SUBMITTED FINAL 12/03/10

MARYLAND'S PHASE I

WATERSHED IMPLEMENTATION PLAN

FOR THE CHESAPEAKE BAY

TOTAL MAXIMUM DAILY LOAD

Date:
December 3, 2010











Table of Contents

TABLES **TOC-2**

FIGURES **TOC-2**

EXECUTIVE SUMMARY **ES-1**

INTRODUCTION ..... **i**

1.0 INTERIM AND FINAL NUTRIENT AND SEDIMENT TARGET LOADS **1-1**

2.0 CURRENT CAPACITY **2-1**

3.0 ACCOUNTING FOR GROWTH **3-1**

4.0 GAP ANALYSIS **4-1**

5.0 COMMITMENT AND STRATEGY TO FILL GAPS **5-1**

6.0 TRACKING AND REPORTING PROTOCOLS **6-1**

7.0 CONTINGENCIES FOR SLOW OR INCOMPLETE IMPLEMENTATION **7-1**

8.0 APPENDICES **8-1**

A. Sub-allocation Process for the Chesapeake Bay TMDL……...8-1

Because of Their Size and Technical Nature the Remaining Appendices are Separate Documents

B1. Detailed Targets and Reduction Schedule
B2. Maps of Maryland Chesapeake Bay Watershed
C. NPDES Dischargers in the Maryland Bay Watershed

Stormwater
D. Executed Montgomery County Final Permit
E. Stormwater Data Tracking Fields
F. MD Stormwater Management By Era
G1 SHA 2009 Annual Report
G2. Baltimore County Annual Report, Section 7
H1. MDE 2009 Inspection & Enforcement Data
H2. Baltimore County Stream Restoration Improves Quality of Life
H3. Information on Federal lands

Gap Analyses
I. Gap Analyses

Maryland's Watershed Implementation Plan Public Outreach
J. Compilation of Public Recommendations
K. List of Public Outreach Events and Dates

TABLES

Table 1.1 Total Nitrogen Final Target Load by Source Sector 1-4
Table 1.2 Total Phosphorus Final Target Load by Source Sector 1-4
Table 1.3 Total Sediment Final Target Load by Source Sector 1-5
Table 2.1 Maryland's 2009 Baseline Compared to Draft Allocations..... 2-1
Table 2.2 Historical and Projected Household Size for Maryland..... 2-7
Table 2.3 Total Air Loadings by Major Basin 2-46
Table 3.1 New/Increased Nitrogen Loads From Development 2010 – 2030, Current Trends 3-5
Table 4.1 Comparison of Urban Land Use Estimations for..... 4-2
Table 4.2 Nitrogen Key Statewide Gap Analysis Results..... 4-4
Table 4.3 Phosphorus Key Statewide Gap Analysis Results..... 4-5
Table 4.4 Percentage Reductions Needed from 2009 Progress Baseline to the Final Target Loads by Sector..... 4-5
Table 5.1 Maryland Phase I Plan Summary Table of Strategies 5-5
Table 6.1 MACS Spot-Checks 6-6
Table 6.2 Nutrient Management Plan Enforcement Actions..... 6-9
Table 6.3 Nutrient Management Annual Report Enforcement Actions..... 6-9
Table 6.4 Nutrient Management Plan Field Inspection Enforcement Actions 6-10
Table 6.5 FY 10 Nutrient Management Plan Inspections 6-10
Table 6.6 Fines Related to Nutrient Management Plan Enforcement Actions 6-11
Table 6.7 Agricultural Complaints..... 6-11
Table 6.8 General Concept for MCBIT development 6-21

FIGURES

Figure 2.1 Maryland's 2011 2-Year Milestone for Stormwater Restoration 2-27
Figure 3.1 Regulatory Constraints: An Uneven Playing Field for Development..... 3-3
Figure 3.2 Estimated N Loads from New Development..... 3-4
Figure 4.1 – Basic Concept of Gap Analysis..... 4-2
Figure 4.2 Total Nitrogen Gap Analysis Projected Reductions (Delivered Loads) 4-6
Figure 4.3 Total Phosphorus Gap Analysis Projected Reductions (Delivered Loads) 4-7
Figure 5.1 – Relative Responsibility for Loads to the Bay 5-52
Figure 6.1 Current Tracking and Reporting Scheme..... 6-3
Figure 6.2 Proposed Tracking and Reporting Schema 6-20

EXECUTIVE SUMMARY

Since 1972, Section 303(d) of the federal Clean Water Act has required states to identify waters that do not meet water quality standards and publicly report them on a list published every two years. For each of the listed waters, states are to determine the maximum amount of pollution that the waters can withstand and still meet standards. This maximum amount of pollution is called a Total Maximum Daily Load (TMDL).

In 1996, the U.S. Environmental Protection Agency (EPA) listed certain sections of the Virginia portion of the Chesapeake Bay as "impaired." That is, water quality, most notably dissolved oxygen, was insufficient to fully support aquatic life. Recognizing the low dissolved oxygen in portions of the Upper Bay, Maryland listed all of the upper Chesapeake Bay tidal water segments as not meeting standards for phosphorus, nitrogen (nutrients) and sediments.

In 2000, the Bay watershed partners signed the Chesapeake 2000 Agreement to clearly identify the actions needed to achieve water quality standards. With this Agreement came the understanding that if the voluntary actions taken were not successful in reaching the water quality goals, EPA would complete a TMDL by the end of 2010. Although much progress has been accomplished, it has not been enough to reach the pollution reduction goals. For the past several years, EPA has led a process to develop TMDLs for the Chesapeake Bay.

A multi-jurisdictional TMDL on the scale of the Chesapeake Bay watershed has never been completed before. There will actually be 294 TMDLs, one for each of the three pollutants (nitrogen, phosphorus and sediment) for 98 impaired Bay segments (Maryland drains to 58 of the segments and will be subject to 174 TMDLs).

In recognition of the complexity and scope of this set of TMDLs, EPA determined that the part of the TMDL known as "reasonable assurance of implementation" needed to be significantly enhanced. "Reasonable assurance" is a demonstration that achieving the load reductions required by the TMDL can reasonably be met, that is, current or anticipated resources and commitments are expected to be sufficient.

This Watershed Implementation Plan (Plan), to be referenced by EPA's TMDL for Chesapeake Bay, supports the reasonable assurance of implementation for Maryland's part of the TMDL.

It contains, consistent with EPA guidance, the following elements:

1. Interim and Final Nutrient and Sediment Target Loads
2. Current Baseline Loading and Program Capacity
3. Account for Growth in Loads
4. Gap Analysis
5. Commitment & Strategy to Fill Gaps
6. Tracking and Reporting Protocols
7. Contingencies for Slow or Incomplete Implementation
8. Detailed Tables of Interim and Final Nutrient and Sediment Target Loads

The Final Plan submitted to EPA has been developed and finalized based on consideration of the public's comments and recommendations. Through a transparent and broad series of public meetings and outreach efforts, comments were solicited, carefully reviewed and evaluated. Final recommendations for strategy selection were further evaluated and selected through the Governor's BayStat process, which brings together all of the State agencies that are involved with the Bay TMDL. Maryland's Plan incorporates the strategies to restore and maintain the Bay.

Given significant time constraints and limitations of current data and models, it is almost certain that the TMDL allocations associated with this Phase I Plan will change during Phase II. This Plan serves as a starting point for finer scale planning during the Phase II process and identifies the implementation strategies needed to achieve a healthy Bay for our families and for future generations.

This Executive Summary provides the context for the Phase I Watershed Implementation Plan (Plan), several "Key Highlights" and brief synopses of the seven elements that make up the Plan.

Purpose of Phase I Watershed Implementation Plan

In general, TMDLs set pollutant limits for all sources by dividing, or "allocating," the maximum allowable pollutant loads among those sources.

As a means of gathering allocation information from states for the Bay TMDLs, EPA has requested that states develop Watershed Implementation Plans (Plans). A key function of the Plan is to identify final target loads to be achieved by various pollution source sectors and in different geographic areas. The final target loads will be used by EPA in setting TMDL allocations.

As noted above, the states' Plans also help to provide "reasonable assurance" that sources of pollution will be cleaned up, which is a basic requirement of all TMDLs. In addition, the Plans are part of a new "accountability framework" that EPA is establishing to ensure the TMDL goals are reached in a reasonable timeframe.

A Three-Phased Planning Process

EPA has laid out a three-phased planning process designed to ensure the involvement of interested parties and offer multiple opportunities to refine the Plan over time.

EPA's primary guidance to the states came in the form of two letters to the Chair of the Chesapeake Bay Principal's Staff Committee, comprised of the state agencies responsible for Bay related restoration programs. The first, "Expectations Letter," signed November 4, 2009, laid out EPA's expectations for the three-phased planning process, including the eight elements of the Phase I Plan. The second, "Consequences Letter," signed December 29, 2009, laid out the key actions and deadlines for the states to meet and the regulatory and other consequences that could be triggered if they are not met.

The Phase I Plan is to be developed at the same time as the Bay TMDLs, which are to be completed by December 31, 2010. In addition to setting final target loads that provide EPA the necessary information to establish TMDL allocations, the Plan also sets "interim target loads." EPA has set the year 2017 to achieve 60% of the needed implementation and 2025 as the deadline for achieving final target loads. Maryland committed to achieve the final target loads by 2020. Consistent with this accelerated implementation date, Maryland's Plan is designed to achieve 70% of the Final Target by 2017, which is reflected in this Phase I Plan. It is recognized that the pollutant reductions and full benefits to the Bay from many of those controls, such as tree plantings, will likely not occur until some time after 2017.

A Phase II Plan, to be developed in 2011, will refine the details of the Phase I Plan by providing more geographic specificity regarding target loads. The Phase II Plan will also include greater detail about pollution controls that the State and partners will implement by the end of 2017. The time allotted for the Phase II planning process will allow significantly more interaction between the State and interested partners to refine the Phase I Plan. As part of the Phase II planning process, EPA will allow states to revise the TMDL allocations established in the Phase I Plan, subject to public review.

A Phase III Plan will be developed in 2017 and will address reductions needed from 2018 to 2020 in Maryland. The TMDL allocations may again be revised to reflect better data, a greater understanding of the natural systems and to make use of enhanced analytical tools, such as updated watershed and water quality models.

Key Components

Maryland's Phase I Plan builds on its precedent setting programs to date. Maryland has been the leader in the Bay restoration. Since 1985 we have reduced nitrogen pollution by 33% and phosphorous pollution by 38%. These reductions were realized, even as a 29% increase in population (1.28 million) occurred in the State between 1985 and 2009. Maryland continues to be a leader – the first State to require nutrient management plans on all farms, the first to commit to implement state-of-the-art technology on all of the State's 69 largest wastewater treatment plants, accounting for 95% of our wastewater flow, and the first State to place stringent air pollution controls on power plants required by Maryland's nationally groundbreaking Healthy Air Act, reducing nitrogen emissions by over 75% from coal fired power plants by 2013.

Over the past four years, Maryland has continued its leadership. We have committed to accomplish Maryland's nutrient reduction goals by 2020 and initiated the switch to measuring progress on the Bay in two year increments instead of once a decade. To ensure that progress is transparent, we have established BayStat to measure this progress in real time – allowing all Marylanders to monitor the restoration of the Chesapeake Bay. We were the first state in the watershed to receive federal approval for our Concentrated Animal Feeding Operation program that meets the new EPA regulations and requires comprehensive nutrient management on poultry farms for the first time. Maryland is also the first State in the watershed to require nutrient removal technology for new and failing septic systems in its Critical Area – the land within 1000 feet of the Bay. Maryland created the Chesapeake Bay 2010 Trust Fund to fund cost-effective projects to reduce non-point source pollution with required monitoring that tracks

implementation and progress. Together with Virginia, we restricted the female crab harvest yielding a tremendous increase in recent catches. We have instituted a Marylanders Grow Oysters Program. We recently achieved a record setting commitment by farmers to plant cover crops – one of the most cost effective nutrient reduction practices available. We were the first state in the Watershed to require environmental site design to reduce stormwater runoff on all new development approved after May of 2010 and implemented one of the most progressive set of stormwater requirements for a stormwater (MS4) permit in the Bay Watershed. The hallmark of Maryland's proposed Plan is that it continues and accelerates implementation of these state-of-the-art practices and programs to achieve the needed pollution reductions.

- **Loading and Capacity Gaps:** Loading gaps are estimated for the Interim and Final target loads. Maryland's Interim Target goal is 70% of the Final Target by 2017. These loading gaps reflect resource capacity gaps to meet the load reductions. Although they have significant uncertainty, they reflect the scale of challenge:

  - **Interim Target by 2017:**
    - Nitrogen: Current actions are expected to achieve about 53% of the 70% Interim Target.
    - Phosphorus: Current actions are expected to achieve 80% of the 70% Interim Target.
    - Completing upgrades of the major municipal treatment plants will substantially close these gaps.
    - The Plan details a set of strategies that will meet the 70% reduction goal for nitrogen, phosphorus and sediments; this estimate will need to be confirmed by planned model runs.

  - **Final Target:**
    - There is greater uncertainty regarding this Target, due to the longer timeframe and associated anticipated changes in technology and programs beyond 2017.
    - Because reductions from point sources will be credited between now and 2017, achieving the remaining 30% reduction will largely be accomplished in the non-point source sectors.
    - Using the current pace of reductions for nitrogen as a measure of "capacity," the Plan estimates at least a 3 fold increase in capacity is needed by 2020.

- **Nutrient Offsets:** The Plan commits to adopting nutrient offset policies and programs for septic system and land development loads. Although the approach is not fixed, the Plan proposes a framework that would create incentives for smart growth and a schedule for development and implementation beginning in 2013.

Trading Programs: To enable offsets, a policy framework and technical and administrative implementation systems are needed to ensure nutrient reductions are achieved. The State's point source to point source trading policy was published in April 2008 (http://www.mde.maryland.gov/programs/Water/Pages/water/nutrientcap.aspx). Complementary programs to administer trading and offsets between point sources and agricultural nonpoint sources, that serve as a foundation for development of an appropriate framework for other point

to nonpoint trades, were initiated in September 2010. In addition, the State proposes integrating that framework with broader trading of "ecological services."

- **Public Comment:** The final selection of strategies and contingencies was based on the public comments on the Draft Phase I Plan. Maryland's Draft Phase I Plan presented a list of strategy options for consideration and discussion during the public comment period which closed on November 8th 2010. A large number of organizations and individuals representing sectors ranging from the Building Association to elementary school children submitted 113 sets of comments. Additionally, over 100 e-mails sent from multiple sources, and 100 letters from students and parents were delivered. Two Petitions with over 1,000 citizen signatures were also submitted. Each of the comments has been reviewed and catalogued. The comments focused generally on cost, the need for additional detail regarding implementation, whether the strategies demonstrated reasonable assurance, the challenges associated with Bay restoration and support for the Chesapeake Bay restoration. The comments were enormously instructive and informative regarding the changes needed to the Draft Plan submitted in September. The comments have informed each of the changes made in this Final Plan. Responses to the comments will be compiled in a formal document which will be published prior to December 31, 2010.

- **Strategy for Achieving the 2017 Interim Target:** The Plan lists strategies that will achieve a 70% reduction of the final target load by 2017. These strategies encompass extensions of current 2-year Milestone commitments and additional proposed strategies. Based on public comments, a subset of strategies that were proposed in the Draft Phase I Plan has been selected to meet the Interim Target and are now reflected in the final Phase I Plan.

- **Strategy for Achieving the Final Target**: Three approaches are proposed for achieving the final target by 2020:

    - Develop new technology and approaches prior to 2017. Examples of innovations might include development of seeds and crops that require less fertilizer and processes to reduce ammonia released from poultry manure.
    - Increase the scope of implementation of existing strategies. Examples include upgrading additional small WWTPs, increasing acres retrofitted with stormwater controls; and more efficient urban runoff controls.
    - Improve regulatory requirements to increase reductions achieved.

- **Sediments:** The Chesapeake Bay TMDL requires both nutrient and sediment reductions. Maryland developed its gap closing strategies with the expectation that reduction practices designed to meet the phosphorus target would also likely meet the sediment target. Phosphorous from nonpoint source runoff binds strongly to sediments and, therefore a percentage reduction in one correlates strongly with the other. EPA validated this approach through its determination that Maryland's draft strategy met both the 2017 Interim Target and the 2020 Final Target for sediment.

The remainder of this Executive Summary presents highlights of the seven key sections of the Plan.

Element 1: Interim and Final Target Loads

Based on analyses conducted by the EPA Chesapeake Bay Program, in consultation with the states and other interested parties, nutrient and sediment load limits have been set that are intended to meet water quality standards. These loads have been divided among the Bay states with the understanding that the states will, in turn, allocate them geographically and among source sectors, such as waste water treatment plants, agricultural sources, septic systems and storm water from developed land.

Maryland has used a similar process to divide the loads among regions and source sectors. Briefly, the allocation process first set waste water treatment plant load allocations at levels equal to Maryland's Enhanced Nutrient Removal Strategy for major wastewater treatment plants (and five of the largest minor plants), and caps set in the 2004 Tributary Strategies for minor facilities. Then, nonpoint sources were reduced by equal percentages between "no action" loads and maximum-feasible-reduction loads. In addition, sources closest to the Bay must achieve greater reductions than sources further away This is more cost effective, because the control of sources closer to the Bay has a greater beneficial impact on Bay water quality.

The allocations described above are referred to as "initial" allocations because the models used by EPA are undergoing significant revision this year, which is likely to influence the distribution of loads among source sectors.

The following tables summarize the statewide interim and final target loads for nitrogen, phosphorus, and sediment by major source sector. Interim target loads were developed subsequent to Bay model verification that the reduction strategies selected by Maryland following the public comment process meet the 2017 goal. The Interim Targets presented will meet the 70% goal.

Total Nitrogen Interim and Final Target Loads by Source Sector

Total Nitrogen - By Sector (Million lbs/yr)					
Sector	**2009 Progress**	**Final Target Load**	**% Reduction from 2009 Progress**	**Interim Target Load**	**% Reduction from 2009 Progress**
UrbanReg	5.098	4.184	18%	4.650	9%
UrbanNonReg	0.551	0.444	19%	0.591	-7%
Agriculture	17.713	13.653	23%	16.606	6%
CAFO	0.080	0.070	12%	0.064	20%
Septic	4.007	2.454	39%	2.975	26%
Forest	7.133	7.133	0%	7.149	0%
Air	0.691	0.686	1%	0.698	-1%
WWTP & CSO	14.148	10.462	26%	8.587	39%
Total	**49.421**	**39.086**	**21%**	**41.319**	**16%**

Total Phosphorus Interim and Final Target Loads by Source Sector

Total Phosphorus By Sector (Million lbs/yr)					
Sector	**2009 Progress**	**Final Target Load**	**% Reduction from 2009 Progress**	**Interim Target Load**	**% Reduction from 2009 Progress**
UrbanReg	0.581	0.383	34%	0.513	12%
UrbanNonReg	0.091	0.056	39%	0.095	-4%
Agriculture	1.364	1.196	12%	1.320	3%
CAFO	0.007	0.004	31%	0.005	28%
Forest	0.349	0.349	0%	0.348	0%
Air	0.041	0.040	2%	0.042	-1%
WWTP & CSO	0.871	0.686	21%	0.571	34%
Total	**3.304**	**2.715**	**18%**	**2.892**	**12%**

Total Sediment Interim and Final Target Loads by Source Sector

Total Suspended Solids By Sector (Million lbs/yr)					
Sector	**2009 Progress**	**Final Target Load**	**% Reduction from 2009 Progress**	**Interim Target Load**	**% Reduction from 2009 Progress**
UrbanReg	382	240	37%	307	20%
UrbanNonReg	18	9	49%	20	-11%
Agriculture	787	700	11%	670	15%
CAFO	0.11	0.04	66%	0.10	8%
Forest	191	191	0%	187	2%
WWTP & CSO	8	78	-889%	62	-677%
Total	**1,387**	**1,218**	**12%**	**1,246**	**10%**

Perhaps the most important element of the Phase I Plan is the set of control strategies and associated Interim Target Loads. The control strategies are estimated to be sufficient to achieve the 2017 Interim Target, i.e., 70% of the Final Target load. The strategies to meet the interim target loads are summarized in Element 5 of this Executive Summary.

Element 2: Current Baseline Loading and Program Capacity

The Phase I Plan is required to identify the current baseline loads, the current capacity to reduce pollution and, while accounting for future growth in loads, determine the "gap" in capacity needed to attain the interim and final target loads.

The following table summarizes the most recent baseline loads relative to Maryland's target loads for nitrogen and phosphorus. Reductions of atmospheric deposition from implementation of the federal Clean Air Act were "taken off the top" before states were given their allocations by EPA. Maryland will separately take credit for the Healthy Air Act and adoption of the California low emission vehicle standards.

Maryland's Estimated 2009 Baseline Compared to Target Loads
(Millions of pounds per year)

Nitrogen			**Phosphorus**		
2009 Progress	Draft Allocation	% Reduction	2009 Progress	Draft Allocation	% Reduction
49.42	39.09	20.9%	3.30	2.72	17.8%

The Plan describes current legal, regulatory, programmatic, financial, staffing and technical capacity for each of the major source sectors accounted for in the Bay TMDL. These sectors are itemized below:

- Wastewater (including federal facilities):
  - Major Municipal Treatment Plants (design flow equal to or greater than 500,000 gallons/day flow)
  - Minor Municipal Treatment Plants (design flow less than 500,000 gallons/day flow)
  - Major Industrial Plants (load equal to a major municipal plant)
  - Minor Industrial Plants
- On Site Sewage Disposal Systems (Septic Systems)
- Regulated Stormwater
- Sediment and Erosion Control
- Concentrated Animal Feeding Operations (CAFOs)
- Agriculture
- Atmospheric Sources
- Other Sources

The capacity analysis for the Phase I Plan is limited to State resources. For programs administered by local governments, and federal agencies (i.e. USDA NRCS) substantial additional analyses will be necessary as part of the Phase II Plan. However, a broad quantitative sense of the current capacity, relative to the reduction goals, can be gained from the loading gap analysis described below.

Element 3: Accounting for Growth in Loads

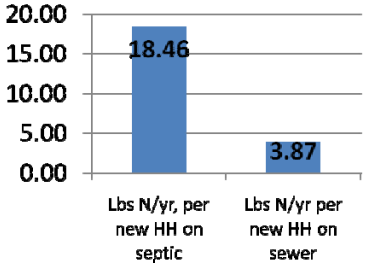
In determining the pollutant load reductions to meet the interim and final target loads, it is necessary to account for future growth. Broadly speaking this can be done in two ways. First, future loads can be estimated and included in quantitative load reduction analyses. Second, policies and programs can be adopted to ensure all future load increases are offset by commensurate load reductions on an as-needed basis.

This Plan uses both approaches. The Plan uses future projections of loads in the calculations used to set strategies for achieving the interim target loads by 2017. This is described further in the next section on the gap analysis.

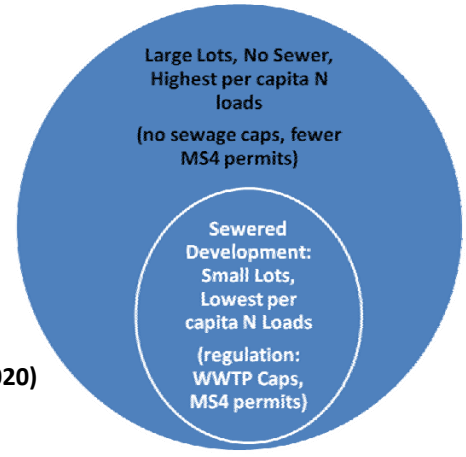
The Plan also offers a schedule for adopting nutrient offset programs for septic system and land development loads. This will build on existing nutrient trading policies and programs. Current trading programs include point-to-point trading and point-to-nonpoint (primarily agricultural sector). The Plan also includes pursuing multi-ecosystem services trading. These approaches would strengthen the market for a more robust trading program for nutrient and sediment management for the Bay.

The proposed approach for offsetting future loads would use different degrees of offsets in three different types of places. Areas with high loads per capita would need to offset loads to a higher degree than areas with low loads per capita. A third category would fall in between. Areas with sewer service and higher density of homes and jobs, served by state of the art sewage treatment, will tend to have lower per capita loads. Areas with low density development on well and septic systems would tend to have higher per capita loads.

In addition to the federal requirement to offset loads, a quantitative analysis of the potential implications of not offsetting future loads in the following example provided by the Maryland Department of Planning, shows that offsetting is needed to accomplish the necessary loading reductions. The example shows that, per household, the load from new development on well and septic is almost 5 times higher than new loads from sewered areas.



263,225 Additional Households Forecasted in Maryland (2010 -2020)
29% served by septic tanks
71% served by ENR WWTP



Element 4: Gap Analysis

The gap analysis addresses several issues. It estimates the loading gap in achieving 70% of the target load by 2017, and the loading gap in achieving the final target load, both of which account for future projected growth in loads. It also provides a broad estimate of the gap in resources, or "capacity," to achieve these target loads.

It is important to understand that these estimates are general and subject to potentially significant changes due to anticipated changes in EPA's watershed model and the underlying data. In addition, the "gaps" depend on the pollution control strategies selected, because the strategies influence the source sector allocations. The gaps reported in this Plan are based on the initial allocation described above.

The Bay TMDL calls for reductions of 20.9% in nitrogen and 17.8% in phosphorus from the 2009 baseline load.

The gap analysis for the 2017 interim goal is summarized in Table A for nitrogen. The edge-of-stream (EOS) loads reflect local loading, whereas, the "delivered" loads account for transport losses as nutrients work their way to the Bay.

Table A
Nitrogen
Key Statewide Gap Analysis Results

Summary Values (million lbs/yr)	Delivered	EOS
Statewide Target	39.09	53.99
2009 Baseline Load	49.42	68.20
2017 70% Goal	42.19	58.22
2017 Reduction Needed	7.22	9.98
2017 Current Capacity Reduction	3.85	5.31
2017 Remaining Reduction Gap	3.39	4.68

The broad implication is that an 88 percent increase in capacity is needed to meet the Interim Target for nitrogen. That is, we have the capacity to reduce about 3.85 million pounds of the 7.22 million pound 2017 reduction goal, leaving a 3.39 million pound reduction gap for which additional capacity is needed (3.39/3.85 = 0.88). Most of this capacity need would be filled by upgrading the major WWTPs.

Table B provides the key statewide findings for phosphorus.

Table B
Phosphorus
Key Statewide Gap Analysis Results

Summary Values (million lbs/yr)	Delivered	EOS
Statewide Target	2.72	3.43
2009 Baseline Load	3.30	4.16
2017 70% Goal	2.89	3.64
2017 Reduction Needed	0.412	0.519
2017 Current Capacity Reduction	0.328	0.413
2017 Remaining Reduction Gap	0.084	0.106

The broad implication is that a 26 percent increase in capacity is needed to meet the Interim Target for phosphorus. That is, we have the capacity to reduce about 0.328 million pounds of the 0.412 million pound 2017 reduction goal, leaving a 0.084 million pound reduction gap for which additional capacity is needed (0.084/0.328 = 0.26). As with nitrogen, most of this capacity need would be filled by upgrading the major WWTPs.

These findings mask the implications for nonpoint source sectors which need greater capacity enhancements than indicated above. Because the point source sector is on track to achieve most of the reduction needed by 2017, the remainder of the gap to achieve the final 2020 Target must be addressed by nonpoint sources. The dominant role of the point source sector in achieving the 2017 goal is depicted in Figure A. Even without accounting for additional reductions in 2016 that could be achieved with full funding of upgrades of the remaining major WWTPs with ENR, the point source reductions are by far the most significant. The agricultural strategies are providing the most significant decrease in the nonpoint source sector.

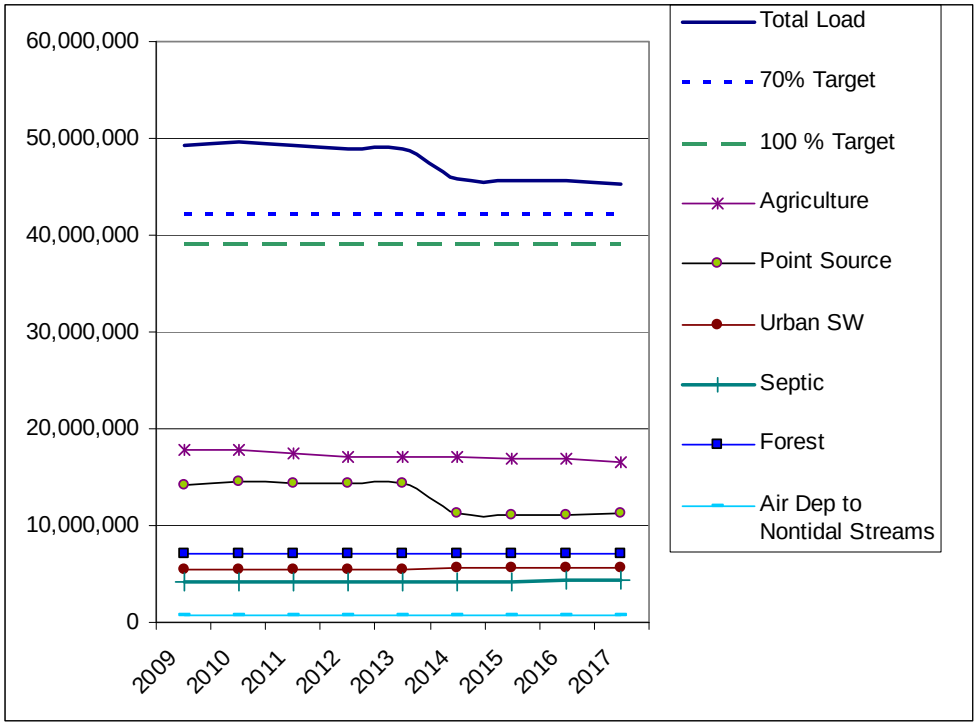


Figure A: Statewide Nitrogen Gap Analysis Projected Reductions (Delivered Loads)

Beyond achieving the 2017 Interim Targets, gaps for nitrogen and phosphorus remain between 2017 and 2020. This additional gap is 3.07 million lbs for nitrogen and 0.166 million lbs phosphorus. As noted above, the nonpoint source sectors will need to close this gap, because most of the point source strategies to reduce loads will be implemented by 2017.

The notion of "Bay Restoration" implies two key factors. First, excessive pollutants must be reduced. Second, load caps must be maintained. Additional resource capacity will be needed for both. The following estimate addresses the resource implications for reductions and notes qualitative implications for maintaining load caps.

Table C
Capacity Increase Needed to Meet Nitrogen Final Target

Source Sector	Number of Years to Meet Final Target with Current Capacity	Multiple of Current Capacity Needed to Meet the Final Target Goal by 2020
Agriculture[1]	25	2 - 4
Urban Stormwater[2]	40	3 - 4.0
Septic Systems[3]	46	4.6

1 This assumes a reduction in delivered load from 17.7 million to 13.8 million at 100,000 lbs EOS reduced per year.
2 This assumes a reduction in delivered load from 5.6 million to 4.5 million at about 16,000 lbs EOS per year.

3 This assumes a 15% reduction goal for septic systems thus reducing the delivered load from 4 to 3.4 million.

Although these are coarse estimates, they give a sense of the scale of effort needed to achieve the nitrogen loading goals in the given time-frame. These investments will significantly improve the Bay and the many rivers draining to the Bay. Investments of this scale will likely generate efficiencies that lower some costs, septic system upgrades being one example. Last, the scale of this endeavor must be viewed at a larger economic context – the economic value of a restored Bay and the job generation associated with the work to restore it.

Element 5: Commitment & Strategies Selected to Fill Gaps

This section of the Plan identifies a broad range of reduction strategies to achieve the 2017 Interim Target (70% of the Final Target Load). The 70% Interim Target for nitrogen is a 7.22 million pound reduction. The 70% Interim Target for phosphorus is a 0.41 million pound reduction. According to the results from the Chesapeake Bay Program the estimated reductions associated with those strategies is approximately 8.05 million pounds for nitrogen, 0.41 million pounds for phosphorus and 146 million pound reduction for total suspended solids.

Implementation of the MD strategies is projected to reduce more nitrogen than is needed to meet the 70% Interim Target for nitrogen and just meet the goal for phosphorus. The nitrogen goal is exceeded because most of the reduction strategies remove both nitrogen and phosphorus and the high level of implementation needed to achieve the phosphorus goal automatically results in more nitrogen reduction than is necessary. This gives the plan an even higher degree of reasonable assurance that MD will meet the 70% Interim Target for nitrogen.

The Plan describes enforceable and otherwise binding means to ensure controls are implemented, the primary resource needs both for implementation and compliance verification. This is described further in the Tracking and Reporting section (Element 6).

For the Final Target loads, a wide range of pollution reduction controls are included in this Plan, beyond the strategies selected to meet the 2017 load reduction targets. Many of these strategies for the Final Targets are considered contingencies and are listed under Element 7. These are not quantified and would require additional research to determine their viability.

The strategies are presented in the following table.

Maryland Watershed Implementation Plan: Summary Table of Strategies

Strategy	Description	Units	2010-2011	2012-2017	Total	Estimated Cost
Point Sources						
Major WWTPs (Not including Blue Plains)	Upgrade 68 Wastewater Treatment Plants to Maryland's Enhanced Nutrient Removal (ENR) standards. At the current rate of implementation, 24 plants will be operational by June 30, 2011, accounting for an estimated 740,000 lbs/year reduction in nitrogen. Full funding is available for implementation of the 2011 Milestone. The State projects it will be able to provide funding to maintain the construction schedule for upgrade projects through FY 2012. In 2011, determine all options to close the Bay Restoration deficit including consumption and income based strategies. In 2012, pursue statutory change to amend Bay Restoration Fund fee to provide funding needed to complete the upgrades for FY2013.	plants	24	44 (Of which, funding has been committed to 8 plants)	68 (66 majors not including Blue Plains + 2 private)	All major WWTPs not including Blue Plains $2.461 B 36 Facilities $1.186 B (Not upgraded yet and need funding commitments)
Blue Plains Waste Water Treatment Plant Upgrades	Complete BNR facilities at the Blue Plains Wastewater Treatment Plant to achieve a nitrogen reduction of 190,000 lbs/yr. Facility is on schedule for ENR upgrade by 2015 and will result in a total nitrogen reduction of approximately 875,000 lb/yr expected by 2017	plants	1	1	1	$402 M
Major Industrial	Continue Retrofits and Optimization at Major Industrial Treatment Plants to meet the Tributary Strategy load cap.	plants		11	11 (9 major facilities + 2 Dredged Material Containment Facilities)	
Minor Industrial	Identify loading targets and issue schedules in permits by 2017 for reductions of approximately 23.5%, representing approximately 143,000 lbs/yr reduction, for minor industrial sources	plants		477	477	

Strategy	Description	Units	2010-2011	2012-2017	Total	Estimated Cost
Federal facilities - major	Continue ENR Retrofits at Major Federal WWTPs in accordance with July 2006 MOU with DOD. Originally 7 facilities, 3 of which were privatized (1 of the 3 is included in Major Municipal List: APG Main); remaining 2 private plants are included in this count, for a total of 6.	plants		6 Total: 4 federal 2 privatized	6	
Upgrade Large Minor Municipal WWTPs (0.1-0.5 MGD)	Evaluate feasibility of the largest minor municipal WWTPs for potential upgrade based on flow, load, capacity needs, community interest, technical feasibility and cost-effectiveness. Select 5 plants, with approximately 1.0 million gallons per day discharge flow for upgrade by 2017, with estimated nitrogen load reduction of about 45,000 lbs/yr. Cost of upgrade to ENR roughly $58 M.	plants		5	5	$58 M
Eliminate Sewer Overflows	Older combined sewer systems designed to collect and transport sewage to treatment plants during dry weather also serve as stormwater drains during rain events. Once combined sewers are full,, the blended effluent is discharged to waterways resulting in Combined Sewer Overflows. Sanitary sewer overflows occur when pipes or pumping stations fail and let sewage spill into waterways. Eliminate overflows through consent orders requiring system repair and upgrades and penalties assessed when failures occur. Long-term control plans are in place. Costs are the MD portion of the EPA's 2008 Clean Watershed Needs Survey	Systems		4	4	CSO: $0.463 B SSO: $1.374 B

Strategy	Description	Units	2010-2011	2012-2017	Total	Estimated Cost
Urban Stormwater						
MS4 Phase I Permitted Counties	Renew permits to require Nutrient and Sediment reductions equivalent to stormwater treatment on 30% of the impervious surface that does not have adequate stormwater controls for MD's largest counties subject to Phase I Municipal Separate Storm Sewer System (MS4) Permits. In 2011, convene workgroup to determine funding options, schedules, and most cost effective practices with local government. In 2012, if local utilities or other systems of charges are not being implemented, seek legislation requiring local stormwater utilities. Alternative cost effective practices include forest buffer planting, stream restoration, wetland restoration, pavement removal and operational practices. Selection of practices and timing of implementation will be based on cost-effectiveness, pollutant removal efficiency and maximizing available funding.	Nutrient and Sediment Reductions Equivalent to treatment of 30% pre-1985 impervious surface acres	10%	20%	30%	$2.614 B
SHA MS4 Phase I and II	Renew permit to require Nutrient and Sediment reductions equivalent to stormwater treatment on 30% of the impervious surface that does not have adequate stormwater controls Develop work plan to meet nutrient and sediment reduction goals through system retrofitting and equivalent alternative practices and trading in 2011. Alternative practices include forest buffer planting, stream restoration, wetland restoration, pavement removal and operational practices. Selection of practices and timing of implementation will be based on cost-effectiveness, pollutant removal efficiency and maximizing available funding.	Load reduction equal to 30% per-1985 impervious surface acres .	0% MS4 Phase I 0% MS4 Phase II	30% in MS4 Phase I areas 20% in MS4 Phase II areas	30% in MS4 Phase I areas 20% in MS4 Phase II areas	$1.0 B

Strategy	Description	Units	2010-2011	2012-2017	Total	Estimated Cost
MS4 Phase II (CE and WA Counties, larger municipalities, and federal facilities)	Require Nutrient and Sediment reductions equivalent to stormwater treatment on 20% of the impervious surface that does not have adequate stormwater controls in smaller jurisdictions (less populated counties and municipalities) through required Phase II MS4 permits.	Nutrient and Sediment Reductions Equivalent to treatment of 20% pre-1985 impervious surface acres		20%	20%	$365 M
Existing Urban Nutrient Management Law	Regulate fertilizer applications on 220,000 acres of commercially managed lawns (for example, golf courses and athletic fields) through Maryland's Nutrient Management Law.	acres (annual)	220,000	220,000	220,000	$0.69 M
Enhanced Urban Nutrient Management	Require modification of lawn fertilizer formulation to eliminate phosphorus to the extent practicable and to require the use of slow release nitrogen fertilizers on lawns and managed turf. Additional options to receive reductions are addressed.	acres (annual)		220,000	220,000	
Regenerative Stormwater Conveyance	Implement stream restoration and connection to the flood plain to mimic natural stream conditions and provide a nutrient and sediment reduction	linear miles		12	12	Included in MS4 costs
Rural Residential Tree Planting	Increase rural resident tree planting and homeowner association property including conversion of turf grass to tree covers. May also consider mandatory stream and waterway buffers.	acres		600	600	$5.25 M (Included in MS4 costs)

Strategy	Description	Units	2010-2011	2012-2017	Total	Estimated Cost
Urban Tree Canopy	State is implementing urban tree canopy goals based on reasonable expectations in gains by accounting for available lands and hydrologic flow paths in urban areas. The intent of the urban tree canopy was to target half of the older developed areas, particularly those developed prior to stormwater management, where urban trees may be particularly valuable for water and air quality. Urban tree canopy is defined as at least 100 trees to an acre	acres		1,200	1,200	$36 M (Included in MS4 costs)
Septics						
Continue Upgrade of new and failing Septic Systems in the Critical Area	Retrofit 5,700 septic systems by 2017 with current program using best available technology	systems	2,100	3,600	5,700	80.5 M
Septic hookups to ENR plants	Connect failing septic systems to Wastewater Treatment Plants with advanced nutrient removal technologies.	systems	704	226	930	35.7 M
Require upgrade all systems in Critical Area	In 2011, assess options to phase in requirement to retrofit all septic systems in the Critical Area using best available technology (the land within 1000 feet of tidal waters) beginning in 2012. Assessment to include viability of tax credits, income based criteria for grant eligibility and other means to facilitate upgrades. (BAT upgrade of additional 27,552 systems in Critical Area for a total of 32,379) Initiate phase-in in 2012.	systems		27,552	27,552	358.2 M

Strategy	Description	Units	2010-2011	2012-2017	Total	Estimated Cost
Agriculture-	**Managing the Land to Improve Water Quality**					
Cover Crops	Plant 180,000 acres of commodity and 175,000 acres of traditional cover crops. Cover crops are small grains such as wheat or rye that are planted in the fall after the harvest of corn, soybeans and other summer crops to absorb unused fertilizers that may remain in the soil. Cover crops also provide a ground cover to prevent soil erosion in the winter. The Maryland Agricultural Water Quality Cost Share Program implements this program with funding from the Chesapeake Bay Restoration Funds, 2010 Trust Fund and targeted Federal grants.	acres (annual)	325,000	355,000	355,000	$107.4 M
Soil Conservation & Water Quality Plans	Develop Soil Conservation and Water Quality Plans on an additional 257,049 acres. Develop a comprehensive plan for a farm that addresses natural resource management on agricultural lands and recommends best management practices (BMPs) that control erosion and sediment loss and manage nutrient runoff. 764,630 acres of Maryland farm land will be managed under a current SCWQP. Farmers may receive technical and financial assistance to install BMPs.	acres (annual)	764,630	764,630	764,630	$11.7 M
Conservation Tillage	Conservation Tillage involves planting and growing crops with minimal disturbance of the surface soil. No-till farming, a form of conservation tillage, is used to seed the crop directly into vegetative cover or crop residue with no disturbance of the soil surface. Minimum tillage farming involves some disturbance of the soil, but uses tillage equipment that leaves much of the vegetative cover or crop residue on the surface. The potential is 764,630 acres.	acres (annual)	764,630	764,630	764,630	
Continuous No-Till Conservation	Of the 764,630 acres in conservation tillage maintain 150,000 acres of continuous no-till farming, a form of conservation tillage in which seed is applied into the vegetative cover or crop residue with no disturbance of the surface soil. Conservation Tillage involves planting and growing crops with minimal disturbance of the surface soil. No-till farming, a form of conservation tillage, is used to seed the crop directly into vegetative cover or crop residue with no disturbance of the soil surface. Minimum tillage farming involves some disturbance of the soil, but uses tillage equipment that leaves much of the vegetative cover or crop residue on the surface.	acres (annual)	150,000	150,000	150,000	$3 M

Strategy	Description	Units	2010-2011	2012-2017	Total	Estimated Cost
Water Control Structures	Construct Water Control Structures on 7,250 acres. These structures are used in constructed drainage systems to control water depth and flow rates. They also increase water retention and decrease the quantity and quality of pollutants downstream. Cost-Share funds are available for the installation of these structures through the Maryland Agricultural Water Quality Cost-Share (MACS) program and USDA's Environmental Quality Incentives Program (EQIP).	acres	2,050	5,200	7,250	$0.98 M
Stream Protection with Fencing	Protect 3,800 acres of Pastureland Using Fencing. Pasture fencing keeps farm animals out of streams and prevents streambank erosion. Cost-Share funds are available for the installation of these systems through the Maryland Agricultural Water Quality Cost-Share (MACS) program and USDA's Environmental Quality Incentives Program (EQIP).	acres	3,000	800	3,800	$0.35 M
Stream Protection without Fencing	Utilize Stream Protection without Fencing on 3,000 acres. Watering troughs provide a safe, reliable source of water for livestock that is away from streams. The troughs help protects stream banks from erosion that may be caused by farm animals. Cost-Share funds are available for the installation of these systems through the Maryland Agricultural Water Quality Cost-Share (MACS) program and USDA's Environmental Quality Incentives Program (EQIP).	acres	1,800	1,200	3,000	$0.37 M
Streamside Grass Buffers	Plant 7,000 acres of Streamside Grass Buffers on Private Lands. Grasses planted next to waterways filter and take up nutrients coming off the land, stabilize the soil and provide wildlife habitat. Cost-Share funds are available for the implementation of grassed buffers on agricultural land through the Maryland Agricultural Water Quality Cost-Share (MACS) program, 2010 Chesapeake Bay Trust Fund and USDA's Conservation Reserve Enhancement Program (CREP).	acres	1,600	5,400	7,000	$1.27,M

Strategy	Description	Units	2010-2011	2012-2017	Total	Estimated Cost
Streamside Forest Buffers	Plant 3,000 acres of Streamside Forest Buffers on Private Lands. Trees planted next to waterways filter and take up nutrients coming off the land, stabilize the soil and provide wildlife habitat. Cost-Share funds are available for the implementation of riparian forest buffers on agricultural land through the Maryland Agricultural Water Quality Cost-Share (MACS) program, 2010 Trust Fund and USDA's Conservation Reserve Enhancement Program (CREP).	acres	500	2,500	3,000	$4.9 M
Wetland Restoration	Construct 1,000 acres of Wetland Restoration on Private Lands. A wetland is an area of land where the soil is wet or covered with water. Wetlands are often called swamps, marshes, or bogs. Cost-Share funds are available for the implementation of wetlands on eligible agricultural land through the Maryland Agricultural Water Quality Cost-Share (MACS) program, 2010 Chesapeake Bay Trust Fund and USDA's Conservation Reserve Enhancement Program (CREP). Funding for wetlands creation, restoration, and enhancement is also available from various federal sources, State and local governments and nonprofit organizations.	acres	550	450	1,000	$3.375 M
Retire Highly Erodible Land	Retire 2,300 acres of Highly Erodible Land on Private Lands. Land that is especially vulnerable to erosion is removed from crop or hay production and is planted in either grass or forest. This land usually is not disturbed for at least 10 years. Cost-Share funds are available for the retirement of highly erodible agricultural land through the Maryland Agricultural Water Quality Cost-Share (MACS) program, 2010 Chesapeake Bay Trust Fund and USDA's Conservation Reserve Enhancement Program (CREP).	acres	1,800	500	2,300	$3 M
Cropland Irrigation Management	Crop irrigation is used to decrease climatic variability and maximize crop yields. This results in a decrease in runoff and an increase in the crop's ability to uptake nutrients therefore less available for nutrient runoff. Yields are 20% to 25% higher than in un-irrigated fields. Nutrient uptake of irrigated acres are greater, resulting in less residual nutrients remaining in the soil for runoff.	acres (annual)		40,616	40,616	$1.2 M

Strategy	Description	Units	2010-2011	2012-2017	Total	Estimated Cost
Vegetative Environmental Buffers	A vegetative environmental buffer, or VEB, is the strategic planting of combinations of trees and shrubs around poultry houses to address environmental, production, and public relations issues by providing a vegetative filter to lower emissions of ammonia, dust, odor, feathers, and noise on a potential of 75 acres. In addition to offering a practical, efficient, and cost-effective means of capturing emissions, a properly designed VEB program can help to conserve energy and reduce air-borne pathogens by offering shade and slowing wind speeds, as well as create a more attractive landscape and screen routine operations from view.	operations	50	250	300	$0.75 M
Vegetated Open Channels	A suite of innovative alternative practices designed to enhance the removal of nutrients once they leave the field. These include increasing vegetative buffers that protect ditches from sediment and nutrient runoff. This may include reengineering of drainage channels to reestablish floodplains or redirect storm flows to wetland areas.	acres		1,212	1,212	$1.8 M
Stream Restoration Non-Coastal Plain	Restoration of drainage channels and streams utilizing stream recreation techniques. Options include in stream and riparian wetlands, designing channels to reestablish natural flow paths, and establishing habitat.	miles		2	2	$0.9 M

Strategy	Description	Units	2010-2011	2012-2017	Total	Estimated Cost
Agriculture-	**Managing Animal Wastes and Phosphorus**					
Addressing the Phosphorus Imbalance- Alternative uses of manure and revision of the P Site Index for nutrient management	Addressing the phosphorus balance requires a systematic approach to provide tools and technology that will work synergistically for the farmer and the environment. Maryland's goal is to provide sufficient soil phosphorus availability for agronomic optimum crop production while simultaneously minimizing the potential for off-site phosphorus losses from agricultural production fields to natural water bodies. The State of Maryland will support development of a revised P Site Index that incorporates the best available science in an effort to more appropriately identify the risk for phosphorus loss from agricultural lands. The expected revisions of the current P Site Index will more accurately assess P transport and delivery pathways across different landscapes, will incorporate site-specific soil P saturation information, and emphasize the importance of immediate manure and biosolids incorporation following land application. Initial preliminary review of probable revisions to the P Site Index indicates significant reductions in cropland eligible to receive additional phosphorus, particularly in areas of historically high concentrations of animal agriculture. These outcomes require management solutions that must also include economically viable alternative uses of animal manures, biosolids and other organic wastes. Development of market-based solutions that include value-added or energy-related technologies is essential.					
Manure Transport	Transport an additional 10,000 tons of manure out of the watershed for 2010-2011 and an additional 25,000 tons for 2012-2017. Excess manure is transported away from farms with high soil phosphorus levels to other farms or locations that can use the manure safely. 50% of the funding for this program is available through the Maryland Agricultural Water Quality Cost Share Program (MACS). The remaining 50% of the funds is provided by Special Funds (Poultry Companies match). Cost-share is also provided for transporting excess manure from Dairy operations.	tons (annual)	60,000	85,000	85,000	$6.75 M

Strategy	Description	Units	2010-2011	2012-2017	Total	Estimated Cost
Dairy Manure Incorporation Technology	Implement Dairy Manure Incorporation Technology on 2,500 acres for 2010-2011 and an additional 2,500 acres for 2012-2017. Dairy manure is incorporated into the soil at the time of application utilizing low disturbance technology. Ammonia loss from incorporation will be reduced up to 95% compared to surface application. Initial cost-share funding is through a demonstration grant supported by the Chesapeake Bay Trust (CBT). Evaluation by MDA and NRCS technical workgroups for cost-share funding will be done to determine eligibility for cost-share funding through the Maryland Agricultural Water Quality Cost-Share (MACS) program and USDA's Environmental Quality Incentives Program (EQIP).	Acres (annual)	2,500	5,000	5,000	$0.78 M
Poultry Litter Incorporation Technology	Use Poultry Litter Incorporation Technology on 2,500 acres. Poultry litter is incorporated into the soil at the time of application utilizing minimum disturbance technology which significantly reduces ammonia loss. Initial 2 years of funding through USDA Conservation Innovative Grants (CIG) and National Fish and Wildlife Foundation (NFWF) grant sources.	acres (annual)		2,500	2,500	$0.35 M
Poultry Waste Structures	Construct 53 Poultry Waste Structures. These structures protect poultry waste from rain so that it can be used as a crop fertilizer when conditions are right or transported to another location. Cost-Share funds are available for the installation of these structures through the Maryland Agricultural Water Quality Cost-Share (MACS) program and USDA's Environmental Quality Incentives Program (EQIP).	structures	50	3	53	$0.48 M
Livestock Waste Structures	Construct 145 Livestock Waste Structures. Animal waste is stored in structures to protect it from the weather until it can be used as a crop fertilizer when conditions are right or transported to another location. Cost-Share funds are available for the installation of these costly systems through the Maryland Agricultural Water Quality Cost-Share (MACS) program and USDA's Environmental Quality Incentives Program (EQIP).	structures	80	65	145	$5.5 M

Strategy	Description	Units	2010-2011	2012-2017	Total	Estimated Cost
Runoff Control Systems	Construct 180 Runoff Control Systems. Runoff control systems use a variety of techniques to direct rainwater to places where it won't cause nutrient runoff or soil erosion. Gutters and downspouts on barns and grading of the land are examples of ways to direct runoff from rainfall. Cost-Share funds are available for the installation of these systems through the Maryland Agricultural Water Quality Cost-Share (MACS) program and USDA's Environmental Quality Incentives Program (EQIP).	systems	75	105	180	$0.22 M
Phytase	With the advent of phytase addition to the diet and feed for all poultry in Maryland we have seen a steady reduction in the phosphorus levels in the manure. In early 2004 the Bay Program documented a 16% reduction in P. More recent results show a 24% reduction. The research shows up to a 33% reduction is easily achievable. 16% is the current reduction efficiency in the model. This efficiency will be increased to a 24% reduction efficiency adjustment immediately, followed by a 32% proposed reduction efficiency as supported by field demonstrations.	Percent reduction (annual)	24%	32%	32%	
P-sorbing Materials	"Phosphorus-sorbing" materials soak up dissolved phosphorus, keeping it from flowing downstream on a potential of 1,000 acres. Engineered systems in which drainage water passes through phosphorus-sorbing materials, such as gypsum, drinking water treatment residuals , or acid mine drainage residuals, can potentially remove large percentages of phosphorus as well as sediment, heavy metals, and other pollutants.	acres (annual)		1,000	1,000	$0.75 M
Poultry Litter Treatment	A surface application of an acidifier is added to poultry litter to acidify poultry litter and maintain ammonia in the non-volatile ionized form (ammonium) in the poultry house. Proposed treatment of 96,000 tons. Consider use of the Chesapeake and Coastal Bays Trust Fund for support. Limited funding through Farm Bill programs.	tons (annual)		96,000	96,000	$3.3 M
Mortality Composters	Requires dead bird composters at all poultry operations for bird mortality,	composters	20	125	145	$1.01 M

Strategy	Description	Units	2010-2011	2012-2017	Total	Estimated Cost
Agriculture-	**Managing Fertilizer and Manure Applications**					
Nutrient Management Compliance	Maryland law requires farmers to implement Nutrient Management Plans that require they efficiently use manure or fertilizer needed to grow a healthy crop and ensure that excess nutrients are not lost to the environment. 1,325,004 acres are subject to the requirement to have and implement a nutrient management plan. MDA implementation inspections average a compliance rate of 75%.	acres (annual)	993,753	993,753	993,753	$29.1 M
Decision / Precision Agriculture	Use Precision Agriculture on 100,000 acres of farmland from 2010-2011 and 220,000 acres from 2012-2017.. Precision agriculture seeks to maximize the efficiency of nutrient application to cropland, thereby minimizing waste and nutrient runoff to the Bay.	acres (annual)	100,000	220,000	220,000	$13.71 M
100-ft CAFO setbacks	100 foot or 35 foot required setbacks for CAFO manure application on a potential of 2,500 acres. Based upon EPA regulations for CAFOs the infield spreading of manure is restricted.	acres (annual)		2,500	2,500	
10-ft riparian setbacks for application of crop nutrients	Require 10 ft application setbacks for the application of crop nutrients, bringing consistency to several programs regulating nutrients on a potential of 5,280 acres.	acres (annual)		5,280	5,280	

Strategy	Description	Units	2010-2011	2012-2017	Total	Estimated Cost
Natural Filters on Public Land						
Tree Planting - Forest Brigade	Plant one million trees on public lands by 2011 through the Department of Public Safety and Corrections Forest Brigade.	acres	1,550		1,550	
Wetland Restoration	Implement 555 acres of Wetland Restoration on public land. A wetland is an area of land where the soil wet or covered with water. Wetlands are often called swamps, marshes, or bogs. Dedicated funding is available through Maryland's Tributary and Wetland Restoration fund. Other potential funding sources include Maryland's Ecosystem Enhancement Program, Program Open Space, Chesapeake and Atlantic Coastal Bays 2010 Trust Fund, as well as competitive funding programs such as the Transportation Enhancement Program and Corporate Wetlands Restoration Partnership.	acres	555	600	1,155	$9.186 M
Streamside Forest Buffers	Plant 345 acres of Streamside Forest Buffers on public land. Trees planted next to waterways filter and take up nutrients coming off the land, stabilize the soil and provide wildlife habitat. Dedicated funding is available through Maryland's Tributary and Wetland Restoration fund. Other potential funding sources include Maryland's Ecosystem Enhancement Program, Program Open Space, Chesapeake and Atlantic Coastal Bays 2010 Trust Fund, as well as competitive funding programs such as the Transportation Enhancement Program and Corporate Wetlands Restoration Partnership.	acres	345	300	645	$2.213 M
Tree Planting - Other	Plant 450 acres of trees on public lands. Trees planted next to waterways filter and take up nutrients coming off the land, stabilize the soil and provide wildlife habitat. Potential funding sources include Maryland's Ecosystem Enhancement Program, Program Open Space, Chesapeake and Atlantic Coastal Bays 2010 Trust Fund, as well as competitive funding programs such as the Transportation Enhancement Program and Corporate Wetlands Restoration Partnership.	acres	450	3,000	3,450	$4.539 M

Strategy	Description	Units	2010-2011	2012-2017	Total	Estimated Cost
Streamside Grass Buffers	Plant 69 acres of Streamside Grass Buffers on public land. Grasses planted next to waterways filter and take up nutrients coming off the land, stabilize the soil and provide wildlife habitat. Dedicated funding is available through Maryland's Tributary and Wetland Restoration fund. Other potential funding sources include Maryland's Ecosystem Enhancement Program, Program Open Space, Chesapeake and Atlantic Coastal Bays 2010 Trust Fund, as well as competitive funding programs such as the Transportation Enhancement Program and Corporate Wetlands Restoration Partnership.	acres	69		69	
Grassland	Restore 45 acres of Grassland on public land. Grass planted next to waterways filter and take up nutrients coming off the land, stabilize the soil and provide wildlife habitat. Potential funding sources include Maryland's Ecosystem Enhancement Program, Program Open Space, Chesapeake and Atlantic Coastal Bays 2010 Trust Fund, as well as competitive funding programs such as the Transportation Enhancement Program and Corporate Wetlands Restoration Partnership.	acres	45		45	
Natural filters on Other Public Lands	Maryland will increase partnerships with local governments, non-profits, universities, other state agencies to implement natural filters.	Acres		600	600	$8.725 M
Air						
Maryland Healthy Air Act	Implement Maryland's Healthy Air Act (effective January 1, 2009). The emission controls on power plants will reduce nitrogen entering the Bay by over 300,000 pounds each year.	Pounds per year	Approximately 300,000 (the first phase of the HAA was implemented in 2009)	305,882 (the second phase of the HAA will be implemented on 1/1/2012	305,882 lbs per year	1.8 to 3.0 billion dollars to implement by 2013
Expand Diesel Engine Retrofit Program	Currently the Port of Baltimore partnered with the Environmental Finance Center to use stimulus money to retrofit dirty diesel truck engines to 'clean diesel' technologies for the Clean Air Act. It is estimated the project will reduce NOx emissions by 7 tons per year.	Pounds per year	approximately 43 lbs per year	approximately 43 lbs per year	approximately 43 lbs per year	Approximately $800,000 in 2010/11

Strategy	Description	Units	2010-2011	2012-2017	Total	Estimated Cost
Low Emission Vehicle Requirement	In 2007, Maryland passed Clean Cars Legislation, which requires by 2011 that all new cars meet the strictest emissions standards allowed under federal law.	Pounds per year	This program starts with the 2011 Model Year	approximately 2,000 lbs per year	approximately 2,000 lbs per year	Approximately $1,000 per new car purchased (it is estimated that about 200,000 new cars are sold in MD annually)

Reasonable Assurance

Maryland has strengthened the reasonable assurance in the Plan by expanding the Phase I Watershed Implementation Plan to include additional detail, timelines and schedules as appropriate. Key additions include:

- Outlining a strategy to address the Bay Restoration Fund shortfall in funding to complete the necessary upgrades for wastewater treatment plants. In addition to ensuring the necessary cash flow is available for 2012 and outlining steps to close the funding gap, a commitment to incorporate ENR discharge limits into NPDES permit renewals and a contingency to reduce funding from full to partial grant is included to ensure reasonable assurance.

- Outlining a stategy to ensure available funding for stormwater controls. In 2011, Maryland commits to convening formal discussion with stakeholders to determine funding options, schedules, and most cost effective practices with local government. In 2012, if the creation of local utilities or other systems of charges to support stormwater programs such as those that currently exist in 5 Maryland jurisdictions, is not underway, Maryland will seek legislation requiring development of local stormwater utilities. Alternative cost effective practices include forest buffer planting, stream restoration, wetland restoration, pavement removal and operational practices. Selection of practices and timing of implementation will be based on cost-effectiveness, pollutant removal efficiency and maximizing available funding. The State Highway Administration which also complies with this requirement has determined that based on rough cost estimates, the use of cost effective practices which achieve the same reduction in pounds of pollutants, may reduce costs by as much as two-thirds. The State also commits to pursue federal funding for stormwater projects on three tracks: a federal funding authorization, a formal agreement for retrofits at federal facilities and a commitment from the U.S. Army Corps of Engineers.

- To ensure appropriate contingencies are in place for agricultural practices, if the goals for best management practices are not met, Maryland has added a commitment to put in place a regulatory requirement for the use of cover crops in 2014 on agricultural acres for which manure or bio-solids (sewage sludge) are applied,

- Schedules are provided for:
    - Upgrades of certain major industrial discharges;
    - Evaluation of minor industrial discharges;
    - Retrofits at major federal WWTPs;
    - Evaluation of potential upgrades a minor municipal discharges; and
    - Enhancing permit requirements for MS-4 Phase I jurisdictions
    - Enhancing permit requirements for MS-4 Phase II jurisdictions
    - Phasing in the upgrade of additional septic systems

The schedules rely heavily on work to be conducted in collaboration with all stakeholders in 2011 to develop the most cost effective options for implementation.

Accounting for Progress in Reductions: Maryland identifies implementation targets in the Watershed Implementation Plan. Accounting, Tracking and Reporting are an important part of the Plan strategy and progress will be closely monitored for the two year milestones by tracking both implementation and water quality. However, it is important to note that the Plan incorporates the concept of adaptive management. Adaptive management requires that projections be made as to how to meet a goal and recognizes that in complex projects such as this, changes will be necessary. Implementation targets are surrogates for actual pound reductions and, as needed, Maryland may determine that targets for one practice may be reduced and increased for another to meet goals. The critical commitment is the nutrient reduction represented by an implementation practice. As long as the required reductions are met, Maryland will meet its milestones.

