947.6
	Sector: Forest			
		114,226.2	114,226.2	114,226.2
	Sector: Urban			
		112,542.0	112,542.0	112,542.0
	Sector: Water			
		1,992.4	1,992.4	1,992.4

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Nitrogen Landuse Loads (lbs)

	Landuse	Scenario 1 Edge of Stream	Scenario 2 Edge of Stream	Scenario 3 Edge of Stream	Allocation Edge of Stream	Scenario 1 Delivered	Scenario 2 Delivered	Scenario 3 Delivered	Allocation Delivered
	Sector: Agriculture								
		196,122.8	196,122.8	196,122.8	109,763.6	194,105.5	194,105.5	194,105.5	107,754.7
	Sector: Forest								
		228,525.3	228,525.3	228,525.3	223,376.2	217,231.2	217,231.2	217,231.2	212,169.8
	Sector: Urban								
	Combined Sewer Systems Land	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Construction	12,600.8	12,600.8	12,600.8	10,256.1	11,571.2	11,571.2	11,571.2	9,342.8
	County Phase I/II MS4	763,533.0	763,533.0	763,533.0	480,687.4	723,795.1	723,795.1	723,795.1	449,640.6
	Extractive	6,745.2	6,745.2	6,745.2	5,924.0	4,967.7	4,967.7	4,967.7	4,339.6
	Federal Developed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Municipal Phase II MS4	36,184.1	36,184.1	36,184.1	21,687.6	36,184.1	36,184.1	36,184.1	21,687.6
	Non-regulated	56,914.6	56,914.6	56,914.6	36,122.0	55,151.8	55,151.8	55,151.8	34,714.5
	Regulated Industrial Facilities	10,001.4	10,001.4	10,001.4	6,336.0	9,491.9	9,491.9	9,491.9	5,947.5
	SHA Phase I/II MS4	69,057.4	69,057.4	69,057.4	44,548.9	64,858.8	64,858.8	64,858.8	41,419.7
	State Phase II MS4	70,408.0	70,408.0	70,408.0	45,330.4	60,386.3	60,386.3	60,386.3	38,470.7
		1,025,444.7	1,025,444.7	1,025,444.7	650,892.3	966,406.9	966,406.9	966,406.9	605,563.0
	Sector: Water								

URBAN STORMWATER SCENARIO FOR ANNE ARUNDEL COUNTY MS4 SECTOR (SHEET 2 OF 2)

Scenario 1 and 2 and 3 are the same and represent – 2010 No Action

	Landuse	Scenario 1 Edge of Stream	Scenario 2 Edge of Stream	Scenario 3 Edge of Stream	Allocation Edge of Stream	Scenario 1 Delivered	Scenario 2 Delivered	Scenario 3 Delivered	Allocation Delivered
		19,594.4	19,594.4	19,594.4	19,594.4	19,085.2	19,085.2	19,085.2	19,085.2

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Phosphorus Landuse Loads (lbs)

	Landuse	Scenario 1 Edge of Stream	Scenario 2 Edge of Stream	Scenario 3 Edge of Stream	Allocation Edge of Stream	Scenario 1 Delivered	Scenario 2 Delivered	Scenario 3 Delivered	Allocation Delivered
	Sector: Agriculture								
		22,598.9	22,598.9	22,598.9	15,924.4	22,235.6	22,235.6	22,235.6	15,618.5
	Sector: Forest								
		7,345.6	7,345.6	7,345.6	7,125.7	6,910.7	6,910.7	6,910.7	6,698.0
	Sector: Urban								
	Combined Sewer Systems Land	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Construction	3,293.7	3,293.7	3,293.7	2,374.4	2,986.3	2,986.3	2,986.3	2,127.6
	County Phase I/II MS4	68,330.6	68,330.6	68,330.6	32,845.7	64,078.2	64,078.2	64,078.2	30,147.2
	Extractive	1,516.1	1,516.1	1,516.1	1,202.2	1,132.3	1,132.3	1,132.3	894.4
	Federal Developed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Municipal Phase II MS4	3,871.5	3,871.5	3,871.5	1,803.1	3,871.5	3,871.5	3,871.5	1,803.1
	Non-regulated	4,211.0	4,211.0	4,211.0	1,909.2	4,086.6	4,086.6	4,086.6	1,827.7
	Regulated Industrial Facilities	1,019.8	1,019.8	1,019.8	508.8	940.7	940.7	940.7	459.0
	SHA Phase I/II MS4	7,207.7	7,207.7	7,207.7	3,686.4	6,456.1	6,456.1	6,456.1	3,221.5
	State Phase II MS4	7,376.4	7,376.4	7,376.4	3,891.8	5,002.7	5,002.7	5,002.7	2,497.3
		96,826.9	96,826.9	96,826.9	48,221.7	88,554.3	88,554.3	88,554.3	42,977.8
	Sector: Water								
		1,195.6	1,195.6	1,195.6	1,195.6	1,131.3	1,131.3	1,131.3	1,131.3