Element 6: Tracking and Reporting Protocols

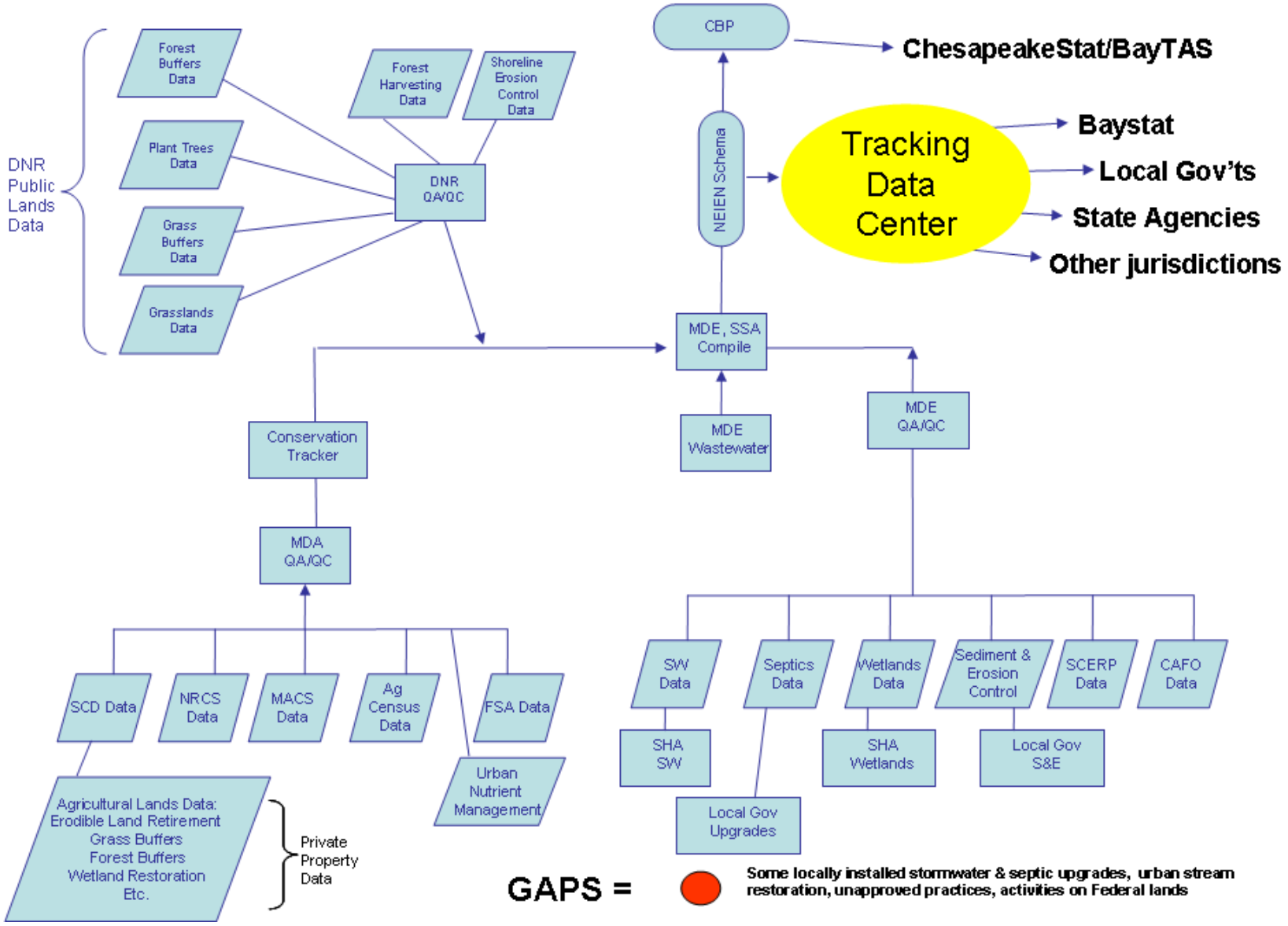
This section of the Plan is organized in three main categories, point sources regulated under NPDES permits, non-point sources including regulated stormwater and agricultural BMP tracking and reporting. It describes the current implementation tracking and reporting procedures for each of the source sectors. It also describes procedures for verifying the practices are actually installed. The information being tracked supports the Bay Program annual evaluations of implementation (model inputs), Maryland's BayStat, and other information needs. An overview of the key elements of the system, with proposed enhancements, is reflected in the chart on the next page.

A key need is improved acquisition of information from the source. In many cases the source of data are locally administered programs that face resource limitations in performing primary functions and view tracking and reporting as a secondary priority. The Bay TMDL limits and new nutrient offset requirements will create strong incentives to track and report control practices; however, staffing levels and funding are challenges.

The Chesapeake Bay Regulatory and Accountability Program (CBRAP) grant is providing resources to enhance the State's programs. A portion of the CBRAP funding is being directed toward the tracking and reporting function, notably for urban stormwater management, Concentrated Animal Feeding Operations (CAFOs) and nutrient management planning.

A third priority is enhancement of tracking data management after the work is done and the results are reported to the State. The Plan considers the establishment of a tracking data process, which is identified in the chart below. These functions are still being evaluated among the State agencies in coordination with similar federal systems under development that might serve some of the needs envisioned by the tracking data proposal.

Revised Proposed Tracking System



Element 7: Contingencies for Slow or Incomplete Implementation

The strategy options were refined and strategies for achieving the 2017 Interim Target are selected and outlined in this Plan. Each strategy is required to be accompanied by commitments that demonstrate reasonable assurance that the strategy will be implemented as outlined. As discussed briefly in Element 5, implementation commitments have been added to the Plan where necessary. In many cases, such as those related to strategies for which there are funding gaps, contingency actions have been outlined to ensure that if the implementation strategy is not ultimately achieved, an alternative implementation mechanism is identified.

Conclusion

By building this Plan on strategies that accelerate Maryland's proven programs; by proposing a set of strategies that exceeded the reductions required; and then by soliciting public comment on those strategies to inform the selection of final strategies and contingencies in the Final Plan, Maryland's Plan maximized the opportunity for meaningful public input and provides the necessary assurance that these critical reductions can be achieved by 2020.

This opportunity, combined with the realization that a restored Chesapeake Bay is finally within our sights, will guide our decision making over the next several years as we work hand in hand with all Marylanders including local governments, stakeholder organizations, farmers, scientists, and all who are interested in developing the most practical, cost effective means if implementation. We are confident of this process and the results it will produce based on the significant participation and positive results to date, as well as the commitment to devising solutions embodied in the comments on the draft Plan.

It is important to note the calculations made to estimate loadings, reductions, and percentage of progress will change based on changes to EPA's Bay model in early 2011. The model is currently being refined and the model data output is subject to change. For these reasons, this Plan has been finalized based on the best available scientific data currently available, with the understanding that the strategies will be refined during the Phase II process.

This Phase I Plan addresses challenging issues such as, reducing further pollution from point source and non-point source sectors, offsetting new pollution loads, and seeks to create incentives for best management practices and restoration. It is not possible to meet Maryland's pollution reduction requirements without each of these elements in the Plan.

This Phase I Watershed Implementation Plan outlines the basis for the strategy necessary to reduce Maryland's pollution loads by the amount required to restore water quality and will provide the foundation for a more detailed Phase 2 Plan in 2011 and the Phase 3 Plan in 2017.

INTRODUCTION

Restoration of water quality in the Chesapeake Bay has been a critical issue for the citizens of Maryland, state environmental agencies and the U.S. Environmental Protection Agency (EPA) since 1983. Programmatically and technically, significant progress has been made, but we have seen only localized improvement in water quality in the face of rapid growth, despite our best efforts. In 2000, an agreement was signed by leaders across the watershed including state Governors, the Mayor of the District of Columbia, the EPA Administrator and the chair of the Chesapeake Bay Commission that, collectively, signatories would voluntarily achieve water quality standards in Chesapeake Bay and its tidal tributaries by 2010 or would develop and implement a Total Maximum Daily Load (TMDL).

Since the 2010 commitment has not been met, EPA has developed, in cooperation and coordination with the Chesapeake Bay States, a TMDL for the Chesapeake Bay and its tidal tributaries. The TMDL quantifies how much we need to reduce pollutant loads, specifically nitrogen, phosphorus and sediments, to achieve water quality standards – it does not say how those reductions will be achieved.

For most TMDLs, EPA requires that a discussion of "reasonable assurance of implementation" be included in a TMDL. In most cases, program commitments, funding, and regulatory requirements provide "reasonable assurance" that the nonpoint source component of the TMDL, the "load allocation," will be achieved. Reasonable assurance for the point source component, the "wasteload allocation," is assumed to be assured through permitting programs.

In this instance, understanding the cost and difficulties of restoring the Bay, EPA has required the jurisdictions' Watershed Implementation Plans (Plans) to include more detailed reasonable assurance.[1] These Plans will be completed in two phases. Phase I presents the strategies and approaches, with dates for completion and estimated pollutant reduction amounts to achieve, by 2017, the implementation measures necessary to achieve 70% of the reduction needed to fully implement the TMDL by 2020. In lesser detail, it presents the strategies and approaches to implement the remaining 30% implementation needed to complete our commitment by 2020.

Phase II of the Watershed Implementation Plans, due in November 2011, will be developed in consultation with local interests, county and municipal governments, federal facilities, other major institutions, and the agricultural and forestry communities to add detail to the Plan presented here. Between now and 2011, consultation will add geographic specificity, more detailed time lines, enhanced quantification, and additional local government practices including development of funding mechanisms, regulatory development, contractual plans, two-year milestones to assess progress, and other programs to assure that the watershed implementation plans are "enforceable or otherwise binding."

[1] EPA's legal rationale for this requirement is provided in its Watershed Implementation Plan Expectations Letter of November 4, 2009 from EPA Region III Acting Administrator William C. Early to the Chair of the Chesapeake Bay Principle's Staff Committee L. Preston Bryant, Jr., Virginia Secretary of Natural Resources.

EPA listed eight required elements for inclusion in the watershed implementation plans, as follows:

1. Interim and Final Nutrient and Sediment Target Loads
2. Current Baseline Loading and Program Capacity
3. Account for Growth
4. Gap Analysis
5. Commitment & Strategy to Fill Gaps
6. Tracking and Reporting Protocols
7. Contingencies for Slow or Incomplete Implementation
8. Appendix with Detailed Targets and Schedule:
    a. Loads divided by 303(d) segment drainage and source sector
    b. Reduction Schedule with 2-year target loads (Used by EPA for Milestone Evaluation)
    c. No later than November 2011: Update to include loads divided by local area and controls to meet 2017 interim target load

Revisions to the watershed model used for the allocations in the TMDL are underway, and the revised model will be available for use in Phase II. Although the Bay-wide TMDL loading will not change, it will be possible to modify sector or geographic allocations between Phase I and Phase II.

The Clean Water Act provides clear authority to the federal government to enforce, or delegate to the States enforcement of point source discharges. Maryland has broader authority to maintain the quality of its waters, including broad authority to control nonpoint sources of pollution, a significant portion of which comes from agricultural operations.

Accounting for Progress in Reductions: Maryland identifies implementation targets in the Watershed Implementation Plan. Accounting, Tracking and Reporting are an important part of the Plan strategy and progress will be closely monitored for the two year milestones by tracking both implementation and water quality. However, it is important to note that the Plan incorporates the concept of adaptive management. Adaptive management requires that projections be made as to how to meet a goal and recognizes that in complex projects such as this, changes will be necessary. Implementation targets are surrogates for actual pound reductions and, as needed, Maryland may determine that targets for one practice may be reduced and increased for another to meet goals. The critical commitment is the nutrient reduction represented by an implementation practice. As long as the required reductions are met, Maryland will meet its milestones.

1.0 INTERIM AND FINAL NUTRIENT AND SEDIMENT TARGET LOADS

In November 2009, EPA announced the allocation of preliminary basin-wide target loads of nitrogen and phosphorus that when achieved, would meet water quality standards throughout the Chesapeake Bay and its tidal tributaries. These draft basin-wide loads, based on data from the Chesapeake Bay Program (CBP) Watershed Model current at the time (Phase 5.2), were allocated to eight major tributary basins by jurisdiction (the six Bay watershed states and District of Columbia). Maryland received initial target loads for five major basins: the Potomac River, the Patuxent River, the Western Shore, the Susquehanna River, and the Eastern Shore.

Element 1 of the Watershed Implementation Plan (Plan), "Interim and Final Nutrient and Sediment Target Loads," requires the determination of target loads of nitrogen, phosphorus, and sediment by source sector for each Bay segment-shed (the area draining to a Bay water quality segment), and the identification of the amount and location of loads from individual or aggregate point sources. Specifically, per EPA's "expectations letter" of November 4, 2009 to the Principals' Staff Committee detailing the Agency's expectations for the Phase I Plans, the jurisdictions are expected to *"subdivide those [major basin] targets by the pollutant source sector within each of the 92 areas draining to Section 303(d) tidal water segments."* Interim targets are to be met by 2017 and final targets by 2025.[2]

Additionally, *"EPA expects the final target loads to be consistent with loads needed to achieve the water quality standards in the Bay. Assuming they are, EPA will consider this information when it establishes draft (by August 15, 2010) and final (by December 31, 2010) wasteload allocations [WLAs] for point sources and load allocations [LAs] for nonpoint sources within each of the 92 303(d) segments of the Bay and its tidal tributaries and embayments in the Bay TMDL."*

The Maryland Department of the Environment (MDE) undertook the development of an "initial target loads sub-allocation process" to address the key task of Element 1: the distribution of Maryland's five major basin target loads of nitrogen, phosphorus, and sediment to the finer geographic scale of 58 Maryland segment-sheds by pollutant source sector. This was a critical task, because the segment-shed target loads form the basis for the WLAs and LAs in the Bay TMDL, which is comprised of individual TMDLs for each tidal Bay water quality segment listed as impaired by nutrients and/or sediment on the Bay states' and District's "303(d)" lists of impaired waters. In Maryland, this list is found under Category 5 of the 2008 *Integrated Report of Surface Water Quality in Maryland*.

Thus, the Bay TMDL is expected to address the water quality impairments due to nutrients and sediment in all of Maryland's main Bay and tidal Bay tributary waters listed on the State's 2008 *Integrated Report* as impaired by those pollutants.

Maryland's sub-allocation process was first developed using CBP Phase 5.2 Watershed Model output available at the time (November 2009-March 2010). The finalized process used output

[2] Maryland has chosen to accelerate its efforts and meet the final target loads by 2020.

from the updated CBP Phase 5.3 Watershed Model, revised major basin nutrient target loads and draft sediment target loads issued by EPA to the states and DC on July 1 and August 15, 2010, respectively, and certain principles of distribution, or decision rules, similar to those that guided EPA's allocation of basin-wide loads to the major basins by jurisdiction.

Adjustments to the source sector allocations were made as warranted. Information based on the refined target loads was then run through the Bay model to verify that the sub-allocation results would achieve water quality standards. The Bay model then distributed the validated target loads by source sector to Maryland's fifty-eight Bay segment-sheds. In this manner, Maryland met its obligation to *"subdivide…[major basin] targets by the pollutant source sector within each of the 92 areas draining to Section 303(d) tidal water segments."*

Appendix A, "Sub-allocation Process for the Chesapeake Bay TMDL" provides a detailed explanation of the development of Maryland's sub-allocation process, and the methodology it applies to address this component of Element 1 of the Phase I Watershed Implementation Plan.

Appendix B1, "Detailed Targets and Reduction Schedule," provides interim and final target loads for Maryland's segment-sheds by source sector, and a state-wide annual load reduction schedule. The interim target loads were developed subsequent to Bay model verification that the reduction strategies selected by Maryland following the public comment process meet the 2017 goal. The selected strategies are presented in Section 5 of this report. The final target loads reflect the results of Maryland's sub-allocation process and its subsequent refinement by the Bay Workgroup and Bay Cabinet. The final point source and nonpoint source target loads provided in Appendix B1 meet the EPA targets at the state-wide level and meet water quality standards. Appendix B2 provides a set of maps detailing Maryland's Bay segment-sheds.

EPA's expectations for Element 1 further state: *"Jurisdictions must also identify the amount and location of loads from individual (where possible) or, as necessary, aggregate point sources, with their Watershed Implementation Plans submitted in 2010…EPA also expects Phase I Watershed Implementation Plans to include information for permit writers to issue permits for point sources that are consistent with individual, aggregated, or gross wasteload allocations, as follows. For significant wastewater facilities, EPA expects States and the District to include loads from individual facilities based on design flow and effluent limits. For nonsignificant municipal facilities, EPA expects States and the District to include effluent limits applicable to facilities in different ranges of design flow."* [EPA notes that in Maryland a significant wastewater discharger is defined as a "facility treating domestic wastewater and the design flow is greater than or equal to 0.5 Millions gallons per day (MGD).]

The EPA letter continues: *"For nonsignificant industrial facilities, EPA expects jurisdictions to include appropriate effluent limits and/or loading limits for nutrients and sediment. EPA encourages States and the District to estimate loads from individual MS4 areas, sites with industrial stormwater permits, and CAFOs. Where such estimates are not possible, EPA expects the States and the District to identify practices that it expects these permittees to implement so that a permit writer can incorporate into an MS4, industrial stormwater, construction, or Concentrated Animal Feeding Operations (CAFO) permit."*

Appendix C, "NPDES Dischargers in the Maryland Bay Watershed," provides a comprehensive list of significant and non-significant municipal and industrial wastewater facilities within the State's Bay watershed area, with locations and available permit information on these point sources. The individual or aggregate point source target loads for these facilities are included in Appendix B1, "Detailed Targets and Reduction Schedule."

For individual MS4 areas, sites with industrial stormwater permits, and CAFOs, MDE was not able to provide separate estimated loads for these permitted entities in the Phase I Plan. MDE has provided *aggregate* NPDES-regulated stormwater target loads, encompassing all NPDES-regulated stormwater dischargers. MDE has identified stormwater management practices required as conditions of the applicable stormwater permit categories, in order to be consistent with the wasteload allocations of the TMDL.

Looking beyond Phase I to the Phase II Watershed Implementation Plan (draft due by June 1, 2011, final by November 1, 2011), EPA notes that States and the Districts are expected to *"divide nonpoint source load allocations and any wasteload allocations for aggregate point sources among small geographic areas and facilities or sources where appropriate."* MDE's sub-allocation process will allow the State to define finer scale allocations within the segment-sheds, both by county-segment-shed area (the portion of a segment-shed within the geographic boundaries of a county) and by a county's geographic boundaries (as a sum of the portions of multiple segment-sheds that lie within those boundaries). [3] It is expected that the disaggregation of aggregate stormwater loads for distribution to the various NPDES-regulated stormwater permit categories may be accomplished as part of the State's Phase II Plan.

The following tables summarize the statewide interim and final target loads for nitrogen, phosphorus, and sediment by major source sector. Interim target loads were developed subsequent to Bay model verification that the reduction strategies selected by Maryland following the public comment process meet the 2017 goal.

[3] During the Phase II Plan process, as the scale becomes more refined, the interests of municipalities will also be considered with respect to the sub-allocation process.

Table 1.1 Total Nitrogen Final Target Load by Source Sector

Total Nitrogen - By Sector (Million lbs/yr)					
Sector	**2009 Progress**	**Final Target Load**	**% Reduction from 2009 Progress**	**Interim Target Load**	**% Reduction from 2009 Progress**
UrbanReg	5.098	4.184	18%	4.650	9%
UrbanNonReg	0.551	0.444	19%	0.591	-7%
Agriculture	17.713	13.653	23%	16.606	6%
CAFO	0.080	0.070	12%	0.064	20%
Septic	4.007	2.454	39%	2.975	26%
Forest	7.133	7.133	0%	7.149	0%
Air	0.691	0.686	1%	0.698	-1%
WWTP & CSO	14.148	10.462	26%	8.587	39%
Total	**49.421**	**39.086**	**21%**	**41.319**	**16%**

Table 1.2 Total Phosphorus Final Target Load by Source Sector

Total Phosphorus By Sector (Million lbs/yr)					
Sector	**2009 Progress**	**Final Target Load**	**% Reduction from 2009 Progress**	**Interim Target Load**	**% Reduction from 2009 Progress**
UrbanReg	0.581	0.383	34%	0.513	12%
UrbanNonReg	0.091	0.056	39%	0.095	-4%
Agriculture	1.364	1.196	12%	1.320	3%
CAFO	0.007	0.004	31%	0.005	28%
Forest	0.349	0.349	0%	0.348	0%
Air	0.041	0.040	2%	0.042	-1%
WWTP & CSO	0.871	0.686	21%	0.571	34%
Total	**3.304**	**2.715**	**18%**	**2.892**	**12%**

Table 1.3 Total Sediment Final Target Load by Source Sector

Total Suspended Solids By Sector (Million lbs/yr)					
Sector	**2009 Progress**	**Final Target Load**	**% Reduction from 2009 Progress**	**Interim Target Load**	**% Reduction from 2009 Progress**
UrbanReg	382	240	37%	307	20%
UrbanNonReg	18	9	49%	20	-11%
Agriculture	787	700	11%	670	15%
CAFO	0.11	0.04	66%	0.10	8%
Forest	191	191	0%	187	2%
WWTP & CSO	8	78	-889%	62	-677%
Total	**1,387**	**1,218**	**12%**	**1,246**	**10%**

2.0 CURRENT CAPACITY

In terms of the eight elements of a Phase I Plan defined in EPA guidance, this section addresses Element 2: "Current Loading Baseline and Program Capacity."

2.1 Current Loading Baseline

EPA has provided estimates of nutrient and sediment 2009 baseline loads and allocated load limits to the Bay watershed jurisdictions that are predicted to meet water quality standards in the Chesapeake Bay, as shown in Table 2.1.

Table 2.1 Maryland's 2009 Baseline Compared to Draft Allocations

	Nitrogen			**Phosphorus**		
	2009 Progress	Draft Allocation	% Reduction	2009 Progress	Draft Allocation	% Reduction
Eastern Shore	12.38	9.71	22%	1.17	1.09	7%
Potomac	18.51	15.70	15%	1.01	0.90	11%
Susquehanna	1.52	1.08	29%	0.06	0.05	22%
Western Shore	13.94	9.74	30%	0.77	0.46	40%
Patuxent	3.05	2.85	7%	0.29	0.21	27%
MD Total	49.42	39.09	21%	3.30	2.72	18%

The current (2009) loading baseline information was used to determine the reduction in loadings needed to attain the target allocations, after accounting for anticipated future growth.

A note regarding Maryland's air allocation is warranted: EPA has separated the nitrogen deposition into two categories: 1) deposition occurring on the land; and 2) deposition occurring directly onto the tidal waters of the Bay. Atmospheric deposition directly to the land and non-tidal waters is considered contained within the allocated loads presented above in Table 2.1 because the nitrogen atmospheric deposition becomes mixed with the nitrogen loadings from the land-based sources. Once it is land deposited, it is to be managed as part of BMPs for other sources. Direct deposition to tidal waters will be addressed by implementing state requirements and federal policies and requirements under the Clean Air Act (CAA).

2.2 Program Capacity

"Program Capacity" is defined as the current legal, regulatory, programmatic, financial, staffing and technical capacity available to meet the target loads. For the purposes of this element, program capacity has been reviewed with respect to two broad areas:

2.2.1 Statewide Programmatic Capacity and Interagency Coordination,
2.2.2 Capacity Related to Individual Source Sectors

The evaluation in Phase I focuses primarily on the State's capacity; however, where information is readily available it is referenced for local government, federal government, and private sector capacities.

The gap analysis, Section 4, provides another useful measure of program capacity. It compares the pollutant reductions that can be achieved with current capacity to the reductions needed to achieve the interim and final target loads.

A description of each area demonstrating "Program Capacity" follows in Section 2.2.1.

2.2.1 Statewide Programmatic Capacity and Interagency Coordination

In the "Expectations Letter" from EPA, dated November 4, 2009, states are urged to "consider whether additional reductions could be achieved with existing capacity" (Element 2, p. 26). Maryland has made considerable progress in accelerating current capacity by developing 2-year Milestones to achieve additional reductions of nutrients and sediment. For Maryland, the first 2-Year Milestones consist of a suite of 34 specific and accelerated actions that will result in an additional reduction of 3.75 million pounds of nitrogen and 193,000 pounds of phosphorus from reaching the Bay by the end of 2011. The Milestones represent reductions beyond those realized with current capacity and independent of the strategies proposed in this Plan to meet the allocations.

It is important to underscore that these efforts were made in coordination with and through the Chesapeake Bay Program Executive Council. They represent a significant acceleration of the reduction strategy to meet Bay goals.

To date, Maryland has been the leader in the Bay restoration and has thus developed significant capacity. Since 1985 Maryland has reduced nitrogen pollution by 33% and phosphorous pollution by 38%. These reductions were realized, even as a 29% increase in population (1.28 million) occurred in the State between 1985 and 2009. Maryland continues to be a leader – the first State to require nutrient management plans on all farms, the first to commit to implement state-of-the-art technology on the State's 67 largest wastewater treatment plants, accounting for 95% of our wastewater flow, and the first State to place stringent air pollution controls on power plants required by Maryland's nationally groundbreaking Healthy Air Act, reducing nitrogen emissions by over 75% from coal fired power plants by 2013.

Maryland has committed to accomplish the needed pollution reductions by 2020 and initiated the switch to measuring progress on the Bay in two year increments instead of once a decade. To ensure that progress is transparent, we have established BayStat to measure this progress in real time – allowing all Marylanders to monitor the restoration of the Chesapeake Bay. Maryland was the first state in the watershed to receive federal approval for our Concentrated Animal Feeding Operation program that meets the new EPA regulations and requires comprehensive nutrient management plan implementation by poultry farms for the first time. Maryland is the first State to require nutrient removal technology on new and failing septic systems in the Critical Area (land within 1,000 feet of tidal waters, see MDE website for the complete definition). The State created the Chesapeake Bay 2010 Trust Fund to fund cost-effective projects to reduce non-point

source pollution. Together with Virginia, Maryland restricted the female crab harvest yielding a tremendous increase in recent catches. The State recently achieved a record setting commitment by farmers to plant cover crops – one of the most cost effective nutrient reduction practices available. Maryland was the first state in the Watershed to require environmental site design to reduce stormwater runoff on all new development approved after May of 2010 and implemented one of the most progressive set of stormwater requirements for a stormwater (MS4) permit in the Bay watershed.

In addition, the first 2-Year Milestone accounts for growth by including higher amounts of reductions to offset the nonpoint source pollution impacts from forecasted new development and new septic tanks. Until an offset policy is in place, Maryland proposes to continue to offset new development and new septic tank impacts through subsequent 2-year Milestones. The consideration of achieving additional reductions with current capacities is factored into the gap analysis in Section 4.

Maryland's 2-year Milestones and "BayStat" initiative monitors and tracks progress. This has been a concerted effort by the State to focus and meet monthly to assess and report on progress. This work provides benefits on several levels. First, BayStat has provided greater coordination, efficiency and accounting for statewide implementation efforts. BayStat and the 2-year Milestone commitments have also increased public access to significantly increased levels of information about results and progress. Please see the *BayStat website* for more information. In addition to Maryland's on-going efforts to optimize the nutrient reductions achieved with current capacities, the State has a system of programs that provide a broad institutional capacity for water quality management. These programs are described in Maryland's Continuing Planning Process (CPP), which is required by Section 303(e) of the federal Clean Water Act. The full *2007 CPP document* is available on MDE's website.

A brief outline of the broad programmatic areas addressed in Maryland's 2007 CPP follows:

1. Water Quality Standards
2. Water Quality Management Planning
3. Discharge Permits: Limitations, Pretreatment and Enforcement
4. Sewerage, Water Supply, Solid Waste Facilities: Planning
5. Sewerage, Water Supply, Solid Waste Facilities: Construction and Operation
6. Non-point Source Control: Regulation
7. Non-point Source Management Practices: Technical and Financial Assistance
8. Groundwater Supply Quality and Quantity Control
9. Solid and Hazardous Waste Management: Regulation
10. Aquatic and Terrestrial Habitat Protection
11. Technical Analysis and Evaluation
12. Public Participation/education

New programs have also been implemented by State agencies to provide the public with opportunities to promote environmental stewardship among all citizens. Programs include:

1) Marylanders Grow Oysters - provides opportunities for waterfront landowners to grow young oysters in protected cages off their docks until they are large enough to be relocated to nearby oyster sanctuaries (www.oysters.maryland.gov);

2) Marylanders Grow Trees - encourages citizen landowners to purchase, plant, and register on-line trees on their properties with a goal of 50,000 trees planted annually. Coupons for $25 off trees at participating nurseries can be downloaded from the website. Homeowners can also calculate the monetary benefits afforded by planting different types of trees on their property. (www.trees.maryland.gov); and,

3) Partnership for Children in Nature - Children are a proven catalyst for getting adults to change behavior, and this program implements a variety of actions to engage children with nature, not only for their own benefit, but their parents' and the Bay's as well. These and other programs are described on the Maryland Smart, Green, and Growing website (www.green.maryland.gov).

2.2.2 Capacity Related to Individual Source Sectors

MDE issues permits to protect Maryland's water resources by controlling industrial and municipal wastewater discharges. Surface water discharges are regulated through combined State and federal permits under the National Pollutant Discharge Elimination System (NPDES). Groundwater discharges are regulated through State issued groundwater permits. Also related to the protection of groundwater is the coordination with all local health departments for the regulation of individual wells and septic systems.

The stormwater pollutant discharges are regulated by the Maryland's NPDES municipal stormwater permit program. Municipal stormwater permits require the jurisdictions to develop comprehensive programs to reduce storm drain system pollution to the maximum extent practicable and show reduction of pollutants pursuant to EPA approved TMDLs, and to improve water quality. The summaries are provided in narrative form to describe programmatic highlights specific to Maryland. These summaries are arranged by source sector.

2.2.2.1 Municipal Wastewater Treatment Plants

Major (Significant) Municipal Wastewater Treatment Plants:

Maryland classifies municipal wastewater treatment plants (WWTPs) with a design flow capacity[4] of 500,000 gallons per day or greater (0.5 million gpd) to be "major" or "significant" plants. The combined flow of these plants comprises more than 95% of the total sewage flow generated in Maryland.

[4] Design capacity for significant facilities shall meet the following two conditions:
(1) A discharge permit was issued based on the plant capacity, or the Maryland Department of the Environment (MDE) issued a letter to the jurisdiction with design effluent limits based on the new capacity as of April 30, 2003.
(2) Planned capacity was either consistent with the MDE-approved County Water and Sewer Plan as of April 30, 2003, or shown in the locally-adopted Water and Sewer Plan Update or Amendment to the County Water and Sewer Plan, which were under review by MDE as of April 30, 2003 and subsequently approved by MDE.

MDE currently has in place an Enhanced Nutrient Removal (ENR) Cap Strategy that allows flow increases at major sewage treatment plants to design capacity, while establishing a nutrient loading cap. According to Maryland's Chesapeake Bay Tributary Strategies Statewide Implementation Plan, the Point Source Strategy is a two-part plan to (1) upgrade significant WWTPs to state of the art ENR technology to meet concentrations of 4.0 mg/l or less total nitrogen and 0.3 mg/l or less total phosphorus and (2) maintain the nutrient load caps for all point sources.

The Bay Restoration Fund (BRF) provides up to 100 percent grant funding for the eligible portion of ENR upgrade of 67 major WWTPs. The BRF is a dedicated fund, financed by wastewater treatment plant users. Part of the fee is paid by septic system users and is utilized to upgrade onsite systems and to subsidize the implementation of cover crops on agricultural land each year to reduce nitrogen loading to the Bay.

The State's current financial capacity to reduce loads from major WWTPs is reflected in the schedule of plant upgrades and current revenue projections for the BRF maintained by MDE's Engineering and Capital Projects Program, within the Office of Budget and Infrastructure Financing. The Bay Restoration Fund Advisory Committee is charged with evaluating the adequacy of fees. The Advisory Committee projected a deficit beginning in FY 2012 and will finalize a recommendation to close this deficit in December of 2010. Maryland is able to fund the planned construction schedule in FY2012.

In addition to ENR upgrades, some major WWTPs require enhancements not eligible for BRF funding, but are a necessary part of the overall formula for successful nutrient reductions. These include measures to address excessive inflow and infiltration (I/I), additional or expanded pumping stations and other needs. These activities can receive funds from a variety of sources that are described in Section 2.2.2.12 on "Additional Resources."

In addition to the commitments made in this Plan, the Department of the Environment will continue to work during the Phase II planning process to identify and advance other suitable funding sources to achieve nutrient reduction from point sources.

Minor (Non-significant) Municipal Wastewater Treatment Plants

The term "minor" refers to those wastewater treatment plants with design capacity of less than 500,000 gallons per day. According to Maryland's Chesapeake Bay Tributary Strategies Statewide Implementation Plan, annual nutrient load goals for minor facilities are based on design capacity or projected 2020 flow, whichever is less, and effluent concentration limits of 18 mg/l total nitrogen and 3 mg/l total phosphorus. The 2020 projected flows are based on the county growth rates provided by the Maryland Department of Planning. Expanding non-significant facilities cannot exceed 6,100 lbs/ year in nitrogen and 457 lbs/year in phosphorus.

The set of strategies that demonstrate the ability to make reductions beyond the interim target loads includes a determination of the feasibility of upgrading five of the largest minor WWTPs.

Additional capacity will be needed as this strategy option was selected. This is described in Section 5, with the associated cost estimates.

Capacity needs for maintaining loads below the caps are reflected in the Water Resource Elements (WREs) of recent local (county and municipal) comprehensive land use plans. Information about WWTP capacity would be useful in supporting the selection of which minor WWTPs to upgrade if that strategy option is selected. The county and municipal WRE information, while not presented in this Plan will inform the Phase II planning process.

2.2.2.2 Industrial Wastewater Treatment Plants

Major Industrial Treatment Plants

Significant industrial wastewater treatment plants are those with a minimum total nitrogen discharge of 75 pounds per day or a minimum total phosphorus discharge of 10 pounds per day. This is equivalent to the load at the threshold between minor and major municipal treatment plants of 500,000 gallons per day at a concentration of 18 mg/l total nitrogen or 3 mg/l total phosphorus, which are typical concentrations for minor municipal WWTPs. There are eleven such facilities in Maryland, including one federal facility,[5] and two dredged material placement facilities, which were added to the list in 2010.[6]

Reductions from nine major industrial plants, consistent with Maryland's 2004 Tributary Strategy cap, are under way with completion dates estimated to be in 2015. These load reductions were established on a case-by-case basis with consideration of 1) recent load reductions relative to the initial baselines established in 1985, that is, credit for already making reductions; and 2) additional load reduction potential. Target loads for two dredged material placement facilities are based on approved TMDLs. The reductions from major industrial facilities necessitate private sector capacity. The State generally has sufficient capacity to manage the regulatory oversight function for this sector.

Minor Industrial Treatment Plants

The nutrient reduction capacity for minor industrial facilities is a function of the capacity for the private sector to make reductions that are technically and financially reasonable and the government capacity to regulate these sources.

There are many minor industrial facilities of varying types and sizes. MDE has performed a preliminary evaluation of the potential for reductions from subcategories of minor industrial sources based on an understanding of technical feasibility. The preliminary evaluation suggests a nutrient reduction potential from current loads of approximately 23.5% by 2020. This evaluation is the basis of the strategy option for this sector, which is included in the set of options that are projected to go beyond the 2017 Interim Target Load. This strategy option is described further in Section 5.

[5] Naval Support Facility at Indian Head in Charles County with an annual TN load cap of 1,777 lbs/yr and an annual TP load cap of 740 lbs/yr.
[6] The Hart Miller Island containment facility is being decommissioned and the Cox Creek facility is coming on line.

MDE is using a phased approach for addressing nutrient loads from non-significant industrial facilities: 1) As part of the Phase I planning process, MDE conducted a detailed review of very rough estimated loads from minor industrial facilities, which was developed by the EPA Bay Program office with support by an engineering consultant. MDE's analyses found that the EPA significantly over estimated loads from this sector, for example, inclusion of facilities located in other states; daily discharge flows from "mini marts", of 200,000 gallons (equivalent of a large town); and assuming swimming pools have year-round discharges with nutrient concentrations five to ten times the appropriate values. EPA accepted MDE's refined estimate, which serves as the starting point for this Phase I Plan.

2) MDE is continuing to refine the loading estimates to identify and verify the non-significant industrial discharges of nutrients. This will be accomplished through an extensive survey to determine the nature as well as quantity of nutrients produced by these facilities. This activity could benefit from additional staffing capacity

3) Using information collected in Phase I, Phase II and activities conducted between 2011 and 2017, MDE will refine nutrient expectations for facilities and incorporate them into revised requirements. To do this in a timely way, with sufficient education and outreach to the affected sources, could necessitate additional capacity; however, that determination is yet to be made.

2.2.2.3 Onsite Sewage Disposal Systems

The Maryland Department of Planning (MDP) developed 2007 septic data analysis based on "2004 Flush Fee Analysis." Original 2004 data was updated in 2007. Based on the 2007 data, there are approximately 430,000 onsite sewage disposal systems (OSDS) or septic systems in Maryland, with 51,500 in the Chesapeake Bay and Coastal Bays Critical Area[7]. Of these 418,500 are in the Bay Watershed and 46,300 are in the Chesapeake Bay Critical Area, 134,800 within 1,000 feet of a perennial stream, and 237,500 are located outside 1,000 feet of the perennial stream buffer.

Based on MDP's 2009 Historical and Projected Household Size for Maryland's Jurisdictions listed below, about 1,088,100 people in the Bay Watershed were served by septic systems in 2007. This accounts for about 2.5 people per EDU served by the septic system.

Table 2.2 Historical and Projected Household Size for Maryland

Census 1990	Census 2000	Census 2005	Census 2010	Census 2015	Census 2020	Census 2025	Census 2030
2.67	2.61	2.59	2.56	2.53	2.51	2.49	2.47

MDE's review of the Bay Program's 2009 population estimates indicated that the Bay Program population per EDU served by septics ratio was higher than Maryland estimates and higher than estimates from other Bay States. The population for Maryland estimated by the Bay Program on septic is 1,454,693 and the proportion of persons per septic is estimated at 3.31, in stark contrast to the figures in Table 2.2. The concern is that nitrogen loads for septic sector are based on

[7] The Critical Area is the 1,000 foot area around the tidal water shoreline.

population; and higher population per EDU used in the 2009 progress model runs resulted in an approximately 25 percent higher septic sector nitrogen load than Maryland believes is accurate.

In 2010, the Bay Program agreed to review and make appropriate changes in Maryland's population served by septic systems as well as associated nitrogen loads. MDE expects that 2011 model run will reflect lower population per septic ratio as well as lower nitrogen load associated with septic systems.

Financial capacity related to septic system upgrades

The *Bay Restoration Fund* (BRF), established in 2006, provides up to 100 percent funding for the upgrade of septic systems to the best available technology (BAT). The current BAT has an average cost per septic system of $13,000 and reduces the nitrogen load by about half. Except in the Critical Area, where all new and replacement systems are required to be upgraded, it is a voluntary program. As of July 2010 a total of 2,194 systems have been upgraded with BAT, 1,038 of which are in the Critical Area.

The BRF may also fund replacement of multiple on-site sewage disposal systems located in the same community with a new community sewerage system. The system must be owned by a local government and be one that meets enhanced nutrient removal (ENR) standards.

Maryland also requires all septic systems serving newly constructed buildings, and all replacement septic systems in the Critical Area to include nitrogen removal upgrades. It is estimated that this requirement will result in 600 septic system upgrades per year.

Last, Maryland law requires MDE to fund the nitrogen removal costs for upgrades resulting from failing systems in the Critical Area during calendar years 2010, 2011 and 2012. Beginning in FY 2011, funds are provided by grant to a county or its representative to manage the program locally. Counties provide BAT grant funding to homeowners and businesses based on the following priorities:

1. Failing septic systems or holding tanks in the Critical Area
2. Failing septic systems or holding tanks not in the Critical Area
3. Non-failing septic systems in the Critical Area including new BAT installation
4. Non-failing septic systems outside the Critical Area

For septic systems outside the Critical Area, the BRF grant can range from 25% to 100% of the BAT upgrade cost based on income.

In addition to the BRF, MDE provides limited funding such as Supplemental Assistance grants and low interest Water Quality Revolving Loan Fund loans to connect areas with failing septic systems to wastewater treatment plants.

Staffing capacity related to septic system upgrades

MDE's Wastewater Permit Program includes 14 FTEs responsible for issuing municipal and industrial groundwater discharge permits, issuing permits for on-site sewage disposal systems,

overseeing local approving Authority onsite sewage disposal and Bay Restoration fund programs the review and approval of best available technologies.

Additional staffing capacity will be needed to address new requirements proposed in the WIP (see Chapter 5).

2.2.2.4 Regulated Stormwater

The Clean Water Act (CWA) defines stormwater as a point source discharge and a majority of Maryland's urban areas are permitted by Phase I and Phase II NPDES stormwater permits. NPDES stormwater permits are based on Maryland's Stormwater Management and Erosion and Sediment Control Programs which are required statewide. Since Maryland's Stormwater Management Act of 1982, all incorporated counties and municipalities in the State have been regulated and required to adopt ordinances that establish controls on any development that disturbs more than 5,000 square feet of earth. The primary goal of the State's program is to maintain after development, as nearly as possible, the predevelopment runoff characteristics. The regulations have evolved over the years, most recently in 2000 and 2007, to include greater water quality criteria and protection of water resources.

All development that received local plan approval after May 4, 2010 has been required to use environmental site design (ESD) to the maximum extent practicable. ESD is defined as using small-scale stormwater management practices, nonstructural techniques, and better site planning to mimic natural hydrologic runoff characteristics and minimize the impact of land development on water resources. Additionally, Maryland requires that new model ordinances be approved locally that specify a comprehensive plan review and approval process, stronger as-built and bonding requirements, and routine inspection, maintenance, and enforcement of BMPs. These regulations established a goal to return post development hydrologic characteristics to that of "woods in good condition" using ESD. This approach ensures that 98% of Maryland's annual runoff is managed by state-of-the-art stormwater management practices. For more information on Maryland stormwater management programs, see the *Stormwater Management Program* on MDE's website.

Basic descriptions of each program are listed below with some recent highlights.

Legal and Regulatory Capacity: The legal and regulatory capacity to manage stormwater in Maryland is defined at the federal, state and local levels.

Federal: Maryland's NPDES Municipal Stormwater Permits - Phase I and Phase IIs: CWA, Section 402 and 40 CFR Part 122, requires that all municipalities with populations over 100,000 and 11 categories of industrial activity obtain Phase I NPDES municipal separate storm sewer system discharge permits. Smaller municipalities, industries, and construction sites, and State and federal properties are regulated under NPDES Phase II discharge permits. Together, these permits cover the majority of urban Maryland. Municipal stormwater permits require the development of comprehensive management programs to reduce storm drain system pollution to the maximum extent practicable (MEP), show a reduction of pollutants pursuant to EPA

approved TMDLs, and improve water quality. Typical NPDES stormwater permit conditions require jurisdictions to undertake actions necessary to provide:

- Legal Authority: Provide certification from appropriate legal counsel that adequate authority exists to control discharges from the municipal storm drain system;
- Source Identification: Map storm drain pipes and best management practices, land use, impervious cover, and watershed restoration projects in geographical information system (GIS) format;
- Management Programs: Implement erosion and sediment control, stormwater management, illicit connection detection and elimination, and public education and outreach programs;
- Watershed Assessment: Evaluate all urban watersheds thoroughly regarding water quality and develop goals and action plans for restoration;
- Stormwater Watershed Implementation Plans: Provide water quality improvement projects for 20% of a jurisdiction's impervious surfaces based on TMDLs and local watershed assessments during each five-year permit cycle;
- Assessment of Control: Document work toward meeting watershed restoration goals; stormwater WLAs using chemical, biological, and physical monitoring; and
- Program Funding: Provide an annual financial analysis of the capital, operation, and maintenance expenditures necessary to comply with permit conditions.

State: Maryland's Stormwater Management Law and Regulations: The entire State is regulated under Maryland's stormwater management law (Environment Article 4 §201.1 and §203) and stormwater management Code of Maryland Regulations (COMAR) 26.17.02, which have recently undergone significant enhancement as part of the State's Stormwater Management Act of 2007. The Law and regulations requires that locally implemented programs:

- Prevent soil erosion from any development project;
- Maintain 100% of the predevelopment groundwater recharge volume for the site;
- Capture and treat stormwater runoff to remove pollutants and enhance water quality;
- Restore, enhance and maintain the chemical, physical, and biological integrity of the waters of the State;
- Implement a channel protection strategy to reduce downstream erosion in receiving streams;
- Maintain the integrity of stream channels for their biological function, as well as for drainage;
- Implement quantity control strategies to prevent increases in the frequency and magnitude of out-of-bank flooding from large, less frequent storm events;
- Safeguard fish and aquatic life and scenic and ecological values;
- Establish a comprehensive process for approving grading and sediment control plans and stormwater management plans that takes into account the cumulative impacts of both; and
- Review planning, zoning, and public works ordinances to remove impediments to ESD implementation.

Performance Standards for Stormwater Management in Maryland

To prevent adverse impacts of stormwater runoff, the State of Maryland has developed fourteen performance standards that must be met at development sites. These standards apply to any construction activity disturbing 5,000 or more square feet of earth. The following performance standards shall be addressed at all sites where stormwater management is required:

Standard No. **1** Site designs shall minimize the generation of stormwater and maximize pervious areas for stormwater treatment.

Standard No. **2** Stormwater runoff generated from development and discharged directly into a jurisdictional wetland or waters of the State of Maryland shall be adequately treated.

Standard No. **3** Annual groundwater recharge rates shall be maintained by promoting infiltration through the use of structural and non-structural methods. At a minimum, the annual recharge from post development site conditions shall mimic the annual recharge from pre development site conditions.

Standard No. **4** Water quality management shall be provided through the use of environmental site design practices.

Standard No. **5** Structural BMPs used for new development shall be designed to remove 80% of the average annual post development total suspended solids load (TSS) and 40% of the average annual post development total phosphorous load (TP). It is presumed that a BMP complies with this performance standard if it is:

- sized to capture the prescribed water quality volume (WQv),
- designed according to the specific performance criteria outlined in this manual,
- constructed properly, and
- maintained regularly.

Standard No. **6** Control of the two-year and ten-year frequency storm events is required if the local authority determines that additional stormwater management is necessary because historical flooding problems exist and downstream floodplain development and conveyance system design cannot be controlled. In addition, safe conveyance of the 100-year storm event through stormwater management practices shall be provided.

Standard No. **7** To protect stream channels from degradation, the channel protection storage volume (Cpv) shall be based on the runoff from the one-year frequency storm event. Environmental site design practices shall be used to the maximum extent practicable to address Cpv. Any remaining Cpv requirements shall be addressed using stormwater practices described in Chapter 3 of the Maryland Stormwater Design Manual.

Standard No. **8** Stormwater discharges to critical area with sensitive resources [e.g., cold water fisheries, shellfish beds, swimming beaches, recharge areas, water supply reservoirs, Chesapeake

and Atlantic Coastal Bays Critical Area (see Appendix D.4)] may be subject to additional performance criteria or may need to utilize or restrict certain BMPs.

Standard No. **9** All stormwater management practices shall have an enforceable operation and maintenance agreement to ensure the system functions as designed.

Standard No. **10** Every BMP shall have an acceptable form of water quality pretreatment.

Standard No. **11** Redevelopment, defined as any construction, alteration or improvement on sites where existing land use is commercial, industrial, institutional or multifamily residential and site impervious area exceeds 40%, is governed by special stormwater sizing criteria depending on the amount of increase or decrease in impervious area created by the redevelopment.

Standard No. **12** Certain industrial sites are required to prepare and implement a stormwater pollution prevention plan and file a notice of intent (NOI) under the provisions of Maryland's Stormwater Industrial National Pollutant Discharge Elimination System (NPDES) general permit (a list of industrial categories subject to the pollution prevention requirement can be found in Appendix D.6). The requirements for preparing and implementing a stormwater pollution prevention plan are described in the general discharge permit available from MDE and guidance can be found in the United States Environmental Protection Agency's (EPA) document entitled, "Storm Water Management for Industrial Activities, Developing Pollution Prevention Plans and Best Management Practices" (1992). The stormwater pollution prevention plan requirement applies to both existing and new industrial sites.

Standard No. **13** Stormwater discharges from land uses or activities with higher potential for pollutant loadings, defined as hotspots in Chapter 2 of the Maryland Stormwater Design Manual, may require the use of specific structural BMPs and pollution prevention practices. In addition, stormwater from a hotspot land use may not be infiltrated without proper pretreatment.
.
Standard No. **14** In Maryland, local governments are usually responsible for most stormwater management review authority. Therefore, prior to design, applicants should always consult with their local reviewing agency to determine if they are subject to additional stormwater design requirements. In addition, certain earth disturbances may require NPDES construction general permit coverage from MDE (see Appendix D.7).

Ensuring Woods in Good Condition for New Development

Maryland's Stormwater Management Act of 2007 requires that any new development greater than 5,000 square feet implement ESD to the MEP to replicate woods in good condition. These practices significantly reduce the growth in nutrients and sediments from new development and, when implemented with redevelopment and stormwater retrofits as described in this WIP, will ensure net reductions in pollutants to meet stormwater WLAs. The following is a summary of the process by which ESD to the MEP assures achievement of the woods in good condition outcome for new development.

Current Maryland law and regulations require that ESD be used to the MEP to control stormwater from new and redevelopment. MDE developed and adopted technical requirements

for ESD and defined the MEP standard in Chapter 5 of the 2000 Maryland Stormwater Design Manual (Manual). The new criteria for ESD are based on the runoff curve number (RCN) hydrology method developed by the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS). The basic goal in Chapter 5 of the Manual is that ESD planning techniques and practices are to be implemented to replicate runoff characteristics similar to "woods in good condition."

MDE developed Table 5.3 (pages 5.21 and 5.22 of the Manual and shown below) to simplify the determination of stormwater management requirements to meet the "woods in good condition" goal. When soil type and proposed site imperviousness is known, Table 5.3 is used to determine the amount of rainfall required to be captured and treated in ESD practices to mimic wooded conditions. This target rainfall amount or "P_E" is used to design ESD practices according to the following equation:

- ESD_v = Runoff volume (in feet^3 or acre-feet) captured in specific ESD practices

  $$= \frac{(P_E)(R_v)(A)}{12}$$ where:

  - P_E = Rainfall target used to determine ESD goals and the size of practices
  - R_v = the dimensionless volumetric runoff coefficient
    = 0.05 + 0.009(I) and I is percent impervious cover
  - A is the drainage area (in feet^2 or acres)

The MEP standard is met after all reasonable options for implementing ESD are exhausted. When the target P_E is only partially treated in ESD practices, Table 5.3 is used to determine a reduced RCN. This is used to calculate additional stormwater management requirements to meet woods in good condition. In addition to the new technical design criteria, phased plan submissions must occur at various stages of design in order to ensure compliance with the ESD to the MEP standard. These stages include Concept, Site Development, and Final stormwater management plans.

Technical Considerations for ESD Design Table 5.3 is based on the "Change in Runoff Curve Number Method" (McCuen, R., MDE 1983) and the RCNs are based on USDA/NRCS hydrology. Primary factors include hydrologic soil group (HSG), land use or cover, hydrologic condition, connectivity of impervious cover, and antecedent runoff condition (ARC). When using the Chapter 5 methodology, the following considerations apply to ESD design:

- Table 5.3 provides ESD management requirements for four distinct HSGs (A, B, C, and D). Predevelopment conditions may show disturbance to existing soils and in these cases the HSG classifications found in USDA/NRCS Soil Surveys and models (e.g., TR55) may not apply. Where site soils have been altered, the following may be used to determine HSG for uncompacted soils:

HSG	USDA Soil Texture
A	Sand, loamy sand, or sandy loam
B	Silt loam or loam
C	Sandy clay loam
D	Clay loam, silty clay loam, sandy clay, silty clay, or clay

Table 5.3 Rainfall Targets/Runoff Curve Number Reductions used for ESD

Hydrologic Soil Group A										
%I	RCN*	P_E = 1"	1.2"	1.4"	1.6"	1.8"	2.0"	2.2"	2.4"	2.6"
0%	40									
5%	43									
10%	46									
15%	48	**38**								
20%	51	40	**38**	**38**						
25%	54	41	40	39						
30%	57	42	41	39	**38**					
35%	60	44	42	40	39					
40%	61	44	42	40	39					
45%	66	48	46	41	40					
50%	69	51	48	42	41	**38**				
55%	72	54	50	42	41	39				
60%	74	57	52	44	42	40	**38**			
65%	77	61	55	47	44	42	40			
70%	80	66	61	55	50	45	40			
75%	84	71	67	62	56	48	40	**38**		
80%	86	73	70	65	60	52	44	40		
85%	89	77	74	70	65	58	49	42	**38**	
90%	92	81	78	74	70	65	58	48	42	**38**
95%	95	85	82	78	75	70	65	57	50	39
100%	98	89	86	83	80	76	72	66	59	40

Hydrologic Soil Group B										
%I	RCN*	P_E = 1"	1.2"	1.4"	1.6"	1.8"	2.0"	2.2"	2.4"	2.6"
0%	61									
5%	63									
10%	65									
15%	67	**55**								
20%	68	60	**55**	**55**						
25%	70	64	61	58						
30%	72	65	62	59	**55**					
35%	74	66	63	60	56					
40%	75	66	63	60	56					
45%	78	68	66	62	58					
50%	80	70	67	64	60					
55%	81	71	68	65	61	**55**				
60%	83	73	70	67	63	58				
65%	85	75	72	69	65	60	**55**			
70%	87	77	74	71	67	62	57			
75%	89	79	76	73	69	65	59			
80%	91	81	78	75	71	66	61			
85%	92	82	79	76	72	67	62	**55**		
90%	94	84	81	78	74	70	65	59	**55**	
95%	96	87	84	81	77	73	69	63	57	
100%	98	89	86	83	80	76	72	66	59	**55**

Cp_v Addressed (RCN = Woods in Good Condition)

RCN Applied to Cp_v Calculations

Table 5.3 Runoff Curve Number Reductions used for Environmental Site Design (continued)

Hydrologic Soil Group C										
%I	RCN*	P_E = 1"	1.2"	1.4"	1.6"	1.8"	2.0"	2.2"	2.4"	2.6"
0%	74									
5%	75									
10%	76									
15%	78									
20%	79	**70**								
25%	80	72	**70**	**70**						
30%	81	73	72	71						
35%	82	74	73	72	**70**					
40%	84	77	75	73	71					
45%	85	78	76	74	71					
50%	86	78	76	74	71					
55%	86	78	76	74	71	**70**				
60%	88	80	78	76	73	71				
65%	90	82	80	77	75	72				
70%	91	82	80	78	75	72				
75%	92	83	81	79	75	72				
80%	93	84	82	79	76	72				
85%	94	85	82	79	76	72				
90%	95	86	83	80	77	73	**70**			
95%	97	88	85	82	79	75	71			
100%	98	89	86	83	80	76	72	**70**		

Hydrologic Soil Group D										
%I	RCN*	P_E = 1"	1.2"	1.4"	1.6"	1.8"	2.0"	2.2"	2.4"	2.6"
0%	80									
5%	81									
10%	82									
15%	83									
20%	84	**77**								
25%	85	78								
30%	85	78	**77**	**77**						
35%	86	79	78	78						
40%	87	82	81	79	**77**					
45%	88	82	81	79	78					
50%	89	83	82	80	78					
55%	90	84	82	80	78					
60%	91	85	83	81	78					
65%	92	85	83	81	78					
70%	93	86	84	81	78					
75%	94	86	84	81	78					
80%	94	86	84	82	79					
85%	95	86	84	82	79					
90%	96	87	84	82	79	**77**				
95%	97	88	85	82	80	78				
100%	98	89	86	83	80	78	**77**			

Cp_v Addressed (RCN = Woods in Good Condition)

RCN Applied to Cp_v Calculations

- Where site soils have been compacted from earlier construction, predevelopment conditions should be based on the most permeable HSGs or from pre-compaction testing.

- The RCN values in Table 5.3 were derived for the average 1-year, 24-hour rainfall event for Maryland, which is 2.7 inches.

- RCNs used for predevelopment characteristics shall be based on "woods in good hydrologic condition" and are labeled in the green area on Table 5.3 for each soil group. A target P_E is determined by correlating the RCN for "woods" with proposed impervious area (%I) and on-site HSGs.

- The target P_E is used to calculate ESD_v which is the volume needed to replicate runoff conditions for woods. Alternative surfaces, nonstructural, or micro-scale practices, may be used to meet ESD goals when designed according to the criteria in the Manual.

- Runoff may be captured and treated using a single ESD practice or technique or a series of interconnected practices and techniques.

- When a project is divided into multiple drainage areas, ESD requirements may be addressed as follows:

    - Where individual drainage areas share a common outfall and the land use or proposed impervious cover is considered relatively homogeneous, ESD requirements could be addressed cumulatively over these areas.

    - When a project is divided into separate drainage areas that do not share a common outfall, or when the land use is distinctly non-uniform, ESD requirements should be addressed for each individual drainage area.

    - Individual practices may be oversized to compensate or "over manage" for other practices. However, the size of any one practice may not be larger than that required to store runoff for the 1-year 24-hour design storm (Q_1).

Determining Compliance with ESD_v Goals

As noted above, soil type and proposed site imperviousness are used in Table 5.3 to determine the amount of rainfall (or target P_E) required to be treated in ESD practices to replicate runoff conditions on a wooded site. This target P_E may be used in the ESD_v equation (below) to determine the total volume requirements for the site. These targets may be treated by using any one or a combination of practices listed in Chapter 5 of the Maryland Stormwater Design Manual.
The practices include alternative surfaces (green roofs, permeable pavements, and reinforced turf), nonstructural practices (disconnection of rooftop and non-rooftop runoff and sheetflow to conservation areas), and a list of nine different micro-scale practices.

$$ESD_v = \frac{(P_E)(R_v)(A)}{12}$$

ESD_v can be addressed by achieving a cumulative volume provided in ESD practices over the entire site. When two or more micro-scale practices are used, their volumes are easily added. However, when alternative surfaces or nonstructural practices are used, it will be necessary to determine an equivalent ESD volume for these practices. In this way, cumulative volumes for all practices may be determined. Examples of how this may be done are discussed below.

Implementation of alternative surfaces will cause a reduced RCN and these are noted in Chapter 5 in Table 5.4 (green roofs) and Table 5.5 (permeable pavements). Using this information MDE calculated equivalent ESD volumes per square foot (ESD_v/ft^2) for each reduced RCN as noted in Table 1 below. The ESD_v/ft^2 is then multiplied by the surface area of the practice (in ft^2) to determine ESD_v for the alternative surface. This can be subtracted from the target ESD_v for the site and the remaining volume is required to be treated in other practices. An example of how to use Table 1 is provided below.

- When permeable pavements are used on A soils with a 9-inch subbase, a reduced RCN of 62 is assigned (from Table 5.5 of Chapter 5, and Table 1 below).

- MDE has calculated an ESD_v/ft^2 of 0.183 for an RCN of 62 as shown in Table 1. ESD_v is calculated as follows:

  $ESD_v = (ESD_v/ft^2)(A)$; where A = area of the alternative surface in ft^2

- The ESD_v/ft^2 in Table 1 assumes a volumetric runoff coefficient (R_v) of 0.95.

- The ESD_v for this practice can be subtracted from the target ESD_v for the site and the remaining volume is required to be treated in other practices.

- This same procedure can be used for green roofs using the information in Table 1.

Table 1. ESD Values for Green Roofs

Roof Thickness	RCN[1]	ESD_V/ft^2	Equiv. P_E (in.)
2"	94	0.035	0.4
3"	92	0.05	0.6
4"	88	0.077	1
6"	85	0.095	1.2
8"	77	0.134	1.7

ESD Values for Permeable Pavements

Hydrologic Soil Group									
	A			B			C		
Subbase	RCN[2]	ESD_V/ft^2	Equiv. P_E (in.)	RCN[2]	ESD_V/ft^2	Equiv. P_E (in.)	RCN[2]	ESD_V/ft^2	Equiv. P_E (in.)
6"	76	0.138	1.7	84	0.101	1.3	93	0.043	0.5
9"	62	0.183	2.3	65	0.175	2.2	77	0.134	1.7
12"	40	0.206	2.6	55	0.196	2.5	70	0.16	2

[1] Effective RCN from Table 5.4, p. 5.42

[2] Effective RCN from Table 5.5, p. 5.48

When nonstructural practices are used, the P_E or rainfall amount treated, is based on the length of flow over the disconnected area. For example, a disconnection flow path length of 30 feet for rooftop runoff is equivalent to treating a P_E of 0.4 inches of rainfall. The P_E of 0.4 inches may be used in the ESD_v equation to determine the volume provided for this practice. As in the example described above, the area (A) and volumetric runoff coefficient (R_v) parameters shall be specific to the impervious area that is disconnected. The calculated volume may be added to the volume of other ESD practices to provide a total ESD_v achieved for the site.

After alternative surfaces and nonstructural practices are implemented, the remaining rainfall/volume requirements may be treated in micro-scale practices. Guidelines for calculating the volume available for specific micro-scale practices are outlined in Chapter 5 of the Manual. In general, this involves accounting for the storage above the practice and within the filter media. The volume provided in each micro-scale practice is added to all other practices to determine a total volume for the entire ESD system.

When the cumulative volume for all practices meets or exceeds the target ESD_v for the project, then MEP goals are met. However, when these goals are not met, the system must be re-evaluated until the review agency is satisfied that all reasonable ESD options have been exhausted. If all options have been examined and the rainfall/volume targets are not managed completely, structural practices will be necessary.

When structural practices are necessary, it will be useful to calculate the cumulative rainfall amount that is treated in the ESD system. When the rainfall amount is known, Table 5.3 is used to determine a reduced RCN. The P_E treated for the system may be determined by rearranging the ESD_v equation as follows:

$$P_E = \frac{12 \times ESD_v}{R_v \times A}$$

This equation will convert the volume available in all ESD practices to a treated rainfall amount (P_E). The area (A) and volumetric runoff coefficient (R_v) parameters used in the equation shall be specific to the entire system of ESD practices. Table 5.3 is then used to correlate the P_E for the system with percent impervious area to obtain a reduced RCN. Using the reduced RCN, the

volume of runoff from the proposed project is determined and the volume required in structural practices to replicate runoff to woods in good condition is calculated.