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Sediment Landuse Loads (lbs)

	Landuse	Scenario 1 Edge of Stream	Scenario 2 Edge of Stream	Scenario 3 Edge of Stream	Scenario 1 Delivered	Scenario 2 Delivered	Scenario 3 Delivered
	Sector: Agriculture						
		6,548,387.6	6,548,387.6	6,548,387.6	6,516,528.1	6,516,528.1	6,516,528.1
	Sector: Forest						
		3,619,042.1	3,619,042.1	3,619,042.1	3,436,115.2	3,436,115.2	3,436,115.2
	Sector: Urban						
	Combined Sewer Systems Land	0.0	0.0	0.0	0.0	0.0	0.0
	Construction	1,767,605.8	1,767,605.8	1,767,605.8	1,714,185.6	1,714,185.6	1,714,185.6
	County Phase I/II MS4	19,300,987.0	19,300,987.0	19,300,987.0	18,467,591.9	18,467,591.9	18,467,591.9
	Extractive	926,197.4	926,197.4	926,197.4	845,895.8	845,895.8	845,895.8
	Federal Developed	0.0	0.0	0.0	0.0	0.0	0.0
	Municipal Phase II MS4	1,377,678.9	1,377,678.9	1,377,678.9	1,377,678.9	1,377,678.9	1,377,678.9
	Non-regulated	750,997.4	750,997.4	750,997.4	750,799.2	750,799.2	750,799.2
	Regulated Industrial Facilities	270,299.2	270,299.2	270,299.2	244,361.7	244,361.7	244,361.7
	SHA Phase I/II MS4	2,325,716.5	2,325,716.5	2,325,716.5	2,024,397.7	2,024,397.7	2,024,397.7
	State Phase II MS4	3,384,698.9	3,384,698.9	3,384,698.9	2,158,245.0	2,158,245.0	2,158,245.0
		30,104,181.1	30,104,181.1	30,104,181.1	27,583,155.7	27,583,155.7	27,583,155.7
	Sector: Water						
		0.0	0.0	0.0	0.0	0.0	0.0

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URBAN STORMWATER SCENARIO FOR ANNE ARUNDEL COUNTY MS4 SECTOR (SHEET 1 OF 4)

Scenario 1 – 2011 Progress Scenario 2: 2017 proposed plan Scenario 3: 2025 proposed plan

Scenario List

Compare Scenarios

Geographic Scale:	County with Federal Split
Geographic Area:	Anne Arundel, MD - Non-Federal
Scenario 1:	AnneArundel_2011Progress_MS4phase1+septic_July 2
Scenario 2:	AnneArundel_2017_MS4phase1+septic_July2012
Scenario 3:	AnneArundel_2025_MS4phase1+septic_July 2012
Compare to Allocations:	☑
Load Type:	Landuse

Compare

Landuse Acres

	Landuse	Scenario 1 Acres	Scenario 2 Acres	Scenario 3 Acres
	Sector: Agriculture			
		18,947.6	18,947.6	18,947.6
	Sector: Forest			
		114,226.2	114,620.2	114,915.7
	Sector: Urban			
		112,542.0	112,148.0	111,852.5

URBAN STORMWATER SCENARIO FOR ANNE ARUNDEL COUNTY MS4 SECTOR (SHEET 2 OF 4)

Scenario 1 – 2011 Progress Scenario 2: 2017 proposed plan Scenario 3: 2025 proposed plan

Nitrogen Landuse Loads (lbs)