Design Equations for Estimating P_E

The design criteria for micro-scale practices in Chapter 5 of the Manual provide equations that estimate P_E when certain filtration and infiltration practices are used. These equations (5.1, 5.2, and 5.3) allow for quick estimates of the rainfall amount that may be treated in an individual facility. In addition, the equations may be rearranged to solve for A_f to estimate the surface area needed to achieve ESD goals. These equations are best used as planning and design tools during the concept review process. The specific practices that apply these equations are landscape infiltration, micro-bioretention, bio-swales, grass swales, and rain gardens. As an example, equation 5.1 (Manual, page 5.85) is shown below for landscape infiltration:

$$P_E = 20 \times \frac{A_f}{DA}$$

where: P_E = specific rainfall captured and treated by the practice
A_f = surface area of the practice
DA = contributing drainage area to the practice
20 = a surface area constant (explained below)

Equations 5.1, 5.2, and 5.3 were derived from equations in Appendix D.13 and Chapter 3 of the Manual, which are used to determine the minimum surface area of filtering and infiltration practices. An analysis of the original equations in the Manual found that when practices are designed to treat impervious areas close to the source (e.g., the drainage area is at or near 100% impervious), the amount of rainfall treated can be based on the relationship between drainage area and surface area of the facility. The drainage area to surface area relationships are approximately 5% for landscape infiltration; 7.5% for micro-bioretention and bio-swales; and 10% for rain gardens.

MDE used these relationships to develop the surface area constant provided in equations 5.1, 5.2, and 5.3. For example, in equation 5.1, the surface area constant is 20. This was determined by using the drainage area to surface area ratio of 5%, and the surface area to drainage area ratio is equal to the reciprocal, or 20. The surface area constants in equations 5.2 (Manual, page 5.98) and 5.3 (Manual, page 5.105) were determined in a similar fashion.

During the early stages of project planning, these equations can be used to estimate the amount of management that could be achieved on site. When considering the areas available for ESD implementation, a quick estimate of the amount of rainfall (P_E) that could be treated is provided. This allows an early assessment of the design during concept reviews when comparing to P_E targets.

Another application of the equations above is to estimate the surface area (A_f) needed for an individual facility to meet ESD goals.

For example, by rearranging equation 5.1 the surface area (A_f) of a landscape infiltration practice required to meet a specific P_E can be calculated as follows:

$$A_f = DA \times \frac{P_E}{20}$$

These surface area estimates are conservative and therefore, can be considered a first step toward evaluating compliance with ESD targets. The designer can demonstrate the feasibility of compliance with management requirements on a two dimensional level during concept plan submissions. When A_f is provided, it can reasonably be assumed that the corresponding ESD volumes will be met as long as the minimum depths specified for each practice are used.

As a project moves toward the site development phase, the initial estimates for surface area and P_E treated could be adjusted as the dimensions of individual practices are fine tuned. For example, it may be desirable to make an individual practice deeper to provide greater volume (and greater P_E treated) and compensate for other drainage areas that do not have enough management. In addition, site constraints may dictate that the surface area of a facility may not be as large as originally planned, and therefore, the depth would need to be adjusted in order to achieve the required volume.

Design Process and ESD Computations – A Step by Step Overview

The comprehensive plans review process detailed in Chapter 5 of the Manual requires that plans be submitted for review and approval during the Concept, Site Development, and Final Design stages. This is an iterative process that builds upon each stage of design to provide a stormwater strategy that considers the unique characteristics of the site. This will ensure that all reasonable options for implementing ESD are exhausted in the early stages of design in order to comply with the MEP standard.

The flow chart on page 12 shows how the information in each step of the review process works toward the final design. During the Concept phase, options for implementing alternative surfaces, nonstructural practices, and micro-scale practices are evaluated. Calculations will assess the feasibility of achieving P_E and ESD_v goals. The Site Development phase provides more detailed computations for individual drainage areas as grading plans are finalized. The dimensions of individual practices are adjusted in order to optimize all ESD opportunities and to account for site constraints. The ESD to the MEP standard must be demonstrated prior to proceeding to the next phase. Final plans will include details of ESD designs and computations for any structural practices necessary to address total treatment requirements (e.g., Cp_v, Qp, or Q_f).

The design process for ESD implementation is presented below. This will describe the information presented on stormwater management plans to demonstrate compliance at the Concept, Site Development, and Final Design phases. With each phase, specific requirements are outlined, the expected outcome for both designers and plans reviewer is stated, and the specific technical process is presented. It should be noted, that the process described below is a suggested methodology. Because ESD practices and techniques involve a wide array of choices

and decisions that may be made on any given project, there may be other acceptable means for achieving ESD to the MEP.

Concept Plan Design and Computations

The Concept design phase is the first step in project development and includes mapping natural resources, an initial layout of the project, and preliminary locations of ESD practices and management options. The purpose is to ensure that all options for ESD are exhausted prior to progressing toward more detailed phases of project design. The developer/designer must demonstrate how ESD is to be implemented and review authorities will evaluate the design to determine the feasibility of meeting the MEP standard.

1. **Determine Stormwater Management Requirements** – This initial step will evaluate proposed conditions and estimate stormwater treatment requirements to replicate runoff characteristics from a wooded site. Implementation of ESD to meet management requirements will include the following information:

   - **Initial Site Data** – Natural resources and existing conditions are mapped and proposed limits of disturbance, site layout of buildings, roadways and impervious areas are identified. Site data will include drainage areas, soil types, land use, and proposed impervious cover.

   - **Determine RCNs for Wooded Conditions** – Table 5.3 tabulates the RCNs for wooded conditions for A, B, C, and D soils. A composite RCN can be computed for "woods in good condition" when different soil types exist on site.

   - **Determine ESD Targets** – Existing soils and impervious cover estimates are used to determine rainfall targets (P_E's) from Table 5.3. The total ESD_v required is then calculated for the target rainfall (P_E).

2 **Preliminary ESD Options** – ESD strategies are employed such as reducing impervious area, protecting natural resources, maximizing the use of landscaped areas for disconnecting runoff, allowing sheetflow, and integrating practices into the proposed site layout of buildings and infrastructure. The feasibility of using alternative surfaces, nonstructural, and micro-scale practices is evaluated and the location of potential management areas is identified. A drawing or sketch identifying the preliminary location and approximate size of each practice is provided.

3 **Preliminary Design**– Using the location and areas available for ESD, an estimate of the amount of rainfall (P_E) captured and treated in these practices will be provided. Initial calculations will also be made to estimate proposed dimensions to show the total volume provided in ESD practices. The preliminary design will show how the proposed rainfall targets and corresponding ESD_v can be achieved by using a combination of alternative surfaces, nonstructural, and micro-scale practices.

➥ ***Concept plans may be submitted after completing these steps. Documentation will be provided to demonstrate that all opportunities for using ESD practices have been evaluated. The plan review authorities will determine whether the proposal is feasible and compliance with the MEP standard is addressed.***

Site Development Plan Design and Computations

The Site Development plan will provide more details and computations as a project progresses toward Final design. Comments from the review agency during Concept approval will be addressed and the location of practices, their drainage areas, and the management options to be implemented will be provided at this stage. This step provides an interim check by review agencies to assess compliance with the ESD to the MEP standard before allowing the design to progress to the final phase.

4 **ESD Practice Design** – After the Concept phase, the final site layout, exact impervious area locations and acreages, proposed topography, and proposed drainage areas will be provided. As site utilities such as water, sewer, electric, and storm drains are located, the design of ESD practices becomes progressively more detailed. Options to use alternative surfaces and nonstructural practices should be maximized to provide treatment for the target rainfall (P_E). Micro-scale practices are sited and final dimensions are provided so that calculations can show the volume of runoff captured and treated. More detailed calculations will quantify the cumulative effects of practices used in combination or as a treatment train.

5 **Design Assessment** - After completing the design of ESD practices, the next step is to determine if "woods in good condition" goals have been met. This requires evaluating the cumulative effect of all practices on site. This is accomplished as follows:

- **Determine if ESD Targets are Met:** After alternative surfaces and nonstructural practices have been implemented, the remaining volume to be treated in micro-scale practices is determined. When the total ESD_v is provided in all practices, then ESD to the MEP is achieved and plans may proceed toward final design.

- **Evaluate Additional ESD Opportunities:** If the required ESD_v is not achieved, then the project will be re-evaluated to determine whether additional ESD measures can be reasonably implemented. The final dimensions of ESD practices may be adjusted to provide greater volume. When the review agency agrees that ESD to the MEP has been achieved, structural practices may be used to address any remaining management requirements.

- **Determine Additional Management Requirements:** When structural practices are determined to be necessary, the amount of rainfall treated (P_E) with the proposed ESD practices is determined. Table 5.3 is used to correlate the P_E treated with the reduced RCNs. Remaining stormwater management requirements are calculated to mimic runoff conditions for a wooded site.

- **Design Structural Practices if Necessary:** Structural practices are located and designed according to criteria in Chapter 3 of the Manual.

- **Complete Design:** Before submitting Site Development plans, the designs for the ESD practices should be ready for completion. This includes all pertinent details, standards, and specifications needed to verify that designs are in accordance with the requirements listed in Chapter 5.

➥ ***Site Development plans may be submitted after completing these steps. Documentation will be provided to demonstrate that ESD practices have been implemented to the MEP with the proposed plan. Review agencies will need to confirm that ESD has been implemented to the MEP prior to allowing structural practices to address remaining management requirements.***

Final Plan Design and Computations

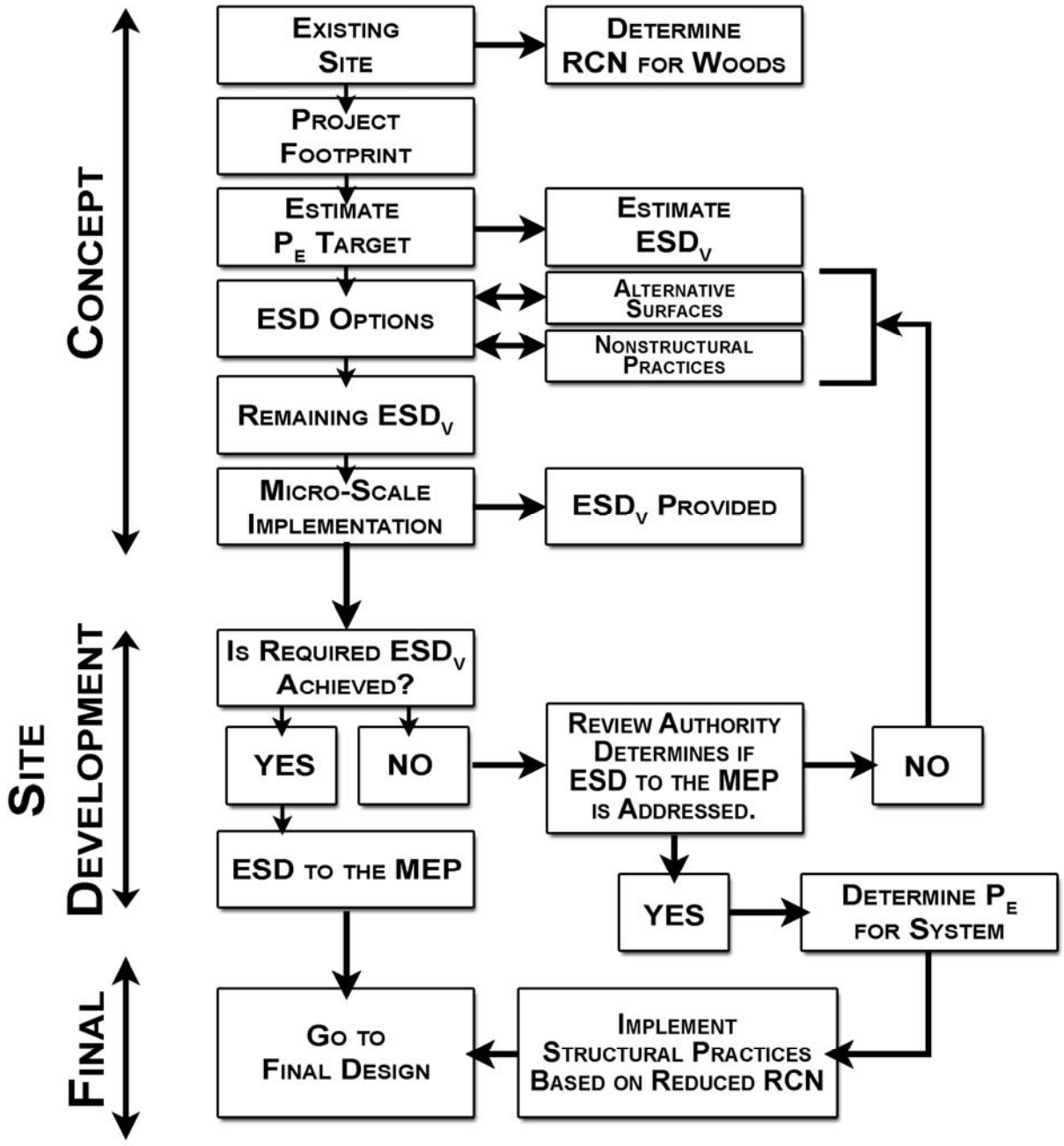
After Site Development plan approval, the developer may prepare Final plans by addressing comments from the review agency. After all reasonable ESD options have been exhausted, structural practices may be needed to address any remaining stormwater requirements. Final construction drawings, hydrology and hydraulic computations, and final erosion and sediment control plans will be submitted at this phase of design.

6 **Finalize ESD Design and Address Remaining Stormwater Requirements** – Any comments from the review agencies will be addressed as details and computations for ESD practices are completed. After all reasonable options for implementing ESD have been exhausted, the design of structural practices may be needed to address any remaining Cp_v or local Q_p and Q_f requirements.

➥ ***Final plans may be submitted after completing these steps***

Design Examples are provided below. A flow chart is also provided to outline the ESD design and calculation procedures used in the examples. This information is intended to provide guidance on how to design and assess compliance with ESD requirements. However, because a range of options for ESD implementation exists on every development site, and the size and complexity of a project may dictate more detailed information at different stages of review, the following method is not the only way to show compliance with the MEP standard.

New Development
ESD Design and Calculations



For more information on the State's law, regulations, and model ordinance, please see:

Maryland's Stormwater Management Law
http://mlis.state.md.us/asp/web_statutes.asp?gen&4-201

Code of Maryland Regulations
http://www.mde.state.md.us/assets/document/26.17.02.%202009.pdf

MDE's Model Stormwater Ordinance for local adoption
http://www.mde.state.md.us/assets/document/Model%20Stormwater%20Ordinance%20w%20emerg%20reg%20revisions%2004-12-2010.pdf

Local: County and Municipal Legal Authority: Local governments have adopted ordinances that ensure the necessary authority to implement Maryland's stormwater management laws and regulations. MDE/WMA's Sediment, Stormwater, and Dam Safety Program has approved 20 out of 23 Counties (Anne Arundel, Harford and Howard Counties remain) and 38 out 38 Municipalities regarding stormwater management ordinances that comply with revised and updated stormwater regulation (COMAR 26.17.02.). Several of the local jurisdictions are working through their newly elected Council or Commissioners for final adoption of the latest approved changes. In addition, many have engaged in various types of cross-regulation review to help identify and correct conflicts between regulations that are barriers to innovative stormwater management practices.

Compliance Capacity for MS4s and Stormwater Retrofits: A key goal of the Bay restoration strategy will be to install stormwater controls (retrofits) and water quality improvement projects on land that was developed prior to the implementation of Maryland's Stormwater Management Law in 1985, and enhancing water quality for early BMPs implemented between 1985 and 2002.

Maryland's urban stormwater retrofit program and performance standards are based on a mix of State and federal voluntary and regulatory efforts, and will be adjusted as needed toward meeting Chesapeake Bay TMDLs. Maryland began a voluntary retrofit program in 1984, known as the Stormwater Pollution Control Cost Share Program. This program was expanded in the 1990's with the Small Creeks and Estuary Cost Share Program, and again in 2010 with the Chesapeake Bay Trust Fund. Thousands of urban acres across the State have been retrofit with these funds.

MDE has developed specific structural stormwater best management practice performance standards that are referenced in the 2000 Maryland Stormwater Design Manual (*Manual*), and the implementation of ESD to the MEP that are referenced in the 2009 Manual update. Additionally, Maryland's *Manual* provides specific design criteria for stream channel protection. Many stormwater retrofits are combined with stream restoration practices that are designed to provide stable stream hydrology. The goal of most stream restoration projects is to reintroduce the stream to the floodplain where enhanced nutrient and sediment removal may take place. Several rivers listed as impaired for nutrients in urban Maryland have been delisted after the

implementation of stormwater retrofits, stream restoration, and other watershed restoration techniques. Please see EPA's, "Baltimore County Stream Restoration Improves Quality of Life" (WIP, Appendix H2).

Maryland has written watershed retrofit requirements into NPDES municipal stormwater permits since 1999. These retrofit requirements are based on existing impervious surface area with no or minimal stormwater management. An example of a comprehensive watershed retrofit program and associated BMP data can be found in Baltimore County's most recent NPDES annual report Appendix (WIP, Appendix G2). Previously, 10% of a jurisdiction's unmanaged urban areas were required for retrofitting during a five year permit term. The current round of permits, which began with Montgomery County in February 2010, require that an additional 20% of a jurisdiction's unmanaged impervious area be treated.

Maryland's NPDES stormwater permits, modeled after Montgomery County's permit, will be used to accelerate urban runoff reductions toward meeting the Chesapeake Bay TMDL by 2020. Major new provisions of these permits require the restoration of an additional 20 percent of a jurisdiction's impervious surface area; implementing regional strategies for the elimination of trash; and the development of watershed implementation plans, with milestones and schedules, to achieve stormwater WLAs and water quality standards for impaired waters affected by stormwater discharges. MS4 Phase I permit renewals are currently underway and are scheduled to be completed by March, 2011.

Stormwater Retrofit Performance Criteria

Stormwater retrofits are an opportunistic endeavor. Getting whatever water quality benefit that is available wherever you can find it in a constrained urban environment is a fundamental component of any comprehensive watershed management plan. In the 1990's, Maryland's MS4 stormwater retrofit criteria were based on locally-driven watershed management plans, goals, and objectives. As TMDLs and the restoration of Chesapeake Bay became more prevalent in the 2000's, it became necessary for MDE to establish a yardstick for stormwater retrofits in order to judge MS4 program compliance and to ensure that water quality criteria can be met. This process is dynamic and will continue to adapt and evolve toward meeting the Chesapeake Bay TMDL.

A key issue for this Phase I Plan is the tracking and verification of how much progress is made toward retrofit goals. This is accomplished through one of the State’s 2-year Milestone commitments, which is tracked on Maryland’s BayStat website. In 2008, based generally on the 2004 Tributary Strategy, Maryland established a Chesapeake Bay restoration goal to retrofit 40% of existing developed lands, or approximately 416,000 acres, by 2020. This acreage estimate was based on the 5.1 version of Chesapeake Bay Model. To meet this schedule, approximately 90,000 additional acres need to be restored by the end of 2011. This is the basis for Maryland’s Chesapeake Bay 2011 Milestone for stormwater, which is summarized in Figure 2.1.

To date, Maryland has accomplished approximately 78,856 acres of the Chesapeake Bay watershed restoration goal. Most of these stormwater retrofits were implemented through the NPDES stormwater permits issued to Baltimore City; and Anne Arundel, Baltimore, Carroll,

Charles, Harford, Howard, Frederick, Montgomery, and Prince George's counties; and the State Highway Administration. Additional retrofits outside of the federally regulated envelope have been implemented locally and through the former State's Stormwater Pollution Control Cost Share and Small Creeks and Estuary Cost Share Programs and newly created Chesapeake Bay 2010 Trust Fund. Additional information on stormwater management Tracking and Reporting Protocols can be found in Section 6 of this report.

Stormwater Acres Restored				
	Goal		Actual	
	2011	increment	restored	remains
2008	129,541	39,541	39,541	90,000
2009	129,541	69,541	53,815	75,725
2010	129,541	99,541	78,856	50,685
2011	129,541	129,541		

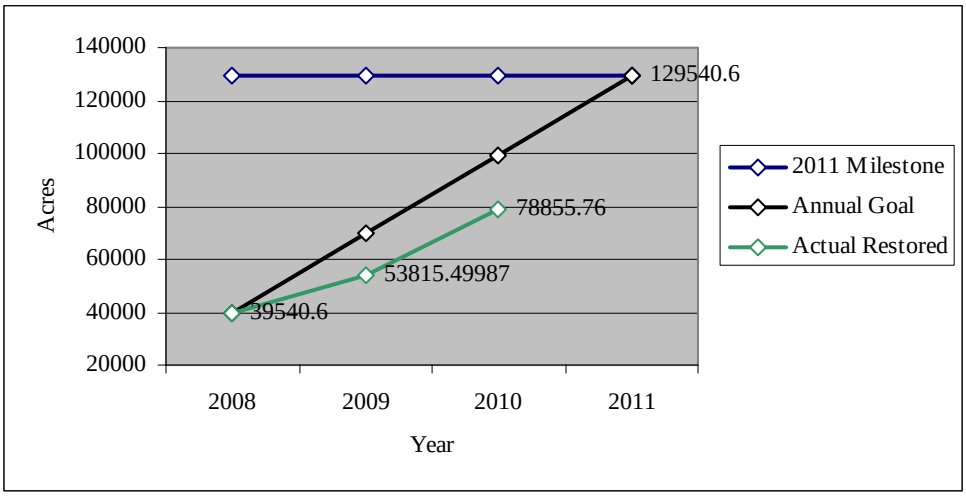


Figure 2.1 Maryland's 2011 2-Year Milestone for Stormwater Restoration

During the implementation of stormwater MS4 retrofits, numerous restoration and accounting issues became apparent. To provide improved guidance to the regulated community, an MS4 stormwater workgroup is simplifying the reporting of traditional, new, and alternative best management practices (BMPs) and the impervious areas they control. First, the inclusion of total maximum daily loads (TMDLs) and specifically the Chesapeake Bay TMDL in municipal stormwater permits dictated that "restoration" must be defined as meeting TMDL requirements and water quality criteria. Second, implementing water quality improvement projects on a certain percentage (30% by 2017) of a locality's impervious surface area in each permit term is the strategy.

Another fundamental element in defining stormwater retrofits is providing a minimum BMP design volume that needs to be met. This performance standard will allow Maryland to have greater confidence in its WIP planning and implementation because an acre retrofit will now

have a known pollutant removal efficiency based on this design criteria. Maryland believes that structural BMP retrofits be designed to meet the *Manual's* WQ_v criteria. This criteria is currently used to set the regulatory requirements for redevelopment in Maryland. Additionally, many of the CBP approved BMP efficiencies are based upon designs that treat 1 inch of runoff volume. BMPs that achieve less than the WQ_v provide opportunities for additional management and should still be pursued where viable. These facilities, however, will need to be pro-rated based on the WQ_v treated and impervious acre equivalent if no retrofitting has been done.

Retrofits shall be credited according to the following criteria:

- An acre for acre impervious credit will be given when a structural BMP is designed to provide treatment for the full WQ_v (1 inch), or

- A proportional volume of credit will be given when less than the WQ_v is provided: (percent of 1 inch treatment volume achieved) * (drainage area impervious acres)

Retrofit of a Dry Pond Constructed Circa 1985

i. original design = 2 and 10 year peak management
impervious acre drainage area = 15 acres

ii. retrofit design = 1 inch, or WQ_v
impervious acre credit = 15 acres

iii. retrofit design = 0.5 inch
impervious acre credit = 7.5 acres, (50% of WQ_v * 15 acres)

The stormwater workgroup will also research new and alternative water quality treatment practices. MDE's goal is to expand the group of urban BMPs that can be used by local governments to facilitate implementation, achieve greater pollutant load reductions, and increase affordability. An accounting system is being developed for translating the pollutant load reductions associated with alternative BMPs into "equivalent" impervious acre treated. This will ensure consistency with the current restoration framework of Maryland's MS4 permits, which require that a certain percent of a jurisdiction's impervious surface area be restored. This framework has been used by Maryland in its Plan development will inform the renewals of MS4 permits. Establishing alternative BMP efficiencies and equivalent impervious acres restored will require collaboration with both EPA and the other Bay States. Maryland and its local jurisdictions will need assurances from EPA that certain BMPs implemented will deliver specific pollutant reductions in the CBP model. Maryland's NPDES stormwater workgroup is eager to work with EPA to assure that BMPs implemented will deliver specific pollutant reductions in the CBP model. The following is a list of alternative urban BMPs that the stormwater workgroup has identified for possible retrofit credit:

Stream restoration	Pet/animal waste
Outfall stabilization	Regenerative outfalls
Urban forest buffers	Removal of impervious surfaces
Stormwater management by era	Impervious surface disconnects
Wetlands restoration	Downspout disconnects
Forest conservation	Rain barrels and rain gardens
Tree planting	Septic system upgrade
Urban nutrient management	Agricultural BMPs
Trash removal	Redevelopment and land use policies
Education	Public outreach and stewardship
Street sweeping	Disconnection of illicit discharges
Inlet cleaning/vacuuming	Floodplain restoration
Watershed association activities	Reduction in vehicle trips
Sub-soiling	Meadow creation
Shoreline erosion control	Lawn fertilizer reduction
Urban growth reduction	Land conservation

Alternative Urban BMPs to be Explored for Stormwater WIP

MDE has provided the CBP with a proposal for simplifying the accounting of stormwater BMPs. The method is based on assigning pollutant removal efficiencies to land areas developed during specific regulatory eras in Maryland with known pollutant removal efficiencies, see *Stormwater Management by Era* in Appendix F. While this method is still under consideration by the CBP, because of its usefulness, Maryland has begun to use it for WIP planning and modeling to meet the Bay's TMDLs.

Maryland plans to issue Phase II MS4 permits that will require 20% impervious area retrofit or its equivalent. The new Phase II MS4 General Permit is scheduled to be completed by June, 2011. These aggressive Phase I and Phase II MS4 permits will provide significant water quality treatment by 2020 for 30% to 50% of Maryland's existing impervious surfaces with little or no stormwater management. MDE will continue to provide local program guidance and explore new and alternative BMPs that may be used in comprehensive watershed implementation plans at a reduced cost. Enforcement of these new permit provisions through MS4 reviews and audits will assure that permit retrofit requirements and stormwater WLAs are met. MDE will use monitoring data, strategic in-house model runs, and the latest science on new and alternative BMPs to continually reassess and realign MS4 permit retrofit requirements so that 2017 and 2020 stormwater WLAs are met.

New Development and Residual Designation

Maryland's policy for controlling stormwater discharges for areas beyond federal regulation is two-fold. First, State regulations require stormwater management for any earth disturbance greater than 5,000 square feet for all new development and redevelopment. State performance criteria require that forest hydrology be replicated post-development. Second, for existing urban areas not subject to federal regulation, which amounts to less than 10% of the State's urban area, Maryland funds stormwater retrofits through the Chesapeake Bay Trust Fund. Due to stringent statewide stormwater regulations for new and redevelopment and effective retrofit funding programs, Maryland believes that additional NPDES designation is not needed at this time.

Maryland was approved as EPA's designee for administering the NPDES program in 1974. The power to designate additional areas for stormwater permit coverage rests with the State. Maryland has a strong history of residual stormwater designation. While the CWA required 8 large and medium jurisdictions with populations of greater than 100,000 to attain NPDES stormwater permit coverage in the State, MDE choose to designate 3 additional municipalities in the early 1990's. They include Carroll County, Charles County, and the Maryland State Highway Administration. The primary reasons for designated these entities were populations approaching the 100,000 threshold and municipal ownership of significant storm sewer systems. Since that time, federal coverage of smaller municipal storm sewer systems in Maryland has been expanded under NPDES Phase II regulation. Maryland will use its Phase III WIP process in 2017 as an opportunity to reassess its designation criteria based upon evidence toward meeting WLAs.

Technical Capacity: Maryland's Stormwater Design Manual: The Stormwater Act of 2007 required the enhancement of the "2000 Stormwater Design Manual." Based on the Act, a 2009 Manual Supplement was approved for ensuring ESD to the MEP. This supplement and recent design examples are available on MDE's website.

Model Ordinances for the 2007 State Stormwater Law: To assist in implementation of new technical requirements for the 2007 Stormwater Act, MDE developed model ordinances for local governments to adopt in whole or with local refinements.

Stormwater Management Guidelines for State & Federal Projects: MDE has published the "Maryland Stormwater Management Guidelines for State & Federal Projects". These Guidelines supplement the Stormwater Management Regulations (COMAR 26.17.02) and the "2000 Maryland Stormwater Design Manual, Volumes I & II". The Guidelines, which became effective July 1, 2001, provide information necessary for submittal of stormwater management plans by State and federal agencies to MDE's Water Management Administration for review and approval. These guidelines were updated on April 16, 2010 to reflect the "Stormwater Management Act of 2007" and the recently enacted COMAR 26.17.02 regulations.

Tracking and Reporting: Maryland tracks its stormwater management program, stormwater retrofit projects and watershed restoration activities through several programs. These include NPDES municipal stormwater permit annual reports; projects funded by the former Stormwater Pollution Control and Small Creeks Cost Share Programs; the 2010 Chesapeake Bay Trust Fund;

and other regulatory permitting authorities including Nontidal and Tidal Wetland Permits, Waterway Construction Permits, Erosion and Sediment Control and Stormwater Management Approvals. All stormwater BMPs and retrofits will need to be recorded on MDE's Urban BMP Database, which is submitted to the CBP each November for model updates and calibration. Maryland is currently working to ensure that all BMPs are recorded on MDE's Urban BMP Database, and that these data will be compatible with the Chesapeake Bay Program's NEIEN. Finally, Maryland is in the process of developing the next generation of data recordation through its Stormwater Map Project. MDE uses local GIS databases (point and shape files) to document watershed restoration activities (e.g., stormwater BMPs, stream restoration projects, etc.). Maryland's Stormwater Map Project and the use of GIS will eliminate duplication and ensure full accounting of projects

Stormwater and Financial Capacity: Stormwater management in Maryland has evolved from an urban flood control function, to a water and resource management function, to an environmental protection and regulatory function. This evolution has forced changes in how stormwater systems are planned, designed, constructed, operated, and financed. The stormwater function has evolved from a basic capital construction and maintenance program supported primarily by local taxes, to a program of integrated water resource management, environmental enhancement, and recreational services requiring a multi-faceted benefit-based finance system.

The State has recognized the need to establish dedicated funds for stormwater since the early 1990's. In 1992, the General Assembly enacted enabling legislation that allows localities to develop a "system of charges" to finance stormwater programs. To date, six local jurisdictions in Maryland have developed a stormwater user charge. The City of Takoma Park implemented a "System of Charges," Montgomery County developed a "Water Quality Protection Charge" that pays for the structural maintenance of stormwater facilities, and most recently the City of Rockville and City of Annapolis passed legislation to implement a stormwater utility fee. Also, Prince George's County uses an a*d valorum* Tax that provides funding for many of its environmental programs and capital improvements. The Town of La Plata has a stormwater fee on the Town's quarterly service bill and Charles County has an annual Environmental Service Fee and a one time stormwater impact fee for new lots.

MDE continues to support the development of a "system of charges" by local governments. During the 2010 Legislative session, proposed Senate Bill 686 (HB 999), Watershed Protection and Restoration Act, if passed, would have required each county and municipally to adopt certain laws or ordinances to establish a "stormwater remediation fee" and the creation of the local "watershed protection and restoration funds" into which these fees would be placed. The funds would be used for implementation of local stormwater management plans.

Local stormwater utility fees will be an important step in the development of a sustainable funding model for the pollution controls that will be needed to meet the Bay TMDL. The General Assembly also recognized this need in passing the Chesapeake Bay 2010 Trust Fund in 2008. which funds stormwater projects. The federal government also recognized this need in its consideration of S.1816, the Chesapeake Clean Water and Ecosystem Restoration Act of 2009, sponsored by Senator Cardin. Maryland continues to support the development of a "system of

charges" by local governments as well as federal initiatives to provide cost-share funding for stormwater management programs throughout the State.

Currently, MDE offers financial assistance through low interest loans involving the State Revolving Loan Fund with a delayed payment plan contingent upon starting a "system of charges." MDE is revising the Integrated Project Priority Systems for Rating and Ranking Clean Water Point and Nonpoint Sources Capital Projects for funding available through the Maryland Water Quality Financing Administration. The draft revised criteria proposes to address Nutrient Reduction benefits to the Chesapeake Bay as part of the Project Environmental Water Quality Benefit Score. Priority would be given to projects with the greatest benefit to the Chesapeake Bay by considering resulting nutrient reduction and the relative effectiveness of the 8-digit watershed where that reduction will take place. The public comment period began on October 8, 2010 with Public Hearing held November 10th. Once adopted, the new system will be used for establishing funding priorities starting FY 2012.

In addition, technical assistance is provided through MDE publications, "Financing Stormwater Management: The Utility Approach," "Potential Revenues from Stormwater Utilities," and "Model Ordinances for Stormwater Utility," to assist in the development of a regional or watershed Stormwater Utility.

A majority of Maryland's stormwater retrofits will result from requirements in NPDES municipal stormwater permits, which have significant restoration requirements. Local jurisdictions fund retrofits through their operating budgets, municipal capital bonds, and stormwater utilities. Most of those programs incorporate additional State and federal funding. Current annual funding for Maryland's 11 individual NPDES municipal separate storm sewer systems is $121,951,000. Additional retrofits across the State are financed through the Chesapeake Bay 2010 Trust Fund grant program.

2.2.2.5 Erosion and Sediment Controls

Maryland law requires review and approval by local Soil Conservation Districts (SCD) of a State erosion and sediment control plan for any earth disturbance of 5,000 square feet or more and 100 cubic yards or more. Plan approval exemptions may be given for agricultural uses. Grading ordinance adoption and project inspection is required by local jurisdictions. There are State administrative, civil and criminal penalties for sediment pollution. Various programmatic improvements include requiring sediment control plan approval, prior to issuing grading and building permits; requiring training and certification of "responsible personnel"; shifting enforcement authority from local to State control and establishing delegation criteria for the State to authorize local enforcement; limiting the exemption for single-family residential construction on 2-acre lots; requiring NPDES stormwater discharge permits for all construction activity that disturbs over 1 acre; and authorizing enforcement for sediment pollution from agricultural land.

Maryland's Erosion Control Law and regulations specify the general provisions for program implementation; provisions for delegation of enforcement authority; requirements for erosion and sediment control ordinances; exemptions from plan approval requirements; requirements for training and certification programs; criteria for plan submittal, review and approval; procedures

for inspection and enforcement; and applicant responsibilities. Clearly defining minimum standards is essential to make erosion and sediment control work. Maryland has established minimum criteria for effective erosion and sediment control practices.

Standards and Specifications for Soil Erosion and Sediment Control are incorporated by reference into State regulations and serve as the official guide for erosion and sediment control principles, methods, and practices. Maryland updated its standards and published the new "2010 Maryland Standards and Specifications for Soil Erosion and Sediment Control" in the Maryland Register for public review and comment on August 27, 2010. The regulation and new standards are expected to take effect before the end of 2010. A growing number of SCDs are taking on compliance responsibilities for their counties to ensure that urban erosion and sediment control plans are implemented properly. The process includes pre-construction meetings with developers to assure the proper sequencing of site disturbance is followed and site inspections. Many developers appreciate the improved accessibility and turnaround that local oversight allows. Under state law, districts can charge fees to cover the cost of urban plan reviews and compliance activities.

Well-trained construction personnel help to ensure that quality implementation and maintenance occur. Maryland provides a "Responsible Personnel Training for Erosion and Sediment Control" program.

Maryland's sediment control law and regulations specify the general provisions for program implementation; provisions for delegation of enforcement authority; requirements for erosion and sediment control ordinances; exemptions from plan approval requirements; requirements for training and certification programs; criteria for plan submittal, review, and approval; procedures for inspection and enforcement; and applicant responsibilities. Clearly defined minimum standards are essential to make erosion and sediment control work. These criteria are established in the "Standards and Specifications for Soil Erosion and Sediment Control" which is incorporated by reference into State regulations and serves as the official guide for erosion and sediment control principles, methods, and practices in the State.

Areas that were evaluated during the review period and revision of the new Maryland standards included: environmental site design requirements, the use of coagulants, revised stabilization standards, new standards for best management practices, and new technology. Maryland has been working with all stakeholders including the Natural Resources Conservation Service (NRCS) and the Maryland Association of Soil Conservation Districts (MASCD) through a technical review workgroup as part of this development and update process. MDE continues to research and investigate the feasibility of using turbidity as a trigger for identifying excessive pollutants (e.g., sediment) and to evaluate the State's current water quality standard for turbidity.

Draft "2010 Maryland Standards and Specifications for Soil Erosion and Sediment Control" http://www.mde.state.md.us/assets/document/sedimentstormwater/MD_ESC_Standards_10-15-09_DRAFT_III.pdf

Draft Erosion and Sediment Control Regulations (i.e., COMAR 26.17.01) Proposed Changes

http://www.mde.state.md.us/assets/document/sedimentstormwater/Draft_ESC_Regulations_10-15-09.pdf

Erosion & Sediment Control Guidelines for State and Federal Projects

Maryland has also published the "Maryland Erosion and Sediment Control Guidelines for State and Federal Projects" on the Department's web site. Supplementing the Erosion And Sediment Control Regulations (COMAR 26.17.01) and the "Maryland Standards And Specifications For Soil Erosion And Sediment Control", the Guidelines provide information necessary for submittal of erosion and sediment control plans by State and federal agencies to MDE's Water Management Administration for approval.

Staffing Capacity Related to Regulated Wastewater and Stormwater Programs:

The Sediment, Stormwater and Dam Safety Program has oversight responsibility for the State's stormwater management programs, writes regulations, performs research, provides technical support, conducts local program review, and is responsible for plan review on all State and federal projects. The Program includes 8 FTE for the delegation of erosion and sediment control enforcement authority, local stormwater program review in support of the State's Stormwater Management Act, and administration of the NPDES municipal stormwater permit program; and 11 FTEs and 14 approved consultant firms to review of erosion/sediment control and stormwater management of State and federal construction projects.

WMA Compliance Program is responsible for enforcement. The staff includes 42 cross-media inspectors responsible for inspection of regulated point sources, with 19 FTEs for inspection and enforcement of State and federal stormwater laws and regulation.

MDE's Engineering and Capital Projects Program includes 13 FTE managing MDE funded capital projects. Among them WWTP nutrient removal upgrades, sewer rehabilitation, failing septic connections to WWTPs, nonpoint source water quality improvement projects and other infrastructure upgrades.

MDE's Office of Budget and Infrastructure Financing includes 55 FTEs managing various MDE funding programs, such as Bay Restoration Fund (BRF), Water Quality Revolving Loan Fund (WQRLF), Drinking Water Revolving Loan Fund (DWRLF) and several other State grant programs, including projects funded by the special federal funding sources. Staffing capacity needs related to Regulated Wastewater and Stormwater Programs are discussed in Chapter 5.

2.2.2.6 Agriculture

Maryland's has a strong history of commitment to providing the resources, leadership, and credibility to perform in this sector. Over time, Maryland has been a leader in identifying key resource concerns and bringing the science, and technology together to form viable environmental solutions for Maryland farmers. The underpinnings of our previous successes will continue to serve farmers and the Bay as we pursue this effort.

Future success in the agriculture sector will be driven by Maryland's:

- Leadership role in Chesapeake Bay restoration efforts,
- History of providing financial support for cost effective solutions,
- Engagement of our farm community,
- Strong conservation partnership in Maryland,
- Strong verification and quality assurance found in programs, and
- Depth of BMPs in the Plan, including practices that have been proven effective and newer practices with great potential.

Our leadership role in Chesapeake Bay restoration efforts

Maryland agricultural policies and programs have historically led efforts in the watershed to manage agricultural non point loads. Cost share models developed in Maryland, Maryland's Nutrient Management Program standards, Maryland's Manure Transport Program, and Maryland's use of phytase in poultry feed have all been replicated by other watershed states. Maryland will continue to be innovative, bringing science-based technologies that are practicable for farmers and improve water quality. This Plan includes new technologies to enhance farm management, improve nutrient utilization and reduce nutrient losses.

Our history of providing financial support for cost effective solutions

Since 1984, with the inception of Maryland Agricultural Water Quality Cost Share (MACS) Program, the State of Maryland has realized the value and importance of offsetting the capital implementation costs. Over $120 million has been made available to incentivize the adoption of water quality technology, most of which would be otherwise out of the financial reach of farmers. Many BMPs are of such low or slow return, they are unaffordable otherwise. The farmer share of the project costs promotes stewardship and instills a sense of ownership. These commitments continue as Maryland enacted the Chesapeake Bay Restoration Fund to provide program support wastewater and septic upgrades, along with a dedicated funding source for cover crops. These legacies are repeated yet again with the passage of the Chesapeake and Atlantic Bays 2010 Trust Fund as a means to fund solutions to non-point source impacts to our waters.

The engagement of our farm community

Maryland farmers have been integral players in not only implementing environmental strategies but planning them as well. The Agriculture Workgroups, modeled during

Maryland Tributary Strategy development, demonstrated the capacity and commitment to provide meaningful input to develop workable strategies. Farmers have been engaged throughout the WIP development process, providing input and feedback, even under a very compressed time frame. Phase II will provide even greater interaction as the process is tailored to local watersheds. While planning is important, implementation is the key. As demonstrated by the SFY 2011 Winter Cover Crop Program, Maryland farmers stepped up to enroll over 500,000 acres of winter crops to improve water quality demonstrating their willingness to participate in programs vital for Bay restoration..

The strong conservation partnership in Maryland

The Conservation Partnership to deliver agricultural conservation practices in Maryland includes Soil Conservation Districts, USDA-Natural Resources Conservation Service and the Maryland Department of Agriculture. The Conservation District structure provides locally led conservation program development and implementation. First authorized in the late 1930's, their mission has been the protection and enhancement of America's invaluable natural resources. SCDs, with a presence in every county in Maryland, provide the vehicle for the conservation practice delivery to individual landowners. Since the beginning of formal efforts to restore the Chesapeake Bay, conservation districts have been earning the trust of individual landowners, building credibility as the technical experts of conservation. Conservation District commitment to this effort will bear the same fruit now as in the past, building on the trust and relationships established with landowners over the last 50 years.

The USDA, Natural Resources Conservation Service (NRCS) provides the technical underpinning for conservation practice and program development and implementation in the Chesapeake Bay and across the nation. Providing technical supervision, engineering assistance and related support have been the mainstays of our largest federal partner in agricultural conservation. Sound technical standards for BMPs to improve water quality ensure performance and intended outcomes.

Recognizing President Obama's Executive Order and the elevated role of federal agencies in Chesapeake Bay restoration efforts, Maryland believes there is a key opportunity to formalize the role of USDA in our respective State efforts to implement Watershed Implementation Plans. Targeted federal Chesapeake Bay Watershed Initiative and other USDA resources funds should translate into specific contributions toward State WIP goals. Governor O'Malley will be forwarding a letter to Secretary Vilsack requesting such an agreement as a means clearly define and commit the federal resources that will be vital to our efforts.

The strong verification and quality assurance found in programs

Considerable resources in Maryland are committed to quality assurance and quality control with respect to agricultural program delivery. In both incentive programs as well as regulatory authority, the State is committed to provide public assurance that performance matches requires standards. Outlined in detail in Chapter 6-Section 6.2.1

(pg 6-3), the verification procedures and protocols for grant program and regulatory requirements are intended ensure desired outcomes in an efficient, cost effective manner. Ensuring conservation practices are properly installed and maintained, translates to credibility in modeled expectations and delivery of expected environmental improvement.

The strength of BMPs in the Plan including newer practices with promising potential

The suite of BMPs in the Maryland is broad by design. It recognizes that environmental management in agriculture is site-specific, requiring an array of practices and approaches to solving a range of management challenges. The Plan also provides for flexibility in implementation and the State's ability to adaptively manage the progress toward established goals using different BMPs as necessary. The flexibility to vary levels of implementation, plus the opportunity presented by a wide variety ultimately enhances likelihood of success. The proposed agricultural BMPs in the Plan includes proven practices such as cover crops, nutrient management, livestock waste structures, etc., and newer practices such as decision/precision agriculture, poultry litter treatment and p-sorbing materials, etc. Maryland's ability to pursue these new practices coupled with EPA's commitment to gauge their performance and model their delivery further enhances Maryland's capacity to achieve targets.

Maryland's agricultural sector reduces nutrient and sediment through the following programs and requirements:

- Private Landowners/Farmers/Operators
  Responsibilities include: Financing, implementing, and maintaining best management practices to address site specific nutrient and sediment issues on their property and lands they lease.

- State Government
  Responsibilities include: Provide staff, technical resources and funding to Soil Conservation Districts for technical assistance to farmers and landowners for the implementation of best management practices.

- Federal Government
  Responsibilities include: Provide staff, technical resources and funding to Soil Conservation Districts for technical assistance to farmers and landowners for the implementation of best management practices.

- Local Governments
  Responsibilities include: Provide staff and funding to Soil Conservation Districts for technical assistance to farmers and landowners for the implementation of best management practices

- Soil Conservation Districts

Responsibilities include: Provide technical assistance and guidance on Federal, state, local and private programs available to farmers and landowners for the implementation of best management practices and coordinate planning, engineering design, and implementation activities and funding between state, district, local and federal programs.

Programmatic Capacity: Current Agricultural Implementation Programs

Maryland Agricultural Water Quality Cost-Share (MACS) Program helps farmers control nutrient runoff and protect water quality and natural resources on their farms and comply with federal and state environmental regulations. MACS provides farmers with grants to cover up to 87.5 percent of the cost to install best management practices (BMPs) on farms to control soil erosion, manage nutrients, and safeguard water quality. A maximum funding level of up to $20,000 per project and $50,000 per farm applies. Farmers receiving MACS funds for animal waste treatment and containment projects may receive up to $75,000 per project with a maximum of $100,000 per farm, when combined with other BMPs. In many instances MACS and USDA funds may be combined (Agriculture Article 8-(701-705)). The program was first authorized in 1984 and, to date, has provided over 120 million dollars in conservation improvements.

Cover Crop Program provides cost-share assistance to farmers to implement this best management practice. Cover crops absorb unused crop nutrients remaining in the soil following the fall harvest and acting as a ground cover to keep the soil from washing away during the winter months. Maryland continues to refine the program, providing tiered incentives in 2004 to encourage early planting which maximizes nutrient uptake. Cost-share support is administered through MACS.

Soil Conservation And Water Quality Program helps farmers and landowners to develop plans featuring a menu of best management practices uniquely suited to each site. Soil conservation district staff provides technical assistance to develop these plans, and design and implement BMPs which help farmers and landowners protect natural resources while maintaining production goals. Farmers are also advised about funding assistance and apprised of new research and technologies in land and water management.

Maryland Nutrient Management Program provides financial and technical assistance to farmers to help them meet requirements of the Water Quality Improvement Act. Farmers who have a gross income of $2500 or more; or, who have 8000 pounds or more of animals are required to have a nutrient management plan. It also requires University of Maryland fertilizer management guidelines to be followed for nutrient application on certain non-agricultural lands. Nutrient management plans address the timing, application and management of all nutrient sources used in the farming operation. Maryland Department of Agriculture certifies private and public sector nutrient management consultants who provide technical assistance in the development and implementation of nutrient management plans. University of Maryland Extension develops nutrient management plans for farmers, provides training to consultants and training to farmers to become certified to do their own nutrient management plan. Cost-share for private sector development of plans is available from MACS or EQIP (Agriculture Article 8-(801-806)).

Maryland Manure Transport Program provides cost-share assistance of up to $20 per ton to transport manure from animal operations with excess waste or documentation of phosphorus over-enrichment to farms where it is land applied in accordance with a nutrient management plan or for alternative uses. Cost-share support is administered through MACS (Agriculture Article 8-704).

Environmental Quality Incentives Program (EQIP) provides financial assistance of up to 75 percent for the installation of BMPs, with a maximum of $450,000 for any individual or eligible entity through 2007. Approximately 60 percent of the funds are directed to livestock related conservation practices. Funds are also available to address locally identified conservation concerns. Contracts are from one to ten years in length. The program is administered by NRCS through local soil conservation districts. Projects may be co-cost-shared with MACS Program support.

Conservation Reserve Program (CRP) And Conservation Reserve Enhancement Program (CREP), administered by USDA, are designed to set aside and implement conservation measures to protect highly erodible land and other sensitive farmland for a period of ten to fifteen years. CREP also targets creation of riparian buffers and wetland restoration. The state also offers cost-share through the MACS Program for installation of BMPs and may purchase easements under CREP.

Conservation Stewardship Program (CSP) supports ongoing conservation stewardship of agricultural lands by providing assistance to producers to maintain and enhance natural resources. Administered through NRCS, it provides tiered payments to qualified farmers who are managing natural resources on their farms to achieve certain levels of soil and water quality as well as other identified natural resource objectives. Cost share is also available to enhance current conservation efforts.

Wetland Reserve Program (WRP) is administered through NRCS and provides financial incentives to landowners seeking to restore nontidal wetlands. Payment includes compensation for a wetland easement as well as cost-share funding to restore wetlands. There are three options for participants: permanent easements, a 30-year easement, and a restoration cost-share agreement. Permanent easements are conservation easements in perpetuity. USDA pays for the easement as well as 100 percent of the cost of restoring the wetland. A 30-year easement is a conservation easement lasting for 30 years. USDA pays 75 percent of what would be paid for a permanent easement as well as 75 percent of restoration costs. A restoration cost-share agreement is an agreement to reestablish a degraded or lost wetland habitat. USDA pays 75 percent of the restoration costs. This does not place an easement on the property. The landowner provides the restoration site without reimbursement and agrees to maintain it for a minimum of 10 years.

Low Interest Loans For Agricultural Conservation (LILAC) Program is available to help farmers install best management practices or purchase equipment to protect natural resources and safeguard water quality. Loans offered through the LILAC program can help farmers bridge the cost-share gap that exists in many government conservation incentive programs. These loans are

guaranteed by the State Revolving Loan Fund and are available at lending institutions throughout the state.

Operation And Maintenance Plans For Public Drainage And Public Watershed Associations outline upkeep activities that the PDA intends to perform for a two to three year period. These activities are designed to minimize the environmental impacts of agricultural drainage ditches while maintaining functioning drainage systems. Public drainage systems were created to reduce flooding, address landowners' drainage needs, and protect public health and improving the transportation infrastructure while supporting local economies. Cost-share assistance for the installation of several eligible best management practices for drainage ditches may be available from (Agriculture Article 8-(601-603) and Article 25-(52-121H)).

Rural Abandoned Mine Program (RAMP) is administered by NRCS. The district conservationist is in charge of this land reclamation program on a county-wide basis and soil conservations districts are involved in design, approval, and inspection of implemented BMPs to assure their performance as specified by law.

Staffing Capacity and Technical Assistance for Soil Conservation Districts: Under the Water Quality Improvement Act of 1998 there was specific language inserted into the Annotated Code of Maryland COMAR 8-405 regarding "Adequate personnel and resources for soil conservation districts." The COMAR language specifically states that "the Governor shall include in the annual budget bill an amount sufficient to employ not less than 110 field personnel in the soil conservation districts under this title."

A comprehensive analysis of the resource needs to implement Maryland's Tributary Strategies was conducted in 2004. The agricultural components of the strategy would require 160 technical staff in the local soil conservation district to fully implement. Maryland currently approximates a deficit of about 80 FTEs for Soil Conservation District (SCD) staff necessary to meet the agricultural management goals of the Bay Watershed Implementation Plan.

Maryland currently supports many of the SCD staff through the Clean Water Act Section 117 Chesapeake Bay Implementation Grant, The Clean Water Act Section 319(h) Grant, Coastal Zone Management Act grant, the Maryland Chesapeake and Coastal Bays 2010 Trust Fund (2010 Trust Fund) and State general funds. This fund is able to leverage federal grant funding. The 2010 Trust Fund is a special fund with revenues generated through motor fuel tax and rental car tax receipts. This fund is expected to expand with the recovery of the economy.

Legal and Regulatory Capacity: There are a number of Federal state and local regulations and programs designed to address wetlands, land use, agricultural and other activities that contribute to nutrient and sediment run-off into the Chesapeake Bay. Chief among these are the Water Quality Improvement Act of 1998 (WQIA) and the Maryland Agricultural Water Quality Cost-share (MACS) Program of 1982. The 1984 Chesapeake Bay Critical Area Law requires that all farms located within the Critical Area must develop and implement a Soil Conservation and Water Quality Plan approved by the local soil conservation district. In 2002 these requirements were extended to farms in the Coastal Bays Watershed. Implementation of BMPs that make

economic sense are effective (saving soil and nutrients) and farmers will adopt and maintain them.

The Maryland Department of Agriculture's responsibility is to ensure that BMPs are implemented. This occurs through three main reviews within the Office of Resource Conservation of the Maryland Department of Agriculture: Nutrient Management Plan Implementation Review Maryland, Agricultural Water Quality Cost Share Program (MACS) Quality Assurance Review and the MACS Spot-check review. MDA has also developed a review program for the Manure Transport Program. Nutrient reduction benefits that are applied for a BMP are based on research results approved by the Chesapeake Bay program for utilization in the Chesapeake Bay Model. (Additional details on these monitoring and evaluation efforts are found in Chapter 6.)

The MACS Program has a manual which sets forth all of the policies and procedures of installing the Best Management Practices for MACS. It also includes information on spot checks. The Natural Resource Conservation Service also has a series of manuals, Field Office Technical Guides (FOTG), that describe the standards and specifications for all BMPS. The MACS Program manual relies on the established technical standards and specifications in the FOTG for the actual placement and installation of BMPS. The Nutrient Management Program has a "Fact Sheet" that outlines the steps and processes that occur in an implementation review.

The Maryland Department of Agriculture, Maryland's Soil Conservation Districts and the Maryland Department of Environment have established a memorandum of understanding (MOU) to insure orderly, timely and effective investigation, correction and prosecution, when necessary, of individual cases of water pollution caused by agricultural activities in Maryland.

2.2.2.7 Concentrated Animal Feeding Operations

A Concentrated Animal Feeding Operation (CAFO) is a medium or large animal feeding operation that discharges or "proposes to discharge" manure, litter or process wastewater. "Proposes to discharge" is an EPA term that means that the facility is designed, constructed, operated and maintained such that it WILL discharge runoff containing manure, litter or process wastewater to the waters of the United States or, in the case of the Maryland program to the waters of the State. If a medium AFO has a conveyance system, such as a swale, ditch, or pipe, to remove runoff containing manure, litter or process wastewater from the production areas to surface waters of the State it is a CAFO. A large AFO does not need to have a swale, ditch, or pipe to be a CAFO since the EPA definition of a CAFO defines large AFOs as point sources. According to EPA CAFO regulations, the CAFO owner or operator determines whether the AFO discharges or "proposes to discharge' runoff containing manure, litter or process wastewater. The CAFO owner/operator makes this determination based on the operation's design, construction, operation, and maintenance because he or she is the one most familiar with the drainage patterns at the specific AFO site and is best equipped to make the determination of whether or not a discharge may occur. A small AFO is <u>not</u> a CAFO unless MDE or the EPA specifically designates the operation as a CAFO. Reasons for this include the potential for one or more pollutants in the discharge to contribute to stream impairment.

Maryland has also gone beyond the federal requirement, defining a Maryland Animal Feeding Operation (MAFO), which is a large animal feeding operation that does not discharge or "propose to discharge" runoff containing manure, litter, or process wastewater. If an operation is a medium or small AFO that does not discharge or "propose to discharge," it is not a MAFO unless MDE designates it as one. Reasons for designating a MAFO include the type or location of animal waste storage or animal access to surface water is likely to cause a discharge of pollutants to ground or surface waters of the state.

Legal and Regulatory Capacity: Maryland implemented regulations governing Animal Feeding Operations (AFOs) effective January 2009 as listed in the Code of Maryland Regulations (COMAR) under Subtitle 8 "Water Pollution" in sections 26.08.01 General, 26.08.03 Discharge Limitations, and 26.08.04 Permits. Maryland's CAFO Program is current with federal regulations having been approved by EPA on January 29, 2010 after a rigorous review of Maryland's regulations, general permit and fact sheet.

The Maryland General Discharge Permit for Animal Feeding Operations, applicable to Concentrated Animal Feeding Operations (CAFOs) and Maryland Animal Feeding Operations (MAFOs) became effective December 2009. Together, the regulations and General Discharge Permit are designed to control nutrients from Maryland's largest agricultural animal operations.

Also essential to the regulatory capacity for CAFOs at COMAR 15.20.07 and 15.20.08, are Maryland's regulations for developing nutrient management plans (Pursuant to Title 15 of Maryland's Agriculture Article). Among other information, these regulations include Maryland's technical standards for soil testing, which specify how to evaluate nutrient content of soils. They also specify who is eligible to develop a Nutrient Management Plan.

The number of CAFOs and status of notices of intent (NOI) to be regulated by Maryland's general permit are tracked by MDE with senior management oversight by MDEStat. As of November 2010, 550 NOIs had been received by MDE, with 102 classified as MAFOs, 430 classified as CAFOs and 18 have been withdrawn. MDE has an *on-line search system* to access more specific information, which can be found on the MDE website.

Of the CAFOs that have filed their NOI, approximately 187 CNMPs [r2]have been developed and submitted to MDE. Those plans have been developed by Technical Service Providers (TSPs) through the USDA, NRCS EQIP program, MDA and SCD staff in our local soil conservation district offices and with the assistance of the UMD nutrient management plan writers in each county.

MDA and district staff has been trained by NRCS to write planning aspects of the CNMP with financial assistance from the Maryland Association of Soil Conservation Districts (MASCD). Additional MDA and SCD planners are being certified through NRCS and that certification process is ongoing. There are approximately 20 MDA and SCD staff involved in the process of writing CNMPs for CAFO permits.

As additional farms submit a NOI, MDE and MDA are working together to exchange information to facilitate the process. The responsibility to make contact with those remaining

farmers is that of MDE. Once that contact is made, MDA staff provide assistance in completing the necessary paperwork with the permit i.e. NOI, supplementary information form, compliance schedule and CNMP status form. In addition, MDA and SCD staff are assisting farmers by providing any technical assistance recommended by MDE as a result of the CAFO determination site visit. MDE and MDA have also conducted joint site visits to determine CAFO eligibility.

In addition to the efforts previously mentioned, MDE and MDA have provided extensive outreach to the poultry farmers on the Eastern Shore. Public meeting have been held within the region to explain the requirements of the CAFO permit. UMD has developed and presented training for CAFO operators on the management issues of operating a CAFO permitted farm. MDA has addressed integrator staff on the requirements of the CAFO permit and how farmers need to operate in order to comply with their permit. At the local level MDA and SCD staff have met with farmers to discuss with them one on one the CAFO permit and how it may impact them.

Further information on the *CAFO program*, including updated information on number, category and location of operations, is available by contacting the program, which maintains a webpage on the MDE website.

Permit Conditions

According to the general permit conditions, CAFOs must send in the NOI and a Comprehensive Nutrient Management Plan (CNMP). MAFOs must send in the NOI and a Maryland Department of Agriculture Nutrient Management Plan (NMP) and a Soil Conservation and Water Quality Plan (Conservation Plan)must be developed for the production area in accordance with the NRCS National Planning Procedures Handbook.

The Conservation Plan [for the production area] must be based upon an assessment of possible resource concerns (such as those described in the Maryland Environmental Evaluation Checklist MDCPA-052), and include scheduled practices that shall be implemented based on applicable NRCS conservation standards in effect upon the date of issuance of this General Permit, and any additional applicable Maryland interim or national NRCS conservation standards at the time of permit registration (if such standards have also been approved by the Department for use in addressing the requirements of this permit). Resource concerns identified in the assessment that must be addressed, include, but are not limited to, the following:

1. *Storage for animal manure and litter, including the need for any additional storage and/or manure transfer, in accordance with NRCS practice standards 313 and 634;*
2. *Heavy use areas, including any recommendations to provide a stabilized surface in accordance with NRCS practice standard 561;*
3. *Diversion of storm water in accordance with NRCS practice standard 362;*
4. *Vegetation within 35' of the production area in accordance with NRCS practice standard 342;*
5. *Mortality management in accordance with NRCS practice standard 318; and*
6. *If an existing production area is less than 35' from surface water, the use of a filter strip or water control structure, in accordance with NRCS practice standards 393 or 587.*

Central to the general permit are the Nine Minimum Standards to Protect Water Quality. These are found in the "Special Conditions" Part IV, B. and are outlined below.

Nine Minimum Standards to Protect Water Quality: The permittee's NMP and Conservation Plan shall meet the following standards:

1. *Ensure adequate storage capacity* [for animal waste].
2. *Ensure proper management of mortalities to prevent the discharge of pollutants into waters of the State.*
3. *Divert clean water, as appropriate, from the production area to keep it separate from process wastewater*
4. *Prevent direct contact of confined animals with waters of the State*
5. *Chemical Handling*
6. *Conservation practices to control nutrient loss, including site-specific conservation practices.*
7. *Protocols for manure and soil testing.*
8. *Protocols for the Land Application of Manure and Wastewater.*
9. *Record Keeping.*

The full *general permit*, which elaborates on the Conservation Plan for production areas and the nine minimum standards, is available on MDE's web page.

Compliance and Enforcement: MDE's CAFO/MAFO Program has developed standard operating procedures and regulations to ensure compliance and enforcement measures are carried out. This includes regular inspections, response to public citizen complaints and violation notices or enforcement actions when appropriate.

Staffing Resources: MDE's CAFO/MAFO Program has 5 staff. In the summer of 2010, MDE obtained grant funding to expand the program's inspection capabilities by two additional staff and two vehicles through the FFY2010 Chesapeake Bay Regulatory and Accountability Program (CBRAP) grant.

Routine inspections will be the primary action that will determine compliance with the CAFO/MAFO requirements and ensure the protection of water quality. It is anticipated that approximately 250 inspections will be performed per year.

MDA has also received CBRAP grant funding to assist farmers with compliance. MDA will create a position for a rapid response specialist to work directly with CAFO/MAFO operations to assure they are meeting the obligation of their permit requirements. MDA staff conduct field evaluation of the facilities and the feeding operation. Requirements for proper waste storage, mortality composting, runoff controls and housekeeping are reviewed for proper functioning and standards and specifications are being maintained. MDA intends to conduct up to 50 site visits per year with a focus on poultry operation on the lower eastern shore.

2.2.2.8 Atmospheric Deposition

Federal Programs and Actions

Background Information[8]

Atmospheric deposition of nitrogen is a contributing source to the Chesapeake Bay watershed. Pollutants can travel anywhere from a few yards to a few thousand miles before depositing as a part of the pollutant load to our land and water (USEPA 2001). The regional transport of nitrogen oxide (NOx) pollution is well documented. Since nitrogen oxides and other pollutants may be transported long distances, pollutants are analyzed by "airshed."

The Clean Air Act (CAA) explicitly addresses air pollution and atmospheric deposition. The CAA was amended in 1990 and Congress included authorization to reduce emissions of sulfur dioxides and nitrogen oxides from utilities to address the problem of acid rain. At the same time, Congress added requirements to the CAA that the Environmental Protection Agency (EPA) assess the impact of atmospheric deposition of toxic air emissions and other air pollutants of concern on certain waterbodies (USEPA 2001).

On March 10, 2005, EPA issued the Clean Air Interstate Rule (CAIR) to cap emissions of sulfur dioxide (SO2) and NOx in 28 eastern States and the District of Columbia. When fully implemented, CAIR would reduce SO2 emissions in these states by over 70 percent and NOx emissions by over 60 percent from 2003 levels. After a legal challenge to the CAIR rule, EPA recently proposed phase I of a two phase replacement rule for the original CAIR proposal. While significant NOx reductions are achieved, a stronger rule would have greater benefits for the Chesapeake Bay by further reducing NOx transport into the Chesapeake Bay watershed.

Modeling

Throughout the modeling process several modeling scenarios were run using different air allocations, land uses, and BMPs. The most relevant scenario is the 2009 Progress scenario. This presents the current loadings. The nitrogen and phosphorus atmospheric loadings for the 5 major model basins in Maryland are given in Table 1 for the 2009 Progress scenario. The total for the state is 0.69 million pounds per year total nitrogen and 0.04 million pounds per year for total phosphorus.

[8] Information related to federal air actions was drawn from a memo dated August 13, 2010 provided to MDE by Tetra Tech, Inc., containing references that are not cited in this Plan.

Table 2.3 Total Air Loadings by Major Basin

Major River Basin	2009 Progress	
	Total nitrogen (lbs/year)	Total phosphorus (lbs/year)
Susquehanna River Basin	47,644	2,701
Western Shore	57,490	3,577
Patuxent River Basin	22,205	1,595
Potomac River Basin	151,637	8,337
Eastern Shore	412,007	24,805
Total	690,982	41,015

As previously mentioned, there are current regulations in place to reduce air deposition. Loads of oxidized nitrogen are decreasing and will continue to decrease until 2020 and beyond. The nitrogen load reductions are the result of 1) federal level reductions in mobile emissions, 2) federal level reduction in the interstate CAIR, and 3) state reduction due to current State Implementation Plans (SIPs). These loads are estimated in the model as the 2020 Air Scenario, which accounts for the full implementation of these measures (Linker 2010). The 2020 Air Scenario was used to help make air deposition allocations.

EPA relied on current laws and regulations under the CAA in the air controls to be used as a basis for the air deposition allocation. These controls, with a national air modeling analysis, provided a resulting allocated load to air deposition from direct deposition to the tidal waters of the Bay and its tidal tributaries. The air allocation scenario represents emission reductions due to regulations implemented through the CAA authority to meet National Ambient Air Quality Standards for criteria pollutants in 2020. The air allocation scenario includes:

- Clean Air Mercury Rule (CAMR)
- Best Available Retrofit Technology (BART): used for reducing regional haze and the off-road diesel and heavy duty diesel regulations
- On-Road mobile sources: includes Tier 2 vehicle emissions standards and the Gasoline Sulfur Program, which affects SUVs, pickups, and vans that are now subject to same national emission standards as cars
- On-Road Heavy Duty Diesel Rule – Tier 4: new emission standards on diesel engines starting with the 2010 model year for NOx, in addition to some diesel engine retrofits
- Clean Air Non-Road Diesel Rule: off-road diesel engine vehicle rule, commercial marine diesels, and locomotive diesels (phased in by 2014) require controls on new engines
- Electric Generating Units (EGUs): CAIR second phase in place in coordination with earlier NOx SIP
- Non-EGUs: Solid Waste Rules (Hospital/Medical Waste Incinerator Regulations)

The 2020 Maximum Feasible Scenario in the Bay model also includes a reduction of ammonia deposition of 15 percent due to estimated ammonia emission programs within the Bay Program States. From a State and Sector analysis of NOx emissions and deposition, an estimated 50 percent of emissions from Bay States becomes deposition to the Chesapeake watershed. Applying this attenuation estimate for ammonia emissions, we assume a 15 percent decrease in

wet and dry ammonia deposition for the Maximum Feasible Scenario due to ammonia emission control management practices in the Bay Program States (Linker 2010).

Allocations

Nitrogen deposition air allocations are based on addressing the federal requirements of the CAA. In determining the allowable loading from air deposition, EPA separated the nitrogen deposition into: 1) deposition occurring on the land and 2) deposition occurring directly onto the tidal waters of the bay. Atmospheric deposition directly to the land is considered in the allocated load to jurisdictions because the nitrogen atmospheric deposition becomes mixed with the nitrogen loadings from the land-based sources. Once it is land deposited, it is to be managed as part of BMPs for other sources. In contrast, the nitrogen deposition to tidal waters is a direct loading without management controls.

The regulations and controls previously described were modeled using the national air models. Based on these models and the air allocation scenario, the nitrogen deposition direct to tidal waters is 15.7 million pounds per year. The Maryland air deposition allocations provided by EPA in July 2010 are 0.69 million pounds per year total nitrogen and 0.04 for total phosphorous, which are close to the 2009 model progress run.

Maryland Air Related Program Information

MD Air Programs

The DNR Power Plant Research Program (PPRP), established under the Power Plant Siting and Research Act of 1971, functions to ensure that Maryland meets its electricity demands at reasonable costs while protecting the State's valuable natural resources.

PPRP is mandated to conduct consolidated reviews of all issues related to power generation in Maryland, including new and existing facilities, and to evaluate future planning options. Past evaluations have included assessments and plant-specific studies and more general monitoring, research and modeling projects, e.g., atmospheric deposition - analyzing sources, fate, and effects of acid rain precursors, toxic metals, and nitrates, including their impacts on the Chesapeake Bay; and, studies of impacts to aquatic life - studying fate and transport of power plant related toxic substances in the Chesapeake Bay and Maryland tributaries.

Air Quality Monitoring and Permitting Programs

MDE carries out mandates from the Federal Clean Air Act and administers air pollution monitoring, planning, and control programs to improve and maintain air quality. The programs are geared to protect the health and welfare of both the citizens and the environment of Maryland.

Ambient Air Monitoring

Measures and analyzes ground-level concentrations of criteria pollutants, air toxics, and meteorology; conducts special research monitoring initiatives, coordination of air-shed modeling, year-round daily air quality forecasts, and AQI reporting. Mobile Sources Implements control measures to reduce motor vehicle related emissions; operates the Vehicle Emissions Inspection Program (VEIP), Diesel Emissions Control Program, and others to regulate emission of pollutants from cars and trucks.

Air Quality Compliance

Ensures compliance at stationary sources of air pollution; conducts inspections, responds to complaints, provides compliance assistance and pursues enforcement actions when necessary. Air Quality Planning leads and manages air quality programs to protect public health and the environment from air pollution; develops plans and regulations to limit and reduce air pollution; supports efforts to make information about air pollution available to the public.

Air Quality Permitting

Issues permits to construct and operate to ensure that stationary sources of air pollution are constructed and operate within regulatory requirements to meet state and federal air quality requirements established to protect human health and the environment. Maryland maintains an extensive inventory that identifies all of the sources that contribute to the air deposition of nutrients in the Chesapeake watershed. It is available as *Appendix A* to Maryland's most recent State Implementation Plan document.

The Maryland Healthy Air Act

The Maryland Healthy Air Act (Annotated Code of Maryland Environment Title 2 Ambient Air Quality Control Subtitle 10 Health Air Act Sections 2-1001 - 2-1005) was developed with the purpose of bringing Maryland into attainment with the National Ambient Air Quality Standards (NAAQS) for ozone and fine particulate matter by the federal deadline of 2010. The act and the subsequent regulations also require the reduction of mercury emissions from coal-fired electric generating units and significantly reduces atmospheric deposition of nitrogen to the Chesapeake Bay and other waters of the State.

The Healthy Air Act requires the most stringent reductions from coal fired power plants of any east coast state. The HAA requires reductions in nitrogen oxide (NOx), sulfur dioxide (SO2), and mercury emissions from large coal burning power plants. NOx is the most important pollutant contributing to Maryland’s ground-level ozone or “smog” problem and also contributes significantly to nitrogen pollution in the Chesapeake Bay. MDE implements the Healthy Air Act through regulation. The regulations became effective on July 16, 2007.

Over 95 percent of the air pollution emitted from Maryland’s power plants comes from the largest and oldest coal burning plants. The emission reductions from the Healthy Air Act come

in two phases. The first phase requires reductions in the 2009/2010 timeframe and, compared to a 2002 emissions baseline, reduce NOx emissions by approximately 75%.

The second phase of emission controls occurs in the 2012/ 2013 timeframe. At full implementation, the HAA will reduce NOx emissions by approximately 75% from 2002 levels. Gains in nitrogen reduction have been counted in Maryland's initial 2 Year Milestone, from the period of 2009- 2011. Over 300,000 pounds of nitrogen has been reduced to date. See the Governor's BayStat *website* for further information.

2.2.2.9 Forest

Manual for Erosion & Sediment Control on Forest Harvest Operations

The 2005 Maryland Erosion and Sediment Control Standards and Specifications for Forest Harvest Operations, provides regulatory requirements for timber cutting in Maryland's forests.

2.2.2.10 Extractive

Surface water discharges associated with mining operations are managed under the industrial discharge permits addressed in Section 2.2.2.2. Soil erosion considerations are addressed by sediment control plans required in Mining and Reclamation plans. "Maryland Standards and Specification for Soil Erosion and Sediment Control" manual, with associated authorities is addressed in Section 2.2.2.5. The erosion control plan approval is required by Soil Conservation Districts (SCDs). The staffing capacity for SCDs varies by district office and will be addressed in greater detail in the Phase II Plan.

2.2.2.11 Additional MDE Program Capacity

Capacity Related to Enforcement and Compliance

MDE staff are on call during the regular workweek and after normal working hours, to ensure that all environmental emergencies are promptly addressed. Citizens may report any environmental emergency that poses an immediate threat to the public health or the well-being of the environment such as oil and chemical spills or accidents causing releases of pollutants by calling a toll free number (866) 633-4686.

Enforcement of criminal violation of environmental laws is handled by the Environmental Crimes Unit of the Office of the Attorney General. On MDE's website information can be obtained about enforcement, including frequently asked questions, recent enforcement and compliance-related press releases, FY 2009 Annual Enforcement Report, previous years' reports and the MDE Newsletter "eMDE" Enforcement and Compliance (E & C) Notes, all available at: http://www.mde.state.md.us/AboutMDE/enfcomp.asp

MDE's enforcement activity has increased steadily in recent years. From FY07 to FY10, the number of enforcement actions taken by MDE increased 54%. The increase in the same time frame for water pollution related violations is 21%.

Wetlands and Waterways Program

This program is responsible for the protection and management of Maryland's tidal and nontidal wetlands and waters. The Nontidal Wetlands and Waterways Division regulates activities conducted in nontidal wetlands and their buffers, and nontidal waterways, including the 110-year floodplain. The Tidal Wetlands Division regulates activities conducted in tidal wetlands. In addition to its regulatory responsibilities, the Program also creates, restores, and enhances nontidal wetlands and streams, provides training and technical assistance and assists in the development of watershed management plans.

2.2.2.12 Additional Resources

USDA Farm Bill - Chesapeake Bay Watershed Initiative Summary

As part of the President's Strategy for Restoring the Chesapeake Bay, the USDA committed to new implementation activities in the Bay watershed by 2025. This includes the Chesapeake Bay Watershed Initiative, authorized in the 2008 Farm Bill that provides NRCS with $43 million in fiscal year 2010 and up to $72 million in 2011. The CBWI will provide the Bay region's farmers with assistance to implement agricultural conservation practices. It will be used to work with local and State partners to target priority watersheds and conservation practices to maximize water quality improvements in the Bay and its tributaries. This financial contribution represents one of the largest single federal investments in the clean-up effort.

NRCS has established three focus areas to demonstrate water quality improvements through expanded producer outreach efforts and intensive conservation planning and implementation activities. Maryland's "Showcase Watershed" was announced in June 2010 in the Upper Chester River watershed. The Upper Chester watershed covers about 23,300 acres. Fifty percent of the watershed is in Kent County and 49 percent is in Queen Anne's County. The majority of the land is farmland, poultry facilities, horse farms, nurseries and cattle farms. NRCS is working with federal agencies and other partners to develop a monitoring plan for these areas to evaluate the impact on water quality. Using its Cooperative Conservation Partnership Initiative, NRCS will enter into agreements of up to five years with eligible partners interested in enhancing conservation on agricultural and non-industrial private forest lands. NRCS has made available at least $5 million in financial assistance from two programs—the Environmental Quality Incentives Program and the Wildlife Habitat Incentive Program—in the Chesapeake Bay Watershed for this effort in 2010. Further information is available on the *NRCS Website*.

Chesapeake Bay Regulatory and Accountability Program (CBRAP) Grants

The US EPA *CBRAP grants* are designed to assist States to develop new regulations, design TMDL watershed implementation plans, reissue and enforce permits, and provide technical and compliance assistance to local governments and regulated entities. A portion of the $11.2M grant funds are directed to aid Maryland to implement and expand its regulatory, accountability, and enforcement capabilities in support of reducing nitrogen, phosphorus, and sediment loads delivered to the Bay to meet the water quality goals. In Maryland, CBRAP will enable MDA to expand its Nutrient Management Program. The Nutrient Management Program requires

additional resources for plan development, operator compliance assistance, and education and outreach programs. The goal is to bring more operators into compliance, to foster further understanding of the benefits of nutrient management and to promote better management and use of all nutrients and organic wastes. By understanding and implementing nutrient management best practices, urban land managers and farm owners and operators can significantly reduce the nitrogen and phosphorus run off in the Chesapeake Bay. For further information about the grant see the federal grants *CBRAP website*.

In addition, the Maryland Water Quality Revolving Loan Fund (WQRLF) established by the Federal Government in the Clean Water Act of 1987 (P.L. 100-4) makes below market rate of interest loans to local governments for water quality improvement projects. The types of water quality improvement projects eligible to be funded through the WQRLF program include the upgrade and expansion of existing wastewater treatment plants, upgrade of sewer mains, interceptors, pumping stations, and non-point source pollution including capping of closed landfills. A portion of the funding is provided to agricultural producers through MDA's Low Interest Loans for Agriculture Conservation (L ILAC) to increase conservation project implementation. For more information visit MDA's website http://www.mda.state.md.us/pdf/2008_lilac.pdf

The Supplemental Assistance Program provides grant assistance to local governments for planning, design, and construction of needed wastewater facilities. This program provides state grant funding for sewerage projects that are needed to address high priority public health or water quality problems. Funding priority is given to disadvantaged communities and/or communities that are non-compliant with their water quality permits. This Program helps pay for compliance-related WWTP rehabilitation; the connection of older, established communities with failing septic systems to public sewers; and the correction of system deficiencies such as combined sewer overflows (CSO), excessive inflow and infiltration (I/I), or antiquated pump stations. This Program also provides additional funds to small and low-income communities to help keep nutrient removal upgrade of WWTP more affordable.

Financial and Programmatic Capacity Related to Non Point Sources

Federal 319(h) Grant Program: This program administers the State's CWA §319(h) grant. Maryland Section 319(h) to help fund State nonpoint source management projects to eliminate water quality impairments caused by nonpoint sources.

The 319 Program is in the Water Quality Protection and Restoration (WQPR) Program, part of MDE's Science Services Administration. The §319(h) grant supports staffing of Maryland's TMDL implementation coordination. The WQPR Program has a central technical and coordination role in developing Maryland's Chesapeake Bay TMDL Watershed Implementation Plan.

The 319 Program also plays a lead role in helping to achieve protection and improvement of Maryland's water quality by promoting and funding state and local efforts, water quality monitoring, stream and wetland restoration, education and outreach, and other measures to

reduce and track nonpoint source pollution loads. More information is available on MDE's *319(h) Grant Program web page*.

Federal Coastal Zone Management Act Grant Program: The main objectives of CZMA are to "preserve, protect, develop, and where possible, restore or enhance the resources of the nation's coastal zone." The key feature of CZMA was the creation of a partnership among federal, state, and local governments. CZMA's success is a direct result of the ability of states to work with local communities to design coastal management programs that address specific issues and priorities affecting local areas. The Maryland Chesapeake & Coastal Program, administered by the Maryland Department of Natural Resources, is a partnership among local, regional and state agencies. The *Program* collaborates with many private organizations, such as local land trusts and economic development groups.

Chesapeake and Atlantic Coastal Bays Trust Fund: To accelerate Bay restoration, in November 2007, Maryland established the Chesapeake and Atlantic Coastal Bays Trust Fund. The Trust Fund accelerates Bay restoration by focusing limited financial resources on the most effective non-point source pollution control projects as identified in the State's Tributary Strategies and the 2-Year Milestones. Generated from rental car and motor fuel tax revenue, the Trust Fund for fiscal year 2009 is valued at $9.6 million; Funding for fiscal year 2010 is $20M. It is anticipated that when fully-funded, the Trust Fund will generate $50M annually. In FY09, over $6 million was directed to agricultural practices such as cover crops, buffer planting and animal waste management. In FY10, funding for these same practices increased to $13.9M. For further information see, http://dnr.maryland.gov/ccp/funding/trust_fund.asp and http://www.baystat.maryland.gov/trustfund_info.html

The Maryland Water Quality Revolving Loan Fund: The *Maryland Water Quality Revolving Loan Fund* (WQRLF) makes below market rate of interest loans to local governments or a person as defined in Annotated Code of Maryland, Environmental Title 1-101(h), for water quality improvement projects. There is no limit to the amount of loan funding a project may receive through this program. A loan recipient must establish one or more dedicated sources of revenue for repayment of the loan. Federal funding for this program became available in January 1988. Federal regulations under 40 CFR Part 35-3100 (Subpart K), authorizes The United States Environmental Protection Agency (EPA) to make capitalization (cap) grants to the States for deposit in State Water Pollution Control Revolving Loan Fund. Starting with FFY 2010 federal appropriation, 30% of the federal amount must be allocated for loan forgiveness/grants to disadvantaged communities and 20% must be allocated to "Green Reserve" projects provided sufficient applications were received. Under federal regulations, the State must agree to deposit into the WQRLF matching funds equaling at least 20 percent of the amount of each federal capitalization grant. The State annually prepares an Intended Use Plan (IUP) as part of its federal grant application, and identifies water quality improvement projects targeted to receive funding from the designated federal cap grant and State match.

The types of water quality improvement projects eligible to be funded through the WQRLF program include the upgrade and expansion of existing wastewater treatment plants, upgrade of sewer mains, interceptors, pumping stations, and non-point source pollution including capping of closed landfills. A portion of the funding is provided to agricultural producers through MDA's

Low Interest Loans for Agriculture Conservation (L ILAC) to increase conservation project implementation. For more information visit MDA's website http://www.mda.state.md.us/pdf/2008_lilac.pdf

Transportation Enhancement Program: The Transportation Enhancement Program (TEP) are funds provided by Federal Highways through the Surface Transportation Program and administered through the State Highway Administration to mitigate and enhance areas that are impacted by the intermodal transportation system. These funds are distributed through a competitive grant process once a year and provide a good source of funding for eligible environmental enhancement projects including reforestation, wetlands enhancement and riparian buffer plantings. Grants range between $100k to $1 million. The TEP program has been instrumental in the implementation of Natural Filters projects on public lands for FY10 ($500k) and FY11 ($600k). For more information on this program visit SHA's website at http://www.sha.maryland.gov/Index.aspx?PageId=144

Program Open Space: Program Open Space (POS) acquires recreation and open space areas for public use. The Program administers funds made available to local communities for open and recreational space through the State real estate transfer tax and from federal programs, such as the Land and Water Conservation Fund of the National Park Service, U.S. Department of the Interior. The Program coordinates the acquisition of lands for the use of all units of DNR. Stateside POS funds are allocated to purchase land for state parks, forests, wildlife habitat, natural, scenic and cultural resources for public use. A portion of stateside funds are also dedicated to capital improvements, critical maintenance, and operations in state parks as well as restoration on newly acquired properties. Two of the largest restoration projects to date implemented for Natural Filters on Public Lands have been POS projects. For more information visit DNR's website at http://www.dnr.state.md.us/land/landconservation.asp

Maryland's Ecosystem Enhancement Program : The fundamental purpose of Maryland's Ecosystem Enhancement Program (ME2) is to provide a better model for mitigation in the State by targeting our limited resources (funding) towards mitigation that enhances Bay Restoration. This is done through a simple, ecosystem based targeting approach using the Maryland GreenPrint Program. ME2 targets sites by looking at gaps in the Green Infrastructure and provides highly beneficial projects in these areas that will yield nutrient reductions far greater than those found in a typical mitigation project. In addition, all mitigation done through ME2 is implemented at a ratio greater than what is required by regulation. Therefore each additional acre not required as mitigation is counted towards restoration.

Coastal America/CWRP: Coastal America has been in existence since 1991 and is a partnership (MOU) between 9 federal sub-cabinet agencies working together to integrate activities in the preservation of coastal ecosystems. Coastal America supports two nationwide partnerships, the Coastal Ecosystem Learning Centers and The Coastal Wetlands Restoration Partnership (CWRP). The CWRP strives to leverage federal and state funding with private/corporate contributions in the areas of wetlands and aquatic resources restoration. http://www.coastalamerica.gov/

3.0 ACCOUNTING FOR GROWTH

In terms of the eight elements of a Phase I Plan defined in EPA guidance, this section addresses Element 3: "Accounting for Growth" in loads.

In determining the pollutant load reductions to meet the interim and final target loads, it is necessary to account for the growth in future loads. Broadly speaking this can be done in two ways. First, future loads can be estimated and included in quantitative load reduction analyses. Second, policies and programs can be adopted to ensure all future load increases are off set by commensurate load reductions on an as-needed basis.

This Plan uses both approaches. The Plan uses future projections of loads in the calculations used to set strategies for achieving the interim target loads by 2017. This is described further in the Section 4 on the gap analysis.

The Plan also offers a schedule for adopting nutrient offset programs for septic system and land development loads. This program will build on the existing nutrient trading policies and programs.

3.1 Background: Smart Growth and Managing the Growth in Loads

Maryland has long recognized the impact of growth and development on natural resources and has instituted policies and implemented strategies to reduce that impact. The Priority Funding Area law reduces growth impacts by focusing growth in areas with a certain density and infrastructure. Maryland uses State *Priority Funding Areas* (PFAs) to direct state investments in infrastructure to areas with existing development of certain densities and where infrastructure already exists. State investments in infrastructure reduce overall costs and make these lands more attractive to developers. Growth within the PFAs helps preserve agricultural and resource lands by developing other lands inside urban areas instead. PFA growth also helps minimize stormwater pollution by reducing the amount of land consumed to accommodate new growth, and reduces the nutrient pollution from septic systems by sending household wastewater to treatment plants instead of into a septic system that discharges directly into the ground.

In 2009, a new State law required local governments to track certain measures and indicators to measure the level of smart growth occurring in local jurisdictions. The law also establishes a goal to increase the percentage of growth within the PFAs and decrease it outside PFAs. Local governments are also required to set growth goals to keep pace with the State goal and report annually on ordinances and regulations that support the goal.

The State has also enacted other measures to help direct growth and development to areas that reduce impacts to the environment. The *Sustainable Communities Act of 2010* broadened an existing tax credit focused on historic structures to one that emphasizes the importance of dense, sustainable development near mass transit in a variety of urban centers throughout the state. This tax credit supports the goals of the Main Street Maryland Program that aim to strengthen traditional downtown business districts. The Sustainable Communities Act also supports Transit-

Oriented Development that allows Marylanders greater choice in how they move between home, work, and play.

Land Conservation, the practice of preventing land from being developed, is an important component of Smart Growth. While the goal of Smart Growth is to direct as much growth to appropriate areas as possible, some growth will inevitably occur outside of the PFAs. Maryland works hard to protect valuable forests and farms from being developed. Once a property converts to a developed use it rarely, if ever, is returned to its previous state of field or forest. Organizations including the Maryland Agricultural Land Preservation Foundation (MALPF), the Maryland Environmental Trust (MET), Program Open Space (POS), and others work diligently to make sure that these lands remain in their current state into the future to protect the Bay and to make certain that future generations can enjoy them.

Governor Martin O'Malley required the Departments of Environment, Natural Resources, Planning, Agriculture, and Transportation to create systems to track progress in meeting goals for development, land preservation, and water quality restoration. Following the model of CityStat, the agencies have supported BayStat, GreenPrint, AgPrint and the soon-to-be released GrowthPrint to quantify and report on progress towards goals.

Local government implementation of the aforementioned laws is crucial to reducing harmful sprawl and associated increased nutrient and sediment pollution reaching the Chesapeake Bay. Article 66B of the Maryland Annotated Code provides local governments with land use management authority, and requires that local governments write and update plans for future growth and development. These plans are referred to as Comprehensive Plans. Comprehensive plans in Maryland must include numerous "elements" that address specific areas of public responsibility, such as land use, transportation, community facilities, mineral resources, development regulations, sensitive areas, water resources, and implementation. The water resources element and a municipal growth element were recently added to the required comprehensive plan content, signaling a change in the way that planning considers the effect of growth on the natural environment. This concern is echoed by the creation of the Chesapeake Bay TMDL and the requirement that state and local governments collaborate to create Watershed Implementation Plans to identify how to reduce pollution entering the Bay and prevent increases in pollution from future development.

3.2 Key Issues

Nutrient caps on Waste Water Treatment Plants (WWTPs), without similar constraints on loads from septic systems, create imbalanced incentives for development. Presently, caps on nutrient loads from WWTPs constrain development in sewered areas. There are no similar pollution limits on development using septic systems. This imbalance is at cross purposes with water resource goals (see Figure 3.1). The figure, provided by the Maryland Department of Planning, shows that, per household, the load from new development on well and septic is almost 5 times as great as new loads from sewered areas. This is due in part to average lot sizes being larger in unsewered areas.

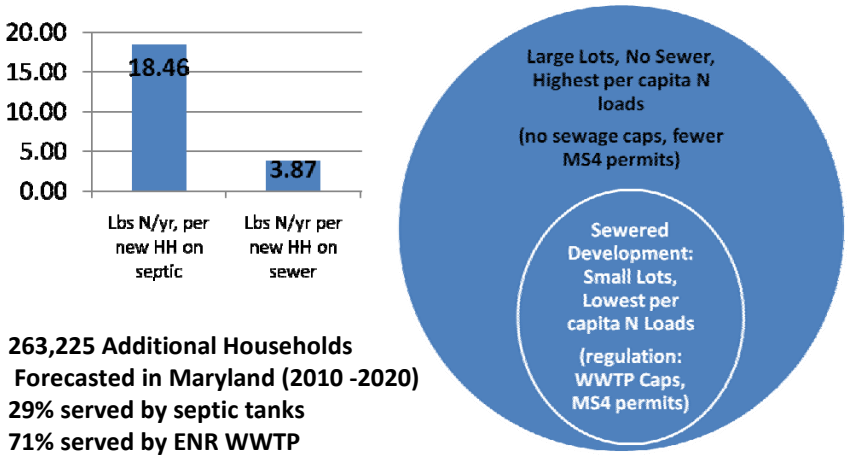


Figure 3.1 Regulatory Constraints: An Uneven Playing Field for Development

The amount of pollution from new sources can be effectively managed by using both of EPA's options for accounting for growth referenced in the opening of this section. If current trends continue, it is estimated that Maryland will add another 264,000 households from 2010 to 2020, or 430,000 from 2010 to 2030. About 72% will be served by WWTPs and 28% by well and septic.

Total nitrogen loads from the new development projected on sewer (counting both point and nonpoint source contributions) will be on the order of 727,000 lbs N/yr (188,000 households) by 2020 and 1.2 million lbs N/yr (309,000 households) by 2030. Loads from expected development on well and septic will be on the order of 1.4 million lbs N/yr by 2020 (75,000 lots) and 2.3 million lbs N/yr by 2030 (124,000 lots)[9] (see Figure 3.2). Per household, the load from new development on well and septic is almost 5-times as much as new loads from sewered areas (See Figure 3.1). Thus, while the number of new households projected on sewer is roughly 2.5 times that on well and septic, the nitrogen load from new development on well and septic may be almost twice that from new development on sewer. Under EPA's guidelines, the total 3.5 million

[9] All numbers represent reasonable, best estimates provided by MDP's Growth Simulation Model. These estimates could also be made using a range of figures which may better capture varying economic conditions that would either stimulate or depress anticipated development. Household growth and load estimates are based on regional cooperative forecasts, zoning, current trends, and generalized data from the Chesapeake Bay Watershed Model. New development on sewer is assumed to be in the form of ¼-acre lots that contribute nonpoint source loads of 3.28 lbs TN per acre per year, served by ENR WWTPs discharging effluent at 4.0 mg/l TN (the vast majority of development on sewer will be served by one of 67 major WWTPs, all of which are being upgraded to ENR). New development on septic tanks is assumed to be in the form of 2-acre lots that contribute nonpoint source loads of 3.15 lbs TN per acre per year (from the land), with an additional discharge of 12.16 pounds of TN per year (EOS) from the septic system.

lbs of nitrogen from new development by 2030 must be accounted for in future load projections and reduction strategies, or offset on a case-by-case basis, or some combination of the two.

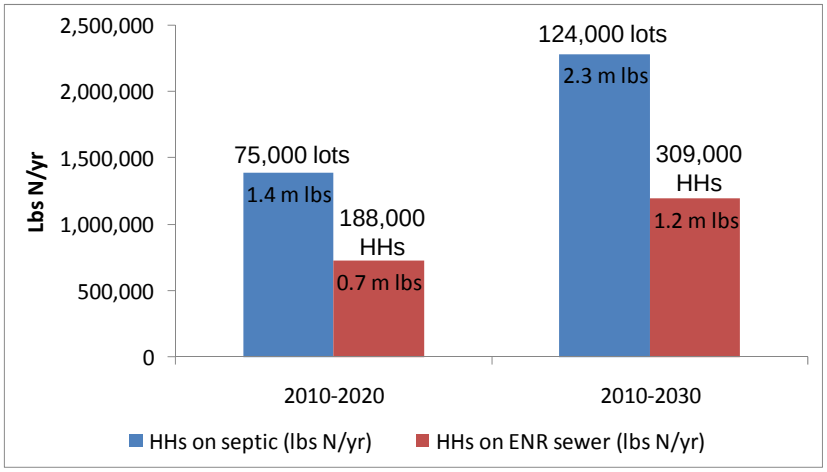


Figure 3.2 Estimated N Loads from New Development

The more development that occurs in sewered areas served by advanced WWTPs, the less the total nitrogen load increase from new development will be. For example, if all projected new development expected on well and septic by 2030 was, instead, on ENR sewer, the total new or increased load from development would be 1.7 million lbs N/yr rather than 3.5 million lbs N/yr. This would limit loads from new development to a level that could be accommodated by current WWTP allocations above current flows. There is no realistic way this could happen, but it is clear that the greater the percentage of future growth directed to sewered areas, the less pollution has to be offset through additional load reduction by other source sectors. The following Table 3.1 further illustrates this[10].

[10] Targeted agricultural load reductions by 2020 are assumed to be equal to those listed in the September 2004 Maryland Tributary Strategy Executive Summary (10.57 million lbs N reduction).

Table 3.1 New/Increased Nitrogen Loads From Development 2010 – 2030, Current Trends

New/ Increased Nitrogen Loads from Development 2010 – 2030, Current Trends		
Source	Target Load Allocation or Offset Required	
	As % of Ag Target Reduction required by the Tributary Strategy	As % of Total Remaining WWTP Allocation under the Tributary Strategy (capacity beyond current flows)
Development on Well & Septic (28%)	22%	120%
Development on Sewer (72%)	11%	63%
All Development	33%	183%
If All On Sewer	16%	88%

Source: Maryland Department of Planning

We currently have few well established BMP options to cost-effectively achieve substantial load reductions beyond those already targeted for the agricultural sector, yet that is what is necessary to generate offsets of the necessary magnitudes. Offset generating activities other than farming BMPs must be part of the solution – such as nitrogen reducing septic systems, more stormwater retrofits, upgrades to non-major WWTP, etc. – but many will cost more per pound of nitrogen reduced than targeted options. Targeted agricultural practices might also be used to generate offsets on farms that have achieved target reduction levels, but can benefit from additional implementation. Relatively recent or innovative practices targeted for relatively low implementation levels may have considerable potential as offset generators in this way. Examples include Manure Transport (e.g., pelletizing and distributing), Decision/Precision Agriculture, Water Control Structures, Phosphorus-sorbing Materials, Poultry Litter Treatment and Alternative Crop Production (e.g., switchgrass). An effective offset strategy should acknowledge these realities.

Future development on well and septic and the associated loads could exceed estimates, depending on how quickly WWTPs reach their caps. For example, growth on sewer by 2020 in some counties is expected to exceed current permitted WWTP capacities by around 40,000 households[11]. If all of this growth was diverted to sewered areas served by other WWTPs with adequate capacity, possibly in other counties, the additional load from development would be 121,000 lbs/yr. If it was all diverted to non-sewered areas, the load would be 730,000 lbs/yr. Reality will undoubtedly fall somewhere between the two extremes. The goal is to ensure the number is closer to 121,000 lbs/yr, to better support pollution reductions needed to meet the Bay TMDL.

[11] If zoning and other policies improved to support a Smart Growth scenario, there would be more sewer demand by 2020 (i.e., in some counties the sewer demand would be expected to exceed current permitted WWTP capacities by around 62,000 households).

3.3 Accounting for Growth and Offset Strategy

Based on the key issues discussed above, Maryland is using seven objectives to guide its strategy to minimize and offset growth in loads:

1. Account for nutrient loads from new development.
2. Encourage development that will result in relatively small increases in loads to accommodate future growth.
3. Ensure an adequate supply of offset generators and help achieve targeted load reductions of the agricultural sector.
4. Balance incentives between development in and outside of sewered areas, commensurate with their relative impacts on the TMDL, to minimize increased loads from future development;
5. Provide local government the ability to use land use decisions to contribute directly to TMDL goals;
6. Recognize State and local governments accountability for impacts of land use decisions on TMDLs; and
7. Ensure that management of land use and the regulation of pollution are mutually supportive.

The first three of these goals also serve as action steps to implement a strategy to offset growth in loads. These are elaborated upon in the next three subsections.

3.2.1 Account for nutrient loads from all new development

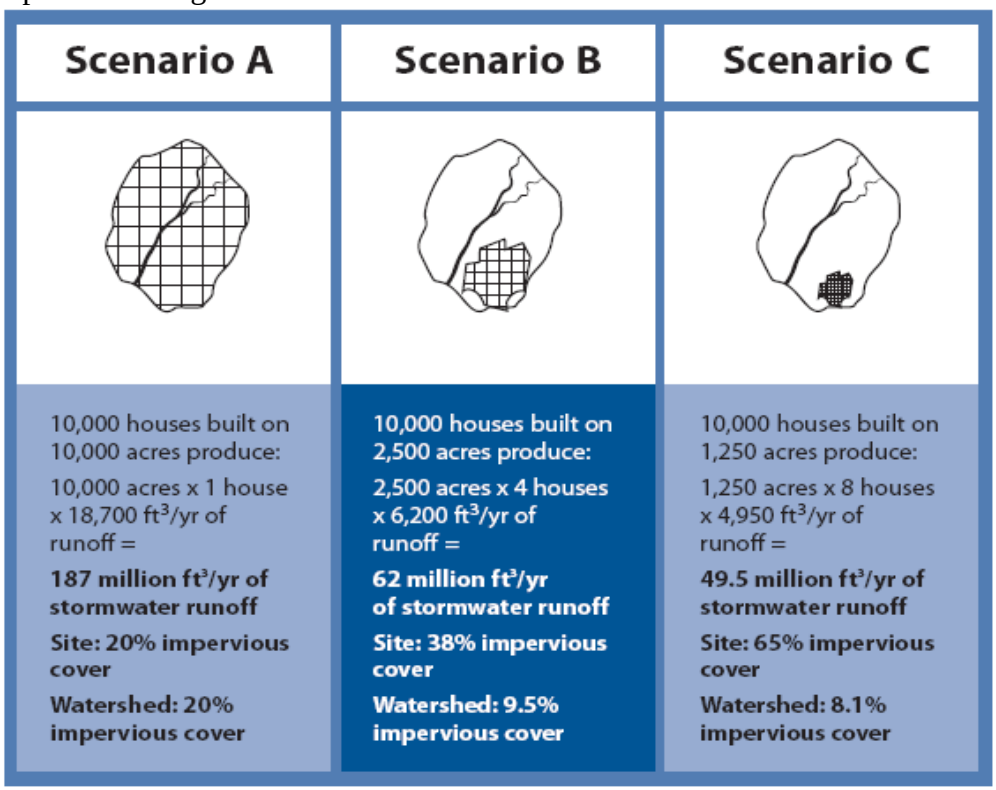
New development must be accounted for under the strategy to account for growth, whether the development is within or outside sewered areas. The State will rely on local governments, who regulate land use, to participate in and support this accounting. This can be accomplished through a statewide approach or a local alternative that achieves the same ends. This will be a significant subject for consideration in during the Phase II Plan development process. See Section 3.4 for a preliminary schedule for development and implementation of offset policies and procedures.

3.2.2 Encourage development that will result in relatively small increases in loads to accommodate growth

This is an essential aspect of the strategy to account for growth. It is essential that incentives be established to prevent loads from increasing, because it is difficult and costly to offset loads. Furthermore, the potential for offsetting loads has technical limitations discussed above relative to Table 3.1.

The proposed statewide approach for offsetting future growth in loads is designed to prevent loads so as to minimize the need for offsets. Any alternative strategy proposed should also establish incentives to avoid loads.

Statewide Approach to Offsetting Future Loads: Generally speaking, areas served by sewer accommodate additional development at substantially lower per capita nitrogen loading rates. But, as discussed in the key issues section above, sewer service or lack thereof is not the only important determining influence. Zoning and other land use management plans and programs also shape the nature of development and its post-development loading rates. Maryland is proposing to designate target loads for some new or increased sources and establish offset requirements for others in light of these factors that determine the nature of development and its post-development loading rates.



To illustrate, consider three alternative ways to accommodate 10,000 residential units in a 10,000 acre watershed, at densities of one dwelling per acre, four dwellings per acre and eight dwellings per acre. These alternatives are compared here graphically to illustrate relative implications for stormwater runoff, impervious cover at the site and watershed scales, and percentage of land use affected at the watershed scale (graphic from "Protecting Water Resources with Higher-Density Development", U.S. Environmental Protection Agency, Smart Growth Program, January 2006, http://www.epa.gov/smartgrowth/water_density.htm). As already illustrated in the discussion of "Key Issues" above, the implications for nitrogen loads from developed sources are similar in relation to these scenarios: the more a given amount of development is concentrated and served by advanced WWTPs, the lower the total point and nonpoint source nitrogen load.

To accomplish this, areas served by sewer and unsewered areas within each jurisdiction will be classified into Low, Moderate and High Per Capita Loading categories. "Per capita," as used here, means nitrogen loads per total number of residents plus jobs accommodated within a given geographic area. Classification will be based on estimates of total residential and employment populations and total nitrogen loads (point and nonpoint source components) from development in each area.

The number of residents and jobs in each area will be estimated using Maryland Property View, Census data, and the Department of Labor, Licensing and Regulation's ES202 employment data, with the last of these supplemented by data local governments will be asked to provide for Phase II local Watershed Implementation Plans. Local governments will also be given the opportunity to demonstrate reasonable expectations of increased future residential and employment population. If demonstrated, these estimates will be incorporated to adjust the State's estimates of residents and jobs.

Point and nonpoint source loads from development will be estimated using inventories of point sources, developed land uses and septic systems in conjunction with Chesapeake Bay Program Watershed Model data on loads from development-related sources by County-Segment. Per capita loading rates calculated from these data will be used to classify areas into Low, Moderate and High Per Capita Loading categories.

Target loads for new and increased sources will be designated for new development and redevelopment in Low Per Capita Loading areas – those likely to accommodate it at the lowest per capita nitrogen loading rates. These will generally be areas served by ENR WWTPs and accommodating relatively high densities of residents and jobs. Offsets will be required in all other areas.

More specifically:

- Development and redevelopment in Low Per Capita Loading areas and Moderate Per Capita Loading areas will not be required to offset increased point source loads from wastewater.
- Redevelopment (defined per State Stormwater Management Regulations) within Low Per Capita Loading areas will be required to meet established stormwater management requirements (relating to impervious cover, Environmental Site Design (ESD) to the maximum extent practicable (MEP), or watershed management plans) as provided in the approved local ordinance. Redevelopment projects in these areas will not be required to offset post-development non-point source loads.
- New (or Greenfield) development within Low Per Capita Loading areas will be required to satisfy stormwater management regulations and offset post-development non-point source loads above the standard forest loading rate established by MDE.
- All development in Moderate Per Capita Loading areas would be required to offset increased point and post-development nonpoint source loads (including septic system loads) in excess of the standard forest loading rate established by MDE.
- High Per Capita Loading areas may be subject to greater offset requirements, i.e., development may be required to offset point and post-development nonpoint source loads in excess of the standard forest loading rate established by MDE, at a ratio that is higher than that required in Low and Moderate Per Capita Loading areas.

Local Alternative Approaches to Offsetting Future Loads: Local governments will have the opportunity to propose other approaches, provided they satisfy EPA's guidelines and are judged to be as or more effective in supporting the TMDL than the statewide strategy. To that end, they need to effectively address the seven objectives, listed above, to develop the statewide strategy as the guiding framework for local alternatives.

3.3.3 Ensure an adequate supply of offset generators and help achieve targeted load reductions of the agricultural sector.

The offset requirements proposed need to result in a net decrease in non-point source loads by requiring each development, except redevelopment in a sewered area, to offset its own nonpoint source load in addition to a safety margin. In most cases this will be based on the forest loading rate threshold used to compute offset requirements.

The safety margin is intended to:

- Compensate for unknown shortcomings in expected load reduction achievements in the development sector, should they be indicated by new data or changes in our understanding of loading rates, BMP efficiencies and implementation rates, and
- Contribute to our ability to achieve targeted load reductions in the agricultural source sector, so it can function as an "offset generator" for the offsets needed to facilitate development.

Offsets under the trading policy must be generated through load reductions beyond those targeted in the base strategy to reduce existing loads. Possible generators include farms that have already implemented targeted reductions, septic system nitrogen upgrades outside targeted areas (e.g. Maryland's Critical Area), upgrades to non-major WWTPs, and other source reductions beyond those needed to meet water quality standards.

Starting with the Phase II planning process, strategies need to be developed. The strategy should address both target load reductions and an adequate supply of offset generators. The strategy needs to be designed to work in concert with the nutrient trading policy; take advantage of the ability of market forces to find innovative solutions to the problems involved; and incorporate the essential role of outreach and delivery of assistance to the farm community. Maryland's trading program has not generated credits, but based on the Maryland Association of Soil Conservation Districts Eco-Trading Project, there should be eligible farms with an adequate supply of offset generators.

3.4 Preliminary Schedule for Developing Offset Policies and Procedures for Septic Systems and Land Development

As of the date of this Plan, Maryland has not determined how to structure or quantify offsets, but will do so according to the following schedule. This will be initiated in the Phase I planning process.

2011 Research and develop more detailed approaches for offsets. Evaluate the need for legislative and regulatory changes for the strategy. Obtain stakeholder and public comment. If needed, seek necessary authority to undertake research, the appointment of a task force, and/or authorization to implement elements of the offset procedures.

2012 Finalize the development of the offset policies and procedures.

2013 Initiate the implementation of the offset policies and procedures.

An essential element to offset policies and procedures will be finding opportunities for load reductions that are above and beyond reductions needed to meet the Chesapeake Bay water quality standards. Maryland's nutrient trading program is currently oriented primarily toward reduction opportunities from the agricultural setting.

3.4.1 Tasks and Options for Developing Offset Policies and Procedures

A variety of issues must be addressed as part of the strategy for offsetting future growth in nutrient and sediment loads. Many of these issues were emphasized in public comments from stakeholders in response to the draft Phase I Plan. Accordingly, Maryland will work collaboratively with local governments and stakeholders during 2011 and 2012 to complete key tasks needed to meet the 2013 implementation date.

1. Complete a statewide inventory and classification of high, moderate and low per capita loading areas (PCLAs) with appropriate input from local governments
2. Provide outreach and assistance for appropriate activities to local governments. For example:
    a. Evaluate the supply of offset credit generation within qualified geographies
    b. Assess potential for growth under alternative scenarios to support economic development and local comprehensive plans
    c. Provide jobs data to support PCLA classifications;
    d. Determine if estimated future development should be used to make PCLA classifications
3. Determine how institutional and market mechanisms for offsetting loads will be implemented in subsequent years. This will require a framework to address issues of supply, transactions, regulatory accountability and perpetuity in ways that will be practical and effective.
4. Investigate options through which the State or local governments can better achieve the seven objectives of the growth and offset strategy, in consultation with other stakeholders. These options may include the following:

    a. Per the Phase I Plan, consider and, if appropriate, develop differential offset ratios for high, moderate and low PCLAs
    b. Ensure that offset ratios outside of low PCLAs compensate for low, or no, offsets inside of PCLAs.
    c. Develop incentives for individual development projects in low and moderate PCLAs to maximize jobs/residential densities and FARs (floor area ratios) in appropriate locations.
    d. Determine how and when Water Resource Elements of local comprehensive plans should be revised, to reflect the Bay Watershed Implementation Plan Target Loads.
    e. Explore creation of new offset generator supplies that go beyond implementation of BMPs on individual sources. These might include establishment of a fees-in-lieu mechanism to support collection, processing and distribution of pelletized

livestock and poultry manure; upgrades to additional major-minor WWTPs; and retrofitting existing septic systems.

f. Strategically reserve the supply of cost-effective offset capacity to encourage development in low PCLAs; for example, make portions of the offset generator market accessible only to offset consumers in Low PCLAs.
g. Determine if offset requirements can be effectively used to help achieve targeted load reductions. This would create a supplemental revenue stream to support target reductions where funding may otherwise be inadequate.
h. Minimize or eliminate factors that could encourage the private offset market to convert farmland to forest, in ways that would contradict State and local goals for preservation of agricultural land and the industry or compromise land capacity to support local food production.

Ecosystem Services Markets and Private-Sector Involvement

Maryland has several existing programs which could provide significant opportunity for allowing private investment in mitigating and enhancing ecosystem services. These include Maryland's Nutrient Trading Program, forest banking through the Forest Conservation Act requirements, Critical Area regulations, wetland banking to meet requirements for wetlands mitigation and State and regional greenhouse gas reduction goals. Maryland's Nutrient Trading program is described in more detail below.

Currently, however, private ecosystem market involvement and activity in these programs is low to non-existent for a variety of reasons. Nonetheless, the potential exists for incentivizing the considerable funding power of the private marketplace to assist Maryland in meeting its TMDL and other environmental goals and to increase economic development. Already, several private entities exist and are operating in the region (Bay Bank, Restore Capital, and GreenVest as examples) that are positioned to facilitate the valuation of ecosystem services, tracking, and connecting buyers (developers) with sellers (private landowners).

In June 2010, the Governor's Green Jobs and Industry Task Force recommended establishment of a working group to assess the existing programs and make recommendations on how to incentivize private, ecosystem markets in Maryland. In response, DNR has established an "Ecosystems Services Working Group" (ESWG); which members include State environmental, planning, and economic development agencies, environmental restoration and investment companies, and non-profit organizations that specialize in ecosystem markets and financing. The ESWG is on schedule to make an initial set of recommendations by mid-December, 2010. It is expected that this initial report will recommend further exploration of a short-list of identified issues with a mandate to report back by June, 2011 with specific, actionable items. The goal of these recommendations will be to identify changes in the existing programs designed to actively promote the private sector and landowners to play a much larger role in conservation and restoration by reducing government barriers, increasing market incentives, providing financial income to landowners, and recovering the 'true costs' of ecosystem services lost through land conversion and infrastructure development.

Maryland's Existing Nutrient Trading Program

The Maryland Nutrient Trading Program will play a critical role in enhancing water quality in the Chesapeake Bay and its tributaries by providing economic incentives for the reduction of nitrogen and phosphorus loads. In the development of its nutrient trading program, Maryland defined the role of water quality trading as an offset to accommodate both population and economic growth under a cap structured to produce no net increase in loadings and uses the local water quality standard of the TMDL as the baseline that applies to all sources.

MDE, through a public process, has developed a Policy for Nutrient Cap Management and Trading (Policy), which took effect on April 17, 2008. One aspect of Maryland's approach is unique. Other states allow trading in lieu of upgrading a WWTP. In Maryland, upgrade of major WWTPs is required and the Bay Restoration Fund (BRF) was instituted to fully fund these upgrades. Trading is not available as a substitute for the upgrades.

Nutrient reductions achieved through the upgrades must be maintained to meet Bay water quality goals. The Policy addresses both the need to achieve early nutrient load reductions from point sources through enhanced nutrient removal (ENR) upgrades and the need to address new or increased point source nutrient loads associated with a growing population. The need to address planned growth is met through various environmentally sensitive offset/trading options and requirements outlined in the Policy. Facts about the Nutrient Cap Management/Trading Policy (Phase One) are available with a summary of the Policy and frequently asked questions on the MDE website. For further information see the Policy for Nutrient Cap Management and Trading website: http://www.mde.maryland.gov/programs/Water/Pages/water/nutrientcap.aspx

Maryland nonpoint source trading policy supports offsets between point sources and nonpoint source, primarily from the agricultural sector. This nonpoint source framework allows trades to offset permitted point source loads and trades for other purposes, for example, environmental advocacy organizations purchasing loads to retire credits. Offsets can only be generated once a farm has met certain baseline levels of conservation treatment and related load reductions.
.

The Maryland nonpoint source trading platform, an on-line system, incorporates both the Chesapeake Bay Program models and the national Nutrient Trading Tool (or NTT) developed by USDA's Natural Resources Conservation Service. This system will initially begin with nutrient trades, but is designed with the capacity to add or "stack" both sediment and carbon. This same platform could also serve as the base for trading supplementary environmental credits generated by other ecosystem services such as wetland mitigation and habitat restoration. For more information on Maryland's Non Point Source Trading Program, visit http://www.mdnutrienttrading.com/

Although much work has been put into the development of Maryland's Nutrient Trading Program, no trades have taken place to date. The ESWG described above is evaluating the current program and will likely make recommendations to allow this program to realize its design potential.

4.0 GAP ANALYSIS

In terms of the eight elements of a Phase I Plan defined in EPA guidance, this section addresses Element 4: "Gap Analysis." This section documents an evaluation of the loading cap and the gap between current restoration capacities and those needed to meet Bay goals. The analysis accounts for future growth in pollutant loads, relying on several important assumptions related to future anticipated growth. For brevity, the gap analysis in Section 4 focuses on the State scale.

4.1 Gap Analysis Assumptions and Methodology

Maryland's Phase I gap analysis was conducted at a statewide scale by key source sectors. This gap analysis is conducted using the "initial" target loads for each sector developed via a process that was similar to the Bay Program's process of allocating loads among the states (See Section 1).[12] Briefly, point source loads were set at levels consistent with Maryland's point source cap strategy. Then nonpoint sources were reduced by equal percentages from "no action" to the maximum feasible reduction[13].

For each sector, EPA has identified the current loading baseline through the year 2009. The gap analysis was conducted relative to this baseline using the following conceptual approach:

- Estimate current loads from the sector, e.g., stormwater, agriculture, wastewater, etc.
- Estimate current pace of load reductions (current programmatic capacity to reduce loads)
- Project future reductions with current capacity to reduce loads
- Account for future growth in loads
- Identify the loading gap at a future date, e.g., 2017, which is a reflection of the program capacity gap.

The analysis method is illustrated in the following diagram:

[12] These "initial" target loads were eventually adopted as the targets for Maryland's Phase I Plan. It had been thought that these loads would be changed through a negotiation process; however, that process was not conducted as part of the Phase I plan development process.

[13] The maximum feasible reduction, which varies by source sector, is affectionately called the "everything, by everybody, everywhere" or "E3" scenario. The equal percentage reduction by sector between "no action" and E3 accounts for the varying degree of effort and technical feasibility among sectors of achieving reductions. This "equal percent reduction" can be contrasted with an equal percent reduction between "no action" and zero load, which would not account for the varying degree of feasibility among sectors.

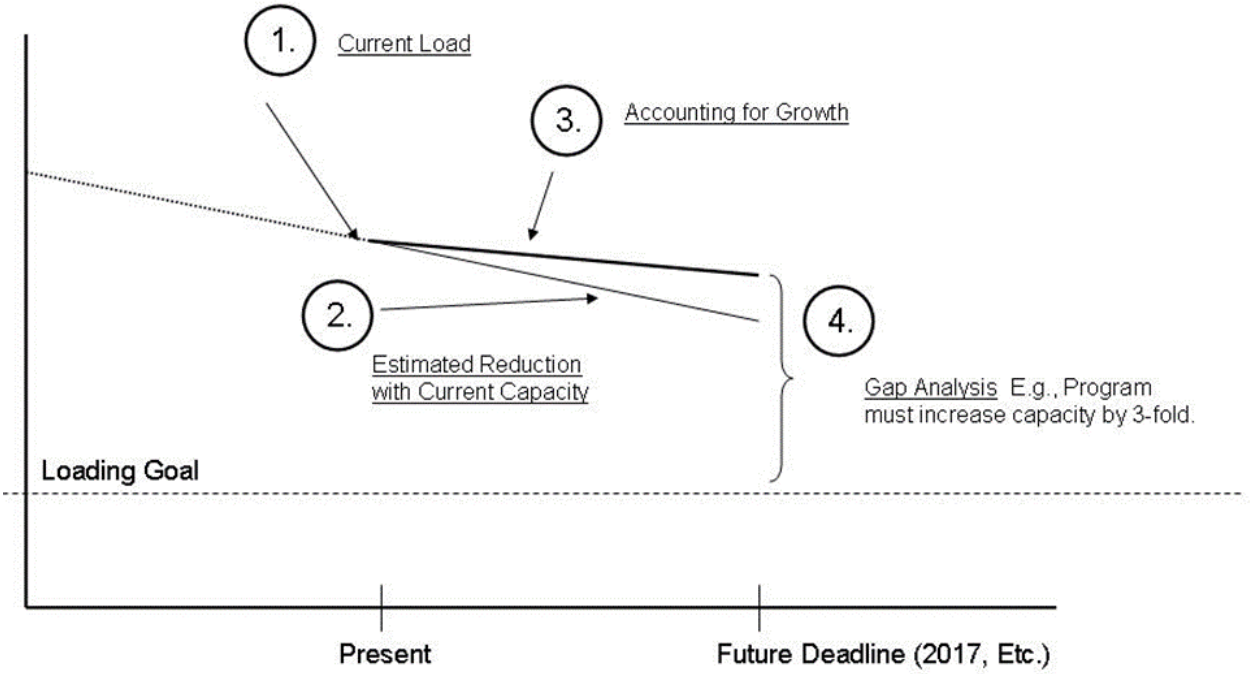


Figure 4.1 – Basic Concept of Gap Analysis

Interpreting the Gap Analysis

The gap analysis has some significant uncertainties at both the statewide scale and sector scale of analysis. A significant factor is differences in land use acreages among federal, State and local data sources. The following example illustrates the implications for urban stormwater management. Table 4.1 compares federal, State and local data on developed land use for two representative counties in Maryland.

Table 4.1 Comparison of Urban Land Use Estimations for Federal, State and Local (Acres)

Sample County A

Land Use Source	Urban Pervious	Urban Impervious	Total Urban
EPA Model for Phase I WIP	62,333	19,063	81,396
State Land Use	N/A	N/A	130,088
County A	94,659	35,996	130,655

Sample County B

Land Use Source	Urban Pervious	Urban Impervious	Total Urban
EPA Model for Phase I WIP	86,892	30,173	117,065
State Land Use	N/A	N/A	175,699
County B	124,306	35,366	159,642

As summarized in Table 4.1, the federal and local estimates of developed land area differ significantly. For consistency with the EPA modeling framework Maryland's gap analysis uses the federal land use.

Although the land use data will be refined in the Phase II process, the issue will not be fully resolved[14]. Thus, it is anticipated that additional significant refinements will be necessary between the Phase II and Phase III steps in the WIP process.

It's also important to properly interpret the effects of "future anticipated growth." Future land use changes, which is considered "growth" when the land is developed, can lead to both increases and decreases in loads. That is, loading changes associated with land use changes can counteract each other as follows.

MDE estimated annual losses or gains in land use based on projections supplied by the EPA Chesapeake Bay Program. These trends informed the gap analysis by providing a basis for estimating future reductions in load due to loss of cropland, or gains in load due to forest loss from urban and suburban development. The changes in load are significant in terms of the change in acres and loads. For the 2017 time horizon, projected cropland loss and forest land increases implies an estimated reduction of about 230,000 lbs/year of delivered nitrogen load to the Bay. However, urban expansion implies an increase of about 195,000 lbs/year in delivered load. Refer to Appendix I for further information.

4.2 Statewide Results of Loading Gap Analysis

The Bay TMDL calls for reductions of 21% in nitrogen and 18% in phosphorus from the 2009 baseline load. The following tables demonstrate the results of the statewide loading gap analysis for nitrogen (Table 4.2), phosphorus (Table 4.3). These are followed by Table 4.5 which represents the "Percentage Reductions Needed from 2009 Progress Baseline to the Default Target Loads."

Whenever possible, information is broken out by TN and TP in delivered loads to the Bay, using the default allocation as the starting point. If relevant, the projections include information about anticipated progress based on financial commitments. These financial commitments are necessarily uncertain. Assuming the commitments are in place in future years, the gap analysis is presented as "full funding." However, to be pragmatic, the gap analysis has also been conducted for certain sectors, where capital financial commitments are crucial. In this way, the gap is determined by the economic outcome, e.g., for WWTP upgrades to ENR, which represent large capital expenditures over time.

Table 4.2 provides the key statewide findings for Nitrogen. The edge-of-stream (EOS) loads reflect local loading, whereas, the "delivered" loads account for transport losses as nutrients work their way to the Bay.

[14] The Phase 5.3 watershed model is being updated and re-calibrated for use in the Phase II WIP process. This updated model is expected to be available in Late Spring 2011. Thus, it will leave many issues to be resolved following the Phase II process.

Most of the figures in Table 4.2 are apparent; however, several deserve explanation. Row C is the estimated nitrogen load as of the end of 2009. It marks the starting value, or baseline, from which reductions are estimated. Row D represents a 70% reduction from the 2009 baseline (Row C) to the statewide target (Row B). Row E is the total reduction needed from the 2009 baseline to reach the statewide target. Row F is the pounds of reduction needed from the 2009 baseline to reach a 70% reduction goal by 2017.

Row G is the amount of load that is predicted to be reduced with the current capacity of existing programs between 2009 and 2017. That is, it is the anticipated load reduction if we keep making reductions at roughly the current pace of progress. Row G is central to the "gap analysis," because it defines the remaining load reduction needed to achieve the 2017 Interim Target load reflected in Row H. This Interim Target is based on meeting a 70% reduction. The Strategies presented in Chapter 5 may meet or exceed this goal. Row I is the additional reduction needed after 2017 to reach the Final Target load. Row J is the combined gap in meeting the 2017 interim target plus the remaining load reduction needed to achieve the final target.

Table 4.2 Nitrogen Key Statewide Gap Analysis Results

Summary Values (million lbs/yr)	Delivered	EOS
A. Baywide Target	187.44	258.90
B. Statewide Target	39.09	53.99
C. 2009 Baseline Load	49.42	68.20
D. 2017 70% Goal	42.19	58.22
E. Total Reduction Needed to Final Target (C-B)	10.33	14.21
F. 2017 Reduction Needed (C -D)	7.22	9.98
G. 2017 Current Capacity Reduction	3.85	5.31
H. 2017 Remaining Reduction Gap (F - G)	3.39	4.68
I. 2017 - 2020 Reduction Need	3.07	3.99
J. Total Remaining Gap (H + I)	6.46	8.14

Maryland's 2009 nitrogen load is about 49.4 million pounds relative to the 39.1 million pound Final Target Load (DEL). This implies a 10.3 million pound reduction in nitrogen from the 2009 baseline is needed to meet water quality standards in the Bay.

A 7.22 million pound reduction (9.98 million EOS) is needed to achieve the 2017 Interim Target Load of 42.19 million pounds. Current capacities are predicted to achieve a 3.85 million pound reduction by 2017, leaving a load reduction gap of about 3.39 million pounds (4.68 million EOS). The reduction with current capacity is about 47% short of the 2017 Interim Target, that is, a 47% gap in reaching the 2017 goal with current capacity.

A further reduction of 3.07 million pounds (3.99 million EOS) is needed, beyond the 2017 target, to achieve Maryland's Final Target Load of 39.09 million pounds per year (53.99 million EOS).

Table 4.3 provides the key statewide findings for phosphorus. Maryland's 2009 load is about 3.30 million pounds relative to the 2.715 million pound Final Target Load. This implies a 0.585 million pound reduction in phosphorus is needed to meet water quality standards in the Bay.