	Landuse	Scenario 1 Edge of Stream	Scenario 2 Edge of Stream	Scenario 3 Edge of Stream	Allocation Edge of Stream	Scenario 1 Delivered	Scenario 2 Delivered	Scenario 3 Delivered	Alloc Deliv
	Sector: Agriculture								
		196,122.8	196,122.8	196,122.8	109,763.6	194,105.5	194,105.5	194,105.5	107,7
	Sector: Forest								
		228,525.3	229,224.3	229,748.6	223,376.2	217,231.2	217,920.6	218,437.7	212,3
	Sector: Urban								
	Combined Sewer Systems Land	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Construction	12,600.8	12,600.8	12,600.8	10,256.1	11,571.2	11,571.2	11,571.2	9,34
	County Phase I/II MS4	690,763.8	569,411.0	463,778.2	480,687.4	652,054.4	533,641.9	431,308.0	449,(
	Extractive	6,745.2	6,745.2	6,745.2	5,924.0	4,967.7	4,967.7	4,967.7	4,33
	Federal Developed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Municipal Phase II MS4	36,184.1	36,184.1	36,184.1	21,687.6	36,184.1	36,184.1	36,184.1	21,6
	Non-regulated	56,914.6	56,914.6	56,914.6	36,122.0	55,151.8	55,151.8	55,151.8	34,7
	Regulated Industrial Facilities	10,001.4	10,001.4	10,001.4	6,336.0	9,491.9	9,491.9	9,491.9	5,94
	SHA Phase I/II MS4	69,057.4	69,057.4	69,057.4	44,548.9	64,858.8	64,858.8	64,858.8	41,4
	State Phase II MS4	70,408.0	70,408.0	70,408.0	45,330.4	60,386.3	60,386.3	60,386.3	38,4

URBAN STORMWATER SCENARIO FOR ANNE ARUNDEL COUNTY MS4 SECTOR
(SHEET 3 OF 4)

Scenario 1 – 2011 Progress Scenario 2: 2017 proposed plan Scenario 3: 2025 proposed plan

Phosphorus Landuse Loads (lbs)

	Landuse	Scenario 1 Edge of Stream	Scenario 2 Edge of Stream	Scenario 3 Edge of Stream	Allocation Edge of Stream	Scenario 1 Delivered	Scenario 2 Delivered	Scenario 3 Delivered	Alloc Deliv
	Sector: Agriculture								
		22,598.9	22,598.9	22,598.9	15,924.4	22,235.6	22,235.6	22,235.6	15,6
	Sector: Forest								
		7,345.6	7,368.8	7,386.3	7,125.7	6,910.7	6,933.2	6,950.1	6,69
	Sector: Urban								
	Combined Sewer Systems Land	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Construction	3,293.7	3,293.7	3,293.7	2,374.4	2,986.3	2,986.3	2,986.3	2,12
	County Phase I/II MS4	57,448.5	35,415.2	15,639.7	32,845.7	53,570.0	32,589.2	13,834.1	30,1
	Extractive	1,516.1	1,516.1	1,516.1	1,202.2	1,132.3	1,132.3	1,132.3	894.
	Federal Developed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Municipal Phase II MS4	3,871.5	3,871.5	3,871.5	1,803.1	3,871.5	3,871.5	3,871.5	1,80
	Non-regulated	4,211.0	4,211.0	4,211.0	1,909.2	4,086.6	4,086.6	4,086.6	1,82
	Regulated Industrial Facilities	1,019.8	1,019.8	1,019.8	508.8	940.7	940.7	940.7	459.
	SHA Phase I/II MS4	7,207.7	7,207.7	7,207.7	3,686.4	6,456.1	6,456.1	6,456.1	3,22

URBAN STORMWATER SCENARIO FOR ANNE ARUNDEL COUNTY MS4 SECTOR (SHEET 4 OF 4)

Scenario 1 – 2011 Progress Scenario 2: 2017 proposed plan Scenario 3: 2025 proposed plan

Sediment Landuse Loads (lbs)