Current capacities are predicted to achieve a 0.328 million pound reduction by 2017, which leaves a gap of about 0.084 million pounds. The reduction with current capacity is about 20% short of the 2017 Interim Target. A further reduction of 0.166 million pounds, beyond the 2017 target, is needed to achieve Maryland's Final Target Load of 2.715 million pounds per year.

Table 4.3 Phosphorus Key Statewide Gap Analysis Results

Summary Values (million lbs/yr)	Delivered	EOS
A. Baywide Target	12.52	15.81
B. Statewide Target	2.715	3.43
C. 2009 Baseline Load	3.30	4.16
D. 2017 70% Goal	2.89	3.64
E. Total Reduction Needed to Final Target (C-B)	0.585	0.73
F. 2017 Reduction Needed (C -D)	0.412	0.519
G. 2017 Current Capacity Reduction	0.328	0.413
H. 2017 Remaining Reduction Gap (F - G)	0.084	0.106
I. 2017 - 2020 Reduction Need	0.166	0.31
J. Total Remaining Gap (H + I)	0.25	0.43

4.3 Summary of Source Sector Gap Analyses

Table 4.5 shows the percentage reductions needed for each key source sectors from the 2009 baseline to meet the Final Target loads. The percentage reductions differ from the "equal percent reduction of reducible load" used in setting the allocations because past progress is credited.

Table 4.4 Percentage Reductions Needed from 2009 Progress Baseline to the Final Target Loads by Sector[15]

Sector	Phosphorus % Reduction from 2009 Loads	Nitrogen % Reduction from 2009 Loads
Urban Regulated	34%	18%
Urban Non-Regulated	39%	19%
Agriculture	12%	23%
CAFO	31%	12%
Septic	N/A	39%
Forest	0%	0%
Air*	2%	1%
Non-Point Source Total:	17%	19%
Point Source Total:	21%	26%
Total	18%	21%

[15] These estimated reductions to meet the default target loads do NOT reflect the reductions for the ultimate Phase I allocations. Further, they represent a static condition of 2010 land use.

4.3.1 Nitrogen Load Reduction Gap: Figure 4.2 shows the projected net load reductions between 2009 and 2017 compared with the 70% Interim Loading Target and 100% Final Loading Target[16]. It reflects current capacities to meet the load reductions and is a "net" reduction, because it accounts for future growth in loads due to land use changes and other factors. It shows a 4.37 million pound gap in achieving the Interim Target by 2017 after accounting for anticipated reductions with current capacity. The most significant reductions are anticipated to occur in the point source and agricultural sectors.

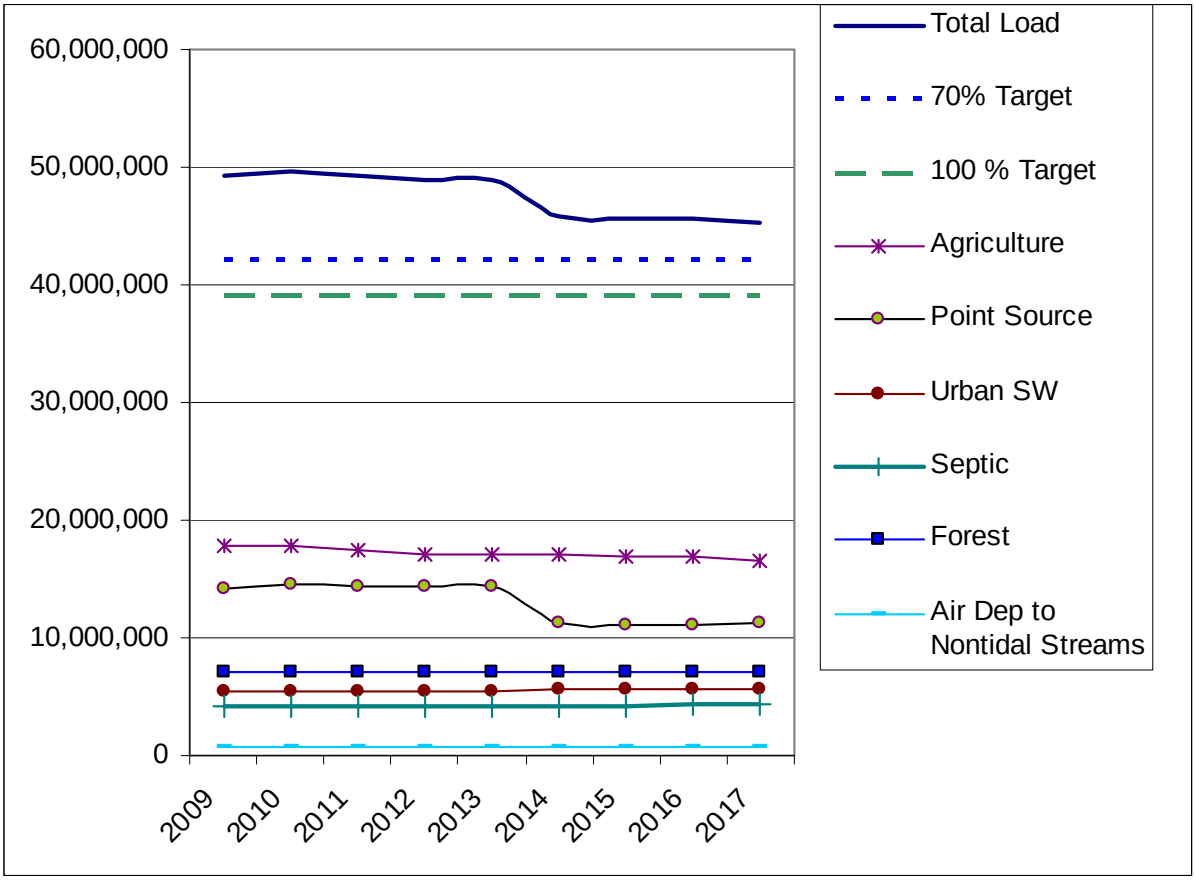


Figure 4.2 Total Nitrogen Gap Analysis Projected Reductions (Delivered Loads)

The unlabeled table below summarizes some of the key assumptions of this gap analysis.

[16] Note that these are estimates of loads "delivered" to the Bay, so they reflect transport losses. BMP reduction calculations should be based on edge-of-stream (EOS) loads, which are reported elsewhere in this document.

Key Assumptions in Figure 4.1:
- Point Source loads do not account for the shortfall in ENR upgrade funding
- Agriculture reflects current 2-yr Milestones projected into the future.
- Urban retrofits projected from past MS4 performance.
- Includes Urban Nutrient Management
- Growth accounts for Septics, land use change, point source flow.

4.3.2 Phosphorus Load Reduction Gap: Figure 4.2 shows the projected net load reductions between 2009 and 2017, compared with the 70% Interim Loading Target and 100% Final Loading Target[17]. It reflects current capacities to meet the load reductions and is a "net" reduction because it accounts for future growth in loads. It shows a 126,000 pound gap in meeting the Interim Target in 2017 after accounting for anticipated reductions with current capacity. The most significant reductions are anticipated to occur in the point source and agricultural sectors.

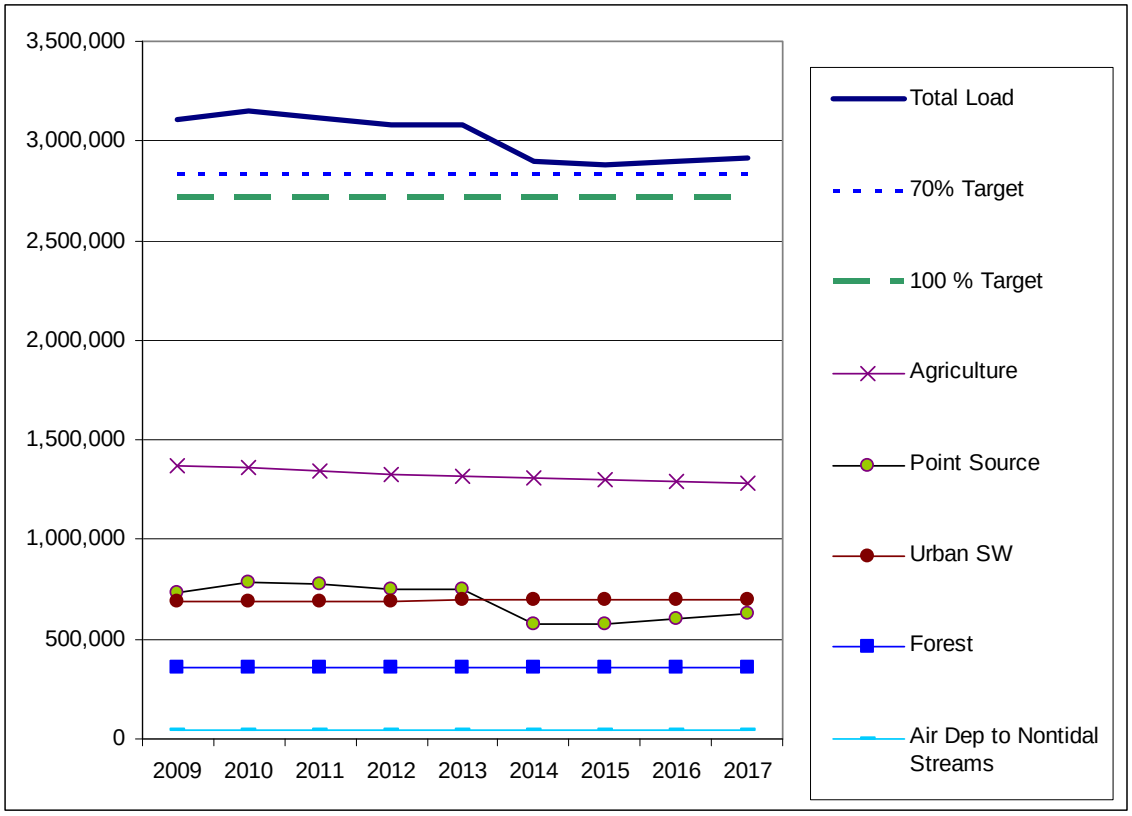


Figure 4.3 Total Phosphorus Gap Analysis Projected Reductions (Delivered Loads)

Further information on the gap analysis by source sector is available in Appendix I.

[17] Note that these are estimates of loads "delivered" to the Bay, so they reflect transport losses. BMP reduction calculations should be based on edge-of-stream (EOS) loads, which are reported elsewhere in this document and addressed further in Appendix I.

5.0 COMMITMENT AND STRATEGY TO FILL GAPS

This section addresses Element 5 – the commitment and strategy to fill gaps for slow or incomplete implementation.

EPA expects that Maryland will develop and commit to a strategy to systematically fill the gaps identified in Element 4 at the State scale of the Phase I Watershed Implementation Plan. The wide range of strategies included in this Plan is provided as a set of strategies, modified and selected in consideration of the public comment process, which was completed on November 4, 2010. The strategies are organized into three broad categories. These are 1) strategies built on Maryland's current 2-Year Milestones, 2) additional reduction strategies associated with the six major pollution source sectors, and 3) reduction strategies suggested by the public via various stakeholder involvement processes (See Appendices J and K).

Section 5.2 describes the strategies for which it is possible to outline dates for key actions, a timeline for development and implementation, approximate units of implementation and their associated nutrient reductions. Assurances of implementation verification and compliance are addressed in Element 6, Tracking and Reporting Protocols.

Maryland's approach has been to conduct the gap analyses, acknowledge the State scale gap or "total gap" derived from all the sectors, and to identify strategy options that are sufficient to meet or exceed the Interim Target of reducing 70% of the Final Target load by 2017. The purpose of this approach was to provide options for public comment. is gives assurance that there are more than enough specific strategies to achieve the 2017 targets. Based on public comment, a subset of these strategy options first proposed in the Draft Plan was selected to meet the Interim Target load for the final Phase I Plan.

5.1 Approach to Formulate Options to Fill the Gap

As outlined above, the focus of the assessment was to develop a cumulative sum of potential practices that could be used to exceed the State scale gap for achieving the 2017 Interim Target Load (Table 4.2 and Table 4.3). The approach to develop options to fill the overall State scale gap uses three basic components.

First, Maryland's initial 2-Year Milestone goals established in May 2009 were considered. BMPs in Maryland's 2009-2011 2-Year Milestones were projected based on opportunity for accelerated implementation beyond the milestone level of implementation. This included accelerated implementation of existing BMPs, promotion of new innovative practices and new approaches to land management that will be expanded into future milestone periods.

Second, after accelerated implementation of the milestone practices was maximized, Maryland analyzed additional control options including other BMPs and policy changes. Potential future reductions from six main sectors were assessed. The list of practices and management strategies is presented in Section 5.2 with the associated load reductions for the following seven sectors: WWTPs, urban, natural filters on private land, natural filters on public land, air, septics and agriculture. Controls include approved Chesapeake Bay Program (CBP) BMPs in addition to

innovative practices that have not been officially approved by the CBP but are practiced in Maryland. When a new BMP is proposed as a possible option to fill Maryland's nutrient or sediment gap, additional information is included with timelines for implementation, for the CBP's BMP approval process to allow credit, and to develop programs that would assure implementation.

Third, Maryland considered a wide variety of proposals generated through the public process. Between Fall 2009 and Spring 2010, it became increasingly clear that public groups were interested in having a role to inform the Plan. Organizations ranged from the agricultural and business sectors to environmental advocacy and non-governmental organizations to local governments. A series of public informational meetings were convened. Some meetings were offered in conjunction with EPA and others were conducted independently at locations around the State. Meetings such as the regional exchanges, held in June and July 2010, were structured to obtain public views on implementation challenges and to solicit ideas for solutions to the challenges. Meeting notes were posted on the MDE website following each exchange. The State also established an online "suggestion box" to allow the public to submit ideas via the web. The proposals were added to this Plan and are reflected in Section 5.2 below. During the Fall of 2010, Marylanders provided significant comments on the Draft Plan which informed the final selection of strategies.

The proposals, covering a very wide range of policy, regulatory and funding options, are presented in Appendix J with some brief, initial State agency responses. Appendix K also contains a complete list of all the events and outreach efforts. In addition, the final Phase I Plan reflects some suggestions received during the formal public comment period. State responses to these formal comments are recorded in a separate comment response document.

The final selection of a set of strategies derived from these three components was compiled into a summary table that is presented below. It should be noted that this list of strategies is also limited by those that can currently be simulated and credited by the EPA Chesapeake Bay watershed model. This enables an estimate of the nutrient reductions that would be achieved upon implementation of the strategies. Given that the set of strategies presented in this final Phase I Plan meets the 2017 Interim Target, this approach also demonstrates that additional options remain for achieving the Final Target.

Assurance of Achieving Final Target Loads

Although this list of strategy options is designed to meet the Interim Target, it also has components that address the Final Target. First, the use of a 70% reduction goal positions Maryland's Interim Target reduction strategy closer to the meeting the Final Target.

Implementation of the MD strategies is projected to reduce more nitrogen than is needed to meet the 70% Interim Target for nitrogen and meet the 70% Interim Target for phosphorus. The nitrogen goal is exceeded because most of the reduction strategies remove both nitrogen and phosphorus and the high level of implementation needed to achieve the phosphorus goal automatically results in more nitrogen reduction than is necessary. This gives the plan an even higher degree of reasonable assurance that MD will meet the 70% Interim Target for nitrogen.

Second, the set of strategies that were evaluated using the EPA watershed model were selected to be more than necessary to meet the 70% Interim Target for nitrogen and sediment. By intentionally exceeding the Interim Target for these pollutants, Maryland's load reduction analysis also begins to evaluate specific, quantitative options for meeting the Final Target.

Third, the remaining options that have not yet been quantified provide a large set of potential strategies to draw on for further development. Some of these options are identified in the additional categories that follow.

Fourth, there is the potential for developing new technologies and nutrient management approaches. Examples of innovations might include development of seeds and crops that require less fertilizer, processes to reduce ammonia released from poultry manure and more efficient urban runoff controls.

Finally, there is the potential to increase the scope of implementation of existing strategies. This includes expanding the acreage on which various BMPs are applied or the number of sources to which controls are applied.

Sediment

The Chesapeake Bay TMDL requires nutrient, phosphorous and sediment reductions. Maryland developed its gap closing strategies with the expectation that reduction practices designed to meet the phosphorus target would also likely meet the sediment target. Phosphorous from nonpoint source runoff binds strongly to sediments and, therefore a percentage reduction in one correlates strongly with the other. EPA validated this approach through its determination that Maryland's draft strategy met both the 2017 Interim Target and the 2020 Final Target for sediment.

Strategy Content

Funding and implementation alternatives are included with the strategy information. The total cost was estimated based on the capital and operating costs needed to implement the strategy by 2017. Available existing programs were listed and if they were inadequate, additional sources of funding and/or legislative measures are listed. Maryland also included timelines to request additional funds and/or pass legislation. This content is Maryland's anticipated implementation plan but may change as annual State and federal budgets are developed.

Currently the EPA's Phase 5 watershed model does not provide pound per unit (acre, system, operation) statewide averages for individual BMPs. The relative impact of each strategy is also not available. Thus the anticipated load reductions estimated below use Maryland average pound per unit values from the Phase 4.3 model. The pound per unit change between the two models is unknown because the models utilize different BMPs, effectiveness estimates, land uses and land use loading rates. The models also vary in how BMPs are simulated when implemented on the same area. For these reasons Maryland's strategies may result in different individual BMP pound per unit reduction estimates than what is provided below. Once the Phase 5 model is

analyzed for individual BMP pound per unit values the estimated load reductions will be updated.

Maryland identifies implementation targets in the Watershed Implementation Plan. Accounting, Tracking and Reporting are an important part of the Plan strategy and progress will be closely monitored for the two year milestones by tracking both implementation and water quality. However, it is important to note that the Plan incorporates the concept of adaptive management. Adaptive management requires that projections be made as to how to meet a goal and recognizes that in complex projects such as this, changes will be necessary. Implementation targets are surrogates for actual pound reductions and, as needed, Maryland may determine that targets for one practice may be reduced and increased for another to meet goals. The critical commitment is the nutrient reduction represented by an implementation practice. As long as the required reductions are met, Maryland will meet its milestones.

Table 5.1 Maryland Phase I Plan Summary Table of Strategies

Strategy	Description	Units	2010-2011	2012-2017	Total	Estimated Cost
Point Sources						
Major WWTPs (Not including Blue Plains)	Upgrade 68 Wastewater Treatment Plants to Maryland's Enhanced Nutrient Removal (ENR) standards. At the current rate of implementation, 24 plants will be operational by June 30, 2011, accounting for an estimated 740,000 lbs/year reduction in nitrogen. Full funding is available for implementation of the 2011 Milestone. The State projects it will be able to provide funding to maintain the construction schedule for upgrade projects through FY 2012. In 2011, determine all options to close the Bay Restoration deficit including consumption and income based strategies. In 2012, pursue statutory change to amend Bay Restoration Fund fee to provide funding needed to complete the upgrades for FY2013.	plants	24	44 (Of which, funding has been committed to 8 plants)	68 (66 majors not including Blue Plains + 2 private)	All major WWTPs not including Blue Plains $2.461 B 36 Facilities $1.186 B (Not upgraded yet and need funding commitments)
Blue Plains Waste Water Treatment Plant Upgrades	Complete BNR facilities at the Blue Plains Wastewater Treatment Plant to achieve a nitrogen reduction of 190,000 lbs/yr. Facility is on schedule for ENR upgrade by 2015 and will result in a total nitrogen reduction of approximately 875,000 lb/yr expected by 2017	plants	1	1	1	$402 M
Major Industrial	Continue Retrofits and Optimization at Major Industrial Treatment Plants to meet the Tributary Strategy load cap.	plants		11	11 (9 major facilities + 2 Dredged Material Containment Facilities)	
Minor Industrial	Identify loading targets and issue schedules in permits by 2017 for reductions of approximately 23.5%, representing approximately 143,000 lbs/yr reduction, for minor industrial sources	plants		477	477	

Strategy	Description	Units	2010-2011	2012-2017	Total	Estimated Cost
Federal facilities - major	Continue ENR Retrofits at Major Federal WWTPs in accordance with July 2006 MOU with DOD. Originally 7 facilities, 3 of which were privatized (1 of the 3 is included in Major Municipal List: APG Main); remaining 2 private plants are included in this count, for a total of 6.	plants		6 Total: 4 federal 2 privatized	6	
Upgrade Large Minor Municipal WWTPs (0.1-0.5 MGD)	Evaluate feasibility of the largest minor municipal WWTPs for potential upgrade based on flow, load, capacity needs, community interest, technical feasibility and cost-effectiveness. Select 5 plants, with approximately 1.0 million gallons per day discharge flow for upgrade by 2017, with estimated nitrogen load reduction of about 45,000 lbs/yr. Cost of upgrade to ENR roughly $58 M.	plants		5	5	$58 M
Eliminate Sewer Overflows	Older combined sewer systems designed to collect and transport sewage to treatment plants during dry weather also serve as stormwater drains during rain events. Once combined sewers are full, the blended effluent is discharged to waterways resulting in Combined Sewer Overflows. Sanitary sewer overflows occur when pipes or pumping stations fail and let sewage spill into waterways. Eliminate overflows through consent orders requiring system repair and upgrades and penalties assessed when failures occur. Long-term control plans are in place. Costs are the MD portion of the EPA's 2008 Clean Watershed Needs Survey	Systems		4	4	CSO: $0.463 B SSO: $1.374 B

Strategy	Description	Units	2010-2011	2012-2017	Total	Estimated Cost
Urban Stormwater						
MS4 Phase I Permitted Counties	Renew permits to require Nutrient and Sediment reductions equivalent to stormwater treatment on 30% of the impervious surface that does not have adequate stormwater controls for MD's largest counties subject to Phase I Municipal Separate Storm Sewer System (MS4) Permits. In 2011, convene workgroup to determine funding options, schedules, and most cost effective practices with local government. In 2012, if local utilities or other systems of charges are not being implemented, seek legislation requiring local stormwater utilities. Alternative cost effective practices include forest buffer planting, stream restoration, wetland restoration, pavement removal and operational practices. Selection of practices and timing of implementation will be based on cost-effectiveness, pollutant removal efficiency and maximizing available funding.	Nutrient and Sediment Reductions Equivalent to treatment of 30% pre-1985 impervious surface acres	10%	20%	30%	$2.614 B
SHA MS4 Phase I and II	Renew permit to require Nutrient and Sediment reductions equivalent to stormwater treatment on 30% of the impervious surface that does not have adequate stormwater controls Develop work plan to meet nutrient and sediment reduction goals through system retrofitting and equivalent alternative practices and trading in 2011. Alternative practices include forest buffer planting, stream restoration, wetland restoration, pavement removal and operational practices. Selection of practices and timing of implementation will be based on cost-effectiveness, pollutant removal efficiency and maximizing available funding.	Load reduction equal to 30% per-1985 impervious surface acres	0% MS4 Phase I 0% MS4 Phase II	30% in MS4 Phase I areas 20% in MS4 Phase II areas	30% in MS4 Phase I areas 20% in MS4 Phase II areas	$1.0 B

Strategy	Description	Units	2010-2011	2012-2017	Total	Estimated Cost
MS4 Phase II (CE and WA Counties, larger municipalities, and federal facilities)	Require Nutrient and Sediment reductions equivalent to stormwater treatment on 20% of the impervious surface that does not have adequate stormwater controls in smaller jurisdictions (less populated counties and municipalities) through required Phase II MS4 permits.	Nutrient and Sediment Reductions Equivalent to treatment of 20% pre-1985 impervious surface acres		20%	20%	$365 M
Existing Urban Nutrient Management Law	Regulate fertilizer applications on 220,000 acres of commercially managed lawns (for example, golf courses and athletic fields) through Maryland's Nutrient Management Law.	acres (annual)	220,000	220,000	220,000	$0.69 M
Enhanced Urban Nutrient Management	Require modification of lawn fertilizer formulation to eliminate phosphorus to the extent practicable and to require the use of slow release nitrogen fertilizers on lawns and managed turf. Additional options to receive reductions are addressed.	acres (annual)		220,000	220,000	
Regenerative Stormwater Conveyance	Implement stream restoration and connection to the flood plain to mimic natural stream conditions and provide a nutrient and sediment reduction	linear miles		12	12	Included in MS4 costs
Rural Residential Tree Planting	Increase rural resident tree planting and homeowner association property including conversion of turf grass to tree covers. May also consider mandatory stream and waterway buffers.	acres		600	600	$5.25 M (Included in MS4 costs)

Strategy	Description	Units	2010-2011	2012-2017	Total	Estimated Cost
Urban Tree Canopy	State is implementing urban tree canopy goals based on reasonable expectations in gains by accounting for available lands and hydrologic flow paths in urban areas. The intent of the urban tree canopy was to target half of the older developed areas, particularly those developed prior to stormwater management, where urban trees may be particularly valuable for water and air quality. Urban tree canopy is defined as at least 100 trees to an acre	acres		1,200	1,200	$36 M (Included in MS4 costs)
Septics						
Continue Upgrade of new and failing Septic Systems in the Critical Area	Retrofit 5,700 septic systems by 2017 with current program using best available technology	systems	2,100	3,600	5,700	80.5 M
Septic hookups to ENR plants	Connect failing septic systems to Wastewater Treatment Plants with advanced nutrient removal technologies.	systems	704	226	930	35.7 M
Require upgrade all systems in Critical Area	In 2011, assess options to phase in requirement to retrofit all septic systems in the Critical Area using best available technology (the land within 1000 feet of tidal waters) beginning in 2012. Assessment to include viability of tax credits, income based criteria for grant eligibility and other means to facilitate upgrades. (BAT upgrade of additional 27,552 systems in Critical Area for a total of 32,379) Initiate phase-in in 2012.	systems		27,552	27,552	358.2 M

Strategy	Description	Units	2010-2011	2012-2017	Total	Estimated Cost
Agriculture-	**Managing the Land to Improve Water Quality**					
Cover Crops	Plant 180,000 acres of commodity and 175,000 acres of traditional cover crops. Cover crops are small grains such as wheat or rye that are planted in the fall after the harvest of corn, soybeans and other summer crops to absorb unused fertilizers that may remain in the soil. Cover crops also provide a ground cover to prevent soil erosion in the winter. The Maryland Agricultural Water Quality Cost Share Program implements this program with funding from the Chesapeake Bay Restoration Funds, 2010 Trust Fund and targeted Federal grants.	acres (annual)	325,000	355,000	355,000	$107.4 M
Soil Conservation & Water Quality Plans	Develop Soil Conservation and Water Quality Plans on an additional 257,049 acres. Develop a comprehensive plan for a farm that addresses natural resource management on agricultural lands and recommends best management practices (BMPs) that control erosion and sediment loss and manage nutrient runoff. 764,630 acres of Maryland farm land will be managed under a current SCWQP. Farmers may receive technical and financial assistance to install BMPs.	acres (annual)	764,630	764,630	764,630	$11.7 M
Conservation Tillage	Conservation Tillage involves planting and growing crops with minimal disturbance of the surface soil. No-till farming, a form of conservation tillage, is used to seed the crop directly into vegetative cover or crop residue with no disturbance of the soil surface. Minimum tillage farming involves some disturbance of the soil, but uses tillage equipment that leaves much of the vegetative cover or crop residue on the surface. The potential is 764,630 acres.	acres (annual)	764,630	764,630	764,630	
Continuous No-Till Conservation	Of the 764,630 acres in conservation tillage maintain 150,000 acres of continuous no-till farming, a form of conservation tillage in which seed is applied into the vegetative cover or crop residue with no disturbance of the surface soil. Conservation Tillage involves planting and growing crops with minimal disturbance of the surface soil. No-till farming, a form of conservation tillage, is used to seed the crop directly into vegetative cover or crop residue with no disturbance of the soil surface. Minimum tillage farming involves some disturbance of the soil, but uses tillage equipment that leaves much of the vegetative cover or crop residue on the surface.	acres (annual)	150,000	150,000	150,000	$3 M

Strategy	Description	Units	2010-2011	2012-2017	Total	Estimated Cost
Water Control Structures	Construct Water Control Structures on 7,250 acres. These structures are used in constructed drainage systems to control water depth and flow rates. They also increase water retention and decrease the quantity and quality of pollutants downstream. Cost-Share funds are available for the installation of these structures through the Maryland Agricultural Water Quality Cost-Share (MACS) program and USDA's Environmental Quality Incentives Program (EQIP).	acres	2,050	5,200	7,250	$0.98 M
Stream Protection with Fencing	Protect 3,800 acres of Pastureland Using Fencing. Pasture fencing keeps farm animals out of streams and prevents streambank erosion. Cost-Share funds are available for the installation of these systems through the Maryland Agricultural Water Quality Cost-Share (MACS) program and USDA's Environmental Quality Incentives Program (EQIP).	acres	3,000	800	3,800	$0.35 M
Stream Protection without Fencing	Utilize Stream Protection without Fencing on 3,000 acres. Watering troughs provide a safe, reliable source of water for livestock that is away from streams. The troughs help protects stream banks from erosion that may be caused by farm animals. Cost-Share funds are available for the installation of these systems through the Maryland Agricultural Water Quality Cost-Share (MACS) program and USDA's Environmental Quality Incentives Program (EQIP).	acres	1,800	1,200	3,000	$0.37 M
Streamside Grass Buffers	Plant 7,000 acres of Streamside Grass Buffers on Private Lands. Grasses planted next to waterways filter and take up nutrients coming off the land, stabilize the soil and provide wildlife habitat. Cost-Share funds are available for the implementation of grassed buffers on agricultural land through the Maryland Agricultural Water Quality Cost-Share (MACS) program, 2010 Chesapeake Bay Trust Fund and USDA's Conservation Reserve Enhancement Program (CREP).	acres	1,600	5,400	7,000	$1.27,M

Strategy	Description	Units	2010-2011	2012-2017	Total	Estimated Cost
Streamside Forest Buffers	Plant 3,000 acres of Streamside Forest Buffers on Private Lands. Trees planted next to waterways filter and take up nutrients coming off the land, stabilize the soil and provide wildlife habitat. Cost-Share funds are available for the implementation of riparian forest buffers on agricultural land through the Maryland Agricultural Water Quality Cost-Share (MACS) program, 2010 Trust Fund and USDA's Conservation Reserve Enhancement Program (CREP).	acres	500	2,500	3,000	$4.9 M
Wetland Restoration	Construct 1,000 acres of Wetland Restoration on Private Lands. A wetland is an area of land where the soil is wet or covered with water. Wetlands are often called swamps, marshes, or bogs. Cost-Share funds are available for the implementation of wetlands on eligible agricultural land through the Maryland Agricultural Water Quality Cost-Share (MACS) program, 2010 Chesapeake Bay Trust Fund and USDA's Conservation Reserve Enhancement Program (CREP). Funding for wetlands creation, restoration, and enhancement is also available from various federal sources, State and local governments and nonprofit organizations.	acres	550	450	1,000	$3.375 M
Retire Highly Erodible Land	Retire 2,300 acres of Highly Erodible Land on Private Lands. Land that is especially vulnerable to erosion is removed from crop or hay production and is planted in either grass or forest. This land usually is not disturbed for at least 10 years. Cost-Share funds are available for the retirement of highly erodible agricultural land through the Maryland Agricultural Water Quality Cost-Share (MACS) program, 2010 Chesapeake Bay Trust Fund and USDA's Conservation Reserve Enhancement Program (CREP).	acres	1,800	500	2,300	$3 M
Cropland Irrigation Management	Crop irrigation is used to decrease climatic variability and maximize crop yields. This results in a decrease in runoff and an increase in the crop's ability to uptake nutrients therefore less available for nutrient runoff. Yields are 20% to 25% higher than in un-irrigated fields. Nutrient uptake of irrigated acres are greater, resulting in less residual nutrients remaining in the soil for runoff.	acres (annual)		40,616	40,616	$1.2 M

Strategy	Description	Units	2010-2011	2012-2017	Total	Estimated Cost
Vegetative Environmental Buffers	A vegetative environmental buffer, or VEB, is the strategic planting of combinations of trees and shrubs around poultry houses to address environmental, production, and public relations issues by providing a vegetative filter to lower emissions of ammonia, dust, odor, feathers, and noise on a potential of 75 acres. In addition to offering a practical, efficient, and cost-effective means of capturing emissions, a properly designed VEB program can help to conserve energy and reduce air-borne pathogens by offering shade and slowing wind speeds, as well as create a more attractive landscape and screen routine operations from view.	operations	50	250	300	$0.75 M
Vegetated Open Channels	A suite of innovative alternative practices designed to enhance the removal of nutrients once they leave the field. These include increasing vegetative buffers that protect ditches from sediment and nutrient runoff. This may include reengineering of drainage channels to reestablish floodplains or redirect storm flows to wetland areas.	acres		1,212	1,212	$1.8 M
Stream Restoration Non-Coastal Plain	Restoration of drainage channels and streams utilizing stream recreation techniques. Options include in stream and riparian wetlands, designing channels to reestablish natural flow paths, and establishing habitat.	miles		2	2	$0.9 M

Strategy	Description	Units	2010-2011	2012-2017	Total	Estimated Cost
Agriculture-	**Managing Animal Wastes and Phosphorus**					
Addressing the Phosphorus Imbalance- Alternative uses of manure and revision of the P Site Index for nutrient management	Addressing the phosphorus balance requires a systematic approach to provide tools and technology that will work synergistically for the farmer and the environment. Maryland's goal is to provide sufficient soil phosphorus availability for agronomic optimum crop production while simultaneously minimizing the potential for off-site phosphorus losses from agricultural production fields to natural water bodies. The State of Maryland will support development of a revised P Site Index that incorporates the best available science in an effort to more appropriately identify the risk for phosphorus loss from agricultural lands. The expected revisions of the current P Site Index will more accurately assess P transport and delivery pathways across different landscapes, will incorporate site-specific soil P saturation information, and emphasize the importance of immediate manure and biosolids incorporation following land application. Initial preliminary review of probable revisions to the P Site Index indicates significant reductions in cropland eligible to receive additional phosphorus, particularly in areas of historically high concentrations of animal agriculture. These outcomes require management solutions that must also include economically viable alternative uses of animal manures, biosolids and other organic wastes. Development of market-based solutions that include value-added or energy-related technologies is essential.					
Manure Transport	Transport an additional 10,000 tons of manure out of the watershed for 2010-2011 and an additional 25,000 tons for 2012-2017. Excess manure is transported away from farms with high soil phosphorus levels to other farms or locations that can use the manure safely. 50% of the funding for this program is available through the Maryland Agricultural Water Quality Cost Share Program (MACS). The remaining 50% of the funds is provided by Special Funds (Poultry Companies match). Cost-share is also provided for transporting excess manure from Dairy operations.	tons (annual)	60,000	85,000	85,000	$6.75 M

Strategy	Description	Units	2010-2011	2012-2017	Total	Estimated Cost
Dairy Manure Incorporation Technology	Implement Dairy Manure Incorporation Technology on 2,500 acres for 2010-2011 and an additional 2,500 acres for 2012-2017. Dairy manure is incorporated into the soil at the time of application utilizing low disturbance technology. Ammonia loss from incorporation will be reduced up to 95% compared to surface application. Initial cost-share funding is through a demonstration grant supported by the Chesapeake Bay Trust (CBT). Evaluation by MDA and NRCS technical workgroups for cost-share funding will be done to determine eligibility for cost-share funding through the Maryland Agricultural Water Quality Cost-Share (MACS) program and USDA's Environmental Quality Incentives Program (EQIP).	Acres (annual)	2,500	5,000	5,000	$0.78 M
Poultry Litter Incorporation Technology	Use Poultry Litter Incorporation Technology on 2,500 acres. Poultry litter is incorporated into the soil at the time of application utilizing minimum disturbance technology which significantly reduces ammonia loss. Initial 2 years of funding through USDA Conservation Innovative Grants (CIG) and National Fish and Wildlife Foundation (NFWF) grant sources.	acres (annual)		2,500	2,500	$0.35 M
Poultry Waste Structures	Construct 53 Poultry Waste Structures. These structures protect poultry waste from rain so that it can be used as a crop fertilizer when conditions are right or transported to another location. Cost-Share funds are available for the installation of these structures through the Maryland Agricultural Water Quality Cost-Share (MACS) program and USDA's Environmental Quality Incentives Program (EQIP).	structures	50	3	53	$0.48 M
Livestock Waste Structures	Construct 145 Livestock Waste Structures. Animal waste is stored in structures to protect it from the weather until it can be used as a crop fertilizer when conditions are right or transported to another location. Cost-Share funds are available for the installation of these costly systems through the Maryland Agricultural Water Quality Cost-Share (MACS) program and USDA's Environmental Quality Incentives Program (EQIP).	structures	80	65	145	$5.5 M

Strategy	Description	Units	2010-2011	2012-2017	Total	Estimated Cost
Runoff Control Systems	Construct 180 Runoff Control Systems. Runoff control systems use a variety of techniques to direct rainwater to places where it won't cause nutrient runoff or soil erosion. Gutters and downspouts on barns and grading of the land are examples of ways to direct runoff from rainfall. Cost-Share funds are available for the installation of these systems through the Maryland Agricultural Water Quality Cost-Share (MACS) program and USDA's Environmental Quality Incentives Program (EQIP).	systems	75	105	180	$0.22 M
Phytase	With the advent of phytase addition to the diet and feed for all poultry in Maryland we have seen a steady reduction in the phosphorus levels in the manure. In early 2004 the Bay Program documented a 16% reduction in P. More recent results show a 24% reduction. The research shows up to a 33% reduction is easily achievable. 16% is the current reduction efficiency in the model. This efficiency will be increased to a 24% reduction efficiency adjustment immediately, followed by a 32% proposed reduction efficiency as supported by field demonstrations.	Percent reduction (annual)	24%	32%	32%	
P-sorbing Materials	"Phosphorus-sorbing" materials soak up dissolved phosphorus, keeping it from flowing downstream on a potential of 1,000 acres. Engineered systems in which drainage water passes through phosphorus-sorbing materials, such as gypsum, drinking water treatment residuals , or acid mine drainage residuals, can potentially remove large percentages of phosphorus as well as sediment, heavy metals, and other pollutants.	acres (annual)		1,000	1,000	$0.75 M
Poultry Litter Treatment	A surface application of an acidifier is added to poultry litter to acidify poultry litter and maintain ammonia in the non-volatile ionized form (ammonium) in the poultry house. Proposed treatment of 96,000 tons. Consider use of the Chesapeake and Coastal Bays Trust Fund for support. Limited funding through Farm Bill programs.	tons (annual)		96,000	96,000	$3.3 M
Mortality Composters	Requires dead bird composters at all poultry operations for bird mortality,	composters	20	125	145	$1.01 M

Strategy	Description	Units	2010-2011	2012-2017	Total	Estimated Cost
Agriculture-	**Managing Fertilizer and Manure Applications**					
Nutrient Management Compliance	Maryland law requires farmers to implement Nutrient Management Plans that require they efficiently use manure or fertilizer needed to grow a healthy crop and ensure that excess nutrients are not lost to the environment. 1,325,004 acres are subject to the requirement to have and implement a nutrient management plan. MDA implementation inspections average a compliance rate of 75%.	acres (annual)	993,753	993,753	993,753	$29.1 M
Decision / Precision Agriculture	Use Precision Agriculture on 100,000 acres of farmland from 2010-2011 and 220,000 acres from 2012-2017.. Precision agriculture seeks to maximize the efficiency of nutrient application to cropland, thereby minimizing waste and nutrient runoff to the Bay.	acres (annual)	100,000	220,000	220,000	$13.71 M
100-ft CAFO setbacks	100 foot or 35 foot required setbacks for CAFO manure application on a potential of 2,500 acres. Based upon EPA regulations for CAFOs the infield spreading of manure is restricted.	acres (annual)		2,500	2,500	
10-ft riparian setbacks for application of crop nutrients	Require 10 ft application setbacks for the application of crop nutrients, bringing consistency to several programs regulating nutrients on a potential of 5,280 acres.	acres (annual)		5,280	5,280	

Strategy	Description	Units	2010-2011	2012-2017	Total	Estimated Cost
Natural Filters on Public Land						
Tree Planting - Forest Brigade	Plant one million trees on public lands by 2011 through the Department of Public Safety and Corrections Forest Brigade.	acres	1,550		1,550	
Wetland Restoration	Implement 555 acres of Wetland Restoration on public land. A wetland is an area of land where the soil wet or covered with water. Wetlands are often called swamps, marshes, or bogs. Dedicated funding is available through Maryland's Tributary and Wetland Restoration fund. Other potential funding sources include Maryland's Ecosystem Enhancement Program, Program Open Space, Chesapeake and Atlantic Coastal Bays 2010 Trust Fund, as well as competitive funding programs such as the Transportation Enhancement Program and Corporate Wetlands Restoration Partnership.	acres	555	600	1,155	$9.186 M
Streamside Forest Buffers	Plant 345 acres of Streamside Forest Buffers on public land. Trees planted next to waterways filter and take up nutrients coming off the land, stabilize the soil and provide wildlife habitat. Dedicated funding is available through Maryland's Tributary and Wetland Restoration fund. Other potential funding sources include Maryland's Ecosystem Enhancement Program, Program Open Space, Chesapeake and Atlantic Coastal Bays 2010 Trust Fund, as well as competitive funding programs such as the Transportation Enhancement Program and Corporate Wetlands Restoration Partnership.	acres	345	300	645	$2.213 M
Tree Planting - Other	Plant 450 acres of trees on public lands. Trees planted next to waterways filter and take up nutrients coming off the land, stabilize the soil and provide wildlife habitat. Potential funding sources include Maryland's Ecosystem Enhancement Program, Program Open Space, Chesapeake and Atlantic Coastal Bays 2010 Trust Fund, as well as competitive funding programs such as the Transportation Enhancement Program and Corporate Wetlands Restoration Partnership.	acres	450	3,000	3,450	$4.539 M

Strategy	Description	Units	2010-2011	2012-2017	Total	Estimated Cost
Streamside Grass Buffers	Plant 69 acres of Streamside Grass Buffers on public land. Grasses planted next to waterways filter and take up nutrients coming off the land, stabilize the soil and provide wildlife habitat. Dedicated funding is available through Maryland's Tributary and Wetland Restoration fund. Other potential funding sources include Maryland's Ecosystem Enhancement Program, Program Open Space, Chesapeake and Atlantic Coastal Bays 2010 Trust Fund, as well as competitive funding programs such as the Transportation Enhancement Program and Corporate Wetlands Restoration Partnership.	acres	69		69	
Grassland	Restore 45 acres of Grassland on public land. Grass planted next to waterways filter and take up nutrients coming off the land, stabilize the soil and provide wildlife habitat. Potential funding sources include Maryland's Ecosystem Enhancement Program, Program Open Space, Chesapeake and Atlantic Coastal Bays 2010 Trust Fund, as well as competitive funding programs such as the Transportation Enhancement Program and Corporate Wetlands Restoration Partnership.	acres	45		45	
Natural filters on Other Public Lands	Maryland will increase partnerships with local governments, non-profits, universities, other state agencies to implement natural filters.	Acres		600	600	$8.725 M
Air						
Maryland Healthy Air Act	Implement Maryland's Healthy Air Act (effective January 1, 2009). The emission controls on power plants will reduce nitrogen entering the Bay by over 300,000 pounds each year.	Pounds per year	Approximately 300,000 (the first phase of the HAA was implemented in 2009)	305,882 (the second phase of the HAA will be implemented on 1/1/2012	305,882 lbs per year	1.8 to 3.0 billion dollars to implement by 2013
Expand Diesel Engine Retrofit Program	Currently the Port of Baltimore partnered with the Environmental Finance Center to use stimulus money to retrofit dirty diesel truck engines to 'clean diesel' technologies for the Clean Air Act. It is estimated the project will reduce NOx emissions by 7 tons per year.	Pounds per year	approximately 43 lbs per year	approximately 43 lbs per year	approximately 43 lbs per year	Approximately $800,000 in 2010/11

Strategy	Description	Units	2010-2011	2012-2017	Total	Estimated Cost
Low Emission Vehicle Requirement	In 2007, Maryland passed Clean Cars Legislation, which requires by 2011 that all new cars meet the strictest emissions standards allowed under federal law.	Pounds per year	This program starts with the 2011 Model Year	approximately 2,000 lbs per year	approximately 2,000 lbs per year	Approximately $1,000 per new car purchased (it is estimated that about 200,000 new cars are sold in MD annually)

5.2 State Plan to Meet Target Allocations: Identified Gap Closers

The sections below elaborate on the key strategies in Table 5.1 and provide additional detail on funding and potential pound reductions. The units specified in the table are what are entered in the Bay Model in a form called an "input deck." The model then calculates the loading reductions based on agreed upon BMP efficiencies, accounting for the use of multiple BMPs on the same acre of land, delivery factors, and in some cases slopes and types of soils.

5.2.1 Municipal and Industrial Wastewater

Options to decrease and maintain loads from major and minor municipal and industrial wastewater treatment plants (WWTP) are described below.

Base Programs that Provide Annual Reductions

The following list of practices is included in Maryland's 2009-2011 Milestone. Additional strategy and funding details for annual reduction practices are described in Element 2.

A) Continue ENR Retrofits at 69 Major Municipal Wastewater Treatment Plants (>0.500 MGD)

There are a total of 69 Major Municipal Wastewater Treatment Plants (WWTPs) with flow of >0.5 million gallons per day (MGD). Two facilities, Boonsboro and Piney Orchard, were added to the original list of 67 for a total of 69 major WWTPs. The 69 WWTPs include Maryland's portion of the Blue Plains facility.

In accordance with NPDES permits, both Boonsboro and Piney Orchard, are required to upgrade to ENR. However these facilities are not eligible for BRF funding. Boonsboro, became a major due to expansion to design capacity of more than 0.5 MGD, and Piney Orchard, is a privately owned WWTP.

MDE included these two facilities in the major category based on the design flow criteria, and accounted for the projected reductions from these facilities. Boonsboro WWTP has been upgraded; no additional funding is needed. Cost estimates for upgrading Piney Orchard are not included in BRF estimates.

Blue Plains is described separately. It's a multijurisdictional facility and BRF costs will be cost-shared with other jurisdictions, including DC and Virginia. The description, cost and load reductions below reflect information that pertains to all 67 publicly owned facilities including Blue Plains. In addition, individual cost estimates are provided for Blue Plains below.

2009-2011 Milestone:

- Upgrade 14 wastewater treatment plants to enhanced nutrient removal (ENR) technology.

Anticipated Load Reductions 2009-2011 Milestone
780,000 lbs/year of nitrogen reduced

- Enhance BNR facilities at the Blue Plains Wastewater Treatment Plant.

Maryland has funded a capital BNR upgrade project that was substantially completed with remaining punch list items in early 2011.

Anticipated Load Reductions 2009-2011 Milestone
190,000 lbs/yr of nitrogen reduced

2012-2017 Strategy

Maryland plans to upgrade 67 Public Major WWTPs by 2017 to Enhanced Nutrient Removal (ENR).

24 of the 67 public plants will be operational by June 30, 2011. The 67 are expected to be upgraded by 2017, including Maryland's portion of Blue Plains.

Projected Load Reductions (2009-2017)
4,849,466 lbs of TN reduced - 68 majors
874,900 lbs/yr of TN reduced - Blue Plains
5,724,366 lbs of TN reduced -69 Majors

Funding of 67 Major WWTPs

The total cost of the ENR upgrades at 67 facilities is: $2.86 billion, i.e., $2.46 billion for the 66 public major facilities plus $0.402 billion for the Maryland portion of Blue Plains. 36 facilities have not been upgraded yet and will need funding commitments for an estimated amount of $1.186 billion This estimate includes two privatized plants (Piney Orchard and Boonsboro), however it does not Blues Plains.

Total cost includes the cost of planning, design and construction, including state and local shares. Local share may include the cost of additional upgrades. The eligible portion of ENR upgrade of the major wastewater treatment plants is funded by the Maryland's Bay Restoration Fund. Other funding sources include the Biological Nutrient Removal (BNR) Grant, Supplemental Assistance, State Revolving Loan Fund, local or community funding or match, USDA Rural Development Funds, and other federal funding.

Estimated ENR eligible BRF cost:	$1.482 billion
Projected BRF funding available:	$0.945 billion
Projected BRF need:	$0.537 billion

Currently, the State provides 100 percent of eligible cost for the ENR upgrades. The ENR capital upgrades at the 67 public major WWTPs and the Maryland portion of Blue Plains are eligible for a total of $1.482 billion. Full funding is available for implementation of the 2011 Milestone, but a state funding gap is projected after 2012.

If the State continues to provide 100 percent grant funding for these upgrades using the Bay Restoration Fund, the program can fund $945 million out of the eligible BRF total of $1.482 billion, leaving a funding shortfall of about $537 million starting in FY 2012.

Implementation Commitments:
December 2010: Maryland's Bay Restoration Fund Advisory Committee will finalize a report outlining a recommended option to fill the projected deficit.
January 2011: Propose budget that covers projected cash requirements funding to meet current construction schedule for FY2012 projects.

January 2011: Charge Bay Restoration Advisory Committee to identify range of options to restructure fee to raise the needed revenue to fully fund remaining projects including fee based on consumption, income or other criteria and by December 2011 recommend fee structure to be implemented by July 1, 2013.

January 2012: Propose amendment to Bay Restoration Fund statute to change fee to generate the necessary revenue to complete the ENR strategy commitment.

Continual:
ENR discharge limits are incorporated into the NPDES permit renewals to ensure ENR implementation.

Contingency:
If the Bay Restoration Fund statute is not changed in 2012 to generate the necessary revenue to complete the ENR strategy commitment, all funding for ENR projects will be reduced from 100% grant to provide partial grant funds for each remaining project. Local governments would be responsible for the balance of the necessary funding. State low interest loan funds would be available to assist.

Additional Discussion:
This contingency is not anticipated to be necessary. During the 2010 legislative session, the Maryland General Assembly acknowledged the Bay Restoration Deficit and provided that it is the intent of the committees that the Bay Restoration Fund Advisory Committee work in consultation with the Maryland Department of the Environment and the Department of Budget and Management during the 2010 legislative interim on a plan to eliminate the deficit for funding the upgrade of the State's 67 major wastewater treatment plants to enhanced nutrient removal technology. In addition, it is the intent of the committees that this funding plan be implemented during the 2011 legislative session

The Strategy outlined above includes work in 2011 to restructure the fee to ensure that the necessary revenue to complete projects is raised while also ensuring that the structure is equitable. By assessing options including consumption based, income based and other alternatives, greater equity can be achieved in the fee system.

Other funding sources include the State Revolving Loan Fund, local or community funding or match, USDA Rural Development Funds, federal funding, and revenues from offset requirements or trading programs.

Sector Additional Need
10 additional FTEs for enforcement and verification at a cost of $4.2 M over 6 years. These additional FTEs are for all sectors under municipal and industrial wastewater in addition to Major Municipal WWTPs.

In 2011 MDE will evaluate sector requests, all available staff resources, opportunities for reassignment of existing staff; funding sources, including availability of federal funding and legislative approaches to address additional sector needs.

B) Blue Plains Upgrades

The Blue Plains Wastewater Treatment Plant is the largest advanced wastewater treatment plant in the world, with a capacity of 370 MGD and a peak capacity of 1.076 billion gallons per day. Maryland's portion of the Blue Plains flow is 169.6 MGD. It is one of 67 facilities included in ENR Strategy and eligible for BRF grant funding.

Strategy

Upgrade Blue Plains to ENR by 2015.

Anticipated Load Reductions by 2017 (delivered)
874,900 lbs/yr of TN reduced

Estimated Cost
The cost to upgrade Maryland's portion of Blue Plains to ENR is estimated at:

a) Total Cost:	$402 Million
b) ENR eligible cost:	$203 Million, of which $22 million authorized in FY2011;
c) Annual O&M cost:	$21 M/yr

Implementation Commitments:

As part of Maryland's commitment to installing ENR at the largest 67 facilities, Maryland will contribute about $203 million to the Washington Suburban Sanitation Commission (WSSC) share of the upgrade at the Blue Plains facility. Other funding sources include the Biological Nutrient Removal (BNR) Grant, Supplemental Assistance, State Revolving Loan Fund, local or community funding or match, USDA Rural Development Funds, and other federal funding.

The implementation commitments discussed above for Maryland's ENR program also are applicable for this facility.

Additional Discussion:

In addition, EPA recently reissued the NPDES discharge permit for the Blue Plains facility imposing ENR compatible discharge limits. Blue Plains is required to place the new facility in operation by July 1, 2014; and to begin compliance with total nitrogen (TN) limits by January 2015.

Maryland intends to continue to advocate for increased federal funding for the upgrades of the Blue Plains facility that are commensurate with the federal contribution to the wastewater load.

Sector Additional Need

No additional needs anticipated.

Additional Program, Practices and Policies to Meet the 2017 Goal for Point Sources

C) Retrofit/Optimization at Major Industrial Treatment Plants to meet the Tributary Strategy Goal

Strategy
Complete issuance of NPDES permits with wasteload allocations identified in Maryland's Tributary Strategies in 2011. The following significant industrial treatment plants are not yet meeting their Bay allocation and have schedules to meet those allocations:

July 1, 2011: Grace Davison has a major manufacturing plant located in the Baltimore Harbor. Grace Davison-Bay limits become effective July 1, 2011. Limits of 310,737 lbs/yr TN and 1809 lbs/yr TP represent over 50% reduction since 2003 and over 80% reduction since tracking of loadings was first initiated.

September 2013: Erachem Comilog is a company located in the Baltimore Harbor area that is engaged in manganese ore reduction and the manufacture of manganese chemicals. New permit limits of 13,800 lbs year TN (which is a reduction from previous allocation of 95,000 lbs per year) are effective in 2013.

2014: Upper Potomac River Commission POTW – This is the treatment plant for the process wastewater from Newpage Corporation in western Maryland discharging to the North Branch Potomac River. The discharge permit renewal is being processed with an anticipated three year compliance schedule.

2014: Naval Surface Warfare Center at Indian Head- The Department of Defense operates a major facility at Indian Head Maryland. Renewal of their wastewater discharge permit from their industrial operation is pending with nutrient limits anticipated to be effective no later than calendar year 2014.

2014: Severstal Sparrows Point (the steel manufacturing facility formerly known as Bethlehem Steel) has a discharge permit renewal pending. This facility uses source

water from the Back River POTW and as a result their Bay limits will be tied to the schedule of reductions at Back River POTW since Back River is a major source of nutrients in Severstal's discharge. However, one outfall of process wastewater at Severstal will include new technology based limits that will reduce ammonia nitrogen as much as 82,000 lbs/year, with anticipated effective date of three years

During 2015: Masonville Dredge Material Containment Facility is a new facility to be operated by the Maryland Port Administration to dewater dredge materials from the Baltimore Harbor. TN and TP loads (net) are required in the discharge permit to become zero in 2015.

2011-2017: MDE will monitor compliance with schedules and load caps.
Report progress to the Bay Stat and EPA/Bay Program.

Projected 2009-2017 Load Reductions (delivered)
534,407 lbs/yr of TN reduced

Estimated Cost:
Implementation is privately funded.

Funding Strategy:
Private; dependent on plant-specific situation.

Additional Sector Need:
None

D) Minor Industrial Dischargers

There are many minor industrial facilities of varying type and size (477 individual sources). MDE has performed a preliminary evaluation of the potential for reductions from subcategories of minor industrial sources based on an understanding of technical feasibility. This evaluation suggests a nutrient reduction potential from current loads of approximately 23.5 percent by 2017. This evaluation is the basis of the strategy option for this sector, which is included in the set of options that are projected to go beyond the 2017 Interim Target Load.

Implementation Commitments:

2011: MDE will conduct an extensive survey to determine the nature as well as quantity of nutrients produced by minor industrials. MDE will continue to refine the loading estimates to identify and verify the non-significant industrial discharges of nutrients;
2012-2013: MDE will finalize evaluation of the survey and complete refinement of the loading estimates. Based on the outcomes of the survey and estimates, where appropriate MDE will negotiate and issue NPDES permits that will include loading targets and schedules for upgrade.

2013-2017: MDE will monitor compliance with schedules and load caps, and Report progress to the Bay Stat and EPA/Bay Program.

Anticipated Load Reduction (2013-2017) Load Reductions (delivered)
143,323 lbs of TN reduced

Estimated Cost:
No cost estimate is presently available. Cost is dependent on outcome of MDE's evaluation of opportunities and negotiations with the permitted entities.

Funding Strategy:
The majority of the costs will likely be borne by the private sector. Industries would be responsible for necessary retrofits and funding.

Sector Additional Need
5 FTEs: Permit writers in the NPDES permits program to conduct the evaluation of opportunities for reductions, revise permits and issue those permits for minor industrial facilities at a cost of $2.25 M over 6 years or $375,000 annually.

In 2011 MDE will evaluate sector requests, all available staff resources, opportunities for reassignment of existing staff; funding sources, including availability of federal funding and legislative approaches to address additional sector needs.

E) Continue ENR Retrofits at Major Federal WWTPs

Originally there were seven federal facilities; three of which were privatized. One of these three plants is accounted for in the major municipal category (APG Main). The remaining two privatized plants are included in this category, for a total of 6 plants.

Strategy:

MDE issued NPDES permits for all federal facilities requiring the following schedules to meet ENR limits during 2011-2015:

1. 2011: Ft. Dietrick WWTP
2. 2012: Naval Surface Warfare Center Indian Head
3. 2015: United States Naval Academy WWTP.
4. 1013 USDA BARC East (non-DOD federal)
5. 2012: APG-Edgewood (To be privatized)
6. 2010 Fort Meade (Private) (effective upon permit modification)
7. 2013 APG Main (Privatized, included in the major municipal category)

2009-2017: MDE will continue to monitor compliance with schedules and permit limits (ongoing) and refer violations to EPA for follow-up actions as necessary.

F) Evaluate the Largest Minor Municipal Treatment Plants (0.1-0.5 MGD)

Evaluate the feasibility of upgrading five of the largest minor municipal WWTPs to ENR treatment by 2017.

Strategy:
Evaluate the largest minor municipal WWTPs for potential upgrade based on load capacity needs, community interest, technical feasibility and cost-effectiveness.

2011: MDE will evaluate feasibility, cost effectiveness permitting and funding options. Facilities will be selected in consultation with State agencies and local governments. Identify additional facilities as a contingency.
2012: MDE will make final determinations regarding upgrade of minor plants, propose permit revisions for selected facilities and identify potential funding sources.
2013: MDE will issue revised NPDES permits and seek funding to assist local governments with upgrades.
2014-2017: MDE will monitor compliance with schedules and permit limits.

Anticipated Load Reduction 2012-2017 (delivered)
45,000 lbs/yr of nitrogen.

Estimated Cost
Total Cost: $58 million

Funding Strategy:

These upgrades may be funded by the State Revolving Loan Fund, local or community funding or match, USDA Rural Development Funds, federal funding, and revenues from offset requirements or trading programs. The options to address funding for this sector include increasing the BRF fee revenue up to 100%. Decisions are expected starting in FY 2012.

Sector Additional Need
2 new FTEs (1 for grant management and 1 engineer) to implement new nutrient requirements for minor facilities at a cost of $75,000/FTE/yr over 6 years or $125,000 annually.

In 2011 MDE will evaluate sector requests, all available staff resources, opportunities for reassignment of existing staff; funding sources, including availability of federal funding and legislative approaches to address additional sector needs.

G) Combined Sewer Systems

Older combined sewer systems were designed to collect sewage and transport it to sewage treatment plants during dry weather but also serve as stormwater sewers during rain events. During rain events, rainwater is mixed with raw sewage and conveyed to WWTPs. Once combined sewers are full, however, the blended effluent

is discharged directly to waterways resulting in Combined Sewer Overflows (CSOs), which can contribute to local water quality and public health problems and are of particular concern because of the contribution of pathogenic organisms from these untreated sources.

Sanitary sewer overflows occur when sewer systems fail due to power outages at pumping stations, breaks or clogs in sewer lines and other factors that may cause sewage to overflow and contaminate surface and groundwater.

Strategy

Maryland will continue to oversee CSO separation/elimination through enforcement of existing consent orders and Revolving Loan Fund financing of repairs. In addition, Maryland will ensure continued compliance with overflow reporting regulations adopted in 2005 and will continue with its 2009 enforcement initiative.

In Maryland, CSO-related consent orders are in effect in eight communities: Allegany County, Cumberland, Frostburg, La Vale, Westernport, Baltimore City, Salisbury and Cambridge. Federalsburg is being considered for a consent order but is not under one at the time of this writing. Baltimore City and Salisbury have completed the required upgrades. The Long Term Control Plans (LTCP) to address the elimination of the CSOs have been developed and submitted to MDE by all jurisdictions. CSO communities are in the process of evaluating, designing and completing various stages of the upgrades by 2024.

SSO-related consent orders are in place for major sewerage systems including Baltimore City, Baltimore County, Allegheny County and the Washington Suburban Sanitary Commission requiring long-term control plan implementation and mandating billions of dollars in repairs to the sewerage systems. Anne Arundel County has completed required repairs and is no longer covered by a consent order. Stipulated penalties are collected for each spill to foster a sense of urgency by the local jurisdiction for the necessary repairs. In 2005, Maryland issued regulations requiring reporting of all spills over 55 gallons and since 2009, Maryland has been assessing penalties for all spills as part of a special enforcement initiative. For more information see: (http://www.mde.maryland.gov/permits/watermanagementpermits/water1/ssoeinitiative.asp).

Anticipated Load Reductions

Projected 2009-2017 Load Reductions (delivered) – 145,000 lbs/yr of nitrogen. Over 145,000 pounds per year based on anticipated completion of CSO separation in Cambridge and Federalsburg and Baltimore City. However, total CSO loads may change with the evaluation of the Salisbury system.

Funding Strategy

Maryland is using a variety of funding strategies including local or community funding or cost-share with the Supplemental Assistance Program, the State low interest Revolving Loan Fund, USDA Rural Development Funds and other special federal funding.

Sector Additional Need

None anticipated at this time

5.2.2 Urban Stormwater Loads

The general strategy will increase watershed restoration requirements for municipal separate stormwater sewer systems (MS4) by requiring nutrient and sediment reductions through a combination of treatment of pre-1985 acres and alternative methods. This is in addition to the current 2-Year Milestone goal through calendar year 2011, which is:

"Retrofit Stormwater Management systems on 90,000 acres: Stormwater management systems help control nonpoint source pollution through the use of structural and non-structural techniques that intercept, filter and treat runoff from developed lands."

Additional Program, Practices and Policies to Meet the 2017 Goal for Non-Point Source Urban Stormwater

A) Increase NPDES Watershed Restoration Requirements for MS4 Phase I County permits, including SHA.

The strategy requires reductions in nutrients and sediments equivalent to retrofitting 30% of the pre-1985 impervious cover for Maryland's ten largest counties and the State Highways Administration (SHA) subject to Phase I Municipal Separate Storm Sewer System (MS4) permits. The load reduction associated with this strategy is estimated on the basis of an average reduction efficiency of 25% for total nitrogen.

The funding strategy explicitly recognizes that, to achieve nutrient and sediment reductions in the accelerated time frame dictated by the Bay Watershed Implementation Plan, more cost-effective reduction methods will be necessary, including the funding of reductions from other source sectors. The following key elements of the strategy support reasonable assurance of the implementation of this element of the Plan:

- Establish impervious acreage treatment requirements in NPDES municipal separate storm sewer system (MS4) permits to achieve specific reductions in sediment, phosphorus and nitrogen consistent with this Phase I Watershed Implementation Plan. These permits will require the development of a detailed watershed restoration strategy that contains the following elements:
  - A systematic watershed assessment shall be conducted and a detailed restoration plan developed for all watersheds;
  - Stormwater watershed implementation plans for each EPA approved stormwater wasteload allocation (WLA).
  - Completion of restoration efforts for twenty percent of the counties' impervious surface area that is not already restored to the maximum extent practicable (MEP).
  - Development of an ongoing, iterative process that continuously implements structural and nonstructural restoration projects, existing program enhancements, new and additional programs, and alternative BMPs where EPA approved TMDL WLAs are not being met according to the benchmarks and deadlines established as part of the counties' watershed assessments.

- The State will enhance permitting, compliance, technical assistance, and other programmatic activities using existing resources, including the recent staffing additions secured during FY 2009 and grant allocations from the Chesapeake Bay Implementation Grant Program (CBRAP).
- The State will continue to support the development of local stormwater utility fee systems, which will provide greater support for county and municipal stormwater programs, including enhancing watershed restoration activities required under the NPDES MS4 permits.
- The State is considering grants to local governments for this need, e.g., Chesapeake and Coastal Bays Trust Fund (See narrative below).
- Continue to pursue federal authorization for funding, e.g., the Cardin Bill.
- Pursue federal legislation to enable the US Army Corps of Engineers to assist in habitat restoration and water quality projects consistent with the Plan.
- To reduce costs and assure the feasibility of achieving allocations of nutrient and sediment targets in MS4 permits, MDE will work collaboratively with a coalition of stormwater professionals and the Chesapeake Bay Program Urban Stormwater Workgroup to explore and assess additional strategies and best management practices that can be used to restore urban watersheds, explore trading opportunities within the urban stormwater sector, establish criteria for evaluating and certifying best management practice efficiencies for new practices, and evaluating local watershed restoration efforts to determine which strategies are most cost effective at achieving nutrient and sediment reductions.
- Maryland will continue to utilize State public lands to support urban nutrient and sediment reduction goals.
- MDE will conduct program audits to ensure permit requirements meet waste load allocations.

Anticipated Load Reduction

Projected Annual Load Reductions (delivered) - 49,775 lbs/yr of nitrogen
Projected 2012-2017 Load Reductions (delivered) – 248,875 lbs of nitrogen.
2012-2020 Projected Load Reduction - 355,200 lbs of nitrogen.

Estimated Cost

Maryland has developed preliminary cost estimates for the stormwater strategies, which will be refined in the Phase II WIP. Cost estimates vary by region and the particular setting of the implementation. For example, stormwater retrofits performed on one acre of land can range from approximately $4,000/acre for conversion of a dry pond to a wet pond to over $200,000/acre for highway retrofits and green streets projects[18]. Several local jurisdictions have estimated that their per acre costs for stormwater retrofits is in the range of $50,000/acre. The costs for highway and green streets retrofits are elevated because the transportation corridor is highly constrained, which limits the design

[18] Maryland Department of Transportation estimates. Estimate for green streets retrofits, $167,000/acre, Thomas R. Schueler, Chesapeake Stormwater Network, Maryland Association of Counties presentation, Ocean City, August 20, 2010.

alternatives. Local jurisdiction cost estimates of $50,000/acre reflect the full cost of treating impervious surfaces in highly constrained urban areas.

A figure of $18,000/acre is used in this Phase I WIP as an interim estimate based on Maryland's 2008 Clean Water Needs Survey. It is lower than other estimates because it reflects Maryland's intent to allow alternative means of achieving the nutrient and sediment goals by the urban stormwater sector at an accelerated pace in contrast to strictly using traditional methods of treating impervious surfaces. This flexibility is an intentional aspect of the State funding strategy that is designed to contain costs and thereby increase the feasibility of implementation in the prescribed time frame.

1. Total Cost
   a. To implement strategy by 2017:
      i. MS4 Phase I Counties - $2,614,000,000
      ii. SHA[19] - $1,000,000,000
   b. Annual cost - $ 435,700,000 /year [without SHA]
      Annual SHA Cost - $160,000,000 /year

2. Existing Baseline Program

Program Name	Source	Amount
MS4 Phase I Counties	Local, State and Federal	$116,000,000/yr
MS4 Phase I SHA	State and Federal	$ 6,000,000/yr

Source: WIP Section 5.2.2.4 MD Stormwater management program annual report summary through 3rd quarter of 2010 (9/23/10).

Implementation Commitment:

County Permits: MS4 permits require stormwater Waste Load Allocation implementation plans to be submitted for approval by MDE within one year of the adoption of a TMDL. These plans will describe local funding strategies. Maryland has submitted to EPA a schedule for reissuance of all expired MS4 permits to EPA and intends to have all new MS4 permits permit provisions which are required to support the State's Watershed Implementation Plan in place during 2011.

Funding Strategy:

While permit requirements assure implementation, the State recognizes the significant cost for stormwater controls and commits to two additional implementation strategies as follows:

State and Local Revenue:

State law enacted in the 1982 authorized local governments to collect fees (e.g., plan review, inspection, grading fees, etc.) to implement stormwater management programs. In 1991, Maryland enacted a law authorizing local jurisdictions to develop a "system of

[19] This estimate is for both Phase I and Phase II MS4 areas.

charges" or a stormwater utility. To date, five jurisdictions (e.g., Tacoma Park, Montgomery County, Prince George's County, City of Rockville, and City of Annapolis) have enacted these fees to fund stormwater projects. State legislation proposed during 2010 would have required each county and municipally to establish a "stormwater remediation fee" and create local "watershed protection and restoration funds" to pay for implementation of local stormwater management plans. The legislation did not pass.

In 2011, the State will convene a formal discussion with stakeholders to identify potential options for adequate revenues, a period of time for research, development and enactment of local revenue systems. To assist with start-up costs, MDE offers financial assistance through low interest loans involving the State Revolving Loan Fund, to create these fee systems. MDE also offers a delayed payment plan contingent upon starting a "system of charges." Grants may also be made available in a cost sharing arrangement.

In addition to stormwater fee systems, local governments may use volunteers to implement various labor-intensive elements of programs. Other funding may include a combination of State Revolving Loan Fund, the Chesapeake Bay 2010 Trust Fund, local, community and non-profit funding, regulatory fees, and various other grant funding.

The Chesapeake Bay 2010 Trust Fund is a major commitment to finance non-point source restoration programs. The Fund was designed to provide $50 million annually. The $50 million annual commitment will enable Maryland to leverage that revenue to increase local capacity to finance stormwater retrofit costs. While the funding level is currently lower due to revenue decreases associated with the current economy, this is anticipated to be a short term problem.

Federal Revenue:

The federal government has also long recognized the stormwater funding need. By way of example, the Clean Water Needs Survey designed to assess water related infrastructure needs includes stormwater projects. The State will pursue federal funding for stormwater projects on three tracks:

1) In 2011, Maryland will ask its Congressional delegation to work to pursue the authorization for federal funding for the Chesapeake Bay jurisdictions through either pending or new legislation;
2) In 2011, Maryland will also work directly with federal agency representatives to refine cost estimates, conduct local financial feasibility analyses, determine the federal share of stormwater costs and develop a strategy with a time line to secure federal share of funds. The outcome will be documented in Maryland's Phase II WIP. Maryland will also ask its federal facilities to enter into a schedule providing for stormwater controls and retrofits on a schedule similar to that required of local governments;
3) In 2011, Maryland will request that the U.S. Army Corps of Engineers formally pursue the necessary prioritization of stormwater projects in Maryland within it capital project improvement plan.

Contingency:

As a contingency, for local jurisdictions that have not adopted fees by the end of 2012, the State will pursue a statewide system of fees.

Additional Discussion:

In addition to convening a formal discussion with stakeholders to identify potential options for adequate revenues, a period of time for research, development and enactment of local revenue systems, and assisting with start-up costs, and providing delayed payment contingent upon starting a "system of charges," MDE will also convene a group of experts to identify the most cost effective practices to achieve retrofit requirements. For example, the State Highway Administration has estimated using the most cost effective practices may reduce its costs by as much as two-thirds.

Finally, costs may be controlled by using alternative means of achieving nutrient and sediment reductions. These alternatives may include funding reductions from non-urban stormwater sources pursuant to State and federal trading programs. This will not relieve the stormwater sector from other restoration goals that have longer time horizons, but rather, is designed to allow the stormwater sector to meet nutrient and sediment goals sooner than would otherwise be financially feasible.

See: Section 2.2.2.4 "Regulated Stormwater" subsection "Stormwater and Financial Capacity" for background and supporting material.

State Highway Administration Permits: For the Maryland Department of Transportation funding is provided by the Maryland Transportation Trust Fund, which is currently constrained to dedicated revenue sources, the two largest being the motor fuel tax and the vehicle titling tax. For mitigation projects expected to be funded from the Transportation Trust Fund, substantial additional funding is needed for project construction, land acquisition and increased staff capacity to undertake the activities proposed (i.e. engineering, specialized project design management, construction management and inspection). Maryland will rely on a recently appointed "Blue Ribbon Commission on Transportation Funding" to identify and recommend new or alternative fund sources to fund TMDL commitments and other transportation needs.

In 2010 the Maryland General Assembly appointed the "Blue Ribbon Commission on Maryland Transportation Funding" to identify options for sustainable, long-term revenue sources for transportation funding including sources to fund TMDL commitments. The Blue Ribbon Commission, which first met on September 27, 2010, will review, evaluate and make recommendations concerning Maryland Transportation submitting a final report on or before November 1, 2011 to the Governor and General Assembly.

MDOT is anticipating additional funding for surface transportation projects in the 111th Congress through surface transportation authorization legislation. If no other funding can be identified for these commitments MDOT will find other opportunities to offset their Waste Load Allocation. State Highway Administration efforts are already being redirected towards meeting the TMDL within currently available funding levels.

Sector Additional Need**:** The costs above are primarily capital costs. It's critical that staffing at the state and local levels be boosted in the very near term to manage the accelerated implementation.

The average annual cost for local jurisdiction, over six years from 2012-2017, is predicted to increase about 3.75-fold, from $116 million to about $436 million. Although a more accurate projection must be developed in the Phase II Plan, and subsequent local MS4 WLA implementation plans, estimated near-term minimum expected needs are outlined below:

State Staffing:

- 5 FTEs (@75,000) - MS4 Program Permit Writers/Technical Assistance for increased stormwater project management (5 additional permit writers and engineers to provide technical assistance, review implementation plans and annual reports, and expand permitting to additional entities.): $2.25 million or $375,000 annually.
- 5 FTE's (@70,000) - MS4 Program Enforcement and Verification (5 additional engineers, inspectors and planners to conduct triennial reviews, verify implementation, and assess compliance.): $2.1 million or $350,000 annually.

Other State and Local Staffing and Technical Assistance:

- 2 FTEs x 10 jurisdictions (@ $75,000) for increased stormwater project management**: $1.5 million.
- $250,000 x 10 jurisdictions for consulting services: $2.5 million.
- 1 FTE x 10 jurisdictions (@ $75,000) for soil conservation district staff salaries, fringe benefits and associated costs to support increased urban plan review work load: $750,000.
- 1 FTE for MDA to support the increased pace of trading between the urban and agricultural sectors.

** This annual cost would include implementation project development: Identifying potential projects, field validation for access and utility conflicts, securing property access, design, securing permits, field support during construction and post construction inspection. It would also include management of new funding including grant management, invoicing, etc. It would also include involvement in the development and implementation of enhanced tracking and reporting.

B) Increase NPDES Watershed Restoration Requirements for Phase II MS4 Jurisdictions

The strategy for MS4 Phase II jurisdictions is similar to the Phase I MS4 strategy with the exception that the 2017 target is based on the nutrient and sediment reduction that would be achieved by treating 20% of the pre-1985 impervious cover in Phase II jurisdictions, including the State Highway Administration (SHA). The load reduction associated with this strategy is estimated on the basis of an average reduction efficiency of 25% for total nitrogen. This strategy will also apply to federal lands. Information regarding the federal

Lands was provided by EPA to Maryland. The information regarding the facilities and the loads are provided in Appendix H3.

The funding strategy explicitly recognizes that, to achieve nutrient and sediment reductions in the accelerated time frame dictated by the Bay watershed implementation plan, more cost-effective reduction methods will likely be necessary, including the funding of reductions from other source sectors. The following key elements of the strategy support reasonable assurance of the success of this plan:

- Establish impervious acreage treatment requirements in NPDES municipal separate storm sewer system (MS4) Phase II General permits to achieve specific reductions in sediment, phosphorus and nitrogen consistent with this Phase I Watershed Implementation Plan20.
- The remaining actions that demonstrate reasonable assurance for Phase II MS4 jurisdictions are the same as for Phase I jurisdictions discussed above.

Anticipated Load Reduction

Projected Annual Load Reductions (delivered) - 4,375 lbs/yr of nitrogen
Projected 2012-2017 Load Reductions (delivered) – 21,875 lbs of nitrogen.

Estimated Cost

The method of estimating costs is described in the Phase I MS4 section above.

1. Total Cost
   a. To implement strategy by 2017
      i. MS4 Phase II Local Governments - $365,000,000
      ii. SHA – Estimate included with Phase I MS4 estimate above.
   b. Annual cost - $ 60,800,000 /year [Local Government Only]

2. Existing Baseline Program

Program Name	Source	Amount
MS4 Phase II Local Governments	Local, State and Federal	Not Estimated
MS4 Phase II SHA	State and Federal	Included in Phase I MS4 section above

Funding Strategy

The funding strategy for achieving the Phase II MS4 sector targets will have many of the same elements described in the Phase I MS4 section above. However, given the varied characteristics of Phase II jurisdictions, funding strategies will depend on local input during the Phase II Watershed Implementation Plan development process and more

[20] Agreements between some counties and small Phase II jurisdictions without stormwater programs might be necessary.

detailed assessments conducted during the initial year of the Phase II MS4 General permits.

Sector Additional Need: The costs above are primarily capital and non-staffing costs. It's critical that staffing be increased in the very near term to manage the accelerated implementation.

Local Government Permits: The average annual cost over six years, 2012-2017, is to a great degree a completely new cost. Although the details and estimates will be refined in the Phase II Plan and subsequent local MS4 WLA implementation plans, the State and local needs are expected to be consistent with the Phase I needs. In addition, approximately fifty Phase II jurisdictions with no current retrofit programs would need program implementation resources. A detailed estimate will be included in the Phase II Watershed Implementation Plan.

C) Existing Urban Nutrient Management Law – Reporting of Regulatory Compliance

Urban nutrient management is implemented on 220,000 acres of land and currently tracked by Maryland Department of Agriculture (MDA) but not included in Maryland's 2009 progress run. MDA will begin reporting this BMP effective 2010.

Strategy
Require soil sampling and fertilizer applications according to University of Maryland (UMD) recommendations on 275,000 acres of commercially managed lawns (for example, golf courses and athletic fields) through Maryland's Water Quality Improvement Act. Since 1998, MDA has regulated approximately 700 applicators who apply fertilizer to 10 or more acres of non-agricultural land, including private lawns, golf courses, public parks, airports, athletic fields and state owned land such as restoration areas and highway right-of-ways. Applicators are required to take soil tests, follow University of Maryland Extension guidelines when applying nutrients, and maintain certain records of fertilizer applications. A compliance rate of 80% counts 220,000 acres under this regulation.

Funding
Currently, MDA has 1 FTE to provide inspection for 700 operations. To provide adequate inspection, tracking and accountability an additional 3 FTE are required. The total cost to the State to implement this strategy from 2012-2017 is $4,150,000; the annual cost is $692,000

Funding Strategy
The strategy to increase funding for the inspections needed to meet EPA expectations for reasonable assurance is to request funds through the EPA Accountability and Tracking Grant.

Anticipated Load Reductions
Projected Annual Load Reduction (delivered) – 385,000 lbs/yr N- 59,400 lbs/yr P
Projected 2012-2017 Load Reductions (delivered) – 385,000 lbs/yr N- 59,400 lbs/yr P

D) Urban Nutrient Management - Expanded

Eliminate phosphorus in fertilizers used on lawns and use only slow release nitrogen fertilizers on lawns and managed turf. Discontinue inappropriate use of fertilizers as deicers. Create economic disincentives for the use of fertilizers used by homeowners. Assure sound nutrient recommendations on residential turf.

Strategy
Enact legislation to further reduce phosphorus content in lawn fertilizers. Require the use of slow release nitrogen fertilizer on lawns. Ban phosphorus in lawn fertilizers except for establishment of new lawns. Develop taxing structure for lawn fertilizer. Prohibit use of fertilizers as deicers. Revise UMD nutrient recommendations for managed turf to reduce nitrogen use.

Legislation (HB 553/SB 609) passed during the 2009 Maryland General Assembly defines "low phosphorus fertilizer" as containing not more than 5% phosphorus and sets application rates not to exceed .25 lb P /1,000 sq. ft. and .5 lb/1,000 sq. ft. per year. Beginning April 1, 2010, phosphorus in newly registered lawn fertilizers may not exceed 1.5%. Beginning April 1, 2011, fertilizers with more than 5% P may not be used on established lawns and must not be labeled for lawn use. Retail establishments are prohibited from selling fertilizer for lawns unless it is a "low phosphorus fertilizer". Licensed lawn and landscape firms are not required to use "low P fertilizers".

The new legislation would enact requirements for point of sale regulation of slow release nitrogen products. Fertilizers sold in Maryland for use on lawns would be required to contain slow release nitrogen. Fertilizers used on lawns would be subject to tax and revenue will be used to offset additional regulatory oversight. Requirements for use of "low P fertilizers" on lawns would be extended to commercial applicators. Formulation requirements would further reduce phosphorus in lawn fertilizers used by homeowners to zero except when establishing or renovating a lawn. All fertilizer products would be banned for use as deicers.

Funding
None required as this strategy can be implemented with legislative action

Funding Strategy
NA

Anticipated Reductions
220,000 acres/385,000 lbs/yr N- 59,400 lbs/yr P

E) Regenerative Stormwater Conveyance

A regenerative stormwater conveyance (RSC) system is a method of conveying stormwater that is often applied to down-cut headwater streams and stormwater outfalls. The system typically consists of a series of beds separated by weir structures that moderate stream flow, promote infiltration and reconnects the stream with the flood plain. Well designed systems incorporate organic materials that promote subsurface biological processes with denitrifying potential. Based on the number of RSC type

projects most recently submitted for funding from the Chesapeake and Coastal Bays Trust Fund, Maryland expects an annual implementation rate of about two linear miles a year (10,560 linear feet).

Stream restoration and connection to the flood plain mimics natural stream conditions and provides a nutrient and sediment reduction in some places. Although this methodology is currently implemented in Maryland, it is relatively new and guidelines for site selection are needed so that fish barriers and other non-desired side effects are not created from implementing this practice.

The State has convened a workgroup to evaluate this strategy by defining designs to yield pollution reduction and habitat creation or improvement. This workgroup will also produce site selection criteria for determining the most appropriate locations for the spring of 2011 and be adopted into State policy by the end of the year. Once pollutant reduction and habitat improvement data have been collected on these practices Maryland will submit a proposal to the CBP for approval as a BMP. Based on the projects already underway that include monitoring of these practices, Maryland estimates a request will be submitted in 2012.

Maryland will work with local governments to develop tracking and reporting protocols for this type of practice to ensure no double counting occurs with other restoration activities. Use of the National Environmental Information Exchange Network (NEIEN), outlined in Element 6, will provide the platform to ensure accurate, consistent, non-duplicative implementation data.

Anticipated Load Reduction

The Chesapeake Bay Program does not have an approved reduction estimate for this practice; however, the Bay Program's Phase 4.3 model stream restoration reduction efficiency provides a reasonable placeholder value. Researchers are monitoring two sites to evaluate effectiveness.

Annual Estimated Reductions @ 10,560 feet/yr: 211 lbs of N, 37 lbs P and 26,928 lbs of sediment
From 2012-2017 this equals 1,266 lbs N, 222 lbs P, and 161,586 lbs sediment
From 2012-2020 this equals 1,899 lbs N, 333 lbs P and 242,352 lbs sediment

Estimated Cost
Implementation practices of this type are likely to become part of future stormwater nutrient reduction strategies for Phase I and Phase II MS4 jurisdictions. Consequently, the funding strategy for this practice will likely be embedded in the MS4 strategies in the future.

1. Total Cost
    a. To implement strategy by 2017: $250/ft x 10,560 ft/yr x 6 yrs = $15,800,000
    b. Annual cost - $2,600,000/yr

2. Existing Baseline Program
   No Estimates Readily Available

   Funding Strategy
   Implementation practices of this type are likely to become part of future stormwater nutrient reduction strategies for Phase I and Phase II MS4 jurisdictions. Consequently, the funding strategy for this practice will likely be embedded in the MS4 strategies in the future.

   The Chesapeake and Coastal Bays Trust Fund, local government funds, and non-profit implementation programs provide additional potential funding sources. Specifically, the National Fish and Wildlife Foundation is interested in convening a "Blue Ribbon Panel" to evaluate these practices. The Chesapeake Bay Trust awarded a Pioneer Grant to the Severn River Keeper of $65,000 for the scientific analysis lead by Chesapeake Biological Lab to develop the nutrient efficiencies of the regenerative stormwater conveyance BMP. The project started in May 2010 and runs through April 2012. The latest round of Chesapeake and Coastal Bays Trust Fund proposals included 22 submissions. Of those 18 were exclusively for regenerative stormwater conveyance or included at least one site proposed for implementation. Many Maryland counties have implemented these practices with their own funds and are actively pursuing additional sites for project implementation.

   Where credit is taken for these practices under MS4 permits, it will be necessary to account for additional actions to achieve the overall nutrient reduction targets estimated for this practice above. This accounting matter will be addressed in the Phase II watershed implementation planning process.

   Sector Additional Need: The additional needs for this practice are outlined in the MS4 stormwater sections.

F) Rural Residential Reforestation

Rural residential tree planting addresses properties of limited housing density that include lawns and fields but are not used for agricultural purposes. These rural areas often include single family homes located on five or more acre lots where there is the opportunity to reforest larger low-density parcels. This action would reduce nutrient and sediment runoff by converting landuse from turf grass or open fields to forest. EPA watershed model land use loading factors for turf grass versus forest will provide the nutrient and sediment benefits.

Strategy

- (2011) Begin GIS analysis to identify the opportunities for planting.
- (2011) Work with existing local government programs on opportunities for transferring their concepts to other jurisdictions. Choose a pilot area and cluster potential planting areas in high priority watersheds.
- (2012) Begin implementation in pilot area, continue outreach to transfer existing local program concepts to other jurisdictions, and identify additional planting areas.

- (2012-2017) continue to identify planting areas and identify funding sources that leverage both public and private dollars. There is also a potential for markets based on carbon sequestration, etc. to be identified in these out years.

Rural resident tree planting will include the conversion of turf grass into trees. It will also facilitate the conservation of home owner association properties into forest cover. Another aspect will be to consider conservation of existing forest in new development of rural residential development (i.e. farmland being developed). Maryland may also consider mandatory stream and waterway buffers.

These lots, because of their land use and density, are not currently serviced by traditional agricultural and forestry programs, such as the Soil Conservation Districts and are typically not managed under county stormwater programs. Maryland has existing State and county level programs in place that could be combined to implement reforestation, and other forestry practices, on rural residential lands. Baltimore County coordinates their Rural Residential Stewardship Initiative project where the county designs and plants trees along with the landowners, who then agree to monitor and maintain the projects. Landowners are provided information materials describing why the County reforested their land and what the landowner can do to maintain the newly planted acres. For some landowners participation in this project provides their property with enough forest that they enroll in the Department of Natural Resources FCMA/WAP programs. These programs provide property tax credits and result in continued management under a Forest Stewardship Plan.

GIS mapping of rural reforestation opportunities by land conservation status (publicly owned, conservation easement, low density not in easements, and different development potentials) should be conducted to show the opportunities for implementation. Bay Bank's Land Server may be able to determine eligible properties. Land Server also has the ability to link targeted lands to markets such as carbon sequestration to generate a higher incentive for the land owner. Once targeting is complete outreach to these targeted landowners would be extensive. To successfully implement reforestation on rural residential lands there needs to be a stewardship outreach and education component. This could be conducted by University of Maryland Extension Forestry Stewardship Educator's and the watershed restoration specialists from the Watershed Assistance Collaborative. Another strategy to reach potential participants would be to take out ads in local newspapers and hold local information sessions.

DNR forestry staff can serve as a technical resource and train non-profit partners to implement this practice. The potential opportunity for these reforestation projects is high but requires extensive coordination and planning because there are so many different land owners. Non-profit organizations are often much better received and can be very effective in working with private property owners.

Estimated potential is 100 acres a year. Reductions are based on benefits of converting turf grass and open fields to trees.

Implementation practices of this type are likely to become part of future stormwater nutrient reduction strategies for Phase I and Phase II MS4 jurisdictions. Where credit is

taken for these practices under MS4 permits, it will be necessary to account for additional actions to achieve the overall nutrient reduction targets. This accounting matter will be addressed in the Phase II watershed implementation planning process.

Estimated Cost
Implementation practices of this type are likely to become part of future stormwater nutrient reduction strategies for Phase I and Phase II MS4 jurisdictions. Consequently, the funding strategy for this practice will likely be embedded in the MS4 strategies in the future.

Funding
Beyond DNR assistance and county participation, the Hughes Center for Agro-Ecology is also a potential partner for funding and outreach support.

Anticipated Load Reduction
600 ac/ 3,003 lbs N, 651 lbs P, 49 tons sediment per year
From 2012-2017 this equals 18,018 lbs N, 3,906 lbs N and 294 tons of sediment

G) Urban Tree Canopy

Creating 200 acres a year of urban tree canopy has been identified as part of the 2017 reduction strategy. This has been incorporated in the modeling conducted by the Chesapeake Bay Program for this Phase I WIP development; however, it is presently not possible to quantify the effect of this strategy.

Strategy
Maryland's Forest Conservation Directive has committed the State to implementing urban tree canopy goals based on reasonable expectations in gains by accounting for available lands and hydrologic flow paths in urban areas. The intent of the urban tree canopy in Maryland's goals was to target half of the older developed areas, particularly those developed prior to stormwater management, where urban trees may be particularly valuable for water and air quality. These areas are established communities and city centers that the state has been encouraging to develop canopy assessments. Urban tree canopy is defined as at least 100 trees to an acre.

It is likely that the accounting for this practice will need to allow for a "pro-rating" system consisting of a combination of activities including greater acreages with lower tree densities and areas with existing trees that are supplemented to reach the 100 tree/acre density.

In Phase II Maryland will extrapolate goals for cities and communities based on existing urban tree canopy pilot areas.

Anticipated Load Reduction
Maryland will consult with EPA to estimate specific reduction rates based on the location of the trees during the Phase II process. UFORE Hydro model has been used to quantify the benefits of urban tree canopy and could be used to estimate specific reduction rates.

Estimated Cost
$30,000 an acre for total of $36,000,000 for 1,200 acres by 2017

Funding Strategy
Implementation these practices are likely to become part of future stormwater nutrient reduction strategies for Phase I and Phase II MS4 jurisdictions. Consequently, the funding strategy for this practice will likely be embedded in the MS4 strategies in the future.

Schedule and Accounting of Implementation
Some of the implementation practices of this type are likely to become part of future stormwater nutrient reduction strategies for Phase I and Phase II MS4 jurisdictions. In such cases the schedule of implementation will follow that of the MS4 pace of implementation. Where credit is taken for these practices under MS4 permits, it will be necessary to account for additional actions to achieve the overall nutrient reduction targets estimated for this practice above. Given the interest in urban reforestation, it is also possible that non-MS4 jurisdictions will contribute to this implementation strategy. Issues of partial credit for urban tree canopy density that is less than the defined "100 trees per acre" for full credit will pose an additional accounting issue to be addressed with the Chesapeake Bay Program. These accounting matters will be addressed in the Phase II watershed implementation planning process.

5.2.3 Natural Filters

Increasing forest acreage will directly result in nutrient and sediment reductions. Stricter preservation of forest will decrease the loads from new development. Both approaches are utilized in Maryland's WIP. The following list of practices is included in Maryland's 2009-2011 Milestone and implementation is expanded until 2017. One new strategy has been added, "Natural Filters on Other Public Lands." These natural filters are for implementation on public lands, specifically lands managed by the Department of Natural Resources, as well as other state agency lands and federal and local lands. Natural filter implementation on private lands is captured in the agricultural section of this report. Additional strategy and funding details for annual reduction practices are described in Element 2.

A) Tree Planting

Plant trees for a total of 3,450 acres by 2017

Strategy
Forests are our most strategically important natural resource. Trees protect water quality, clean our air and provide wildlife habitat. One large tree can eliminate 5,000 gallons of stormwater runoff each year, and well placed trees can help reduce energy costs by 15 to 35 percent.

Anticipated Load Reduction
2010-2011: 450 acres / 5,400 lbs N
2012-2017: 3,000 additional acres; additional 3,000 acres reduces 41,745 lbs nitrogen
Total of 3,450 acres for a total of 47,145 lbs nitrogen reduced

Estimated Cost
Total Amount to Implement 2012-2017: $4,538,744

Funding Strategy
Existing funding is available from the Chesapeake and Atlantic Coastal Bays Trust Fund, state operating and capital budgets and existing federal programs. A wide range of implementation options will be developed during Phase II WIP development. Two examples include tax incentives and statewide regulation for natural filter implementation. Maryland will also explore shifting its existing state work force to meet WIP staffing goals. Additional potential funding sources include Maryland's Ecosystem enhancement Program, Program Open Space, Chesapeake and Atlantic Coastal Bays Trust Fund, as well as competitive funding programs such as the Transportation Enhancement Program and Corporate Wetlands Restoration Partnership.

B) Grassland Planting

Plant grasses in 2010 and 2011 as part of Maryland's 2-Year Milestone commitment.

Strategy
Increasing planting of grasses creates a filter to take up nutrients coming off the land, stabilizes the soil and provides wildlife habitat.

Anticipated Load Reduction
2010-2011: 45 acres/ 315 lbs N

Estimated Cost
Maryland does not propose implementation for 2012-2017 so there is no associated cost estimate.

Funding Strategy
Funding to meet this milestone have included Maryland's Ecosystem enhancement Program, Program Open Space, Chesapeake and Atlantic Coastal Bays Trust Fund, as well as competitive funding programs such as the Transportation Enhancement Program and Corporate Wetlands Restoration Partnership.

C) Tree Planting – Forest Brigade

Maryland will plant trees through its Forest Brigade program as part of its 2011 milestone commitment.

Strategy
Forests are our most strategically important natural resource. Trees protect water quality, clean our air and provide wildlife habitat. One large tree can eliminate 5,000 gallons of stormwater runoff each year, and well placed trees can help reduce energy costs by 15 to 35 percent.

Anticipated Load Reduction
2010-2011: 1,550 acres / 18,900 lbs N

Estimated Cost
Maryland does not propose implementation for 2012-2017 so there is no associated cost estimate.

Funding Strategy
Funding to meet the 2011 commitment is provided through the Department of Public Safety and Corrections Forest Brigade.

D) Wetland Restoration

Maryland will continue to restore wetlands on public lands through 2017. Wetlands are highly valuable lands in terms of their abilities to both improve water quality and as important habitat for many species.

Strategy
The strategy is to restore an additional 555 acres to meet the 2011 milestone commitment and, annually, through 2017, to restore 100 acres.

Anticipated Load Reduction
2010-2011: 555 acres/ 15,940 lbs N
2012-2017: 600 additional acres; additional 600 acres reduces 17,232 lbs of nitrogen
Total of 1,155 acres for a total of 33,172 lbs nitrogen reduced

Estimated Cost
The estimated total cost of implementation from 2012 to 2017 is $9,185,945.

Funding Strategy
Dedicated funding is available through Maryland's Tributary and Wetland Restoration Fund. Additional existing funding is available from the Chesapeake and Atlantic Coastal Bays 2010 Trust Fund, state operating and capital budgets and existing federal programs. A wide range of implementation options will be developed during Phase II WIP development. Two examples include tax incentives and statewide regulation for natural filter implementation. Maryland will also explore shifting its existing state work force to meet WIP staffing goals. Other potential funding sources include Maryland's Ecosystem Enhancement Program, Program Open Space, Chesapeake and Atlantic Coastal Bays Trust Fund, as well as the Transportation Enhancement Program, and Corporate Wetlands Restoration Partnership.

E) Streamside Forest Buffers

Plant forest buffers from 2010-2017

Strategy
Increase streamside forest buffers by 645 acres by 2017. Streamside forest buffers are linear wooded areas along rivers and streams that help filter nutrients, sediments, and other pollutants from runoff. These buffers remove nutrients from groundwater. In addition to their ability to improve water quality, their value for enhancing terrestrial and aquatic habitat make forest buffers a highly desirable practice.

Anticipated Load Reduction
2010-2011: 345 acres / 9,900 lbs N
2012-2017: 300 additional acres; additional 300 acres reduces 8,616 lbs of nitrogen. Total of 645 acres for a total of 18,516 lbs nitrogen reduced

Estimated Cost
Total amount to implement 2012-2017: $2,213,235

Funding Strategy
Dedicated funding is available through Maryland's Tributary and Wetland Restoration Fund. Additional existing funding is available from the Chesapeake and Atlantic Coastal Bays Trust Fund, state operating and capital budgets and existing federal programs. A wide range of implementation options will be developed during Phase II WIP development. Two examples include tax incentives and statewide regulation for natural filter implementation. Maryland will also explore shifting its existing state work force to meet WIP staffing goals. Other potential funding sources include Maryland's Ecosystem Enhancement Program, Program Open Space, Chesapeake and Atlantic Coastal Bays Trust Fund, as well as the Transportation Enhancement Program, and Corporate Wetlands Restoration Partnership.

F) Streamside Grass Buffers

Maryland will plant grass buffers to meet its 2011 milestone commitment. Buffers are highly valuable lands in terms of their abilities to both improve water quality and as important habitat for many species.

Strategy
Maryland will plant 69 acres of grass buffers by 2011. Grass buffers are linear strips of grass or other non-woody vegetation between the edge of fields and streams, rivers, or tidal waters. Grass buffers filter nutrients coming off the land, stabilize the soil, and provide wildlife habitat.

Anticipated Load Reduction
2010-2011: 69 acres / 1,173 lbs N

Estimated Cost
Maryland does not propose implementation for 2012-2017 so there is no associated cost estimate.

Funding Strategy
Dedicated funding is available through Maryland's Tributary and Wetland Restoration Fund. Other potential funding sources include Maryland's Ecosystem Enhancement Program, Program Open Space, Chesapeake and Atlantic Coastal Bays Trust Fund, as well as the Transportation Enhancement Program, and Corporate Wetlands Restoration Partnership.

G) Natural filters on public lands

DNR, in collaboration with the Watershed Assistance Collaborative, is working with local governments and non-profits to identify public lands suitable for implementation of natural filter projects. Expanding this scope to universities and other large public land owners (correctional facilities, hospitals, etc.) will likely capture up to 100 additional acres per year of Natural Filter projects. Maryland will increase partnerships with local governments, non-profits and universities and also partner with other state agencies and federal lands to explore potential for additional natural filter implementation.

Strategy

To accomplish this, Maryland will initiate evaluation in conjunction with the University of Maryland System, the Departments of Education, Health and Mental Hygiene, and Corrections, County Departments of Education, Health, and Parks and Recreation, and the Federal Departments of Defense, Education, Transportation, and Health and Human Services to begin evaluating opportunities. The current DNR Natural Filters program and Watershed Assistance Collaborative will coordinate and implement local land projects.

Chesapeake and Coastal bays 2010 Trust Fund priority watersheds will define the target areas for potential buffer restoration projects and projects will be focused on these areas.

Anticipated Load Reduction

A conservative estimate of implementation of natural filters on public lands is 100 acres a year for a total of 600 acres in 2017 and 900 acres in 2020. Using Watershed Model 4.3 estimates, and assuming these acres will not be filtering agricultural stormwater but urban, the unit load reductions per acre are 4.29 lbs/ac for N and 0.93 lbs/ac for P, and 0.07 tons/acre for sediment. The pounds of nitrogen reduced would be 429 per year, 93 pounds of phosphorus per year and 7 tons of sediment per year. By 2017 this equates to 2,574 pounds of nitrogen, 558 pounds of phosphorus, and 42 tons of sediment. By 2020 the total pound reductions would be 3,861 for nitrogen, 837 for phosphorus, and 63 tons of sediment.

600 acres by 2017: 2,574 lbs N, 558 lbs P, 42 tons sediment per year

Estimated Cost

Total to implement 2012-2017: $8,725,498

Funding Strategy

The Chesapeake and Coastal Bays 2010 Trust Fund will be used to fund Natural Filters projects. Additional existing funding is available from competitive funding sources, the state operating and capital budgets and existing federal programs.

A wide range of implementation options will be developed during Phase II WIP development. Two examples include tax incentives and statewide regulation for natural filter implementation. Maryland will also explore shifting its existing state work force to meet WIP staffing goals.

Also, Maryland may provide additional restoration on Program Open Space (POS) purchases. The amount of acres that will be purchased is unknown from year to year but POS is typically a viable source for restoration acres given funding levels remain at current levels. Enhancement of existing easement programs may be an additional source of funding. To accomplish this modify the state land preservation programs (MALPF, Rural Legacy) by establishing a water quality BMP set-aside component, whereby a percentage of the monies paid to new enrollees in these preservation programs is sequestered and dedicated to implement natural filters. Tree plantings, wetland restoration and buffer plantings may be implemented on these properties.

5.2.4 Septics Systems

The installation of best available technology (BAT) to septic systems reduces nitrogen discharges by 50%.

Base Programs that Provide Annual Reductions

The following list of practices is included in Maryland's 2009-2011 Milestone. Additional strategy and funding details for annual reduction practices are described in Element 2.

Base Programs that Provide Annual Reductions

The following list of practices is included in Maryland's 2009-2011 Milestone. Additional strategy and funding details for annual reduction practices are described in Element 2.

A) Continue Use of Best Available Technology for Septic Systems

The initial 2-Year Milestone (2009-2011) set a goal of upgrading 3,000 septic systems to best available technology (BAT)

Strategy

Through fiscal year 2009, 900 systems were upgraded with BAT and 2,100 additional septic systems are anticipated to be completed by adding nutrient removal technology by the end of 2011.

Maryland will continue the existing program of upgrading septic systems with BAT nitrogen removal technology. Based on this program and the estimated annual BRF funding of $7.8 million, Maryland projects the upgrade of 600 septic systems annually from 2012 to 2017 for an additional 3,600 systems over six years.

Based on the design of the current program, and current funds, Maryland will upgrade 5,700 systems statewide between 2010 and 2017. (See Strategy "C" below for a discussion of additional upgrades beyond the current program.)

Anticipated Load Reduction
51,186 lbs nitrogen reduced

Funding
The program is funded by the Bay Restoration Fund (BRF). A $30 annual fee is collected from each home served by an onsite system. The average State income between FY2007 and FY 2010 was over $14 million per year. Sixty percent, or approximately $8.5 million/yr, is used for septic system upgrades and the remaining 40 percent is required to be used for cover crops.

Estimated Cost for the upgrade of 3,600 septic systems (2012-2017):
Based on the installation and maintenance costs, the average cost of an upgrade is estimated to be $13,000. The total annual cost to upgrade of 600 systems (@13,000 per system) is $ 7.8 million.

Annual Need for 2012-2017

Annual capital cost for 600 (@$13,000 per septic)	$ 7.8 million
Annual MDE administrative cost	$ 0.7 million
Annual average BAT cost (BRF)	$ 8.5 million

	From BRF (million)	Needed Funds (million)
SFY2012	8.5	8.5
SFY2013	8.5	8.5
SFY2014	8.5	8.5
SFY2015	8.5	8.5
SFY2016	8.5	8.5
SFY2017	8.5	8.5
Total Amount	51.0	51.0

Total Annual Cost of upgrade of 3,600 systems (@13,000 per system):

Estimated cost of 2,100 systems (2010 – 2011):	$27.3 million
MDE administrative cost (2010 – 2011):	$ 2.2 million
Estimated cost of 3,600 systems (2012-2017):	$46.8 million
MDE administrative cost (2012-2017):	$ 4.2 million
Total Cost 2012-2017 (BRF funding)	$80.5 million

Additional funding of $106,000 is being provided through the Chesapeake Bay and Coastal Bays 2010 Trust Fund to repair of 10 failing septic systems in the Critical Area of the Middle Chester watershed.

B) Septic hookups to ENR plants

Strategy
Connect 930 failing septic systems to Wastewater Treatment Plants with advanced nutrient removal technologies.

Addressing failing septic systems is a high priority for the State. Maryland is funding hookups of 704 failing septics to Wastewater Treatment Plants with advanced nutrient removal technologies as a gap closer to meet Maryland's 2-year Milestone by the end of 2011. The total cost of these connections is estimated at $23 million or approximately $32,700 per connection. These projects are scheduled to be completed by 2011. Between 2012 and 2017 Maryland expects to fund connection of at least 226 additional failing septics to Wastewater Treatment Plants. A total of 930 failing septic systems will be connected to plants by 2017.

Anticipated Load Reduction
This strategy will achieve the following nitrogen load reductions:

704 connections:
6,200 lbs of N reduced

226 connections:
1,990 lbs of N reduced

Total Load Reduction 930 systems
8,190 lbs N reduced

Funding Need from 2012-2017

Total cost of 704 connections:	$23.0 million
Total cost of 226 connection:	$12.7 million
Total cost of 930 septic connections:	$35.7 million

Connection of 704 systems is fully funded and planned to be completed by 2011. Based on estimated project costs and funding to-date, an additional $3.6 million in local funds will be needed to complete connection of 226 septic systems to wastewater treatment plants.

Funding Strategy
These projects are funded by the Water Quality Revolving Loan Fund (WQRLF) loans and supplemental assistance grants.

The Supplemental Assistance Program provides grant assistance to local governments for planning, design, and construction of needed wastewater facilities. This program provides state grant funding for sewerage projects that are needed to address high priority public health or water quality problems. Funding priority is given to disadvantaged communities and/or communities that are non-compliant with their water quality permits. This Program helps pay for the connection of older, established communities with failing septic systems to public sewers. In addition, the Maryland Water Quality Revolving Loan Fund (WQRLF) established by the Federal Government in the Clean Water Act of 1987 (P.L. 100-4) makes below market rate of interest loans to local governments for water quality improvement projects.

Connection of 704 failing septics to WWTPs is being funded by the above programs as well as local government. In addition, over $1 million was provided by federal government to complete these projects. No additional funding will be needed to complete these projects.

Connection of 226 systems is also being funded by the above programs. To date, MDE provided almost $3.6 million in SRF and $0.5 million in Supplemental Assistance grants. Additional $3.6 million in SRF and $1.4 million in Supplemental Assistance grants was authorized in FY 2011. No additional State funding will be needed. Local government will provide the remaining $3.6 million to complete these projects.

C) Require upgrade of all septic systems in the Critical Area (CA) with BAT

There are approximately 46,300 septic systems in the Critical Area that drains to the Chesapeake Bay.

Strategy (beyond current program)

This strategy requires the upgrade of 70% of the existing 46,300 septic systems in the Critical Area by 2017. This requires 32,379 septic systems to have nutrient removal technology added.

Of the 32,379 systems, the existing program will upgrade 4,827 septic systems, leaving a remainder of 27,552 upgrades to be accomplished through additional grant funding or regulation.

Estimated Cost:
The average cost of BAT upgrade is estimated to be $13,000. The total cost to upgrade the remaining 27,552 septic systems is $358.2 Million.

Funding Strategy
Upgrading septic systems in the Critical Area will be accomplished through a combination of funding and regulatory requirements that will be phased in. Current regulatory requirements will be gradually expanded and funding for upgrades will supplement the installation of upgrades as available. State law requires that new and replacement systems in the Critical Area are to be upgraded and, for the next three years, that grant funds be provided for those upgrades of replacement systems. During FY2011, Maryland will assess options and develop a detailed strategy for implementation setting forth a timeline for expansion of regulatory requirements, the extent to which sizing grant awards based on a property owner's income will increase the number of systems that can be upgraded using BRF funds, and the potential for tax incentives or credits to incentivize upgrades. This detailed plan will be completed in 2011. Necessary regulatory and/or legislative changes will be initiated in 2012 according to the plan developed in 2011.

Sector Additional Need:

MDE

- 3 FTEs for technical assistance for additional 27,552 septics. - $1.35 million
- 3 FTEs for Enforcement and Verification of additional septics- $1.05 million
- Local costs to be identified in Phase II

Anticipated Load Reduction
247,416 lbs nitrogen reduced

5.2.5 Agriculture

Maryland agriculture loads to the Bay have reduced significantly over the last 25 years.[21] Implementation progress through 2009 show a 38% decline in agricultural loads for nitrogen and a 40% decline in phosphorus loads (delivered). The agricultural sector will need to achieve an additional 23% reduction in nitrogen and 12% in phosphorus loading needed to meet the Final Target Load. Through a combination of voluntarily programs for BMP implementation, regulatory programs for nutrient management and animal feeding operations and the gradual loss of agricultural land, agricultural loads to the Bay, in Maryland, constitute 39% of the total source sector loading (Figure 5.1).

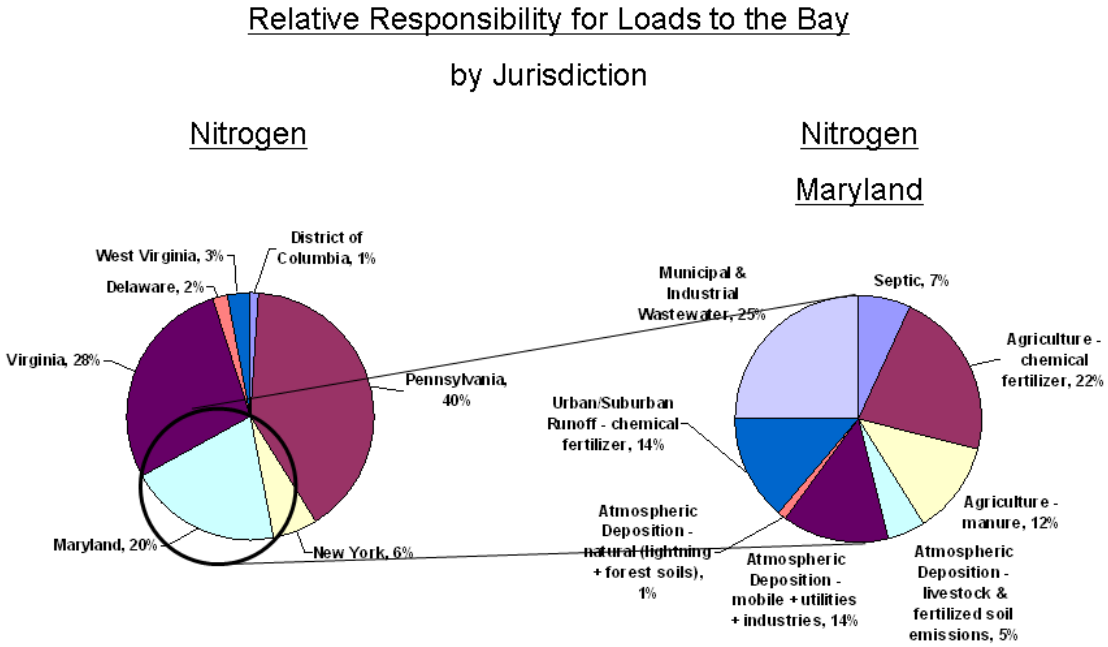


Figure 5.1 – Relative Responsibility for Loads to the Bay [22]

[21] Data source: Chesapeake Bay Program Watershed Model P5.3_Loads-Acres_07302010 files for 1985 No Action compared to 2009 progress run.
[22] Source: Chesapeake Bay Program Watershed Model, Phase 4.3. 2007.

In order to develop programs and policies to accelerate our implementation and gain further reductions, we need to recognize where within the agricultural sector the loads are coming from and focus our efforts to target our resources in effectively managing these loads. As mentioned previously, agriculture is responsible for 39% of the Maryland loading to the Bay. Within the 39% total Ag load, chemical fertilizer represents 22% of the nutrient inputs and animal manure contributes 12% of the load, with air deposition from chemical fertilization and livestock emissions providing an additional 5% of the total loading. The manure loads for livestock, that comprise 12% of the total loading, are derived mainly from poultry (6% of the total Maryland load) and an expanding horse population with beef cattle and dairy and swine providing a small percentage of the remaining load. Going forward, Maryland's plan to address further load reduction within the agricultural sector should recognize and reflect the diverse nature of where the agricultural loadings are originating and how to effectively manage them effectively.

The remaining gap to meet the 2017 goals for agriculture is 1.1 million lbs of nitrogen and approximately 44,000 pounds of phosphorus reduction (delivered load).[23] Although Maryland's agricultural options to fill this gap will focus mainly on nitrogen reduction through additional implementation of some of the 2-Year milestones and additional controls from other BMPs, additional phosphorus reduction will be realized for these practices and if not needed to meet the TMDL may be utilized for trading between source sectors.

Enhanced Programs that Provide Annual Reductions

Meaningful strategies to reduce nutrient and sediment loads in the agricultural sector will be based on three key elements. The first group of strategies focuses on applying effective conservation technologies in the management of agricultural land. Existing and evolving tools will provide water quality benefits locally and to the Chesapeake Bay as well as enhancing capacity to produce food and fiber. The second group of strategies revolves around the proper management of animal waste and related phosphorus issues. Using best available technology, Maryland will address critical challenges related to animal agriculture. The third group of strategy elements key on the sound use of crop nutrients and how to apply the latest refinements in agronomic recommendations, timing and methods of applications to maximize crop utilization and minimize potential for nutrient losses.

Details for annual reduction practices are described in Element 2

Managing the Land to Improve Water Quality

A) Cover Crops

Nutrients may remain in the soil after a crop is harvested, regardless of nutrient uptake by summer crops, especially during drought years. During the winter, these nutrients, particularly nitrate, are subject to leaching to groundwater. To help prevent nitrate leaching, small grains (rye, barley or wheat) are planted without fertilizer in September or early October on land otherwise fallow over winter. The plants, in turn uptake the residual nitrogen into their tissues as they grow, preventing it from leaching to groundwater. In addition, the plants and roots of cover crops help anchor the soil to

[23] See Tables 1.1, 1.2, and 1.3 Total Interim and Final Target Loads by Source Sector above.

decrease erosion and reduce phosphorus losses, add organic matter to soil and help suppress weeds.

Strategy
MDA Winter Cover Crop Program provides cost share support to promote the planting of both traditional cover crops and cover crops which may be harvested for grain, referred to as commodity cover crops. In both traditional and commodity cover crops, no fall fertilizer is applied. Maryland has incentivized payment rates to maximize the program's effectiveness through increase funding for certain grain types, location, planting dates, and application methods. Maryland has an annual goal of 355,000 acres of cover crops on private lands.

In the fall of 2011, MDA plans to initiate a regulatory change within the nutrient management regulations to discontinue any fall fertilization of all small grain crops unless a soil test shows residual nitrogen levels are not sufficient to provide an adequate stand of the crop. All small grain crops planted for harvest outside the MDA Winter Cover Crop Program that did not receive fall fertilizer would function as a cover crop and would be tracked toward WIP implementation goals.

Annually plant 180,000 acres of commodity and 175,000 acres to traditional cover crops (355,000 acres).

Estimated Cost
Total Costs to implement strategy 2012-2017 $107,400,000
Annual Cost: Cost Share Incentives- $17,900,000
Staffing- (see Technical Assistance Program)

Funding Strategy
Funding is provided through Bay Restoration funds, Chesapeake and Coastal Bays Trust Fund and Farm Bill programs. The Maryland Department of Agriculture will work with NRCS to utilize new Farm Bill funding to offset State expenditures for program costs.

Anticipated Load Reductions
355,000 acres annually/2,079,400 lbs N

Contingency
If this annual goal is not met in 2013, Maryland will put in place regulations in 2014 to require the use of cover crops on acreage that receives manure or biosolids.

B) Soil Conservation Water Quality Plans

A Soil Conservation and Water Quality Plan (SCWQP) is comprehensive plan that addresses natural resource management on agricultural lands and utilizes best management practices (BMPs) that control erosion and sediment loss and manage runoff. SCWQPs include management practices such as crop rotations and structural practices such as sediment basins and grade stabilization structures. At the request of a farmer, a Soil Conservation District, Maryland Department of Agriculture (MDA) or USDA professional works with the farmer to determine the group or system of practices needed to address specific erosion and runoff concerns on the farm. The practices are designed to

control erosion within acceptable levels and to be compatible with management and cropping systems. A SCWQP can be used for up to ten years without revision if substantial changes in management do not occur. Nutrient reduction is only one of many benefits derived from SCWQPs. Also included in a SCWQP are recommendations concerning forestry management, wildlife habitat and plantings, pond construction and management, and other natural resource management recommendations.

Strategy
Local soil conservation district staff write plans for landowners and operators through a combination of state, federal and local trained planner staff. Plans need constant updates due to changes in the landscape, ownership or the operation and plans that expire after 10 years. All current plans that expire every ten years will need to be rewritten. Soil Conservation and Water Quality Plans will cover a total of 764,630 acres. BMPs implemented as part of a SCWQP include grass swales, grass waterways, diversions, drop structures, contour strips, etc.

Funding
Soil conservation planners are funded through state general funds, federal Farm Bill funds, Chesapeake Bay and Coastal 2010 Trust fund and Chesapeake Bay Implementation grant funds. For staffing needs, see (P) Technical Assistance for Soil Conservation Districts below.

Total cost to implement strategy 2012- 2017 = $11,667,402

Funding Strategy
Cost share funding provided by MACS, and federal Farm Bill programs.

Anticipated Load Reductions
257,049 ac/159,371 lbs N from the milestone actions for a total of 474,070 lbs reduction for the total acreage of 764,630.

C) Conservation Tillage

Conservation Tillage involves planting and growing crops with minimal disturbance of the surface soil. No-till farming, a form of conservation tillage, is used to seed the crop directly into vegetative cover or crop residue with no disturbance of the soil surface. Minimum tillage farming involves some disturbance of the soil, but uses tillage equipment that leaves much of the vegetative cover or crop residue on the surface.

Strategy
Maintain the existing extent of coverage at 764,630 acres of conservation tillage. MDA will collect information on Conservation Tillage acres utilizing the National Agricultural Statistics Service (NASS) farmer survey data on the level of tillage implementation.

Funding
Incentives for farmers to utilize conservation tillage are currently available through Farm Bill programs.

Funding Strategy
Continued incentive payment through Farm Bill programs

Anticipated Load Reductions
764,630 ac/3,524,944 lbs N

D) Continuous No Till

The Continuous No-Till (CNT) BMP is a crop planting and management practice in which soil disturbance by plows, disk or other tillage equipment is eliminated. CNT involves no-till methods on all crops in a multi-crop, multi-year rotation. When an acre is reported under Continuous No Till, it is not eligible for additional reductions from the implementation of cover crops and nutrient management application reductions because the benefits of cover crops and nutrient management application reductions are accounting in the CNT.

Multi-crop, multi-year rotations on cropland are eligible. Crop residue should remain on the field. Planting of a cover crop might be needed to maintain residue levels. Producers must have and follow a current nutrient management plan. The system must be maintained for a minimum of five years. All crops must be planted using no-till methods.

Strategy
Maintain 150,000 acres of no-till farming, a form of conservation tillage in which seed is applied into the vegetative cover or crop residue with no disturbance of the surface soil. Information on continuous no till is collected by MDA. Maryland's 2-Year Milestone is to document up to 150,000 acres eligible under this management practice.

Funding
Incentives for continuous no-till are available through Farm Bill programs.
Total to implement strategy 2012-2017 = $3,000,000
Annual cost = $500,000

Funding Strategy
Continue to utilize Farm Bill programs to provide incentives.

Anticipated Load Reductions
150,000 ac/150,000 lbs N over and above the load reduction for conservation tillage.

E) Water Control Structures / Drainage Management

A structure in a water management system that manages runoff from farm fields, controls the direction or rate of flow, maintains a desired water surface elevation or increases the retention time of the water.

Strategy
The practice may be applied as a management component of a water management system to control the stage, discharge, distribution, delivery, or direction of water flow. Water control structures function similar to a stormwater pond and provide in field retention of

water to allow denitrification to occur. Maryland's 2-Year Milestones provide for up to 7,250 acres of cropland managed by water control structures.

Estimated Cost
Total Amount to Implement 2012-2017 = $981,600
Annual Cost = $163,600

Funding Strategy
Currently 87.5% of the funding for this practice is available through the Maryland Agricultural Cost Share program and Farm Bill programs.

Anticipated Load Reductions
7,250ac/64,800 lbs N

F) Stream Protection with Fencing

Direct animal contact with surface waters and resultant streambank erosion often results in nutrient loss from pastures and damage to waterways. Stream protection with fencing involves the fencing of narrow strips of land along streams to completely exclude livestock. The fenced areas may be planted to trees or grass, but are typically not wide enough to act as streamside buffers. If this is done, remote watering and stream crossings must be provided.

Strategy
Maryland's 2017 strategy includes installing an additional 3,800 acres of fencing.

Estimated Cost
Total Cost to implement strategy 2012-1017 $353,800
Annual Costs $58,966

Funding Strategy
Funding is provided by the Maryland Agricultural Water Quality Cost Share program (MACS) and Farm Bill programs.

Anticipated Load Reduction
3,800 ac/ 25,802 lbs N

G) Stream Protection without Fencing

This BMP involves the use of troughs or "watering holes" in remote locations away from streams, as well as the placement of stream crossings. Despite its designation in the Tributary Strategy documents, the stream crossings usually have some length of fencing adjacent so that livestock will not bypass the crossings. In some instances, trees are planted away from the stream to provide shade for the livestock.

Strategy
Maryland's 2017 strategy includes installing an additional 3,000 acres of the BMP.

Estimated Cost
Total Cost to implement strategy 2012-2017 = $370,800
Annual cost = $61,800

Funding Strategy
Funding is provided by the Maryland Agricultural Water Quality Cost Share program (MACS) and Farm Bill programs.

Anticipated Load Reduction
3,000 ac/10,200 lbs N

H) Streamside Grass Buffers

Grassed Buffers are linear strips of maintained grass or other non-woody vegetation between the edge of fields and streams, rivers or tidal waters. Grassed buffers help filter nutrients, sediments and other pollutants from runoff, as well as remove nutrients from groundwater.

Strategy
Farmers and operators utilize grass buffers where forest buffers are not appropriate. New CAFO regulations require additional buffers. As part of Maryland's 2017 strategy up to 7,000 acres will be implemented.

Estimated Cost
Total Cost to implement 2012-2017 $1,265,000
Annual Cost $210,833

Funding Strategy
Funding provided by MDA and USDA, Farm Service Agency through the CREP program.

Anticipated Load Reductions
Private: 7,000 ac/119,420 lbs N

I) Streamside Forest Buffers

Riparian Forest Buffers are linear wooded areas along rivers and streams that help filter nutrients, sediments and other pollutants from runoff as well as remove nutrients from groundwater. In addition to their ability to improved water quality, their value at enhancing terrestrial and aquatic habitat make forest buffers an important BMP for natural resources managers.

Strategy
Maryland landowners and farmers utilizing the CREP program continue to convert land to riparian buffers. New incentive rates and stepped up outreach activities will encourage more participation. Part of Maryland's 2017 strategy will provide for an additional 3,000 acres.

Estimated Cost
Total Cost to implement 20121-2017 $4,912,500
Annual Cost $818,750

Funding Strategy
Funding is provided by MDA and USDA for implementation and land rental rates

Anticipated Load Reductions
Private: 3,000 ac/86,160 lb N

J) Wetland Restoration

Wetlands are highly valuable lands in terms of their abilities to both improve water quality and as important habitat for many species. A wetland is an area of land where the soil is wet or covered with water. Wetlands are often called swamps, marshes, or bogs. This strategy entails the reintroduction of wetlands in agricultural settings where they have been lost in the past.

Strategy
Focus on hydric soil and marginal lands and partner with Ducks Unlimited and other government and private entities and landowners. Maryland's 2017 strategy calls for 1,000 acres for this practice.

Estimated Cost
Total Cost to implement 2012-2017 $3,375,000
Annual Cost $562,500

Funding Strategy
Cost-Share funds are available for the implementation of wetlands on eligible agricultural land through the Maryland Agricultural Water Quality Cost-Share (MACS) program, 2010 Chesapeake Bay Trust Fund, USDA's Conservation Reserve Enhancement Program (CREP), and Ducks Unlimited, and other State and federal cost share programs... Funding for wetlands creation, restoration, and enhancement is also available from various federal sources, State and local governments and nonprofit organizations.

Anticipated Load Reduction
Private: 1,000 ac/28,720 lbs N

K) Retirement of Highly Erodible Land (HEL)

This option involves the removal of highly erodible land from crop or hay production. The land is planted into either grass or forest and is usually not disturbed for at least 10 years.