	Landuse	Scenario 1 Edge of Stream	Scenario 2 Edge of Stream	Scenario 3 Edge of Stream	Scenario 1 Delivered	Scenario 2 Delivered	Scenario 3 Delivered
	Sector: Agriculture						
		6,548,387.6	6,548,387.6	6,548,387.6	6,516,528.1	6,516,528.1	6,516,528.
	Sector: Forest						
		3,619,042.1	3,631,640.9	3,641,090.0	3,436,115.2	3,448,030.7	3,456,967.
	Sector: Urban						
	Combined Sewer Systems Land	0.0	0.0	0.0	0.0	0.0	0.0
	Construction	1,767,605.8	1,767,605.8	1,767,605.8	1,714,185.6	1,714,185.6	1,714,185.
	County Phase I/II MS4	15,013,551.1	0.0	0.0	14,427,314.1	0.0	0.0
	Extractive	926,197.4	926,197.4	926,197.4	845,895.8	845,895.8	845,895.8
	Federal Developed	0.0	0.0	0.0	0.0	0.0	0.0
	Municipal Phase II MS4	1,377,678.9	1,377,678.9	1,377,678.9	1,377,678.9	1,377,678.9	1,377,678.
	Non-regulated	750,997.4	750,997.4	750,997.4	750,799.2	750,799.2	750,799.2
	Regulated Industrial Facilities	270,299.2	270,299.2	270,299.2	244,361.7	244,361.7	244,361.7
	SHA Phase I/II MS4	2,325,716.5	2,325,716.5	2,325,716.5	2,024,397.7	2,024,397.7	2,024,397.
	State Phase II MS4	3,384,698.9	3,384,698.9	3,384,698.9	2,158,245.0	2,158,245.0	2,158,245.

SEPTIC SCENARIO FOR ANNE ARUNDEL COUNTY MS4 SECTOR (SHEET 1 OF 1)

Scenario 1 – 2011 Progress Scenario 2: 2017 proposed plan Scenario 3: 2025 proposed plan

Compare Scenarios

Geographic Scale:	County with Federal Split
Geographic Area:	Anne Arundel, MD - Non-Federal
Scenario 1:	AnneArundel_2011Progress_MS4phase1+septic_July 2
Scenario 2:	AnneArundel_2017_MS4phase1+septic_July2012
Scenario 3:	AnneArundel_2025_MS4phase1+septic_July 2012
Compare to Allocations:	☑
Load Type:	Septic

Compare

Septic Systems

Septic Zone	Scenario 1 Systems	Scenario 2 Systems	Scenario 3 Systems
Critical Area	13,548.2	13,067.4	3,954.2
Within 1000 ft of a perennial stream	22,735.0	22,400.6	16,075.2
Outside of the Critical Area, not within 1000 ft of a perennial stream	5,587.9	5,480.3	3,446.2

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Septic Loads (lbs)

Scenario 1 Edge of Stream	Scenario 2 Edge of Stream	Scenario 3 Edge of Stream	Allocation Edge of Stream	Scenario 1 Delivered	Scenario 2 Delivered	Scenario 3 Delivered	Allocation Delivered
515,009.9	465,140.4	228,388.4	285,595.6	509,260.0	459,861.6	224,413.7	281,664.5

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Percent change in Septic Loads from Scenario 1 to Scenario 2

SepticZone	% Change Nitrogen
Critical Area	-7.5
Within 1000 ft of a perennial stream	-12.0
Outside of the Critical Area, not within 1000 ft of a perennial stream	-7.8

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Percent change in Septic Loads from Scenario 1 to Scenario 3

SepticZone	% Change Nitrogen
Critical Area	-73.6
Within 1000 ft of a perennial stream	-40.9
Outside of the Critical Area, not within 1000 ft of a perennial stream	-44.4

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Percent change in Septic Loads from Scenario 2 to Scenario 3

SepticZone	% Change Nitrogen
Critical Area	-71.4
Within 1000 ft of a perennial stream	-32.8
Outside of the Critical Area, not within 1000 ft of a perennial stream	-39.7

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APPENDIX B

URBAN STORMWATER STRATEGY MAPS

Urban stormwater strategy maps for each of the 12 major County watersheds can be accessed via the link below:

http://www.aacounty.org/DPW/Watershed/WIPdocuments.cfm

Scroll down to "Watershed Level Chesapeake Bay TMDL WIP Strategy Maps (June 2012)"