Strategy
Focus on steeply sloped areas. Maryland's 2017 strategy includes a goal of 2,300 acres for this option.

Estimated Cost
Total Cost to implement 2012-2017 $3,000,000

Annual Cost $500,000

Funding Strategy
Funding provided by MDA and USDA-Farm Services Agency through the CREP program.

Anticipated Load Reductions
2,300 ac/21,965 lbs N

L) Cropland Irrigation Management

Cropland under irrigation management is used to decrease climatic variability and maximize crop yields. The potential nutrient reduction benefit stems not from the increased average yield (20-25%) of irrigated versus non-irrigated cropland, but from the greater consistency of crop yields over time matched to nutrient applications. This increased consistency in crop yields provides a subsequent increased consistency in plant nutrient uptakes over time matched to applications, resulting in a decrease in potential environmental nutrient losses.

Strategy
Utilizing NASS data Maryland will begin tracking acres under irrigation for reporting to the Chesapeake Bay program. It is estimated that this will impact 40,616 acres.

Estimated Cost
Total Cost to implement 2012-2017 $1,200,000
Annual Cost $200,000

Funding Strategy
Funding provided by Farm Bill programs .

Anticipated Load Reductions
40,616ac/280,000 lbs N annually

M) Vegetative Environmental Buffers

A vegetative environmental buffer, or VEB, is the strategic dense planting of combinations of trees and shrubs around poultry houses to address environmental, production, and public relations issues. Research conducted by the University of Delaware have indicated that mature tree plantings can offer filtration benefits for poultry operations by entrapping dust, odor, feathers, and noise emitted by air exhaust from ventilation systems. Documentation on the effectiveness of VEB's in reducing nitrogen losses to the environment through ammonia emission reductions needs further research. This practice has been proposed as a land use change for the area directly planted to trees and shrubs. From 2010-2011, 50 vegetative environmental buffers and in 2012-2017, 250 vegetative environmental buffers will be implemented.

Strategy
Currently utilized and promoted by farmer and the poultry integrators. New research by ARS will help quantify benefits. Will resubmit results to the Chesapeake Bay Program for approved BMP efficiency.

Estimated Cost
Total cost to implement strategy 2012-2017 = $750,000
Annual cost = $125,000

Funding Strategy
The practice is currently promoted and being implemented with Farm Bill cost-share incentives.

Anticipated Load Reduction
75 acres/1,950 lbs N/annual

N) Vegetated Open Channels

A suite of innovative alternative practices designed to enhance the removal of nutrients once they leave the field. These include increasing vegetative buffers that protect and process nutrients and sediment in drainage channels. This may include reengineering of drainage channels to slow flow, reestablish floodplains or redirect storm flows to offline wetland areas, and converting to environmentally friendly maintenance practices to mimic original stream characteristics.

Strategy
To manage on the eastern shore, 1,212 acres draining to channels with vegetative buffers. Maryland's Drainage Management program would incentivize cost share funding for maintenance activities to promote environmentally friendly options and practices.

Estimated Cost
Total Cost to implement 2012-2017 = $1,800,000
Annual Cost = $300,000

Funding Strategy
Reestablishment of funding for Public Drainage Association maintenance activities as required under COMAR Agricultural 8-602 and 2 new FTE to manage maintenance and inspection activities. Investigate Trust funding and grant programs NFWF, CIG, etc.

Anticipated Load Reductions
1,212 acres; nutrient reduction TBD

O) Stream Restoration in the Non-Coastal Plain

Restoration of drainage channels and streams utilizing stream restoration techniques. Options include instream and riparian wetlands, tree shading, designing channels to reestablish natural flow paths and establishing habitat.

Strategy
Farmers and landowners could adopt this strategy to enhance in-stream flow and habitat improvements.

Estimated Cost
Total Cost to implement 2012-2017 = $900,000
Annual Cost = $150,000

Funding Strategy
Explore grants and Chesapeake Bay and Coastal Trust Fund for demonstration projects. Possible tax incentive to pay for implementation. Requires legislative change to expand MACS program to become eligible for cost-share funding.

Anticipated Load Reduction
2 miles: nutrient reduction TBD

P) Technical Assistance for Soil Conservation Districts

To provide adequate technical resources to the farm community will require additional trained technical staffing at the Maryland Department of Agriculture. The ability of the agricultural sector to achieve the TMDL goals is constrained by a lack of staffing to outreach, educate, plan, design, engineer, and provide construction inspection. Program delivery is only effective if "boots on the ground" are available to connect with the farm community.

Strategy
Under the Water Quality Improvement Act of 1998 specific language was inserted in the Agriculture Article §8-405 regarding "Adequate personnel and resources for Soil Conservation Districts". The statute requires a minimum of 110 technical staff in the SCDs. In 2007 a bill (HB2) was passed, that provided a 5 year funding plan to bring state technical staff in SCD up to 110 employees by 2012. MDA would introduce legislation to extend HB2 for 5 more years, to 2017, and revise the funding plan to provide for 160 FTE. This would require 80 additional FTEs from current staffing levels by 2017.

Estimated Cost
Total cost to implement 2012-2017 = $67,800,000
Annual amount $11,300,000

Funding Strategy
This will require increasing General Funding for conservation staff in the Office of Resource Conservation Operations from the current level of $5.5 million over the next 6 years to an annual amount in 2017 of $15 million to support technical staff at 160 FTE. Annual allocations would need to increase by $2 million annually the first 4 years and $1.5 million additional in 2017. This proposed legislative change would be done during the 2013 General Assembly session.

Q) Verification and Inspection of Cost Shared Practices

Verification and inspection of State and federal cost shared practices to assure they are implemented and maintained according to standards and specifications as outlined in Chapter 6 of this Plan. To assure adequate compliance and tracking, additional resources are needed.

Strategy

Building upon the standard inspection protocol for MACS outlined in Chapter 6, in 20103 MDA will hire three additional FTEs to conduct additional field inspections.

Funding

Total cost to implement 2012-2017 = $900,000
Annual Cost = $150,000

Funding Strategy

MDA will request EPA Chesapeake Bay Regulatory Accountability Program (CBRAP) grant funds for additional verification staff.

Managing Animal Waste, Biosolids and Phosphorus

A) Soil Phosphorus Balance

Maryland's goal is to provide sufficient soil phosphorus availability for agronomic optimum crop production while simultaneously minimizing the potential for off-site phosphorus losses from agricultural production fields to natural water bodies. Addressing this soil phosphorus balance requires a systematic approach to provide tools and technology that will work synergistically for the farmer and the environment. Our ability to accurately assess and meet the phosphorus needs of crop production must be balanced with implementation of our best science on phosphorus transport that will minimize the movement of phosphorus through surface or sub-surface drainage pathways. The best tools to evaluate the risk of phosphorus movement need to consider a wide array of factors and site conditions. As the understanding of off-site phosphorus dynamics has advanced it has become clear that less manure and biosolids will be land applied. These outcomes require management solutions that must also include economically viable alternative uses of animal manures, biosolids and other organic wastes. Development of market-based solutions that include value-added or energy-related technologies is essential.

a. P Site Index

The P Site Index is a site-specific assessment tool that identifies the relative risk for phosphorus losses from agricultural production fields to nearby bodies of water. The P Site Index is currently used in the development of agricultural nutrient management plans.

The State of Maryland will support development of a revised P Site Index that incorporates the best available science in an effort to more appropriately identify the

risk for phosphorus loss from agricultural lands. The revised P Site Index will offer site-specific management options for reducing off-site phosphorus transport.

The P-site index has been used in Maryland to implement nutrient management requirements since 2001. The length of program implementation has yielded a large data-set allowing University of Maryland scientists to assemble information from 9000 fields from 2001-2008. They are currently in the process of being analyzed to refine the P Site Index tool and better calibrate phosphorus risks. New factors may include differentiation between Piedmont and Coastal Plain calibration factors and differentiated management scenarios.

The process of revising the current P Site Index will be a collaborative effort beginning in late 2010/early 2011 with a highly focused working session for soil P scientists from regional land-grant universities, hosted by the University of Maryland's College of Agriculture and Natural Resources, on December 9 and 10, 2010. The P science working session will be followed by a technical workshop in Spring 2011, at which draft revised P Site Index scenarios will be vetted with technical, science policy and regulatory agency professionals with the goal of gathering input and suggestions for modification, improvement and refinement of the revised P Site Index. The expected revisions of the current P Site Index will more accurately assess P transport and delivery pathways across different landscapes, will incorporate site-specific soil P saturation information, and emphasize the importance of immediate manure and biosolids incorporation following land application. The science re-evaluation will improve prediction of the risk of off-site P transport by surface loss pathways in the western region of Maryland and more accurately assess the risk of off-site P transport by subsurface drainage pathways on the Eastern Shore. Initial preliminary review of probable revisions to the P Site Index indicates significant reductions in cropland eligible to receive additional phosphorus, particularly in areas of historically high concentrations of animal agriculture.

The information garnered at the technical workshop will be used to produce the revised P Site Index. An educational implementation forum for regional state agency personnel and extension educators will be held in the late spring 2011. The goal of the implementation forum will be to discuss relevant recent scientific advances, evaluate the past performance of the current P Site Index, and offer approaches for implementation of the revised P Site Index. It is anticipated that the revised P Site Index will create an increased need for alternative uses of manure and biosolids, as opposed to land application on agricultural fields, especially in western Maryland and the lower Eastern Shore. Maryland anticipates that implementation recommendations for a revised P Site Index will be prepared by summer 2011, at which time Maryland's BayStat will begin reviewing recommendations from the workshop for inclusion as state policy with an implementation target date for fall 2011.

Beginning in 2013, the State will report aggregated data reflecting phosphorus applications to cropland within specifically defined geographic areas. Data will be gathered from annual nutrient management reporting information and will reflect phosphorus applications by crop type before and after changes to the P-site index.

Additionally, the entire P-site index will be peer reviewed every five years by a scientific panel of subject matter experts, appointed by BayStat, beginning in 2015. This review of the P-site index will be based on the pounds of reduction of phosphorus applied for crop production as it relates to achieving the intended goal of minimizing transport and reducing phosphorus reserve levels in soil.

b. Alternative uses of manure and biosolids

The second, and equally important, element to address phosphorus issues is providing alternative uses for the manure and biosolids that will no longer be land applied as a result of revisions to the P Site Index risk assessment tool.

Analyses have instructed that there is not one single option and practical solutions will vary based on market conditions, available capital, geography, types of manures and biosolids managed, their location and concentration. While challenging, there are a few threads that seem constant in every discussion. The most successful strategies will be likely be market-based, providing returns to capital and returns to management for farms generating manure, wastewater facilities generating biosolids and end users of products. Strategies that can provide multiple or additional benefits or products will present more market flexibility and avoid risks with single stream outputs. For example, processes that provide greater utilization of fertilizer by-products through a more balanced nitrogen to phosphorus ratio will likely have greater applicability in the region. The availability or development of demand for end products or by-products is key to generating capital returns.

The generation of energy coupled with marketable by-products, for example, provide a more systematic and comprehensive path to managing excess manure and biosolids. While we have opened certain doors through the authorization of renewable energy credits, there remain a few barriers to fully implementing energy-based strategies. Working with utilities to ensure adequate opportunity with respect to net metering will be important.

Cost effectiveness of farm scale technologies must be weighed against farmers' interest or capacity to add another level of management to the operation. To the extent that third party, private sector solutions can be developed and sustained through sufficient return to capital and management is the ideal.

The opportunity now is to initiate a pilot project in Maryland to test and demonstrate the viability of available technologies. Thermophyllic or anaerobic digestion of animal wastes and biosolids for energy and fertilizer by-products, generating bio-char through pyrolysis, and smaller scale waste to energy systems, by example, are all ripe for application in the region, including Maryland's Eastern Shore.

Agricultural and wastewater interests in the region will need to work with EPA and USDA to secure funding to develop and deploy innovative manure and biosolids management technologies. As discussions begin on the next Farm Bill, priority should be given to alternative uses of manure. Land grant universities should also be

engaged in seeking resources to develop and demonstrate effect alternative uses of manure and biosolids.

Interim strategies will need to direct farmers to Alternative Manure Use practices as supported by NRCS and Farm Bill programs

Funding
New Farm Bill authorization, Energy interests, wastewater treatment plant owners, private investment or grants

B) Manure Transport

The Manure Transport Program provides grants to help poultry and dairy producers transport excess manure off their farms. Animal producers with high soil phosphorus levels or inadequate land to utilize their manure in accordance with the nutrient management plan can receive cost-share assistance of up to $20 per ton to transport excess manure to other farms or alternative use facilities that can use the product in an environmentally sound manner. Cost-share rates are 20 percent higher for farms located in Dorchester, Somerset, and Wicomico and Worcester counties in response to legislative requirement to target the Lower Eastern Shore due to the large number of poultry operations in this region and their potential impact on water quality.

Strategy
The Maryland Department of Agriculture coordinates and tracks manure transport to assure manure that is relocated to another farm or out of the watershed is utilized appropriately according to the sending and receiving farms nutrient management plan. Annually 50,000 tons of manure is relocated. Approximately 35,000 tons are transported out of the watershed. Maryland's 2-Year Milestone is to transport out of the watershed and additional 10,000 tons to alternative uses. The total relocated is 60,000 tons, with 45,000 tons removed out of the watershed. By 2017 Maryland will provide transport for an additional 25,000 tons for a total of 85,000 tons relocated. Excess manure is transported away from farms with high soil phosphorus levels to other farms or locations that can use the manure safely.

Funding
Total Cost to implement 2012-2017 = $6,750,000
Annual Cost = $1,125,000

Funding Strategy
Funding is provided by the poultry companies, state general funds, the Chesapeake and Coastal Trust Fund.

Anticipated Load Reductions
45,000 tons of manure transported out of the watershed by 2011
85,000 tons of manure transported out of the watershed by 2017.

C) Dairy Manure Incorporation

On fields that utilize dairy manure as fertilizer, the manure is incorporated into the soil at the time of application using low disturbance technology. This practice can reduce ammonia loss to the atmosphere by up to 95% compared to traditional surface application

Strategy

To help offset the cost to the farmer, custom applicators with the equipment are available if the demand is sufficient. The 2-Year Milestone is for 2,500 acres of cropland utilizing this technology.

Estimated Cost

Total Cost to implement by 2017 = $780,000
Annual Cost = $130,000

Funding Strategy

Cost share funding to offset the costs could be available from the Chesapeake and Coastal Bays Trust Fund and the Farm Bill programs. Equipment costs are currently eligible for income tax subtraction modification.

Anticipated Load Reductions

2,500 ac/22,000 lbs N annually
5,000 acres annually by 2017 reduces 44,000 lbs

D) Poultry Litter Incorporation

Poultry litter is incorporated into the soil at the time of application as fertilizer utilizing minimum tillage technologies which significantly reduce ammonia loss. Research has shown it extremely effective in reducing both volatilization of N and sediment/P losses from rain events. Further N reductions will be realized by reducing the total N application because more ammonia is captured in the soil for plant utilization and less ammonia is lost to the atmosphere.

Poultry litter is incorporated into the soil at the time of application as fertilizer utilizing minimum disturbance technologies which significantly reduce ammonia loss.

Strategy

Currently farmers are utilizing vertical tillage equipment such as the “turbo till” to incorporate manure. A new injection technology is being used and demonstrated on the Eastern Shore of Maryland. Initial 2 years of funding through Conservation Innovative Grants (CIG) and National Fish and Wildlife Foundation (NFWF) grant sources are working with University of Maryland, Penn State and University of Delaware researchers to improve earlier prototypes for improved efficiency. Maryland has set a 2017 milestone goal of 2,500 acres utilizing various incorporation options.

Estimated Cost

Total Cost to implement 2012-2017 $350,000
Annual Cost $58,333

Funding Strategy
Funding incentives for incorporation are currently available through Farm Bill programs. MDA will investigate income subtraction modification legislative revision to offset equipment costs during the 2013 General Assembly session.

Anticipated Load Reduction
2,500 ac/13,000 lbs N annually

E) Poultry Litter Storage Structures

Animal Waste Management Systems are designed for the proper handling, storage, and utilization of wastes generated from animal confinement operations. Storage sheds are used for storing for solid wastes. Adequate storage ensures wastes are only applied when crops can use the accompanying nutrients and soil and weather conditions are appropriate.

Strategy
Provide adequate storage of poultry litter for all poultry operations. Maryland's 2017 strategy is to provide for 53 additional operations (27 CAFO and 26 AFO)

Estimated Cost
Total Cost to implement 2012-2017 = $480,000
Annual Cost = $80,000

Funding Strategy
Funding provided by the Maryland Agricultural Water Quality Cost Share program, the Chesapeake and Coastal Bays Trust fund, and Farm Bill programs.

Anticipated Load Reduction
53 operations/11,130 lbs N
27 CAFO/ 26 AFO

F) Livestock Waste Storage Structures

Animal Waste Management Systems are designed for the proper handling, storage, and utilization of wastes generated from animal confinement operations and includes a means of collecting, scraping, or washing wastes from confinement areas into appropriate waste storage structures.

Strategy
Provide adequate storage for all livestock operations. Lagoons, ponds, or steel or concrete tanks are common structures used for the treatment and/or storage of liquid wastes while storage sheds or pits are used to store solid wastes. Controlling runoff from roofs, feedlots, and "loafing" areas are also part of these systems. Adequate storage ensures wastes are only applied when crops can use the accompanying nutrients and soil and weather conditions are appropriate. Maryland's 2017 strategy is to provide for 145 structures (7 CAFO and 138 AFO).

Estimated Cost
Total Amount to Implement 2012-2017 = $5,525,000

Annual Amount = $920,833

Funding Strategy
Funding provided by the Maryland Agricultural Water Quality Cost Share program, the Chesapeake and Coastal Bays Trust Fund and Farm Bill programs.

Anticipated Load Reduction
145 Structures/76,995 lbs N
7 CAFO/138 AFO

G) Runoff Control Systems

This practice retrofits existing animal waste storage structures that may not have runoff control. Runoff controls help prevent runoff from upslope areas and roofs to the feedlot or "loafing" area of animals. By controlling this runoff, potential waste nutrients to streams is kept in an area where it can be better managed. Animal confinement runoff control consists of practices such as upslope diversions and directed downspouts to minimize offsite water entering the facility.

Strategy
Retrofit older operations with roof runoff controls, or clean water diversions. Maryland's 2017 strategy is to retrofit 180 operations (4 CAFO and 176 AFO)

Estimated Cost
Total Cost to implement 2012-2017 $220,000
Annual Cost $36,666

Funding Strategy
Funding provided by the Maryland Agricultural Water Quality Cost Share program, the Chesapeake and Coastal Bays Trust Fund, and Farm Bill programs.

Anticipated Load Reduction
180 systems/11,821 lb N
4 CAFO/ 176 AFO

H) Phytase Enhancement

With the advent of phytase addition to the diet and feed for all poultry in Maryland we have seen a steady reduction in the phosphorus levels in the manure. In early 2004 the Bay Program documented a 16% reduction in P. More recent results show a 24% reduction. The research shows up to a 33% reduction is easily achievable. The current reduction efficiency is 16% current and would increase to 32% by 2017 based on field and production demonstrations. .

Strategy
Update the Chesapeake Bay model with the current 24% reduction. Continue monitoring of P levels in poultry manure to document further reductions.

Estimated Cost
None

Funding Strategy
None-Integrator funding

Anticipated Load Reduction
16% current model 32% proposed reduction in P in poultry manure.

I) Drainage Phosphorus-sorbing Materials (PSMs)

The University of Maryland and the USDA Agricultural Research Service (ARS) have demonstrated through an existing research project at the University of Maryland-Eastern Shore the application of "Phosphorus-sorbing" materials to absorb available dissolved phosphorus in cropland drainage systems for removal and reuse as an agricultural fertilizer. These in-channel engineered systems can capture significant amounts of dissolved phosphorus in agricultural drainage water by passing them through phosphorus-sorbing materials, such as gypsum, drinking water treatment residuals.

Strategy
Based upon the research expand the use and retrofit ditches with water control structures with PSM filters. Can provide for up to 1,000 acres of cropland drainage with additional P removal.

Estimated Cost
Total Cost to implement 2012-2017 $750,000
Annual Cost $125,000

Funding Strategy
Potential funding through Farm Bill programs or the Maryland Agricultural Water Quality Cost Share program (MACS).

Anticipated Load Reductions
1,000ac/40% P reduction TBD

J) Poultry Litter Treatment

A surface application of alum, an acidifier, is added to poultry litter to acidify poultry litter and maintain ammonia in the non-volatile ionized form (ammonium) (reference see Developing Best Management Practice Definitions And Effectiveness Estimates For Nitrogen, Phosphorus And Sediment In The Chesapeake Bay Watershed Final Report December 2009 Dr. Thomas Simpson and Sarah Weammert University of Maryland Mid-Atlantic Water Program).

Strategy
Expand the use by growers by offsetting the cost for utilization. The proposed option could apply to 96,000 tons of poultry manure.

Estimated Cost
Total cost to implement strategy by 2017 $3,300,000
Annual cost $550,000

Funding Strategy
Limited funding through Farm Bill programs for 3 year usage. Work with NRCS to expand utilization and contract limits.

Anticipated Load Reduction
96,000 tons/150,000 lbs N annually

K) Mortality Composting

Composting provides a safe and desirable method for disposing of dead birds by converting nitrogenous materials (manure and birds) and carboniferous materials (straw or sawdust) into a humus-like substance that can be used as a nutrient source for soil building and healthy plant growth. Composting substantially reduces the volume of carcasses, kills pathogens, prevents odors and produces a stable, odorless, humus-like material that is useful as a nutrient source and soil amendment.

Strategy
Requires separate dead bird composters at all poultry operations for bird mortality as part of all CAFO operations.

Estimated Cost
Total cost to implement strategy by 2012-2017 = $1,008,000
Annual cost = $168,000

Funding Strategy
Funding provided by MACS and Farm Bill program.

Anticipated Load Reduction
TBD

Managing Fertilizer and Manure Applications

A) Nutrient Management Compliance

Nutrient management plans outline the optimum use of nutrients to minimize nutrient loss while maintaining crop yield. Soils, plant tissue, manure and/or sludge tests are used to develop application rates that meet projected crop yields based on soil productivity or historic yields of a site. With plan implementation, farmers follow guidelines for the amount, timing, and placement of nutrients on each crop. Plans are prepared by the University of Maryland Extension and certified private consultants and are typically revised every year but may be written for up to three years to incorporate management, fertility and technology changes.

Strategy
Plans are written by certified private sector nutrient management planners and local University of Maryland Extension staff. Regulatory compliance and enforcement is the responsibility of MDA. Based on field inspections to determine compliance with nutrient management requirements, approximately 75% of operations are in compliance. Non-compliance assessments most often occur for not keeping nutrient management plans up

to date. Therefore MD is using 75% of the 2011 acreage for credit as under nutrient management plans or 993,753 acres.

Funding
Currently MDA has 6 inspection staff to provide coverage for 6,000 operations. To provide adequate inspection, tracking and accountability an additional 8 inspectors and 2 administration staff are required. Additional needs are for MACS cost share funding at $500,000 annually to support plan development and updates. MDA will utilize additional funding of $1,650,000 annually for University of Maryland Extension to provide plan writing assistance, training, and certification.

Total Cost to implement strategy 2012-2017 = $29,100,000
Annual Cost = $4,850,000

Funding Strategy
Funding is provided by state general funds and the Chesapeake and Coastal Bays Trust fund to support MDA regulatory compliance staff and UM Extension technical assistance to farmers. MDA will continue to work with the EPA Tracking and Accountability grant to support program enforcement capacity.

Anticipated Load Reductions
993,753 acres per year / 3,090,572 lbs. N / 268,313 lbs P

B) **Precision/Decision Agriculture**

Precision/Decision Agriculture is used to improve the agronomic, environmental and economical management of crop production in accordance with in-field variability. This management requires the use of a GPS (Global Positioning System) and information management tools such as GIS (Geographic Information System) to input field conditions and assess management information and understand variable management requirements. Precision soil sampling, PSNT testing, variable rate nutrient application, and record keeping/yield monitoring using GPS/GIS software are implemented by agricultural operations to nutrient rates and placement are optimized. There are numerous software programs and agricultural equipment on the market that a program participant may use.

Strategy
Maryland's 2-Year Milestones include quantifying up to 100,000 acres of cropland utilizing this management option. 20,000 acres already exist under this BMP. MDA is working with the University of Maryland in demonstrating and testing innovative equipment, and conducting research to quantify the nutrient reduction. This will be submitted to the Chesapeake Bay Program to adopt as a nutrient reduction efficiency. The University of Maryland Extension and agri-business community will provide equipment and training for operators.

Funding
Total cost to implement strategy 2012-2017 = $13,712,000
Annual cost = $2,285,333

Funding Strategy
Chesapeake and Coastal Trust Fund providing demonstration funding and technical staff to work with farmers. Farm Bill program providing a per acre payment for adoption of management option on the farms.

Anticipated Load Reductions
220,000 ac/ 440,000 lbs N annually

C) 100 foot or 35 foot required setbacks for CAFO manure application

The earlier write up of the CAFO/MAFO strategy is in a different chapter. This chapter describes the different strategy options and each CAFO or MAFO will have a slightly different mix of BMPs depending on the specific farm. There are a number of agricultural management practices that will be implemented on CAFO/MAFO farms (e.g., nutrient management, heavy use area pads, manure storage, manure transport) and we have not accounted for them under the permit section. When the benefits of the permit are accounted for the agricultural practices can be added. Based upon EPA regulations for CAFOs the field spreading of manure is restricted to maintain a 100 foot setback from streams. The setback restriction is reduced to 35 feet if the setback area is vegetated.

Strategy
This is regulatory requirement of the CAFO permit for field spreading. It will require farmers who spread manure to maintain up to 2,500 acres of current cropland in a permanent buffer for compliance.

Estimated Cost
None required

Funding Strategy
none

Anticipated Load Reductions
2,500 ac =30,000 lbs N

D) 10 foot required setbacks for all fertilizer application

MDA and MDE have discussed this so that it will bring consistency to several programs regulating nutrients. To assure that commercial fertilizer and sludge is applied in a manner to have adequate buffer protection. Application of this option requires buffering of 5,280 acres. Requires a regulatory change.

Estimated Cost
None required

Funding Strategy
None

Anticipated Load Reduction
5,280 ac/ 63,360 lbs N

5.2.6 Air

Base Programs that Provide Annual Reductions

The following list of practices is included in Maryland's 2009-2011 Milestone. Additional strategy and funding details for annual reduction practices are described in Element 2.

A) Maryland Healthy Air Act
Implement Maryland's Healthy Air Act (effective January 1, 2009). More than one-third of the pollution entering the Chesapeake Bay comes from the air. Pollutants released into the air (primarily from power plants and vehicle emissions) eventually make their way back down to the earth's surface and are dispersed onto the land and transported into waterways. The emission controls on power plants will reduce nitrogen entering the Bay by up to 300,000 pounds each year and will reduce mercury significantly.

Anticipated Load Reduction
305,882 lbs

Additional Program, Practices and Policies to Meet the 2017 Goal for Air

A) Low Emission Vehicle Requirement
Maryland is implementing the California low emission vehicle requirements. Small reductions will begin in 2013 and be annual..

Anticipated Load Reduction
2000 lbs annually

B) Expand Diesel Engine Retrofit Program
Currently the Port of Baltimore is partnering with the Environmental Finance Center to use stimulus money to retrofit dirty diesel truck engines to 'clean diesel' technologies. One possible strategy is to expand this program to reduce emissions and ultimately a portion of deposition.

Load reduction TBD

5.3 Review of Implementation Tools

To fully develop Phase II of the WIP Maryland will investigate a wide range of implementation options. Maryland will begin this review in January of 2011 and continue throughout Phase II development. The two objectives of this statewide comprehensive study are to promote implementation and assess economic implications. Specific implementation tools are presented below:

Septic Systems

To help meet the septic tank target load, the State will investigate several potential options over the next year. These include connections to Wastewater Treatment Plants with enhanced nutrient removal (ENR) treatment and regulating upgrades for all new and replacement systems.

One option is the use of the Bay Restoration Fund to connect properties using septic tanks to an existing WWTP achieving enhanced nutrient removal (ENR) treatment, where it is cost-effective to do so and where sprawl growth will not be encouraged. As a starting point for discussion, all of the following conditions would need to be met for properties to become eligible for State funds for this option:

1. The environmental impact of the septic tank is documented by the local government and confirmed by MDE.
2. It can be demonstrated that:
    a. The replacement of the septic tank with service to an existing WWTP achieving ENR treatment is more cost-effective for nitrogen removal than upgrading the individual septic tank; or
    b. The individual replacement of the septic tank is not feasible
3. The project is consistent with the County's comprehensive plan and water and sewer master plan;
4. The septic tank was installed as of October 1, 2008, and the property the septic tank serves is located in a Priority Funding Area; and
5. The recipient of Bay Restoration Funds to connect properties using septic tanks to an existing WWTP achieving ENR treatment levels has taken adequate steps to guarantee that any future connection to the WWTP constructed with Bay Restoration Funds also shall meet all of the above conditions.

In addition, the State will assess the benefits of developing personal income criteria to determine the percentage of Bay Restoration Funds that should be available to individuals for upgrades and connecting properties using septic tanks to public sewer.

Stormwater

In 2011, Maryland will develop a stormwater retrofit strategy allowing off-site stormwater retrofits and alternative cost effective practices.

To assist in the development of stormwater utilities and recognizing the barrier of start-up costs, MDE offers financial assistance through low interest loans involving the State Revolving Loan Fund. It also offers a delayed payment plan contingent upon starting a "system of charges."

Natural Filters

Options to increase buffers, wetlands and land retirement on public and private lands have been raised. One option is to develop a program to expand riparian buffers statewide with appropriate limitations. Finally, MD will assess feasibility of adding natural filters, such as oysters, as a BMP.

Technical Assistance

During Phase II, Maryland will develop a comprehensive plan to shift the existing state work force to meet WIP staffing goals.

Tax Incentive Opportunities
In addition to the aforementioned reviews, several potential strategy and contingency options are conducive to tax incentives (corporate, transfer or property) or tax assessments. Given the variety of potential approaches and financial implications Maryland is committing to conduct assessments, with stakeholder involvement, to evaluate the options. In broad terms, the activities that would be subject to potential tax incentives include, but are not limited to, the following:

- Reforestation of residential suburban and other land currently in turf (may include stream buffers as a variation)
- Establishment of non-structural shoreline erosion controls on residential and other waterfront properties
- Transfer of development rights program
- Development of Soil and Water Quality Conservation plans on agricultural land (may include incentives for varying levels of plan implementation)

The proposed timeline for this assessment is as follows:

2011 - Secure funding or task State Comptroller with conducting study. Better define the activities for which tax incentives would be considered in consultation with appropriate stakeholders during the Phase II WIP process. The outcome would be refined study parameters and initiation of the study (or studies).

2012 - Finalize the studies. For options to advance forward, initiate the authorization process, e.g., draft legislation.

2013 - Secure the authority and set up implementation mechanisms including tracking, reporting and evaluation processes. Incorporate into WIP

2014 - Full implementation.

2016 – Evaluation and refinement if necessary.

Once the study is complete any viable opportunities will be added as either strategies or contingencies to Maryland's WIP.

6.0 TRACKING AND REPORTING PROTOCOLS

This section addresses Element 6: Tracking and Reporting Protocols and provides an overview of how Maryland accounts for the implementation of point source and non-point source controls and BMPs in the following sectors:

Point Source
Nonpoint Source
- Agriculture
- Stormwater
- Septics
- Natural Filters

6.1 Point Source

Tracking and Reporting
The Maryland Department of the Environment's Water Management Administration (WMA) is the delegated authority to carry out and administer the NPDES Program in Maryland. MDE's surface water discharge permits combine applicable State and NPDES requirements into one permit for facilities that discharge to state surface waters. Through the surface water discharge permitting process, dischargers are inventoried, inspected and enforced. Dischargers are required to file self-monitoring results at the frequency specified by the permit with WMA in the form of Discharge Monitoring Reports (DMR) and Monthly Operating Reports (MORs). This information is entered in the EPA's Integrated Compliance Information System (ICIS) database by WMA's Compliance Program, which oversees compliance and enforcement activities of State/NPDES discharge permits in Maryland. DMRs are routinely entered into the ICIS system monthly or quarterly as stipulated by the discharge permits. Noncompliance reports are generated from ICIS at least quarterly that will include those permitees in significant noncompliance with permit effluent limits or reporting requirements. The Compliance Program reviews and tracks DMRs manually during physical site inspections and as part of established QAQC procedures to verify data and reporting integrity.

Point source control upgrades are also reported to Maryland's BayStat on a monthly basis through a spreadsheet with a record for each plant, current status (e.g., planning, design, construction), expected completion, etc. The spreadsheet also provides the expected immediate and long-term load reduction for each upgrade. BayStat monitors specific facilities scheduled to complete Enhanced Nutrient Removal (ENR) upgrade within the 2-Year Milestone. BayStat reviews anticipated changes to the schedule or effluent loads and considers proposed contingency actions.

Maryland will work with the federal agencies to ensure any point source control activities occurring on Federal lands will be tracked either through the traditional data collection pathways (MDE) or through a separate data pathways to be developed. Federal reporting is also designed to have a place on Maryland's BayStat website.

Verification

The State has thousands of municipal and Industrial facilities regulated under the Maryland Department of Environment" Pollution Control Program, of these 287 have nutrient discharges that are specifically tracked by MDE and an additional 500 minor industrial facilities are being evaluated for nutrient impacts and potential reductions. MDE's Science Services Administration is responsible for the auditing of these 287 and potentially 500 more facilities. The data downloaded from the EPA's ICIS undergoes an extensive analysis, editing, and verification process prior to input in the MDPS database in MDE/SSA. The quality of the data is assessed using various methods such as (1) checking the data for missing and/or redundant values; (2) checking the data ranges against permit values and detection limits; (3) estimating and comparing monthly/annual averages of data with previous year's averages; (4) identifying questionable data through charts/plots, and individually contacting the facilities as needed. This database also enables the State to closely track nutrient pollution from significant Point Sources, which produce over 90 percent of the total nutrient loads from point sources discharged to Maryland's ten major tributaries and the Chesapeake Bay.

Upon QA/QC completion, fiscal year updates for significant facilities are submitted digitally to the Chesapeake Bay Program nutrient database manager by January of each year. In addition, calendar year updates for non-significant facilities are submitted by October. The fiscal year loading calculations for significant municipal facilities are also reported to BayStat in January of each year.

Relevant information is also available to the public through the Enforcement and Compliance History Online (ECHO) as well as at the Bay Program at http://www.chesapeakebay.net

6.2 Nonpoint Source BMPs

Tracking and Reporting of Nonpoint Source Best Management Practices is coordinated through the Maryland Department of Environment. MDE consolidates information reported through the State and Local Agencies and then reports this information to the Chesapeake Bay Program. This information from the State and Local Agencies is received in various formats and scales, some of which is summary information. See Figure 6.2.1 for detailed information on the current tracking and reporting work flow.

Maryland will work with the federal agencies to ensure any non-point source control activities occurring on Federal lands will be tracked either through the traditional data collection pathways, NEIEN or through a separate data pathways to be developed.

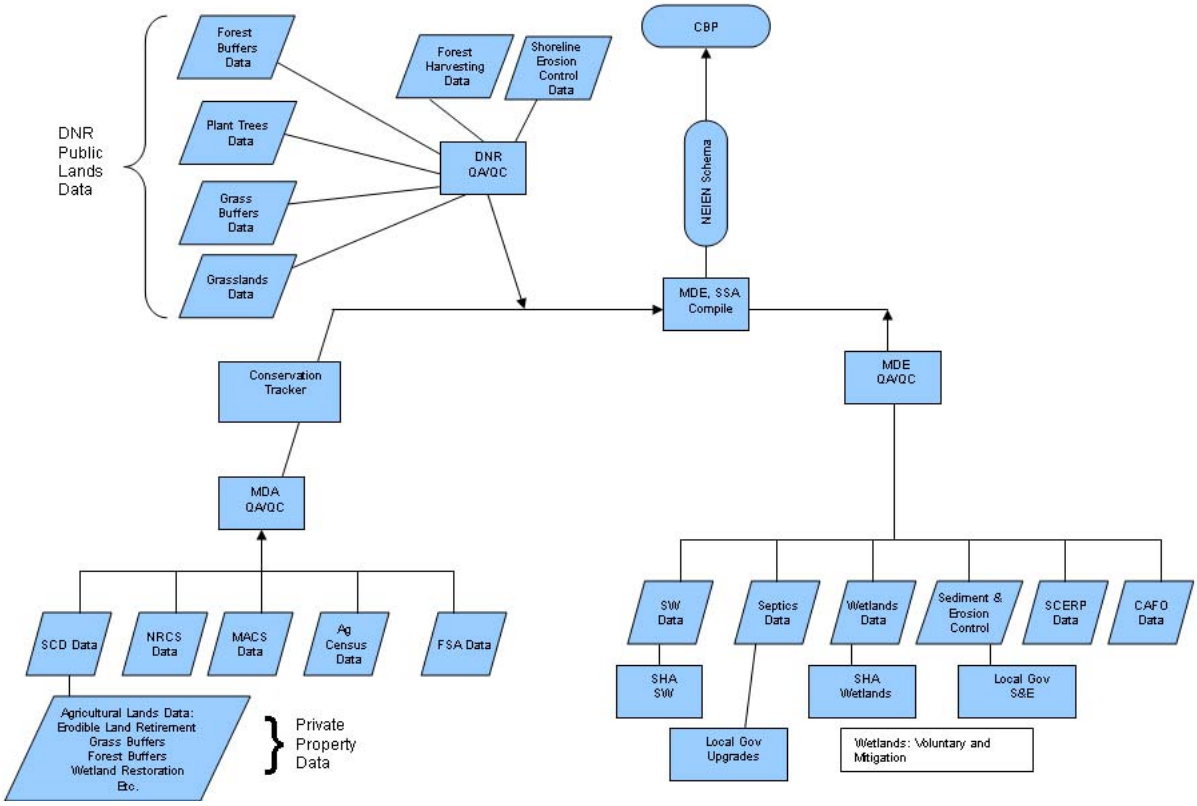


Figure 6.1 Current Tracking and Reporting Scheme

6.2.1 Agricultural BMPs

Tracking and Reporting

Maryland Department of Agricultural (MDA) tracks and verifies all agricultural information. MDA provides information on programs and best management practice implementation monthly to BayStat using a spreadsheet format. Agricultural information is also submitted to the Chesapeake Bay Program annually through MDE and the NEIEN reporting system. MDA has recently developed a new internal database tracking system called Conservation Tracker that comprehensively accounts for agricultural BMPs implemented with and without public assistance. Prior to Conservation Tracker MDA was only able to account for BMPs installed with State cost share funding. Local Information is provided by Soil Conservation District staff who upload information in Conservation Tracker on a daily basis.

<u>Conservation Tracker</u>

Prior to 2009 MDA was only able to account and report for BMPs installed using State cost-share funds through the Maryland Agricultural Water Quality Cost-Share (MACS) Program. Realizing this reporting deficiency, MDA developed a comprehensive reporting system known as Conservation Tracker to account for all BMPs implemented with public assistance, regardless of funding source.

Data Collection and Maintenance
Conservation data is collected locally by Soil Conservation District (SCD) staff from information maintained in farm-specific Soil Conservation and Water Quality Plans. Once collected, SCD staff are responsible for the timely reporting of this data using a local Conservation Tracker terminal. Data is stored centrally at MDA in an ORACLE RDBMS and is maintained and backed-up nightly per MDA Information Technology Department Standard Operating Procedures.

Verification and Quality Assurance Procedures
Conservation data obtained using Conservation Tracker will be reviewed and verified for conformation to program requirements and validated using data quality objectives established by MDA Office of Resource Conservation Operations. Only data that are supported by appropriate quality control criteria and meet the data quality objectives will be considered acceptable for reporting.

Data validation occurs at the time of entry into the Conservation Tracker System through the extensive use of field validations, including table lookups, formulas, and data-type restrictions. Once processed in the database, MDA generates various quality control charts and reports on a quarterly basis to identify potential data quality issues. Evaluation and verification of any data issue is resolved locally by Soil Conservation District Staff.

MDA performs cross checks with the quarterly updates to Maryland property view. When account IDs are changed in Maryland Property view a report is generated and sent to field offices to confirm or change information in conservation tracker. This may include subdividing of parcels and new ownership information being added to the database or deletion of the parcel if it is no longer an agricultural operation. Additionally, field validation of BMP implementation is managed through annual Quality Assurance Reviews (QARs). Field checks of 10% of all BMPs implemented within the active maintenance life span are conducted and documented to assure they continue to function in accordance with design standards and specifications. Cross checks/validation are conducted with MACS Agreements and Nutrient Trading Program assessment reports for accuracy.

Verification
Four main reviews occur within the Office of Resource Conservation: Nutrient Management Plan Implementation Review, Maryland Agricultural Water Quality Cost Share Program (MACS) Quality Assurance Review (Discussed under Data Quality Assurance), the MACS Spot-check review, and the Maryland Cover Crop Program**.** MDA has also developed a review program for the Manure Transport Program.

The MACS Program has a procedures manual utilized by all 24 soil conservation districts which sets forth all of the policies and procedures of installing the Best Management Practices for MACS. It also includes information on spot checks. The Natural Resource Conservation Service also has a series of manuals (Field Office Technical Guides – FOTG) that describe the standards and specifications for all federal cost shared BMPs. The MACS Program manual relies on the

established NRCS technical, standards and specifications in the FOTG for the actual placement and installation of all BMPs.

MACS Quality Assurance Review

The MACS Quality Assurance Review (QAR) process occurs once a year for every Soil Conservation District and consists of an overall review of the State's 24 Soil Conservation District operations. The review is conducted to determine that programs are administered according to applicable technical guidelines. The review team consists of a representative from the Maryland Department of Agriculture, Office of Resource Conservation (usually the Operations' office Area Coordinator and/or someone from the MACS Staff), a Natural Resource Conservation Service (NRCS) Engineer, and local SCD staff. A list of MACS Practices installed within the last year is supplied to the review team utilizing a standardized protocol. The review team inspects the project files in the Soil Conservation District Office and conducts field verification of the practices and their operation installed in the field. The results of the review are corresponded to all parties involved and the Soil Conservation District Staff. Any deficiencies are noted and training and/or follow up is offered or required to the field staff if needed or the operator to bring the practice into compliance. Follow-up reports or revaluations are conducted.

MACS Spot-checks

MACS Spot-check review process is conducted once a year. All completed practices within their maintenance life are eligible for review. A random, computer generated sampling of 10% of all practices is used for the review. The MACS Office at MDA Headquarters generates the random sample and sends it to the Soil Conservation Districts for a field review of the practice(s).

The field inspection is to determine whether the BMPs were constructed according to plan specifications and whether the BMPs are being maintained (Note that this inspection is in addition to the monitoring and inspection that takes place during BMP construction). Where the teams find unsatisfactory conditions, a letter of notification is sent to the farmer identifying the issue to be addressed and establishing a time frame to correct the problem. The BMP is re-inspected again, normally within a year, to ensure compliance and performance. Possible reasons for unsatisfactory conditions could include a lack of maintenance or a change of ownership. If there has been a change in ownership, MDA institutes a transfer of maintenance requirements to the new owner through the Property Transfer process. If the new owner does not agree to maintain the BMP, MDA seeks repayment from the original owner of principle and in some cases, interest. Maintenance issue are required to be addressed using the same technical standards applied during design and construction.

When a project is reviewed and determined satisfactory, it is removed from the inspection eligible list for two years. Once the maintenance life (typically ten or fifteen years, depending on the practice) is completed, the practice is removed from the eligible list. A practice is not reviewed if it is within 6 months of expiring. The review team consists of Soil Conservation District staff, which is located in the SCD offices.

Table 6.1 MACS Spot-Checks

Year	No. of Spot Checks	No. of BMPs
2007	**572**	**711**
2008	**579**	**719**
2009	**559**	**695**

Manure Transport Program

MDA has developed inspection and verification of program compliance procedures for the Manure Transport program. These cover activities at the application and claim stages and there are guidelines for on site farm status reviews. Onsite reviews take place during or immediately after implementation and will focus on; a) receiving operation utilization of manure transported is consistent with the nutrient management plan; b) crops or crop residue in a field are consistent with the nutrient management plan; c) "Delivery Site Guidelines" or "Stockpiling Guidelines" have been followed or are being followed and d) any residual manure will not cause any water quality concerns.

The review procedures include; a) selection of up to 10% of any of the active and completed agreements; b) inspections conducted as a result from a complaint from an adjacent property owner of others; and c) inspections in conjunction with a nutrient management implementation review.

All active agreements are eligible for review. The review team consists of the Office of Resource Conservation's Manure Transportation Program Project Coordinator (MDA Headquarters), local Soil Conservation District staff (located in the SCD offices) and/or the Nutrient Management Implementation Staff (Regional NM Offices). If the applicant fails to comply with program guidelines, follow up action is taken by requiring corrective actions, possible exclusion from future participation, liability for funds paid, and referral to the Nutrient Management Implementation team for compliance enforcement.

Cover Crops

MDA Cover Crop Program is administered at the field level by Soil Conservation Districts. Farmers are required to fall certify all cover crop acres planted within 7 days of the planting deadline. Since they may be eligible for planting incentives based on early planting dates, farmers are required to fall certify fields planted in accordance with up to three deadlines. SCDs conduct field checks on at least 20% of acres of small grains that are certified as being planted for 100% of participants who fall certify. If participants fall certify for more than one planting date, the participant may have multiple field checks. If any issues arise with the participant's 20% field check, the SCD then expands the field check to include all the participant's certified acres. An additional random check of 10% of contracts is conducted in the spring to verify killdown.

Nutrient Management Plan Compliance Assurance

The Water Quality Improvement Act of 1998 requires farmers with gross annual income of $2,500 or more or livestock operations with 8,000 pounds or more of live animal weight to

manage their farms using nutrient management plans that protect waterways from excess crop fertilizers and animal waste.

Nutrient Management Plan reviews are conducted to determine whether the plans were written accurately and properly implemented. Farmers are required to have and implement nutrient management plans for their operations and they are required to submit the Nutrient Management Annual Implementation Reports (AIR) by March 1st, documenting nutrients applied, by crop type, during the previous year.

The Maryland Department of Agriculture's Nutrient Management Program maintains a separate database for regulatory compliance. Nutrient management implementation in the agricultural sector is tracked to comply with multiple regulatory requirements:

- Farmers submit an initial nutrient management plan to MDA written by a certified nutrient management planner.
- Farmers must submit an Annual Implementation Report (AIR) to MDA by March 1 for the previous calendar year. The AIR notes any changes to the operation, crops grown, fertilizer use, acreage managed, animal production, etc.
- Farmers are responsible to keep prescribed records of nutrient inputs and outputs.

Nutrient Management Certification Reviews

Nutrient Management Plans (NMPs) are reviewed by 3 regional MDA staff to assure plans are prepared in accordance with appropriate requirements. This review is an evaluation of the work of the professional individuals certified and licensed by MDA to develop plans for Maryland farmers and is designed to ensure the quality of plans prepared. MDA has been conducting reviews of plans since 2003. Plans can be prepared by the farmer (with technical assistance from a University of Maryland Extension expert) or consultants, but plans can only be prepared by those that have been certified (farmer or consultant). Consultants who do not prepare the plans properly risk losing their licenses.

Nutrient Management Plan Implementation Review

Field inspections of plans started in 2005 and MDA officials strive to complete about 400 inspections per year. The review process includes a targeted selection of farmers to be reviewed. The strategy for indentifying farms to inspect is weighted toward those operations considered to have the greatest risk for water quality impacts-primarily operations managing manure. For example, of the 427 implementation reviews planned statewide for 2010, 282 (66%) are focused on operations involving manure. In the regions of the state with the highest concentrations of animals, (Western MD, and the Eastern Shore), 79% of the reviews are targeted toward operations involving manure. For the farmer selected, three fields are picked and the farmer's records of what he grew, and what he said he applied in terms of fertilizer are compared to the nutrient plan. The farmer is required to maintain records documenting the rate, timing, and method of nutrient applications, as well as crop yields. Farmer requirements are included in the Maryland Nutrient Management Program Plan Implementation Review Process for Operators, which is available to all farmers and prepared by the MDA Office of Resource Conservation. A four-part Nutrient Management Program Plan Implementation Evaluation report is prepared to document the review and serves as the compliance enforcement notification when certain deficiencies are noted in the review. Any problems noted during the review requires notation on

the Evaluation form and a follow-up review. The timing of the follow-up review depends on the deficiency noted. Failure to correct the deficiency within the allotted time warrants further enforcement action, including fines. The most common problem cited during recent implementation reviews is the failure to have a current Plan

Nutrient Management Cross-Compliance

As a more efficient use of staff resources, and to leverage performance, MDA staff conducts cross compliance checks between nutrient management compliance and applications for financial assistance programs. Farmers who are out of nutrient management compliance or have not submitted required nutrient management documentation are not eligible to participate in state incentive programs. Farmers who receive financial assistance for agricultural waste management BMPs must have their nutrient management plan reviewed and approved by nutrient management staff prior to receiving payment. Farmers who receive financial assistance for nutrient management planning services are required to have their plan reviewed and approved prior to receiving payment. MDA does annual inspections of all state certified nutrient management service providers annually, by reviewing at least three of their NMP to assure they meet standards. Follow up actions can include suspension of plan writing certification. Farmers or service providers that apply nutrients to agricultural land are required to become state certified and attend training to maintain their certification. Farmers who fail to have a plan or file yearly AIRs are subject to enforcement with fines of up to $250 from MDA and $10,000 from MDE.

The following Tables provide recent information on inspection activities:

Table 6.2 Nutrient Management Plan Enforcement Actions

Program Performance & Verification: Nutrient Management Plan Submission

FY	NMP ac submittals outstanding	Enforcement Actions
2006	223,000	1,099
2007	201,000	1,635
2008	100,000	1,733
2009	4,300	55
2010	700	20

Table 6.3 Nutrient Management Annual Report Enforcement Actions

Program Performance & Verification: Nutrient Management Annual Reports

FY	AIR required	% Submitted in FY	Enforcement Actions
2006	5969	75%	154
2007	6080	86%	254
2008	5800	98%	302
2009	5514	97%	553
2010	5554	96%	473

Table 6.4 Nutrient Management Plan Field Inspection Enforcement Actions

Program Performance & Verification: Nutrient Management Field Inspections

FY	NMP Site Inspections	NMP Compliance	Enforcement Actions
2006	167	78%	0
2007	500	89%	0
2008	450	65%	90
2009	400	69%	191
2010	391	73%	173

Table 6.5 FY 10 Nutrient Management Plan Inspections

Program Performance & Verification: Nutrient Management Plan Inspection-FY10

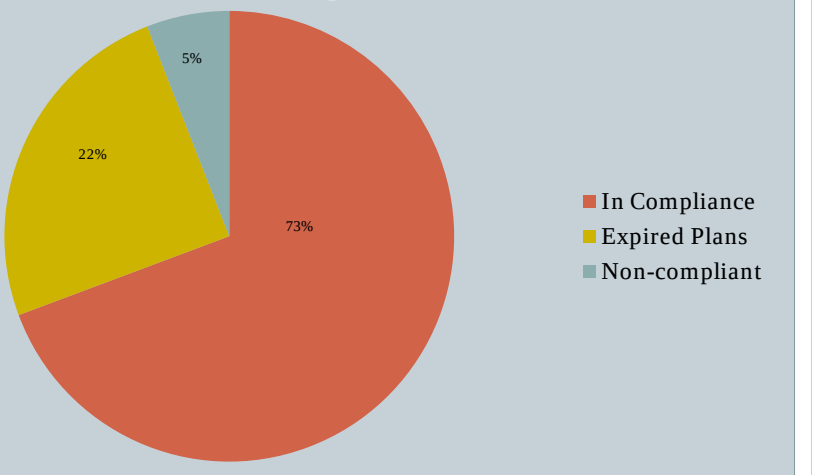
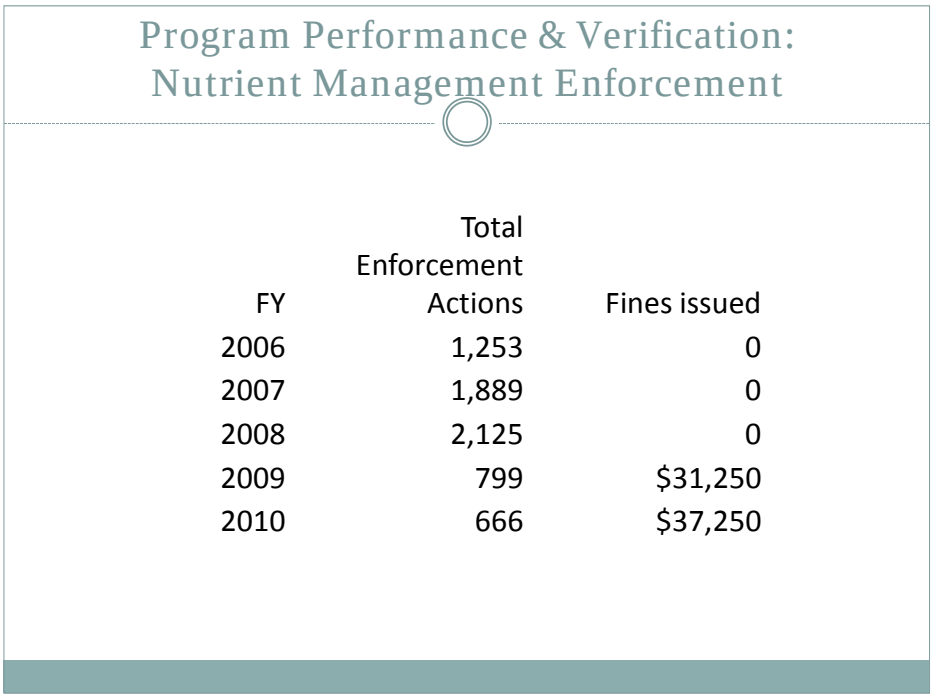


Table 6.6 Fines Related to Nutrient Management Plan Enforcement Actions



Agricultural Complaints

MDA regional compliance staff conduct on-farm inspections in response to citizen complaints. These inspections are to assess and remedy any alleged potential for pollution and to assure the existing BMPs are maintained and functioning as intended. Regional compliance staff respond to over 100 complaints a year and work with MDE, with the local SCD office and the operator on any corrective actions.

Table 6.7 Agricultural Complaints

	FY10	FY09	FY08	FY07	FY06
Agricultural Complaints					
Inspections	72				
Status					
Closed	64	64	96	76	82
Pending Enforcement	6		6		
Open	2				
Enforcement Actions	1	4	4	2	0
Complaint Type					
Agronomic	19	14	52	29	28
Livestock	18	10	13	5	7
Odor	6				
Manure	29	47	36	35	38

CAFO/MAFO Rapid Response
Under a new initiative MDA provides staff to work directly with CAFO/MAFO operations to assure they are meeting the obligation of their permit requirements. MDA staff conducts field evaluation of the facilities and the feeding operation. Requirements for proper waste storage, mortality composting, runoff controls and housekeeping are reviewed for proper functioning and continued maintenance with standards and specifications. MDA intends to conduct up to 50 site visits per year with a focus on poultry operation on the lower eastern shore.

6.2.2 Septic Systems

Best Available Technology Upgrades

Tracking and Reporting
Installation of Septic Systems Best Available Technology (BAT) upgrades using the Bay Restoration Fund (BRF) is tracked by MDE's WMA Wastewater Permits Program. There are approximately 430,000 septic systems in Maryland. Of these, 52,000 systems are located within the "Critical Area," land within 1,000 feet of tidal waters in Maryland. The typical septic system does not remove nitrogen, instead delivering an estimated 12 to 18 pounds of nitrogen per year to local waters. An upgraded, nitrogen-removing septic system cuts a system's nitrogen load in half.

The Maryland Department of the Environment has upgraded over 2,000 septic systems to nitrogen removing BAT through the Bay Restoration Fund (BRF) Onsite Sewage Disposal System (OSDS) grant program. Upgrading failing septic systems in the Critical Area is the Department's highest priority. As a condition of being approved as a BAT in Maryland, the upfront cost of a BAT is to include five years of operation and maintenance. For this five-year period, each BAT system is required to be inspected and have necessary operation and maintenance performed by a certified service provider at a minimum of once per year but at least at the frequency the manufacturer or engineer recommendation.

WMA Wastewater Permits Program provides monthly updates to BayStat on the number of installations by county as well as a monthly summary of installations in the Critical and outside the Critical Area.

Verification
MDE requires local Health Departments to report installation of the BAT systems upon completion of the final inspection. Reporting requirements include the name of the applicant, location, the date of the installation and the description of BAT technology installed. In addition, certified service providers are required to report to MDE all inspections and maintenance performed for BAT systems.

Septic Connections to Wastewater Treatment Facilities

Tracking and Reporting
Septic Connections to Wastewater Treatment Facilities are provided through Water Quality Financing Administration. An annual report is compiled and the information is provided to MDE's SSA.

Verification
MDE project managers conduct site visits and construction inspections and findings are documented as Construction Monitoring Reports (CMRs). Fund recipients must submit requests for fund disbursement; grantees submit "reimbursement payment requests", while loan recipients submit "cash draw request forms". These must be accompanied by certain supporting documentation (inc. costs incurred, local share/matching funds, recipient payment to vendors, and funds received from other sources), all of which is verified by MDE prior to disbursement. Further, disbursements are reviewed prior to approval.

"As-built" drawings must be submitted to MDE and MDE performs a final inspection prior to project closeout.

6.2.3 Stormwater

As summarized in Element 2, Maryland law and regulation mandates implementation of a stormwater management program at the local government level for private and local projects, and at the State government (e.g., MDE) for State and federal projects that exceed 5000 square feet of land disturbance. These stormwater management programs review and approve new and redevelopment projects, and require the inspection and ensure maintenance of all stormwater management practices (e.g., inspected once every three years and maintain).

Tracking and Reporting
Currently, MDE uses two methods to track Urban Stormwater. The first method is an empirical method which tracks individual Urban Stormwater BMPs through its Stormwater BMP database and MS4 Reporting. This information is received from local government agencies along with State Agencies. As part of the State's stormwater management program there is a requirement for local programs to submit extensive data on best management practice (BMPs) on forms such as MDE's Notice of Construction Completion (NOCC) form, and see Appendix E which itemizes the stormwater data tracking fields. This information is continually updated on Maryland's Urban Best Management Practice database as projects are completed. The data are used for statewide tracking purposes and submitted to the CBP annually as part of Maryland's suite of programs to restore the Chesapeake Bay. The Science Services Administration (SSA) reviews and tracks the BMPs and coordinates QAQC procedures with the localities to verify data and reporting integrity.

MDE's Water Management Administration (WMA) is responsible for conducting biennial reviews of counties and municipalities applying for erosion and sediment control enforcement authority and triennial reviews for all local stormwater management programs. Reporting of stormwater BMPs, inspection, and maintenance have been significantly enhanced through

Maryland's NPDES municipal stormwater permits. In addition to the routine implementation of stormwater management on all development since the 1980's, these permits require retrofitting at an ambitious rate on earlier development where there is very little water quality control. All stormwater retrofits and urban water quality improvement projects are being reported to Maryland BayStat. The data appear on spreadsheets that specify permit requirements, compliance status, nitrogen reduction benefits, and operating and capital expenditures toward meeting the 2-Year Milestones. BayStat reviews retrofit implementation and pollutant loads and considers proposed contingency actions. This information has been provided via electronic data tables or hard copies annually to MDE Stormwater program coordinators.

MDE's Science Services Administration Program ensures that the reported practices fit into EPA/Chesapeake Bay Program Model. Maryland's stormwater management practices will follow the Maryland Design Manual and includes Stormwater Ponds, Stormwater Infiltration, Stormwater Filtration, Open Channel Practices, Environmental Site Design (ESD) practices, Alternative Surfaces, etc.

EPA's list of practices does not include Maryland's latest law and regulation changes and volumes that are controlled by these practices. Maryland has provided additional BMPs to be approved by EPA as part of "Stormwater Management by Era," and will continue to work with EPA on updating acceptable BMP list.

Additionally, MDE has proposed to CBP to track Stormwater BMPs by Management Era with estimated efficiencies. This theoretical method accounts for BMPs that were installed during an Era which had specific requirements as laid out in MD Stormwater Management Laws (1985, 2001, and 2007). See Appendix F, Stormwater Management by Era proposal for more specific information on this approach (includes a logic model diagram). As the Chesapeake Bay Program model continues to evolve, MDE will work with CBP to provide the necessary Stormwater information.

Verification

Each locality is responsible for the implementation of its stormwater management program. Each locality has its own fees, fines, and penalties and the State has enforcement tools to assure compliance. Levels of inspection are verified through the triennial review or delegation enforcement authority process. MDE also conducts triennial reviews of local stormwater management programs and requires a stormwater management practice completion form, as-builts, bonding, maintenance agreements, etc, all part of the implementation of a stormwater management program.

Maryland's stormwater management program requires maintenance and inspection of all BMPs. Therefore, practices are updated on yearly basis where they are removed, updated (retrofitted), modified (infiltration practice failed and reconstructed to sand filter, etc.), and/or corrected. The State's Stormwater Management law requires the urban BMPs be inspected at least once every three years. Maryland counties and municipalities propose ordinances that must be reviewed and approved by MDE. These ordinances require specific inspection, maintenance, and enforcement procedures. See Appendix G1 and H1 for inspection and enforcement records. Once again, MDE inspects all State and federally owned facilities. Oversight of local stormwater

management programs and BMP implementation is conducted by the WMA. In recent years, triennial reviews have been replaced with technical exchange and outreach to local plan review agencies and inspectors. This has been paramount due to the development of new stormwater management regulations in 2000 and a new Stormwater Management Act in 2007; local ordinance reviews in 2002 and 2009; and a statewide review of all stormwater management programs in 2004 that resulted in the development of Maryland's 2005 Stormwater Management Maintenance and Inspection Guide. Currently MDE staff are meeting and going over design examples for meeting ESD to the MEP and technical workshops will be held across the State in the Fall of 2010 for local and State plan review agencies.

The State has over 33,000 facilities in its urban BMP database. More than 22,000 of these have been verified by MDE's Science Services Administration, which is responsible for the auditing of the database. The SSA works with the localities on practice verification every year prior to submittal to CBP. This information goes through a rigorous verification process under an established QA Plan . NPDES municipal stormwater individual permits issued to the most populous areas of the State require additional BMP reporting requirements including annual reports that document the stormwater best management practices, inspections, maintenance, and enforcement as well as additional restoration and retrofit data. The enforcement of these permits from MDE reviews and EPA audits have resulted in improved BMP maintenance and inspection programs (see Appendix G1 (SHA Annual Report) and MDE 2009 Inspection & Enforcement Data in Appendix H1).

In addition, MDE issues NPDES municipal stormwater permits to 10 Counties and State Highway Administration as well as General Permits for Construction Activity, Municipal and State and Federal Agencies. These ensure the implementation of their stormwater management programs as well as require watershed restoration for existing impervious surfaces. Local jurisdictions that are under NPDES municipal stormwater permit are required to submit annual reports that document the stormwater best management practices, inspections, maintenance as well as additional restoration and retrofits.

MDE's SSA works with the localities on practice verification every year prior to submittal to CBP. This information goes through a rigorous verification of the data with and established QA Plan[24].

6.2.4 Natural Filters

Tracking, Reporting and Verification

Natural Filters and Forest Brigade BMPs are tracked by the Department of Natural Resources staff in a detailed project spreadsheet that includes the following information: (site location, acres, BMP type- wetlands, riparian buffers, tree planting, TN lbs, TP lbs and TS, funding source, and GIS coordinates for each site). This information is reported through the Governor's Delivery Unit (GDU) on a monthly basis to BayStat. Each site has been planned and planted by DNR staff (Forestry and Watershed Services) – therefore each site verification and QA/QC is

[24] See, MDE Quality Assurance Plan for Urban Stormwater Best Management Practices Data Tracking, approved by EPA on 1/08/03.

done in the field by Department staff at the time of the planting. The installation of every project has been field verified with GIS coordinates collected, photos taken, and other relevant information collected and contained in a GIS database. Monitoring of older projects for mortality and other issues is also done annually by field staff of the MD-DNR. Wetlands are tracked by the Department of the Environment and information is provided annually to the Chesapeake Bay Program and NEIEN. Monitoring and QA/QC is done by the lead sponsoring entity.

6.3 Strengths and Weakness of the Current Reporting System

Strengths

Agricultural BMP tracking has recently been upgraded through MDA's Conservation Tracker. This system provides more comprehensively accounts for BMPs installed with either state or federal financial assistance. MDA is part of a regional workgroup to establish standard reporting and verification of farm specific conservation practices that are not cost-shared but provide water quality benefits. MDA expects to begin tracking and reporting of these additional practices within one year.

The Chesapeake Bay Program requires the NPS BMPS to be delivered using the NEIEN system. This delivery system decreases the risk of data being discounted and allows the data to be more compatible with ChesapeakeStat and the Chesapeake Registry.

Weaknesses

MDA is working on an alternative for tracking continuous no-till acreage. Under recent agreement with the National Agricultural Statistics Service, conservation tillage acreage will be collected via survey and projected statewide. Additionally MDA is working with the farm community to track BMPs installed without public assistance, such as those on Amish and Mennonite farms.

The tracking of wetland projects is a complicated process. The reporting of projects by multiple partners presents a challenge to avoid counting duplicate records, which are sometimes reported for different time periods. There is also a general lack of specific information on site locations. The compilation of accurate data is also dependent on the timely and complete submittal of the entities involved with restoration.

Urban Stormwater information is housed within the Local jurisdictions. These jurisdictions have varied and sometimes antiquated collection systems. These variations increase the need for QA/QC at the State level. A large amount of time is spent geo-locating the practice if Lat/Long is not provided. The practice itself might be called a Trademark name which causes the State QA/QC person to have research the practice.

6.3.1 Procedural/regulatory impediments to better tracking and accounting of BMPs

The primary impediments are inadequate staff and funding. Other impediments can be either inconsistent response from controlling agencies (e.g., local reporting on stormwater BMPs), and the ability to display (other then in an aggregated form) proprietary data (agricultural practices).

For Urban Stormwater, in a majority of cases, the needed data elements are rarely all reported. Hence, 90% of past and current efforts have been devoted to filling in the missing elements and correcting anomalous entries.

MDE accepts wetland data in varying levels of detail and formats to reduce the reporting burden on the entities performing restoration, and does spend additional time in clarifying and follow up to complete data fields. A draft task in the Habitat Goal Implementation Goal Work Plan in the Chesapeake Bay Program is to develop a single improved data reporting process by 2013.

Tracking of New Development

Currently there does not exist a centralized "New Development Database" or tracking system. There are, at present, two types of authorities for recording the information regarding construction (Erosion and Sediment Control Plans). There are the delegated counties, which have their own systems. There are non-delegated areas which include counties, State and Federal projects regardless of location, and specific areas in some delegated counties where in the State has the authority. Therefore, Construction Compliance and Completion Reports are stored at the Local and State levels depending on whom is the delegated authority. Using this method of tracking (i.e., Erosion and Sediment Control Plans) has inherent risks. The plans only provide "disturbed acres." This could over estimate the acreage of actual development (i.e., reforestation after construction) and having an approved plan does not necessarily mean development occurred. Also, a plan could be for redevelopment or the construction might not have occurred or occurred at a lesser level than within the Plan.

MDPropertyView database is updated annually and includes statewide parcel data that can be used to identify the number and acreage of parcels that have been developed each year. The parcel data are from the Maryland State Department of Assessments and Taxation and are linked geographically to parcel maps. In addition, every 5 years MDP updates and releases a by county, Statewide land use data layer. These periodic updates also are used to provide an indication of the level of development within the State.

6.3.2 New Development Forecasts

Land Changes

Currently there are several methodologies to predict land use changes. The Chesapeake Bay Program provides a comprehensive land cover change through the process developed and used by the United States Geologic Survey (USGS). This has been provided to the states by County and provides for Maryland a Development Gain and a Forest/Agriculture Loss. In addition, the MDP Growth Simulation Model (GSM) is a more Maryland-specific model that incorporates local zoning code to forecast land cover change and increases in septic tanks within Maryland over time. The land use analysis techniques that support the GSM and the results of GSM forecasts have been shared and vetted with local governments in Maryland for a decade. The Chesapeake Bay Program Growth Model will be used along with the Maryland Department of Planning Growth Simulation Model (GSM) to forecast future growth within the Maryland watershed to calculate a range of expected increases to loads in the Phase II WIP or an overall increase that incorporates relative change in CBP land use forecasted by the Maryland-specific GSM. In addition, a longer-term change adjustment is needed to ensure that the mitigating impact of local and State smart growth and other land use programs (e.g., Critical Area Program) are credited in the Chesapeake Bay Program watershed model and growth model. As part of this effort, Maryland will work through the CBP management framework (e.g., Goal Implementation Teams) to implement this adjustment.

To forecast "New development acres", MDP uses the most recent data of actual acres developed from the MDPropertyView database and other applicable Maryland State Data Center information and then forecasts acres developed through the 2-Year Milestone. The forecasts are used to estimate additional nutrient and sediment loadings expected for each 2-Year Milestone. After each 2-Year Milestone is complete, data on actual amounts of new development acres and septic tanks installed will be determined by MDP and MDE. The difference between actual and estimated amounts will be carried over into the next 2-Year Milestone either as a credit or deficit. More information on *MDPropertyView* can be found on MDP's website. Also, to facilitate the gathering of more timely data on new development, MDP will request this information through annual reports that local governments must submit to MDP. 2009 legislation requires the reporting of *additional measures/indicators*, which must be reported beginning in July 2011. Forecasts of new development for the 10-year timeframe of the WIP (including initial forecasts for each milestone) will be completed through use of the CBP Land Change Model and/or the MDP Growth Simulation Model—both can be used to forecast future development acres and future septic tanks. At the beginning of each 2-Year Milestone, the forecasts will be revised based on the method described above. The MDP Growth Simulation Model also forecasts future sewered households, which is used to make assumptions about future WWTP flows**.**

Septic (OSDS)

For each 2-Year Milestone, to forecast "new septic tanks", MDE surveys sanitarians statewide to determine the actual number of septic tanks installed in the year previous to the 2-Year Milestone and assumes that number will be installed each year during the milestone. USGS has also provided Septic Tank forecasts.

6.3.3 Proposed Future Tracking Methods

Maryland is working toward a common reporting system which consolidates a sector's information and generates reports that can be used by federal, state and local agencies to report implementation efforts. It will provide consistent reporting for all implementation activities at all areas for all levels (local, State and Federal). It also will be capable of tracking both offset generation and consumption.

MDE continues to improve the collection of stormwater data through the use and development of a GIS data tracking system and better mapping as proposed through the 2010 Chesapeake Bay Regulatory Accountability Program (CBRAP) grant. The ultimate goal of one project within the grant is to allow localities and permittees to submit BMP data and/or appropriate acreage and documentation of water quality improvements electronically (e.g., web portal or electronic data transfer) that populates the proposed MDE GIS Data Tracking System which can provide appropriate data to CBP, other entities, as well as watershed information back to localities and permittees.

The proposed Maryland Chesapeake Bay Implementation Tracking (MCBIT) data-tracking center will be composed of representatives from the main data collectors:

- Maryland Department of Natural Resources (DNR)
- Maryland Department of Agriculture (MDA)
- Maryland Department of the Environment (MDE)
- Maryland Department of Planning (MDP)
- Federal Government (CBPO/EPA)

MCBIT Team objectives include:

- Coordinate partner activities to identify funding, design, build and operate MCBIT data center
- Determine list of data submission reporting parameters from NGO's, State and Federal agencies
- Identify data export reporting needs (CBP Models, Scenario Builder, BayStat, MDP Growth Simulation Model which can Coordination with NEIEN, etc to seamlessly exchange information between all groups
- Include component to address offset - future development acres and future septic tanks, etc

6.3.4 Current Activities

MCBIT has compiled a draft list of implementation data fields that each organization tracks and also the names of groups (and frequency) to which each organization will provide implementation data (BayStat, EPA, etc)

In addition, MCBIT has determined that the most efficient process for providing quality implementation tracking data meeting is to use the below flow model which will draw off reporting information (from all State agencies) from the accepted NEIEN, point source and DNR

data sources to provide timely and accurate data. This process will be instituted in a phased approach and will meet the federal tracking requirements and also complement the current federal implementation tracking efforts.

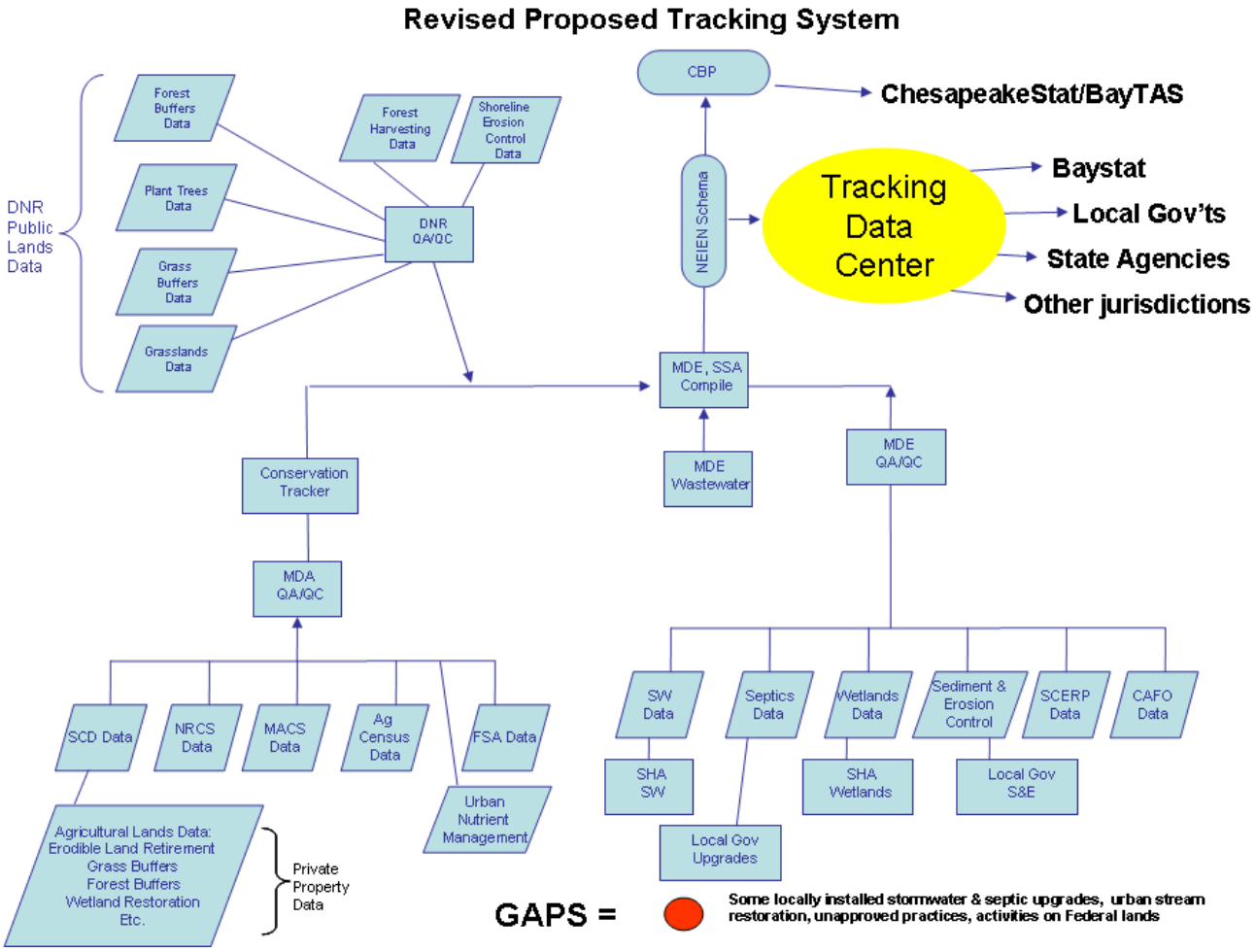


Figure 6.2 Proposed Tracking and Reporting Schema

Table 6.8 General Concept for MCBIT development

General Concept	Resolution	Reporting Frequency	Time Frame
Phase 1 – **DATA INPUT**: Use existing data feeds from State agencies **DATA OUTPUT**: BayStat level reporting information drawn from NEIEN, point source and DNR feed.	Regional and County	Monthly. However, some would be annual. The level of detail that is provided for the monthly reporting for BayStat is at a coarser scale than what is required for reporting of implementation to the CBPO, e.g. Animal waste management systems for the CBPO include animal type, AU, county and tributary are needed; manure transport for the CBPO include where the manure came from and where it went to whereas for BayStat only the poultry manure that leaves the watershed is reported.	2010
Phase 2 – **DATA INPUT**: Web based reporting system submitting data into respective state agencies. **DATA OUTPUT:** Reporting information drawn from NEIEN, point source and DNR feed. feed.	Location specific	Monthly	2011

Timeline and Milestones for implementing actions and revisions to reporting systems:

February 2010	Establish Maryland Chesapeake Bay Implementation Tracking (MCBIT) Team.
March 2010	Review of Draft MCBIT plan by Plan Interagency Team
April 2010	Local review of MCBIT plan by Pilot and source sector teams. Complete list of data submission reporting parameters from NGO's, State and Federal agencies
May 2010	Preliminary review of MCBIT plan by Plan Interagency teams
October 2010	Preliminary review of MCBIT plan by Plan Interagency teams
December 2010	Public review of draft MCBIT plan
February 2011	Draft MCBIT plan report due to EPA (10/1/10)

April 2011	Final MCBIT plan report due to EPA (11/1/10)
June 2011	MCBIT data center complete (Beta version)
November 2011	MCBIT Data center operational at local scale
December 2011	First report due to EPA/Bay Program

7.0 CONTINGENCIES FOR SLOW OR INCOMPLETE IMPLEMENTATION

This section addresses Element 7: Contingencies for Slow or Incomplete Implementation (and 2-Year Milestones)

If delays in adoption occur for expected strategies identified in Element 5, Maryland will implement contingencies that ultimately achieve the State's load allocation. Adoption may not occur because of possible delays in passing new or revised legislation, regulations, local ordinance, and/or permit issuance or renewals; and/or if participation rates with voluntary, incentive based programs are not achieved; and/or if compliance rates with regulatory programs are not achieved. Through Governor O'Malley's BayStat process, and local input gathered from outreach events, the tributary teams and Watershed Assistance Collaborative (WAC), the State of Maryland identified potential contingencies. As stated in Element 5, these have been adopted after consideration of the views expressed through the public comment process.

7.1 Timeline to Review Progress

Implementation progress of possible strategies identified in Element 5 of Maryland's WIP will be reviewed monthly through the BayStat process. Each month Governor O'Malley meets with his BayStat team - the Secretaries of the Maryland Departments of Agriculture, Environment, Natural Resources and Planning, scientists from the University of Maryland and other key staff - to make sure the State's Bay restoration work is on track. These sessions provide a regular opportunity for the team to assess progress, evaluate what's working and what's not, and adapt efforts accordingly. Through this existing framework, progress will be tracked and if Maryland is falling short on implementing key actions it will then look at contingencies with the opportunity to be implemented immediately. Element 6 of Maryland's WIP details a tracking system to improve transparent and consistent monitoring, tracking and reporting, and assess the effectiveness of implementation actions for meeting Maryland's 2-Year Milestones and TMDL goals.

Contingency implementation will be needed if any expected strategy is falling behind its implementation schedule. Currently, for milestone tracking, BayStat provides a monthly agency goals and actions assessment that outlines, for each milestone action, the number of units implemented cumulatively and the associated pound reduced. Based on the pound reduction goal and actual implementation for that milestone, a percentage of the goal achieved is calculated. This score indicates if a milestone is considerably behind (0-49%), behind (50-69%), on track (70-90%), or ahead (>90%). If a milestone is considerably behind or behind BayStat analyzes why and determines if a contingency is needed. A contingency may not be warranted if the implementation or funding schedules are on track. For example, if upgrades to a wastewater treatment plant are not scheduled to be operational until the end of a milestone period and construction is on schedule, a contingency is not needed. This same milestone approach will be applied to TMDL implementation tracking and reporting to determine if contingencies are needed.

7.2 Accounting for Progress in Reductions

Maryland identifies implementation targets in the Watershed Implementation Plan. Accounting, Tracking and Reporting are an important part of the Plan strategy and progress will be closely monitored for the two year milestones by tracking both implementation and water quality. However, it is important to note that the Plan incorporates the concept of adaptive management. Adaptive management requires that projections be made as to how to meet a goal and recognizes that in complex projects such as this, changes will be necessary. Implementation targets are surrogates for actual pound reductions and, as needed, Maryland may determine that targets for one practice may be reduced and increased for another to meet goals. The critical commitment is the nutrient reduction represented by an implementation practice. As long as the required reductions are met, Maryland will meet its milestones.

7.3 Catalogue of Alternative Strategies

These alternatives are provided in addition to specific contingencies identified in Chapter 5.

A) Increase NPDES Watershed Restoration Requirements for MS4 Phase I and MS4 Phase II permits, including SHA

Maryland could fall short of its urban stormwater 2017 reduction goal, statewide, in at least two ways. First, it might be determined that the effectiveness of controls is less than what is estimated. In that case the contingency would be to increase the amount of controls, reflected as an increase in the percentage of impervious area treated, or equivalent reductions from alternative practices through the MS4 Phase I permit. A similar increase in treatment area could be assigned to achieving the Final Target Loads if necessary.

Another way Maryland could fall short of the urban stormwater goal would be a short fall in the pace of implementation, e.g., fewer than expected acres treated or equivalent reductions. Enforcement of these new permit provisions through MS4 reviews and audits will ensure that permit retrofit requirements and stormwater WLAs are met. MDE will use monitoring data, strategic in-house model runs, and the latest science on new and alternative BMPs to continually reassess and realign MS4 permit retrofit requirements so that 2017 and 2020 stormwater WLAs are met. In the event that regular program review and enforcement fall short, then MDE may use consent decrees to enforce that pace of implementation. However, if this contingency situation arises, another sector, such as non-MS4 urban jurisdictions, might need to address the gap in the short run. Maryland's strategy will be to evaluate the pace of the Phase I and Phase II jurisdictions in 2014 so that a contingency can be executed if necessary.

B) Evaluate ENR Retrofits at Minor Federal WWTPs

Potentially 8 plants will be retrofitted.

C) Retrofit Minor Municipal (<0.1)

The smallest WWTPs contribute very little nutrient load, but may have impacts locally. Upgrades will be implemented where needed and cost-effective to meet local nutrient reduction milestones; they are listed as a local, rather than statewide option. These upgrades may be funded by the State Revolving Loan Fund, local or community funding or match, USDA Rural Development Funds, federal funding, and revenues from offset requirements or trading programs.

D) Septics - Other Options

To fully develop Phase II of the WIP and to achieve additional nitrogen load reductions from septic systems, over the next year Maryland commits to develop State specific options for requiring septic nitrogen removal upgrades for:

- All new septic systems outside Critical Area;
- All replacement septic systems outside Critical Area;
- All septic systems at point of sale;
- Use of BRF obtained from septic users to fund connection of multiple on-site sewage disposal systems to existing advance wastewater treatment facility; and,
- Require nitrogen load offsets from all new septic systems statewide.

Funding would potentially be provided by the private sector, Bay Restoration Fund, and tax incentives.

E) Chesapeake Bay Model Refinements

Several potential strategies and options are conducive to providing additional reduction within the current load allocation for agriculture. Certain options, while labeled contingencies, should be addressed now in order to properly account for existing issues within the current model and BMPs with water quality benefits that the model can not currently handle.

1) Use annual USDA National Agricultural Statistics Service (NASS) data (where available) to calculate crop yields vs. the current 7 year USDA NASS Agricultural Census data.

Strategy

EPA Chesapeake Bay Program modelers need to implement the recommendations of the Agriculture Workgroup of the Chesapeake Bay Program to provide accurate data. These previous problems with the model inputs were put off due to timing considerations to finalize the model. Time to complete was estimated at 4+ months.

Funding

None - EPA Chesapeake Bay Program role

2) Increase the spatial resolution of yield data by using state level vs. Bay watershed data for maximum yields, and county level vs. state level yield data to calculate the nutrient management application rate

Strategy

EPA needs to improve spatial resolution of yield data. Maryland county specific crop yield are 15-30 bushels higher than Chesapeake Bay program model yields. The potential reduction benefits stems from the difference in plant uptake and removal rates per acre that equate to a decrease in potential environmental nutrient loss. This previous problem with the model was put off due to timing concerns to finalize the model. Estimated time to fix 6 months.

Funding

None - EPA Chesapeake Bay Program role

3) Model outputs need to be tested BMP by BMP in order to assure the calculations are working correctly and to provide users with a per acre nutrient reduction load to compare reduction effectiveness of individual BMPs.

Strategy

EPA Chesapeake Bay Program modelers need to assure the model is working correctly. Currently two BMP options, Continuous No Till and Decision/Precision Agriculture, act as land conversion BMPs and remove acres available for any additional BMPs, e.g., cover crops and nutrient management.

Funding

None - EPA Chesapeake Bay Program role

F) Agronomic improvements

New higher yielding seed varieties have the added benefit of making more efficient use of applied nutrients. As a result, yield goals will increase and fertilizer needs may remain static or decline. For example current seed varieties are on average 40% to 50% efficient at utilizing applied nutrients to produce a commodity. Current tests on new seed varieties indicate an efficiency of up to 60% in utilizing available fertilizer.

Strategy

While the Chesapeake Bay Program will adjust the crop uptake rates and subsequent nutrient efficiency in the model as new seed varieties are adopted and utilized, the potential reduction in residual nutrients on cropland acres would be recognized and credited now.

Funding

No public incentive support needed, farmers will adopt based on increased yields and cost effectiveness.

Anticipated Load Reduction

500,000ac/10% reduction of residual N TBD annually

G) Heavy Use Poultry Area Concrete Pads

Provide stabilization by installing concrete pads to protect an area on a farm which is being utilized frequently and intensively by livestock or farm equipment (only if specifically for areas adjacent to the entrance of a poultry house or poultry waste storage structure). The purpose of this practice is to stabilize facility areas on the farm which are disturbed due to frequent and intense livestock or equipment use in order to prevent or abate pollution of the waters of the State. This practice is currently required for all CAFO poultry operations by EPA Compliance Program to provide protection for manure to come in contact with the ground. However, EPA Chesapeake Bay Program asserts that this practice provides no water quality benefit but may serve as a source of increased impervious cover

Strategy

This practice may be applied only to farms which have been determined to have severe erosion and water quality problems along areas of frequent and intense livestock or equipment use, and where there is a need for properly designed artificial or vegetative cover in order to prevent the delivery of animal waste, sediment and nutrients to the waters of the State. Maryland's 2017 goal is to implement pads at 600 poultry operations. Funding provided through the Maryland Agricultural Water Quality Cost Share Program.

Funding

Funding provided through the Maryland Agricultural Water Quality Cost Share Program and Farm Bill program. Total to implement 2012-2018 $11,778,000 Annual $1,963,000

Anticipated Load Reduction

400 operations/132,000 lbs by 2011
600 operations by 2017

H) In-house poultry ammonia emission control

Ammonia emission reductions could be achieved by constructing and retrofitting poultry houses with flooring that helps reduce the creation of ammonia. Companies are researching new ventilated plenum flooring (patent pending) for poultry houses that will result in drier litter, reducing the volume of waste by using less bedding material, lowering ammonia emissions, and promoting faster-growing and healthier chickens.

Strategy

Poultry integrators may potentially see adoption of this technology based on the benefits alone to chicken growth. Within the next seven years a limited number of new poultry houses could potentially utilize this technology if cost could be offset. This has limited potential.

Funding

Explore grants and the Chesapeake and Coastal Bays Trust Fund to offset installation costs.

I) Voluntary BMPs

Certain conservation program evaluations document the significant number of BMPs that farmers install on their farms without technical or financial assistance. Such practices will vary in their design and construction and whether or not they meet existing practice standards. This under-reporting of practices fails to accurately reflect the conservation efforts applied and how water quality benefits are measured. While these practices are currently not included in Maryland's Conservation Tracker database, Conservation Tracker has the structural capacity to house this information. Of greatest value are those BMPs implemented since 2005 when the model was last calibrated. Maryland plans to implement a system by which to more accurately identify such BMPs and work with the CBP to determine the appropriate nutrient reduction efficiencies to be assigned to these practices.

Strategy

MDA is working collaboratively with other Bay State partners to develop a definition and reporting protocol for voluntary BMPs. Funded by NRCS and led by the National Association of Conservation Districts, the project will establish a means by which to credibly identify and track BMPs implemented outside state and federal cost share programs.

Maryland will also be initiating a pilot program where soil conservation districts would conduct on farm walking inventories of all of the current practices farmers have installed without incentives. An on-farm nutrient calculation tool will be utilized to assess the farm and to analyze additional management options. EPA CBP needs to set BMP efficiencies for practices that provide water quality protection but do not meet NRCS standards and specifications.

Funding

In addition to the funding provided by NRCS to NACD, MDA has received a Conservation Innovation Grant (CIG) to conduct on-farm assessments in the showcase watershed. Up to 23,000 acres will be inventoried in the pilot. There will be plans to expand statewide.

Anticipated Load Reduction

TBD

J) Mandatory Cover Crops

Strategy

Require cover crops to be planted on the highest risk acres. Through a regulatory change, all acres that receive municipal or other sludge products, and all acres that receive manure or any other organic source of nutrients, would be required to plant a cover crop in the fall.

Funding

No cost, regulatory change.

Anticipated Load Reduction
No additional load reduction. Acreage affected: 250,000 acres.

K) Structural, vegetative, and non-structural shore erosion

Seven miles of shore stabilization projects on land that reduces erosion and stabilizes shorelines. Climate change and rising sea level are impacting certain areas of the State. Mitigation options to protect shorelines provide nutrient and sediment reductions. Funding provided through the State Revolving Loan Fund, private landowners, and other federal and State sources. Explore options through the Farm Bill and the Chesapeake and Coastal Bays Trust Fund, and Living Shorelines Grant from the Chesapeake Bay Trust in partnership with NOAA and the Department of the Environment.

L) Forest Conservation Act Enforcement

Since the enactment of Maryland's Forest Conservation Act (FCA) in 1993 Maryland has protected an average of 9,440 acres of forest each year that have gone through the land development process. However, even with FCA in place, Maryland has lost an average of 3,600 acres of forest each year through development. Strengthening FCA to meet a "no net loss of forest" in Maryland could conceivably save (or in some cases create) more than 3,000 acres of forest each year.

Strategy
Strengthen Maryland's Forest Conservation Act (FCA) by requiring that State and local FCA programs be amended to require a "no net loss of forest" approach. DNR will work in conjunction with the Sustainable forestry Council, local governments and other stakeholders, amendments can be crafted to meet this approach. The recommended approach would be to encourage forest mitigation banks and strengthen fee in lieu of payments where necessary to encourage banking. This approach would use forest mitigation banks to encourage the creation and retention of forests in areas providing the greatest benefit to local ecosystems and the Bay.

Funding
Mitigation Banks would be funded privately.

Anticipated Nutrient Loading Reductions:
Due to the current economic slowdown there has been a reduction in development permits issued statewide, reducing the current annual loss of forest to approximately 2,000 acres per year. This will be considered when developing a "no net loss of forest approach" for Maryland.

M) Agricultural conservation strategies on DNR land

Adopt applicable actions and practices from President Obama's Chesapeake Bay Executive Order section 502 to DNR properties. To accomplish this, DNR would amend their agricultural leases mandating the farmer implement identified practices and abide by management actions outlined in the lease agreement. Some potential options follow. One is to implement N fertilizer use efficiency to maximize the net benefit from the

lowest-needed amount of manure or commercial fertilizer N nutrients entering the row crop system. The CBP does not currently have a definition and effectiveness estimate for this, but when MDA pursues approval for the precision agriculture milestone action this practice should be included as a subset of precision agriculture.

DNR could also require farmers on leased land to minimize commercial fertilizer use where manure nutrients are available. Currently DNR leases state that a tenant shall not apply any organic additives (including manure) to the soil without prior approval from DNR. In areas with imbalances of nutrients from animal manure DNR could require manure applications over chemical fertilizers. Where commercial fertilizers are allowed, lease language could be edited to include operation and maintenance requirements.

Manage nutrient applications to row crop land to minimize nutrients available for runoff. In doing so, apply manure and chemical fertilizer application during the growing season only, do not apply any manure to frozen ground, inject or otherwise incorporate all manure or organic fertilizer to minimize the available dissolved P and volatilized N, and do not apply nutrients to HELs. DNR leases should include language that prohibits winter application; however, more internal DNR and external MDA discussion on the advantages/disadvantages of injection and incorporation is warranted before adding this requirement to leases.

Use conservation tillage or continuous no-till on all row crops to reduce soil erosion and sediment loads except on those lands that have no erosion or sediment loss. DNR leases should require a conservation tillage method but internal DNR and external MDA discussion is needed to determine the advantages/disadvantages of continuous no-till.

N) Utilize watershed restoration in smaller jurisdictions (Non-MS4 areas)

Expand MS4 type retrofits to smaller urban areas and require restoration of pre-1985 acres. All options are new restoration requirements. Load reductions are based on 25% stormwater efficiency.[25] Pre-1985 acres are based on the Phase 5.3 model. Restore 40% of pre-1985 acres at 25% SW efficiency by 2020, 20% by 2017. Establish a Chesapeake Bay Watershed Restoration requirement in the NPDES municipal stormwater permits; require an implementation plan and schedule; monitor and report compliance; and, continue to provide technical assistance, training, and outreach.

Restoration and/or water quality improvements may be funded through a combination of State Revolving Loan Fund, 2010 Chesapeake Bay Trust Fund, local, community and non-profit funding, regulatory fees, stormwater utilities, increased 106 grant and other federal funding, and revenues from offset or trading programs.

<u>Anticipated Load Reduction</u>
Projected Annual Load Reduction (delivered) – 6,750 lbs/yr
Projected 2012-2017 Load Reductions (delivered) –33,750 lbs of nitrogen.

[25] The 25% nitrogen removal efficiency is used as a conservative place holder to estimate nitrogen removal. Other practices or measures may be used to achieve targeted load reductions.

8.0 APPENDICES

Appendix A: Sub-allocation Process for the Chesapeake Bay TMDL

Background: The Shifting Spatial Scale of Bay Restoration

Maryland's development of a process to further distribute, or sub-allocate, the major tributary basin target loads provided by EPA should be understood in the context of State and federal efforts to restore the Chesapeake Bay over time.

The Major Tributary Basin Scale

In 2000, Maryland, Bay state partners, and EPA renewed their commitments and set new goals to restore water quality throughout the Chesapeake watershed by reducing nutrient loads to the Bay. In 2003, the State revised its "Tributary Strategies" plan, setting forth a suite of programs, actions, controls, and best management practices for each source sector across the State at the major tributary basin scale (for 10 major basins). The strategies were designed to achieve certain nutrient reduction goals, based on assumptions about the load reduction efficiencies that could be expected from each practice in each sector. Since its inception, the Tributary Strategies Program, under the Maryland Department of Natural Resources, has tracked the State's Bay restoration efforts, based on making progress toward meeting nutrient reduction goals at the major tributary basin scale.

The Chesapeake Bay Water Quality Segment-shed (TMDL) Scale

While these and other Bay restoration efforts have moved forward over time, it is important to note that Maryland has identified nearly all of the waterbodies in its tidal Maryland 8-digit watersheds, now aligned with and incorporated in 53 Chesapeake Bay water quality segments, as impaired by nutrients and/or sediment on its "303(d) List," or what is now known as the Category 5 list of impaired waters in the State's *Integrated Report of Surface Water Quality in Maryland*. Most of these listings date back to 1996/1998 lists and are subject to a Memorandum of Understanding between MDE and EPA requiring that all of the State's 1996/1998 listings be addressed by 2011. Thus, it is imperative for Maryland (and, similarly, Virginia and the District of Columbia) that the Chesapeake Bay TMDL be developed at the Bay water quality segment scale, and that it establish individual TMDLs for each segment-shed, i.e., the land area draining to a given water quality segment. In this way, it is expected that, when implemented, the nutrient and sediment wasteload and load allocations assigned to each segment-shed will address Maryland's tidal Bay segment impairments for those pollutants, and, along with the other Bay states' TMDLs, result in meeting water quality standards throughout all of the 92 Bay segments that comprise the Chesapeake Bay mainstem and its tidal tributary waters—a critical goal of Bay restoration. See Appendix B2 for maps of Maryland's Bay segment-sheds.

The County and County-Segment-shed (Implementation) Scales

An innovation of the Bay TMDL project is the concurrent development of watershed implementation plans (Plans) by the Bay watershed jurisdictions, in order to provide reasonable assurance by all parties that the goals of this TMDL will in fact be achieved. Along with documenting assessments of program capacity, gap analysis, accounting for

growth, commitments and strategies, one of the key elements of the Phase II Plan will be the further sub-allocation of the segment-shed target loads—developed for the present Phase I Plan as the basis for the TMDL wasteload and load allocations—to a still-finer "local area" scale so that local governments can be provided geographically-specific targets to enable implementation of the TMDL within their areas of jurisdiction.

In Maryland, with its strong and well-established system of county governments, it is appropriate to provide these *implementation scale* sub-allocations at the county-segment-shed level. The county-segment-shed is the intersection of a segment-shed, or portion thereof, with a portion of a county's geographic area. There are a total of 124 county-segment-sheds within the Maryland Bay watershed. Maryland's Initial Target Loads Sub-allocation Process allows the TMDL allocations to be distributed at this scale. The process can also provide "county-scale" allocations – the sum of multiple county-segment-shed allocations that fall within a single county's geographic boundaries. The distribution of target loads of nutrients and sediment by source sector at these local scales sets the stage for a practical implementation plan that incorporates a wide array of efforts at every level of action, and provides a framework for accountability, tracking and reporting progress, and building a partnership among the federal, State, and local governments, as well as the private sector, non-governmental organizations, stakeholders, and concerned citizens. See Appendix B2 for maps of Maryland's county-segment-shed boundaries.

The Chesapeake Bay Program Phase 5.3 Bay Watershed Model (Assessment) Scale

The finest geographic scale for the assessment of land-based sources of pollutant loads and loading rates from a range of land uses within the Chesapeake Bay watershed is the segmentation scheme of the Chesapeake Bay Program (CBP) Phase 5.3 Watershed Model, which divides the Maryland portion of the Bay watershed into 443 "land-river" segments. The modeled land-river segmentation is aligned with county geographical boundaries as well as the Bay segment-sheds, thus allowing model output at the land-river segment scale to be aggregated up to identify target loads at both the county and segment-shed levels, in addition to the county-segment-shed areas described above. Target loads identified at these various scales can be further aggregated up to the major tributary basin level in order to verify that they are consistent with the loads EPA allocated to the State at the major basin scale as the nutrient and sediment reduction targets needed to meet the Bay TMDL water quality goals.

The Sub-allocation Process -- General Overview

Upon EPA's release in November 2009 of preliminary major basin target loads of nitrogen and phosphorus by jurisdiction, MDE worked with these initial loads and Phase 5.2 Watershed Model output to begin developing a method that would enable the distribution, or of those basin target loads to all source sectors at multiple scales (statewide, tributary basin, segment-shed, etc.). The intent was to develop an objective process that could be evaluated, reviewed, refined, and approved by Maryland's Bay agencies and Bay Cabinet prior to EPA's expected release of *revised* nutrient target loads in July 2010, as well as draft sediment loads in August 2010, based on the upgraded Phase 5.3 version of the Bay Watershed Model. MDE completed this effort, and the approved sub-allocation process was then applied to the revised nutrient and sediment target loads to produce initial target load allocations by source sector in a time frame that would permit evaluation and refinement, following which these

refined initial target loads served as the basis for development of a model input deck of practices and controls that was submitted to the Bay Program Office for a model run to verify that the proposed actions, if implemented, would achieve the loading targets and that the target loads were distributed in a manner such that water quality standards are met.

From December 2009 through April 2010, MDE:

- Created a framework of decision rules, similar to those used by EPA to allocate the Bay-wide target loads to each jurisdiction by major basin, to guide the distribution of loads to all source sectors across the Maryland Bay watershed, in a manner that is equitable, effective, and consistent with achieving water quality standards;

- Using Phase 5.2 Watershed Model output, constructed an interactive spreadsheet format for analyzing loadings under several scenarios (No Action, E3, Tributary Strategies, 2008 Progress), thus allowing a comparison of those scenarios to an "allocation scenario" of target load reductions for each source sector that result in the desired water quality response, as predicted by the model data;

- Presented the process framework and its key elements (including the guiding principles of equity, reducible load, crediting previous action, and relative effectiveness), with pilot sub-allocation results for the Patuxent River basin (by source sector, at the basin level), for internal and interagency review;

A description of the decision rules and principles that guided the sub-allocation of the major tributary basin loads to certain source sectors on the basis of an equitable level of effort is provided in the following section of this appendix.

An overview of the refined sub-allocation process, applied herein to EPA's revised basin allocations to generate final 2020 target loads by source sector and segment-shed, is provided by the following table:

STEP	SECTOR	ASSUMPTIONS
1	Forest	2009 Progress
2	Atmospheric Deposition to Non-tidal Streams	Federal Programs
3	Major Municipal	ENR Cap Strategy
	Major Industrial	TS Cap Strategy
	Minor Municipal	TS Nutrient Reductions Goal*
	Minor Industrial	23.5% Reduction**
4	Urban	Based on Reducible Load (NA to E3) and Relative effectiveness – Equitable reductions
	Agricultural	
	Septics	

***Aggregate Target includes ENR upgrades for five largest minor plants**
****Based on MDE preliminary evaluation of technical feasibility**

As the table indicates, the sub-allocation procedure that distributes loads based on an equitable level of effort is applied to those source sectors indicated in Step 4, as one part of the State's overall approach to determining how the 2020 final target loads are assigned.

Step 1 accounts for loads from forested land use areas, assigning a portion of the allocated load to forested land, based on current levels as reflected in the Bay Model 2009 Progress scenario run.

Step 2 accounts for the load from atmospheric deposition of nitrogen to Maryland's non-tidal streams, based on expected reduced levels of nitrogen from this source as a result of the implementation of federal regulations to reduce air deposition of nitrogen to the tidal waters of the Bay.

Step 3 accounts for the point source category of wastewater treatment plants (WWTPs), including all significant (major) and non-significant (minor) municipal and industrial facilities discharging treated wastewater within the Maryland Bay watershed. These point sources are assigned target loads based on existing State programs and strategies, since they are geographic specific and identifiable sources of pollutant discharge that have permit requirements by which achievable load reductions can be calculated based on permit effluent limits, State policy requirements for Enhanced Nutrient Reduction (ENR) for all significant plants, and reported discharge flows.

Step 4 - After target loads are set for all the sources in Steps 1 through 3, the remaining portion of the allocated load is distributed to the remaining sources using an operation based on

achieving reduction targets through equitable levels of effort and relative effectiveness, as described herein. As the method for assigning loading targets to the agricultural, urban, and septic system sources, Step 4 is a critical stage in the overall assignment of target loads to all source sectors.

Decision Rules for Maryland's Initial Target Loads Sub-allocation Process

The technical operation for making the calculations to determine the load distributions at the heart of the sub-allocation process involves a spreadsheet analysis that uses data provided by the Phase 5.3 Watershed Model output. The data provide loading results at the land-river segment scale under various model scenarios runs: 2010 No Action, E3, Tributary Strategies, and 2009 Progress. The spreadsheet analysis allows a comparison of the resulting loads under each scenario. For example, comparing E3 loads to No Action loads shows the theoretical maximum load reductions that would obtain by doing "everything everywhere by everybody" (E3, or the limit of technical feasibility applied globally) as opposed to doing nothing at all (No Action). Thus, the development of an "allocation scenario" at the same scale would provide a set of target loads that identify the *additional* load reductions that are needed to meet water quality goals, relative to those achieved under other scenarios, most critically the 2009 Progress scenario loads which indicate the "current" average annual nutrient and sediment levels thus far achieved, based on the most recent reported implementation data included in the Phase 5.3 Model.

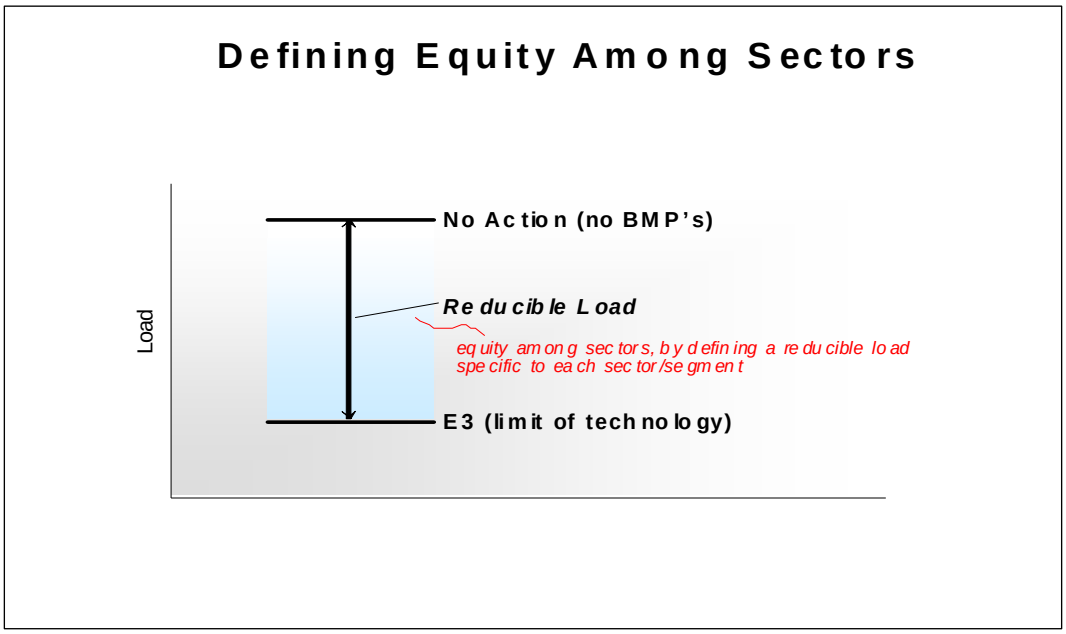
Four key principles guided the formulation of certain decision rules that were applied in the spreadsheet analysis to determine the way the major basin loads are distributed to the segment-sheds by source sector:

1. Maintaining **equity** in assigning required levels of effort among source sectors;
2. Giving **credit for existing actions** - account for all nutrient and sediment reductions achieved to date;
3. Consideration of **relative effectiveness** - optimize results by increasing effort in areas that have the greatest impact on water quality in the Bay;
4. Consideration of the **opportunity for reductions** - evaluate the overall "reducible load" available in each segment-shed.

Equity among Sources

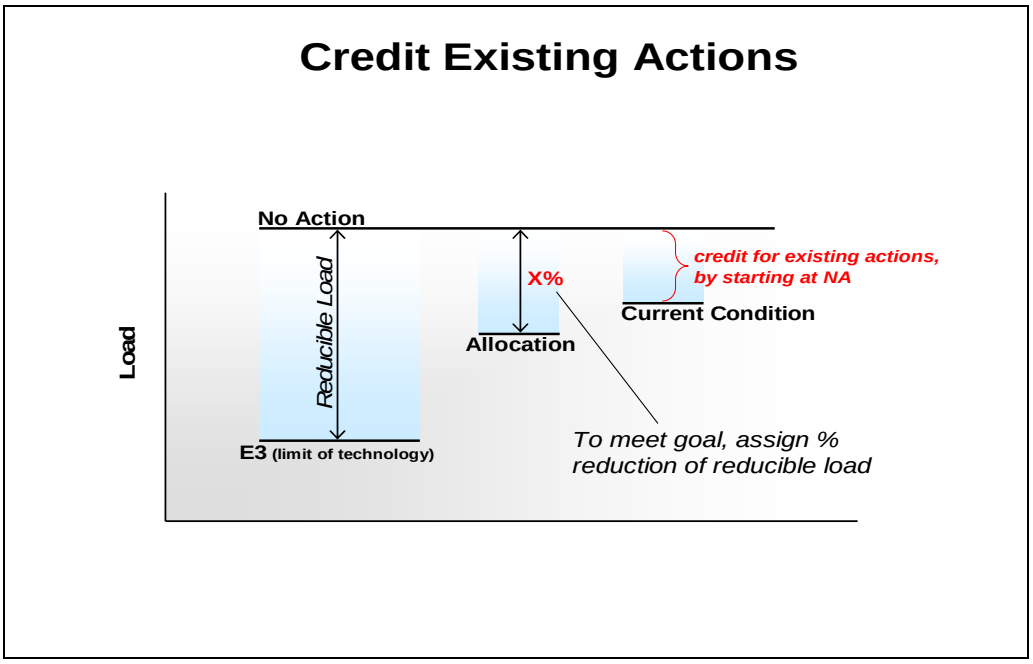
In order to develop an allocation scenario that achieves these goals, the sub-allocation process estimates a "reducible load" for each nonpoint source sector or associated land use, defined as the difference between No Action and E3, based on generally accepted assumptions as to what constitutes E3 for a given source sector. A target for each land-river segment is then determined as that fraction of the overall reducible load, equivalent for all source sectors within that segment, required to obtain the necessary water quality response. The level of effort needed to achieve that percentage of the total reducible load is then adjusted on the basis of the "relative effectiveness" of the segment, i.e., the impact nutrient reductions from that drainage area are expected to have on dissolved oxygen levels in the main Bay (and, similarly, the impact of sediment reductions on water clarity and submerged aquatic vegetation (SAV)). It is also constrained to assure that the allocation will not be greater than the current loads. This approach allows an equitable distribution of the major basin loads, with a fixed range in the "level of effort" between the least and most effective segments. The goal is to produce a fair, efficient,

and effective allocation of loads to achieve the necessary water quality response with the least amount of effort overall.



Credit for Existing Actions

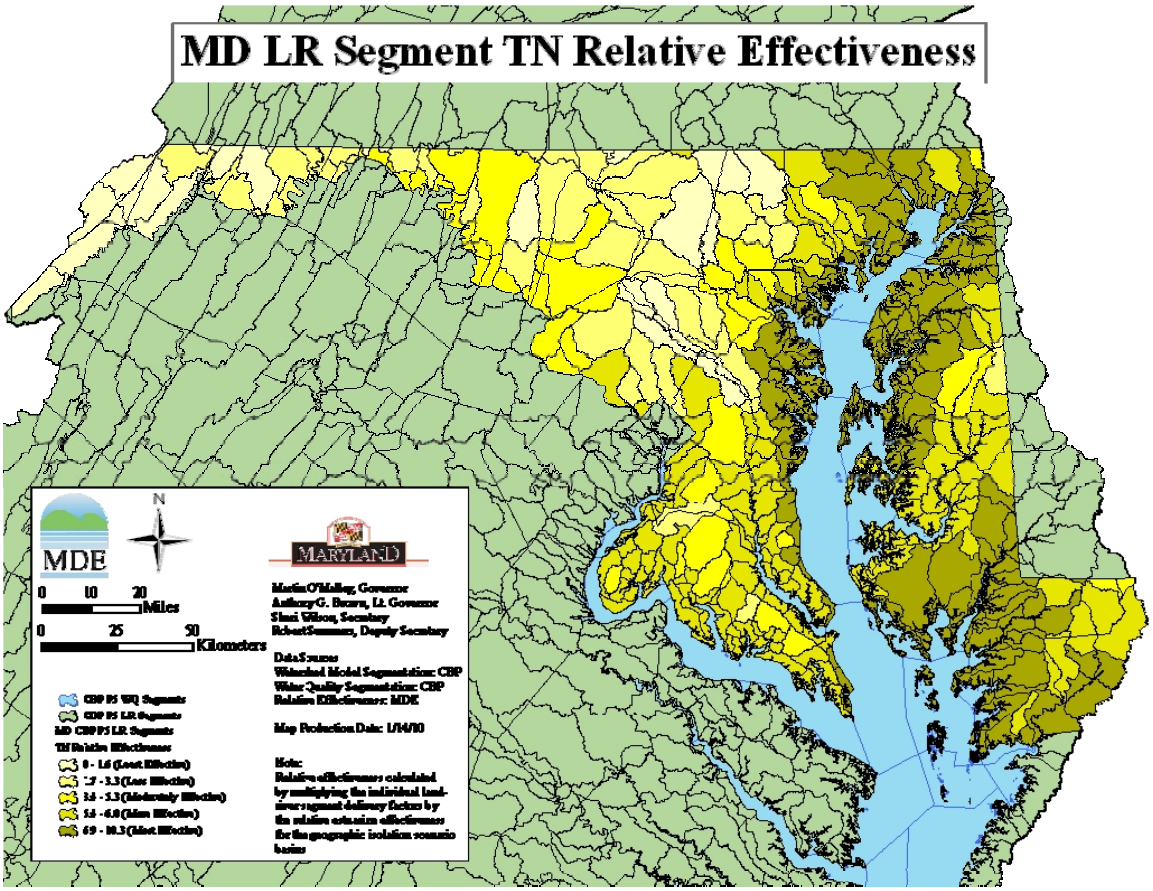
Actual baseline loads, however, are not determined by the No Action scenario, but rather by the "current condition" of the 2009 Progress scenario. By determining and applying the load reductions *already* achieved from all previous and existing actions, based on the most recent available data input to the Phase 5.3 watershed model, it is possible to set a "current" average annual baseline load from which to determine the additional reductions required to meet the target loads of the allocation scenario. In other words, the required reduction is not from the No Action load to the Allocation load, but rather from the Current Condition load to the Allocation (i.e., the *remaining* fraction of the reducible load still to be achieved after crediting all previous reported actions).



Relative Effectiveness

In order to distribute the major basin loads to the segment-sheds in a way that optimizes the attainment of the desired result of restoring water quality in the Chesapeake Bay and its tidal tributaries, it is necessary to consider the relative impact that reductions in nutrients and sediment from different segment-sheds have on water quality response in the Bay. This means that geographic proximity and other factors affect the amount of "delivered loads" of those pollutants to the Bay in relation to the loads derived from "loading rates" established by land use and source sector. For example, due to "delivery factors," reducing a pound of nitrogen in a segment-shed in the upper Potomac River basin will not produce the same change in dissolved oxygen in the main Bay as reducing a pound of nitrogen in a segment-shed in the lower Patuxent River basin.

To maximize the desired changes in water quality response, the sub-allocation process imposes a factor of "relative effectiveness" on each segment-shed. This "effectiveness factor," based on model output that identifies changes in water quality response by land-river segment, accordingly adjusts the level of effort required within a given segment-shed across all source sectors. The application of the effectiveness factor establishes a range in the level of effort from the least effective to most effective segment-sheds, adding a degree of refinement in the purposeful distribution of loads.



Opportunity for Reductions

To further refine the delineation of the areas where optimal changes in water quality response in the Bay may be obtained by the *least* nutrient and sediment reductions, it is necessary to also consider where there is the greatest opportunity to make these highly effective load reductions. Based on the reduction rates for predominant source sectors in the land-river segments that comprise each Bay water quality segment drainage area, it is possible to rank the segment-sheds by the degree to which their land use and source sector composition offers the maximum opportunity to achieve effective reductions.

Addressing Specific Pollutant Source Sectors in the Sub-allocation Process

The land-based sources contributing to the excessive nutrient and sediment loads that have resulted in the impairment of water quality in the Chesapeake Bay and its tidal tributaries can be divided into two main categories: point sources and nonpoint sources. Strictly speaking, point sources are those sources of pollutants that are discharged to surface waters from an identifiable "point," e.g., a pipe or an outfall. The most common type of point source is a municipal or industrial wastewater treatment plant (WWTP). Such point sources are subject to assignment of wasteload allocations (WLAs) in TMDLs. However, EPA also considers such sources as mining operations, dredge material placement sites, and stormwater discharges regulated by National Pollution Discharge Elimination System (NPDES) permits as point sources and therefore also subject to assignment of WLAs in TMDLs. Nonpoint sources are all those other sources whose

pollutant discharges are diffuse, such as runoff from farm land. Nonpoint sources are subject to assignment of a Load Allocation (LA) in TMDLs.

For the purposes of developing 2020 final target loads using MDE's sub-allocation process, the pollutant source sectors are delineated in a somewhat different manner, for reasons that will be explained herein. There are two main categories of source sectors considered in the sub-allocation process: 1) municipal and industrial WWTPs; and 2) all other land-based sources of nutrient and sediment discharges. These two categories reflect a decision to assign target loads to the WWTPs on a different basis than that which drives the sub-allocation of loads to the other sources (with the exception of forest and atmospheric deposition sources, as explained below).

Significant Municipal and Industrial WWTPs

Because WWTPs have known geographic locations and discharge points, with specific discharge permit limits and design flows by which to calculate loading rates, it is a fairly straightforward matter to assign target loads to these facilities, particularly in the case of the "significant" municipal and industrial WWTPs, those with design flows equal or greater than 0.5 million gallons per day (MGD). For significant municipal facilities, the State is implementing an Enhanced Nutrient Reduction (ENR) Cap Strategy. It requires upgrades of major WWTPs to the state of the art ENR technology, which enables them to meet concentration limits of 4 mg/l or less total nitrogen TN and 0.3 mg/l or less total phosphorus. The Cap Strategy requires all WWTPs to maintain established nutrient load caps. For the Phase I Watershed Implementation Plan, the nutrient target loads for these significant WWTPs are based on the ENR Cap Strategy requirements and their design flow capacity[26]. For significant industrial facilities, target loads were established on a case-by-case basis with consideration of load reductions relative to the 1985 baseline (i.e., reductions already achieved) and additional load reduction potential. Target loads for two dredged material placement facilities are based on approved TMDLs.

Nutrient or sediment information is not available for every NPDES permittee in Maryland's Chesapeake Bay watershed who was discharging under a permit at the time of the EPA Bay TMDL. To the extent that such discharges were occurring during the model calibration process, they are indirectly included in the results and therefore assumed to be included in the total load assigned in the TMDL. However, due to lack of specific information, these discharges have been assigned wasteload allocations in the input deck based on default assumptions (where available) regarding flow and concentrations. These facilities should provide, at a minimum, nutrient and/or TSS monitoring data with their next NPDES permit renewal application. Renewed NPDES permits for these discharges will require monitoring to verify existing loads and to either (1) verify that these loads do not contribute to any exceedance of the WLAs (determination of no reasonable potential to contribute to an exceedance of local WQS and/or

[26] Design capacity for significant facilities shall meet the following two conditions:
(1) A discharge permit was issued based on the plant capacity, or the Maryland Department of the Environment (MDE) issued a letter to the jurisdiction with design effluent limits based on the new capacity as of April 30, 2003.
(2) Planned capacity was either consistent with the MDE-approved County Water and Sewer Plan as of April 30, 2003, or shown in the locally-adopted Water and Sewer Plan Update or Amendment to the County Water and Sewer Plan, which were under review by MDE as of April 30, 2003 and subsequently approved by MDE.

Bay TMDL WLA) or (2) incorporate an effluent limit consistent with the local WQS and /or Bay TMDL WLA (where monitoring data shows reasonable potential to contribute to an exceedance of local WQS and/or Bay TMDL WLA). As a result, Maryland may include more specific information on these facilities in future phases of its watershed implantation plan that may be used to initiate modifications to the TMDL wasteload allocations. For the facility specific notes that are currently available see Appendix B1.

Non-significant Municipal WWTPs

For non-significant municipal treatment plants (i.e., plants with design flows less than 0.50 MGD), aggregate target loads were assigned based on Maryland's Tributary Strategies annual nutrient loading caps for minor facilities. The original Tributary Strategies loading caps were based on design capacity or projected 2020 flow, whichever is less, and effluent concentration limits of 18 mg/l TN and 3 mg/l TP. The final target loads are generally consistent with the Tributary Strategy goals, with the exception that five of the largest such facilities were assigned loads based on ENR upgrades.

Non-significant Industrial WWTPs

Aggregate target loads of nutrients for non-significant industrial treatment plants are based on a preliminary evaluation by MDE of the potential for reductions from subcategories of minor industrial sources based on an understanding of technical feasibility. The preliminary evaluation suggests a nutrient reduction potential from 2009 loads of approximately 23.5% by 2020. Aggregate target loads reflect Maryland's correction of Bay Program data (see Minor Industrial Treatment Plants in Section 2 of this report).

Combined Sewer Overflows/Sanitary Sewer Overflows

Target loads for CSOs/SSOs were based on continuing CSO separation/elimination through enforcement of existing consent orders. The assigned allocation of 35,000 pounds per year of TN was estimated based on the anticipated completion of CSO separation in Cambridge, Federalsburg, and Baltimore City by 2017, but assumes the elimination of remaining CSOs in other communities will not be completed until after the final target year of 2020.

Forest

For forested land use areas the target load is based on current loading rates as reflected in the Bay Model 2009 Progress scenario run.

Atmospheric Deposition

For atmospheric deposition of nitrogen to Maryland's non-tidal streams the target load is, based on expected reduced levels of nitrogen from this source as a result of the implementation of federal regulations to reduce air deposition of nitrogen to the tidal waters of the Bay.

Source Sectors with Targets Based on Reducible Load

Target loads for the last four source sector categories below have been assigned through the sub-allocation process described above. Using Phase 5.3 Watershed Model output, each of the source sectors within each land-river segment is assigned a certain percentage of its reducible load (from "No Action" to "E3"), adjusted by a factor based on the relative effectiveness and opportunity for reduction of that particular segment, in order to meet a target load determined as necessary to obtain the required water quality response. The additional effort needed from each sector to meet a given target load depends upon how far the No Action load has already been reduced in that sector by all previous credited actions to date, as reflected by the current loading of the 2009 Progress Scenario run. This additional effort may be expressed as a percentage of reduction from the current load needed to achieve the target load.

The target loads for each source sector are aggregated up from the land-river model segment scale to the TMDL segment-shed scale to obtain the initial target loads for each of the land areas in Maryland that drain to specific impaired Bay water quality segments. Along with the target loads assigned by different methods for the sources described above, these segment-shed target loads that provide the basis for the wasteload and load allocations established in the Chesapeake Bay TMDL.

Regulated Urban (NPDES Regulated Stormwater Discharges)

NPDES regulated stormwater discharges are assigned an aggregate point source target load based on urban land use areas in counties with Phase I and Phase II Municipal Separate Storm Sewer System (MS4) permits. In addition to the county Phase I or Phase II permits, the aggregate target loads include stormwater discharges from other NPDES regulated entities such as Phase II municipality MS4s, the State Highway Administration MS4, industrial stormwater, and other state and federal permitted entities within the Phase I and Phase II jurisdictions.

Non-regulated Urban (Non-NPDES Regulated Stormwater Discharges)

This category assigns a nonpoint source target load to stormwater discharges from sources in counties that are not currently regulated by NPDES Phase I or Phase II MS4 permits, based on the urban land use areas in those counties. Target loads are based on the reducible load from this source and are assigned as part of the Load Allocation (LA) in the TMDL.

Septics (Onsite Sewage Disposal Systems (OSDS))

Target loads for septic systems are assigned based on the reducible load determined for this source and on information on the number and location of OSDS installations in the State's portion of the Chesapeake Bay watershed.

Agriculture

The target loads for Agriculture include the land use categories of crop, pasture, animal feeding operations (AFOs), and concentrated animal feeding operations (CAFOs). Targets for

agricultural sources were assigned based on the reducible load determined for this sector through application of the sub-allocation process. CAFOs followed the same process, but the production areas were allocated separately from other agricultural sources because technically they are a regulated source and must be placed in the wasteload allocation; the other agricultural sources are included in the load allocation.

The 2020 final target loads of nitrogen, phosphorus, and sediment allocated to Maryland's segment-sheds by source sector are provided in Appendix B1, which also includes interim target loads developed to achieve 70% of the final targets by 2017, and a state-wide load reduction schedule.